



## The Great Migrations

### IN THE FILM

The central theme of **earth** is the effect the sun's energy has on life on the planet's surface, and the seasonal change that results from its tilted orbit. As the sun's energy intensifies in the northern hemisphere's spring, it releases the tundra from its blanket of snow resulting in massive herds of caribou migrating north to take advantage of the burgeoning vegetation. As the chill of autumn comes to the Tibetan steppe, flocks of Demoiselle cranes battle the winds of the Himalayas in a find winter shelter in India.

As the warming sun comes to the Antarctic, Humpback whales set off from the tropics for their feeding grounds there. **earth** sweeps across the surface of the planet to witness these great migrations. The journeys are fraught with danger. A portion of the migrating animals will not survive, but by making the journey, they ensure the survival of their species as a whole.

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### MIGRATION FACTS...

- most migrations are triggered by environmental changes: food shortage, changes in temperature, changes in length of daylight
- only the tropics don't experience these changes
- environmental changes work with a genetically inherited sense of impending change to impel animals to migrate
- billions of animals migrate, from the smallest insect to the Humpback whale
- a migration journey may be just a few hundred feet or thousands of miles over land, or through air and sea
- most animals navigate during their migration using the sun as their guide
- elephants use the sun in combination with land cues
- Humpback whales are thought to use magnetite in their brains to detect changes in the Earth's magnetic field
- many experienced migratory birds use landmarks to pilot their way

### THE CARIBOU TRAIL: THE LONGEST OVERLAND MIGRATION

#### CARIBOU FACTS...

- caribou are found across Northern Europe and Asia from Scandinavia to Siberia as well as in Alaska, Canada and Greenland
- they eat grass and plants in summer and lichen in winter
- a female caribou gives birth to one or two calves after about an eight-month gestation
- male and female caribou both have antlers
- reindeer are caribou

The caribou undertake the world's longest land migration: some 2,000 miles. As spring arrives in the northern hemisphere and the sun returns to the Arctic, the thaw moves north across the tundra and more than three million caribou follow. The caribou's migration is matched to the pattern and speed of the melt. They travel in vast herds searching for fresh pasture and a place to calve, taking advantage of the new plant growth and the nutrition this will offer their newborns.

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### ARCTIC TUNDRA FACTS ...

- the tundra is the most northerly of Earth's major terrestrial biomes, circling the globe to the south of the North Pole
- it has very cold winters; short, cool summers and little rainfall
- winter temperatures can fall to -60°F (-51°C)
- summer temperatures can rise to between 37°F (2.7°C) and 50°F (12.2°C)
- the soil of the tundra is frequently frozen
- a meter below the surface is permanent ice: permafrost
- no trees grow in the tundra

### LONG RANGE TRAVELERS

Caribou are built for their epic journey. Their hooves are large and concave. These act like snowshoes, holding the caribou up both on winter snow and on the soggy summer tundra. In water, they operate as enormous paddles, propelling the animal forward. Caribou can swim across fast-flowing rivers and large lakes with ease. They even have the added benefit of a kind of flotation jacket. The hollow hairs of their coat trap air and help to keep them afloat. Nevertheless, they take care when crossing rivers, either scouting for a safe crossing point or waiting for favorable conditions in which to cross.

### DANGEROUS ENCOUNTERS

Throughout their journey the caribou herds have to keep constantly on the move. Calves born on the migration must be on their feet and running the day they emerge. This is a perilous time for the caribou. Their constant companions are wolves. They shadow the herds as they migrate. The wolves' hunting strategy is to run at the caribou, creating panic and chaos in which they can separate young calves from their mothers. Once a wolf

is chasing it, the calf has a fifty-fifty chance of survival. If it can stay on its feet, it is capable of outrunning a wolf. A caribou can run at 50 miles (80 kilometers) per hour. If it makes one mistake, the wolf will be on the calf.

### GREY WOLF FACTS...

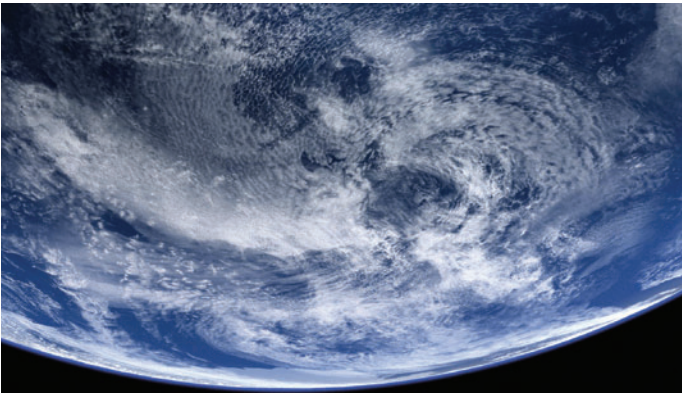
- grey wolves travel greater distances than any other land mammal except the caribou
- the wolves may hunt alone, but usually they hunt in packs of 3 to 30 members
- the size of a pack's territory in Alaska and Canada is about 600 square miles (1,500 sq km) but it can be as large as 1,000 square miles (2,500 sq km)
- grey wolves are good swimmers and will pursue their prey into water

At the other end of the scale, another danger for the caribou are mosquitoes. These are widespread in the caribou's summer range and a major irritant to them. If a caribou spends too much time and energy running away from mosquitoes, it will not eat enough and put on sufficient weight in the summer to see it through the following winter.

