



Early life survival and growth of Coho Salmon (*Oncorhynchus kisutch*) in a small Lake Superior tributary

Jeffrey Bauer, Brenna Conway & Nicholas Salinas * Biology * University of Wisconsin - Eau Claire
Advisor: Dr. David Lonzarich

Introduction

Coho Salmon (*Oncorhynchus kisutch*) were introduced into the Lake Superior basin in the late 1960s and have established breeding populations in many Wisconsin streams. The species has been extensively studied within its native range, but until recently there has been little research on the Great Lakes populations. In this study, we hypothesized that survival, and growth of juvenile Coho Salmon over their first summer would be correlated with age. Young-of-the-year fish were captured in early and late summer 2012 from the Onion River, Bayfield County, Wisconsin.



Methods

Field Collections:

- Samples were taken on May 5 and August 22, 2012 (n=100) during periods of base flow (<10cfs)
- Sample locations were 100m long and approximately 2km upstream from the mouth in Lake Superior

Sample preparation and data collection. —

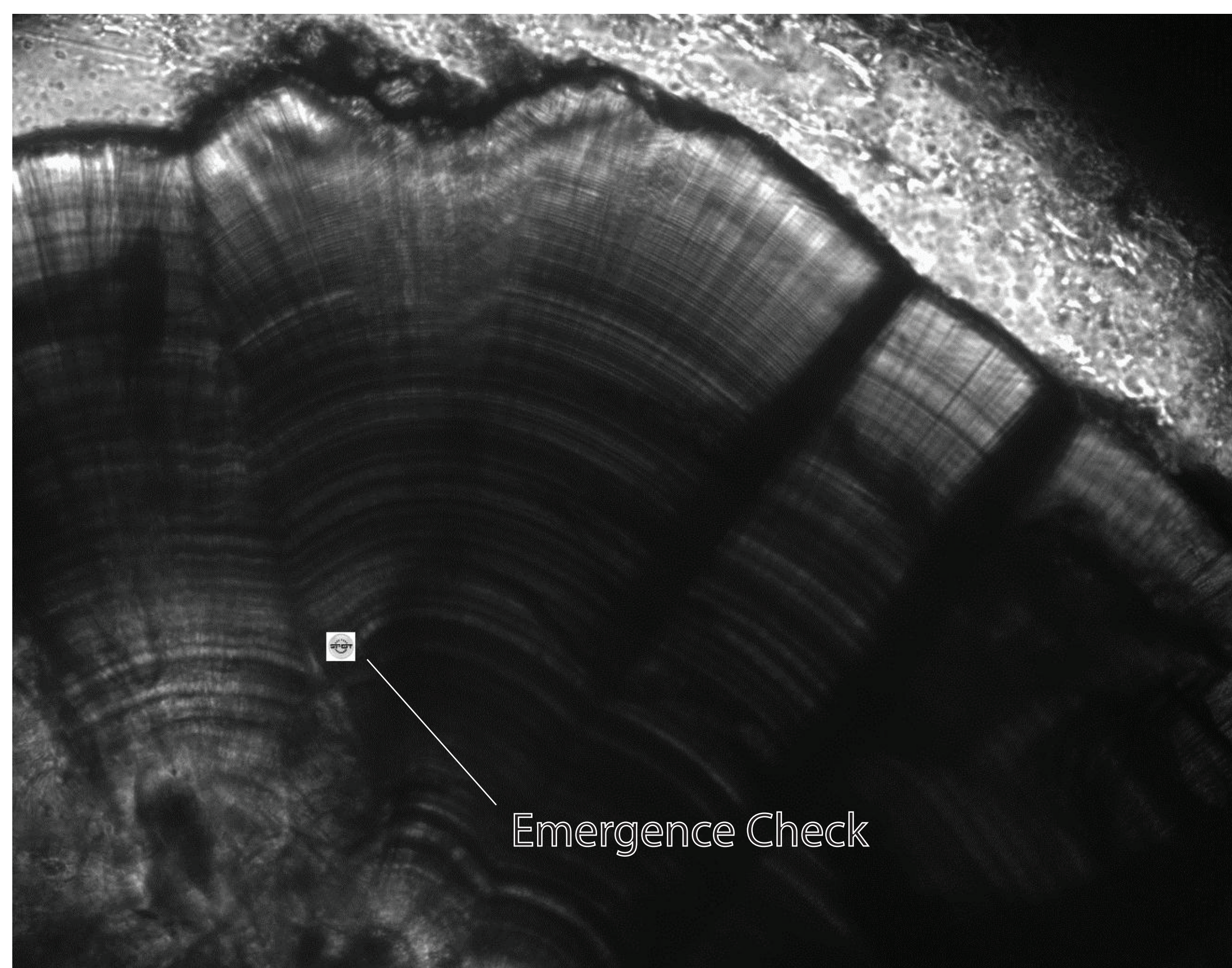
- Total length (+/- 0.1 mm) and weight (+/- 0.1g) were recorded for each fish.
- Left and right sagittal otoliths were removed. Left otoliths were dried and mounted on microscope slides using super glue.
- Each polished otolith was imaged, and emergence checkpoints were noted and marked on each photo.
- Daily growth rings were counted for each sample (similar to counting rings on a tree) in order to back calculate date of emergence. Samples were separated into age categories based on the Julian Date of emergence.

