
Migration in Fish

CONTENTS

Migration:

MIGRATION- **"A regular, seasonal, large scale, long distance, movements of a population twice a year between a fixed breeding and non breeding area". (LACK)**

"Specialized behavior especially evolved for the displacement of the individual in space". (DINGLE 1980)

- Many types of fish migrate on a regular basis, on time scales ranging from daily to annually or longer.

- They travel over distances ranging from a few metres to thousands of kilometres.

Some examples of Migratory fish species

- The cod *(Gadus morhua)*
- Herrings *(Clupea harengus)*
- Salmon *(Salmo sp.)*
- Eel *(Anguilla anguilla)*
- Hilsa *(Hilsa ilisha)*
- Three-spined stickle back *(Gasterosteus)*
- Lampreys *(Petromyzon marinus)*

Migration for...

- Feeding or Alimental Migration
- Spawning Migration
- Juvenile Migration
- Recruitment Migration
- Seasonal Migration

Feeding or Alimental Migration

Takes place in fishes for feeding.

In high populations fishes exhaust food resources in an area quickly and therefore must migrate constantly in search of new feeding resources.

Salmons, cods and sword fish constantly migrate for food from one place to another in the sea.

Spawning Migration

Takes place in breeding season in those fishes which have spawning grounds far away from feeding places.

Migratory fishes such as eels and salmons and a large number of riverine fishes spawn in tributaries of river in hills and migrate in large number for laying eggs in these oxygen rich waters.

Juvenile Migration

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.

Types of migration

- Alimental migration: this is in search of food and water.
- Gametic migration: for reproduction.
- Climatic migration: to secure more suitable climatic conditions.
- Osmoregulatory migration: maintains Osmoregulation.

Methods of migration

- **By drifting**: fishes are carried passively by water currents. This is called drift, may result in directional movements.
- **Random locomotory movements**: random in direction, lead to a uniform distribution or to an aggregation.
- **Oriented swimming movements**: in a particular direction**:**

  (a) Towards or away from the source of stimulation.

  (b) At some angle to an imaginary line running between them and the source of stimulation.

Migration based on duration

Daily: Mainly for food gathering

Annual: Mainly for reproduction

Generational: Parent migrate to release eggs and die, their young ones migrate back to their homes

Patterns of migration

- POTAMODROMOUS MIGRATION
- OCEANODROMOUS MIGRATION
- DIADROMOUS MIGRATION

(a) Anadromous migration

(b) Catadromous migration

(c) Amphidromous migration

POTAMODROMOUS MIGRATION

- Fishes living in the fresh water generally show upstream migration of adults for spawning and the spent fish return downstream to feeding area.

