

WELCOME TO THE *JUNIOR SCIENTIFIC LITERASEA LAB* PROGRAM

Welcome to the Ocean Institute's *Junior Scientific LiteraSEA Lab* program! Consulting scientific literature before conducting an investigation is a common practice among scientists. During this two-hour program, students are introduced to "very kid-friendly" scientific papers that lead them down an exciting road of discovery. We have developed this innovative program to assist second and third grade teachers in meeting Language Arts and Science Content Standards.

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. To prepare your students, please print the scientific papers that can be found on pages 10 – 18 of this Teacher Materials packet and review them with your students. These papers will be the basis for the four activity stations we will be doing during this program. 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.

We are excited to present to you our *Junior Scientific LiteraSEA Lab* program and are pleased that you'll be joining us. 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. If you have questions on scheduling, please contact Alexis Honens at (949) 496-2274, extension 610.

Sincerely,
Rick Baker
Vice President of Education

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A. ADMINISTRATIVE CHECKLIST FOR PROGRAM

This preparation package contains information for the *Junior Scientific LiteraSEA Lab* program that takes place in the Ecology 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
- Collect Acknowledgement of Risk and Waiver from each participant
- Contact parents to remind them to sign and return the Acknowledgement of Risk and Waiver
- 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
- Read the scientific papers to your 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

When you arrive for your Junior Scientific LiteraSEA Lab 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. Return to the front of the Student Services building to wait for our staff.

B. DESCRIPTION OF PROGRAM

Consulting scientific literature before conducting an investigation is a common practice among scientists. During this program, students are introduced to “very kid-friendly” scientific papers that lead them down an exciting road of discovery. The stations have been carefully designed to include second and third grade science standards. This program emphasizes the importance of reading as part of the scientific process. **Please read the scientific papers to your students before arriving for the program.**

Students will be divided into groups and rotate through four stations.

- **Squid Dissection: “Reproductive Success of Squid Before Being Caught”**
It has been noted that the squid population seems to be decreasing. Squid live for two years before they reproduce and die. Fishermen catch squid as they congregate to mate and lay their eggs. They must catch the squid before they die. Are the squid being caught before they have the chance to reproduce, or is there another problem? Students dissect squid to determine how many of the squid had a chance to reproduce before they were caught. After this data is collected and discussed, the dissection will continue with an exploration of the adaptations of squid.
- **Seasonal Change: “Winter Storm Waves and Their Effect on the Number of Organisms in Shallow Rocky Reefs”**
Plants and animals are adapted to survive under a number of harsh conditions. During this simplified study, students sort two samples of shells, crab molts, dry seaweed, and other artifacts to determine number and type. This data is graphed on a simple bar graph to discuss the adaptations of different organisms to seasonal changes.
- **Life Cycles: “The Relationship of Season to Larval Animals in Plankton Samples”**
Students explore the life cycles of ocean animals in the Ocean Institute tanks. They learn that organisms produce offspring of their own kind and that, while some offspring resemble their parents, others look very unlike the adult forms into which they develop. Students view the adult animals with the wet table camera systems, use microscopes to observe their larval planktonic forms, and study plankton samples.
- **Adaptations for Defense: “Common Defense Mechanism of Plants and Animals of Southern California”**
Students use the Discovery Pool and Think Tank to study adaptations of marine organisms. They identify organisms with simplified field guides and observe their defense mechanisms. Defensive strategies, including camouflage, hiding, hard spines, and hard shells, will be noted. Several species of animals may be touched. Students record and analyze their findings to determine which strategy is the most common among plants and animals of southern California.

C. LINKS TO CALIFORNIA CONTENT STANDARDS

Grade Two**Science Standards**Life Sciences

- 2.a. Students know that organisms reproduce offspring of their own kind and that the offspring resemble their parents and one another.
- 2.c. Students know many characteristics of an organism are inherited from the parents. Some characteristics are caused or influenced by the environment.

Investigation and Experimentation

- 4.a. Make predictions based on observed patterns and not random guessing.
- 4.e. Construct bar graphs to record data, using appropriately labeled axes.
- 4.f. Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.
- 4.g. Follow oral instructions for a scientific investigation.

English-Language Arts StandardsReading Comprehension*Comprehension and Analysis of Grade-Level-Appropriate Text*

- 2.2 State the purpose in reading (i.e., tell what information is sought).
- 2.4 Ask clarifying questions about essential textual elements of exposition (e.g., *why*, *what if*, *how*).
- 2.5 Restate facts and details in the text to clarify and organize ideas.
- 2.6 Recognize cause-and-effect relationships in a text.

