Natural History: Riparian Habitat

Winding through the seemingly hostile surroundings of the arid Southwest deserts are rare, shady, cool, moist green streamside ribbons of trees, shrubs, and grasses called "riparian corridors." It is in these attenuated oases that are found some of the most diverse plant and animal species in the world.

Beaver Creek, a small tributary of the Verde River that flows past Montezuma Castle and Montezuma Well, born from snowmelt high in the pine-clad mountains to the north, is one such riparian corridor. It is representative of the most common riparian community in the American Southwest, and is a globally endangered community, which is found in fewer than 20 places in the world. Only five extensive stands of this rare forest type remain in Arizona. Even though riparian communities make up less than two percent of the land area in Arizona, they are the most biologically diverse.

As much as 90 percent of the resident wildlife in Arizona depends on riparian areas such as Beaver Creek for their very survival. Because of the harsh arid surroundings of riparian corridors, they feature a greater variety of species than can be found in more hospitable regions, such as deciduous forests in the Eastern United States. This "stream of life" provides food, water, shelter, refuge, breeding grounds, wintering habitat, and migration corridors for an amazing diversity of birds, mammals, reptiles, fishes, and amphibians. Trees found here are primarily cottonwood, willow, and sycamore, with scattered stands of walnut, ash, and alder. Deer, mountain lion, javelina, mule deer, trout, leopard frogs, raccoons, beavers, and other animals, including threatened and endangered species, use riparian corridors like this one as they move across the desert areas and travel from low elevations to high-elevation habitats. At least 400 different bird species have been found in the Verde River/Beaver Creek riparian corridor. Many migrating birds, such as the summer tanager and hooded oriole, use this and other such corridors to migrate to Central and South America every winter. Several endangered, threatened, and candidate Arizona species, including the Southwestern willow flycatcher, bald eagle, and common blackhawk, depend upon the corridor to help sustain their populations. More than 1,000 pairs per 100 acres of breeding birds have been found along the Verde River and tributary riparian communities. In fact, scarce Southwestern riverways like Beaver Creek are home to more species of breeding birds than anywhere in the world outside of tropical rainforests, and are among the highest numbers reported in North America.

Riparian environments benefit all of us. They improve water quality by filtering out toxic compounds; stabilize water supplies and moderate floods; reduce soil erosion, and stabilize stream banks; increase biodiversity by providing plant and animal habi-

tats; and providing recreation sites for human visitors. With so much life relying on this fragile environment, the value of these systems to wildlife and people is now more extreme than ever. During the last 100 years, over 95 percent of the riparian habitat in Arizona has been lost or significantly altered due to human impacts including the pumping of ground water, which drains the water from underlying aquifers; land use practices such as grazing, farming, and recreational uses altering the vegetation and surface water supply; the building of dams and straightening of river courses (channelization); and the introduction of exotic plant species such as salt cedar. The last is especially damaging, because the proliferation of salt cedar and other exotics discourages the germination of highly significant native plants like cottonwood and sycamore. It is interesting to note that native riparian habitats have been found to support the greatest number of bird species outside of tropical rainforests; and that habitats dominated by salt cedar and other exotics support many fewer species, in part because exotics provide less shade and fewer food sources.

Visitors to Montezuma Castle today can marvel at not only the well-preserved cliff dwellings that people of the Sinaguan culture occupied for over 300 years, but also the rich and relatively natural riparian environment of Beaver Creek, with its diversity of animal and plant life, that made their lives possible and productive.

Educator's Outline for

RIPARIAN RETREAT

BACKGROUND: Riparian areas have many values, including important ecological values for entire communities of life. Riparian areas are like green ribbons of life on or near watercourses (streams, lakes, ponds, etc.). They are the areas that support plant communities that grow best when their root systems are near the level of high ground water. These zones range in width from narrow ribbons in desert and mountain areas to wide bands on the plains and lowlands.

OBJECTIVES

After completing this exercise the student will be able to

1. describe the characteristics of a riparian area
2. state its importance to humans and wildlife

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science
Language Arts Standard 3 – Listening and speaking

GROUP SIZE: 25

DURATION: 1 to 2 hours

SETTING: Classroom

Riparian areas provide space, shelter, and food for both food and wildlife. Riparian areas create food for the plant and animal communities with which they are associated. For example, leaves and insects that have fallen from vegetation into a stream provide nourishment for some aquatic life. Vegetation may also provide shade from the sun for aquatic plants and animals and land-dwelling creatures at the water's edge.

The riparian zone may serve as a buffer between the uplands and the water. Riparian areas are also transportation corridors or highways for animals that depend on water bodies for food and shelter. The banks of riparian areas store water during periods of high flow such as rainstorms or snowmelt and release this water to the stream at low flow times. Riparian vegetation strengthens the stream banks. This tends to prevent erosion and maintains the stream channel, keeping the water clear. The riparian plant community, especially shrubs and trees, provides shelter for animals as large as deer. Trees and marshy areas provide shelter for nesting birds and the banks provide homes for burrowing animals.

Among the many values of riparian areas, they have esthetic and recreational values for humans. They are used for fishing, hiking, camping, picnicking, and resting.

The major purpose of this activity is to familiarize students with the characteristics of riparian habitats and ecosystems.

PROCEDURE:

1. Find out if anyone has ever been to a stream or riverbank. What was it like? Were there plants growing there? What did the area look like? Was it hot or cool? Encourage the students to talk and share descriptions of areas by a stream or riverbank that they have been to or that they have seen pictures of.

2. Next tell the students that the kind of area they have been describing has a special name. It is called a "riparian area." Riparian areas are important natural areas for people and wildlife. Next, ask the children to get comfortable and close their eyes and listen, and imagine the place you will be describing. They will be imagining these things from their own point of view, as themselves, in the setting you will describe.

"It is a hot summer day. You are in a meadow spread with knee-high grasses and, here and there, masses of tiny blue wildflowers. The ground beneath your feet is uneven, but you are not in a hurry as you walk slowly toward a grove of trees. As you near the trees, you notice the changing colors of green you see. A breeze whispers through, showing first shiny green, then dull green sides of the leaves. As you step into the grove of trees, you are surrounded by a welcome coolness. You immediately feel the protection of the canopy of green above your head. A tap-tap-tapping sound breaks into your thoughts. Searching about among the rough-barked trunks, your eyes finally spot a bird, black and white with a touch of red on its head, clinging to a vertical tree trunk and bobbing its head in time to the rhythmic tapping.

"Breathing deeply, you fill your senses with not only the vision and the cool, but now, the very scent of 'green.' The aroma of earth and growing things is strong, and you detect here and there almost a memory of the sweet perfume of the flowers, and once in a while a pungent but not unpleasant drift of wet soil and the deteriorating leaves and grasses of last season.

"Wandering, you notice once-closely-packed tree trunks becoming farther apart and grasses that come to your knees being overshadowed by chest-high bushes. Although these bushes have no thorns, they nevertheless snag your shirt and pant legs. Your exposed arms are lightly scratched by the fine twig ends. Several of the bushes are covered with small berries: pink and pale green, blushing into red in the warm sun.

"Farther on, the bushes are taller. You find yourself pulling aside thick, taut willows taller than your head. You carefully choose a safe path along the precarious trail beneath your feet. Suddenly your left foot drops six inches and, looking down to examine the terrain more closely, you note the tunnel of a burrowing creature collapsed by your weight. Moving on again you feel the whisper of an abandoned spider web touch the side of your face. Brushing it aside, you notice that the slope of the land is steeper. You pause, listening ... listening.

