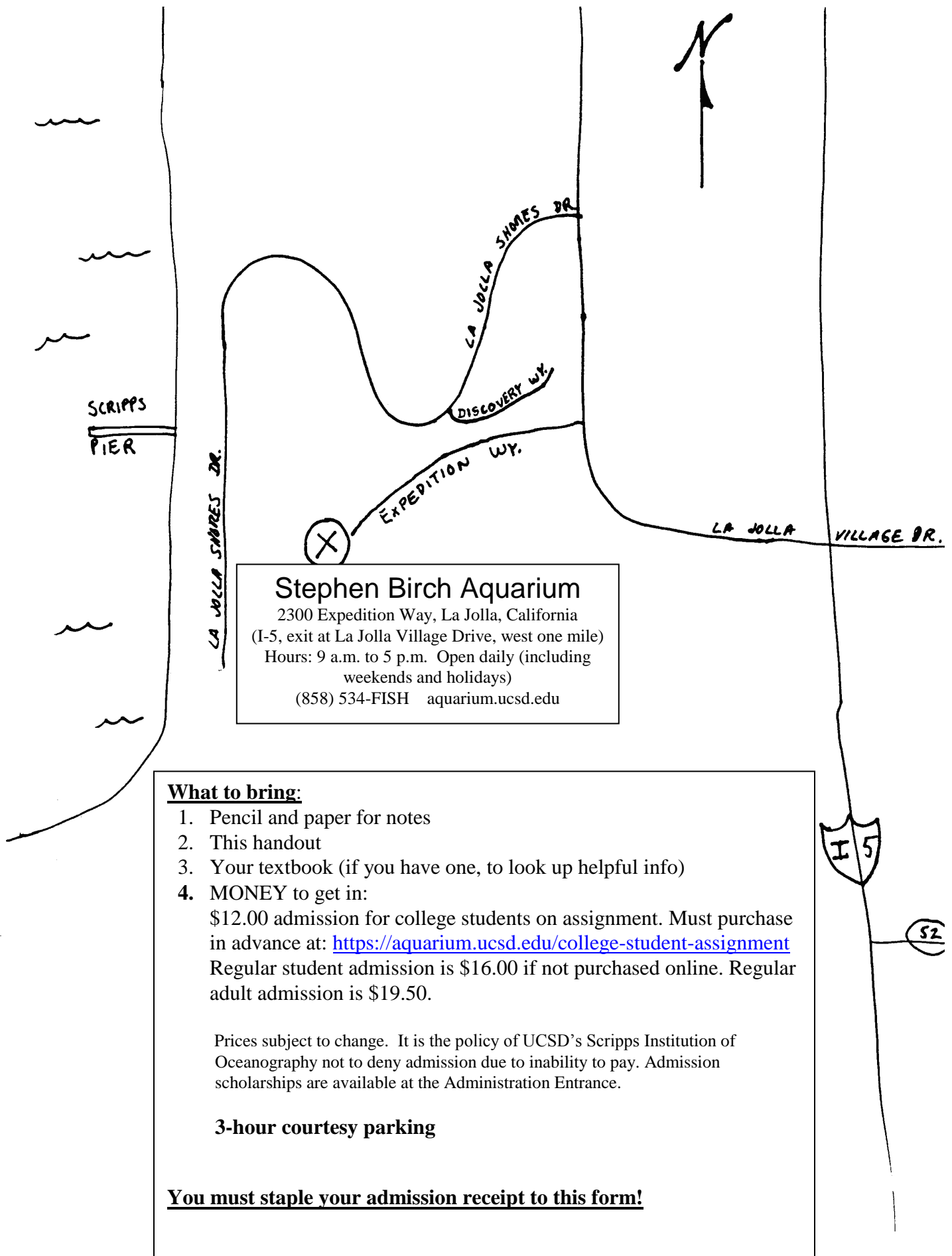


OCEANOGRAPHY FIELD TRIP ANSWER SHEET
(PLEASE ATTACH RECEIPT AS PROOF OF ATTENDANCE)

