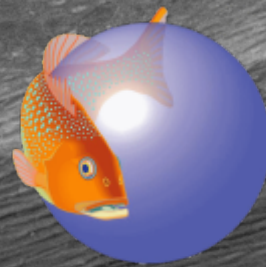
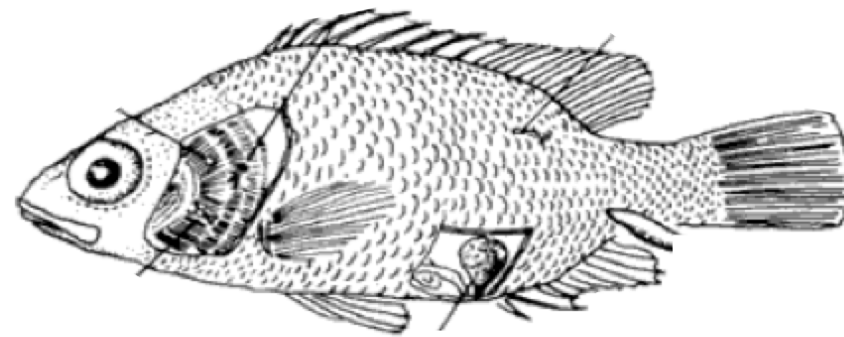
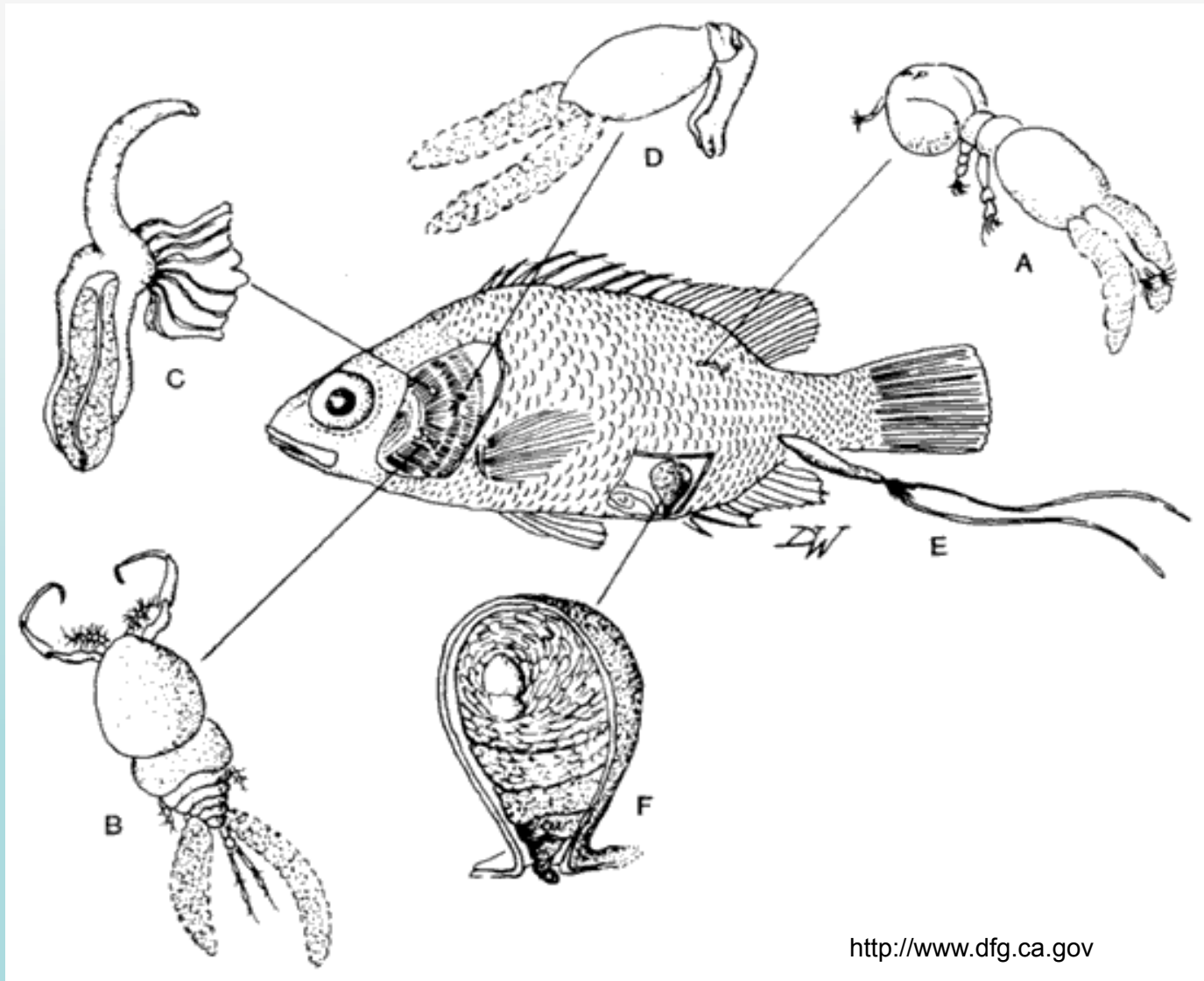


# Parasitology and pathology in FishBase



FishBase





<http://www.dfg.ca.gov>

# PARASITISM

- a non-mutual symbiotic relationship between biologically very different species, where one species, the parasite, benefits at the expense of the other, the host (wiki)
- Greek parásītos: one who eats at another's table  
παρά: besides, next to; σίτος: grain, food
- The host will suffer harm but will not die ( $\neq$  predators)
- The parasite cannot survive without host (obligate)



# Classification

- **By size:** microparasites vs macroparasites
- **By site of infection:** ectoparasites vs endoparasites
- **By transmission cycle:** direct vs indirect cycle

# Classification

## Microparasites

- **Protozoa**
- microscopical
- unicellular
- Multiplication in the host
- Very fast generation time (hours, days)
- Usually acute diseases
- High immune protection

## Macroparasites

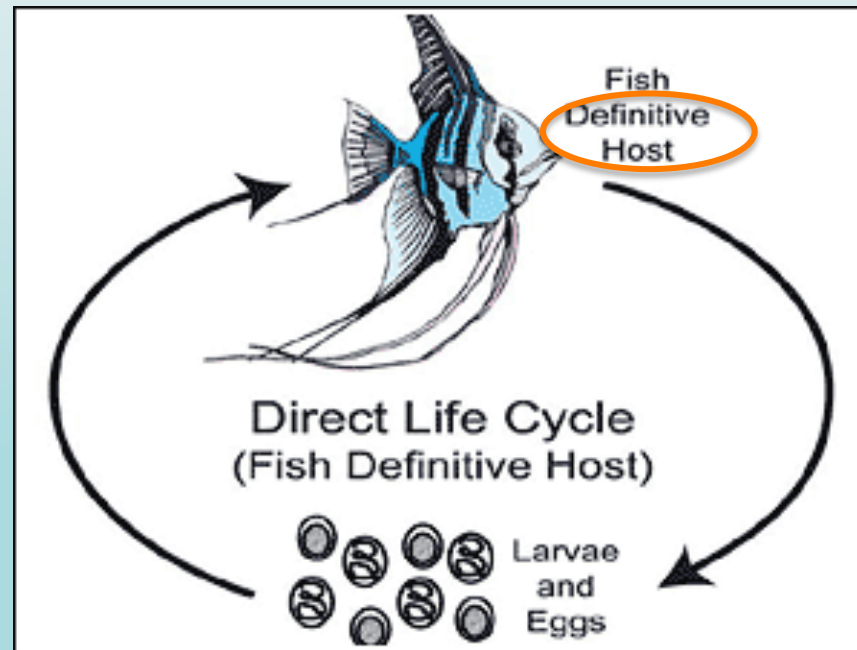
- **Helminths and arthropods.**
- macroscopical
- multicellular
- No or rare multiplication on/in the host
- Long generation time (weeks, months)
- Usually chronic disease in adults and acute in children
- Low immune protection.

# Classification

- **Ectoparasites**: parasites that live on the body surface
- **Endoparasites**: parasites that live in the internal organs or tissues of its host

# Life cycles

- Direct life cycle: 1 host

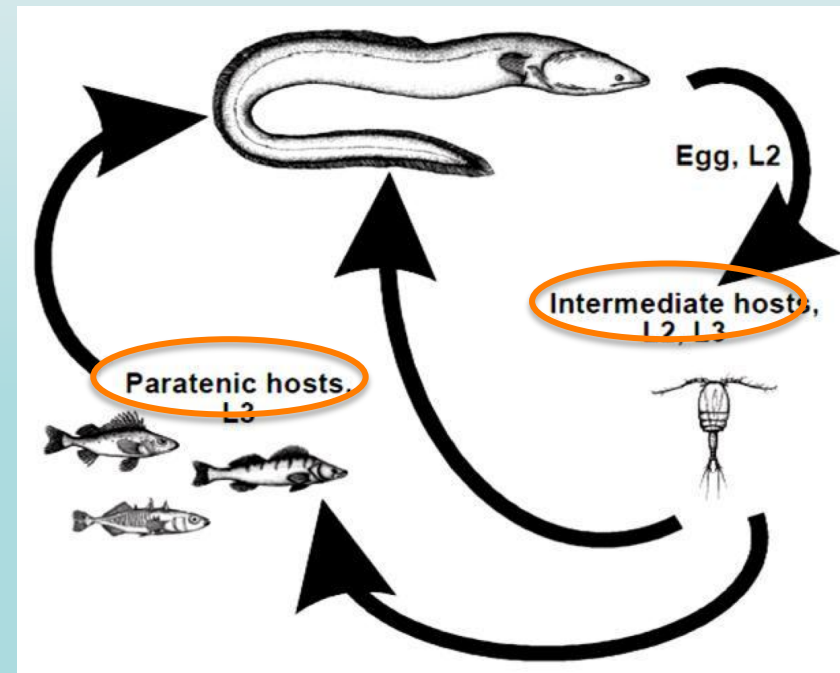


<http://www.simplydiscus.com>



# Life cycles

- Direct life cycle: 1 host
- Indirect life cycle: at least 2 hosts:



# Some definitions

- **Definitive host**: the organism in which a parasite reaches sexual maturity (adult stage)
- **Intermediate host**: the organism in which parasite undergo developmental change but no sexual maturity (larval stages)
- **Vectors**: micropredators that transmit infections between hosts (eg mosquitos)
- **Paratenic or transport host**: not always obligatory, it contains the larval/dormant stage which will not undergo any development or maturation, used as transport

# Some definitions

Host specificity: the number of host species a parasite can exploit successfully

- **Specialist (oioxenous species\*)**: a parasite species infecting a single host species
- **Stenoxeneous species\***: a parasite species infecting a small group of related host species
- **Generalist (euryxenous species\*)**: a parasite species infecting two or more hosts across several clades

\* Euzet & Combes 1980

# Some definitions

- **Prevalence:** number of infected individuals
- **Infection intensity:** number of parasites per infected host
- **Epidemiology:** the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems ([www.who.int](http://www.who.int))
- **Endemic:** disease or condition regularly found among particular people or in a certain area.
- **Epidemic:** a widespread occurrence of an infectious disease in a community at a particular time
- **zoonosis:** diseases and infections that are naturally transmitted between vertebrate animals and humans



# Fish parasites

- **Paperna, I., 1982** Parasites, infections et maladies du poisson en Afrique. CPCA, Doc. Tech., (7) : 202 p.

