

Name _____

Section# _____

Due Date _____

EXERCISE 5**STEPHEN BIRCH AQUARIUM STUDY**

STUDENT LEARNING OUTCOMES for this exercise. Students will be able to:

1. Appreciate the diversity and natural history of marine organisms and their special adaptations to the marine environment.
2. Recall information about the organisms from this exercise.
3. Examine characteristics of organisms and predict the adaptive value of those traits.

INTRODUCTION: To be read prior to visiting the aquarium.

In the Fall of 1992 the Stephen Birch Aquarium opened, replacing the Vaughn Aquarium on the Scripps Institution of Oceanography campus. The aquarium is divided up into various marine biogeographic regions. Within each region displays occur with a plaque denoting the habitat and occupants.

This exercise is arranged to generally walk you through the aquarium from beginning to end. Questions will help direct you to a tank or a choice of tanks. All tanks may not be available for viewing all the time. To answer the questions in this exercise, observe the animals in their tanks and read the information plaques and signs.

As some displays fail from time to time and new individuals are added before plaque information is developed, you may find animals shifted to new locations. If you find this is the case, look for the animal in another tank, ask a docent for help, or clearly indicate that the display was NOT AVAILABLE for observation. Be aware that all other students must also have indicated that the display was not available for this to be a legitimate response. Blank answer areas will be graded as incorrect.

BEFORE YOU GO:

- a. Visit the Stephen Birch Aquarium website: <http://www.aquarium.ucsd.edu> From the home page, click on "Plan a Visit" at the top of the page. On the "Plan a Visit" page's left-hand menu you will find information on open hours (daily 9-5), directions, a map and more. You also may want to check out the feeding schedule and plan your visit during those hours.
- b. Bring a valid I.D. and your student I.D. to receive the student discount admission rate.
- c. To enter, go through the education gate. Purchase your tickets online to receive a larger discount: <http://aquarium.ucsd.edu/Education/College/>
- d. You must verify your visit by stapling your dated receipt or ticket to the first page of this exercise. Also put your name on either in case the verification and the exercise become separated.
- e. Be sure you do not duplicate the answers of any other student. It's fine to work with a partner but do not split the work and be careful that all the answers are your own. Duplicate work receives a zero.
- f. Visiting the aquarium is a mandatory lab exercise.
- g. General directions from I-5: I-5 to La Jolla Village Drive, west about one mile, left on Expedition Way to the aquarium. Parking is free for the first 3 hours.

NORTH PACIFIC COAST DISPLAY

1. **Tank 1.** The Pacific Sardine. The California Sardine fishery failed in the early 1940's. Along with its demise, fishing communities that depended upon the fishery, like in Monterey, failed too. Although over-fishing is a known contributor it is not known what actually caused the collapse. What can be done to figure out this problem?

2. Sardines are good schoolers. What adaptive value might be associated with schooling behavior?

NORTHWEST COAST DISPLAYS

3. **Informational Plaque.** What current is a major influence over the types of (terrestrial) plants and animals occurring along the western North American coast?

4. **Tank 2.** Among the many interesting invertebrates living off the coast of the Pacific Northwest, the sun star and giant octopus (tank 5) fascinate us by their unusual size. Describe how these coastal waters can support the many species of invertebrates including these oversized creatures.

5. **Tank 3.** The **sea anemones** seen in this and nearby tanks (and throughout the aquarium) are members of the phylum **Cnidaria**. This phylum has a saclike digestive system. They have a very simple nervous system with no brain and a type of symmetry with neither right nor left side. This type of symmetry is called **radial symmetry**. In spite of having a very simple nervous system, they are carnivores and capture their food by stinging them, the same way their relatives the jellyfish do (seen in tank 8 and nearby tanks). What advantage might a carnivore with such a simple body plan gain from having radial symmetry? Hint: Imagine you are an anemone, a carnivore with no eyes and no ability to stalk or in any way chase after your prey.

6. **Tank 4.** There are several large red abalone in this tank. Abalone are relatives of clams, mussels and octopus. Once found as an entrée in most seafood restaurants, why is it no longer on the menu?

7. **Tank 5.** Cool water species such as *Enteroctopus dofleini* can be found off San Diego at depths of 400-500 ft. and grow to greater than 20 feet. What is the life span of this large invertebrate?

SOUTHERN CALIFORNIA DISPLAYS

8. **Tank 8 & adjacent tanks to the right.** Jellyfish, like the sea anemone, are Cnidarians. They use their stinging tentacles to subdue other organisms and consume them. Do the moon jellyfish in tank 8 or the jellyfish in nearby tanks appear to be able to swim with such strength as to chase down prey?

9. Some larger marine animals, like turtles and sharks, eat jellyfish. A large number of irresponsibly disposed plastic grocery bags floating in the ocean look like jellyfish. Why is this a problem?

10. **Tank 10.** Coastal Lagoon. Many immature forms of bony fish such as bass, halibut, turbot, and surf perch live in bays and estuaries. As they mature, they leave the estuary and migrate to the open coast. These estuaries and bays are considered good nurseries for the young of many species of invertebrates as well.

a. Describe the reasons these shallow waters make good nurseries.

b. Why is it important that people become more aware of these habitats?

11. Several flatfish (turbot, flounder, sole & halibut) live on the sandy bottom of tank 10, as well as in tank 3 previously visited, and in the large kelp bed tank #19. (Rays are **not** included in this group.) While lying flat, how many eyes are seen in a flatfish?

12. These fish start off life with an eye on either side of their head. As they develop, the eye shifts to join the other eye on one side of their face. Using a **drawing** of a turbot, flounder, sole or halibut, accurately positioned and **label** each of the anatomical features to help demonstrate that they are lying on their sides:

(For help with fin identification on a fish that is NOT a flatfish, see the last page of this handout.)

