

# LESSON 3 Hungry Reef Fish

## Lesson at a Glance

Students work in cooperative groups as they engage in an inquiry investigation of the feeding styles of various reef fish with different types of mouth parts, or feeding behaviors. Students will identify a research question/hypothesis, devise an experimental procedure to collect data to answer their question, construct a chart to compare the feeding adaptations of reef fish, and write a conclusion to complete the laboratory activity.

## Lesson Duration

Three 45-minute periods

## Essential Question(s)

How do the unique mouth features of different reef fish help them to feed in the coral reef habitat?

## Key Concepts

- Reef fish have different styles of feeding and different mouth structures, depending on the type of food they eat.
- The unique mouth features of reef fish help them to feed in the coral reef habitat.

## Instructional Objectives

- I can identify, and describe the unique features of reef fish that help them feed.
- I can describe the relationship between the feeding structures of reef fish, and how they function for survival in the coral reef habitat.
- I can identify variables and devise an experimental procedure to collect data to answer my question and validate my hypothesis.
- I can construct a chart to organize and analyze data.
- I can write a conclusion based on evidence.

### Related HCPSIII Benchmark(s):

Science SC.5.1.1  
Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments.

Science SC.5.1.2  
Formulate and defend conclusions based on evidence.



**Benchmark Rubric:**

<b>Topic</b>		<b>Scientific Inquiry</b>	
<b>Benchmark</b> <a href="#">SC.5.1.1</a>		Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments	
<b>Rubric</b>			
<b>Advanced</b>	<b>Proficient</b>	<b>Partially Proficient</b>	<b>Novice</b>
Identify the variables in scientific investigations, explain why variables need to be controlled, and give examples of how to control variables in scientific experiments	Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments	Identify, with assistance, the variables in a scientific investigation or the importance of controlling the variables	Recognize, with much assistance, the variables in scientific investigations
<b>Topic</b>		<b>Scientific Inquiry</b>	
<b>Benchmark</b> <a href="#">SC.5.1.2</a>		Formulate and defend conclusions based on evidence	
<b>Rubric</b>			
<b>Advanced</b>	<b>Proficient</b>	<b>Partially Proficient</b>	<b>Novice</b>
Formulate and defend conclusions that are supported by detailed evidence and make connections to the real world	Formulate and defend conclusions that are supported by evidence	Make conclusions that are partially supported by evidence	Make conclusions without evidence

**Assessment Tools**

Rubric Assessment 1 for Participation in Fish Feeding Inquiry Investigation  
(See *Student Worksheet* at end of lesson for complete version.)

<b>Rubric Assessment Part I</b>					
<b>Fish Feeding Inquiry Investigation Criteria</b>	<b>Possible Points</b>	<b>Assessment</b>			
		Self Rating	Peer 1 Rating of You	Peer 2 Rating of You	Teacher Rating of You
Followed instructions.	5				
Practiced laboratory safety at all times.	5				
Worked well with other group members.	5				
<b>Total Points</b>	15				

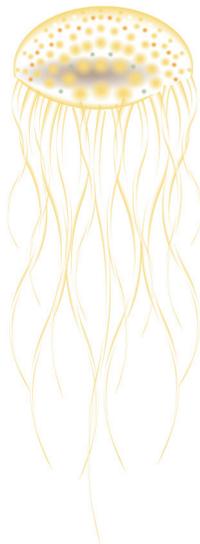
## Assessment/Evidence Pieces

### Lesson

- Student Worksheet *Fish Feeding Inquiry Worksheet* (one per team)
- Student Worksheet *Fish Feeding Self-Evaluation*

## Materials Needed

Teacher	Class	Group	Student
<ul style="list-style-type: none"> <li>• Clear bowl with water</li> <li>• 2-3 Shells</li> <li>• Sand (enough to form layer on bottom of clear bowl with water)</li> <li>• 2 Tubs of water</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Hard cookies (e.g., stone cookies)</li> <li>• Cardboard egg carton (cut dime-sized hole into bottom of each cup)</li> <li>• Small gummy worms</li> <li>• Mini marshmallows (several handfuls)</li> <li>• Toothpicks, popsicle sticks</li> <li>• Raisins (several handfuls)</li> <li>• Oreo cookies</li> <li>• Twelve-inch pieces of string</li> <li>• Large gummy rings or loops</li> <li>• Paper towels</li> </ul> <p><b><u>Inventor Boxes (utensils/tools)</u></b></p> <ul style="list-style-type: none"> <li>• Needle-nose pliers</li> <li>• Regular pliers (blunt tips)</li> <li>• Tongs, forceps, chopsticks</li> <li>• Large spoon</li> <li>• Turkey baster, straws, coffee stirrers</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>



## Instructional Resources

Teacher Reading: *Eating Habits and Mouth Parts of Reef Fish*

Student Reading: *Fish Feeding Inquiry Station Card Information Page (Stations 1-5)*

Student Reading: *Fish Feeding Inquiry Station Card Special Instructions (Stations 1-5)*

Student Worksheet: *Fish Feeding Inquiry Worksheet (one per team)*

Student Worksheet: *Fish Feeding Self-Evaluation*

## Student Vocabulary Words

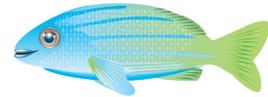
**ambush predator:** an organism that hides and waits for prey to pass, rather than actively chasing prey.

