FISH DISEASES

TEMPERATURE STRATIFICATION

- not harmful; causes dangerous water quality changes
- common in ponds >1.5 m deep, rare in shallow ponds
- formation of two distinct water layers:
  - Epilimnion (warm surface layer)
  - Metalimnion
  - Hypolimnion (cool bottom layer)

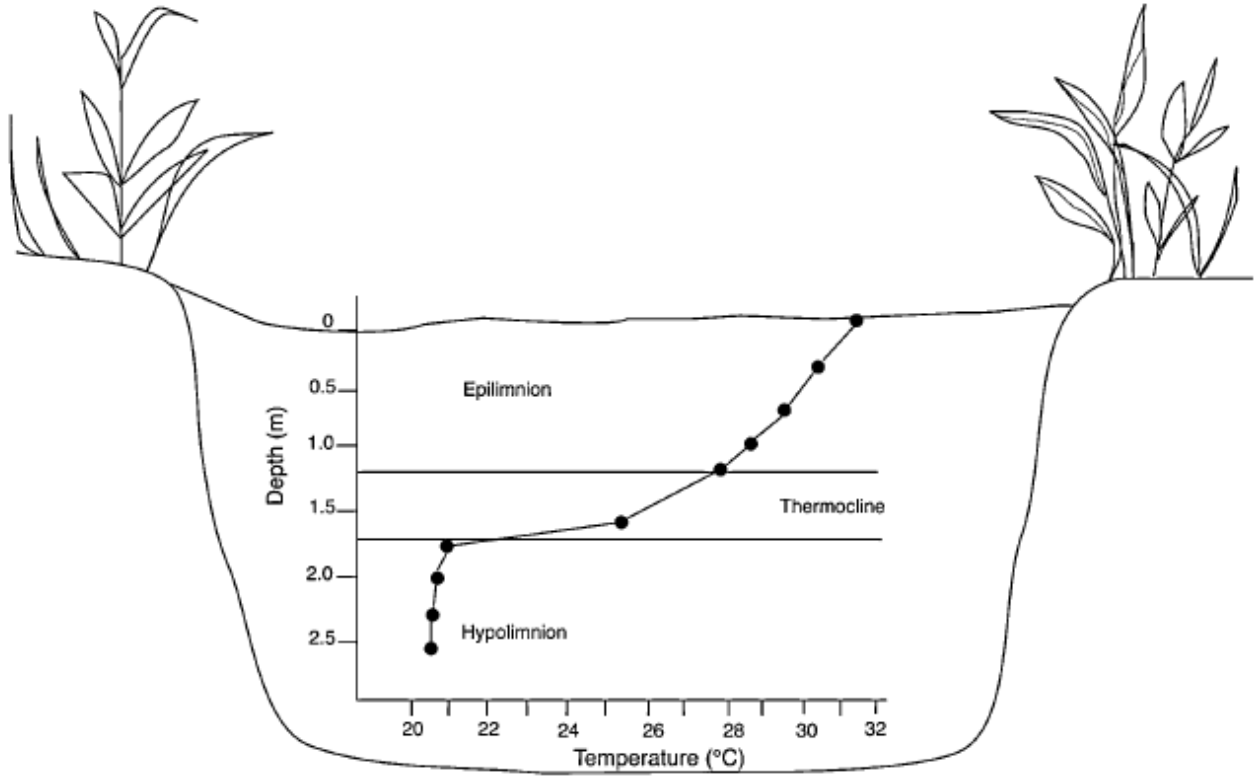


Fig. II-3. Typical temperature zones in a stratified pond.

TEMPERATURE STRATIFICATION

Effects on Water Quality

- sudden mixing can cause:
  - rapid oxygen depletion
  - accumulation and release of toxic substances - methane and hydrogen sulfides gases
  - fish kill

Predisposing Factors:

- strong winds
- cold rain
- harvesting (seining)
- aeration

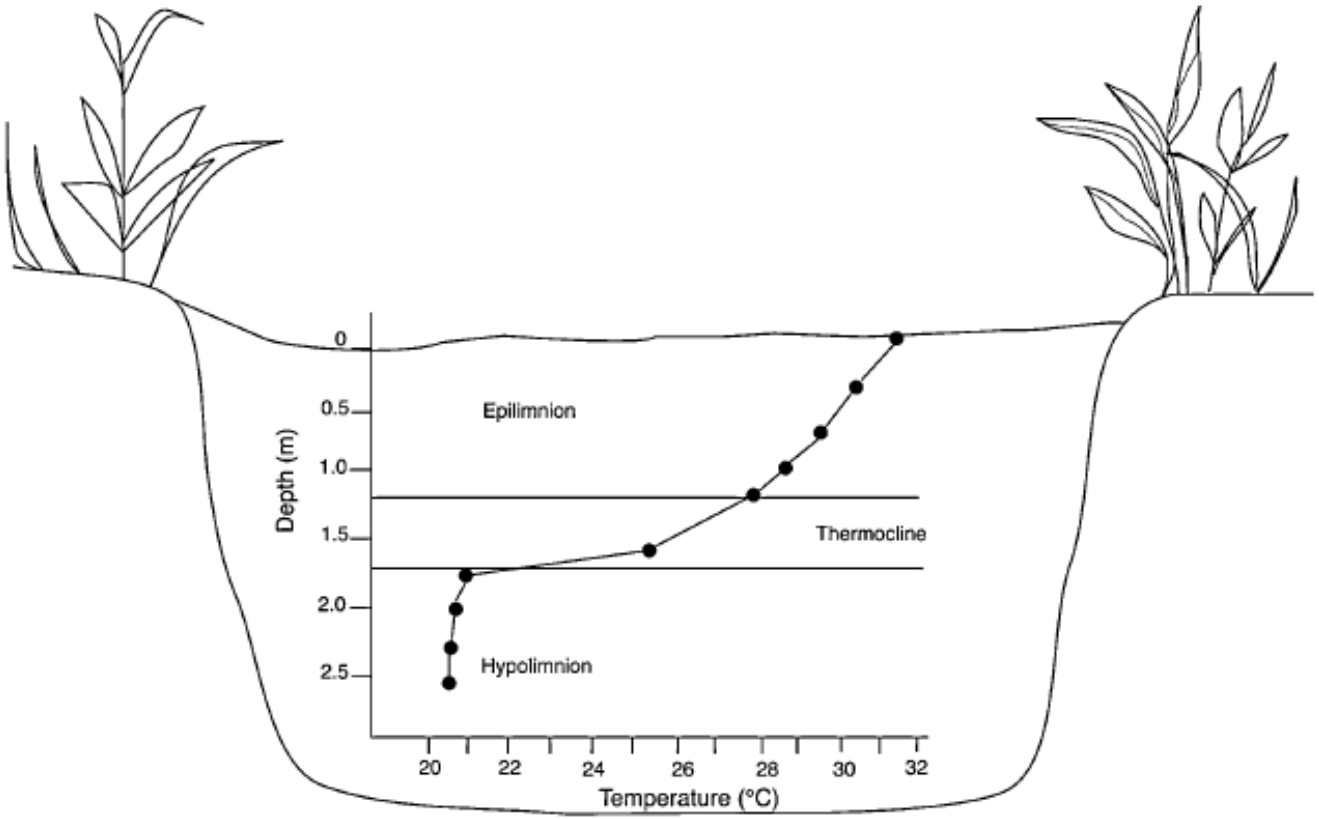
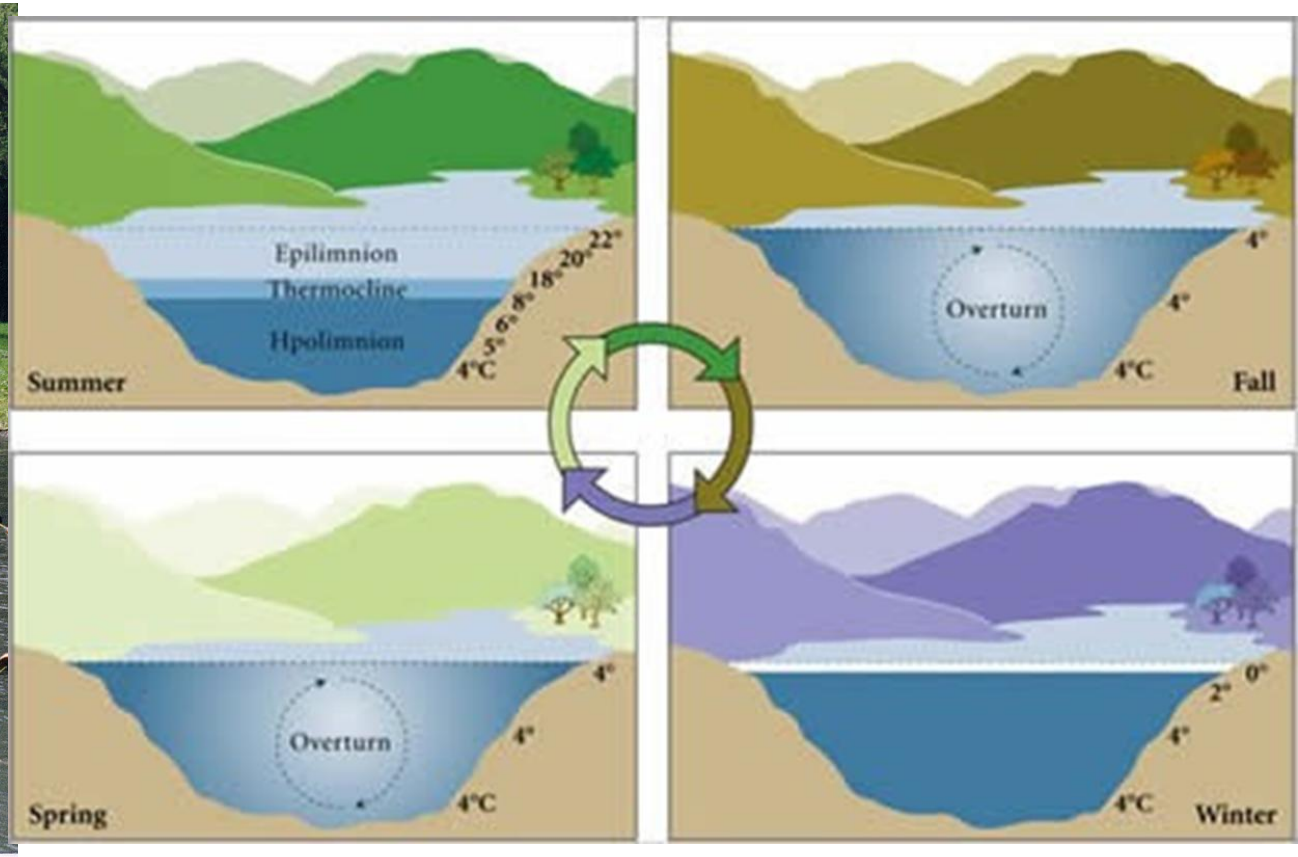


Fig. II-3. Typical temperature zones in a stratified pond.


