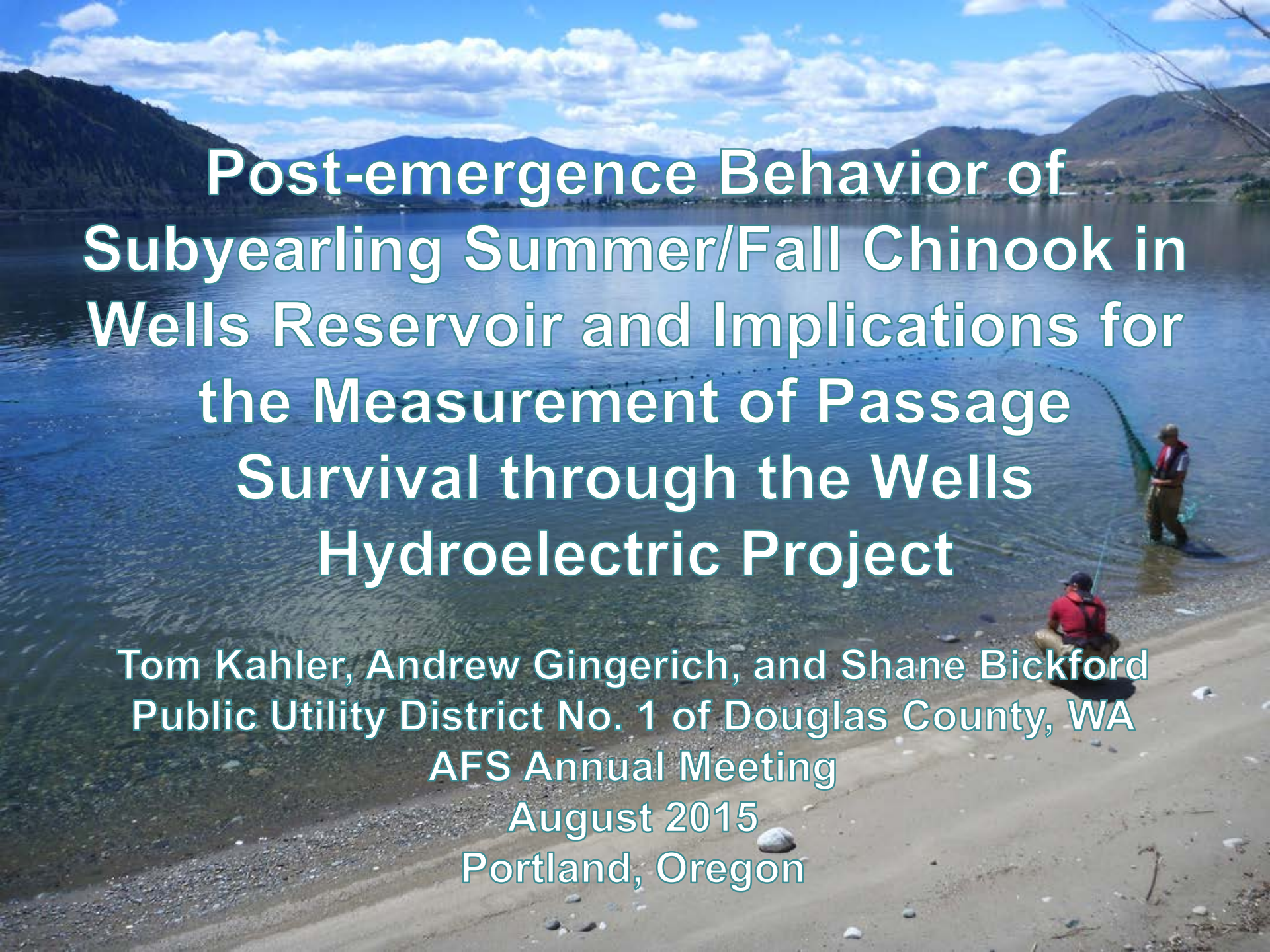
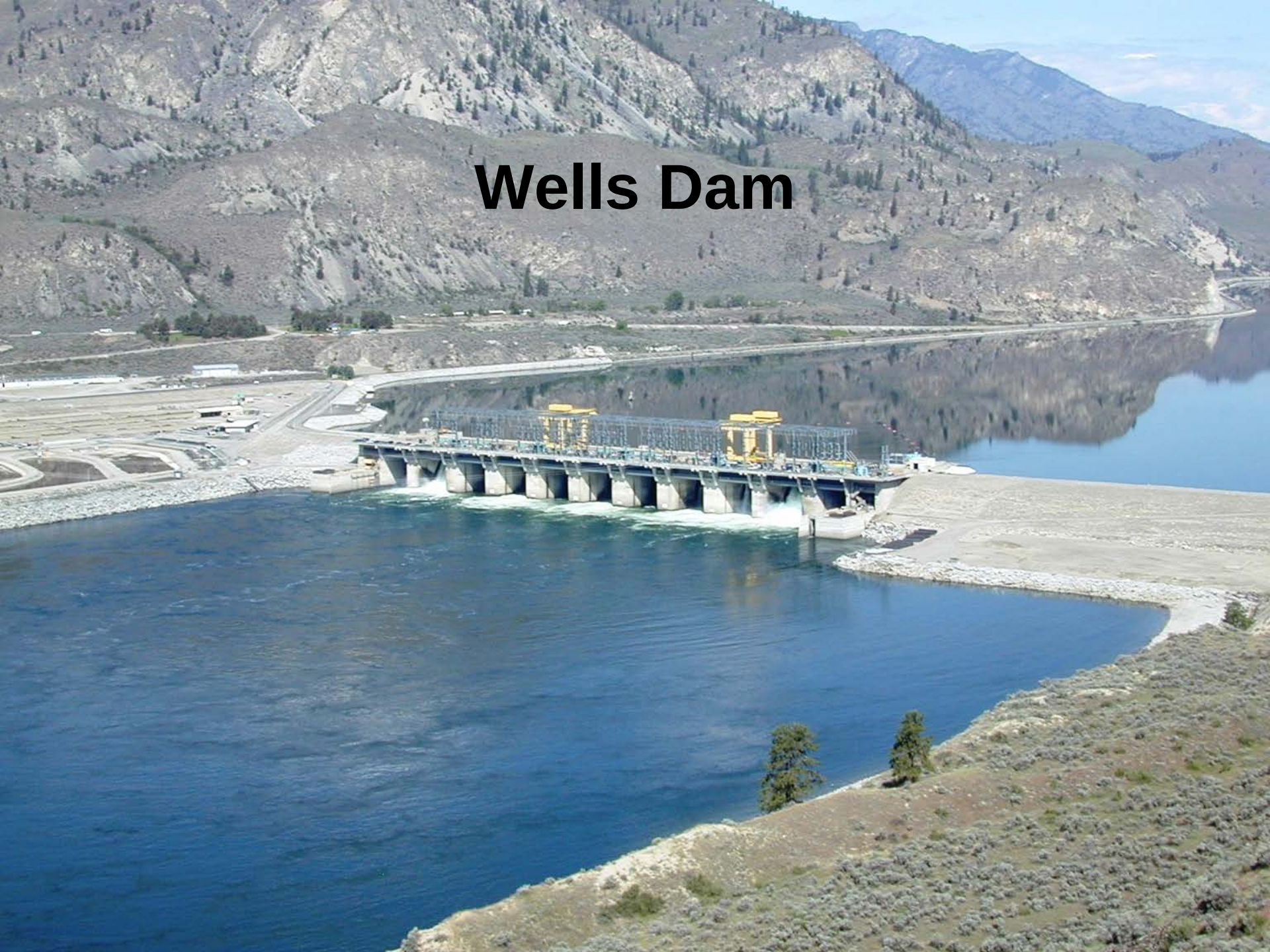


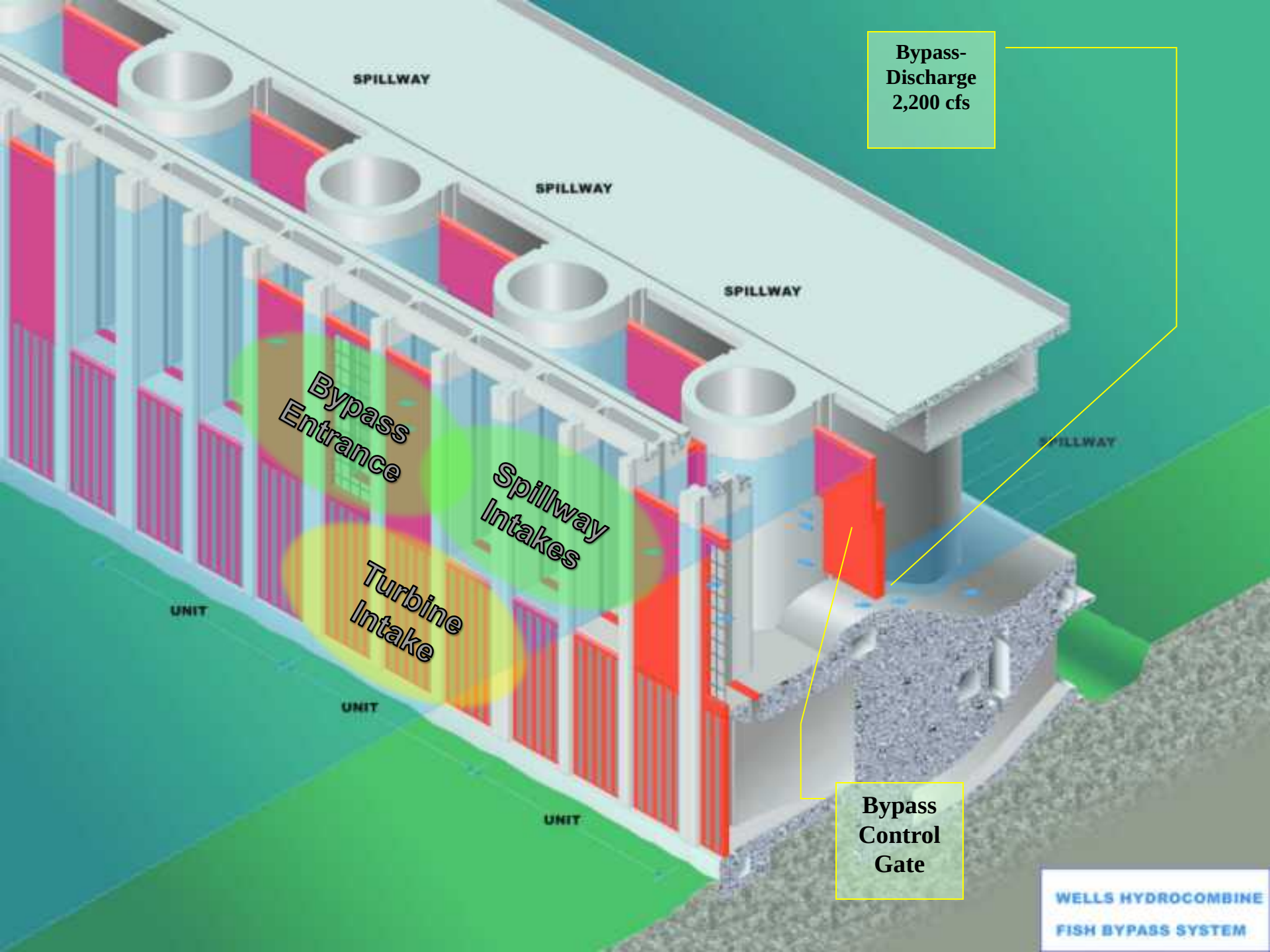
Post-emergence Behavior of Subyearling Summer/Fall Chinook in Wells Reservoir and Implications for the Measurement of Passage Survival through the Wells Hydroelectric Project

Tom Kahler, Andrew Gingerich, and Shane Bickford
Public Utility District No. 1 of Douglas County, WA

AFS Annual Meeting
August 2015
Portland, Oregon


Mica
Revelstoke
Arrow Lakes
Duncan
Keenleyside
Kootenay Lake
Canada
U.S.
Grand Coulee
Chief Joseph
Wells
Albeni Falls
Libby
Hungry Horse
Noxon
Rocky Reach
Columbia R.
Pend Oreille Lake
Flathead Lake
Rock Island
Kerr
Seattle
Little Goose
Lower Monumental
Montana
Wanapum
Lower Granite
Priest Rapids
Dworshak
Washington
Ice Harbor
The Dalles
Portland
McNary
Bonneville
John Day
Hells Canyon
Oxbow
Idaho
Brownlee
Willamette R.
Oregon
Boise Projects
Jackson Lake
Snake R.
Corps of Engineers Dams
Dams owned by Others


Wells Dam


Bypass-
Discharge
2,200 cfs
SPILLWAY
SPILLWAY
SPILLWAY
SPILLWAY
Bypass
Entrance
Spillway
Intakes
Turbine
Intake
UNIT
UNIT
UNIT
Bypass
Control
Gate
WELLS HYDROCOMBINE
FISH BYPASS SYSTEM

