Parasitic infections in greater amberjack in Greece

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Parasites

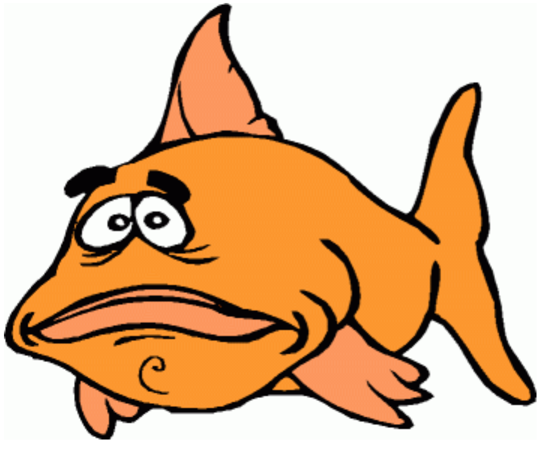
Parasitism

In biology/ecology, parasitism is a non-mutual symbiotic relationship between species, where one species, the parasite, benefits at the expense of the other, the host.

WIKIPEDIA
The Free Encyclopedia

The "expense"

- In nature the expense is usually low
- In aquaculture it is BIG !!!



The cost of parasitic diseases

SPECIAL ISSUE ARTICLE 196

Economic costs of protistan and metazoan parasites to global mariculture

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There are many ways to categorize parasites

- Macroparasites/microparasites
- Metazoa/protozoa
- Extracellular/intracellular
- Endoparasites/Ectoparasites
- Obligate/facultative parasites
- Generalists/Specialists
- Direct/Indirect

Evolution of parasites

- Parasites co-evolve with their host
- A successful parasite does not want to kill its host
- Less evolved parasites (eg *Cryptocaryon irritans*) are more pathogenic
- More evolved parasites are less harmful to their host
- They evolve strategies to "escape" host immune system
- They evolve strategies to disperse
- Some of these strategies are very resourceful and really fascinating

Aquaculture: Treatment or management?

We need to know:

- Life cycle
- Biology
- Ecology

Successful management = break the life cycle

Most important parasites in the Greek aquaculture

- Protozoa (*Cryptocaryon irritans, Amyloodinium ocellatum*)
- Myxosporea (*Enteromyxum leei, Sphaerospora testicularis*)
- Monogeneans (*Sparicotyle chrysophrii, Diplectanum aequans*)
- Digenean (*Cardicola aurata*)
- Crustacean (*Lernanthropus kroyeri, Ceratothoa oestroides*)

Main parasites of greater amberjack

Europe

- *Zeuxapta seriolae*
- *Heteraxine heterocerca*
- *Neobenedenia* sp.
- *Paradeontacylix* sp.
- *Amyloodinium ocellatum*

