

LESSON 2 Whale Feast Feeding Discovery Lab

Lesson at a Glance

Students work in cooperative groups and participate in a hands-on lab activity simulating the feeding methods of various *cetaceans*. Students construct a chart and bar graph to compare the feeding styles of baleen and toothed whales, and write a conclusion to complete the lab activity.

Lesson Duration

Two 45-minute periods

Essential Question(s)

How are the feeding methods of baleen and toothed whales similar and different?

Key Concepts

- Whales have different mouth structures that enable them to feed on different types and quantities of food.
- Humpback whales are baleen whales that feed on large amounts of small prey that can only be found in cold, northern nutrient-rich marine environments.

Instructional Objectives

- I can state the similarities and differences in the feeding methods of humpback whales and other baleen and toothed whales.
- I can pose questions and develop a hypothesis based on observations.
- I can collect data using observations and experiments, and organize the data into tables and graphs.

Related HCPS III Benchmark(s):

Science SC.3.1.1 Pose a question and develop a hypothesis based on observations.

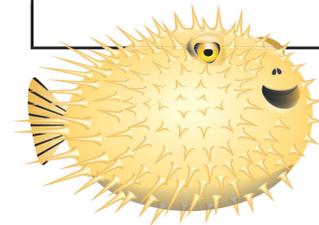
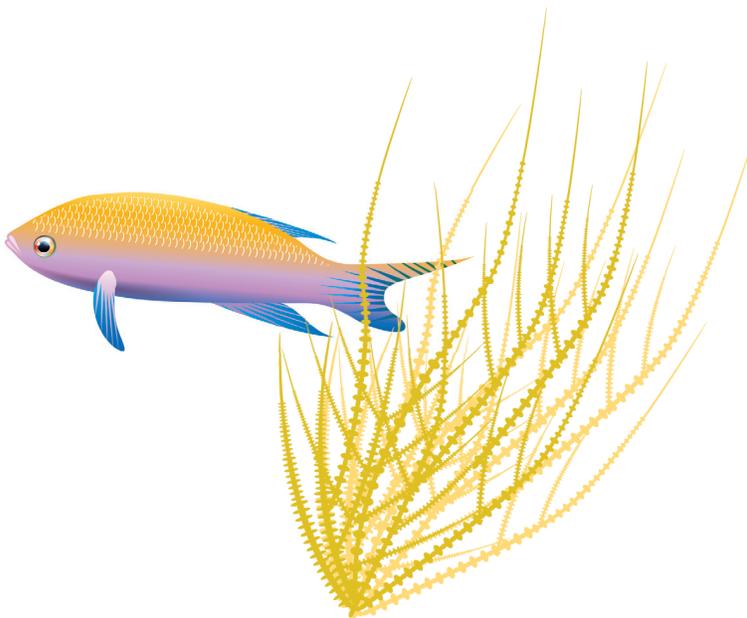
Science SC.3.1.2 Safely collect and analyze data to answer a question.

Science SC.3.4.1 Compare distinct structures of living things that help them to survive.

Science SC.3.5.1 Describe the relationship between structure and function in organisms.

Math MA.3.11.1 Pose questions, collect data using surveys, and organize the data into tables and graphs.

Math MA.3.12.1 Interpret data (e.g. tallies, chart, tables, bar graphs, line plots) and state what the representation shows about the set of data.



Assessment Tools

Benchmark Rubric:

Topic		Scientific Inquiry	
Benchmark SC.3.1.1		Pose a question and develop a hypothesis based on observations	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Pose a question and develop a hypothesis based on logical inferences and observations	Pose a question and develop a hypothesis based on observations	Pose a question or develop a hypothesis partially based on observations	With assistance, pose a question or develop a hypothesis

Topic		Scientific Inquiry	
Benchmark SC.3.1.2		Safely collect and analyze data to answer a question	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Summarize and share analysis of data collected safely to answer a question	Safely collect and analyze data to answer a question	With assistance, safely collect and analyze data	With assistance, safely collect data and attempt to analyze data

Topic		Cells, Tissues, Organs, and Organ Systems	
Benchmark SC.3.4.1		Compare distinct structures of living things that help them to survive	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Group living things by the distinct structures that help them to survive and provide justification for the grouping	Compare distinct structures of living things that help them to survive	Describe a few ways in which distinct structures of living things help them to survive	Name distinct structures of living things that help them to survive

Topic		Unity and Diversity	
Benchmark SC.3.5.1		Describe the relationship between structure and function in organisms	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Classify the structures of organisms according to their function	Describe the relationship between structure and function in organisms	Identify the relationship between structure and function in an organism	Recall that structures in organisms are related to the functions they perform

Topic		Data Collection and Representation	
Benchmark MA.3.11.1		Pose questions, collect data using surveys, and organize the data into tables and graphs	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Pose meaningful questions, collect data using surveys, and effectively and accurately organize the data into tables and graphs	Pose questions, collect data using surveys, and organize the data into tables and graphs, with no significant errors	Pose questions, collect data using surveys, and organize the data into tables and graphs, with a few significant errors	Pose questions, collect data using surveys, and organize the data into tables and graphs, with many significant errors