Grade Three**Science Standards**Life Sciences

- 3.a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.
- 3.b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
- 3.d. Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.

English-Language Arts StandardsReading Comprehension*Comprehension and Analysis of Grade-Level-Appropriate Text*

- 2.3. Demonstrate comprehension by identifying answers in the text.
- 2.4. Recall major points in the text and make and modify predictions about forthcoming information.
- 2.6. Extract appropriate and significant information from the text, including problems and solutions.

Literary Response and Analysis*Structural Features of Literature*

- 3.1. Distinguish common forms of literature (e.g., poetry, drama, fiction, nonfiction).

Narrative Analysis of Grade-Level-Appropriate Text

- 3.4. Determine the underlying theme or author's message in fiction and nonfiction text.

D. ADMINISTRATIVE PREPARATION FOR PROGRAM

ADMINISTRATIVE CONTACT

For questions regarding the *Junior Scientific LiteraSEA 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 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. Read the scientific papers to your students 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.

TEACHER INFORMATION: DURING THE 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.
- Work cooperatively with Ocean Institute instructors and your parent chaperones to solve student and chaperone management problems.

- Report any problems (including facilities and management) to the Ocean Institute staff as soon as possible.
- Spend a few minutes completing a program evaluation at the end of the program.

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.
- The rooms are crowded and noisy. Please make sure your chaperones know that the instructors need a certain amount of teaching space in order to distribute materials to students and effectively teach. Please ask your chaperones to turn off their cell phones and to not carry on conversations with each other that add additional noise.

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 retrieve 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. **Please make sure that the students are familiar with the scientific papers.**

FORM FOR THE JUNIOR SCIENTIFIC LITERASEA LAB PROGRAM

Please make sure to have all the completed forms with you upon arrival for your program.

Acknowledgement of Risk and Waiver

Each participant must have this form signed by a parent or guardian to participate in the *Junior Scientific LiteraSEA Lab* 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. This form is available under 'Required Forms' on the program web page.

STUDENT CLOTHING AND SUPPLY LIST

For safety reasons, students participating in the *Junior Scientific LiteraSEA Lab* 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
- Rubber-soled, closed-toe shoes

Optional Items:

- Money for the gift and book store

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 Pacific Coast Highway
- 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 Pacific Coast Highway
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot

E. JUNIOR SCIENTIFIC LITERASEA PAPERS

Attachment Research Paper

Winter Storm Waves and their Effect on the Number of Organisms in Shallow Rocky Reefs

Introduction

There are seasonal changes in the ocean just as there are seasonal changes on the land. For example, the water temperature is colder during the winter and warmer during the summer. Also, in southern California, large storms occur in winter while the ocean is calmer during the summer. Winter storms create large waves that affect both the shoreline and the deeper water. Waves cause a back and forth movement, called a **surge**, deep in the water. If the waves are bigger, the surge is felt deeper in the ocean.

This surge can pull plants and bottom animals off the rocks, and some things, like kelp and sea fans, cannot reattach. Bottom animals have different ways to stay attached to the rocks. This means that they have **attachment strategies**. They can use a muscular foot, tube feet, or they can hide in cracks. Although these animals have attachment strategies, they can still be pulled from the rocks and tossed around in the surge. If the animal does not reattach to the rock, it can be smashed and killed.

This study will look at the survival of shallow rocky reef plants and animals affected by the surge of severe winter storm waves. The study counts the remains of plants and animals that have died during calm summer months and the plants and animals that have died during stormy winter months. We will use this information to answer two questions. First, we want to know if there is a difference in the counts between winter and summer. Second, we want to know if surge caused this difference. Upon further investigation, we will answer an additional question: Which is the most successful adaptation against surge from winter waves?

Methods

Field Sampling Equipment:

1. Meter measuring tape
2. SCUBA gear
3. Collecting bags

Definition of terms:

Tube feet – A tubular projection ending in a suction cup that is used to move in sea stars, sea urchins, and sea cucumbers.

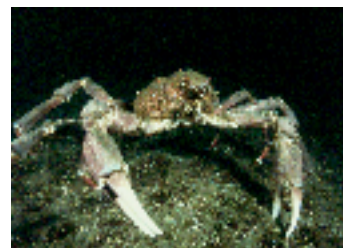
Muscular foot – The bottom of a snail that is flat and muscular to form a creeping sole, or foot, able to move and hold on to a surface.



