WELCOME TO THE LIVING SYSTEMS LAB AND/OR CRUISE PROGRAM

We are pleased that you will be joining us for a Living Systems program! Your students will be embarking on a fun and fascinating exploration of living systems and the biotic and abiotic components that define them. The Living Systems Laboratory is typically combined with the Living Systems Cruise to create a more extensive program but either program can be done separately. If your program includes the boat make sure to read the sections about the boat and have a manifest completed.

In order to better address your needs, we have designed our Living Systems programs to help fourth through sixth grade teachers meet California Science Content Standards. We built our At-Sea Learning Center and re-outfitted the ***R/V Sea Explorer*** to create many new ways for students to experience and investigate a variety of living systems. We are proud to be able to offer your students this one-of-a-kind learning experience, and are pleased that you will be joining us.

Please take a few moments to familiarize yourself with the materials we have included, and share them with other teachers and chaperones who will be joining you. These materials contain important information to prepare you, your chaperones, and your students for your visit. Make sure to link to the 'Required Forms' found just under this 'Prep Pack' link on the web site to find the required Acknowledgement of Risk and Waiver form.

If you have any questions before your program, please do not hesitate to contact our program director, Linda Blanchard at (949) 496-2274, extension 314 for lab questions or Tim Sullivan at (949) 496-2274, extension 315 for boat questions. If you have questions on scheduling, please contact Alexis Honens at (949) 496-2274, extension 610.

Sincerely,
Rick Baker
Vice President of Education

TABLE OF CONTENTS

A. ADMINISTRATIVE CHECKLIST FOR PROGRAM

This preparation package contains information for the *Living Systems Lab* program that takes place in the At Sea Learning Center. Please review the package carefully to ensure that you will be prepared for your program.

Immediately upon receiving your program agreement…
- ❑ Carefully review the Teacher Preparation Package
- ❑ Arrange your transportation
- ❑ Return your signed program agreement and deposit to the Ocean Institute in order to confirm your reservation.

Two months before your trip…
- ❑ Confirm student and adult numbers with the Ocean Institute
- ❑ Arrange for parent chaperones—please limit the number to 2 adults for every 12 students

One month before your trip…
- ❑ Begin student preparation
- ❑ Copy and distribute Acknowledgement of Risk and Waiver to each student and adult participant

Two weeks prior to the trip…
- ❑ Mail program payment to the Ocean Institute—full payment must be received a minimum of 10 days before your program
- ❑ Contact parents to remind them to sign and return the Acknowledgement of Risk and Waiver
- ❑ Collect Acknowledgement of Risk and Waiver from each participant
- ❑ Contact the Ocean Institute with any changes in the number of participants. We cannot guarantee our ability to accommodate changes in numbers of students or adults within two weeks of your program date

One week prior to the trip…
- ❑ Review behavioral expectations with students
- ❑ Distribute Student Clothing and Supply List
- ❑ Contact the Ocean Institute with any last minute questions or changes

24 hours to go!!!…
- ❑ Prepare nametags for students and adults
- ❑ If inclement weather is expected, contact the Ocean Institute for status of the program.
- ❑ Complete ship manifest listing ALL students and adults if you are participating in the Living Systems Cruise.

***When you arrive for the Living Systems Laboratory* program…**
- ❑ Unload the bus in front of the Ocean Institute
- ❑ Check in at the Student Services building with a final head count and all Risk and Waiver forms.
- ❑ If necessary, students may use the restroom facilities that are located within the teaching complex. Please do so quietly so as not to disturb other programs. Then return to the front of the Student Services building to wait for our staff.

OR

When you arrive for the Living Systems Boat Program…
- ❑ Unload the bus in front of the Ocean Institute
- ❑ Check in at the Student Services building with a final head count
- ❑ If necessary, students may use the restroom facilities—please limit use to 7 girls and 7 boys at a time
- ❑ Have your Manifest filled out with the full name of each passenger (including chaperones) for the ***R/V Sea Explorer*** Floating Lab Specialist who will greet you before the program
- ❑ Seasickness remedies should be taken at least 60 minutes before departure

B. DESCRIPTION OF PROGRAM

Living Systems Lab / Cruise Combination Program
The Living Systems Laboratory is typically combined with the Living Systems Cruise to create a more extensive program but they can be done separately. If you choose to combine them, your students should be divided into 2 equal sized groups before you arrive at the Ocean Institute. One group will start with the cruise and the other will start with the lab.

