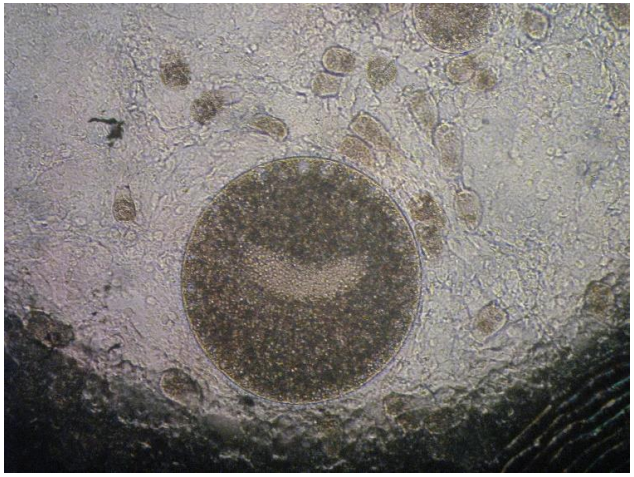
Economic impact of parasitic diseases in Rainbow Trout



Niels Henrik Henriksen

Veterinarian

The Danish Aquaculture Organization

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Niels Henrik Henriksen

ParaFishControl

Dansk Akvakultur

Veterinarian, fish health expert

Working for the Danish fish farmers organization since year 2000

- Fish health plans
- Disease eradication
- Medicine availability
- Legislation
- Vaccination
- Fish welfare

FEAP Fish Health Commission

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Main species in Denmark

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Species	2017 Tonnes
Trout	43000
Blue mussel	3000
Eel	500
Pike Perch	250
Salmon	800
Sturgeon	2

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Parasites in European trout farming

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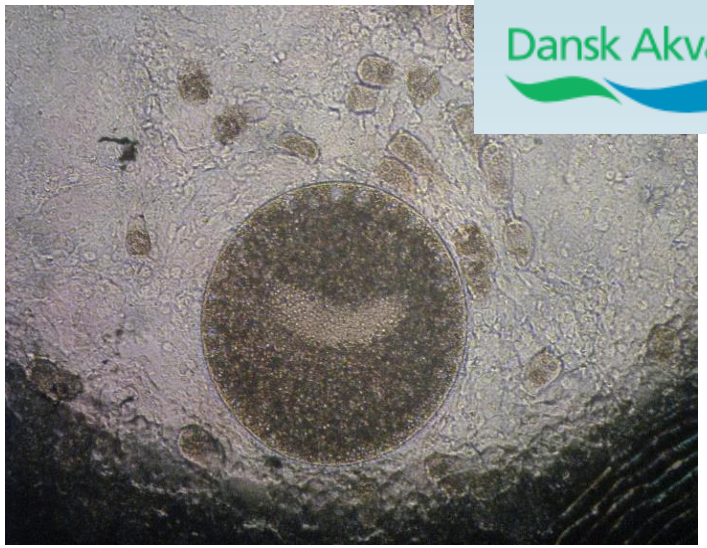
Main problem



A lot of pathogenic parasites

No or only few
medicines available

Economical impact is high
but often difficult to estimate

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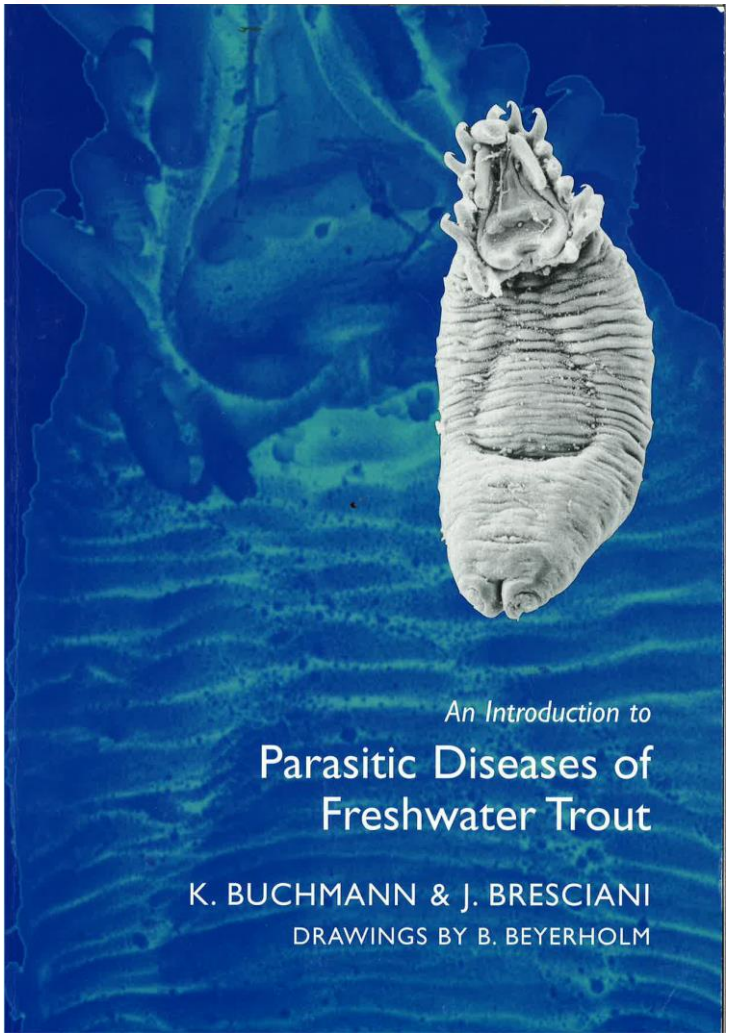
Trout parasites