Greece

- *Zeuxapta seriolae*
- *Paradeontacylix* sp.
- *Cryptocaryon irritans*

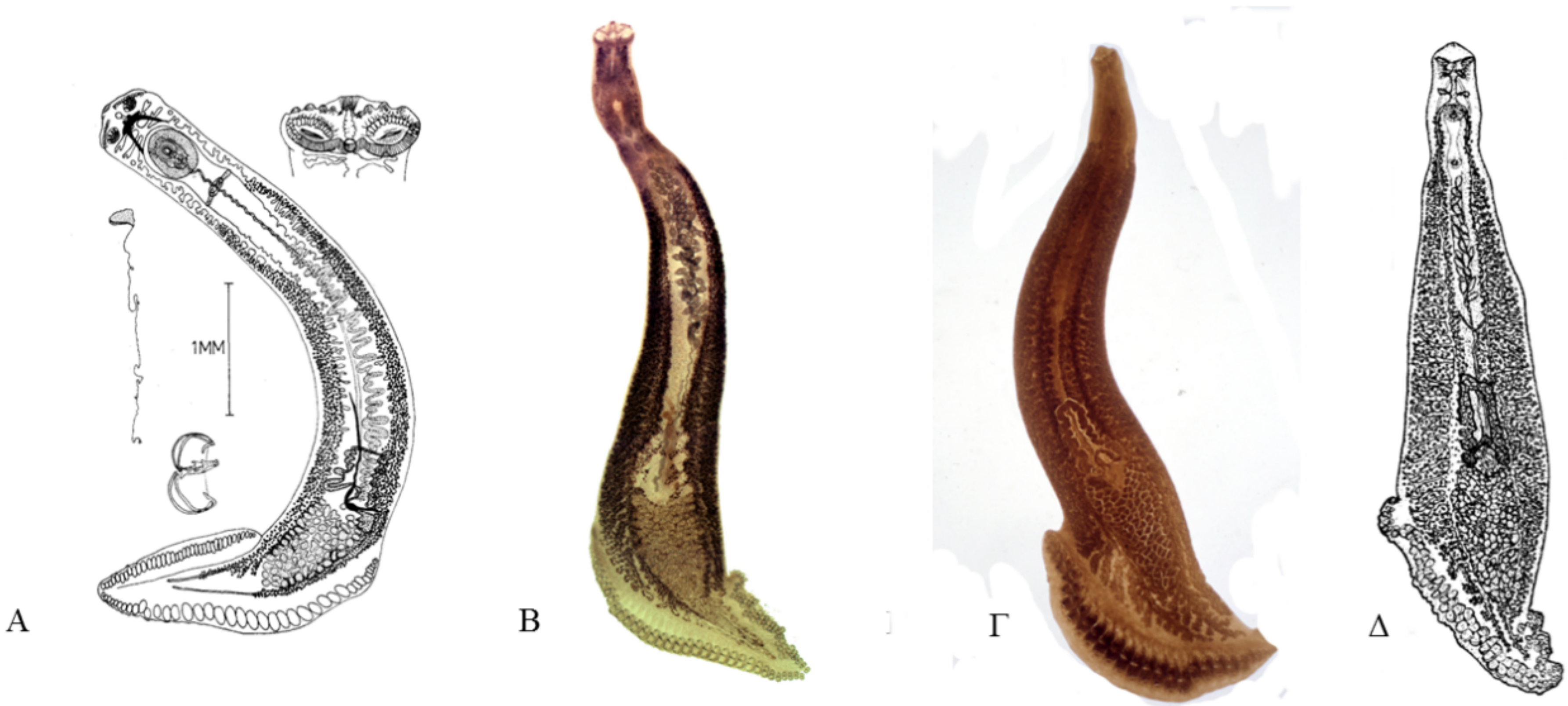
Zeuxapta seriolae

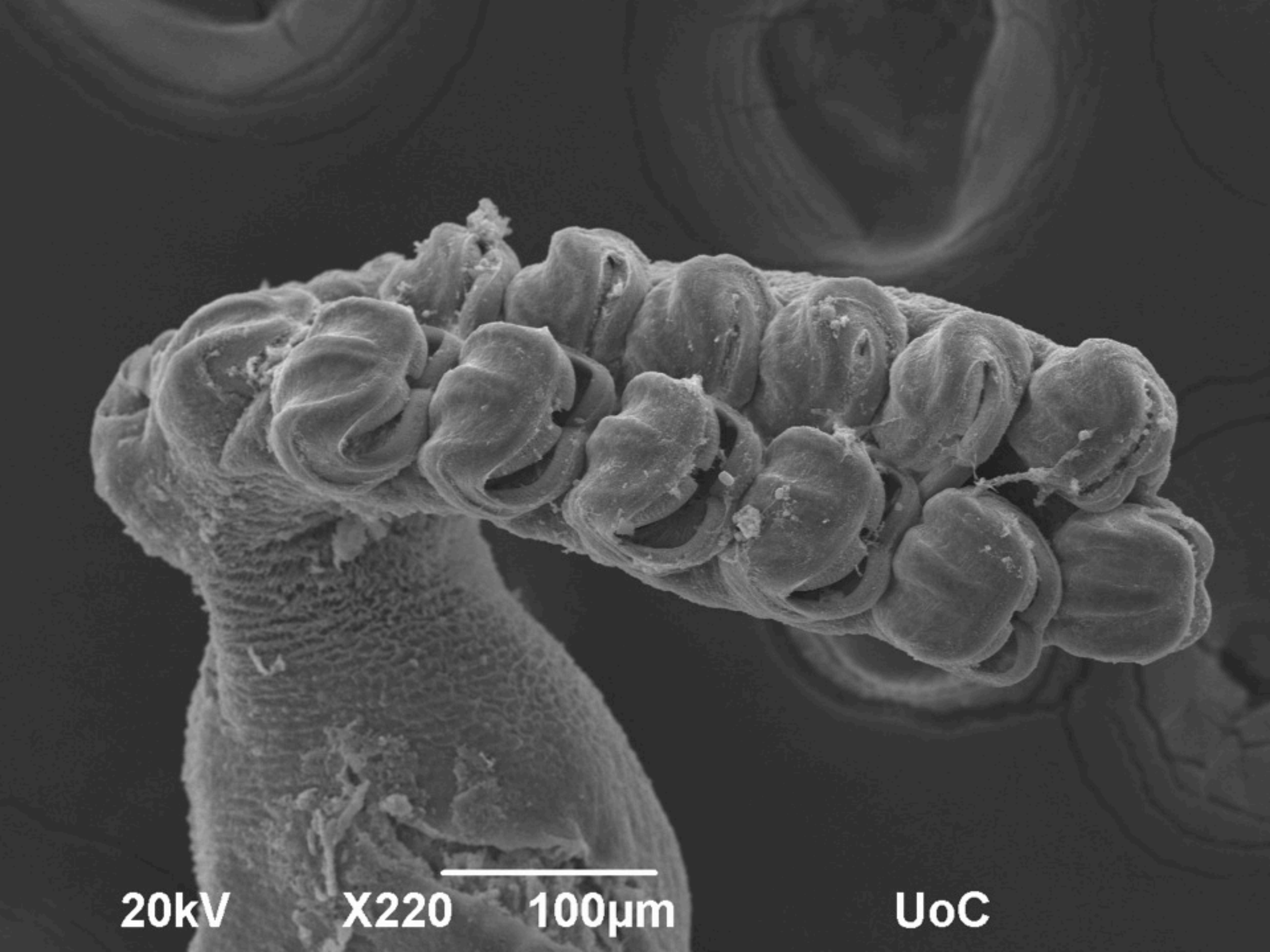
- Monogenean worm
- Gill parasite
- Direct life cycle
- Highly host specific
- Causes anemia
- High mortality in cultured amberjacks

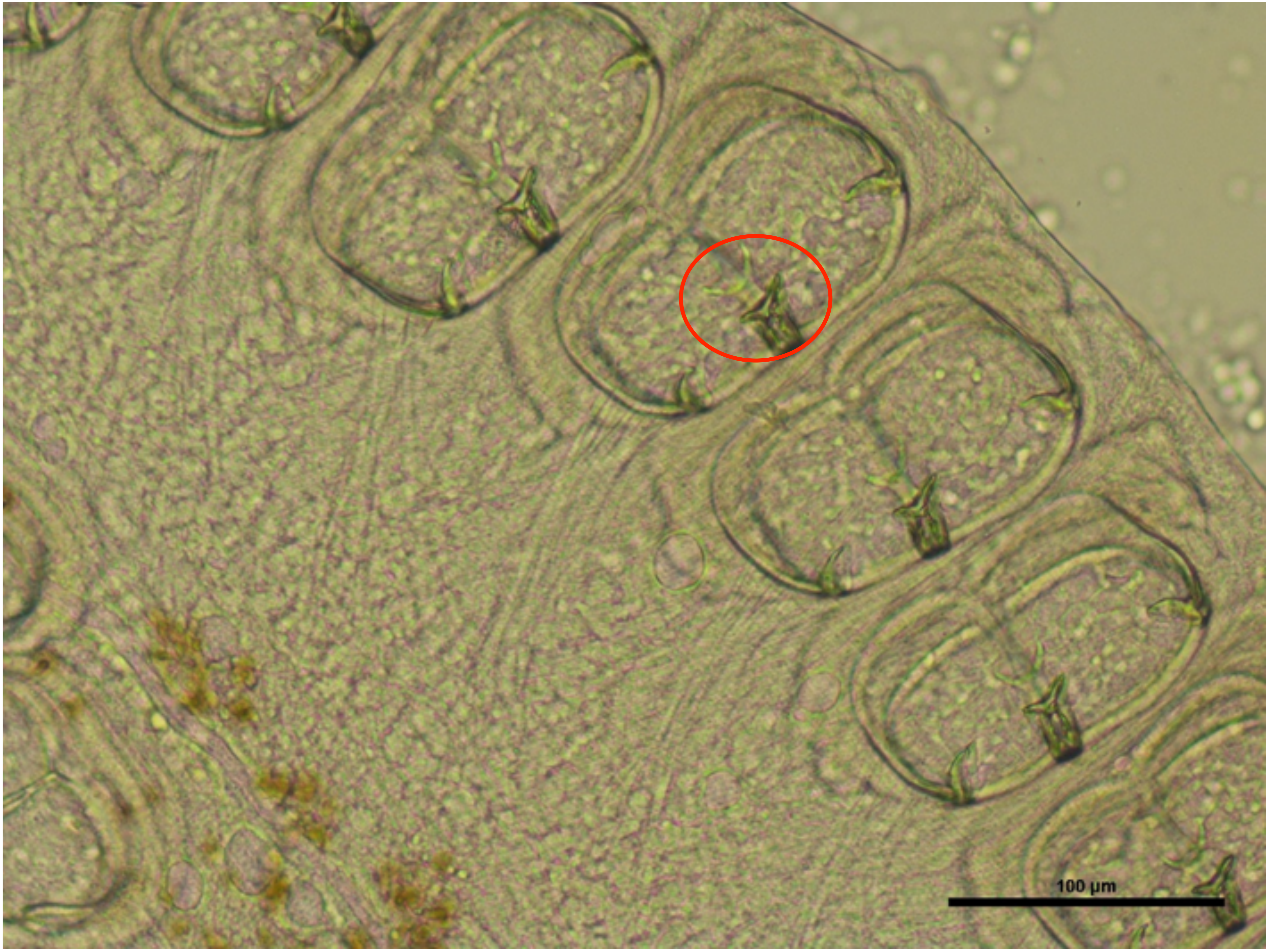
Identification

- Host-specificity
- Morphology of the parasite
- PCR (COI, 28s)