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Stephen Birch Aquarium
2300 Expedition Way, La Jolla, California
(I-5, exit at La Jolla Village Drive, west one mile)
Hours: 9 a.m. to 5 p.m. Open daily (including weekends and holidays)
(858) 534-FISH aquarium.ucsd.edu

What to bring:

1. Pencil and paper for notes
2. This handout
3. Your textbook (if you have one, to look up helpful info)
4. MONEY to get in:

\$12.00 admission for college students on assignment. Must purchase in advance at: <https://aquarium.ucsd.edu/college-student-assignment>
Regular student admission is \$16.00 if not purchased online. Regular adult admission is \$19.50.

Prices subject to change. It is the policy of UCSD's Scripps Institution of Oceanography not to deny admission due to inability to pay. Admission scholarships are available at the Administration Entrance.

3-hour courtesy parking

You must staple your admission receipt to this form!

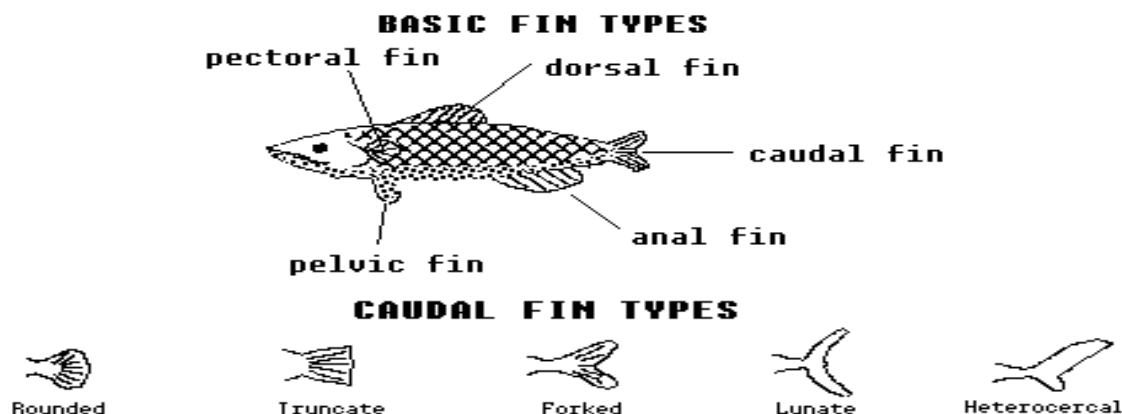
OCEANOGRAPHY FIELD TRIP

AQUARIUMS

The following questions can be answered by observing the various organisms within the aquariums.

As you make your way through the aquariums you will notice fish of various shapes, sizes and colors. We will try to understand these variations in terms of their function as adaptations to the particular niche (occupation) of the organism.

A good deal of insight into the particular niche which a fish fills can be garnered from an inspection of its fins. It is necessary at this point, therefore, to point out the various fin types and their function.



Pelvic and **pectoral** fins are used primarily for maneuvering; however, in some fish they have been modified for other uses. **Dorsal** and **anal** fins are generally used as stabilizers; again however, in some fish they have been modified for other purposes. The **caudal** fin is most important in propelling the fish forward. The more rounded the caudal fin is, the less efficient it is for propulsion, but the more flexible it is and hence the better it is for maneuvering and accelerating at low speeds. Fish with rounded to truncate caudal fins swim slowly or remain motionless most of the time. However, when prey approaches they quickly accelerate to capture it and hence are known as **lungers**. Lunate fins are quite ridged, hence are designed for high-speed cruising, but not for maneuvering. Fish that continually swim at high speeds in search of prey tend to have lunate caudal fins and are referred to as **cruisers**. The shape of the heterocercal fin generates a degree of lift as the fish swims and thus is important to fish (i.e. sharks) which do not have **swim bladders**. These gas-filled sacs are present in the gut of many fish and are used to control buoyancy.

