Mean Annual Discharge and Atlantic Salmon

Species Information

Common Name: Atlantic Salmon
Genus: Salmo salar

Stressor Details

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

Life Stage & Context

Life Stages: Smolt
Geography: Catamaran Brook, NB, Canada
Season: Winter

Descriptions

Overview

Final curve was derived from a linear regression.

System capacity was derived from smolt totals. This data was gathered using a fish-counting fence near the stream mouth to enumerate the smolts emigrating in the spring. Atlantic salmon smolts are typically age 3 when emigrating.
To normalize and rescale each ecological response, each value was scaled by the maximum ecological response observed in the study such that mean habitat capacity percentage (normalized response) = response / maximum ecological response observed.
Note that mean density in Cataman brook as estimated by digitizing densities from Fig. 2 pg. 512 of Imre et al. 2005.
Implicit pathway of effect: Total Atlantic salmon smolt outmigration in Catamaran Brook is positively associated with higher average winter discharge.

Function Derivation

Observational data. Final curve was derived from linear regression.

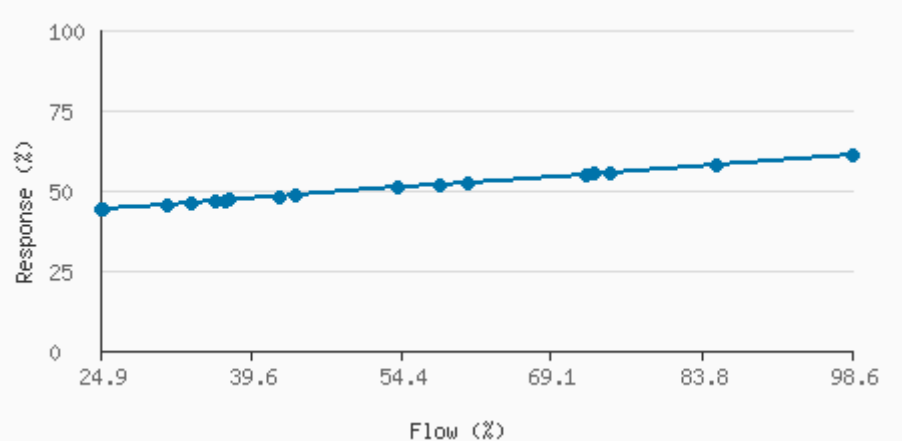
Transferability of Function

Appropriate for winter stream flow impacts on Atlantic Salmon smolt. General transferability to other salmon stocks in unclear, but likely appropriate for other autumn-spawning salmonids (i.e., regions with similar hydrology to the Catamaran Brook).
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 winter streamflow data (discharge) for Catamaran Brook was collected using a streamflow gauging station located in the mid-basin. See methods of Cunjack et al. 2013 for details.
Data was then standardized by dividing absolute flow by MAD to achieve %MAD values (see Rosenfeld & Enright 2024). Such standardization allows for comparison of flow metrics across a wide range of stream sizes (see Rosenfeld et al. 2017).

Stressor Response Data



?PERCENT_MAD	Mean System Capacity (%)	SD	low.limit	up.limit
24.91769231	43.9710692	0	0	100
25.26738462	44.0514985	0	0	100
31.50723077	45.4866631	0	0	100
33.78138462	46.0097185	0	0	100
36.19030769	46.5637708	0	0	100
37.26046154	46.8099062	0	0	100
37.62738462	46.8942985	0	0	100
42.44338462	48.0019785	0	0	100
44.09461538	48.3817615	0	0	100
54.08276923	50.6790369	0	0	100
58.12476923	51.6086969	0	0	100
60.88615385	52.2438154	0	0	100
72.52969231	54.9218292	0	0	100
73.246	55.08658	0	0	100
74.80861538	55.4459815	0	0	100
85.37307692	57.8758077	0	0	100
98.56138462	60.9091185	0	0	100

Citations

Cunjak, R.A., Linnansaari, T., and Caissie, D. 2013. The complex interaction of ecology and hydrology in a small catchment: a salmon's perspective. Hydrol. Process. 27: 741-749.