"You hear the high drone of insects ... it has come upon you so gradually that you are surprised that you didn't hear it before ... now it seems almost frighteningly loud. And beneath the buzzing drone, and lower in pitch and volume, is the sound of water gently spilling over rocks.

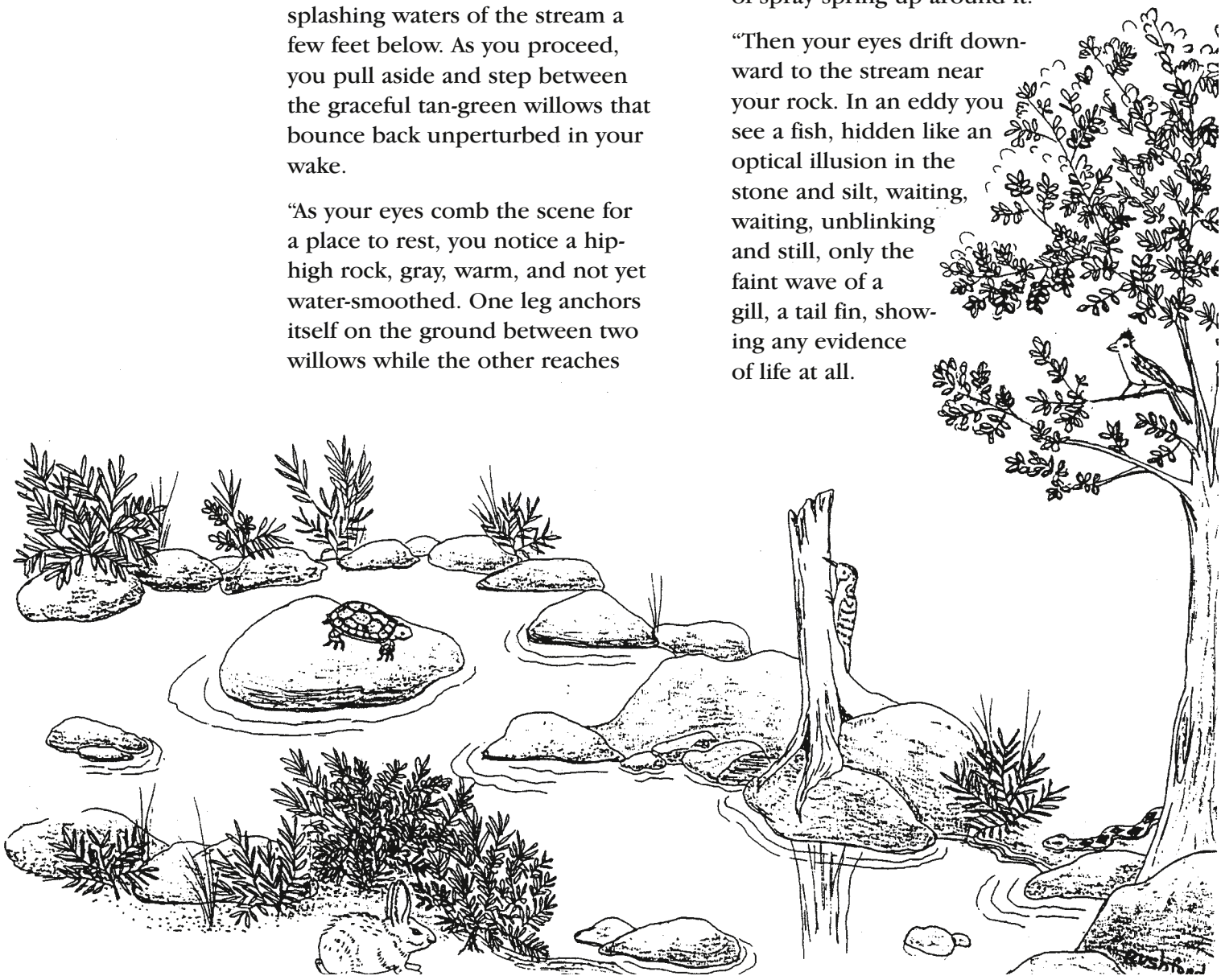
"Above the water you see thou-

sands of minute milling spots before your eyes, the creators of that high buzzing sound. It is made by hundreds of swarming insects in a mass, too thick to enter. A dragonfly flashes by with its iridescent pinks and greens, darting here, pausing, darting there, pausing, snatching dozens of the dots, relishing a meal in an unending bug buffet.

"You step aside, ducking beneath the swarming bugs. You smile as your eyes come to rest on the splashing waters of the stream a few feet below. As you proceed, you pull aside and step between the graceful tan-green willows that bounce back unperturbed in your wake.

"As your eyes comb the scene for a place to rest, you notice a hip-high rock, gray, warm, and not yet water-smoothed. One leg anchors itself on the ground between two willows while the other reaches over the water to the rock. You pause and bend toward the water, gathering a handful of pebbles from the streambed. With the pebbles in your hand you swing up onto the warm, gray perch of the rock. You settle down and look at the still-wet pebbles... gray, pink, tan, and cool in your warm hand. After you examine them carefully, you toss the stones one at a time into the stream, listening to the pleasing plop of stone on water and watching the white fountain of spray spring up around it.

"Then your eyes drift downward to the stream near your rock. In an eddy you see a fish, hidden like an optical illusion in the stone and silt, waiting, waiting, unblinking and still, only the faint wave of a gill, a tail fin, showing any evidence of life at all.



"You watch to follow the fish a few feet until it blends too much with rocks and ripples. As your eyes continue downstream, you catch sight of a small, brown animal sliding into the water. A slight splash on the stream's edge announces the disappearance of its paws, another splash a few feet away precedes a fur-slicked head plowing its way to the opposite bank. Again you see the sleek body as it disappears silently into a clump of reeds.

"As you continue to look downstream you notice that all kinds of small insects are now dancing across and above the water. A small ripple occurs in the water, then another and another. You realize that the fish are rising up from below their water homes and feeding on the bug hatch.

"Several yards downstream, a frog begins to croak. Much nearer, another frog offers a complacent reply. You look around to see if you can find the source of the reply, think that you spot it, but then realize, with a smile, that it is a small, gray-green frog hopping now through the brush.

"You search for a moment more as more frogs telegraph their messages back and forth. You slowly get up from your rock along the streamside and head back home."

3. Ask the students to continue to sit quietly with their eyes closed and review the whole experience. Ask them to pay particular attention to their favorite images. Tell them they are going to be asked to describe this setting as they saw it. Invite them to open their eyes.

4. Ask them to describe their favorite images. Optional: Once each student has done this, invite all of the students to select art materials. Each should draw or paint his or her favorite images on the paper provided. Once they are finished, have the students tape up their artwork on a display area.

5. Ask the students to identify some of the characteristics of riparian areas. Also ask them to hypothesize some of the many reasons that riparian areas are important and have value — intrinsically to wildlife, and to people.

EXTRA CREDIT:

1. Visit a riparian habitat. Look for things that you encountered on your imagery. List things that were not in your imagery.

2. Generate a list of things that could be done to make it possible for people to visit a riparian area without damaging or destroying it.

