

Evaluation of Chinook Salmon Fry Survival in Lookout Point Reservoir, Oregon, 2018

Tobias Kock and Russell Perry
U.S. Geological Survey

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Study Code: JPL-17-04-LOP

Research Goal and Objectives

Goal

Estimate survival of Chinook salmon fry in Lookout Point Reservoir during 2017

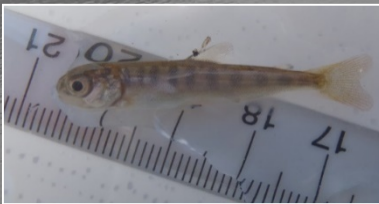
Objectives

Use a staggered release-recovery study design (staggered release model) to estimate fry survival during April-June, 2017

Use a parentage-based tagging *N*-mixture study design (*N*-mixture model) to estimate fry survival during April-October, 2017

Compare estimates from the two study designs, and to available literature, and develop recommendations for an approach that could be used at other locations within the Willamette Project

Background



Review of Tagging Study Designs to

Johnson et al. *Journal of Great Lakes Research*, 37(3):397-407, 2011
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Review of Marking Methods and Release-Capture Designs for Estimating the Survival of Very Small Fish: Examples from the Assessment of Salmonid Fry Survival

JOHN R. SKALSKI¹, REBECCA A. BUCHANAN², and JIM GREGSWOLD³

¹Clinton River Research, School of Aquatic and Fishery Science, University of Washington, Seattle, Washington, USA
²Novena Fisheries Technology, Inc., Cheyenne, Wyoming, USA

The survival of very small fish can have a major impact on the dynamics of fisheries stocks. Noninvasive marking techniques have been developed or adapted to small fish in order to determine either overall fish mortality or emigration events. Some techniques provide "best" marks, while others provide individual fish identification with or without the need for recapture sampling. The review 20 marking techniques in the context of conducting survival studies for small fish, with examples focused on individual fry survival. Various alternative release-capture designs for conducting survival investigations are also examined. These approaches can be used to estimate survival parameters, while the use of all these methods capable of estimating fish survival. The review assesses marks and survival fish-specific marks. The approach based on a review of fish marking methods is capable of statistically comparing survival. Assessments are discussed to carefully consider their choice of marking techniques with the design and analysis of the release-capture study area.

Keywords: survival marks, external marks, mark-recapture, survival estimation, tagging

INTRODUCTION

Small fish represent both the early life stages of many species and the adults of other species. Measuring the survival of small fish is important for effective management of many protected populations (e.g., Pacific salmonids, Characina spp.). Legal, ethical, and economic considerations make it imperative that survival studies be carefully designed and conducted. Electronic tagging, acoustic radio telemetry are commonly used to tag larger fish for estimating survival and recruitment. While assessment, probability assessment, and modeling alternative management practices, the smaller fish (<50-mm fork length), the logistics of marking and conducting release-recapture studies is more difficult and precision. Fewer tagging options are available,

and tagging and handling effects are often intensified relative to larger fish. Furthermore, survival estimation methods are more dependent on tag choice than for larger fish. The result is a relative lack of precise survival information through early life stages for the small fish in general.

For example, vast amounts of informative new exist on the survival of endemism Pacific salmonids between emigration and adult return returns arising from Puget Sound, Great Thompson (PIT) (Fry et al., 2004; Fry et al., 2005; Skalski et al., 1998; Smith et al., 2002; Sushman and Skalski, 2007), Idaho (Skalski et al., 2004), and various age-0 (Fry et al., 2007). However, these tag technologies are typically not appropriate for small juvenile salmonids between emigration from the gravel and seaward migration, a life stage reference to fry by some salmon biologists. Fry may be difficult to identify or may migrate seaward or downstream to feed. At some point, the small juvenile species will engage in directed seaward migration. The inability to tag very small fish with existing electronic

Address correspondence to R. A. Buchanan, Clinton River Research, School of Aquatic and Fishery Science, University of Washington, Seattle, WA 98195-2214, USA. E-mail: rabaduch@u.washington.edu

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Work Completed for Compliance with the 2008 Willamette Project
Biological Opinion, USACE funding: 2011

Work Completed for Compliance with the 2008 Willamette Project
Biological Opinion, USACE funding: 2012

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Biological Opinion, USACE funding: 2014

LIFE-HISTORY CHARACTERISTICS OF JUVENILE SPRING CHINOOK SALMON REARING IN WILLAMETTE VALLEY RESERVOIRS

Prepared for
U. S. ARMY CORPS OF ENGINEERS
PORTLAND DISTRICT – WILLAMETTE VALLEY PROJECT
333 S.W. First Ave.
Portland, Oregon 97204

Prepared by

Fred R. Mouzyk
Kym Essig
Jeremy D. Roemer
Thomas A. Friesen

Oregon Department of Fish and Wildlife
Upper Willamette Research, Monitoring and Evaluation Program
Corvallis Research Lab
28655 Highway 34
Corvallis, Oregon 97333