**barbel:** a whisker-like organ near the mouth found in some fish.

**carnivore:** an animal that feeds on other animals.

**herbivore:** animals that eat plants.

**omnivore:** animals that eat plants and animals.



## Lesson Plan

### Lesson Preparation

- Review the Science Background provided in the Unit Overview, and the Teacher Reading *Eating Habits and Mouth Parts of Reef Fish*.
- Review the student reading and special instruction sheets. Prepare the materials for the five Inquiry Investigation stations (inventor's boxes), and copies of the student readings and teacher resource worksheets (if needed). Be sure to prep enough materials to allow each team to repeat trials to validate data. Have extra consumable supplies ready in labeled plastic bags to distribute as each procedure is completed.
  - 1) **Station 1 The Cruncher:** Hard cookies (one large piece per student), paper towels, Station 1 ID Card, inventor's box (chopsticks, tongs, small plastic spoons).
  - 2) **Station 2 The Picker:** Cardboard egg carton with dime-sized holes cut into bottom of each cup, inventor's box with needle-nose pliers, regular pliers (blunt tips too large to fit into egg carton holes), large tongs, popsicle sticks, chopsticks, gummy worms, Station 2 ID Card. Turn egg carton over so bottom is facing up. Place four gummy worms inside four of the holes, and four gummy worms sticking out from four of the holes.
  - 3) **Station 3 The Biter:** Tub of water, mini marshmallows, inventor's box (toothpicks, popsicle sticks, "Chinese" blunt chopsticks, large straws), Station 3 ID Card.
  - 4) **Station 4 The Sucker:** Tub of water, raisins, large spoon, Station 4 ID Card, inventor's box (pipette, blue bulb from ear cleaning kit, turkey baster, eye dropper).
  - 5) **Station 5 The Pointers:** Oreo cookies (one per student), paper towels, 12-inch piece of string (one per student), large gummy rings, Station 5 ID Card.
- Provide each station with an ample supply of paper towels for cleanup activities.
- Make copies of the *Fish Feeding Inquiry Worksheets* (one worksheet for each team), the *Fish Feeding Inquiry Station Card Special Instructions* for each station, the student readings *Fish Feeding Inquiry Station Card Information Page* (one for each team member at each station), and the *Fish Feeding Inquiry Evaluation* (one per student).

- Post the following information in the classroom where all students can see it, to facilitate cooperative group work:

**Lab Roles:**

READER: Reads the written instructions and information to the group members.

RECORDER: Writes the required information neatly and accurately.

MATERIALS: Responsible for setting up the supplies and materials.

JANITOR: Responsible for cleanup.

### I. *Feeding Behavior of Hungry Reef Fish*

- Ask the students to describe what they had for breakfast, and how they ate it. Where did they find the food? What did they use to eat with?
- Announce to students that for this inquiry investigation they must attempt to feed like the different reef fish that live in a coral reef habitat.

### II. *Establishing Guidelines for Group Work*

- Assign cooperative groups, and distribute one copy of the *Fish Feeding Inquiry Worksheet* to each group.
- Discuss with the students what it means to work cooperatively in a group. Explain the lab roles, referring to the display on the wall. Tell the students they will be switching roles for each station as they conduct several trials, so members will have a chance to play different roles.
- Give students a few minutes to plan who will take each role for the first trial.

**NOTE:** *Teacher may choose to have students go to only one lab station do several trials and then have each group report back to the rest of the class their findings or conclusions from their particular station.*

### III. *Fish Feeding Discovery Lab*

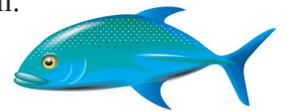
- Students should read information sheet found at their assigned lab station. Ask students what are they wondering? What questions do they have about their fishes feeding method?
- Ask a student to read aloud the purpose of the lab, as stated on the Student Worksheet. Explain how students must form a question that the inquiry investigation can answer for their specific fish type, based on the purpose statement. Brainstorm ideas as a whole class to ensure the students are on the “right track.” Facilitate the brainstorming in such a way that it suggests a question similar to: How do the various features of the mouth help different reef fish to effectively/efficiently feed in the coral reef habitat?
- Inquiry process to facilitate student engagement:
  - 1) Inform each group that now they are going write their own question on the *Fish Feed Inquiry Worksheet*.
  - 2) Formulate a hypothesis that would allow the team to collect data to answer their question. Hypothesis is “an idea that can be tested by an experiment or observation” (ScienceSaurus, 2005). You may use either of the following formats: “if...then...” or “if...then...because...” Remind students that the hypothesis must be a testable hypothesis, which means it can easily be measured.

- 3) Examine the inventor's box to get ideas before brainstorming how they would collect data on the most effective feeding mechanism/structure/behavior for their assigned fish type.
- 4) Identify the variables involved with their inquiry before they devise an experimental design. Discuss the importance of controlling variables in an investigation. Emphasize lab safety, and cooperative group work.
- 5) Make sure the students understand that the information they collect is *their* data. They must use these data to construct a chart in the *Data Analysis* section of the *Fish Feeding Inquiry Worksheet* after the lab station activities are completed.

D. Demonstrate a possible experimental procedure for bottom-feeding fish:

- Fill a clear bowl with water, and add enough sand to form a layer on the bottom.
- Place a few shells inside the sand layer.
- Have a student volunteer use his/her fingers (the "tools") to dig in the sand in search of the shells. Explain to the students that *goatfish* have long appendages (barbels) attached to the bottom of their mouths. *Goatfish* use the barbels to dig in the sandy bottom near the reef to search for worms and shellfish.