<http://www.fao.org/docrep/008/ad792f/AD792F00.htm#TOC>

- English:

<https://www.sdstate.edu/sites/default/files/nrm/outreach/pond/upload/Fish-Parasites.pdf>

# Microparasites

1. MALADIE VIRALE: LA LYMPHOCYTOSE
2. MALADIES ASSOCIEES AUX INFECTIONS BACTERIENNES
3. EPITHELIOCYTOSE
4. INFECTIONS FONGIQUES
  - 4.1 Saprolégnioses
  - 4.2 Branchiomycozes
5. INFECTIONS DERMIIQUES ET BRANCHIALES PAR DES PROTOZOAIREs ECTOPARASIT
  - 5.1 Protozoaires divers, à l'exception d'Ichthyophthirius
  - 5.2 Ichthyophthiriase, la maladie des points blancs
6. INFECTIONS DU SANG PAR DES PROTOZOAIREs ENDOPARASITES
7. INFECTIONS DES ORGANES INTERNES PAR DES PROTOZOAIREs ENDOPARASITES
  - 7.1 Protozoaires divers, à l'exception des Sporozoaires
  - 7.2 Sporozoaires: Myxosporidies
  - 7.3 Sporozoaires: Microsporidies

# Macroparasites

## 8. INFECTIONS PAR DES TREMATODES ET PAR DES VERS MONOGENEA

- 8.1 Infections par les métacercaires de Trématodes
- 8.2 Infections dues aux Dactylogyridés Monogenea
- 8.3 Infestations par des Monogenea Gyrodactylidés
- 8.4 Infestations par des Monogenea Polyopisthocotylidés
- 8.5 Infestations par des Trématodes Clinostomatidés
- 8.6 Infestations du poisson par des Trématodes adultes

## 9. INFESTATIONS DU POISSON PAR DES VERS CESTODES

## 10. INFESTATIONS DES POISSON PAR DES VERS NEMATODES

- 10.1 Infestations et lésions par des nématodes larvaires
- 10.2 Les poissons hôtes définitifs de Nématodes

## 11. INFESTATIONS DU POISSON PAR LES ACANTHOCEPHALES, VERS A TETE ARMEE

## 12. INFESTATION DES POISSONS PAR DES ANNELIDES: HIRUDINES

## 13. INFESTATION DU POISSON PAR DES CRUSTACES: ARGULES ET COPEPODES

- 13.1 Infestation par des argules
- 13.2 Infestations par Copépodes Ergasilidés
- 13.3 Parasitisme par des Copépodes Lernéidés
  - 13.3.1 *Lernaea* parasites et genres voisins
  - 13.3.2 *Lamproglena* et *Lamproglenoides* parasites

## 13.4 Notes sur les autres Copépodes parasites signalés sur les poissons en Afrique

## 14. INFESTATIONS DE POISSONS PAR DES CRUSTACES ISOPODES

# Aquaculture & treatment

## 19. PISCICULTURE ET SANTE PUBLIQUE

### 19.1 Problèmes de santé publique associés à la consommation du poisson



## 20. L'UTILISATION DES PRODUITS CHIMIQUES DANS LA PROPHYLAXIE ET LA THERAPIE DES INFECTIONS ET DES MALADIES PISCIARES

### 20.1 Méthodes d'application des produits chimiques thérapeutiques

#### 20.1.1 Traitement externe du poisson

#### 20.1.2 Traitement interne du poisson

### 20.2 Risques et limites des agents chimiques en pisciculture

### 20.3 Effet des produits chimiques sur l'environnement

### 20.4 Toxicité des produits chimiques pour le poisson et effets secondaires

### 20.5 Problèmes d'application et de manipulation des agents chimiques



# Bacterial infections

Especies touchees: Toutes les espèces de poissons sont potentiellement sensibles

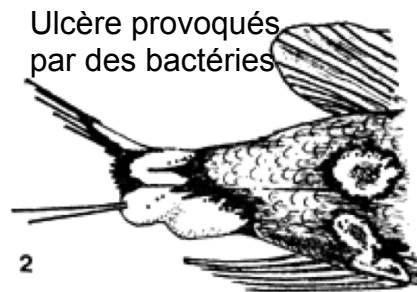
Signes externes: hémorragies dispersées sur la peau; ulcères et nécroses sur la peau, pertes d'écaillles

Cause: Des bactéries gram-négatives rustiques, du genre *Aeromonas* *Pseudomonas* et dans les eaux saumâtres, *Vibrio*, sont les agents étiologiques les plus fréquents

Diagnose: Un problème critique dans l'identification correcte et de la détermination de leur rôle comme parasites primaires ou secondaires



Hydropisie (ascite) chez la carpe commune



Ulcère provoqués par des bactéries



Pourriture des branchies provoquée par des myxobactéries

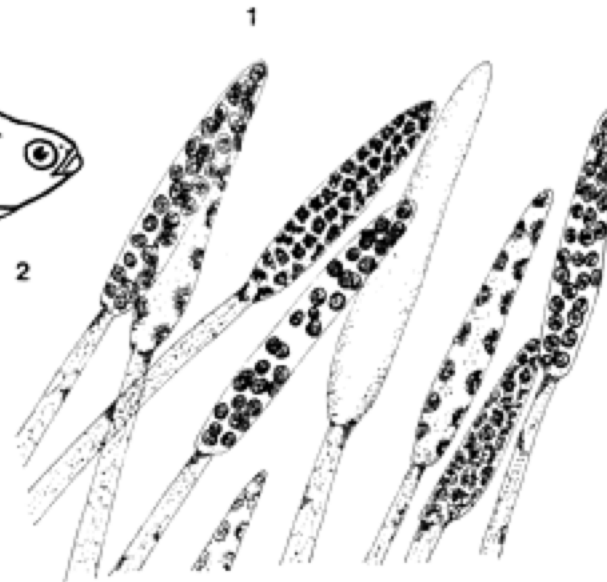
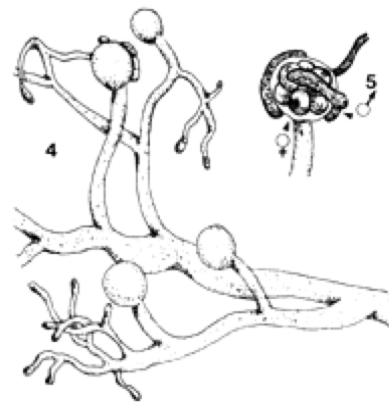
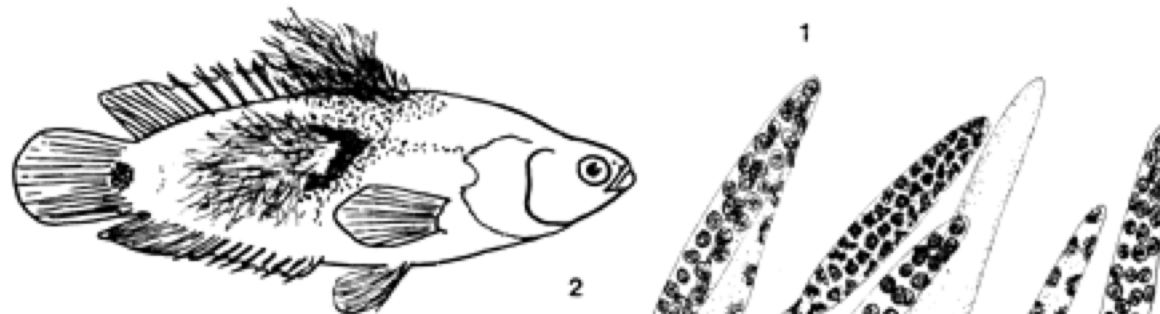
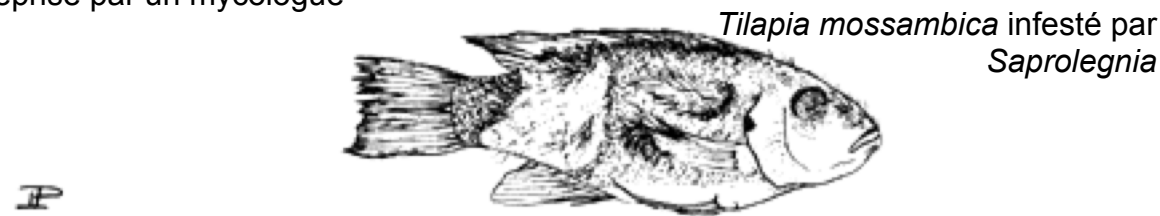
# Fungal infections

Especies touchees: Toutes les espèces de poissons d'eau douce peuvent potentiellement être affectées

Singes: Lésions isolées ou généralisées de la peau, couvertes d'amas cotonneux constitués par une masse (mycelium) de filaments fongiques (hyphes)

Cause: Infection par des champignons, les membres du genre *Saprolegnia* sont les plus communs

Daignose: difficile, doit être entreprise par un mycologue



# Skin and gill infections by ectoparasitic protozoa

Espèces touchées: Ubiquistes, les infections touchent particulièrement les alevins