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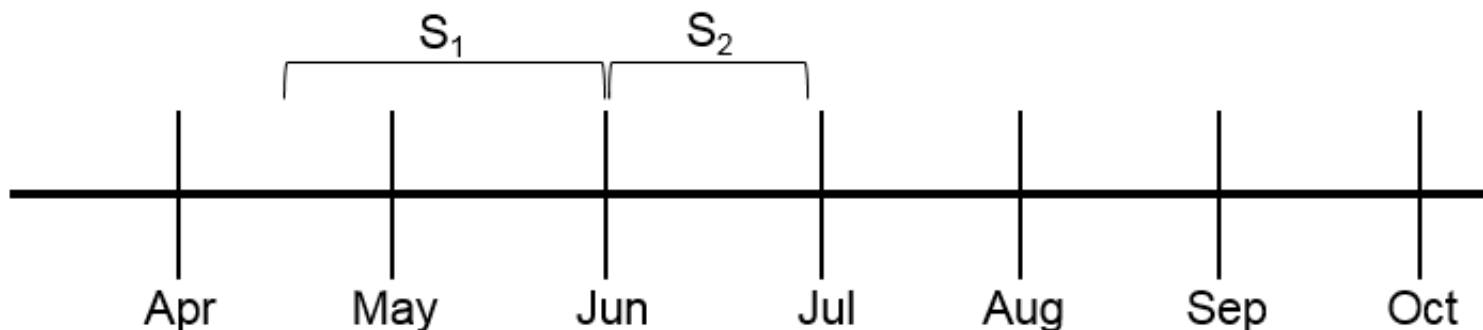
June 2015

