

OCEA-01, The Oceans



SEYMOUR MARINE DISCOVERY CENTER AT LONG MARINE LABORATORY INSTITUTE OF MARINE SCIENCES UNIVERSITY OF CALIFORNIA, SANTA CRUZ

This is the self-guided field trip assignment to the Long Marine Lab/Seymour Discovery center. Call (459-3800) or go online (http://www2.ucsc.edu/seymourcenter/visitor_information.html) to find updated information on hours. *NOTE the center is closed Mondays (including President's Day), but is open weekend days. Allow at least 2-3 hours for your visit.*

Bring your student ID! The Seymour Center is FREE to UCSC students.

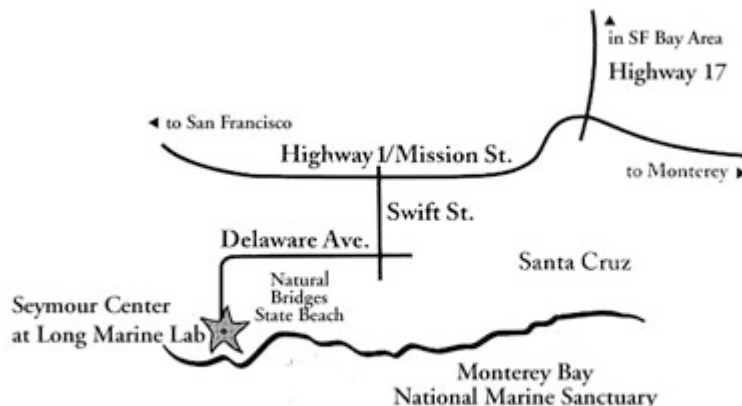
NOTE: YOU MUST SIGN IN

Or you cannot receive credit for this assignment!

You must sign in at the desk as part of this class- the Sign-in list is organized by name.

Getting there:

You can take Metro Bus 20, but it involves a bit of a walk. There is also a UCSC shuttle, information is available at <http://www2.ucsc.edu/taps/lml.html>. Finally, you can go to the LML page http://www2.ucsc.edu/seymourcenter/visitor_information.html for updates on hours, how to get there, etc.



PART –I: Exploring the Discovery Center

The Seymour center is not meant to be mainly an aquarium or a museum, but instead is primarily to teach visitors about the conduct of marine science. It gives a great overview of the diversity of things that marine scientists actually do, and also of some of the ocean research now going on at UCSC. The exhibits are organized into “pods”- which are currently named by colors, each with several examples of scientists and their work and organized around the main themes of doing science in any field: Observations, hypotheses, experiments, and analysis. Explore the parts of each exhibit indicated to answer the following questions.

A) OBSERVATION (The “Orange” Pod)

Marine scientists are good observers—they inspect things carefully, they measure, weigh, and count, and they record what they see. Observation involves looking closely and carefully. Researchers ask, "What's it like?" and "How can I describe it?" Observation includes senses other than sight, including hearing, taste, smell, touch. Scientists count things and measure things such as size, weight, temperature, speed, etc. They notice variables such as the time of day, tides, season, weather, and position. Tools extend a scientist's senses.

First check out the “you can be a researcher” video. It gives a general idea of what its like to be a marine scientist, gather data on field expeditions.

Now enter the looking pod and learn about the kinds of "hands-on" studies that take place in the field. These are different from laboratory or controlled fieldwork studies. Read the quotes in “great moments in science.” Does this sound good? _____. *(if yes, quick change your major!)*

DR. BURNEY LEBOEUF - *Elephant Seal Field Studies*

Elephant seals have fascinated scientists ever since they made a successful comeback from the brink of extinction. Dr. LeBoeuf has studied elephant seal behavior for many years to learn about reproductive behavior, parenting methods, and diving and feeding habits.

Turn the wheel at this exhibit (“year of the seal”) and see what the seals are doing out at Año Nuevo Island at different times of the year. Also listen to the video, and flip up the panels to read some of the research findings.

1. What are the male, female, and pup seals each doing in the current month?
2. How long can Sea Elephants dive? To what maximum depth (in both meters and feet) are they thought to dive?
3. How much do adult male Sea Elephants weigh? At this size, how do researchers actually manage to weigh them?

