FISH HEALTH MANAGEMENT

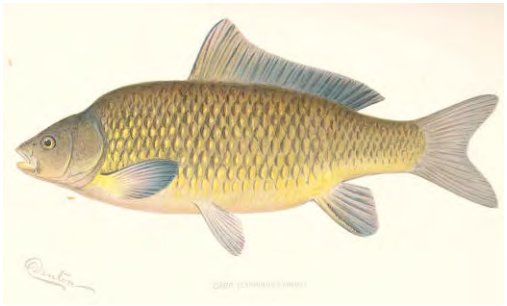
PDFs available online in

ENGLISH / GREEK / SPANISH / FRENCH / GALICIAN / HUNGARIAN / NORWEGIAN / POLISH /TURKISH

HEALTH MANAGEMENT -CARP

(Cyprinus carpio)

English



Developed by AQUARK Greece with HAKI, Hungary and AMC Ireland within the PESCALEX project.

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Education and Culture DG
Lifelong Learning Programme

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The PESCALEX project was funded with support from the LEONARDO da VINCI Programme of the European Commission
(IRL/05/B/F/PP-153180, LLP/LdV/TOI/2008/IRL-509).

AQUALEX Fish Health Toolset

The **AQUALEX Fish Health Toolset** was developed in order to combine teaching and learning in a specific subject area (fish health) with basic language learning in those languages most important in the European aquaculture industry. Its fish health materials should not be regarded as a comprehensive fish disease manual for the selected species, for there are many such reliable and comprehensive publications.

The following topics and species were selected by industry users as well as VET providers:

- Fish Health/Disease Management for Trout, Sea Bass, Turbot and Carp
- Fish Farm Quality Assurance Manual
- Basic Techniques for Fish Haematology

A unique feature of the **AQUALEX Fish Health Toolset** consists in its supporting language units, designed to help users not only to find the information/content they need, but also to enable them to communicate in the workplace in their targeted language.

* For those users who need fast access to reliable multi-lingual information on matters concerning fish health, the Toolset contains a **multi-lingual fish diseases glossary** in English, French, German, Spanish, Italian, Greek, Norwegian, Polish, Hungarian, Turkish and Galician.

* For those users who need to learn or to improve their language skills, the Toolset provides online language lessons in the above-mentioned languages.

The **AQUALEX Fish Health Language Support** is available at three levels.

Level 1 (Common European Framework of Reference for Languages - CEFR) levels A1, A2)

The priority for many **first-time language learners** is to understand and convey simple but vital pieces of information (i.e., keywords) in a new language. The AQUALEX language lessons for Beginners (**English, French, Spanish, Greek, Norwegian, Polish, Hungarian, Turkish, Portuguese, Swedish** and **Galician**) are designed to enable complete beginners to use their native language knowledge of familiar items in the workplace/laboratory, in step-by-step visual presentations with audio input (www.aqualex.org and www.pescalex.org Level I) This method gives them a chance to fast-track their language learning at their chosen time and at their own speed.

Level 2 (CEFR levels B1, B2)

Having picked up the first essentials in a user-friendly way, **students or workers** aiming to improve their language skills can progress at their own speed through the Toolset Fish Health course materials in **English, French, Spanish, Greek, Norwegian, Polish, Hungarian, Turkish** and **Galician**, online (www.aqualex.org or www.pescalex.org Level II). They can acquire vocationally relevant information on the above aspects of fish health, either in the native or the targeted language.

Level 3 (CEFR levels C1, C2)

For the seasoned practitioner, Ph.D student or academic, the Toolset contains two **multi-lingual fish diseases and aquaculture glossaries** in **English, French, German, Spanish, Italian, Greek, Norwegian, Polish, Hungarian, Turkish and Galician**. These online resources present high-level information and detailed definitions in the accepted academic format.

