Using the Juvenile Salmon Acoustic Telemetry (JSATS) system to evaluate adult Pacific lamprey movements and fate in Columbia River reservoirs, 2011-2014.

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Department of Fish and Wildlife Resources
University of Idaho

US Army Corps of Engineers®

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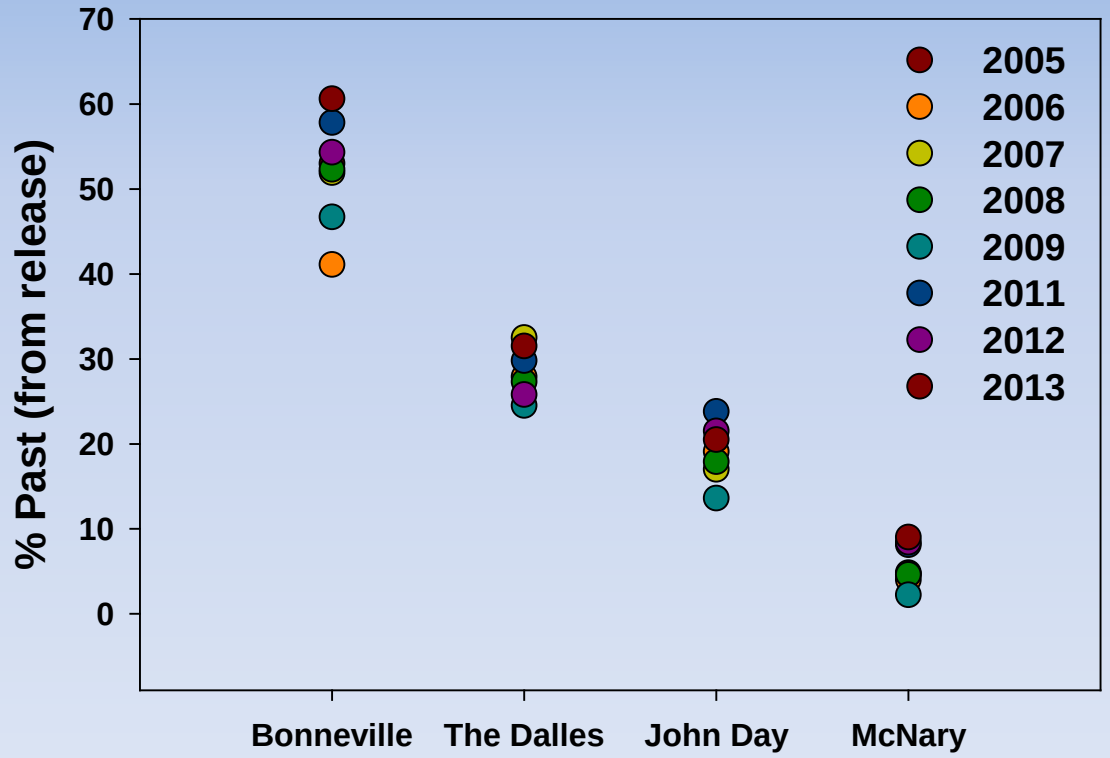
Adult lamprey reach escapement (HD-PIT)

- 39-59% of HD-PIT tagged adults released below Bonneville Dam did not pass (2005-2013)
- Above Bonneville Dam, 58% of adults did not pass The Dalles (2008 RT, year with best telemetry monitoring)
- **Fate of unaccounted lampreys?**



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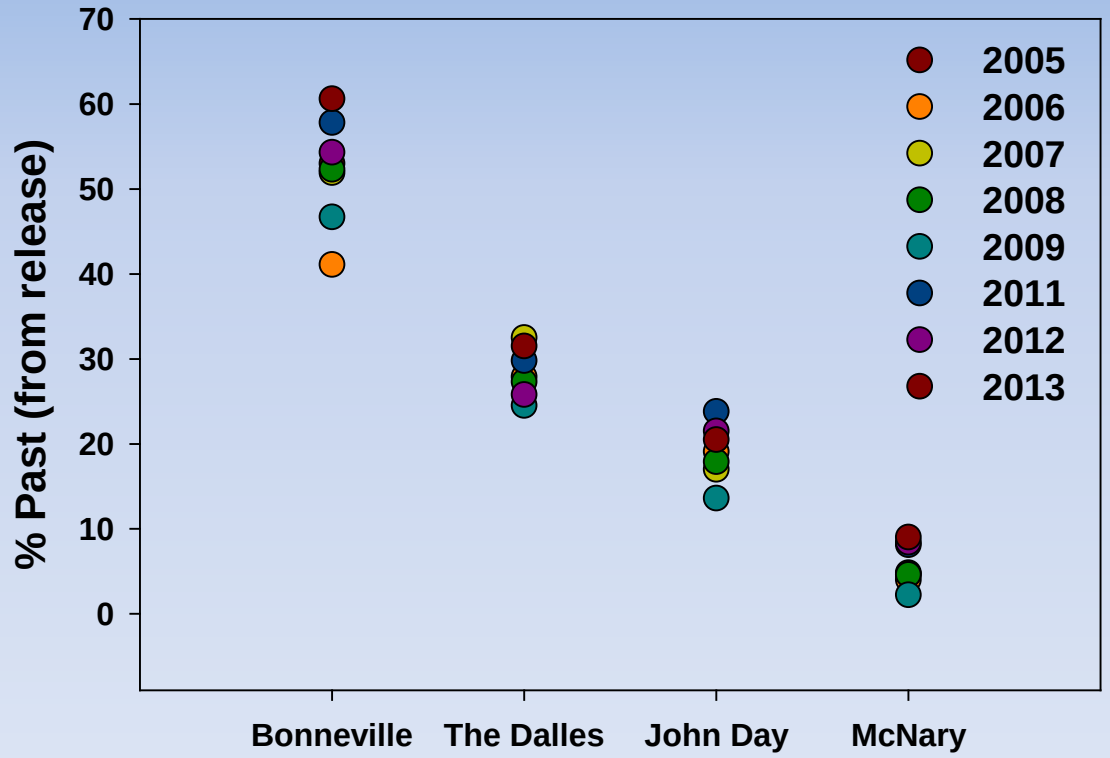
Adult lamprey reach escapement (HD-PIT)

- Mortality?
- Tailrace spawning?
- Unmonitored tributaries?
- Overwintering in mainstem followed by tributary entry in spring?
- Monitor with JSATS technology:
  - suitable for deep water
  - longer tag life
  - no external antenna



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Objectives

- Monitor behavior and determine fate of adult Pacific lamprey above Bonneville Dam
  - Reservoir behavior
  - Distribution and fate
  - Tributary entry
- Monitor behavior and determine fate of adult Pacific lamprey below Bonneville Dam
  - Fate after release
  - Downstream movements?
- Conduct multiyear analysis

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Lamprey Tagging

- Lamprey captured WA shore fish ladder
- Weight, length, and girth
- Surgically implanted JSATS tag and Half Duplex (HDX) PIT

JSATS tag 23 x 8 x 4 mm
Tag life = 400 days @ 10 sec
1.7 g Tag burden ~ 0.4%

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JSATS Monitoring

- Acoustic Receiver (aka “Node”) and hydrophone
- Acoustic Release
- ~ 35 day deployment duration

