

□ CLASS NEMATODA (Round worms)

- Common genera include *Capillaria*, *Camallanus*, *Anisakiosis* (*Hysterothylacium*, *Anisakis*, *Porrocaecum*, *Raphidascaris*, *Contracaecum*), *Philometra* and *Eustrongylides*.
- **CAPILLARIA** is large round worm (1-2 cm) and live in the intestinal tract. Eggs are barrel-shaped and have a polar plug on each end of eggs. **DIRECT LIFE CYCLE**. **Enteritis and rapid weakening are seen.**
- **CAMALLANUS** live in the gastrointestinal tract of fish (**perch, pike**) and is 2-20 cm long. They are easily recognised as a red-small thread-like worm protruding from anus of the fish. **INDIRECT LIFE CYCLE** (Copepod, crustacea is 1st IH, **fish is final host******) **It is not much pathogenic. They suck the blood so, can cause anemia.**

- **PHILOMETRA** are found in the intestine, body cavities/tissues, swim bladder and gonads of **carps and salmon fish** (marine and freshwater fish). Males are 2-5 mm, females upto 70 cm long. Worms are usually **red in color** and the much larger females **contain live larvae** and **burst easily when placed in water**. The gravid female penetrates the epidermis and leaves the fish. In sea water, the female bursts to release thousands of larvae which are presumably then ingested by an intermediate host.
- **INDIRECT LIFE CYCLE**. Philometra has a two-host life cycle. Larval worms are transmitted through an **1st intermediate host-copepods** to **the final host-fish****** (especially carp, salmon). When parasitizing a body cavity, larvae are released through the gut with the feces of the host or the female migrates to the skin surface to release larvae. The gravid female penetrates the epidermis and leaves the fish. In sea water, the female bursts to release thousands of larvae which are presumably then ingested by an intermediate host.
- This migration of the parasite in the fish can cause damage to **skeletal joints**, result in **internal bleeding**, and **inflammation of visceral organs**. **Emaciation** and **lowered growth rates** may result from this. These parasites may be severely pathogenic in **fish ovaries** and can affect reproduction.

- **EUSTRONGYLIDES** larva is typically very long, coiled, and red (due to presence of hemoglobin). **INDIRECT LIFE CYCLE**. Eustrongylides is a nematode that uses **fish as its 2nd intermediate host**.***** **The definitive host is a bird**, a common visitor to ponds. Once the **tubifex worm (1st IH)** containing the L3 stages is eaten by a fish, the nematodes migrate (within the fish) into the body cavity.
- They are found encyst (in the fluid of thin-walled, 0.5-1 cm diameter cysts within the abdominal cavity) or free (3-5 cm, upto 10 cm) form in the muscle, body cavity and, frequently, over the external surface of internal organs such as the liver of fish (2nd IH). The larvae are found in the fluid of thin-walled cysts within the abdominal cavity.
- An infected fish often has more than one nematode in its body cavity and **cause little damage**. Because of the large size of the worms, infected fish may appear **unsuitable for retail sales**. It can cause **internal bleeding**
- Eustrongylidosis is a fish-borne zoonosis for human health. It can cause **gastritis and intestinal perforation in humans**

ANISAKIOSIS

- **INDIRECT LIFE CYCLE.** The live cycles of Anisakidae comprise of **invertebrates and fish as intermediate hosts**, and **fish, sea mammals** as well as **fish-eating birds** being **definitive hosts**.
- Anisakidae include Anisakis, Poroecaecum, Raphidascaris, Hysterothylacium and Contracaecum (Syn. Ascaris, Thynnascaris) genus.
- Anisakiosis is an important fish-borne zoonosis. Some of these group nematodes can cause «**Visceral Larva Migrans**». Although these parasites can infect humans after consumption of raw or insufficient cooking fish, there is risk related to not only on the presence of living organisms but it is also connected to the dead parasites that capable of producing proteins and could induce hypersensitivity and allergic reactions.

- *Anisakis* does not result in high losses, however, it is an important problem for the fishing industry because infection can reduce the quality of the flesh. Migrating larvae can cause considerable damage in many organs. Third stage larvae grow up to 2 cm in length, are almost colourless and are found in the gut and flesh.
- During infection in humans, other clinical manifestations are important. Some of these signs consist of epigastric pain, as well as systematic or gastrointestinal symptoms, fever, diarrhea, vomiting, gastric and duodenal ulcers and intestinal obstruction.
- No surviving anisakids survived neither after freezing nor salting (freezing at -20°C in all parts of the products for at least 24 hours and salting during 24 hours).
- At examination, both encapsulated and nonencapsulated larvae can be seen in fish.

□ CLASS ACANTHOCEPHALA (Thorny-headed)

- Acanthocephalans are parasites that live in the intestines of many fish species world wide (salmon, trout, carp). The adult worms are found in the intestine and sometimes in the stomach or pylorus. Acanthocephalans, also known as 'thorny headed' or 'spiny headed' worms
- They vary in length from 1 mm to 50 mm in fish. Bodies cylindrical or flattened with anterior end bearing hooked proboscis (spiny-headed worms- anterior end is bearing hooked). They have a proboscis and anchors themselves in the intestinal wall of their host. Acanthocephalans are dioecious and often sexually dimorphic, with the females growing larger than the males.
- Genera commonly found in fishes are *Acanthocephalus*, *Neoechinorhynchus*, *Echinorhynchus* and *Pomphorynchus*. The shape of the proboscis, the arrangement and the number of proboscis hooks are important characteristics used to definitively identify.