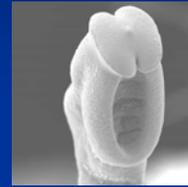
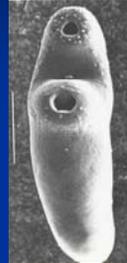


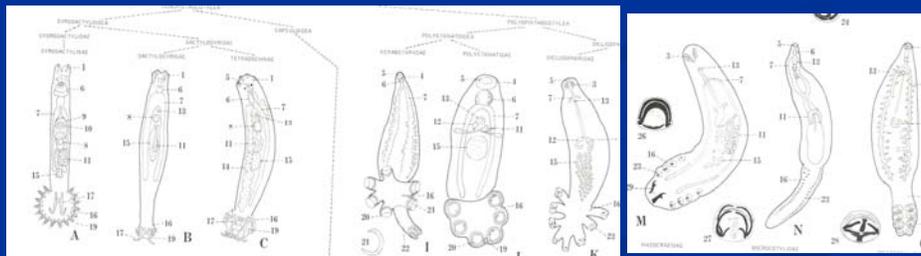
## SECTION III: Multicellular Parasites

- Includes helminths and copepod parasites
  - Helminths:
    - Monogenetic trematodes-ecotoparasitic flatworms
    - Digenetic trematodes-flatworms, primarily endoparasites
    - Cestodes-tapeworms
    - Nematoda-round worms
    - Acanthocephalans-spiny-headed worms
  - Copepods – gill maggots, gill lice

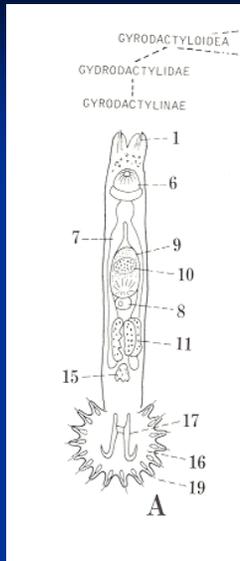


## Monogenea (Monogenetic Trematodes)

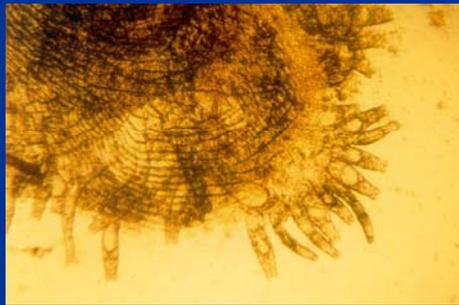
- Primarily ectoparasitic flatworms, parasites of cold-blooded aquatic vertebrates
- Exhibit simple (direct) life cycles-complete their life cycle on one host.
- Possess an organ of attachment called an opisthaptor (haptor) typically equipped with hooks, hooklets, clamps, and/or bothria.



## Monogenetic Trematodes-*Gyrodactylus*



- Found on the gills, fins or body surfaces of fish (numerous species)
- Can cause disease problems in aquaculture
- Identification:
  - Small, transparent, contain developing embryos inside the adult (viviparous)
  - Opisthaptor has 12-16 marginal hooks and 2-4 large anchors



## Monogenetic Trematodes-*Gyrodactylus*



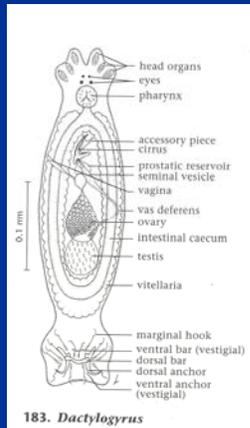
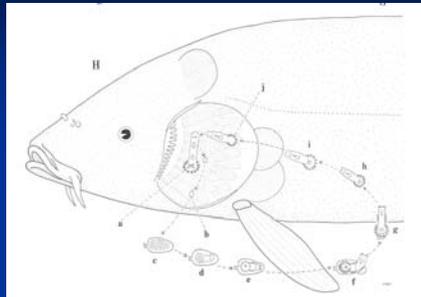


