

Animal Migrations

Eco-Meet Study Guide

Helpful Hints:

This study guide will focus on animal migration. The Eco-Meet test may consist of multiple choice, true/false, fill in the blank, matching, label a diagram, short answer, or identification using pictures. Anything in this study guide has the potential to be on the test. Pay close attention to words in bold, diagrams, and charts – it's easy to pull questions from that information.

What is Migration?

Animal **migration** is the regular movement of animals from one region to another. Usually migrations are seasonal, but examples will show that is not always the case. Migration is different from an animal's general wandering in that migration usually has these three features:



1. Migration is... movement of a greater distance than the animal normally travels within its home range.
2. Migration is... movement that is purposeful and directional.
3. Migration is... movement that has a defined beginning and end.

This study guide will focus only on animal migration. It is interesting, however, to note that by other definitions of migration plant seeds, entire habitats, humans, and even genes can migrate!

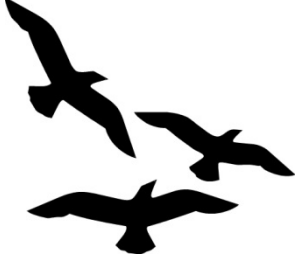





Types of Migration

Scientists classify migrating animals into two groups based on their reason for migrating. The terms **obligate migration** and **facultative migration** are used to describe why a species migrates. We will go into further detail about why animals migrate in the next section. Use the table below to understand the difference between these two types of migration.

Obligate Migration	Facultative Migration
	
<p><i>Individuals in these species MUST migrate each year for survival.</i></p> <p><i>These migrations tend to be very consistent year to year in both their timing and their path. These are almost always complete migrations. The longest migrations are usually obligate migrations.</i></p>	<p><i>Individuals in these species "choose" to migrate or not. Their "choice" depends on resource availability.</i></p> <p><i>These migrations are usually done to find a great quantity of resources, even though resources in the current location have not run out. Partial migrations are typical in this case, and interruptive migrations are facultative as well. Facultative migrations are usually shorter in distance.</i></p>

Four additional terms classify migrations based on the different ways animals behave. **Complete migration**, **partial migration**, **differential migration**, and **interruptive migration** are all terms to describe which or when individuals within the species migrate. Use the visuals below to understand these terms.

Complete Migration	Partial Migration	Differential Migration	Interruptive Migration
			
<p><i>ALL individuals of these species make the migration every year, as is the case for the Arctic Tern.</i></p>	<p><i>SOME individuals of these species will migrate when the time comes, and some will not, as is the case for the American Robin.</i></p>	<p><i>These species have different migration patterns for different GROUPS. Young Herring Gulls migrate a shorter distance than older gulls. Male American Kestrels migrate a shorter distance and at a different time than female American Kestrels.</i></p>	<p><i>These species do not migrate at all some years, but some or all may migrate other years. Blue jays are an example of this, as they will suddenly all migrate if food runs out in their area.</i></p>

Why Animals Migrate

For a wild animal trying to survive, long-distance travel is energy-expensive and dangerous! We would expect creatures who do not have to migrate to survive better than creatures who do. This has led scientists to conclude that migrations only evolve in a species if the benefits of the new location outweigh the high costs of getting there.

The motivation for migration is different for different species. The three most common reasons for animal migration are:

- 1.** ...To move between sites that offer different necessary resources: sites for feeding, sites for breeding, sites for hibernation, etc.
- 2.** ...To avoid seasonal environmental conditions such as droughts, floods, or freezing temperatures.
- 3.** ...To follow the availability of their food source. This can tie in with seasonal conditions, as food sources (plants or prey) may be scarce seasonally.

How they Navigate

How wild animals navigate during migration is a question that has fascinated humans for a long time! Some species are able to migrate vast distances (even across the world!) and they do not use a map, compass, or GPS device. In fact, some species are able to navigate through migration even though no living individual of that species has made the migration before! (Monarch butterflies are an excellent example of this. Read more about them on page 11). Clearly, the animals are navigating. But how?