Note: one of the best times to see Elephant Seals, just up the road at Año Nuevo State Park, is around Valentines Day—you can see the bulls fighting for female harems, check out several hundred animals, and see how Elephant Seal romance works! Info and tour reservations: http://www.parks.ca.gov/?page_id=523

DR. GARY GRIGGS - *Coastal Geologic Processes*

Studying coastal processes involves looking at the same parts of the coast over time and across many seasons to see how it changes. Dr. Griggs studies of coastal cliffs and beaches to visualize, measure, and document erosion. Comparing views of older photos to new ones, summer photos to winter ones, this exhibit shows what's happening along our coast. Look at the flip-pages to see some ways our coastline has changed over the past 100 years. Compare then-and-now photographs of crumbling cliffs at Natural Bridges and Wilder Ranch.

1. How many bridges did Natural Bridges State Beach have when Santa Cruz was founded? When did each collapse?

Now open the Pull drawers below the exhibit.

2) How was the Purisma formation rock thought to have been formed?

3) Pull open the sand drawers and look closely at the different sand samples. Recall the idea of "sources and sinks" from our sediments lecture. Look carefully at sample from Santa Cruz vs. Bay of Naples- hypothesize about the primary reason these sands look so totally different. What can you guess about geology of the mountains or coasts near each location?

DR. JOHN PEARSE - *Tide Pool Ecology: Long-term Observations*

John Pearse has studied life in the intertidal for more than 25 years, returning to the same locations to document how they change—or don't change—over time. Each visit involves the same routine of observation. He uses a transect grid to count and record the plants and animals present.

1. Compare the left and right hand quadrants. (the right should look very familiar!) What are the dominant organisms at each location? How do these locations differ physically?

2. Estimate the percentage cover of aggregating anemones at Davenport Landing using the quadrant method described.

B) Experimentation ("Green" pod)

Marine scientists test everything—they gather samples, do experiments, try things out and watch to see what happens.

Scientists do experiments. They ask, "What happens if we do this...?" They collect data. Some science happens by trial-and-error. Scientists test things initially to learn what they're like. But the most important and focused kind of experimentation is called "hypothesis testing", where scientists formulate a specific idea that it is *possible* to test and get a clear answer. Even if it does not test the entire question you are interested in, it is a way to move forward.

Visit the testing pod to check out some of the tools scientists use to gather samples and run tests. These instruments are invented for investigating life on Earth and are used deep in the depths of the oceans, with marine mammals in water and air, and to sample the environmental toxins that accumulate everywhere.

DR. PEGGY DELANEY - Ocean Drilling Project (ODP)

In the ODP, the JOIDES drillship can drill 9,150 m down—through five miles of water, then a mile or more of mud and rock. The core samples represent a cross-section of the record of deposits on the seafloor over geological time. Dr. Delaney subjects the cores to a wide variety of tests to gather clues to Earth's history. Take a trip back in time to the Cretaceous period to examine what secrets are hidden in the sea floor:

1. How long ago was the Cretaceous period?

2. Check out the flip-board and research findings, and list some of the questions or topics that can be addressed using ancient ocean sediment cores:

The Dynamic Planet – Tracking marine organisms

Animated migrations as tracked by TOPP researchers display on a revolving globe (NOTE: this exhibit is not always turned on—but if it is, you should definitely check it out!)

1. What does TOPP stand for?

2. Go to www.topp.org. When Elephant Seals leave Año Nuevo, where do they go? Where is John Sealwart right now?

DR. RUSS FLEGAL - *Heavy Metals in the Environment*

Dr. Flegal uses a variety of sophisticated instruments to test marine soil and water samples for heavy metals such as lead, copper and chromium. He studies how such elements move through the environment and into the food chain. Metals like lead and copper are some of the most useful elements we know, but when they build up in the air, soil, and water, they can be deadly.

Find out how scientists test for these toxins and where they come from.

1. What kind of objects can leach trace metals into the environment?
2. By what percentage did lead contamination drop from 1973-1988? Why?

C) Analysis ("Purple" Pod)

Marine scientists find answers—they look for patterns in their data and try to figure out what's going on. Scientists look at the data they've accumulated for patterns like repetition, long-term changes, and interactions. Scientists ask questions like "How does this happen?" and "Why?" Scientists use patterns they find as clues to what might be going on. Figuring things out is like detective work or solving a puzzle: you have all the pieces, but how do they fit together to show the whole picture? They try to piece together a scenario that fits and makes sense of the data.

DR. MARY SILVER - *Marine Snow Studies*

For more than 20 years, Mary Silver has been studying marine snow, the tiny bits of dead plant, animal and other material that constantly shower down toward the deep ocean floor. Using a remotely operated vehicle (ROV) to film and collect the snow, Dr. Silver studies its origins and make-up, destination, and role in the marine ecosystem.