Permanent attachment – Organisms that cannot move once attached. Examples of ways used to attach are glue, cement, and holdfasts.



Jointed legs – Legs of crabs and their relatives with exoskeletons that are hinged for movement.



Sampling Procedure (occurs before program)

1. Rocky reefs were selected in open coastline areas that are affected by winter storms. These reefs were between 20 and 35 feet deep.
2. All dead plants and animals were collected from a 5-meter area around the reef by SCUBA divers.
3. Summer samples were taken during a calm period in August, and winter samples were taken in March after a very stormy period.
4. All samples were dried for study in the lab.

Study Procedure

Student researchers will:

1. Work on either the winter or the summer sample.
2. Sort the dry specimens according to scientific classes. For example, snails, bivalves, sea stars, sea urchins, seaweed, crabs, barnacles, and sea fans.
3. Count the specimens in each group and put the results on the data sheet.
4. Use this data to make a bar graph for the final results.

Further investigation: (Time permitting)

1. Re-sort the specimens according to attachment types. For example: permanent attachment, muscular foot, tube feet, and jointed legs.
2. Count the specimens in each group and put the results on the data sheet.

Results

Class will supply results during scheduled program.

Defense Adaptations Research Paper

Common Defense Mechanism of Plants and Animals of Southern California

Introduction

Plants and animals have many types of adaptations to help them survive. Different species of animals use different strategies for survival. Some of these adaptations help the animals defend themselves from **predators**, the animals that eat them. These strategies are called **defense strategies**. Some animals may hide so their predators will not be able to see them. Other animals may be hard or spiny so they are not easy to eat.

In this study, we will look at the defense strategies of some of the plants and animals found in southern California. We will observe samples that have been collected by the Ocean Institute staff. We will use field guides to identify the plants and animals.

The different defense strategies that will be identified and categorized include camouflage, spines, hard outer surface, pinching or biting, stinging cells or poison, hiding and disruptive coloration. After observing and collecting data on the animals, we will determine the most common defense adaptation.

Methods

Definition of terms:

Adaptations – Characteristics that help plants and animals survive in their environment.

Camouflage – An organism's protective coloration that enables it to blend in with its environment.



Disruptive coloration – Spots and stripes break up the body shape.

Hiding – Not seen because of physical location. For example, under sand, under rock, in crevices.



Hard – Hard outer coat may be a shell or exoskeleton (protective hard outer “shell” of organism including crabs, lobsters, and insects).



Spiny – Hard projections.



Poison and stinging cells – Chemicals that cause pain or death. Stinging cells inject poison.



Pinching or biting – Using a claw or claw-like part or mouth.

Sample

- The aquarists have collected the specimens in the Ocean Institute tanks from the local waters off Dana Point. They represent the common local species.

Study Procedures

Student researchers will:

1. Use field guides to identify plants and animals on their list.
2. Find and observe these organisms in the tanks.
3. Decide what defense adaptations it has.
4. Record results on the data board.

Results

Class will supply results during scheduled program.

Life Cycles Research Paper

Larval Animals in Plankton Samples

Introduction

This study will explore the life cycles of animals that live in the ocean. We will study sea stars, sea urchins, sea snails, and crabs. These animals go through a larval stage, and the larva of each animal does not look like the adult animal. When these animals are in the **larval stage**, they drift with the ocean currents. They are called **plankton** because they drift with the current. By studying a plankton sample, we can learn if a certain species of animal has reproduced. When animals produce offspring, it is called **reproduction**.

Most animals reproduce during specific seasons, not all year long. We will study larval stages of animals to determine which animals have recently reproduced.

During this study, you will observe plankton samples collected on the research vessel **Sea Explorer**. Samples of ocean water will be collected off Dana Point, and research will focus on when (the time of year) and what (the type of animal) larval forms are found. You will use pictures and microscope slides of the animals to identify different species of plankton found in a sample of ocean water. You will also match the larval stage with the adult stage of each animal.



Plankton Sample



Sea Stars



Sea Urchins



Sea Snail



Crab

Method

Equipment

1. The plankton net is 30 cm X 90 cm (1 ft X 3 ft) made with standard mesh size plankton netting.



2. The microscopes are stereo scopes with 20X and 40X magnification.



Sampling Area

- Dana Point, California located in the southern part of Orange County.