No Picture

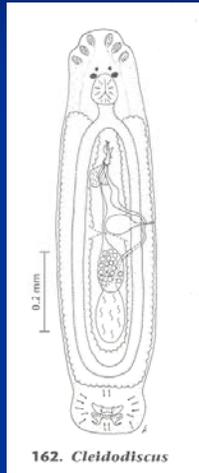
gyrodactylus 01.mpeg

## Monogenetic Trematodes-*Dactylogyra*

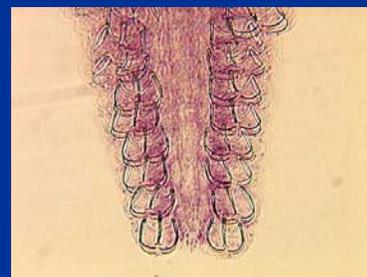
Key features for identification:  
 \*2 prs eyespots  
 \*Haptor with 1 set anchors and 14 marginal hooks



## Monogenetic Trematodes-Numerous other species

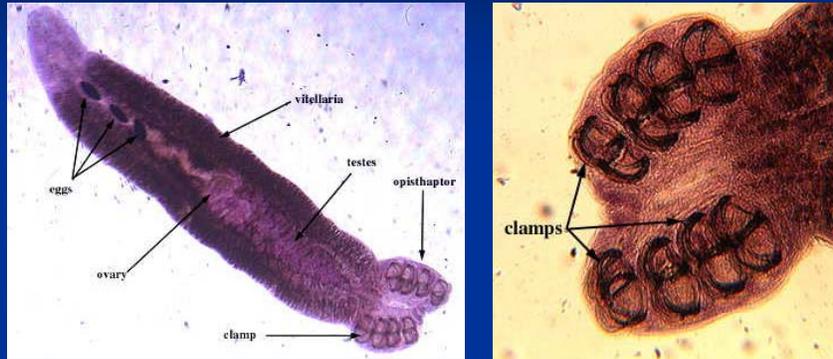


## Other Monogenetic Flukes



*Microcotyle spinicirrus*

## Other Monogenetic Flukes

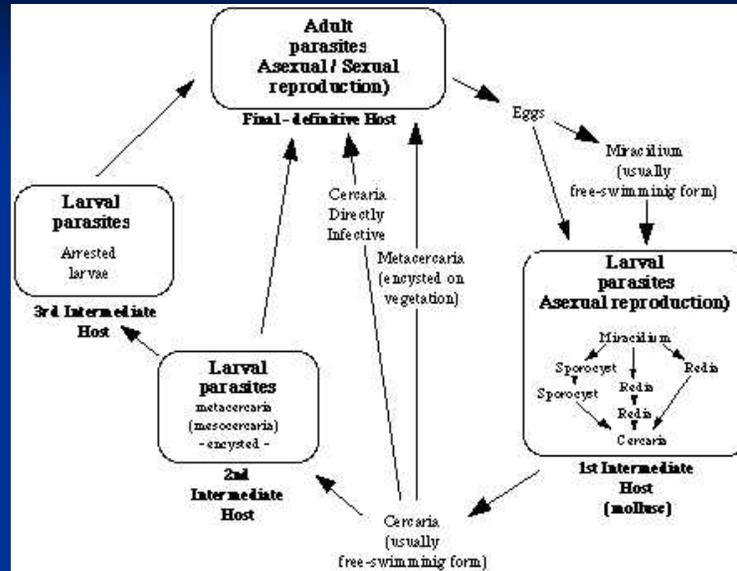


*Discocotyle sagittata*

## Digenea (Digenetic Trematodes)

- Require more than one host to complete their life cycle
- Adult stage is parasitic in vertebrates (fish may be infected by adult and larval stages)
- Almost all digenes undergo part of their larval development in molluscs (commonly snails)

