

# Gram Stain

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(-)



Crystal Violet



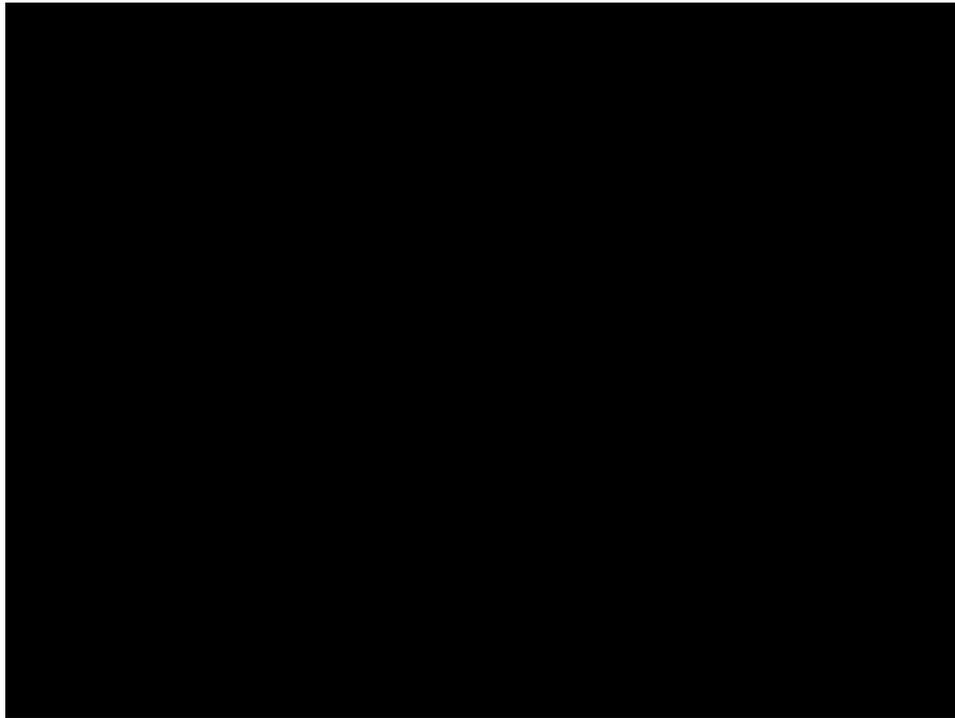
Iodine



Decolorize



Safranin



# BACTERIAL DISEASES OF FISH

## USFWS CERTIFIABLE BACTERIAL PATHOGENS

- *Aeromonas salmonicida* (Furunculosis)
- *Edwardsiella ictaluri* (Enteric Septicemia)
- *Renibacterium salmoninarum* (Bacterial Kidney Disease)
- *Yersinia ruckeri* (Enteric Redmouth)

## GENERAL BACTERIAL SEPTICEMIA

- Hemorrhaging (vent, gills, internal organs, epidermis).
- Bloody fluid in body cavity.
- May also include abscesses and/or ulcers.
- Usually occurs with gram-negative rod bacteria.
- Any bacteria may cause a clinical disease under the right conditions.

## GRAM-NEGATIVE BACTERIA

# ENTERIC REDMOUTH

**Pathogen:**

*Yersinia ruckeri*

**Host Species:**

Cold, Cool, and Warm water fishes.

**Geographic Range:**

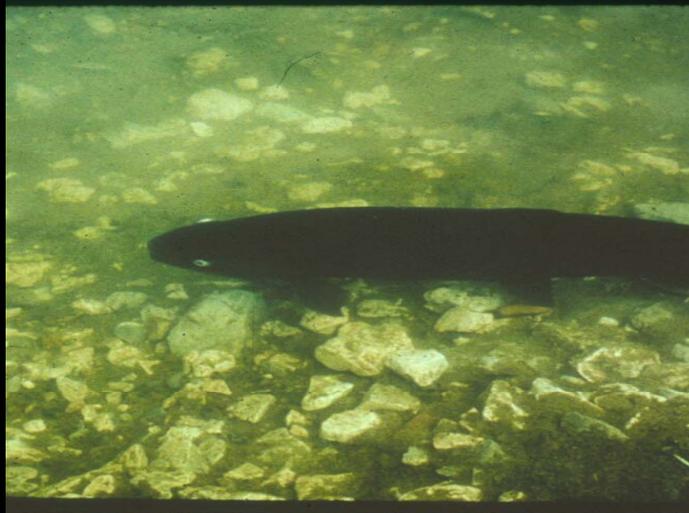
North America, Europe.