Topic	Data Interpretation		
Benchmark MA.3.12.1	Interpret data (e.g., tallies, chart, tables, bar graphs, line plots) and state what the representation shows about the set of data		
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Interpret data and state what the representation shows about the set of data, with accuracy	Interpret data and state what the representation shows about the set of data, with no significant errors	Interpret data and state what the representation shows about the set of data, with a few significant errors	Interpret data and state what the representation shows about the set of data, with many significant errors

Assessment/Evidence Pieces

Lesson

- Whale Feast Feeding Discovery Lab Assessment
- Student Worksheet Whale Feast Feeding Methods Discovery Lab Data Collection Sheets

Materials Needed

Teacher	Class	Group	Student
<ul style="list-style-type: none"> • Old hand towels (extra) • Discover Lab Card (1 per station) • A funky hat 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Small portion cup (2 per group) • Crisp rice cereal (2 small cups full per group) • Plastic comb (1 per group) • Chopsticks (1 pair per group) • Plastic tub/pan (1 per group) fill with enough water so cereal will float – not too high or it will spill • Hand towels (1 per group) • Paper towel 	<ul style="list-style-type: none"> • Worksheet: <i>Whale Feast Feeding Discovery Lab Data Collection Sheets</i>

Instructional Resources

Teacher Reading : *Whale Feast Lab Station Discovery Card Instructions*

Teacher Reading : *Whale Feast Lab Station Discovery Card Information Sheet*

Student Worksheet: *Whale Feast Feeding Methods Discovery Lab Data Collection Sheets*

Teacher Answer Key: *Whale Feast Feeding Methods Discovery Lab Data Collection Sheets*

Assessment Tool: *Whale Feast Feeding Discovery Lab Assessment*

Student Vocabulary Words

adaptations: special traits that help living organisms survive in a particular environment.

amphipod: a group of small aquatic invertebrates; related to crabs and shrimp.

baleen: overlapping plates that hang from the sides of a baleen whale's upper jaw; used for feeding.

cetacean: a marine mammal in the Order *Cetacea*, including whales, dolphins, and porpoises.

esophagus: the long muscular tube that carries food from the mouth to the stomach.

hypothesis: an idea that can be tested by experiment or observation.

invertebrate: an animal without a backbone.

krill: shrimp-like planktonic crustaceans; a major food source for baleen whales.

mysticete: the group of cetaceans that feed with baleen instead of teeth.

odontocete: the group of cetaceans that feed with teeth (do not have baleen).

plankton: microscopic organisms that are suspended in the water column and transported by tides and current.

predator: an animal that hunts other animals for food.

prey: an animal hunted or caught for food.

ventral pleats: long folds in the skin under the mouth that expand when the whale takes in large amounts of water and food.

zooplankton: small planktonic animals that drift in open water.

Lesson Plan

Lesson Preparation

- Read the Science Background provided in the Unit's Overview.
- Make copies of Student Worksheets *Whale Feast Feeding Methods Discovery Lab Data Collection Sheets* (all 5 pages) and *Whale Feast Feeding Discovery Lab Assessment*, one per student.
- Copy and laminate the *Whale Feast Lab Station Discovery Card Instructions and Information Sheet* (Create a two-sided page: Information sheet in front and instruction sheet on the back). There will be one two-sided sheet for Toothed Whales and one two-sided sheet for Baleen Whales.
- Post the following information in the classroom where it will be visible to all students to facilitate cooperative group work:

Lab Roles:

1. **READER:** Reads the written instructions and information to the group.
2. **RECORDER:** Writes the required information neatly and accurately.
3. **GEARHEAD:** Responsible for setting up the supplies and materials.

Set up the lab activity stations with the following materials: Set up enough stations to allow all student groups to be at stations at the same time.

- a. Lab Station
3–5 oz. paper cups (1 per group), crisp rice cereal (poured into the paper cup), tub of water, plastic comb (1 per station), chopsticks (1 pair per group) hand towel, paper towels, Lab Station Discovery Card.

Safety Note:

During the lesson students may spill water onto the floors. This may cause slippery conditions. ALL students should be using covered shoes to do this lab activity.

Remind students to walk carefully (NO running and/or horseplay) and to follow all classroom safety rules. Students should also tell the teacher when they see water on the ground so that the teacher can clean it up.

Safety Note:

Goggles should be worn over the eyes at all times and should not be removed until the end of the lab when the teacher instructs them to.