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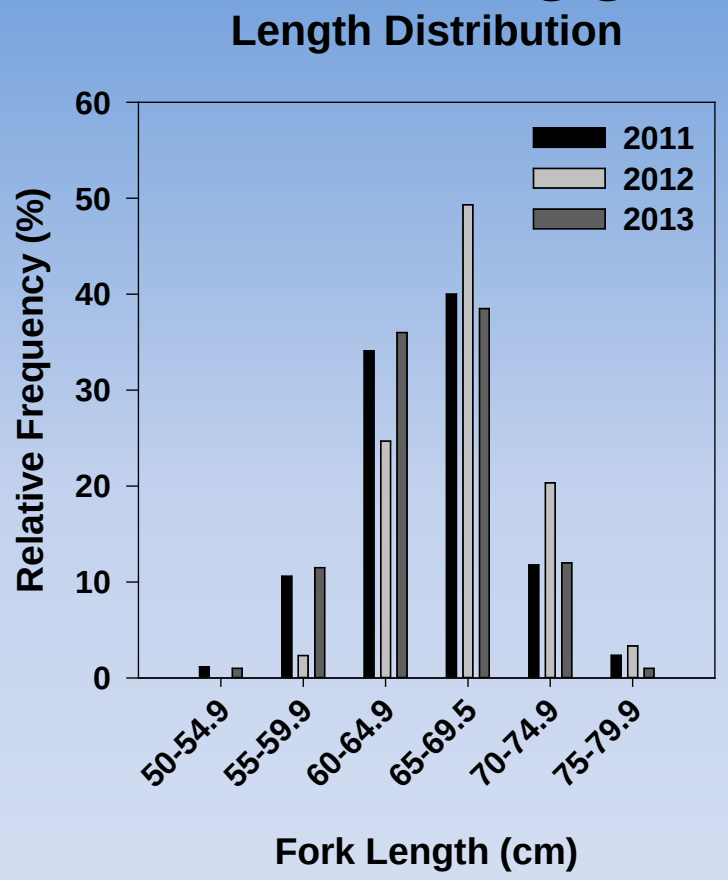
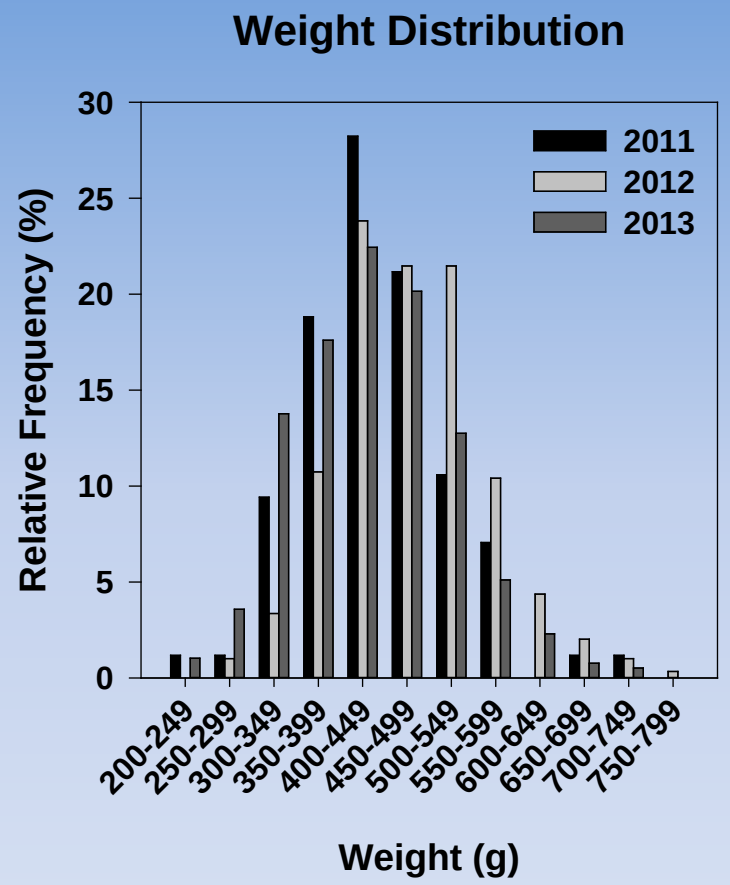
Tagging Results





2013 mean weight = 433 g
2012 mean weight = 479 g
2011 mean weight = 438 g

2013 mean length = 64.8 cm
2012 mean length = 67.0 cm
2011 mean length = 65.0 cm

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Release Sites

JSATS Monitoring - 2011

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JSATS Monitoring - 2012

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JSATS Monitoring - 2013

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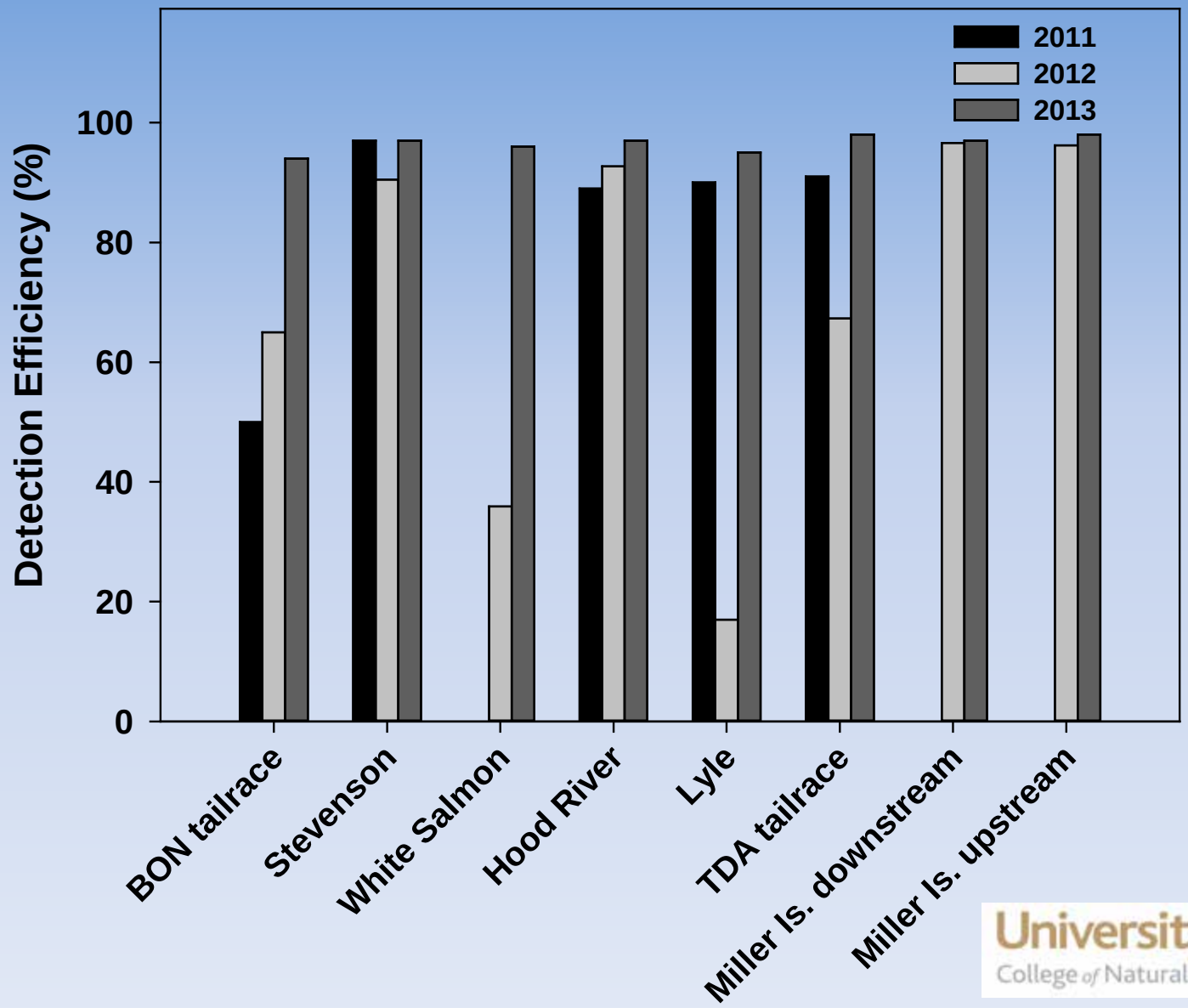
Detection Efficiency



