The Geographical Distribution of Infectious Pancreatic Necrosis Virus (IPNV) Infecting Salmonids in Central Newfoundland, Canada

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THE GEOGRAPHICAL DISTRIBUTION OF INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV) INFECTING SALMONIDS IN CENTRAL NEWFOUNDLAND, CANADA

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ABSTRACT

Cone, D. K., and A. R. Moore. 1981. The geographical distribution of infectious pancreatic necrosis virus (IPNV) infecting salmonids in central Newfoundland, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1043: iv + 7 p.

The geographical distribution of infectious pancreatic necrosis virus (IPNV) infecting mature salmonids in an extensive (7,000 sq km) and relatively pristine drainage system in central Newfoundland was studied. The virus was isolated from landlocked Atlantic salmon (Salmo salar) and/or brook trout (Salvelinus fontinalis) at four of seven widely separated collection sites of different habitat types. The fish appeared to be only carriers of the virus since clinical signs of disease were absent in fish sampled. It was concluded that IPNV occurs naturally in salmonids of this drainage system. The consequences that this IPNV might have on policies of future enhancement programs and fish farming in the province are briefly discussed.

Key words: salmonids, fish disease, infectious pancreatic necrosis virus, Newfoundland.

RÉSUMÉ

Cone, D. K., and A. R. Moore. 1981. The geographical distribution of infectious pancreatic necrosis virus (IPNV) infecting salmonids in central Newfoundland, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1043: iv + 7 p.

On a étudié la distribution géographique de la nécrose pancréatique virale (NPV) qui infecte les salmonidés adultes dans un bassin hydrographique très vaste (7 000 km^2) et relativement vierge situé au centre de Terre-Neuve. À quatre des sept emplacements bien distincts sélectionnés dans différents types d'habitats, on a isolé le virus du saumon d'eau douce (Salmo salar) ou de l'omble de fontaine (Salvelinus fontinalis). Aucun symptôme de maladie n'ayant été constaté chez les poissons échantillonnés, tout semble indiquer que les poissons n'étaient que porteurs du virus. On en a conclus que la NPV se rencontre naturellement chez les salmonidés de ce bassin hydrographique. On fait un bref exposé des conséquences que pourrait avoir la NPV sur les politiques des programmes futurs de mise en valeur des salmonidés et sur l'élevage des poissons dans la province.

INTRODUCTION

The purpose of this study was to examine the geographical distribution of viral diseases of wild, non-migratory salmonids inhabiting the Exploits River system, central Newfoundland. The need to obtain this information was considered important for future enhancement programs that might unknowingly distribute undesirable pathogens throughout the system or into other systems. Infectious pancreatic necrosis virus (IPNV) was detected. Because this virus is a serious disease of salmonid fry, the present note describes the location and incidence of infection.

DESCRIPTION OF THE STUDY SITE

The Exploits River system is located in central Newfoundland and drains northeasterly to the Bay of Exploits, Notre Dame Bay (Fig. 1). It lies on a Precambrian shield basin that encompasses nearly 7,000 sq km of coniferous forest and numerous streams, rivers, and lakes (Fig. 2). The dominant fishes are brook trout (*Salvelinus fontinalis*), landlocked and migratory Atlantic salmon (*Salmo salar*), and threespine stickleback (*Gasterosteus aculeatus*). Arctic char (*Salvelinus alpinus*) also occur in some lakes.

The parts of the river system studied are removed from any major settlement and are essentially unperturbed. The forest is, however, being logged and from Red Indian Lake to the town of Bishop's Falls, the Exploits River is used annually for the transport of free floating logs.

Fish hatcheries are absent in the Exploits River system and there is no documented record of hatchery-reared fish of any sort being released there. However, from 1967 to 1974, 600 to 700 adult, wild Atlantic salmon were transported annually from the Humber River system (west coast of Newfoundland) and released into Noel Paul's Brook, 25 km southeast of Red Indian Lake. This transfer was part of an enhancement program that exists today as an artificial spawning channel and two upwelling incubation boxes for sea-run Atlantic salmon. Since 1976, approximately 1.5 million fry have been distributed to tributaries (see Fig. 2) flowing into the main stem of the Central Exploits (i.e. between Red Indian Lake and Grand Falls); these planting sites were not part of the water bodies sampled in the present study (Fig. 2).