Living Systems Laboratory
The Living Systems Lab will study the interactions between biotic and abiotic components that define our many aquaria as living systems. Students will explore the requirements of a marine aquarium and its inhabitants, examine the internal systems of a fish through a detailed dissection, and determine the water quality of the lab aquariums through a variety of chemical tests. The students will receive a brief group introduction and then will be divided into smaller groups to rotate through the following four lab stations.

- **Investigating Digestion**
  Students observe and identify the external anatomy of a mackerel. They use their observations to generate a hypothesis about mackerel diet. Then, they dissect the mackerel to examine the digestive system and test their hypothesis. Students discuss the effects of the biotic component (digestion) on the aquarium environment (ammonia).

- **Jellies, Biotic Interactions, and the Food Chain**
  Students follow the transfer of energy from its abiotic energy source (the sun) through a food chain that begins with phytoplankton and ends with adult jellyfish. Using microscopes, students examine each successive member of the food chain, how it interacts with its food source, and how it serves as food for the next level.

- **Water Quality in the Ocean Institute Aquaria**
  Students test the abiotic factors, including dissolved oxygen, pH, temperature, and salinity, of the water in a holding tank to determine if local coastal organisms will survive in this tank as part of the Ocean Institute's living collection. If needed, students suggest ways to improve the water quality in the holding tank.

- **Creating an Aquarium Assemblage**
  Student teams of four get a list of animals and must determine which of the animals can live together in an aquarium. Students examine the six animals on their species list and complete data cards. They identify the animals and describe the predator/prey relationships between the animals. They explore the interaction between the abiotic characteristics and biotic components found in an aquarium.

Living Systems Cruise
The two-hour cruise aboard the ***R/V Sea Explorer*** examines local coastal marine populations, introducing students to a variety of scientific equipment used in the collection and study of marine species. The students focus on the examination of offshore ecosystems and organisms, beginning with an observation of marine birds along the jetty wall as the vessel prepares to leave the harbor. Once upon the open ocean, the vessel scouts out sea lions as students discuss marine mammal adaptations, and the staff prepares for deployment of the ship's scientific equipment. If cetaceans (dolphin or whales) are sighted in the area, there are about 20-30 minutes to locate and observe these marine mammals before returning to the harbor for the final three teaching stations. These teaching stations give the students the opportunity to examine the organisms collected during the cruise.

- **The Benthic Grab**
  Students help set the Benthic Grab to collect a sample of mud from the sea floor. Once retrieved, students sort through the sample to identify organisms that live in the mud.

- **The Otter Trawl Net**

Students help set the Otter Trawl Net to collect a sample of the organisms that live on the sea floor. Once retrieved, students sort through the sample and identify organisms and their adaptations for life on the sea floor.

- **The Plankton Net**
  Students help set the Plankton Net to collect a sample of the organisms that drift close to the sea surface. Once retrieved, students observe a sample under a microscope and identify phytoplankton and zooplankton.

  Some of the Living Systems Cruises will have trained adult volunteers onboard to help collect and process samples for collaborative research projects. These projects include a fluorometric analysis of phytoplankton productivity for Scripps Institution of Oceanography, Geographic Information System study of benthic fish populations by Saddleback College, and biotoxin analysis of phytoplankton by the California Department of Public Health.

C. LINKS TO CALIFORNIA CONTENT STANDARDS

Science Standards Addressed during the Living Systems Laboratory/Cruise

Grade Four

Life Sciences

2.a. Students know plants are the primary source of matter and energy entering most food chains.
2.b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in the ecosystem.
2.c. Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.
3.a. Students know ecosystems can be characterized by their living and nonliving components.
3.b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

Investigation and Experimentation

6.f. Students will follow a set of written instructions for a scientific investigation.

Grade Five

Life Sciences

2.a. Students know many multicellular organisms have specialized structures to support the transport of materials.