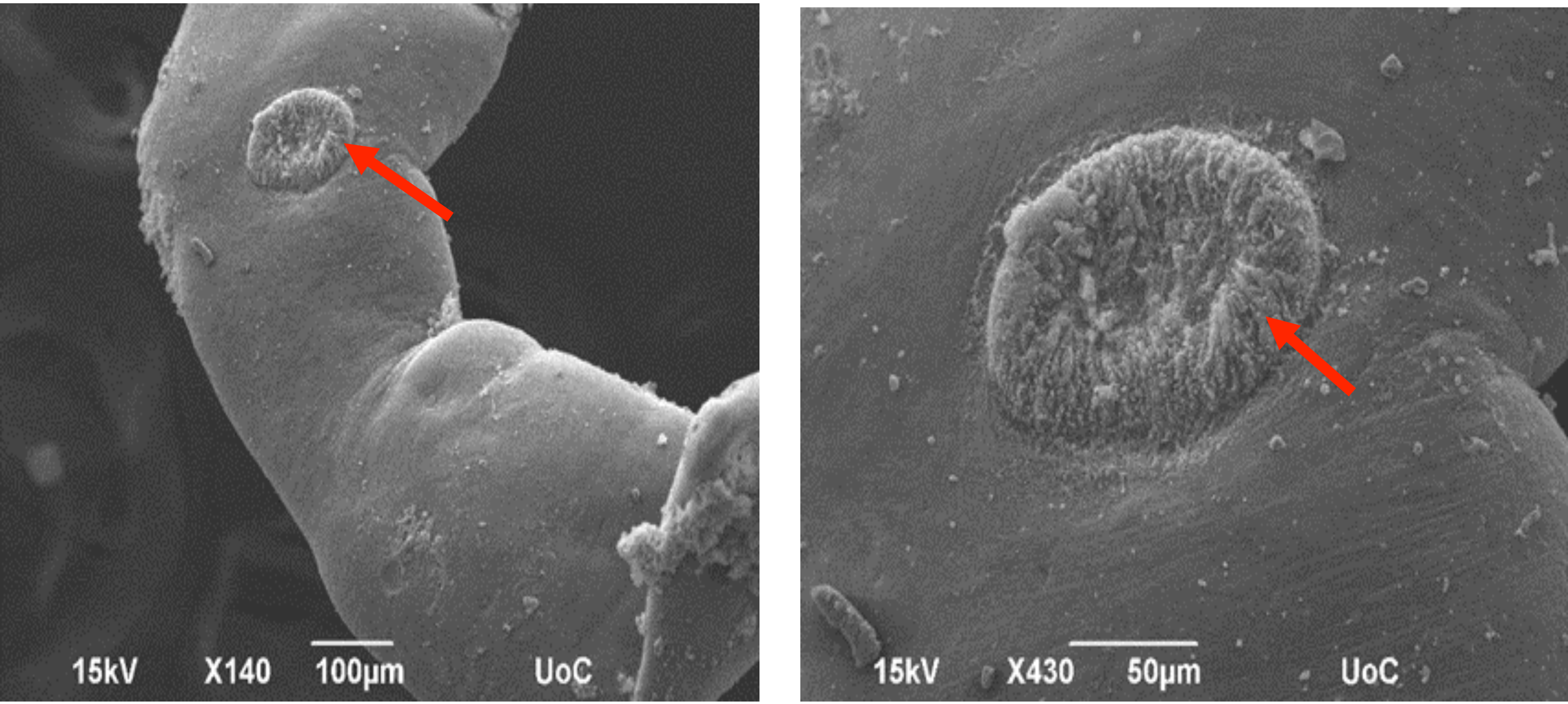
Morphology




20kV
X220
100µm
UoC


100 µm

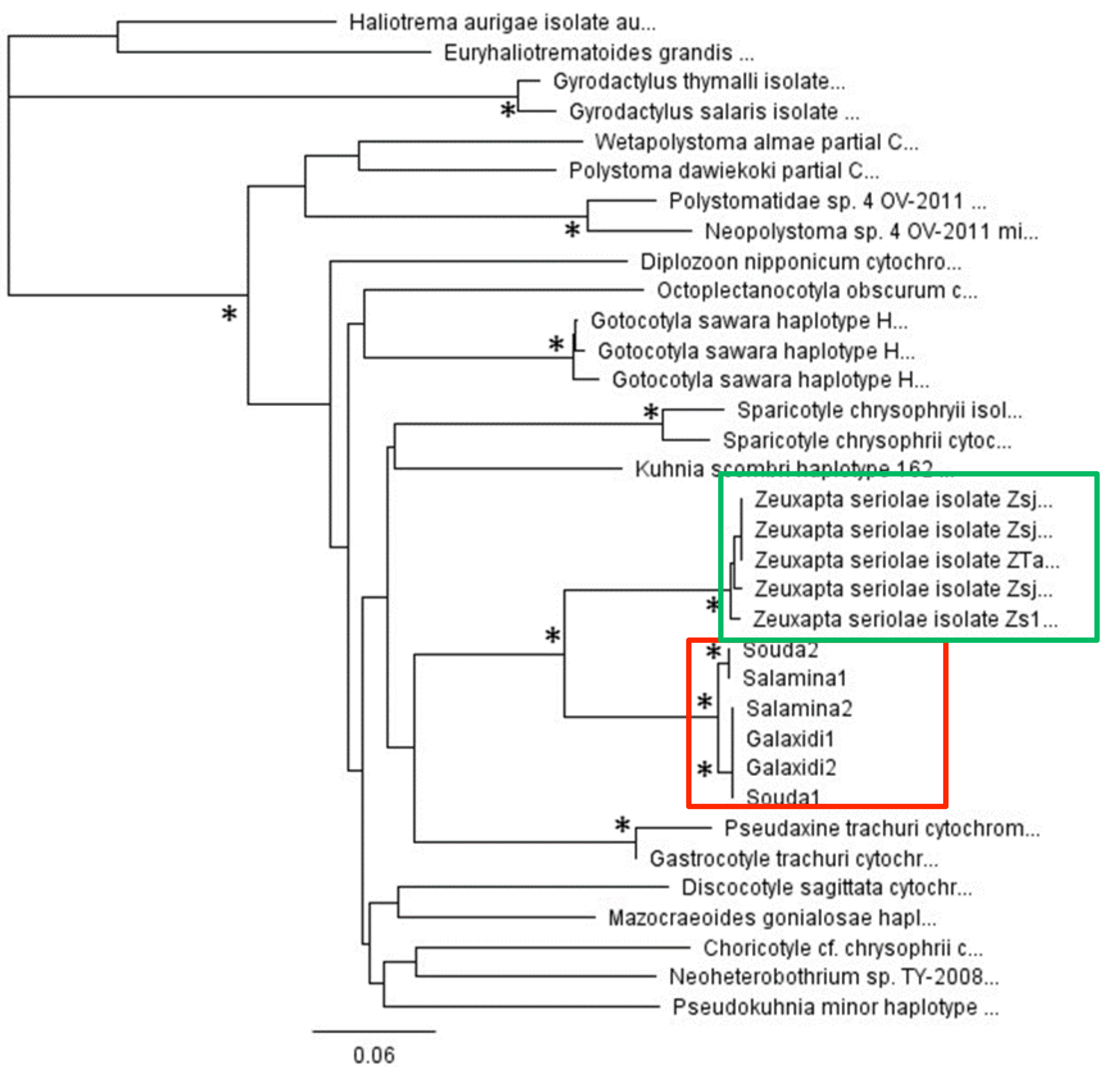

100 µm


15kV X140 100µm UoC
15kV X430 50µm UoC

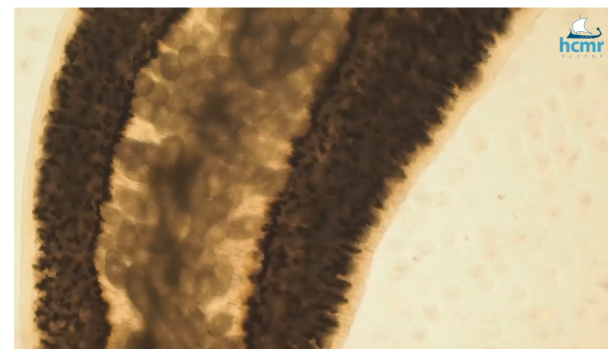
Molecular characterization
BLAST results

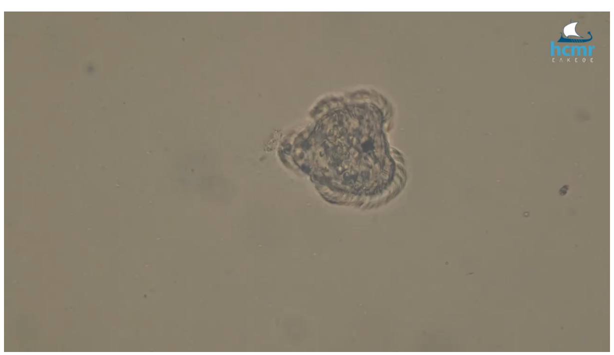
Description	Max score	Total score	Query cover	E value	Ident	Accession
Zeuxapta seriolae isolate Zsjf3aJF13 cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial	814	814	98%	0.0	84%	KP119287.1
Zeuxapta seriolae isolate Zsjf3aJF13 cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial	866	866	93%	0.0	84%	KP119287.1