Scientists studying migration have found a number of different ways creatures navigate. Each species uses different skills and techniques to find their way, and most species are limited and cannot use all the methods listed below. However, most species have been found to have multiple navigation skills, so that they can use different clues as they get closer to their destination or as conditions change. For example, a species that primarily uses the sun 's position to navigate might turn to using the magnetic field to navigate if the day is cloudy.

Skills Used in Navigation:

- **Position of the Sun:** Some species can determine the direction they are moving in by looking at the position of the sun in the sky.
- **Earth's Magnetic Field:** Some species can sense the magnetic fields created by the Earth's north and south poles and distorted by landforms. These animals use the magnetic fields almost as car lanes, knowing the direction they are traveling by their position in the magnetic field.
- **Position of the Stars:** Some species have been shown to use the stars and constellations to navigate. Experiments done inside planetariums have shown that changing the orientation of the starry sky will change the direction these species try to go.
- **Smells:** Some species use scent to recognize familiar places.
- **Landmarks:** Some species use visual clues such as rivers, mountains, or even smaller landmarks to find their way.

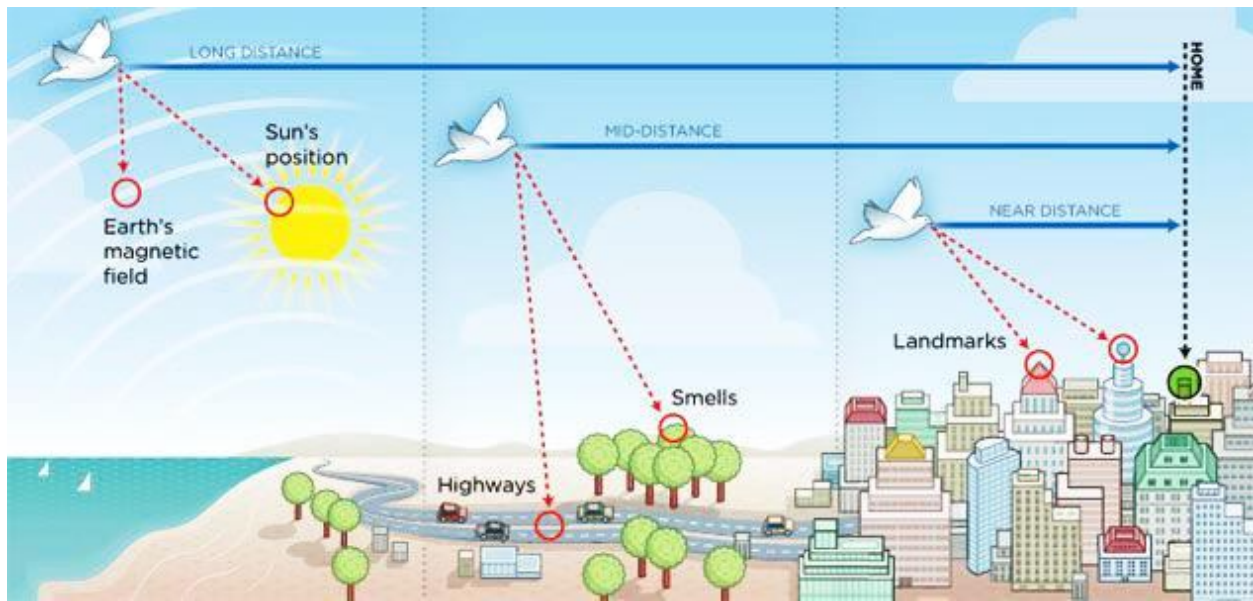


Figure 1: *Example of Navigating during Migration. Notice that the animal uses different skills at different points on its journey. Having multiple navigation skills helps to ensure a species will be successful in migration.*

Animal Migrations

Though not all animals migrate, those that do include species of birds, mammals, reptiles, amphibians, fish, insects, and crustaceans. Migrating species vary in their reason for migrating, their types of migration, the distances traveled, and their navigation skills.

On the following pages, we will explore migrating animals in each of 6 animal groups: birds, mammals, reptiles & amphibians, fish, insects, and marine animals.

