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# Parental Caring and Growth in fishes



Dr. Amrutha Gopan  
Assistant Professor  
School of Fisheries

Centurion University of Technology and Management  
Odisha



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# Parental Caring Fishes

Guard their eggs and young ones.

Produce only very few numbers of eggs.

Exhibit territorial behaviour.

Elaborate courtship behaviour.

Guarders are divided into 2 types



# 1. Substratum Spawners

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- 4 categories depending on the substratum

## a. Lithophils (Rock spawners)

Spawn on flat rocks

Males clean the substratum

Courtship and fertilization, on the clean substratum

e.g. gobies and puffer fish

## b. Phytophils (Plant spawners)

Deposit their eggs on plants. e.g. Cat fishes



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### **c. Aerophils (Terrestrial spawners)**

- Deposit their eggs on the underside of the overlying rock or plant (above the water level)
- Spraying or splashing the water by males over the eggs to keep the eggs moist.
- e.g. *Characin* spp.

### **d. Pelagophils**

- Released in open water
- Eggs are sticky
- Eggs are always found in clusters
- Parental care is exhibited by both male and female fish
- Climbing perch

## 2.Nest Spawners



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### a.Lithophils

- They use gravel; for building nests and guarded by males
- e.g. cichlids

### b.Phytophils

- Build their nests by using plant material
- e.g. Bowfin.

### c.Psammophils

- Build their nests on sandy bottom.
- e.g. *Cichlosoma* spp.



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## d. Aphrophils

- Build their nest by bubbles and froth
- e.g. Siamese fighter and Gourami

## e. Speleophils

- Build their nests in natural or constructed cavities of burrows.
- e.g. Cat fishes.



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# Burrow Nest Spawners

## a. Polyphils

- Build their nests with miscellaneous materials.
- e.g. Arowana.

## b. Ariadnophils

- Build their nests by using plant materials, held together by secretion of kidney, once the fertilization is over, males drive away the female
- e.g. Stickle backs.

## c. Actinariophils

- Make use of sea anemones.
- Lay their eggs in and around sea anemones to avoid predation.
- e.g. *Amphiprion* (clown fish)



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# Bearers

## 1. External Carriers

### Transfer brooders

- Eggs are carried by various means to deposited elsewhere in a suitable area.
- e.g. Cyprinodontids

### Forehead brooders

- After spawning female transfer the eggs on to the depression or hook like structure on the forehead of males.
- e.g. Kurtidae

## Eggs attached to cephalic hook

The male nursery fish (Kurtus) of New Guinea, carries the mass of eggs on the forehead, held in a cephalic hook (Fig. 5.48).

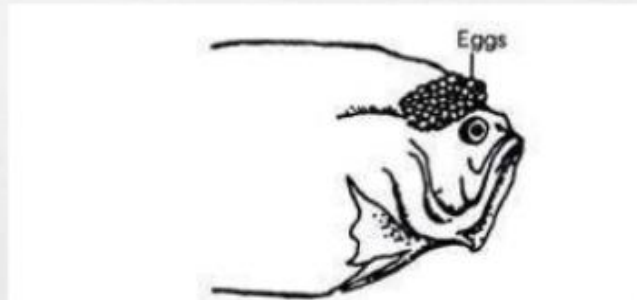
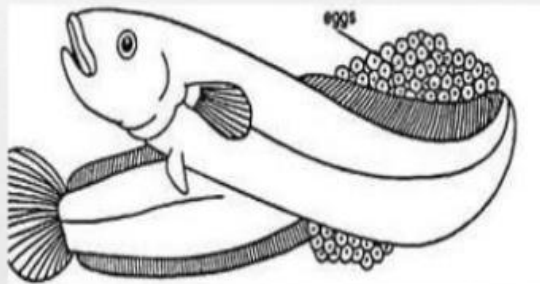


Fig. 5.48 : Male nursery fish carrying egg mass on forehead

## Coiling around Eggs

The butter fish (Pholis) rolls the eggs into a round ball and then one of them remains on guard by curling around it. It is often the male that guards the egg ball till hatching of young.