Investigation and Experimentation

6.f. Students will select appropriate tools and make quantitative observation.
6.g. Students will record data by using appropriate graphic representations and make inferences based on those data.
6.h. Students will draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.

Grade Six

Ecology (Life Sciences)

5.a. Students know energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism through food webs.
5.b. Students know matter is transferred over time from one organism to others in the food web and between organisms and the physical environment.
5.c. Students know populations of organisms can be categorized by the functions they serve in an ecosystem.
5.d. Students know different kinds of organisms may play similar ecological roles in similar biomes.
5.e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

D. ADMINISTRATIVE PREPARATION FOR PROGRAM

ADMINISTRATIVE CONTACT

For questions regarding the *Living Systems Lab* program, please contact:

Linda Blanchard, Director of Lab Programs and Volunteers
Telephone Number: (949) 496-2274, extension 314
E-mail: lblanchard@ocean-institute.org

For questions regarding the Living Systems Cruise or Marine Mammal Cruise, please contact:

Tim Sullivan, At Sea Coordinator
Telephone Number: (949) 496-2274, extension 315
E-mail: tsullivan@ocean-institute.org

For questions regarding scheduling, please contact :
Alexis Honens, Program Reservation Coordinator
Telephone Number : (949) 496-2274, extension 610
E-mail: ahonens@ocean-institute.org

INTRODUCTION

Thank you for choosing the Ocean Institute as your field trip destination. We appreciate the time and effort it takes to prepare your students for their program, and we will do everything we can to make their experience as rewarding as possible.

Please make sure that all of the participating teachers have a copy of these teacher materials. The information contained here can help you find answers to your questions, develop your preparation timeline, and prepare both your students and chaperones. This packet also contains directions to the Ocean Institute as well as contact phone numbers—please call us at any time with any questions you may have about your field trip.

TEACHER INFORMATION: BEFORE THE PROGRAM

You can do several things before you arrive to help make your program run as smoothly as possible:

- Review the program goals, station activities, and expected student behaviors with the students before you arrive. Have them complete the classroom activities, and make sure they have a clear understanding of the educational concepts they will explore during the program.
- Spend some time choosing and preparing your parent chaperones. Review the program goals, station activities, and expected student behaviors with them before you arrive. Make sure that they have a clear understanding of their role as a chaperone.
- Have a signed Acknowledgement of Risk and Waiver for each student and chaperone before boarding the bus.
- Notify the Ocean Institute staff of students with any special health or behavioral considerations.
- Send program payment to the Ocean Institute at least 10 days before the scheduled date of your field trip.
- Have a completed Manifest for the ***R/V Sea Explorer*** if on the boat program.

TEACHER INFORMATION: DURING YOUR PROGRAM
Ocean Institute instructors are all well trained to work with students of different ages and abilities. Both you and the adult chaperones can help the instructors monitor student behavior and safety. There are several things that you can do to help facilitate the smooth running of your educational program:

- Work cooperatively with Ocean Institute instructors and your parent chaperones to manage students during the program.
- Report any problems (including facilities and management) to the Ocean Institute staff as soon as possible.

CHAPERONE INTRODUCTION AND INFORMATION
Adult chaperones play a significant role in safety and the educational quality of the program. We request that you bring no more than 2 adults per 12 students. We ask your chaperones to help us in the following ways:

- Work cooperatively with Ocean Institute instructors and classroom teacher to enforce all safety rules and help keep students on task at the teaching stations.
- Guide students efficiently to different stations throughout the program.
- Act as a positive role model for the students by exhibiting enthusiasm for learning without answering questions directed at students.

PAYMENT
Payment must be received 10 days before your program date. Please mail a **single check** for the total amount of the program minus the deposit you have already paid. Please make checks payable to **Ocean Institute**.

FINAL COUNT
Call the Ocean Institute two days before your program if the number of students or adults changes. When you arrive at the Ocean Institute for your program, you must have an accurate count of total students and adults participating in the program. If the number of participants listed on your Confirmation Form is not accurate, call the Ocean Institute immediately. **We cannot guarantee that changes in numbers of students or adults can be accommodated if requested within two weeks of your program date.**

STUDENT AID
The Ocean Institute maintains a student aid fund for students who are unable to obtain sufficient funding to attend the program. Please call (949) 496-2274, extension 0 for more information and to receive the necessary forms for student aid.