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Viral diseases

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Koi carp Herpes virus (KHV)

Carp papilloma (Carp pox)

Spring viraemia of carp

- SVC virus
- Not present in warm climate countries
- Unusual in extensive culture
- The virus is present throughout the year

Susceptible species
Freshwater carp of one or two summers
Silver carp
Crusian carp
Catfish (under experimental conditions)
Grass carp
Pike
Guppy
Introduction by ornamental fish

Incubation period
- 7 to 60 days (14-28 days in field)

Distribution
- Most European countries with carp culture

Mortality
- Steady mortality
- up to 30% depending of fish health status and environment
- Less in extensive culture

Temperature
- In spring when water temperature is between 10 and 15C and never >20C

Clinical symptoms

Behavioural changes
- Swimming on the edge of enclosures

External Clinical Signs
- Exophthalmia
- Extreme ascites
- Swelling of the vent
- Petechiae on the skin
- Darkening of the skin
- Inflamed vent

Internal signs
- Haemorrhages on skin, gills, abdominal adipose tissue, swim bladder and other internal organs
- Haemorrhages on the muscle (petechiae)
- Bloody fibrinous Ascites
- Purulent Peritonitis

Diagnosis
- Cell culture
- 7 to 21 days
- ELISA
- few hours

Histology
- Necrosis of the haemopoietic tissue, liver and spleen
- Lymphocytic encephalitis

Transmission
- Clinically infected or asymptomatic fish through water and equipment
- Water-infected fry transport
- Blood-sucking parasites (*Argulus, Piscicola)*
- Induction
- Stress from temperature change, transport, grading

- high stocking density
- Physical damage
- Hibernating fish are handicapped if there was a strong frosty winter or a mild one without feeding
- Fish immune response starts only at temperatures higher than 14C
- In spring energy requirements are high but natural food production has not yet taken place

Prevention

- Purchase fish from SVC free farms
- Good hygiene practices
- Regular pond disinfection (liming, drying, freezing)
- Assessment of individual fish when carp are prepared for the winter ponds
- Start feeding in spring as soon as possible (if no natural food is available)

Action

- No SVC Treatment exists
- Antibiotic treatment for the secondary bacterial infections after Antibiogram(*Aeromonas hydrophila*)
- Don't sell infected stock for stocking or breeding purposes
- Don't move fish either within the farm or to different farms
- Reduce the spread of the disease

Fast Diagnosis

- Quarantine suspected populations
- Disinfection measures
- Important to control extoparasites (especially blood sucking - transmission by carp, lice and leeches)

Treatments

- No effective and safe vaccine for SVCV
- Some (non EU) countries are using SVC live vaccines
- 2 vaccines (inactivated and attenuated virus) were developed in Europe but got nolicense yet
- Ip or oral vaccination in autumn with live virus induces high and long lasting immunity
- Heistinger: oral vaccination in Austrian farms induced immunity and less than 1% mortality in Austrian farms
- Subunits based on SVCV glycoprotein were not successful e.g failure of Belgian Pharos S.A (baculovirus expressed G protein)
- Contrary to Novirhabdoviruses - very few DNA vaccines were tested for SVCV

Legal framework

- SVC is notifiable in EU (voluntary control)
- List III of Council directive 91/67/EEC
- SVC is a notifiable disease for UK

Koi carp Herpes virus (KHV)

- Also known as cyprinid herpesvirus-3 or CyHV-3) is classified as a DNA
- virus belonging to the virus family Herpesviridae
- Closely related to carp pox virus
- KHV is believed to remain in the infected fish for life;
- therefore, exposed or recovered fish should be considered as carriers of the virus

Pathogen

- cyprinid herpesvirus-1 or CyHV-1
- and cyprinid herpesvirus-2 or CyHV-2

Mortality

- May cause between 80-100% mortality in susceptible populations
- Fry more susceptible than mature fish.
- Starts within 24 to 48 hours after onset of clinical signs.
- Affects fish of all ages

Temperature

- Water temperatures between 22° and 27 °C

Clinical signs

- Often non-specific
- May produce severe gill lesions seen as red and white patches
- White patches are due to necrosis of the gill tissue

External signs

- Bleeding gills, sunken eyes, pale patches or blisters on the skin, notched nose
- Microscopic examination of gill biopsies often reveals high numbers of bacteria and various parasites

Internal signs

- Variable and non-specific
- May include greater than normal adhesions in the body cavity
- Mottled appearance of internal organs

Behavioural changes

- Affected fish often remain near the surface
- Swim lethargically/ uncoordinated swimming.
- Exhibit respiratory distress

Transmission

- Direct contact with infected fish
- Fluids from infected fish and water, mud or other vectors in contact with contaminated systems
- Through the gills and possibly the gut.

Diagnosis

Direct methods

- virus isolation and identification from blood, fecal, mucus ad gill clip samples
- PCR techniques (testing for the presence of KHV DNA material).

Indirect tests

- ELISA) and VN testing (on blood sample)

Differential diagnosis.

- Spring Viraemia of carp (SVC)
- Carp pox (cyprinid herpesvirus-1 or CyHV-1).