TANK #1

1. Determine which way the current in the tank flows (HINT: Watch the movement of tiny bits of debris and/or the speed at which the sardines swim. Fish going with the current move faster.) Do the sardines generally swim with or against the current?
 - a. with
 - b. against

TANKS #2, #3 and #4

2. Most of the fish in these tanks are rockfish. What kind of caudal fin do rockfish have?
 - a. rounded to truncate
 - b. truncate to forked
 - c. forked to lunate
 - d. heterocercal
3. Would rockfish be lungers or cruisers?
 - a. lungers
 - b. cruisers

4. Which are more streamlined?
a. rockfish
b. sardines (tank #1)
5. Observe fish in several different tanks. Which caudal fin type tends to occur on the **least** streamlined fish?
a. rounded
b. truncate
c. forked
d. lunate
e. heterocercal
6. Which caudal fin type tends to occur on fish having the largest (relative to body size) pelvic and pectoral fins?
a. rounded
b. truncate
c. forked
d. lunate
e. heterocercal
7. Below are listed some of the defense mechanisms that rockfish have against larger predatory fish. Which does not apply?
a. camouflage
b. spiny dorsal fins
c. ability to outmaneuver predators
d. ability to outrun predators
e. ability to see backwards

TANK #5

8. Observe the octopus for a while. Why does it need such a large head?
a. for buoyancy regulation
b. to collect seawater for jet propulsion
c. for enveloping prey
d. for absorbing the shock of colliding with rocks

JELLY FISH TANKS

9. Which of these types of human trash are most often mistaken for jellyfish by animals that eat jellyfish?
a. plastic container lids
b. plastic bags
c. old Frisbees
d. plastic water bottles
10. The term **nekton** refers to free swimmers whose movements are largely unaffected by currents, whereas organisms that drift with the currents are called **plankton**. Jellyfish are
a. nekton
b. plankton

TANK #10

11. This is a good tank to observe the effects of light refraction. What appears to happen to objects on the bottom of the tank as your eyes get within an inch of the glass?
a. they appear to move away from you
b. they appear to move toward you
c. nothing
12. Based on your observation in question #11 where are the **real** objects on the bottom of the tank?
a. the real objects are closer than they appear.
b. the real objects are farther away than they appear.
c. the real objects are in the same place they appear to be

TANKS #13 and #15

13. In these tanks there are several benthic (bottom-dwelling) animals. If they are to remain on the bottom without expending a great deal of energy, it is important for such creatures to have a body density greater than that of seawater. Consider the behavior and composition of each of these organisms. Which would have the LOWEST body density? (Hint: Shell is denser than flesh or water.)
- California Moray
 - California Spiny Lobster
 - Red Abalone
 - Wavy Top Snail

TANKS #4, 15, & 16

14. The state fish of California is:
- Red Abalone
 - Señorita
 - Yellowfin Croaker
 - Garibaldi

TANK #16

15. How might submarine canyon-dwelling fish benefit from the persistent sandfalls in this habitat? (HINT: think about how nutrients, oxygen and carbon dioxide usually vary with depth in the ocean.)
- they receive nutrients from seawater downwelled with the sand
 - they receive oxygen from seawater downwelled with the sand
 - they receive carbon dioxide from seawater downwelled with the sand

KELP FOREST TANK

16. Why are there no sea urchins in this tank? (HINT: Think about what is special about this tank compared to all of the other tanks.)
- the water is too deep for them
 - they cannot tolerate surge (water motion due to waves)
 - they are hazardous to the fish
 - they would eat the bottom part (holdfast) of the kelp and the kelp would die
17. Which caudal fin type characterizes the Leopard Shark?
- lunate
 - heterocercal
 - truncate
 - forked
18. Which of these fish probably does not have a swim bladder (buoyancy control device)? (HINT: Watch them swim, float, or lie on the bottom. Also consider caudal fin type.)
- Giant Sea Bass (biggest fish in the tank)
 - Leopard Shark
 - Olive Rockfish
 - Broomtail Grouper
19. Which of the organisms in this tank is not likely to occur in the same native habitat of Giant Kelp? (HINT: The native habitat for Giant Kelp is much deeper than this tank.)
- Giant Sea Bass (biggest fish in the tank)
 - Green Algae
 - Broomtail Grouper
 - Olive Rockfish