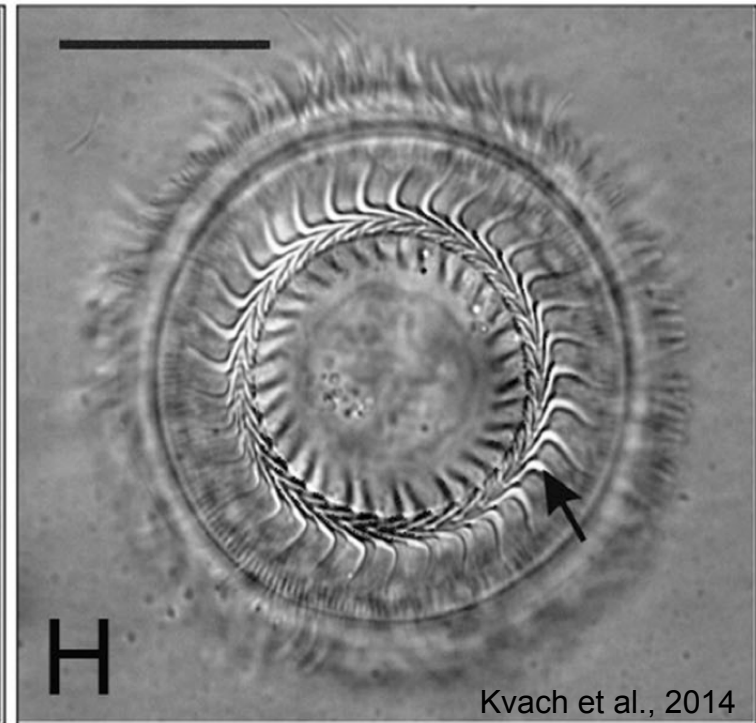
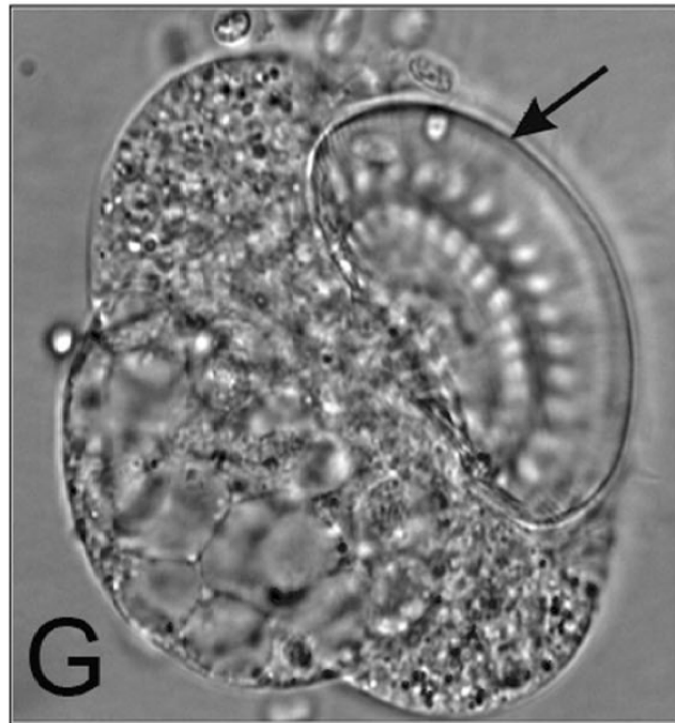
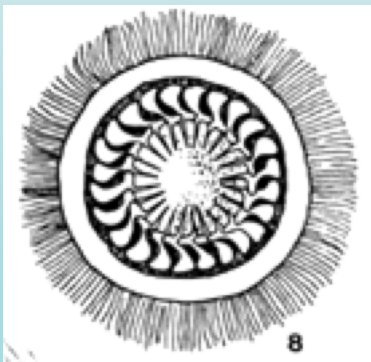
Signes externes: Changements sur la peau, coloration anormale, érosion de l'épithélium branchial

Cause: flagellés ectoparasites des genres *Costia* etc, Ciliés des genres *Trichodina*, *Epistilis*, *Glossatella*, etc

Diagnose: Le poisson doit être examiné frais, pour *Trichodina* - en forme de coupe

## *Trichodina*

(40 µm)



*Trichodina* peut causer de sérieuses pertes sur des alevins de poissons chats ou carpes

# Blood infections by endoparasitic protozoa

Espèces touchées: Cichlidés, nombreux genres de Siluridés, Cyprinidés, Mormyridés, Ophiocéphalidés, Mugilidés

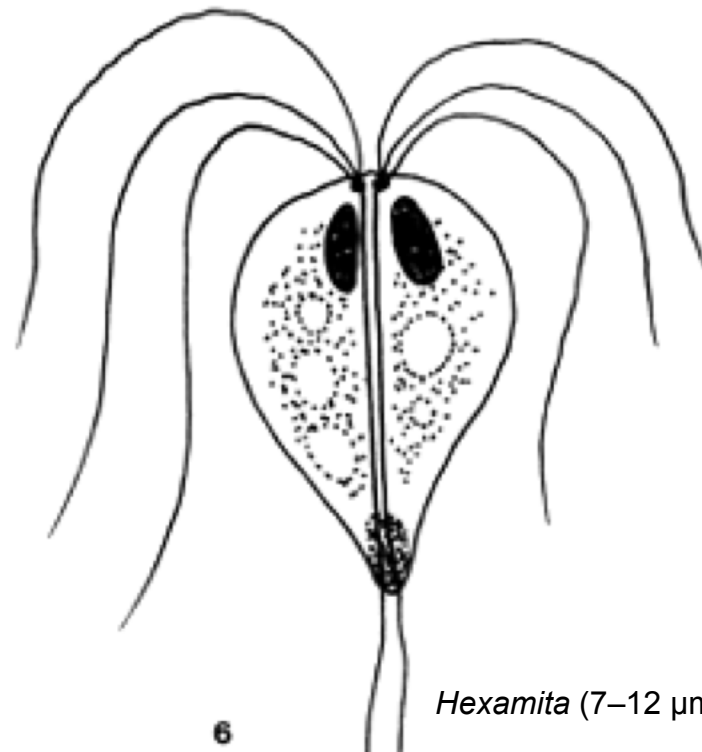
Signes: aucun, les infections par hémogrégarines sont associées à des proliférations lymphomatiques

Causes: Protozoaires parasites dans le sang: les flagellés *Trypanosoma* et *Cryptobia* (Trypanosomidés) les sporozoaires *Dactylosoma* (syn. *Babesiosoma*)

Diagnose: détection dans des préparations sanguines sur des lames colorées au Giemsa



1  
*Trypanosoma* (25–50  $\mu\text{m}$ )



6  
*Hexamita* (7–12  $\mu\text{m}$ )

# Endoparasitic protozoa

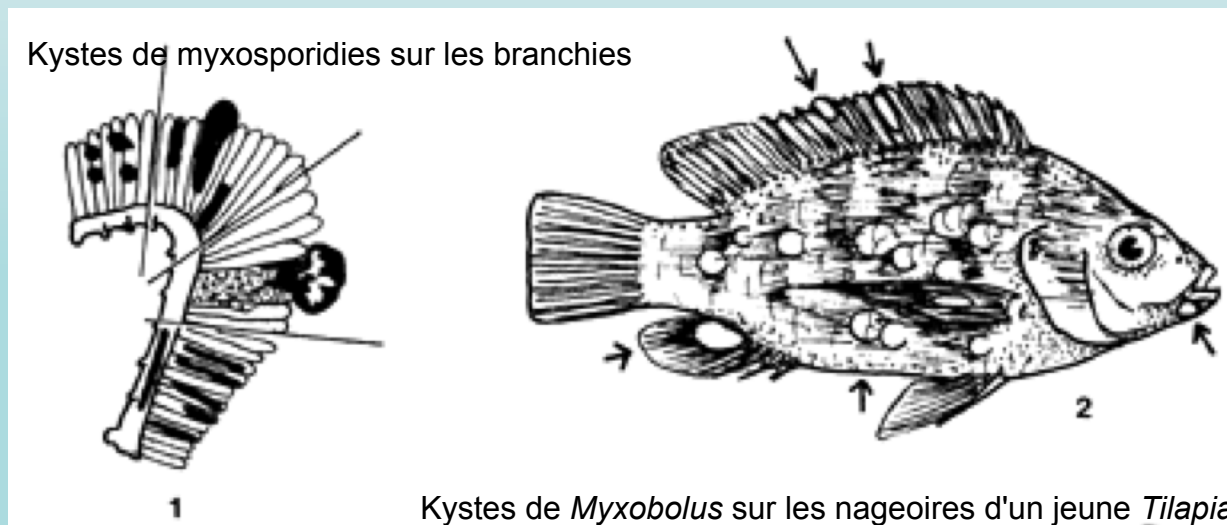
## Myxosporidia

Espèces touchées: très communs chez les Cichlidés, les Cyprinidés et les Mugilidés des eaux saumâtres.

Signes: kystes sur la peau, dans le derme et l'hypoderme, dans les muscles, sur les branchies

Cause: *Myxobolus*, *Henneguya* et *Thelohanellus*

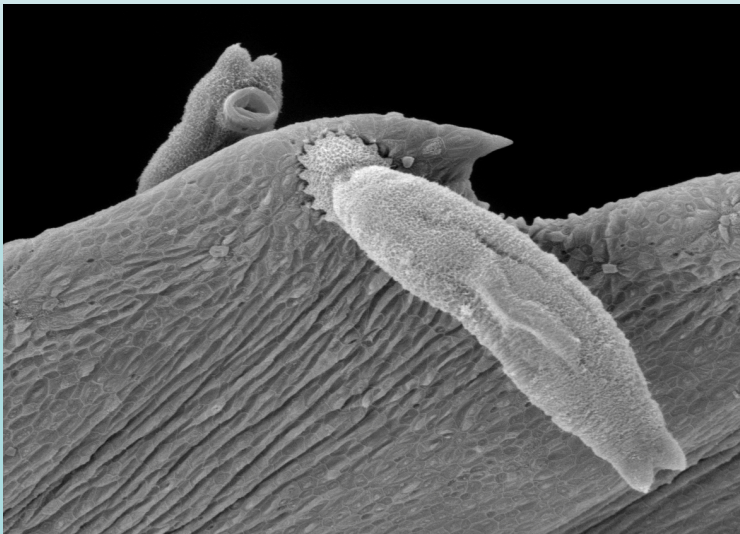
Diagnostic: examen de leur contenu au microscope





# Helminths

Distinction between Platyhelminths (flatworms, which include cestodes and trematodes) and the Nematelminthes (nematodes).



