

## WELCOME TO THE ADVANCED PROGRAMS AND INTERNSHIPS

One of our most exciting program offerings is our High School Certification Program. Participating high school students can choose from several options and create their own program. When their program is completed they will have achieved two goals; their community service requirement will be met, and they will be eligible to work at the Ocean Institute as an intern side-by-side with our instructors.

As usual, we still offer our classic Advanced Floating Laboratory on the *R/V Sea Explorer*. This program has grown now to include some exciting new technology including a CTD for water chemistry and a new hydrophone. The Floating Laboratory program teaches applications of marine science through hands-on sampling and analysis. The program is designed to help students apply scientific thinking processes and skills learned in the classroom to their offshore field experience.

This is the preparation package for our Advanced Programs. All of our instructors have degrees in marine science or a related field and are trained educators. Please take the time to communicate the academic nature of this trip to your students and chaperones. The enclosed checklist will assist you in the sequence and timing of your preparation.

If you have any additional questions, please call the Ocean Institute.

Rick Baker  
Senior Program Director, Science  
Ocean Institute



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## A. ADMINISTRATIVE CHECKLIST FOR PROGRAMS

This preparation package contains information for our Advanced Programs. Some of the information may not apply to the program that you have scheduled. Please review the package carefully to ensure that you will be prepared for your program.

### ***Immediately upon receiving this package...***

- Carefully review the Teacher Preparation Package
- Arrange your transportation

### ***Two months prior to your trip...***

- Confirm student and adult numbers with the Ocean Institute
- Arrange for parent chaperones—please limit the number to 2 adults per 12 students

### ***One month prior to your trip...***

- Begin student preparation
- Copy and distribute Acknowledgement of Risk and Waiver to each participant, including adult chaperones and teachers

### ***Two weeks prior to your trip...***

- Mail program payment to the Ocean Institute—full payment must be received a minimum of 10 days before your program
- Collect Acknowledgement of Risk and Waiver from each participant
- Contact parents to remind them to sign and return the Acknowledgement of Risk and Waiver

**Note:** We cannot guarantee that changes in numbers of students or adults can be accommodated if requested within 2 weeks of your program date

### ***One week prior to your 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!!!...***

- If inclement weather is expected, contact the Ocean Institute for status of the program
- Prepare nametags for students and adults
- Complete ship manifest listing ALL students and adults

### ***When you arrive for your 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 names of all passengers (including chaperones) for the ***R/V Sea Explorer*** Specialist, who will greet you before the program. The Manifest is in the Appendix
- Seasickness remedies should be taken at least 30 minutes prior to departure

## B. PROGRAM DESCRIPTIONS

### ADVANCED FLOATING LABORATORY

The Advanced Floating Laboratory program offers a catalog of time-tested, student-led activities. The program provides an introduction to biological, chemical, and geological sampling techniques using a broad range of sampling equipment. Student oceanographers apply sampling and research protocols for water quality and biological monitoring.

- **Navigation and Weather**

This station introduces students to one aspect of data collection at sea. They use a wind meter, a Beaufort scale, cloud formation chart, and a barometer to monitor the weather off of Dana Point throughout their trip. Latitude and longitude are calculated by triangulating compass bearings. This information is a necessary part of the data collection process in any field research scenario.

- **Secchi Disk / Forel-Ule**

Students observe and record water clarity with a secchi disk. The ocean is a dynamic, complex living system. Warm water currents can cause upwelling, which introduces nutrients to the upper level, or photic zone, of the water column. This reduces water clarity because of phytoplankton blooms and suspended particulate matter. Numerical values are assigned to track the changes in clarity. The ocean color ranges from brown red to green to sapphire blue. Each color provides clues to the agents that are suspended in the water column. In addition to the data provided by these two pieces of equipment, plankton is collected with a specialized net. Together, these pieces of information begin to form a picture of the ocean dynamics for that day.

- **Water Chemistry**

Students collect data about the water column by retrieving water samples with a Van Dorn bottle. Each group tests a sample from a specified depth. They gather data about the pH, salinity, dissolved oxygen, and temperature. The data is compared to the values received by the Hydrolab probe and discussed during the conclusion. Students interpret their results and discuss any deviations that are found.