## DISEASE SIGNS

- Acute: Reddening (hemorrhage) in the mouth, hemorrhages in the lower intestine, hypertrophied spleen, yellow discharge from the vent; signs similar to other bacterial septicemias.
- Chronic: Fish are dark and lethargic; commonly have bilateral exophthalmia, which may progress to rupture of eye; petechial hemorrhages occur on/in viscera and musculature.

## EPIZOOTIOLOGY

- Low-level mortality that increases significantly with stress.
- Acute infections in smaller fish (<12.5 cm); chronic in larger fish.
- Severity of infection & mortality greatly decrease below 10°C.





# FURUNCULOSIS

**Pathogen:**

*Aeromonas salmonicida salmonicida*

**Host Species:**

Primarily Freshwater

**Geographic Range:**

North America, South America, Europe, Asia, Africa

## DISEASE SIGNS

- Acute: Indication of disease is noted 2-3 d before mortality; fish darken and go “off” feed, viscera are hemorrhagic, kidney tissue is soft, enlarged spleen, pale/enlarged liver.
- Subacute: More gradual onset of disease; internal lesions present; external lesions (furuncles) common.
- Chronic: Similar to subacute, healing around lesions.
- Latent: No mortality or clinical signs of A.s.

## EPIZOOTIOLOGY

- Transmitted horizontally (fish to fish contact, or in the water)
- Disease is temperature dependant
  - Develops within 4-12 d @ 20 C
  - Below 13 C, chronic infections develop
  - Below 9 C, signs may not develop
- Adverse water conditions may precipitate clinical disease



## OTHER DISEASES CAUSED BY *A. salmonicida*

- Usually involve sub-species other than *A. salmonicida salmonicida*. (Also lack pigment)
  - *A. salmonicida achromogenes*
  - *A. salmonicida masoucida*
- Diseases Include:
  - Goldfish Ulcer Disease
  - Carp Erythrodermatitis
  - Trout Ulcer Disease

## Goldfish Ulcer Disease

- Commercial goldfish farms.
- White tufts on skin.
- Progresses to large necrotic lesions.
- Septicemia may be observed; caused by secondary bacteria infection.



## CARP ERYTHRODERMATITIS

- Begins as small hemorrhagic areas, develop into ulcers.
- Grass carp and silver carp are most susceptible.
- Bacteria are only present in lesions.
- Occurs between 4 & 30°C.

## TROUT ULCER DISEASE

- Begins as epithelial thickening, progresses to white tufts, and eventually develop into ulcers.
- Internal signs are similar to those of Furunculosis.

## MOTILE *AEROMONAS* SEPTICEMIA

**Also Known As:**

**Bacterial hemorrhagic septicemia, hemorrhagic septicemia.**

**Pathogens:**

*A. hydrophila*, *A. formicans*, *A. liquifaciens*.