NEARSHORE CANYON EXHIBIT (A 3D model showing the shape of the bottom off Southern California. You will find it just past the Giant Kelp Tank. Questions 20-23.)

20. This is a great illustration of our translational continental margin!!! What is the deepest spot on the model?
- San Nicholas Basin
 - San Clemente Basin
 - San Diego Trough
 - Catalina Basin

21. Where would turbidity currents moving down La Jolla Canyon deposit their load? (Hint think about where water would end up if you poured it into the La Jolla Canyon on this model.)
- a. San Nicholas Basin
 - b. Cortez Basin
 - c. San Diego Trough
 - d. Catalina Basin
22. If turbidites are much more abundant than any other sediment type on this continental margin and turbidity currents flow from land always toward greater depths, where would sedimentation rates be the slowest? (Which of these would receive the least sediment from turbidity currents?)
- a. San Nicholas Basin
 - b. San Diego Trough
 - c. Catalina Basin
 - d. San Pedro Basin
 - e. Santa Monica Basin
23. Given that Southern California has a translational continental margin, the Catalina Basin was probably formed by
- a. river erosion
 - b. faulting
 - c. turbidity currents

TANKS #22, #25, #26, #27 and #28

24. How does the size, shape, and coloration of the fish which live in shallow tropical waters compare with those which live in the more temperate waters off California.
- a. tropical fish are generally smaller, less elongated and less brightly colored
 - b. tropical fish are generally larger, more elongated and less brightly colored
 - c. tropical fish are generally smaller, less elongated and more brightly colored
 - d. tropical fish are generally larger, more elongated and more brightly colored

TANK #29

Mutualism is a relationship between two different organisms in which both organisms benefit, while commensalism refers to the situation where only one organism benefits and the other is unaffected. Parasitism occurs when one organism is benefited and the other is harmed by the relationship.

25. What is the relationship between the anemone fish and the anemone? (Hint: If the fish leaves the anemone to forage, it comes back to the anemone to eat its meal.)
- a. mutualism
 - b. commensalism
 - c. parasitism
26. What kind of relationship exists between coral and zooxanthellae? (You will have to read and interpret the information on the wall across from tank #27.)
- a. mutualism
 - b. commensalism
 - c. parasitism

PREUSS PLAZA (tide pool area outside overlooking the ocean)

27. Watch several ocean waves near the pier as they approach the shore. What happens to their wavelength?
- a. it gets shorter near shore
 - b. it gets longer near shore
 - c. it remains unchanged as waves travel from deeper to shallower water
28. Using a watch (or just count 1-one thousand, 2-one thousand, 3-one thousand as best you can) time the period of a pair of waves at the deep end of the pier and then time the period of the same wave pair at the shallow end of the pier. Use pier pilings as reference points for beginning and ending the timed period. How does depth affect period?
- a. wave period is greater in deep water
 - b. wave period is greater in shallow water
 - c. wave period is not affected by depth

29. Time how long it takes a wave to pass 5 pier pilings in deep water and then time how long it takes the same wave to pass 5 pier pilings in shallow water. Which statement is true?
- waves take less time to travel a given distance in deeper water
 - waves take less time to travel a given distance in shallower water
 - depth does not affect how long it takes waves to travel a given distance
30. Watch sea foam as it passes below the pier. In which direction is the longshore current moving?
- right to left (to the south)
 - left to right (to the north)
31. About 400 meters south of the pier is the head of La Jolla Canyon – a large submarine canyon that extends to a depth of over 3000 feet. All the following observations are potentially linked to the presence of the canyon, but which is **NOT** observed from your vantage point?
- the sandy beach ends about 700 meters south of the pier
 - the water color is a deeper blue over the canyon
 - there is no kelp growing in the canyon because the water is too deep