Treatment

- No treatment available.
- Currently there is no approved vaccine

Prevention

- Use only certified stock from reliable supplier
- Quarantine is best method to avoid the introduction of pathogens
- Quarantined fish require dedicated equipment
- Must be kept in a separate system for 30 days

Action

- Slaughter entire population is a logical option.
- All materials and systems to be cleaned and disinfected.
- Biofilters and biofilter media exposed to the virus should also be thoroughly cleaned and disinfected.
- Prior to disinfection, equipment should be cleaned of debris or organic build-up, as these may reduce the effectiveness of the disinfectant.

Legal framework

- KHV is now listed as a notifiable fish disease by the OIE.

Carp papilloma (Carp pox)

- Herpesvirus (identified in Japan) Described by Gessner at 1563 as carp pox,
- *Epithelioma papillosum* or *Papillosum cyprinii*.
- This is the oldest recognised fish viral disease.

Clinical symptoms

- They appear like blobs of jelly or candle wax on the fish skin.
- Ulceration and secondary infections could be severe
- Retarded growth
- Whitish to opaque lesions sometimes also pigmented
- Irregular shape warts up to several centimetres in diameter and few millimetres in thickness
- Tumour multicentral formation but no case of metastasis to other organs
- Hyperplasia may persist for several months
- Sometimes spontaneous regression can take place

Histology

- Hyperplasia of epithelial cells with intercellular connections
- Mitotic figures
- Some intranuclear Cowdry type A inclusion bodies
- Between epithelia normal mucous cells exist

Temperature

- They develop usually in summer and regress in autumn and winter
- Re-occurrence next summer is not uncommon.

Bacterial diseases

Carp / Cyprinid Erythrodermatitis

Motile *Aeromonas* septicaemia

Columnaris

Carp / Cyprinid Erythrodermatitis

Pathogen
Aeromonas salmonicida subsp nova (atypical)

Susceptible species
Fresh water
Ornamental fish
goldfish
koi carp
other cyprinids
eel
whitefish

Mortality

- Relatively low
- Depends on environmental conditions and fish health status
- Rarely more than 20 % but it can produce low-level grumbling mortalities/moribund stocks

Clinical picture

Behavioural Changes
External clinical signs

- Haemorrhages on the skin and the base of fins
- Sporadic fingernail size ulcers (3cm)
- Could extend through muscle to abdominal cavity
- Location:
  - dorsal side of lateral line behind the head
  - base of tail fin
- Characteristic white border around the open red ulcers
- If this border turns black the lesions are healing
- After moving fish in spring spontaneous recoveries (without treatment) might occur

Diagnosis

Bacteriology

- Sometimes pathogen isolation only possible in acute cases
- Antibiogram (5-7 days)
- Must avoid drug resistance
- IFAT (1 day –confirmation)

Temperature

- Asymptomatic infections
- Summer disease
- Clinical disease always above 22C

Transmission

- Carrier fish
- Contaminated water
- Equipment
- Birds
- Employees
- Blood sucking parasites (*Argulus*)

Prevention

- Quarantine purchased fish
- Reduce stress
- Avoid overcrowding especially at high water temperature
- Routine bacteriology before moving fish in spring and autumn

Vaccination

- Cross protection from Furunculosis vaccines
- Primary vaccination
- Immuno-competence at 5g
- Immersion at 5g
- At least 20 days prior movement to infected waters
- Vaccinate healthy stock
- Fish should be able to swim in the vaccine solution (1:10 in water)
- Antigen Uptake through the gills
- Dose:100 kg biomass per Lt of vaccine
- Protection : 8-12 months
- Booster vaccination
- Immersion or Oral or injection
- 6 months after primary vaccination

Action

- Reduce the spread of the disease

Fast Diagnosis

Bacteriology

- Antibiogram (2 days)

Prevention

- Stress reduction
- No handling
- No grading
- Avoid overcrowding
- Improve water flow

Treatment

- Chemotherapy
- more difficult at water temp <15C - lower feed consumption
- Injection of valuable fish (broodstock)

Vaccination

- Often vaccination in SVC stock is not successful
- Effective vaccines exist

Motile *Aeromonas* septicaemia

Pathogen

- Various motile Aeromomads
- *Aeromonas hydrophila*
- Occurs along with SVC and Erythrodermatitis
- in ASIA rise culture is closely related to Epizootic Ulcerative Syndrome (EUS)
- Disease in Frogs, turtles and snakes
- In humans causes
  - Gastroenteritis
  - Wound infections
  - Septicaemia