**Susceptible Species:**

**All fishes.**

**Geographic Range:**

**World-wide.**

## DISEASE SIGNS

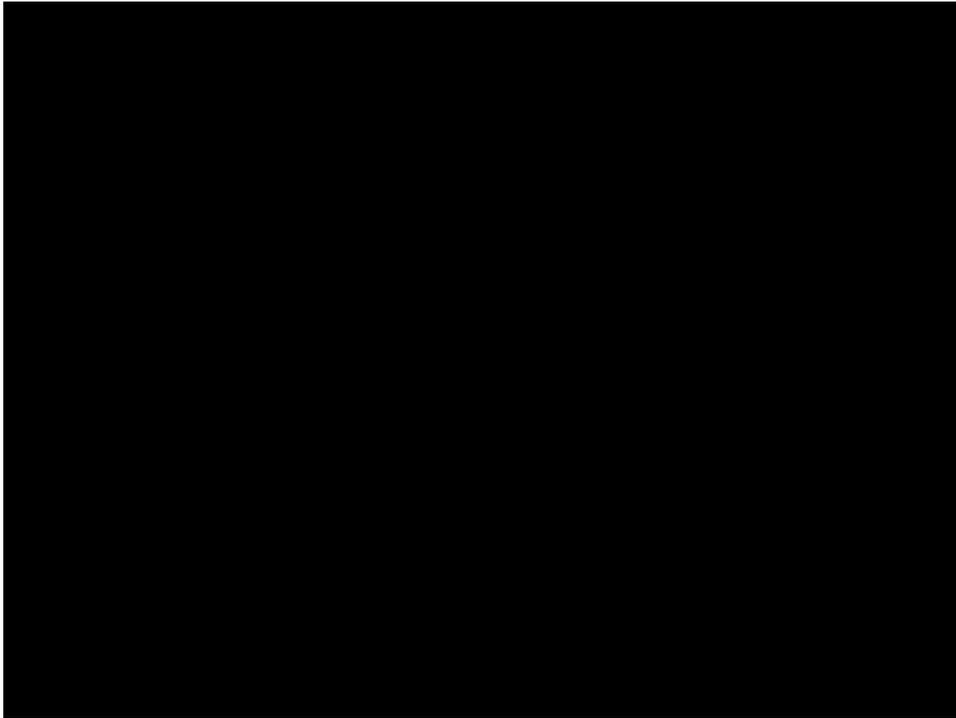
- Clinical signs similar to those of generalized septicemias caused by other gram-negative rods

## DISEASE SIGNS

- Hemorrhaging (vent, gills, internal organs, epidermis).
- Ascities fluid in body cavity.
- Abscesses and/or ulcers.

## EPIZOOTIOLOGY

- Ubiquitous in water.
- Usually Stress Related.
- Water temperatures above 10°C.



## BACTERIAL GILL DISEASE

**Pathogen:**

*Flavobacterium* spp. (especially *F. branchiophila*)

**Host Species:**

Salmonids.

**Geographic Range:**

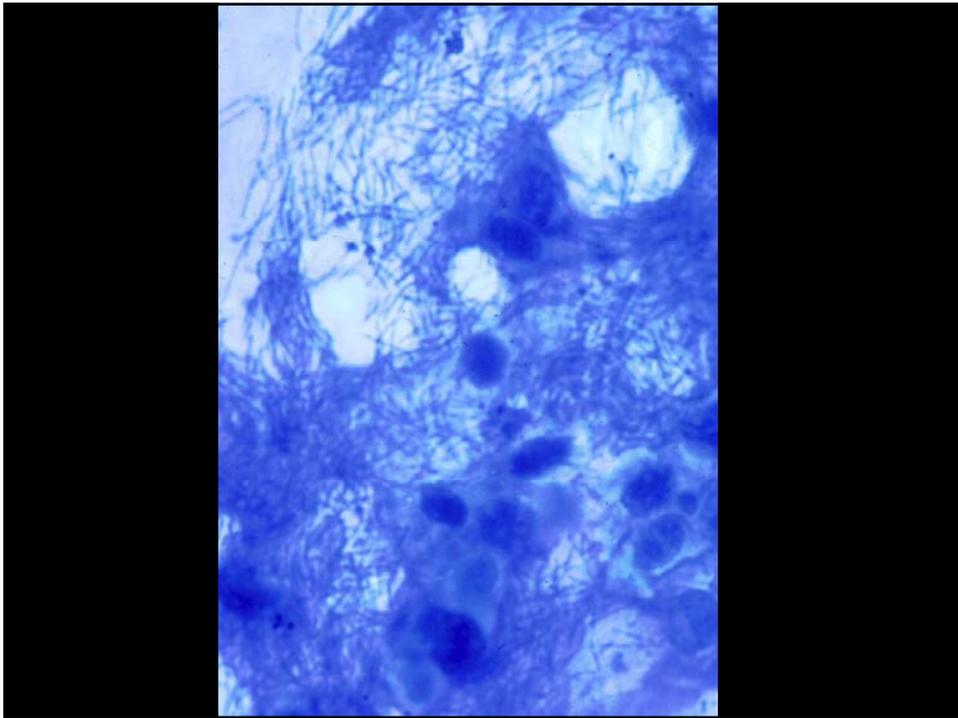
World-wide.