2017 Study Design

R1
 $n = 44,138$
FL = 43 mm

R2
 $n = 44,143$
FL = 96 mm

R3
 $n = 3,922$
FL = 107 mm



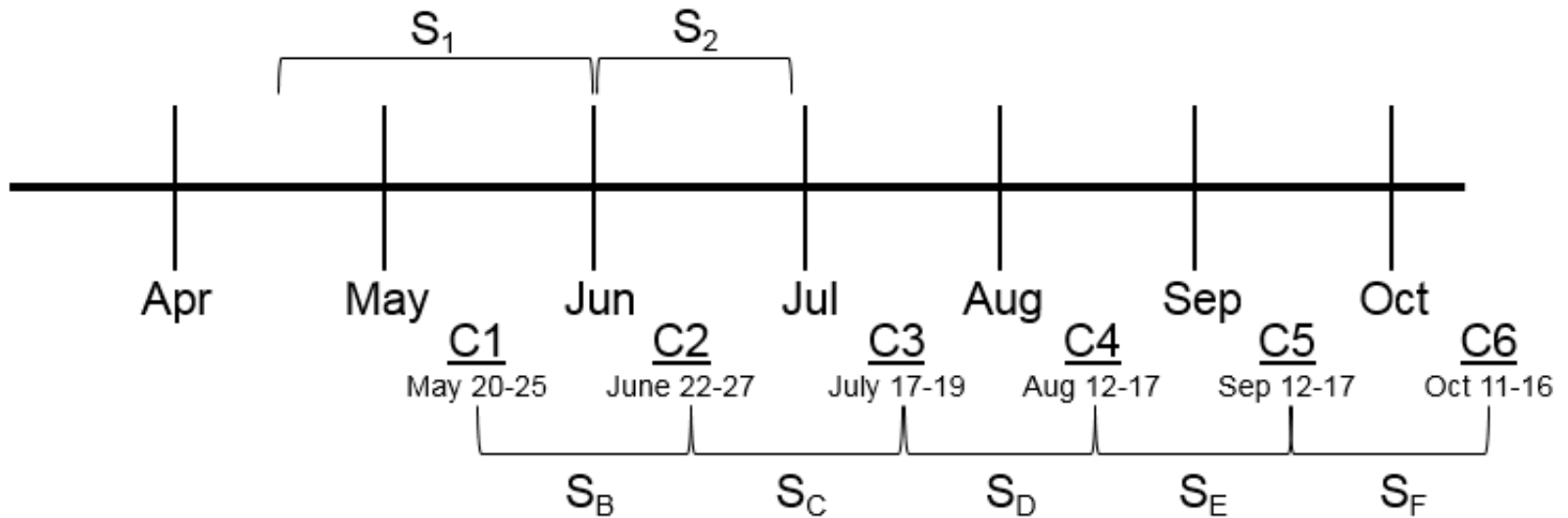
2017 Study Design

R1
 $n = 44,138$