- E. Tell the students they will have a certain amount of time to complete the activity, to record their data, and repeat their trials to validate data. Remind the students that in order to accurately test their hypothesis they will need to conduct each experiment at least four times per station.



#### IV. Fish Feeding Discoveries

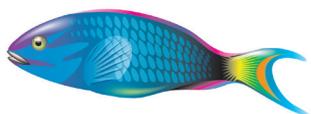
- A. After the students have completed their inquiries, they should collaborate with their team members to complete the Inquiry Worksheet (If necessary, explain how to construct a chart to compare data from each station. You might write this table up on the board in your classroom to use as an example).

REEF FISH:	What it eats:	Description of mouth features or behavior used for feeding:
Longnose Butterflyfish		
Moray eel		
Blenny		
Scorpionfish		
Trumpetfish		
Parrotfish		
Goatfish		

- B. Ask each group to work together to write their conclusion. Make sure the students understand that the conclusion should be formulated using the information they recorded during the lab activity. If the conclusion does not support the hypothesis, it should be stated that way.
- C. Have student groups report out to the class the findings from their lab experiments. Each group should present the type of organism, what it eats, the method the organism uses to eat, the hypothesis the groups came up with and the results of the experiment. Did the results of the experiment support or refute the group's hypothesis?
- D. Students will complete the Fish Feeding Self-Evaluation to assess their participation at the end of the activity.

### Extended Activities

1. Consider having students view a video or website of these organisms to make a connection with what they experienced in their labs and provide reinforcement.
2. Ask each group to design a reef fish model, or illustration showing the unique features it uses to feed. Add their creations to the coral reef habitat wall mural.



# LESSON 3 - Teacher Reading

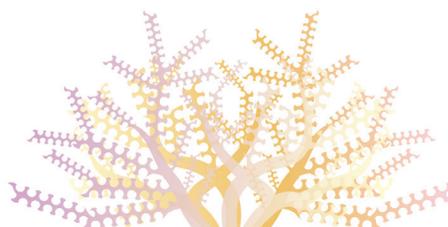
## Eating Habits and Mouth Parts of Reef Fish

There are many sizes, shapes, and colors of reef fish living in the coral reef habitat. They have different methods and adaptations for feeding, depending on the area of the reef they inhabit, and the composition of their diet. Reef fish live in areas above the reef, on the surface of the reef, in reef crevices and caves, and on the sandy bottom near the reef. Reef fish often eat a particular type of food, have a certain feeding style, and have special mouth features to help them feed.

*Herbivores* feed on algae that grow on the surface of the reef, or that live within other organisms (e.g., the algae inside coral polyps). *Herbivores* have mouth forms and teeth designed to scrape the algae off rocks and coral. Reef fish that eat zooplankton, invertebrates, and other fish are *carnivores*. *Carnivores* have unique mouth forms and teeth, depending on the type of animal they eat.

Some *carnivores* have small mouths useful for plucking zooplankton from the water column. Other *carnivores* have large mouths and engulf their prey, swallowing it whole. Many *carnivores* have unique mouth features that help them feed in a particular area of the reef, or on a particular type of prey. For example, the *longnose butterflyfish* has a very long snout that allows it to probe into deep crevices to find worms and other invertebrates; the goatfish has structures hanging from its lower jaw (barbels) that help it dig in the sand to find invertebrates.

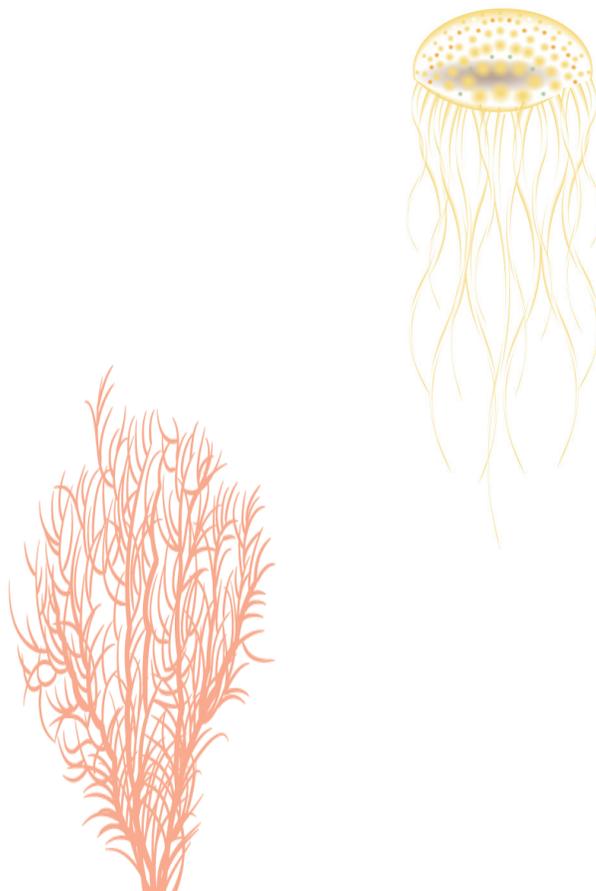
Reef fish that are *omnivores* eat algae and other animals. These fish do not have as specialized a diet as some of the *herbivores* and *carnivores*.