Wells Surface Bypass System

Passage Efficiency

- Fish Guidance Efficiency (3-year study):
  - 92.0% for spring Chinook and steelhead
  - 95.3% sockeye
  - 96.2% subyearling Chinook
- Balloon-tag studies: no measurable injury or mortality through the Bypass System

Survival Phase Designations

Wells HCP Phase Designations

Phase III (Standard Achieved)

- 91% Combined Adult and Juvenile Project Survival or
- 93% Juvenile Project Survival

Phase III (Additional Juvenile Studies)

- 95% Dam Passage Survival or
- 95% Calculated Dam Passage Survival

Juvenile Survival Rates

Juvenile **Project** Survival Measured ≥ 93%

Yearling Spring Migrants:

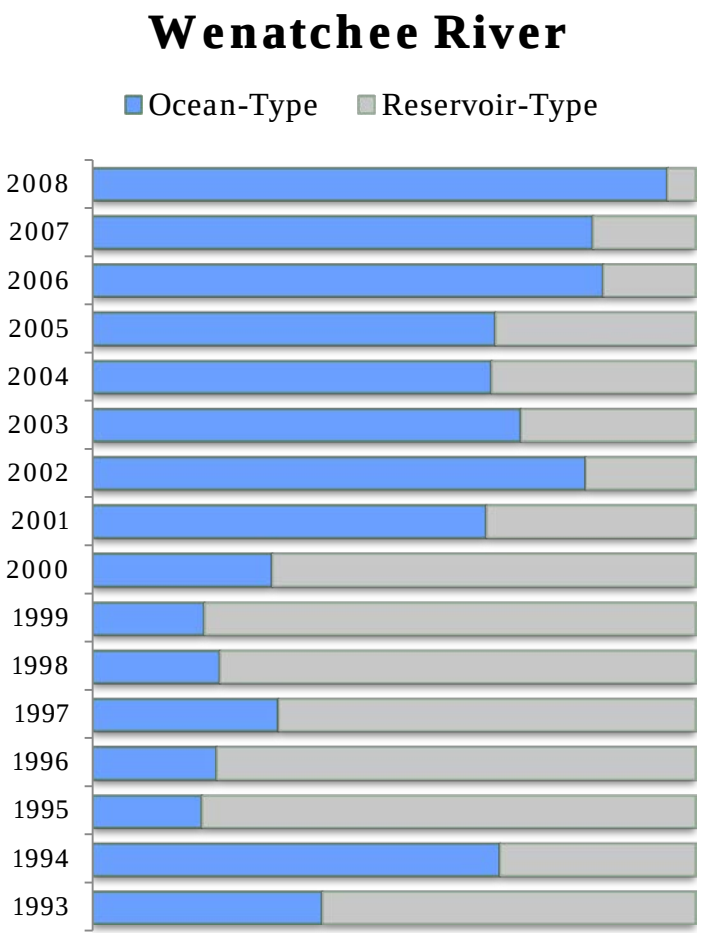
- 1998 – 99.7%
- 1999 – 94.3%
- 2000 – 94.6%
- 2010 – 96.4%
- 4-year average **96.3%**

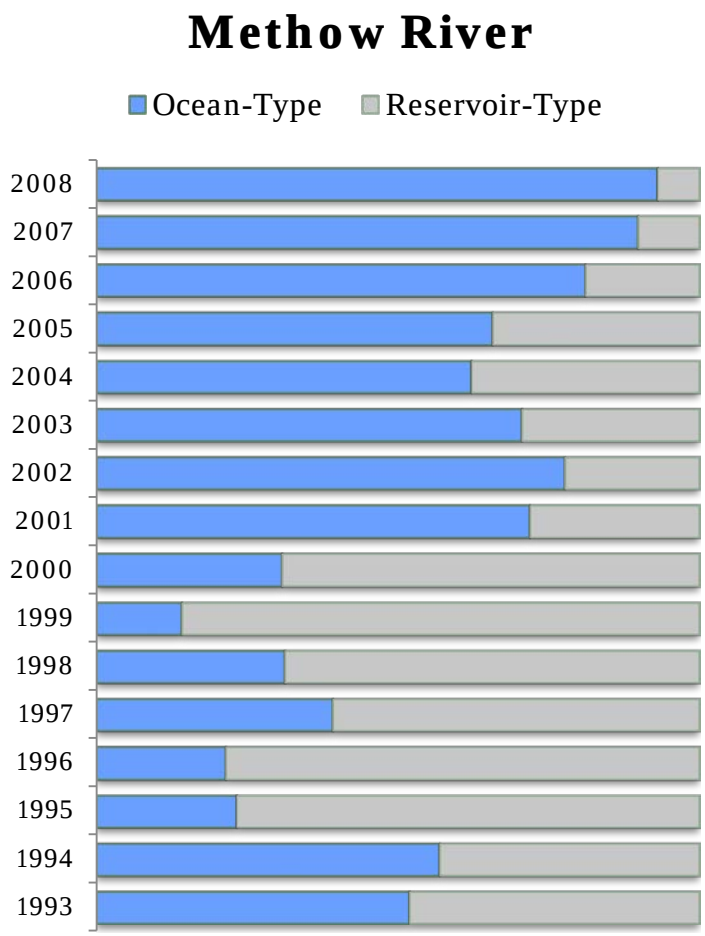
What about Subyearling Chinook?

Wells Reservoir

Summer/Fall Chinook Life-history Traits

Variation in stock composition





Subyearling Chinook Survival Rates?

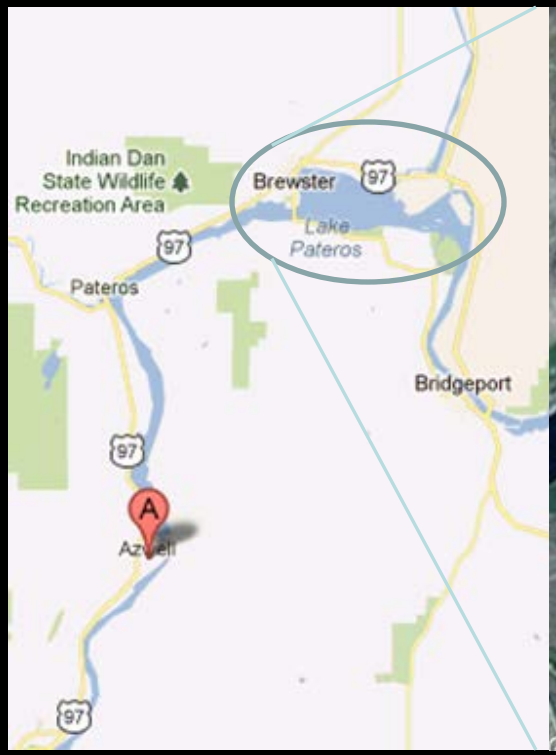
Calculated Dam Passage Survival - Subyearling Chinook

- Calculated to exceed 95% based on 96.2% Guidance Efficiency (but must mitigate at 7% until measured)

How to get to Phase III Standard Achieved?

- 2011-13 Wells Subyearling Chinook Life-History Study
  - PIT-tagged >50k wild age-0 Chinook in the Reservoir
  - Monitoring behavior, migration rates, timing, etc.
  - Evaluating results against survival-study assumptions
  - Comprehensive report in 2015