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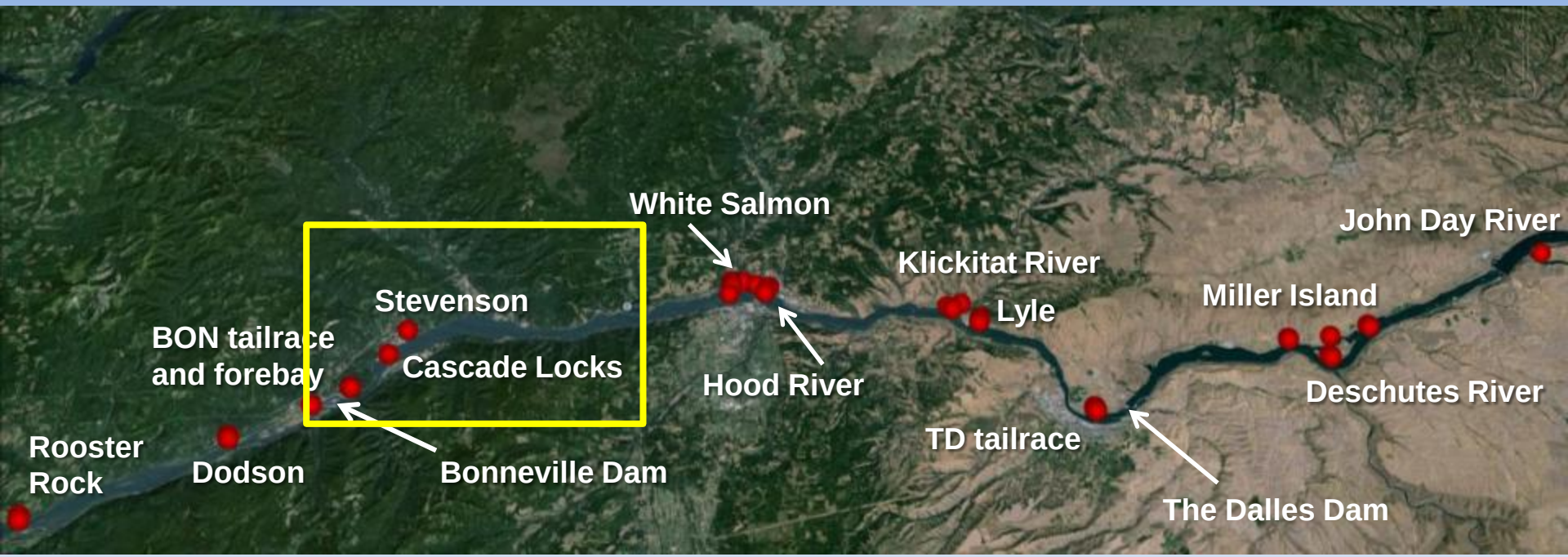

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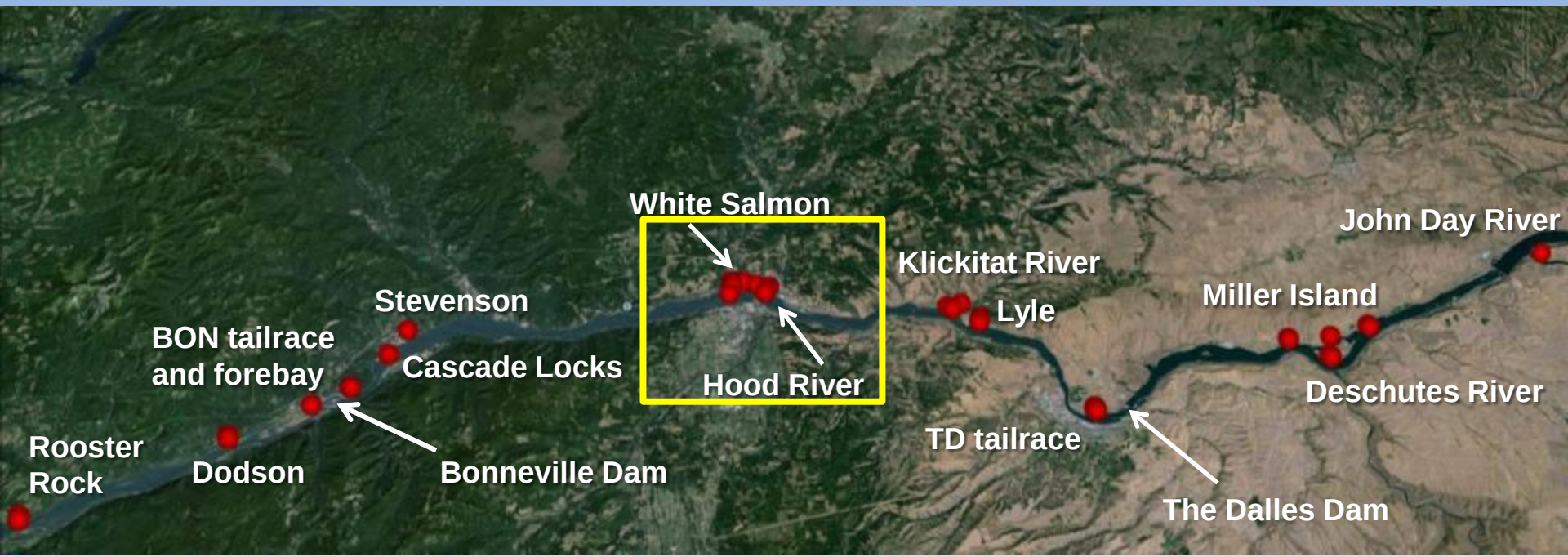

