Fish Form & Function – Inside & Out

Materials

For the leader:

Whiteboard

Markers (different colors)

PowerPoint slides (projector)

For the activity:

Fish

Dissecting Kit

Gloves (1 for each student)

Petri dish

Tray

Copies of Exterior and Interior Black Sea Bass images

Images of diet items

Overview

Scientists studying ecology ask broad questions about how the patterns and behaviors of animals change through space and time and the environmental factors that influence the distribution and abundance of individuals. Therefore for fish ecologists, a major question when understanding a population of fish is: what do they eat. Understanding what a fish eats can provide a lot of information about how that fish interacts with its environment. If it only eats things that live on the bottom of the ocean, then we know that fish spends a lot of time near the bottom of the ocean. Scientists also use information from diet studies to understand where different species of fish fit into the food web of the ecosystem, and thus what species need to be present for that fish to survive.

Answers to questions about diet of individual fish, as well as for the entire population, have important implications for understanding marine food webs, managing fisheries, and protecting marine and aquatic systems. Management and conservation decisions are made using the "best available science," which for fish includes knowledge of how a population is interconnected with other organisms within the ecosystem and what factors effect these interconnections. Therefore, by understanding diet of individuals we can better understand patterns of the population as a whole and thus make better management and conservation choices.

Motivating Questions: **How do scientists learn about the parts of a fish? What does it tell them about the fish?**

Take Home Message

Scientists study the form and function of the outsides and insides of fish to learn about how they move, eat, survive, etc.

Engage: Lead the students in a discussion about what they know about fish characteristics and what we can learn from their stomachs.	10 minutes
Explore: Lead the students in an investigation of the external and internal anatomy of a fish.	25 minutes
Make Sense: Lead the students in a discovery of fish stomachs. Then students share their observations, ask questions, and discuss what they can learn from the growth curves.	10 minutes
Total:	**45 minutes**

Audience

Elementary and middle school students (K-5th grade).

New Jersey Core Curriculum Content Standards - Science

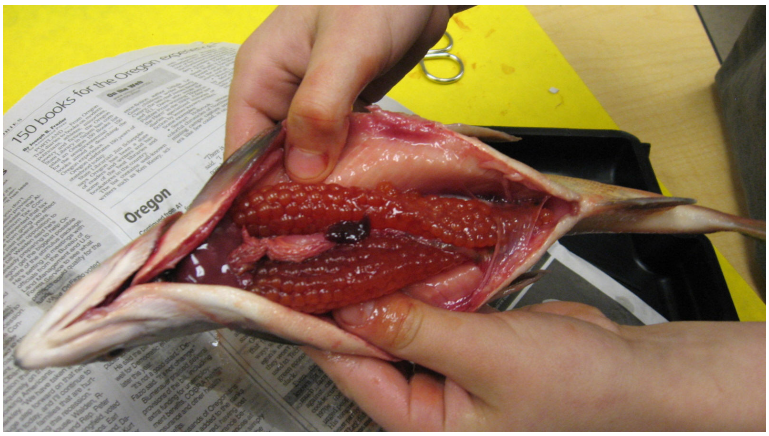
Grade	Content Statement	CPI#
2	Living organisms: exchange nutrients and water with the environment, reproduce, grow and develop in a predictable manner.	5.3.2.A.1
4	Living organisms: interact with and cause changes in their environment, exchange materials (such as gases, nutrients, water, and waste) with the environment, reproduce, grow and develop in a predictable manner.	5.3.4.A.1
4	Essential functions required for the well being of an organism are carried out by specialized structures in plants and animals.	5.3.4.A.2
4	Essential functions of the human body are carried out by specialized systems: digestive, circulatory, respiratory, nervous, skeletal, muscular, reproductive.	5.3.4.A.3
4	Building and refining models and explanations requires generation and evaluation of evidence.	5.1.4.B.1
4	Evidence is used to construct and defend arguments.	5.1.4.B.3
6	Systems of the human body are interrelated and regulate the body's internal environment.	5.3.6.A.1
8	Evidence is generated and evaluated as part of building and refining models and explanations.	5.1.8.B.1
8	Carefully collected evidence is used to construct and defend arguments.	5.1.8.B.3

Preparation (40 minutes)

1. Write the motivating questions on the board:

   How do scientists learn about the parts of a fish? What does it tell them about the fish?

2. Make class copies of the Exterior and Interior anatomy images of Black Sea Bass.
3. Write the title "Characteristics of Our Fish" on the board, to fill in as the students make observations about the fish during the activity.
4. If you are using a real fish:
   a. Purchase a WHOLE fish from your local fish market (stress that you do not want a fillet, but rather a whole fish). The activity is designed around using a Black Sea Bass, but you can use any type of fish available. If using another species, make sure you research where the fish lives, how it moves around, and what it eats.
   b. Turn the fish so the dorsal fin is pointing down towards the tray. Locate the anus. Using a scalpel make an incision from the anus towards the front most part of the skin underneath the lower jaw (as shown below).



c. Locate the stomach and intestines of the fish. Make a small incision at the bottom of the intestines to separate it from the anus. Using your fingers pinch the top part of the stomach (near the mouth) and squeeze out the contents onto a petri dish. Make sure to leave the stomach and intestines inside of the fish.

d. Close up the fish and lay the fish on its side on the tray for the students to observe.