# LESSON 3

## Fish Feeding Inquiry Station Card Special Instructions Lab Station 1: The Cruncher

1. Read “The Cruncher” information page.
2. Variables to consider:
  - Number/size/type of cookies
  - Placement of cookie
  - Criteria to meet to successfully “feed” on cookie
3. Place a cookie on a paper towel for each member of your group.
4. Use your strong teeth to break off a chunk of the cookie and crunch it to very small pieces. **No hands allowed!** Compare effectiveness with other utensils in inventor’s box. Which tool was the easiest to break the cookie and create crumbs?
5. Create an appropriate table to record your data for Station 1. Eat the rest of your cookie. Can you make scrape marks on the cookie like this reef fish makes on coral?
6. Repeat trials to validate data.

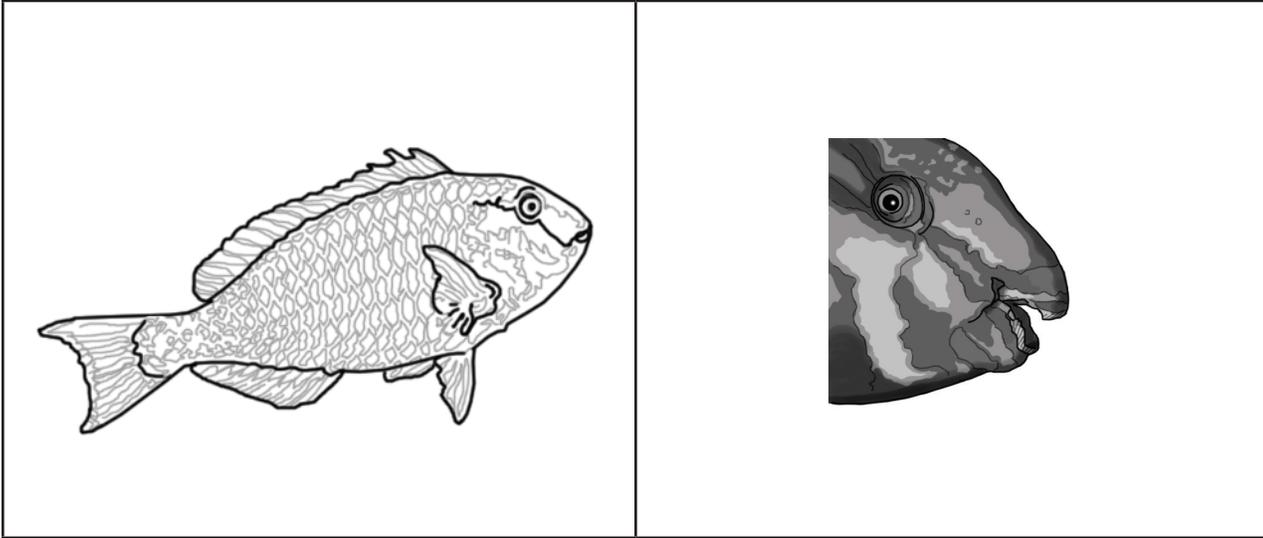


# LESSON 3

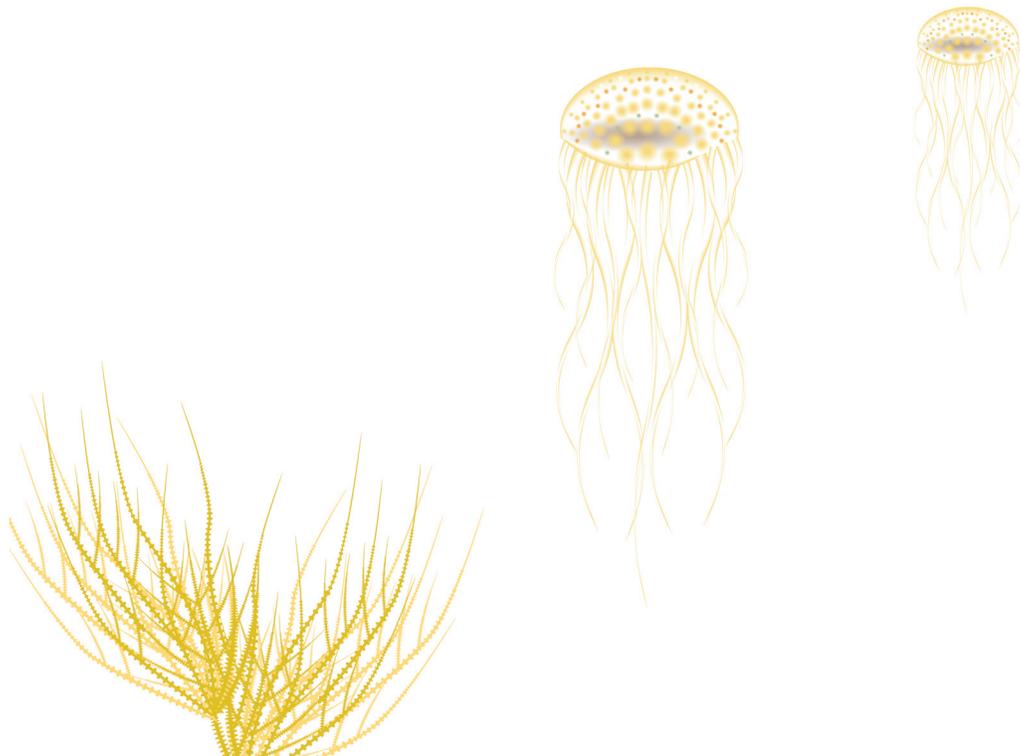
## Fish Feeding Inquiry Station Card Information Page