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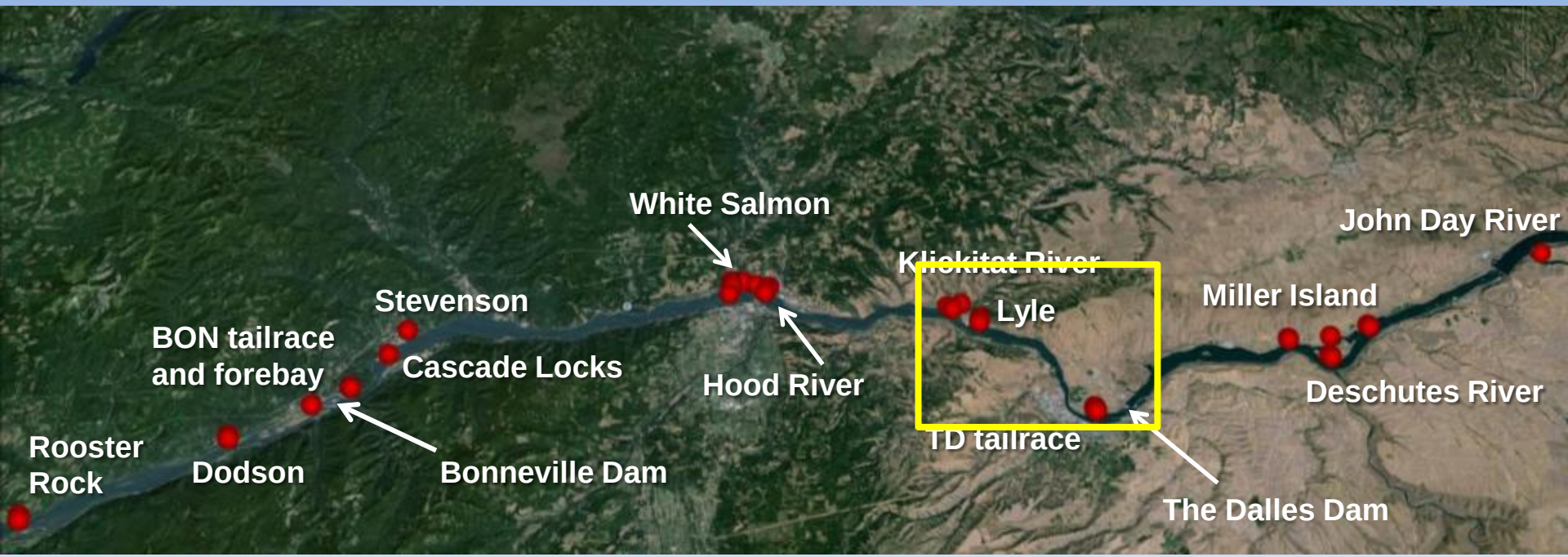

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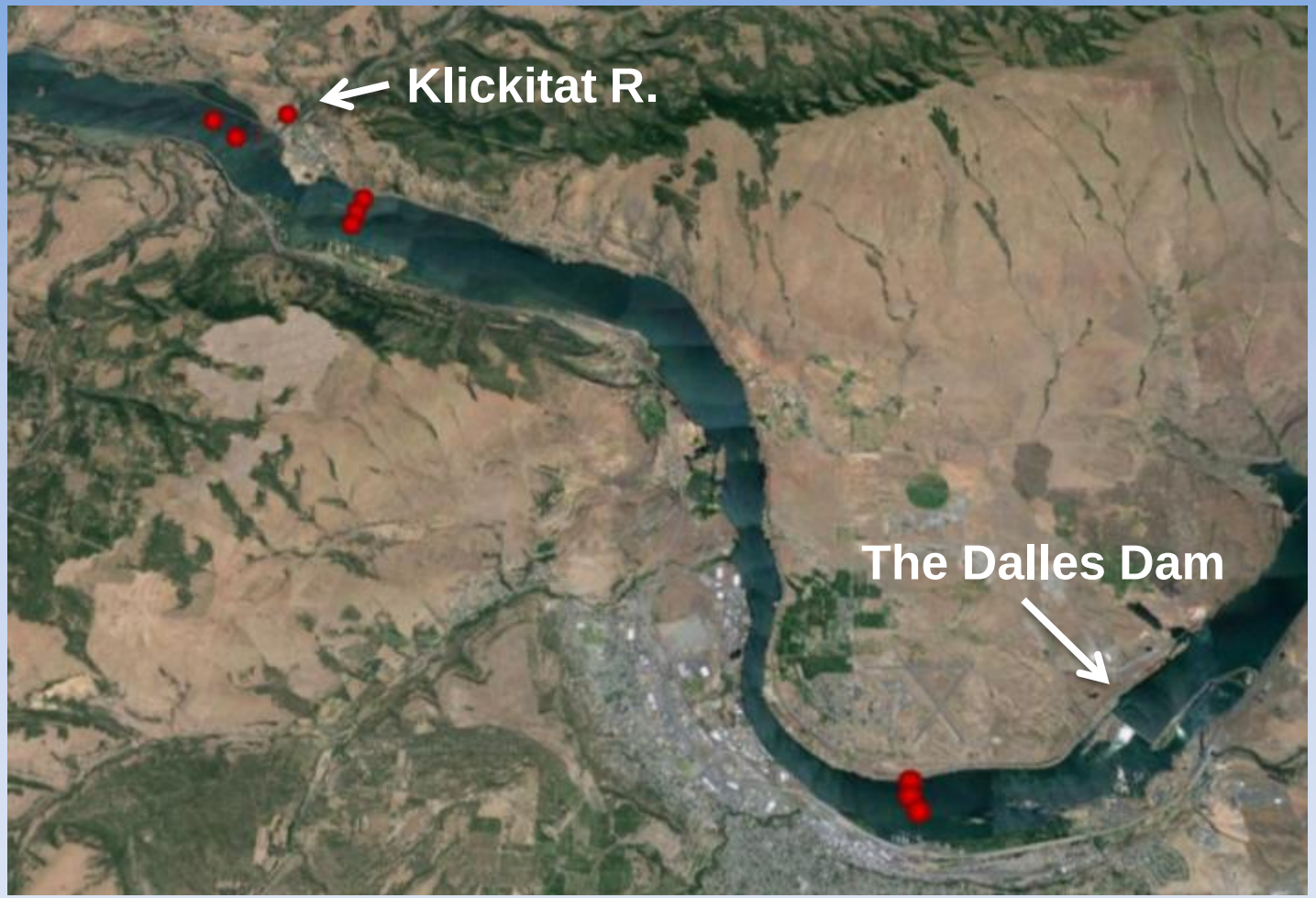

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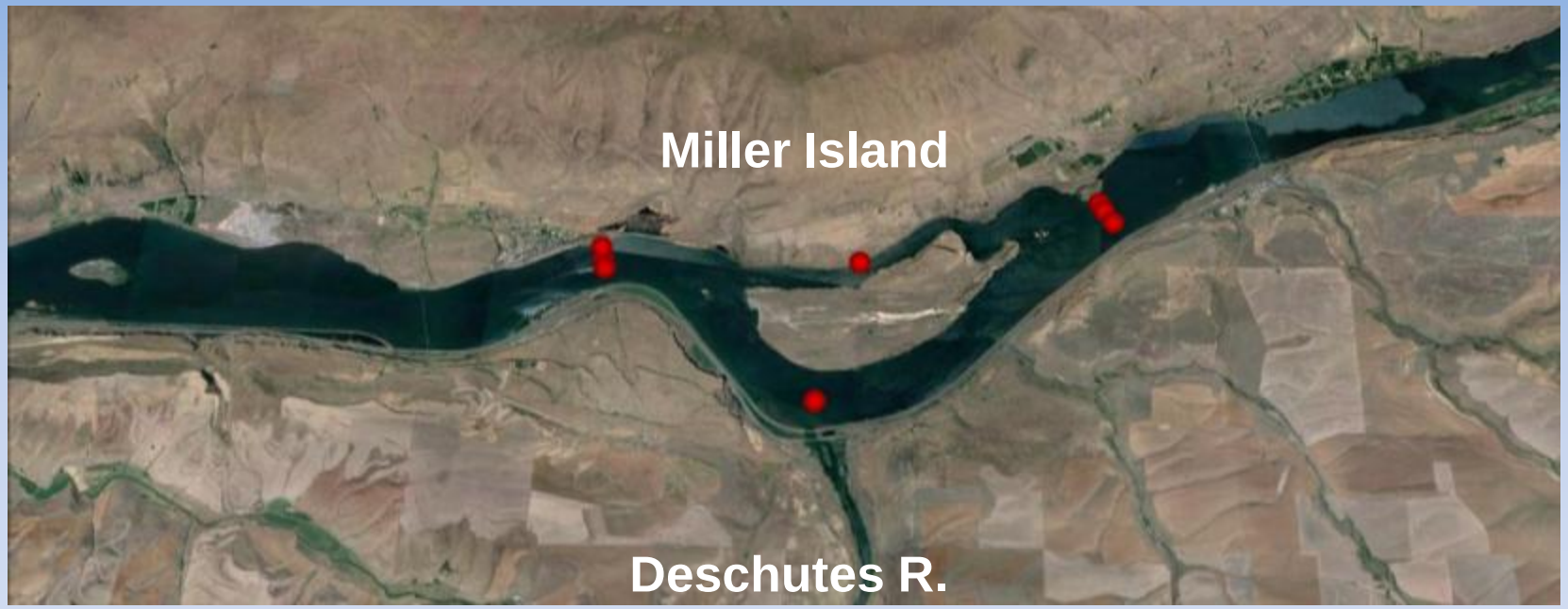