Data Analysis:

- Emergence distributions were plotted for the two sample periods
- Using weight(g) and length(cm) at capture and estimated size at emergence we were able to estimate daily growth rates for each age category.
- Good et al's (2001) maximum likelihood method allowed us to examine the magnitude of directional mortality between the two samples.

Good et al., 2001 S.P. Good, J.J. Dodson, M.G. Meekan, D.A.J. Ryan. Annual variation in size-selective mortality of Atlantic salmon (*Salmo salar*) fry. Canadian Journal of Fisheries and Aquatic Sciences, 58 (2001), pp. 87-95.

- The products of the maximum likelihood function we were able to generate age specific mortality and total mortality of the cohort.
- It is assumed in this model that size-selective mortality is the only type of mortality



Results

Effects of Age on Survival and Growth

Survival

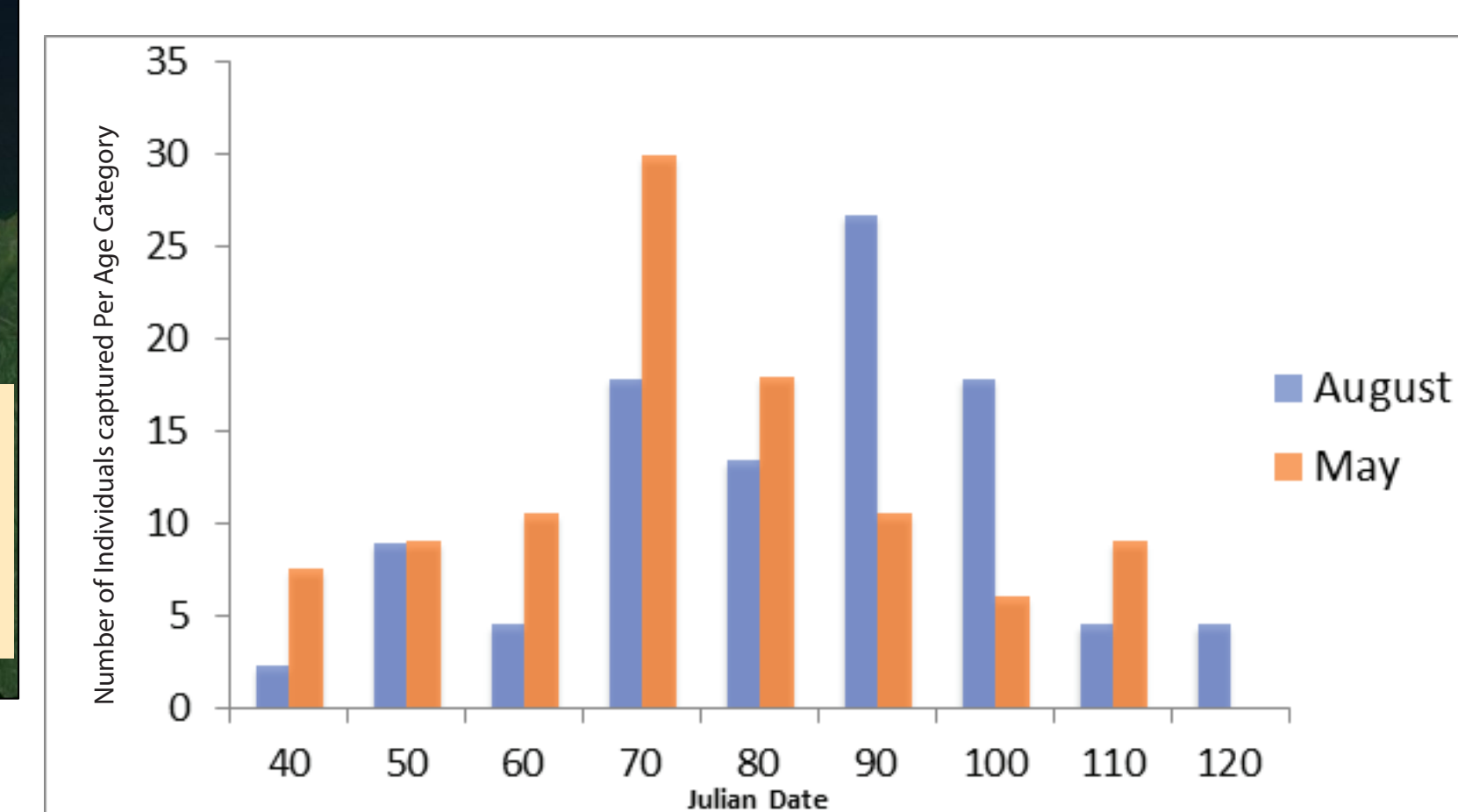


Figure 1. Frequencies of emergence date for Coho salmon (*Oncorhynchus kisutch*) fry in the Onion River in Bayfield County, WI for samples taken on May 5 and August 22, 2012. n=67 May and n= 46 August. The August sample displayed a shift in age distribution and fish emerging later were more prevalent in the fall sample when compared to the spring. Emergence dates are in bins of 10 day increments grouped as +/- 5 days of the category designation.

