

Control of the Parasitic Flagellate *Ichthyobodo salmonis*, a Causative Agent of Marine Mortalities of Juvenile Chum Salmon

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Survival of juvenile salmon in the ocean is affected by various factors including diseases caused by infectious organisms. *Ichthyobodo salmonis* is an ectoparasitic flagellate infecting the skin and gills of salmonid fishes such as Atlantic salmon (Isaksen et al. 2011). In Japan, the parasite has been recorded as *I. necator* from juvenile chum salmon at hatcheries (Urawa 1992a; and others). Infection experiments have indicated that heavy parasite infections cause severe erosion of the skin epidermis of juvenile chum salmon (Fig. 1), resulting in high mortality of anadromous hosts due to osmoregulatory failure when they migrate into the coastal ocean (Urawa 1993). The parasitic infections commonly occur at salmon hatcheries (Urawa 1992a, 1996). A bath with a dilute formalin solution is the most effective way to treat infected fish (Fig. 2A). In Japan, however, the use of formalin on hatchery fish is restricted because of revision of the Pharmaceutical Affairs Law in 2003. Alternative effective treatment methods are currently not available for hatchery salmon, and some hatchery managers believe that the recent decrease of chum salmon returns in Japan might be partly caused by parasite infections.

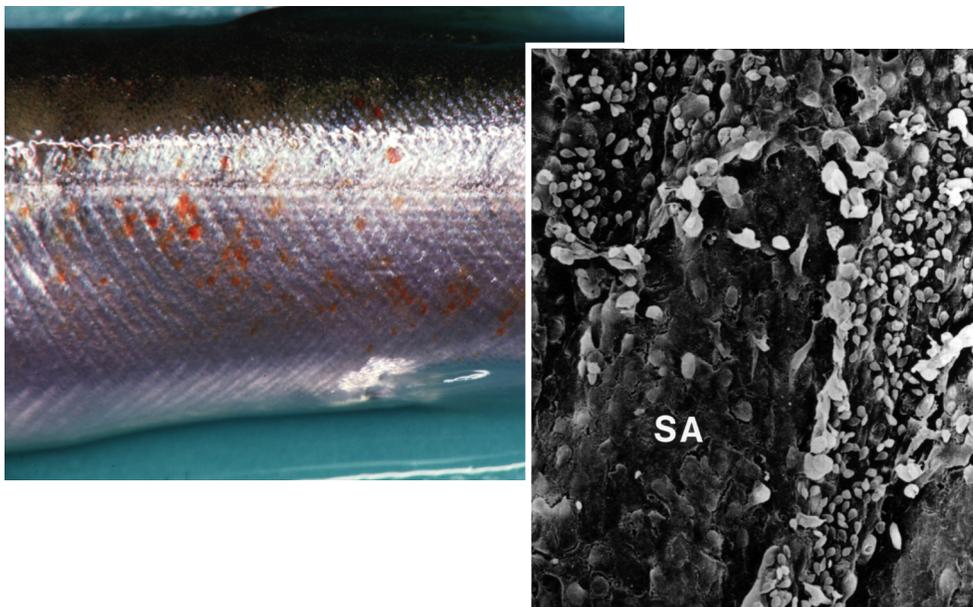


Fig. 1. Heavy parasitic infection caused severe erosion and hemorrhage in the skin epidermis of juvenile chum salmon, and a large area of the epidermal upper layer (SA) was sloughed off. The right image was observed by a scanning electron microscopy (cited from Urawa 1992b).

The present study aimed to develop a safe method to control *I. salmonis* infections of juvenile chum salmon. Various concentrations of salt and vinegar solutions were tested on juvenile chum salmon heavily infected with *I. salmonis*. A 10-min bath with a high concentration (5%) of salt water decreased parasite density (Fig. 2B), but also had a high risk of killing the juvenile fish because the parasite infections reduced the fish's tolerance to salt water (Urawa 1993). Because *I. salmonis* on anadromous salmon can survive even in sea water (Urawa and Kusakari 1990), low concentrations of salt water were not effective to control the parasite infections. A bath containing 0.4-1.0% corn vinegar could control the parasite, but exposure to a 1% corn vinegar (pH 3.9) bath over 15 minutes weakened or killed the treated fish (Fig. 2D). The present treatment study suggested that a one-hour exposure in a bath of low concentration (0.4%, pH 4.5) of corn vinegar is a safe method to control *I. salmonis* infections on juvenile chum salmon at hatcheries (Fig. 2C).