## Digenetic Trematodes



## Metacercarial Stages in Fish Black-Spot Disease

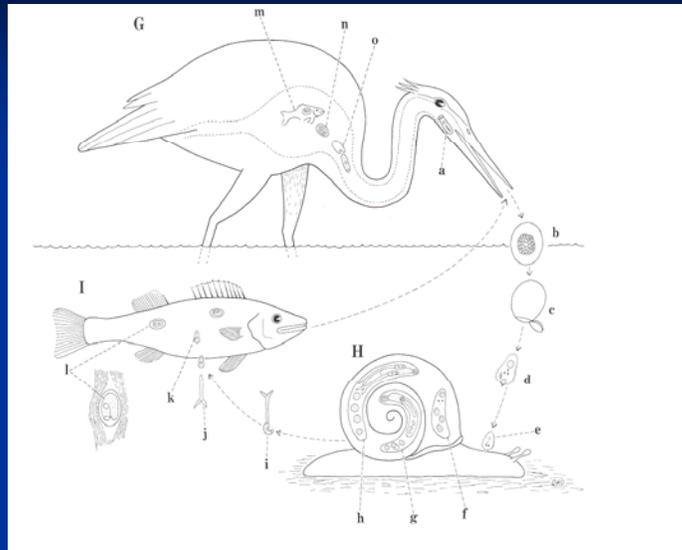
- Caused by metacercariae of a number of species including *Crassiphiala bulboglossa*, *Uvulifer ambloplitis*, *Apophallus* spp., etc.
- Metacercariae appear as small black spots in the skin of numerous fish especially bass, perch, and sunfish



*Posthodiplostomum minimum* – “White Grub”



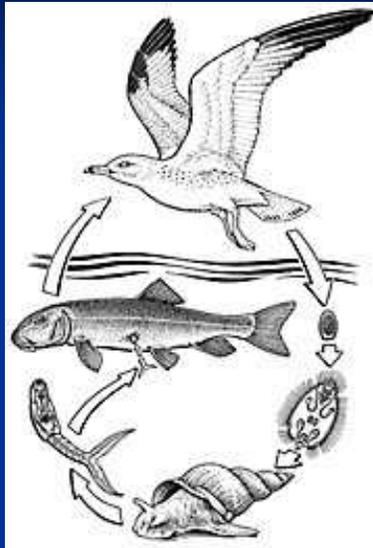
*Clinostomum marginatum* – “Yellow Grub”



