

Whales and Dolphins

ZOOGUIDES volume 2

TEACHERS NOTES



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INTRODUCTION

The ZooGuides™ series of software from REMedia provides a resource for K-12 teachers and librarians on life science topics. This guide offers suggestions, activities, and references for integrating the Whales and Dolphins ZooGuide into your curriculum. Other volumes in the series include:

Butterflies of the World
Mammals of Africa
The Rainforest
World of Reptiles
Life in the Desert
Animals in Danger
Natural History of Yellowstone

Use this program:

- as an encyclopedic reference;
- to teach major biological concepts such as Evolution, Life Cycles, Anatomy, Reproduction, and Ecology; and
- to understand and appreciate the intricate and fascinating lives of cetaceans.

What is in this Guide

The Whales and Dolphins Teacher's Guide offers suggestions for incorporating the accompanying CD-ROM into Life Science and Biology classes. These ideas are divided into two general levels, K-6 and 7-12. Feel free to adapt any of the activities to meet your specific curricular goals (e.g., You may want to use a suggestion for a K-6 group that was written at a 7-12 level or vice versa).

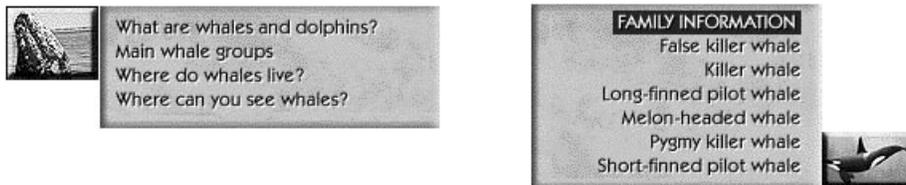
In addition, this guide provides information to complete activities by incorporating the various sections of the program and makes Whales and Dolphins a richer reference than an encyclopedia is. Read from a chapter, look at and listen to movies, and use the chapters on families of whales and dolphins to get a more complete picture of their world.

Finally, use this Teacher's Guide as a quick reference for the data provided in the ZooGuide. A list of helpful reference materials is provided so that your students can do more in-depth research once the program has sparked their imagination and interest.

USING WHALES AND DOLPHINS ZOOGUIDE

Navigating

There are “chapter” buttons on the left and right hand sides of your screen. Visit any of the chapters to access various kinds of information. To see the title of a chapter, move your mouse pointer over the chapter name. The current chapter is highlighted darker than the other chapters. When you are in a chapter, moving the mouse pointer over the current chapter button will display a list of the chapter’s contents.



Click on the topic or species you are interested in and you will go to the relevant section of the current chapter

To choose a different chapter, click once on any of the other chapter buttons.

Playing Movies



Chapter topics have text and accompanied by a movie, animation, or still pictures and narration.

To access these enhancements, click once on the picture and press the play button. Use the other buttons located under the picture to control the volume, to pause, or to jump forward or backward in the movie.

Viewing Pictures

There are two kinds of pictures accompanying the text for many of the individual cetacean species. One is an artist's rendering that can be expanded to full screen view by clicking on it once. The enlargement includes information about size and weight of that species of cetacean. The second type of picture is an actual photograph which can be expanded by clicking on any of the thumbnail photographic images visible on the screen under the artist's rendering (note: not all species have photographs). The enlargement provides for closer study and more detail in the image. To return to the smaller view of either kind of picture, click on it again.

The pictures contained in the Whales and Dolphins ZooGuide can be directly accessed from a folder called Pictures located on the CD-ROM. Use the pictures with the activities described in this Teacher's Guide or for other class projects.

*Note for Windows users: You can open the pictures using a graphics program or the View32 application which is installed as part of QuickTime. If the files are not visible in the 'Open' dialog box, type *.* in the 'File name' area in this dialog box.*

Getting Help

There is on screen help available in the ZooGuide. To access it, click on the Whales and Dolphins title bar. The help system uses text and graphics to explain the functions of the different sections of the program. Click on the title bar again to return to the program.

Other Buttons

There are four other buttons in the viewing window. They allow you to:



Print the text or graphic on a page. If a photo or painting is enlarged it will be printed. If the photo or painting on a page is not enlarged, the text for that page will be printed. If you viewing a quiz, the print button can be used to print a copy of the quiz for that chapter.



Get an index of all the whale and dolphin species contained in the program.



Take a quiz for the current chapter



Exit the program.

INTEGRATING PARTS OF THE ZOOGUIDE

The Whales and Dolphins ZooGuide has several zones of student-program interaction. They can be used singly or integrated to create more in-depth explorations of the program. For example, if students are learning about whale feeding behavior, they can look at the information under Social Behavior in the Ecology chapter. To get more refined information, they can look at specific species mentioned such as the blue whale and common dolphin by using the Species Index buttons. By viewing the movies, reading the text, and checking the maps where these cetaceans roam, students can get a more complete picture of feeding behavior than they could by looking at only one component.

K-6 classes may want to use the parts of the program individually especially with younger students, increasing the integration with more interested or older students. The pictures, movies, and animations are probably the most useful parts of the program at this level. They provide interesting facts and attention grabbing footage.

7-12 classes can explore the chapters, text, graphics and individual species information separately or together depending on your focus. The activities included in this guide give other examples of how to integrate the parts of the ZooGuide to create projects and lessons that will motivate your students. It also provides suggestions for integrating Whales and Dolphins into your Life Science or Biology curriculum.

ACTIVITIES FOR K-6 TEACHERS

This section of the Teacher's Guide offers 15 activities and ideas for integrating the Whales and Dolphins ZooGuide into your life science curriculum. The activities range from writing stories to making maps of whale habitats.

Each activity lists the topic covered, the sources of information it will use, materials you will need, a step-by-step description of the activity, and discussion questions to help you conclude and find out what your students have learned in the process. Modify, delete, or edit these activities to tailor them to your specific needs. Also look at the 7-12 activities for other ideas and ways to use the ZooGuide with your students.

K-6 Activity 1:

TOPIC: **Introducing Cetaceans to Your Students**

SOURCES: Introduction chapter in Whales and Dolphins ZooGuide
Dictionary
Students' knowledge of whales and dolphins

MATERIALS: Pencil, markers, crayons, or colored pencils
Lined paper
Poster paper

ACTIVITY: In this introductory activity, students will learn the term cetacean and its meaning, demonstrate their knowledge of whales and dolphins by naming as many as they can, and explain why whales are mammals and not fish.

Ask students to make a list of cetaceans and write them on the chalkboard or overhead projector. Look at various pictures of cetaceans using the ZooGuide's Species Index (buttons on the right side of the window). Then ask the following questions:

1. What characteristics do these animals have in common?
2. They are called cetaceans, what does that mean? (Use a dictionary or the Introduction chapter of the Whales and Dolphins ZooGuide to find the meaning.)
3. Think about how a fish looks. How are whales and fish different in body structure, behavior, and child-rearing?

Now that your students have answered these questions, have them draw a whale or dolphin from memory and draw a fish on the same page. Can they point out the differences and similarities in the two kinds of animals? An alternative to drawing these pictures is to have students find pictures of fish and cetaceans in magazines, cut them out, and discuss similarities and differences as a group.

DISCUSSION: Discuss and reinforce the learning experience this activity provides by asking the following questions:

1. Why do you think scientists call whales and dolphins cetaceans?
2. What have you learned about cetaceans that you didn't know before you started this activity today?
3. Why do you think that people in the past confused whales with fish?

