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: Marsh Creek, 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

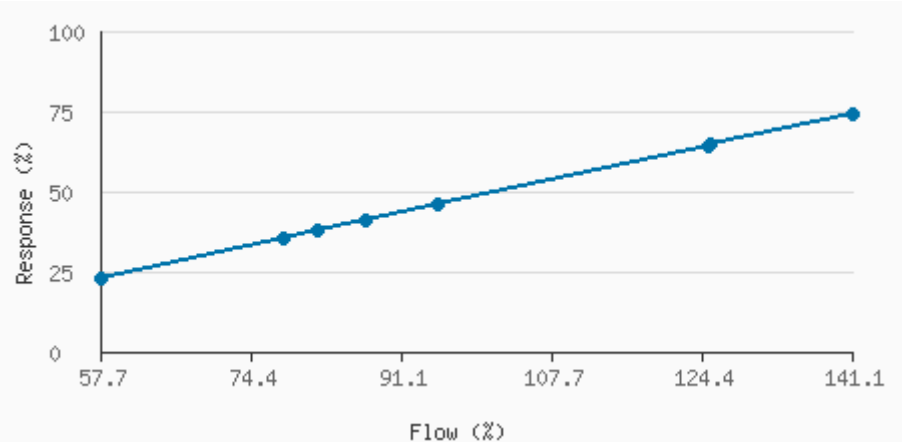
Transferability of Function

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

> The authors used a downstream gage on the Middle Fork Salmon River at Shoup as a proxy for Marsh Creek flow. This proxy was considered reliable because the temporary gage records from Marsh Creek showed a "correspondence" and "synchronous flows" ($r(8\ df) = 0.938$, $P < 0.01$) with the Middle Fork gage records.

Stressor Response Data



?PERCENT_MAD	Mean System Capacity (%)	SD	low.limit	up.limit
57.73684211	23.0694737	0	0	100
78.12105263	35.5038421	0	0	100
81.9	37.809	0	0	100
87.18421053	41.0323684	0	0	100
87.18947368	41.0355789	0	0	100
95.25789474	45.9573158	0	0	100
125.2210526	64.2348421	0	0	100
125.4526316	64.3761053	0	0	100
141.0631579	73.8985263	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."