FL = 43 mm

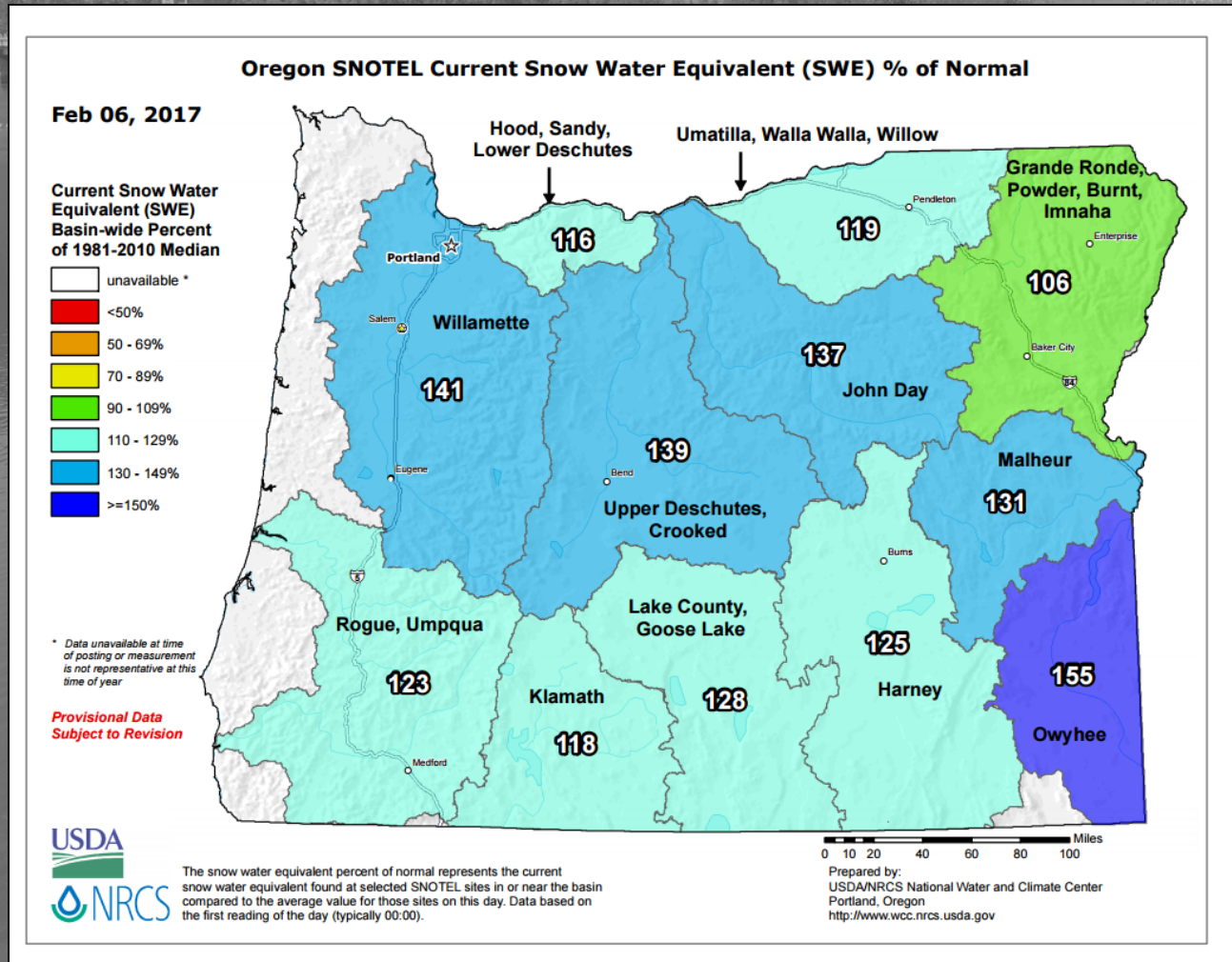
R2
 $n = 44,143$
FL = 96 mm

R3
 $n = 3,922$
FL = 107 mm

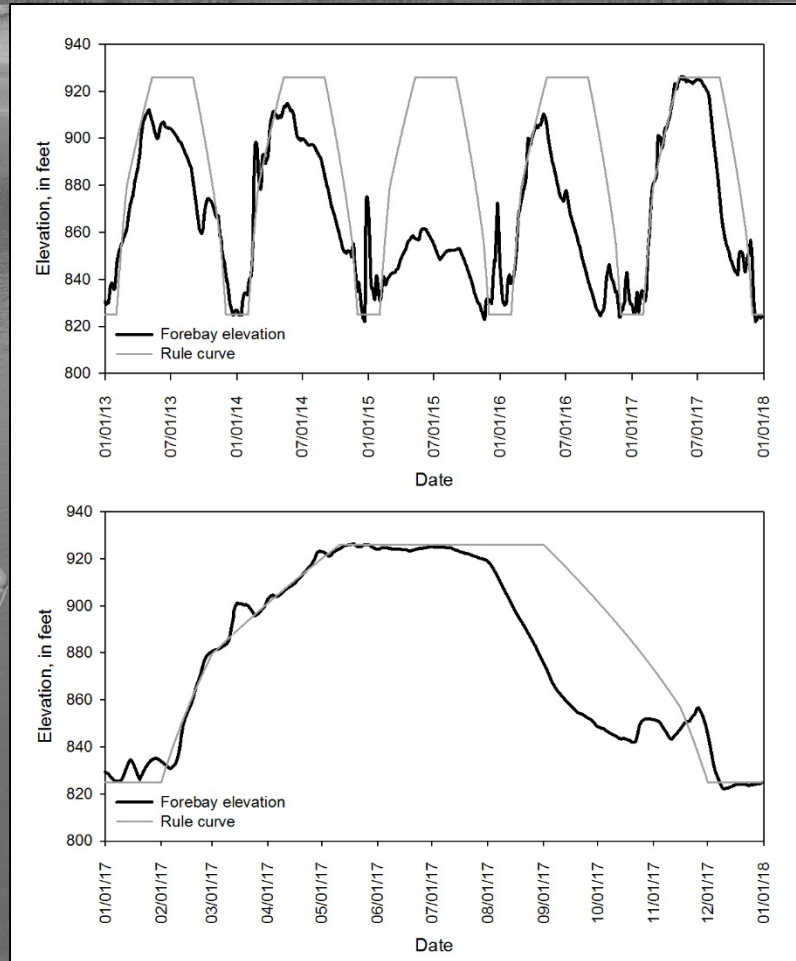
Assumes “closed system”
- No spill at dam