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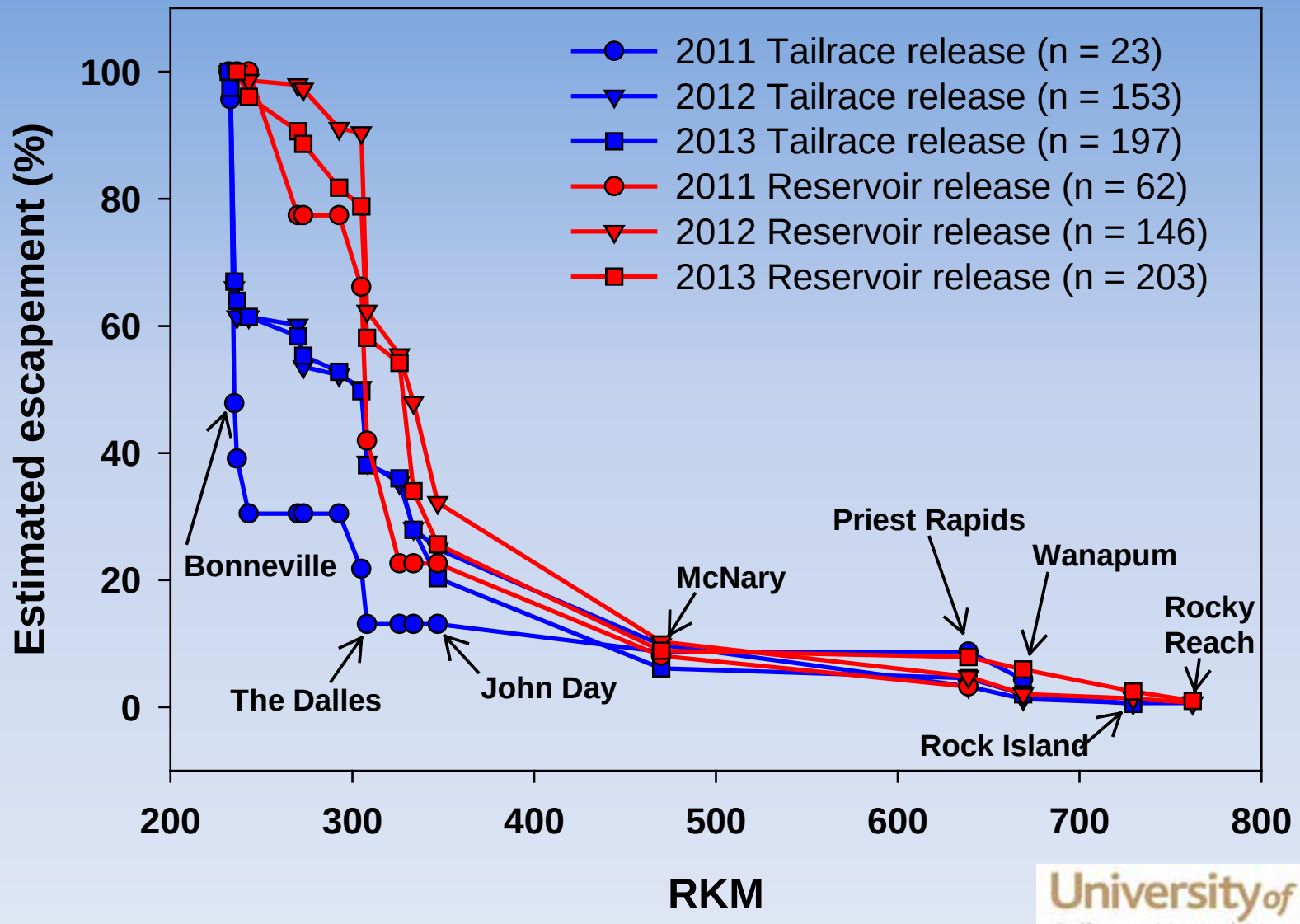
Escapement Estimates



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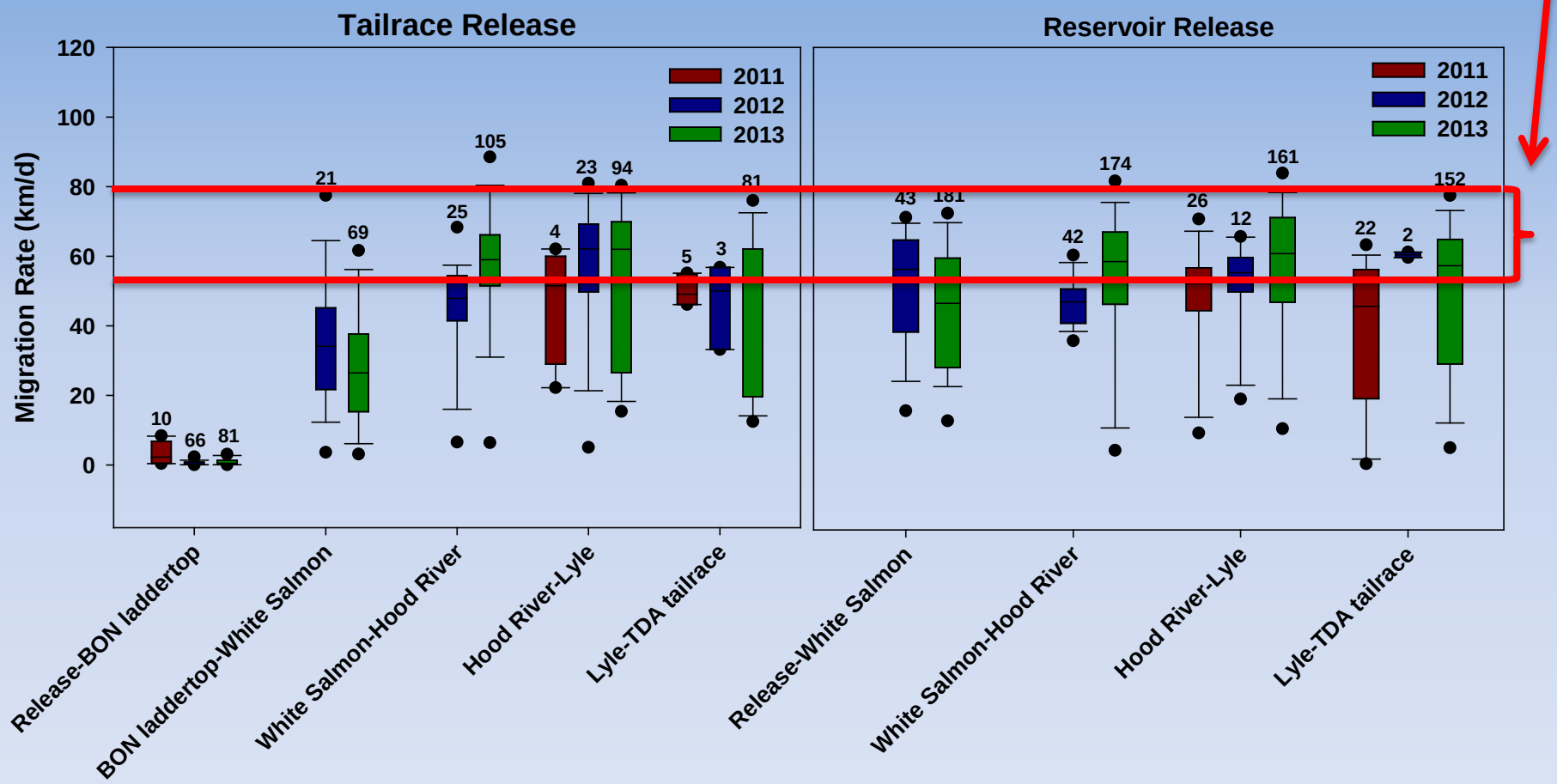
Migration Rates