Epilimnion
Thermocline
Hpolimnion
22°
20°
18°
8°
6°
5°
4°C
Summer
Overturn
4°
4°
4°C
Fall
Overturn
4°
4°
4°C
Spring
0°
2°
4°
4°C
Winter

TEMPERATURE STRATIFICATION

Prevention & Management

- Perform regular DO and temperature profiling – every 0.3 m depth
  - Note for sharp changes at thermocline (immediate aeration)
  - Early detection – prevent losses

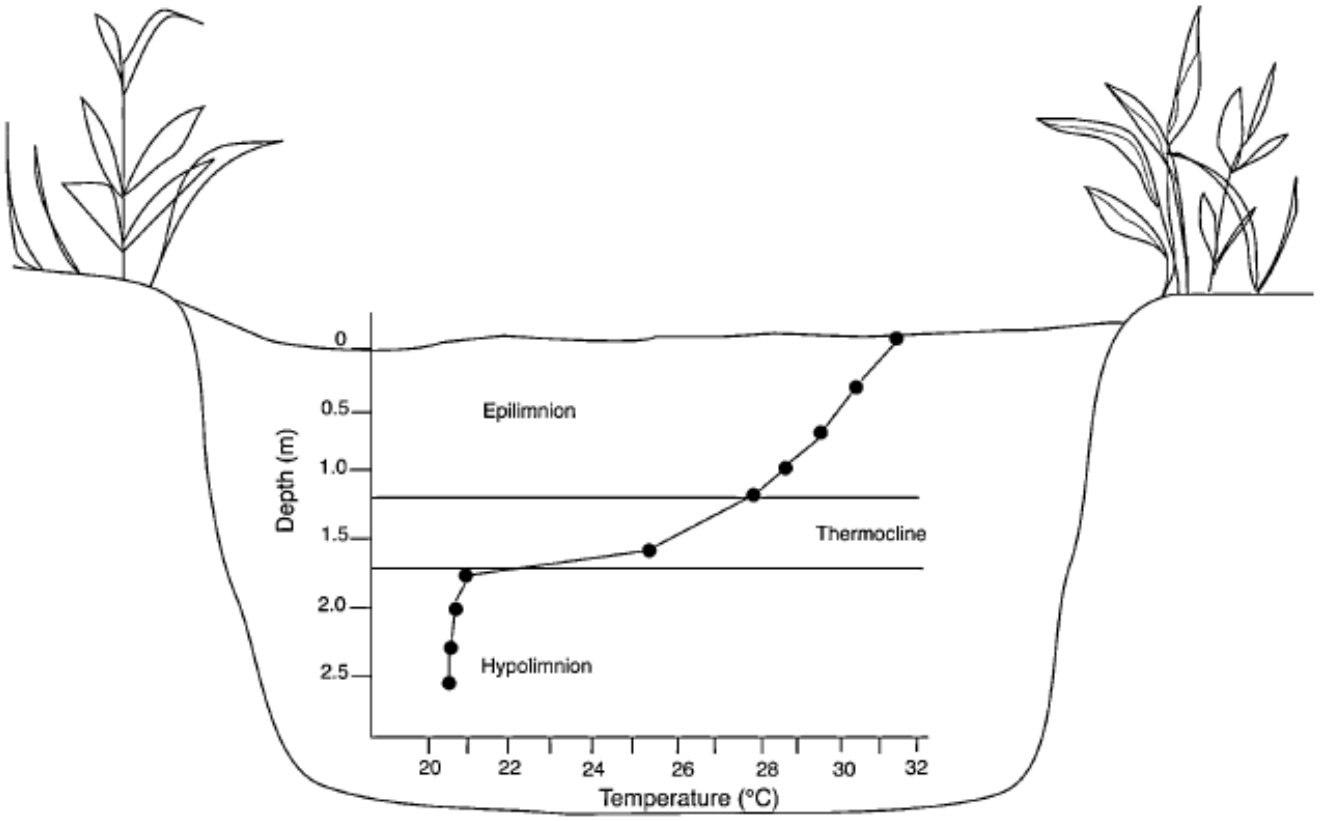


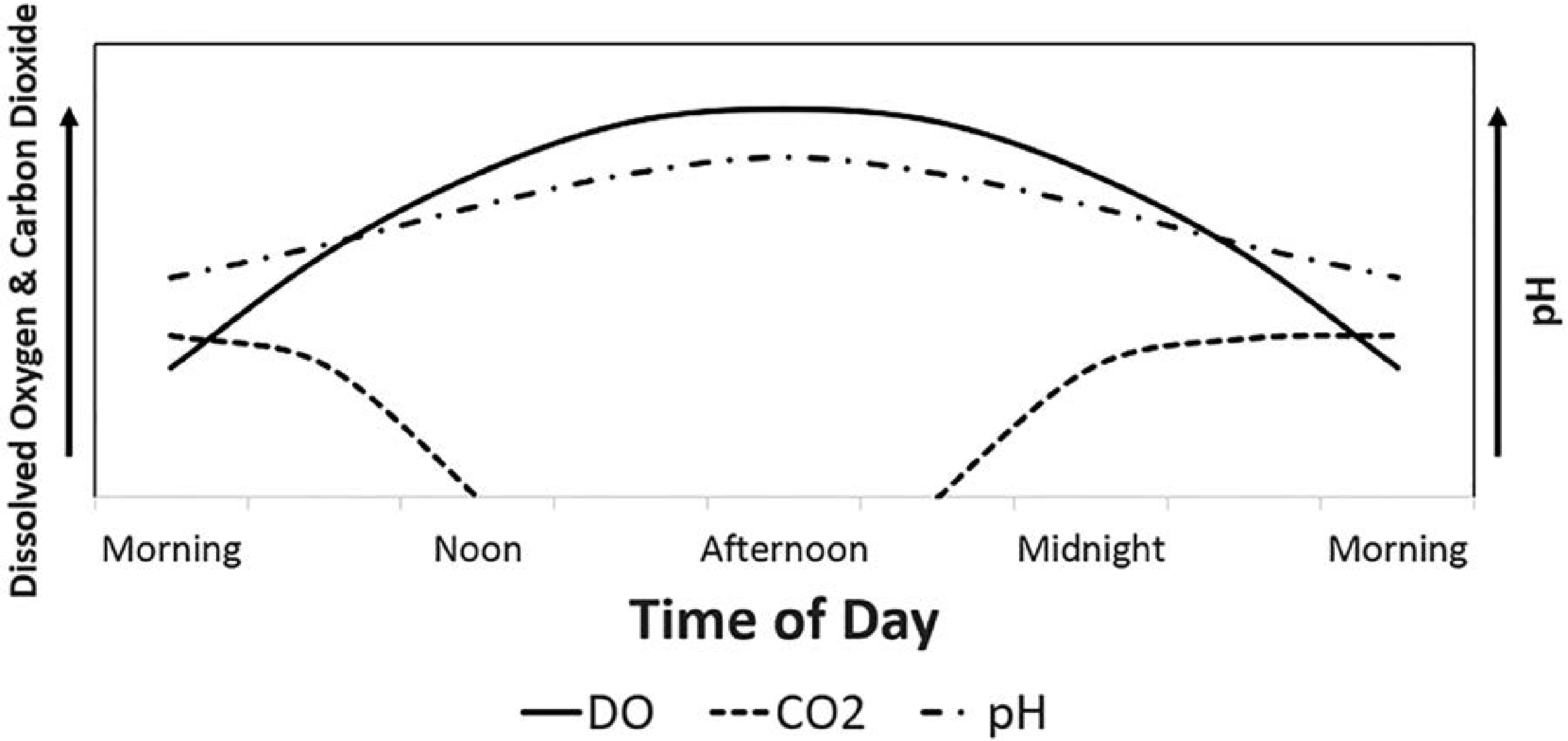
Fig. II-3. Typical temperature zones in a stratified pond.

ENVIRONMENTAL DISEASES

ENVIRONMENTAL DISEASES

ENVIRONMENTAL HYPOXIA

- low concentration of dissolved oxygen (DO) exists in the water
  - Sources
    - Photosynthesis
    - Diffusion from air
    - Wind cycling
  - Consumed by:
    - Fish respiration
    - Microorganisms (for decomposition)
    - Plants (respire at night)
  - Causes
    - High temperature
    - Increase fish and microbial metabolism
    - Cloudy/overcast days
    - Aeration failure
    - Use of groundwater


Dissolved Oxygen & Carbon Dioxide
pH
Morning
Noon
Afternoon
Midnight
Morning
Time of Day
DO
CO2
pH

ENVIRONMENTAL DISEASES

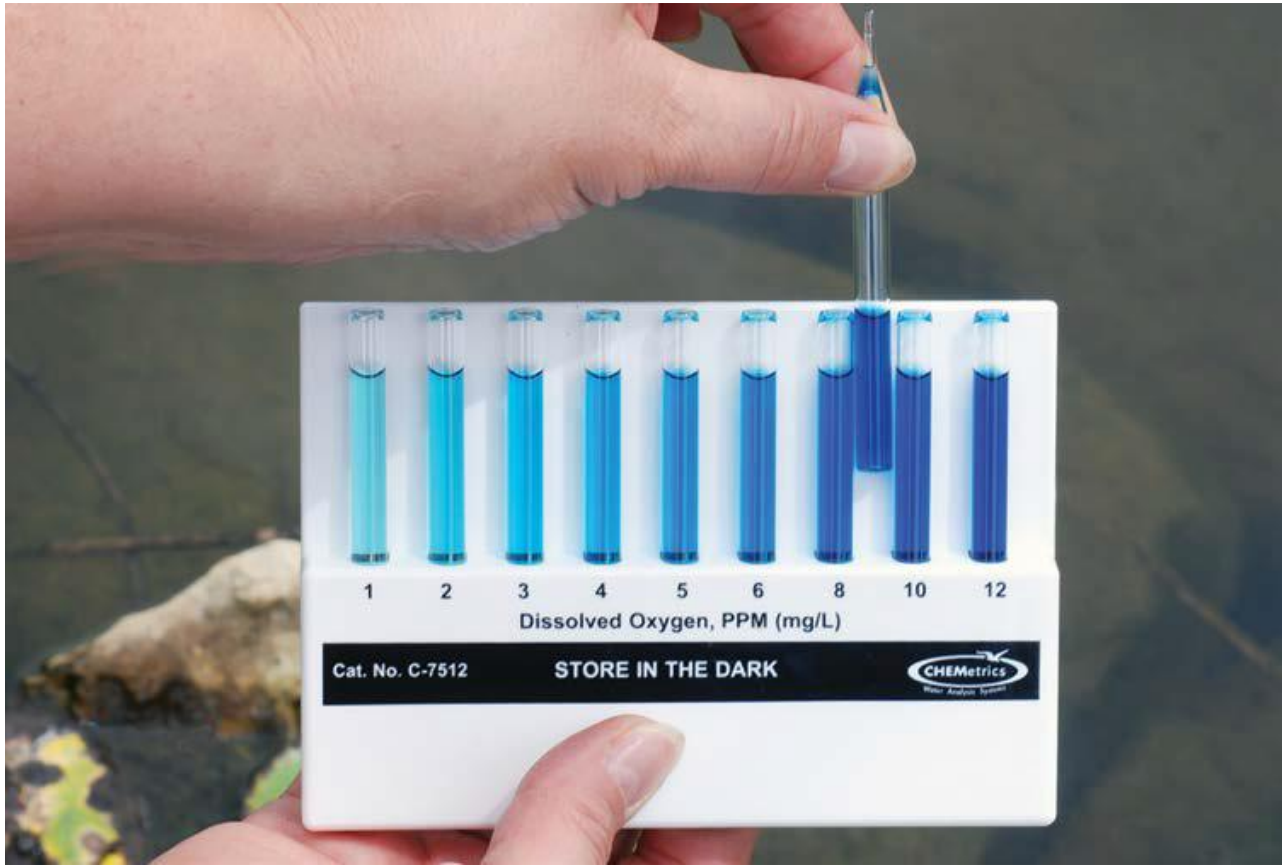
ENVIRONMENTAL HYPOXIA

- Clinical Signs
  - Acute
    - sudden mass mortality
    - lethargy
    - piping
    - anorexia
    - agonal respiration
  - Chronic
    - stress
    - decrease feed intake & efficiency
    - decrease growth rate
    - decrease Reproduction

ENVIRONMENTAL DISEASES

- ENVIRONMENTAL HYPOXIA
  - Diagnosis
    - Measurement of DO
    - History and clinical sings
  - Management/Treatment
    - immediate oxygen intervention
      - < 3–4 mg/l (catfish)
      - < 4–5 mg/l (salmonids)
    - water circulation
    - reduce feeding and/or stocking density
    - avoid excessive algal blooms
    - aerate groundwater before use


YSI

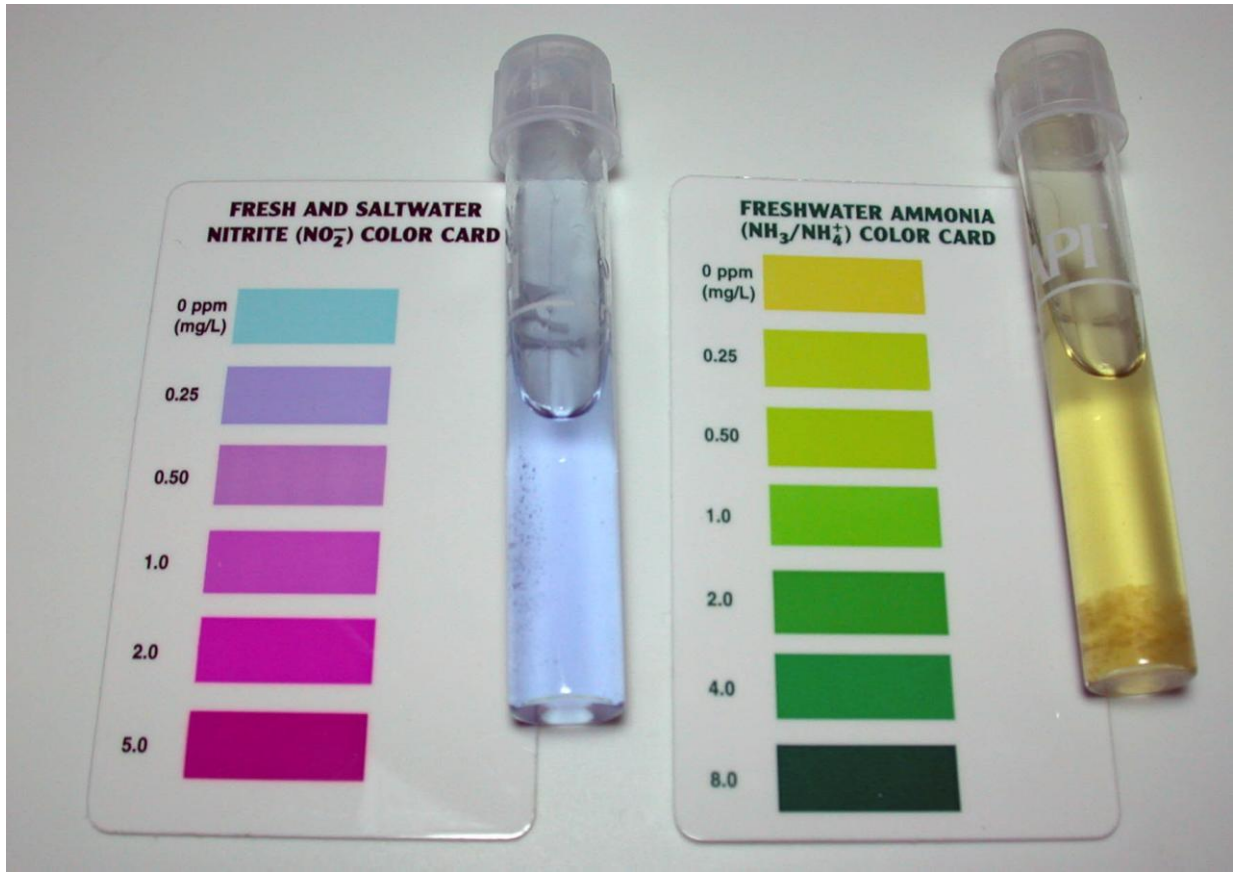

1
2
3
4
5
6
8
10
12
Dissolved Oxygen, PPM (mg/L)
Cat. No. C-7512
STORE IN THE DARK
CHEMetrics

