S. S. College, Jehanabad

Department: Zoology

Class: M.Sc. Semester IV

Subject: Zoology

Topic: Migration in fishes

Mode of teaching: Google classroom & WhatsApp

Date & Time: 06.07.2020 & 10:30

Teacher: Narendra Sharma

To join Department's group, students can use following link
https://chat.whatsapp.com/EHuHNfQzoAzJBMFNJvsjQx
or scan QR Code
WhatsApp No.: +91 94300 55191

Join "Zoology, S. S. College" WhatsApp group

Migration in fishes

Q. 1. Migration in Fishes.

→

Introduction :→ Migration in fish is a mysterious events of Nature which has not yet been solved completely. This phenomenon is characterised by regular periodic movements life homing. According to Cohen (1970) about 8,000 fesh fresh water species, 12,000 marine water and 120 diadromous species show regular migration. Approx 70% of total migrants are found in tropical waters.

Due to seasonal as well as environmental changes a large number of animals are forced by the internal (e.g.- Hormones, Blood concentration etc.) as well as external stimulus (e.g. Temperature climatic). To move from one place to the other place for their later survival for food getting and for the preparation of their own races, such phenomenon of animals from one place to the other is usually known as the "Migration". The individuals which participate in the migration is called migrants or migratory individuals.

Definition of migration → The term migratio

has been derived from a latin word and it means travelling. It has been defined in various ways by different workers. Thompson (1942) has defined migration as "a shift in what may be called the centre of gravity of the population." Nikolsky (1963) regards migration as "an adaptation towards increasing the Abundance of a species.":

The recognition of "Home" or Homing :→

Homing is a complex, instinctively and physiologically dictated behaviour of migration. Fish compels the fish to return to its original locality after undertaking migratory journeys. (This instinct is seen most prominently in the 'Salmon'. Fish inhibiting smaller water bodies such as lakes, ponds and pools also have this remarkable instinct and if displaced they can return to their home territories.) Creffing (1959) has defined homing as "the return to a place formerly occupied, instead of going to other equally probable new places.":

Types of Migratory Fish :-

According to the Myers (1949) migratory fish can be classified into three main categories :-

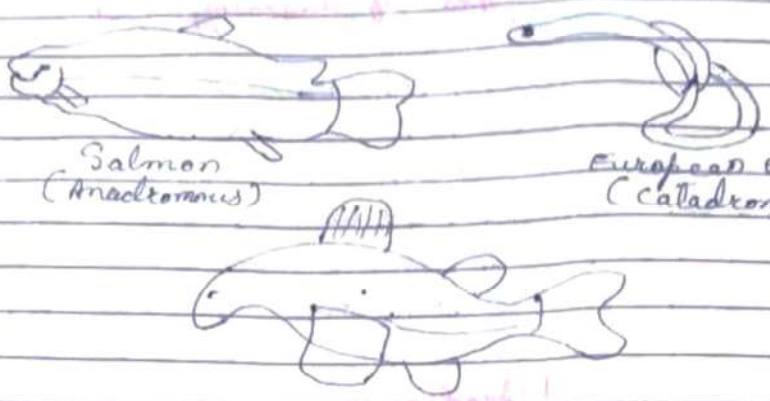
(1.) Diadromous fishes
(2.) Potamodromous fishes
(3.) oceanodromous fishes.

(1.) Diadromous fishes :- These fish migrate between fresh water and sea water. These can further be sub-divided into three types :-

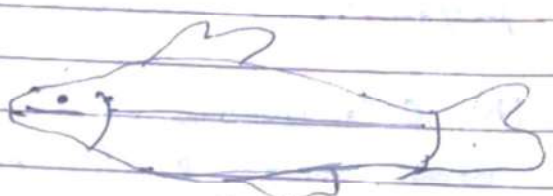
(a) Anadromous fishes :- These fishes migrate from sea to fresh water for Breeding (Spawning) purpose. e.g. Salmons, Lamprey, Hilsa etc.

(b) Catadromous :- These fishes migrate from fresh water to the sea chiefly for Spawning e.g. European eel, American eel.

(c) Amphidromous :- These fishes migrate from sea water to fresh water and vice-versa but not for breeding. This may be for food. The movement may occur regularly at some definite stage of their life cycle e.g. Crabies undertake migration for food.



(2.) Potadromous fishes ⟶ These fishes live and migrate only with in fresh waters e.g. Carps, Trouts etc.



Carps

(3.) Oceanodromous fishes ⟶ These fishes live and migrate only with in the Sea e.g. Atlantic Herring, Sardines, Mackerel & Tuna. These fishes generally migrate to colder water regions for the purpose of spawning, and then return to their parents

Herring

Movements in fishes can be caused by :-

Drift :- when the fish are carried passively by the ~~water~~ water currents. This type of movements is mostly employed by larvae & late rarely by adults.

