

# Reproduction in fishes-Maturity Stages

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# INTRODUCTION

- Reproduction is a fundamental biological process which enables continuation of species.
- In fisheries biology, reproduction assumes greater significance to understand sexual dimorphism, process of maturation, size or age of maturity, breeding season, spawning area, sexual segregation, migration, fecundity, embryonic, larval development and recruitment.

## Types of reproduction

- In fishes, generally the sexes are separate exhibiting bisexual reproduction, but sometimes they are hermaphrodites and rarely parthenogenesis is seen.
- In **bisexual reproduction**, sperms and eggs are produced in male and female sex organs called **testis** and **ovaries** respectively.
- In hermaphrodites, both the sex organs are in a single individual and may develop simultaneously; such fishes are called synchronous hermaphrodites.
- e.g. *Polynemus heptadactylus*.

- Development of male gonads before female gonads (**protandrous hermaphrodites** e.g. *Sparus* spp.)
- Development of female gonads before male gonads (**protogynous hermaphrodites** e.g. Grouper).
- Development of young ones without fertilization. e.g. **Parthenogenesis.**
- sperm serves only one of its two functions, that of inciting or triggering the egg to develop.
- It does not take any part in heredity.
- The resultant young ones are always females (gynogenesis) e.g. *Poecilia formosa*

# Male reproductive organ (Testis)

- It consists of a pair of testes which lies ventral to the kidneys.
- The testes are free anteriorly but posteriorly they continue as sperm ducts which open into urinogenital papillae.
- The spermatogonia undergo a number of maturation stages to develop motile sperms. This process is called **spermatogenesis**.
- In the space between the seminiferous tubules there are interstitial cells called Leydig cells, which are endocrine in function and produce male sex hormones called testosterone.

# Female reproductive organ (Ovary)

- A pair of elongated sac like structures found in the abdominal cavity just ventral to the kidney which are called ovaries.
- The ovaries are free anteriorly but each ovary continues posteriorly as oviduct.
- Two oviducts fuse and open exteriorly by a genital aperture.

- The wall of the ovary consists of **three layers**.
  - **Peritoneum** (outermost thin covering layer).
  - **Tunica albuginea** (made up of connective tissue, muscle fibres and blood capillaries).
  - **Germinal epithelium**.
- The germ cells in the germinal epithelium are called **oogonia** which undergo a number of maturation stages to become a ripe ovum.
- This process is called **oogenesis**.

## **Breeding**

- It refers to successive stages of courtship, mating and spawning.

## **Courtship**

- It is the heterosexual reproductive communication system which ultimately leads to mating.

## **Mating**

- It refers to the sexual act itself in which at least one male and one female come close together and release their gametes more or less simultaneously into the surrounding media (external fertilization) or by the transfer of sperm from male into female (internal fertilization).



## Spawning

It is the process of release of gametes

- Oviparous
- Viviparous.

## Fertilization

### External fertilization

- Eggs and from female and milt (liquid containing sperm) from male are released simultaneously to the exterior environment where they meet each other for fertilization.

### Internal fertilization

- Sperms are deposited into the reproductive organ of the female where fertilization takes place.

# Spawning Stages

## Pre-spawning

- Different stages of development of gonad (Testis and Ovary) takes place.

## Spawning

- Release of sperms and eggs occurs.

## Post spawning

- Recovery stage where maturation of gonads begins again from the initial stage

## **“ Maturation”**

- cyclic, morphological changes which the male and female gonads undergo to attain full growth and ripeness.

## **“Spawning”**

- release of male and female gametes from the body of fish.

## **“Breeding”**

- all these events along with their pre-spawning and spawning phases.

## **“ The breeding season”**

- time of peak maturity - spawning occurs in a population.

# Maturity stages

- '**Maturity stages**' is unique - accepted meaning in Fisheries Biology.
- As a measure to observe the degree of ripeness of the ovaries and testes of a fish.
- The term **first maturity** - spawning for the first time.
- Cycle of maturity of gonads - and observe them with large number of samples at weekly intervals.

# Maturity Stage in the Female Fish

- On the basis of shape, size, colour of the ovary and other histomorphological features, at least six maturity stages can be recognized.

## 1. **RESTING PHASE (Immature):**

- ✓ The ovaries are small, thin, thread like, translucent, pale or dirty white in colour with inconspicuous vascularization.
- ✓ The ovaries occupy only a small part of the body cavity and ova are not visible to the naked eye.
- ✓ Histologically, the ovary shows ovigerous lamellae, having nests of oogonia, and immature oocytes in the stage I and II are visible under a microscope

## 2. EARLY MATURING PHASE

- ✓ Ovaries become slightly larger, thicker, opaque and are light yellowish in colour.
- ✓ There is an increase in the weight of the ovary and they occupy nearly  $\frac{1}{2}$  of the body cavity.
- ✓ Histologically, oocytes in stage III and IV are present in large number.

## 3. ADVANCED MATURING PHASE

- ✓ There is a further increase in the weight and volume of the ovaries, which have a deep yellow colour and occupy  $\frac{2}{3}$  to  $\frac{3}{4}$  of the body cavity.
- ✓ Vascular supply increases and the blood capillaries become conspicuous.
- ✓ Immature oocytes are reduced in number while stage IV and stage V oocytes are present in large number.
- ✓ A few stage VI oocytes may also be seen.

## 4. MATURE OR PRESPAWNING PHASE

- ✓ The ovaries are further enlarged occupying almost the entire body cavity.
- ✓ They are turgid, deep yellow in colour and a large number of spherical ova are visible to the naked eye through the thin ovarian wall.
- ✓ The blood supply increases considerably.
- ✓ Both translucent and opaque ova are present and the ovaries attain their maximum weight.
- ✓ The fish becomes gravid due to ripe ova tucked inside, and the abdomen becomes round.
- ✓ The ova are not discharged till the environmental conditions become favourable.
- ✓ Histologically, a large number of ova in stage VII, and ripe eggs are seen in the ovary.

## 5. SPAWNING PHASE

- ✓ Ovaries are very much enlarged, occupying the entire body cavity.
- ✓ They are turgid and yellow in colour with a large number of translucent eggs.
- ✓ Ovarian wall is very thin, almost transparent.
- ✓ Eggs are present in the oviduct also, and the fish spawns a number of times during this period.
- ✓ The ovary is now said to be in running phase.
- ✓ At the beginning of this phase, ova are extruded by applying a gentle pressure on the abdomen.



## 6. SPENT PHASE

- The ovaries are flaccid, shrunk and sac-like reduced in volume and have a dull colour.
- The vascular supply is reduced.
- Some unspawned large ova and a large number of small ova are present.
- Histologically, the ovary shows atretic and discharged follicles, along with stage I and II oocytes.

# Maturity Stage in the male Fish

## **Immature:**

- ✓ Testis small, translucent, whitish

## **Developing or resting:**

- ✓ Testis white, flat, convoluted, easily visible to the naked eye, about  $\frac{1}{4}$  length of the body cavity.

## **Developed:**

- ✓ Testis large, white, no milt produced when pressed or cut

## **Ripe:**

- ✓ Testis large, opalescent white, drops of milt produced when pressed or cut

## **Spent:**

- ✓ Testis shrunk, flabby, dirty white in colour.