Zeuxapta seriolae isolate Zsjf3aJF13 cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial	823	823	98%	0.0	85%	KP119287.1

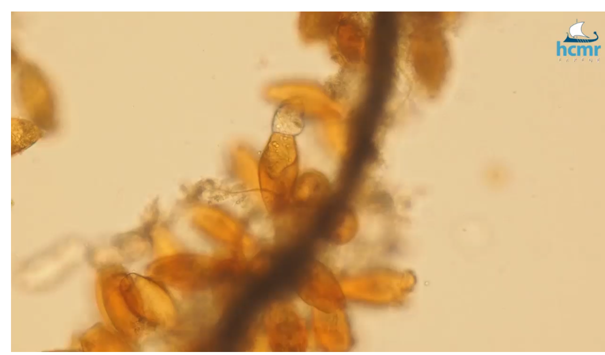
Phylogeny (COI)



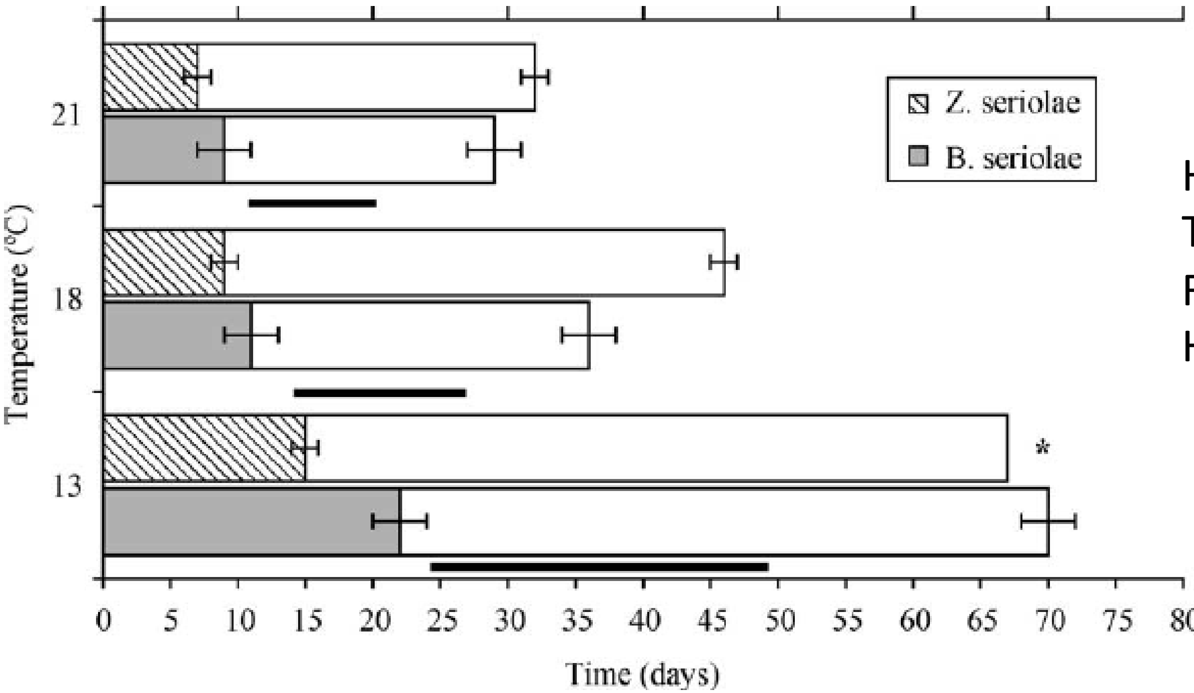
Life cycle







Life cycle 2



Hatching: 6-8 days
Time to maturity ~ 30-35 days
Fecundity: up to 500 eggs/daily
Hatching success: >70%

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Effects of temperature on fecundity in vitro, egg hatching and reproductive development of *Benedenia seriolae* and *Zeuxapta seriolae* (Monogenea) parasitic on yellowtail kingfish *Seriola lalandi*