### SUMMER RANGE AND WINTER RANGE

In their summer range the caribou have access to a rich supply of food, which means that both adults and calves can gain weight and build their strength in order to survive the following winter. This is crucially important for the survival of the herd. They head south again to their winter range often after the first severe autumn storm. Here the weather is less harsh and the snow cover less impenetrable, which means they will still be able to find food. They often migrate to a different area of their winter range in successive years so they avoid stripping an area of available food.

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### FROM THE TROPICS TO THE POLAR SEAS: THE 4,000 MILE JOURNEY OF THE HUMPBACK WHALE

#### HUMPBACK FACTS ...

- Humpbacks are among the largest mammals on Earth. They can grow up to around 48 ft (15 meters) long and can weigh more than 33 tons
- they feed on krill and small fish, each whale eating up to 1.1–1.65 tons of food a day
- they are found in all the oceans of the world, apart from the Mediterranean and the extreme Arctic
- they mature between 6 and 8 years of age and a female may give birth once every 2 to 3 years – the gestation period lasts about 12 months
- a Humpback whale calf is between 10-15 feet (4–5 meters) long when it's born and weighs up to 1.1 ton
- they can live up to 70 years of age, the average being about 50
- all Humpbacks sing
- the whale song varies geographically and is more often heard when they are in tropical waters



#### IN TROPICAL WATERS

**earth** follows the migration of the Southern hemisphere population of Humpbacks. They spend their winter, from May through late November, in the warm waters of the tropics: waters that are suitable for breeding and calving. During these winter months, a Humpback calf develops rapidly by suckling frequently on its mother and consuming her high-energy milk: it has a 45-60% fat content. The calf will need all its strength to endure the epic 4,000-mile journey it will make with its mother to the waters off the Antarctic peninsula.

The calf's mother doesn't feed at all in these months; she survives on her blubber. Tropical waters are comparatively poor in nutrients. They support a diversity of life, but not the large populations of krill and small fish that a whale needs to feed on. By the time November comes the whales must migrate in order to feed on the vast quantities of food they will find in the Antarctic.

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### THE JOURNEY SOUTH

Mothers and calves tend to be the last whales to begin their migration, delaying until the calf is as strong as possible. The journey south is long, arduous and potentially perilous for a young whale and a weak mother whale that hasn't eaten for four months. On their journey they will cross half the globe, from the tropics all the way to the edge of Antarctica. The Humpback's migration is the longest migration undertaken by any mammal on the planet. When they're migrating, Humpbacks travel at an average speed of about 5 mph (8 km/hr).

As they leave the calm of the tropical seas behind them the waters become colder and rougher. It's essential that the mother and calf stay close to each other; young Humpback calves making their first migratory journey to Antarctica are particularly vulnerable to attacks by sharks and Killer whales. To avoid getting separated and losing track of each other, mother and calf keep in contact by slapping their fins on the surface of the water. They can hear these sound signals above the roar of the ocean.

The journey for the calf is massively energy consuming. It conserves energy by swimming in its mother's slipstream. It positions itself just behind the mother's widest diameter, just underneath and to the side of her dorsal fin. By doing this, it can keep pace with its mother using only 75% of the effort it would use otherwise. Nevertheless, even employing this energy-saving strategy, many calves die of exhaustion during the journey.

### THE ANTARCTIC SUMMER

The Humpbacks reach their destination in time for the brief, three-month Antarctic summer. At last, after their 4,000-mile journey, the whales can feed.



### ANTARCTIC SUMMER FACTS ...

- Antarctic waters are rich in nutrients
- the continuous 24 hours of daylight in summer produce an annual bloom of phytoplankton in the Antarctic Ocean
- phytoplankton are the basis for the Antarctic Ocean food chain
- krill, small shrimp-like creatures, feed on the phytoplankton and multiply in vast numbers
- swarms of krill become concentrated in ice-free bays and attract whales

The arrival of the whales in the Antarctic coincides with the melting of the sea ice and the explosion in numbers of swarming krill. Humpbacks sometimes feed on the krill cooperatively using a method called "bubble netting." A group of whales dive perhaps 160 feet (50 meters) below a shoal of krill then slowly return to the surface in a spiral formation, blowing bubbles. These underwater bubbles create a sort of curtain that herds the krill together and forces them towards the surface at the center of the circle. Eventually the whales surface, their mouths wide open as they take in mouthfuls of the mass of krill trapped in the middle of the circle of bubbles.

As the season changes and the sun starts to sink below the horizon again, the whales will make their return journey to the warm water of the tropics.

