Mean Annual Discharge and System Capacity for Chinook Salmon

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Species Information

Common Name: Chinook Salmon
Genus: Oncorhynchus tshawytscha

Stressor Details

Stressor Name: Flow; Discharge
Units: %
Metric: Mean annual discharge
Scale: linear
Function Type: continuous
Vital Rate/Process: Total number of spawners

Life Stage & Context

Life Stages: Adults
Geography: Nicola River, BC, Canada
Activity: Spawning
Season: All Seasons

Descriptions

Overview

> Warkentin et al. (2022) used a time series of adult recruitment from the Nicola River to estimate the effects of August low flows in the brood year (x-axis) on returning adult recruits 4 years later (y-axis). The SR function was derived by regressing the annual residuals from the stock-recruit function on August low flows, reasoning that higher than average adult returns are correlated with higher than average flows in the brood year, and lower than average predicted flows (negative residuals) are correlated with lower flows (See figure 4e in Warkentin et al. 2022 for support of this mechanism). Average adult population size was added to the residuals to generate the final y-values (adult population response) for the final SR function, which was then standardized to a maximum of 1 (or 100% capacity; see Rosenfeld and Enright 2025).

Function Derivation

> Observational data (multi-year over time); N = 22

Transferability of Function

> Appropriate for late summer low flow spawning impacts on chinook salmon adults; general transferability to other chinooks stocks in unclear, but likely appropriate for other fall-spawning stocks in the B.C. interior (i.e., regions with similar hydrology to the Nicola R.).
>
> The relationship may be unreliable if extrapolated to a flow range outside the original data (see the Average Salmonid flow-ecology SR function entry based on Rosenfeld and Enright (2025) for a more generalizable function across a wider range of flows).

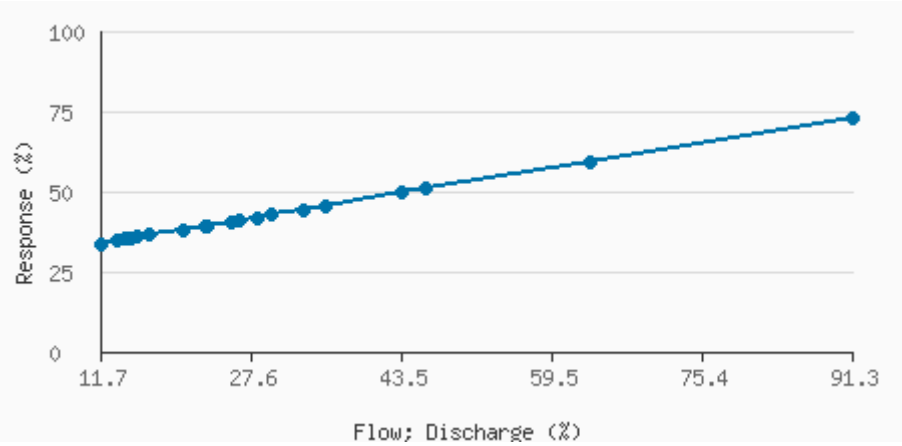
Source of Stressor Data

> MAD + estimated water usage based off HYDAT hydrometric data and an estimate of annual water usage (unpublished data, Ptolemy; Summit Environmental Consultants Ltd., 2007). See supplement in Warkentin et al. 2022 for further

information.

Stressor was then standardized to % MAD.

Stressor Response Data



?PERCENT_MAD	Mean System Capacity (%)	SD	low.limit	up.limit
11.65536913	33.7311309	0	0	100
13.49328859	34.6317114	0	0	100
13.51208054	34.6409195	0	0	100
14.38926174	35.0707383	0	0	100
14.99161074	35.3658893	0	0	100
15.65167785	35.6893221	0	0	100
16.8	36.252	0	0	100
16.94630872	36.3236913	0	0	100
20.36946309	38.0010369	0	0	100
22.90268456	39.2423154	0	0	100
23.0385906	39.3089094	0	0	100
25.52885906	40.5291409	0	0	100
26.39899329	40.9555067	0	0	100
28.23993289	41.8575671	0	0	100
29.75268456	42.5988154	0	0	100
29.88288591	42.6626141	0	0	100
33.14295302	44.260047	0	0	100
35.56946309	45.4490369	0	0	100
43.72281879	49.4441812	0	0	100
46.19798658	50.6570134	0	0	100
63.53187919	59.1506208	0	0	100
91.34194631	72.7775537	0	0	100

Citations

Warkentin, L., Parken, C. K., Bailey, R., & Moore, J. W. (2022). Low summer river flows associated with low productivity of Chinook salmon in a watershed with shifting hydrology. Ecological Solutions and Evidence, 3(1), e12124.