International Council for the Exploration of the Sea
Montreal, 1975.

C.M. 1975/E:18
Fisheries Improvement Committee
Ref. Anadromous and Catadromous Fish Cttee

APPROACHES TO THE CONTROL OF SALMONID DISEASES IN ATLANTIC CANADA

by

R.M. MacKelvie

Environment Canada
Fisheries and Marine Service
Halifax Laboratory
1707 Lower Water Street
Halifax, Nova Scotia, Canada B3J 2R3

SUMMARY

Newly proposed Fish Health Protection Regulations which represent the minimal national requirements for an effective disease control programme in Canada, and which are to replace the existing Salmonidae Import Regulations are described. Despite the changes reflected in the new title, the regulations are still directed toward the protection from disease of salmonid species, since these are the fish of greatest importance to Canadian aquaculture. With certain exceptions, the proposed regulations are based upon certification of a fish culture facility following satisfactory completion of a prescribed number and frequency of inspections for certain designated fish pathogens in the various fish lots contained therein. Upon certification, live fish and eggs may be shipped across international and interprovincial boundaries. Special exceptions are made for eggs obtained from wild spawners and to dead cultured fish destined for the food market. Sampling procedures for inspection purposes, that are based on obtaining a 95% probability of detecting disease agent carriers in fish lots with assumed carrier prevalences, are explained. The establishment and functions of a National Registry of Fish Diseases are briefly described.

In addition to the proposed minimal national requirements, individual provinces, or groups of provinces, are free to apply additional controls felt necessary to safeguard their special interests. Atlantic Canada is in the fortunate position of being relatively disease-free; it also has the potential to make important contributions to food production through mariculture in its coastal and brackish waters. An efficient diagnostic centre is essential for counteraction to accidental introductions of alien pathogens, and also to assist in controlling the pathogens that are indigenous. The establishment of a specific pathogen free production facility to reduce the necessity for stock importation is being actively promoted as the ideal additional control measure for our region.

TEXT

At the time of writing, publication of a notice of intention regarding the implementation of recently drafted Fish Health Protection Regulations for Canada, although imminent, has not yet appeared. For this reason the word "approaches" must be retained in my title; hopefully by the time of presentation, the expected announcement will have been made thus affording a more positive view of our efforts directed towards the control of fish diseases in this country. The proposed new Fish Health Protection Regulations are broader in scope and intent than the existing Salmonidae Import Regulations which they are to replace; however, despite the changes that are reflected in the new title, the thrust is still directed towards the protection of all species and hybrids derived from species of fish belonging to the Family Salmonidae. These fish are considered to have the greatest economic value; the infectious diseases which afflict them are well known, and methods are available for diagnosis. The proposed new regulations represent the minimal, national requirements for an effective disease control programme; individual provinces, however, are free to apply any additional controls that they may deem necessary to safeguard their special interests. The Atlantic provinces have particularly good reason for so-doing.

Experience has shown that uninhibited shipment of uninspected live fish is the single most important cause for the wide dissemination of the more serious fish diseases. Thus, a prohibition of movement across international and interprovincial boundaries of fish and fish products from facilities that do not meet certain standards has been adopted as the means of control. It should be emphasized that the proposed regulations require that except for the special case of eggs taken from wild spawners, the source facility and not any particular shipment of its products is required to meet the standards set for the certification that is necessary before imports across international and interprovincial boundaries may be permitted. The process leading to this certification of a facility involves regularly scheduled inspections of the various fish lots contained therein using approved methods that are designed to maximize the probability of detecting certain designated infectious agents. The methods adopted are modified and updated from those previously published as Fisheries Research Board of Canada Miscellaneous Special Publication No. 23, 1974.