*Posthodiplostomum minimum* – Yellow Grub



*Diplostomum spathaceum* – Eye Fluke



## *Bolbophorus confusus*



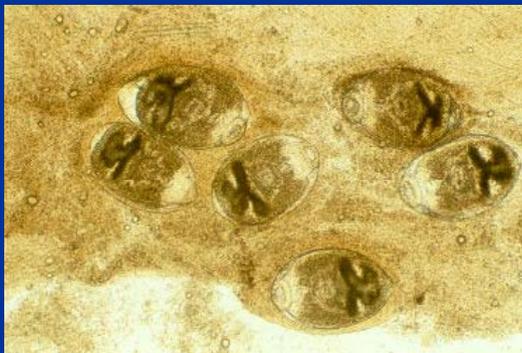
Significant losses to catfish producers

Eggs



## *Centrocestus formosanus* – Gill Trematode

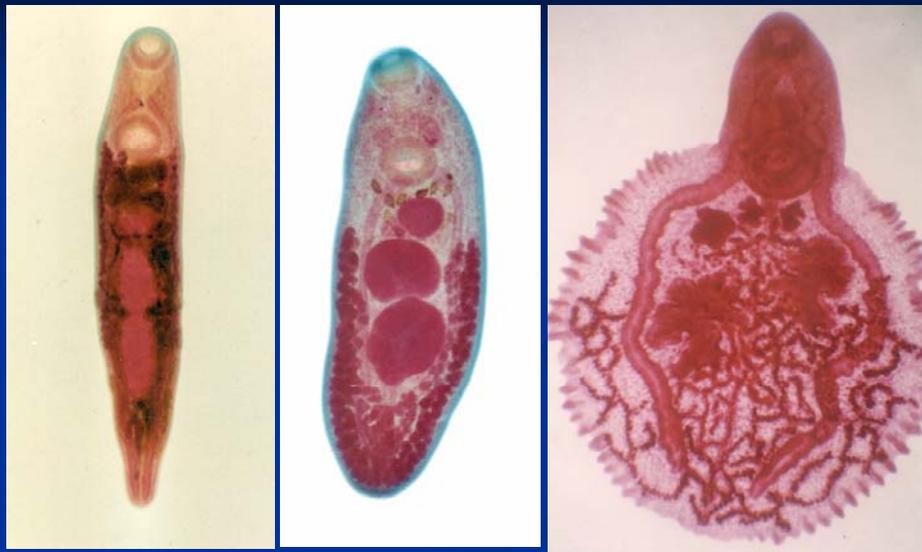
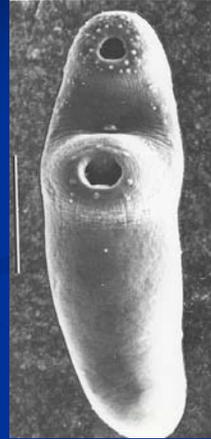
- \*An exotic found in Hawaii, Florida, Texas, & Utah
- \*Intermediate host – invasive snail (*Melanooides tuberculatus*)
- \*Final hosts – green heron & great egret in U.S.
- \*Causes heavy losses among fish raised by tropical fish farmers and may be harmful to wild fish (e.g., endangered fountain darter)



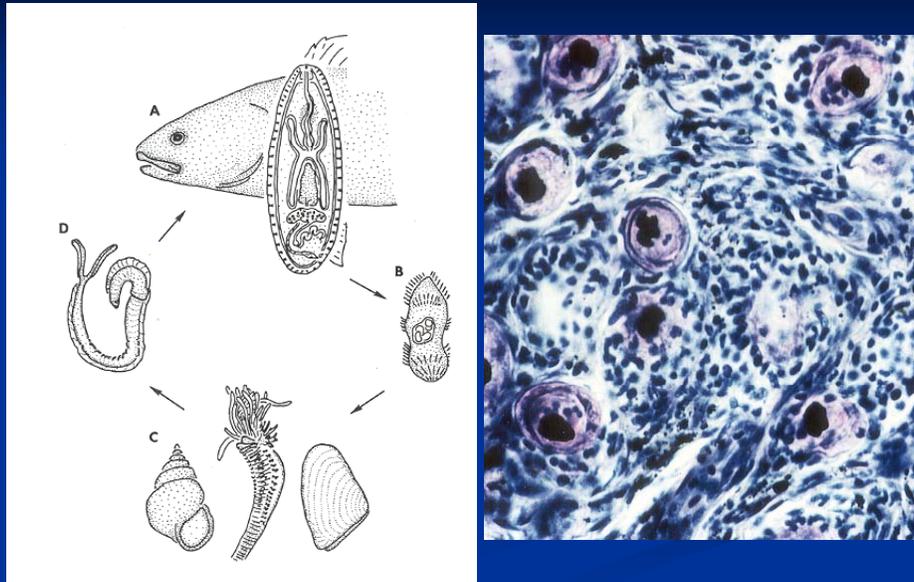
Parasite induces an unusual inflammatory response

## Adult Stages in Fish

- Primarily reside in internal organs, especially intestinal tract, urinary bladder, & blood vessels (e.g., *Sanguinicola*)
- Usually not pathogenic