ENVIRONMENTAL DISEASES

NEW TANK SYNDROME

- immature biofilter – within first 4-6 weeks after setting up a new tank
- occurs when the pH exceeds 7 (ammonium to ammonia)
- leads to buildup of ammonia and nitrite

- Clinical signs
  - lethargy
  - anorexia
  - sudden deaths
    - lethal: >~1.0 mg UIA/L
    - sublethal: >~0.5 mg UIA/L
- Diagnosis: Water quality testing


FRESH AND SALTWATER
NITRITE (NO_2^-) COLOR CARD
0 ppm (mg/L)
0.25
0.50
1.0
2.0
5.0
FRESHWATER AMMONIA
(NH_3/NH_4^+) COLOR CARD
0 ppm (mg/L)
0.25
0.50
1.0
2.0
4.0
8.0


FRESHWATER AMMON
(NH_3/NH_4^+) COLOR CA
0 ppm (mg/L)
0.25
0.50
1.0
2.0
4.0
8.0

ENVIRONMENTAL DISEASES

NEW TANK SYNDROME

- Treatment/Management:
  - temporary reduce or stop feeding
  - reduce stocking density
  - perform water changes (25-50% water change – daily to weekly, depending on ammonia concentration)
  - add zeolite
  - add chloride (for nitrite toxicity)
  - improve/assess biofiltration system
  - fishless cycling:
    - add fish only when ammonia & nitrite is absolute zero or slowly over time

ENVIRONMENTAL DISEASES

OLD TANK SYNDROME (CHRONIC WATER QUALITY PROBLEM)

- infrequent or no water changes
- “topping off” instead of replacing water
- common in tanks with large carnivorous fish

- Effects
  - gradual pH drop – fish adapt, minimal signs
  - rapid pH drop – stress and sudden death

ENVIRONMENTAL DISEASES

OLD TANK SYNDROME (CHRONIC WATER QUALITY PROBLEM)

- Treatment
  - Perform small, daily water changes
  - Avoid rapid pH correction (prevent shock & ammonia toxicity)
  - Gradual restoration of normal water parameters
- Prevention
  - Regular large water changes
  - Maintain buffering capacity (alkalinity)
  - Avoid reliance on “topping off” only

ENVIRONMENTAL DISEASES

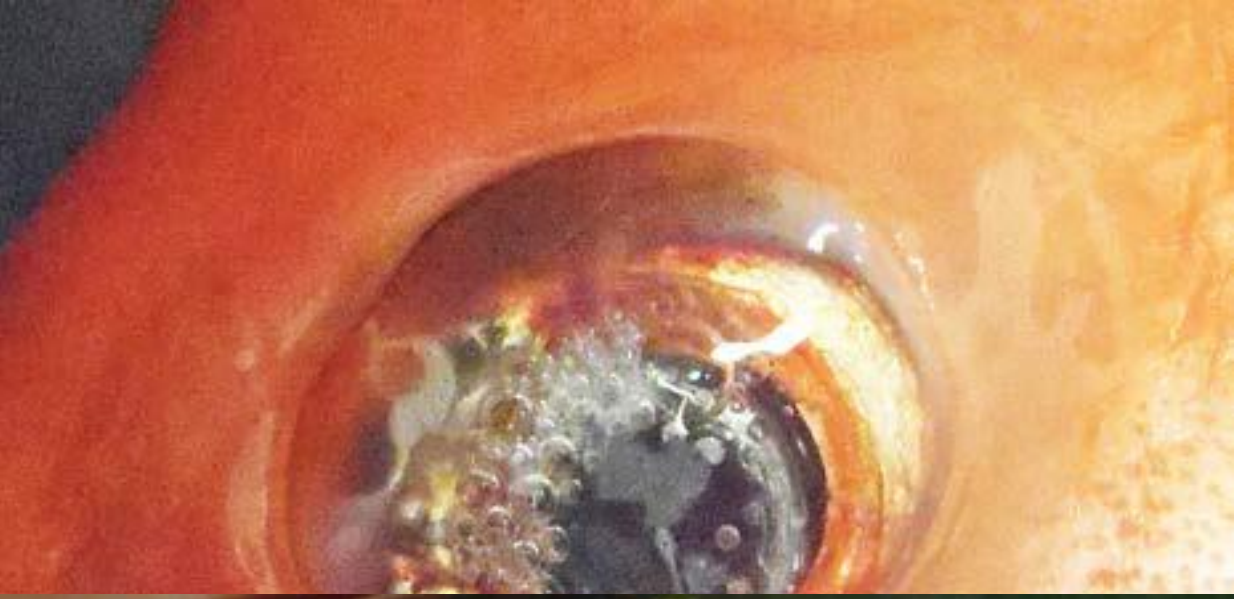
GAS BUBBLE DISEASE

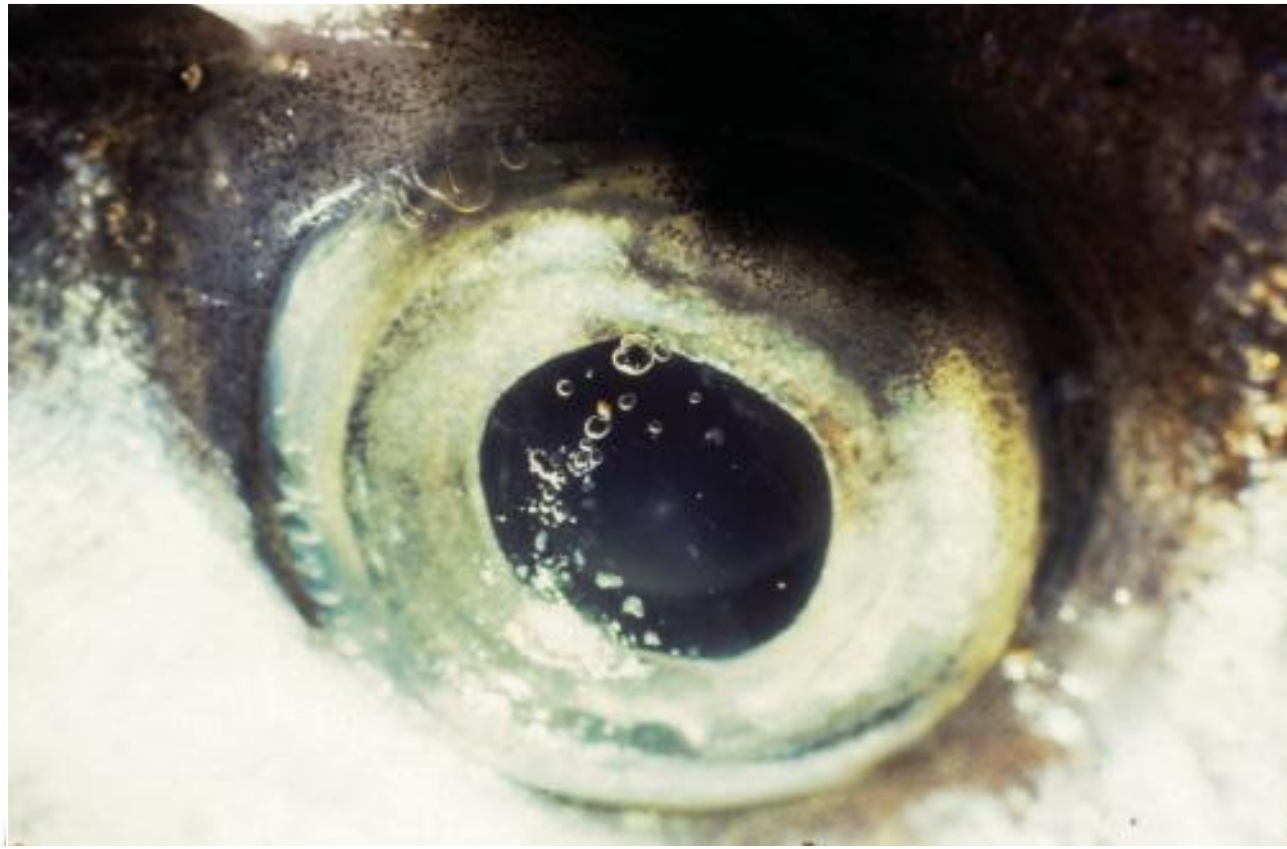
- similar to “bends” among divers
- caused by gas supersaturation in water
  - use of untreated tap water
  - water with trapped air bubbles
  - rapid water temperature and pressure changes
  - excessive supplementation of gases
  - heavy aquatic plant growth