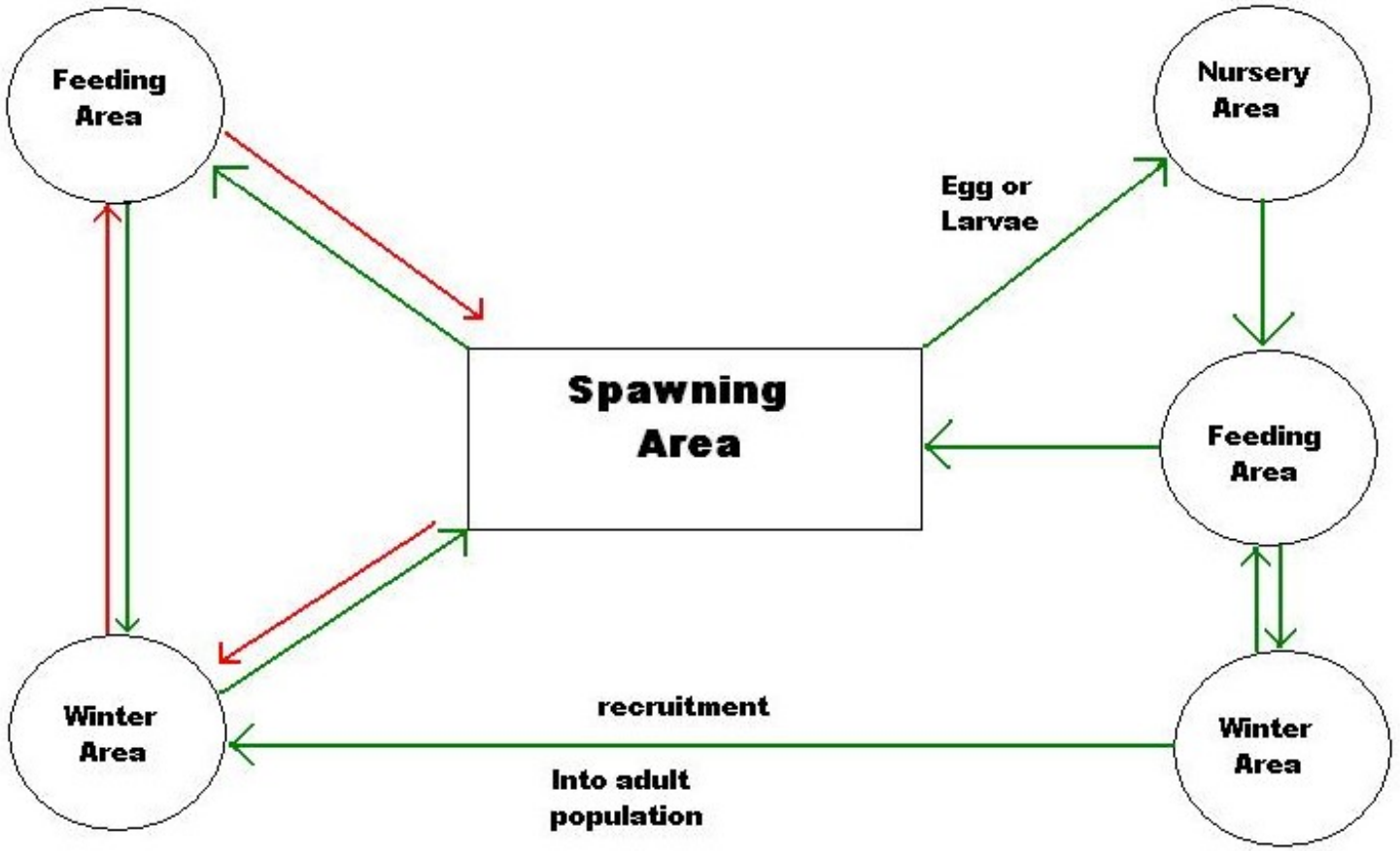
  e.g. Cat fishes, Trout, Clupeids etc

OCEANODROMOUS MIGRATION

- Many marine fish species travel long distances in the sea and visit specific areas, such as spawning area, nursery area, feeding area, winter area, etc.

  e.g. Herrings, Cod, *Pleuronectes*, Tunnas etc.

Pattern of movements in oceanodromous fish migration



DIADROMOUS MIGRATION

- These are truly migratory fishes that migrate between the sea and fresh water, and are of three types:

  (a) **Anadromous migration**: When fresh water fish exhibit migration from spawning areas (fresh water) to feeding areas (ocean).

  e.g. Brown trout, *Petromyzon*, *Gasterosteus etc.*

DIADROMOUS MIGRATION

- **Catadromous migration:** Fish which spend most of their life in fresh water, but return to the ocean for spawning are called catadromous. e.g. *Anguilla*
- **Amphidromous migration:** diadromous fishes migrate from fresh water to the sea or vice versa, their purpose is not for breeding. e.g. Gobies

Factors influencing migration

- Physical factor: Bottom materials, depth of water, temperature, turbidity, photoperiodism etc.
- Chemical factor: pH, smell, taste of water, quality and quantity of pollutants, dissolved gases etc.
- Biological factor: Sexual maturity, blood pressure, food, memory and endocrine glands etc.
- Availability of food.
- Temperature: High temperature of sea water in summer provides stimulus to *salmon* for migration. Temperature of fresh water rises move upstream for spawning.
- Salinity of water: *Stenohaline* fishes do not possess large scale migration. *Euryhaline* fishes possess large scale migration, they migrate from fresh water to sea from ocean to fresh water for *spawning. e.g.* Salmon*, Anguilla, Hilsa, Gastrosteus*

Factors influencing fish migration

- Intensity and duration of light: Some fishes are attracted towards light and can be trapped by placing light at suitable points. *Petromyzon* and *Acipenser* migrate during night.
- Water current: Influences the direction of movement of fishes. Eggs and Fry are passively transported along with the current with feeding grounds. After spawning spent Salmon are carried by the river currents towards the sea.
- The stage of maturity of the Gonads and Endocrine Glands are also important factors governing migration.