- a) pectoral fins
- b) pelvic fins
- c) caudal (tail) fin
- d) anal fin
- e) dorsal fin
- f) operculum (gill cover)
- g) mouth and
- h) eyes

13. **Tank 13.** Spiny lobster. The lobster is a member of the phylum Arthropoda. This is a group containing insects, spiders, crabs, etc. What physical attributes do lobsters share with spiders that would place them all in the same phylum? (Note: They do not have the same number of legs.)

14. Do these spiny lobsters have large claws (like the “Maine” lobsters) or small claws?

15. **Tank 15.** Territoriality. The Garibaldi aggressively defends its territory, even against human divers. There are 3 color phases of this fish.

a. Why do you think the young Garibaldi are not brightly colored like the adults?

b. How is their adult territorial **behavior** related to their being given protected status by the state of California?

16. **Big Tank 19. The Kelp Forest.** The **shovelnose guitarfish** (also in tank #14) is sometimes called a shovelnose shark. (Look for a fish whose front looks like a ray, and whose tail looks like a shark). In fact, however, it is classified as a ray, not as a shark. Rays (tank #10 and #14) and sharks that commonly rest on the sea floor have spiracles. Spiracles are a pair of auxiliary **incurrent** openings, located just behind the eyes. These openings are valves that pump water into and over their 5 pairs of gills that appear as external slits.

Where on the body of a shovelnose guitarfish or a ray, are these 5 pairs of gill slits, that are used for **excurrent** water flow, located?

17. What possible advantage is it, for these animals that rest buried in the sand, to have their gill openings located where they are? (Consider why these animals are buried when trying to answer this question.)

18. The swell sharks in tank 19 have a different behavior than the black tip reef shark in the outdoor display located several feet to the right of the exit of the aquarium lobby. **Describe** the activity of the swell sharks. (Compare their different activity levels to the black tip reef shark at the end of the exercise.)

MEXICO DISPLAYS

19. **Tank 20.** (Note the coloration pattern of the back and belly of the Jack and the puffer fish before leaving this tank. It will be referred to later.)

The speed of a fish can be determined by the shape of its caudal fin (tail). If it is crescent or fork-shaped, the fish is a fast swimming, open water fish. If it is broad and broom-shaped, it is more maneuverable, but slower. Compare the caudal fin of the Jacks and the groupers in tank 20 by means of **drawings** of each. Label your sketch with the correct name of the fish. (For help with fin identification, see the last page of this handout.)

20. Which would be the faster?

21. **Tanks 20-33.** Notice the extreme variation in color and body shape of the tropical fish from Australian, Mexican and Micronesian waters.

a. **Tank 21.** The long nose butterfly fish displays a phony eye-spot located posteriorly (near the tail). What possible advantage would these fish gain from this coloration during an attack by a predator?

b. For those fish with dark spots located away from their head, how have they camouflaged their actual eyes?

22. **Tank 22.** This tank displays island wrasse, a small colorful fish. Most fish swim by moving their bodies in a side-to-side motion. Wrasse, however, tend to swim in a different fashion. What fins do they primarily use? (For help with fin identification, see the last page of this handout.)

23. **Opposite wall from Tank 22.** Most sharks bear their young alive. However, some do lay eggs. Observe the small display tank across from tank 22. This small tank holds the egg cases of what 2 species of sharks?

24. Near this same small tank is another that displays the egg cases layed by California squid. How large are the baby squid that have just hatched and are swimming around?

TROPICAL SEAS

25. **Tank 26 & 27.** Coral are just the skeletons of the coral animals. The living coral reef organisms in these and other tanks are all Cnidarians (see question 5). Knowing the manner by which other Cnidarians capture their food, what do you think these corals eat?

26. **Tank 29.** Mutualism display. One of the more peculiar relationships is that which has formed between the anemone and the anemone fish. Anemones will sting, paralyze and eat small fish. The anemone fish (in this tank its is a red saddleback anemone fish) when first encountering an anemone, will lightly brush against a few tentacles repeatedly for a few hours and then it can safely nestle among the anemone's tentacles.

What benefit does the **anemone** get from this relationship?

What benefit does the **anemone fish** get from this relationship?

27. **Tank 32.** The chambered nautilus seen in tank 32 is a relative of the octopus and squid. (All are members of the class Cephalopoda in the phylum Mollusca.) But the nautilus is the only living Cephalopod that retains an external shell.

a. How do they maintain their buoyancy?

b. According to the plaque how might you age an empty shell of a chambered nautilus?

28. **Outdoor Shark Exhibit.** Leave the lobby, go the outside and go to the right. You will walk between the door of the bookstore on your left and the restrooms on your right. Walk all the way to the back to the outdoor shark exhibit that displays the **blacktip reef sharks**.

Sharks, like many fish species, display an adaptation called countershading (dark upper body, light lower body). Countershading tends to occur in open water fishes that have no natural hiding places. You saw countershading in the Jacks and the puffer fish (See question 18.) It is also present, to a lesser extent, in the sardines you saw at the beginning of this exercise.

How does the countershading color pattern help these epipelagic (shallow, open ocean) fish camouflage themselves? (Hint: Imagine yourself underwater first looking up at these fish and then looking down at them.)

29. **California Gray Whale** information plaque next to breaching whales fountain outside the entrance. (Pass it on the way back to the parking lot.) What is the migration route followed by these whales?

30. Are they an endangered species?

Don't forget to staple a DATED ticket or receipt to the first page of the assignment.