*Gyrodactylus ostendicus* Huyse & Malmberg  
2004

*Pseudoterranova decipiens* Krabbe, 1878  
<http://www.biodiversidadvirtual.org>

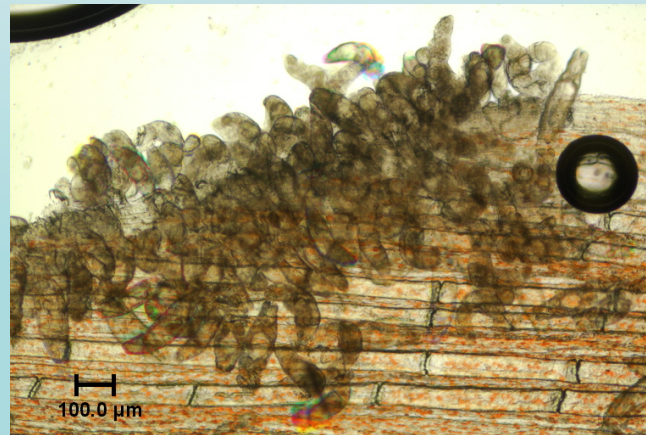
# Monogenean ectoparasites

Especies touchees: la plupart des familles des poissons africains

Signes externes: branchies infectées parfois pâles ou recouvertes de lambeaux de tissu blanchâtre, parfois mortalités massives, parfois sans effet pathogène apparent

Cause: petits vers accrochés aux branchies (de 0,2 à 1,5 mm de longueur): *Dactylogyrus*, *Gyrodactylus*, *Enterogyrus*, *Cichlidogyrus*

Diagnose: immédiatement après que l'on ait tué le poisson, analyse microscopique



*Gyrodactylus ostendicus* dans gobiidae



*Cichlidogyrus arthracanthus* Paperna, 1960  
dans *Tilapia zillii* (400 µm)



# Nématodes

- Infestations and lesions by larval nematodes (intermediate host)

Espèces touchées: Potentiellement toutes les espèces de poissons d'eau douce et saumâtre, les infections les plus graves touchant les poissons prédateurs

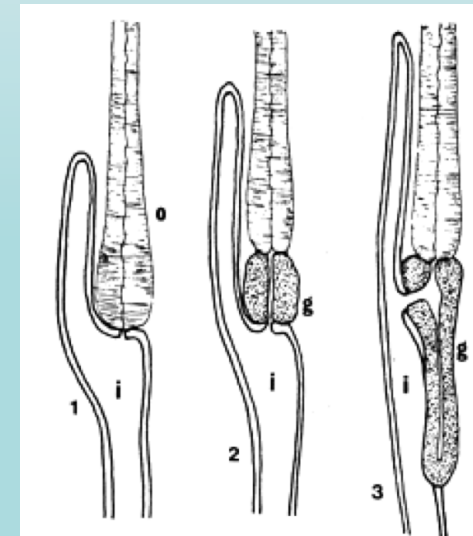
Signes: Capsules de tailles variables dans les tissus, nécroses dans le derme, l'hypoderme et les viscères; gonades déformées ou atrophiées. Des vers ronds, rouges ou blancs dans les capsules et dans les lésions

Cause: Infestation par des nématodes larvaires, plus communément des genres *Contracaecum* et *Ampliccaecum* (Hétérochéilidés) et du genre *Eustrongylidés* (Dioctophymidés).

Diagnose: L'identification des larves de nématodes au niveau des espèces, est très difficile



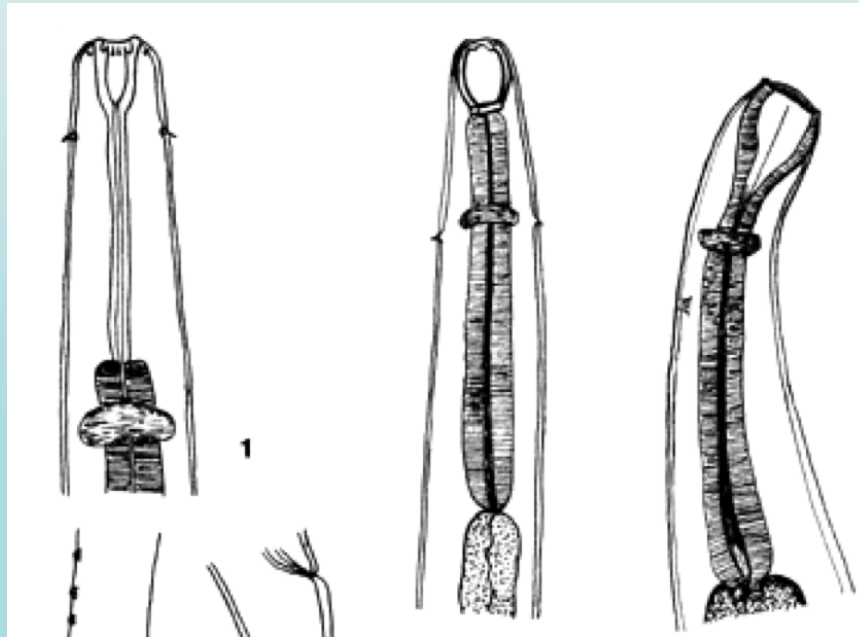
Prolifération de nématodes larvaires dans l'estomac d'un *Bagrus docmac*



1. *Ampliccaecum* 2. *Porrocaecum* 3. *Contracaecum*

# Nematodes

- Infection by adult nematodes (in definitive fish host): 40 species belonging to 18 genera that represent 9 families



*Rhabdochona congolensis*; *Procamallanus laevionchus*; *Cucullanus barbi*

# Zoonotic helminths

	Freshwater fish	Marine fish
<b>Cestodes</b>	Diphyllobothrium spp	Diphyllobothrium spp
<b>Nematodes</b>	Gnathostoma spp Capillaria philippinensis	Anisakis simplex Pseudoterranova decepiens Eustrongyloides spp
<b>Trematodes (flukes)</b>	Clonorchis sinensis Opistorchis spp Heterophyidae spp Echinostomatidae spp	

Very different clinical picture: from asymptomatic infection to hemorrhagic complications and deadly tumors. Prevention by cooking or freezing before consumption (*Helminthiases humaines transmises par les poissons*. Chappuis & Loutan, Revue Médicale Suisse 2006)

# PATHOLOGY

- Fish diseases are a major concern in intensive aquaculture, commercial aquaristics, and in polluted water bodies.
- This table reports all reported pathologies for each species
- For each pathology the following data are available: name of disease, country and locality, date, prevalence, infection intensity, mortality rates, photographs, ...



**Lernaeocera infection (copepods), *Gadus morhua* L.**



© Möller & Anders (1989)

**'Cauliflower disease' (papillimavirus)  
*Anguilla anguilla* L.**



© G. Basseleer

**Infection *Uronema* (algae)**

### List of diseases for *Clarias gariepinus*

Show all disease photos for this species

Africa: almost Pan-Africa, absent from Maghreb, the upper and lower Guinea and Nigal province. Asia: Jordan, Israel, Lebanon, Syria and southern Turkey. W Europe and Asia. Several countries report adverse ecological impact after intro



[Trichodinosis, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Piscicola Infestation \(Piscicola sp.\), Parasitic infestations \(protozoa, worms, etc.\)](#)

[Sanguinicola Disease, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Fish Louse Infestation 2, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Procamallanus Infection 14, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Dolops Infestation, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Chilodonella Infection, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Henneguya Infection 4, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Gyrodactylus Infestation 5, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Phyllodistomum Infestation 8, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Neodactylogyrus Infestation 2, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Astiotrema Infestation, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Quadriacanthus Infestation, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Polyonchobothrium Infestation 2, Parasitic infestations \(protozoa, worms, etc.\)](#)

[Macrogyrodactylus Infestation 1, Parasitic infestations \(protozoa, worms, etc.\)](#)



### *Clarias gariepinus* maladies

<b>MainRef:</b>	Paperna, I. 1996			
<b>Nom de la maladie:</b>	Chilodonella infection Les infestations parasitaires (de protozoaires, vers, etc)			
<b>Pays:</b>		<b>Année:</b>		
<b>Localité:</b>	République centrafricaine			
<b>Les maladies sont produites en:</b>	<input type="radio"/> œufs	<input type="radio"/> frire	<input type="radio"/> femmes	<input type="radio"/> dans la nature
	<input type="radio"/> larves	<input type="radio"/> mineurs	<input type="radio"/> les hommes	<input type="radio"/> en culture
<b>Prévalence:</b>				
<b>Intensité:</b>	haut		<b>Mortalité:</b>	catastrophique (plus de 80%)
<b>Type de culture:</b>			<b>Température de l'eau.:</b>	
<b>Remarques:</b>	Infestation se produit généralement dans la peau et les branchies.			

[Plus d'informations sur la maladie](#)

### *Clarias gariepinus* maladies

<b>MainRef:</b>	Paperna, I. 1996			
<b>Nom de la maladie:</b>	Infestations parasitaires gyrodactylus Infestation 5 (protozoaires, vers, etc)			
<b>Pays:</b>	Nigeria	<b>Année:</b>		
<b>Localité:</b>	non spécifié (écloserie au Nigeria)			
<b>Les maladies sont produites en:</b>	<input type="radio"/> œufs	<input type="radio"/> frire	<input type="radio"/> femmes	<input type="radio"/> dans la nature
	<input type="radio"/> larves	<input type="radio"/> mineurs	<input type="radio"/> les hommes	<input type="radio"/> en culture
<b>Prévalence:</b>				
<b>Intensité:</b>			<b>Mortalité:</b>	catastrophique (plus de 80%)
<b>Type de culture:</b>			<b>Température de l'eau.:</b>	
<b>Remarques:</b>	Infection atteint jusqu'à 90% de mortalité (Obiekezie et Taege, 1964).			