I. Observations, Questioning, and Hypothesis

- A. Introduce the terms, *observation*, question, and *hypothesis* by engaging the students in a fun brainstorming activity.
- B. Put on a funky hat and ask students to describe what they notice. Encourage the students to respond with detailed descriptions of the funky hat. List their responses on the board under the title Observations, and explain that an observation is the act of examining something carefully using one or more of your five senses. (Suggestion: You may need to remind students that observations are based only on what they see, hear, smell, feel, or taste. Also, you may not need to use all of your senses to make observations all the time [i.e. you would not use your sense of taste for the hat]. Once you start to explain why something is, you are no longer observing. This is a fine distinction that not all students will be able to make.)
- C. Discuss with students that detailed observations should allow someone to “see” the object by reading the description. The more details they give, the clearer the picture. Have students review their descriptions of the hat and see if their observations were detailed enough for someone who hasn’t seen the hat to know how it would look. (Suggestion: You may want to have someone who hasn’t seen the hat to draw it based on the observations made by the class.)
- D. Next, ask students to make observations about a picture (for example, the guitar shark provided). List their observations, then elicit and list questions they have related to the observations. Encourage students to develop “why” questions as well.
- E. Define the term hypothesis as “an idea that can be tested by an experiment or observation” (ScienceSaurus, 2005). Use some of the “why” questions to practice forming hypotheses. You may use either of the following formats: “if...then...” or “if...then...because...”. Use the “why” questions to practice developing hypotheses.
- F. Provide additional practice as necessary to improve student’s ability to develop research questions and hypotheses from detailed observations.

II. *Whale Feast Feeding Discovery Lab: Data Collection*

- A. Engage the students in an interactive, hands-on lab activity simulating the difference in the feeding features of different whales. Tell the students they will practice feeding like different types of whales to learn about how their physical structures (i.e. teeth vs. baleen) help them to survive.
- B. Divide the students into cooperative groups, and distribute all 5 pages of the student worksheet *Whale Feast Feeding Methods Discovery Lab Data Collection Sheets*.
- C. Discuss what it means to work cooperatively in a group with the students.
 - Display and explain the lab roles.
 - Tell the students they will be switching roles for each station, so that each member has a chance to play each role at least once. This means that each student group will run through three trials at each station.
 - Ask the students to plan who will take each role for each station.
 - Everyone is responsible for making sure their workstation is clean and the lab station is set up for the next group. *Please review Safety Notes with students as well.
- D. Ask a student to read the purpose of the lab. Have the students form a question that the lab activity will answer, based on the purpose statement. Brainstorm ideas as a whole class, and ask each group to write the question they form on their worksheets. (Refer to the teacher answer key *Whale Feast Feeding Methods Discovery Lab Data Collection Sheets* for recommended responses.)
- E. Ask students to take the questions that they posed and use it to write their own hypothesis for this experiment. Remind students that a hypothesis is “an idea that can be tested by an experiment or observation” (ScienceSaurus, 2005). Go over the formats that they can use to write their hypothesis. (“if...then...” or “if...then...because..”) Give the groups time to write a hypothesis on their lab worksheet.
- F. Review the lab procedures with the students. Emphasize lab safety and cooperative group work. Make sure the students understand that the information they record is their *data*.
- G. Explain the importance of a data table in a scientific investigation. Make sure the students understand that organizing data into tables helps people see patterns in the data.
 - Explain to students that they will be using tally marks to record their data in the data table on the worksheet.
- H. Assign each group to a station. Tell the students they will have a certain amount of time to complete the activity and to record their data at each station. (Be on task!)
- I. Use a signal (for example, a whale song) to inform the students when it is time to change to the next activity. Allow time for students to explore and record information at each station (approximately 5 to 10 minutes).
- J. Have the students record their observations and answer the lab questions in a dry area near each lab station, to avoid getting their lab papers wet.

III. *Whale Feast Discovery Lab: Data Analysis/Conclusion*

- A. After the students have completed gathering their data, have them construct a graph to display their data.
1. Students should create a bar graph comparing the type of mouth of the whale and the number of “food” it was able to gather.
 2. They need to label the x-axis: Type of mouth
 3. They need to label the y-axis: Number of cereal caught
 4. Have them use the tally marks on their data tables to complete their bar graphs.
[Note: You may need to help students number the y-axis.]
- (Refer to the teacher answer key *Whale Feast Feeding Methods Discovery Lab Data Collection Sheets* for sample graph.)
- B. Have students write a conclusion to complete the lab activity. Make sure the students understand that the conclusion should answer the question they formed, using the information they learned and the data they recorded during the lab activity.
- C. Have a class discussion to compare and contrast data results. Compare the data between groups. If there are big differences in the amount of Rice Krispies each group caught through the same method, discuss why. (In scientific research, good methods are replicable and achieve similar results no matter what scientist is performing the experiment.)
- D. Have the students write their conclusions on Page 4 of the data collection sheets.
- E. Ask the students to complete the *Whale Feast Feeding Discovery Lab Assessment* page to assess their lab participation.
- F. Optional: Give each student a Krill Cake (a crisp rice treat), or have the students use a recipe to prepare them in class.