Susceptible species
All fresh water and sea water
All warm water and cold water
Mainly in pond water culture
carp
goldfish
catfish

Distribution

Worldwide

Mortality

- Difficult to calculate because occurs concurrently with other infections

Temperature

- Range >10C
- Spring disease in ponds

Clinical symptoms

- Peracute form with no symptoms
- Not typical - looks like any bacterial septicaemia
- Haemorrhages and ulcerations on the skin and muscle (chronic form)
- Might have co-infection by *Saprolegnia*
- Necrosis on the fins and tail (fin and tail rot)
- Exophthalmia
- Ascites
- Sloughing off the scales
- Haemorrhages on gill and vent

Internal signs

- Haemorrhages in visceral organs and muscle
- Blood -tinged fluid in abdominal cavity
- Enlarged spleen and kidney

Diagnosis

- Bacteriology (hind kidney)
- Antibiogram (5-7 days)
- Must avoid drug resistance
- IFAT (1 day – confirmation)

Transmission

- Motile Aeromonads: normal water microflora
- Could be isolated even in tap water
- Present on gills and skin, gut of healthy fish
- Facultative pathogens affecting immuno-compromised fish in poor conditions

Prevention

- Control underlying factors
- Reduce stress
- Avoid overcrowding

- Improve water quality
- Improve general hygiene
- Drain and disinfect ponds after use
- Vaccination
- Unlikely to be developed due to ubiquitous nature and many serotypes

Action

- Reduce the underlying factors

Fast Diagnosis

Bacteriology

- Antibiogram (2 days)
- Stress reduction
- No handling
- No grading
- Avoid overcrowding
- Improve water flow
- Avoid antibiotic treatment (pathogens are ubiquitous)

Columnaris

Pathogen

- *Cytophaga columnaris* is the causative agent
- Filamentous cells
- Gram-negative
- Slender and rather long bacilli, 0.3- 0.5 *11-m* long.

Susceptible species

- Many species world-wide

Mortality

- In most cases the mortality is low but the morbidity is high.
- Tropical cyprinids have high mortality

Temperature

- 15°C and above

Clinical picture

Behavioural changes

- Lethargy
- Loss of appetite
- Increased production of mucus
- Stressed young fry and fingerlings are most susceptible.

External appearance

- White spot on head, gills, fins or body, surrounded by reddish tinge
- Lesions may appear as small grey-white spots to deep, open, hemorrhagic ulcers
- Necrotic skin erosions
- Affected gills
- Damaged fins
- Tail rot

Internal Clinical Signs

- Observation of accumulations of long filamentous rods in wet mounts mainly in the affected fish gills.
- Yellow pigmented colonies on nutrient low agar Gram-stained preparations obtained from gills or skin lesions
- Isolation in selective culture media,
- Polymerase chain reaction (PCR) may also be used to confirm the presence of the bacterium.

Diagnosis

- Bacteria are not usually found systemically until a relatively large amount of external skin or gill damage has taken place

Wet preparations:

- *F. columnaris* shows a slow gliding movement.
- Gather into characteristic column-like masses
- Filamentous cells on the columns display an active flexing movement
- Cells are Gram-negative, slender and rather long bacilli,0.3 – 0.5 long
- The bacteria grows well on low nutrient cytophaga agar, producing pale yellow thizoid colonies, or variable size and shape

Transmission

- Water Transmission
- Entry through the gills or abraded skin.

Prevention

- Outbreaks appear to be stress related so optimal husbandry conditions and nutrition required in order to avoid outbreaks.
- Avoid over-feeding

Treatment

- No commercially available vaccine
- Antibiotics can be applied in medicated feed given during a confirmed infection
- Sulphonamides or antibiotics added to the food.
- Sulphamerazine and oxytetracy- cline administered therapeutically in a two-stage regime: 220 mg/kg/day for 10 days followed by 50--75 mg/kg/day for 10 days.

Action

- Water quality is an important factor as the pathogen can survive for long periods in hard water and high organic load
- Survival time reduced significantly in water with a pH of 6.0.
- Soft water of about 10 ppm $CaCO_3$, of low organic matter content, does not provide a favourable environment for the organism.