## *Sanguinicola* - Blood Fluke

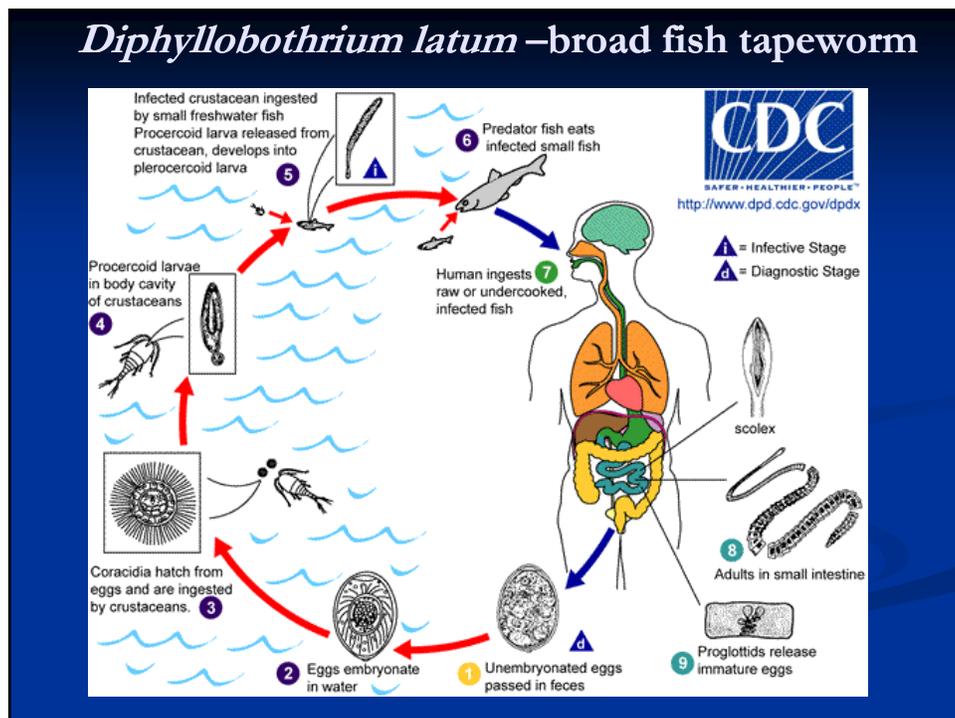


## Cestodes-Tapeworms

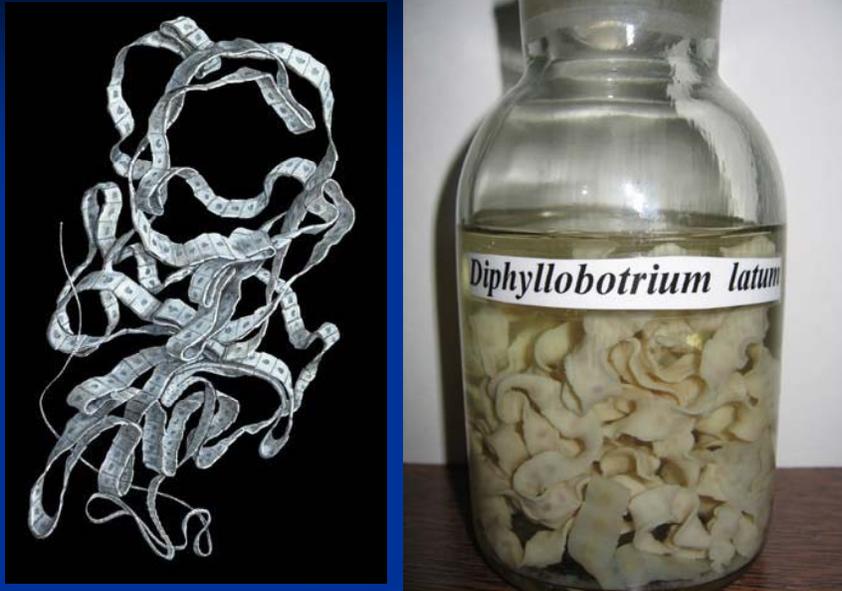
- Body consists of an anterior scolex (head), neck region and series of proglottids (“segments”)
- Scolex may have suckers, spines or grooves to aid in attachment
- Life cycle is complex with multiple hosts (unlike digenes, other invertebrates beside snails, serve as intermediate hosts)
- Adult tapeworms primarily found in intestinal tract, whereas larval stages (metacestodes or plerocercoids) found in the muscle or visera
- Fish can serve as intermediate hosts or final hosts