### Lab Station 1: The Cruncher

#### Parrotfish



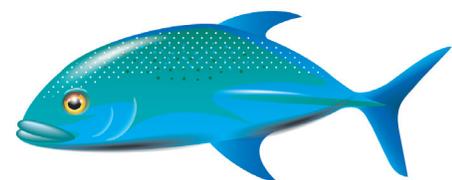
*Parrotfish* eat algae. They scrape the algae off coral rocks, or bite off chunks of living coral using their strong teeth. Their teeth are joined together to form hard plates that look like a beak, which is where they get their common name. Their Hawaiian name is *uhu*, which means “loose bowels.” They swallow chunks of coral that get crunched up in their digestive system, and exit as sand. *Parrotfish* produce much of our beach sand.



# LESSON 3

## Fish Feeding Inquiry Station Card Special Instructions Lab Station 2: The Picker

1. Read “The Picker” information page.
2. Variables to consider:
  - Size of hole in egg carton
  - Type/size of worms
  - Depth/number of worms
  - Time (seconds) allowed to “feed”
  - Time required to capture all worms
3. Use the tools provided in the inventor’s box to compare effectiveness of mouth parts.
4. Does the effectiveness of tool vary with the depth of the worm?
5. Create an appropriate table to record your data (e.g., number of worms, time for feeding) for Station 2 ..... then, eat your worms.
6. Repeat trials to validate data.



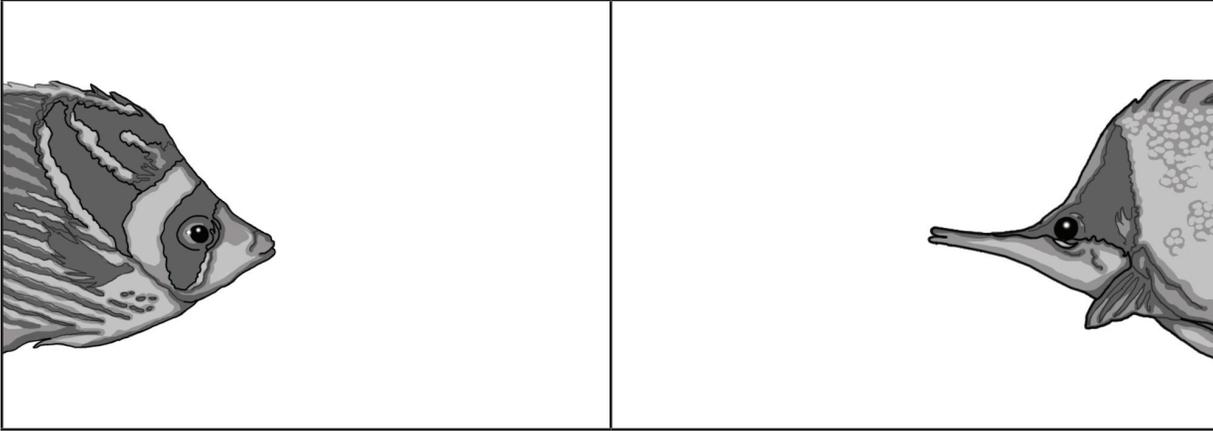
# LESSON 3

## Fish Feeding Inquiry Station Card Information Page Lab Station 2: The Picker

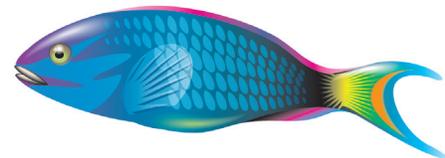
Raccoon Butterflyfish

and

Longnose Butterflyfish



*Butterflyfish* eat small invertebrates, coral polyps, and plankton. Most *butterflyfish* pick invertebrates off the coral. They have small teeth inside a small mouth at the end of their snout. The *longnose butterflyfish* has a long snout that is useful for probing into deep crevices. Its Hawaiian name is *lauwiliwili nukunuku oi'oi*, which means “the long-nosed fish which flitters around like a wiliwili leaf,” and is the longest Hawaiian name for a reef fish.