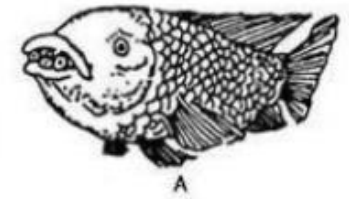


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A Butterfish (Pholis) curling around the eggs

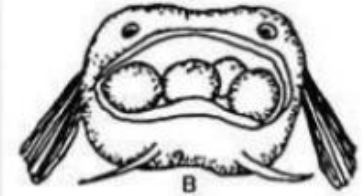
## Eggs and young in mouth cavity

In many cichlids (Example: Tilapia), the female broods the fertilized eggs in her mouth. After hatching she allows the young to take refuge in her buccal cavity in times of danger.



A

In most marine cat fishes (Arius) and cardinal fishes, the male carries the eggs and young ones in his mouth. The male does not take food during this period



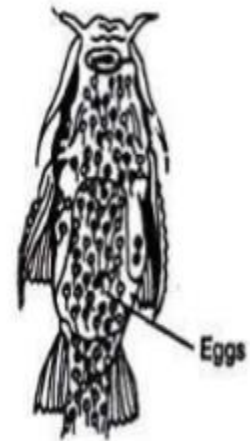
B

A. Female *Tilapia* carrying eggs in her mouth.  
B. The male Brazilian cat fish carrying eggs in a pouch present inside the lower lip

## Eggs in Integumentary cups

During the breeding season, the skin of the lower surface of the body of female becomes soft and spongy. Immediately after the eggs are fertilized, the female presses her body against the eggs in such a manner that each egg becomes attached to the skin by a small, stalked cup. The eggs remain fixed in this position till hatching.

Ex. The cat-fish, *Platystacus* of Brazil



*Platystacus* bearing eggs in integumentary cups

## Eggs kept in brood pouches

The fertilized eggs are transferred by the female into the brood pouch of the male. The brood pouch is found on the lower surface of the abdomen.

During the males so called 'pregnancy', he provides nutrients and oxygen to the fertilized eggs for several weeks.

After hatching, fry may return to the pouch when in danger.



## Care of Independently Swimming Young's

In some fishes, parental care does not stop with the caring of the eggs. These fishes defend their young ones by placing them in a safe place, away from predators and enemies.

Ex. Young ones of **Tilapia, seahorse and pipe fish** are protected by their parents either in the oral cavity of mother or in the brood pouch of the father.

In the case of **cichlid fish**, both male and female secrete a nutritious substance from their body, which are taken up by their young ones.

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## **Mouth brooders**

- Carry their eggs in the mouth till the young ones hatch out.
- Young ones move around their parents. If find any danger, jumps into the mouth of the mother

## **Skin brooders**

- Fertilized eggs are attached on to the skin.
- Once the fertilization is over, Eggs get attached to the spongy skin of the female.
- e.g. south american cat fish

## **Pouch brooders**

- Deposit the eggs in a cutaneous pouch
- In the case of male sea horse (Hippocampus), females deposit the fertilized eggs into the pouches of the males.

## 2. Internal Bearers

### Ovi-ovoviviparous

- Fertilization is internal
- incubation is external
- No nourishment from the parents.
- e.g. sharks and skates

### Ovoviviparous

- Fertilization internal
- incubation is also internal without any nutrient supply from the females
- they get protection
- e.g. many sharks and skates and living fossil fish, *Latimeria chalumnae*



