

Fish Parasitology



Parasitism:

It is defined as an intimate and obligatory relationships between two heterospecific organisms during which the parasite, usually the smaller of the two partners is metabolically depended on the host. Parasitology: The term 'parasitology' is originated from Greek word- 'Para' means beside, 'sitos' means food and 'logus' means study. It is the branch of science which deals with the study of the relationship between the parasite and host. This discipline includes several approaches to the study of parasitic organisms such as phylogeny, morphology, ecology, life history, physiology, chemotherapy, serology, immunology and bio chemistry. Fish parasitology: It is the branch of science that deals with the study of parasite of fishes. It includes the infection and disease of fish caused by parasite.

Host: It is an organism which is physiologically larger than a parasite, belongs to a different species and provide protection and supply nourishment to the parasite. Definitive or final host: The host in which parasite reaches sexual maturity and reproduces it's termed as definitive or final host. e.g. aquatic bird in the case of *Clinostomum* Intermediate host: The host which harbours the larval stages of parasite for development but not to reach sexual maturity is known as intermediate host. e.g. Fish in the case of *Clinostomum*

Reservoir host: When a host harbours a parasite till sexual maturity but tolerate the infection of the parasite, specifically harmful to another animal and act as a source of infection of economically important animals is known as reservoir host. e.g. trash fish are source of infection of Ich disease. Dog is the reservoir host of Entamoeba species of man. Paratenic host: A host in which the immature parasite undergoes no development but remains infective to a definite host, is called paratenic host. e.g. *Calyptospora funduli*, the ingested sporozoites do not proliferate but undergo a kind of 'maturing', a prerequisite for becoming infective. Vectors: The hosts which carries and transmit the infective stage of parasite from one host to another are called as vectors.

Importance of studying fish parasitology

- For identification of parasite
- For identification of diseases
- Scope of parasitology in the fisheries

Parasite: The term “parasite” is originated from Greek word- ‘Para’ means besides and ‘sitos’ means food. So parasites are those animal which cling to relatively large animals externally or internally for food and also for completion of their life cycle. Among these two organisms, smaller one is parasite and larger one is host. On the basis of host specificity, parasites are divided into three types-

1. **Monoxenous** parasites: The parasites which are adapted for life in only one host species i.e. they are specific for it and exhibit a strict specificity.
2. **Oligoxenous** parasites: The parasites which can live in several hosts, even though one or more among them may be the typical host.
3. **Polyxenous** parasites: The parasites which do not have host specificity and being capable of infecting many hosts. e.g. *Ichthyobopodo* sp. infect all teleosts

On the basis of number of host for completion of their life cycle

Parasites are divided into three types-

1. Stenoxenous parasites: The parasites which complete their life cycle in a single host individual are known as stenoxenous parasites.
2. Heteroxenous parasites: The parasites which require more individuals for completion of their life cycle are known as heteroxenous parasites.