Fungal diseases

Saprolegniasis (*Saprolegnia parasitica*)

Branchiomycosis

Saprolegniasis *Saprolegnia parasitica*

- Sources of fungal spores exist in all aquatic systems
- Most frequent in water
- Peaquatic fungi
- in river water
- well water
- ground water and
- spring water

Pathogen

- *Saprolegnia parasitica* is ubiquitous.

Susceptible fish species

- All fish species.

Temperature

- No specific range
- Development is quicker at higher temperatures.

Clinical Symptoms

- *Saprolegnia* is primarily found on dead tissue and multiplies quickly
- It produces a fluffy mass, particular on fertilised eggs
- The sporangia of the fungus contain hundreds of motile spores, which aid rapid fungal spread to other susceptible hosts.
    - If the susceptibility (also against bacterial, viral and parasitic infections) of fish increases due to:
    - poor water quality
    - high stocking density
- *Saprolegnia* can also invade muscle tissue
- *Saprolegnia* is usually a sign that something else is wrong (except for physiologically compromised animals, e.g. fungal infection of male salmonids after spawning)
- Previous damage to the mucus membranes of the fish predisposes the animal to fungal infection
- In practice mainly male salmonids are very susceptible to *Saprolegnia* infection induced by certain hormonal caused skin structure changes

Mortality

- Generally low
- Rarely the primary cause of disease
- In cases of massive invasion mortalities can occur.
- The unpleasant appearance of such makes them un-saleable

Diagnosis

- Simple skin scrape preparation
- Microscopy at 25x magnification
- Fungal hyphae and spores.

Transmission

- Horizontal transmission
- Water
- Fish to fish
- Equipment
- Insufficient health condition

Prevention

- Optimise health conditions
- Improve water quality
- Reduce of the stocking density
- Optimise feeding
- Control other possible diseases (examination and diagnosis)
- which cause secondary fungus infections.

Action

- Remove dead eggs or fish immediately
- Most active chemotherapeutants (e.g. malachite green) which have been used for many years for fish disease control are not approved for use.
- In Germany malachite-green oxalate is licensed for the prevention of Saprolegniasis in salmonid eggs during incubation. The license applies only for egg treatment.

Branchiomycosis

Common in Europe, but only occasionally reported in U.S. fish farms. Commonly known as Gill rot

Pathogen

- *Branchiomyces sanguinis* and *Branchiomyces demigrans*
- Both species of fungi are found in fish suffering from environmental stress

Susceptible species	
Branchiomyces sanguinis	*B demigrans*
Crucian carp	pike
tench	tench
trout	
bleak	

Mortality

- High, up to 50% in some cases

Temperature

- *Branchiomyces* sp. grow at temperatures between 57° and 95°F but grow best between 77° and 90°F

Behavioural changes

- Swimming at water surface
- Rapid opercular movements
- Fish may appear lethargic
- Gasping for air at the water surface
- Asphyxia

Clinical Signs

- White & red patches (mottled appearance) on gills
- Obstruction of blood circulation in gills leading to haemorrhages, resulting in necrotic tissue

Diagnosis

- Microscopy of gills

Transmission

- Fungal spores from necrotic tissue carried in the water
- Detritus on pond bottoms.

Treatment

- No treatment known

Prevention

- Avoidance is the best control.
- Reduce organic load
- Increase water exchange
- Maintain good water quality
- Prevent stress from overcrowding
- Do not transport infected fish
- Prevent movement of the disease to non-infected areas.
- Formalin and copper sulphate have been used to help stop mortalities

Action

- All tanks and raceways must be disinfected and dried
- Ponds must be dried and treated with quicklime (calcium oxide).

Parasitic diseases

Flagellates
- ***Hexamita*** **or** ***Octomitus salmonis***

Ciliates
- ***Trichodina*** **sp.**
- ***Tripartiella*** **sp.**
- ***Trichodinella*** **sp.**
- ***Glossatella / Apiosoma***
- **Tetrahymena (fresh water) / Uronema (marine water)**

Cestodes
- ***Caryophyllaens*** **sp.**
- ***Bothriocephalus*** **sp.**
- ***Ligula intestinalis***

ACANTHOCEPHALA **(Spiny headed worms)**

Crustacea
- ***Argulus foliaceus*** **Fish louse**
- **Lerneosis**

Piscicola Leech

Flagellates

Hexamita or *Octomitus salmonis*

Pathogen

- *Hexamita* (scientifically now correctly *Octomitus salmonis*, but *Hexamita* is still more common)
- Parasite typical of weak fish
- Heavy infections are commonly observed as secondary infections in fish in poor health conditions
- *Hexamita* has often been observed in fish infected with VHS and it has been speculated that the parasite may even be able to act as a carrier of VHSV (and therefore perhaps of other viral pathogens) although scientific confirmation is lacking
- Likely explanation for the frequency of concurrent infections is that *Hexamita* is a secondary invader of VHS compromised fish

Susceptible fish

- Mainly salmonids of all age groups
- Ornamental fish are susceptible as well as grass crap.