Spill at Lookout Point Dam

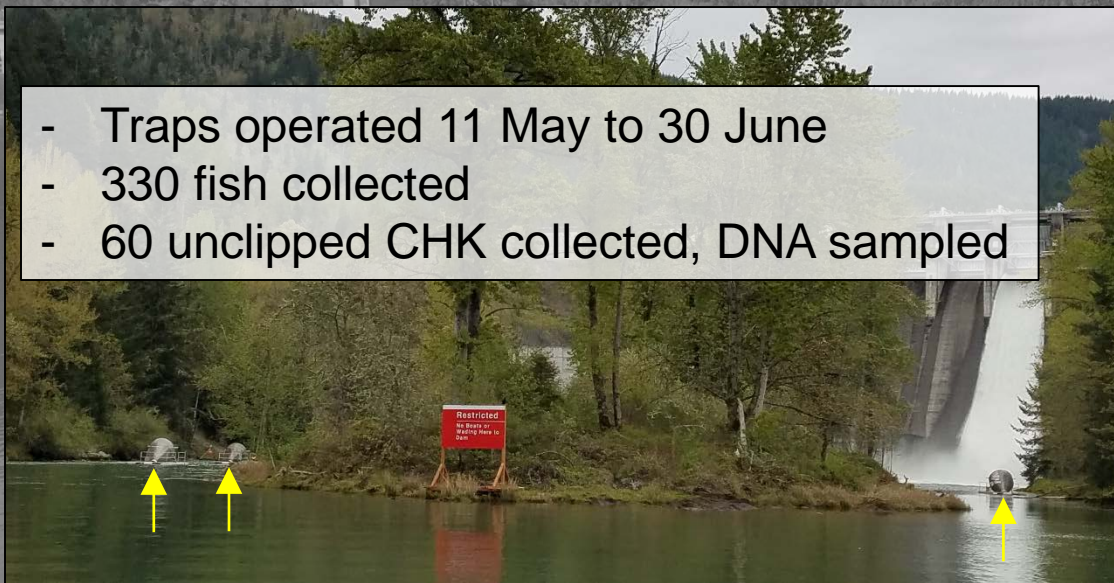


Spill at Lookout Point Dam



Estimating Dam Passage

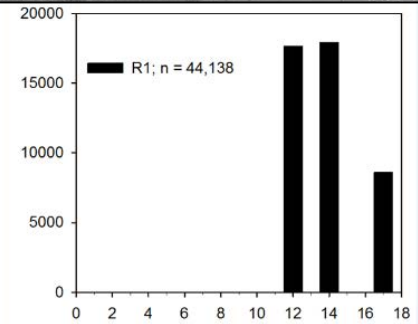
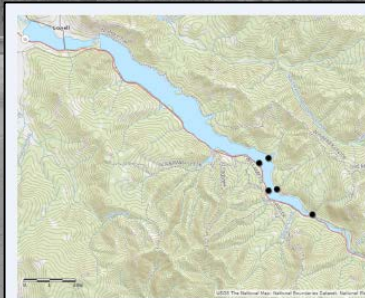
- Traps operated 11 May to 30 June
- 330 fish collected
- 60 unclipped CHK collected, DNA sampled



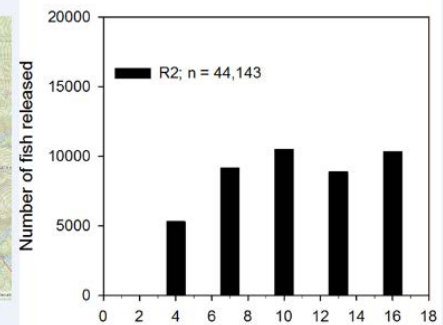
Release date	# released	# collected	% collected
16-May	991	19	1.9
24-May	994	36	3.6
1-June	1063	25	2.4
15-June	1066	22	2.1