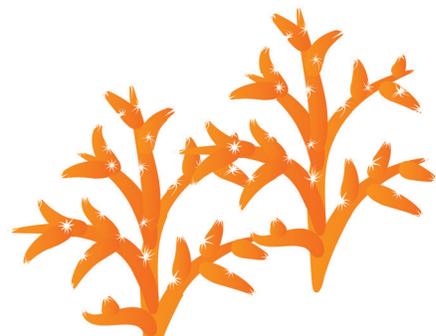


# LESSON 3

## Fish Feeding Inquiry Station Card Special Instructions

### Lab Station 3: The Biter

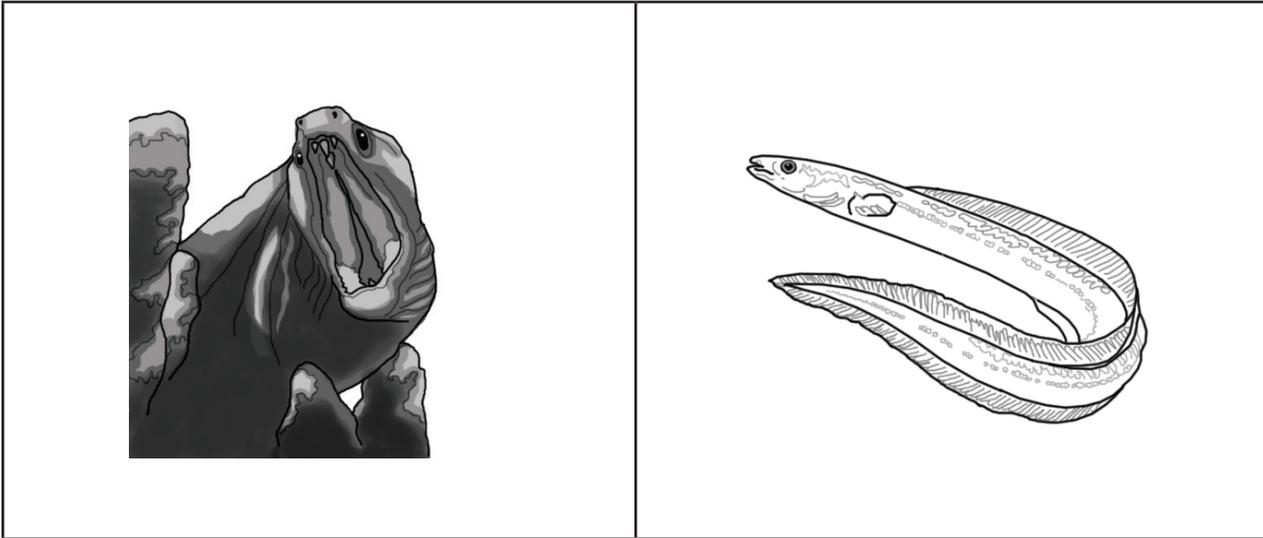
1. Read “The Biter” information page.
2. Variables to consider:
  - Number/size of floating marshmallows
  - Depth of water/size of tub
  - Criteria to determine successful “feeding” (e.g., shortest time to capture 5/10 marshmallows or time to capture 1 marshmallow or time to capture all floating marshmallows)
3. Place a handful of marshmallows into the tub of water.
4. Hold two toothpicks in one hand and two toothpicks in your other hand using your pointer finger and thumb. Make sure that the toothpicks are held in your hand horizontally so that the ends of the toothpicks face one another.
5. Try to stab a marshmallow with different utensils/tools in the inventor’s box... compare to the effectiveness of the toothpicks.
6. Create an appropriate table to record your data for Station 3.
7. Repeat trials to validate data.



# LESSON 3

## Fish Feeding Inquiry Station Card Information Page Lab Station 3: The Biter

### Moray Eel



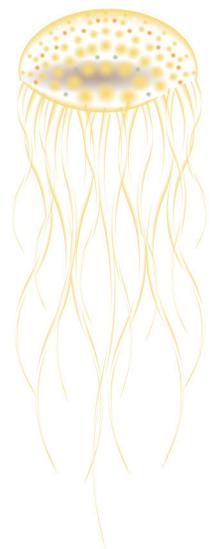
Most moray eels capture slippery fish and octopus with their long, sharp teeth. The teeth are usually curved inward so that it is difficult for the prey to wriggle away. Morays have strong jaws and large mouths that open wide. Most moray eels hide in caves and crevices during the daytime, and come out at night to hunt. Their Hawaiian name is *puhi*. In ancient Hawai'i, *Puhi* were considered special to *ali'i* (chiefs).



# LESSON 3

## Fish Feeding Inquiry Station Card Special Instructions Lab Station 4: The Sucker

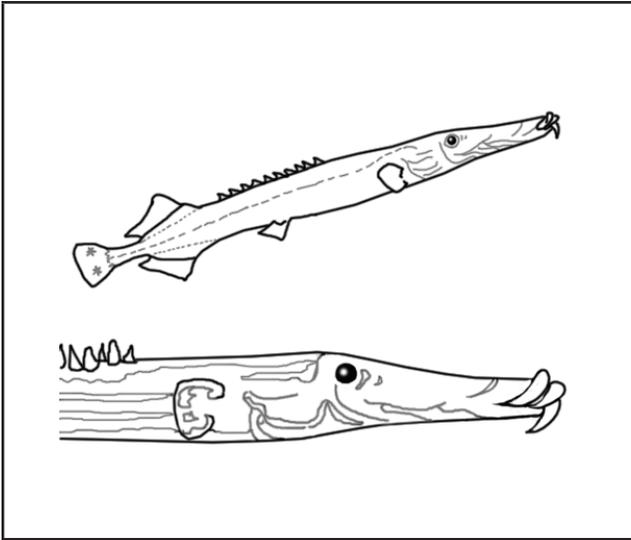
1. Read “The Sucker” information page
2. Variables to consider:
  - Number/size of raisins
  - Depth of water / size of tub
  - Number of stirs to create turbulence
  - Criteria to determine successful “feeding”
  - Recording time to suck 1 raisin, or 5/10 raisins, or all raisins in tub
3. Place a handful of raisins in the tub of water.
4. Stir the water with the spoon, so that the raisins move around.
5. Use different utensils/tools from the inventor’s box to suck up a raisin as it moves by.
6. Create an appropriate table to record your data for Station 4.
7. Repeat trials to validate data.