Random locomotry movement :- This may lead to a random divergence of the species specially if there are differences in environmental fields such as light, temperature etc.

Orientated locomotry movement :- When movement is caused by one particular stimulus leading to migration of the species either towards or away from the source. Speed is an important factor in migrating fish.

According to Heape (1961) fish mainly migrate for three primary reasons thereby

giving rise to —

(1) Gametic migration (Spawning / breeding migration)

(2) Alimental migration (Feeding migration)

(3) Climatic migration (wintering migration)

Later Meyers (1963) added another category —

(4) osmoregulatory or protective migration (for water and mineral balance).

(1) Gametic or Spawning migration :→

According to Vasnetsov (1953) spawning migration is undertaken by a fish to ensure better survival and proper development of their eggs and larvae. Anadromous migration is more commonly noted in fish while catadromous is relatively uncommon as seen in Eels.

(2) Alimental or Feeding migration :→

Feeding migration are brought about mainly due to shortage of suitable food supply in the wintering and spawning grounds. Food requirement by the body after

exhaustive exhaustive spawning or wintering conditions probably provides the stimulus for feeding migrations, so that the fish have an access to food resources of different areas.

(3.) Climatic or wintering migration →

Wintering migration are initiated in fish due to inactive physical conditions and low BMR either after feeding of before spawning. This depends both on the conditions of the fish and environmental changes. These fishes, therefore, need to move to areas with more favourable abiotic conditions which provide better protection.

(4.) Osmoregulatory or protective Migration →

Spawning, feeding and wintering migration can all be regarded as protective migration as they ensure further life of the fish. yet, some mass movements may arise due to sudden unfavourable biological or Environmental environmental conditions like a stormy weather. These migration are not cyclical.

The speed at which the fishes can swim →

The speed at which the fishes can

swim is related with their migrations and possible reactions to water currents.

There are two types of speed :-

(i) Maximum speed :- The fish can travel at maximum speed which is more or less equal to 10 times of its own length per second but this speed can be only kept up for about a minute.

(ii) Minimum speed :- It is considerably less about 3 times of its own length per second. The 3 times rule can be applied to fish from 10 – 100 cm in length for species such as Salmon, Cod & Herring.

Fish	Maximum km/hr	Sustainable speed miles/hr	Nature of Migration
Crobies	0.8	0.5	Amphidromous
Anguilla rostrata	4.2	2.6	Catadromous
Pleuronectes platessa	4.7	2.9	Oceanodromous
Salmotrutta fario	8.2	5.3	Potamodromous
Pacific Salmon	5	3.2	Anadromous

Table of Speed of few migratory fishes.

How fishes detect their Home :-

The following three important hypothesis depict about the fishes detect their home, these are :-

(a) Gradient theory :-

According to this theory there are some fishes which are able to follow the gradient theory.

(i) Ciard (1921-39) :- proposed that Salmon always swim in the direction of coolest water & thus these are guided by temperature gradient

(ii) Power (1939) :- [Power & Clark (1943) & Collins (1952)] have clearly shown that relatively high Co_2 tensions can repel migratory fishes on that basis these workers have suggested that Salmon might be guided by Co_2 gradient.

(b) Odour hypothesis :-

According to Harless findings the odour of the natal stream is imprinted in the Salmon when they are fry or fingerling. That odour may be derived from the unique plant community of the drainge basin of streams & flora with in that stream, once after being imprinted in brain. It continues through their adult life which serve to influence the

orientation of salmon migrations.

(C) Fishes are human navigators :→
Fishes are true navigators and able to accomplish something for which men require instruments charts & tables.
At first it was assumed that the animal has a biological clock and some ability to perceive small differences in both azimuthal and altitudinal angles of Sun.

Factors influencing migrations :→
Migrations are influenced by several factors which may be physical, chemical & biological.

(i) Physical factors :→ It includes bottom material, depth of water, pressure (water & Atmospheric) temperature, light intensity, photoperiod, current, turbidity, topography, gradient etc.

(ii) chemical factors :→ It influences salinity, pH taste & smell and also pollutants of water.

(iii) Biological factors :→ It influences sexual maturity, blood-pressure, food, nursery, physiological clock, memory, hunger, predators, competitors,

endocrine glands etc.

Some important factors were discussed below :-

(i) Temperature → Higher temp of the sea water in summer provides a stimulus to Salmon for Sea-ward migration. When the temp of fresh water in river rises the fishes move up stream for spawning.

(ii) Light → The intensity & duration of light also influences the migration of many species some of them Lamprey & Sturgeons.