Educator's Outline for

BLUE RIBBON NICHE

BACKGROUND: Each animal in a community has a role — an "occupation." This role is called its ecological niche. The niche includes such things as the animal's preferences for food, shelter, and space. If niche is an animal's "occupation," then habitat is its "address." This activity is designed to focus on riparian niches and habitats.

OBJECTIVES

After completing this exercise the student will be able to

1. identify the ecological role (niche) of different organisms that live in riparian habitats
2. describe the basic characteristics of riparian habitats
3. describe conditions that affect riparian habitats

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: A variety of art materials: e.g., paint, clay papier-mache, glue, wire, string, brushes, construction paper. Nature magazines for photos (optional), reference books.

Traditionally, a riparian zone has been defined as a distinctive habitat dependent upon the flowing water from a stream or river. However, some biologists extend the definition to include standing and even sub-surface water. Riparian zones contain a wide variety of wildlife and vegetation. Many animals that live here cannot survive without the special conditions that the riparian zone provides. Riparian areas often provide more shade, higher humidity, and more diversity in animals and plants than surrounding areas. The width of a riparian area depends on the amount of available water, soil types, minerals, water table, geologic structures, and many other factors. Riparian habitats are both aquatic and terrestrial, and are characterized by wide diversity in life forms.

In such settings, animals favoring riparian habitats fill niches. For example, frogs are commonly found in areas of calm waters in riparian zones. Frogs are predators, once they mature beyond their algae-eating tadpole stages. They need moisture, sunlight, and grasses or other vegetative shelter. Their eggs must be deposited in water that is permanent enough to allow a year-long period to hatch, grow into gilled tadpoles, and finally transform into insect-eating, air-breathing frogs. Fish and wading birds prey on both. Raccoons, foxes, and other animals eat both tadpoles and frogs, a well as fish. It is the interrelatedness of all these "occupations" and "addresses" that characterize the uniqueness and beauty of riparian zones.

Riparian areas are easily affected by natural and human-caused changes. Spring flooding and flash floods dramatically affect vegetation and wildlife. Excessive use of riparian areas by humans, livestock, and wildlife can result in destruction of riparian vegetation and destabilization of the stream or riverbank, causing

increased rates of erosion. In arid areas of the west, whole stream flows have been diverted from original channels to provide water for farming and livestock use. Development and recreational pressures also threaten this unique habitat. Riparian zones are fragile and can be destroyed easily.

The major purpose of this activity is for students to become familiar with some of the characteristics of riparian species, niches, and habitats.

PROCEDURE: This activity is designed to involve a visit to an actual stream site. If this is not possible, see the "variation" for an alternative approach.

1. Select a local stream or standing body of water that the students may have some familiarity with. Tell the students that dozens of different animals and plants live in, around, above, and below that aquatic habitat. Ask the students to generate a list of the animals that they think live in the water and its nearby environment. The water and its associated ecosystems may be considered a "riparian" area.

2. Assist the students in verifying which of the animals they list actually do live in your region and might live in this area. The list may be obvious, making it possible for you and the students to quickly decide. However, some animals may be in question, and you may want the students to consult references. Also, without additional research, many animals may not be identified which do live in the area.

3. Once the list is verified, have the students each choose an organism. Ask each student to create an artform. representation of his or her animal. They can use drawing, painting, collage, sculpture, magazine image, or any other art form of their choice. Be sure to ask the students to make their work durable enough to be displayed out of doors. Each art form should have a hook, string, or support to allow it to be hung on branches, stuck in the soil, or placed on a solid surface.

4. The students should be familiar with how the organism they have chosen "makes a living." That is, they should know its occupational role in the habitat. They should know what animals or plants their organism depends upon and which organism depends upon their animal. Discuss the concepts of niche and habitat with the students at this point for emphasis. Habitat is the animal's "address." Niche is the animal's "occupation" at that address.

5. The next step is to visit the riparian habitat that was selected in the first procedure. Emphasize personal safety and regard for the habitat. Select a "starting place" where the entire class can gather.

6. Ask the students to place their animals in appropriate places within the habitat. Tell the students to stay in a limited area so that all of the animals can be seen from the starling place. After each animal is placed in its appropriate spot in the habitat, have all the students return to the starting place.

7. Ask each student to go to his or her animal — one by one — to tell about the

animal and its niche in two or three sentences. Make sure all of the students can hear one another clearly during this process. Once each of the students has done this, gather the students together and discuss the concepts of niches and interrelatedness.

8. From the starting place, point out the effects the body of water has on the surrounding area. Introduce the word "riparian" to the discussion. Have the students identify and discuss the characteristics of riparian habitats. Ask them to consider things that might change this riparian habitat as a suitable place for their organism to live. Identify, if possible, examples of changes that would have negative consequences for one or more kinds of animals. Identify, if possible, examples of changes that would have positive consequences for one or more kinds of animals.

9. Have one or two students volunteer to demonstrate the consequences of a change that would damage the habitat for one or more of the animals. They could do this by removing the animals that would be immediately affected by the change. For example, severe pollution would affect the aquatic dwellers — fish, frogs, mosquitoes, etc. Ask the students to discuss the possible effects on the remaining animals in the area. Repeat with a different change; e.g. fire development, damming, stream diversion.

10. Ask the students to summarize what they have learned about niche, habitat, and riparian environments. Ask the students to gather their artwork animals from the environment and return to the classroom.

VARIATION: There is no substitute for the quality of experience gained from an actual site visit. If, however, a site visit is impossible, these alternatives are possible:

1. Create a simulated riparian area on the school grounds using chalk, paper cutouts, and other materials.

2. Limit the scale of a simulated riparian area to the classroom — or even a tabletop!

EXTRA CREDITS:

1. Have the students identify the basic niches found in all enviromments: producers, consumers, and decomposers. Break down the consumer category into predator and prey groupings. Identify animals in each grouping for local riparian and aquatic habitats.

2. Discuss what types of natural and human-caused changes could affect riparian areas.

3. Investigate what kind of repairs can be done to riparian zones after extensive damage has occurred. If it seems useful and appropriate, explore the possibility of a riparian restoration team working in your community to reinstate the health of any riparian areas that have been degraded.

OBJECTIVES

After completing this exercise the student will be able to

1. list and describe the effects of habitat loss on migrating waterfowl.

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 30

DURATION: 2 hours

SETTING: Playing field/Gym

MATERIALS: Large playing field or gym, paper plates–two for every three students, clearly marked to differentiate top from bottom.

Educator's Outline for

DUCKS LIMITED

BACKGROUND: Ducks are remarkable migrating waterfowl. They require the presence of wetlands in their breeding habitat and their wintering grounds. And because these two regions are often thousands of miles apart, they need wetlands to provide them with food and rest in between.