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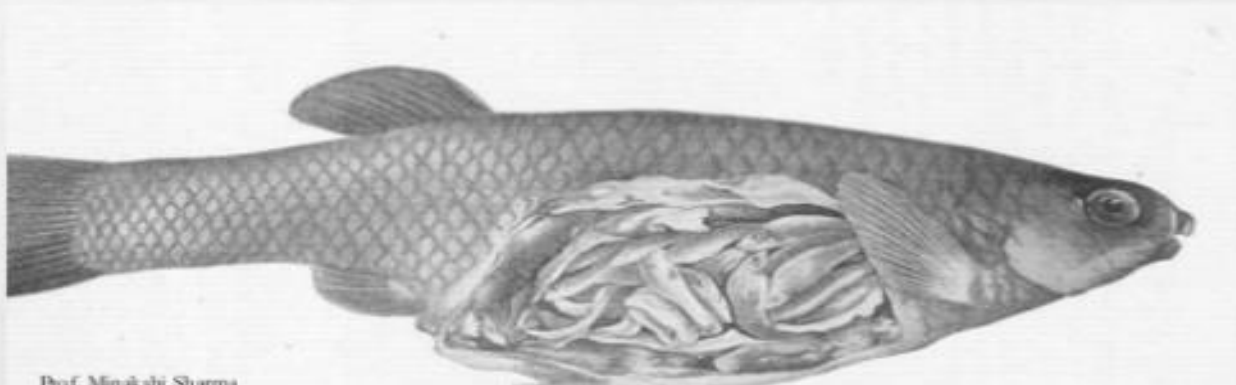
# Viviparous

- Fertilization internal
- incubation is internal
- get nutrient supply from females.
- e.g. Carcharinidae and poeciliidae

## Viviparity

The embryos develop freely in a sac inside the ovary, feeding upon an “embryotrophic” material, apparently produced by the discharged ovarian follicles. The sac becomes highly vascular and remains as such during the months of pregnancy.

**Ex.** Teleosts, species (Zoarces, Gambusia and Poicilia)  
Shiner-perch (*Cymatogaster aggregata*)



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# Gonadosomatic index

**Gonadosomatic index** which is an **index** of gonad size relative to **fish** size is a good indicator of gonadal development in **fish**

The percentage of body weight of **fish** that is used for production of eggs is determined by the **gonadosomatic index**.

$$GSI = \frac{\text{Weight of gonad} \times 100}{\text{Weight of fish}}$$



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# Growth in Fishes

Growth is a characteristic feature of living beings.  
Every organism grows and attains its normal size.

Growth is actually an increase in any dimension of any organism in relation to time.

Growth is the process of addition of flesh as a result of protein synthesis.

Knowledge of fish growth is of vital importance for obtaining high yield of fish.

The rate of growth varies from species to species and sometimes it varies even among species also.



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# Rate of fish growth is influenced by many factors:

## 1. Different Localities:

Individuals of same species grow at different rate in different localities.

## 2. Seasonal Effects:

The different temperatures in different seasons affect growth of fish. In summer the fish grow fast, however, in winter growth is slow.

## 3. Availability of Food and Oxygen:

This is the most important factor influencing growth of fish. In ecologically balanced water body, growth rate is high because of ample supply of oxygen and food.

## 4. Population Density:



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**4. Population Density:** Higher population density shows slow growth while low density shows high growth rate.

## 5. Age:

Fish continue to grow throughout their life but with increasing age, growth rate is slow and in extreme old age fish growth is extreme slow. Growth slows down at the onset of sexual maturity when large amount of nutrient material periodically go into egg or sperm formation.



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## 6. Adaptive Character:

Sharks and Sturgeon grow very fast into large size because of constant food supply, which provides protection against their predators.

However, in Goby growth is slow, resulting in small size of the body.

This is an adaptation to overcome problem of limited food supply and is related to increased reproductive capacities as they have more danger of destruction by predators.



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# Growth Curve:

Growth curve is obtained when either length or weight of a fish is plotted against time periods.

The curve obtained is sigmoid or S-shaped.