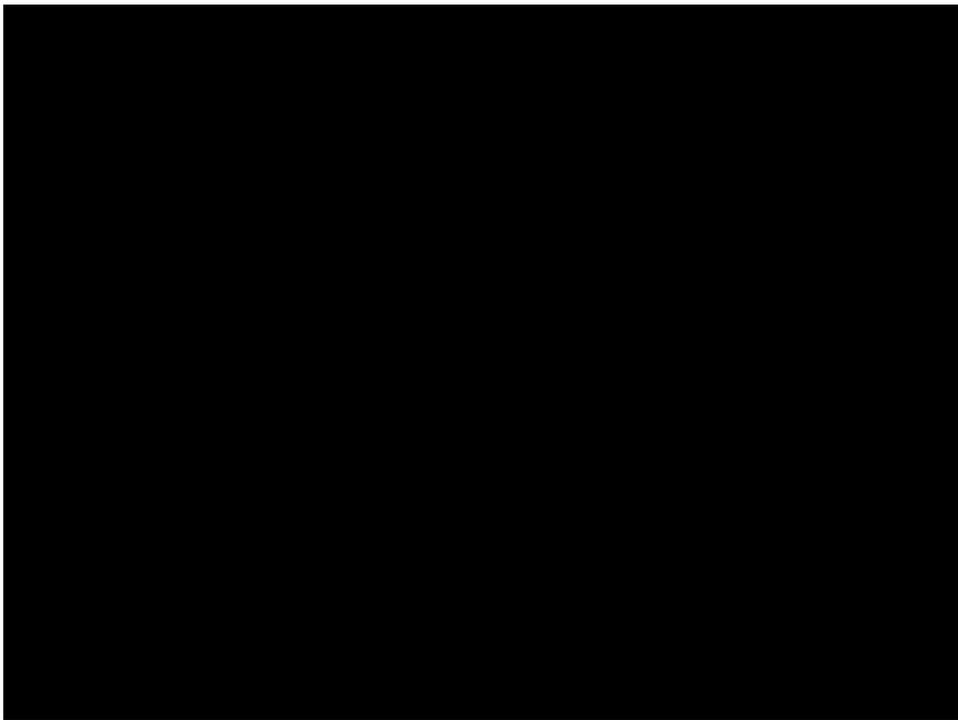
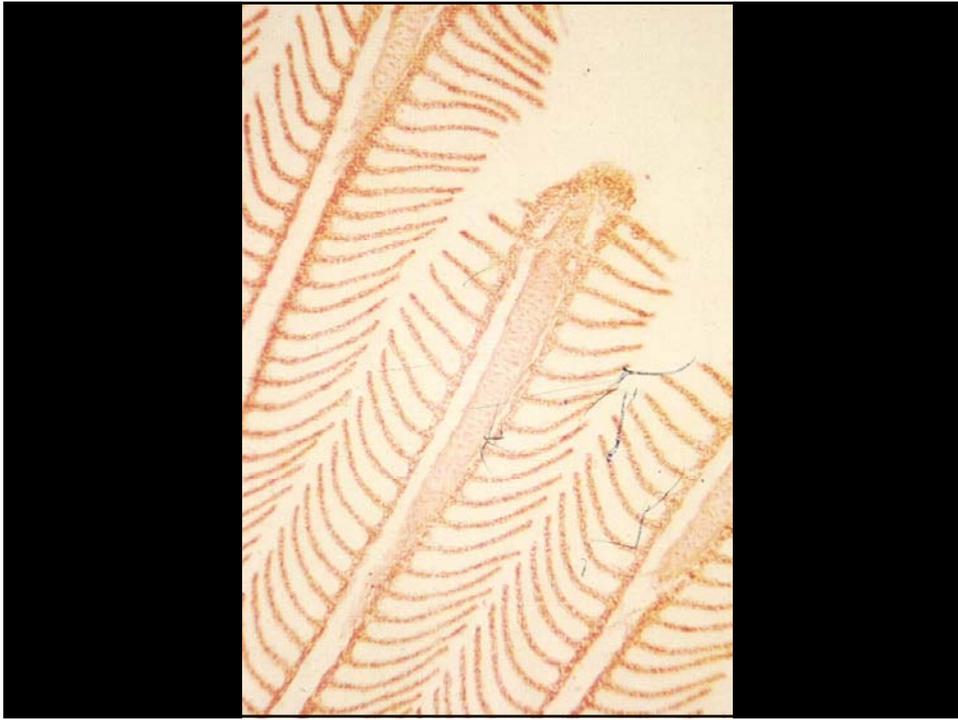
## DISEASE SIGNS

- Fusion of gill filaments (“Clubbing”).
- Increased mucus on gills.
- Increased gill activity.
- Extended opercula.
- Fish are “off feed.”
- Fish may be lethargic.