Heteroxenous parasites are also divided into two types-

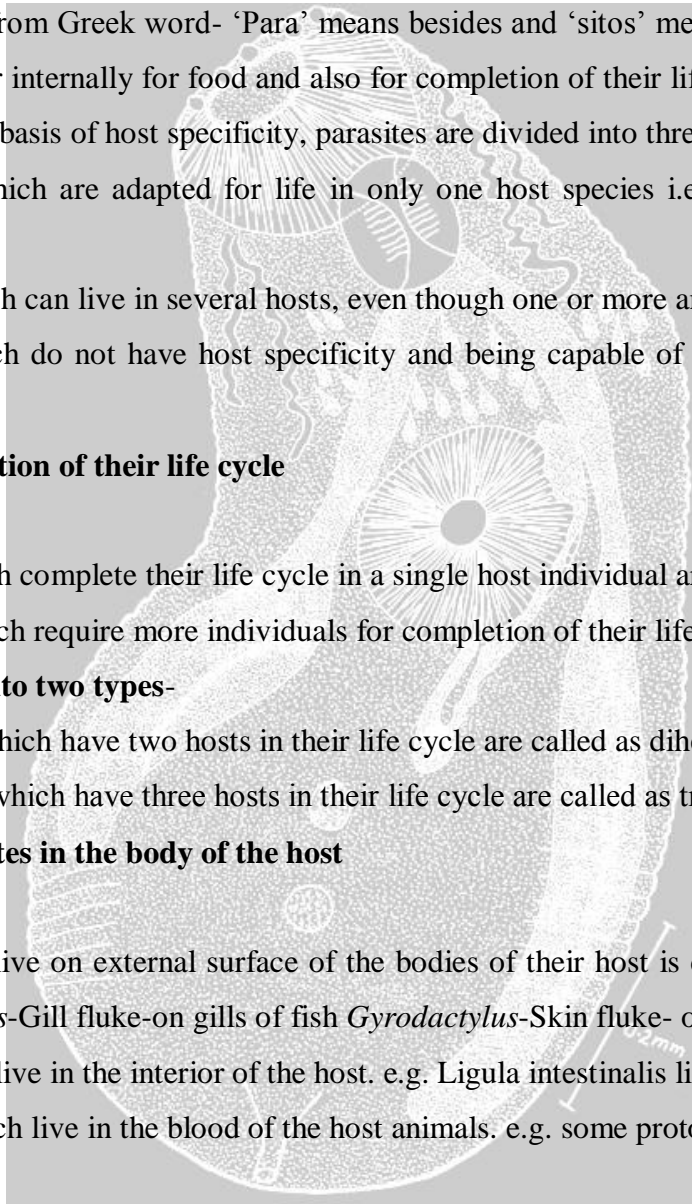
- Diheteroxenous parasites: The parasites which have two hosts in their life cycle are called as diheteroxenous parasites. e.g. *Trypanosoma*
- Triheteroxenous parasites: The parasites which have three hosts in their life cycle are called as triheteroxenous parasites

According to the localization of the parasites in the body of the host

Parasites are also divided into two types-

1. **Ectoparasite:** The parasites which live on external surface of the bodies of their host is called ectoparasite. In fish, they are found on skin, gills and fins. e.g. *Dactylogyrus*-Gill fluke-on gills of fish *Gyrodactylus*-Skin fluke- on skin of fish
2. **Endoparasite:** The parasites which live in the interior of the host. e.g. *Ligula intestinalis* live in visceral cavity of fish.
3. **Haemoparasites:** The parasites which live in the blood of the host animals. e.g. some protozoan and nematode parasites

On the basis on dependency-



1. **Permanent** parasite: A parasite which permanently live in contact with its host, is called permanent parasite.
2. **Facultative** parasite: A parasite which can live without a host is called facultative parasite.
3. **Obligatory** parasite: A parasite which cannot live without a host is called obligatory parasite.
4. **Periodic** parasite: A parasite which visits its host at intervals.

Note: The role of parasitology in fisheries Science

1. Disease as a contributing factor to natural mortality:

- Total mortality (Z)**=Fishing mortality (F) +Natural mortality (M).
- Six major sources of natural mortality in fish: predation, starvation, spawning, stress, disease, environmental catastrophies and senility.
- Natural mortality is largely dependent on the degree of fishing mortality.
- Diseased fish are likely to be more easily caught than healthy fishes.
- Mortality due to disease is partly replaced by mortality due to fishing.