Summer Chinook migration rates in Bonneville Reservoir (54 – 79 km/d)



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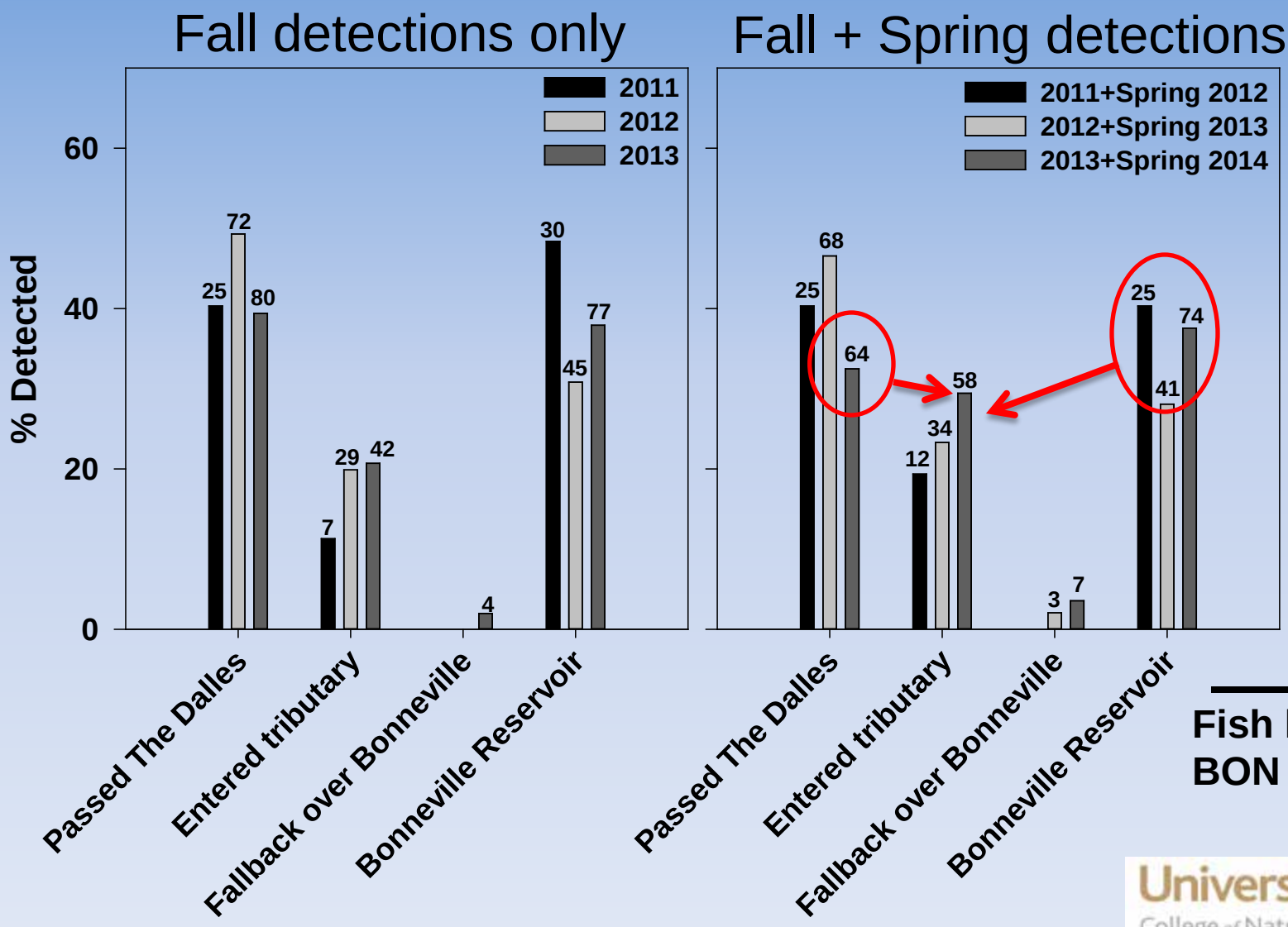
Final Fates – Reservoir Release



2011 – 17%
2012 – 9%
2013 – 4%

Fish last detected in BON reservoir in Fall entering trib in Spring

Fish last detected in BON reservoir in Fall

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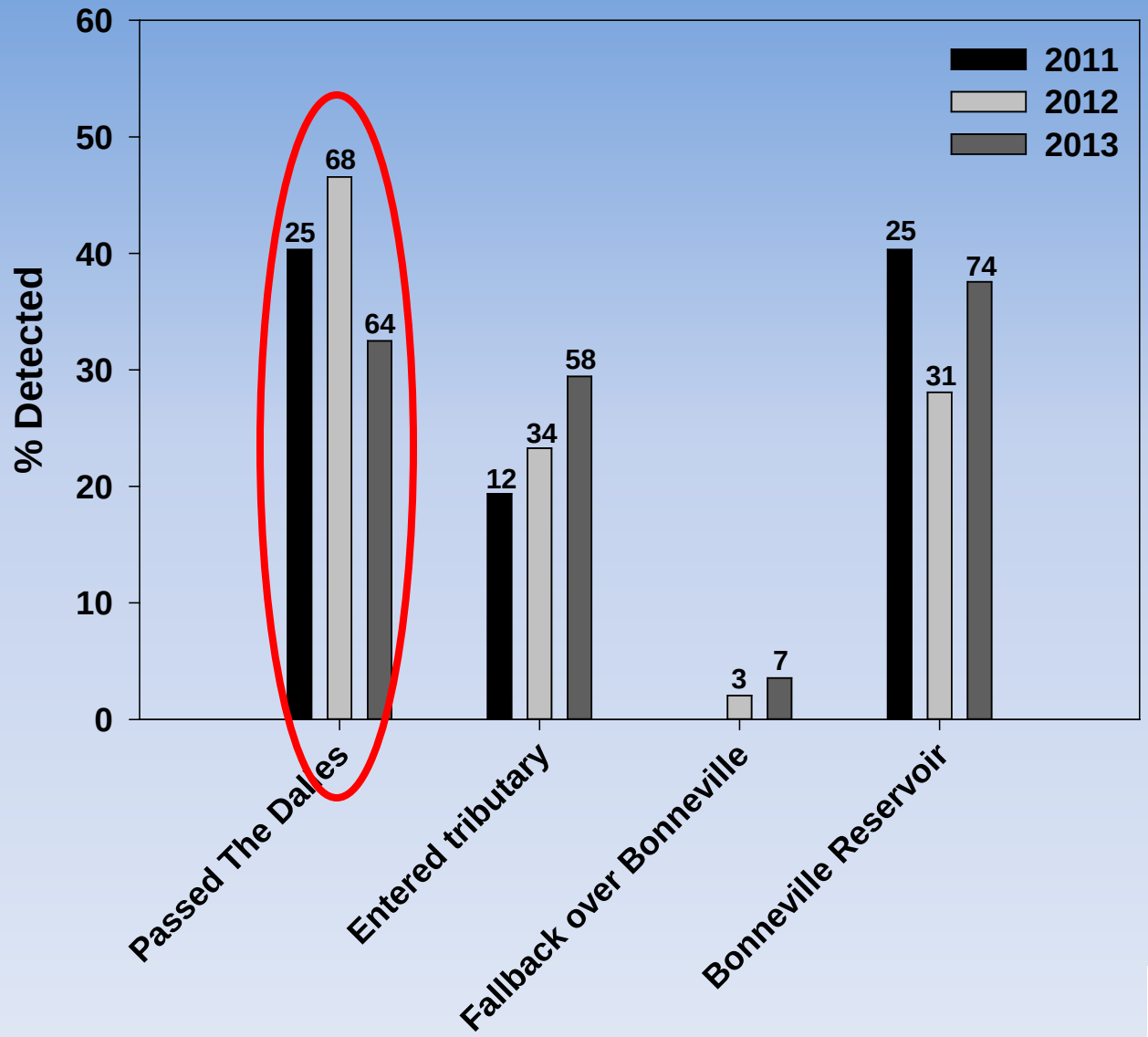
Final Fates – Reservoir Release