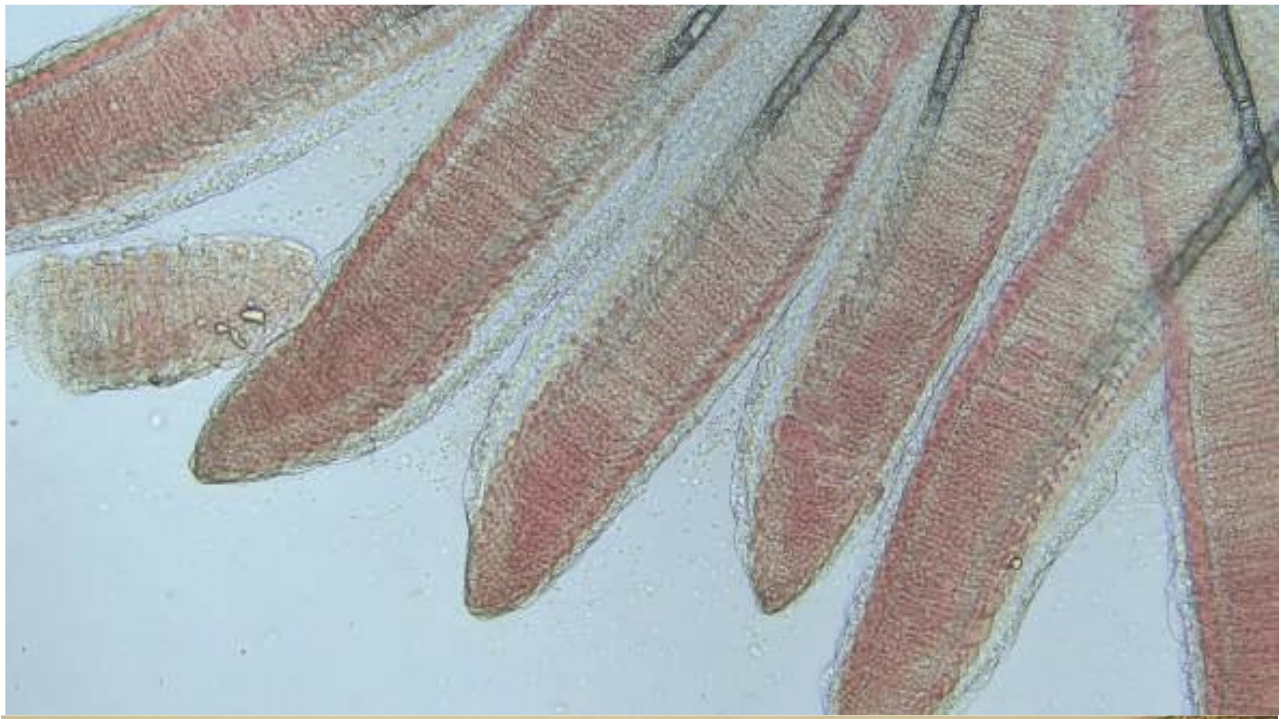
ENVIRONMENTAL DISEASES

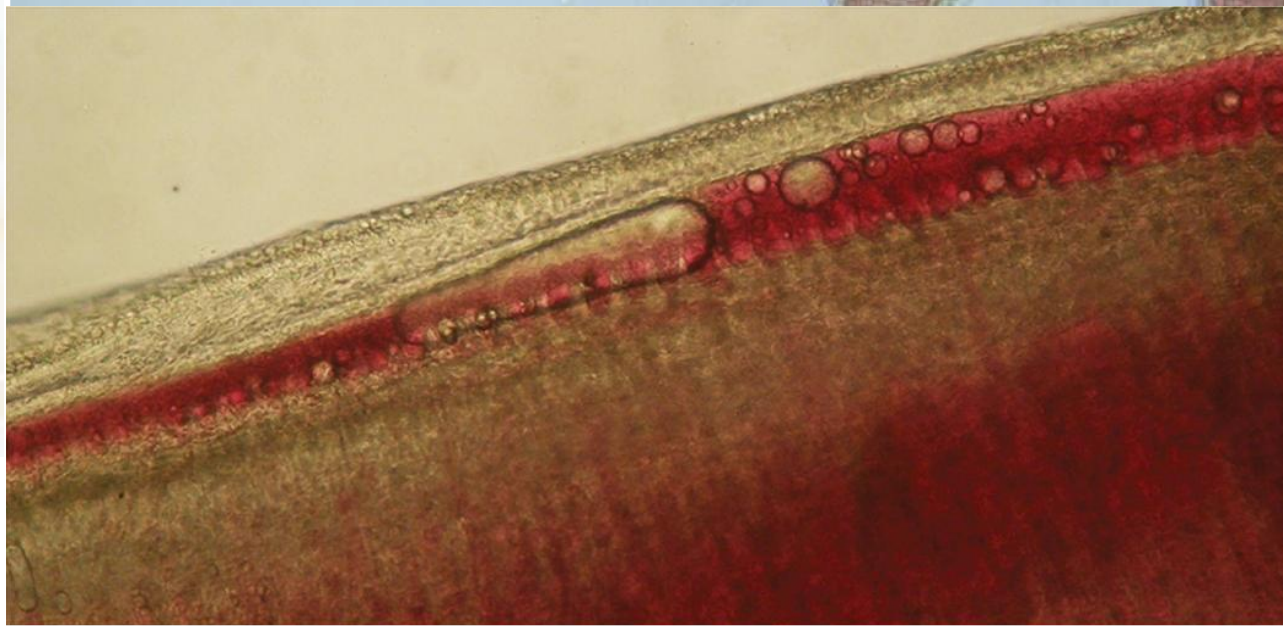
GAS BUBBLE DISEASE

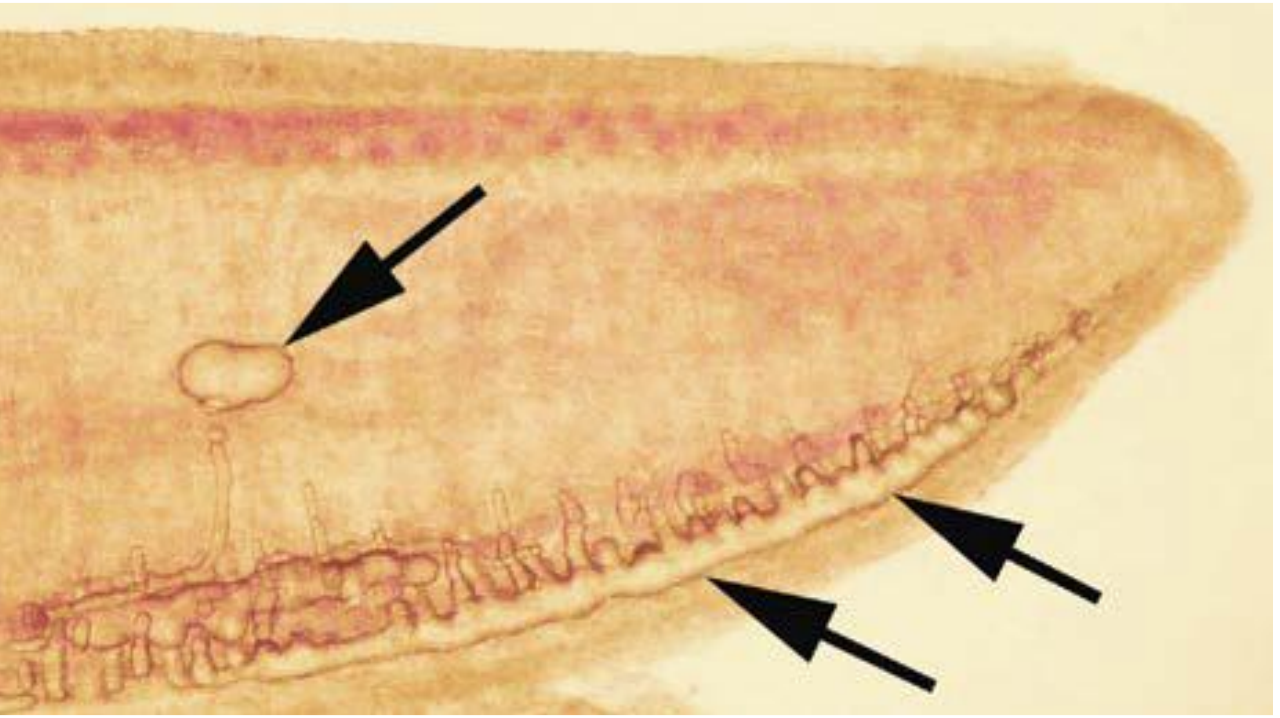
- causes tissue damage, circulatory blockade and death due to gas bubble formations.
- Clinical Signs
  - exophthalmia and cataracts
  - uncoordinated swimming, nervousness, impaired buoyancy
  - hemorrhage, ulcers, necrosis

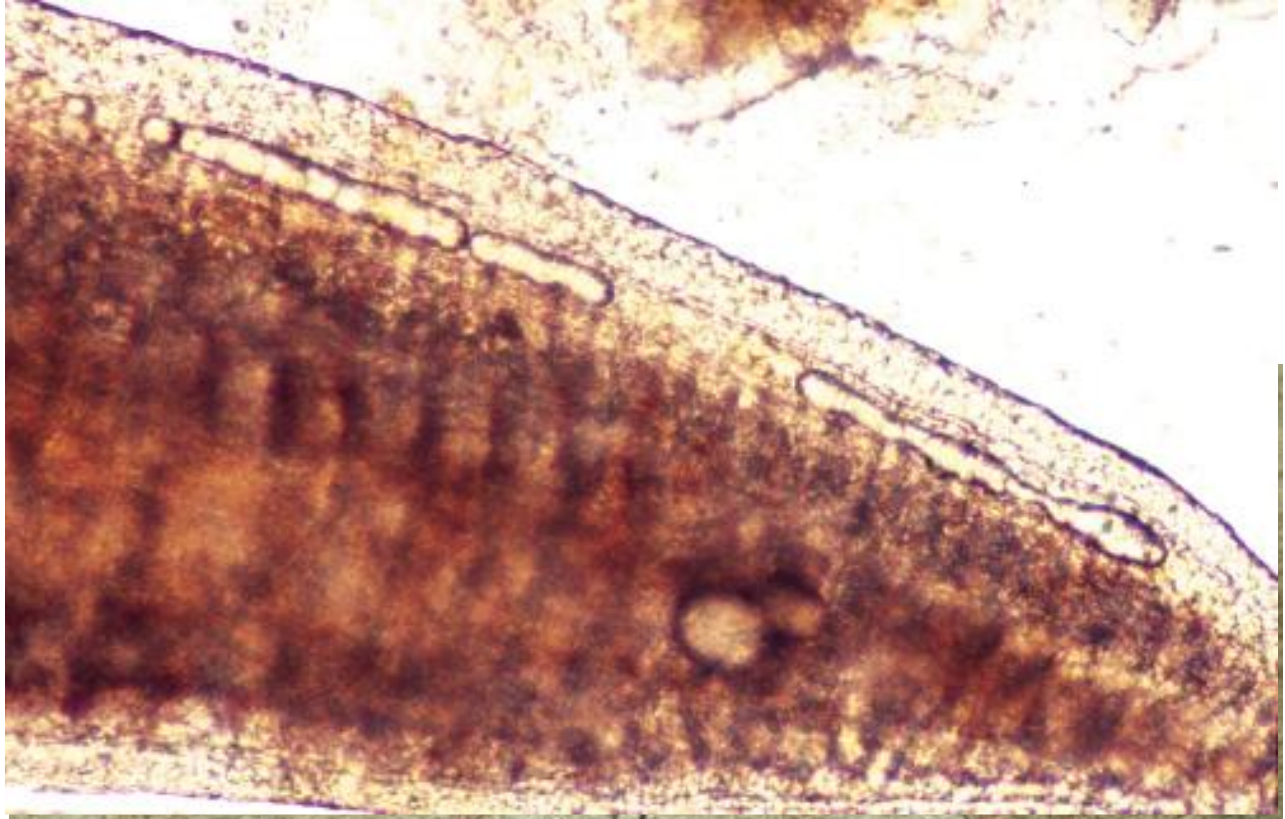


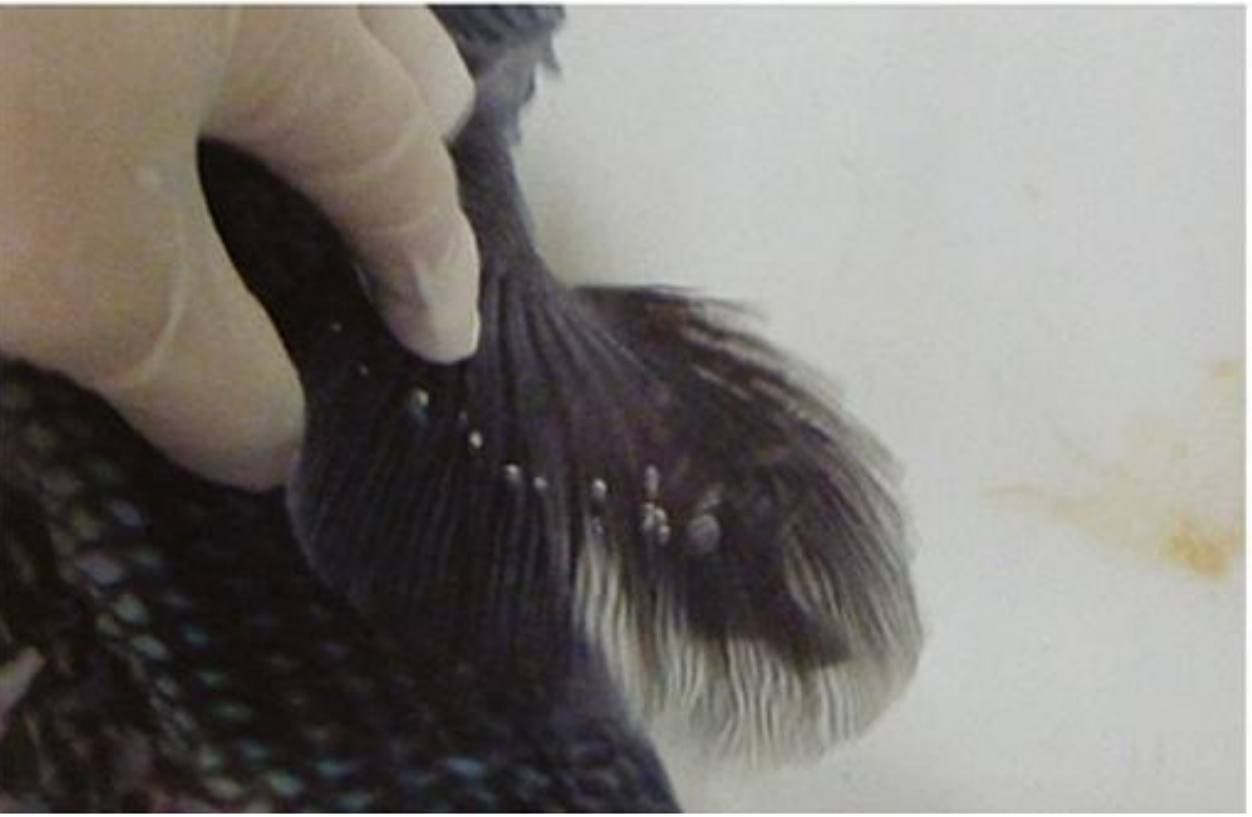












ENVIRONMENTAL DISEASES

GAS BUBBLE DISEASE

- Diagnosis
  - visual inspection of the eyes, lamella of gills and skin
  - gill biopsy
  - measure total gas pressure (TGP meter or saturometer) or dissolved oxygen
- Prevention
  - allow water to degas before use
  - avoid rapid temperature fluctuations
  - use proper aeration and water conditioning

ENVIRONMENTAL DISEASES

GAS BUBBLE DISEASE

- Management/Control
  - removal of the possible cause
  - 6 mg/kg at peribulbar injection
  - 2.5–5.0 mg/kg IM q3-7days of acetazolamide upto 3mos treatments – resolve gas bubbles within the choroidal gland and anterior chamber.