Amoebae
Phylum Rhizopoda
Thecamoeba
Vexillifera

Flagellates
Phylum Mastigophora
Dinoflagellida
Piscinoodinium

Kinetoplastidea
Trypanoplasma (Cryptobia)
Ichthyobodo

Diplomonadida
Hexamita
Spironucleus

Apicomplexans
Phylum Apicomplexa
Eimeria

Microsporidians
Phylum Microspora
Loma
Nucleospora (Enterozytozoon)

Ciliates
Phylum Ciliophora
Apiosoma
Ambiphrya
Epistylis
Trichodina
Trichodinella
Ichthyophthirius multifiliis
Capriniana
Chilodonella

Leeches
Phylum Annelida
Class Hirudinea
Piscicola

Crustaceans
Phylum Arthropoda
Class Crustacea
Argulus
Ergasilus
Salmincola

Molluscs
Phylum Mollusca
Unio
Anodonta
Pseudanodonta
Margaritifera

Myxosporidians
Phylum Myxozoa
Myxobolus
Henneguya
Ceratomyxa
Myxidium
Chloromyxum
Sphaerospora
Tetracapsula (PKX)

Flatworms
Phylum Platyhelminthes

Monogeneans
Class Monogenea
Tetraonchus
Gyrodactylus
Discocotyle

Cestodes
Class Cestoda
Cyathocephalus
Proteocephalus
Eubothrium
Diphyllobothrium
Triaenophorus

Digeneans (Trematodes)
Class Digenea
Crepidostomum
Phyllodistomum
Nanophyetus
Sanguinicola
Diplostomum
Tylodelphys
Apatemon

Nematodes
Phylum Nemathelminthes
Class Nematoda
Camallanus
Philonema
Cystidicoloides
Cystidicola
Pseudocapillaria
Anisakis
Cucullanus

Acanthocephalans
Phylum Acanthocephala
Acanthocephalus
Echinorhynchus
Pomphorhynchus
Neoechinorhynchus

(*Lepeophtheirus salmonis*)

Trout parasites
Some very important

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- PKD, Proliferative kidney disease
  - *Tetracapsula bryosalmonae*
- White spot disease
  - *Ichthyophthirius multifilis*
- Costiasis
  - *Ichthyobodo necator*
- Whirling disease
  - *Myxobolus cerebralis*
- Sea lice
  - *Lepeophtheirus salmonis*
- Gill Amoebae, freshwater
- Anisakidosis
  - *Anisakis spp*

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Fighting external parasites in trout production today

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Mainly biocides (few medicines)

Water treatment

- Formaldehyde
- Peracetic acid
- Hydrogen peroxide
- Chloromine T
- Copper sulphate

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Often no wonder drug exist!!!

