

VACCINES FOR IMMUNIZING SALMONIDS IN SALT WATER

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The major obstacle to rearing salmonids in net pens in salt water has been bacterial disease--in particular, vibrio disease (vibriosis) caused by the gram negative halophile Vibrio anguillarum. When naive salmon are crowded and subjected to the various stresses concomitant with introduction to salt water, they often fall prey to vibriosis or the various carry-over pathogens from the freshwater phase of their life cycle (Scott 1968; Novotny 1975).

Researchers in Japan (Hayashi, Kobayashi, Kamata, and Ozaki 1964) were the first to inject bacterins into saltwater-reared rainbow trout, Salmo gairdneri, to prevent vibrio disease. Later, Fryer et al. (1972), described the oral administration of a formalin-killed sonicate of V. anguillarum to protect fish from a natural vibrio challenge at Lint Slough, Oregon.

During the past 3 years our research group of the National Marine Fisheries Service (NMFS) at Manchester, Washington has relied on intraperitoneal injection of bacterin to successfully control vibriosis in experimentally-reared salmonids in salt water. The technology for mass injection developed by NMFS has been successfully used by commercial growers who vaccinated more than 1 million coho salmon Oncorhynchus kisutch, in Puget Sound during the past several years.

A new serotype of the vibrios organism (designated 1669) was isolated during an epizootic in Puget Sound near Manchester in November of 1973 (Harrell, et al. 1976). Bivalent vaccines made from this

organism (1669) and the original Manchester area isolate of V. anguillarum (775) have proven to be an effective means of prophylaxis against both serotypes.

In order to avoid the 2 week post-vaccination delay before fish are introduced to salt water, our research group has been using a bacterin-antibacterial preparation for intraperitoneal injection. The vaccine is prepared to deliver 675 μ g heat-killed 775 vibrio organism, 225 μ g of the 1669 type vibrio with 75 μ g Furacin^{1/2/} and 95 μ g liquamycin^{3/} per 0.15 ml dose. Because of U.S. Food and Drug Administration regulations, this concoction would not be legal on a commercial fish farm; however, in experimental research where fresh water is at a premium it has proven useful and effective.

A third method of vaccine delivery was recently described (Amend and Fender 1976) which utilizes the osmotic gradient between the fish and surrounding media (immersion method) to carry the antigen into the animal. We recently tested this method on pink salmon, O. gorbuscha, fry that had an average weight of 1.8 gm. One lot of 727 fish were vaccinated with a bivalent vaccine via the immersion method, and a control group of 574 pink fry received the same treatment without killed bacteria but media only. Forty days after introduction to salt water, 490 unvaccinated control

1/ Nitrofurazone, Eaton Veterinary Laboratories.
2/ Reference to trade name(s) in this publication does not imply endorsement of commercial product(s) by the National Marine Fisheries Service, NOAA.
3/ Oxytetracycline HCL, Pfizer, Inc.

salmon had died from vibriosis and only two vaccinated salmon were lost, both to vibriosis. An identical experiment was started at the same time using chum salmon O. keta fry. Unfortunately, any data on the effectiveness of the delivery system for chum salmon fry was marked after a near total mortality from furunculosis, a bacterial disease which is caused by Aeromonas salmonicida.

Researchers attempting to accumulate data on vaccines for vibrio disease are often handicapped when furunculosis becomes evident in experimental lots of fish. Furunculosis has been isolated from saltwater reared fish after 3 or more months in the net-pens (G. Marquart, Domsea Farms, Bremerton, WA 98210, pers. comm.), and there is evidence to indicate that it is transmissible in salt water (Scott 1968; Novotny, in press).

In summary, the utilization of the salmonid immune response to protect fish against vibriosis in salt water has been successful. Furthermore, the most effective bacterin delivery system to activate this response should become evident in the very near future because several researchers are currently investigating this subject.

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