During July and August 1981, samples (10 to 35) of mature brook trout (10.7-22 cm in length) and/or landlocked salmon (11.5-35 cm in length) were collected by angling and gillnet fishing at seven sites within the drainage system (Fig. 2). Site 1 was Red Indian Lake, the largest (19,200 ha) and deepest (143 m) in the system; the fish were collected at the western extremity of the lake at the mouth of Star River (Fig. 2). Site 2 was Ambrose Lake (3,500 ha) that is situated 20 km southeast of Red Indian Lake. Site 3 was a shallow stream immediately downstream of a wooden dam at the outlet of Ambrose Lake. Site 4 was an unnamed slow-moving creek, heavily overgrown by shrubs, that flows into the north side of the Exploits River, 20 km below the Red Indian Lake. Site 5 was a pool (30 by 20 m), 1 km upstream of site 4. Site 6 was a shallow spring-fed unnamed lake (4 ha), 12 km south of the town of Bishop's Falls and the Exploits River. Site 7 was Rocky Lake (40 ha), a relatively shallow lake

that forms part of the upper reaches of Great Rattling Brook, 45 km south of Bishop's Falls.

MATERIALS AND METHODS

The fish samples were brought on ice to a field station at Bishop's Falls. The fish were measured, sexed, and tissue samples comprised of one part spleen, one part pyloric caeca, and three parts kidney were combined into pools, each pool consisting of tissues from five fish. Tissues from S. fontinalis and S. salar were pooled separately.

The pools were stored in screw cap vials on ice for two days prior to processing for viral isolation. Tissue homogenization, dilution, inoculation onto cell lines, and conditions of incubation followed the method outlined in the Fish Health Protection Regulations: Manual of Compliance (Anon. 1977). Three cell lines (RTG-2, CHSE-214, FHM) were used, and an antiserum neutralization test was used to confirm the cause of any observed cytophathic effect.

RESULTS

The only virus detected in the fish examined was IPNV. It was detected in brook trout and landlocked salmon from Ambrose Lake (site 2) and brook trout from sites 4 and 5 and Rocky Lake (site 7). It was not detected at site 3 and Red Indian Lake, nor from landlocked salmon in Rocky Lake. The frequency of positive tissue pools from the various sites and fish is summarized in Table 1. In all cases, a positive tissue pool caused a cytopathic effect on all three cell lines used in the study.

None of the fish examined showed signs of disease and presumably represented carriers of the virus.

DISCUSSION

The high frequency with which positive pools were encountered indicates that IPNV is very common among the salmonids of the Exploits River system. Unfortunately we are unable to calculate the exact prevalence of infection at each site because the tissue samples were pooled in anticipation of low prevalences of infection. However, its presence in fish from different types of habitats and from sites separated by as much as 100 km does indicate that it occurs throughout much of the system. It should be pointed out that in view of this widespread distribution, the apparent absence of the virus at some sites must be treated with reservation since the numbers of samples collected are less than optimal for the detection of rare diseases in a large host population (see Ossiander and Wedemeyer 1973).

The finding of IPNV at presumed high prevalence levels in wild fish populations is unique among studies of this virus. In all other reports where IPNV has been isolated from fishes in the wild, it has been associated with

carriers originating from, or living nearby a hatchery with a history of the disease (Sonstegard et al. 1973; Munro et al. 1976; Roselund 1977; Bucke et al. 1979; Yamamoto and Kilistoff 1979). Yamamoto and Kilistoff (1979) undertook a comprehensive study of IPNV in salmonids in Alberta; in many lakes the virus was not detected while in others it was isolated from brook trout and rainbow trout of hatchery origin. The only conclusive evidence supporting transmission of IPNV in the wild trout of Alberta was an isolation from a brook trout inhabiting a lake not included in recent stocking programs. Yamamoto and Kilistoff (1979) concluded that wild fish do not readily acquire the viral infection from stocked fish and that over the course of 5-6 years the incidence of carriers reduced to undetectable levels, presumably as a result of discontinued plantings and removal of the original stocks by angling pressure and natural mortality.

Hatcheries are absent from the Exploits River system and, except for the swim-up fry that are distributed from the spawning channel and incubation boxes at Noel Paul's Brook, cultured fishes have never been released there. The fact that the sites sampled in the present study are essentially pristine and have not received fry plantings from the Noel Paul's facility makes us conclude that the IPNV isolated is part of a self-sustaining wild virus population. Indeed, the high population densities of salmonids throughout the sytem and the occurrence of the annual migrations of sea-run Atlantic salmon up the main rivers are probably ideal situations for a virus to maintain an abundant widespread distribution.

Our observations will probably have some effect on the future policies of enhancement programs and fish farming in the province. On one hand it seems that artificial transfer of fish within the drainage system would do little to expand an already extensive geographic distribution of the virus. On the other hand, IPNV is a certifiable disease controlled by Canadian Fish Health Protection Regulations. Therefore, interprovincial and foreign export of live fish and/or eggs from fry rearing facilities such as that at Noel Paul's Brook or from future hatcheries constructed in the river system may be severely restricted by the presence of the virus.

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Table 1. The collection dates and number of positive tissue pools/number of pools sampled for infectious pancreatic necrosis virus (IPNV) in salmonids sampled at seven sites in the Exploits River system, central Newfoundland. Each pool represents tissues from 5 fish. See text and Fig. 2 for the exact locations of each site.