Try to count the marine snow in the snow box and see how hard it is. Read about natural historian Ken Norris's cruise to another world with Dr. Silver (in flip pages). These two scientists make quite a pair!

1. Is marine snow primarily organic material or inorganic material?
2. What is the ecological importance of marine snow?

DR. JIM ESTES - *Otter and Killer Whale Interactions*

Dr. Estes has studied the role of sea otters in the coastal ecosystem of Alaska's Aleutian archipelago since the early 1970s. He recently linked the dramatic population decline of sea otters in the 1990s to killer whales that were unable to find enough of their usual seal and sea lion prey.

1. How many sea otters per day is it estimated that it would take to feed a killer whale?
2. Summarize the observations Estes has made which together suggest Killer whales shifted their diet to Otters during this period:

SALMON and ROCKFISH

Salmon and Rockfish are two of the most economically important fish species on the west coast- as well as here on the central coast. Chances are, if you eat fish then you have eaten both of these species many times at restaurants or from fish markets. (Rockfish is often sold as "rock cod"). With ever increasing fishing pressure, managing these fish is a huge challenge. It turns out knowing in detail the life history of each fish, how long they live, and how fast they grow is key. But finding out these things can be very challenging- especially for a species like rockfish that live on the bottom in deep water.

1. Summarize the main *differences* in life history between Salmon and Rockfish:
2. What is an "otolith"? Why are Otoliths useful to scientists studying fish life history?
3. Touch the rings on the interactive otolith model- What was the historical event which occurred the year the 13.5 inch rockfish in the example was born? (does this make you feel any differently about ordering rock cod ? why or why not?)
4. Which species has a faster growth curve (i.e., grows faster)- Salmon, Rockfish, or Humans?

The Great Pacific Garbage Patch

Check out the exhibit on plastics, especially plastic water bottles, and the newly discovered phenomenon that is now being called “the great Pacific Garbage Patch.”

1) Where is the “Patch”. Why is it located where it is (what physical forces create it), and how big is it estimated to be?

2) How many times *more plastic* vs. natural ocean plankton exist in the center of the patch?

3) do you have one of those plastic water bottles with you right now?

PART –II: Aquarium and Touch Tank

Please search among exhibits and aquaria to find the necessary information that will allow you to answer the questions below.

1. Sunflower sea stars have approximately 700 tube feet on each arm.
 - a) How many total tube feet do they have?
 - b) Calculate the sunflower stars rate of movement by using the grid on the tank and timing their movement for one minute across the grid.

2. Compare the kind of stars in the Touch Tank- (Usually there are four -all of these are local starfish, but they generally live below the level of the tide pools we saw on the field trip.) Touch each one and feel its surface- briefly describe the feel of each:

Jewel star:

Leather Star:

Bat star:

Short-spined star:

a) Stars are in a group called **echinoderms**, which means “spiny skin” --which of these stars feels to the touch as though it fits in that category, and which not?

b) What is the special feature of the Short spined star? (Ask the docents about “pedicellaria”, and ask for a demonstration.. but watch out for your arm hairs..!)

3. In the smaller touch tank, usually there is a Gum Boot Chiton, a Sea Cucumber, and several purple sea urchins. Touch them all.

a) Ask the docents: which of these creatures are Echinoderms? For each that is: do they look very related to the stars, or seem to fit in the “spiny skin” category? Ask the docents in what other ways they are similar (i.e., How does its body plan fit with this class of animal?)

b) Ask the docents: which of these are mollusks? For each that is, how does its body plan show its related to other mollusks- (like clams, or banana slugs)- and also what unique features does it have?

4. In the large touch tank, there should usually be three very distinct looking kinds of algae (seaweeds). What are the three main colors of the algae you see?

a) Ask the docents: what accounts for these three very different colors? Which of these algae types you see is the most abundant (important) in local ecosystems, and why?

OPTIONAL:

Go to the Rocky Reef tank. Spend some time observing the Leopard Shark, the Cabezon, and the Monkey-Faced Eel. Look closely at the mouth, head shape, and especially the eyes of each one of these fishes.

Now after carefully considering these three very memorable faces: if you were writing a children's story called "The Cabezon, The Leopard Shark, and The Monkey Faced Eel"; in your story what kind of a character would each of these fish be?

That's it! And on your way out:

Be sure to check out the Blue whale skeleton out front and walk out to the bluff to see the newly reconstructed Grey Whale skeleton.. If you look down into the water, there is a decent chance you'll see a sea otter or two...