ENVIRONMENTAL DISEASES

BAROTRAUMA

- physical tissue damage caused by a change in air or water pressure.
- major cause of by-catch mortality in bony fish (brought up from depth)
  - swim bladder hyperinflation and rupture
  - exophthalmos and buphthalmos
  - organ compression
  - esophageal, gastric, cloacal, or anal prolapse.
- recompression – improve survival.

ENVIRONMENTAL DISEASES

BAROTRAUMA

- Clinical Signs
  - surface recumbency immediately post-catch
  - dyspnea/tachypnea
  - ataxia or hyperactivity
  - exophthalmos or buphthalmos
  - organ compression
  - prolapse of the esophagus and cloaca
  - gas emboli in the skin and fins
  - death

ENVIRONMENTAL DISEASES

BAROTRAUMA

- Diagnosis
  - History and clinical signs
  - Gill/fin biopsy
  - Radiography and CT scan
  - Necropsy

- Prevention/Management/treatment
  - Catch fish at shallow depths (<6 m) when possible
  - Recompression
  - Swim bladder aspiration

VIRAL DISEASES

INTRODUCTION TO VIRAL DISEASES

TRANSMMISSION

- Horizontal
- Vertical
- Fomites (containers and/or nets) – non-enveloped viruses
- Mechanical and biological vectors (aquatic invertebrates and piscivorous birds)
- Asymptomatic carriers
- Latency
- Spill-over and spill-back
- Increased global movements

INTRODUCTION TO VIRAL DISEASES

RISK FACTORS

- Poor biosecurity
- Permissive water temperature
- Permissive salinity
- High organic loads
- Low water flow-rate or turnover
- Exposure to wild fish
- Trauma

INTRODUCTION TO VIRAL DISEASES

MANAGEMENT

- Increase aeration (95-100%)
- Isolation
- Adjust water temperature
- Increase water-flow rate or turnover
- Clean and disinfect water
  - UV disinfection
    - IPVN and adenoviruses requires higher doses
  - Ozone disinfection

INTRODUCTION TO VIRAL DISEASES

MANAGEMENT

- Clean and disinfect fomites
  - Sodium hypochlorite
  - Chlorine-based disinfectants
  - Alcohols
  - Iodophors
  - Peroxygen compunds
  - Chlorhexidine gluconate
  - Phenols
  - Quarternary ammonium compounds

INTRODUCTION TO VIRAL DISEASES

PREVENTION

- Good biosecurity measures
- Reduce or resolve stressors
- Reduce potential exposure and transmission

VIRAL DISEASES

LYMPHOCYSTIS DISEASE

- caused by Family *Iridoviridae*; Genus *Lymphocystivirus*
  - Lymphocystis disease virus (LCDV-1) – flesus founder and plaice
  - Lymphocystis disease virus (LCDV-2) – dab
    - causes hypertrophied dermal fibroblasts to form a nodule/plaques in skin and viscera
- most common viral disease of aquarium fish; a cosmetic concern and an indicator of stressors.
- Characteristics
  - Lower water temperature allows longer clinical periods
  - Viable in water for about 1 week
  - IP: weeks to months
  - Latency

VIRAL DISEASES

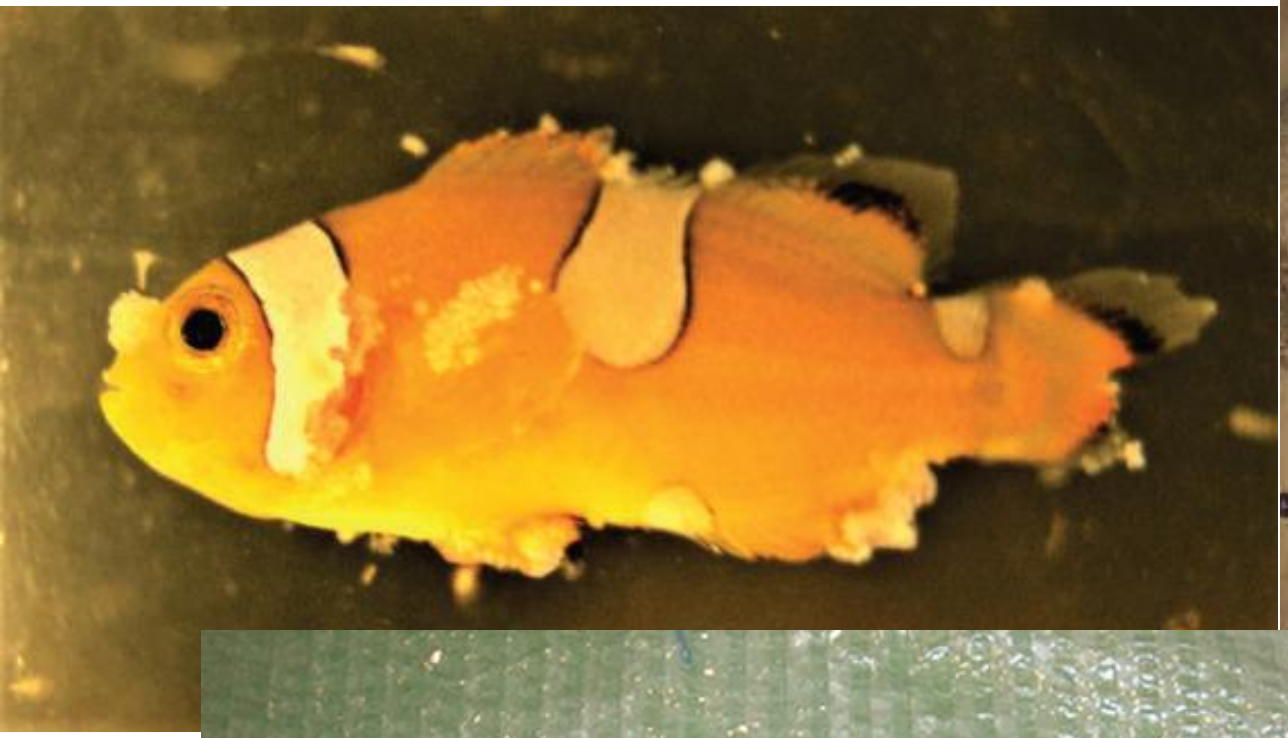
LYMPHOCYSTIS DISEASE

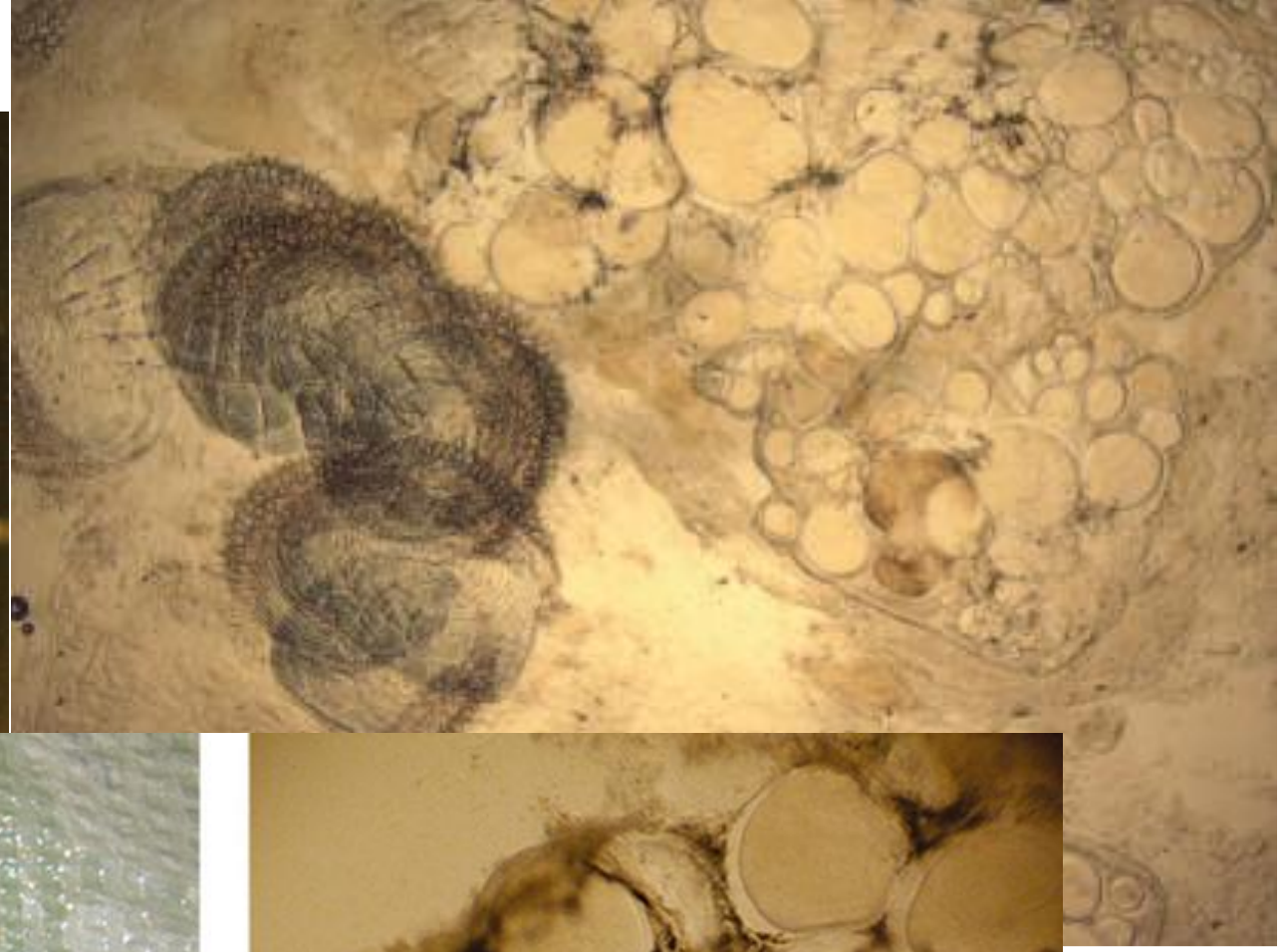
- Characteristics of LCDV
  - Lower water temperature allows longer clinical periods
  - Viable in water for about 1 week
  - IP: weeks to months
  - Latency

