

# **PISCES – OSMOREGULATION**

## **1. Introduction**

**Osmoregulation** is the process by which fishes maintain the balance of **water and salts (electrolytes)** in their body fluids despite living in different aquatic environments.

Fishes live in:

- **Freshwater**
- **Marine (Sea water)**
- **Brackish water**

Since water concentration differs in these habitats, fishes must regulate:

- Water intake and loss
- Salt gain and loss

## **2. Basic Concept**

### **Osmosis**

Movement of water from low solute concentration to high solute concentration through a semi-permeable membrane.

### **Osmotic Conditions**

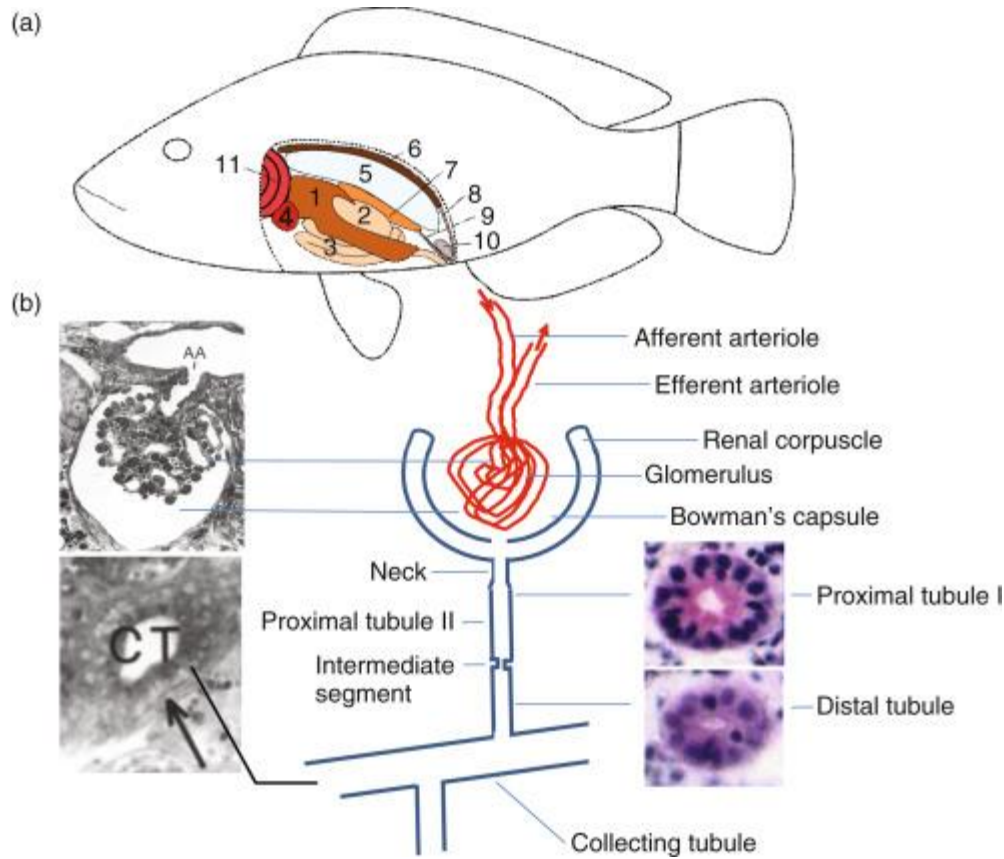
| <b>Condition</b> | <b>Meaning</b> |
|------------------|----------------|
|------------------|----------------|

|                     |                 |
|---------------------|-----------------|
| Hypertonic Solution | has more solute |
|---------------------|-----------------|

|                    |                 |
|--------------------|-----------------|
| Hypotonic Solution | has less solute |
|--------------------|-----------------|

|          |                            |
|----------|----------------------------|
| Isotonic | Equal solute concentration |
|----------|----------------------------|

### 3. Osmoregulation in Freshwater Fishes



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#### Example:

- Rohu
- Catla
- Carp

#### □ Osmotic Nature:

- Body fluids are **hypertonic** to surrounding water.
- Water continuously enters the body by osmosis.

#### □ Problems Faced:

- Excess water enters body.

- Salts diffuse out.