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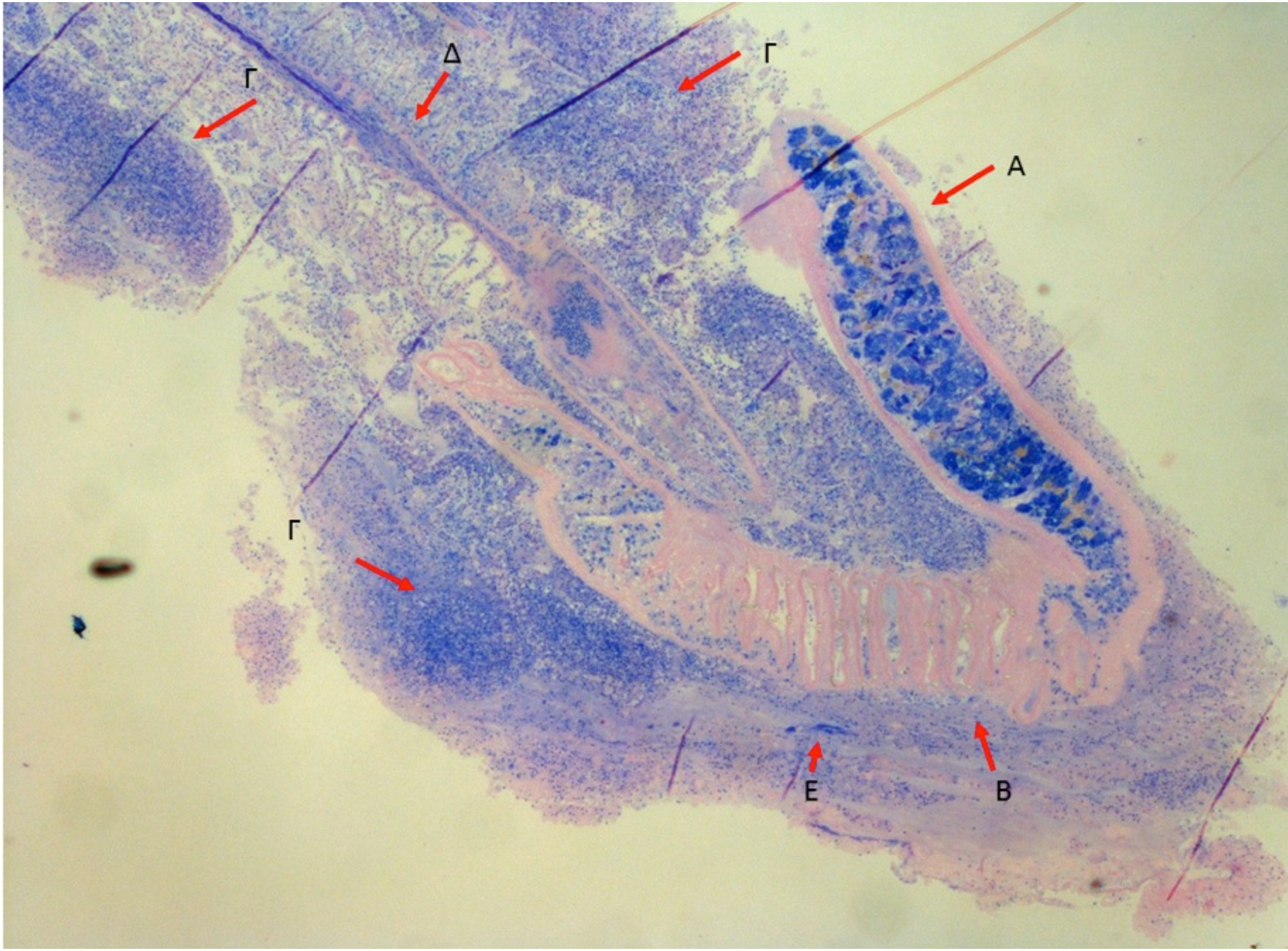
Some simple (naïve) calculations

	# fish	parasite abundance	fecundity	spawning days	hatching success %	% attaching host	**# parasites**	**new parasite abundance**
gen 1	1000	5	500	5	70,00%	10,00%	**875.000**	**875**
gen 2	1000	875	500	5	70,00%	1,00%	**15.312.500**	**15.313**