Growth

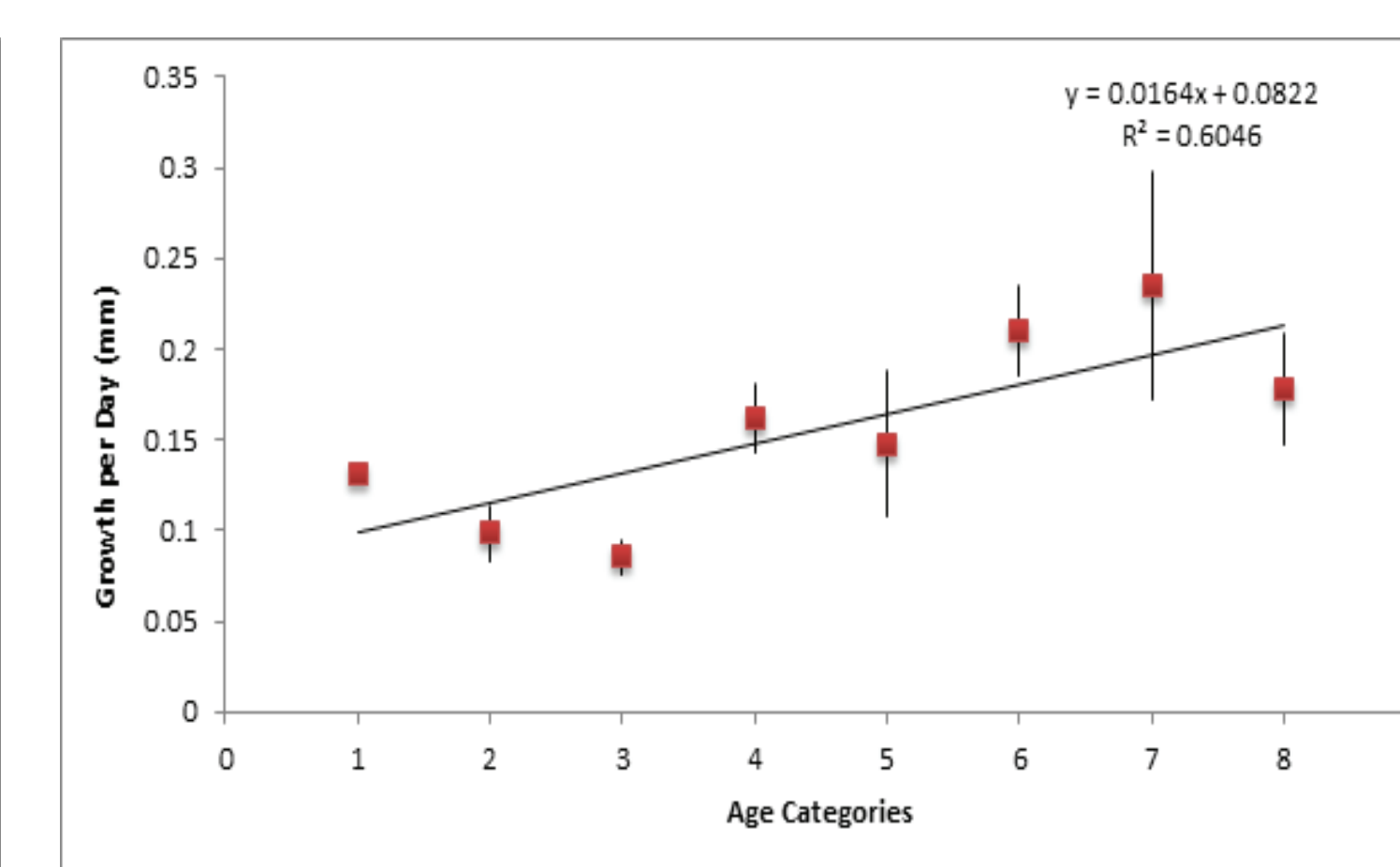


Figure 3. Mean growth (mm) per day by age category for Coho salmon (*Oncorhynchus kisutch*) fry samples collected from the Onion River in Bayfield County, WI on May 5, 2012. Comparisons of the means (± SE) was significant (p=0.004) and fish emerging later in the year were growing at faster rates than those emerging earlier. Age categories are in bins of which emergent dates were grouped together in 10 day increments (n=67).