2011 Seining Locations



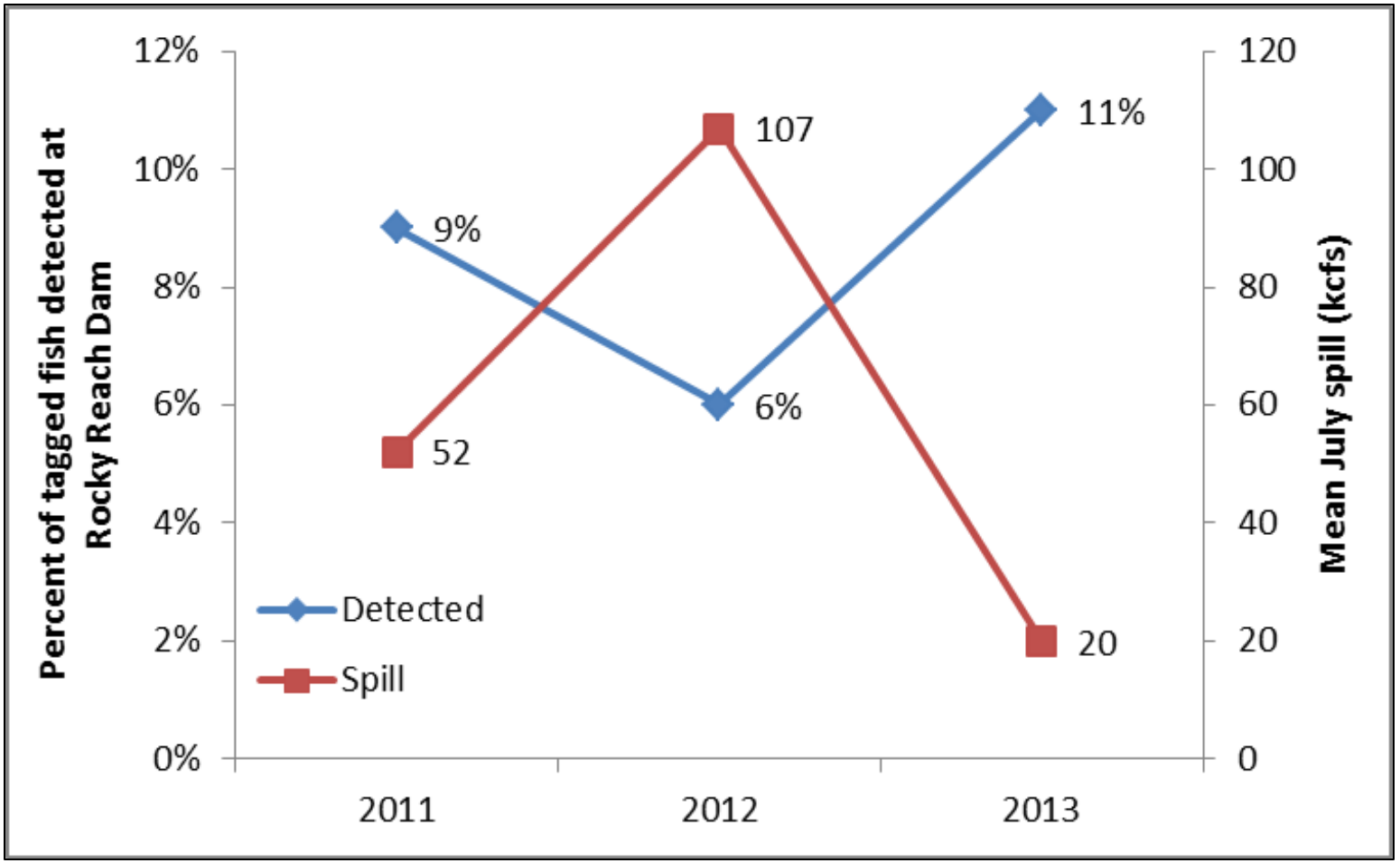
2011 Locations Below the Methow

Seining Location Added in 2012

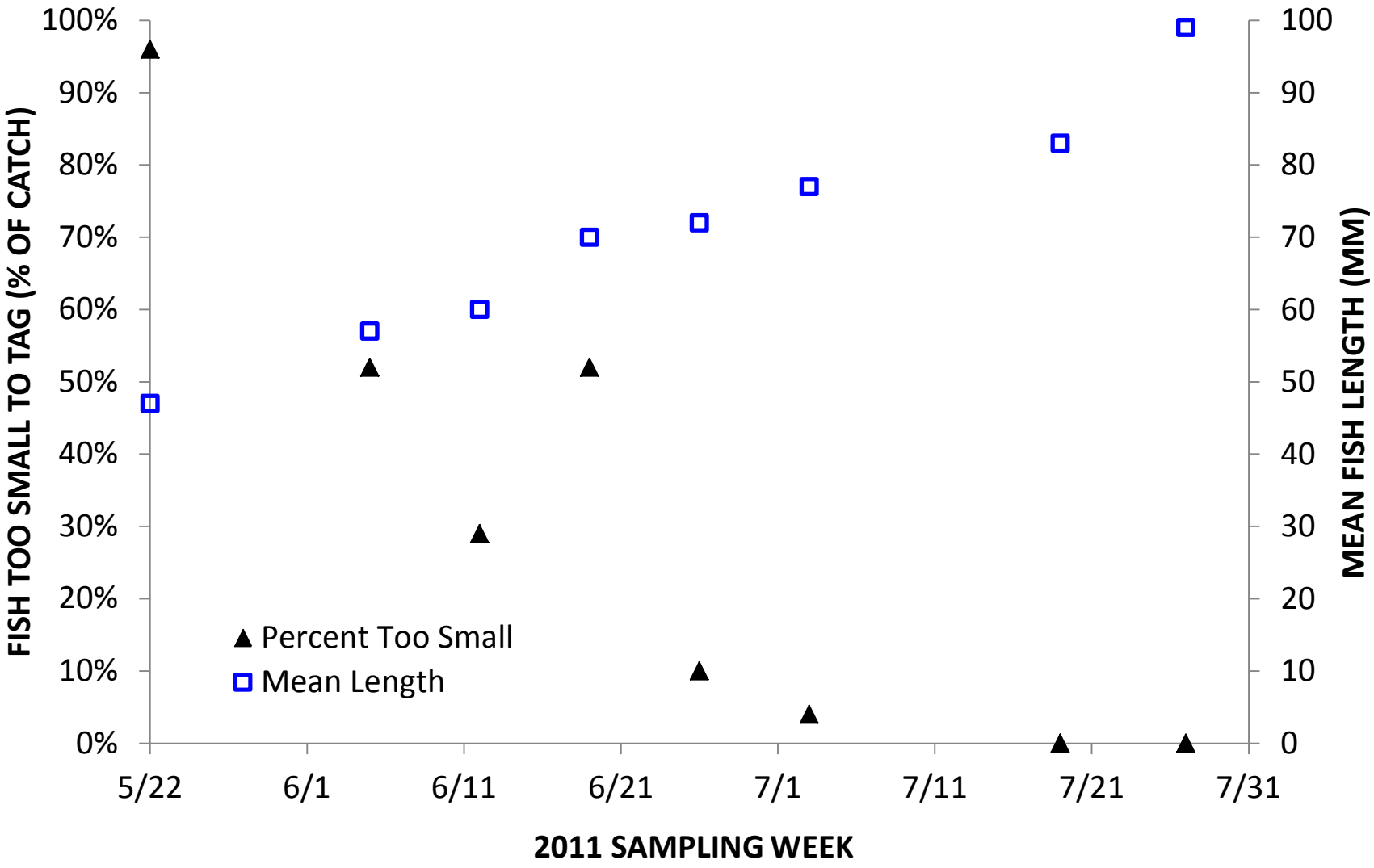
Summary Statistics

	2011	***2012***	***2013***	***Total***
First Release Date	22-Jun	26-Jun	19-Jun	--
First Arrival to Rocky Reach	25-Jun	30-Jun	25-Jun	--
Last Release Date	10-Jul	14-Jul	12-Jul	--
Last Arrival to Rocky Reach	2012	31-Aug	31-Aug	--
Total Tagged and Released	13,223	19,876	17,665	50,764
Total Detected at RRH	1,200	1,157	1,989	4,346
Total Detections all Sites	2,762	3,552	3,365	9,679
Unique Detections all Sites	2,312	3,109	2,945	8,366
Percent Detected	18%	16%	17%	16.5%
Percent Detected at RRH	9%	6%	11%	8.6%