30 days generation time

Pathology


Δ
Γ
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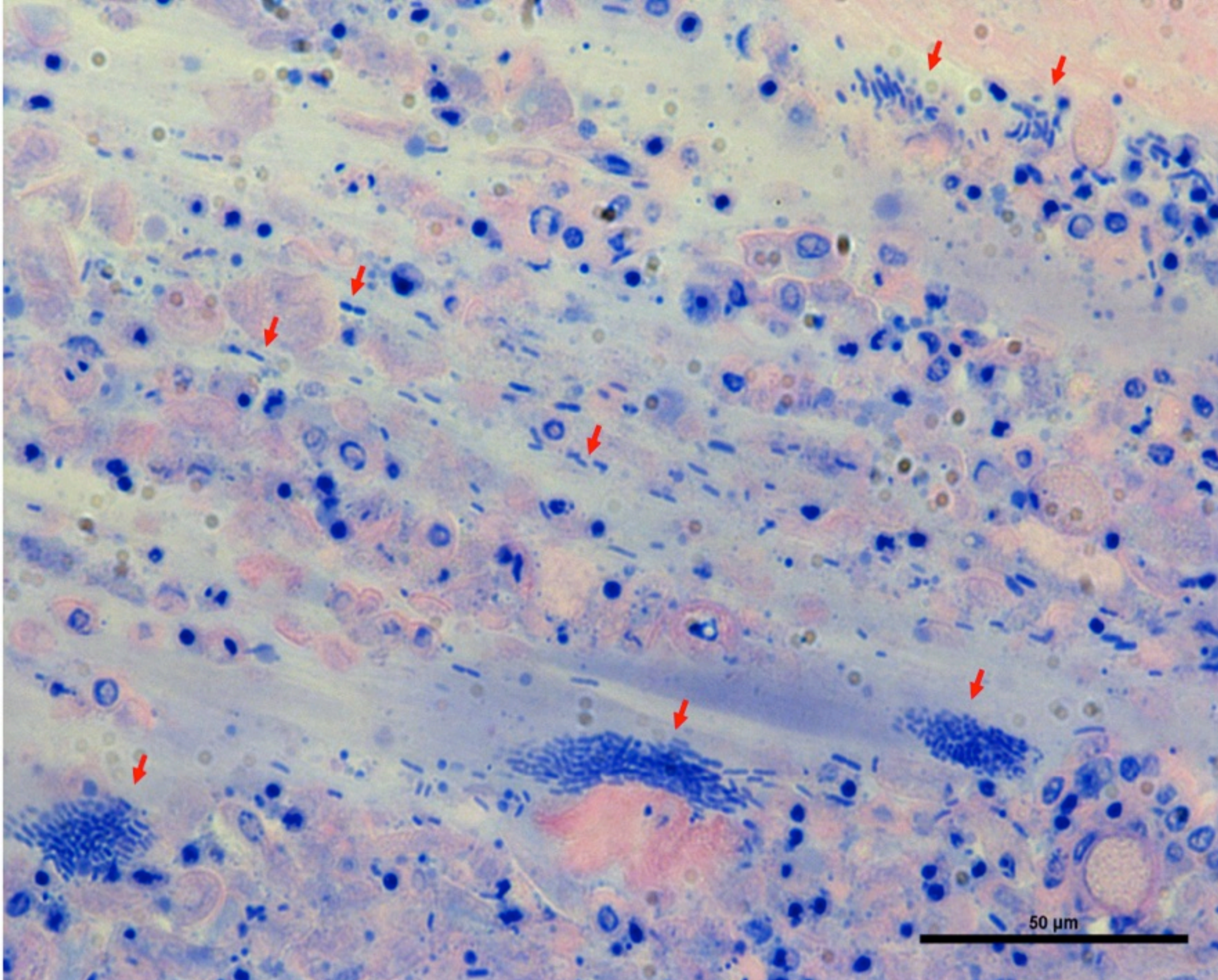
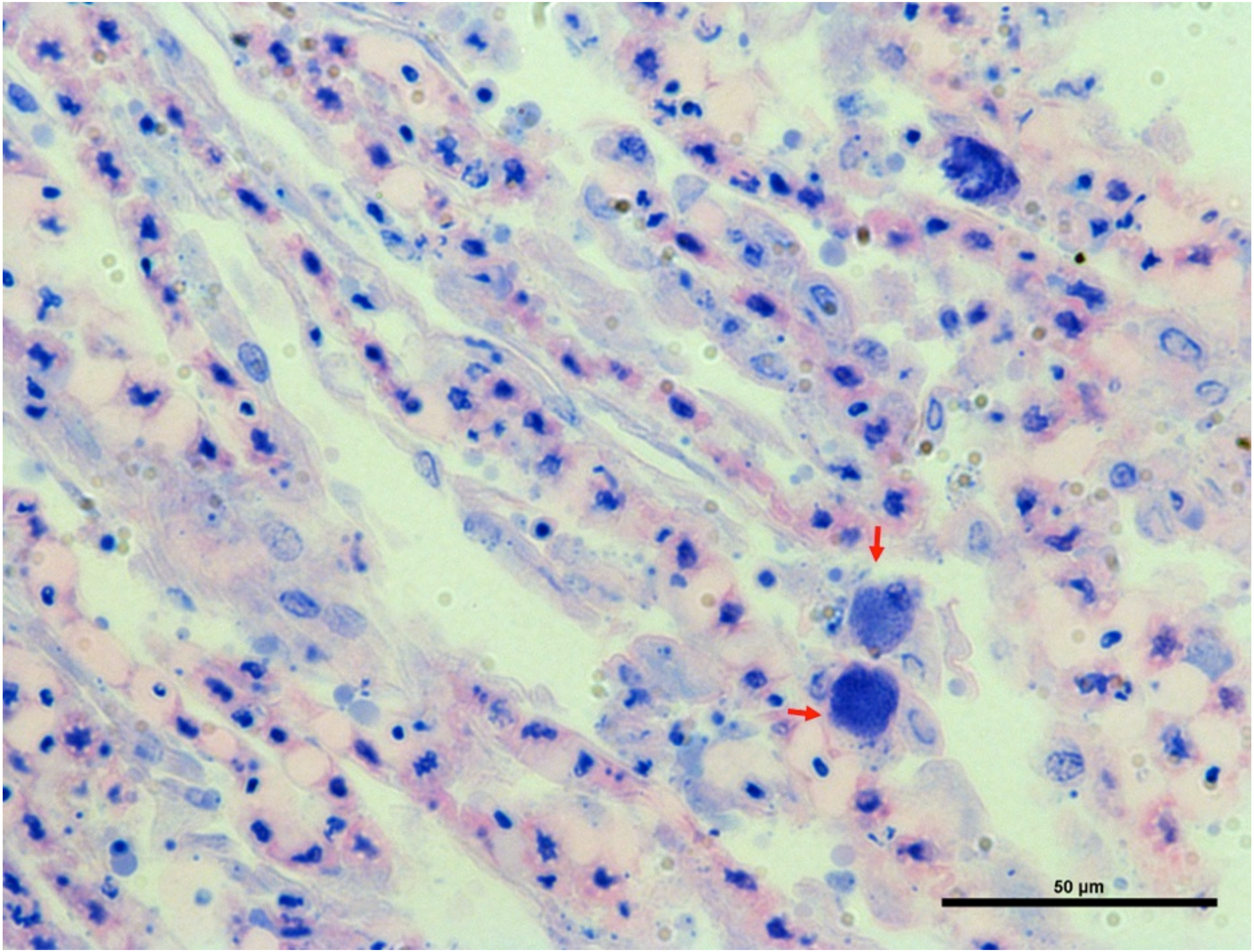
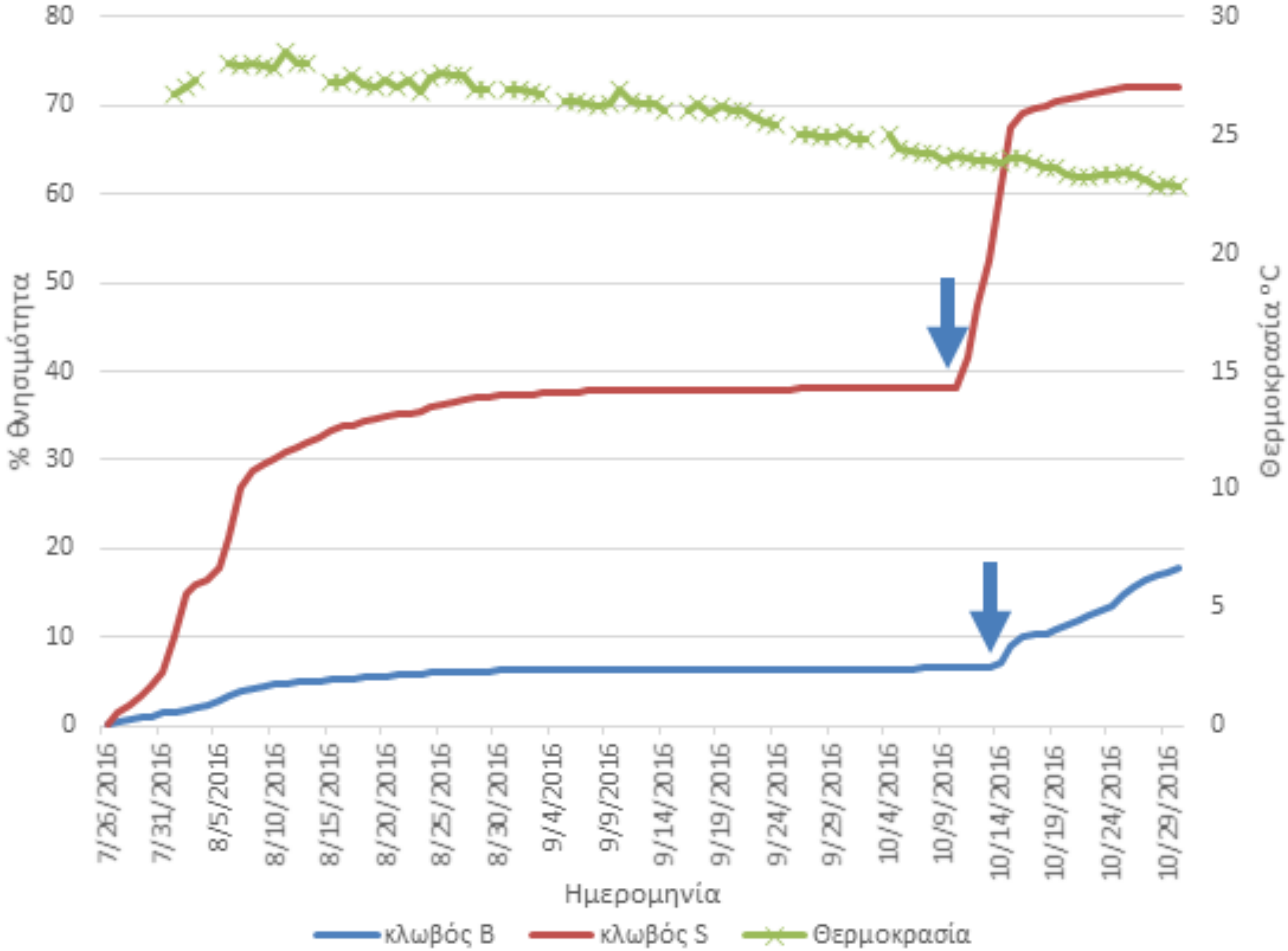