2. Disease as an indicator of pollution effects:

3. Parasites as biological tags:

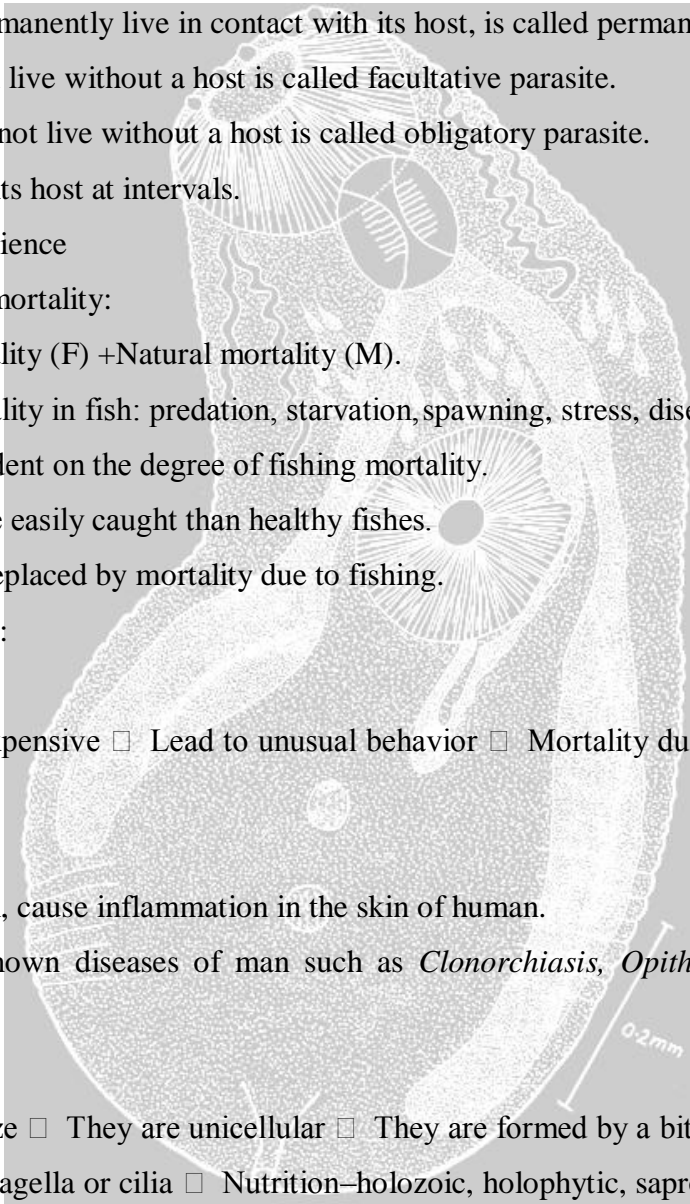
- Disadvantages of artificial tagging: Expensive Lead to unusual behavior Mortality due to tagging Parasites are used as natural tags to replace the artificial tag

4. Human pathogens transferred by fish

- Mycobacterium marinum* from skin of fish, cause inflammation in the skin of human.
- The causative parasites of some wellknown diseases of man such as *Clonorchiasis*, *Opithorchiasi* and *Gnathostomiasis* only occur in freshwater fish.

Parasitic Groups of fishes Protozoa:

- They are small, usually microscopic in size They are unicellular They are formed by a bit of cytoplasm containing one or more nuclei. Locomotor organelles are –pseudopodia or flagella or cilia Nutrition–holozoic, holophytic, saprozoic or parasitic Protozoans are free-living



and parasitic Suture line Polar capsule Polar filament Sporoplasm Iodin vacuoles □ Reproduce by two quite distinct type- sexual and asexual □ They may be ectoparasitic and endoparasitic. □ They are mostly found on the external surface of the fishes. □ Their ability to multiply on or within their hosts e.g. *Ichthyophthirius multifiliis*, *Ichthyobodo necatrix*, *Myxobolus sp.*

Trematoda:

