Mean Annual Discharge and Chinook Salmon

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Species Information

Common Name: Chinook Salmon
Genus: Oncorhynchus tshawytscha

Stressor Details

Stressor Name: Flow
Units: %
Metric: Mean Annual Discharge (MAD)
Scale: linear
Function Type: continuous
Vital Rate/Process: Egg-smolt survival

Life Stage & Context

Life Stages: Juvenile
Geography: Lehmi River, Washington, USA
Season: Fall-Early Summer

Descriptions

Overview

> Arthaud et al. (2010) used a time series of adult returns from the Lemhi River and Marsh Creek populations of Chinook salmon to estimate the effects of tributary stream flow in the brood year on returning adults four to five years later.
> The SR function was derived only the relationship for August flows as minimize pseudo replication from including 2 months (both May and August) with similar underlying flow-ecology mechanisms. Similarly, only one of egg-trap transition rate and egg-smolt survival responses was used because they were highly correlated responses.
> Implicit pathway of flow effect: passage/migration

Function Derivation

> Observational data and expert elucidation

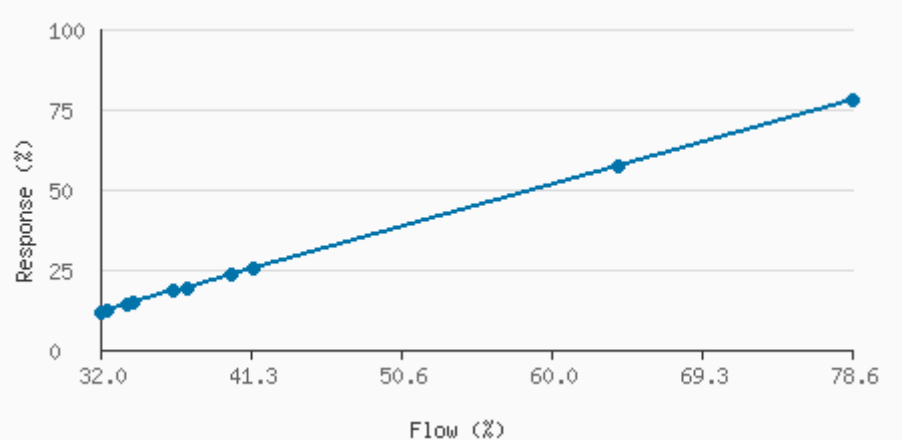
Transferability of Function

> Appropriate for late-summer stream flow impacts on chinook salmon juveniles and egg-to-smolt. General transferability to other stocks in unclear, but likely appropriate for other fall-spawning salmonids (i.e., regions with similar hydrology to the Lehmi River).
> 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

> Stressor data reflects direct field measurements. The Lemhi River has multiple gaging stations, and the authors used the McFarland gage (river km 58) because it was the one of the "most reflective of local rearing conditions".

Stressor Response Data



?PERCENT_MAD	Mean System Capacity (%)	SD	low.limit	up.limit
32.01639344	11.6932787	0	0	100
32.48688525	12.3613771	0	0	100
33.73934426	14.1398688	0	0	100
34.05245902	14.5844918	0	0	100
36.56065574	18.1461312	0	0	100
37.42459016	19.372918	0	0	100
40.16721311	23.2674426	0	0	100
41.5	25.16	0	0	100
64.08196721	57.2263934	0	0	100
78.59180328	77.8303607	0	0	100

Citations

Arthaud, D.L., Greene, C.M., Guilbault, K., and Morrow, J.V. Jr. 2010. Contrasting life-cycle impacts of stream flow on two Chinook salmon populations. Hydrobiologia 655: 171-188.