Suggested References for Teachers

1. For additional information on cetacean species, look up www.enchantedlearning.com/subjects/whales/
2. For Rice Krispies Treats Original Recipe can be found on the box or at <http://ricekrispiestreats.com>



LESSON 2

Whale Feast Lab Station Discovery Card Instructions

Baleen Whales

Instructions: (Here's what you do)

1. Read the information and record in the Whale Feeding Chart.
2. Fill one paper cup with Rice Krispies.
3. Sprinkle the cup of Rice Krispies on the surface of the water in the tub.
4. Skim the plastic comb across the surface of the water to collect as many Rice Krispies as possible, in *one sweeping motion*. (Do not scoop the prey or pin it against the sides of the tub.)
5. *Carefully* remove the crisp rice cereal from the comb, place them on a clean paper towel, and count them. (Use the toothpick to *gently* separate the prey to help you count.)
6. Have each person in the group use the comb to slowly scoop some of the cereal. Each person can only do this once.
7. Use tally marks to record the number of cereal your group captured.
8. Get ready for the next activity:
 - a. Dry off the comb, and wipe up any spilled water with the hand towel. Fold the towel neatly when done.
 - b. Place used paper towels and soggy prey in the trash.



LESSON 2

Whale Feast Lab Station Discovery Card Information Sheet

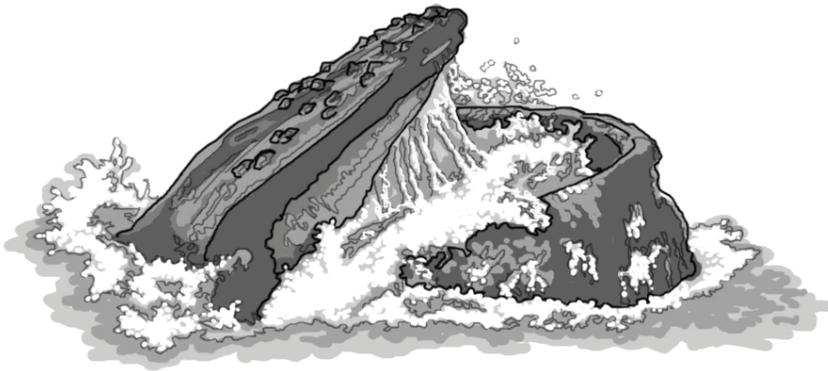
Baleen Whales

Information: (Read this)

Humpback Whales and Blue Whales are examples of baleen whales. Instead of teeth, these whales have baleen, which are flexible plates attached to the upper jaw.

To feed, baleen whales swim to the surface of the water, open their mouths, and expand the ventral pleats in their throats. This allows them to gulp in very large amounts of water and prey. They then use their tongues to push the water out between the baleen plates, and scrape the small fish and krill trapped in the baleen into their mouths.

Humpback whales feed in the cold waters near Alaska during the spring and summer months when small fish, krill and plankton are plentiful. Humpback whales can eat as much as 5,000 pounds of food in a day in preparation for their migration south in the fall. They tend to eat very little during their winter stay.



Sperm Whale Gulping



Krill

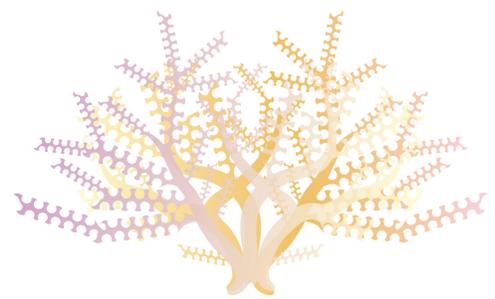
LESSON 2

Whale Feast Lab Station Discovery Card Instructions

Toothed Whales

Instructions: (Here's what you do)

1. You will all take turns trying to catch cereal once. Do not worry if you are not able to catch any. It is okay.
2. To feed like a Sperm Whale, hold one chopstick in your left hand, and the other chopstick in your right hand (like the large teeth in the upper and lower jaws). Try to grasp a piece of cereal. (Do not pin the prey against the sides or bottom of the tub.)
3. Place any cereal you catch on a paper towel.
4. Have each person in the group use the chopstick to try and grab some of the cereal. Each person can only do this once.
5. Use tally marks to record the number of cereal your group captured.
6. Clean up your station:
 - a. Use the comb to gather any leftover cereal and place it on a paper towel.
 - b. Dry off the chopsticks and the comb, and wipe up any spilled water with the hand towel. Fold the towel neatly when done.
 - c. Place used paper towels and soggy prey in the trash.



LESSON 2

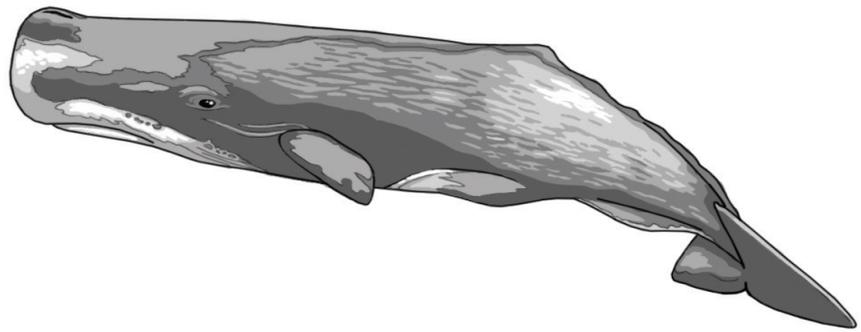
Whale Feast Lab Station Discovery Card Information Sheet

Toothed Whales

Information: (Read this)

Sperm whales are examples of toothed whales. They eat by grabbing prey with their strong teeth and can only eat one prey at a time. They are great predators that can swim very fast and dive very deep to capture their prey.