[Plus d'informations sur la maladie](#)

## Plus d'informations sur *Gyrodactylus Infestation 5*

<b>Principales Ref:</b>	45600	
<b>type de maladie:</b>	Les infestations parasitaires (de protozoaires vers, etc)	
<b>Nom de la maladie:</b>	Gyrodactylus Infestation 5	
<b>Autres noms:</b>		
<b>Caus. l'agent:</b>	Gyrodactylus groschafti	
<b>Groupe:</b>		
<b>Une partie du corps et / ou le comportement affecté par la maladie:</b>		
<input type="radio"/> Skins et / ou ailettes	<input type="radio"/> Ventre	<input type="radio"/> comportement de piscine
<input type="radio"/> Branchies	<input type="radio"/> Anus	<input type="radio"/> Autre comportement
<input type="radio"/> Yeux	<input type="radio"/> Viscères Affligés	<input type="radio"/> D'autres symptômes
<b>Poissons affecté:</b>		
<b>Symptômes:</b>	Les symptômes comprennent la coloration pâle du poisson hôte due à une production excessive de mucus, l'érosion de la peau, perte d'écaillés, et des lésions hémorragiques focaux.	
<b>Traitements:</b>		
<b>Prophylaxie:</b>		
<b>Remarques:</b>		
<b><u>La mortalité et la saisonnalité</u></b>		
<b>Mortalité:</b>		
<b>Saisonnalité:</b>		



## *Oreochromis niloticus* maladies

<b>MainRef:</b>	<b>Nguenga, D. 1988</b>			
<b>Nom de la maladie:</b>	<b>Infestations Dactylogyrus Gill douves maladies parasitaires (protozoaires, vers, etc) infestations Dactylogyrus Gill douves maladies parasitaires (protozoaires, vers, etc)</b>			
<b>Pays:</b>		<b>Année:</b>		
<b>Localité:</b>	à pourvoir			
<b>Les maladies sont produites en:</b>	<input type="radio"/> œufs	<input type="radio"/> frire	<input type="radio"/> femmes	<input type="radio"/> dans la nature
	<input type="radio"/> larves	<input type="radio"/> mineurs	<input type="radio"/> les hommes	<input type="radio"/> en culture
<b>Prévalence:</b>	commun			
<b>Intensité:</b>	faible		<b>Mortalité:</b>	
<b>Type de culture:</b>			<b>Température de l'eau.:</b>	
<b>Remarques:</b>				

**Plus d'informations sur la maladie**



## More information on *Dactylogyrus* Gill Flukes Disease

<b>Main Ref:</b>	60	
<b>Disease type:</b>	Parasitic infestations (protozoa, worms, etc.)	
<b>Disease name:</b>	Dactylogyrus Gill Flukes Disease	
<b>Other names:</b>	Helminthose (gills)	
<b>Caus. agent:</b>	Dactylogyrus sp.	
<b>Group:</b>		
<b>Part of body and/or behavior affected by disease:</b>		
<input type="radio"/> Skins and/or fins	<input type="radio"/> Belly	<input type="radio"/> Swimming behavior
<input type="radio"/> Gills	<input type="radio"/> Anus	<input type="radio"/> Other behavior
<input type="radio"/> Eyes	<input type="radio"/> Viscera Afflicted	<input type="radio"/> Other symptoms
<b>Fish affected:</b>	Different species.	
<b>Symptoms:</b>	Gills swollen and pale, high mucus secretion, spreaded opercula, restless, near inflow, gasping air, heavy ventilation, dark color, loss of weight, cease to feed, swimming with high speed, jumping out of water, scraping against objects. Can cause epithelial outgrowths and tissue swelling on gills. Serious epizootics and mortality (Grabda 1991).	
<b>Treatments:</b>	Masoten bath 25 to 30 g/l for 5 to 10 min. Quinine hydrochloride 30 ppm bath for several days reduced <i>Dactylogyrus</i> on <i>Ctenopharyngodon idella</i> (Edwards and Hine 1974). Masoten bath 25 to 30 g/l for 5 to 10 min. Quinine hydrochloride 30 ppm bath. Can also be treated with Trichlorfon (Dose: 0.25 –3.0 mg/1 liter water for 3 days. The dosage depends on the hardness of the water, the harder the water the more trichlorfon can be used. A 35% water change is recommended after treatment or carbon filter can be used.) and combined with an anti-bacterial drug. FMC ( 1 liter of Formaldehyde (37%) (or 100 ml) 3.7 gm of Malachite Green oxalate (or 0.37 gm) 3.7 gm of Methylene Blue (or 0.37 gm) Dose: 1.0-1.2 ml/100 l tank water or 25 drops/100 l or 1 drop/gallon) can also have good result. When the parasite is resistant to Trichlorfon, Flubendazole (Dose: 100-200 mg/100L for 1-2 days, 50% waterchange should be made), Mebendazole (Dose: 100-200 mg/100L for 2-3 days, afterwards water change should be made. Note: should be dissolved in some alcohol), Levamisole(Dose: 100mg/100L for 1-2 days.), Praziquantel (Dose:300-500 mg/100L for 1-3 days or 150 mg/10L for 2-3 hours), or salt (NaCl) (Dose: 5-10mg/liter aquarium water; 10gm/l for1-2 hours or 5gm/l for 5-7 days). Ref. 41805.	
<b>Prophylaxis:</b>	Appropriate diet, disinfection before stocking (CaO), quarantine.	
<b>Remarks:</b>	The hook of the gillflukes cause severe damage to the gill tissue, this causes the gill cells to be stimulated to produce more mucus than usual. Ref. 41805.	

## *Oreochromis niloticus* Diseases

<b>MainRef:</b>	Paperna, I. 1996			
<b>Disease name:</b>	Contracecum Disease (larvae) Parasitic infestations (protozoa, worms, etc.)			
<b>Country:</b>	Kenya	<b>Year:</b>		
<b>Locality:</b>	Lake Baringo and Lake George			
<b>Diseases occurred in:</b>	<input type="radio"/> eggs	<input type="radio"/> fry	<input type="radio"/> females	<input type="radio"/> in the wild
	<input type="radio"/> larvae	<input type="radio"/> juveniles	<input type="radio"/> males	<input type="radio"/> in culture
<b>Prevalence:</b>	very common			
<b>Intensity:</b>	low	<b>Mortality:</b>		
<b>Type of culture:</b>		<b>Water temp.:</b>		
<b>Remarks:</b>	Prevalence of the infection is 70% with an intensity of 5 worms per fish (Lake Baringo). Also in Lake George, prevalence reached 30% with an intensity of 1 worms per fish.			

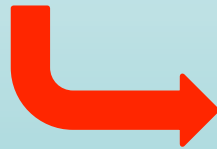
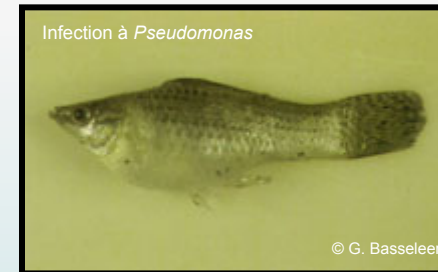
[More information about the disease](#)

- FishBase can help to diagnose (common) fish diseases

## Page de recherche

### Outils

- |  |  |   |  |
|--|--|---|--|
| <input type="radio"/> Identification                               | <input type="radio"/> Comparaison de noms                | <input type="radio"/> Niv. Troph. CSISAPA           | <input type="radio"/> Collections de poissons                  |
| <input type="radio"/> Clés d'identification                        | <input checked="" type="radio"/> Diagnostic pathologique | <input type="radio"/> Aquaculture FAO               | <input type="radio"/> Historique de collecte                   |
| <input type="radio"/> Identification                               | <input type="radio"/> Ma Page Poisson                    | <input type="radio"/> Prises FAO                    | <input type="radio"/> Pyramides trophiques                     |
| <input type="radio"/> Introductions défavorables                   | <input type="radio"/> Outil de dynamique de population   | <input type="radio"/> Analyses des captures         | <input type="radio"/> Paramètres Ecopath                       |
| <input type="radio"/> Introductions mondiales                      | <input type="radio"/> Analyse des fréquences de longueur | <input type="radio"/> Captures CIES                 | <input type="radio"/> AquaMaps                                 |
| <input type="radio"/> Espèces invasives                            | <input type="radio"/> Informations manquantes            | <input type="radio"/>                               | <input type="radio"/> Nouvelle(s) espèce(s) in FishBase        |
| <input type="radio"/> Espèces par écosystèmes                      | <input type="radio"/> Sea Around Us                      | <input type="radio"/> Classification List           | <input type="radio"/> Nouvelle(s) espèce(s) in Welt der Fische |
| <input type="radio"/> Graphiques                                   | <input type="radio"/> FishBase pour les Amériques        | <input type="radio"/> Classification Tree           | <input type="radio"/> Nouvelle(s) Photo(s)                     |
| <input type="radio"/> Produits de la mer                           | <input type="radio"/> FishBase pour l'Afrique            | <input type="radio"/> Statistiques sur les poissons | <input type="radio"/> Stats web                                |
| <input type="radio"/> Shifting Baselines WP2 - Online Toolset      | <input type="radio"/> FishBase for the Red Sea           | <input type="radio"/> Enregistrements mondiaux      | <input type="radio"/> Top 100                                  |
| <input type="radio"/> Preferred algae/plants of herbivorous fishes | <input type="radio"/> FishBase for HighARCS              | <input type="radio"/> Codes pays                    | <input type="radio"/> Coastal Transects Analysis Model (CTAM)  |
|  |  | <input type="radio"/> Catalogue of Life             | <input type="radio"/> Editor messages                          |



**Disease Diagnosis Wizard**

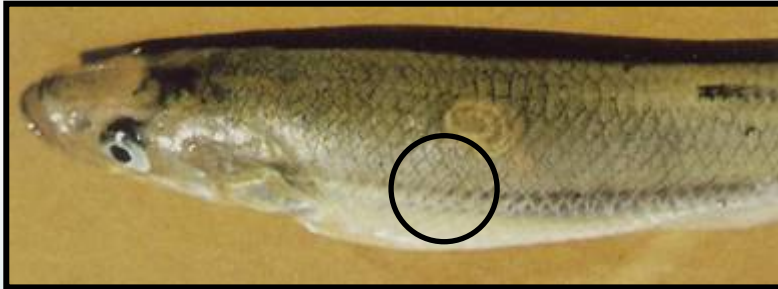
**Step 1**

"This Wizard will help you to diagnose common fish diseases using external symptoms. Note that we cannot guarantee the accuracy of such diagnosis nor will we be liable for any damage arising from the use of this tool."