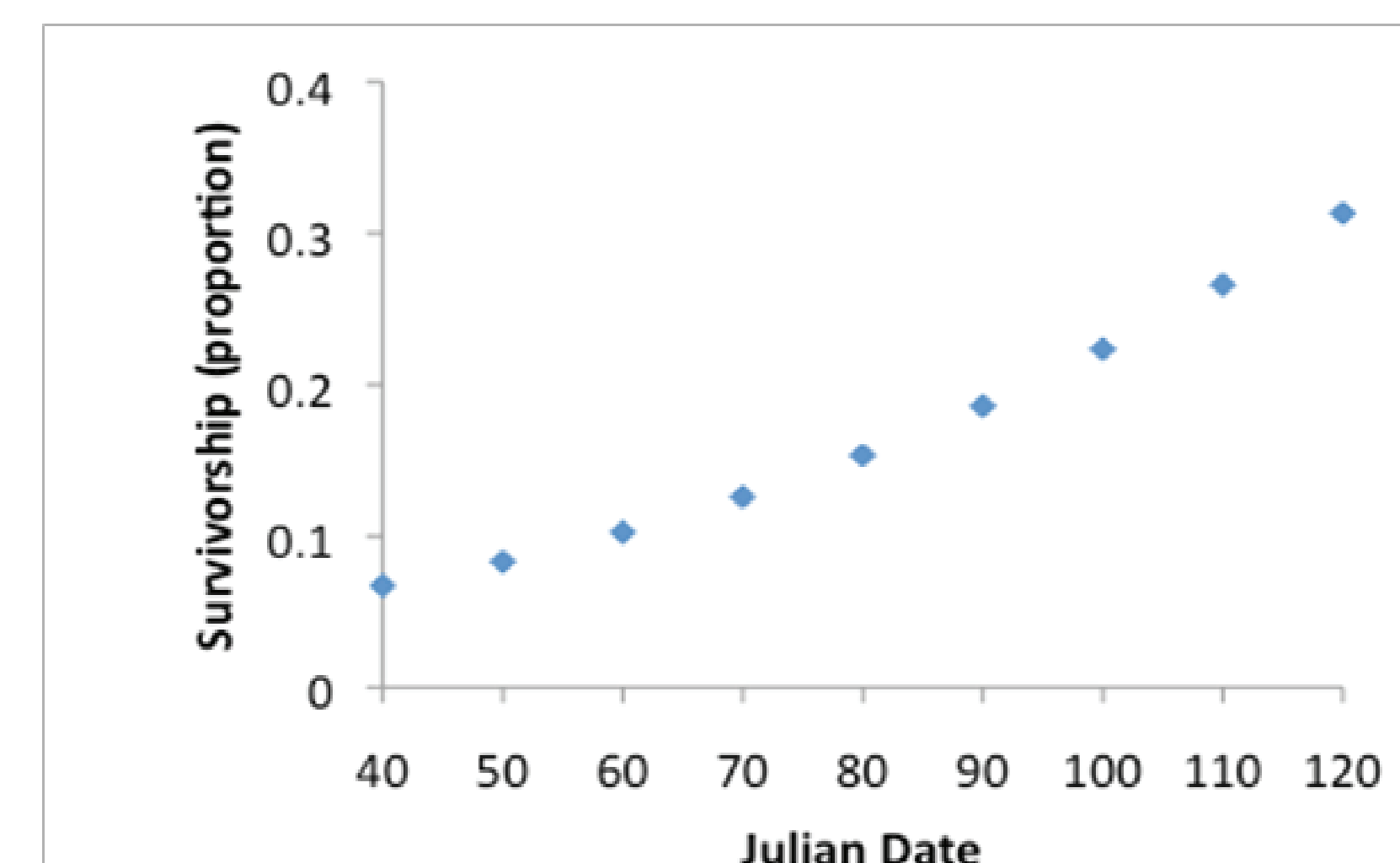


Figure 2. Estimated survivorship proportions by emergence date through the first summer for Coho salmon (*Oncorhynchus kisutch*) collected from the Onion River in Bayfield County, WI, 2012. Fish emerging later in the year experienced lower levels of mortality than earlier emerging individuals.