- It is a class of phylum Platyhelminthes. □ It includes two groups of parasitic flatworms, known as flukes **Monogenea:**
- Monogeneans are a group of parasitic flatworm of the phylum Platyhelminthes and class Monogenea. □ They are platyhelminths flukes primarily on fishes, including Agnatha, the Chondrichthyes and the Osteichthyes □ Most of them are ectoparasite except some in mouth and one in urinary bladder. □ They attack mainly on skin, head, fins, body surface, the surface of nasal or on the gills □ They have bilaterally symmetrical, dorsoventrally flattened body □ No true sucker, sometimes oral sucker present □ Oral opening present □ Mouth usually open into muscular pharynx □ They have no complete digestive system, anus is usually absent. □ Its intestine is called intestinal caecum.
- The most characteristic structure is the haptor, an attachment organ which are situated at the posterior end of the body and bears chitinous hooks and anchors.
- Monogeneans are hermaphrodites, having both male and female organs. □ They have direct life cycle because one host is needed to complete their life cycle □ Most species are oviparous but a few are viviparous. e.g. *Gyrodactylus elegans* -Skin fluke

Diplozoon paradoxum - Twin worm

Dactylogyrus vastator - Gill fluke Marginal hook Anchor Developing embryo

Trematoda: Digenea

- Digenea is a subclass within the Platyhelminthes consisting of parasitic flatworms □ Digeneans are predominately endoparasites. □ They attack mainly the internal organ of body such as liver, gall bladder, air bladder, urinary bladder etc. □ They possess dorsoventrally flattened and unsegmented body □ They have two attachment organs-the oral sucker surrounding the mouth and the ventral sucker or the acetabulum on the ventral surface which have no connection to any internal structure. □ An anterior sucker divorced from the oral opening, known as arhynchus, is occasionally present. □ They are hermaphrodites □ The lifecycle of Digenean involve more than one hosts. And their adult stage parasitic in

vertebrates. □ The final host of digenetic trematodes is a vertebrate where the flukes sexually reproduce and intermediate host is an invertebrate e.g. *Clonorchis sinensis*, *Clinostomum complanatum*

