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Fish migration cause and types?

Migration is the movement of large number of animals from one place to another for feeding, reproduction or to escape weather extremes. There are about 12,000 marine species that regularly migrate within sea water. When large numbers of fishes come together and move socially it may be in two ways

1. **Shoaling** (migrating together socially but without much coordination)
2. **Schooling** (swimming with high degree of coordination and synchronized manoeuvres) as seen in tunas and sardines.

Causes of fish migration

Because of fulfil fundamental need required for survival and growth which may be;

- In search of food (Alimental migration).
- For reproduction or spawning (Gametic migration).
- For protection (Protective migration).
- For better climate (Climatic migration).
- For osmoregulation (Osmoregulatory migration).

Types of fish migration on the basis of habitat

Fishes live in two different types of aquatic habitats, namely, freshwater and marine habitats, which pose different osmotic problems because of which it is difficult to migrate from one type of habitat to another. Fish migrate within same type of habitat or different habitat against osmotic problems it may be following types;

1. **Potamodromous migration**
2. **Oceanodromous migration**
3. **Diadromous migration**
 - I. **Catadromous migration**
 - II. **Anadromous migration**

POTAMODROMOUS MIGRATION

When fishes migrate from one freshwater habitat to another in search of food or for spawning, it is called potamodromous migration. There are about 8,000 known species that migrate within lakes and rivers, generally for food on daily basis as the availability of food differs from place to place and from season to season. Fishes also must migrate to lay their eggs in places where oxygen concentration in water is more and where there is abundance of food for juveniles when they hatch from eggs.

OCEANODROMOUS MIGRATION

This migration is from sea water to sea water. There are no barriers within the sea and fishes have learned to migrate in order to take advantage of favourable conditions wherever they occur. Thus there are about 12,000 marine species that regularly migrate within sea water. Herrings, sardines, mackerels, cods, roaches and tunas migrate in large numbers in search of food by way of **shoaling** (migrating together socially but without much coordination) or **schooling** (swimming with high degree of coordination and synchronized manoeuvres).

DIADROMOUS MIGRATION

When fishes can migrate from fresh water to sea or from sea to fresh water, it is called diadromous migration. There are about 120 species of fishes that are capable of overcoming osmotic barriers and migrate in these two different types of habitats eg; Spawning Migration: This is the migration in fishes for breeding, and so it is related to life cycle. Spawning migration is an adaptation for ensuring the most favourable conditions for the development of the eggs and the larvae. This also gives protection to early stages of fishes from predators. There are two types of spawning migrations. Movement from **freshwater to saltwater for spawning is called catadromous migration**. The reverse movement, that is, **from saltwater to freshwater is termed anadromous migration**.

Catadromous migration

This type of migration involves movement of large number of individuals from fresh water to sea water, generally for spawning as happens in the case of eels (*Anguilla*) inhabiting European and North American rivers.

Both European eel (*Anguilla anguilla* or *Anguilla vulgaris*) and the American eel (*Anguilla rostrata*) migrate from the continental rivers to Sargasso Sea off Bermuda in south Atlantic for spawning, crossing Atlantic Ocean during the journey and covering a distance of about 5,600 km. The adult eels that inhabit rivers are about a metre long, yellow in colour and spend 8-15 years feeding and growing. Before migration the following changes take place in their bodies:

- They deposit large amount of fat in their bodies which serves as reserve food during the long journey to Sargasso Sea.
- Colour changes from yellow to metallic silvery grey.
- Digestive tract shrinks and feeding stops.
- Eyes are enlarged and vision sharpens. Other sensory organs also become sensitive.
- Skin becomes respiratory.
- Gonads get matured and enlarged.
- They become restless and develop strong urge to migrate in groups.

They migrate through the rivers and reach coastal areas of the sea where they are joined by the males and then together they swim in large numbers, reaching Sargasso Sea in about two months. They spawn and die. Each female lays about 20 million eggs which are soon fertilized by males.

First clue about life cycle of eels was given by two Italian scientists Grassi & Calandruccio in 1896. Details of migration and life cycle were later studied by Johann Schmidt (1905). Eggs hatch into leaf-like, semitransparent, larvae having small head called **Leptocephalus**. Leptocephali of American eels take about 10 months to fully grow while those of European eels take about 18 months. Upon reaching coastal waters leptocephali metamorphose into another larval stage called **Elver** or Glass eel. Female elvers ascend to the rivers and metamorphose into yellow-coloured adults, while males stay back in the river mouth and wait for the females to return for spawning journey.

Anadromous migration

Adults of anadromous fishes live and feed in ocean waters but their spawning grounds lie in the tributaries of rivers. Salmons, sturgeons, Hilsa and lampreys are some of the marine fishes that undertake anadromous migration to spawn in rivers.

Atlantic salmon (*Salmo salar*) migrates to the North American rivers for spawning while six species of Pacific salmon (*Onchorhynchus*) migrate to various rivers of Asian countries.

Salmons living in sea are metallic silvery grey in colour but before migration they turn reddish-brown in colour. During fall, they enter rivers and swim energetically against water currents (**contranantent**), clearing all obstacles, including waterfalls and reach tributaries in hilly areas where they make a saucer-like pit in which female lays eggs and male releases smelt over them. Eggs take 2-3 months to hatch in the following spring, when the juvenile stage called **Alvin** emerges out but remains within the nest, obtaining its nourishment from the yolk sac attached to its belly. Alvin then transforms into **Fry** which feed on planktons. Fries are **denatant** (they swim along with water current) and feed and grow into fingerlings which take the shape of adult fish. They change into **Smolt** which congregate at the river mouth in large numbers and then enter sea water in to metamorphose into adult salmons.