ODDITIES EXHIBIT

DIVE DEEP INTO THE SCRIPPS OCEANOGRAPHIC COLLECTIONS

32. How many sediment cores are in the Scripps collection?
- dozens
 - hundreds
 - thousands
 - millions

CRAB'S EYE VIEW OF A CORAL REEF

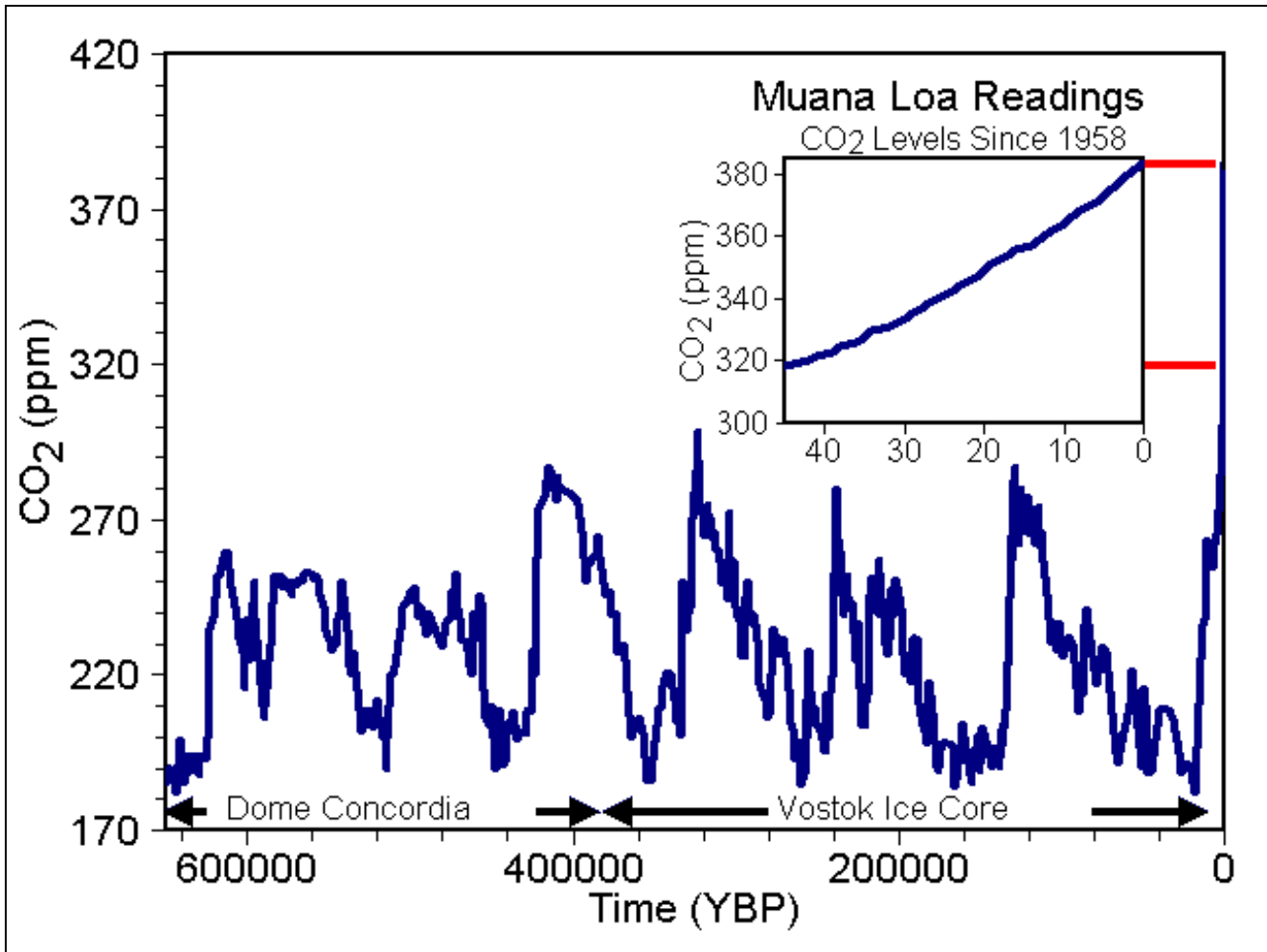
33. What caused the mass coral bleaching events in recent decades?
- ocean warming due to climate change
 - acoustic pollution
 - overfishing in tropical seas
 - tsunamis