The Sperm whale is the largest toothed whale and can eat approximately 2,000 pounds of food in a day. The teeth of Sperm whales are approximately 7 inches long. They mainly eat giant squid. Sperm whales live in all oceans, and feed all year.



Sperm Whale



Giant Squid

LESSON 2 Teacher Answer Key

Whale Feast Feeding Methods Discovery Lab Data Collection Sheets

PURPOSE: To experiment with tools to compare the feeding methods of humpback whales with other types of whales.

FORM A QUESTION:

How are the feeding methods of humpback whales different than other types of whales?

MATERIALS AND LAB PROCEDURE:

- Use the tools and materials at each lab station safely.
- Follow all lab instructions carefully.
- After signal rotate.

DATA COLLECTION:

BALEEN

- A. What does the plastic comb represent? **Answer:** Baleen
 B. What do the Rice Krispies represent? **Answer:** Krill and zooplankton
 C. Explain how you used these tools:

Answer: Skim the plastic comb across the surface of the water to collect as many Rice Krispies as possible in one sweeping motion.

- D. Record your observations (What happened? Was it easy or difficult?):
NOTE: Observations should be written with detail to describe results.
 E. Number of prey captured: **Answer:** will vary



TOOTHED

- A. What do the chopsticks represent? **Answer:** Teeth
 B. What do the Rice Krispies represent? **Answer:** Krill and zooplankton
 C. Explain how you used these tools:
Answer: Held one chopstick in each hand and we tried to pinch the cereal.
 D. Record your observations (What happened? Was it easy or difficult?):
NOTE: Observations should be written with detail to describe results.
 E. Number of prey captured: **Answer:** will vary



DATA TABLE:

Make a chart to compare the type of mouth and number of prey captured. Give your chart a title.

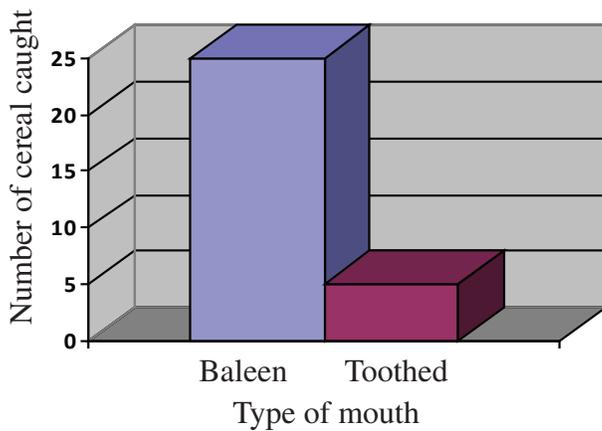
Data on the type of mouth and number of cereal caught

Type of Mouth	Number of cereal caught		
	Trial 1	Trial 2	Trial 3
Baleen (comb)			
Toothed (chopsticks)			

DATA ANALYSIS:

Make a bar graph using the information in your chart. Give your graph a title.

Graph of Whale Mouth and number of cereal caught

**DISCUSSION QUESTIONS:** (accept data that the groups generate)

1. Which feeding style captured the most prey? Can you explain why?

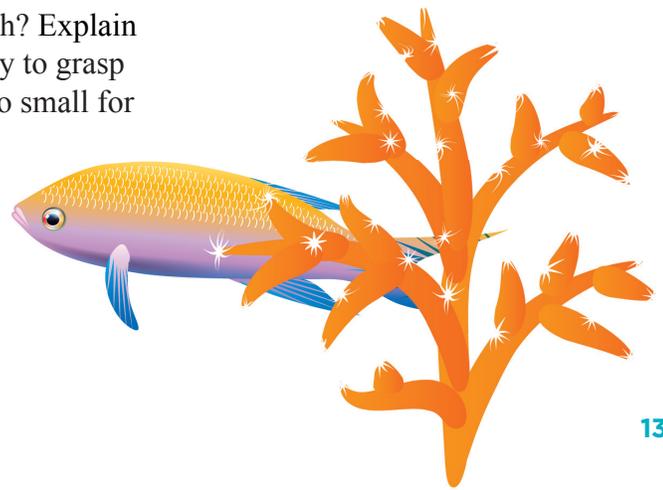
Answer: Baleen whales. The small food is trapped in the baleen so they have more to eat.

2. Which feeding style captured the least prey? Can you explain why?

Answer: Likely response is toothed. Toothed whales and dolphins can only capture one prey at a time. They are not able to capture such small food. They need bigger food to survive.

