Whirling Disease and Athabasca Rainbow Trout

Species Information

Common Name: Athabasca Rainbow Trout
Genus: Oncorhynchus mykiss

Stressor Details

Stressor Name: Whirling Disease
Units: Unitless
Metric: Whirling Disease Risk Factor
Scale: linear
Function Type: continuous
Vital Rate/Process: System capacity

Life Stage & Context

Life Stages: Adults
Geography: Alberta foothills watersheds, excluding National Parks
Activity: All activities
Season: All seasons

Descriptions

Overview

Whirling disease has been detected in some Alberta watersheds, but not in Athabasca rainbow trout ranges, in spite of extensive testing (i.e.,87 sites tested in Athabasca rainbow Trout watersheds during 2016, 2017 and 2019, all tests negative for whirling disease, as of January 2020, M. Veillard, pers. comm. 22 January 2020). The parasite (Myxobolus cerebralis) can cause high levels of juvenile mortality, and rainbow trout in other jurisdictions have been particularly susceptible (Vincent 1996; Nehring and Walker 1996). No specific studies on the vulnerability of Athabasca Rainbow Trout to whirling disease have been conducted, and it is possible that native stocks of fish are more resistant than hatchery-origin stocks (Baerwald et al. 2011). However, if whirling disease is detected in Athabasca Rainbow Trout streams, it is prudent to manage the effects using information from studies on other strains of Rainbow Trout.

The stressor-response curve was derived from an Alberta trout age-class cohort model, using variable survival rates on juvenile trout (Sullivan and Spencer 2016). The population-level effects of whirling disease can be simulated at low, moderate or high levels of risk. This should be qualitatively determined using three factors; the prevalence of whirling disease in the watershed (low, moderate or high), the stream temperature (optimum of 10 0C– 150C mean warmest month = high risk, lower risk at cooler and warmer temperatures), and the gradient of the stream (low risk >4%, moderate risk 2 – 4%, high risk

### Function Derivation

Expert opinion

Transferability of Function

This function was developed for and applied to Athabasca Rainbow Trout. It was based on lines of evidence from risk assessment models for Alberta trout. Until more data is available to refine the curve, it should be used with caution.

Source of Stressor Data

Mainly from studies on trout and char in other jurisdictions, modelled assessments and age-cohort models. No empirical studies on Athabasca Rainbow Trout and whirling disease are currently available (July 2017). This is a categorical variable, set to none (0) when whirling disease detection is negative (as distinct to "no testing for whirling disease"). The sensitivity of Athabasca Rainbow Trout to whirling disease is influenced by water temperature and water velocity. If whirling disease is detected in the Athabasca drainage, following Paul and Reilly (2016) the risk of whirling disease should be mapped in GIS along the stream network in the Athabasca drainage. For a given watershed, the whirling disease severity was ranked as the mean associated risk for a stream or river in the watershed. Using the mean (rather than the maximum) gives fisheries managers an estimate of the expected whirling disease risk in the overall watershed but does not account for the possibility of local 'hot spots' based on temperature or velocity. Disease severity can be adjusted according to local knowledge and updated laboratory results.

Stressor Response Data
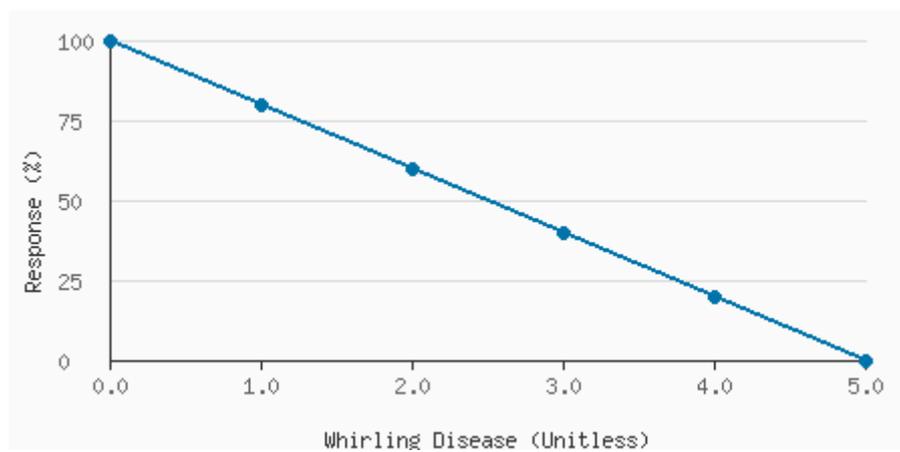
Whirling Disease Risk	Mean System Capacity (%)	SD	low.limit	up.limit
0	100	0	0	100
1	80	0	0	100
2	60	0	0	100
3	40	0	0	100
4	20	0	0	100
5	0	0	0	100

Citations

Government of Alberta. 2024. Whirling disease stressor-response function for Athabasca Rainbow Trout. Environment and Protected Area Native Trout Cumulative Effects Model.

Baerwald, M.R., J.L. Petersen, R.P. Hedrick, G.J. Schisler and B. May. 2011. A major effect quantitative trait locus for whirling disease resistance identified in rainbow trout (Oncorhynchus mykiss). Heredity 106:920-926.

Nehring, R.B. and P.G. Walker. 1996. Whirling disease in the wild: the new reality in the intermountain west. Fisheries 21:28-30.

Paul, A.J. and J. Reilly. 2016. Whirling disease –risk mapping for the Bow River Basin. Technical report for Fisheries Management, Alberta Environment and Parks. Cochrane, AB. 1 Sept 2016. 14 pp.

Sullivan, M.G. and S. Spencer. 2016. Cumulative effect of whirling disease and fishing mortality on Alberta trout populations. Technical report, Fisheries Management, Alberta Environment and Parks. Edmonton, AB. 29 August 2016. 10 pp.

Vincent, E.R. 1996. Whirling disease and wild trout: the Montana experience. Fisheries 21:32-33.