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Medicine VMP Regulation

Biocide Regulation

Water Frame Directive

Growing focus of ERA

Environmental Risk Assessment

EU Technical Guidance For Deriving Environmental Quality Standards

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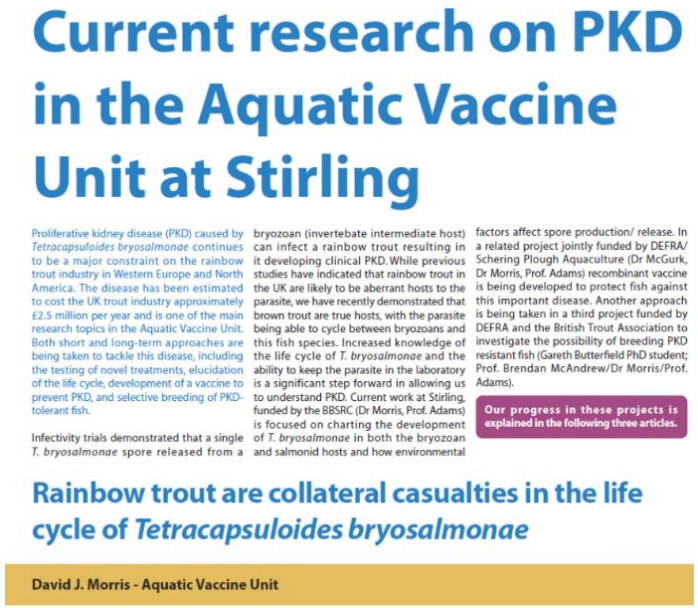
Economic impact

In general only very few information's

Often made by one parasite in one country

Example:



Current research on PKD in the Aquatic Vaccine Unit at Stirling

Proliferative kidney disease (PKD) caused by *Tetracapsuloides bryosalmonae* continues to be a major constraint on the rainbow trout industry in Western Europe and North America. The disease has been estimated to cost the UK trout industry approximately £2.5 million per year and is one of the main research topics in the Aquatic Vaccine Unit. Both short and long-term approaches are being taken to tackle this disease, including the testing of novel treatments, elucidation of the life cycle, development of a vaccine to prevent PKD, and selective breeding of PKD-tolerant fish.

Infectivity trials demonstrated that a single *T. bryosalmonae* spore released from a bryozoan (invertebate intermediate host) can infect a rainbow trout resulting in it developing clinical PKD. While previous studies have indicated that rainbow trout in the UK are likely to be aberrant hosts to the parasite, we have recently demonstrated that brown trout are true hosts, with the parasite being able to cycle between bryozoans and this fish species. Increased knowledge of the life cycle of *T. bryosalmonae* and the ability to keep the parasite in the laboratory is a significant step forward in allowing us to understand PKD. Current work at Stirling, funded by the BBSRC (Dr Morris, Prof. Adams) is focused on charting the development of *T. bryosalmonae* in both the bryozoan and salmonid hosts and how environmental factors affect spore production/ release. In a related project jointly funded by DEFRA/ Schering Plough Aquaculture (Dr McGurk, Dr Morris, Prof. Adams) recombinant vaccine is being developed to protect fish against this important disease. Another approach is being taken in a third project funded by DEFRA and the British Trout Association to investigate the possibility of breeding PKD resistant fish (Gareth Butterfield PhD student; Prof. Brendan McAndrew/Dr Morris/Prof. Adams).

Our progress in these projects is explained in the following three articles.

Rainbow trout are collateral casualties in the life cycle of *Tetracapsuloides bryosalmonae*

David J. Morris - Aquatic Vaccine Unit

America. The disease has been estimated to cost the UK trout industry approximately £2.5 million per year and is one of the main

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Importance of the parasites

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Depends on

- The water source
- The temperature
- Intermediate host
- Number of fish / fish farms
- Management (e.g. all in - all out)

- THE PRODUCTION SYSTEM

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Importance can change Example DK

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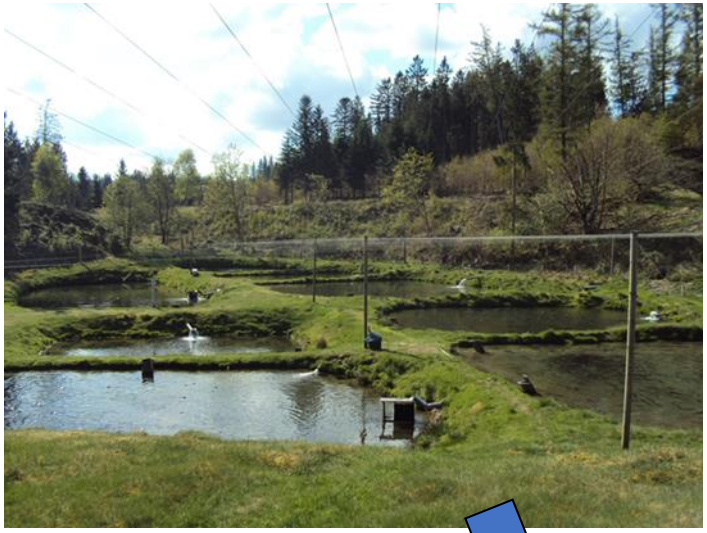

