Combs and Burrows 1957: Incubation Temp and Chinook Eggs

Function Updated by sr_editor on Tue, 02/18/2025 - 19:08.

Species Information

Common Name: Chinook Salmon
Genus: Oncorhynchus tshawytscha

Stressor Details

Stressor Name: Temperature
Units: °C
Metric: Incubation Temperature
Scale: linear
Function Type: continuous
Vital Rate/Process: Survival

Life Stage & Context

Life Stages: Egg
Geography: Laboratory Experiment
Activity: Incubation
Season: Winter

Descriptions

Overview

> Data and plot summarized from Bratovich et al., 2020:
>
> "Myrick and Cech (2001) combined mortality data of Chinook salmon eggs from fertilization to hatching from laboratory experiments for multiple water temperature treatments, ranging from 35°F to 68.4°F (~2 to 20°C) (Figure 4). The function applied to the mortality data appears to be a quadratic function, where mortality decreases at an increasing rate as water temperature warms from about 35°F to 50°F, and higher mortality at an increasing rate as water temperature warms from about 50°F to 65°F. Because these data represent total mortality of incubating eggs over the course of the respective incubation periods for each treatment and study, this relationship was not used to estimate daily mortality rates in this TM. However, it does illustrate the notable increases in mortality that occur with increases in water temperature above about 15°C (59°F)."
>
> Function roughly equal to Survival = -1.0925x2 + 20.202x + 2.9062; R^2 = 0.9936 (where x is temp in degrees C)

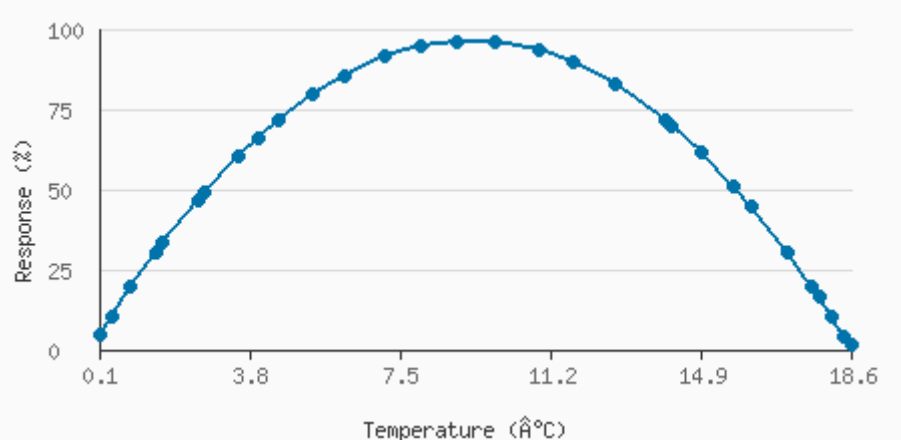
Function Derivation

> Lab experiment

Source of Stressor Data

> Multiple laboratory experiments

Stressor Response Data



Raw Stressor Values	Scaled Response Values 0 to 100	SD	low.limit	up.limit
0.08	4.5	20	0	50
0.39	10.6	20	0	50
0.86	19.5	20	10	50
1.49	30.6	20	20	75
1.65	33.3	20	25	75
2.51	46.7	20	40	75
2.66	48.9	20	45	100
3.53	60.6	20	50	100
4	66.2	20	50	100
4.47	71.4	20	50	100
5.33	79.5	20	55	100
6.11	85.6	20	60	100
7.13	91.4	20	60	100
7.99	94.6	20	60	100
8.86	96.1	20	55	100
9.8	96	20	50	100
10.89	93.3	20	50	100
11.76	89.4	20	40	100
12.77	82.7	20	20	100
14.03	71.3	20	10	100
14.18	69.7	20	0	100
14.89	61.5	20	0	100
15.67	51.2	20	0	100
16.14	44.4	20	0	100
17.01	30.4	20	0	85
17.63	19.5	20	0	85
17.79	16.5	20	0	85
18.1	10.6	20	0	85
18.42	4.3	20	0	85
18.57	1.3	20	0	85

Citations

Bratovich, P., M. Neal, A. Ransom, P. Bedore, and M. Bryan. 2020. Chinook Salmon Early Lifestage Survival & Folsom Dam Power Bypass Considerations. Prepared for the Sacramento Water Forum. September 2020.

Combs, B.D. and R.E. Burrows. 1957. Threshold Temperatures for the Normal Development of Chinook Salmon Eggs. The Progressive Fish-Culturist, 19:3-6.

Myrick, C. A. and J. J. Cech. 2001. Temperature Effects on Chinook Salmon and Steelhead: A Review Focusing on California's Central Valley Populations. Bay?Delta Modeling Forum Technical Publication 01?1.

References

Bratovich et al., 2020 - https://waterforum.org/wp-content/uploads/2020/09/Water-Forum-Water-Temp-Embryo-Survival-TM-9-23-20.pdf