Migrating BIRDS

Birds are the poster-animals for migration! While some birds go on famous migrations, some birds do not migrate at all. Only about 1,800 bird species migrate, of the nearly 10,000 bird species of the world. The great horned owl, for instance, maintains a year-round territory for hunting and breeding and does not move unless that territory is lost to another owl.

Many birds migrate north to south, often following their food to different climates. It is interesting to note, however, that some migrations follow an east to west pattern (see Mediterranean Flyway and East African Flyway, Figure 2).

Flyways are major migration paths used in common by many species of birds. Flyways take advantage of easy-to-navigate landmarks (see Mississippi Flyway, Figure 3), direct routes between popular bird destinations (see the Pacific Americas Flyway, Figure 2), and prevailing winds that make flying long distances easier (see West Pacific Flyway, Figure 2).

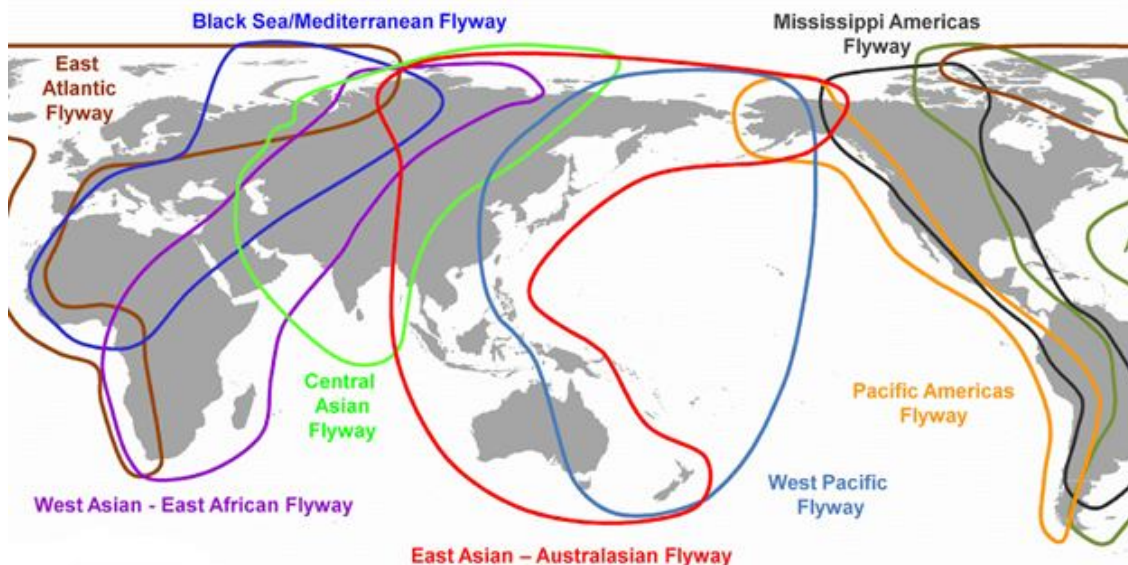


Figure 2: Map of the major bird migration flyways of the world. Do not worry about memorizing these flyways. Know that there are several main flyways and that not all follow a simple North-South migration.

