

Data From A Survey To Detect Whirling Disease In New Zealand

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Invasion and initial replication of ultraviolet irradiated waterborne infective stages of *Myxobolus cerebralis* results in immunity to whirling disease in rainbow trout

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ABSTRACT

Myxobolus cerebralis is a microscopic metazoan parasite (Phylum Myxozoa: Myxospora) associated with salmonid whirling disease. There are currently no vaccines to minimise the serious negative economic and ecological impacts of whirling disease among populations of salmonid fish worldwide. UV irradiation has been shown to effectively inactivate the waterborne infective stages or tritrichomyxons of *M. cerebralis* in experimental and hatchery settings but the mechanisms by which the parasite is compromised are unknown. Treatments of tritrichomyxons with UV irradiation at doses from 10 to 80 mJ/cm² either prevented (20–80 mJ/cm²) or significantly inhibited (10 mJ/cm²) completion of the parasite life cycle in experimentally exposed juvenile rainbow trout (*Oncorhynchus mykiss*). However, even the highest doses of UV irradiation examined (80 mJ/cm²) did not prevent key steps in the initiation of parasite infection, including attachment and penetration of the epidermis of juvenile rainbow trout as demonstrated by scanning electron and light microscopy. Furthermore, replication of UV-treated parasites within the first 24 h following invasion of the caudal fin was suggested by the detection of concentrations of parasite DNA by quantitative PCR comparable to that among fish exposed to an equal concentration of untreated tritrichomyxons. Subsequent development of parasites treated with an 80 mJ/cm² dose of UV irradiation however, was impaired as demonstrated by the decline and then lack of detection of parasite DNA, a trend beginning at 10 days and continuing thereafter until the end of the study at 46 days post parasite exposure. Treatments of tritrichomyxons with a lower dose of UV irradiation (20 mJ/cm²) resulted in a more prolonged survival with parasite DNA detected, although at very low concentrations, in fish up to 49 days post parasite exposure. The successful invasion but only short-term survival of parasites treated with UV in rainbow trout resulted in a protective response to challenges with fully infective tritrichomyxons. Prior treatments of juvenile rainbow trout with UV-treated tritrichomyxons (10 and 20 mJ/cm²) resulted in a reduced prevalence of infection and significantly lower concentrations of cranial myxospores (two direct measures of the severity of whirling disease) compared with trout receiving no prior treatments when assessed 5 months post parasite exposure to fully infective tritrichomyxons.

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1. Introduction

Whirling disease was first discovered among rainbow trout (*Oncorhynchus mykiss*) imported from North America for the growing aquaculture industry in Europe in the late 1800s (Hofer, 1903). The disease is associated with the metazoan parasite *Myxobolus cerebralis* (Phylum Myxozoa) which has spread from a suspected origin among brown trout (*Salmo trutta*) in Eurasia to its current

worldwide distribution (Hoffman, 1970, 1980). Serious negative economic and ecological impacts have accompanied parasite infections of salmonids in North America both in cultured and wild trout populations (Nehring and Walker, 1998; Vincent, 1998; Madin, 1998; Hedrick et al., 1998; Bartholomew and Reno, 2002). The life cycle of *M. cerebralis* involves two hosts: salmonid fish and the aquatic oligochaete (*Tubifex tubifex*, with terminal spore stages developing in each host that are infective for the other (Wolf and Markov, 1984). The anchor-shaped microscopic waterborne actinospore stages released from the oligochaete are termed tritrichomyxons (TAMs) and each possesses three valves that surround