What part of the body or what behavior is affected by the disease?  
Please click respective radio button.

<input type="radio"/> Skin and/or fins	<input type="radio"/> Belly	<input type="radio"/> Swimming
<input type="radio"/> Gills	<input type="radio"/> Anus	<input type="radio"/> Other behavior
<input type="radio"/> Eyes	<input type="radio"/> Viscera	<input type="radio"/> Other symptoms

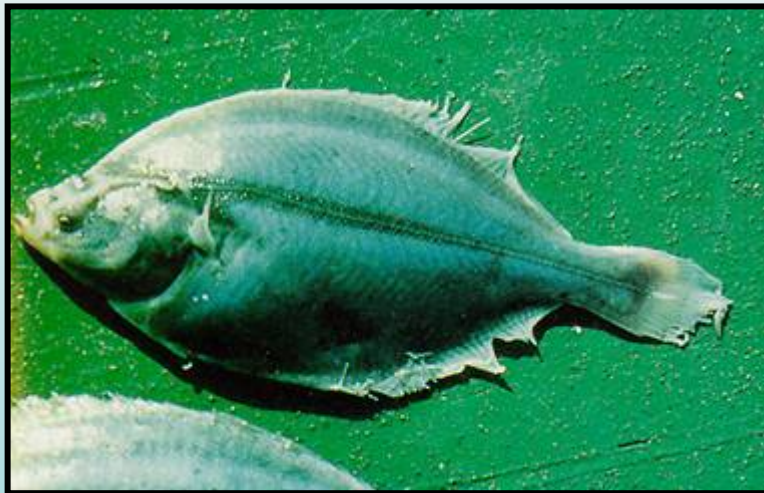




*Nematode infection*



*Secondary fungal infection*



*Syndrome de blanchir*



« trou-dans-la-tête »



*Vibriosis* (bacterial disease, eg cholera)



« Pop-eye »



*Glugea microsporidians*  
(unicellular fungi)

# Aquaculture and parasites

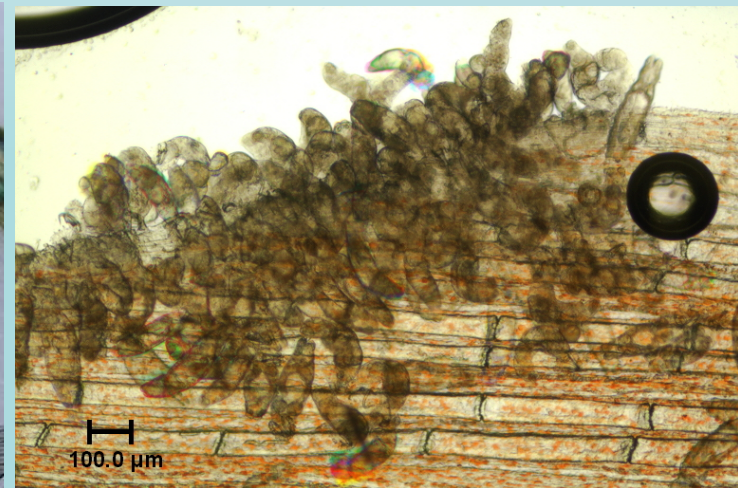
- Artificial high densities, suboptimal rearing conditions & frequent handling: stress!
  - Immunosuppressed, more vulnerable to disease
- Artificial high densities: enhanced pathogen transmission
- Floating sea cages: parasites from wild fish populations
- Transfer of stocks, sourced from wild populations (glass eels)





# Aquaculture and parasites: impact

- Reduced growth
- Moderate to high mortalities
- Parasite resistance to treatment
- Persistent infections: destroy entire stock
- Risk of zoonotic infections: *E. coli*, *Vibrio cholerae*, and *Vibrio vulnificus* infective to man





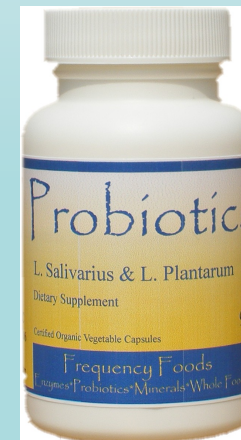
# Aquaculture and parasites: prevention!

- Avoiding exposure (no contaminated feed, quarantine)
- Protection through segregation (young fish weak immunity)
- Selective breeding (resistance, tolerance of stressors)
- Frequent monitoring (water quality, screening fish)
  - early diagnosis (reliable parasite detection methods)



# Aquaculture and parasites: treatment

- Only few drugs are approved
- Gill flukes: formalin, praziquantel bath treatment
- Fin flukes: mebendazole, trichlorfon, salt bath treatment
- *Pseudodactylogyrus* eggs in filters which can't be treated
- Use of pre- and probiotics to increase resistance



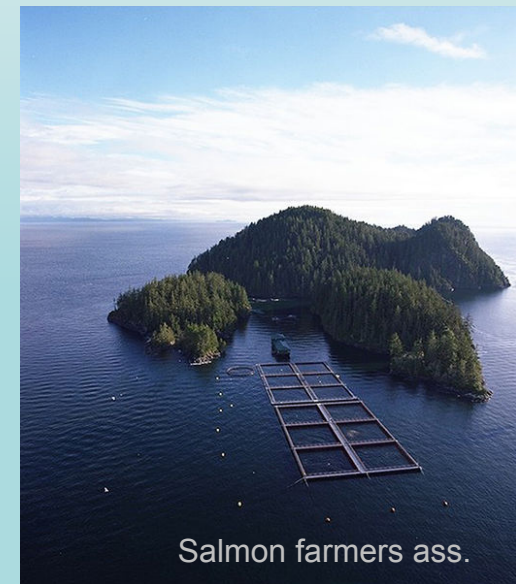
# Treatment

**Table 1.** Chemical treatments for the control of external ciliates. "X" indicates that the chemical should not be used for this type of treatment.

Chemical	Dip	Short-term Bath	Prolonged (indefinite) Immersion
Copper sulfate	X	X	total alkalinity/100 (up to 2.5 mg/L), Do not use if total alkalinity < 50mg/L
Potassium permanganate	X	10 mg/L, 30 min	2 mg/L
Formalin	X	150--250 mg/L, 30 min	15--25 mg/L (2 drops/gallon or 1 mL/10 gallons)
Salt	3%, Duration is species dependent.	1%, 30 min to 1 hr, species dependent	0.02--0.2%

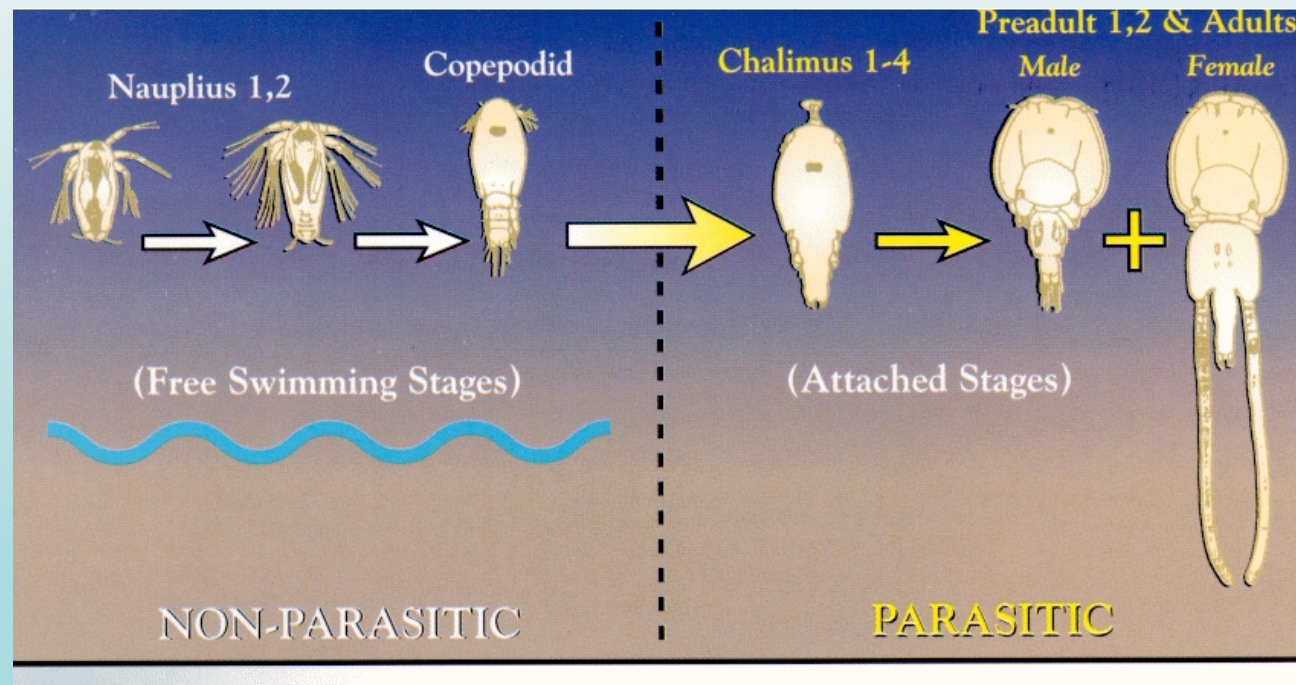
# Invasive parasites: sea lice

- Floating sea cages: high fish densities → disease development
- Free movement of pathogens between farmed & wild fish
- Migrating juvenile salmon become infected
- Carrier of other diseases between farmed and wild salmon
- Most pathogenic; cost €300 million/year