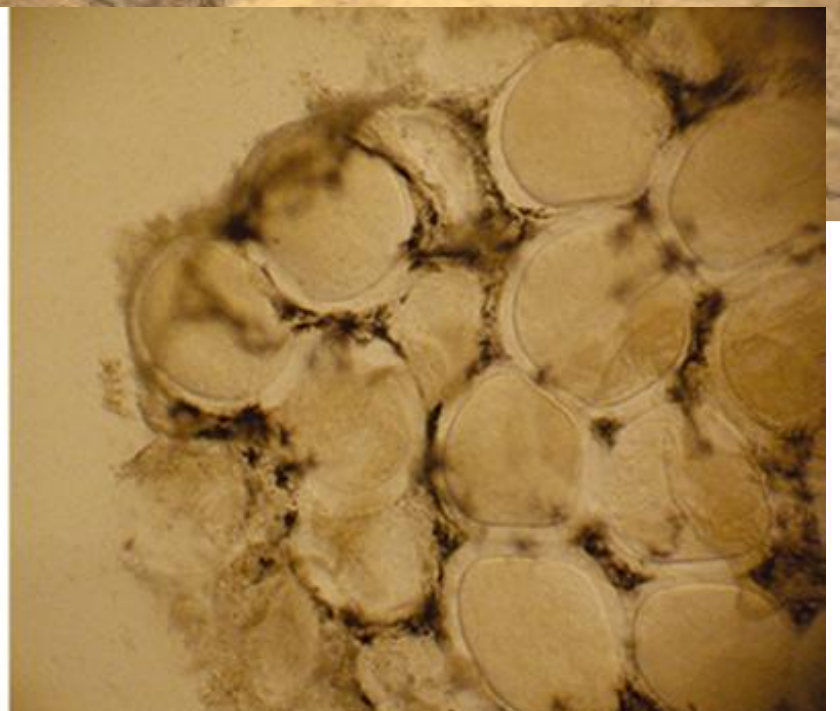
VIRAL DISEASES

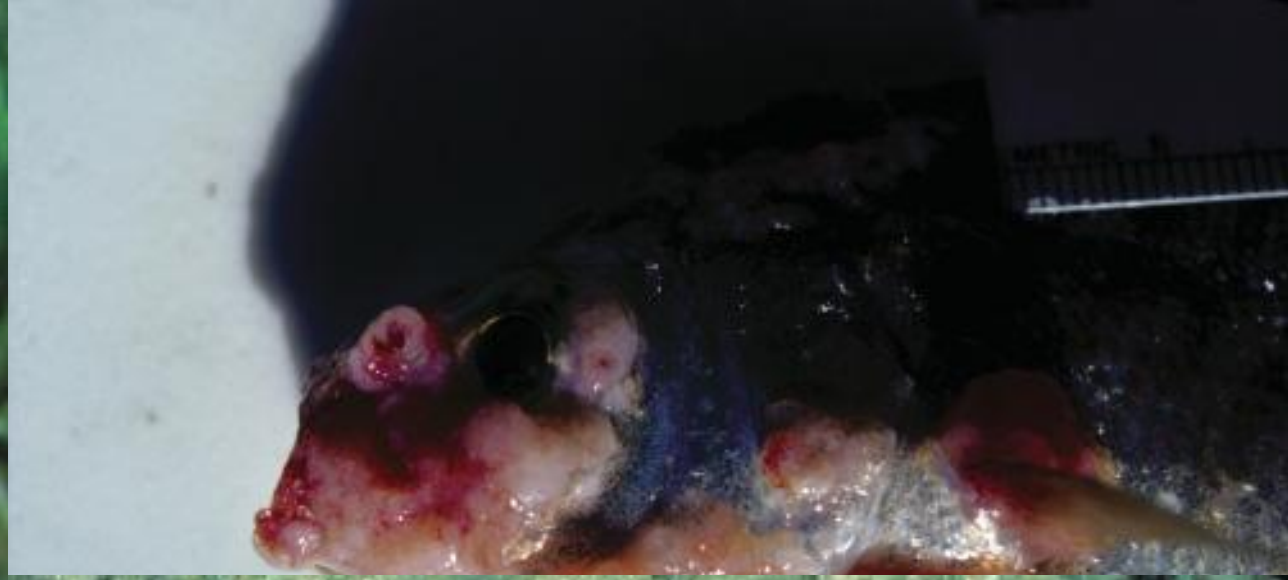
LYMPHOCYSTIS DISEASE

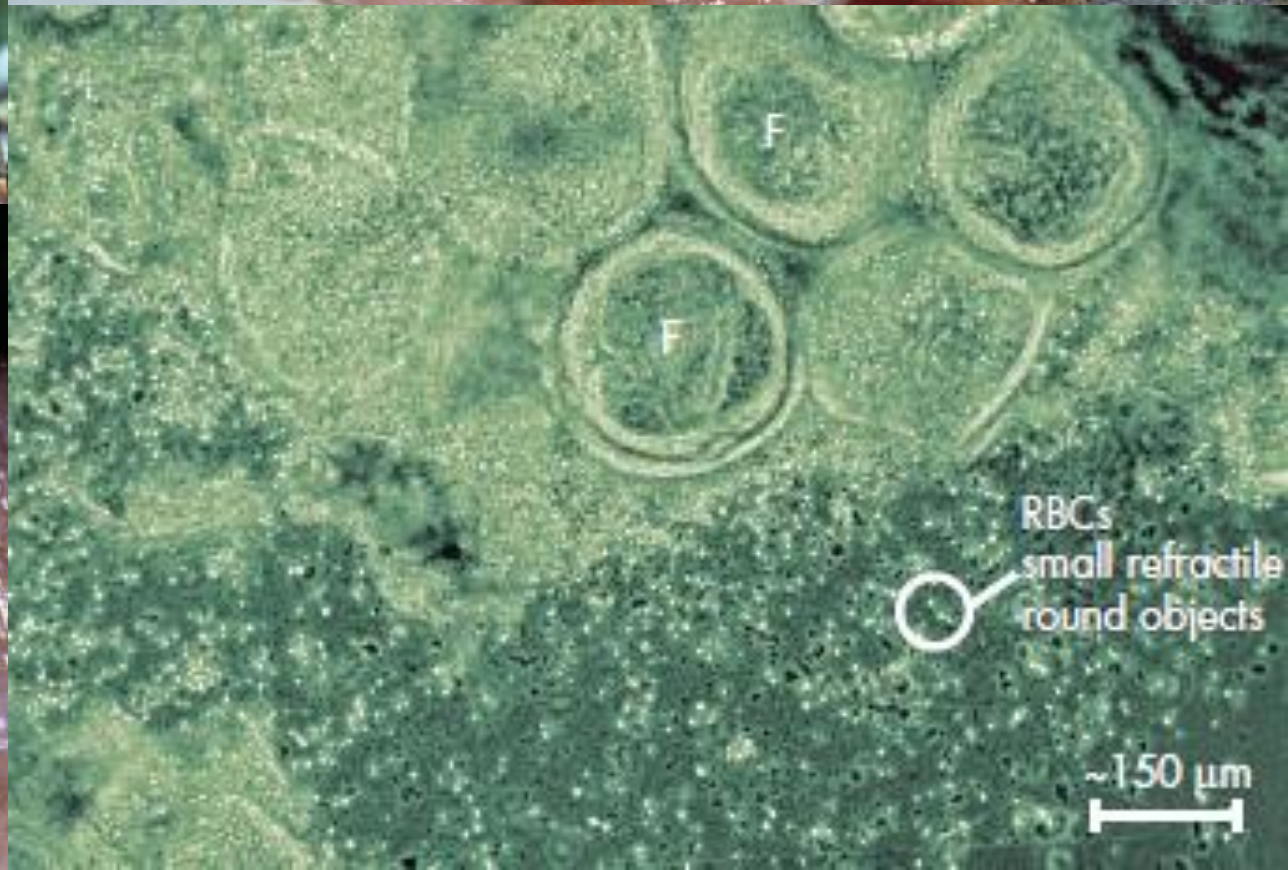
- Transmission
  - direct contact
  - contaminated water
  - infected tissues eaten by susceptible hosts
- Clinical Signs
  - white or tan plaques or nodules on the skin and (rostrum, over the operculum, and near the lateral line).
  - rare systemic signs – poor growth rates and increased susceptibility to secondary infections
  - low morbidity and mortality

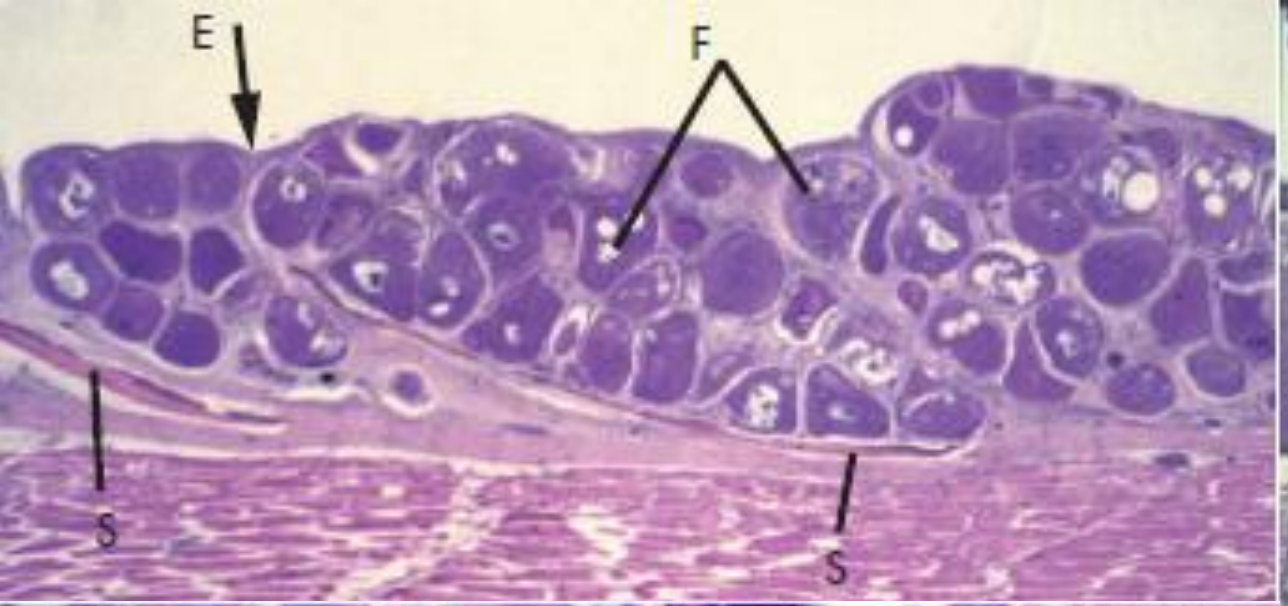









F
F
RBCs
small refractile
round objects
~150 µm


E
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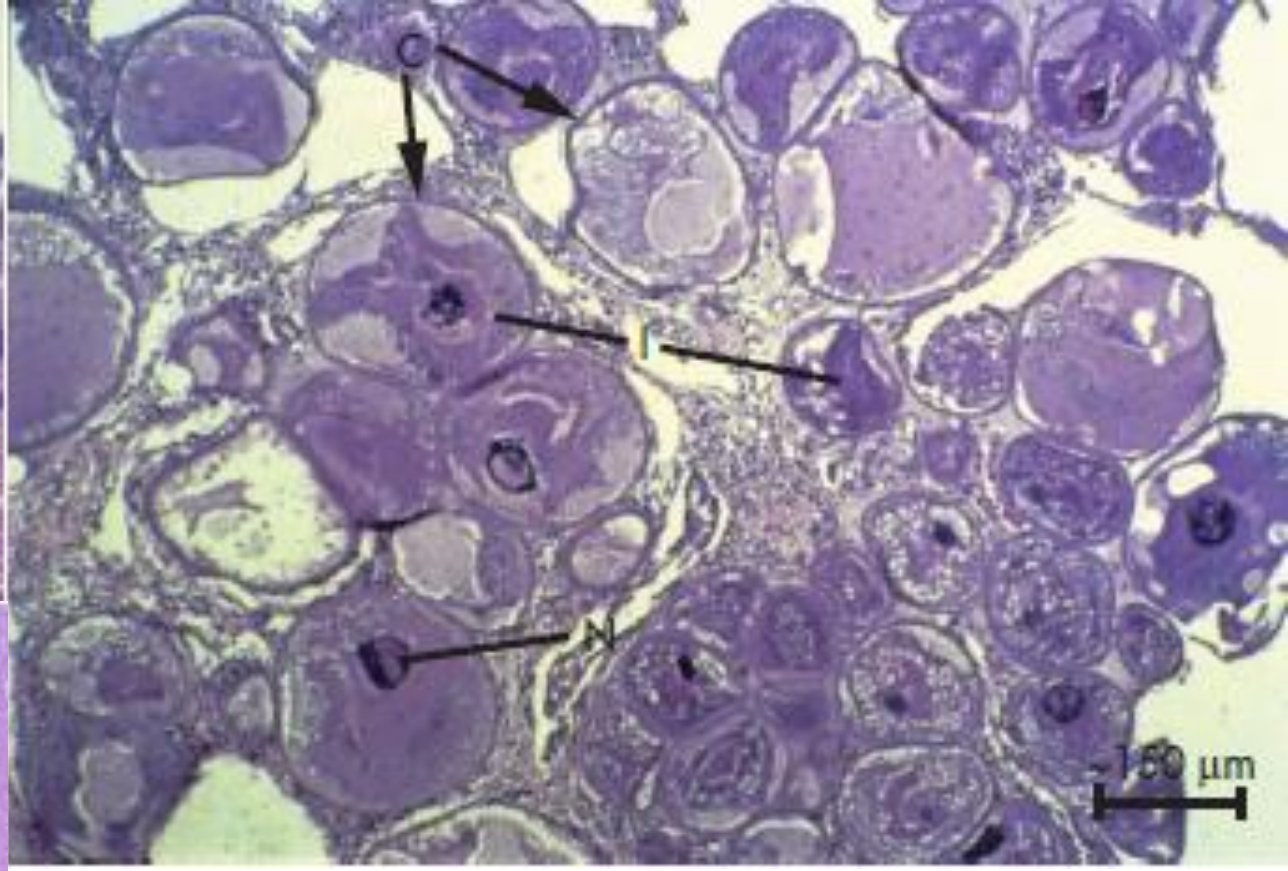
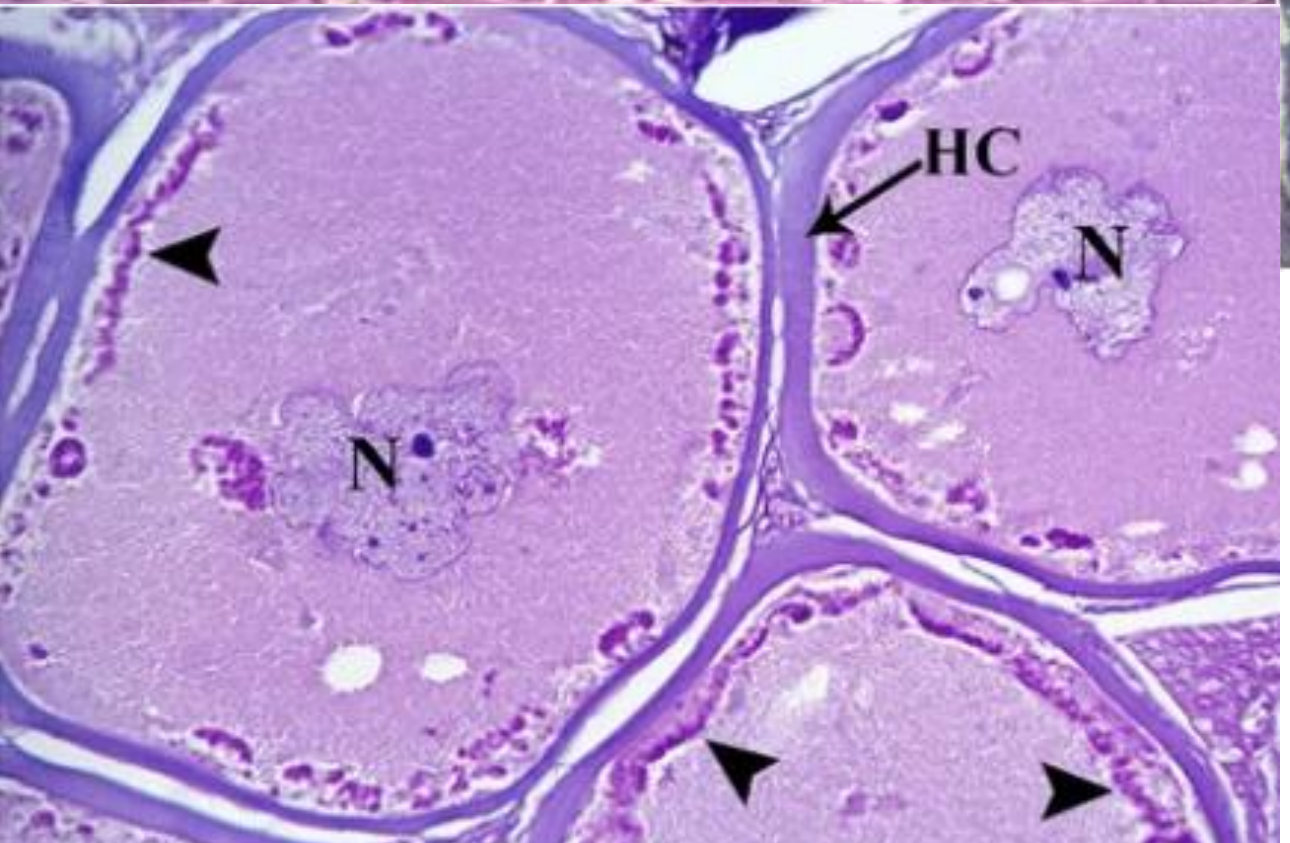

