

Great Science Adventures



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Great Science Adventures

Lesson 1

What are vertebrates?

Vertebrate Concepts:

- All vertebrates have a backbone; their central nervous system is partly enclosed within the backbone.
- All vertebrates have cartilage in addition to, or instead, of bone.
- Vertebrates include fish, amphibians, reptiles, birds, and mammals.

Vocabulary Words: animal living classify vertebrate *organism *species

Construct and Read: *Lots of Science Library Book #1.*

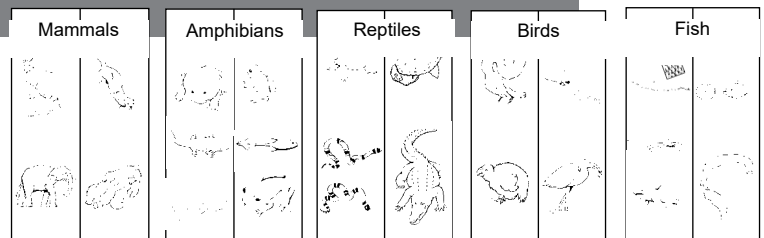
Activities:

Vertebrates – Graphic Organizer

Focus Skill: following directions

Paper Handouts: 5 pieces of 12”x 18” paper
a copy of Graphics 1A-E

Graphic Organizer: Fold each piece of paper in s Shuttle Fold. See page viii for instructions.



This makes Desktop Projects for each type of animal. On the top cover of each Desktop Project, write the name of each group of vertebrates discovered in the *Lots of Science Library Book #1*. *Mammals, Amphibians, Reptiles, Birds, Fish*. Cut out and glue the correct graphic on each *Desktop Project*. Set aside for future use.

Shoe Kingdom – Investigative Loop – Lab 1-1

Focus Skill: classifying

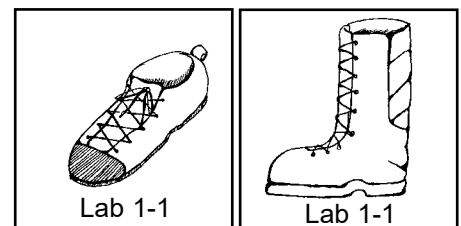
Lab Materials: several different kinds of shoes (sneakers, boots, sandals, various colors, etc.)

Paper Handouts: 8.5”x11” paper a copy of Lab Graphic 1-1 Lab Record Cards (index cards or pieces of 3” x 4” paper)

Graphic Organizer: Make a Pocket Book. See page ix for instructions. This is the student’s Lab Book. Draw/glue Lab Graphic 1-1 on the left pocket.

Concept: Both living things and inanimate objects can be classified.


Research: Read *Lots of Science Library Book #1*. Review classification.







Procedure: Place the shoes (only one of each pair) on the table. List at least three characteristics of each shoe on index cards. Ex: red, heels, buckles; white, no heels, shoelace; black, heels, open-toed, etc. Divide all the shoes into two groups. There is no right or wrong way to classify; you decide. Ex: Group 1 may consist of shoes with heels, and Group 2 may consist of shoes without heels. Name your groups. Now, divide each group again and name them. Continue until only one shoe is assigned to each group.

Observations: Was it easier classifying the shoes in the beginning or the end? What were some difficulties when classifying? Do you think you could have classified the shoes in another way?

Record the Data: Label two Lab Record Cards, “Lab 1-1” and date.

 On each Lab Record Card, draw a picture of a shoe from each group and list its characteristics.

  &   On each Lab Record Card, write the characteristics of each group and the shoes that fit into that group.

Conclusions: What can you conclude about classifying?

Communicate the Conclusions: Label a Lab Record Card, “Lab 1-1” and date. Explain your conclusions about classifying. Store the Lab Cards in the left pocket of the Lab Book.

Spark Questions: Discuss questions sparked by this lab.

New Loop: Choose one question to investigate further. Or, re-classify the shoes using a different method. Or, add new shoes and decide their place in your classification system.

Design Your Own Experiment: Select a topic based upon this *Investigative Loop* experience. See page v for more details.

Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students’ strengths.



1. Research Carl von Linné or Carolus Linnaeus, and the Linnaean system of classification.



2.    Read *Carl Linnaeus: Father of Classification* (Great Minds of Science series) by Margaret Jean Anderson.



3.    Find information on the acorn worms, sea squirts, and amphioxus. Compare and contrast them to invertebrates and vertebrates.