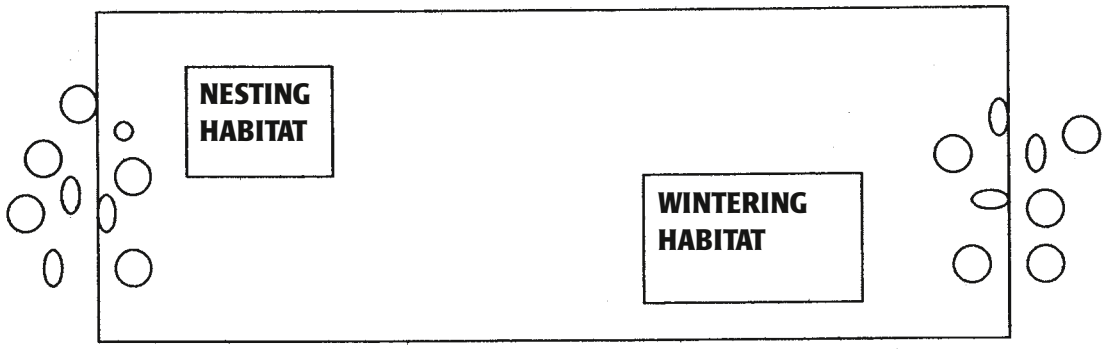
The primary threat to the welfare of waterfowl is the disappearance of wetlands. Without them, dozens of species of ducks, geese, and swans face loss of necessary habitat for survival. Wetlands are dominantly lost to agriculture and commercial development. Many federal, state, and private groups recognize the importance of wetlands to wildlife and are actively trying to preserve these habitats for local wildlife and the vast flocks of migratory birds that span continents on their journeys.

Migration is a mysterious topic for most. How do birds, fish, mammals, and insects travel the immense distances they do with such exactness? Some travel at night, some during the day and others deep within the sea. Yet, unerringly, they locate habitats necessary for the continuation of their species. Scientists proposed that they use the stars, the sun, even the earth's magnetic field for guidance. Other animals, such as salmon, seem to use smell to guide them home from the sea.

The migration routes of North American wildfowl are well known. Their journeys take them over lands in which human use is ever increasing. Agriculture, development, and industry are all diminishing the natural wetlands. Pollution, through pesticides and herbicides, as well as residual lead rather than steel shot from hunting, all take their toll. Natural conditions also affect the migratory birds. Predators, weather, disease, and fire influence both the animals and their habitat.

In this activity we have chosen to simplify the events of migration so as to keep the simulation manageable. In doing so, we have avoided increasing the complexity of involvement between nesting and wintering areas. In actuality, many of the hazards faced by migrating waterfowl are hazards en route. We guide the teacher to emphasize these in discussion rather than during the simulation. Each student (assuming a class size of 30) represents thousands, if not tens of thousands, of waterfowl. Thus the introduction of natural predators, hunters, and short-term contact events was avoided in favor of the long-term loss of habitat.

The major purpose of this activity is for students to dynamically experience some of the major habitat factors, which can affect the successful migration of aquatic birds.



PROCEDURE:

1. Select a large playing area about 70 feet in length. Place the paper plates in two patches on the playing field as shown below:
   Choose the number of plates so that you have one plate for each three students at each end of the field. Designate one of these areas the "wintering habitat" and the other the "nesting habitat." This means you have two sets of plate; one set at the nesting habitat and one set at the wintering habitat.

2. Explain to the students that they are waterfowl and will migrate between these two area; at your signal. Have them understand that the paper plates represent wetlands that provide suitable habitat for them. At the end of each journey they will have to have one foot on a paper plate in order to be allowed to continue. If they cannot get their foot on a plate, they have to move — at least temporarily — to the sideline and watch.

3. Explain to the students that many factors will be affecting these two habitats, causing changes. There will be times of abundant food, water, shelter, and space suitably arranged to meet the habitat requirements of the birds. There will be times when the habitat is stressed, with many factors limiting the potential for ducks to survive. Sometimes the area for available habitat is reduced. Tell the students that for the purposes of this activity only three ducks can occupy a "habitat haven" (paper plate) at any one time.

4. Begin the activity with all the students at the wintering habitat. Announce the beginning of the first migration. On the first try, all the ducks will successfully migrate to the nesting habitat.

5. Explain that there has been no loss in the area of available habitat. Thus, a successful nesting season is at hand. Repeat the instruction to migrate, and

send the ducks to the wintering habitat.

6. Before the students migrate toward the wintering habitat, remove a plate from the wintering habitat.

7. Explain that a large wetland area has been drained and used for agricultural purposes. Have three students stand on the sideline. Emphasize that the loss of habitat caused them to die.

Note: Remind these students that they have a chance to get back in the game. They can come back only if there is available habitat in the nesting ground. If so, they would represent new surviving hatchlings. Instruct them to move to the sidelines of the nesting habitat and wait.

8. Before the next migration to the nesting region, turn over four plates in the nesting habitat. This represents a catastrophic loss. Tell the students that this is the result of an oil spill in the local river, severely damaging shoreline habitat. Instruct the students to migrate.

Note: This results in a large number of students waiting on the sidelines to re-enter in the nesting habitat. Before many cycles are repeated, provide them with re-entry. Each time give the students examples of changes in the habitat conditions that could have taken place, making it possible for them to survive.

9. Repeat the process many cycles as you think are necessary to illustrate habitat variables. Add and subtract wetland, with indication of causes. Emphasize the variety of conditions that can affect habitat. For example:

Factors Limiting Survival of Populations of Migratory Birds

- wetland drainage
- drought
- pollution/contamination
- urban expansion
- conversion to farm land
- converting waterways to canals
- overhunting
- Lead shot in food supply
- disease
- etc.

Factors Conducive to survival of Populations of Migratory Birds

- preservation of wetlands

- high rainfall
- restoration of habitat
- dynamic balance with natural predators
- regulation of hunting and human predation
- etc.

Some limiting factors are a natural and dynamic part of any environment. However, the significant difference in the case of the survival of populations of migratory aquatic birds seems to be the loss of huge areas of suitable habitat, much of it loss by human intervention, e.g., the draining of wetlands.

Be sure to create one or more "disaster" years to illustrate the catastrophic loss of large areas of available habitat. Do remember that, overall, habitat for migratory aquatic birds is diminishing. The activity should end with fewer areas of available habitat that can accommodate all the ducks. The greatest long-term threat to populations of migratory waterfowl is loss of habitat.

10. In discussion, ask the students to identify the apparent causes of duck population decline from year to year. Ask them to imagine what seem to be the major factors contributing to the temporary and permanent loss of habitat for the ducks. Distinguish between short-term (temporary) and long-term (permanent) impacts. Distinguish between catastrophic impacts and gradual changes. Ask the students to support their hypothesis with evidence, seeking additional information through research if necessary.
11. Ask the students to summarize what they have learned about some of the many factors that affect the success of aquatic bird migration. Emphasize the difference between human-caused factors and natural factors.
12. What kind of things can and should be done to stabilize both nesting and wintering habitats and stabilize waterfowl populations? Discuss potential tradeoffs related to any recommendations.

DUCKS LIMITED

1. Explore habitat loss or gain in your community.

2. Research the causes for long-term habitat loss, as well as efforts underway in North America to prevent these increasing losses.

3. Research the natural history of a migratory bird species, including how they navigate.

4. Using a map, plot the major migratory route of North American birds.

5. Visit a wildlife refuge, park or other habitat for migratory waterfowl.

6. What other animals migrate? Are the problems they face similar to ducks?

Educator's Outline for

THE EDGE OF HOME

BACKGROUND: The idea of edges is an exciting concept. It evokes the image of exploration in our minds. It is a powerful metaphor in our culture — the cutting edge, the edge of space, are all commonplace expressions of the excitement of edges. The edges of ecosystems are exciting as well. They represent the places where the evidence of difference is most present. Ecology is the study of the interactions between living things and their environments. Ecology comes from the Greek word oikos, which means "home." The word ecosystem refers to an area where all the living and nonliving things share common interrelatedness — a place formed by the interaction of communities of life forms and their environments. When we use the phrase "edge effect" we are referring to the dynamic relationships that exist where the home territories of various organisms overlap — where habitat types come together. These edges are seldom distinct lines; instead they are usually places where overlap occurs. The whole area or place where there is overlap is called an ecotone. Traditionally, ecotone is defined as the place where two plant communities come together. Here we will use a more expanded definition and include all organisms. It is the ecotone and edge effects contained within it that we will explore in this activity.