The designated diseases fall into two categories. The so-called Certifiable Diseases or Disease Agents are considered to be limited in geographical distribution, are those which are caused by, or are, obligate pathogens, and are of such significance to fish culture that every effort must be made to prevent their spread. If no evidence is found for any of these disease agents for four consecutive inspections conducted at roughly six-monthly intervals, the facility may be certified and live fish may be shipped. [As an interim measure, two instead of four consecutive inspections have been designated to facilitate rapid implementation of these regulations; also to prevent undue hardship on fish culturalists, only two inspections will apply initially when additional diseases are added to those whose absence is currently required for facility certification]. The second category of designated diseases is comprised of the so-called Notifiable Diseases or Disease Agents. These diseases or agents are considered to be more ubiquitous than those causing the certifiable diseases. The causative agents may be free-living and only under special circumstances may give rise to disease. Less serious than the certifiable diseases, they are nevertheless serious enough to pose significant risk to fish populations,

and their introduction may be acceptable neither to the local government authority nor to the importer. If, during an inspection, clinical signs of a notiafiable disease are observed and the causative agent is presumptively identified, these facts are to be noted on the certificate. If, in addition, a notifiable disease agent is found in the internal organs of apparently healthy fish, this finding must also be recorded on the certificate. Such documentation will allow the importer and his local government authority the option to accept or reject shipments of live fish at their discretion.

The regulations for the importation of fish eggs are similar to those for live fish, that is they must derive from a certified facility. In addition, however, eggs from wild fish may be imported if the fish from which they have been taken show no evidence of any of the certifiable disease agents. Because the infectious agents causing certifiable fish diseases have often been identified in wild fish, wild broodstock must be considered a potential source of infection. A complete laboratory examination of such fish must be performed, and since there will be a time lag between spawn collection and final results from laboratory testing of samples, it will be necessary that the eggs be maintained in a temporary holding facility. Whatever the source of eggs, the risks posed by their contamination are to be reduced by surface disinfection using stipulated methods.

Because shipment of dead fish to market for human consumption offers a considerably lessened danger to the fish culture industry, the regulations governing their movement are far less restrictive. Moreover, this greater degree of freedom is advantageous to those areas in which certain fish diseases may be enzootic. For example, the Maritime provinces of Canada, wherein infectious pancreatic necrosis is considered to be enzootic, do not stand to be economically penalized by having access of their products barred to the highly desirable Montreal market. The source facility need be certified free from only two named diseases, neither of which incidentally is yet known to be present in Canada. However if the fish have been processed in such a manner as to destroy these agents, their presence in the source facility becomes immaterial. Further, following such sterilization, these fish or fish products may be used in a fish culture facility as a dietary component.

The manual of compliance which embodies the proposed fish health regulations is specific in the details of the sampling procedures to be employed for the inspection of the various fish lots held in any given facility. A lot is defined as "fish of the same age that have always shared the same water supply, and that have originated from a discrete spawning population". The method of determining the actual number of fish to be sampled in a particular lot is based upon obtaining a 95% probability of detecting a disease agent carrier in a lot with an assumed prevalence of carriers (Ossiander and Wedemeyer, 1973). In selecting fish to fulfill the required sample size, as many moribund and freshly dead fish as are available must be included. To conserve valuable broodstock, a lighter sampling regimen has been designated for them than for production fish. Lethal sampling for production fish is required twice yearly with the sample size to be one that gives a 95% probability of detecting a carrier assuming the minimum prevalence to be 5% for viruses and the designated myxosporidians, and 10% for the bacterial pathogens. The different prevalence levels applied to these agents are in deference to the amount of work involved in their subsequent processing. Whereas samples for the detection of viruses and the myxosporidian pathogen, *Myxosoma cerebralis*, may be pooled within specific limits, bacterial examinations must be performed,

aseptically, on each fish individually. [Examination for *Ceratomyxa shasta*, the second myxosporidian pathogen, also requires that fish be examined individually, but the process is relatively less time-consuming than the bacterial examination] In contrast, sampling of broodstock is to be conducted once yearly only, at spawning time. At that time, reproductive products (with ovarian fluid to account for a majority of these samples) must be sampled at a rate that provides a 95% probability of detecting a carrier assuming a minimum carrier prevalence of 5%. In addition, lethal sampling, based on a 10% carrier prevalence of all designated pathogens must also be conducted for each lot of broodstock.