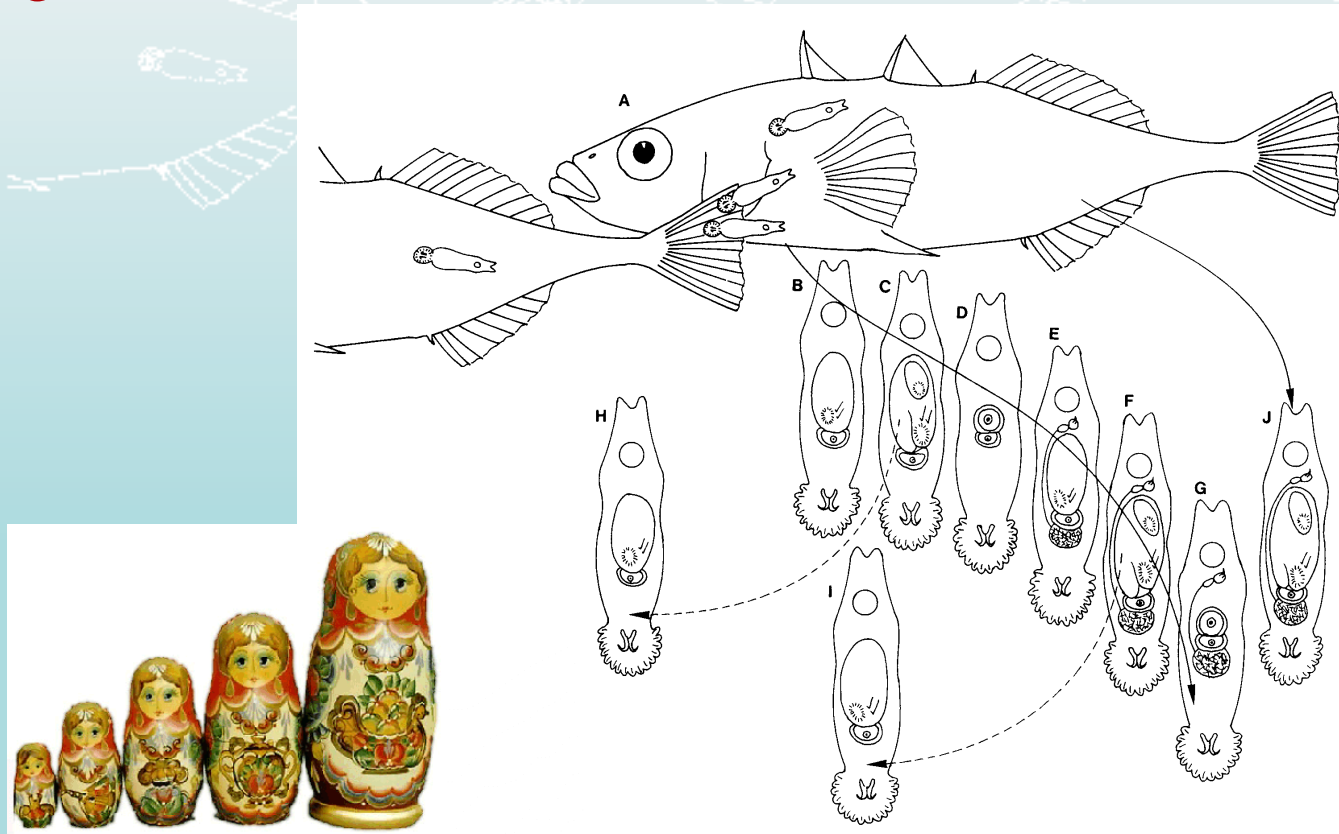
# Invasive parasites: sea lice



[www.upei.ca](http://www.upei.ca)

# Invasive parasites: *Gyrodactylus salaris*

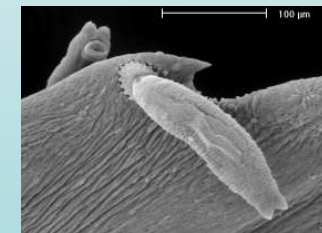
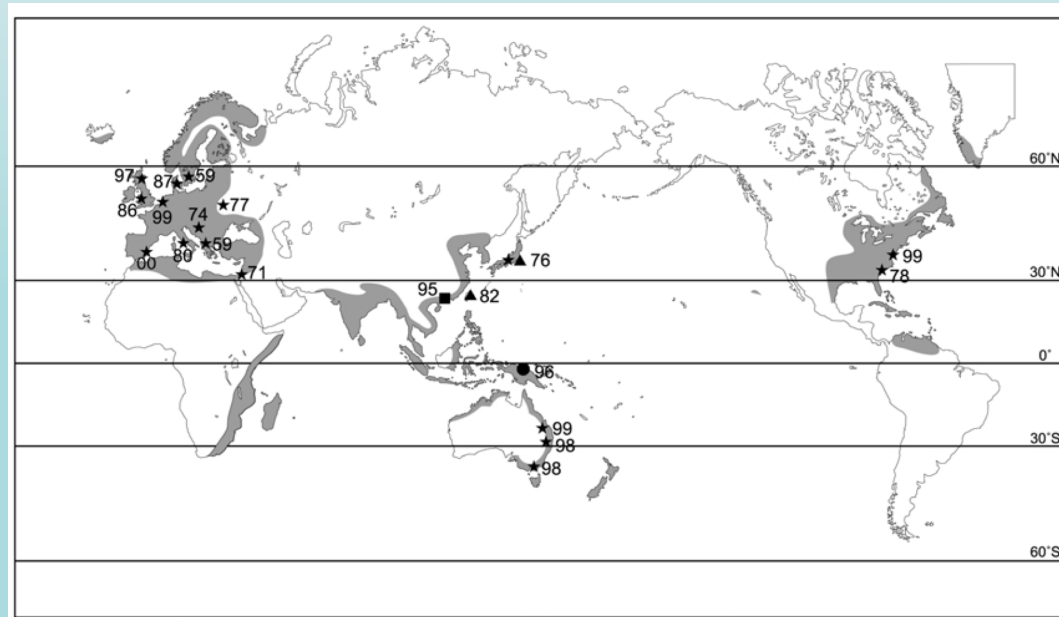
24hr generation time



Kearn, 1995

# Invasive parasites: *Gyrodactylus anguillae*

- Described in Europe 1960
- Serious pest species in eel culture (+ *Pseudogyrodactylus*)
- European eels imported to East Asia and N America
- Worldwide distribution (no genetic variation)



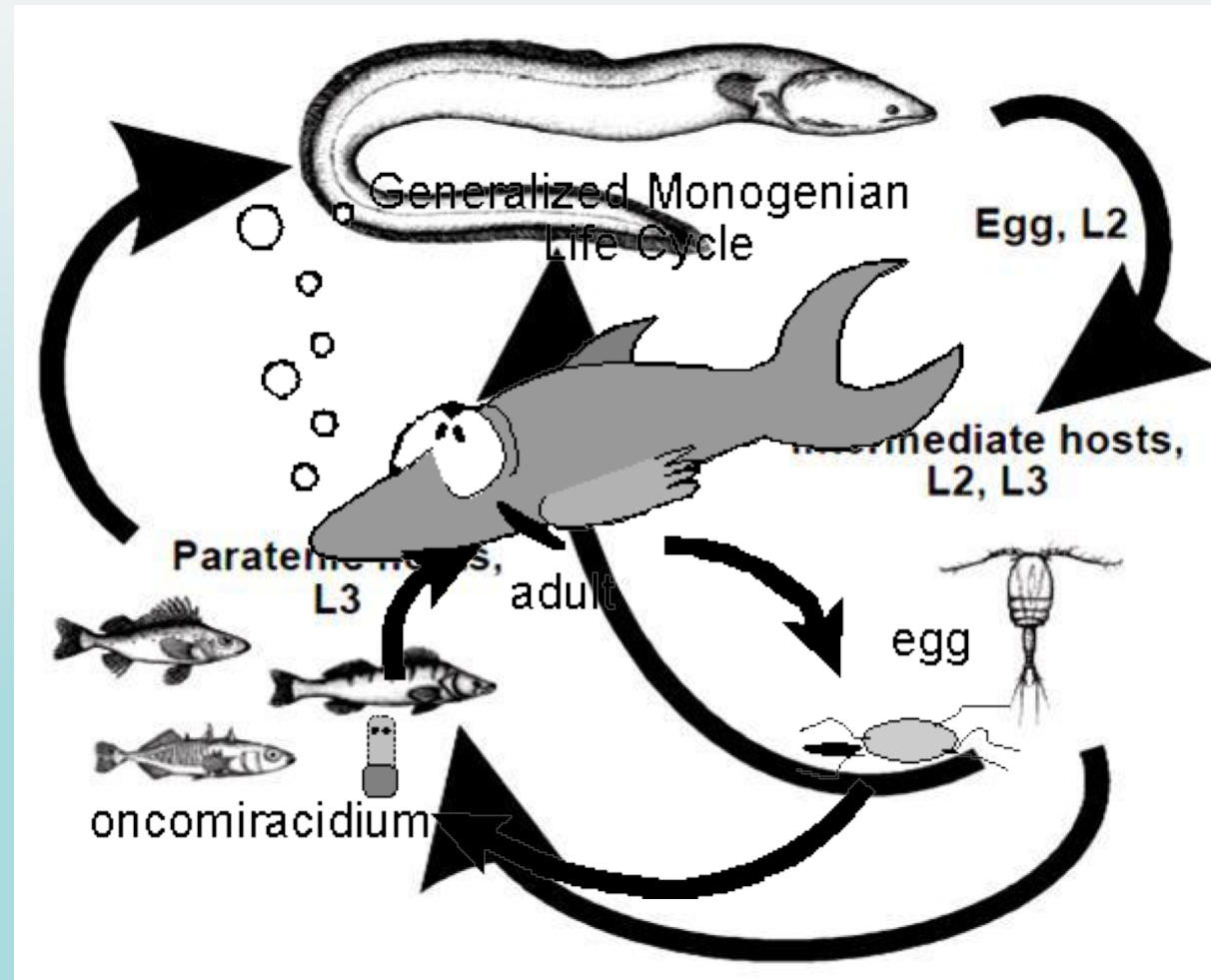


# Invasive parasites: *Anguillicoloides crassus*

- Introduction in Europe in early 1980s through infected stocks
- Flanders : introduction 1983
- 2000: *Anguillicoloides* invaded all Flemish river catchments
- No known cure or treatment
- Dysfunction of swimbladder
- Reduced swimming performance
- Unability to reach spawning grounds
- Stock decline



# Invasive parasites: *Anguillicoloides crassus*



# Case study: Tilapia in DR Congo

- Fisheries & aquaculture large share of food production
- The Nile tilapia *Oreochromis niloticus*



# Case study: Tilapia in DR Congo

- Most widely introduced fish species (102 countries)
- Invasive species (strong competitor, fast grower)
- Population decline Lake Victoria & hybridization
- Ample stocking events throughout DRC
- Natural & human-assisted dispersal along Congo Basin