OBJECTIVES

After completing this exercise the student will be able to

1. identify the characteristics of ecotones or edge conditions in wildlife habitat near their communities
2. evaluate alternatives for maintaining the habitat to support a diversity of wildlife

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25 to 30

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: Poster paints or watercolors, pencils, paper, clipboards, camera (optional). Varied resources as needed: maps, copies of local ordinances, names and phone numbers of officials, habitat specialists, etc..

In local communities, there are abundant edges and edge overlaps. The most accessible is the edge of the school ground. Others, such as stream banks, lake shores, and marsh edges, may be found within walking distance from many schools. Although exploring many edges involves only small parts of ecosystems, it does provide opportunities for understanding the dynamics of change, which take place in wildlife habitats.

In ecotones, direct or indirect evidence for the influence of dominant ecosystems is readily found. The area of overlap tends to be more complex than either ecosystem by itself. For example, in an overlap of forest and marsh, it is common to find forest species growing within the marsh. Trees of the forest, for example, are often malformed in a marsh due to the conditions of excess water.

On occasion they will die and the edges will be strewn with their remnants. In addition to the abundance of life forms commonly seen, indirect evidence abounds — footprints, scat, feathers, etc. — all testimony to the dynamics of such settings. The high activity of ecotones also assures diversity — and diversity means more wildlife. The absence of diversity of life forms in ecotones is often an indication of problems in the ecosystems involved.

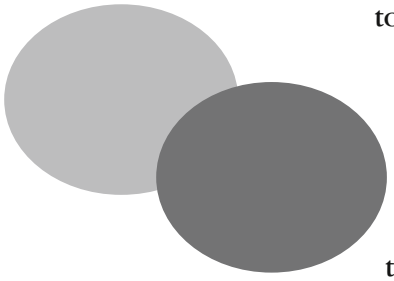
Since "edges" also attract humans, there is the possibility of damage to the ecotone that can affect wildlife. Marshes are often drained or filled in for construction or agriculture. Natural forest near homes is often removed for lawns and gardens. Streams are frequently damned or diverted and rivers channelized to allow boating or shipping.

Evidence of human litter and other refuse on a lakeshore or stream bank are indicators of other human-created problems. Fish kills and a prolonged absence of waterfowl may indicate contaminated water and loss of wetlands. In the face of such indicators, individuals can take action to make a difference. Particularly beginning with small ecosystems, efforts can be made to enhance the likelihood of meeting animals' needs for survival.

The major purpose of this activity is for students to examine the edges of a variety of wildlife habitats; analyze these edges; assess the appropriateness if taking action to enhance the characteristics of a habitat for its capacities to support diverse wildlife; and take action to put their plan into effect if it seems appropriate.

PROCEDURE:

1. Have the students paint two large spots of two different colors on a single piece of paper. Blue and yellow are good choices. Invite them to enlarge the spots until they "touch" each other but do not overlap. On a separate sheet of paper ask them to repeat the process so that the colors not only touch but also overlap. With blue and yellow the overlap produces green and is thus highly visible.



2. Tell the students that you are going to soon take them to a natural setting where there are places that overlap like their paintings did. Tell them that they are going to investigate these places, including the areas where there is some kind of "overlap." First, invite them to sit quietly with their eyes closed and imagine a place where two different environments have come together. Encourage them to visualize what things would be like in the middle of the area where the two environments have come together. Then ask them to concentrate their imagination on the edges of the places where the settings come together. Have them pay careful attention to what things would be like where the settings actually overlapped.

3. Next, ask the students to open their eyes and gather together in groups of

five. Ask them to discuss the concept of edges and the idea of how two different environments or ecosystems could overlap.

4. On the chalkboard draw two large overlapping circles. Put a large number of small squares and triangles in one circle. Avoid the overlap. In the second circle, draw many tiny circles and stars, again avoiding the overlap area. Ask the students to predict what kind of things they would expect to find in the overlapping circles. Draw circles, squares, triangles, and stars in the area of overlap.

Ask the students where the greatest diversity exists. Label the whole area of the overlap the Ecotone, (This is the area of greatest diversity.) Label the two circles as Ecosystem 1 and Ecosystem 2. Ask the students to point out the "edges" of the overlap. These are the places where the two ecosystems come together and interact. The process and results of this coming together, or interaction, are called the "edge effect."

5. Take the students to the edge of the playground to study the edge effect. Choose a place where plants are invading the playground area, or the edge of the lawn where it meets a sidewalk. Have the students consider these miniature ecosystems. Invite them to list the things they find on either side of the edge. Discuss the most pronounced differences. Next, ask them to carefully examine the edge. Have them determine the degree of overlap in characteristics and how wide the zone of shared characteristics is. Point out that this is a miniature ecotone.

6. Take a class to a site in the community that has aquatic edges. You may be able to find a place where a stream enters a lake, a beach, highway edges, the edge of town, and many more that are available in the community. Once there, ask the students to describe the ecosystems. Have them determine the zone of overlap — the ecotone. Stretch a length of rope or string from one ecosystem to another, and have the students make observations every few feet along the line. It helps to mark the string or rope with flow pen bands at one-foot intervals.

Encourage them to list characteristics and inhabitants of both "ecosystems," and to list the characteristics and inhabitants of the "ecotone." Be sure to help them acknowledge both direct evidence and indirect evidence.

7. While still at the site, ask the students to analyze the relative health of the area. Have them look on either side of the "edge," area. What wildlife, if any, is in evidence? Is there diversity in the kinds of vegetation in the area? Is there evidence of wildlife diversity? Ask the students to decide what things, if any, could be changed in order to improve the area as wildlife habitat? If the area could be improved for wildlife, are the limitations of the area the result of prior human action that reduced the quality of the environment? If yes, what do those actions seem to have been? If no, what factors do seem to have affected the quality of the area as wildlife habitat?

8. When you return to the classroom, ask the students to summarize their findings and recommendations. Ask them to identify a range of possible options, and then evaluate the appropriateness or inappropriateness of any actions they might take. Consider tradeoffs involved with each. If the students recommend that there are some changes that they believe can appropriately be made to improve the area for wildlife, ask them to develop an action plan. It is recommended that the action plan involve them personally first, and other people second. For example, if there is litter at the site, the action plan might involve the students attempting to clean the site first as an indication of their commitment before meeting with public officials involved with waste removal. A letter to announce their intent would not compromise this rule. If on the other hand, the area is in good health, the students could find a way to acknowledge any people who bear responsibility for having maintained and protected the quality of the habitat.

9. When their plan of action is underway — whether to improve the environmental quality of in area or to acknowledge those who have protected environmental quality — remind the students of the importance of taking positive action. Being for something tends to be productive and constructive than being against something.

