**Activity Reading Assignment --- Migration Basics**

Migration is a fascinating aspect of animal ecology. Migration inspires us whether we are studying salmon migrating thousands of miles back to their spawning grounds, huge flocks of sandhill cranes migrating across the northern skies, or caribou crossing rivers in the fall.

Migration has captured the interest of humans for centuries. Ancient civilizations devised many myths to explain the periodic appearance and disappearance of vast numbers of animals. For instance, people once thought that tiny birds called swallows buried themselves in the mud at the bottom of lakes to get through the winter. Instead, scientists found out that swallows fly all the way from Europe to Africa and back in one year. Perhaps the truth was harder to believe than the myth.

**What is migration and why do it?**

Animals that live in habitats that are difficult to survive in year round, must evolve a way to cope with the difficult time of year. A strategy used by many mammals and other species is hibernation. Migration is another option for animals that can move across long distances. They survive by leaving the area for part of the year or part of their life, and move to habitats that are more hospitable.

The most common reason to migrate is to take advantage of food, shelter, and water that vary with seasons, or life stage. The availability of food and water can change throughout the year. For instance, the lack of insects and leaves in the winter means there is less food to eat. Some environments have a rainy and a dry season that are very different. Temperatures change between the seasons, some areas getting very cold or very hot which can be hard on some species. Sometimes it is not about getting food but about staying safe. Deep snow may make animals easier to catch by predators, or animals may go to special breeding grounds to keep their young safe when they are especially vulnerable.

Types of migration - there are lots of different kinds of migration. These terms are used to describe attributes of migration such as timing, direction, the reason for migration, and how many of the species migrate. More than one term can be used to describe one species migration patter. Some common types of migration are:

**Seasonal migration**
is migration that corresponds with the change in seasons. Most migration fall within this category. Many altitudinal, longitudinal, latitudinal, and reproductive migrations take place when the seasons change.

**Latitudinal migration**
is the movement of animals north and south. The geese flying south for the winter is one of the most recognizable examples of latitudinal migration. By moving north and south, animals are changing their climate. In the northern hemisphere, the winters are colder as you move north and warmer as you move south. On the other hand, summers in the north can be rich in food, especially in the far north where

summers are short, but the days are very long.

**Altitudinal migration**
is the movement of animals up and down major land features such as mountains. While food may be plentiful in alpine meadows in summer, the winters will be colder and have more snow as you move higher up. Many animals take advantage of the summers, and then move to lower more moderate elevations during the winter.

**Reproductive migration**
is the movement of animals to bear young. The area may be safer for the young because of fewer predators or more shelter from predators. In other cases, the area is safer because the animal requires a different type of habitat when it is young than when it is older.

**Nomadic migration**
is the movement of animals not between known areas, but it looks to us more like wandering. Grazing animals will move across larger expanses as the grasses get eaten and they travel to greener pastures.

**Removal migration**
is the migration of animals that don't come back. This can be when resources such as food, water or shelter are no longer available to animals where they are. The environment can have changed, through fire, flooding, invasive plant species or human development or other causes and the animals need to leave to survive. Another cause of removal migration is when the resources haven't changed, but the population gets too big, there are too many animals and many of them leave to find food, water and shelter elsewhere. Removal migration is what brought immigrants to America in the 1800s.

**Complete migration**
is when virtually all members of the species leave their breeding range during the nonbreeding season. Many North American birds are complete migrants. Most complete migrants breeding in northern temperate and arctic areas (such as Alaska) of North America, Europe, and Asia. Complete migrants travel incredible distances, sometimes more than 15,000 miles (25,000 kilometers) per year. The wintering areas for most complete North American migrants are South and Central America, the Caribbean basin, and the southern most United States.

**Partial migration**
The most common type of migration is partial migration. Partial migrant means that some, but not all, members of a species move away from their breeding grounds during the nonbreeding season. There is an overlap between breeding and nonbreeding ranges of the species. Species like Red-tailed Hawk, Herring Gull, and Golden Eagles are partial migrants over much of their North American range.

**Irruptive migration**
Migrations that are not seasonally or geographically predictable are termed irruptive. Such migration may occur one year, but not again for many years. The distances and numbers of individuals involved

area also less predictable than with complete or partial migrants. In some years, irruptions can be over long distances and involve many individuals, or they can be short and involve only a few.

**Migration Examples**

Humpback whales of the Pacific Ocean head south in the fall to give birth to their young in subtropical waters off Hawaii, and then in late spring head north to spend the summer in the cold waters off Alaska that are rich with food.