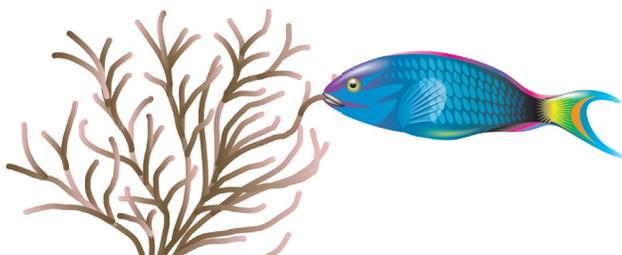
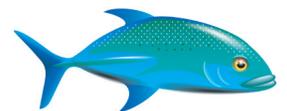
# LESSON 3

## Fish Feeding Inquiry Station Card Information Page Lab Station 4: The Sucker

### Trumpetfish



*Trumpetfish* are ambush predators, which means they hover quietly to wait for their prey to come nearby and then, Whammo! They suck in small fish with their long, tube-like mouths. Their mouths can open very wide, allowing them to swallow fish as big as they are. Their Hawaiian name is *nūnū*.



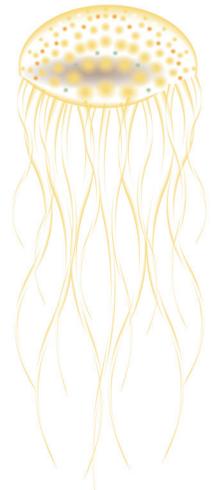
# LESSON 3

## Fish Feeding Inquiry Station Card Special Instructions Lab Station 5: The Pointers

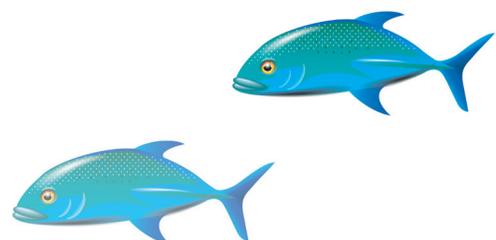
1. Read “The Pointers” information page.
2. Variables to consider:
  - Direction of feeding (i.e. pointing up or down toward food)
  - Type/size of food
  - Criteria to determine successful “eating” (e.g., time to bite/swallow entire gummy ring hanging above your head or to scrape off all the cream filling from an Oreo.....NO HANDS)
3. Eat the cookie following these directions:
  - a. Divide the cookie in half by twisting the two halves so that the cream is only on one side and place the two halves on a paper towel on the table.
  - b. Use your teeth to scrape off the cream filling. **No hands!**

Now, eat the gummy ring following these directions:

- a. Tie one end of a piece of string to the gummy ring.
  - b. Have a lab partner hang the ring above your head.
  - c. Grab the ring with your mouth.
4. Vary the food height or distance above their mouth as they are feeding.
  5. Create an appropriate table to record your data
  6. Repeat trials to validate data.



*What question do you have about fish who are ambush predators? What variables must be considered if collecting data on ambush predators? Devise an experimental design to control the variables and collect data to answer your question about this particular method of feeding.*



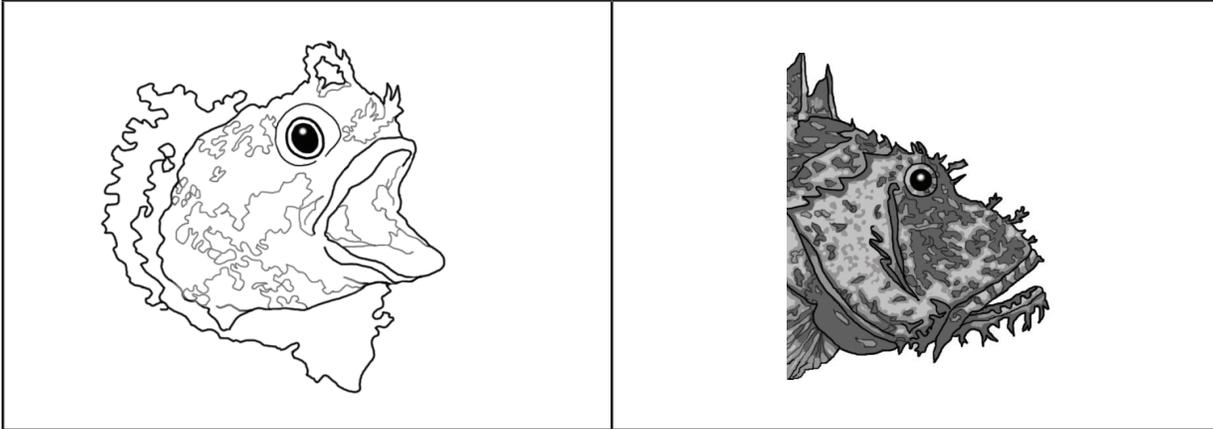
# LESSON 3

## Fish Feeding Inquiry Station Card Information Page Lab Station 5: The Pointers

Blenny

and

Scorpion Fish



Not all reef fish have mouths in front of their heads. Some fish have mouths that are pointed up or down, depending on what they eat. This *Blenny* lives on the reef bottom, and has a wide mouth that is pointed down, so that it can easily scrape algae off of the reef. Its Hawaiian name is *pao'ō*. The *scorpionfish* also lives on the reef bottom, but has a mouth that is pointed up. It is an ambush predator, which means it waits, camouflaged on the reef, until an unsuspecting fish, or invertebrate passes by. It will open its large mouth and engulf its prey, sometimes swallowing it whole.