3. Could a toothed whale capture zooplankton or very small fish? Explain

Answer: No, because toothed whales need large enough prey to grasp onto with their teeth. Zooplankton and very small fish are too small for them to capture.



4. Could a baleen whale eat very large prey? Explain.

Answer: No. Baleen whales can only swallow small prey because they have a small esophagus. They also need very small prey to filter through their baleen plates.

5. Where and when do baleen whales feed?

Answer: Baleen whales feed in cold waters during the summer months when there is lots of food.

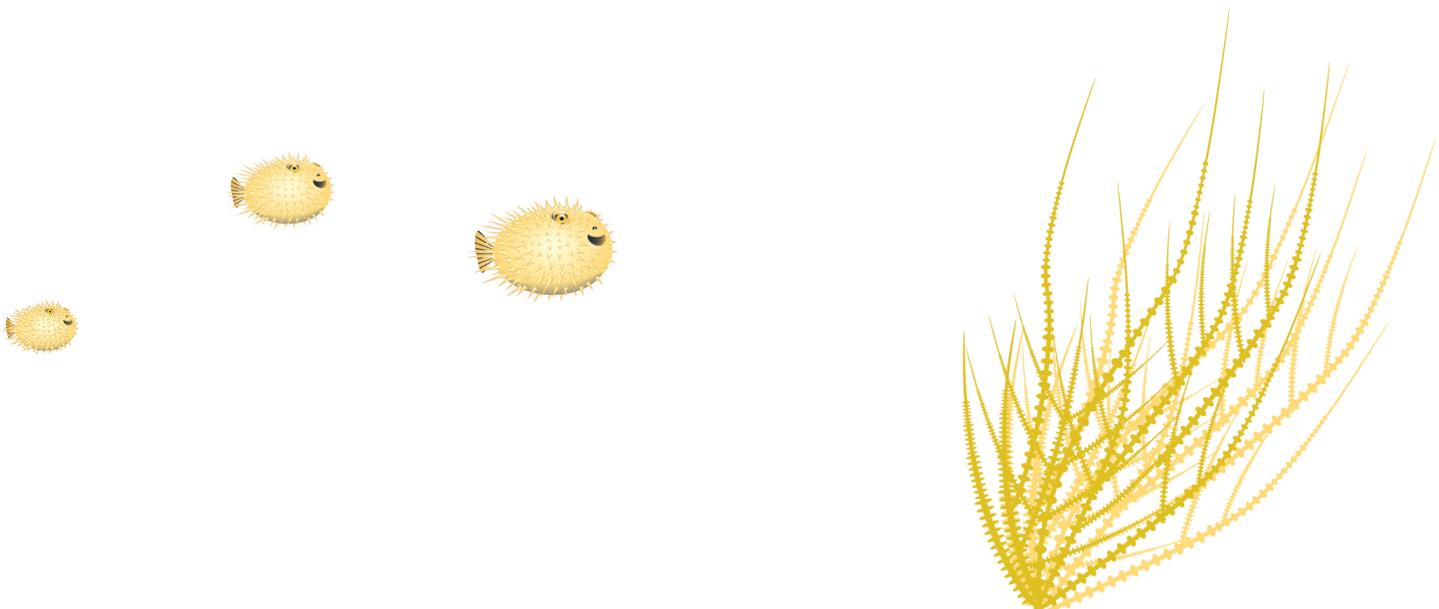
6. Does your data support or refute your hypothesis? Use your data results to explain.

Answer: Varies per student

CONCLUSION:

Work together to write a paragraph explaining what your group discovered about the feeding behaviors of different whales. (Answer your question.)

Sample Answer: Humpback whales feed in cold waters using baleen to filter krill and small fish at the surface of the water. They expand their ventral pleats to gulp in large amounts of prey. Toothed whales, such as Sperm whales, use teeth to capture one large prey at a time. They cannot trap small food easily.



LESSON 2

Whale Feast Feeding Methods Discovery Lab Data Collection Sheets

Group Members: _____

PURPOSE:

To experiment with tools to compare the feeding methods of humpback whales with other types of whales.

WRITE A QUESTION IN YOUR OWN WORDS FOR THIS EXPERIMENT:

Use the question you wrote above to write a hypothesis for this experiment:

MATERIALS AND LAB PROCEDURE:

- Use the tools and materials at each lab station safely.
- Follow all lab instructions carefully.