Anadromous migration in lampreys

Adult lampreys are parasitic on other fishes and live in sea for 3-4 years and grow to become 30 cm long. For breeding, they stop feeding and migrate in rivers hundreds of miles upstream. Males make nest in sand and gravel in which female lays eggs and male fertilizes them. In about 3 weeks time, eggs hatch into 7 cm long, yellowish-brown **ammocoete** larva that lies buried in sand and feeds on detritus by filter feeding method. Larva lives in river for 3-7 years and grows from half centimetre to 17 centimetres long. Then these fully grown larvae start their downstream journey and enter the sea to metamorphose into adults.

Types of fish migration on the basis of direction

1. Latitudinal Migration
2. Vertical Migration

Problem of navigation

How fishes find their way in huge expanses of sea and reach their destinations which lie thousands of kilometres away has been a mystery. It is believed that they orient by the positions of stars and moon in the night sky and sun in daytime to find the direction of swimming. However, it has been experimentally proven by A.S. Hasler that salmon are guided by the odour of their parent stream during return journey. Eels can also migrate to Sargasso Sea using similar odour maps but how leptocephali find their way back to the river mouths, crossing vast stretches of Atlantic Sea is a mystery.

Type1. Latitudinal Migration:

This is performed by fishes like barracudas (*Sphyraena*) and swordfish (*Xiphias*) of the warm tropical seas. They migrate to north in spring and to south in autumn.

Type2. Vertical Migration:

This is performed by many marine and freshwater fishes and is related to light, search of food, protection and also to spawning. The mackerel rises into the surface waters when there is a rich development of plankton. They eat on plankton and go to deep layers after feeding. The swordfish, which normally lives in surface water move downwards to great depths to feed deep water fishes like scopolids. Many pelagic larvae of marine fishes perform diurnal vertical feeding migrations. They follow the vertical movements of their prey, the planktonic invertebrates which move down to great depth by day and rise to surface by night. Many deep water fishes of the order Scopeliformes rise to spawn in the upper layers. Their eggs develop and often their larvae live feeding on the phytoplankton. Among freshwater fishes the clearest example of vertical spawning migration is that of the Lake Baikal Comephoridae. These fishes are viviparous and rise to surface from great depth of the lake to give birth to their larvae.

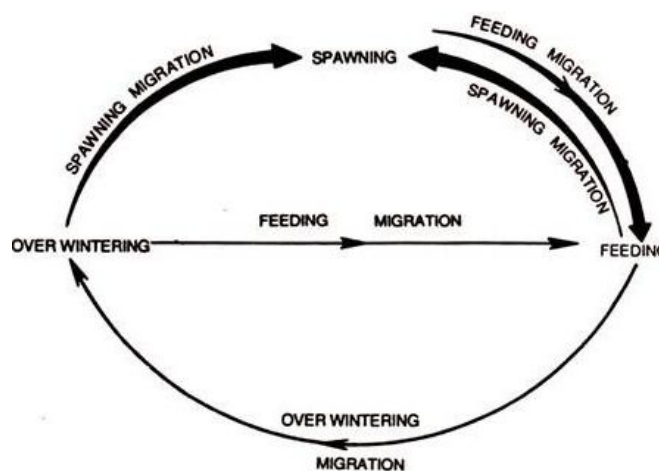


Fig. Migration cycle of various fishes.

Other type of migration is;

Feeding Migration or alimantal migration:

This is the movement from spawning or overwintering grounds to the feeding grounds. Feeding migration can be passive or active. In many fishes the feeding migration even begins in the egg stage. It is a passive feeding migration of eggs and embryos from spawning to feeding ground.

Active feeding migration is performed by many marine fishes like cod. Horizontal feeding migration of cod comprises regular journeys, going from one good feeding ground to another.

Overwintering Migration:

Overwintering and hibernation in fishes are a part of the life cycle of a fish. It is characterized by reduced activity, reduction or stoppage of food consumption, lack of food, poor oxygen condition, low temperature, drought etc. Overwintering do not occur in all fishes.

Overwintering migration is a movement away from feeding to wintering grounds. It occurs only in those fishes which have a wintering ground.

In the wintering ground, fish is in a state of relative inactivity and reduced metabolic rate. It requires protection against predators which are common in feeding ground. Overwintering migration is performed by marine fishes like flatfishes and freshwater fishes like grass-carp.

Shoreward Migration:

In this type of migration there is a temporary movement of fishes from water to land. For example, the common eel travel from one pond to another through moist meadow grass. The mud-skipper, *Periophthalmus* make temporary migration to land by means of modified pectoral fins. The climbing perch, *Anabas* migrates from water to land and even climbs trees to the height of several feet by means of the strong spines on its pelvic fins and gillcovers.

Juvenile migration involves larval stages of fishes which hatch in spawning grounds and must migrate long distances in order to reach the feeding habitats of their parents.

Recruitment migration takes place when large number of larvae moves from nursery habitat to the habitat of adults which may sometimes be distinctly different. Adults of eels live in rivers in Europe and America but their larval stages live and grown in sea and migrate to reach rivers which may take one to two years.

Seasonal migration takes place in fishes that inhabit arctic areas where in summer climate is conducive and food abundant but as winter approaches temperatures fall below zero and food becomes scarce. Hence fishes must migrate towards subtropical and tropical areas to escape extremes of weather conditions.