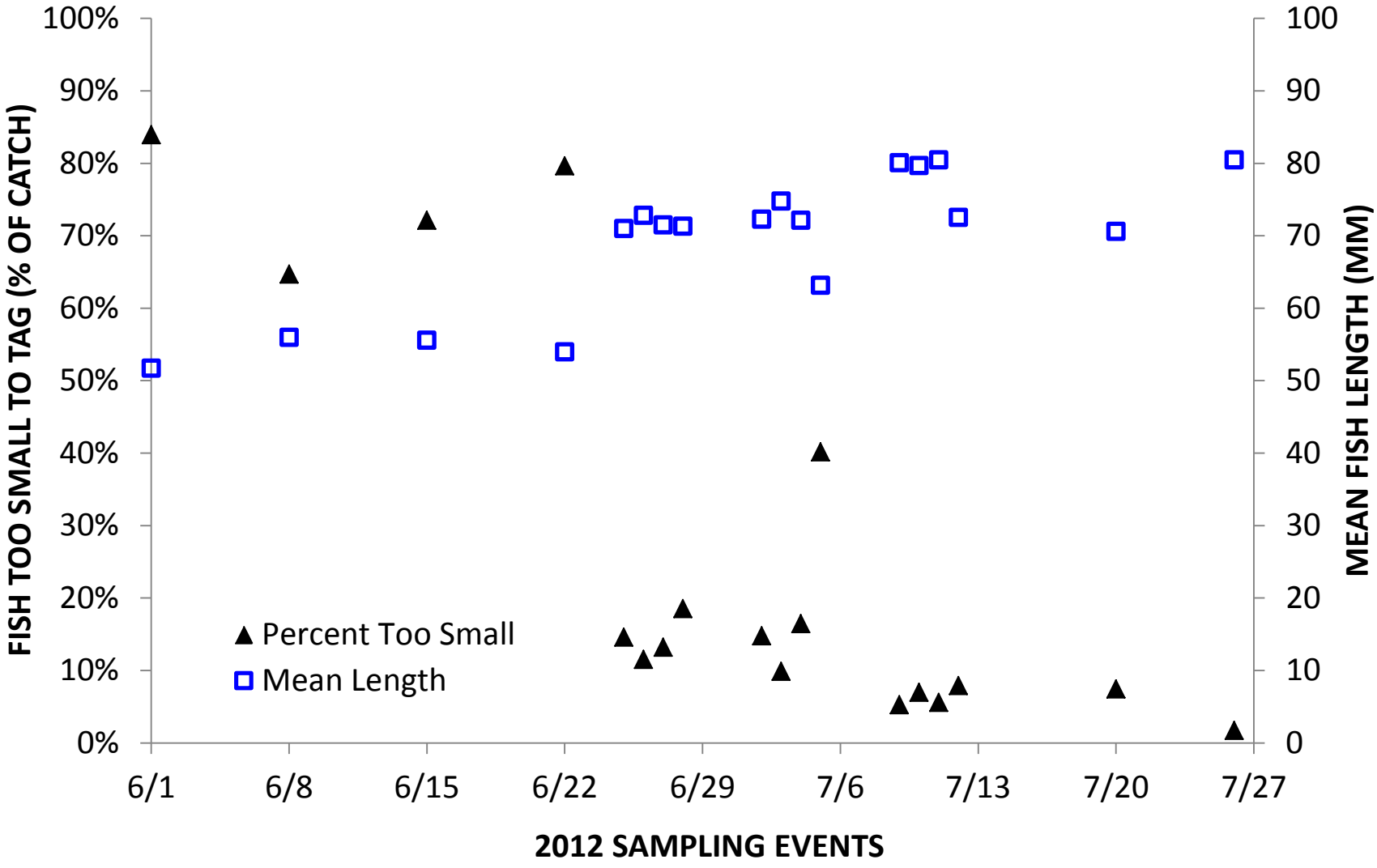
Spill Affects Detections at RRJ



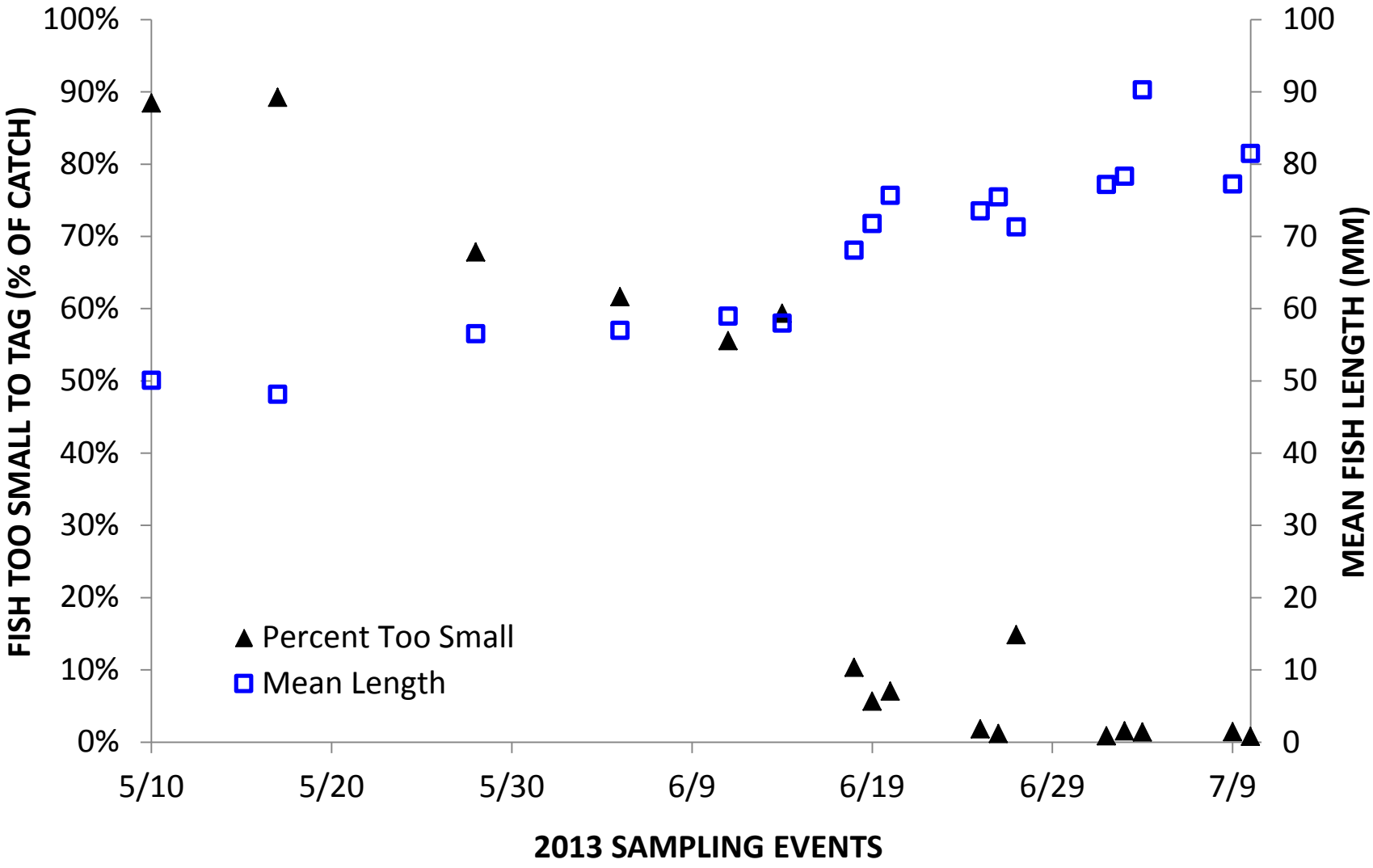
Size Composition 2011



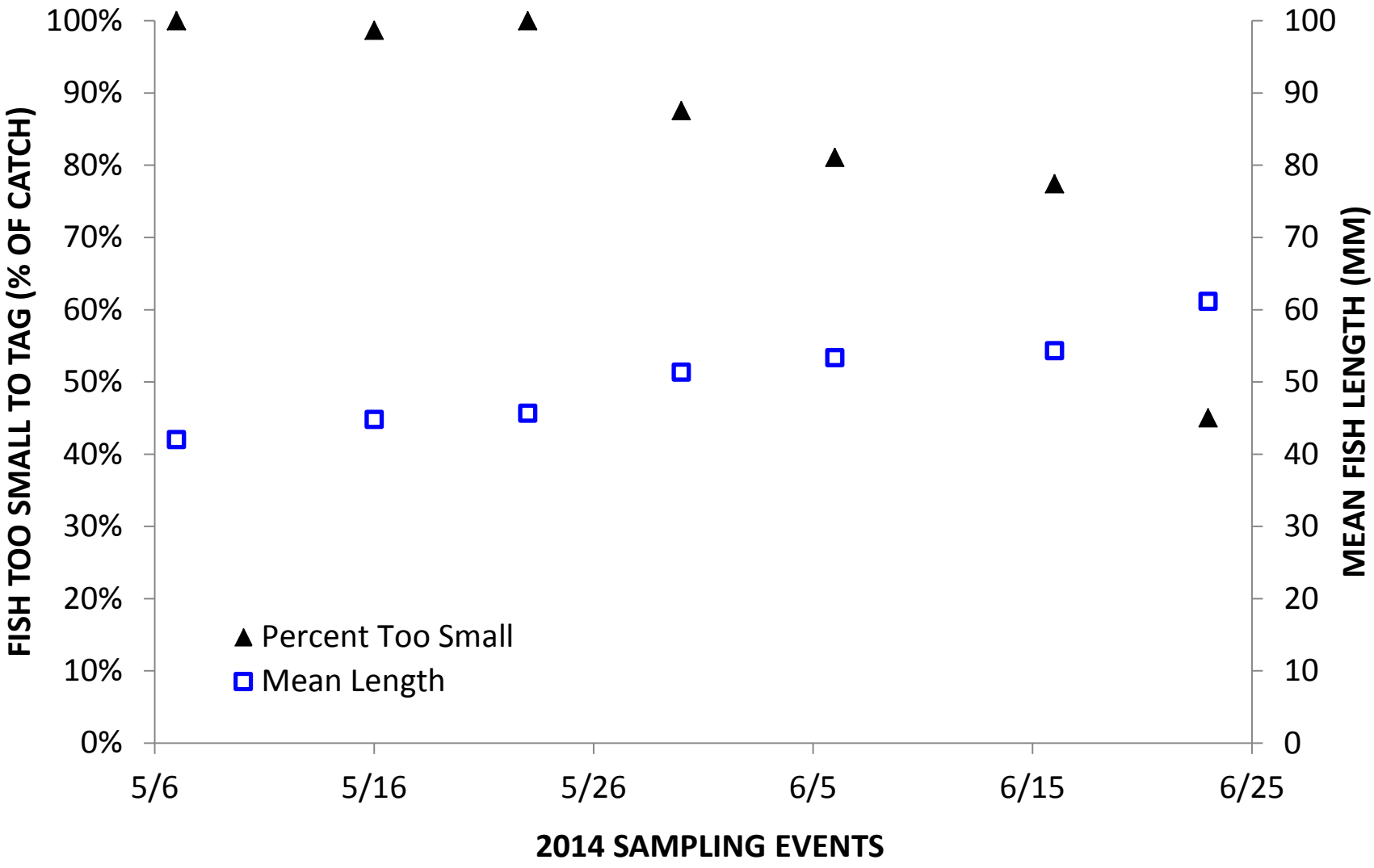
Size Composition 2012



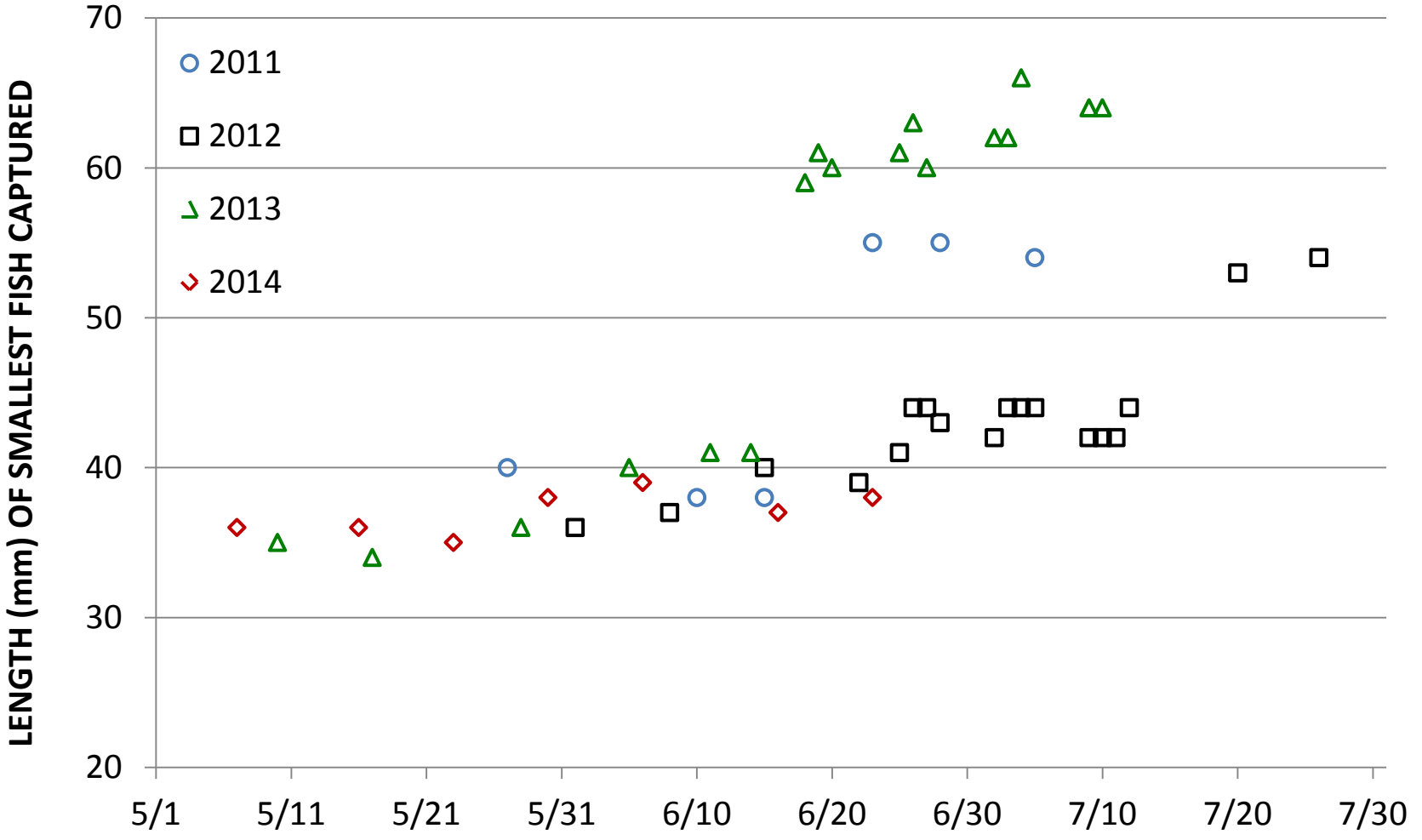
Size Composition 2013



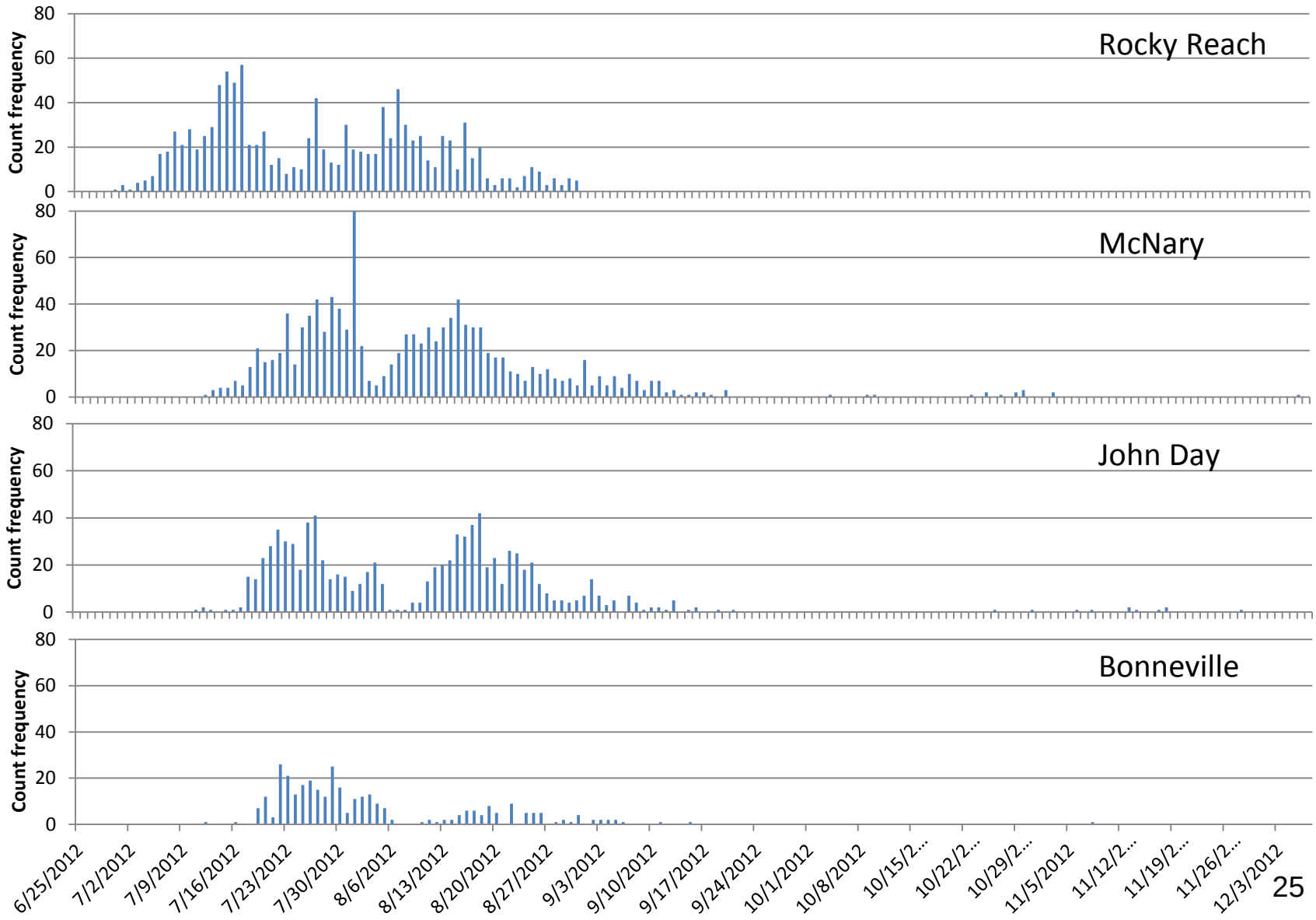
Size Composition 2014



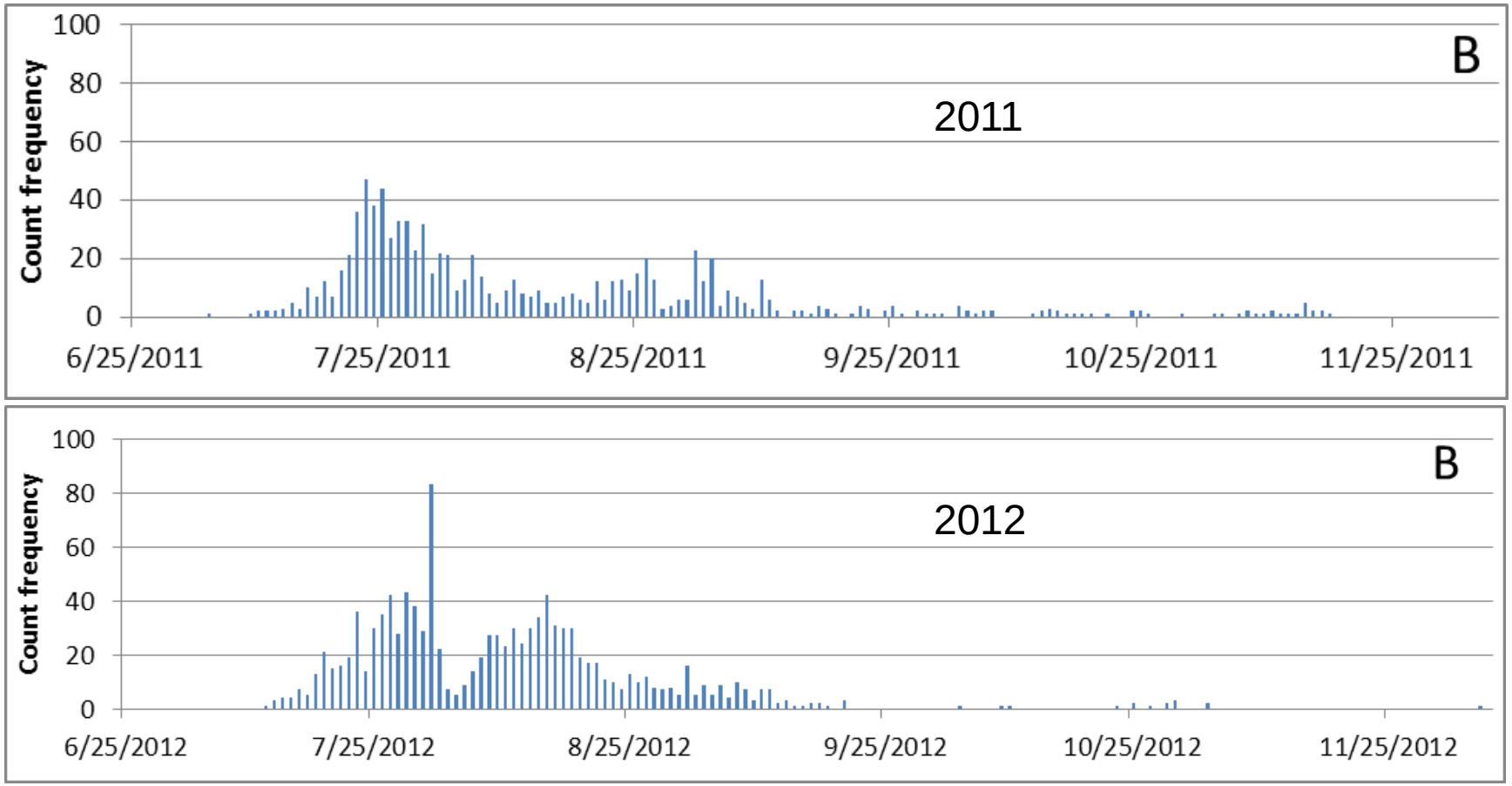
Smallest Fish By Capture Date



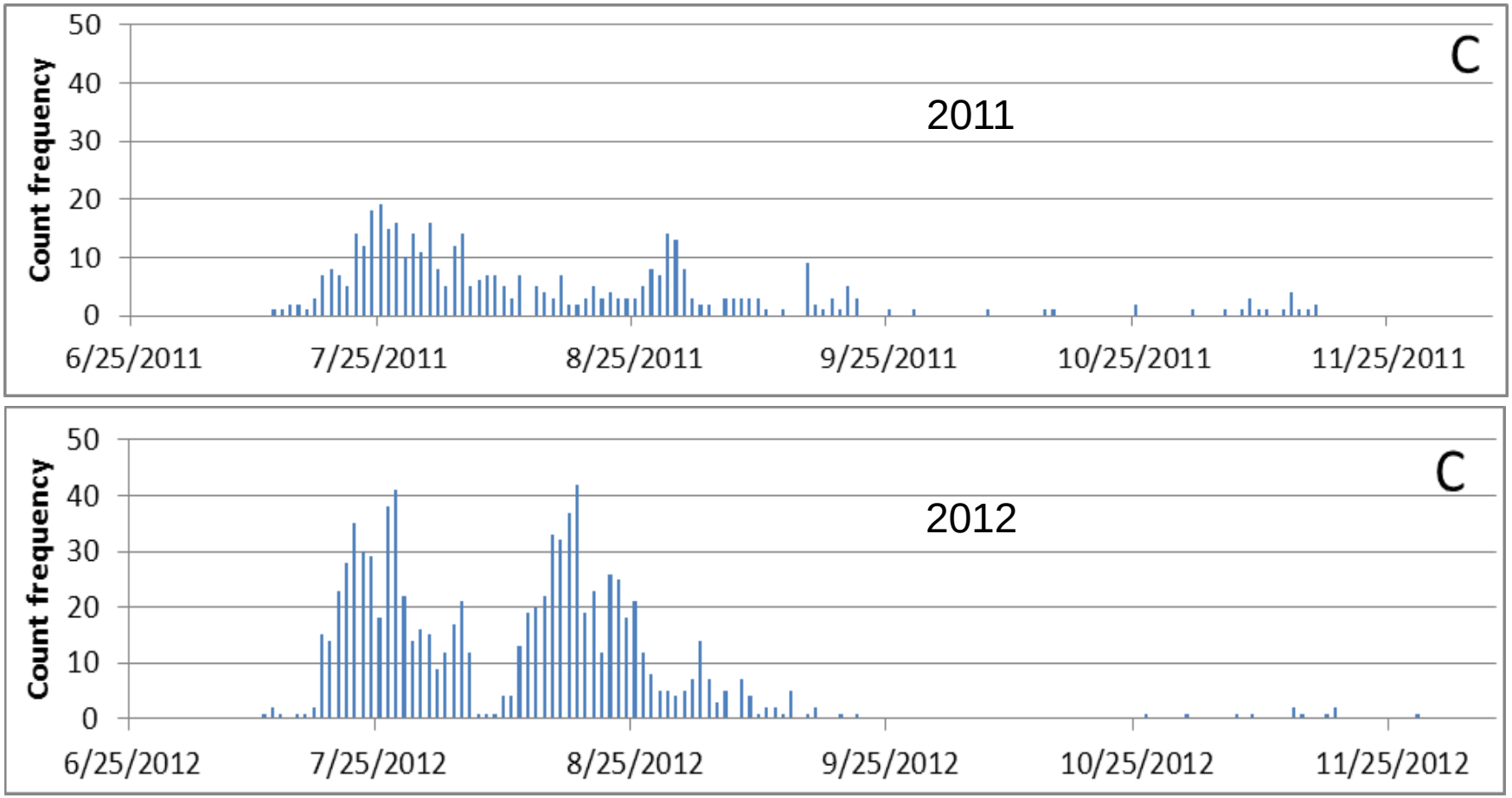
Emigration 2012



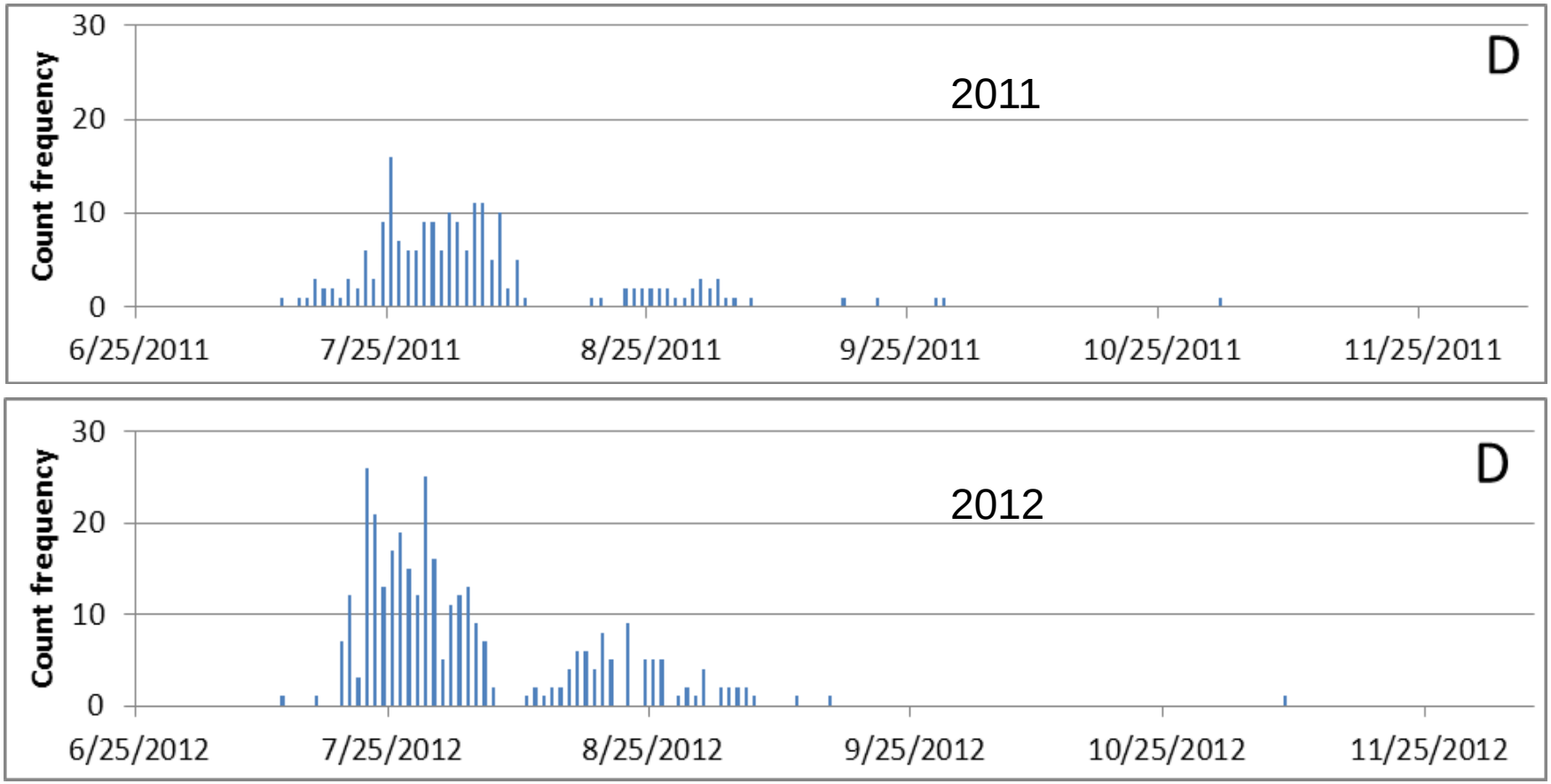
McNary Detections 2011, 2012



John Day Detections 2011, 2012



Bonneville Detections 2011, 2012



Reach-specific Travel Times and Rates

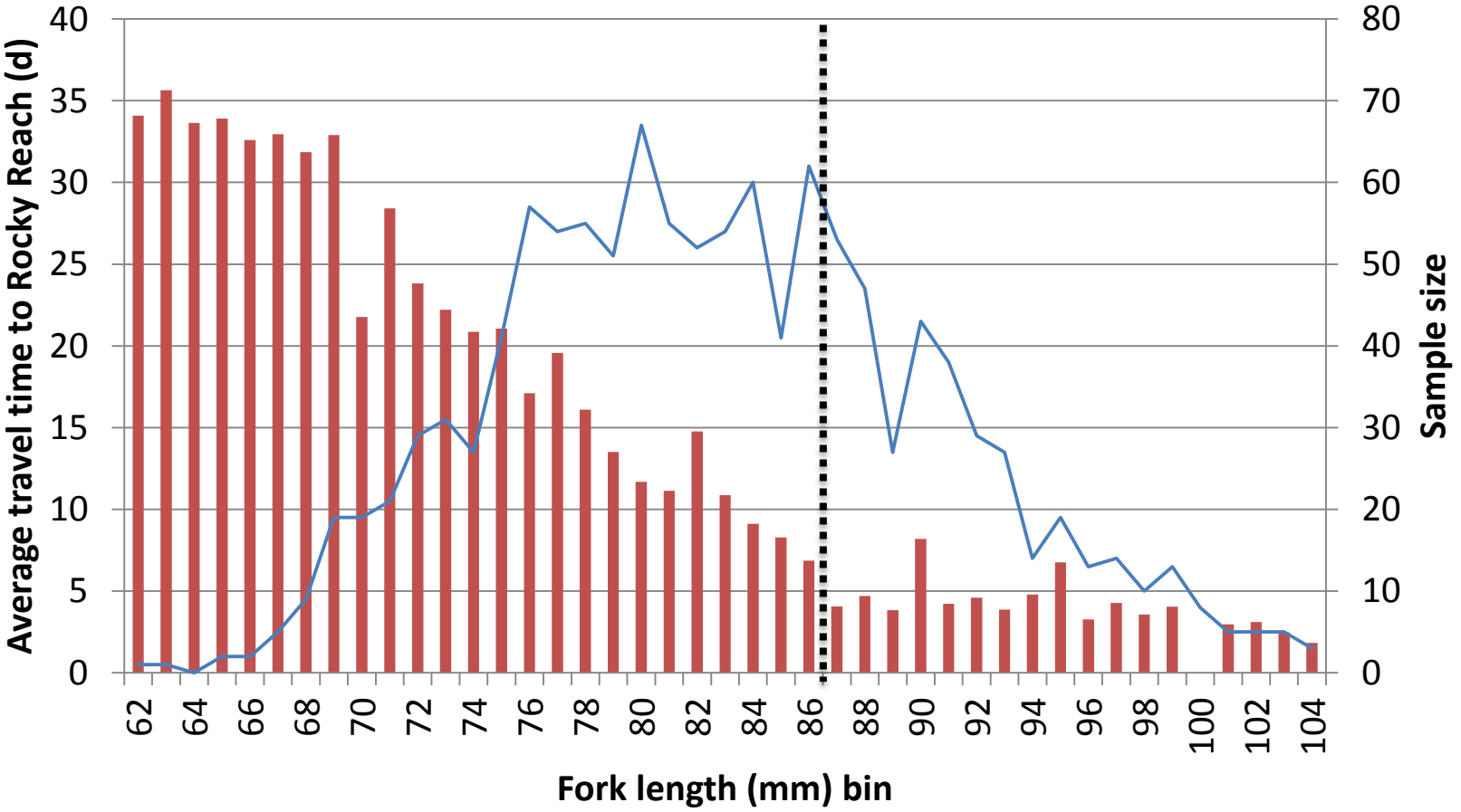
2011

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**19.7** (±0.48; n = 1185)	**4.8**						
RRH (762)			**20.1** (±0.98; n = 188)	**14.5**				
MCN (470)					**7.6** (±0.99; n = 99)	**16.2**		
JDA (347)							**2.5** (±0.29; n = 33)	**44.6**

2012

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**24.8** (±0.44; n = 1083)	**3.8**						
RRH (762)			**15.7** (±1.04; n = 119)	**18.6**				
MCN (470)					**5.0** (±0.51; n = 118)	**24.6**		
JDA (347)							**1.75** (±0.05; n = 47)	**64.0**

Travel Times & Tagging Length - 2011



Different Size Classes - 2011

≥87 mm

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**4.7** (±0.41; n = 121)	**20**						
RRH (762)			**15.78** (±3.08; n = 17)	**18.5**				
MCN (470)					**3.23** (±0.33; n = 6)	**38.1**		
JDA (347)							**1.92** (±0.17; n = 7)	**58.3**