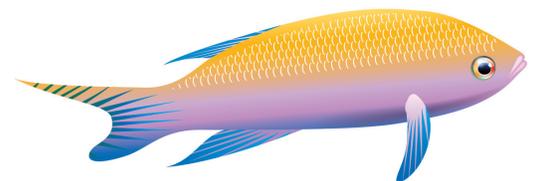
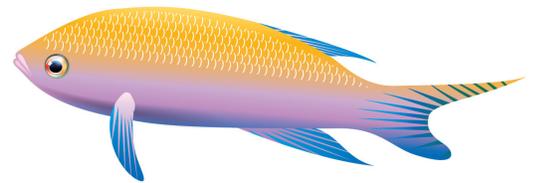
DATA COLLECTION:

Activity 1: BALEEN WHALES

A. What does the plastic comb represent? _____

B. What do the cereal represent? _____

C. Explain how you used these tools:



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D. Record your observations (What happened?):

Activity 2: TOOTHED WHALES

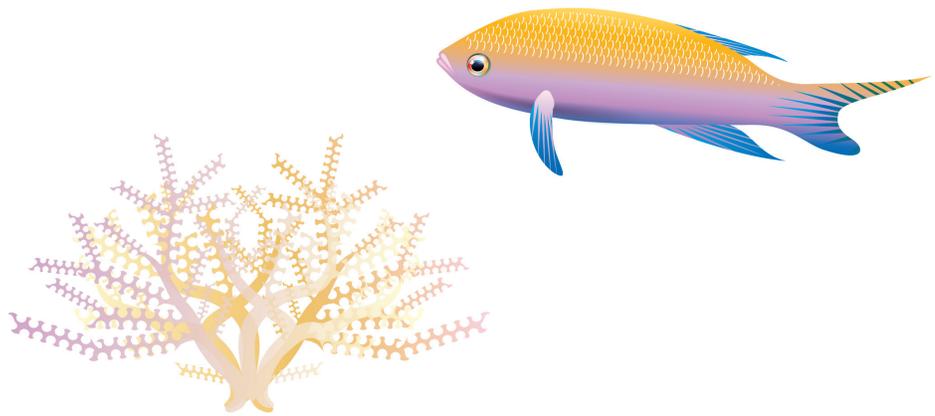
A. What do the chopsticks represent? _____

B. Explain how you used these tools:

C. Record your observations (What happened?):

DATA TABLE:

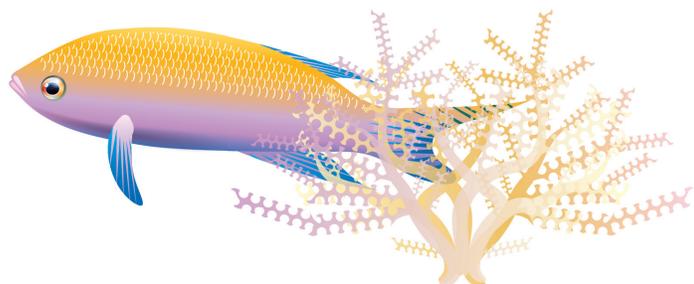
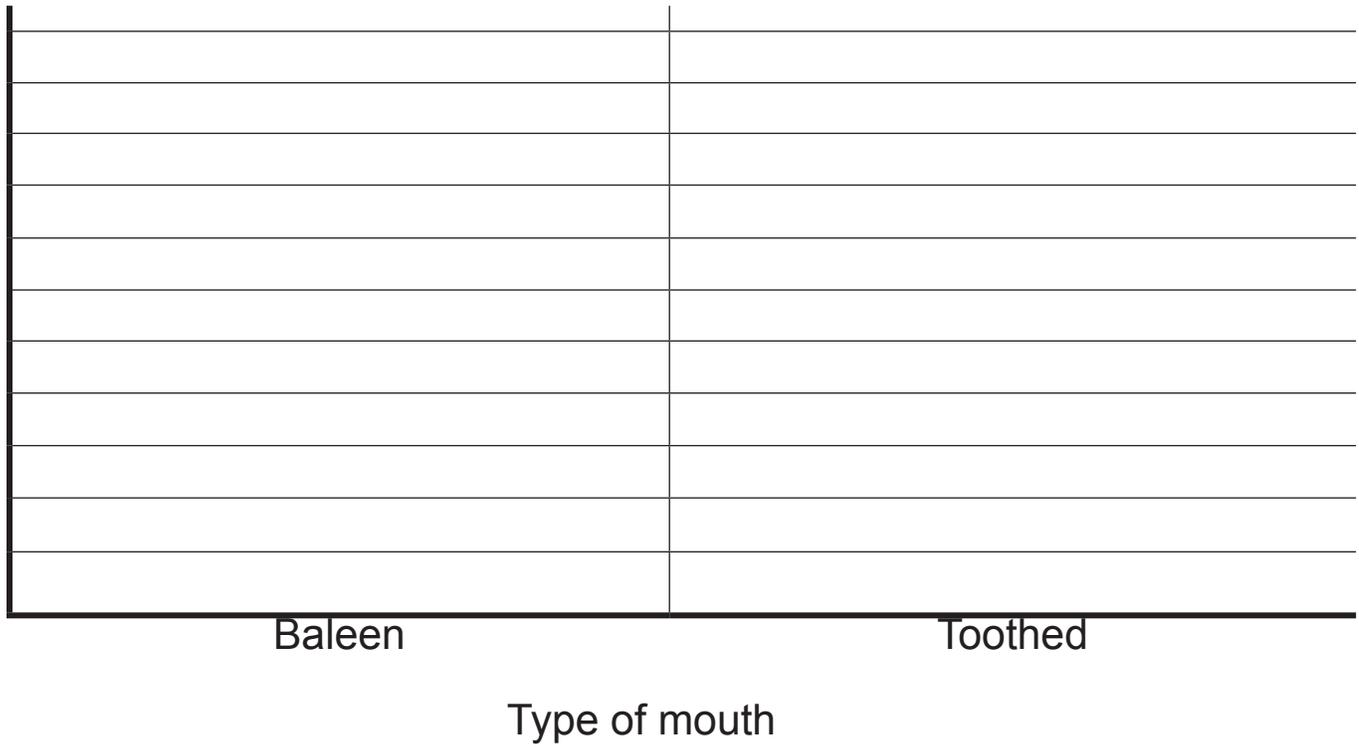
Make a data table to compare the type of mouth and number of prey captured. Give your table a title. Don't forget to make a column for each trial and use a ruler.