4. Using an Internet Search Engine, research vertebrates. Choose two species and compare and contrast their environments.



What are fish?

Vertebrate Concepts:

- Fish make up the largest class of vertebrates with about one-half of all the vertebrate species.
- Fish are cold-blooded, swim with fins, and most breathe underwater using gills.
- Most fish are covered with scales; scales may be smooth or rough edged.
- Most fish lay eggs; some fish bear live young.
- Fish are divided into jawless, cartilaginous, and bony fish.

Vocabulary Words: fish cold-blooded extinct smooth hard

Construct and Read: *Lots of Science Library Book #2.*

Activities:

Goldfish – Activity

Focus Skill: observing

Teacher’s Note: For students to gain a knowledgeable understanding of fish, we highly recommend purchasing goldfish from a local pet store or aquarium. However, if you choose to do this, we recommend that you receive instruction from a professional about the proper care and maintenance of your new pets.

Activity Materials: goldfish (5 or more is recommended) container for goldfish

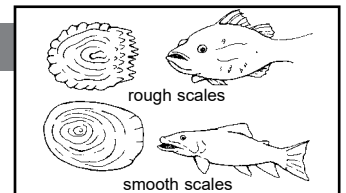
Activity: You will conduct an activity in Lesson 3. Today, just observe the fish. Feed them at the same time every day.

Fish Facts – Graphic Organizer

Focus Skill: recording information


Paper Handouts: 8.5”x11” sheet of paper a copy of Graphic 2A

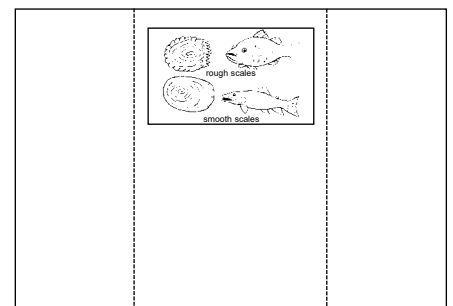
Fish Desktop Project



Graphic Organizer: Make a Trifold Book using the 8.5”x11” paper. Glue/draw Graphic 2A on top of the Trifold Book. Open the Trifold Book and on the inside top two sections:

 Draw pictures of fish showing different sizes and shapes. Show them living in salt water seas and fresh water lakes and rivers.

 Write clue words about fish: *largest class of vertebrates, over 25,000 species, vertebrates with backbone, cold-blooded, swim with fins, most breathe with gills, most lay eggs, divided into three main groups, most are covered with different types of scales: rough scales with small points on surface; smooth surfaced scales; shiny, hard scales; scales with tiny teeth*





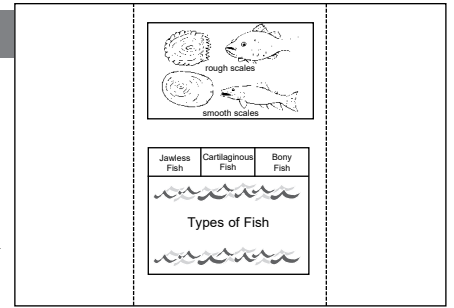
Complete Research and name at least two fish with each type of scale and record your findings on the bottom section of the Trifold Book. Open the *Fish Desktop Project* and glue the Trifold Fish Book to the top of the middle section.

Types of Fish – Graphic Organizer

Focus Skill: labeling

Paper Handouts: a copy of Graphics 2B-E *Fish Desktop Project*

Graphic Organizer: Cut out each graphic, stack them in order, and staple them on the left side. Label the cover *Types of Fish*. Label each top tab accordingly: *Jawless Fish*, *Cartilaginous Fish*, and *Bony Fish*. Information will be added to this *Types of Fish Top Tab Book* in future lessons.



Open the *Fish Desktop Project* and glue the *Types of Fish Top Tab Book* on the bottom of the middle section.

Fish Print – Activity

Activity Materials: tempera paint or poster paint fresh whole fish (with head and fins and scales) paint brush sheet of paper newspaper

Activity: Place the fish on newspaper. Spread out the fins. Brush paint on one side of the fish. Carefully place a sheet of paper on top of the fish. Remove the paper without making smudges. Gyotaku, the art of fish printing, originated in Japan in the mid to late 19th Century.

Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students' strengths.



1. Using an Internet Search Engine, research fish. What known species are live bearing fish? What are their habitats?



2. Using an Internet Search Engine, research fish gills. Draw or report how fish use their gills.



3. Research the life of marine explorer, Jacques Cousteau. Write about his contributions to underwater explorations.



4. Research salt water and/or fresh water fish in your area. Create a bar graph to show the number of each type of fish you locate.



