

von Bertalanffy growth curve for lake whitefish sample from southern Lake Huron in 2009

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December 10, 2013

Abstract

A von Bertalanffy growth curve was fit to Lake whitefish (*Coregonus clupeaformis*) sampled from southern Lake Huron in 2009. Lake whitefish were collected from the commercial fishery as well as the independent survey conducted by the Ontario Ministry of Natural resources. A total of 111 lake whitefish were included in the sample. The von Bertalanffy growth parameters estimated using non-linear least squares were $L_{\infty} = 600 \pm 20$, $k = 0.25 \pm 0.10$, and $t_0 = 0.1 \pm 0.02$.

Introduction

von Bertalanffy growth curve is often used to describe the growth of fish. This paper describes how a von Bertalanffy growth curve can be fit in R and a pdf summary report can be automatically generated using the knitr package.

Materials and Methods

The Data

Lake whitefish collected from both the commercial fishery and the OMNR's offshore index program in 2009 were randomly selected for inclusion in this report. Only fish with both a fork length (mm) and age estimate were considered to be eligible. The sample used in this report was created by randomly selecting up to 10 individuals from each of the available age classes.

The Model

The parameters of the Von Bertalanffy growth equation were found using non-linear least squares by fitting the following model to the observed data:

$$L_i = L_{\infty}(1 - e^{-k(t_i - t_0)}) + e_i \quad (1)$$

L_i is the length of the i^{th} fish at age t_i , L_∞ is the asymptotic length (in mm), k is the Brody growth coefficient, t_0 is the theoretical age at length 0, and e_i is $N(0, \sigma^2)$. The starting value for the asymptotic length was taken as the maximum observed fork length in the sample, while t_0 and k were arbitrarily set to 0.0 and 0.25 respectively. The methods used in this analysis closely follow those described in Quinn and Deriso (1999) and Haddon (2001).

Results

A total of 111 fish were selected for this analysis. The mean size at each age is summarized in table 1 The Von Bertalanffy model appeared to fit the data well. Parameter estimates and confidence intervals are presented in table 2 and a plot illustrating the fitted curve against observed mean size at age has been provided in figure 1.

	Age	Observed	Predicted
	1	189.11	169.14
	2	240.40	251.98
	3	304.30	317.63
	4	335.30	369.66
	5	419.70	410.89
	6	467.00	443.57
	7	492.10	469.47
	8	509.40	489.99
	9	501.00	506.26
	10	517.40	519.15
	11	505.50	529.36
	12	527.00	537.46

Table 1: Observed and predicted size at age of lake whitefish sample from southern Lake Huron in 2009.

	Estimate	Std. Error	t-value	Pr(> t)
1	568.38	15.40	36.92	0.0000
2	-0.52	0.19	-2.67	0.0088
3	0.23	0.02	9.90	0.0000

Table 2: Parameter estimates, standard errors, t-values and associated p-values for Von Bertalanffy growth curve.

Discussion

Older lake whitefish are smaller than younger. Lake whitefish from souther Lake Huron appear to be bigger than yellow perch and smaller than lake trout but

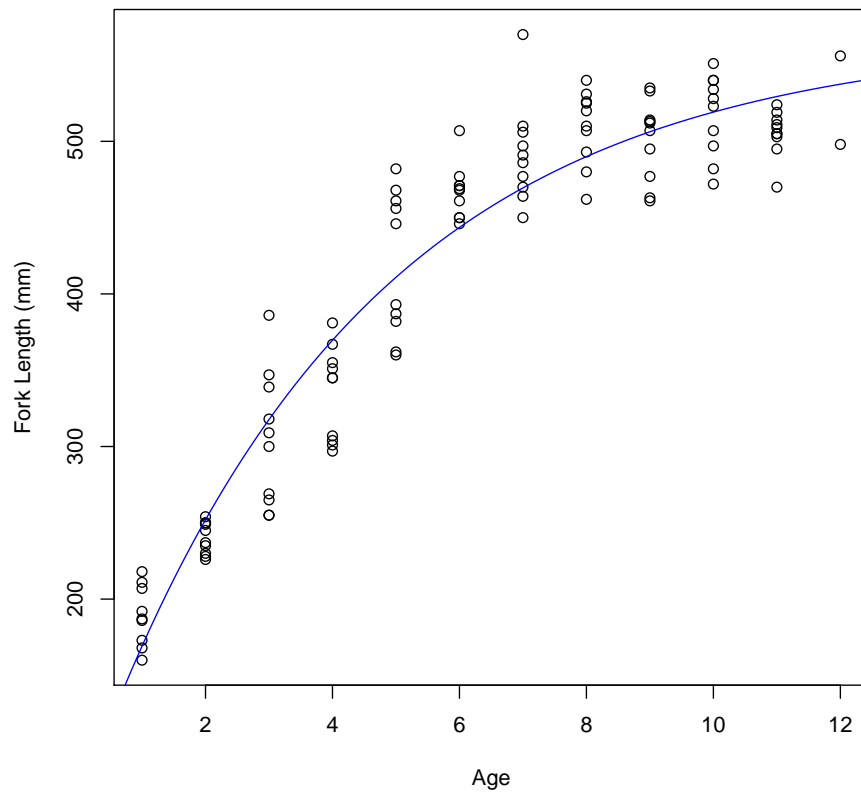


Figure 1: Mean size at age of a sub-sample of lake whitefish collected from southern Lake Huron in 2009. The blue line represents a Von Bertalanffy growth curve fit to the data using non-linear least squared.

grow slower than yellow perch and faster than lake trout. These findings are largely consistent with previous on Lake Huron lake whitefish including....

References

Haddon, M. Modelling and Quantitative Methods in Fisheries, Second Edition, Taylor and Francis, 2001. 424 pages.

Quinn, T.J and R. B. Deriso. Quantitative Fish Dynamics, New York:Oxford University Press, 1999. 542 pages.