## EPIZOOTIOLOGY

- All life stages susceptible.
- Stress related.
- Pathogens are common in water (ubiquitous).





# COLDWATER DISEASE

**Also Known As:**

**Bacterial coldwater disease, peduncle disease.**

**Pathogen:**

*Flavobacterium psychrophilus*  
(Formerly *Flexibacter psychrophilus*)

**Host Species:**

**Salmonids.**

**Geographic Range:**

**North America, Europe.**

## DISEASE SIGNS

- Skin and muscle lesions (usually develop in the peduncle region first, then spread to other areas on the body surface).
- Eventually deeper tissues are eroded
  - Loss of caudal fin
  - vertebral column may be exposed in peduncle region.
- May progress inward.

## EPIZOOTIOLOGY

- Juvenile life stages are most susceptible.
- Ubiquitous in water.
- Water temperatures below 10°C.





# COLUMNARIS DISEASE

**Also Known As:**

Coolwater disease.

**Pathogen:**

*Flavobacterium columnaris*  
(Formerly *Flexibacter columnaris*)

**Host Species:**

All freshwater fishes.

**Geographic Range:**

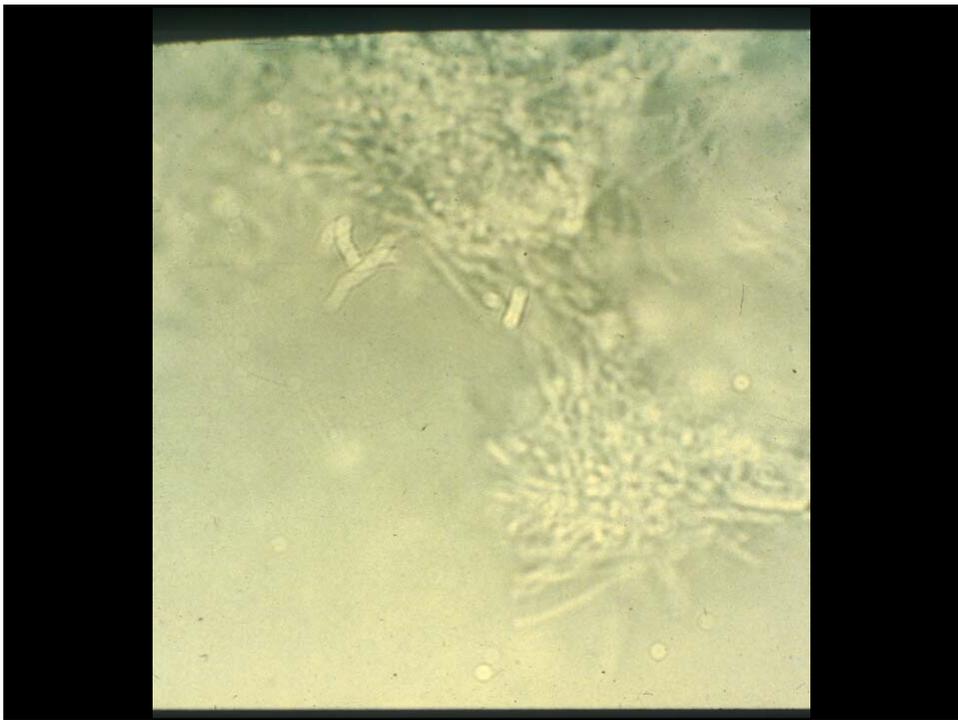
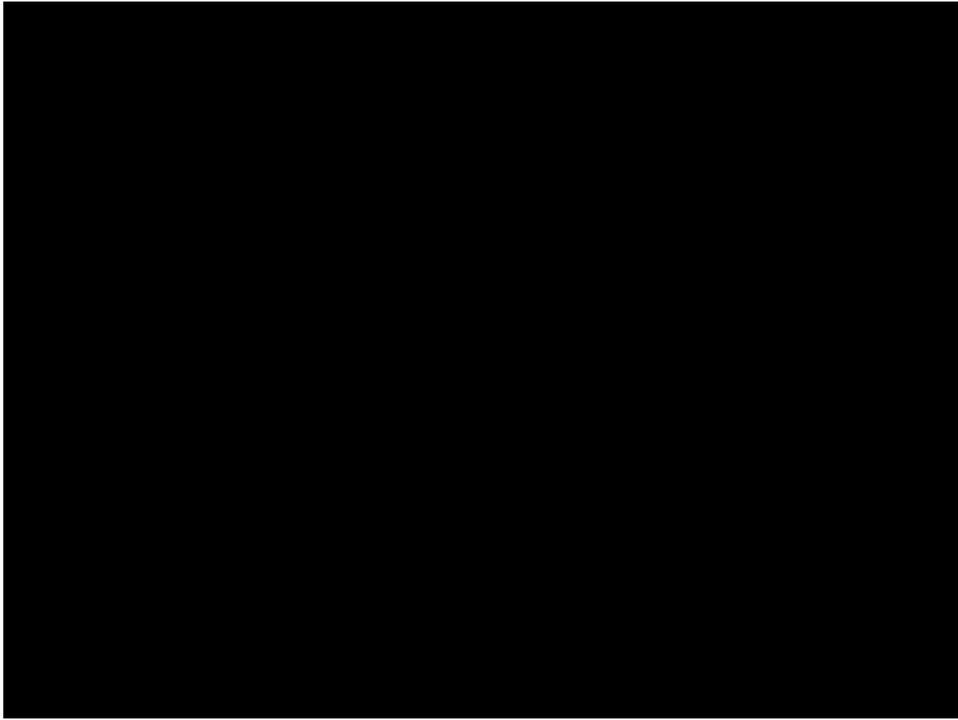
World-wide