5. Read and discuss *Swimmy* by Leo Lionni.



6. & Read and discuss *Nessa's Fish* by Nancy Luenn.



7. Read and discuss *The Major, the Poacher, and the Wonderful One-Trout River* by Dayton O. Hyde.



8. Research the fishing industry. Name at least five countries that depend on fishing as a resource. What fish are native to their area? Locate the countries on a map.



What are jawless fish and cartilaginous fish?

Vertebrate Concepts:

- Jawless fish are the simplest class of fish.
- All jawless fish are extinct except hagfish and lampreys; they lack scales and paired fins.
- Jawless fish have a simple circular opening as a mouth; they latch onto the host or carcass and suck.
- Cartilaginous fish include chimaeras, sharks, and rays.
- The skeleton of cartilaginous fish is made up of cartilage.
- Cartilaginous fish have jaws, paired fins, and paired nostrils.
- Sharks have rounded bodies which taper at the ends with seven gill slits; rays have flattened bodies with five gill slits.

Vocabulary Words: jawless fresh water jaws *cartilaginous *parasites

Construct and Read: Lots of Science Library Book #3.

Activities:

Jawless Fish – Graphic Organizer

Focus Skill: research

Paper Handouts: Fish Desktop Project

Graphic Organizer: Open the *Types of Fish Top Tab Book* to the *Jawless Fish* top tab:

- Draw a picture of jawless fish.
- Write clue words about the characteristics of a jawless fish: *long, tube-like body; slimy, lack scales and paired fins, simple digestive system*
- Complete Research the simple digestive system of a jawless fish and draw a diagram labeling its parts.

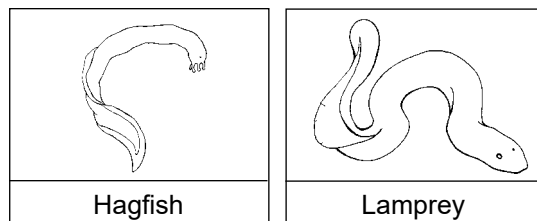
	Jawless Fish	Cartilaginous Fish	Bony Fish







Hagfish and Lamprey – Graphic Organizer

Focus Skill: describing

Paper Handouts: 8.5”x11” sheet of paper a copy of Graphics 3A-B *Types of Fish Top Tab Book*

Graphic Organizer: Make six Mini Matchbooks. Glue/draw Graphics 3A and 3B on two Mini Matchbooks. Store the remaining Mini Matchbooks for future use. Label them *hagfish* and *lamprey* accordingly. Open the Matchbooks:



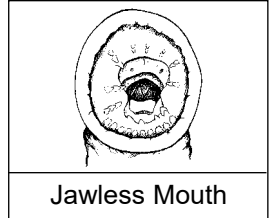
-  Draw a picture of a hagfish and a lamprey.
-   Write clue words about hagfish and lamprey: hagfish – *scavenger, feeds on dead animals.* lamprey – *parasite, fairly large eyes, seven gill openings, fresh and salt water.*
-    Write a sentence describing hagfish and lampreys. Turn to the Jawless Fish top tab of the Types of Fish Top Tab Book. Glue the Hagfish Matchbook and the Lamprey Matchbook on the left side, behind the cover page.







Jawless Mouth – Graphic Organizer

Focus Skill: labeling parts of a whole

Paper Handouts: a copy of Graphic 3C Matchbook from the previous activity
Types of Fish Top Tab Book

Graphic Organizer: Glue/draw Graphics 3C on top of the Matchbook. Label it *Jawless Mouth*. Open the Matchbook:









-  Draw a picture of a mouth of a jawless fish.
-   Write clue words about the mouth of jawless fishes: *simple, circular opening in head; small teeth.*
-    Define the parts of a jawless fish mouth. Label its parts on the graphic. Glue the Jawless Matchbook on the back of the title page.

Cartilaginous Fish – Graphic Organizer

Focus Skill: describing

Paper Handouts: *Types of Fish Top Tab Book*

Graphic Organizer: Open *Types of Fish Top Tab Book* to the *Cartilaginous Fish Top Tab*

















-  Draw a picture of a cartilaginous fish.
-   Write clue words about the characteristics of cartilaginous fish: *skeleton made from cartilage, have jaws, paired fins, paired nostrils*
-    Describe the characteristics of cartilaginous fish.