K-6 Activity 2:

TOPIC: **Comparing Body Size**

SOURCES: Species Index in Whales and Dolphins ZooGuide

MATERIALS: Large poster board or bulletin board
Drawing paper for each group
Markers or crayons for each group. rulers

ACTIVITY: In this activity students will use the information provided on length and weight for 5-10 whales chosen from the 65 species contained in this program. You should probably choose whales of varying lengths to make the activity more interesting (e.g., choose the Blue Whale, the Humpback Whale, the Pigmy Sperm Whale, the Bottle Nosed Dolphin, and the Amazon River Dolphin.) The length and weight for each species are located on the enlargement of the artist's drawing of that whale or dolphin. Click once on the small version to blow it up.

Use a scale of 1 inch = 1 foot or choose your own scale and convert each length. Choose the tallest student in class and convert his/her height to the same scale.

Divide students into groups to work on one or more whales. (One group should also work on the drawing of the tallest student.) They should convert the length using the scale the class decides on and draw a picture of their whale making it the scaled down size.

Students can color their picture using the images of that whale in the ZooGuide as a reference. Cut out the pictures and paste them on a piece of large poster board or tack them to a bulletin board starting with the longest one on top and decreasing in size as you go down the board.

Write the weight of each whale next to its picture. Talk about what 1 ton is equal to (e.g., a car, 2000 pounds, etc.)

DISCUSSION: Discuss the results of the poster activity as follows:

1. Which whale weighs the most? Is it the longest whale?
2. How many (tallest student's name) can fit end-to-end on the longest whale you chose?
3. Does the weight of a whale always decrease as the length decreases?
4. What have you learned from this activity?

Advanced questions

5. Why do whales live in water?
6. What would happen if they tried to live on land?
7. What adaptations do whales have for living in water?

K-6 Activity 3:

TOPIC: **Mapping Cetacean Homes**

SOURCES: Species Index (Map feature) in Whales and Dolphins ZooGuide
 'Where are cetaceans found?' subtopic in Introduction chapter in
 Whales and Dolphins ZooGuide

MATERIALS: One or more large maps of the world
 Markers, crayons, colored pencils
 Scissors
 Glue

ACTIVITY: In this activity students will construct a map showing where
 cetaceans can be found in the world's oceans and large rivers.

Begin by making enlargements of the world map. Make one for a whole class project or several for smaller groups to work on. Students should label the continents and oceans. They should pick 5 or 6 different cetaceans to include on their map and choose a different color to represent each species' habitat. If students are working in small groups you may want to assign the cetaceans that they map to make sure there is as little overlap as possible.

Once students have chosen a color to represent each species of whale or dolphin, they should create a map legend that includes the color code of each cetacean to make the map easy to read.

Next, they can use the information provided in the Species Index section of the ZooGuide to color the regions of earth where their groups of cetaceans live. Once they find the species name in the Index, they can click on the Map button to see the regions where that particular whale or dolphin species lives. Some species inhabit much of the world's oceans while others are confined to relatively small areas.

To add more depth to the assignment, students can draw, color and cut out pictures of the whales and dolphins that are represented on their maps. Alternately, they could print pictures of their group of cetaceans from the Whale and Dolphin Pictures folder located on the CD. These can then be colored, cut out and pasted onto the maps.

Students can display their completed maps around the room or on a bulletin board.

DISCUSSION: Discuss this activity by answering the following questions.

1. Which ocean has more species of cetaceans, the Atlantic or the Pacific?
2. Which whale species has the largest home range?
3. In what part of the world (north, south, equatorial region) do most whales live? Why?

K-6 Activity 4:

TOPIC: **Whale Body Plan**

SOURCES: Introduction chapter pictures in Whales and Dolphins ZooGuide
 'Profile' subtopic in Body Plan chapter in Whales and Dolphins
 ZooGuide
 Other reference books with labeled whale body parts
 Reference book showing common fish and labeled body parts (See
 the list of references at the end of this Guide.)

MATERIALS: Poster paper, markers, colored pencils, or crayons, lined paper

ACTIVITY: Cetaceans live in oceans and rivers along with many other forms of
 marine life. In this activity, students will identify critical structures that
 enable cetaceans to live in water and students will compare them to
 some common fish that also inhabit the underwater world.

Students should work in pairs or small groups and view the pictures of whales shown in the Introduction chapter of Whales and Dolphins ZooGuide. As they look, they should keep a list of common body parts that they see again and again in different species of whales. If they aren't sure of the name of a structure, such as a dorsal fin, they can draw a picture of it and look up the name later.

Once the lists have been completed, students should draw a picture of a cetacean using all of the common parts. For example, they should include the head with eyes on either side, the blow hole, the dorsal fin, the tail fluke, and the flippers. Check to make sure the orientation of the tail fluke is correct. If any students drew it in a vertical direction have them look at the pictures in the ZooGuide more closely.

Instruct students to leave room on the poster paper for another drawing. Have them look up familiar fish like sharks, tuna, or salmon. Study the parts of their bodies, making a list as you go. Then draw a picture of a fish on the same piece of paper with the whale drawing. Include body parts such as eye placement, gills, dorsal fin, pectoral fins, and tail. Color and label the pictures. Use the reference books and the Body Plan-Profile chapter in Whales and Dolphins ZooGuide as a guide.

DISCUSSION: Discuss this activity by answering the following questions:

1. What did you learn about whales' bodies that you didn't know before?
2. What did you learn about fish bodies that you didn't know before?
3. How are cetaceans and fish similar?
4. How are they different?
5. Whales need to breath air, how do fish breath?

K-6 Activity 5:

TOPIC: Identifying Whale Species

SOURCES: Introduction chapter in Whales and Dolphins ZooGuide
Species Index in Whales and Dolphins ZooGuide

MATERIALS: Paper, pen or pencil

ACTIVITY: In this activity, students will familiarize themselves with various species of whales and dolphins.

Students can work in pairs, small groups, or as a whole class to view the pictures of whales and dolphins shown in the Introduction chapter. They should look carefully at one kind of cetacean and try to identify it by looking through the Species Index buttons located on the right side of the screen.

There are 65 different species of cetaceans listed in the Species index. To help narrow down the search, students will have to look for characteristics like body size (small, medium, or large), whether or not the whale in the picture has teeth, and the shape of the head. Feel free to pause movies at any time if you want to study an image more closely.

The following is a list of the different whale and dolphin species students should be able to identify in order of appearance in the chapter topics:

1. Pilot whale, Spinner dolphin, and Humpback whale
2. Gray whale, Blue whale, Dolphin (picture not clear enough to distinguish what kind), Atlantic White Sided dolphin, and Killer whale
3. Blue or Humpback whale, Bottlenose or Spinner dolphins, and Amazon River dolphins

While students are accessing the Species Index, they can watch movies, see pictures, click on the drawing of each species and see a scale of length and weight, and click on the map button to see where that particular species lives. This information can be used as an extension activity or to discuss similarities and differences among cetaceans.

DISCUSSION: Discuss findings from this activity by answering the following questions:

1. What characteristics in the pictures did you use to identify each species?
2. Which whale was the easiest to identify? Why?
3. Where do these whales live? Were you surprised by any of these places?

(It may be a new idea to some students that there are dolphins which live in rivers.)

K-6 Activity 6:

TOPIC: **Development in Baby Whales**

SOURCES: Life Cycle chapter in Whales and Dolphins ZooGuide
 'Social Behavior' subtopic in Ecology chapter in Whales and
 Dolphins ZooGuide
 Reference materials on post-natal development in whales (See list
 at end of this Guide.)