## Tapeworms that use fish as intermediate host

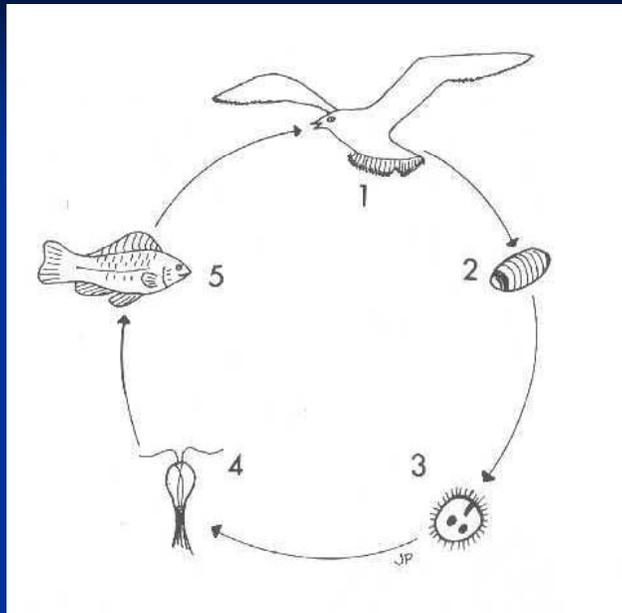
- *Diphyllobothrium latum* – broad fish tapeworm
- *Ligula* spp.
- *Schistocephalus* sp.