<87 mm

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**21.17** (±0.5; n = 1080)	**4.4**						
RRH (762)			**20.52** (±1.02; n = 173)	**14.2**				
MCN (470)					**7.86** (±1.05; n = 93)	**15.6**		
JDA (347)							**2.67** (±0.37; n = 26)	**41.9**

Different Size Classes - 2012

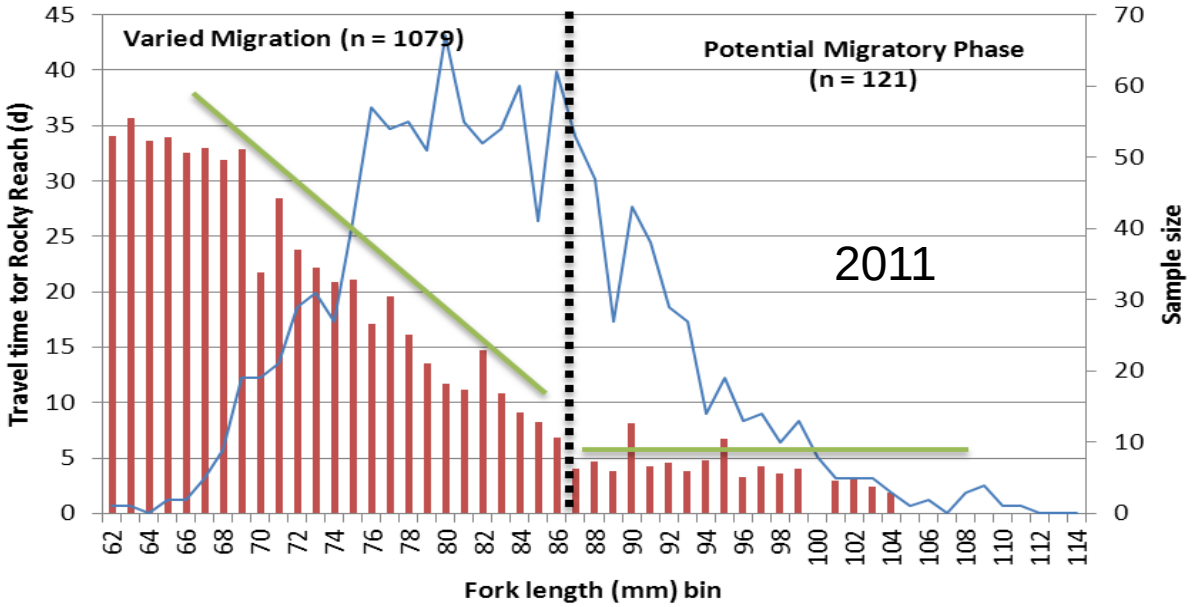
≥87 mm

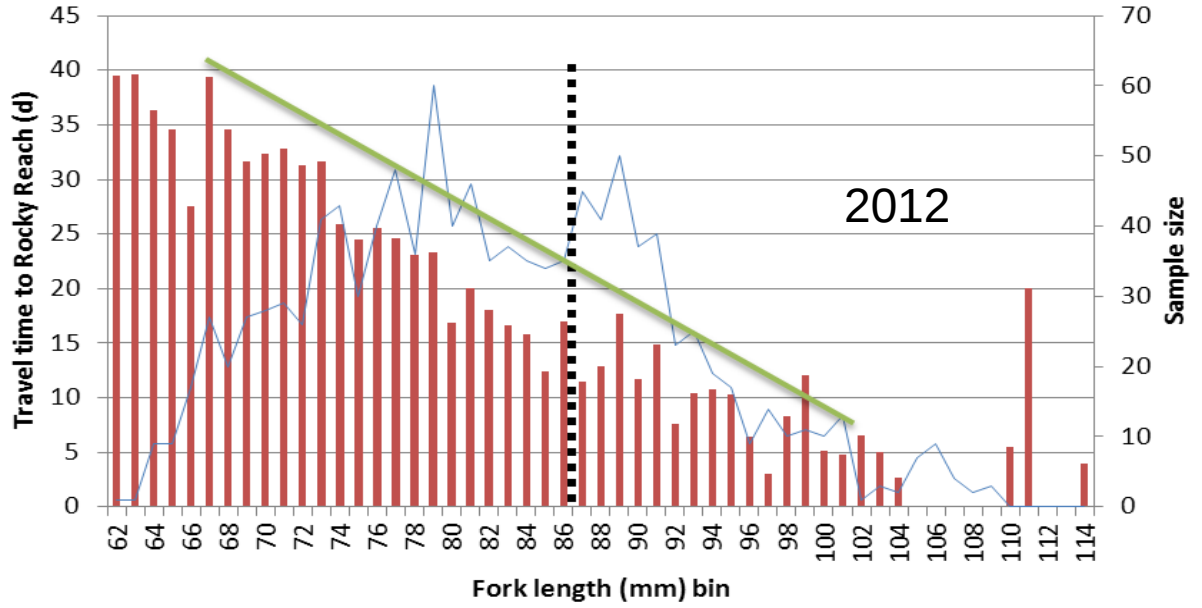
Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**11.05** (±0.7; n = 166)	**8.5**						
RRH (762)			**11.7** (±0.91; n = 15)	**25.0**				
MCN (470)					**3.06** (±0.2; n = 19)	**40.2**		
JDA (347)							**1.54** (±0.06; n = 13)	**72.7**

<87 mm

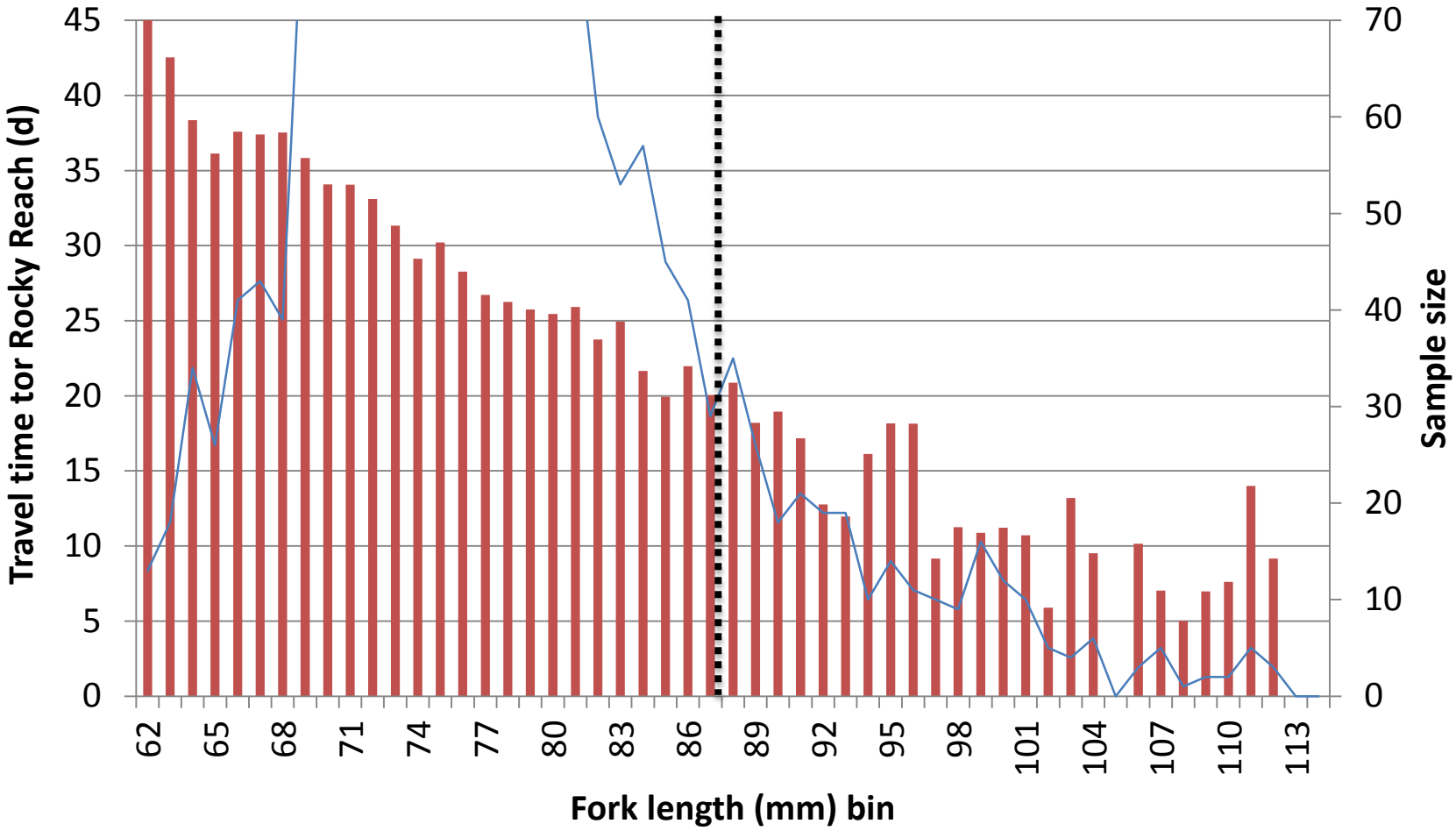
Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**27.24** (±0.46; n = 917)	**3.5**						
RRH (762)			**16.22** (±1.18; n = 104)	**18.0**				
MCN (470)					**5.37** (±0.60; n = 99)	**22.9**		
JDA (347)							**1.82** (±0.07; n = 34)	**61.5**