How do they find ‘THE’ direction?

- Orientation means arranging of an animal in a given direction. The mechanism of ‘orientation’ during fish migration reviewed by Hasler (1971) and Able (1980).
- Fish may recognize its home site by sensory stimulus- vision or olfaction. This is called ‘Homing’ or ‘Piloting’.
- Many environmental factors help the fish in orientation.

  (a) Changing angle of the Sun

  (b) Position of moon

  (c) Magnetic and Electrical fields.

  (d) Water currents

  (e) Olfactory sense

Hormones involved

- Pituitary gland (Prolactin, corticotropin, growth hormone etc)
- Urophysis and Corpuscles of Stannius
- Pineal gland
- Thyroid gland (calcitonin)

Causes of migration

According to Northcote (1978)

- To optimize feeding
- To avoid unfavourable conditions
- To enhance reproductive success
- To promote colonization
- To exploit rich food source, enhance food intake which is necessary for increase in growth rate, fecundity and survival.

Methods for studying fish migration (marking and tagging technique)

- **Tagging technique**: mainly two types of tags are used.

(a) External tag

(b) Internal tag

- **Markers technique**:

(a) Fluorescent dye: Embedded in scales and exposed by UV radiations.

(b) Tetracycline: Deposited in vertebrae and bone as permanent marker.

(c) Radio isotopes: Water soluble and detected by radiation detector.

External Tag

- Mutilation: missing adipose fin (clipping or punching)
- Peterson Discs: most successful of all **tags** named after Danish biologist who invented it in 1894.
  This **tag** consists of two Celluloid or plastic **discs**, about one-half inch in diameter, attached with a pin or wire to some part of the **fish**.
- Carlin Darter Tag: plastic disc with steel wire.
- Visible Implant Elastomer (VIE) Tag: injected as liquid and becomes solidified and transparent.
- Floy Tag: adult migratory fishes with T-bar hook which interlocks with skeleton (by gun).

Peterson disc

Carlin darter Tag

V I E Tag

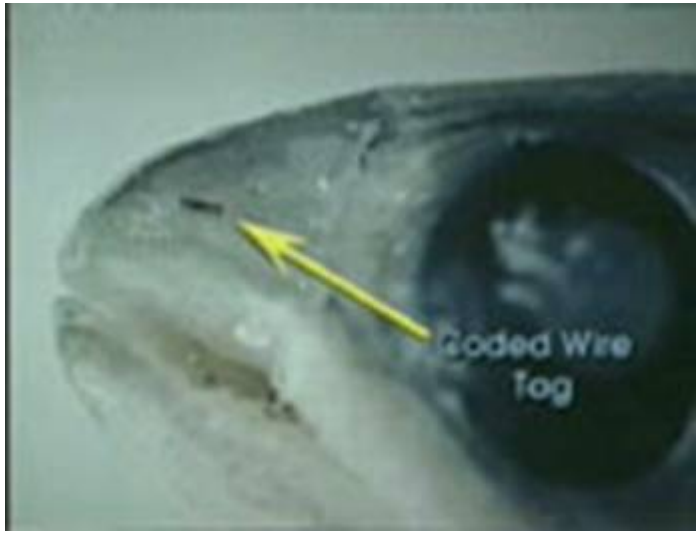
Floy Tag

Internal Tag

- Radio Tag: in shallow and low conductivity water; sends radio signals.
- Sonar Tag: hydrostatic tag, detailed instructions kept inside capsule.
- Coded Wire Tag: placed near snout, neck and detected by metal detector. Mainly used to identify group of fishes.

Radio Tag

Sonar Tag



Coded Wired tag

Advantage of fish migration

- In view of NIKOLSKY, migration is an adaptation towards abundance.
- The nursery or spawning ground may not have enough food to maintain both the mature and immature members of large population.
- Separate spawning, nursery and feeding grounds.
- Focuses the proper environmental conditions for spawning.
- Enhanced reproductive success.

Disadvantage of fish migration

- In pursuing long journey, many migrating fish get lost. Most of them are eaten by predators.