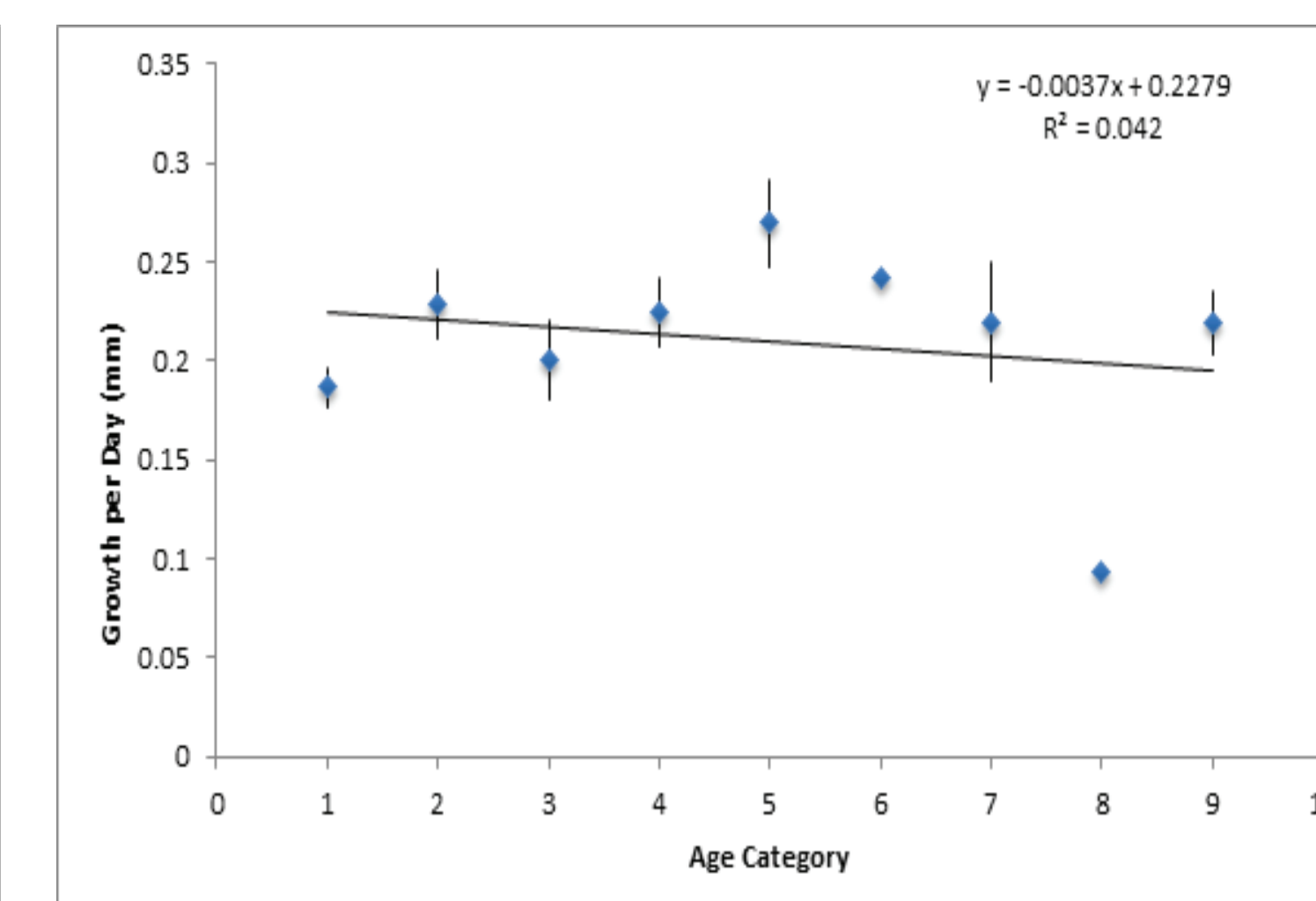