Relationship Between Length at Tagging and Travel Time to RRJFB

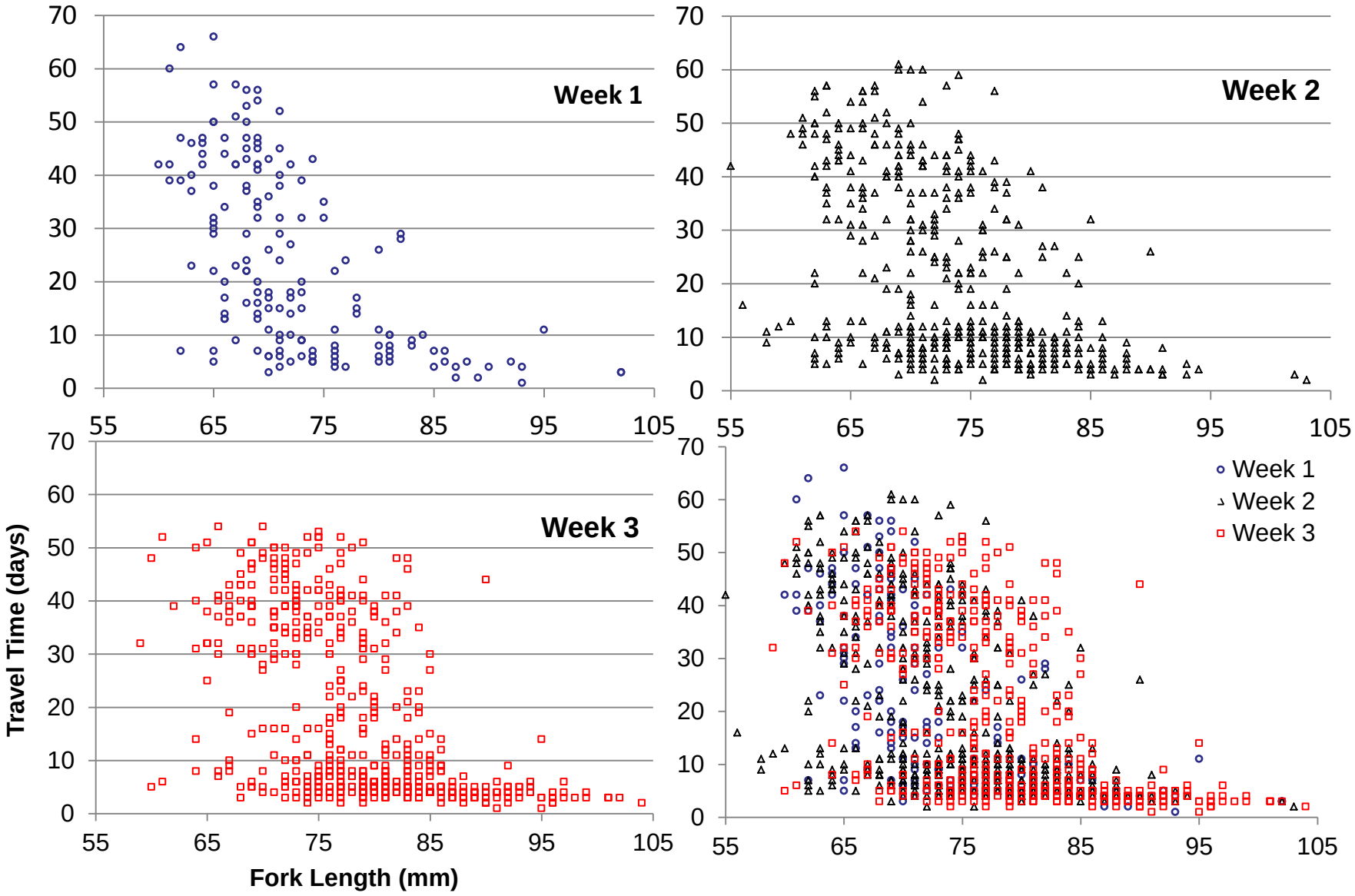




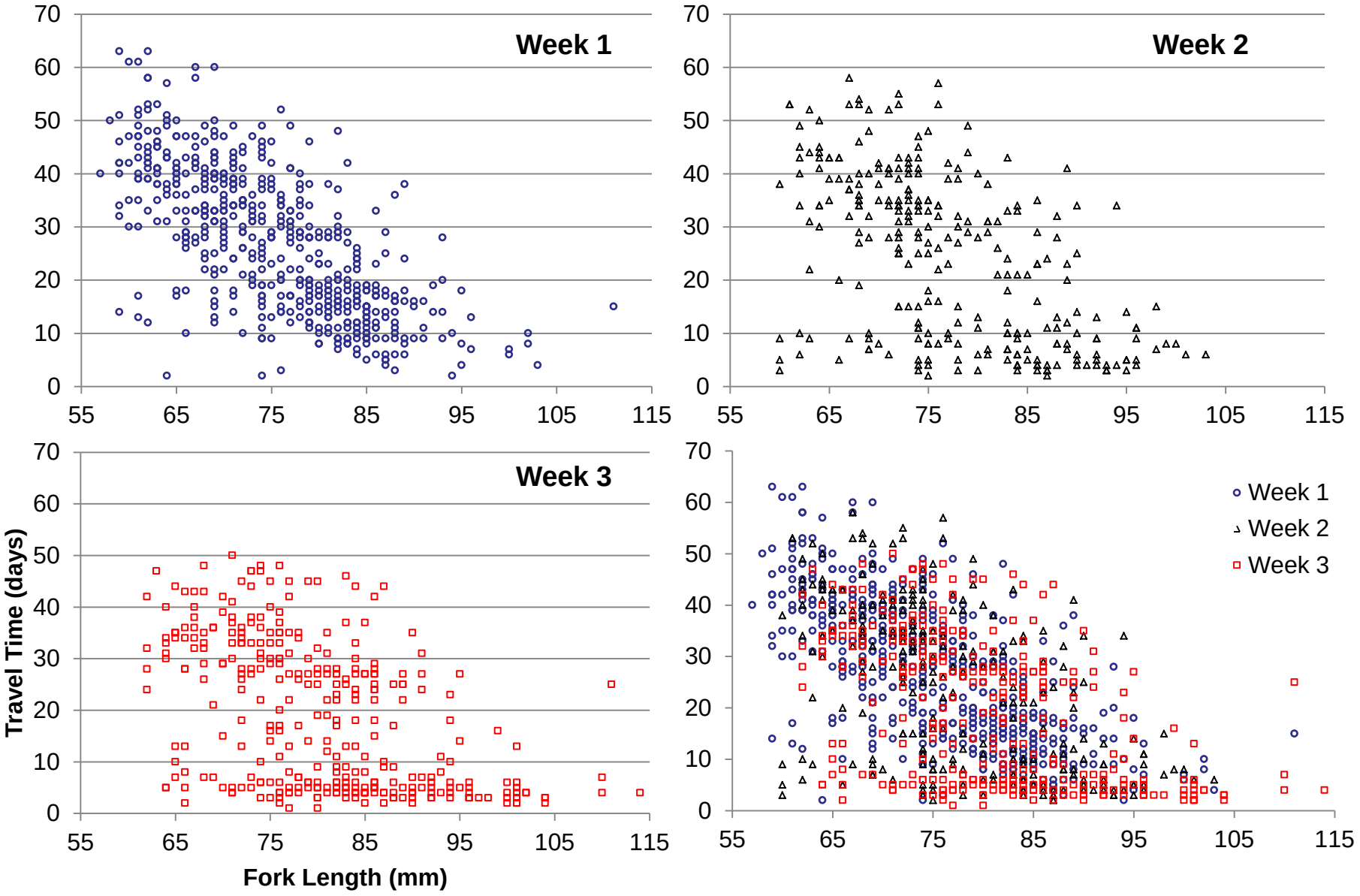
Travel Times & Tagging Length - 2013



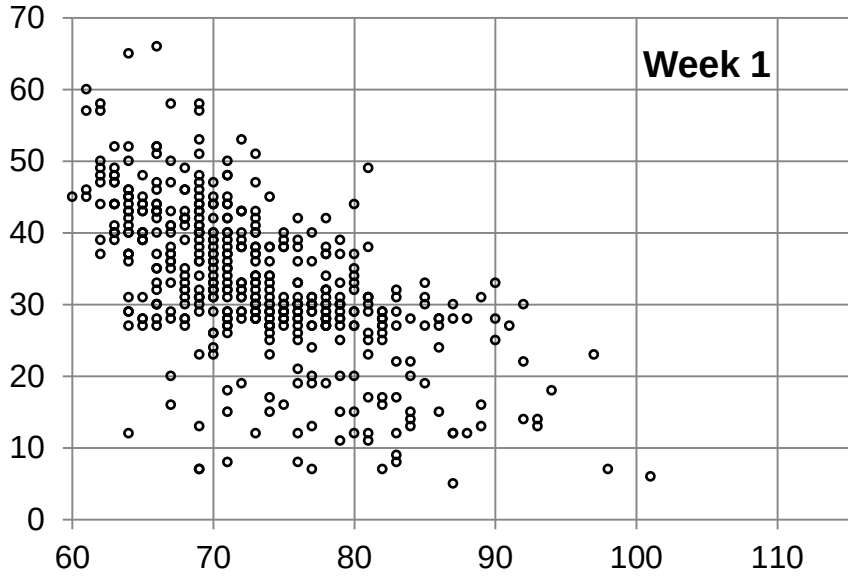
Travel Times & Tagging Length - 2011

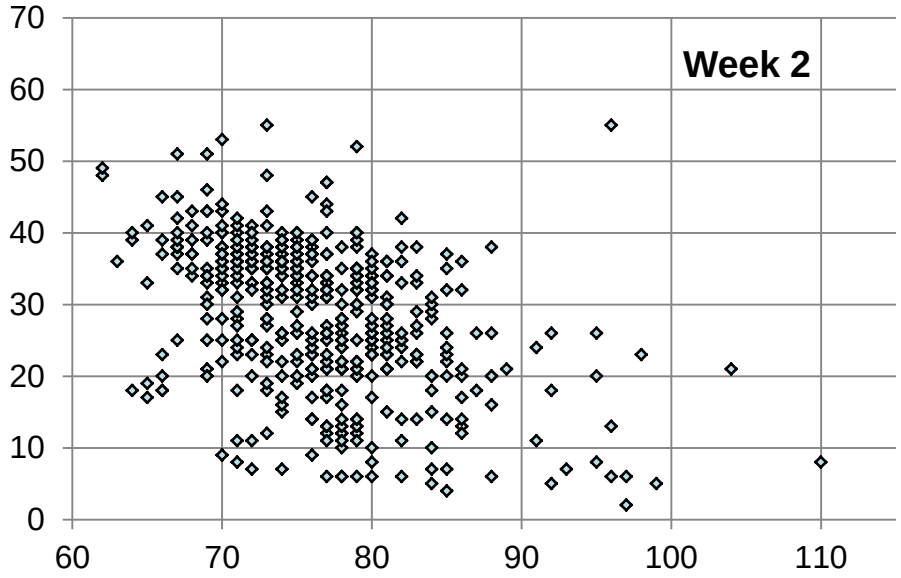


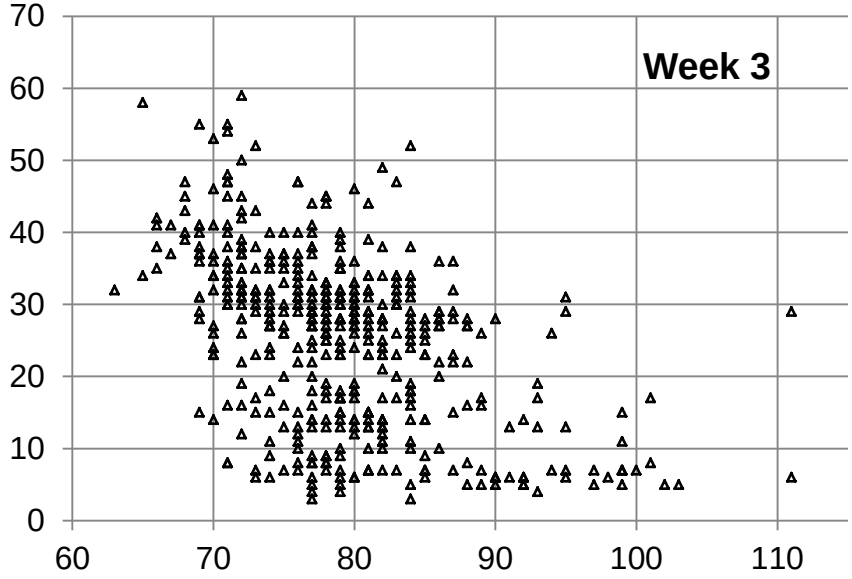
Travel Times & Tagging Length - 2012

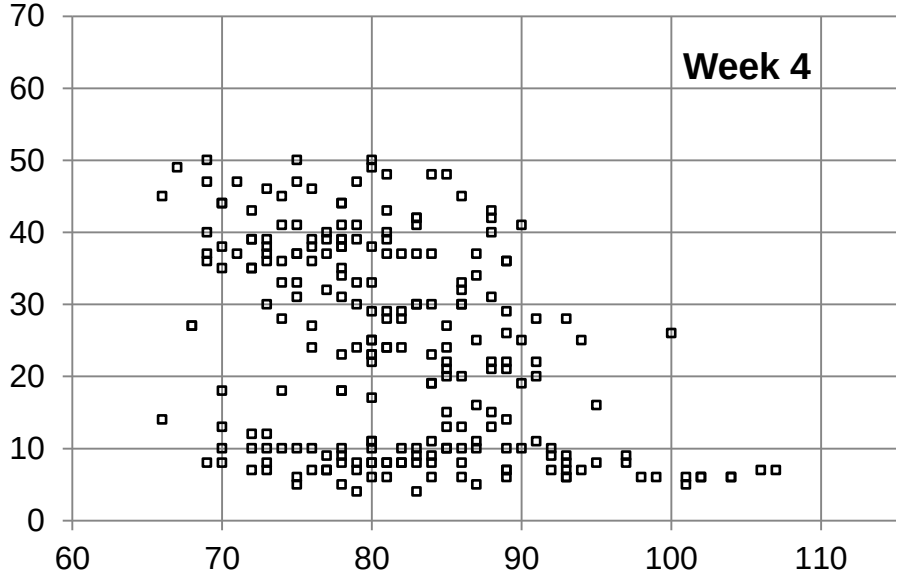


Travel Times & Tagging Length - 2013

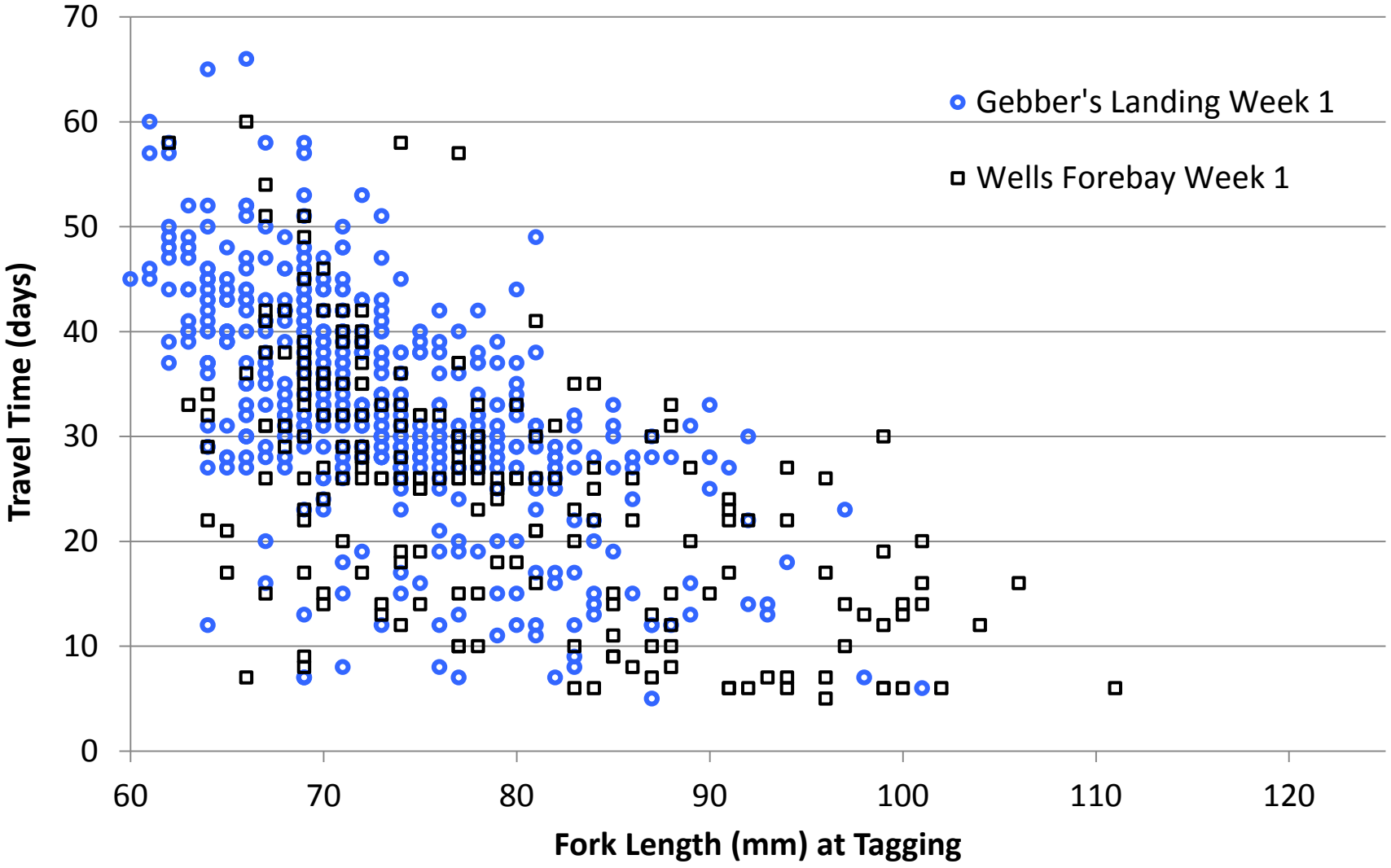




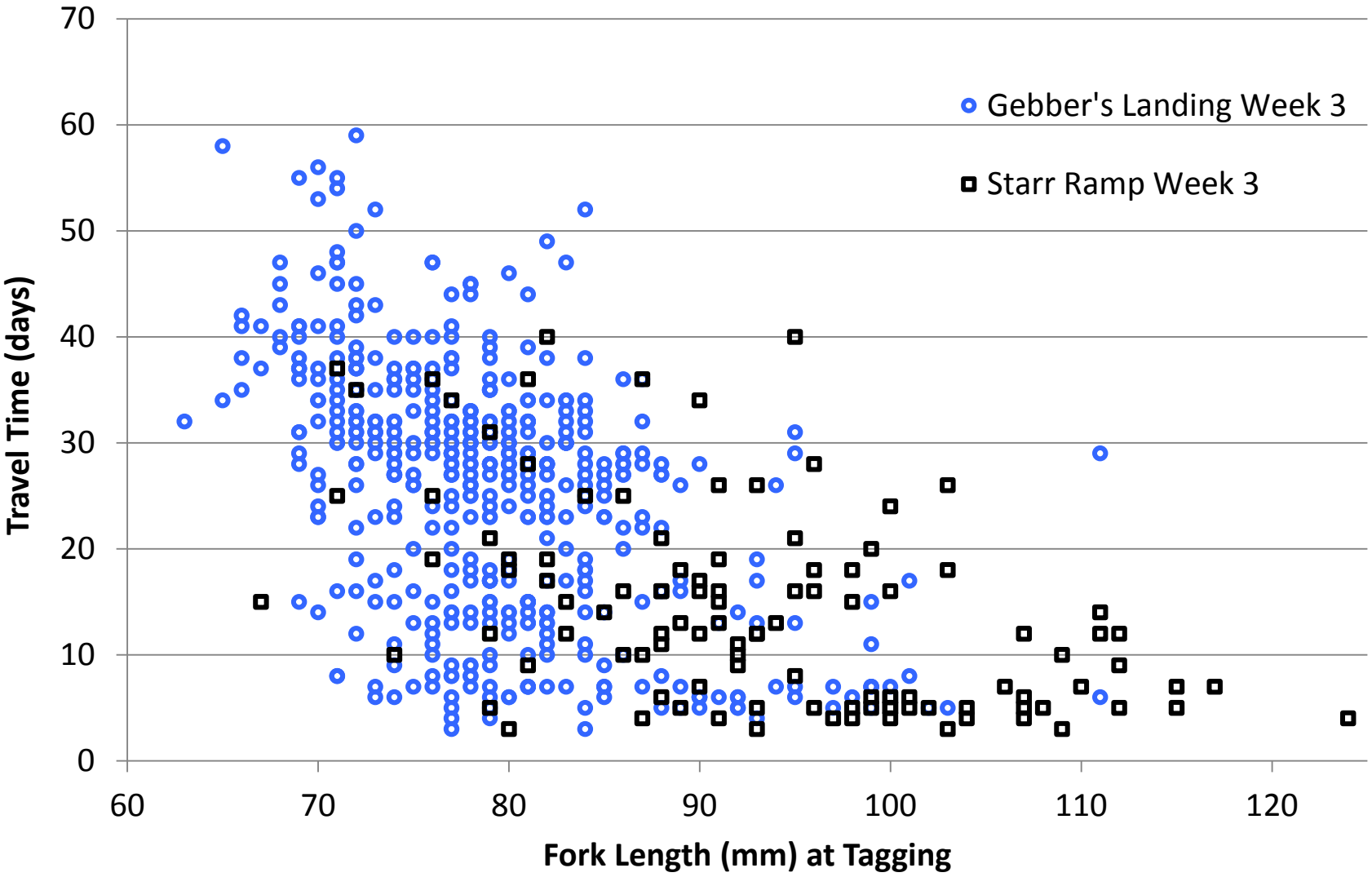




Travel Times & Tagging Length - 2013



Travel Times & Tagging Length - 2013



Comparison of Travel Times to Rocky Reach Dam and Detection Rates for Two Size Classes

2011

Size range (mm)	*Number tagged*	*Number detected*	***% of size class detected at RRD***	***Mean travel time to RRD (days)***	*Std Dev*
<87	12192	1079	**8.9%**	**21.2**	16.6
≥87	1028	121	**11.8%**	**4.7**	4.5

2012

Size range (mm)	*Number tagged*	*Number detected*	***% of size class detected at RRD***	***Mean travel time to RRD (days)***	*Std Dev*
<87	16710	966	**5.8%**	**27.2**	14.1
≥87	2877	187	**6.5%**	**11.5**	8.9

Proportion of Tagged Fish Detected at any Downstream Project During Bypass Operations

2011

Size range (mm)	*Number tagged*	*Number detected*	***Proportion detected (%)***
<87	12192	2046	**16.8**
≥87	1028	271	**26.4**

2012

Size range (mm)	*Number tagged*	*Number detected*	***Proportion detected (%)***
<87	16970	2474	**14.6**
≥87	2877	621	**21.6**

Conclusions

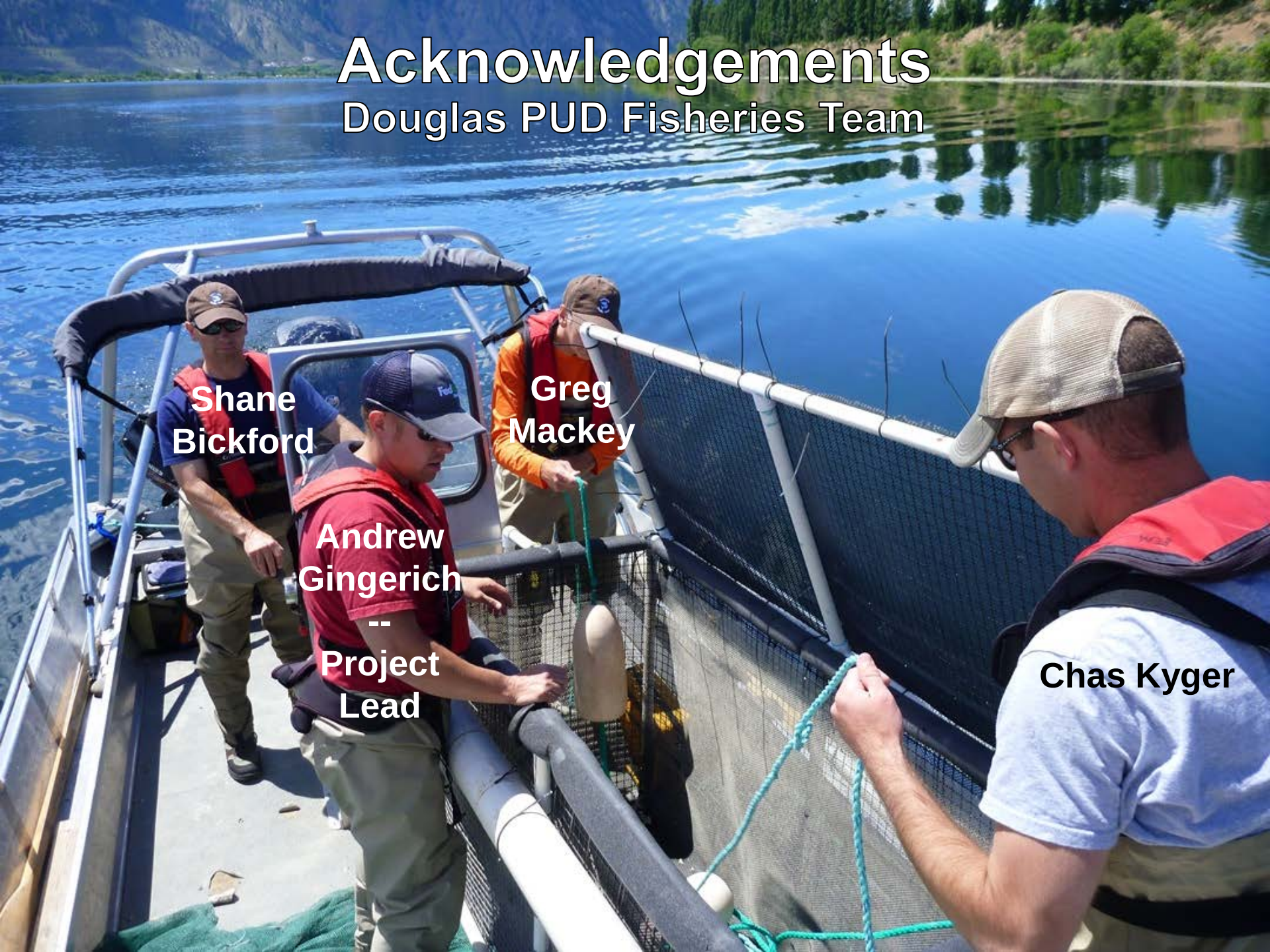
- Subyearling Chinook are abundant and available to beach seining from early May through early July, but are increasingly difficult to capture with this technique from mid-July on.