MATERIALS: Writing paper (large or 8.5 x 11)
 Pen, pencil, or marker
 Chalkboard and chalk

ACTIVITY: In this activity, students will write a story about the life of a baby and
 mother whale. They can work as a class, in small groups, or individ-
 ually.

Before beginning to write, the whole class should familiarize them-
selves with the information in the Life Cycles chapter in the Whales
and Dolphins ZooGuide as well as the movie in the Social Behavior
section of the Ecology chapter for background information. They can
take notes, discuss findings, and share ideas at this stage.

Each group or individual should pick a specific species of whale to
write about (e.g., Humpback whales, Bottlenose dolphins and Gray
whales will probably have the most information to offer about child
rearing).

Students can write the story from the perspective of the mother, the
baby, or a human (or other) observer. If there is an aquarium near
your school, you could take a fieldtrip and gather information for the
stories there. Students could interview marine biologists that work in
the area for more information.

Set the length of the story and let the students combine facts with
their imaginations to create a magical story about the life of a young
whale. Students should include facts learned from the ZooGuide and
other sources such as: what babies eat, how long they are taken
care of, parental involvement (does the father help?), how many
babies a mother has at one time, what the baby does once it grows
up, etc.

DISCUSSION: Discuss this activity by answering the following questions:

1. How is childrearing similar among whales and humans?
2. What baby whale is the largest when born?
3. How do mother whales nurse their young?

K-6 Activity 7:

TOPIC: **Visualizing Calf Milk Consumption**

SOURCE: ‘Birth and Growth’ subtopic in Life Cycles chapter in Whales and Dolphins ZooGuide

MATERIALS: 150-1 pint milk cartons or equivalent
Poster board, markers, colored pencils, or crayons, tape or glue

ACTIVITY: In this activity students will approximate the amount of milk consumed by a whale calf for one day by making a display of 150 pints of milk cartons. This will help cement in their minds how large whale calves are and what 150 pints per day really means.

Begin this activity by reading or letting your students read the Birth and Growth section of the Life Cycles chapter in Whales and Dolphins ZooGuide. This text states that a whale calf can consume 150 pints of milk per day. Ask students how much milk they think that is.

To complete this activity, students will need to **clean** and save their milk cartons from lunch and from home. Set up a collection center and a “thermometer” scale to chart your progress each day.

Students will learn to convert units in the English system from cups to pints and from quarts and gallons to pints. They will also discover that 150 pints is a lot of milk to consume in one day.

Compare whale calf consumption to human baby consumption of milk. Save the equivalent number of cartons of milk that a human baby can drink in one day (~ 2.5 pints/day). Make a display for this amount of milk as well.

Students should make signs for each display to explain what they represent. Include a title such as “ One Whale Calf’s Milk for One Day” and “One Human Baby’s Milk for One Day” and include other interesting facts about baby whales and humans.

DISCUSSION: This activity is intended to teach students about relative size and the need for large amounts of food to satisfy a large baby whale. Discuss answers to the following questions as a way to wrap up this activity.

1. Is 150 pints larger than you thought it would be?
2. What did you expect it to look like?
3. If you compare the size of a human baby with a whale calf, do baby whales drink proportionally more milk than baby whales? (This can be done as an approximation)
4. Try to find out how often baby whales feed per day and compare this to human babies feeding ~8 times per day.

K-6 Activity 8:

TOPIC: **Whale Food Chains**

SOURCES: Species Index in Whales and Dolphins ZooGuide
Science textbook explaining food chains
Reference materials listed in this Guide

MATERIALS: Poster paper
Markers, crayons, colored pencils
Scissors
Glue or tape

ACTIVITY: In this activity, students will discover the connection between organisms in a whale's food chain. To keep this as simple as possible a food chain will be used instead of a food web. If you have students who are older or more interested in finding out about branch food chains and how they fit into the whale food chain, feel free to do a food web.

Define a food chain. Discuss what it means and use the students' diets to make a food chain of their favorite food (e.g., a hamburger, pizza, spaghetti, a hot-dog, etc.). Make a chart with a person at the top followed by the food (e.g., a cow for the hamburger) and continue until you reach the lowest level of food, commonly a plant of some kind. Label the items on the chart and draw arrows from the bottom one up the chain. This will visually show the connection between the organisms in the chain.

Now that your students are familiar with the concept of a food chain, they can make one for a whale of their choice. Before beginning, however, ask your students what they think whales and dolphins eat. Make a list on the blackboard. Your list could include: krill, copepods, crustaceans, squid, octopus, cuttlefish, shrimp, cod, salmon, seals, birds, turtles, other whales, tuna, anchovies, pilchards, herring, mackerel, lantern fish, crabs, and catfish, just to name a few. You may want to choose a cetacean that is well known to your students to complete this activity (e.g., a Bottlenose dolphin, a Killer whale, a Humpback whale, etc.) or you could learn about a new and interesting one such as the Franciscana River dolphin.

Students can work in groups or alone to research the types of food their whale likes to eat. To find this information students should look in the Species Index on the right side of the ZooGuide. Some of the animals eaten by whales in this index are not mentioned or are general such as a reference to shoaling fish. If that is the case for the species a student or group of students picks, they will need to use

another resource to find more specific information. Try your school library or local town library for references.

Once students have listed the primary source or sources of food for their species, they can look up that organism and find out what it eats. Continue this process until you reach a primary producer (plant) to finish the chain. Draw the chain of organisms starting with the whale on top and continuing down the page until you reach the last "link" in the food chain. Use reference books from your library to look up the secondary and tertiary consumers. There may be some names that students don't recognize, such as krill, copepods, cuttlefish, etc. If this is the case, make sure to look them up and find pictures to show the students so that they can include them in their charts.

For older or more advanced students you may want to choose species of whales that have more than one primary food source. Students could then trace a food web instead of a food chain. Some good examples are: Killer whales which eat seals, birds, squid, turtles, and other whales; Common dolphins which eat tuna, anchovies, and pilchards; Atlantic White Sided Dolphins which eat herring, mackerel, and squid; Harbor porpoises which eat cod, herring, squid, and shrimp; and Franciscana River dolphins which eat fish, octopus, squid, and shellfish.

Another extension of this activity is to discuss **HOW** whales get their food. Some are filter feeders, some gather schools of fish, others scoop food from the bottom of the ocean, and so on. This information is also provided in the Species Index of the ZooGuide.

DISCUSSION: Discuss what students have learned about whales' diets by answering the following questions:

1. Name 3 kinds of food that many dolphins and whales like to eat.
2. Why is "Food Chain" a good name for the drawings you made in this activity?
3. Which of the whales you studied eat primary producers (plants and one celled organisms that make their own food)?
4. How do some whales help each other to get food?

K-6 Activity 9:

TOPIC: **Comparing Human and Whale Body Structure**

SOURCES: Body Plan chapter in Whales and Dolphins ZooGuide
Reference books with skeletons of whales and humans

MATERIALS: Enlargement of whale and human skeletons
Enlargement of whale and human body
Markers, colored pencils, crayons
Poster board or bulletin board

ACTIVITY: In this activity students will compare human and whale bodies both internally and externally. From this comparison they will be able to state the similarities and differences between whales and humans.

Begin by viewing the information provided on whale anatomy in the Body Plan chapter of this ZooGuide. Then find and enlarge pictures of whale and human skeletons. Tack them to a bulletin board or poster board and, as a class, label the main parts such as skull, arm bones, hand bones, leg bones, backbone, shoulder bone, rib cage, etc. Ask students what parts of the two skeletons are similar or the same. What parts are different? (Whales have no pelvis or leg bones. They also have different jaw bones than humans) Discuss why there are differences.