Temperature

- All temperature ranges.

Mortalities

- Direct mortalities in fry and ornamental fish.
- Lingering mortality rates

Clinical Picture

Behavioural changes

- Extremely nervous fish behaviour in ponds

Internal signs

- Hind part of the intestine is often paler than normal.

Diagnosis

- Microscopic examination on a scrape preparation of the hind part of the intestine at a magnification of 200x
- The parasite cells swim rapidly so that some experience is needed for exact diagnosis
- *Hexamita* cells can be observed as oval shaped spots.

Transmission

- Easily transferable probably by
- Infected fish
- Water
- Farm equipment
- Employees

Prevention

- Good hygiene especially in the hatchery.

Action

- Medicated feed e.g. Dimetridazol or magnesium sulphate (200-300 mg/Kg feed 5 d)
- Identification of the parasite
- Prescription by a veterinary practitioner

CILIATES

Trichodina sp.

Pathogen

- More a commensal than a genuine ectoparasite.
- *Trichodina, Trichodinella, Tripartiella, Foliella* differ only in shape, size and hooks.
- Damage caused is comparable

Susceptible species

- All species and age groups.

Temperature

- All temperature ranges.

Clinical symptoms

- Grey-blue turbid layer on the skin.
- Mucus and gill injuries
- Gill swelling
- Gill necrosis
- Fin damage in fry and small ornamental fish.

Mortality

- Depends on infection rate and fish size
- High mortality rate only occurs in cases of massive invasion
- Mainly affects rainbow trout fry and fingerlings.

Diagnosis

- Microscopic examination at 60-160x magnification
- Gill or skin scrape preparation.

Transmission

- Infected fish, water
- Undisinfected farm equipment
- Live food for ornamental fish.
- Plants

Prevention

- *Trichodina* often occurs in combination with poor environmental quality producing a decrease of general health conditions
- Hygiene in hatcheries
- Quarantine for ornamental fish

Action

- Microscopical identification of the parasites
- Long-term baths (2-3g/10m^3) with malachite green (for non-food species) Combination of malachite green and Formaldehyde
- Short-term baths using
  - Formaldehyde
  - Chloride
- Liming for big ponds
- Sodium chloride for ornamental fish and sensitive domestic fish fry as short-term
  - baths: 1-1.5%, 20-30 min
- Long-term bath: 0.2-0.3% for at least 10-12 hours
- Treatment with salt is generally not 100% successful.

Tripartiella sp.
Trichodinella sp.

Smaller than skin *Trichodina*

Glossatella / Apiosoma

Pathogen

- *Glossatella* / *Apiosoma* species.
- *Apiosoma* / *Glossatella* infection is a clear sign of the excessive contamination of the water with organic matter.

Susceptible species

- All species and age groups.

Temperature

- Almost all temperature ranges

Mortality

- Acute mortality only occurs with fry with massive infections.

Clinical picture

- Not very clearly defined
- Slight grey-white layer on the skin
- Problems with respiration

Diagnosis

- Microscopic examination of a gill or skin scrape preparation (60-160x).

Transmission

- Infected fish
- Water (especially with highly organically contaminated water)
- Non disinfected farm equipment

Prevention

- Quarantine or immersion bath treatment before stocking
- It would be best of this could be done on the supplying site
- Improve the environmental quality reduce the loading of organic matter
- Hygiene in the hatchery
- Routine examination of fry

Action

- Microscopical identification of the parasites which can be done by experienced fish farmers
- Long-term baths with malachite green (2-3g/10m^3) for non food fish species or combination of malachite green and Formaldehyde, chloride liming for big ponds can be used
- *Glossatella* attaches with a food disk onto the gills or/and onto the cells of the skin and therefore gaseous exchange is affected. This can lead to a kind of "allergic" reaction causing decreasing health and mortality.
- *Glossatella* eats microorganisms and "detritus (organic matter of diverse origin in water) which is whirled towards the mouth opening with help of the cilia.