TRANSPORTATION
Student transportation should be arranged well in advance. **It is important that you arrive on time.** Please schedule yourself to arrive at least 15 minutes before your scheduled program start time. If you arrive late, your program time will be shortened.

Buses can unload in front of the Student Services building. After the students have unloaded, the drivers will be notified of where to park the buses and must obtain an Ocean Institute Bus Parking Permit.

STUDENT BEHAVIORAL EXPECTATIONS
Please take time to discuss the academic nature of their field experience with your students before arriving at the Ocean Institute. While at the Ocean Institute, we expect your students to follow the same behavioral rules you have in your classroom.

STUDENT PREPARATION
We have found that the more familiar the students are with program concepts and content before they arrive, the more they will benefit from and enjoy their experience. We have included classroom activities to introduce important concepts to your students before they arrive for their program.

FORM FOR THE LIVING SYSTEMS LAB or CRUISE PROGRAM
Please make sure to have all the completed forms with you upon arrival for your program. These forms are available under 'Required Forms' on the program web page.

Acknowledgement of Risk and Waiver
Each participant must have this form signed by a parent or guardian to participate in the Living Systems Lab or Cruise program. Please make sure that you have one signed form for each student and adult chaperone when you check in with the Ocean Institute staff in the Student Services Building.

Manifest for the *R/V Sea Explorer*
A Manifest for the *R/V Sea Explorer* must be completed if you have scheduled the Living Systems Cruise. The Coast Guard requires us to have a completed Manifest in order to account for all passengers before we leave the dock. Please have it completed before you arrive at the Ocean Institute—we will lose valuable instructional time if the Manifest needs to be completed when you arrive. It is important that the Manifest is accurate and includes the first and last names of ALL students, teachers, and chaperones. Your Ocean Institute Floating Laboratory Specialist will take a head count before boarding the vessel and the number of this count must match the number on the Manifest.

STUDENT CLOTHING AND SUPPLY LIST
For safety reasons, students participating in any Living Systems Series program need to have and/or wear the following clothing. The weather is often cooler at the Ocean Institute than it is inland so make sure your students are prepared.

- ❑ Jacket
- ❑ Long pants
- ❑ Rubber-soled, closed-toe shoes
- ❑ Hat
- ❑ Sunscreen

Optional Items:

- ❑ Camera with film
- ❑ Money for the gift and book store
- ❑ Sunglasses
- ❑ Seasickness remedies for a cruise program

LAURENA G. CHAMBERS GALLERY BOOK AND GIFT STORE

Chambers Gallery Book and Gift Store is a fun and unique non-profit museum store open daily from 9:00 AM to 5:00 PM and definitely worth the visit. The revenue is directed toward lowering tuition for schools that participate in Ocean Institute programs.

To help accommodate all of the schools that would like to shop each day, please have one teacher from your school check-in with a store staff member before your students begin shopping.

There will be a limit on the number of students allowed to shop at one time and we encourage you to organize them so that they all have time to enjoy the shop. Please have one or two adults in the store to help supervise your students. We ask that all food, drink, and backpacks be left outside while they are shopping. Teachers receive a 15% discount in the shop if members of the Teachers Club and 10% normally.

Please remind your students that sales tax will be added to their items.

In order to ensure a positive experience, we recommend the following:

1. Plan sufficient time before or after your program to shop.
2. All purchases should be stowed safely away and out of sight for the program.
3. Please allow only 10-12 students in *Chambers Gallery* Book and Gift Store at a time. Remaining students should remain outside in a manner that does not interfere with traffic in and out of the building.

DIRECTIONS TO THE OCEAN INSTITUTE

The address of Ocean Institute:
24200 Dana Point Harbor Drive
Dana Point, CA 92629
(949) 496-2274

Directions from Los Angeles:

- Travel south on Interstate 5
- Exit on the Pacific Coast Highway Exit
- Stay in the right lane of the exit ramp and go north on P.C.H.
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot

Directions from San Diego:

- Travel north on Interstate 5
- Exit on the Beach Cities Exit
- Stay in the left lane of the ramp and go north on P.C.H.
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot

E. CLASSROOM ACTIVITIES

ACTIVITY #1: *Science Processes*

Introduction
Students locate and describe in their field notes an object in the classroom. They exchange field notes to identify the unknown objects. This will help them practice the scientific process of observing, comparing, and communicating.