Next compare external body parts by enlarging a picture of a whale and human and tacking them to a bulletin board. Have students label the familiar body parts of both and compare the similarities and differences. Discuss how each animal is designed for its environment (e.g., whales are streamlined, humans have legs for walking on land, etc.).

Finally, compare senses — ask students what the five human senses are. Do whales also have these senses? Can they smell, taste, touch, hear and see? What organs do they use for each sense? How are these organs similar to human sense organs? How are they different? (e.g., The skin around a Whale's blow hole is thought to be sensitive to the presence or absence of water. Smell doesn't seem very important to them. Echolocation uses high frequency sound to locate prey.)

DISCUSSION: Discuss this activity by answering the following questions:

1. How are whales and humans similar?
2. How are whales and humans different?
3. Why don't whales have legs or humans have tail flukes?
4. Do you think that whales and humans are very different or very similar? Why?

K-6 Activity 10:

TOPIC: **Vocal Communication**

SOURCES: 'Vocal Communication' subtopic in Ecology chapter in Whales and Dolphins ZooGuide, other CD's of whale songs

MATERIALS: Percussion instruments (optional)

ACTIVITY: In this activity students will develop a non-verbal form of communication and then create and play a game using this system.

Begin by discussing communication among humans. How do we communicate and why? Do whales and dolphins communicate with each other? How?

Now have students listen to the sounds the whales make in the ZooGuide opening page as well as the Vocal Communication page of the Ecology chapter. If you have access to other examples of whale songs, you can play them as well. What do you think they are saying to each other?

Next have students invent a non-verbal system of communication of their own. You can choose to use percussion instruments such as bells, a triangle, castanets, etc. to represent different parts of the communication system. Alternately, students could make different sounds like whistles and clicks that mimic whale and dolphin sounds.

In creating your own non-verbal form of communication, it will be necessary to decide on its purpose. Will you use it to discuss the weather, to write a poem, to give simple instructions, or to play a game? You can launch into a general discussion of the function of communication in human society and speculate on its use in whale society. You can even discuss the historical components of communication.

Finally, use this invented communication system to play a game or give instructions to students to complete a task. For example, you could use the system to navigate blindfolded through an obstacle course.

DISCUSSION: Once students have completed this activity discuss it by reviewing the following questions:

1. Name three reasons why people communicate. Do you think cetaceans communicate for similar reasons?
2. Were you able to communicate successfully in your invented system? What problems did you have?
3. Was it easy or hard to communicate in the non-verbal system?
4. Can you think of non-verbal communications systems that people use? (e.g., sign language, Morse code, classical music, ballet, baseball signals, etc.)

K-6 Activity 11:

TOPIC: **Migration**

SOURCES: 'Migration' subtopic in Ecology chapter in Whales and Dolphins ZooGuide
Dictionary, other reference materials (optional)

MATERIALS: Map of the world handout
Markers, colored pencils, or crayons
Large lined paper or chalkboard

ACTIVITY: In this activity students will define migration, name several species that migrate, and discuss reasons for migration.

Begin by asking students what migration means. If they don't know the answer, they can look it up in a dictionary. Write the definition on the chalkboard or large piece of paper.

Ask students to name 5 or more species of animals that migrate. (e.g., butterflies, birds, whales, grazing animals in Africa and America, sea turtles, etc.) If they can't come up with at least 5 species do some research in the library to find names of animals that migrate. In addition, make note of why they migrate for later discussion.

Now that you have added the names of several species of animals that migrate to your definition of migration, ask students **why** animals migrate. They should come up with reasons such as food, water, temperature, breeding, etc. Add these items to your list.

Ask students why they think some whales migrate. Read and listen to the information provided in the Migration section of the Ecology chapter in this ZooGuide. Then use the Species Index to look up some of the whales mentioned (e.g., Gray whales and Humpback whales) and any other whales in which you are interested. Use the map feature to see where they live and migrate in the oceans of the world. Draw their migration routes on maps given to each student or group of students. Label the regions that they migrate through and what they do in each area. (e.g., they breed in the warm southern waters, feed as they travel north, and bear their young in northern waters, etc.)

DISCUSSION: Discuss the activity just completed by answering the following:

1. Why do animals migrate? (Give at least 5 reasons)
2. Why do whales migrate?
3. Do humans migrate? Why or why not?
4. Can plants migrate? How?
5. Technically each student in this class migrates everyday to and from school. Describe your migration route and the reasons that you migrate. Where else do you migrate?

K-6 Activity 12:

TOPIC: **Marine Mammals**

SOURCES: ‘Naming Cetaceans’ subtopic Species chapter in Whales and Dolphins ZooGuide
Other reference materials pertaining to marine mammals

MATERIALS: Poster paper
Markers, colored pencils, crayons
Bulletin Board
Thumb tacks or stapler

ACTIVITY In this activity students will identify several marine mammals, define habitat and niche, and create a bulletin board showing this information.

The Whales and Dolphins ZooGuide has been teaching your students about marine life. Ask your students to answer the following questions.

1. What other mammals live in the oceans?
2. What do they eat?
3. Where do they live?
4. Do they interact with cetaceans?

To answer these questions, first ask students to name other mammals that live in the oceans. They should come up with seals, sea otters, and walrus. Introduce them to manatees, elephant seals, and dugongs using reference materials in your school library.

Make a chart of these marine mammals, what they eat, and where they live. Working in groups, have students choose one animal to draw along with one of its favorite foods. Color and cut out these pictures and place them on the bulletin board.

Define habitat and niche and discuss them in the context of the marine mammals you have just studied.

DISCUSSION: After completing the above activity, answer the following questions:

1. How are all marine mammals adapted for life in water?
2. Do they eat similar things? Name three.
3. How are these mammals different from each other?
4. How are they different from land mammals such as cows, cats, humans, etc.?
5. Compare whales with one of the marine animals you studied. How are they similar and different?

K-6 Activity 13:

TOPIC: **Save the Whales**

SOURCES: ‘Cetacean Conservation subtopic in Ecology chapter in Whales and Dolphins ZooGuide
Reference listing local/regional “Save the whales” groups (e.g., Green Peace, International Whaling Commission, local Marine Research Labs at Universities, etc.)

MATERIALS: Writing paper
Pen or pencil
Handout accompanying this activity

ACTIVITY: In this activity students will discover the causes of declining cetacean populations, calculate by how much several of them have declined, and write a letter seeking information from a “Save the Whales” group.

Students should begin by viewing the movie in the Ecology — Cetacean Conservation chapter in this ZooGuide. They can pause it as often as they need to in order to answer the questions on the handout. They can complete this handout individually, in small groups, or as a whole class. Once the questions have been answered, discuss the results. Ask the students what they think can be done to save whales and dolphins. What are the major threats to cetaceans now that most countries have stopped whaling? (Dolphins are killed in tuna nets, river dolphins food supplies are dwindling, global warming is killing some of their food sources, etc.)

Choose a “Save the Whales” group and write them a letter of inquiry. Students can work in groups and choose several organizations to write to or the class can write a single letter. In the letter, students should state what they know about declining whale populations and ask for more information on the topic. In addition, they should ask the organization what they can do to help save the cetaceans of the world.

Once the class has received a response from the organization(s) you have contacted, read the materials they send and discuss what you can do to help cetaceans survive.

DISCUSSION: Discuss this activity with the following questions:

1. Name several problems facing whales and dolphins in the oceans today.
2. What did you learn from the organization that you wrote to?
3. Did any of it surprise you?
4. Why do some countries, like Japan, continue to kill whales?
5. What will you do to help save the whales?

