Natural Limitations and Bull Trout

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Species Information

Common Name: Bull Trout
Genus: Salvelinus confluentus

Stressor Details

Stressor Name: Natural limitations
Units: historical adult system capacity (%)
Metric: Historical adult density
Scale: linear
Function Type: continuous
Vital Rate/Process: Historic adult density

Life Stage & Context

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

Descriptions

Overview

> Native trout are naturally limited by other environmental variables besides water temperature. These limitations occur at varying spatial scales and include both biotic (e.g., productivity, fish community, etc.) and abiotic features (amount of woody debris, substrate composition, water velocity, groundwater input, natural sediment loads, natural flow regimes, etc.). Further, persistence in suitable, but isolated habitats may be limited if connectivity with neighbouring populations is naturally restricted and supplementation or re-colonization following local population decline or extirpation is not possible. These naturally limiting factors mean that a specific native trout population may never and would not be expected to achieve the reference system capacity of 100%, which is set using the most abundant, pristine native trout populations in the province. Understanding the influence of natural limitations on native trout populations today is difficult due to the confounding spatial and temporal effects of human disturbance and harvest. However, the relative status of native trout prior to extensive human disturbance and harvest (i.e., early 1900s) was assessed by the Historic Adult Density (HAD) FSA score, which will be used as a surrogate measure of natural limitations within each watershed in the species historic range. The HAD score is ranked from 1 (very low native trout density) to 5 (very high native trout density), but for this purpose was converted to a percentage-based natural limitations value. It was assumed there is a linear relationship between system capacity and natural limitations (Figure 1).

Function Derivation

> Expert opinion

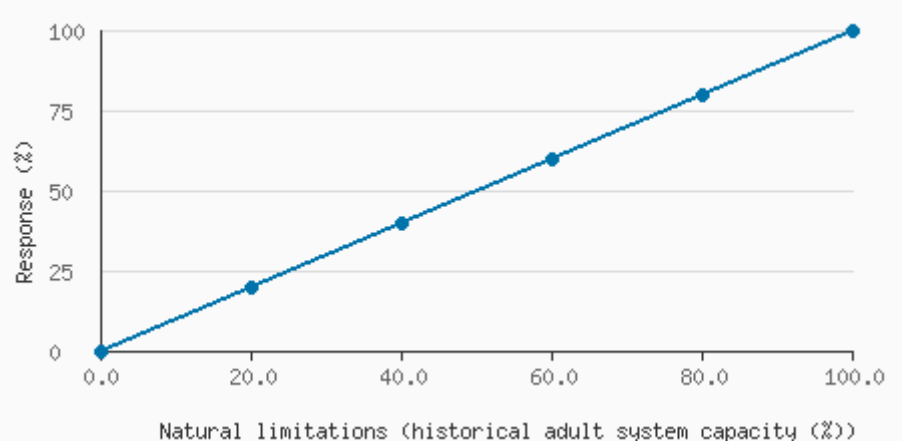
Transferability of Function

> This function was developed and applied to Bull Trout, Athabasca Rainbow Trout, and Westslope Cutthroat Trout. Due to the generalizable nature of the 1:1 relationship, it could be applied anywhere where there is baseline data on the natural carrying capacity of the watershed.

Source of Stressor Data

The natural limitations % was based on Historic Adult Density FSA score within the spatial unit of interest (i.e., HAD 1 = 10%, HAD 2 = 35%, HAD 3 = 60%, HAD 4 = 85%, and HAD 5 = 100%). There is no historic (i.e., >100 years) fisheries survey data; therefore, anecdotes, photographs, local environmental knowledge (LEK), traditional environmental knowledge (TEK) and information on fish barriers were used to inform HAD FSA scores. This included historical accounts from warden reports and angler interviews. Please note, these natural limitations rankings should only reflect limitations other than temperature.

Stressor Response Data



Natural Limitations (%)	Mean System Capacity (%)	SD	low.limit	up.limit
0	0	0	0	100
20	20	0	0	100
40	40	0	0	100
60	60	0	0	100
80	80	0	0	100
100	100	0	0	100

Citations

Government of Alberta. 2024. Natural limitations stressor-response function for Bull Trout, Athabasca Rainbow Trout, and Westslope Cutthroat Trout. Environment and Protected Area Native Trout Cumulative Effects Model.