Details for the transportation and treatment of samples, as well as for the diagnostic methodology to be employed are described in the manual of compliance. One further item anent the proposed Fish Health Programme warrants mention. This is the establishment of a National Registry of Fish Diseases. Of its several functions the more important will be its role to document outbreaks of diseases and disseminate information relevant to such outbreaks. It will be set up to provide periodic overviews and assessments on the state of fish health in Canada and will serve as a coordinating centre in the event of national fish health emergencies.

The foregoing is a resumé of projected minimal, national requirements for an effective disease control programme in Canada. The approach suggested implies certain commitments on the part of the Federal Government. One of these is the establishment of a fish disease Diagnostic Centre to serve the Atlantic region, and this we hope to see instituted as soon as the availability of funds and manpower permits. For, despite our current limited diagnostic capability, we are well aware of the fortunate position we in Atlantic Canada find ourselves in with respect to the known diseases of salmonid fishes, and only through rapid and accurate diagnosis can we hope to control accidental introductions of alien pathogens. Of the eight certifiable diseases or disease agents, only two, infectious pancreatic necrosis (IPN) and bacterial kidney disease are known to occur in this region. Unfortunately the first tentative diagnosis of furunculosis has recently been made in the Restigouche River which separates New Brunswick, the most western of the Atlantic provinces from Quebec. Measures have been taken to contain the suspected outbreak. Of the five remaining diseases (agents), viral hemorrhagic septicemia, which is of major concern in Europe has not yet reached the American continent. The myxosporidian diseases caused by *Ceratomyxa shasta* and *Myxosma cerebralis*, to be found in the United States, are still alien to this country, although the latter is pressing heavily on the Ontario border with the state of Michigan via the Great Lakes drainage system. In Canada, infectious hematopoietic necrosis is confined to British Columbia, although it has spread extensively eastwards in the U.S. And finally, enteric redmouth disease, which gained entry into the prairie provinces through a shipment of diseased fish across the international border, appears to have been contained. Ideally, and the ultimate goal in the approach to the control of salmonid diseases in Atlantic Canada is the establishment of a specific pathogen free (spf) facility supplied exclusively with water from sealed deep wells. Progeny of selected broodstock retained therein would be available to all seekers at nominal cost and so reduce the demand for imported stock. There is no fail-safe mechanism connected with even the best regulated import system including the one currently proposed for national implementation. The provision of one or more such facilities might also aid in our coping with IPN, the more important of the two certifiable diseases that afflict our region. This disease which affects very young salmonids and is now believed to be enzootic in the area is caused by a virus whose

persistence in natural waters has been documented (Desautels and MacKelvie, 1975). Since virtually all our presently operating hatchery facilities are supplied only by surface waters, this virus appears to constitute a continuing hazard. Use of spf facilities should enable young salmonids to be raised to the stage of development after which they are supposed no longer to be susceptible to the disease.

A working group on Mariculture convened in Hamburg in May of this year under terms of reference set forth in the resolutions passed at the 62nd Statutory Meeting of ICES (C. Res. 1974/2:12). The working group concluded that aquaculture represented an important means of meeting a growing world demand for foods and that "the production potential of the coastal and brackish waters of the ICES area alone is very substantial". Atlantic Canada has the potential for an important contribution in this regard and it behooves us to attend particularly to the second of the group's recommendations, the one that calls for research leading to, and implementation of effective disease prevention and control.

REFERENCES

DESAUTELS, D. and R.M. MACKELVIE. 1975. Practical aspects of survival and destruction of infectious pancreatic necrosis virus. J. Fish. Res. Board Can. 32: 523-531.

GILLESPIE, D.C., T.P.T. EVELYN, C. FRANTSI, R.M. MACKELVIE and N. NEUFELD. 1974. Methods for the detection of certain pathogens of salmonid fishes. Fish. Res. Board Can. Miscellaneous Special Publication No. 23.

OSSIANDER, F.J. and G. WEDEMEYER. 1973. Computer program for sample sizes required to determine disease incidence in fish populations. J. Fish. Res. Board Can. 30: 1383-1384.

REPORT ON THE WORKING GROUP ON MARICULTURE. May 5-7, 1975 at Bundesforschungsanstalt für Fischerei in Hamburg.