Cetacean Conservation Questions

Name:

Date:

Read these questions and answer them as you watch the movie in the Cetacean Conservation section of the Ecology chapter.

1. Where were baleen whales found several hundred years ago?
2. What are 2 things that caused cetaceans to die off?
3. Sperm whales used to number 1,250,000. How many are there today?

(Extra credit: What fraction of Sperm whales were killed?)
4. How many Fin whales were there before global whaling began?

(Extra credit: There are only about 100,000 Fin whales left. What fraction were killed?)
5. Blue whales used to number ~ 220,000. How many are left today?

K-6 Activity 14:

TOPIC: **Creating a Whale Storybook**

SOURCES: The Whales and Dolphins ZooGuide
References materials listed at the end of this Guide

MATERIALS: Construction paper
Markers, colored pencils, crayons
Scissors
Glue
B/W or color printer

ACTIVITY: In this activity students will create a storybook about a whale using information they have learned from the Whales and Dolphins ZooGuide and the other activities they have completed.

Ask students to pick their favorite whale or dolphin from those listed in the Index of the ZooGuide. To help students create a story, they should answer the following questions:

1. What is the point of your story? (e.g., Saving a whale from a fishing net, Life as a whale, How to find food in the dark, Why cetaceans live in the water, etc.)
2. What is/are the name/names of the characters in the story?
3. Where does the story take place? (e.g., the past, Indian Ocean, Alaska, etc.)
4. What pictures do you want to include with the story?

Encourage students to use facts from the CD as well as the other references they used during their study of cetaceans. Make sure to include a climax and resolution in each story.

Once the stories are written on paper, students can create a colorful book using construction paper, printouts of images from the ZooGuide, and pictures they draw and color. Bind the books and keep them as references for future classes or discussions about cetaceans.

DISCUSSION: Answer the following questions to reinforce what was learned during this activity.

1. Why did you pick the species you did for your story?
2. What is the most interesting fact about that cetacean that you found out?
3. How much of your story did you create and how much is based on facts?
4. If you gave your book to another student could they write a sequel to it? (This is an extension you can try as another activity.)

K-6 Activity 15:

TOPIC: Whales and Dolphins Review

SOURCES: Whales and Dolphins ZooGuide (including Chapters and Species Index)
All other references used in previous activities

MATERIALS: 40-5" x 8" cards, scissors, markers, crayons, or colored pencils
Nature magazines (e.g., National Geographic) (optional)

ACTIVITY: In this activity students will create flash cards to review what they have learned about whales and dolphins from this ZooGuide. Once the flash cards are made you can use them to play team or board games with the students.

To create the flash cards you need to gather pictures of different kinds of whales and dolphins. Use the print feature in the ZooGuide to get pictures of different whales from the program or print them directly from the Whale and Dolphin Pictures folder on the CD. If you have a color printer, students can simply cut out the pictures and paste them on the flash cards. If you have a black and white printer, students can color the pictures, using the ZooGuide as a reference to get colors accurate. Alternately, you can use nature magazines to find pictures of whales and dolphins to include on the cards.

Working in groups or individually, students can write the name of each whale on the back of the card. In addition, they should include whether it is a toothed or baleen whale and where it lives. This information can be gathered using the Species Index buttons on the right side of the ZooGuide screen.

Make as many cards as you want, focusing on the more common whale and dolphin species, the endangered ones, or the unusual species. Test students' knowledge of these species by asking them to name each whale pictured. Alternately, you can create a board game that uses the cards as a way to advance on the board. You can also use them for true/false games. Be creative with the ideas, including student suggestions for ways to use the cards.

DISCUSSION: Answer the following questions to review this activity.

1. How many whales and dolphins do you recognize as a result of using Whales and Dolphins ZooGuide?
2. Where do most cetaceans live?
3. What do they eat?
4. Which cetacean is your favorite? Why?
5. What else would you like to know about whales and dolphins?
6. Where can you find more information about cetaceans?

ACTIVITIES FOR 7-12 TEACHERS

This section of the Teacher's Guide offers 15 activities and ideas for integrating the Whales and Dolphins ZooGuide into your biology curriculum. The activities range from arguments for evolution to making maps of whale habitats.

Each activity lists the topic covered, the sources of information it will use, a step-by-step description of the activity, and a conclusion section with questions to help you find out what your students have learned in the process. Modify, delete, or edit these activities to tailor them to your specific needs. Also look at the K-6 activities for other ideas and ways to use the ZooGuide with your students.

7-12 Activity 1:

TOPIC: Whales and Dolphins are Mammals

SOURCES: Introduction chapter in Whales and Dolphins ZooGuide
Life Cycle chapter in Whales and Dolphins ZooGuide
Your Biology textbook
References listed at the end of this Guide

ACTIVITY: In this activity students will describe the characteristics of mammals generally and cetaceans specifically. They will also research where in evolutionary history cetaceans returned to the sea and what land animals they are related to.

Use this activity in conjunction with classification studies or with an adaptation or evolution unit.

Begin this activity by asking students to list traits of animals grouped in the class Mammalia. Once they have listed several characteristics, ask students to list animals that are in this class. They should be able to list at least 10. If cetaceans are not among this group, add them and ask students why they belong to this class.

Students can work in groups or individually to answer the following questions. Use the ZooGuide as a reference as well as your Biology textbook when looking up answers.

1. Why are cetaceans part of the mammalian class?
2. Have whales and dolphins always lived in water? How do you know?
3. What land mammal are cetaceans most related to?

4. One characteristic of mammals is that they are warm blooded. How does this trait help cetaceans successfully live in a water environment?
5. How long ago did the precursors of whales and dolphins return to the water?

CONCLUSIONS: To discuss the students findings in this activity, answer the following questions:

1. Could whales and dolphins have evolved as water dwelling animals without having a land animal intermediate?
2. What evidence supports your answer to question 1?
3. Some species of whales are among the largest animals eve to have lived on Earth. How does being a mammal help them achieve such great size?
4. List at least five differences between cetaceans and their land mammal counterparts. How are these differences related to environmental differences?

7-12 Activity 2:

TOPIC: **Comparing Body Structure**

SOURCES: 'Main Cetacean Groups' subtopic in Introduction chapter in Whales and Dolphins ZooGuide
Reference materials listed at the end of this Guide

ACTIVITY: In this activity students will compare the body structures of the six species of porpoises mentioned in the Main Cetacean Groups section of the Introduction chapter of the ZooGuide. This will illustrate the scientific process of naming similar types of organisms based on external characteristics.

Use this activity in conjunction with studies of animal classification. Begin this activity by having students read the information contained in the Main Cetacean Groups section of the Introduction chapter. Discuss the information and watch and listen to the movie provided.

Next, students should use the Species Index on the right side of the page to look up the six species of porpoises. Alternately, they can access the complete list of cetaceans contained in the ZooGuide by using the Index button on the left. Species are listed alphabetically here whereas they are listed by subspecies in the Species Index. Each type of cetacean includes information about that species, a picture which can be enlarged by clicking on it and which shows its length and weight, a map of the regions it inhabits, and, if active, a photo and/or movie.

Once students have read the descriptions and viewed the images, photos and movies they can answer the following questions.

1. What common body structures unite the porpoises?
2. What is the Latin name for a porpoise?
3. What kinds of foods do they eat?
4. Which porpoise has an unusual behavior?

When students have completed the above questions go over the answers or collect and grade them.