This curve illustrates the rate of growth. If rate of growth is plotted against time, such curve is known as growth rate curve

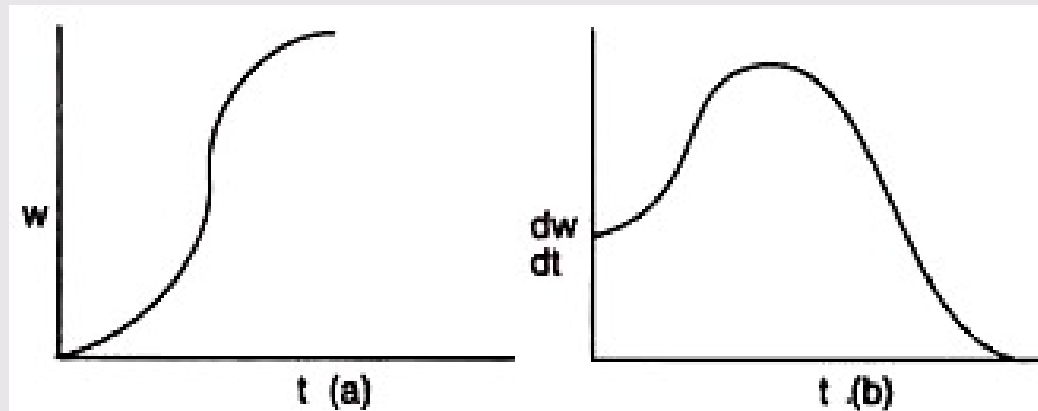


Fig. 14.3a, b : (a) Growth Curve, (b) Growth rate Curve



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# Linear Growth:

Fish growth varies according to various periods.

Maximum growth rate is found just before attaining the sexual maturity of fish.

After maturation of gonads the growth slows and decreases.

A linear growth pattern is seen during the postnatal development of fish, specially during the period of hatching to the sexual maturity.



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This may differ from species to species, and depends on various factors, viz., appropriate and balanced food, optimum temperature for vital activities like metabolism, vitamins and trace elements for proper growth.

Fluctuation in these factors affects growth rate of the fish.

If there is scarcity of food the size of fish will be small, and, if the availability of food is restored to normalcy, the fish grows to normal.



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Growth functions are mathematical equations used to express the increase in body dimensions over time.

Aquaculturists typically report growth using absolute (weight gain per time),

relative (percentage increase in body weight) and

specific growth rates (percentage increase in body dimension per time)

calculated only on the basis of the stocking and harvest data, and do not consider growth within this period.



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# Growth rates

## Absolute growth

One of the quickest, mathematically simplest and frequently used methods in describing growth is the absolute increase in units measured. It is expressed as:

$$Dw = wt - wi \text{ -----Equation (1)}$$

where  $w_t$  is the final weight/length and  $w_i$  is the initial weight/length.



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# Relative growth rate

The relative growth rate (RGR) is mathematically based on the absolute growth rate. It displays the absolute increase in relation to the initial weight/length and is reported as percentage increase over time. Therefore, it is constructed as Equation (1), being additionally divided by the initial weight/length and multiplied by 100.

$$\text{RGR} = \frac{w_t - w_i}{w_i} \times 100$$

where  $w_t$  is the final weight/length and  $w_i$  is the initial weight/length.



## *Instantaneous growth rate*

The instantaneous growth rate (IGR) relies on the absolute growth rate but instead of calculating the absolute values, it uses the natural logarithm:

$$\text{IGR} = \frac{\log(w_t) - \log(w_i)}{t} \quad (4)$$

where  $\log$  is the natural logarithm. All other letters are specified as in the previous equations.



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# Specific growth rate

In analogy to the conversion between the absolute growth rate and the relative growth rate, rate can be transferred into the specific growth rate (SGR) by being multiplied by 100.

Its results are given in percentage increase per day, which is why it is a more flexible method than the RGR.

Accordingly we get: the instantaneous growth

$$\text{SGR} = \frac{\log(w_t) - \log(w_i)}{t} \times 100$$