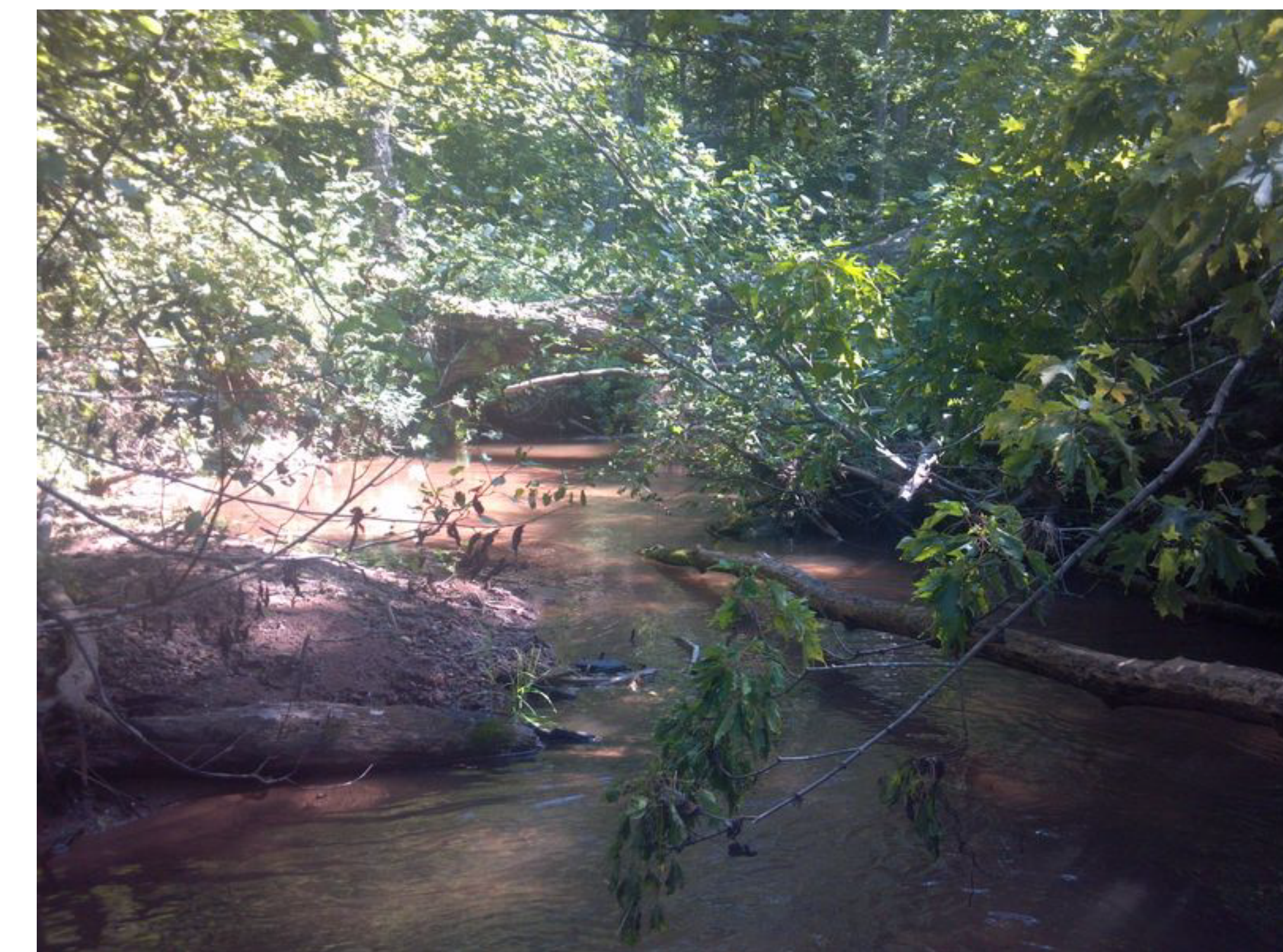