Fish last detected past TDA

All Reservoir released fish

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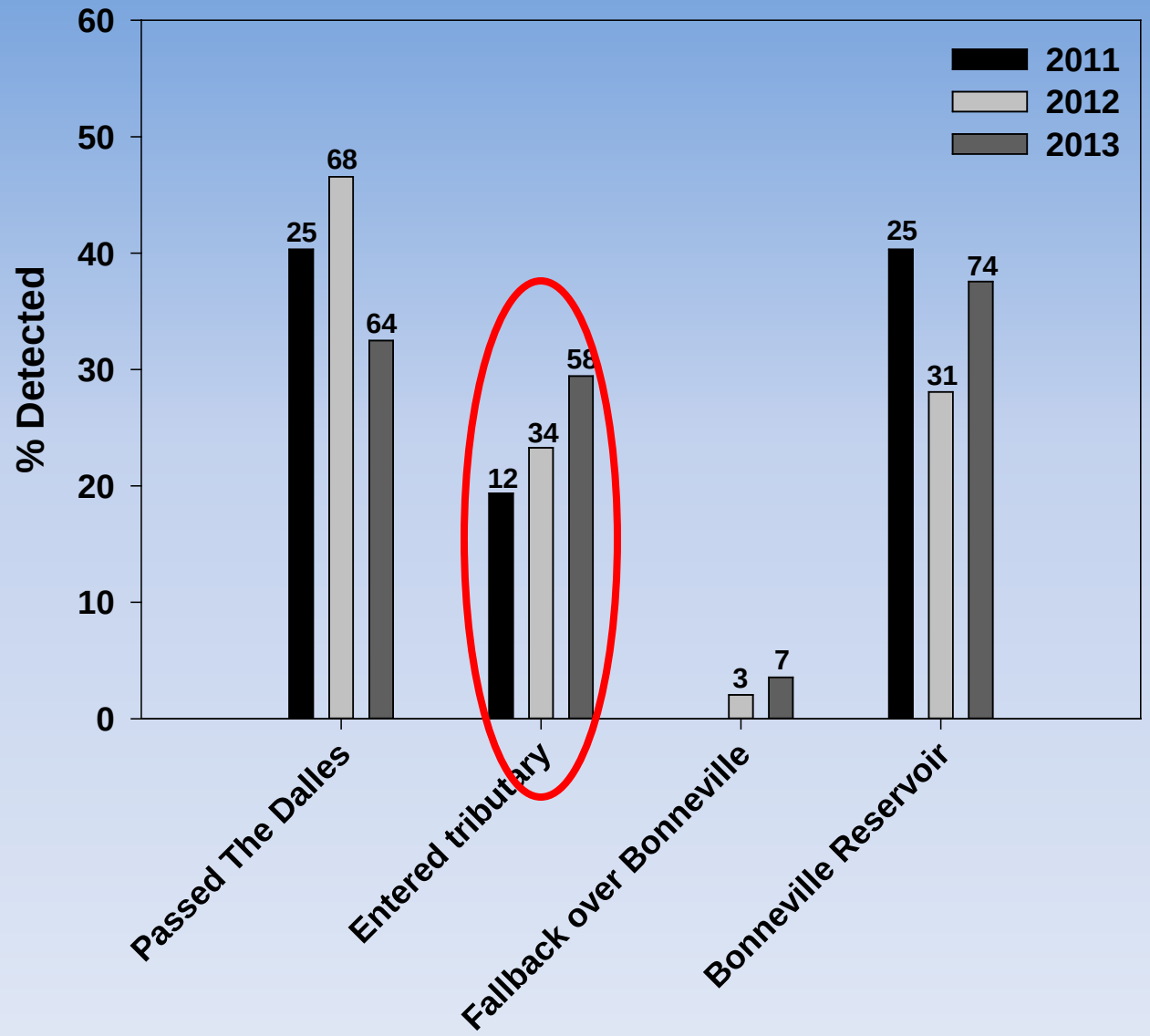
Final Fates – Reservoir Release