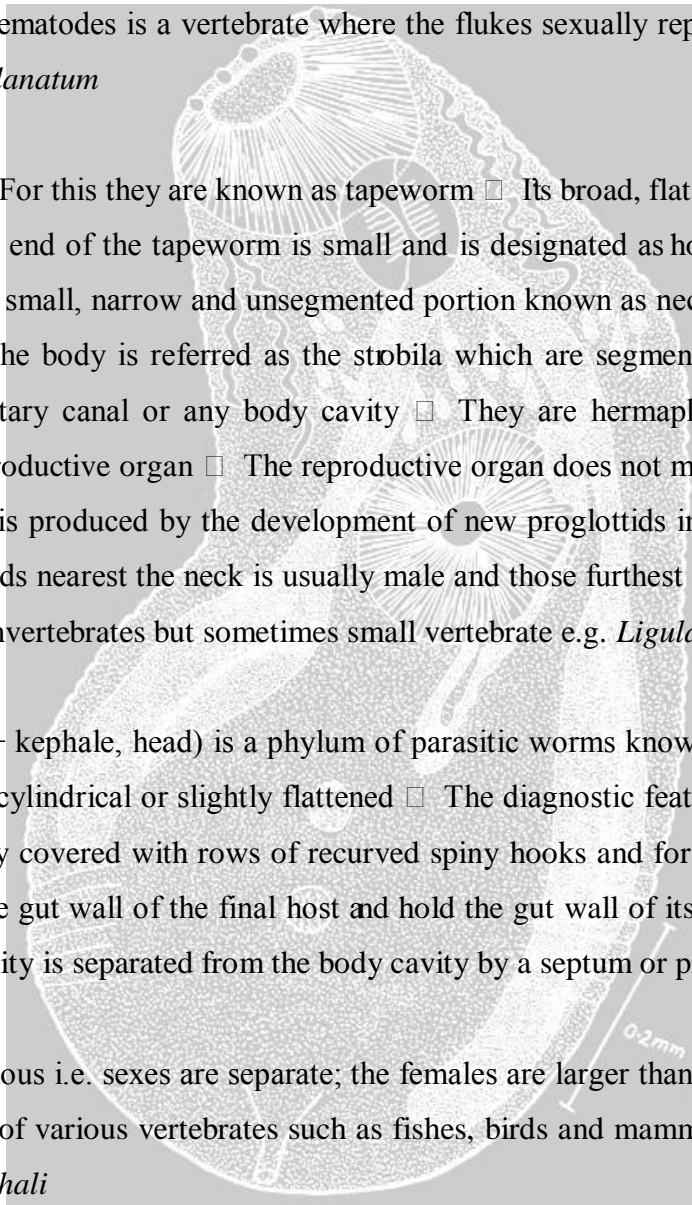
Cestodes

□ Body elongated, flattened and depressed. For this they are known as tapeworm □ Its broad, flat dorsal and ventral surfaces are called surficia.
□ Body is divided into three parts, anterior end of the tapeworm is small and is designated as hold fast organ or attachment organ commonly known as scolex. □ Following the scolex, a small, narrow and unsegmented portion known as neck or growth zone from where the segments or proglottids are budded off. □ The rest of the body is referred as the strobila which are segmented and consisting of many compartments or proglottids. □ They never have an alimentary canal or any body cavity □ They are hermaphrodites □ Each proglottid is a separate unit, consisting one set each male and female reproductive organ □ The reproductive organ does not mature at the same time, so that each segment is first male and later female. □ The strobila is produced by the development of new proglottids in the neck region, so that the proglottids most distant from neck are the oldest. □ Proglottids nearest the neck is usually male and those furthest away are female. □ The lifecycle involve one or more intermediate hosts, mainly various invertebrates but sometimes small vertebrate e.g. *Ligula intestinalis*, *Dibothriocephalus latus*.

Acanthocephala

□ Acanthocephala (Greek *akanthos*, thorn + *kephale*, head) is a phylum of parasitic worms known as acanthocephalans, thorny-headed worms, or spiny-headed worms □ Body is slender, cylindrical or slightly flattened □ The diagnostic feature of the acanthocephala is the presence of an anterior, protrudible proboscis that is usually covered with rows of recurved spiny hooks and for this, these worms are called as spiny-headed worm. □ The proboscis is used to pierce the gut wall of the final host and hold the gut wall of its host while it completes its life cycle. □ Like the body, the proboscis is hollow, and its cavity is separated from the body cavity by a septum or proboscis sheath. □ They lack mouth, anus and digestive tube

□ No circulatory system □ They are dioecious i.e. sexes are separate; the females are larger than the males □ They are endoparasitic worms □ The adult parasite infests the digestive tract of various vertebrates such as fishes, birds and mammals □ They can infect the marine, freshwater and terrestrial hosts e.g. *Pallisentis ophiocephali*



Nematode

- These worms are also called as roundworms or threadworms
- They are endoparasite
- The body is mostly cylindrical, but it may be fusiform or filiform and unsegmented
- The length of the body lies between 0.5mm to 1m.
- Body is covered with a tough, resistant cuticle which is elastic and flexible
- They have no particular attachment organ, may be pointed at one or both end.
- Sexes are separate; the females are larger than the males
- Tail region of male is curve but in case of female it is straight.
- They usually appear colourless or white or yellowish; colouration is generally due to the colour of the intestinal content, especially when it is filled with blood.
- They have complete digestive system
- Some species have one host and some species have two or three hosts in their life cycle e.g. *Ascaris lumbricoides*, *Procamallanus heteropneustes* and *Camallanus lacustris*.