- **Fish Identification and Biogeography**

The *R/V Sea Explorer* is equipped with several otter trawl nets. Students identify two species of fish using dichotomous keys. They record their length and physical features. Once the fish have been identified, students research their typical range to determine if their presence off the Orange County coastline is "normal." Abnormal weather patterns, such as El Niño or La Niña, set off a chain of events that can severely affect local fish populations. Fish species that are found out of their typical range can be considered biological indicators of these weather conditions.

- **Benthic Invertebrate Identification**

Organisms that live in the sediment play several important roles in the ocean environment. They aid in the process of decomposition, are part of the marine food web, and can be used as biological indicators. Students separate and identify several macroinvertebrate species. They describe the role that each animal plays in the marine environment and any notable adaptations that ensure its survival.

- **Plankton and Foram Identification**

Plankton are plants (phytoplankton) and animals (zooplankton) that drift on ocean currents. Phytoplankton are found in the upper level of the water column because they require sunlight to photosynthesize. Zooplankton are found at the same level because of the abundance of food. Students manipulate a live sample of plankton under a video microscope, identify specific organisms, and record their observations. Sieves are used to isolate microfossils known as forams. These protists can indicate fossil fuel deposits as well as record information about past climates. Students use the microscopes in the wet lab to identify their specimens.

## HIGH SCHOOL CERTIFICATION PROGRAM

The High School Certification Program provides motivated students with in-depth training in research techniques, biology, ecology, and water quality monitoring that are required of Ocean Institute Interns. Students begin with the 6-hour survey course that introduces research aboard the *R/V Sea Explorer*, in the Dana Point Marine Life Refuge, and in our laboratories. Interested students may then complete three additional elective courses and a 3-hour practicum in the specialty area of their choice. Upon completion of these courses, students are offered intern positions that meet community service hour requirements for graduation.

### Survey Course: Laboratory (2 hours)

- **Dissection**

Students complete an exploration of the internal anatomy of a pacific mackerel. The dissection focuses on the circulatory, respiratory, digestive, and excretory systems. Students examine blood samples, gill filaments, and stomach contents with a microscope and litmus paper to further their understanding of these systems, and conclude by filling out a necropsy report on the organism.

- **Water Quality in our Aquariums**

Students examine the filtration systems of our tanks, and determine respiration requirements of organisms in our aquariums. Students will conduct tests to measure the pH, salinity, temperature, nitrogen, phosphate, ammonia and dissolved oxygen levels of our tanks and discuss the effects of each of these measurements on the organisms in the tanks.

- **Identification, Classification and Organism Diversity**

Students use dichotomous keys and field guides to identify and classify tank organisms and determine the diet and habitat of each species.

### Survey Course: *R/V Sea Explorer* (2 hours)

- **Research Trawl**

Instructors and students deploy the otter trawl nets along a designated research transect in order to track a range of impacts on the epifauna populations. Students from each team record depth and time coordinates for the research cover sheet. All participants assist the Ocean Institute volunteers in sorting, counting, and identifying the specimens.

- **Benthic Ecology**

Students participate in an environmental monitoring project that includes identifying local infauna at select sites. Ocean Institute instructors deploy a Peterson Grab and retrieve a sample of benthic sediment. Students wash the sample through sieves and identify the invertebrates in order to track changes in populations, biodiversity, and habitat integrity.

- **Plankton Populations**

Students observe phytoplankton and zooplankton collected with a vertical tow net. If there appears to be a plankton bloom, students record species and population numbers. If biotoxins are detected, students prepare a sample for the Health Department.

- **Marine Mammal Bioacoustics**

Several species of whales and dolphin are frequently seen off the coast of Dana Point. Students may encounter these animals and have the opportunity to learn about their natural history as well as their methods of communication. *R/V Sea Explorer* is proud to introduce an acoustic array that allows us to record and analyze their vocalizations. Students log the location, depth, and pod characteristics in our Marine Mammal log.

### Survey Course: Dana Point Marine Life Refuge (2 hours)

- **Introduction to the Marine Life Refuge**

Instructors introduce students to the Dana Point Marine Life Refuge, focusing on zonation and research techniques. Students learn about the organisms that dwell in the intertidal ecosystem and their adaptations for survival in a harsh environment.

- **Water Chemistry/Quality**  
Students analyze the physical and chemical properties of a water sample. They will conduct tests to determine pH, dissolved oxygen, nitrate, phosphate, temperature, and salinity levels. Students discuss their results, the impact these factors have on organisms, and decide on the overall state of the water quality in the Dana Point Marine Life Refuge.
- **Quadrats and Transects in the Refuge**  
Students use transect meter tapes and half-meter quadrats to conduct an official population survey in one of the five designated research sites in the Dana Point Marine Life Refuge.