CONCLUSIONS: To discuss what your students have learned from this activity, discuss the following questions:

1. Why do you think scientists grouped these six species together?
2. Would you have grouped them differently? On what would you base your grouping?
3. As a challenge, look up the English meaning of the Latin name for porpoises. Is the name related to their unique body structure? What is it related to?
4. Are there other cetaceans that share one or more of the characteristics that define porpoises as a separate group? Name 3. (Beak shape, size, or preferred food are all possible choices.)

7-12 Activity: 3

TOPIC: Mapping Cetacean Habitats

SOURCES: Species Index (Map feature) in Whales and Dolphins ZooGuide
‘Where are cetaceans found?’ subtopic Introduction chapter in Whales and Dolphins ZooGuide

ACTIVITY: In this activity students will construct a map showing where cetaceans can be found in the world’s oceans and large rivers.

Begin by making enlargements of the world map. Make one for a whole class project or several for smaller groups to work on. Students should label the continents and oceans. They should pick 10 different cetaceans to include on their map and use different colors to represent each species’ habitat. If students are working in small groups you may want to assign the cetaceans that they map to make sure there is as little overlap as possible between species each group chooses.

Once students have chosen a color to represent each species of whale or dolphin, they should create a map legend that includes the color and name of each cetacean to make the map easy to read.

Next, they should use the information provided in the Species Index section of the ZooGuide to color the regions of earth where their groups of cetaceans live. Once they find the species name in the Index, they can click on the Map button to see the regions where that particular whale or dolphin species lives. Some species inhabit much of the world’s oceans while others are confined to relatively small areas.

CONCLUSIONS: Once students have finished their maps they can answer the following questions regarding the activity.

1. Are cetaceans found everywhere in the world?
2. If not, where are they not found?
3. Which cetacean that you mapped has the widest distribution on earth?
4. Which cetaceans that you mapped are most affected by human activity? Why?

7-12 Activity: 4

TOPIC: **Mammalian Reproduction**

SOURCES: 'Prenatal Development' subtopic in Life Cycle chapter in Whales and Dolphins ZooGuide
Species Index in Whales and Dolphins ZooGuide
Your Biology textbook
Reference materials on reproduction in mammal species

ACTIVITY: In this activity students will chart factors related to reproduction in 10-15 mammal species.

Use this activity when studying reproduction and classification.

Begin by handing out the chart on the next page. Students can then add the names of 10-15 mammals that they will research to fill-in the required data. They should include at least 4 cetacean species in the list and can choose the others or you can assign mammals that have widely varying reproduction traits for maximum contrast.

Use the ZooGuide to look up information on cetacean species and various other reference books to get data on the other mammals listed. This may require using the school library, a public library or a local college library.

CONCLUSIONS: Once students have filled in the charts, ask them to list the mammals chosen in order of gestation time. Then answer the following questions.

1. Does the gestation period correlate to size/weight factors?
2. Which mammal has the longest gestation period?
3. Does gestation time and postnatal care time correlate? How?
4. What role does the environment play in the reproductive cycles of the mammals you charted?
5. What are the advantages of bearing live young as opposed to laying eggs?

Mammal Reproduction Chart

Name:

Date:

Mammal

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

7-12 Activity 5:

TOPIC: **Whale Food Webs**

SOURCES: Species Index in Whales and Dolphins ZooGuide
Biology textbook explaining food web
Other reference materials listed in this Guide

ACTIVITY: In this activity students will discover the connection between organisms by creating a whale food web.

Use this activity when you study ecology, food webs, and life cycles.

Define a food web. Discuss what it means and use the students' diets to make a food web for their favorite food (e.g., a hamburger, pizza, spaghetti, a hot-dog, etc.). Make a chart with a human in the center of the web followed by the food(s) (e.g., a cow for the hamburger) and continue until you reach the outermost food type, commonly a plant of some kind. As you list the direct foods, don't forget to branch out to other organisms that play a role in this food web, including decomposers. Label the items on the chart and draw arrows showing the various connections of all the organisms involved. This will visually show the connection between the organisms in the web.

Now that your students are familiar with the concept of a food web, they should make one for a whale of their choice. Before beginning, however, ask your students what they think whales and dolphins eat. Make a list on the blackboard. Your list could include: krill, copepods, crustaceans, squid, octopus, cuttlefish, shrimp, cod, salmon, seals, birds, turtles, other whales, tuna, anchovies, pilchards, herring, mackerel, lantern fish, crabs, and catfish, just to name a few. You may want to choose a cetacean that is well known to your students (e.g., a Bottlenose dolphin, a Killer whale, a Humpback whale, etc.) or you could learn about a new and interesting one such as the Franciscana River dolphin.

Students can work in groups or alone to research the types of food their cetacean likes to eat. To find this information students should look in the Species Index on the right side of the ZooGuide or use the index button on the left. Some of the animals eaten by whales in this index are not mentioned or are general such as a reference to shoaling fish. If that is the case for the species a student or group of students picks, they will need to use another resource to find more specific information. Try your school library or local town library for references.

Once students have listed the primary source or sources of food for

their species, they can look up that organism and find out what it eats. Continue this process until you reach a primary producer (plant) to finish the web. Draw the web of organisms starting with the whale in the middle and continuing outward until you reach the producers and decomposers. Use reference books from your library to look up the secondary and tertiary consumers. There may be some names that students don't recognize, such as krill, copepods, cuttlefish, etc. If this is the case, make sure to look up these organisms and get an idea of their size as well as what they eat. This information should be included in the web.

An extension of this activity is to discuss HOW whales get their food. Some are filter feeders, some gather schools of fish, others scoop food from the bottom of the ocean, and so on. This information is also provided in the Species Index of the ZooGuide.

CONCLUSIONS: Discuss what students have learned about what whales eat by answering the following questions:

1. Name 3 kinds of food that many dolphins and whales like to eat.
2. Why is "Food Web" a good name for the drawing you made in this activity?
3. Which of the whales you studied eat primary producers (plants and one celled organisms that make their own food)?
4. How do some whales help each other to get food?
5. How is whale intelligence related to eating behaviors?

7-12 Activity 6:

TOPIC: **Parallel Evolution**

SOURCES: 'Echolocation' subtopic in Body Plan chapter of Whales and Dolphins.
Textbook or other resource describing Bats' use of ultrasound in hunting.

ACTIVITY: In this activity students will compare similar adaptations in dolphins and bats used to catch prey.

Use this activity when studying evolution and adaptation.

Begin this activity by having students read and watch the information on echolocation in the Body Plan chapter. Use a textbook or other reference book to find information on bat's use of a similar technique. Then answer the following questions.

1. For what purpose do toothed whales use echolocation?
2. For what purpose do bats use echolocation?
3. Describe two similarities and two differences between how bats and toothed whales use echolocation. (Hint: discuss type of sound emitted, the goal of echolocation, what organs whales and bats use to produce and receive the sounds, the type of environment in which they live, etc.)
4. Why is echolocation in bats and toothed whales an example of parallel evolution?
5. Do other animals use ultrasound? If so, what is its purpose?

CONCLUSIONS: Once students have answered the questions above individually or in groups, gather the whole class to discuss their findings and draw some conclusions about Parallel Evolution.

1. What have you learned from this activity concerning parallel evolution as it pertains to echolocation?
2. Why do you think two different mammals living in two very different environments developed similar techniques for catching prey?

3. Why do you think echolocation isn't used by all nocturnal or deep water dwelling animals?
4. What other adaptations have nocturnal and deep water dwelling animals developed to help them find food or avoid capture?
5. Where can you find more information about echolocation and parallel evolution?