Materials
- ❑ Paper and pencils

Background
Observing: The scientific thinking process from which fundamental patterns of the world are constructed.
Communicating: The scientific thinking process that conveys ideas through social interchanges.
Comparing: The scientific thinking process that deals with concepts of similarities and differences.

Student Challenge
You are scientists who have observed an unidentified organism during your field research. If you carefully describe it, other scientists will be able to identify the organism based on your field notes.

Procedure
1. Choose an object in your classroom and describe it in your field notes. Be as descriptive as you can without actually identifying it. You may also wish to sketch it.

2. When you have completed your field notes, swap your description with that of another scientist. Try to identify the unknown object based on their observations!

3. Were you able to identify the object that was described by another scientist? Were you surprised at the details you noticed about the object? Have you ever used these skills before in your science classes?

ACTIVITY #2: *Pit—The Food Chain Game*

Introduction
Students play a game that illustrates the food chain

Materials
- ❑ Pit Cards
- ❑ Rope to mark the **Pit**

Background
We are all part of a large food web. Food chains are the sequence of organisms in which each is food for the next organism in the sequence (i.e., grass-mouse-snake-hawk). The simple links of a food chain create a web. At the beginning of the food chain is the ultimate source of energy, the sun. Plants take sunlight and convert it to edible energy. Then the hunt is on, beginning with the herbivores munching on plants only to satisfy the appetites of carnivores. The most important link that ties life and death together is the community of decomposers. They break down the nutrients so that plants may use them to grow.

Overview of the Game
There are eight equal teams of students. Each team has a home base on the playing field. In the center of the playing field is the "Pit", a marked off trading area. Each team gets a set of eight cards of the same animal (eight squid or eight sharks). When the trading pit opens, one student runs into the pit with one card held down yelling "trade!" The students exchange cards and run back to home base without looking at the card. When they get to their home base, they decide to keep the card or trade again. Students can only trade one card at a time. The goal is to collect eight cards that form a complete food chain.

Student Challenge
Collect eight cards that form a complete food chain.

Procedure

1. Have your students form a large circle.

2. Set out the eight cards of one food chain in the middle of the circle. They should be out of order. Ask one student to find the first card in the chain. Ask another volunteer to find the second card in the chain. Go until the cards are put in order.

3. Repeat step two with the other food chain. This is a great way to help kids familiarize themselves with the cards and the food chain concept.

4. Explain the ***Pit*** Rules before going outside, giving a demonstration helps alleviate any confusion.

***Pit* Rules**

1. Only one student can bring a card to the trading pit.

2. The card must be held upside down in the trading pit. If it is not, the student must stay in the pit for 10 seconds before going back. This cuts their trading time.

3. A student can only trade once in the pit before heading to home base.

4. The team that collects all the cards first yells “food chain!” and trading stops.

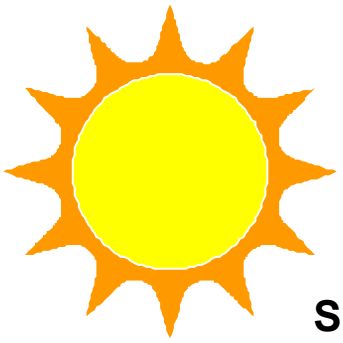
5. All the other teams must create a food chain with the cards they have. Ten points will be given for each card correctly placed.