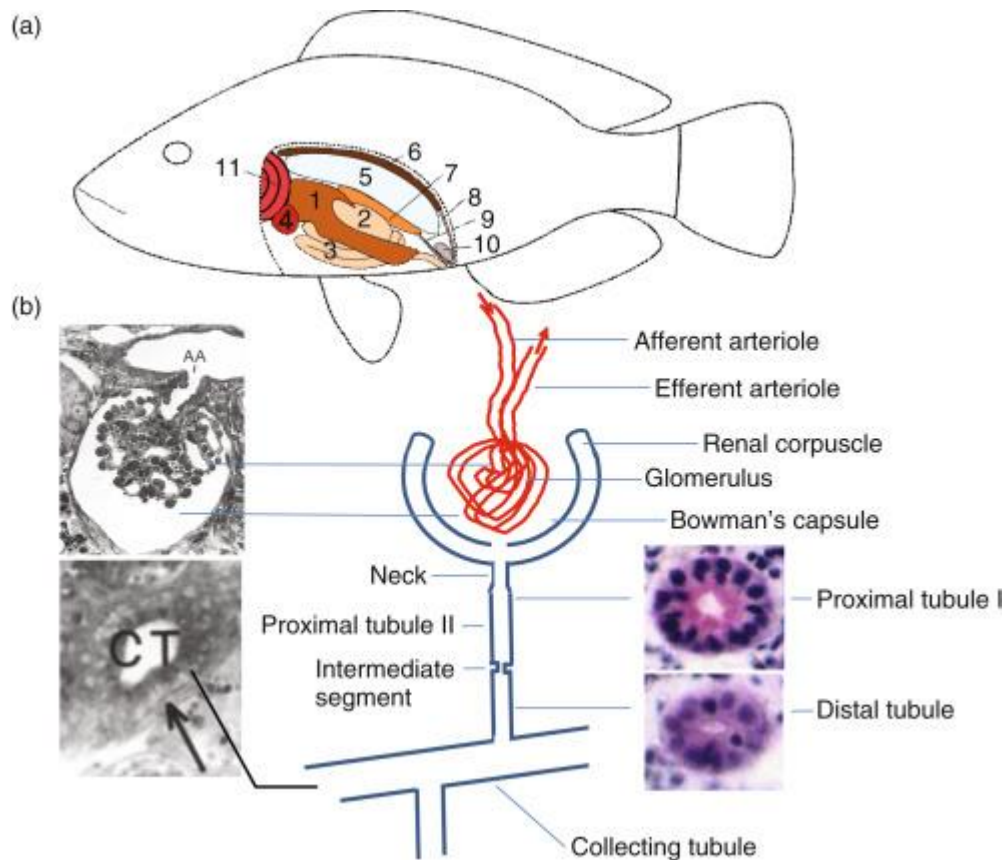
□ **Adaptations:**

1. **Do not drink water**
2. **Produce large amount of dilute urine**
3. **Active absorption of salts through gills (chloride cells)**
4. Well-developed kidneys

□ **Summary:**

Freshwater fishes remove excess water and conserve salts.

#### 4. Osmoregulation in Marine Fishes



### **Example:**

- Tuna
- Shark
- Mackerel

### **Osmotic Nature:**

- Body fluids are **hypotonic** to seawater.
- Water leaves body by osmosis.

### **Problems Faced:**

- Loss of water
- Excess salt gain

### **Adaptations:**

1. **Drink large amounts of seawater**
2. Excess salts removed by:
  - Chloride cells in gills
3. Produce small quantity of concentrated urine
4. Kidneys conserve water

### **Summary:**

Marine fishes conserve water and remove excess salts.

## **5. Osmoregulation in Cartilaginous Fishes**

Examples:

- Sharks
- Rays

### **Special Feature:**

- Retain **urea and trimethylamine oxide (TMAO)** in blood.
- Body fluids become nearly isotonic with seawater.

### **Advantage:**

- Less water loss.
- Reduced need for drinking seawater.

## 6. Role of Organs in Osmoregulation

| Organ     | Function             |
|-----------|----------------------|
| Gills     | Salt exchange        |
| Kidneys   | Urine formation      |
| Skin      | Minor water exchange |
| Intestine | Water absorption     |

## 7. Hormonal Control

- **Prolactin** – Important in freshwater adaptation
- **Cortisol** – Helps in marine adaptation
- **Antidiuretic hormone (ADH)** – Regulates water balance

## 8. Euryhaline Fishes

### Definition:

Fishes that can live in both freshwater and seawater.

### Examples:

- Salmon
- Eel
- Hilsa

### Special Ability:

- Adjust gill function and kidney activity according to environment.

## 9. Comparison Table

| Feature         | Freshwater Fish | Marine Fish          |
|-----------------|-----------------|----------------------|
| Body Fluid      | Hypertonic      | Hypotonic            |
| Water Movement  | Enters body     | Leaves body          |
| Drinking        | No              | Yes                  |
| Urine           | Large & dilute  | Small & concentrated |
| Salt Regulation | Absorb salts    | Excrete salts        |

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## 10. Conclusion

Osmoregulation is essential for survival of fishes.

Freshwater fishes remove excess water, while marine fishes conserve water and remove salts. Special adaptations like chloride cells, kidneys, and hormones help maintain internal balance.