## DISEASE SIGNS

- Fish may die without any clinical signs (highly virulent strains)
- Lesions on body and/or gills.
  - Gills: Radiates from focal point; tissue is pale & necrotic; NO CLUBBING!!!
  - Scaled Fish: Grey-white cutaneous foci on epidermis.
  - Scale-less Fish: dark blue area w/ milky-white veil.
- May have yellow margin around lesion.

## EPIZOOTIOLOGY

- Poor environmental conditions.
- Cool water conditions ( $>14^{\circ}\text{C}$ ).
- High mortality (60-90%)
- Fungi are secondary pathogens.





## **ENTERIC SEPTICEMIA**

**Also Known As:**

**Enteric septicemia of catfish (ESC), hole-in-the-head disease**

**Pathogen:**

*Edwardsiella ictaluri*

**Host Species:**

**Ictalurids.**

**Geographic Range:**

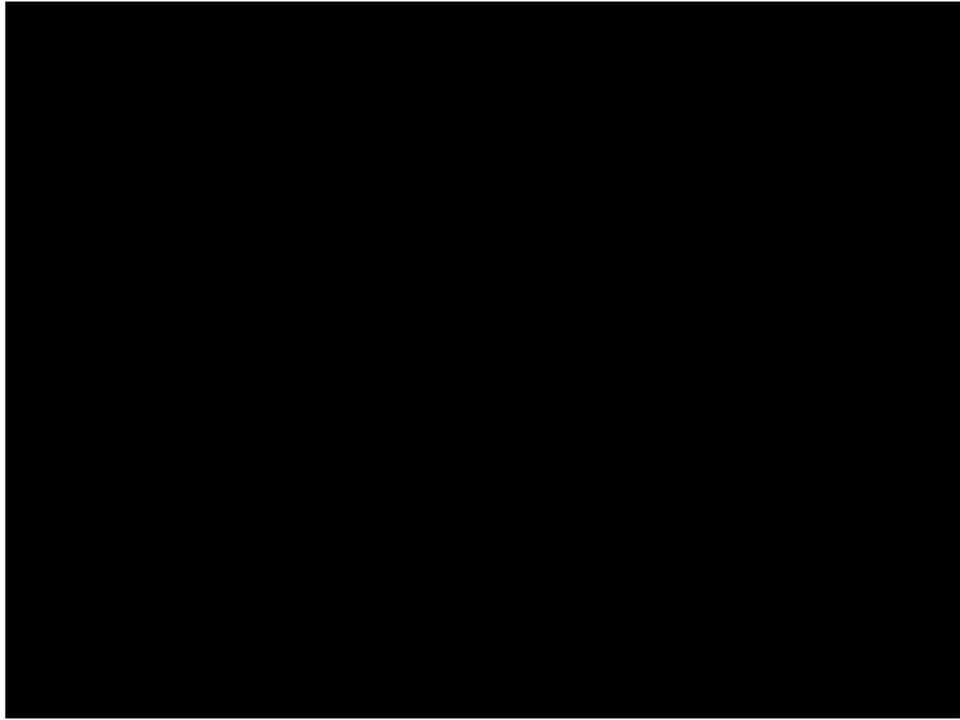
**United States, Thailand.**

## DISEASE SIGNS

- External Signs: Ulceration of the fontanelle of the frontal bones (“hole-in-the-head”); lesions/hemorrhage around mouth, lateral and ventral body surfaces, fins; pale gills; exophthalmia.
- Internal Signs: Petechiae throughout visceral mass, peritoneum & muscles; peritoneal fluid and enlargement kidney, liver, & spleen are sometimes observed.

## EPIZOOTIOLOGY

- Primarily affects fingerlings; adults may be infected.
- Disease results from the uptake of bacteria from water/mud; progression is along olfactory stem to the brain.
- Infection occurs between 20-30°C.
- Over-winters in forebrain & hindgut of carrier fish (low prevalence-- < 1% of population).
- Survives less than 8 d in pond water.



# *Edwardsiella tarda*

## SEPTICEMIA

**Also Known As:**

*Edwardsiella septicemia*

**Pathogen:**

*Edwardsiella tarda*

**Host Species:**

Channel catfish, brown bullheads, carp, goldfish, striped bass, freshwater eel.

**Geographic Range:**

Southeastern & southwestern U.S., southeast Asia.

## DISEASE SIGNS

- Catfish: Small lesions, which develop into large abscesses (filled with malodorous gas and necrotic tissue).