# Tilapia & parasites

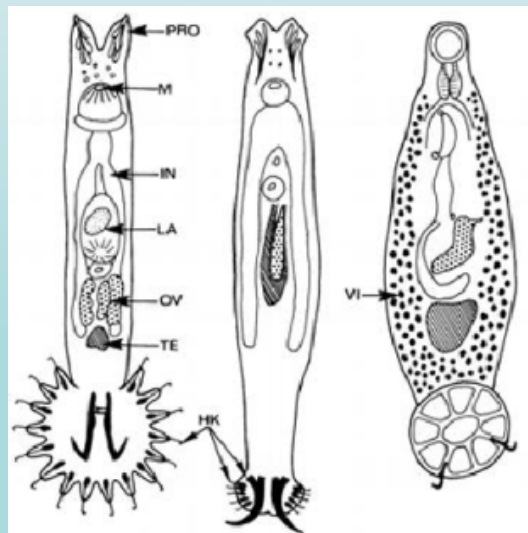
- Host to many parasites (Paperna, 1996)
- Parasite transfer from African tilapias to native Neotropical cichlids (Jimenez-Garcia et al., 2001)
- Parasite transfer from local fish to cultured tilapia (Kaneoko et al., 1998)





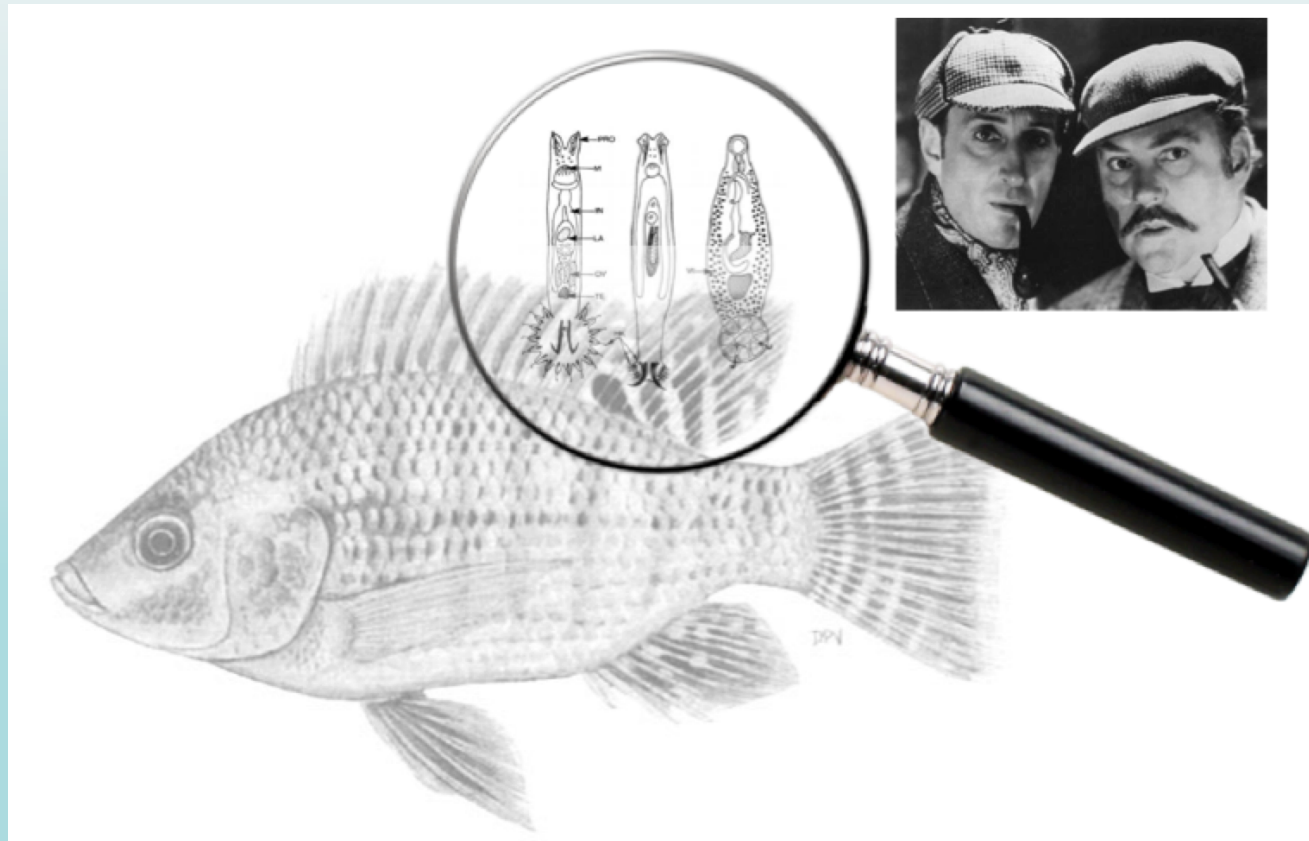
# Aims & questions

- Did stocking of Nile tilapia lead to introduction of alien parasites that pose a threat to local tilapia species?



# Parasites as tool

Despite the damage that parasites can inflict on their hosts, they can sometimes be used as a tool



They can inform us on the diet and migration of their host: biological tag

# Methodology

- Screening historical tilapia collection RMCA (pre- and post-stocking collections and natural populations) to reconstruct autochthonous parasite fauna of the Nile Tilapia and closely related endemic tilapia species
- Compare with parasite fauna newly collected samples
- Assess impact of tilapia introduction in DRC



Musée royal de l'Afrique centrale  
(MRAC, Tervuren)



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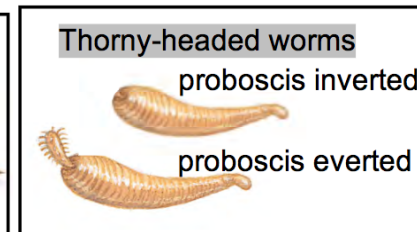
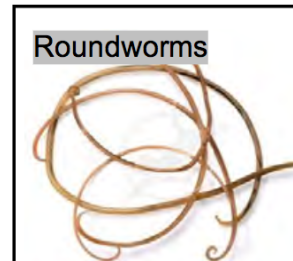
# Conclusion

- Co-introduction of parasites with fish often overlooked or understudied problem
  - Strong impact on local fish species, disease outbreaks
  - No routine control of introduced species
- Sensibilisation and routine screening needed!

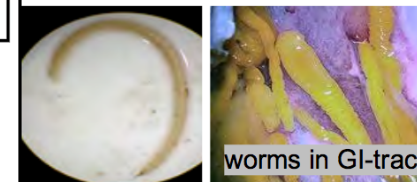
# Methods for preservation

- **Roundworms** -

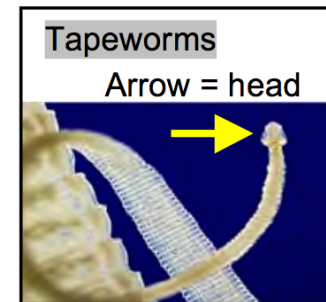
Identification: slender worms, head and tail pointed, often coiled.  
 Preservation: relax in hot physiological saline (NOT water), preserve in 70% ethanol.



- **Thorny-headed worms** - Identification: stout worm that may appear segmented. If head of worm is imbedded in host tissue then remove the section of host tissue with a scalpel to avoid damaging the proboscis. Preservation: relax in water until proboscis everts (may require several hours – overnight), preserve in 70% ethanol.



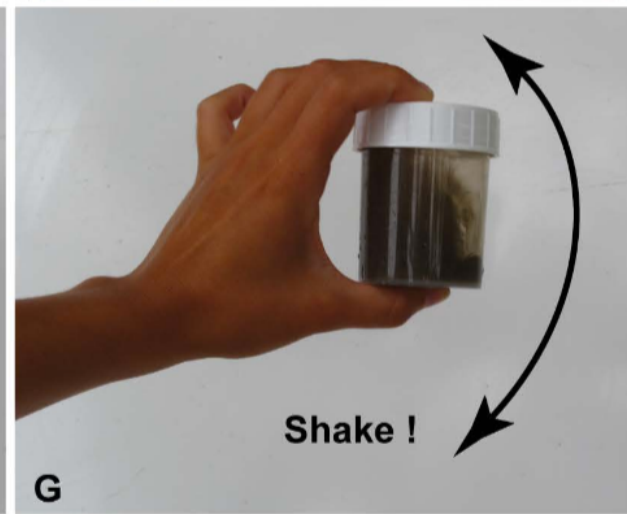
- **Tapeworms** - Identification: flat segmented worms. If head of worm is imbedded in host tissue then remove the section of host tissue with a scalpel to avoid damaging the head. Preservation: relax in hot or cold water or hot physiological saline until worm is dead and limp, preserve in 70% ethanol.

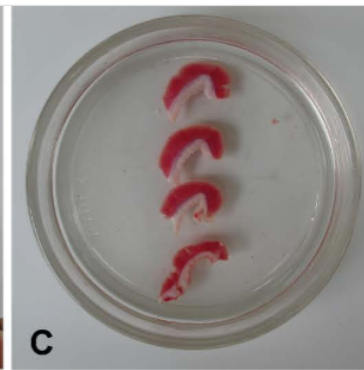


- **Flukes** - Identification: flat worms, typically with two suckers. Preservation: relax in hot or cold water or hot physiological saline until worm is dead and limp, preserve in 70% ethanol.









# Bibliography:

- Parasitism: the diversity and ecology of animal parasites. Eds Bush, Fernandez, Esch and Seed. Cambridge University Press. 2001
- World Health Organization: [www.who.int](http://www.who.int)
- Parasitism. The Ecology and Evolution of Intimate Interactions. Claude Combes. University Chicago Press. 2001
- Introduction fish parasites:  
<https://www.sdstate.edu/sites/default/files/nrm/outreach/pond/upload/Fish-Parasites.pdf>
- Field guide parasitology:  
<http://darwin.biology.utah.edu/PeopleHTML/Fieldguideparasites.pdf>
- Host parasite database NHM London:  
<http://www.nhm.ac.uk/research-curation/scientific-resources/taxonomy-systematics/host-parasites/>  
<http://www.nhm.ac.uk/research-curation/scientific-resources/taxonomy-systematics/host-parasites/database/index.jsp>
- Wormbase: <http://www.wormbase.org/#012-34-5>