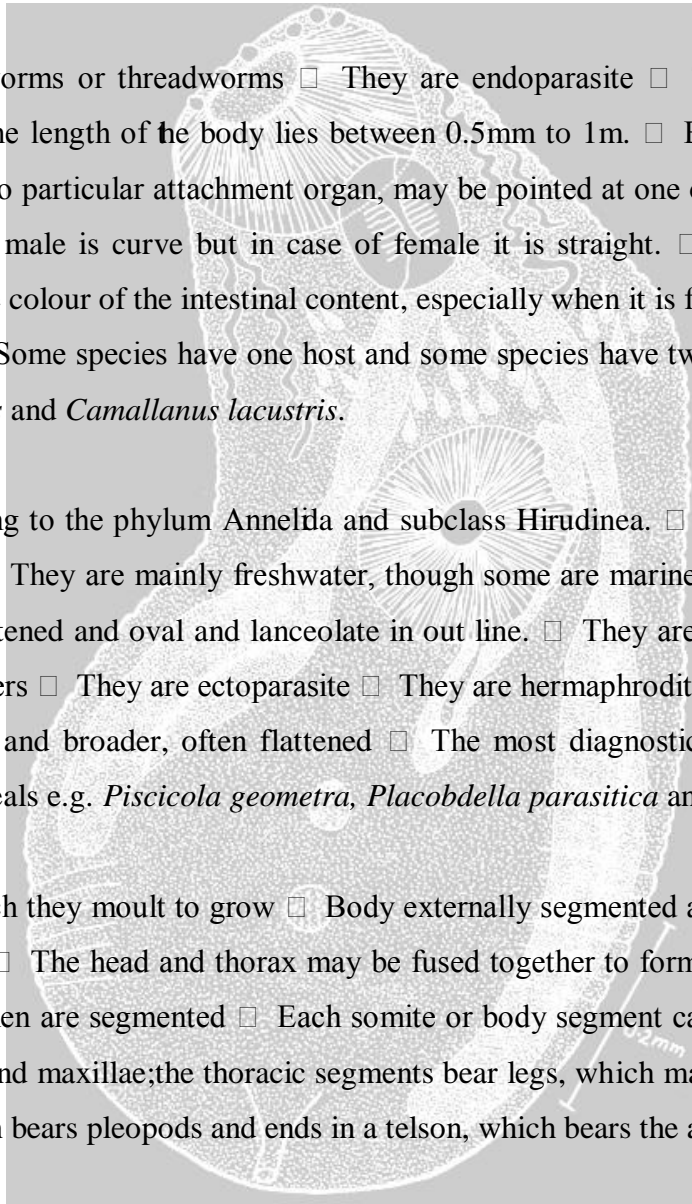
Leech

- Leeches are segmented worms that belong to the phylum Annelida and subclass Hirudinea.
- They are bilaterally symmetrical worms with more or less uniformly metameric bodies
- They are mainly freshwater, though some are marine and others inhabit damp terrestrial habitat.
- The body is more or less dorsoventrally flattened and oval and lanceolate in out line.
- They are always large enough to be observed in naked eye.
- They have anterior or posterior suckers
- They are ectoparasite
- They are hermaphrodites
- The body is clearly divided into two parts: anterior small and narrow; posterior larger and broader, often flattened
- The most diagnostic feature of leeches is their alimentary canal, adapted for their large and frequent blood meals e.g. *Piscicola geometra*, *Placobdella parasitica* and *Macrobdella decora*.

Crustacea

- Body cuticle forms the exoskeleton, which they moult to grow
- Body externally segmented and divisible into three regions the cephalon or head, the thorax and the pleon or abdomen.
- The head and thorax may be fused together to form a cephalothorax, which may be covered by a single large carapace.
- Thorax and abdomen are segmented
- Each somite or body segment can bear a pair of appendages
- Normally head bears two pairs of antennae, the mandibles and maxillae; the thoracic segments bear legs, which may be specialised as pereopods (walking legs) and maxillipeds (feeding legs). The abdomen bears pleopods and ends in a telson, which bears the anus
- Appendages are jointed

Copepoda



□ They occur in vast numbers, millions being present in a cubic meter of water and are important links in many food chains. □ The copepod body is short and cylindrical, and as in all crustaceans, is segmented comprising a head, a thorax and an abdomen. □ The head and thorax are often fused to form a cephalothorax. □ No carapace and compound eyes □ There is a long pair of antennules and a shorter pair of antennae