50 µm


50 µm

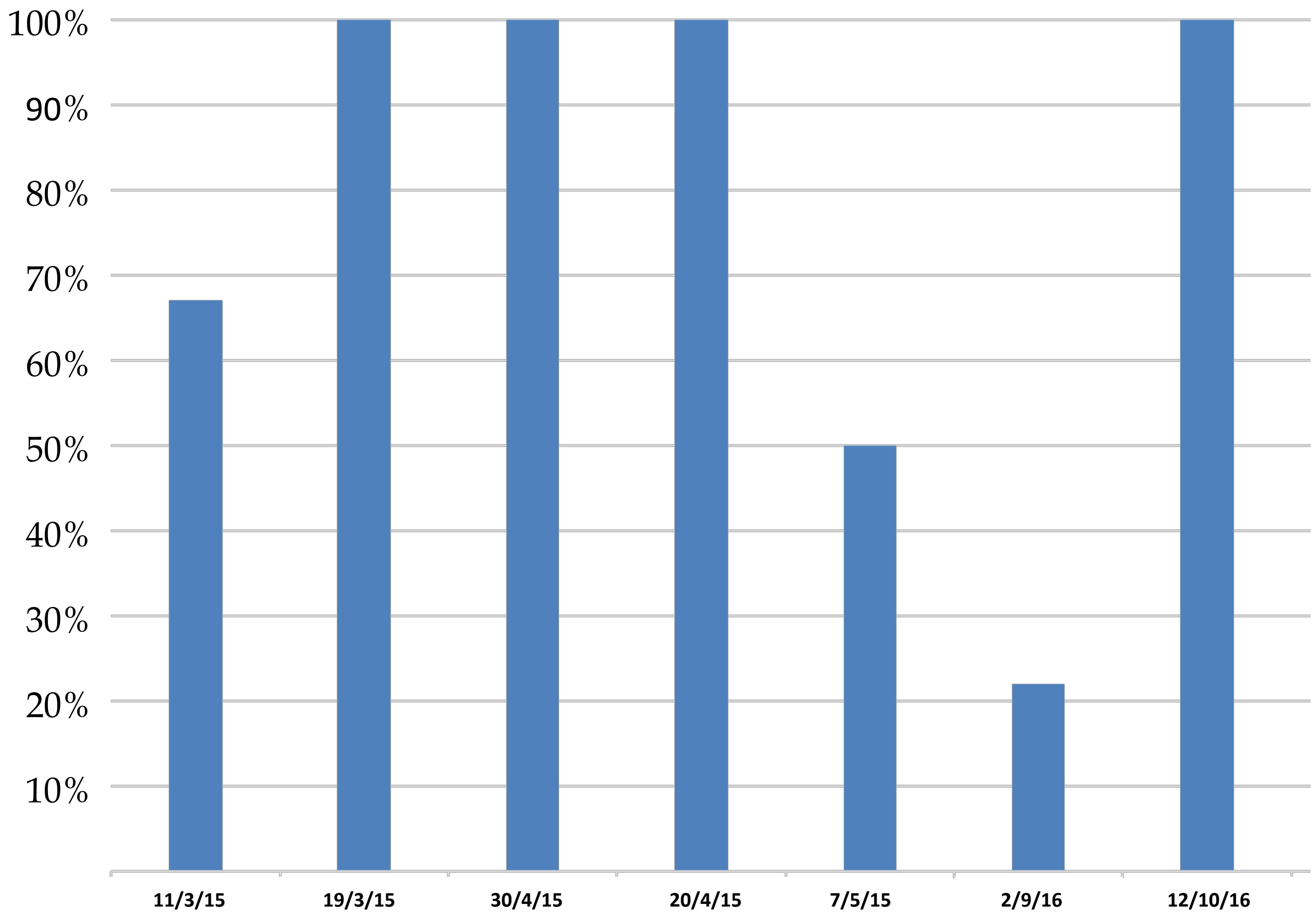
Haematology

Fish code	Hematocrit (%)	Hemoglobin (g/dl)	Weight (g)	Length (cm)
1	8	0.697	146	27
2	32	2.574	198	25
3	8	2.169	223	23
4	30	1.802	192	23
5	31	3.523	121	22
6	29	7.207	398	30
7	14	6.71	385	29
8	16	2.169	100	25
9	25	2.941	161	22
10	35	8.31	283	28

Cumulative mortality (%)