(iii) Water current → The direction of movements is influenced by the water current. Eggs & fry are passively transported along along with water current to their feeding grounds.

(iv) Salinity → The salinity of water is also an important factor. Most of the fresh water fishes are relatively important to salinity & do not undertake large scale of migration.

(v) Food → Availability of food is one of the important factors that is responsible for large scale migration of many species.

(vi) Endocrine glands :→ Baggerman (1962) suggested that gonadal hormones play an important role in the migration of anadromous fishes. Hoar (1965) concluded that TSH plays specific causative role in migration.

Periodicity of Migration :→

Fish species show variations in the periodicity of their migration. Most fish migrations occur at regular intervals and may be daily, monthly, seasonally, yearly, biannually or longer. Thus, pacific salmon may remain at sea for several years before returning to the spawning grounds. Eels spend several years (upto 20) feeding in fresh water before undertaking spawning migration to sea.

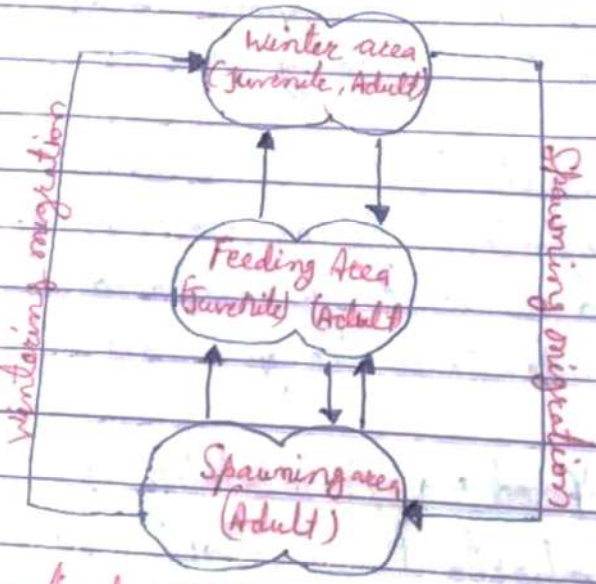
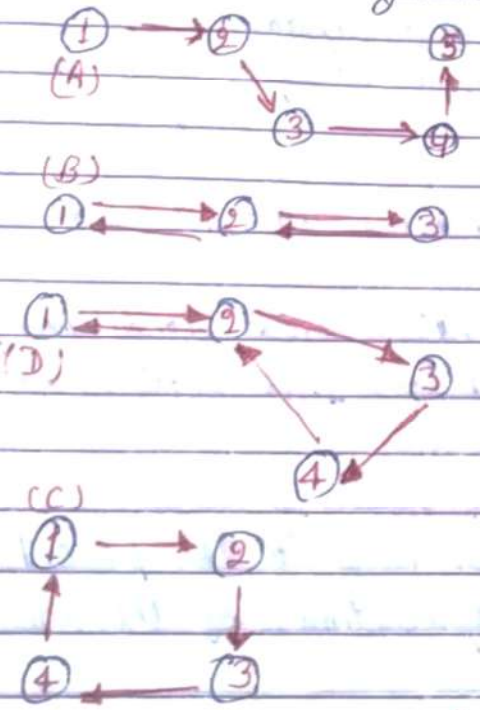


Fig. Generalised pattern of migration between three basic habitats.

Distance, Duration and Degree of Return:-

The distance covered by different migrant fish also vary considerably. Salmon, tunna & eels undertake exceedingly long migrations for feeding. Some fish species undergo daily short vertical migrations for feeding. The duration and the distance covered by a fish depends on the type of environment through which it has to travel to reach its destination. Fish species migrating to a feeding area might spend some time in testing and assessing the suitability of the environments and thus travel long distances taking more time in reaching their destinations.



Showing degree of return for different fish migrations

Migration involves some kind of return movement

or it may be one way migration only.

A fish showing high degree of return may visit many areas more than once during the course of migration : In some cases only one area is visited more than once in return migration. In most cases, spawning area is the area which is visited most precisely during return journey.

Advantages of migration :-

According to Nikolsky (1963) migration is an adaptation towards abundance. Due to migration, the following advantageous steps occur

(i) for getting separate & good spawning, nursery, feeding grounds for both mature & immature members

(ii) for achieving more suitable environment

(iii) Better environmental conditions provide more entities for eggs & larva for creating a good number of spawners.

(iv) for returning to the parent spawning ground after exploitation of the new spawning ground.

Conclusion :-

In a nut shell it can be concluded

that migration is a sport of adaptation which implies the fishes to move ~~for~~ from one place to better place ~~&~~ in order to achieve the purpose of spawning, food & ~~perpetuatio~~ perpetuating their own race. In some cases, the migrant returns while in some cases the adult dies itself for betterment of its progenies.