Tetrahymena (fresh water) / *Uronema* (marine water)

Susceptible species
(*Pilasterides dicentrarchi)*
sea bass
Uronema marinum
Japanese flounder
Turbot
Red sea bream
Bluefin tuna
Tetrahymera sp.
Fresh water species

Temperature

- Wide temperature range

Mortality

- Up to 100% in juveniles

Clinical picture

- Invasion of muscle (obvious)
- Causes deep skin & muscle ulcers
- Invasion of internal organs (obvious only when fish are moribund)
    - kidney
    - liver
    - brain
    - spinal cord

If nervous tissue is affected

- erratic swimming
- loss of equilibrium
- lethargy

Diagnosis

- Ovoid -shaped ciliate parasites (35µm)
- Fresh mounts
- Stained mounts
- Histology sections
- Species identification requires Electron microscopy

Transmission

- *Uronema:* Free living organisms that reproduce by binary fission
- Organic material and debris favour development
- Some strains are more pathogenic
- Pathology when balance between parasite density and host resistance shifts

Prevention

- Regular fish observation
- Close examination of moribund fish
- Hygiene, cleaning of facilities
- Formalin baths to reduce parasite density
- Vaccine development is described in turbot

Action

- Formalin baths only in the early stage of the infection
- No treatment on systemic infection

Cestodes

Caryophyllaens sp.

- Tape worm species found in the intestine
- salmonids and cyprinids

Bothriocephalus sp.

- Grass carp tape worm (*Bothriocephalus*)
- introduced by the grass carp
- now found in all carp species

Ligula intestinalis

- Outside the intestine mainly in
  - carp
  - coregonids

ACANTHOCEPHALA (Spiny headed worms)

Pathogens

Different Acanthocephalan species.

Acanthocephalus sp.
Echynorhynchus sp.
Pomphorhynchus sp.
Acanthorygus Pallisentis sp

- In heavy invasions Acanthocephalans may perforate the gut wall with their proboscis and cause considerable damage with severe local inflammatory response

Susceptible species

- All fish species and age groups
- depending on the Acanthocephalan species

Temperature

- Massive invasions are only seen in winter and early spring

Mortality

- Depending on the species of Acanthocephalan, usually not heavy.

Clinical picture

- Clear external signs are not evident in live fish
- On opening the visceral cavity parasites up to 2cm long can be seen macroscopically on the intestinal wall.

Diagnosis

- With naked eye after dissection of the intestine
- different species can be identified by the head (proboscis) shape when observed microscopically (25x)

Transmission

- Intermediate hosts
- Amphipods (mainly *Gammarus*)

Prevention

- Random sampling and examination by the fish farmer during the winter season when purchasing new fish
- General pond hygiene and yearly liming.

Action

- In some area a medicated feed (Concurat or Mansonil) may be available on prescription after identification of the parasite
- Massive invasions should be controlled
- Such invasions may have also commercially adverse consequences, if consumers see heavily Acanthocephalan-infected guts.

Crustacea

Argulus foliaceus Fish louse

Pathogen

- Small fish parasitic crustacean, Fish louse, *Argulus* spp.
- *Argulus* is not an "obligate" parasite
- Able to move and survive just in water without a host
- A blood sucking parasite and can actively transmit infectious diseases such as SVC, therefore it is important to control *Argulus*.

Susceptible fish species

- All species and age groups.

Temperature at outbreak

- All temperature ranges but mainly in the summer.

Mortality

- Acute mortality only with young fish in case of heavy infections
- *Argulus* can act as a carrier for viral (Spring Viraemia of Carp) or bacterial pathogens (CE).

Clinical picture

Behavioural changes

- Occasional rubbing the fish
- No abnormal behaviour indicative of the presence of these parasites.
- *Argulus* bites can lead to small often reddish inflamed wound

Diagnosis

- With naked eye
- Bite wounds can be seen on the fish skin.

Transmission

- Water
- Infected fish
- Live feed for ornamental fish from infected waters

Prevention

- Random sampling and examination by the farmer himself
- Submission of gill samples (fixed in formaldehyde of 70% alcohol) for examination

Action

- An organophosphate insecticide such as trichlorfon
- 1g/3m^3 water for cyprinids
- 1g/4m^3 water for salmonids
- Products such as trichlorfon should only be used where permission from appropriate authorities has been obtained.
- Do not use trichlorfon in
    - areas used for water supplies
    - drinking places for animals

Lerneosis

Pathogen

- *Lerneae cyprinacea* is the causative agent

Susceptible species

- Over 40 cyprinid species

Mortality

- In most cases the mortality is low, but there often are secondary infections.