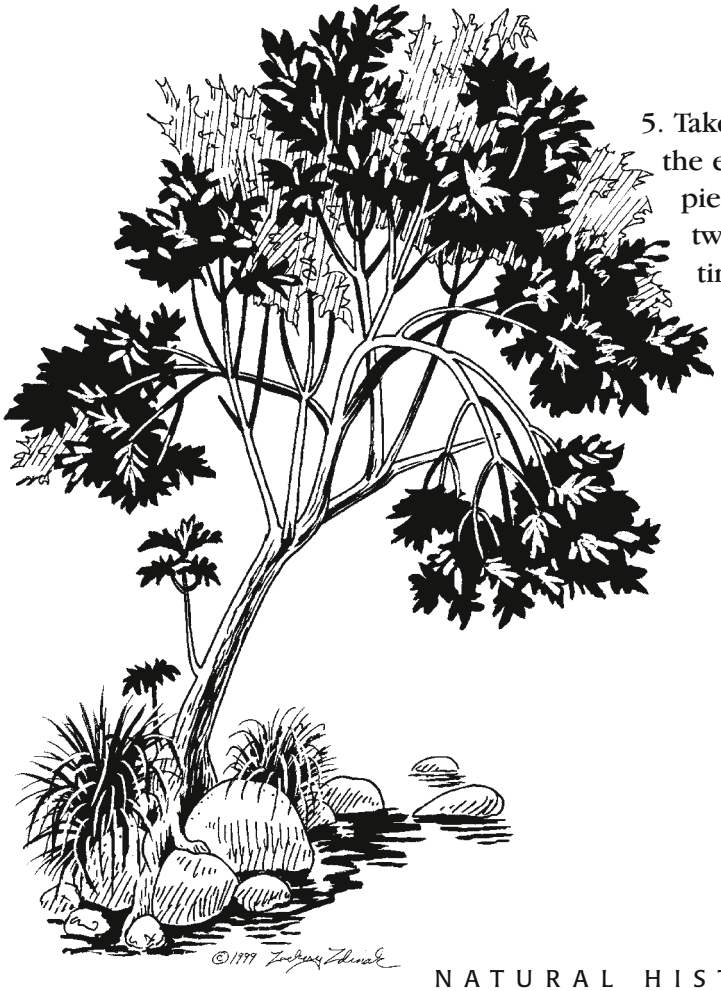
THE EDGE OF HOME

1. Continue the quest for edges! Take action to protect any in danger of being damaged or lost.

2. Identify one species of animal that lives in an aquatic habitat. Write an action plan for your community from the perspective of the needs of that animal.

3. Compare wildlife populations where aquatic and land edges meet. Determine which habitiat is most threatened.

4. Create an ecosystem map or model of your community. Indicate the location of the ecosystems and determine the relative health of the ecosystems.



5. Take a simple piece of paper and measure the edges. Cut the paper into four equal pieces; measure the edges again. Repeat twice again, measuring the edges each time. Support the idea that each new rectangle is a suitable habitat for some aquatic organism, and discuss how diversity is related to "edges."

OBJECTIVES

After completing this exercise the student will be able to

1. demonstrate their understanding of the variety of ways and reasons water is important

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science
Science Standard 5 – Physical Science
Language Arts Standard 2 – Writing
Language Arts Standard 4 – Viewing and presenting

GROUP SIZE: 25 to 30

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: Writing materials

Educator's Outline for

AQUA WORDS

BACKGROUND: Water has uses for humans and animals in our biological functions, health needs, agriculture, industrial production, recreation, esthetics, and many other areas. When students are given the time and opportunity, they can appreciate the importance of water for all living creatures.

The major purpose of this activity is for students to increase their appreciation of the importance of water.

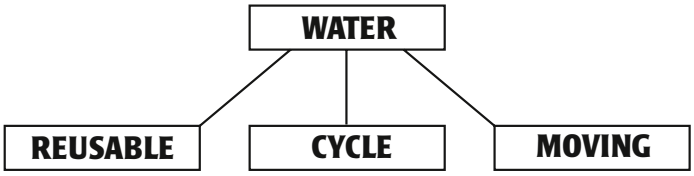
PROCEDURE:

1. Ask the students to think for a moment about some of the ways they have used water that day. Some examples may be suggested to get students warmed up for brainstorming.

2. On a long strip of butcher paper or spacious empty chalkboard, list all of the words connected to water and its importance to people and wildlife that students can name. Keep students stretching into new areas by suggesting new categories if they get bogged down. Don't quit until there are at least 100 words on the list.

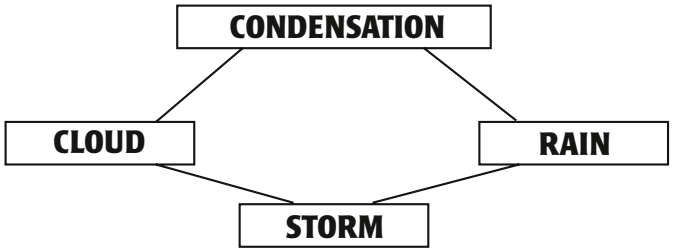
3. Have students complete several kinds of word trees using the words they have listed or others that come to mind. Begin with a simple word tree like this: Note: You could give them this example for a start if they need it.

(A)



Then move to a more diffcult word tree like this:

(B) 1 word

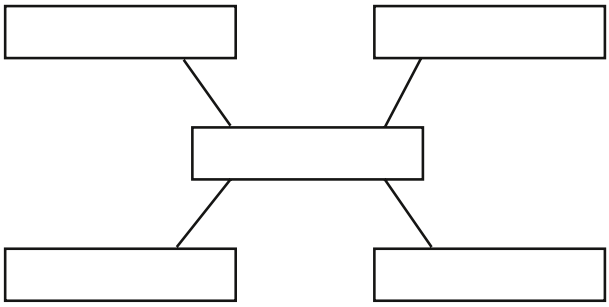


2 words related to #1

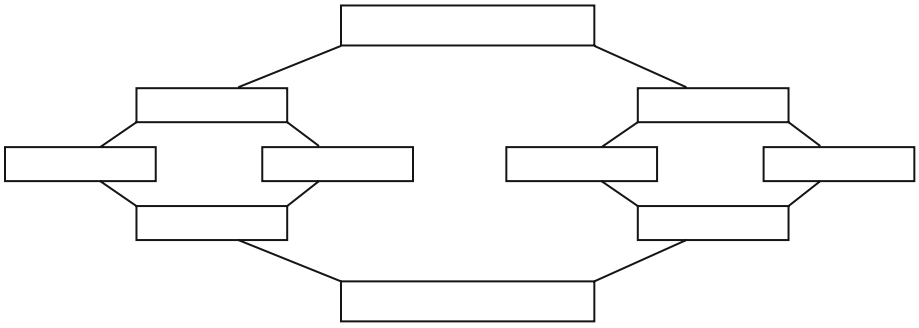
1 word that combines words #2 and #3

Finally, if possible, ask the students to create even more complex word trees like these:

(C)



(D)



In every case, words are either combined or separated, depending on how the lines link to the boxes.

Students can be provided with a handout similar to the attached form to facilitate making the word trees.