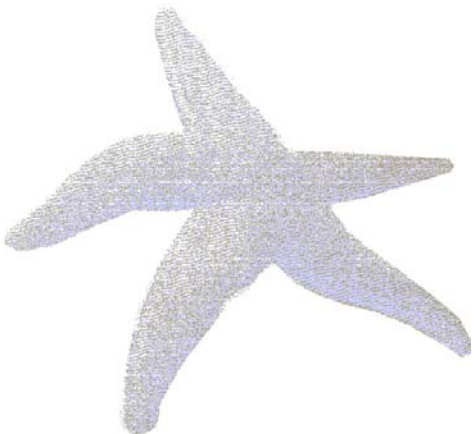
### **ELECTIVE SERIES**

The Elective Series includes the following courses (additional courses will be available in the future):

- **Southern California Fish Identification**  
The class uses slides, video, live observations, and preserved specimens to learn how to identify local fish species. Students use field guides and dichotomous keys to complete the course datasheet.
- **Survey of Marine Mammals**  
This course focuses on identification, natural history, and current issues that are affecting marine mammals. We discuss deep diving, acoustic adaptations, and thermal adaptations. Laboratory demonstrations are incorporated into the program.
- **Introduction to Invertebrate Diversity**  
Students are introduced to taxonomy by classifying our aquarium fauna into phyla. Each lab team identifies the tank invertebrates using field guides, keys, and observation.

### **PRACTICUM**

This is the final stage in training for the internship program. After successfully completing three electives, students will sign up for a three hour practicum in the area of their choosing: intertidal research, animal husbandry, or on board the R/V Sea Explorer. Students will learn the skills necessary for interning, including research protocols in each area, and information about the projects that they will be involved in. In addition to standard tasks and staff assistance, each intern will be responsible for organizing and initiating an individual project, which they will work on throughout their internship—making observations, gathering data, reaching a conclusion, and creating a presentation to share their findings with their peers in a mini-symposium setting.



## C. LINKS TO CONTENT STANDARDS

### ADVANCED FLOATING LABORATORY

#### Earth Sciences

##### **Energy in the Earth System**

- 5.d. Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographical distribution of marine organisms.
- 5.g. Students know features of ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.

#### Chemistry

##### **Acids and Bases**

- 5.b. Students know acids are hydrogen-ion-donating and bases are hydrogen-ion-accepting substances.
- 5.d. Students know how to use the pH scale to characterize acid and base solutions.
- 5.g. Students know buffers stabilize pH in acid-base reactions.

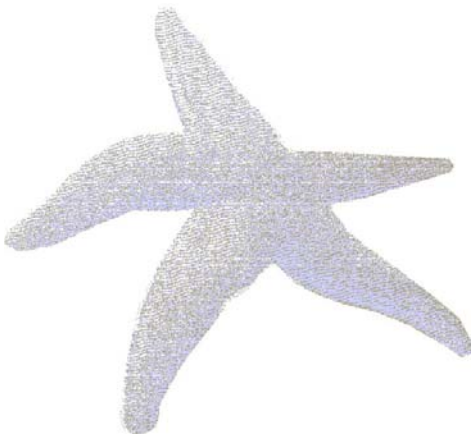
#### Biology/Life Sciences

##### **Ecology**

- 6.a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
- 6.b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
- 6.e. Students know a vital part of an ecosystem is the stability of its producers and decomposers.

#### Investigation and Experimentation

- 1.a. Students select appropriate tools and technology to perform tests, collect data, analyze relationships, and display data.
- 1.c. Students identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- 1.d. Students formulate explanations by using logic and evidence.
- 1.k. Students recognize the cumulative nature of scientific evidence.
- 1.l. Students analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- 1.n. Students know when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent and that the theory is sometimes wrong.



**HIGH SCHOOL CERTIFICATION PROGRAM****Chemistry****Acids and Bases**

5.d. Students know how to use the pH scale to characterize acid and base solutions.

**Biology/Life Sciences****Genetics**

- 2.a. Students know meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.
- 2.d. Students know new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).

**Ecology**

- 6.a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
- 6.b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
- 6.c. Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
- 6.e. Students know a vital part of an ecosystem is the stability of its producers and decomposers.
- 6.g. Students know how to distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change.