Temperature

- 20°C and above

Clinical picture

Behavioural changes

- Loss of appetite
- Stressed young fry and fingerlings are most susceptible.

External appearance

- Attached parasites on skin easily seen with naked eye
- Lesions
- Muscle necrosis, haemorrhaging, inflammation
- affected gills

Internal Clinical Signs

- Observation of accumulations of parasites on gill and skin.

Transmission

- Water Transmission
- Entry through the gills or abraded skin.

Prevention

- Avoid the introduction of infected fish into a system.
- Quarantine fish for at least three weeks at $25^{O}C$
- Drain the pond and treat with lime

Treatment

- Organophosphate insecticides can be used, but they are effective against the copepodid stages, so treatment must be repeated every seven days for at least $27^{O}C$ to kill all the females

Leeches

Piscicola Leech

Pathogen
- *Piscicola* leech.

Susceptible fish species
- All species and age groups.

Temperature
- All temperature ranges
- High multiplication rate between late spring and autumn.

Mortality
- Acute mortality can occur in fry or fingerlings, during major outbreaks.
- High mortality mainly in tench or pike as well as other species living in open water systems.

Clinical picture
Behavioural changes
- No specific behaviour
- Rapid swim movements
- Occasional rubbing

- Wounds from bites may be noticeable.

Diagnosis
- Leeches can be seen with the naked eye
- Up to 50mm length
- Produce red inflamed bite wounds.

Transmission
- Water
- Fish as well as
- Plants or stones from infected water systems (aquaria).

Prevention
- Routine examination after purchase
- Pond hygiene
- Liming

Action
- Organophosphate insecticide such as trichlorfon
- 1g/3m^3 water for cyprinids
- or 1g/6m^3 water to allow survival of food where fish are dependent on natural food
- 1g/4m^3 water for salmonids
- Products such as trichlorfon should only be used where permission from appropriate authorities has been obtained.
- Do not use trichlorfon in
  - areas used for water supplies
  - drinking places for animals
- Quicklime dip bath (pH 10 bath)
- 1g in 2l water for 5 seconds (not for pike, danger of eye damage)
- Return fish to clean water immediately.

Other

Swim Bladder Inflammation

Cataracts

Swim Bladder Inflammation

Susceptible species

- Several carp species in Europe

Clinical signs

- Same gross signs as SVC

Internal signs

- Inflammation of the swim bladder
- Congestion of swim-bladder blood vessels
- Haemorrhages
- Sloughing off the swim bladder wall

Cataracts

Cataracts are defined as a partial or complete opacity of the crystalline lens, and may be attributed to several factors:

- deficiency of amino acids (e.g. zinc)
- vitamins (e.g. riboflavin)

Agents such as

- Helminthes
- viral and bacterial infections
- intoxication

- Osmoregulatory difficulties (e.g. smolts transferring from fresh water to sea water) and
- mechanical damage can also result in cataracts
- Sometimes the causes may not be properly identified.

Susceptible species

- All fish are susceptible

Temperature

- No specific temperature range identified

Mortality

- Mortality is generally low
- Losses may continue over long periods

Clinical picture

- Blindness and subsequent lesions due to unilateral or bilateral opacity of the lens, sometimes with accompanying exophthalmos
- Both temporary and permanent cataracts occur
- Opacities of the lens
- Ulceration
- Swelling
- Gross enlargement of the entire corneal diameter

Factors

- Excessive sunlight
- Toxic substances in the water
- Dietary imbalance
- Mechanical damage may contribute to this type of eye lesion.

Diagnosis

- Cross examination of the eye
- Stained histological sections provide additional information

Transmission

- Not applicable for non-infectious causes

Prevention

- Many causes of cataracts
- Many cataracts are reversible and therefore can be cured
- Identification of the cause is important
- Other cataracts are untreatable
- Likely to lead to permanent blindness in the long term

Action

- Those cataracts that are degenerative and permanent are not generally treatable and are likely to result in blindness
- Those that may be reversed can be treated indirectly by removing or treating the cause(s)

PESCALEX Partners

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Faculty of Fisheries at the University of Rize,
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The Department of Aquaculture, Chemistry and Medical Laboratory Technology at the **University College, Bergen**, Norway.

The **Agricultural University in Szczecin, Poland**.