Ergasilus sp. is a member of a small group of parasitic crustaceans that prey upon freshwater and marine fishes. □ It may be found on the skin, fins, and gills of fishes, but is most frequently found on the gills. □ are known by common names such as gill lice □ They can cause significant morbidity and mortality when heavily infesting fish. □ They have also been implicated as vehicles for other fish diseases. □ *Ergasilus* has a direct life cycle using only fish as a host. □ *Ergasilus* can spend prolonged periods swimming free, and mating takes place while the male and female are swimming. (*Ergasilus* sp.) □ The male then dies. Egg incubation occurs while the egg clusters are attached to the female. □ The offspring hatch and are broadcast into the water. □ The offspring undergo four molts before becoming adults. □ There are several species of Ergasilids and none is too host specific. □ *Ergasilus* infect wide range of fish species like eels, herrings. □ *Ergasilus* causes the injuries by attaching to the fish with its modified antenna turned hooks. Its feeding apparatus further injures the host fish when it inserts the stylet into the epidermis and underlying host tissue causing hemorrhage. □ *Ergasilus* feed on the host's blood and body fluids.

Special points of interest: *Ergasilus* does not infect humans. *Ergasilus* sp. can be found on the gills of many different species of freshwater fishes. Cooking fish kills the parasite. (*Ergasilus* sp.)

Salmonicola: These are copepod organisms *Salmonicola* attach to fish by burrowing an attachment organ called a “bulla” beneath the skin or gill tissue. This bulla anchors the young *Salmonicola* organism in place generally to a part of the fish's bone or cartilage. It lives its entire life then in that spot on the fish. Damage to gill tissues can be extensive, and result from attachment, feeding and the mechanical presence of the parasite. The parasite feeds on the fish's body tissue and body fluids. As the parasite grows, the females develop two caudal egg sacs. These can be easily seen with the naked eye. In some species of *Salmonicola* the egg sacs are dark brown to black in others they are cream to tan in color. *Salmonicola* have a direct life cycle. The egg sacs on the caudal portion of the female's body release eggs into the water column. The eggs develop into larva within the egg shell and then hatch ready to infect a new fish. The young parasites die within a day or two of hatching if they do not find a suitable fish host.

Lernaea - Anchor worm is a common parasite on fish which is clearly visible to the naked eye and can reach 10 to 12mm. The parasite burrows its head into the fish tissue, under a scale and only the body and tail are normally visible. If left on the fish, secondary bacterial infections can occur at the point of contact due to the damage caused by the anchors used to attach itself. *Lernaea* lay eggs which can lay undetected in the pond and can hatch when conditions and water temperatures are right. Normally the parasite attaches itself by the dorsal or tail fin, and is also commonly found in large numbers on the bellies of fish when they are first netted from the mud ponds.

Caligus spp. is an opportunistic parasite and like its close relative the salmon louse, cause problems for both wild and farmed fish in the northern Atlantic. *Caligus* spp. has been found on more than 80 different fish hosts. With an increased number of fish farmed in marine waters, the infection pressure from this parasitic copepod is likely to increase. *Caligus* spp.

Branchiura

□ The branchiurans are also called as fish lice □ They are flattened crustaceans which are temporary parasites on the skin and gill chambers of fishes. □ Body dorsoventrally flattened □ Shieldlike carapace covers head and thorax □ A pair of sessile compound eyes and mouth suckorial □ Antennules and antennae reduced □ First maxillae modified into suckers □ The abdomen is small and unsegmented and there are no gills.

Argulus Sp : Fish Louse (*Argulus Sp.*) Live from skin of largemouth bass. □ is a member of a small group of parasitic crustaceans that prey upon freshwater and marine fishes. □ *Argulus* can be found on the skin, fins, and gills of fishes. □ They can cause significant morbidity and mortality when heavily infesting fish. □ They have also been implicated as vehicles for other fish diseases.