Fish Releases

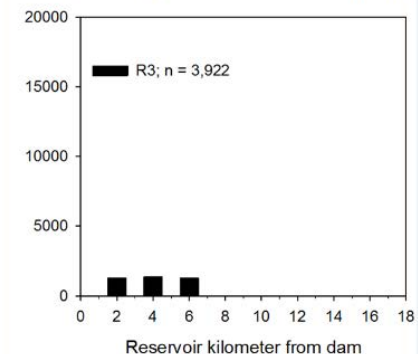
April 18-19, 2017



May 30-June 2, 2017

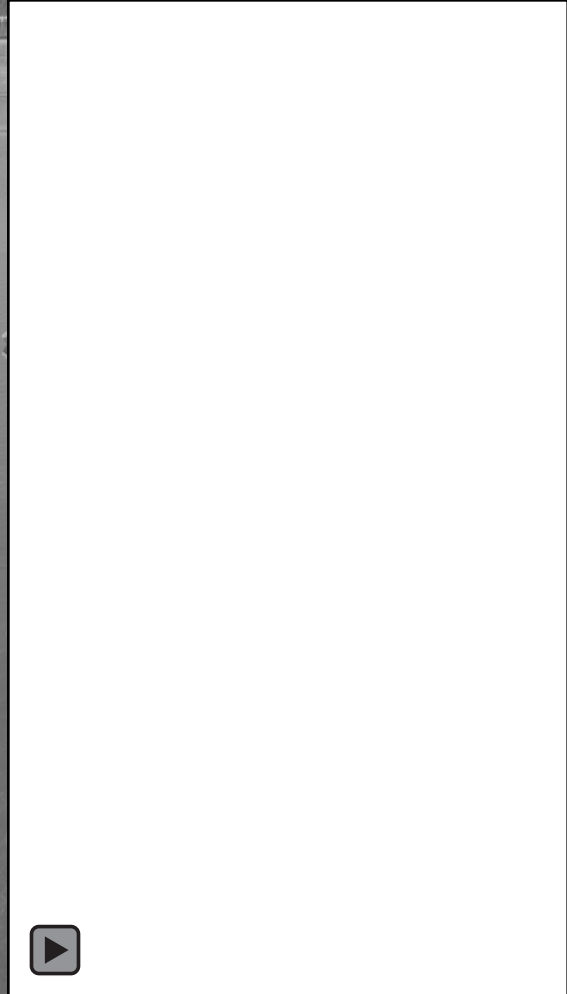


June 28, 2017

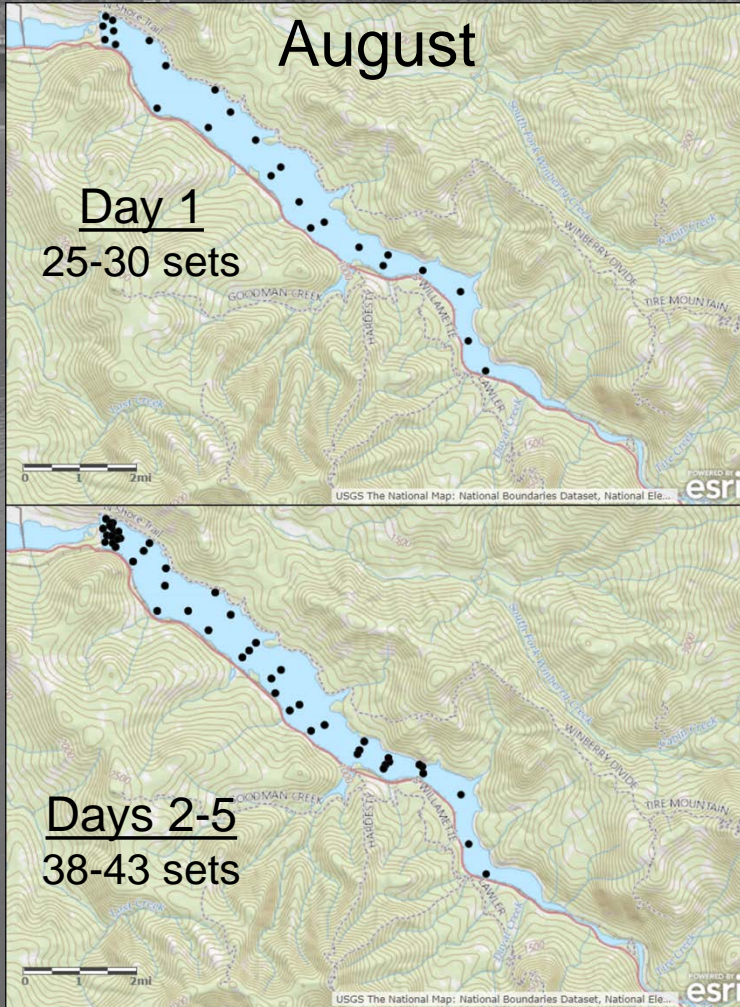


Summer Release

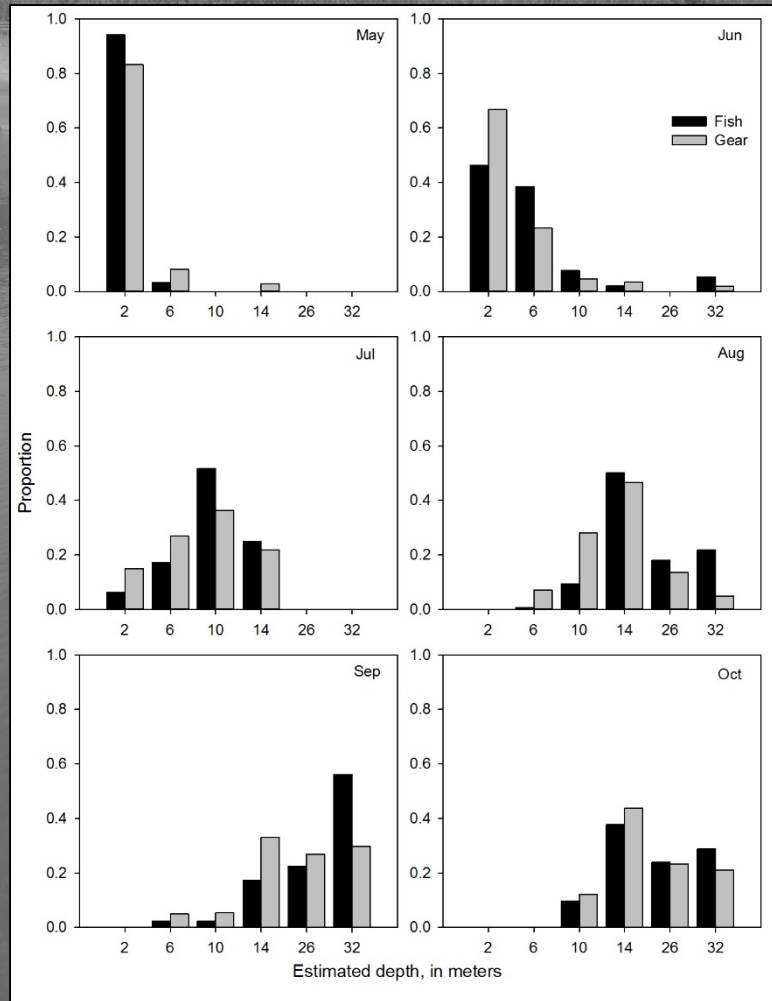
- Fish holding temp. = 14.5°C
- Surface temp. = 20.1°C
- Fish released 40 ft. below surface, water temp. = 14.5°C