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Importance can change Example DK

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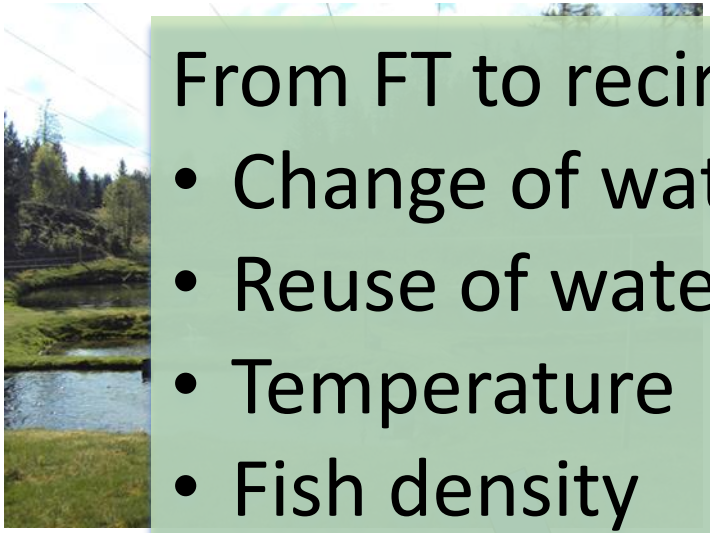
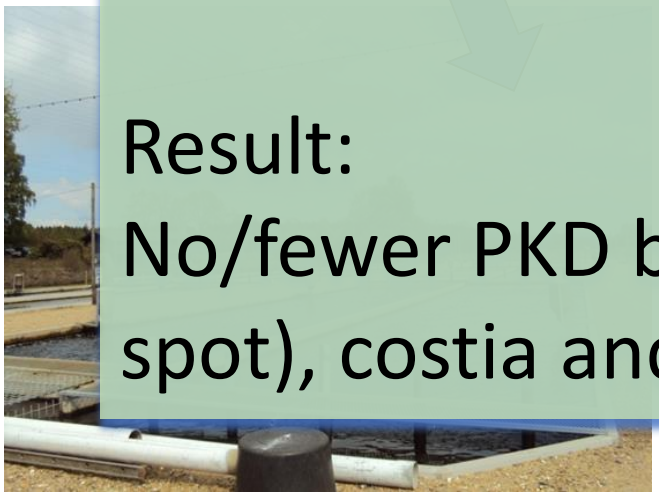


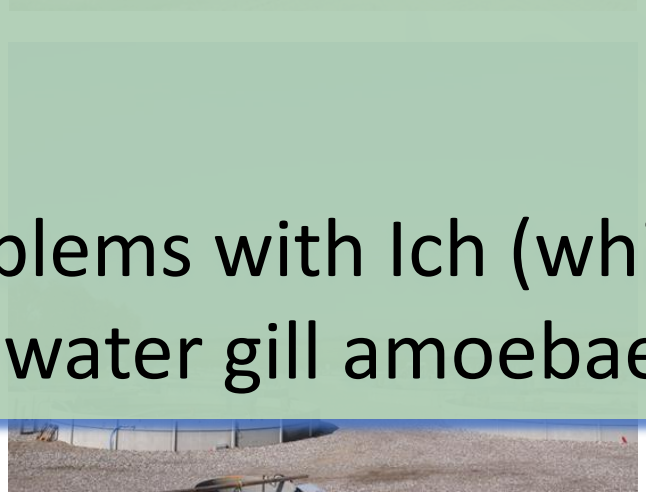
From FT to recirculation

- Change of water source
- Reuse of water
- Temperature
- Fish density



Result:

No/fewer PKD but problems with Ich (white spot), costia and fresh water gill amoebae



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Changing the conditions for parasites

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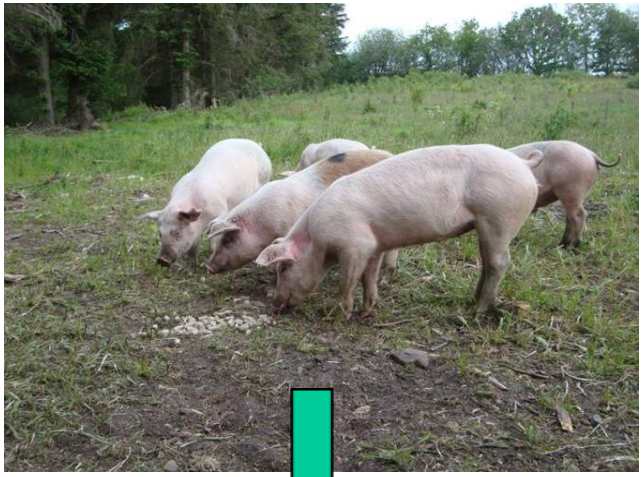