6. The game continues with the second set of cards.

7. Play the game.

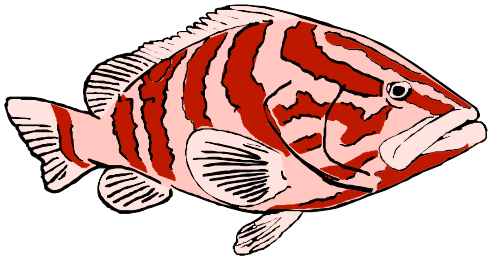
Pit—The Food Chain Game: Marine Food Chain #1

Answer: Sun→Phytoplankton→Zooplankton→Featherduster Worms→Anchovy→Sea Bass→Dolphin→Shark

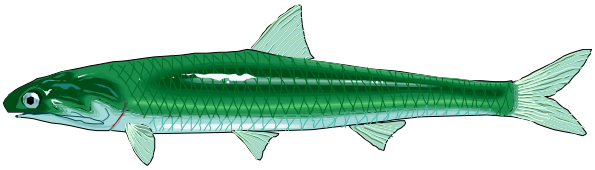


Sun

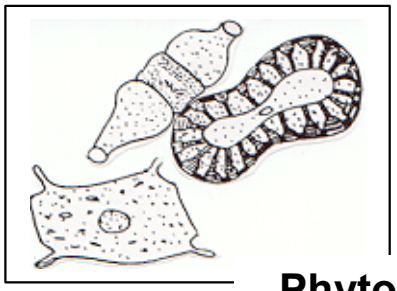
Sea Bass



Great White Shark



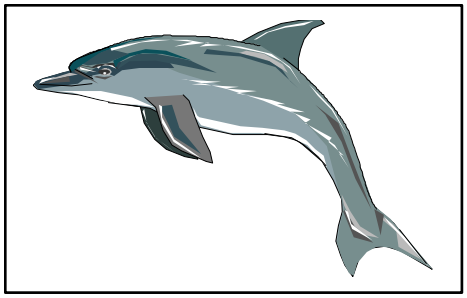
Anchovy



Phytoplankton

Featherduster Worms

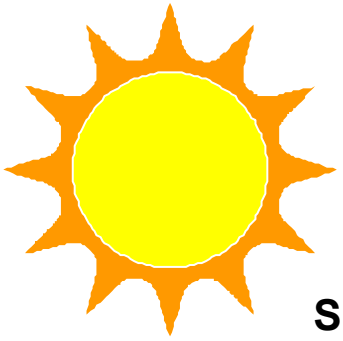
Zooplankton



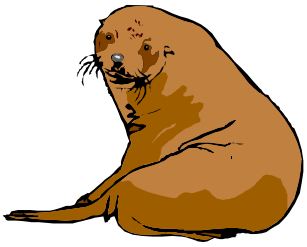
Bottlenose Dolphin

Pit—The Food Chain Game: Marine Food Chain #2

Answer: Sun→Phytoplankton→Zooplankton→Featherduster Worms→Squid→Mackerel→Sea Lion→Orca

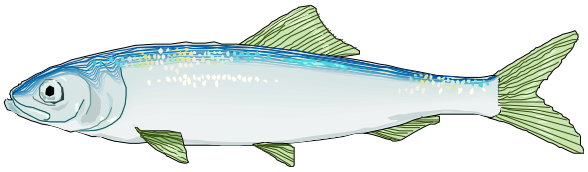


Sun

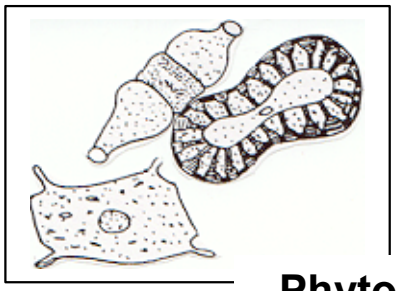


Sea Lion

Squid



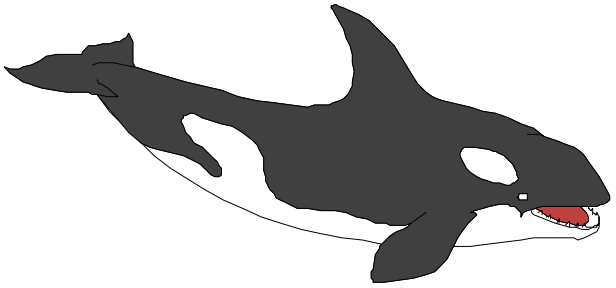
Mackerel



Phytoplankton

Featherduster Worms

Zooplankton



Orca