- Other Species: General bacterial septicemia.

## EPIZOOTIOLOGY

- High water temperatures (>30°C).
- High levels of organic matter present.
- Mode of transmission is unknown.

## VIBRIOSIS

**Pathogens:**

*Vibrio anguillarum* & *Vibrio ordalii*

**Host Species:**

Most marine fishes.

**Geographic Range:**

World-wide (primarily marine).

## DISEASE SIGNS

- Erythema & hemorrhaging at the base of fins, vent, and mouth.
- Petechiae in the musculature.
- Hemorrhagic gills.
- Erythema & hemorrhaging in internal organs.

## EPIZOOTIOLOGY

- Water-borne Pathogen.
- Shed from vent and open lesions.
- Enters through the integument (especially gills).

# COLDWATER VIBRIOSIS

**Also Known As:**

**Hitra disease.**

**Pathogen:**

*Vibrio salmonicida*

**Host Species:**

**Atlantic salmon and rainbow trout.**

**Geographic Range:**

**Scotland, Norway & Eastern Canada**

## DISEASE SIGNS

- Hemorrhaging of the skin, around the mouth, the vent, and most internal organs.
- Occasionally may cause hemorrhaging in muscle tissue.

## EPIZOOTIOLOGY

- Cold water temperatures (<10°C).
- Water-borne pathogen.
- Observed in all age classes.

## PISCIRICKETTSIOSIS

**Also Known As:**

Salmonid rickettsial septicemia, coho salmon septicemia,  
Huito disease.

**Pathogen:**

*Piscirickettsia salmonis*.

**Host Species:**

Salmon, rainbow trout, muskellunge.

**Geographic Range:**

Chile, Ireland, Norway, North America.

## DISEASE SIGNS

- Small white lesions & shallow hemorrhagic ulcers on the skin.
- Fish appear dark and lethargic.
- Peritonitis, ascites, enlarged spleen, swollen grey kidney, & pale necrotic lesions on the liver.

## GRAM-POSITIVE BACTERIA

# BACTERIAL KIDNEY DISEASE

**Pathogen:**

*Renibacterium salmoninarum*

**Host Species:**

Salmonids.

**Geographic Range:**

North America, Europe, Chile, Turkey, Japan.