# LESSON 3

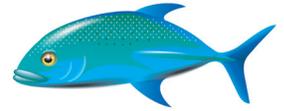
## Fish Feeding Inquiry Worksheet

Group Members:

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**Purpose:**

To experiment with tools to find out how the mouth features of different reef fish help them feed in the coral reef habitat.

Form a Question (for your assigned fish):

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Hypothesis:

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Experimental Procedure:

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### Materials and Lab Procedure:

Examine the tools and materials in the inventor's box at each station. Identify the variables for the station and control variables in your inquiry investigation. Devise an experimental procedure to safely collect data to answer your question and validate the hypothesis. Create an appropriate table to record your data.

### Data Collection:

Record data from your station precisely in the table that your team has created and also in the appropriate space below.

### Lab Station 1: The Cruncher

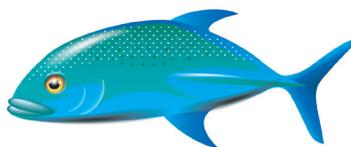
1. Explain in words, or in a drawing, the tools you used, and how you used them:

2. Record your observations (What happened? Was it difficult? Why or why not?):

3. Conclusion based on data collected:

4. Name of reef fish using this method of feeding to "crunch" food: \_\_\_\_\_

5. Describe the fish's *mouth features* and the *type of food* it eats:



## Lab Station 2: The Picker

1. Explain in words, or in a drawing, the tools you used, and how you used them:



2. Record your observations (What happened? Was it difficult? Why or why not?):

3. Conclusion based on data:

4. Name of reef fish who “picks” to obtain food: \_\_\_\_\_

5. Describe the fish’s *mouth features* and the *type of food* it eats:



**Lab Station 3: The Biter**

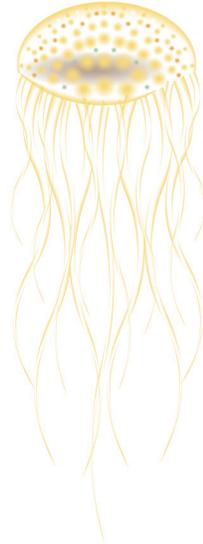
1. Explain in words, or a drawing, the tools you used, and how you used them:

2. Record your observations (What happened? Was it difficult? Why or why not?):

3. Conclusion based on data:

4. Name of reef fish who “bites” its food: \_\_\_\_\_

5. Describe the fish’s *mouth features* and the *type of food* it eats:





**Station 5: The Pointers**

1. Explain in words, or in a drawing, the tools you used, and how you used them:

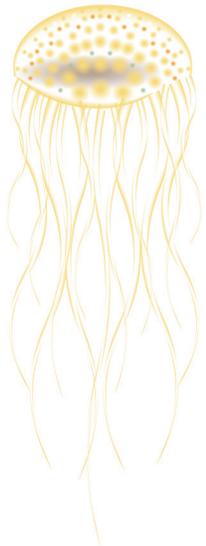
2. Record your observations (What happened? Was it difficult? Why or why not?):

3. Conclusion based on data:

4. Name of reef fish with mouth feature that points at its food in a specific direction:

\_\_\_\_\_

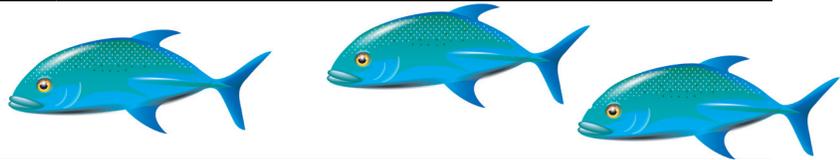
5. Describe the fish's *mouth features* and the *type of food* it eats:



**Data Analysis:**

Construct a chart to summarize data patterns after several trials. Give the chart a title.

Trial #	TOOL	Amount of Food Captured	Observations
1			
2			
3			
4			

**Conclusion:**

Work together to write a paragraph explaining what your group discovered about the mouth features of different reef fish. Use *complete sentences* and descriptive words to answer your initial research question and hypothesis.

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# LESSON 3

## Fish Feeding Inquiry Self-Evaluation

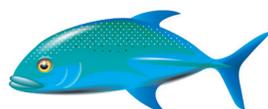
### PART I

1. Rate your own inquiry participation honestly, using the scale below. Write your points in the Self column of the chart.
2. Ask two of your group members to rate your lab participation. They will write their points in the Peer 1 and Peer 2 columns. (See next page for point scale.)

Lab Participation Rubric	Possible Points	Assessment			
		Self Rating	Peer 1 Rating of You	Peer 2 Rating of You	Teacher Rating of You
Followed instructions	5				
Practiced lab safety at all times	5				
Worked well with other group members	5				
<b>Total Points</b>	15				

Rate each category using this Point Scale:

<p>5 = Excellent          4 = Good          3 = Satisfactory          2 = Needs work          1 = Unsatisfactory</p>
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**PART II**

Answer these questions:

1. What did you learn about the structures that fish have that help them to eat and survive in the coral reef?
2. Why is it important to control variables in a scientific investigation?
3. How might I improve the experimental procedure for the next time?
4. What are you still curious about discovering?