Collecting Method (occurs before program)

1. Sampling was conducted from the Ocean Institute's research vessel **Sea Explorer**. After collection, the samples are refrigerated in a sealed sampling container.
2. Sampling procedures
 - Plankton net is lowered to a depth of 1 foot below the water surface
 - Plankton net is towed for 10 minutes
 - Plankton net is washed with sea water to make sure all the plankton are collected into the sampling cup
 - Sampling cup is brought into the Ocean Institute and refrigerated until program time

Study Procedure (occurs in the lab during your program)

Student researchers will:

1. Observe selected adult animals with the Ocean Institute's camera system.
2. Identify larval forms of these animals using diagrams and prepared slides under the microscopes.
3. Observe the collected ocean sample under microscopes and look for the larva of these animals.
4. Compare results among researchers to verify that a minimum of two researchers found the same species of larvae.
5. Write results on the data board.

Results

Class will supply results during scheduled program.

Squid Research Paper

Reproductive Success of Squid

Introduction

Both people on land and animals in the ocean eat squid. Since squid are food for many animals, they might be eaten before they reproduce. To make sure that they can reproduce before they are eaten, they have a short life cycle. After two years, they are ready to reproduce. At night, they come together in large schools to lay egg masses in the mud bottom off the southern California coast. The egg masses contain thousands of individual eggs, and a large group of squid could lay thousands of these egg masses. All the adult squid die after they have laid their eggs, and the sea floor is covered with dead squid that many other animals eat.

Squid fishermen fish when the squid come together at night to lay the eggs. Since squid are attracted to bright lights, squid fishermen shine bright lights to bring the squid near the surface. Once the squid are near the surface, fishermen catch them in big nets. These squid may not have laid their eggs before being caught. If a large number of the squid have not yet laid eggs, the total number of squid could be reduced over time.

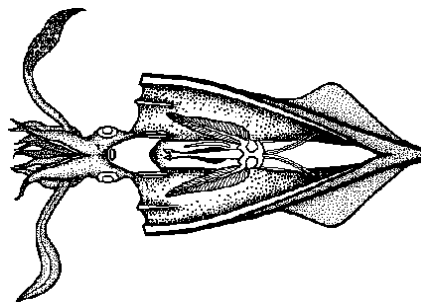
In this study, we will dissect a sample of squid to see how many squid have been caught before they have had the chance to reproduce.



Method

Equipment

Dissecting equipment: pans, scissors, tweezers, probe



Sample

- The squid species studied is the Market Squid (*Loligo*).
- Squid samples are selected randomly from frozen commercial squid

Study Procedure

Student researchers will:

1. Study the external anatomy of squid for adaptations to ocean life.
2. Use proper dissecting techniques to open the squid.
3. Determine if the squid is male or female.
4. Determine if the squid has had time to reproduce by looking at pictures of squid. Squid that look “empty” have reproduced; ones that look “full” have not.
5. Write results on the data board.
6. Continue dissection according to instructions to learn more about the internal anatomy of squid.

Results

Class will supply results during scheduled program.

Vocabulary List for *Junior Scientific LiteraSEA Lab Program*

Before they arrive, the students should be familiar with the following list of scientific terms found in the research papers. During the program, the students will be introduced to additional terms used in the papers. All of the terms will be defined and reviewed during the course of the program.

General Terms

Attachment / reattachment	Microscope
Bar graph	Observe
Characteristics	Permanent
Compare	Reproduce / Reproduction
Classify	Sort (<i>verb</i>)
Defense	Survive
Identify	

Science Terms

Data – information gathered and used to answer a scientific question

Dissect – to cut apart in order to determine structure

Exoskeleton – the protective hard outer “shell” of some organisms, including crabs, lobsters, and insects

Field guide – a book or booklet with pictures and descriptions that is used to identify organisms

Holdfast – the root-like structure that holds kelp and other large seaweeds to the rocky bottom

Juvenile – an immature organism, not able to reproduce yet

Life cycle – the stages in an organism’s life from birth to death

Larva – the juvenile form of an organism, different in shape and appearance from the adult

Molting / Molt – the periodic shedding of the exoskeleton as the organism grows; the exoskeleton after it is shed.

Organism – a living being belonging to one of the five kingdoms

Plankton – floating or drifting organisms in salt or fresh water communities that are moved by the currents

Predator – an animal that hunts other animals for food

Prey – an animal that is consumed by a predator

Rocky reef – the rock formations that come up from the bottom of the ocean and provide a hard surface for attachment and crevices for hiding

Species – a group of related organisms or populations capable of interbreeding

Specimen – an object or portion serving as a sample