Salmon are reproductive migrants that start their lives in freshwater streams, move to the open ocean for their adult lives, then return to their home stream to lay eggs.

Dall sheep of Noatak National Preserve are seasonal, altitudinal migrants that spend summers near the top of mountain ranges and then winter at lower elevations where there is less snow and food easier to find.

Arctic terns are complete migrants that spend all year in summer by alternating subpolar regions in the northern and southern hemispheres.

Golden eagles of Denali National Park and Preserve spend the summer in the north where there is plenty of food, and head south for the winter when there is less food in the north and the temperatures drop far below zero. While all of the golden eagles of Denali do migrate, golden eagles are considered partial migrants because those that live far enough south do not migrate.

Sea turtles return from ocean waters to the coast to lay eggs in the sand, where they hatch and head to the open ocean until it is their turn to lay eggs. They are another example of reproductive migrants.

Locusts change when they get too crowded and become more active and social creating large groups of insects that move across the land in search of new places with plenty of food (and fewer locusts). This adaptation to overcrowding is removal migration.

Great gray owls are an irruptive migrant, migrating southward only occasionally and in numbers that vary greatly. Northern finches and crossbills are also irruptive migrants.

**Migration cues**

How do animals know when to migrate? That depends on the type of migration. For many types of migration it is the change of seasons that spurs animals on. As summer becomes fall, days become shorter and that can trigger animals to prepare for migration. Closer to the equator, the days don't change in length and one theory is that animals become restless after too many days with a constant length.

Other migrations are initiated by seasonal conditions. Food availability can be a motivator for some longitudinal and altitudinal migrators. For example, as plant foods in upper elevations become hidden under snow, animals move down toward the valleys, and then in the spring as the plants come out again, animals move back into the upper areas following the plants as they appear. Nomadic animals move to the next feeding ground as they run out of food where they are. As ponds dry with seasonal changes, animals will move to find available water supplies, and then return during with the seasonal rains.

In some species, migration happens when there are just too many animals too close together. The overcrowding causes many of the individuals to leave in hopes of finding another habitat with less competition. Or when there isn't enough food, not because of the changing seasons, but because the food where they are has been eaten. Then the animals start moving in search of new food.

**Navigation**

How do animals know how to get where they are going? That depends on the animal and where it is going. There is strong evidence that genetics plays a large role in migratory behavior and that animals inherit migratory routes from their parents genetically.

Animals use a variety of different information and senses to navigate. Researchers believe that most animals use a combination of navigation cues, depending on where they are and what the conditions are. In shorter migrations, animals do not need complicated navigation abilities. They can simply follow the food or the water, or head downhill to the valleys in winter and back up toward the ridges in summer.

Researchers have learned a lot about animal migration by studying animal movements. Starlings, for instance, orient themselves using the sun, compensating for how the sun moves across the sky throughout the day. Mallard ducks can find north using the stars of the night sky. Animals as diverse as migratory birds, salamanders, salmon, or hamsters use the geomagnetic field for orientation. Studies of loggerhead turtles revealed that hatchlings have the ability to sense the direction and strength of Earth's magnetic field, which they use for navigating along the turtles' regular migration route. Scientists have discovered a collection of nerve cells in the brains of subterranean Zambian mole rats that enable the animal to process magnetic information used in navigation.

Animals can also use mental maps. Just like people they become familiar with an area and navigate their way using land features like mountain ranges, coastlines, rivers, and even, in the case of dolphins, the shape of the sea floor.

Smell can be a powerful tool for many animals. Many land animals can create mental maps based on the smell rather than the just sight of major land features. Salmon use smell to find the exact stream that they were born. Fish can use water currents that circulate around the oceans, or they can swim against the current or with the current in streams and rivers.

**Adaptations for migration**

Migratory animals that travel long distances have special adaptations to help them get there. The most obvious are birds. They have wings that allow them to fly long distances, their bodies are especially light (they have hollow bones) so they can stay high in the air, and they don't have unnecessary weight to carry around. Geese fly in formation, the shape of a "V", which decreases the wind drag on all the birds along both sides.

Birds add on extra fat stores to give them enough energy for long flights north and south, because they do not eat during the migration. Similarly, whales stock up well on food in the northern seas before heading south for the winter, because they don't eat on the way.

Land animals must rely on their legs and feet to get them where they need to go.

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