Engage (10 minutes)

1. Lead the students in a discussion about what they know about fish.

Q. What makes a fish a fish and not another organism?

Q. What are similarities and differences among fish and other organisms? Among fish and humans?

2. Ask the students what they know about the inside and outside parts of a fish and what we could learn by looking inside a fish stomach. Be accepting of all responses from the students. If they are stuck, ask them what kinds of things or senses they would use to learn about another animal. Ask the students how they tell their friends apart. Have them be specific regarding differences in hair color, eye color, height, etc.

Q. What can scientists learn about a fish from looking at the outside? Looking on the inside? Looking on the inside of a stomach?

Explore (25 minutes)

1. After a few minutes, explain to the students that they will be taking a closer look at fish; in fact they will be fish scientists on a mystery to determine what kind of fish it is and what it last ate.
2. Talk to the students about the outside of the fish:
    a. First we are going to look at the outside of the fish. Introduce external anatomy features of the Black Sea Bass, but do not call it by its name, by showing the Exterior picture or having students look at the fish. Focus on the mouth, body, and fin shapes.
    b. Tell the students that just like we have vocabulary to talk about human anatomy, scientists and fishermen need vocabulary to describe different parts of fish. These body parts are common to most fish. You can use differences in these body parts to help distinguish one fish from another.
    c. Ask the students for their opinions about what the different parts of the fish body can tell us about the fish. (For Black Sea Bass: big eyes to find food, big mouth to eat a lot, sharp teeth to eat other organisms, large tail to move quickly after its prey or away from predators, spiny dorsal fin to protect itself, large pectoral and pelvic fins to change direction quickly/maneuver more easily.)
    d. Ask the students how this fish looks similar or different from other fish they know about (e.g., Nemo, Dory, Tuna, Sharks). Discuss how the forms or parts look different on some of the fish but the function is similar.
3. Talk to the students about the inside of the fish:
    a. Now we are going to look at the inside of the fish. Introduce internal anatomy features of the Black Sea Bass by showing the Interior picture or having students look

inside the fish. *It may be helpful to have an image of human anatomy as well to show the students.

b. Talk with the students about the six organ systems in fish (and humans):
    i. Circulatory – blood, heart, blood vessels
    ii. Digestive – mouth, tongue, stomach, liver, intestines
    iii. Excretory – kidneys, bladder
    iv. Nervous – nerves, lateral line
    v. Reproductive – male and female gonads (sex organs)
    vi. Respiratory – gills, lungs, diaphragm

c. Ask the students for their opinions about what the different parts of the fish inside can tell us about the fish. (For Black Sea Bass: large gills mean the fish swims a lot and quickly so it needs lots of oxygen, short stomach means that it eats a lot and but does not need a long time to digest its food, big swim bladder helps the fish stay in the middle of the water (not at the bottom or top).)

d. Ask the students if they think the inside of different fish look similar or different (e.g., Nemo, Dory, Tuna, Sharks). Why or why not?

4. As a class talk through what the students have just learned about the outside and inside of fish. Use the blank images of the Exterior and Interior of Black Sea Bass to have the students remember the parts of the fish and their functions and what that told us about the fish. Make a list of characteristics about the fish as the students describe the fish you are looking at.
5. Ask the students to use the list of characteristics about the fish to write a description of the fish. Make sure to have the students support their statements of the description by stating what evidence they are using.

Make Sense (10 minutes)

1. Based upon their description of the fish, what types of food do they think the fish would eat? Be accepting of all answers, this is meant to encourage students to use their new information and make predictions about what they might find in the stomach of a fish.
2. To explore the stomachs of fish:
    a. If you are using a real fish, have the stomach contents out and cleaned in a petri dish. Ask the students what they can identify. Talk through the items with the students in terms of what they are (or might be) and how they could determine what it was.
    b. If you are not using a real fish, try to find images of common diet items for Black Sea Bass: sponges, anemones and corals, polychaete worms, gastropods (snails), bivalves, squid, and fish. Talk with the students about what parts of these animals they would expect to find the in the stomachs (e.g., beaks for squid, bones of fish, shell parts of bivalves). Ask the students what they think would be hard to see (e.g., soft parts of all organisms because they are digested quickly and become mushy).
3. After you have talked about the stomachs, again ask the students what kind of fish to they think we are looking at. How would they describe where the fish might live, how it might

behave, and what it might eat? Remind the students there are no right or wrong answers, but rather they are practicing using all of their information to make ideas.

4. After a few students have shared their ideas, show the students a picture of a Black Sea Bass. Depending on your time, you can provide the students with more information about the species (a good resource for you to get more information about Black Sea Bass is FishBase, http://www.fishbase.org/summary/Centropristis-striata.html).
5. Once the discussion slows down, point to the motivating question and ask:
   Q. How do scientists learn about the parts of a fish? What does it tell them about the fish?
   Ask students to share their ideas about the question with a partner. After a minute, ask volunteers to share the ideas they discussed with the entire class. Be accepting of all responses from the students. This is your opportunity to make sure the students understand the "take home message" that you identified.
6. Ask if the students have any questions about the activity.

** Consultations on this lesson plan were provided by:
Dr. Paola Lopez-Duarte and Dr. Olaf Jensen of Rutgers University. **