7-12 Activity 7:

TOPIC: Identifying Cetaceans

SOURCES: Body Plan chapter in Whales and Dolphins ZooGuide
Species Index in Whales and Dolphins ZooGuide
Reference materials listed in this Guide

ACTIVITY: In this activity students will investigate features marine biologists use to identify whale and dolphin species and individual cetaceans in the wild.

Use this activity when you study marine biology, classification, or the scientific method.

Marine biologists use body structure and coloration to help identify individual whales. They do this to estimate population sizes, document longevity, study mating patterns, etc. Use the Body Plan chapter of Whales and Dolphins ZooGuide and other reference materials to describe these features in detail.

Answer the following questions as you do your research.

1. What are the 3 types of dorsal fins scientists have named?
2. In the Profiles section of this chapter, how many types of flukes are shown?
3. How do scientists use coloration to distinguish individuals?
4. Why do they want to be able to recognize individuals?
(Students should give the reasons listed above as well as others.)

Once students have answered these questions, working in groups or individually, show them pictures of 5-10 whales from the ZooGuide or a reference book. Can they describe the kind of dorsal fin, fluke, and coloration found on that whale. If you have access to pictures of several individuals from a single species of whale (e.g., humpbacks) show them to the students and ask them to distinguish each individual from the others using the characteristics learned in this activity. As a further extension, show them several pictures which contain more than one picture of an individual whale. Can they match the individual in several pictures? Explain that this is the task that marine biologists have to do in order to keep track of populations of cetaceans.

CONCLUSIONS: Answer the following questions as part of a discussion of this activity.

1. Do you think identifying individual whales and dolphins is easy? If your answer is no, why not?
2. Humpback whales are recognized as individuals by the shape and color pattern on their tail flukes. Each one has a different pattern and shape just like your fingerprints are unique to you. How do you think scientists discovered this trait?
3. What are the limitations of using body structures and coloration to identify individual cetaceans?

7-12 Activity 8:

TOPIC: **Adaptation and Evolution of Whale Skeletons**

SOURCES: 'Skeleton' subtopic in Body Plan chapter in Whales and Dolphins ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will explore the concepts of adaptation and evolution as they apply to cetaceans.

Use this activity when studying adaptation and evolution or the skeletal system.

Whales are air breathing mammals that spend their lives underwater. They have developed special adaptations that allow them to survive and flourish in this environment. Begin this activity by making a list of ways in which cetaceans are adapted to life underwater. This should include a discussion of how they have developed similar structures to non-mammalian underwater dwellers such as fish.

Focus on the skeletal changes that have taken place since they left the land by comparing their skeletons to those of land mammals such as humans. To do this have students read and listen to the information presented in the Skeleton section of the Body Plan chapter in the ZooGuide. They should be able to list at least 5 differences.

Next have students compare whale flipper bones to human arm bones. They can look up the names of each bone and label it. How are the arms different? How are they similar? Discuss this and other animal "arms" (e.g., horses legs) as evidence that supports evolutionary concepts.

CONCLUSIONS: Discuss the answers to the following questions as a wrap-up to this activity.

1. Comparative anatomy is one type of evidence that supports the theory of evolution. Can you name three others?
2. Explain why whales have lost their legs, developed more delicate rib cages, and gotten strengthened tail muscles. How are each of these adaptations a direct result of the demands of their environment?

3. Humans are adapted for life on land in the same way that cetaceans are adapted for life underwater. Name 5 adaptations that humans have evolved.
4. As a preview of the next activity, ask students what other parts of cetaceans they think are adapted for life underwater.

7-12 Activity 9:

TOPIC: **Adaptation of Cetacean Respiratory and Circulatory Systems**

SOURCES: ‘Breathing’ subtopic in Body Plan chapter in Whales and Dolphins ZooGuide
References listed in this Guide
Your Biology textbook

ACTIVITY: In this activity as in Activity 8, students will explore cetacean adaptations to underwater life. This activity will focus on the Respiratory and Circulatory systems.

Use this activity when studying evolution, the circulatory system, or the respiratory system.

Begin this activity by discussing the seeming paradox that cetaceans are air breathing mammals that live underwater. Ask students to list ways in which they think whales have to be adapted to achieve this.

Students should have come up with ideas such as larger lung capacity, making many trips to the surface everyday to breath, swimming near the surface, etc. as possible explanations.

Now they should read the information and watch the movie provided in the Breathing section of the Body Plan chapter in Whales and Dolphins ZooGuide. Then they can answer the following questions:

1. How are cetaceans adapted to breathing air while living underwater?
2. How does having proportionally more blood and hemoglobin than humans help them adapt?
3. How does controlling their heart rate help?
4. How do they avoid getting “the bends” when they dive deep for food?
5. How do whales use their circulatory system to regulate heat? (See the section of the chapter called Conserving Heat to help answer this question.)

CONCLUSIONS: After answering the above questions, discuss your findings and answer the following questions as a group.

1. How long do you think it took for cetaceans to make all these adaptations to life underwater?
2. Describe what an intermediate between the land animal that evolved into a whale and modern day whales would have been like. Include descriptions of the amount of time they would have spent at the surface compared to now and other relevant comments.
3. Why do you think cetaceans have been so successful at adapting to life in the water?
4. Are whales and dolphins still adapting and changing? How and to what?

7-12 Activity 10:

TOPIC: **Intelligence**

SOURCES: 'Intelligence' subtopic in Body Plan chapter in Whales and Dolphins ZooGuide, references listed in this Guide, your Biology textbook

ACTIVITY: In this activity students will explore the nature of intelligence as applied to non-human organisms. They will attempt to design criteria that can be used to assess intelligence in multiple species.

Use this activity in conjunction with studies of human intelligence as well as evolution and adaptation.

Begin by asking your students the following question: **Are humans the only intelligent form of life on Earth?** Keep a tally of how many students say yes and how many say no. Ask each group (the yeses and the nos) how they define intelligence. Is their definition of intelligence tied to uniquely human behaviors such as using tools? If so, ask them to think of other signs of intelligence such as a highly structured social order.

What other factors could determine intelligence in a species that lives in an environment that is totally foreign to us? This question is in reference to whales who live in a water environment while we live in an air one, but it could be addressed to alien life on other planets.

Ask students to look at the list of intelligence markers that they made above. Cross out any of these that directly relate to having hands with an opposable thumb. How many traits are left? Whales and dolphins do not have hands and fingers. They cannot build as humans can. Are they intelligent anyway? Why or why not?

What advances have they made that might indicate intelligence to humans? (See the Intelligence section of the Body Plan chapter in this ZooGuide for some ideas and information.)

After discussing all of the questions and ideas given above, ask students if they can come up with a new list of traits that define intelligence without strictly adhering to the human model.

CONCLUSIONS: Based on their experiences and answers to the questions above, have students discuss the following.

1. Do all animals possess some form of intelligence? Name some of its forms.
2. Has your definition of intelligence changed as a result of this activity? How?
3. Why is it short sighted of us to measure all intelligence based on the human model?

7-12 Activity 11:

TOPIC: **Habitat and Niche**

SOURCES: 'Cetacean Conservation' subtopic Ecology chapter in Whales and Dolphins ZooGuide
Species Index in Whales and Dolphins ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will define habitat and niche as these terms apply to cetaceans specifically and living organisms in general.

Use this activity when studying ecology, habitats and niches.

Begin this activity by asking students what they think habitat and niche mean. This could be a review or the start of such a unit. Once they have brainstormed ideas, students should read and listen to the information provided in the Cetacean Conservation section of the Ecology chapter in this ZooGuide.