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### ABOVE THE ROOF OF THE WORLD: THE MIGRATION OF THE DEMOISELLE CRANES

#### DEMOISELLE CRANE FACTS...

- Demoiselles are the smallest of the cranes, just 3 ft (90 cm) tall and weighing 4–7 lbs (2–3 kg)
- they have a wing span of 1 ft 6 in (50 cm)
- they live mainly in grassland areas near water but can be found in deserts where water is available
- Demoiselles mate for life and continue their courtship “dance” throughout their lives to maintain their bond
- they usually lay their eggs directly on the ground and their chicks fledge fastest of all cranes at around 55 days
- Demoiselle cranes were given their name by Queen Marie Antoinette, because of their delicate, maiden-like appearance

Demoiselle cranes undertake one of the most challenging migrations in nature. Each year, thousands of them bid to escape the harsh winters of the Tibetan steppe by flying south. They fly in a V-formation at very high altitudes, up to 25,000 feet (7,620 meters), and keep in contact by constantly calling to each other. Their destination is the warmer climates of India, but to get there they have to cross the highest mountain range on Earth: the Himalayas.



#### HIMALAYA FACTS ...

- the planet’s 14 highest peaks are in the Himalayas
- the highest is Mount Everest at 29,028 feet (8,848 meters)
- the Himalayan range of mountains stretches across one-tenth of the planet
- the Himalayas prevent the cold, dry winds of the Arctic from reaching the Indian subcontinent and keep South Asia warm
- they force the monsoon winds blowing north from the tropics to drop their rain as they rise over the mountains

As the sun heats the slopes of the mountains, warm air rises from the valleys. The cranes use the uplift of the thermals to gain height as they fly towards the summit of the mountains. If the weather changes, these small, elegant birds can be buffeted so violently by the wind that they would be forced to give up and delay their attempt to surmount the peaks to another day. They would try again when the sun rises. As they attempt their crossing, they have to judge whether or not they have the strength to battle against the freezing winds around the peaks. If they turn back they will face the bitter extremes of winter on the Tibetan steppes. They must go on if they are to reach their winter sanctuary.



### THE GREAT MIGRATIONS: ACTIVITIES

#### GRADES K-2: SEASONS DIARY

##### Learning objective:

- to understand that the Earth experiences seasonal change

For children of this age to begin to understand the concept of migration they need first to understand that the Earth experiences seasonal change.

##### Tasks

1. Several sequences in the film show seasonal change. The deciduous forest sequence shows it particularly well, although very young children may have difficulty in understanding that a filming trick is used to show change at an accelerated speed. How many changes can children remember seeing (e.g., leaf growth, blossom, spring flowers, animals and their new offspring, etc.)?
2. Have the children seen changes like these in their own environment? Talk about them and create 'seasons' pictures. Collect these together into a gallery of pictures for a particular season.
3. Talk about how seasonal change affects humans. How does it affect the children? Do they wear different clothes? Does what they eat change? Do their daily activities change (e.g., travelling to school, playing, etc.)?



#### GRADES 3-6: SEASON WATCHING

##### Learning objectives:

- to develop skills of scientific observation
- to understand how environmental change impacts on animals

##### Tasks

1. Become a Season Watcher. This can be done by a class as a group or by an individual. Start a notebook in which to keep observations of the natural world. What do children notice about temperature, trees, plants, local wildlife, weather, hours of daylight? Take photographs and make drawings.
2. Think about how the local environment changes seasonally and the effect this might have on wildlife. Talk about how these changes trigger migration.
3. Think about the conditions in the environments the featured animals in **earth** migrate between. How are they different? How are they the same? Record this information in a chart. What impels the animal to migrate? What does the animal find in its new location (e.g., food, water, security from predators during breeding, more favorable weather conditions)?
4. Plot on a map or globe (real or virtual) the routes of the migrating animals featured in **earth**.



### GRADES 7-12: JOURNEYS OF LIFE

#### Learning objective:

- to understand the importance of migration to a species' survival

The stories in **earth** demonstrate vividly the epic and perilous nature of the migration journeys many animals take. Yet, despite the risks, these annual treks continue, indicating this behavior must be immensely beneficial to the species as a whole.

#### Tasks

1. Use the stories of migration in **earth** as the starting point for a discussion of the part played by migration in the continuing survival of a species. How does migration benefit each of the species featured? Does it benefit them in the same or in different ways?
2. Study migration in the local area. Birds are a particularly good focus for a migration project because some stay in a locality all year, some visit during a season and some pass through on their way to another destination. Monitor the bird population in an area and make a record of it.
3. Focus on one of **earth's** migrating animals and research their journey in further detail. How could changes in environmental factors affect these animals? The caribou are a good case in point. As land migrating animals, they have to cope with any obstacle in their way. Roads and pipelines are known to cause problems for caribou, deflecting them from their migratory route. What might be the consequences for the caribou of obstacles placed in their path? What would happen if the caribou were diverted from the rich vegetation of their calving areas? How might the impact of obstacles be limited?
4. Research the navigational devices animals use to pilot their way on their migrations.