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SALMONID DISEASES

A WORKSHOP SUMMARY

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occurs because of the cost of B-vitamins. Fat-soluble hypervitaminosis can occur and should be avoided.

Inorganic elements, as nutrients, are difficult to study. Most research on minerals in fish has been limited to toxicity and osmoregulation studies. All minerals essential to adequate nutrition of higher animals should be considered essential for fish until proved otherwise.

In summary, it has been stated that every disease has a nutritional aspect. I have tried to cover some of the principal factors influencing nutritional diseases. The pathology that occurs in fishes incident to oral ingestion of foods or gill absorption may be termed nutritional as opposed to pathology induced by noningested bacteria, viruses, parasites or other non-nutritional entities. However, the effects of suboptimal food intake, environmental stress and resistance to infectious diseases are all interrelated. The influence of each is variable--disease breaks out only if there is sufficient relationship between them.

PREVENTATIVE MEDICINE: STATUS OF THE LEGAL USE OF VACCINES*

*Anthony Novotny***

The intensive culture of fish in natural marine waters is historically documented as having great potential (because of the amount of water available), and is rapidly moving into expanding production. Production in Japan is measured in thousands of metric tons and in the U.S. and Norway, production is now being measured in hundreds of metric tons.

As production moves from pilot scale to full commercial production, the problems of fish diseases rear their ugly heads and dominate the scene. Although commercial farmers are always interested in the latest developments in the therapeutic treatment of fish diseases, the long-range interest is in disease prevention. Undoubtedly, the future will show that properly balanced diets for use in the marine culture of fish will be of importance in preventing or limiting the ravages of epizootics. But there will be an equal or greater emphasis on the use of specific vaccines.

Use of Vaccine

The vaccine of greatest interest to marine fish farms (at present) is the one used to prevent vibriosis. The disease and the causative organism have been well defined by regional scientists such as Ordal and Pacha. The preparation and successful use of an oral vaccine has been demonstrated in Oregon by Fryer in the laboratory and Garrison in the field. At Manchester, vibriosis has been successfully prevented in coho salmon and cutthroat trout for periods of 4 to 6 months by using direct injections of the vaccine. The use of adjuvants may increase protection through the marketing period, but this requires additional testing.

**Summary of moderator's discussion*

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There will be an interest in both oral and injected vaccines by the growers. Mr. Barry Freidman of Union Carbide indicated to me today (at this workshop) that the present estimates of the cost of the vibrio vaccine will be $0.14 to $0.22 per gram of cells. On the basis of present advice on vaccination procedures, the following cost comparisons can be made:

Oral Vaccination

The minimum level is 5 g of vaccine/kg of food for 15 days, followed by a maximum of 15 days without vaccine before exposure. This could mean 15 days before entry into seawater, or if *Vibrio anguillarum* is not present, it could mean using the oral vaccine up to within a few days of entry into seawater. The degree of exposure to the live organism that is necessary to induce natural antibody production (if there is any) is not known. The Oregon research group is suggesting that a re-vaccination be made at 90 days after the first vaccination for a period of 7 days, although this needs to be tested in the field, and may present some complications.

Assuming a single vaccination period of 15 days, followed by a 15-day "rest" period prior to seawater entry, we have the following for 1 million coho smolts (accelerated zero-age fish):

(1) Entry into seawater: 18 g fish (25/lb)--18,000 Kg (40,000 lbs)

End of vaccination: 13.5 g fish (37.5/lb)--13,500 Kg (30,000 lbs)

Start of vaccination: 9 g fish (50/lb)--9,000 Kg (20,000 lbs)

This is a net gain of 4,500 Kg (10,000 lb) during vaccination. Assuming a net food conversion of 1.5:1, the food used during vaccination is 6,750 Kg (15,000 lb).

(2) The cost, then will range from $4725 to $7425 per million fish.

Injection

Recent field trials using automatic syringes show a minimum injection rate of 700 fish/hour (10,000 fish). Test data reported today (using women trained as fish markers) by Brian Allee on 20,000 fish show a rate of 900 to 1100 fish/hour/person. At 900/hour, this is 7200 fish/worker/day. At a wage rate of $20.00/day, the labor cost of injection is $0.0027/fish, or $2700/million fish.

On the basis of our present tests, there are no indications that an intra-peritoneal injection in excess of 2.5 mg of wet-packed cells per fish will afford appreciable increases in protection. At this rate, the cost of vaccine is $0.00035 to $0.00055/fish, or $350 to $550 per million fish. The total cost, then, will be $3050 to $3250 per million fish. The cost of capital equipment is about $50/worker.

Thus, the oral and injected vaccines are competitive at the projected level of present vaccine prices. And, the injected vaccine affords better protection.

Legal Aspects of the Use of Vaccines in Fish

All animal vaccines fall under the regulations of the 1913 Federal Virus-Serum-Toxin Act. This Act of Congress places the entire control under the U.S. Department of Agriculture (USDA). The Food and Drug Administration (FDA) does not enter into the picture unless the vaccine is used in combination with a drug (including antibiotics). This means that an oral vaccine, an injected vaccine, or an injected vaccine with nondrug adjuvants need only be cleared by the USDA.

The basic problem of vaccine use is not with the growers--it is with the manufacturer of the vaccine. Once a manufacturer has obtained a license to sell the vaccine in interstate commerce, the grower can use the vaccine at his discretion. However, a license for fish vaccine production has never been requested before, and it may take up to 2 years for a manufacturer to satisfy the USDA requirements, which are stringent and too numerous to mention here.

The USDA is not a villain in this matter. To the contrary, they are charged with encouraging the development of vaccines. Until a licensed product is available, a waiver to the license may be obtained for experimental use. And, the experiments can involve large numbers of fish. The USDA is interested in field data to support the data on hand showing the need for and efficacy of the vaccine. Growers interested in using experimental vaccines should contact Dr. David Long (301-436-8675), USDA, Animal-Plant-Health Inspection Service, Federal Center Building, Room 833, 6505 Bellcrest Road, Hyattsville, Maryland 20782.

Need for a Grower's Cooperative

There is a bill in the state legislature that calls for funding an animal diagnostic laboratory at Washington State University to assist livestock growers with their animal disease problems. The bill sets up an assessment program on slaughtered livestock of $0.04/hog; $0.01/sheep; $0.04 to$0.065/cow; and $0.10/horse. Perhaps the time has come for the salmon growers to consider a similar measure by self-assessment, and seek assistance from the federal or state government as a collective for diagnostic services. The disease problems will not disappear, and as the number of growers increases, the available "free" services will be diluted.