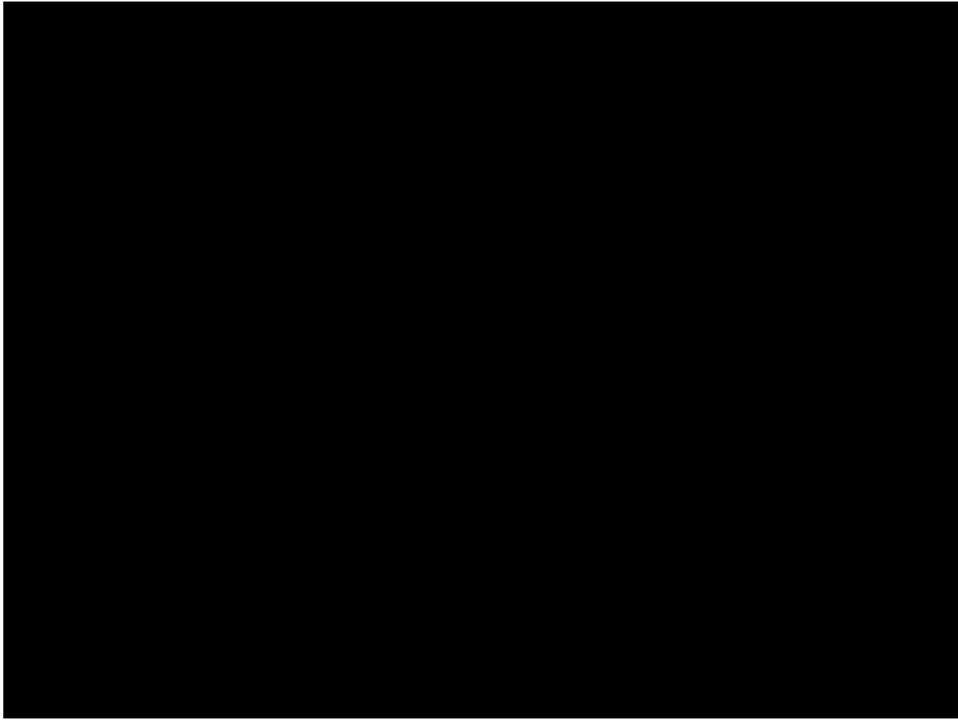
## DISEASE SIGNS

- Chronic (Most Common)
  - Internal Signs: Kidney is edematous, gray and corrugated; white lesions often present (may also occur in liver & spleen); fluid present in abdominal cavity.
  - External Signs: exophthalmia, abdominal distension; may also appear normal.
- Acute ( occurs sporadically)

## EPIZOOTIOLOGY

- May be transmitted both horizontally & vertically.
- Salmonids are susceptible at any life stage (clinical signs usually not observed in fish less than 6 months old).
- Experimentally infected @ temps between 4-20°C (most rapid from 15-20°C).





## PSEUDOKIDNEY DISEASE

**Pathogen:**

*Carnobacterium piscicola*  
(formerly *Lactobacillus piscicola*)

**Host Species:**

Salmonids

**Geographic Range:**

United States, Canada, Great Britain, (world-wide?).

## DISEASE SIGNS

- Internal Signs: Enlargement of the kidney, liver, & spleen; fluid present in abdominal cavity; hemorrhages may be present in muscle, intestine, and testes.
- External Signs: Abdominal distension; erythema at base of fins; sub-dermal blood blisters.

## EPIZOOTIOLOGY

- Occurs in fish 1-yr old and older, especially brood fish post-spawning.
- Mode of transmission is unknown.
- Lactic acid bacteria (i.e. *Carnobacterium*) are normal oral and gut fauna of animals.

## STREPTOCOCCAL DISEASE

**Pathogens:**

*Streptococcus iniae*, *Streptococcus* spp.

**Host Species:**

Freshwater, brackish and marine species.

**Geographic Range:**

United States, South Africa, Japan, China.

## DISEASE SIGNS

- External Signs: Abdominal distension; raised, hemorrhagic, inflamed areas on skin (including the operculum, mouth, bases of fins, dorso-lateral portions of the body; exophthalmia; hemorrhage in the eye.
- Internal Signs: Peritoneal fluid, pale liver, dark spleen, kidney is NOT a target organ
- Often swim in a tail-chasing spiral.

## EPIZOOTIOLOGY

- Epizootiology is not understood.
- Stress increases probability of infection.
- Primary isolation is made from the brain.



Photo: Catfish News