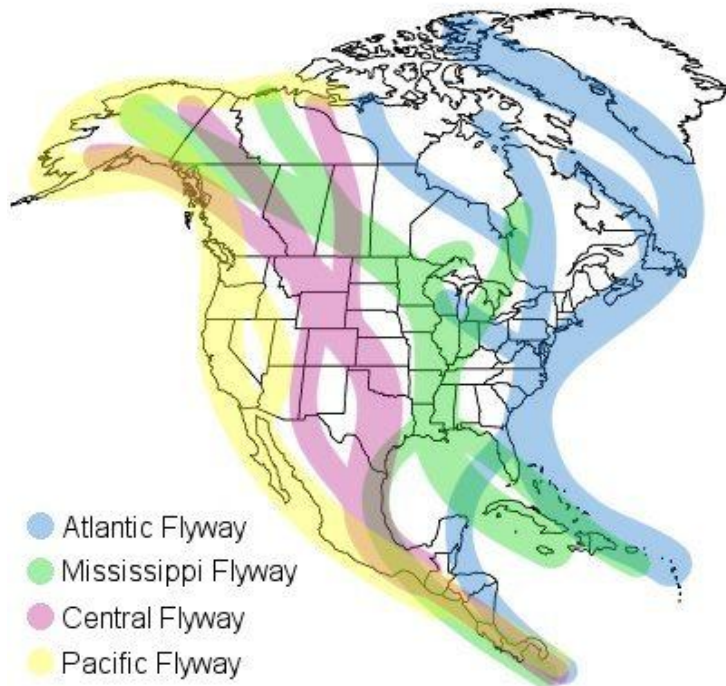


Figure 3: *Map of the North American Flyways. Notice the Mississippi Flyway is used by almost all migrating birds of Illinois. From a bird's-eye-view, the Mississippi River is a clear landmark for navigating north/south.*

Illinois is a pass-through state for many migrating birds in the spring and fall. Those seasons bring an abundance of migrating songbirds, warblers, and ducks, and are an excellent time to go bird watching in Illinois!

Migrating MAMMALS

While many mammals live a mobile lifestyle, only certain species have true migrations. (Look back at page 1 to define migration). Mule deer, found in the Rocky Mountains region, migrate to different habitats to access seasonal food sources. Whitetail deer, on the other hand, roam throughout the year within a home territory.

Mammal migrations are usually confined to one continent, since these creatures are typically terrestrial. Walking migrations are exhausting and slow, so mammal migrations tend to be short distances. Bats and Marine mammals are the exception, as they are not confined to walking. Marine mammals will be considered in the final group of animals: migrating marine animals.

Migrating REPTILES & AMPHIBIANS

Migration is mostly facultative for amphibians and reptiles: not all individuals choose to make the trip. In this case, however, the “choice” is simply a matter of their habitat and the resources it offers. Reptiles and amphibians need to feed, lay eggs, and hibernate (or estivate, which is basically hibernation in hot weather). Individuals who happen to live in an area that meets all those needs may not have to migrate. However, since most reptiles and amphibians keep very small home ranges, most individuals will have to migrate to meet their needs.

Both reptiles and amphibians tend to have very short-distance migrations. They are not large or fast-moving animals, so shorter distances make sense. The exception is definitely sea turtles, who travel vast distances in migration. (Sea turtles will be covered separately in the “marine animals” group.) Amphibian migrations are usually very short distances – just a matter of 20-500 meters! However, certain frogs (in Europe) have been recorded migrating as far as 9 miles.

Amphibians of a single species usually migrate all at once and move at night.

Oftentimes reptiles & amphibians must cross roads during migration. You may notice times in the spring and fall when turtles seem to be common on roads. Help them out by not running them over. If you move a turtle off the road, be sure to place it on the side it was trying to get to, as it is on migration!

The Shawnee National Forest is famous for its twice-yearly snake migration. The park’s famous “Snake Road” is closed in spring and fall, to protect migrating snakes from being run over.

Migrating FISH

Fish also contain migrating species, including salmon, lamprey, sharks, tunas, and eels. Their migrations are usually related to feeding and reproducing, but scientists still do not completely understand fish migrations. One theory even suggests that fish migrate to spread out from their own young, whom they usually eat if they encounter!

While several hundred species of fish migrate thousands of miles across vast oceans, most fish migrations shorter distances and contained to a single river, lake and stream, or other aquatic area. Scientists have found some species of fish navigate by magnetic fields and by smell.

Some species are obligate migrants and some are facultative migrants. There are several examples of differential migration in fish – usually in species whose newly hatched young start life in migration. For example, the longfin eel is born in the open ocean. Young eels find their way to freshwater rivers and streams where they live their entire lives (up to 100 years!), then migrate back to the ocean at the end of their lives to reproduce. Their migrations can span thousands of miles and take years.

Migrating INSECTS

The smallest animals are not excluded from migration! A variety of insect species migrate to meet their survival needs. They include species of butterflies, moths, dragonflies, locusts, and beetles. While some of the migrations are short-distanced, strong fliers have been able to take on longer migrations. The wandering glider dragonfly completes an incredible non-stop migration across the Indian Ocean, between India and Africa.

