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Vibriosis and Current Salmon Vaccination Procedures in Puget Sound, Washington

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ABSTRACT—The National Marine Fisheries Service aquaculture experiment station and several private salmon farms are successfully vaccinating fish against vibriosis via automatic syringe. Delivery systems other than injection are currently being researched and developed by private, governmental, and Sea Grant agencies. Evidently, there is some cross-protection offered by the original Vibrio anguillarum *isolate against a new vibrio species recently isolated at the Manchester, Wash., laboratory.*

VIBRIOSIS IN PEN-REARED SALMON

During the past 5 years the National Marine Fisheries Service (NMFS) has been rearing salmon and trout in saltwater at the NMFS Aquaculture Experiment Station on Puget Sound's Clam Bay near Manchester, Wash. (Novotny, 1975). It was obvious from the beginning that some form of preventive medicine other then chemotherapy was needed if the husbandry experimentation was to be successful. Vibriosis, the common fish disease caused by the marine pathogen *Vibrio anguillarum,* can cause high mortality among salmon in saltwater pens, particularly during the warmer summer months when water temperatures approach 15°C, and populations of fish in the pens are high.

A joint experimental pilot farm operated by the Union Carbide Corporation[1] and NMFS in 1971 involved experimental rearing of large numbers of coho salmon, *Oncorhynchus kisutch,* in saltwater pens. The results of this experiment clearly indicated that antibiotics were needed during vibrio disease outbreaks. After this pilot project proved successful in 1972, the Union Carbide Corporation decided to enter the salmon aquaculture business as Domsea Farms, Inc., and NMFS continued its research at the Manchester station.

VACCINATION PROCEDURES AND RESULTS

Preliminary studies indicated that a single injection of 2-4 mg of killed, wet-packed cells in physiological saline would be sufficient to protect coho salmon against the usual epizootics of vibriosis occurring in the central region of the Puget Sound area.

In the spring of 1973, the majority of experimental fish in the saltwater pens at Clam Bay were vaccinated intraperitoneally with heat-killed bacterin prepared from a *V. anguillarum* organism (Manchester isolate #775) that had been isolated regularly during the earlier net-pen experiments. Maximum agglutination titers of 1:32 were usually attained by 30 days postvaccination and declined over a 3-month period. Apparently, continued exposure to vibrio disease did not result in an anamnestic response in vaccinated fish. By November 1973, cumulative mortalities in our experimental fish were approximately 10 percent, which was decidedly more acceptable than the 60-90 percent losses that had been experienced before the use of chemical therapy or prophylaxis.

Domsea Farms had slightly over a million fish in saltwater pens in Clam Bay during the fall of 1973. Substantial losses began occurring in one of the larger net pens during November, and the moribund and dead fish were showing pronounced lesions typical of vibriosis.

At this time Domsea Farms had no pathology facilities and NMFS obtained several of the diseased specimens for a diagnostic workup. Vibrio organisms were isolated, but the growth characteristics were markedly different from those we had previously encountered. This organism was designated Manchester isolate #1669, and we began to further characterize it serologically and biochemically. Domsea Farms eventually lost approximately 90,000 ¼-pound coho salmon to this pathogen, primarily in one large net pen. Shortly after this, some of our experimental vaccinated coho were lost due to infections by this new pathogen.

No further losses to vibriosis occured with either our experimental fish or Domsea Farms' until the following summer growing season (1974) when nominal losses began to occur in our vaccinated fish.

Another new aquaculture facility, Pacific Ocean Farms, began growing about 300,000 coho salmon near Clam Bay in June 1974. All of these fish had been individually vaccinated by injection with #775 bacterin at least 2 weeks prior to saltwater entry. Our laboratory began to isolate the #1669 vibrio from these fish in August; the incidence increased as the agglutination titer to the #775 organism decreased. The losses continued at a low level until water temperatures dropped below 9°C. Total losses for the production season were

[1]Reference to trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

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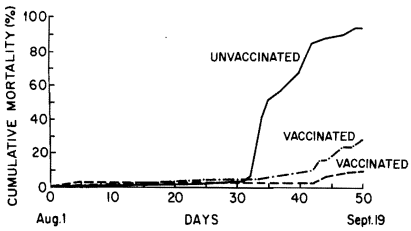

Figure 1.—Mortality of young-of-the-year (0-age) sockeye salmon smolts injected with #775 *V. anguillarum* vaccine. The fish were transferred from fresh water to net pens in the sea on 1 August 1974.

not substantial, even though another, as yet unidentified and unrelated, gall bladder lesion occurred in many of the fish.

On 1 August 1974, we transferred 450 sockeye salmon, *O. nerka,* smolts to saltwater net pens in Clam Bay. One pen contained 150 nonvaccinated control fish. Two pens contained equal lots of sockeye vaccinated with a heat-killed vibrio bacterin (isolate #775). Ninety-eight percent of the nonvaccinated sockeye died within the first 50 days, and only the #1669 type vibrio was isolated. Losses in the two vaccinated lots of fish were minimal at a total of 32 fish (see Fig. 1), primarily due to #1669 type vibrio.

Serological studies with the two vibrio isolates and field observations of the three epizootics caused by the #1669 type organism led us to infer that there was some cross-protection with the #775 bacterin (Harrell et al, 1976).

There are now five aquaculture facilities in Puget Sound that are raising salmon in net pens (Mahnken, 1975). Estimated production for 1975 is 350 metric tons, of which about one-half will have been individually inoculated by injection with a bivalent #775-1669 vaccine. The remainder of the production will be receiving oral vaccines and/or chemotherapy as needed.

FUTURE DEVELOPMENTS

A new method of immunizing fish against vibriosis by immersion is currently under investigation by private (commercial) and federally funded laboratories (D. F. Amend, pers. commun.).

During the summer of 1975 researchers at the Manchester station tested bivalent vibrio vaccines in field situations in cooperation with the Washington Department of Fisheries. The efficacy of several adjuvant preparations for injection with bacterins was also under investigation.

LITERATURE CITED

Harrell, L. W., A. J. Novotny, M. H. Schiewe, and H. O. Hodgins. 1976. Isolation and description of two vibrios pathogenic to Pacific salmon in Puget Sound, Washington. Fish. Bull., U.S. 74:447-449.

Mahnken, C. V. W. 1975. Status report: Commercical salmon culture in Puget Sound. Commer. Fish Farmer Aquaculture News 2(1):8-9,11.

Novotny, A. J. 1975. Net-pen culture of Pacific salmon in marine waters. Mar. Fish. Rev. 37(1):36-47.

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