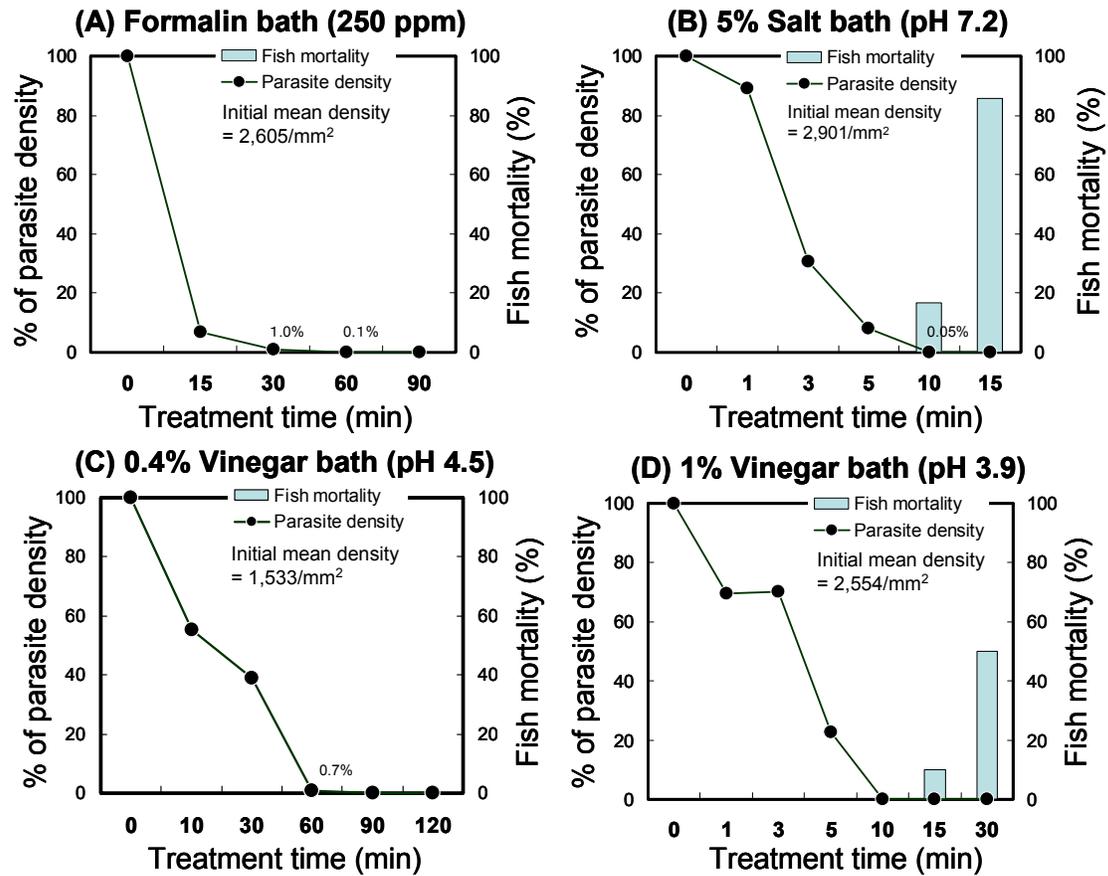


Fig. 2. Effects of various bath treatments on the density of *Ichthyobodo salmonis* on the skin of juvenile chum salmon. Blue bars indicate fish mortality (%) during the treatment.

REFERENCES

- Isaksen, T.E., E. Karlsbakk, K. Watanabe, and A. Nylund. 2011. *Ichthyobodo salmonis* sp. n. (Ichthyobodonidae, Kinetoplastida), an euryhaline ectoparasite infecting Atlantic salmon (*Salmo salar* L.). *Parasitology* 138(9): 1164-1175. doi: 10.1017/S0031182011000916.
- Urawa, S. 1992a. Host range and geographical distribution of the ectoparasitic protozoans *Ichthyobodo necator*, *Trichodina truttae*, and *Chilodonella piscicola* on hatchery-reared salmonids. *Sci. Rep. Hokkaido Salmon Hatchery* 46: 175-203.
- Urawa, S. 1992b. Epidermal responses of chum salmon (*Oncorhynchus keta*) fry to the ectoparasitic flagellate *Ichthyobodo necator*. *Can. J. Zool.* 70: 1567-1575.
- Urawa, S. 1993. Effects of *Ichthyobodo necator* infections on seawater survival of juvenile chum salmon (*Oncorhynchus keta*). *Aquaculture* 110: 101-110.
- Urawa, S. 1996. The pathobiology of ectoparasitic protozoans on hatchery-reared Pacific salmon. *Sci. Rep. Hokkaido Salmon Hatchery* 50: 1-99.
- Urawa, S., and M. Kusakari. 1990. The survivability of the ectoparasitic flagellate *Ichthyobodo necator* on chum salmon fry (*Oncorhynchus keta*) in seawater and comparison to *Ichthyobodo* sp. on Japanese flounder (*Paralichthys olivaceus*). *J. Parasitol.* 76: 33-40.