

Bacterial Kidney Disease (BKD)

I. *Causative Agent and Disease*

Bacterial kidney disease (BKD) is caused by *Renibacterium salmoninarum* (Rs) that can replicate extracellularly and intracellularly within macrophages. BKD, also known as Dee Disease, is a systemic bacterial infection caused by a small, non-motile, Gram-positive coccobacillus. Typically, the course of the disease results in slow chronic fish mortality that occurs in Alaska at much colder water temperatures of 1-2°C than reported elsewhere (11°C).

II. *Host Species*

All salmonids are considered susceptible and the disease usually occurs in fish 6 months or older, i.e., juvenile and adult fish.

III. *Clinical Signs*

In the acute stage, fish may die without exhibiting any clinical signs of disease. In the more typical chronic form of BKD fish may exhibit exophthalmia, petechial hemorrhages and/or vesicles of the skin, and abdominal distention due to the accumulation of ascitic fluid in the abdominal and pericardial cavities. The kidney, which is the target organ, is often enlarged and edematous and may exhibit off-white nodules varying in size. The whole kidney may appear gray, corrugated and swollen. White foci may also be present in other organs, chiefly the liver and spleen.

IV. *Transmission*

The Rs bacteria can be transmitted horizontally from fish to fish or from a water supply containing infected fish. In early fish culture, feeding raw, unpasteurized viscera of infected fish to other fish increased the incidence of the disease in hatcheries. Unlike many other

bacterial pathogens of fish, *R. salmoninarum* can also be transmitted vertically within the egg. The bacteria gain access during egg formation or more commonly enter the yolk through the micropyle after ovulation from contaminated ovarian fluids of the female parent. Transmission from contaminated male seminal fluids during fertilization is another possible route. The organism may survive free in the environment for long periods of time.

V. *Diagnosis*

Presumptive diagnosis of BKD is sometimes possible by observation of the gross pathology and the presence of intracellular and extracellular Gram-positive, small, non-acid-fast, non-sporeforming coccobacilli in Gram stained impression smears of infected tissues. The organism does not grow on TSA but requires a specialized KDM2 media at 15-20°C for 10 to 21 days of incubation. Organisms can be confirmed with a specific fluorescent antibody test, enzyme linked immunoabsorbent assay (ELISA) or by polymerase chain reaction (PCR).

VI. *Prognosis for Host*

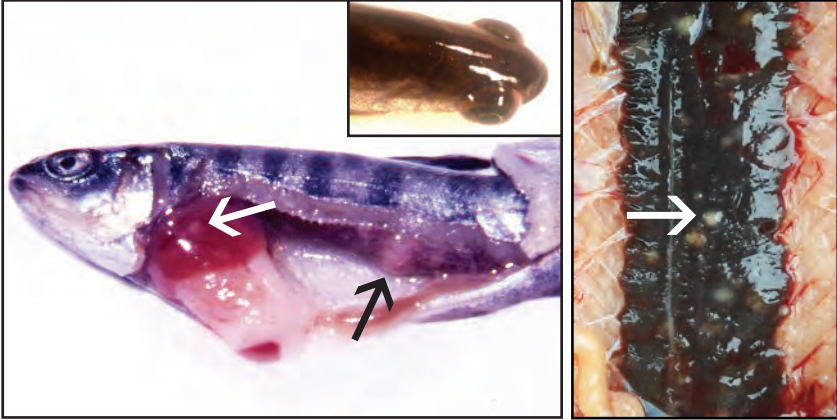
BKD results in chronic fish mortality in both fresh and seawater and can have a detrimental impact on fish populations, generally during the later stages of rearing. Infected fish become carriers for life. In Alaska, losses of coho and Chinook salmon fingerlings from BKD can range from 2-5%/month during final months of rearing. Dietary erythromycin reduces mortality which resumes when the drug is withdrawn. In numerous watersheds within Alaska, Rs antigen has been detected by ELISA in both wild and hatchery stocks of all 5 species of Pacific salmon. Prevalence usually is

BACTERIA

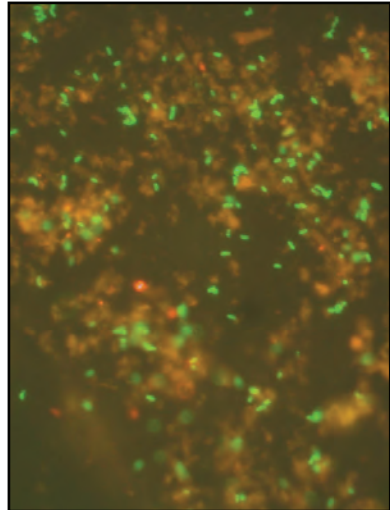
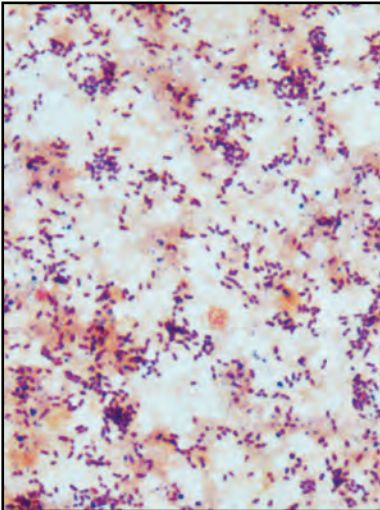
less than 10%, but some systems have carrier rates up to 90%. Wild trout, char and grayling are reservoirs for Rs, often showing prevalences of up to 100%.

VII. Human Health Significance

There are no human health concerns associated with *R. salmoninarum*.



Left: White pustules (arrows) in the posterior kidney and liver of a juvenile coho salmon typical of BKD; **Inset:** Infected fish with exophthalmia; **Right:** White kidney pustules (arrow) in adult Bear Lake sockeye salmon with BKD (photo: CIAA staff).



Left: Stained kidney smear with small Gram-positive coccobacilli typical of *R. salmoninarum*, X 1000; **Right:** BKD bacteria, *Renibacterium salmoninarum*, stained with a fluorescein dye (green), fluorescent antibody test, X 1000.