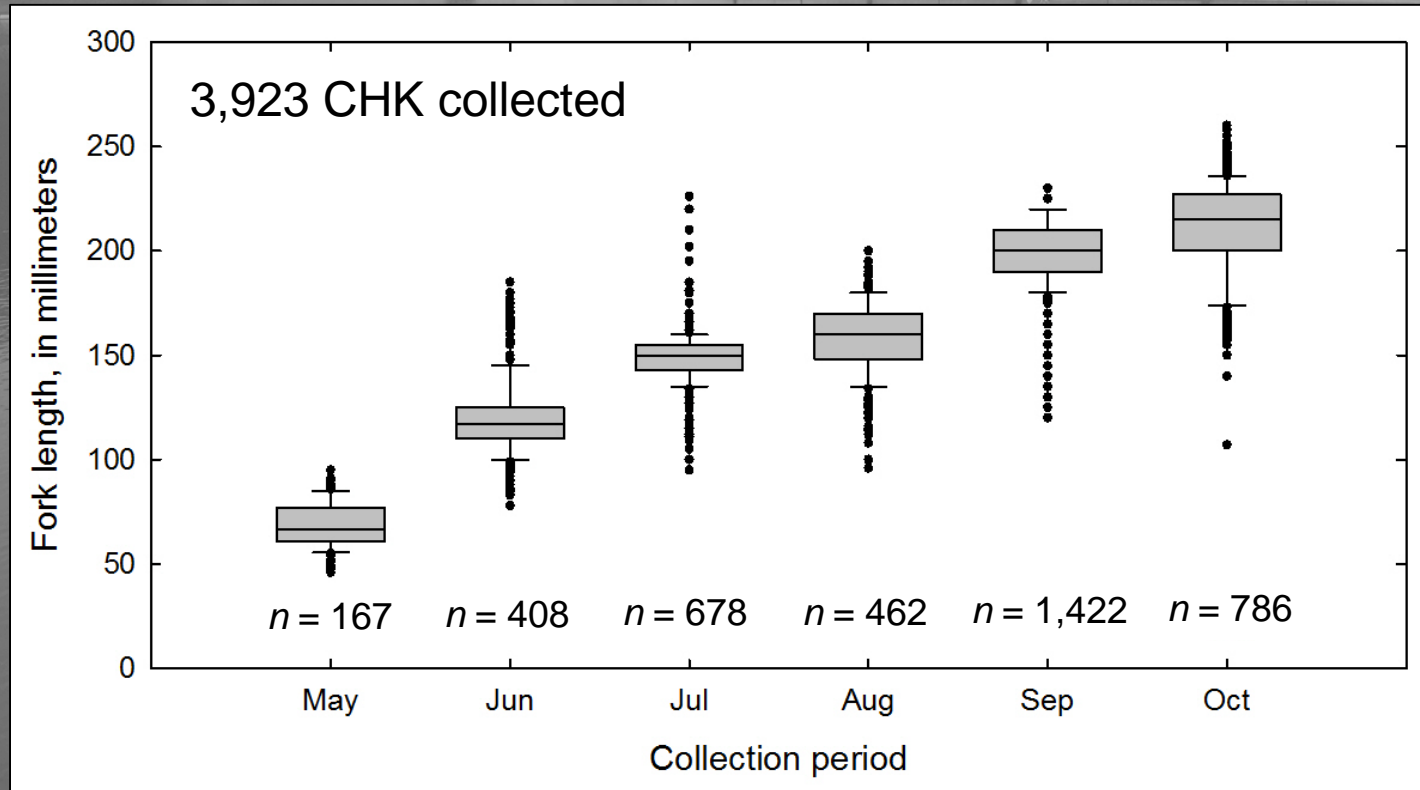
Fish Collection Strategy



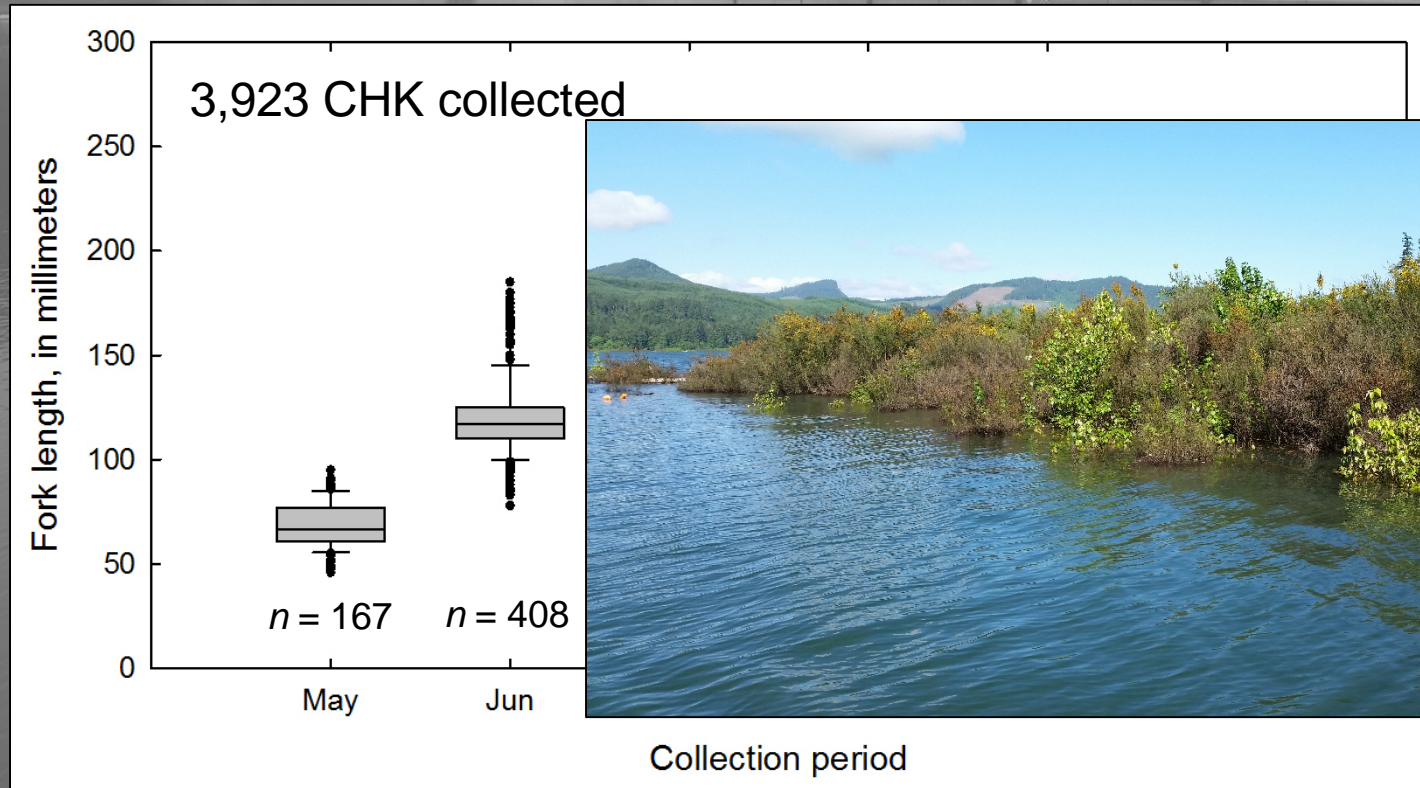
Collection Depth



Chinook Size and Collection Numbers



Chinook Size and Collection Numbers

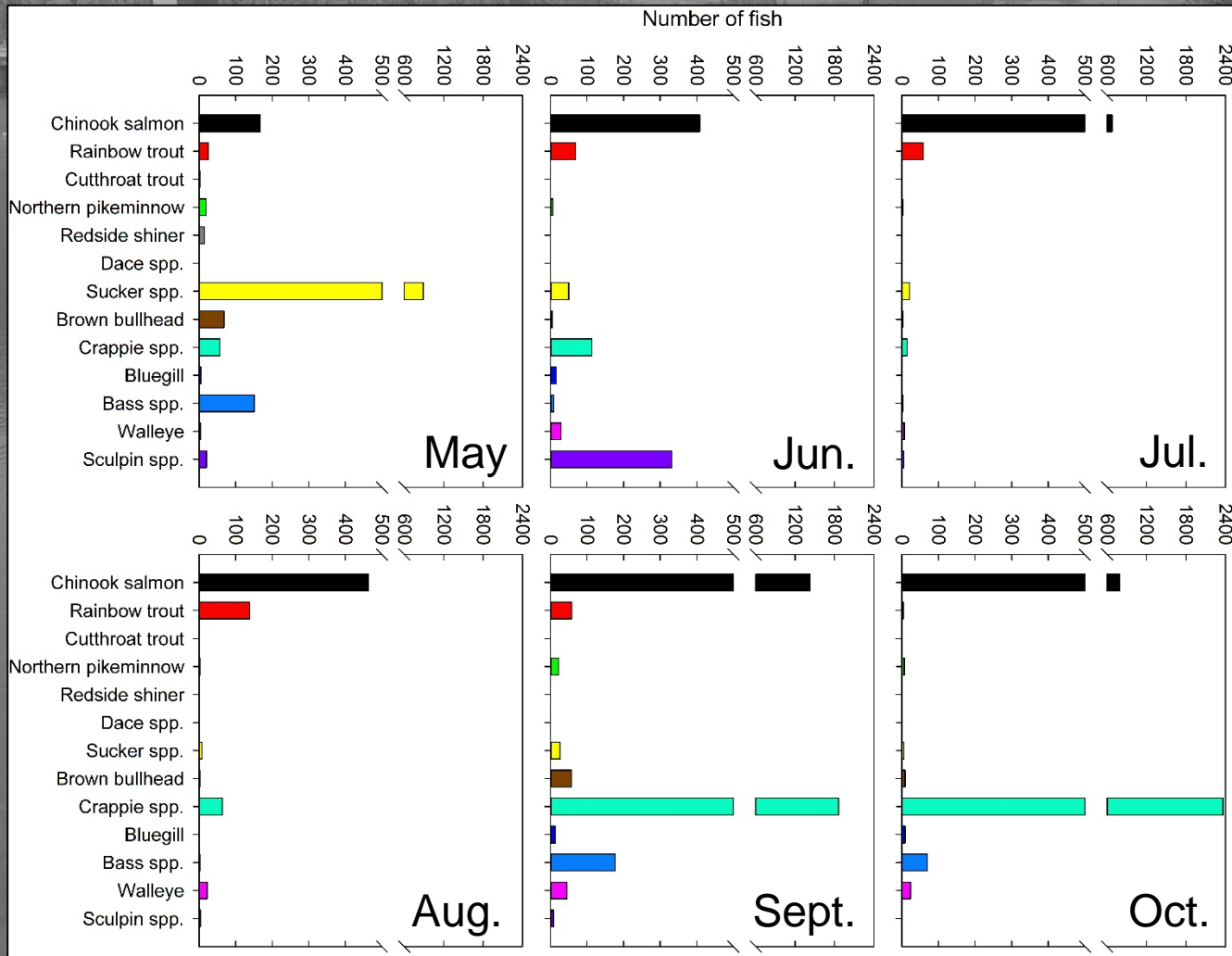


Genetic Samples

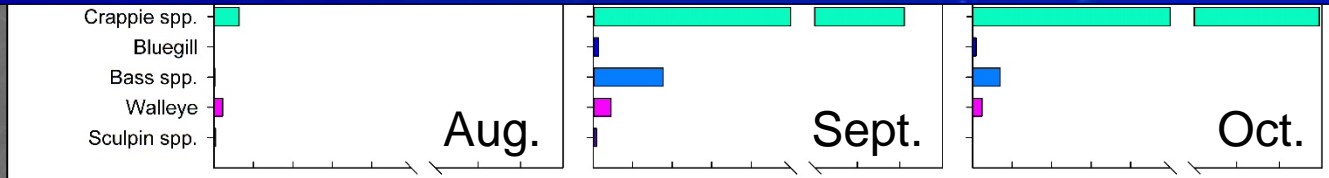
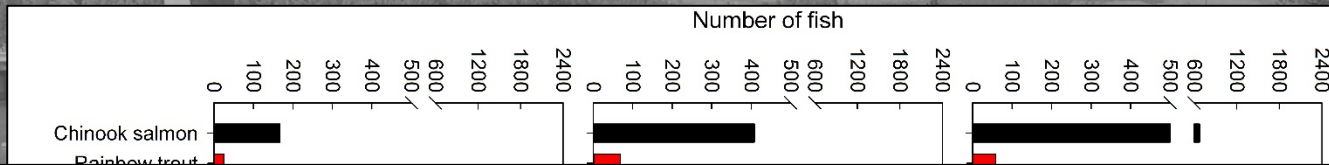
Sample description	Number of samples
Adult spawners	120
Pre-release juveniles	420
Reservoir collected juveniles	3,625
Tailrace collected juveniles	60
Total =	4,225



Total Fish Collection



Total Fish Collection



2018 Plans

- Wrap-up 2017 evaluation
 - PBT samples being processed now
 - Analysis and reporting: spring 2018
- 2018 evaluation
 - 2 release groups
 - mid-April ($n = 136,000$)
 - late-May to early-June ($n = 46,000$)
 - 6 monthly sampling events
 - May-October

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Questions