C
I
N
~150 µm


HC
N
N

VIRAL DISEASES

LYMPHOCYSTIS DISEASE

- Diagnosis
  - examination of skin scrapes under direct microscopy.
  - necropsy or celiotomy.
  - histology – Feulgen-positive intracytoplasmic inclusion bodies
- Management
  - reduction or resolution of stressors
  - surgical debridement with secondary intention healing

VIRAL DISEASES

VIRAL HEMORRHAGIC SEPTICEMIA

- also known as “Egtved disease”
- Caused by a rhabdovirus (Genus *Novirhabdovirus*)
  - Type I – European freshwater (cultured rainbow trout – *Oncorhynchus mykiss*).
  - Type II – marine (Baltic Sea)
  - Type – marine (North Atlantic Ocean)
  - VHSV-IVa – North Pacific, Japanese, and Korean marine isolates.
  - VHSV-IVb – North American freshwater isolates endemic to the Great Lakes region and Saint Lawrence River

VIRAL DISEASES

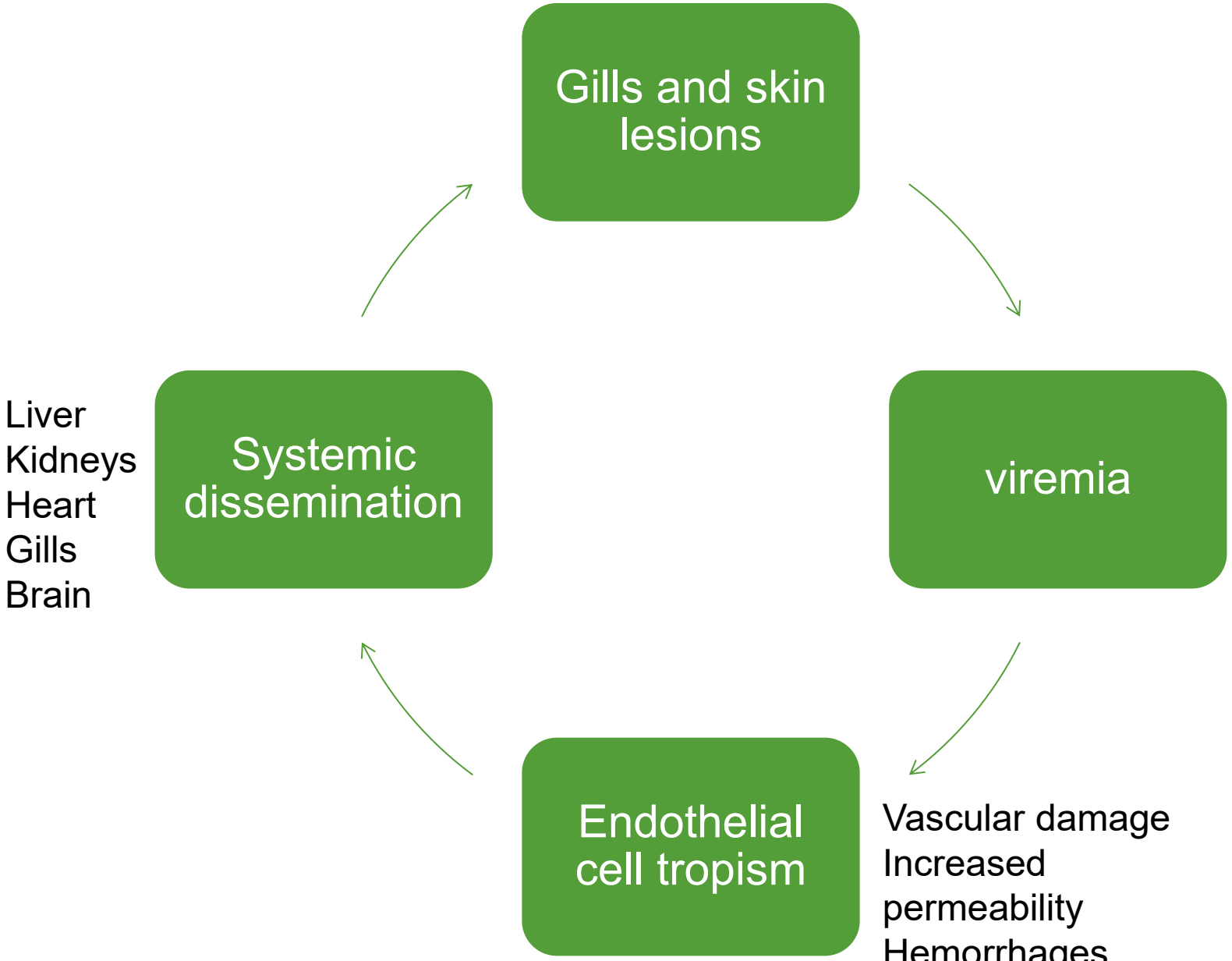
VIRAL HEMORRHAGIC SEPTICEMIA

- Characteristics
  - Survives >1week in water(14°C)
  - Up to 1 week in drying conditions (4°C)

VIRAL DISEASES

VIRAL HEMORRHAGIC SEPTICEMIA

- Mortality Rate
  - Fry – 100%
  - Older fishes – 30-70%
  - 3–12°C (37–54°F) or 8 – 10 ° C (46 – 50 ° F). – highest
- Transmission
  - Horizontal – exposure to urine and ovarian fluids
  - Movement of infected fish
  - Piscivorous birds (mechanical carriers)



PATHOGENESIS OF VHS

VIRAL DISEASES

VIRAL HEMORRHAGIC SEPTICEMIA

- Clinical Signs
  - lethargy
  - slow swimming
  - skin darkening
  - hemorrhages of the skin at the base of fins, around the eyes and mouth
  - exophthalmos
  - gill pallor
  - Ascites
  - Petechiae and hemorrhages in the swim bladder – cyprinids

VIRAL DISEASES

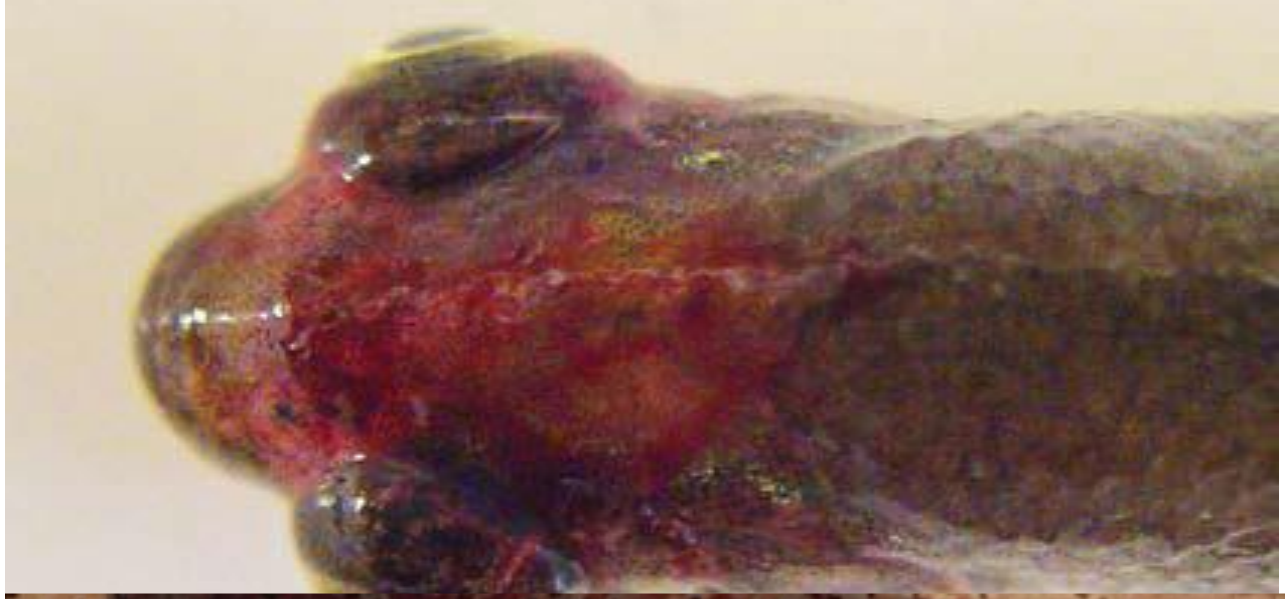
VIRAL HEMORRHAGIC SEPTICEMIA

- DDx
  - Minimal pancreatic damage (vs. IHN/IPN)
  - Relatively normal intestine and gills and no damage to eosinophilic granular cells (vs. IHN)