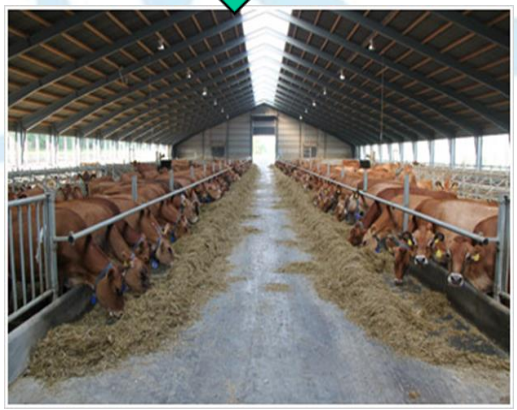

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Economic impact
Where are the money lost/used?

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- Mortality
- Higher feed conversion rate
- Less feeding
- Changing the farm specific production cycles
- Impact on immune system – other diseases
- Extra work on farms, surveillance
- Expenses to medicine / biocides
- Expenses to fish health people (e.g. vets)
- Lack of farm authorization
- Freezing of end product (anisakis)

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Economic impact
Do we have exact figures?

No because the effect can vary from

- parasite to parasite
- farm to farm
- year to year
- country to country

Two situations

1. Clinically outbreaks with high mortality
2. A constant parasite pressure not leading to high mortality but extra money lost/spend
   - Reduced growth
   - Biocide/medicine use
   - etc

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An important factor for economic impact

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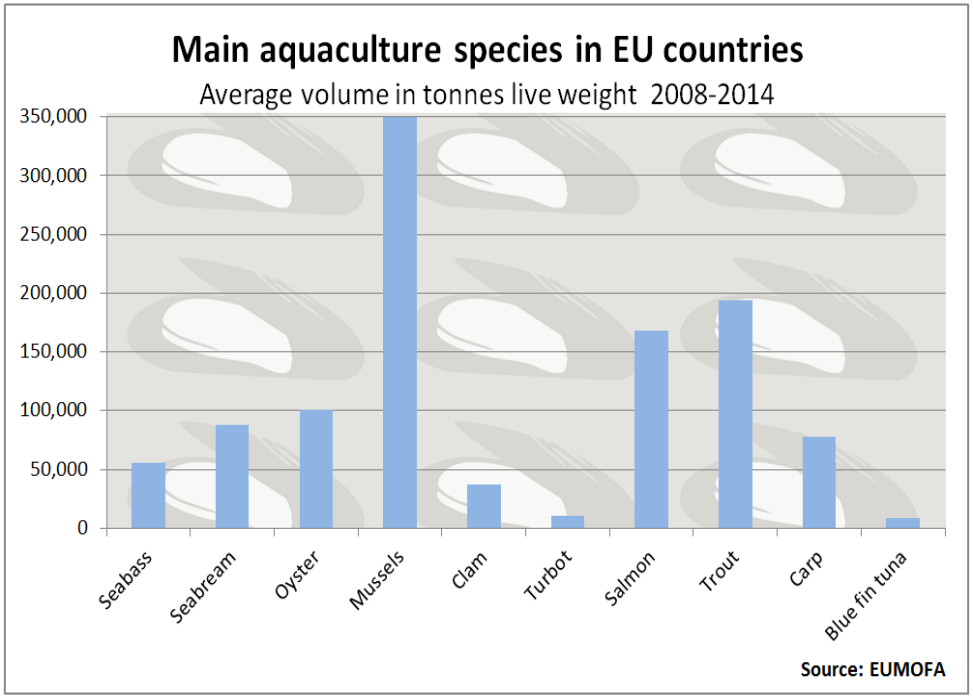
The lack of medicines for parasite treatment!

Except a few licensed VMP for sea lice there is none authorized to trout!!!



+ 90,000 tons trout in Norway

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Economic impact trout
Best guess

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In Denmark we produce 40,000 tonnes of trout

Our best guess is an annually loss of approximately

3 - 6 million € caused by parasites in farmed trout in DK

(no sealice problem!!)

Europe (300,000 tonnes)

Best guess: at least 25 – 50 million € annually!!

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Thank You

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