Next students can use the Species Index to look up Humpback whales and Bottlenose dolphins and describe their habitats and niches. Discuss their findings and answer the following questions.

1. What environmental factors threaten Humpback and Bottlenose habitats?
2. How many of these factors have humans created or contributed to?
3. What can be done to protect cetacean habitats?
4. How can you help them?
5. What niche do cetaceans fill in the world's oceans?
6. What could happen if they all died out? How would this effect humans?

After discussing the answers to these questions ask students if they want to update their original definition of habitat and niche to reflect what they have learned. Help them to extrapolate from the specific example of cetaceans to living organisms in general.

CONCLUSIONS: Wrap up this activity by discussing the following questions.

1. Describe a typical human habitat and niche.
2. What general statement can you make regarding the dangers that face habitats because of human encroachment?
3. Why is it important to preserve diverse habitats and niches?
4. What effect will decreased diversification have on living organisms?

7-12 Activity 12:

TOPIC: **Migration**

SOURCES: 'Migration' subtopic Ecology chapter in Whales and Dolphins
ZooGuide
Dictionary
Reference materials listed in this Guide
Your Biology textbook

ACTIVITY: In this activity students will define migration, name several species that migrate, and discuss reasons for migration.

Use this activity when studying ecology or migration.

Begin by asking students to define migration. Brainstorm ideas and list all features of migration that fit a good definition on the chalkboard. Use a dictionary or your Biology textbook to get a more formal definition.

Ask students to name 10 or more species of animals that migrate. (e.g., butterflies, birds, whales, grazing animals in Africa and America, sea turtles, etc.) If they can't come up with at least 10 species, do some research in the library to find names of animals that migrate. In addition, make note of why they migrate for later discussion.

Now that you have added the names of several species of animals that migrate to your definition of migration, ask students **why** animals migrate. They should come up with reasons such as food, water, temperature, breeding, etc. Add these items to your list.

Ask students why they think some whales migrate. Read and listen to the information provided in the Migration section of the Ecology chapter in this ZooGuide. Then use the Species Index to look up some of the whales mentioned (e.g., Gray whales and Humpback whales) and any other whales in which you are interested. Use the map feature to see where they live and migrate in the oceans of the world. Draw their migration routes on maps given to each student or group of students. Label the regions that they migrate through and what they do in each area (e.g., they breed in the warm southern waters, feed as they travel north, and bear their young in the northern waters, etc.)

DISCUSSION: Discuss the activity just completed by answering the following questions:

1. Why do animals migrate? (Give at least 5 reasons)
2. Why do whales migrate?
3. Do humans migrate? Why or why not?
4. Can plants migrate? How?

7-12 Activity 13:

TOPIC: **Classification**

SOURCES: Species chapter in Whales and Dolphins ZooGuide
Species Index in Whales and Dolphins ZooGuide
Your Biology textbook
Reference materials listed in this Guide.

ACTIVITY: In this activity students will explore the formal scientific classification system using cetaceans as an example. Use this activity when studying the classification system of living organisms.

Begin this activity by asking students if they know the structure of the classification system. Try to get them to use the proper order in their lists. If they aren't sure or forget some of the levels, have them use their textbooks as a resource. Once they have completed the list ask them what Kingdom whales are in. Continue to ask about Phylum, Class, Order, Family, Genus, and species. List these next to each level on the chalkboard. then answer the following questions either as a group or individually.

1. How many of these categories could you name without having to do any research?
2. Where do cetaceans and humans depart company in the classification system?
3. How are cetaceans separated into different genus and species?
4. Why are beluga whales and Chinese river dolphins separate species?
5. What is the definition of species?

Now that your students are familiar with the classification system, ask they to list the names of its parts for humans. What other animals share the same Kingdom, Phylum, and Class as humans and cetaceans?

CONCLUSIONS: Discuss answers to the following questions as a way to conclude this activity.

1. Why do we classify living organisms?
2. Do we classify non-living things? How?
3. What is the closest living relative to cetaceans?
4. How did you use the classification system to help you answer question 3?
5. If you could develop your own classification system, what would it look like?

7-12 Activity 14:

TOPIC: **Social Behavior**

SOURCES: 'Social Behavior' subtopic in Ecology chapter in Whales and Dolphins ZooGuide, reference materials listed in this Guide, your Biology textbook

ACTIVITY: In this activity students will characterize cetacean social behavior and compare it to human social behavior.

Use this activity when studying ecology or social behavior units.

Begin this activity by asking students to list behaviors they associate with cetaceans. They will probably think about dolphins they have seen at aquariums and name playful types of behaviors. They may also be familiar with humpback whale songs. Discuss how these behaviors could contribute to a social structure and order as well as signs of intelligence in the wild.

Students can now read and listen to the information provided in the Social Behavior section of the Ecology chapter in the ZooGuide. After doing so they should answer the following questions.

1. What are two reasons given for why smaller cetaceans, such as dolphins, travel in large groups?
2. Why are large baleen whales often found in groups of no more than three?
3. Describe several examples of Humpback whale social behavior.
4. What other examples of social behavior are discussed?
5. How does your list of behaviors compare with those mentioned in this section? Were there any surprises?

Now make a list of human social behaviors. Group them by function (eg, mating, friendship, family, work, school social rituals). Compare them with the list you now have for cetaceans.

1. How do they compare?
2. Can you identify any parallels between human social behavior and cetacean social behavior? Describe them.

CONCLUSIONS: Discuss your findings from this activity by answering the following questions.

1. Name one social behavior that is common to all animals.
2. Give several examples of social behavior as it applies to infant care in the animal kingdom. (eg, species where the father is the primary care giver, species where the parents share responsibility, species where the mother is the primary care giver, and species where there is no care giver.)

7-12 Activity 15:

TOPIC: Review of Whales and Dolphins ZooGuide

SOURCES: Whales and Dolphins ZooGuide
Reference materials listed in this guide
Your Biology textbook

ACTIVITY: In this activity students will apply what they have learned from the above activities to write a research paper about one species of cetacean.

Use this activity with any of the topics that have been addressed in previous ones, such as ecology, evolution, classification, etc.

Students should be instructed to choose one of the cetaceans listed in the Whales and Dolphins ZooGuide index. Read the information provided for that species, view the pictures, map, and movies (if any are present). Do further research using reference materials contained in the school library or local library. The list of references used in creating this CD are listed at the end of this guide. Use them as a starting point. The paper can be any length but should include the following information:

1. Genus and species name and baleen or toothed whale grouping,
2. Estimate of total population size,
3. Where found in the world, including migration routes if applicable,
4. Description/drawing of body structures (e.g., dorsal fin, flukes, flippers, head shape, coloration, etc.),
5. Mating, prenatal, and postnatal care descriptions,
6. Preferred food sources,
7. Diving behavior (description of habitat and adaptations)
8. Signs of intelligence,
9. Endangered status/conservation efforts of endangered species,
10. Forms of communication, if any.

CONCLUSIONS: Answer the following questions as a way to wrap up this activity.

1. What did you learn about cetaceans that you didn't know before you started this research paper?
2. Do you think that cetaceans are worth researching in terms of intelligence? Why or why not?
3. Why are people so fascinated by cetaceans?

References:

The references listed in this section are divided into three parts: references from the ZooGuide located in the credits section, K-6 activity references, and 7-12 activity references. The references listed were found in a local public library and represent a small portion of the books that are available on this topic. If you cannot find a specific reference listed here, try to find a book with similar content in your school or local library.

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