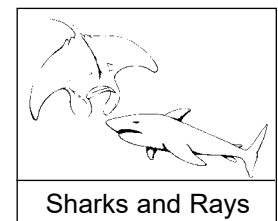
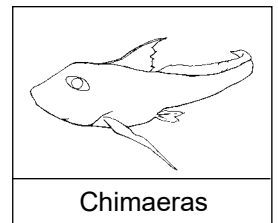
Chimeras, Sharks, and Rays – Graphic Organizer

Focus Skill: describing

Paper Handouts: 2 Small Matchbooks from previous activity a copy of Graphics 3D-E
Types of Fish Top Tab Book

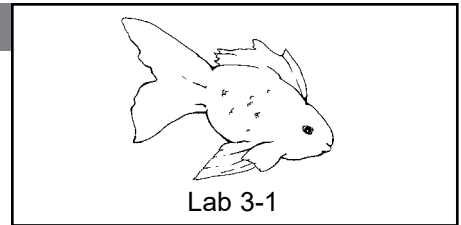
Graphic Organizer: Glue/draw Graphics 3D and 3E on the Mini Matchbooks. Label them *Chimaeras*, and *Sharks and Rays* accordingly. Open the *Chimaeras Matchbook*.

-  Draw a picture of chimaeras.
-   Write clue words about chimaeras: *one pair of gill slits, upper jaw and cranium, fused together, lack scales.*
-    Complete  . List characteristics of chimaeras. Open the *Sharks and Rays Matchbook*.
-  Draw a picture of a shark or ray.
-   Write clue words about sharks and rays: sharks - *rounded bodies, tapers at ends, seven gill slits.* rays - *flattened bodies, five gill slits.* both - *have upper jaw, grow new scales*
-    Complete  . Compare and contrast sharks and rays. Open *Types of Fish Top Tab Book* to the *Cartilaginous Top Tab*; glue these Small Matchbooks on the left side of the Top Tab Book, behind the *Jawless* page.



Breathing Rate - Investigative Loop – Lab 3-1

Note: Your goldfish is neither a jawless fish nor a cartilaginous fish. It is a bony fish.



Focus Skill: cause and effect

Lab Materials: at least 3 goldfish 3 small glass containers 2 bowls large enough to hold glass containers 2 thermometers aquarium fish net ice water watch with second hand

Paper Handouts: Lab Book (from Lesson 1) a copy of Lab Graphic 3-1 Lab Record Cards

Graphic Organizer: Glue/copy Lab Graphic 3-1 on the right pocket of the Lab Book.

Question: Does temperature affect the breathing rate of goldfish?

Research: Read Lots of Science Library Book #3, and review the question.

Procedure: Fill the three glass containers with room temperature water, about 65 - 70° F (18.33 - 21.11° C). Place two of the containers in the bowls of water with the same temperature. One of the containers is not in a bowl. Using the fish net, carefully scoop up a goldfish and place one in each of the three glass containers. Place thermometers in each bowl. In one bowl, add some ice, a little at a time, until the water temperature decreases 5° F (-15° C). In the other bowl, add hot water, a little at a time, until the water increases 5° F (-15° C). Do nothing with the third container.

Observations: Observe the goldfish that is not in a bowl. Count the number of times it opens and closes its mouth in one minute. Observe the goldfish in the cooler water and count. Repeat with the goldfish in the warmer water.

Record the Data: Label three Lab Record Cards, “Lab 3-2” and the date. Write words or phrases that describe your observations of the goldfish in each container.

Conclusions: What do you conclude about the relationship of breathing rates of goldfish and water temperature? **Fish breathe more times per minute in warmer water.**

Teacher’s Note: Immediately after the lab, carefully return the goldfish back to their home.

Communicate the Conclusions: Review the data and draw a conclusion about the differences in your observations. Label a Lab Record Card, “Lab 3-2” and date. Write your conclusion. Store these Lab Record Cards in the right pocket of the Lab Book.

Spark Questions: Discuss questions sparked by this lab.

New Loop: Choose one question to investigate further.



Design Your Own Experiment: Select a topic based upon the experiences in the Investigative Loop. See page v for more details.

Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students’ strengths.



1. Using an Internet Search Engine, research jawless fish.



2. Using an Internet Search Engine, research lampreys.



3. Using an Internet Search Engine, research sharks.



4. Using an Internet Search Engine, research manta rays.