**Evolution**

- 7.d. Students know variation within a species increases the likelihood that at least some members of a species will survive under changes environmental conditions.
- 8.a. Students know how natural selection determines the differential survival of groups of organisms.
- 8.b. Students know the effects of genetic drift on the diversity of organisms in a population.
- 8.d. Students know reproductive or geographic isolation affects speciation.

**Investigation and Experimentation**

- 1.a. Students select appropriate tools and technology to perform tests, collect data, analyze relationships, and display data.
- 1.c. Students identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- 1.d. Students formulate explanations by using logic and evidence.
- 1.k. Students recognize the cumulative nature of scientific evidence.
- 1.l. Students analyze situations and solve problems that require combining and applying concepts from more than one area of science.



## D. ADMINISTRATIVE PREPARATION FOR PROGRAMS

### ADMINISTRATIVE CONTACT

For questions regarding the Advanced Programs, please contact:

Tim Sullivan, At Sea Coordinator  
Telephone Number: (949) 496-2274, extension 315  
E-mail: [tsullivan@ocean-institute.org](mailto:tsullivan@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 telephone numbers—please call us at any time with 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. 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.
- Have a completed Manifest for the *R/V Sea Explorer*.
- 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.

### TEACHER INFORMATION: DURING THE PROGRAM

Ocean Institute instructors are all well trained to instruct students of different ages and abilities. You and the chaperones can help the instructors monitor student behavior and safety. There are several things you can do to facilitate the smooth running of your educational program:

- Work cooperatively with Ocean Institute instructors and parent chaperones to manage students during the program.
- Work cooperatively with Ocean Institute instructors and parent chaperones to solve student and chaperone management problems.
- Report any problems 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.
- Work cooperatively with Ocean Institute instructors and classroom teacher to keep students on task at the stations.
- Guide students 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 the check 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 Program Agreement 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 2 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.

## FORMS

All of the following forms can be found in the Appendix. Please make sure to have all the completed forms with you upon arrival for your program.

### **Acknowledgement of Risk and Waiver**

Each student must have this form signed by a parent or guardian to participate in the programs. Please make sure that you have one signed form for each student and adult chaperone when you check in with Ocean Institute Staff.

### **Manifest for the *R/V Sea Explorer***

A Manifest for the *R/V Sea Explorer* must be completed before the program can begin. 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 BEHAVIORAL EXPECTATIONS**

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

**STUDENT SAFETY RULES**

The Advanced Floating Laboratory and portions of the High School Certification Program take place on the *R/V Sea Explorer*. When you arrive at the Ocean Institute, you will be met by an Ocean Institute Floating Laboratory Specialist who will review the following safety rules with you and your students.

- Walk at all times while onboard the *R/V Sea Explorer*—running and horseplay are not permitted
- Keep both feet on the deck at all times, and remember to stay off the rails
- Keep off the upper deck and access ladder unless permitted by Ocean Institute instructors
- Keep hands off the equipment until instructed to do otherwise

**STUDENT CLOTHING AND SUPPLY LIST**

For safety reasons, students participating in the Advanced Programs need to have and/or wear the following clothing.

- Jacket
- Rubber-soled, closed-toe shoes
- Hat
- Sunscreen

Optional Items:

- Camera with film
- Money for the gift and book store
- Seasickness medication

**AVOIDING SEASICKNESS**

There are several things that you and your students can do to avoid seasickness during your cruise:

- Eat a good breakfast or lunch before the cruise—make sure that you avoid sweets and greasy foods!
- Take anti-motion medication at least 30 minutes before boarding the vessel

**CHAMBERS GIFT AND BOOK STORE**

The Chambers Gift and Book Store is a non-profit museum store open daily from 9:00 AM to 5:00 PM. The revenue is directed toward lowering tuition for schools that participate in Ocean Institute programs. You and your class are encouraged to visit the store. To accommodate all of the schools that plan to shop each day, 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 as well as a three-minute time limit for each student. This is to ensure that all of your students will have time to shop. Please have two or three chaperones in the store to help supervise your students. One chaperone should stand at the door to monitor the students waiting in line. The other two adults should supervise the shoppers and remind them that they must make their selections quickly. Please ask the students to leave food, drinks, and backpacks outside with a friend while they are shopping, and remind them that sales tax will be added to their items.

**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