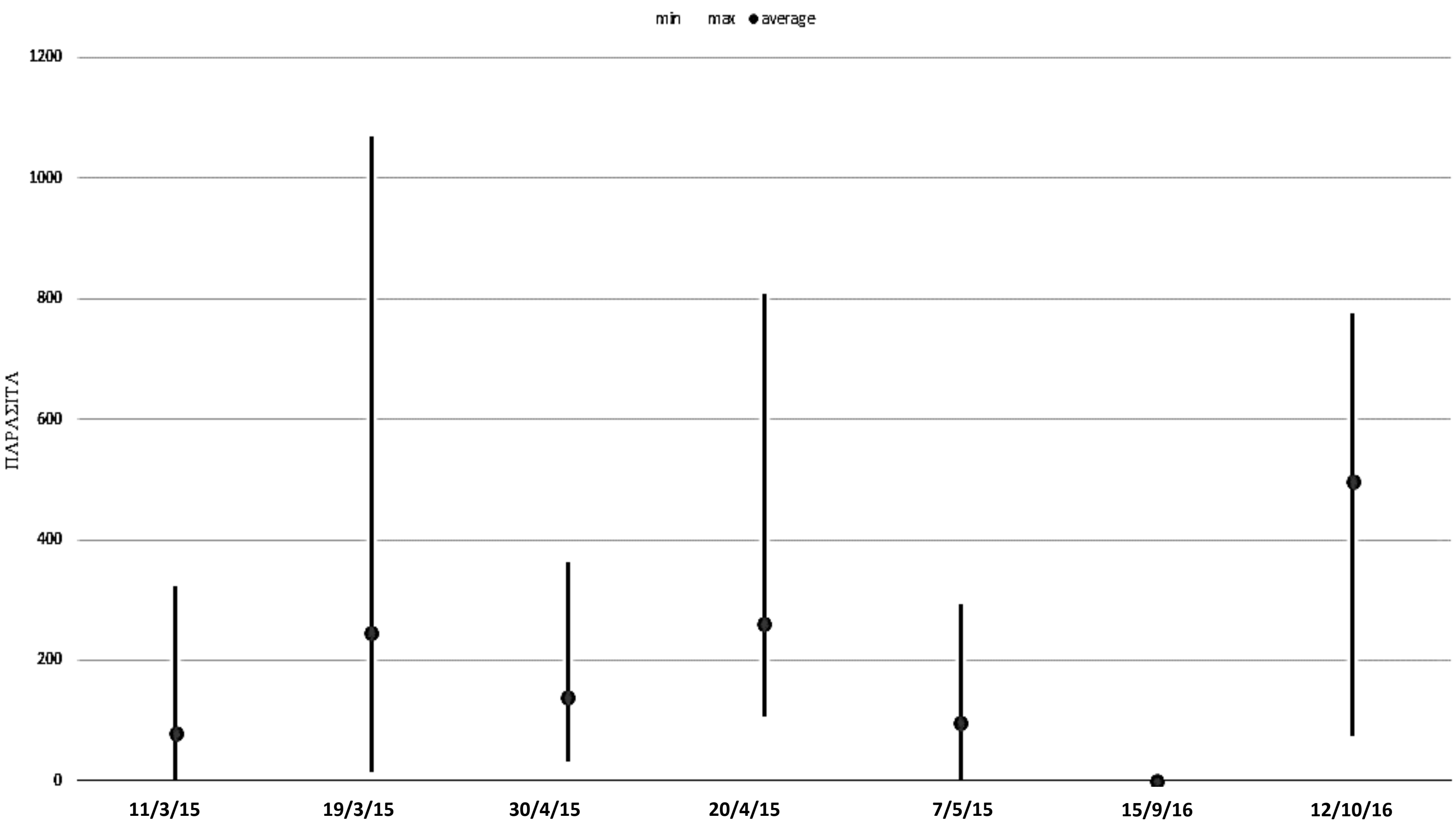


Prevalence

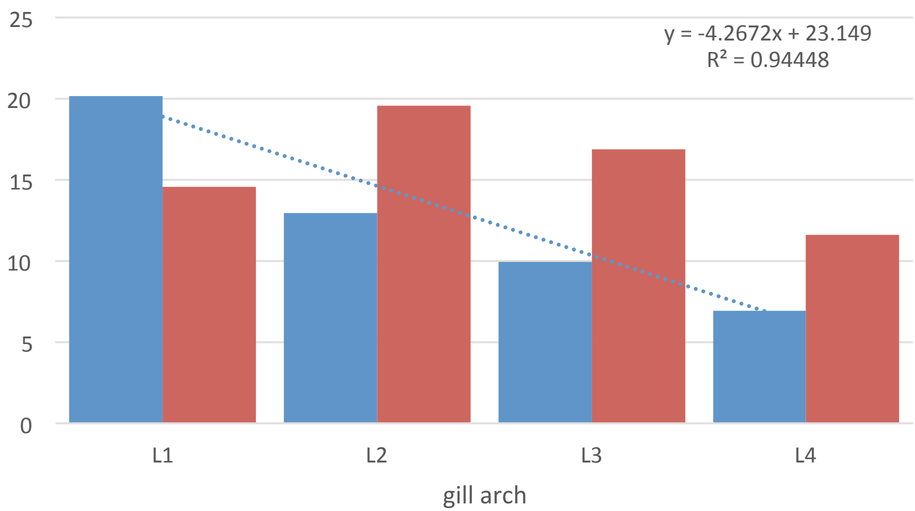


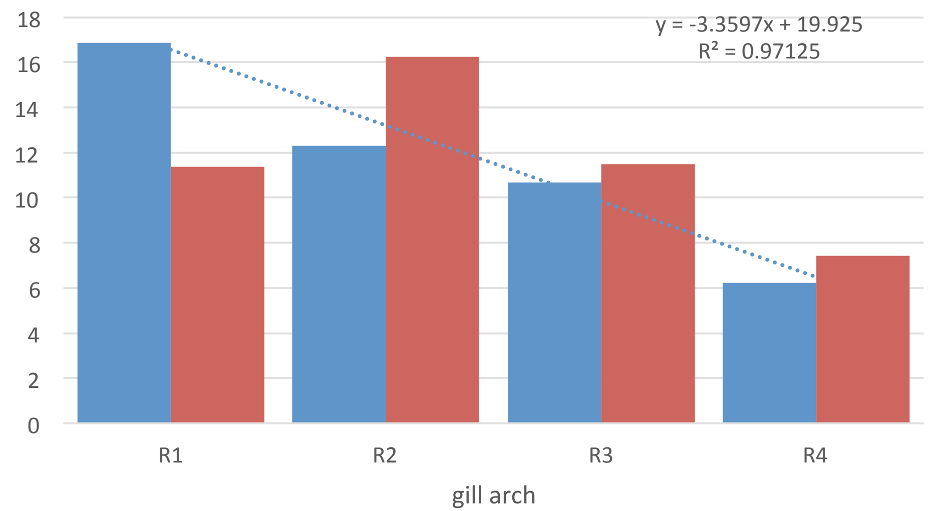
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
11/3/15
19/3/15
30/4/15
20/4/15
7/5/15
2/9/16
12/10/16

Mean abundance



Gill arch preference





Blue: Mature parasites
Red: Juvenile parasites

Results

- 13745 parasites counted on 67 fish
- Prevalence 100% after March
- Maximum intensity >1000 parasites per fish
- Preference for the first gill arch
- Competition between parasite's age classes
- Yearlings most affected
- Continuous source of infection

Source of infection

- Wild populations
- Age class overlap in the same farm

Treatment

- Praziquantel in feed (150-200 mg/kg biomass 2-3 consecutive days – cycle should be repeated 2-3 times with a week interval). Palatability issues. Success depends on intensity of infection.
- Praziquantel baths (10-15 ppm for 30-60') very effective. Two-three baths with a week interval. Dissolve in ethanol or DMSO
- Ivermectin injection for bigger fish (150 μg/kg)
- Ivermectin baths 150 μg/L dissolved in DMSO for 1h. Very effective. Careful in dosage, it can be highly toxic!
- Thyme essential oil very effective in experimental trial (however it killed the fish as well !!!)

Management

- Clean nets
- Monitor fish on monthly basis. If parasites are found….treat!
- Age class overlap. If it cannot be avoided, try to orient the cages in a way that will make parasite disperse harder

Thank you!