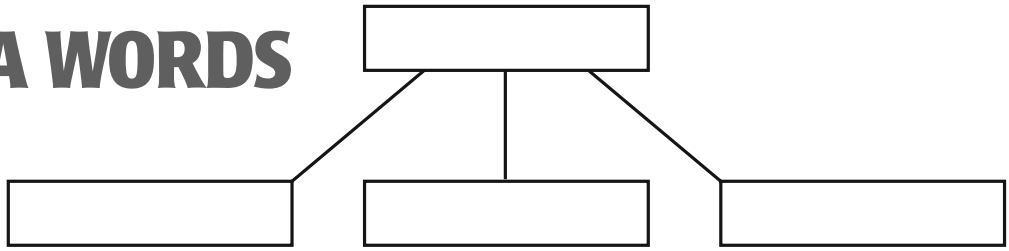
4. When students have finished several word trees, have them look at what they have done, and write one or two poetic definitions using a lot of description. These could begin: "Water..." or "Water is..." For example, using the word tree "B": "Water is gray clouds condensing into a loud summer storm."

5. When students have completed their ideas, have them write them onto various shades of blue, aqua, gray, white, and green construction paper cut in half vertically. Arrange the strips in a steam, river, pond, lake, or ocean shape, on a wall or window.

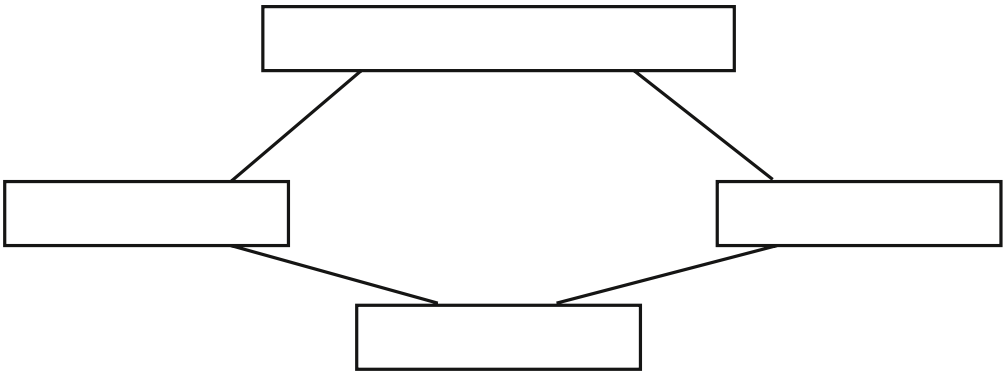
EXTRA CREDIT: An alternative project could be a class book with each student's page included. Students write their poetic definition at the bottom of the page, and illustrate — for example, with watercolors — the top of the page.

AQUA WORDS

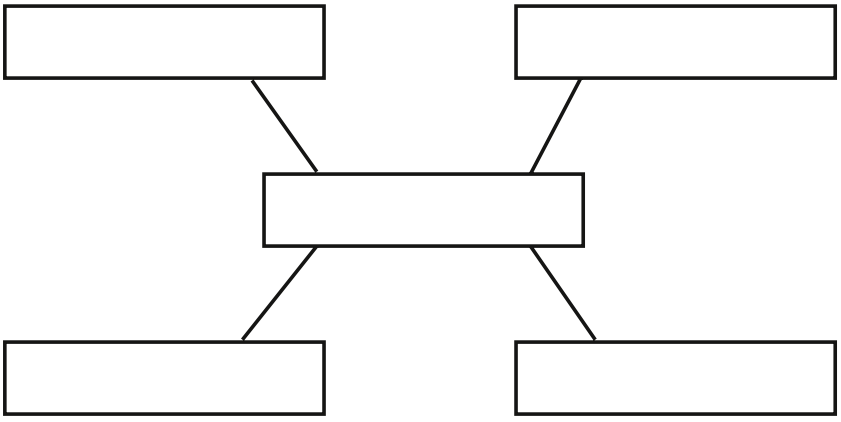
A.



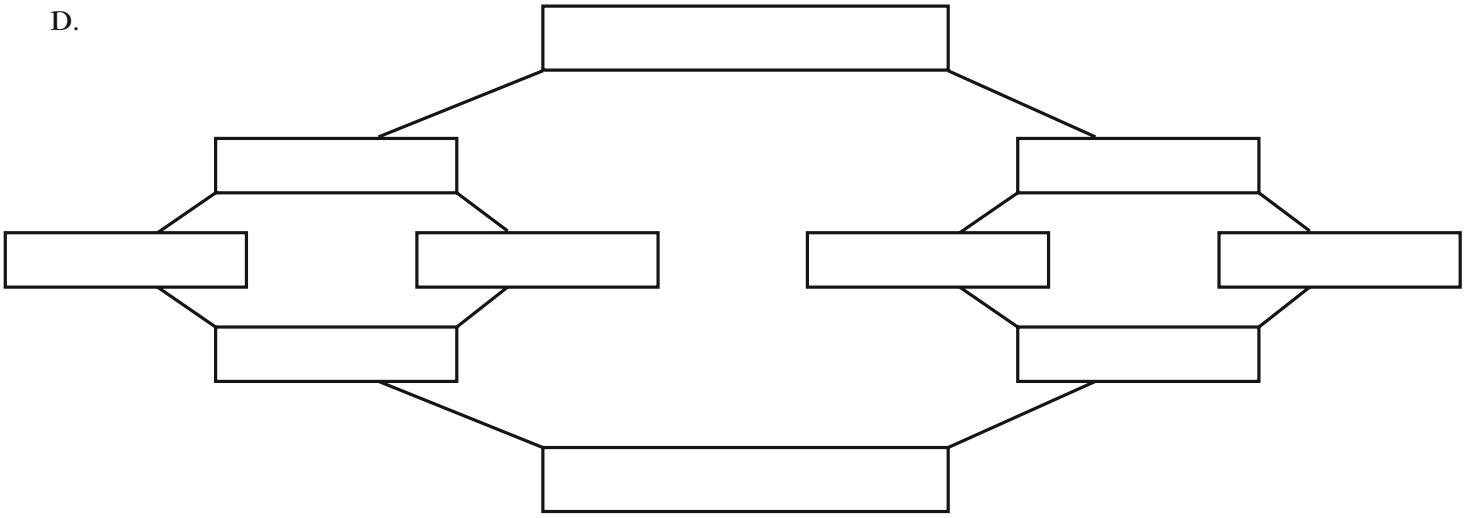
B.



C.



D.



Educator's Outline for

FASHION A FISH

BACKGROUND: Aquatic animals are the products of countless adaptations through the history of each species. These adaptations, for the most part, are characteristics that enhance the animals' likelihood for surviving in their habitat.

Often, as a habitat changes, either slowly or catastrophically, the aquatic animals with adaptations that allow them many options are the ones most likely to survive. Some creatures have adapted to such a narrow range of habitat conditions that they are extremely vulnerable to change. They are over-specialized, and are usually susceptible to death or extinction.

Fish have a variety of adaptations. Some of these adaptations are listed below.

OBJECTIVES

After completing this exercise the student will be able to

1. demonstrate their understanding of a variety of adaptations in fish

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25

DURATION: 1 hours

SETTING: Classroom

MATERIALS: Five reproduction cards for each adaptation: mouth type, reproduction preference, body shape, coloration; art materials and paper.