DATA ANALYSIS:

Make a bar graph using the information in your data table.

Give your graph a title _____.



DISCUSSION QUESTIONS:

1. Which feeding style captured the most prey? _____

Explain why? _____

2. Which feeding style captured the least prey? _____

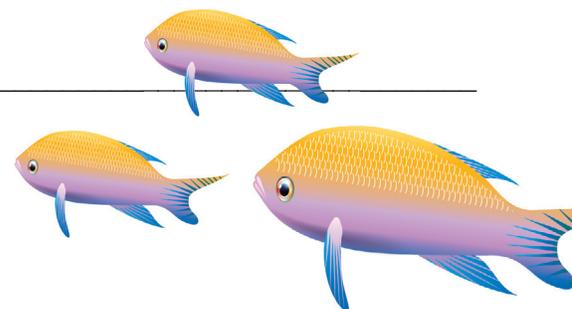
Explain why? _____

3. Could a toothed whale capture zooplankton or very small fish? Explain.

4. Could a baleen whale eat very large prey? Explain. _____

5. Where and when do baleen whales feed? _____

6. Does your data support or refute your hypothesis? Use your data results to explain. _____



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CONCLUSION:

Write a paragraph explaining what your group discovered about the feeding methods of different whales.

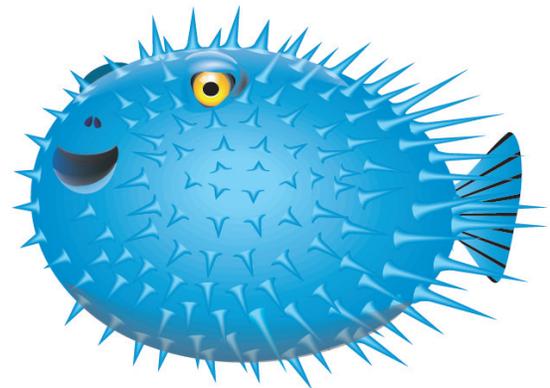
Check your Conclusion:

1. Does your conclusion compare the feeding method of humpback whales with toothed whales?

<u>Yes</u>	<u>No</u>
<input type="checkbox"/>	<input type="checkbox"/>
2. Is your conclusion written with detail and did you give examples?

<input type="checkbox"/>	<input type="checkbox"/>
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**If you checked no, go back and revise!*



LESSON 2

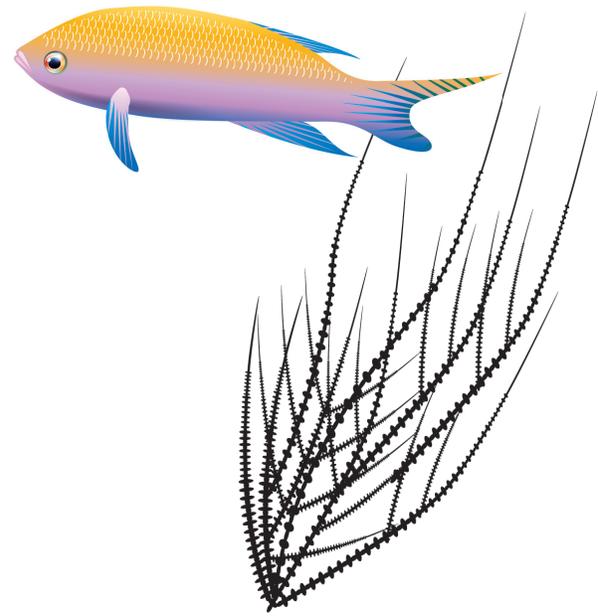
Name: _____

Whale Feast Feeding Discovery Lab Assessment

1. How did you do?
 - a. Rate your lab participation honestly in the table below. Write a comment on how you did in the “Self” column of the table.
 - b. Ask two of your group members to comment on your lab participation. They will write their comments in the Peer 1 and Peer 2 columns.
 - c. Answer the questions below the chart.

Lab Participation Rubric	Self	Peer 1	Peer 2	Teacher
Followed instructions.				
Practiced lab safety at all times.				
Worked well with other group members.				
Helped with the written parts of the lab.				
Helped with the reading parts of the lab.				

2. How did you help your group the most?



3. What can you do better to help your group more next time?