Figure 5. Mean growth (mm) per day by age category for Coho salmon (*Oncorhynchus kisutch*) fry samples collected from the Onion River in Bayfield County, WI in August 22, 2012. Comparisons of the means (± SE) was not significant (p=0.19; n=46). In the fall sample all individuals were growing at similar rates irrespective of emergence date.



Pictures of study area of the Onion River. Photos were taken by Nick Salinas May 5, 2012.

Discussion

The survivorship curve generated showed earlier emerging fish had experienced lower survivorship than those that emerged later. This may suggest earlier emerging fish may have been disadvantaged due to environmental factors such as flooding or increased predation risks. A more general explanation for this pattern is all fish in the population were exposed to the same multitude of factors and higher mortality for earlier emerging categories was based on being exposed to such factors for a longer period of time.

Assuming environmental conditions and predation risks were similar between fish in each sampling group, we found that growth rates (mm) were related to emergence timing for a short time immediately following emergence in the early summer sample. Those that emerged later grew faster than those emerging earlier (p=0.004) and by the fall the growth rates were similar among all age categories. This might indicate that older fish do not secure or maintain territories for the entire summer and there is a steady turnover of individuals within this part of the river.

Acknowledgements

The authors would like to sincerely thank the Office of Research and Sponsored Programs UW-Eau Claire for funding this study, Dr. Lonzarich for his extensive contributions to this study and B. Bausch for assisting in data collection and processing, Dr. Kraker for assistance in method development and statistical analysis, and Dr. Cronje for advice and general helpfulness, particularly in structuring the research paper.