□ *Argulus* spp. has a direct life cycle using only the fish as a host. □ *Argulus* can spend prolonged periods swimming free and mating takes place while the male and female are swimming. □ Clusters of *Argulus* eggs are deposited on submerged objects and after hatching, juveniles must locate a suitable host within a couple of days or they will expire.

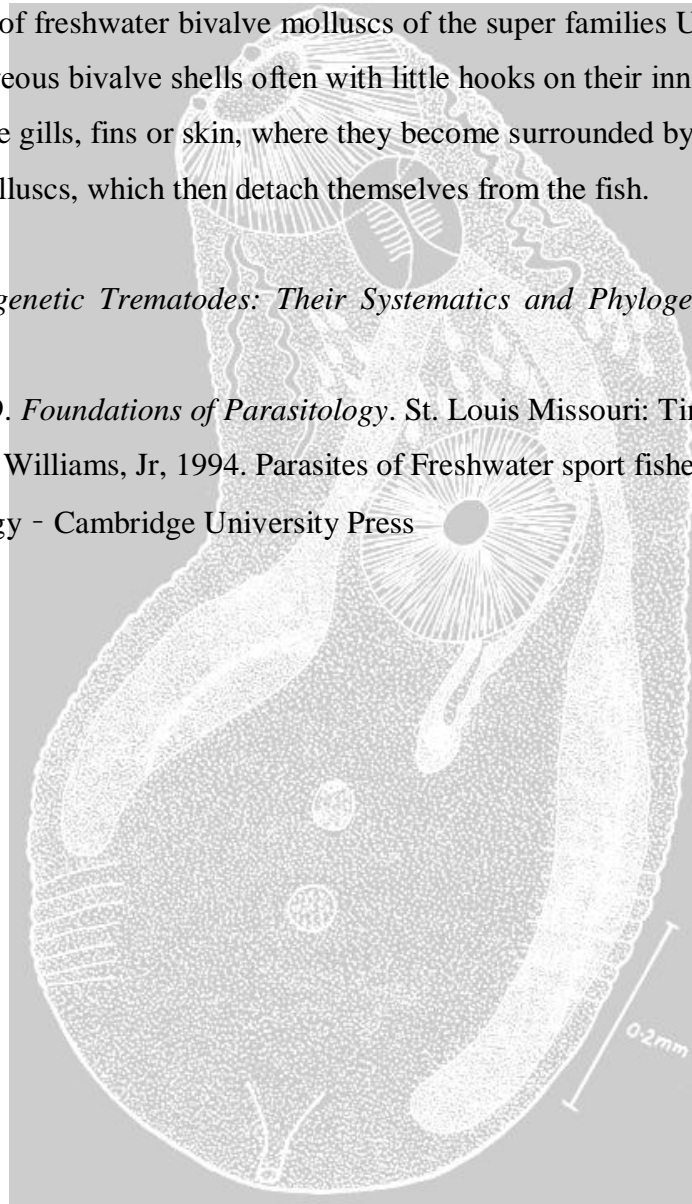
Isopoda

□ Many isopods are only facultative parasite, capable of leading either free or parasitic existence □ They are ectoparasite and produce gall-like depressions in the skin and muscle of the body wall □ Others live in the buccal or branchial cavities □ Isopod in mouth cavity prevents normal feeding and in branchial cavities prevent opercular movement and disrupt respiration.

Glochidia □ *Glochidia* are the larval stages of freshwater bivalve molluscs of the super families Unionoidea and Muteloidea which are parasitic on fins and gills of fish. □ They have calcareous bivalve shells often with little hooks on their inner edges. □ When the larvae come into contact with a suitable host fish, they clamp on to the gills, fins or skin, where they become surrounded by host tissue (epithelial cells). □ This time they undergo metamorphosis to form juvenile molluscs, which then detach themselves from the fish.

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