Even though they are not insects, it is interesting to note that earthworms also migrate. In this case it is a vertical migration of only about 6 feet! Earthworms dig deep underground to ride out winter, and migrate back to the surface to feed in spring.





Migrating MARINE ANIMALS





In Earth's vast oceans, some of the longest animal migrations are possible! Sea turtles, whales, dolphins, porpoises, sharks, tuna, and seals are some of the large marine migrants. Some are obligate and some are facultative. Some are complete and some are partial. Northern fur seals undergo differential migration: after the breeding season in Alaska male seals stay in the Alaskan waters while females migrate nearly 3,000 miles south to southern California for feeding.



While true migrations normally occur on a seasonal or annual cycle, some ocean animals participate in daily **diel vertical migrations**. Such species include the most numerous creature in the world: zooplankton. The migrants move upwards in the ocean during the night to feed closer to the surface where food is abundant while under the protection night brings from heat and predators. They migrate downwards in to deeper waters each day to rest in relative safety.

Example Migrations

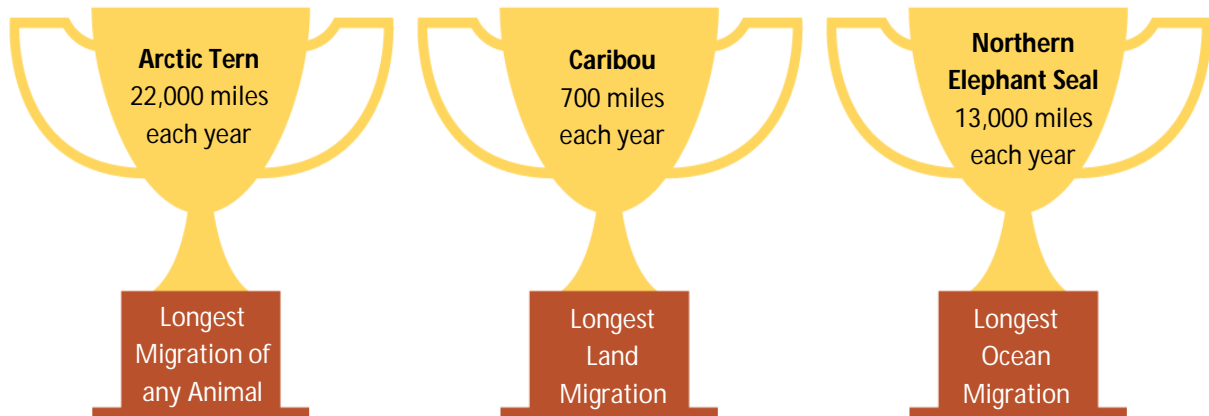
The table below explores ten migratory animals, from a variety of animal groups. Be sure to study this table for the test. While you will not be expected to memorize the table or the distances traveled, the test may contain questions based on general information given here.

Species	Photo	Distance & Destinations	Notes
Canada Goose		<p>Flocks may migrate up to 1,000 miles north into Canada for food through the winter, and return as far south as Texas for summer breeding.</p>	<p>Migration is partial and facultative.</p>
Ruby-Throated Hummingbird		<p>These birds migrate up to 900 miles each way. They winter in Central America where food is plentiful, and migrate to North America for breeding season.</p>	<p>Migration is complete and obligate, though some individuals may not travel as far as others. An incredible, non-stop portion of the journey is the 500-mile flight over the Gulf of Mexico! Even more impressive, female hummingbirds return annually to nest in the very same location/yard they were born in.</p>
American Bison		<p>When vast herds of bison roamed the Great Plains, they migrated about 300 miles north and south across North America to follow the seasonal grass growth.</p>	<p>Herds of as many as 4 million bison used to roam the Great Plains.</p>
Zebras		<p>Part of the Serengeti "Great Migration," zebras migrate about 300 miles each way across the Serengeti of central Africa. They migrate to reach watering holes during the yearly dry season.</p>	<p>The "Great Migration" is a massive movement of 1.5 million wildebeests and hundreds of thousands of zebra, elephants, gazelles, and other large mammals.</p>