- Nearly all subyearlings are too small to PIT tag in May, and nearly all are large enough to tag by the end of July—if you can still catch them!
- Seining captures Chinook <40 mm even into late June, and <45 mm even the third week of July
- Subyearlings exhibit a continuum of migration timing, with passage at downstream projects occurring from spring until termination of bypass operations in mid-November—few detected as yearlings
- Generally, larger fish had faster mean travel times to Rocky Reach over all three years

Conclusions Continued

- Examination of travel rates and fish size reveals complex patterns that appear to indicate two classes of fish: emigrants encompassing the full size range of detected individuals; and a rearing class generally comprising the smaller two-thirds of detected fish
- The distinction between these two classes varies between years and within sampling periods in each year
- The proportions of detected individuals differs by size class, and may differ by capture location and fish origin
- We were unable to tag a representative sample of the run at large
- We failed to identify a size threshold that distinguished active migrants from rearing individuals
- We have more questions than answers

Acknowledgements

Douglas PUD Fisheries Team



Acknowledgements – Continued:

Douglas PUD: Dick Weinstein, Wayne Marsh, Scott Kreiter, Jim McGee, Mary Mayo, Beau Patterson, and the late Darrin Sexton

Biomark, Inc: Ryan Richmond – Biological Project Lead, Scott McCutcheon, Dave Thompson, Heath Hopkins, Phillip Vincent, Jerry Moore, Mike Zobott, Jerek Richardson, Ana Gabica, and Trevor Sato

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Questions?