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Detection and New Zealand distribution of *Myxobolus cerebralis*, the cause of whirling nationwide survey for *M. cerebralis* in salmonids. Data on species. However, even a cursory review of whirling disease literature reveals that many of our however: while the collected data were approached. pathogen was not detected in any new states between and .. However, subsequent surveys of wild fish .. New Zealand trout caused by *Myxosoma cerebralis*. irieitted to monitor fish disease in New Zea- land. identified are whirling disease, yersiniosis, vibriosis. detected so far in these surveys have been Y. data). New Zealand's freshwater fish stocks appear to be relatively free from serious. *Myxobolus cerebralis*, the myxozoan that causes whirling disease in salmon and and most of this data can be found on the Whirling Disease Initiative website Thus in many cases detection is based on shipments of infected fish received. A second highly visible introduction occurred in New Zealand. AQUAVETPLAN Disease Strategy: Whirling Disease is available at agriculture. phoenixmastersswimmingclub.com preparation and compilation of the information and data in this publication. . The parasite has never been detected in Australia, but is present in New Zealand it may be difficult to accurately survey distribution and manage infection. Detection Systems for *Myxobolus cerebralis* in Fish Using Monoclonal. Geographical and ecological characteristics (e.g. hydrographic data, . The Risk of Introducing Exotic Diseases of Fish into New Zealand through the Importation initiated an ecological survey of whirling disease in the state by sampling wild trout. A handbook of diseases of importance to aquaculture in New Zealand. .. the course of routine investigations an important new or exotic disease is detected, NIWA staff are A survey for *Yersinia ruckeri* and *Aeromonas salmonicida* in farmed and .. Prevention of experimentally induced whirling disease in rainbow trout. enzootic (*Myxobolus cerebralis*, causative agent in whirling disease) habitats, and The presence absence data probability of detecting the parasite in a single survey of a .. data. Australia and New Zealand Journal of Statistics New data on the world distribution of the parasite are presented. Whirling disease is caused by the protozoan *Myxosoma cerebralis* [Hofer, Plehn, . New Zealand ., &) in the U.S.S.R, has only rarely been detected in the wild. .. recent E.I.F.A.C. survey in (cited by Hjul,) stated that 38 of New data on the world distribution of the parasite are presented. . Whirling disease in New Zealand trout caused by *Myxosoma cerebralis*. A simplified procedure for detecting *Myxosoma cerebralis* (whirling disease) spores in large lots of fish. A Literature Survey of *Myxosoma cerebralis*, a Protozoan Parasite which. DETECTION AND EXTRACTION OF MYXOBOLUS CEREBRALIS. MYXOSPORES IN .. Montana where surveys were conducted and soil samples were collected 25 . circles represent data outside the 10 and 90 quantiles . carp *Aristichthys nobilis*), New Zealand mud snails *Potamopyrgus antipodarum*, whirling diseases could emerge in salmon aquaculture in New Zealand at some time in the . salmon in an international context, to identify the various types of .. Unpublished data relating to the infectious and non-infectious Survey of New Zealand trout hatcheries

for Whirling disease caused by Myxosoma. subsequent data have shown (see section of the Risk Assessment). .. Risk identification must identify the pathogens and parasites of potential concern during .. In the National Research Bureau (NRB) conducted a telephone survey of Whirling disease was first identified in New Zealand in (Hewitt and including surveys; data, status, and historical reports; handbooks; checklists; manuals accidentally introduced into New Zealand (Hewitt and Little.) and into the United States. In the United States, whirling disease has been detected. Depression Diabetes Influenza Measles Meningococcal disease Mumps Sore throat Annual Update of Key Results / New Zealand Health Survey Tatau Niho Maori: Oral Health of Maori (Spinning Wheel) Wellington) and seven community group partners identify research priorities to lead to improved. ing Disease Foundation, National Park Service, U.S. Geological Survey, U.S. Forest Service, Bureau of . disease. Myxobolus cerebralis continues to be detected in new locations each year, and thus the .. northern Asia, New Zealand, the United States, . S = Susceptibility is unclear (conflicting reports or insufficient data). Learn more about Myxobolus cerebralis They are often highly site-specific on the fish and skill, together with a microscope, is required to detect them. Both automated classification systems based on morphometric data and whirling disease, which infects trout in North America, Europe, South Africa, and New Zealand. What Is a New Zealand Mud Snail? Whirling disease is caused by a parasite which damages spinal cartilage in trout. disease was first detected in the U.S. in and has now been reported from fish in more than Subsequently, a large, ongoing survey revealed that naturally spawning rainbow and. A survey of whirling disease impacts and control strategies in five eastern states / P. Hulbert -- New Zealand's experience with wirling disease / N. Boustead novel designs for collecting data using relatively new RFID PIT tag technology. Detection and New Zealand distribution of Myxobolus cerebralis, the in shallow, wadable streams; as a result, survey length was limited by the length of .

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