<p>Red Bats</p>		<p>These small bats summer and breed in the northern U.S. and Canada, and find food through the winter almost 1,000 miles away in the southernmost states.</p>	<p>Not all bats migrate. Some hibernate, like the little brown bat in Illinois.</p>
<p>Salmon (multiple species)</p>		<p>When only a few inches long, salmon leave their river of birth and head to the open ocean. After several years, they return to freshwater to spawn and lay eggs. Their return journey is around 1,000 miles.</p>	<p>Amazingly, salmon have been found to navigate back to the exact same stream they themselves were born in. Scientists believe they use the Earth's magnetic field to navigate in the ocean, and their sense of smell to locate their exact location of birth.</p>
<p>Monarch</p>		<p>Migration is complete and obligate. Monarchs reproduce and feed in the United States and Canada, and hibernate in Mexico. Their migration one-way can be up to 3,000 miles!</p>	<p>It is fascinating to realize that no monarch lives to see the full migration. It takes several generations of monarchs to achieve the migration in either direction. Scientists are still trying to figure out how later generations of monarchs know where and when to migrate.</p>
<p>Humpback Whale</p>		<p>From their summer feeding grounds in Alaska, both male and female humpbacks migrate around 2,500 miles to Hawaii to find winter food, to give birth, and to rear their calves.</p>	<p>The migration described to the left is taken by only about a third of the world's humpback whales. Two other populations follow different migration routes in different parts of the world's oceans.</p>

<p>Green Sea Turtle</p>		<p>Seas turtles migrate between nesting areas and feeding areas. They hatch from nests on a beach but spend 20-50 years foraging in the ocean before they are old enough to migrate back to their place of birth to mate and lay eggs. The migration to their breeding grounds can be thousands of miles.</p>	<p>Scientists are still studying just how sea turtles navigate back to the very beach they were born on. So far, it is believed they are using a combination of clues from electromagnetic fields, ocean currents, and water composition to find their way.</p> <p>Green sea turtles are globally endangered.</p>
<p>Red Crab</p>		<p>Red crabs migrate to reproduce. They spend most of the year in moist rainforests inland, but must mate and lay eggs in ocean shallows. Both males and females migrate to the ocean each fall, and migrate back after eggs have been laid. Migration in either direction ranges from 3-10 miles.</p>	<p>120 million red crabs of Christmas Island migrate all at once each fall. They leave the forests and head for the shores of their small island home, near Australia. The migration blankets the whole island and has become a tourist attraction.</p>

Super Migrations



Dangers of Migrations

Migrations only evolve in a species if the benefits of the new location outweigh the high costs of getting there. Unfortunately, the costs of migration are getting higher all the time. Migrating animals require extra calories to fuel their travel, and must overcome countless obstacles on their journey. No matter what the species of animal, migration is never easy.

Some of the common dangers encountered on animal migrations are:

Lack of safe places to rest and recover along the way.
Lack of food along the migration route.
Predators on the migration route.
Human hunters waiting along the migration route. (As occurs with ducks).
Pollution encountered in watering holes or food found along the route.
Fences, dams, roads, and even whole cities that block the path.
Moving obstacles such as windmills, cars, and boats along the way.
Unfamiliar dangers such as house cats and electric lines.

To experience the difficulty of migration for yourself, try your luck in Audubon's fun bird migration game online: <http://www.audubon.org/mission-migration-game> .

Studying Migrations

More and more migrating animals are under threat. Over half of all migratory birds in the world are in decline. Scientists hope that by studying animal migrations, we can better understand how to help these species. In order to protect animals, we must not only protect their home range but also their migration routes.

How You can Help

There are simple ways you can help migrating animals! Encourage adults to brake for migrating animals on the road. Put out bird feeders and water, especially in the spring and fall when migrations are at their peak. Don't let cats hunt outdoors, if possible. Together we can help preserve the species who make amazing migrations!