

are no reports of goldfish or carp strains being resistant to *A. salmonicida*.

IMMUNIZATION

Vaccination is an effective method of controlling certain fish diseases, and two vaccines have been developed to control furunculosis. They are used in Scandinavian countries, Canada, and the United Kingdom but are not in use in the United States.

THERAPY

In the United States two antibacterials are approved by the Food and Drug Administration for treating furunculosis of trout and salmon. Terramycin (oxytetracycline) fed at the rate of 2.5–3.0 g/100 pounds of fish per day for 10 days, or Romet fed at this rate for 5 days, are usually effective in controlling outbreaks of furunculosis. Antibacterials should be used only as a last resort, because continued use often results in antibacterial-resistant strains of *A. salmonicida*.

There is no established treatment regimen for goldfish ulcer disease (which has nevertheless decreased in severity in recent years) or for carp erythrodermatitis.

SUGGESTED READING

Bullock, G. L., R. C. Cipriano, and S. F. Snieszko. 1983. Furunculosis and other diseases caused by *Aeromonas salmonicida*. U.S. Fish and Wildlife Service, Fish Disease Leaflet 66. 21 pp.

Detailed description, including diagnosis, cause, clinical signs, host and geographic range, transmission and incubation, detection, and control.

McCarthy, D. H., and R. J. Roberts. 1980. Furunculosis of fish—the present state of our knowledge. Pages 293–341 in M. R. Droop and H. W. Jannasch, eds. Advances in aquatic microbiology, Vol. 2. Academic Press, London.

A comprehensive review of salmonid furunculosis and other *Aeromonas salmonicida* infections. Immunology, virulence mechanisms, etiology, and classification of *A. salmonicida* are also discussed.

NOTE: A fish disease specialist should be consulted for diagnostic assistance whenever a disease is suspected and before chemical treatments are used.

The use of chemicals or drugs on fish intended for human or animal consumption must be in accordance with current laws and regulations.

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Furunculosis is a generalized internal infection prevalent in trout and salmon. The disease was first described in Germany in 1894 and was named for the large raised lesion called a furuncle (Fig. 1) seen in the chronic disease. The bacterium causing the disease is *Aeromonas salmonicida*. For many years it was believed that *A. salmonicida* infected only salmon and trout, but variants of the bacterium have now been found to cause goldfish ulcer disease, carp erythrodermatitis, and infections in some marine fishes.

PATHOLOGY

Furunculosis

Affected salmon or trout darken, stop feeding, and often develop hemorrhages at the bases of fins. The furuncle occurs in long-term chronic disease but not in rapidly developing outbreaks in hatcheries. Internally, hemorrhages occur in the intestine, abdominal walls, and heart. The stomach and intestine are devoid of food.

Goldfish Ulcer Disease and Carp Erythrodermatitis

Externally, affected goldfish or carp have one or more large ulcers (Figs. 2 and 3), which begin as small white areas on the skin and continue to develop and destroy scales, skin, and muscle. In contrast to furunculosis, the causative bacterium nearly always occurs only in the lesions and there is no internal infection. Infected carp may show anemia, protrusion of the eyes, abdominal fluid, and hemorrhages in the gills. Even if affected gold-



Fig. 1. Furunculosis in brook trout, showing furuncle (arrow) commonly seen in long-term infections.

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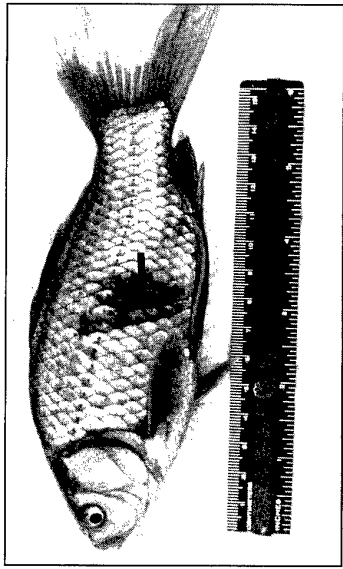


Fig. 2. Goldfish with open lesion (arrow) typical of goldfish ulcer disease.

fish or carp survive, the healed lesions leave fish unsightly and reduce their market value.

DIAGNOSIS

Preliminary diagnosis of *A. salmonicida* infections is based on observing the external clinical signs described. Confirmatory diagnosis requires isolation of the bacterium and identification by various laboratory tests.

HOST AND GEOGRAPHIC RANGE

Although *A. salmonicida* infections usually occur in salmonids and less often in common carp and goldfish, the causative bacterium also infects many other species of warmwater and coldwater fishes—both freshwater and marine. Considering the ubiquitousness of *A. salmonicida*, the geographic range is probably worldwide.

SOURCES AND RESERVOIRS OF INFECTION

Studies have shown that *A. salmonicida* can survive for several days in water, nets, and fish tissues, which thus can serve briefly as reservoirs of infection. However, the main reservoirs of infection are the fish that survive disease outbreaks and become latent carriers of the bacterium.

TRANSMISSION

In farmed fish, transmission results from fish-to-fish contact during disease outbreaks, and from latent car-

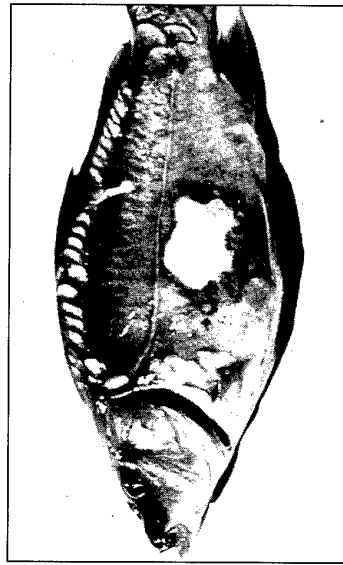


Fig. 3. Carp erythrodermatitis in mirror carp, a form of common carp. Note lesion, in which scales, skin, and muscle have been destroyed.

riers. These carrier fish in the water supply of a hatchery or fish farm shed bacteria, which infect the fish being cultured.

CONTROL

Control methods include prevention and treatment with antimicrobial drugs. Effective control procedures have been developed for salmonid furunculosis but not for goldfish ulcer disease or carp erythrodermatitis.

Prevention

Infection can be avoided by obtaining fish eggs or live fish from sources certified free of furunculosis. Eyed eggs from noncertified sources can be disinfected upon arrival, and must be isolated from later contact with other eggs or with contaminated packing material or containers.

The most reliable egg disinfectants are iodophors—complexes of iodine with inert organic solvents. When used as recommended, they are safe for eyed eggs but are toxic to fry. In the United States, Betadine and Wescodyne can be easily obtained. Similar iodophors, containing 1.0 to 1.6% iodine, are available in other countries.

SELECTION AND BREEDING

Selection and breeding have produced strains of trout with high resistance to furunculosis. This selective breeding approach is recommended for controlling the disease in areas where furunculosis is prevalent. There