MOUTH

1. Sucker-shaped mouth	algae eater
2. Elongated upper jaw	feeds on things below fish
3. Elongated lower jaw	feeds on prey above fish
4. Duckbill jaws	grasps prey
5. Extremely large jaws	surrounds prey

BODY SHAPE

1. Torpedo shape	fast-moving
2. Flat-bellied	bottom feeder
3. Vertical disk	feeds above or below
4. Horizontal disk	bottom dweller
5. Hump-backed	stable in moving waters

COLORATION

1. Light-colored belly	predators have difficulty seeing it from below
2. Dark upperside	predators have difficulty seeing it from above
3. Vertical stripes	can hide in vegetation
4. Horizontal stripes	can hide in vegetation
5. Mottled coloration	can hide in rocks and on bottom

REPRODUCTION

1. Deposits eggs on bottom	trout, salmon
2. Deposits eggs in nests	bass, stickleback
3. Floating eggs	striped bass
4. Eggs attached to vegetation	perch
5. Live bearers	guppies

The variety of fish found in aquatic habitats testifies to the number of adaptations these creatures have made. By examining the nature of adaptations in fish, students can gain greater insight into the characteristics of aquatic habitats.

The major purpose of this activity is for students to investigate the concept of adaptation in fish.

PROCEDURE:

1. Divide the adaptation cards into five groups of four cards each, one each of coloration, mouth type, body shape, and reproductive preference.

2. Pass these out to students working in groups of four to six.

3. Ask the students to "fashion a fish" from the characteristics of the cards. Each group should:

   a. create an artform that represents their fish

   b. name the fish

   c. describe and draw the habitat for their fish

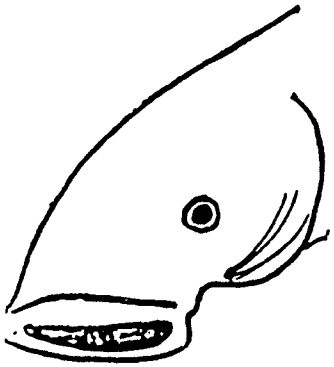
   4. Have each group report to the rest of the class about the attributes of the fish they have designed.

EXTRA CREDIT:

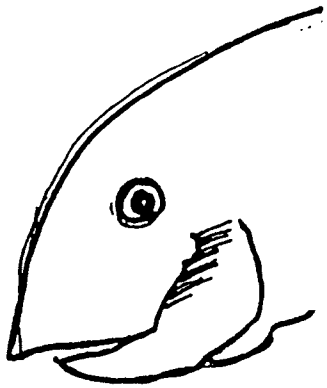
1. Provide each student with an adaptation card from any category and have him or her find real fish that have that adaptation. Note: A collection of books about fish would be necessary to gather. Do not be concerned about reading level as much as profuse illustrations.

2. Show examples of actual fish, and have the students use coloration, body shape, and mouth type to describe the fish's "lifestyle" and speculate on its habitat.

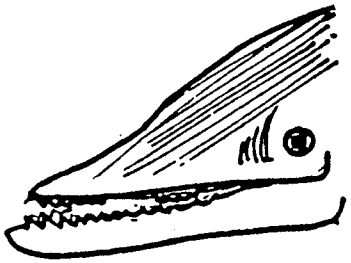
DIFFERENT KINDS OF MOUTH ADAPTATIONS



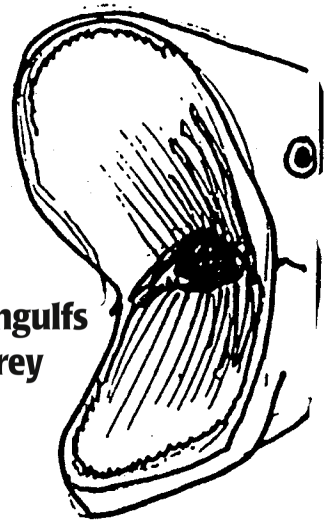
Bottom- and algae-feeders



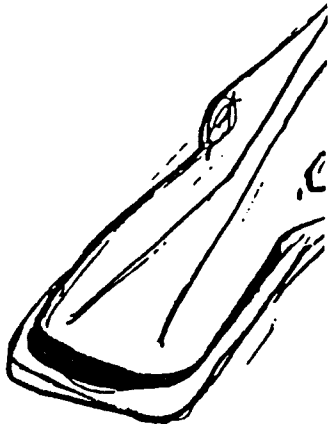
Feeds on prey below



Feeds on prey above

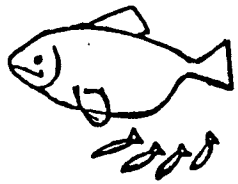


Engulfs prey

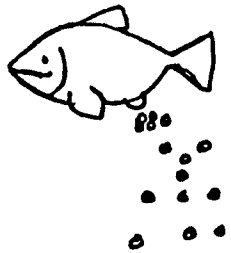


Grasps prey

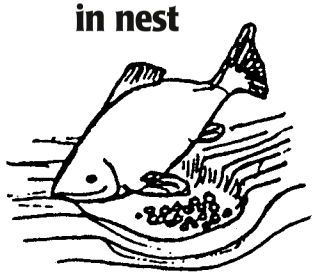
DIFFERENT KINDS OF REPRODUCTION ADAPTATIONS



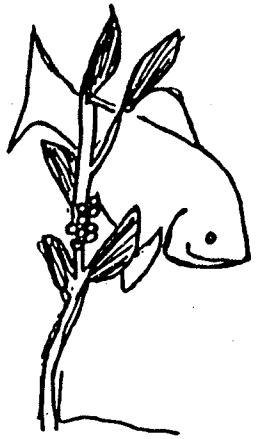
Live born young



Free-floating eggs



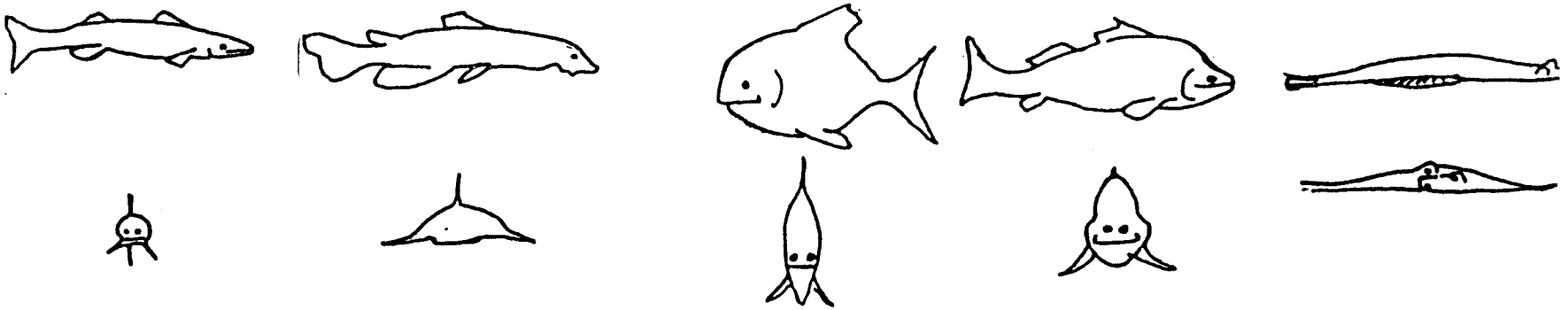
Deposits eggs in nest



Deposits eggs on vegetation

Deposits eggs on bottom

DIFFERENT KINDS OF SHAPE ADAPTATIONS



Torpedo | Flat-bellied | Vertical flat | Humpback | Horizontal flat

DIFFERENT KINDS OF COLORATION ADAPTATIONS