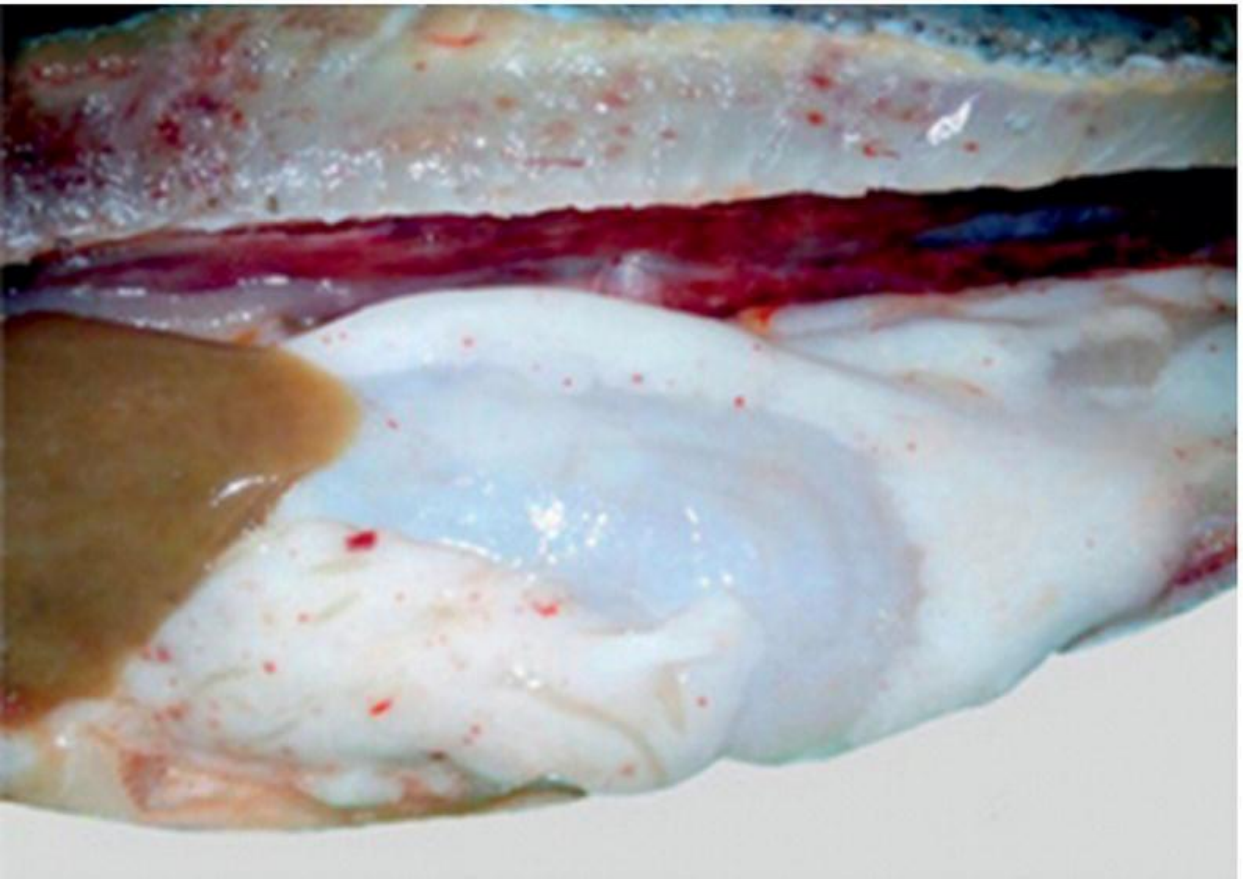
VIRAL DISEASES

VIRAL HEMORRHAGIC SEPTICEMIA

- Diagnosis
  - Necropsy or coeliotomy
    - hemorrhage and serosanguinous ascites, visceral pallor, renomegaly, splenomegaly, and enteritis
  - Viral isolation from hematopoietic organs, brain, and ovarian fluid/milt.
    - < 4 cm fish – whole larvae
    - 4–6 cm fish – whole viscera (especially kidney)
    - > 6 cm fish – individual organs
  - ELISA
  - Fluorescent staining and RT-PCR



(a)



(b)

VIRAL DISEASES

VIRAL HEMORRHAGIC SEPTICEMIA

- Prevention
  - Viral isolation and ELISA on ovaries
  - Use certified VHS-free stock
  - Disinfection of eggs (iodophors)
  - No commercial vaccines available

VIRAL DISEASES

INFECTIOUS HEMATOPOIETIC NECROSIS

- also known as
  - Chinook Salmon Disease Virus
  - Sacramento River Chinook Disease
  - Columbia River Sockeye Disease
  - Oregon Sockeye Disease
- Caused by Infectious hematopoietic necrosis virus (IHNV) , a rhabdovirus
- a major cause of mortality in salmonids, and endemic to the Pacific northwest coast of North America, Japan, Taiwan, Italy, France, and Germany.

VIRAL DISEASES

INFECTIOUS HEMATOPOIETIC NECROSIS

- Risk Factors
  - Affects <2years of age
  - <6mos – highest mortality about 100% at ~10°C
    - < 10°C – chronic, lower mortality
    - > 10°C – more acute but fewer cases
    - No disease above 15°C
  - Older fishes – lower mortality but are as asymptomatic carriers
  - Survives longer in saltwater than in freshwater
- IP – 5to45 days
- Prodromal Period – 5to14days

VIRAL DISEASES

INFECTIOUS HEMATOPOIETIC NECROSIS

- Transmission
  - Ingestion of infected tissues
  - Exposure to feces, urine, and mucus
  - Waterborne spread
  - Vertical (fluids and egg surface contamination)
  - Leeches, copepods, and mayflies (mechanical carriers)

VIRAL DISEASES

INFECTIOUS HEMATOPOIETIC NECROSIS

- Clinical Signs
  - Increased mortality in fry and fingerlings
  - Lethargy
  - Darkened body discoloration
  - Ascites
  - Exophthalmos
  - Hemorrhages at fin bases
  - Gill and visceral pallor
  - Spinal deformities – chronic carrier state in sockeye salmon
  - **Long, thick, off-white fecal pseudocast trailing from rectum**
  - **Necrosis of eosinophilic granular cells of the intestinal layers**
  - **Necrotic bodies in kidney smears**

VIRAL DISEASES

INFECTIOUS HEMATOPOIETIC NECROSIS

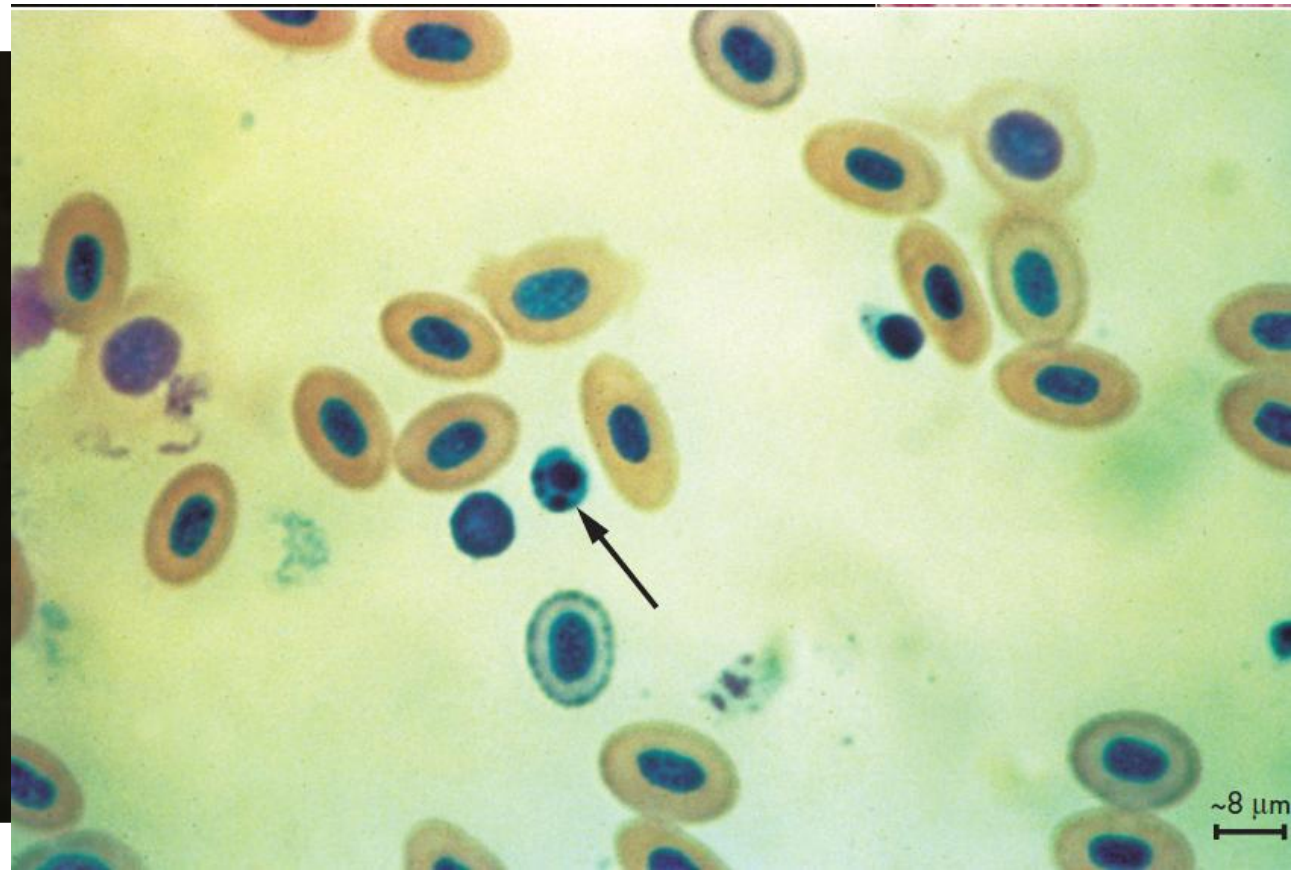
- Major Target Tissues
  - Kidneys
  - Spleen
  - Pancreas
  - Gastrointestinal tract

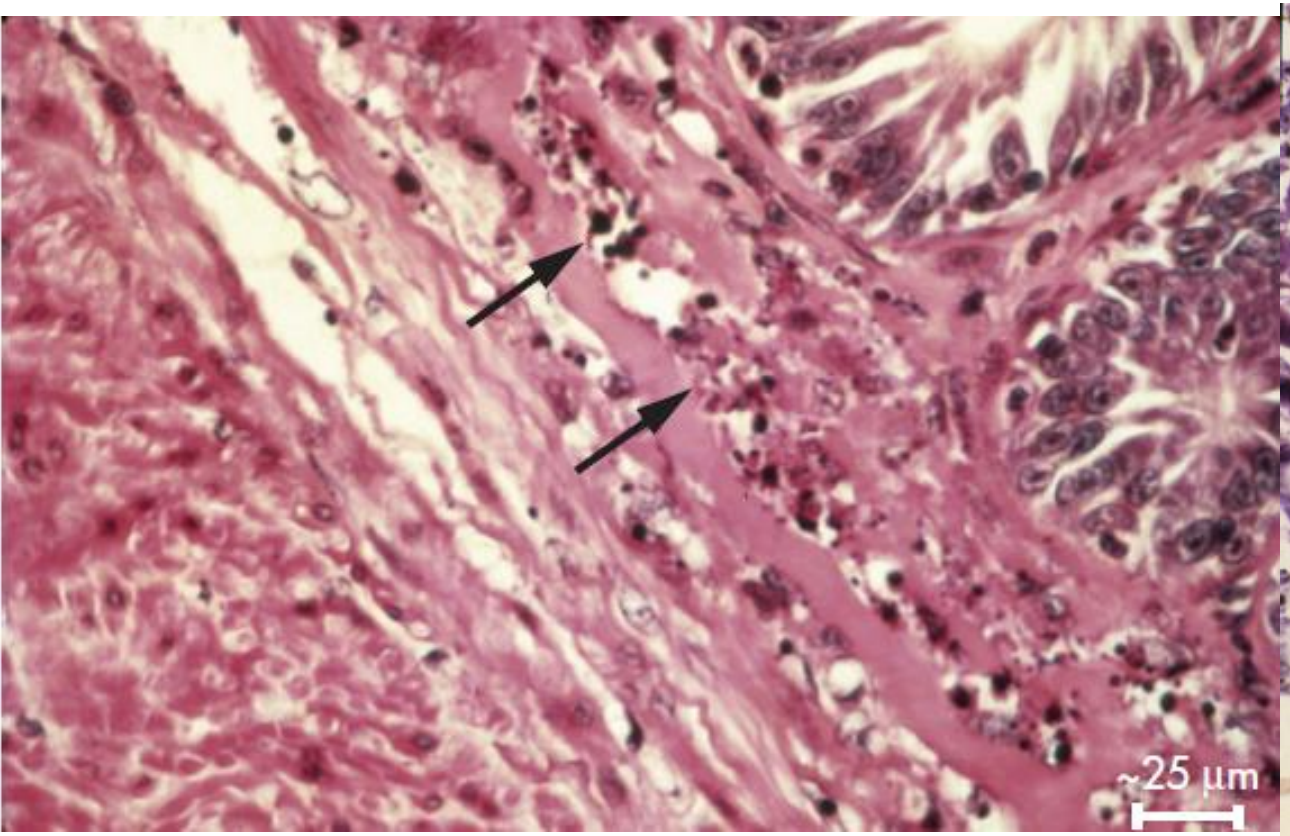
VIRAL DISEASES

INFECTIOUS HEMATOPOIETIC NECROSIS

- Diagnosis
  - Clinical signs at low temperatures and characteristic lesions – presumptive
  - Viral isolation
  - PCR

- Prevention
  - Use certified IHN-free stock
  - Disinfection of eggs (iodophors)
  - Disinfection of surface water source – UV light or ozone
  - Sterilization of feeds for at least 30 minutes at 60°C (140°F).


~8 µm


~25 µm


H
H
~100 µm