CARBONATING OUR OCEANS

34. How much has the acidity of surface waters increased since people began burning fossil fuels?
- 10%
 - 20%
 - 30%
 - 50%
35. From the graph "Evidence of Change" How much has the concentration of CO₂ increased from 1958 to now?
- about 40 ppm
 - about 80 ppm
 - about 120 ppm
 - about 160 ppm

36. The graph showing the increase in CO₂ concentration of from 1958 to the present is one of the most important scientific works of the 20th century. Known as the “Keeling Curve”, after the Scripps scientist that began CO₂ measurements in 1958 atop Muana Loa in Hawaii, it is often considered the “smoking gun” of human-caused climate change. It is, however, but a tiny portion of the graph below showing how CO₂ has varied over the last 650,000 years as measured from ice cores. In the last 650,000 years, when was the last time CO₂ levels were as high as they are today?

- a. 230,000 years ago
- b. 330,000 years ago
- c. 390,000 years ago
- d. never



37. Given that acids have a pH less than 7 and bases have a pH greater than 7, are the oceans currently acidic or basic?

- a. they are slightly acidic
- b. they are slightly basic
- c. they are pH neutral

38. What key component of calcium carbonate shells is removed from seawater by ocean acidification?

- a. calcium
- b. carbonate
- c. silica
- d. phosphorous

EXPEDITION AT SEA

39. What kind of data does a CTD Rosette collect?
- conductivity (a measure of salinity)
 - temperature
 - depth
 - all the above
 - none of the above

MAP SHOWING THE TRACKS OF SCRIPPS RESEARCH VESSELS

40. Which of these ocean regions was **least** explored by Scripps vessels?
- between Hawaii and California
 - the Eastern Pacific near Mexico and Central America
 - the southernmost portions of the Pacific and Indian Oceans

SO MUCH REMAINS TO BE DISCOVERED IN THE DEEP BLUE SEA (specimens on the floor to the far-left of the Cold Water Immersion Suit)

41. Why does the basalt sample have a glassy crust?
- it contained an unusually high concentration of silica
 - it was altered by hydrothermal vents
 - it absorbed siliceous ooze
 - it froze upon contact with ice-cold seawater
42. Note where the Manganese Nodules were dredged. Why would manganese nodules form in that area?
- the depth is well below the calcium carbonate compensation depth
 - the ocean crust is very young in that area
 - the nodules were dredged from a deep ocean trench
 - the nodules were formed by hydrothermal vents

ROBERT SMARGOS EXHIBIT (outside before you get to the Sea Horse Exhibit)

43. Check out the bright yellow WAVE BOUY. How does it measure wave direction and wave energy?
- using GPS
 - using radio triangulation
 - using accelerometers

SEA HORSE EXHIBIT:

44. Which fin type do sea horses use primarily for locomotion?
- pelvic
 - pectoral
 - anal
 - dorsal
 - caudal
45. What do sea horses use their tail for?
- grabbing food
 - holding on to objects so they don't get swept away by currents
 - defense against predators
 - digging holes in the sand