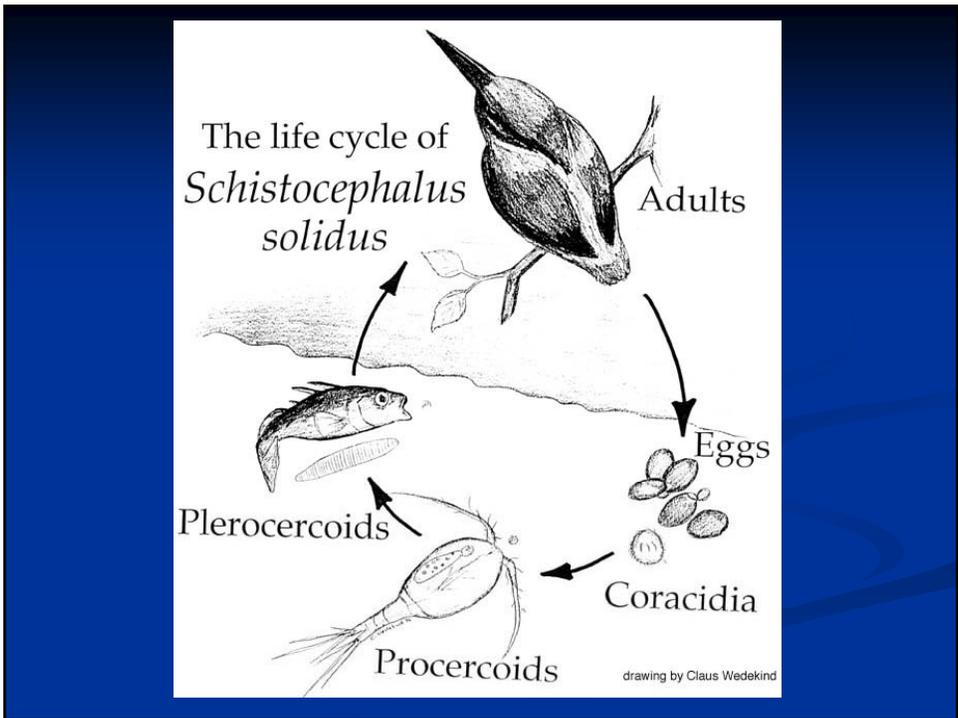


*Diphyllobothrium latum* – broad fish tapeworm



*Ligula intestinalis* – life cycle







*Schistocephalus solidus*

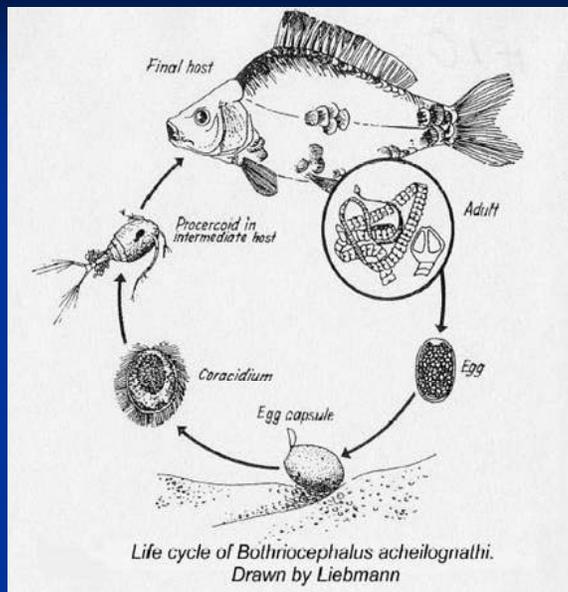


## Tapeworms that use fish as final host (reside in intestinal tract)

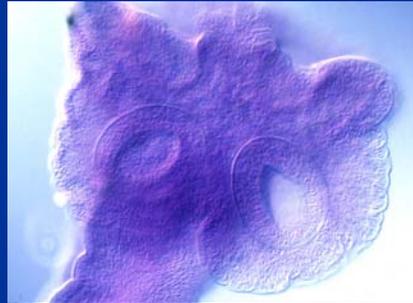
- *Bothriocephalus acheilognathi* – Asian Tapeworm
- *Corallobothrium* spp. – Catfish Tapeworm
- *Proteocephalus ambloplitis* – Bass Tapeworm



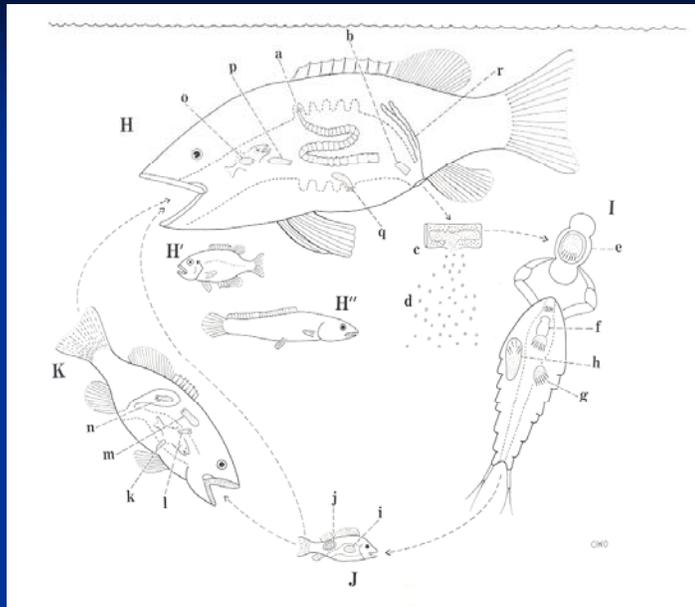
### Life Cycle Asian Tapeworm



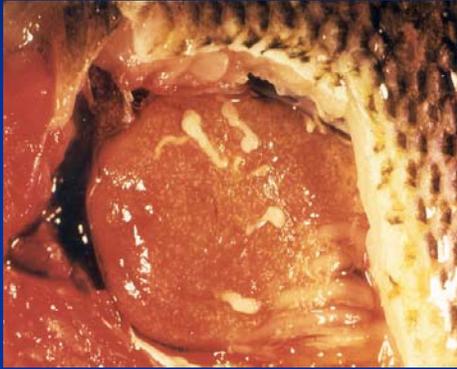
### Catfish Tapeworm



### Bass Tapeworm-Life Cycle



## Bass Tapeworm



Plerocercoids (immature)



Adults (mature)