Site	Date	Landlocked salmon (*Salmo salar*)	Brook trout (*Salvelinus fontinalis*)
1	27/7/81	0/3	0/1
2	20/7/81	4/5	5/6
3	20/7/81	0/3	0/4
4	6/7/81	-	4/4
5	7/7/81	-	1/2
6	15/7/81	-	0/7
7	24/8/81	0/4	3/3

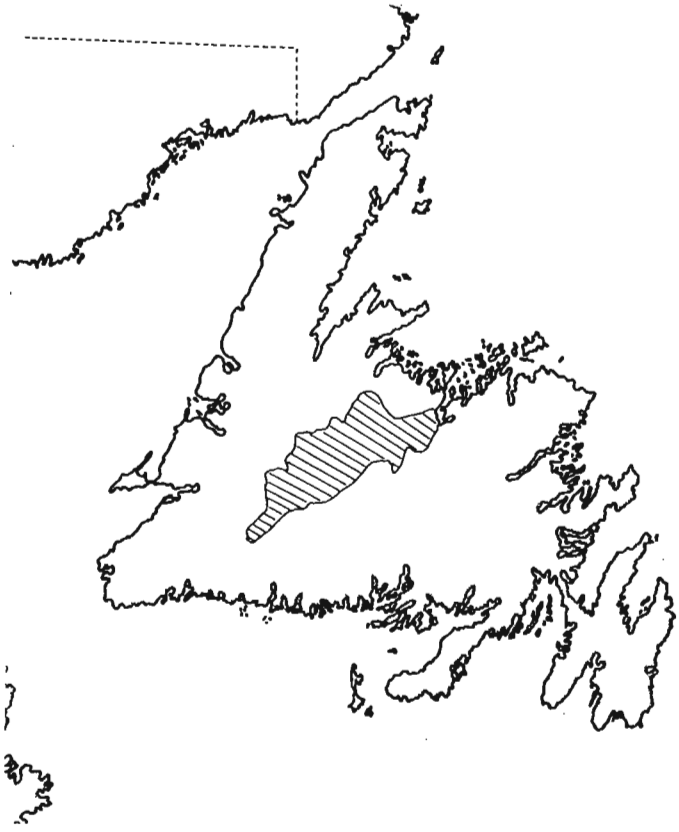

Fig. 1. A map of insular Newfoundland showing the position and extent of the Exploits River system (shaded area).

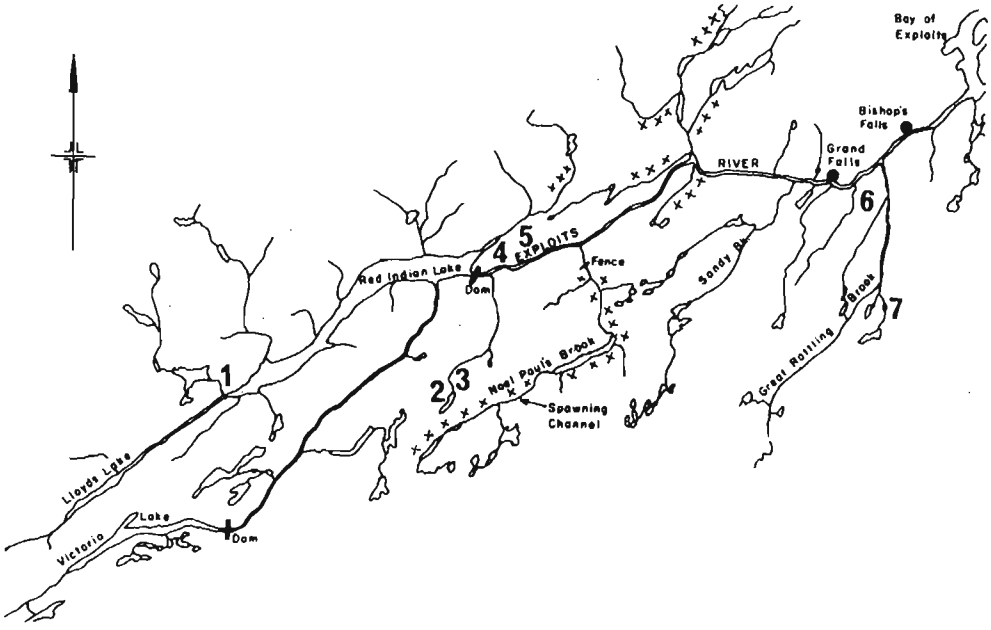

Fig. 2. A map of the Exploits River system, central Newfoundland. The collection sites are numbered 1-7 and are described in the text. The area receiving Atlantic salmon fry from the Noel Paul's Brook spawning channel are marked with an X. Scale is 1 cm to 12 km.