Fish last detected entering a tributary

All Reservoir released fish

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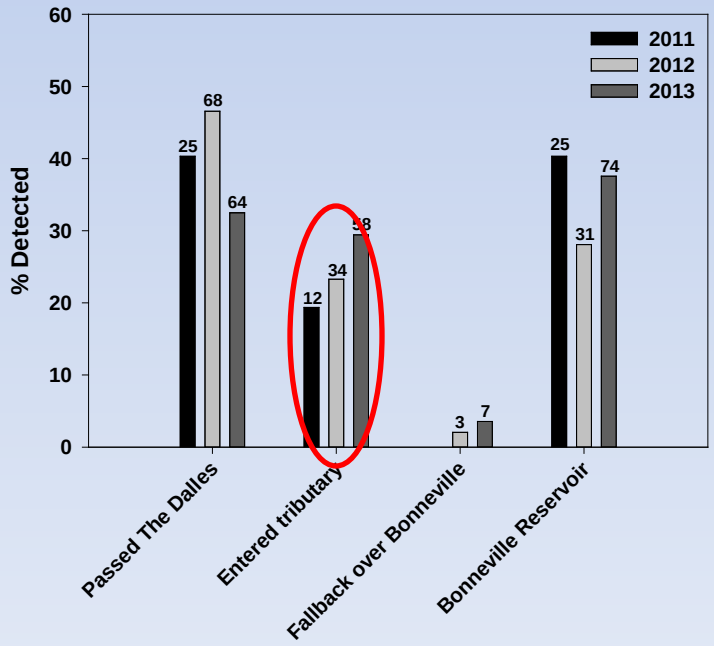
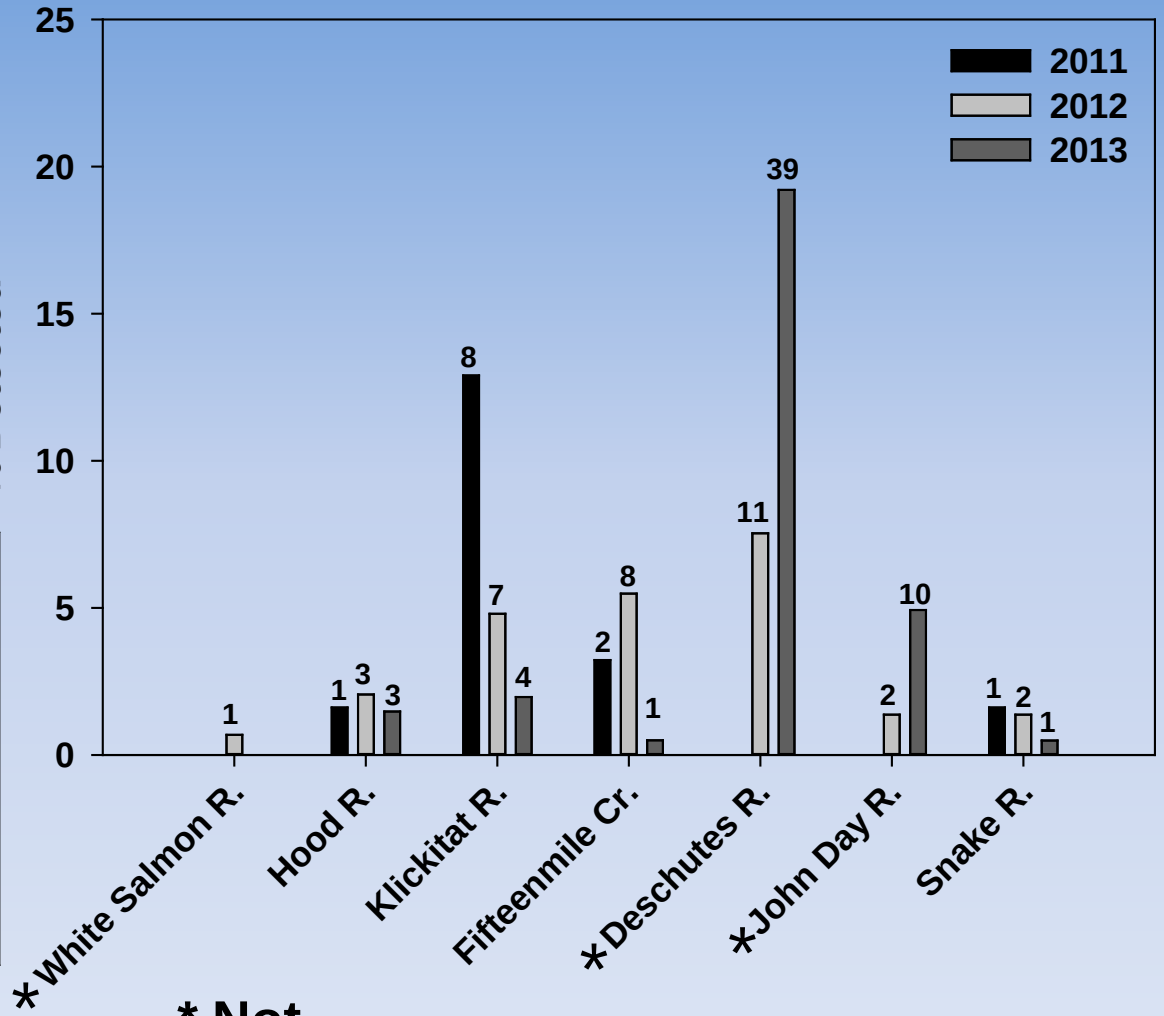
Final Fates – Reservoir Release





*** Not monitored in 2011**

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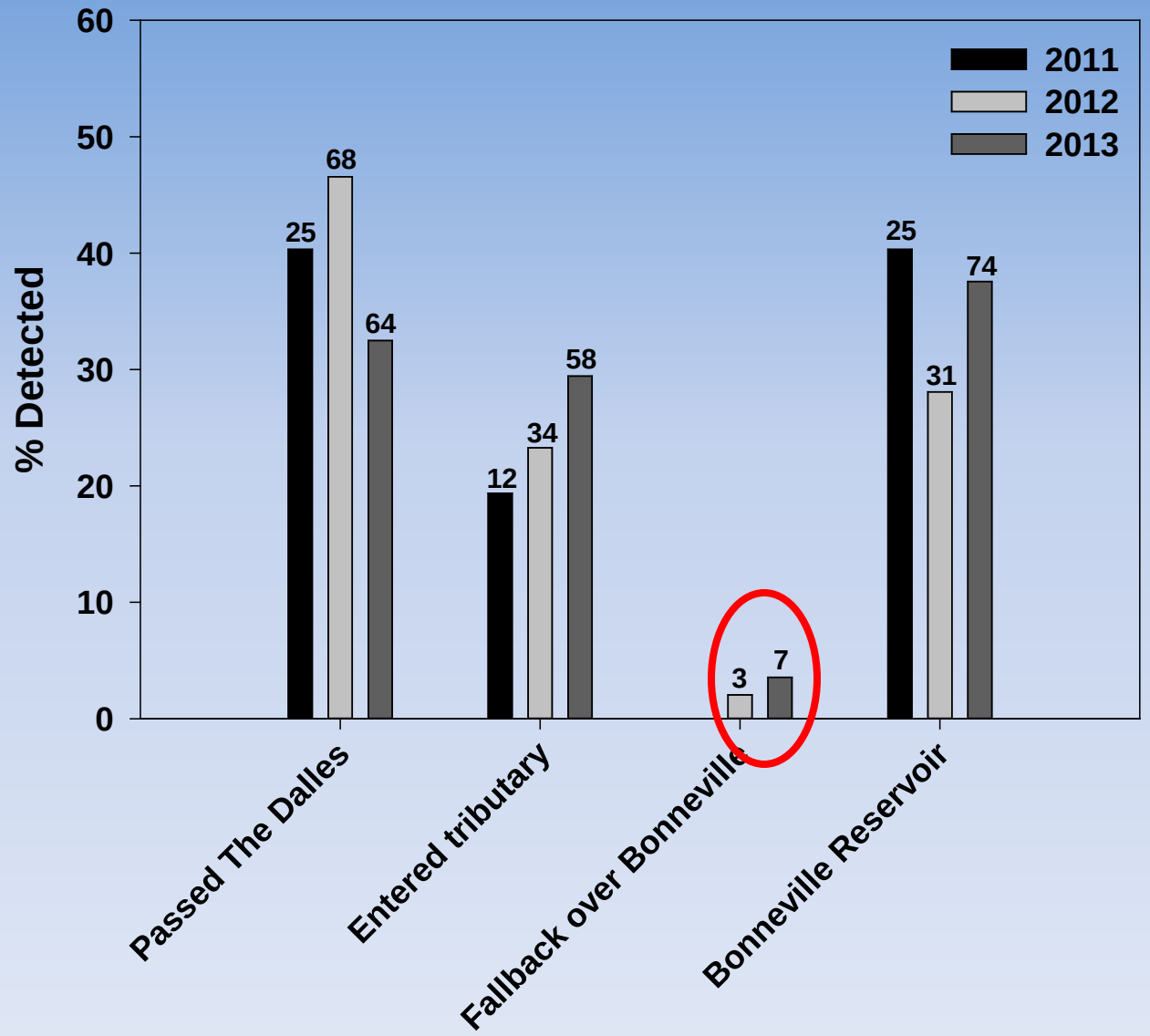
Final Fates – Reservoir Release



Fish detected below BON

All Reservoir released fish

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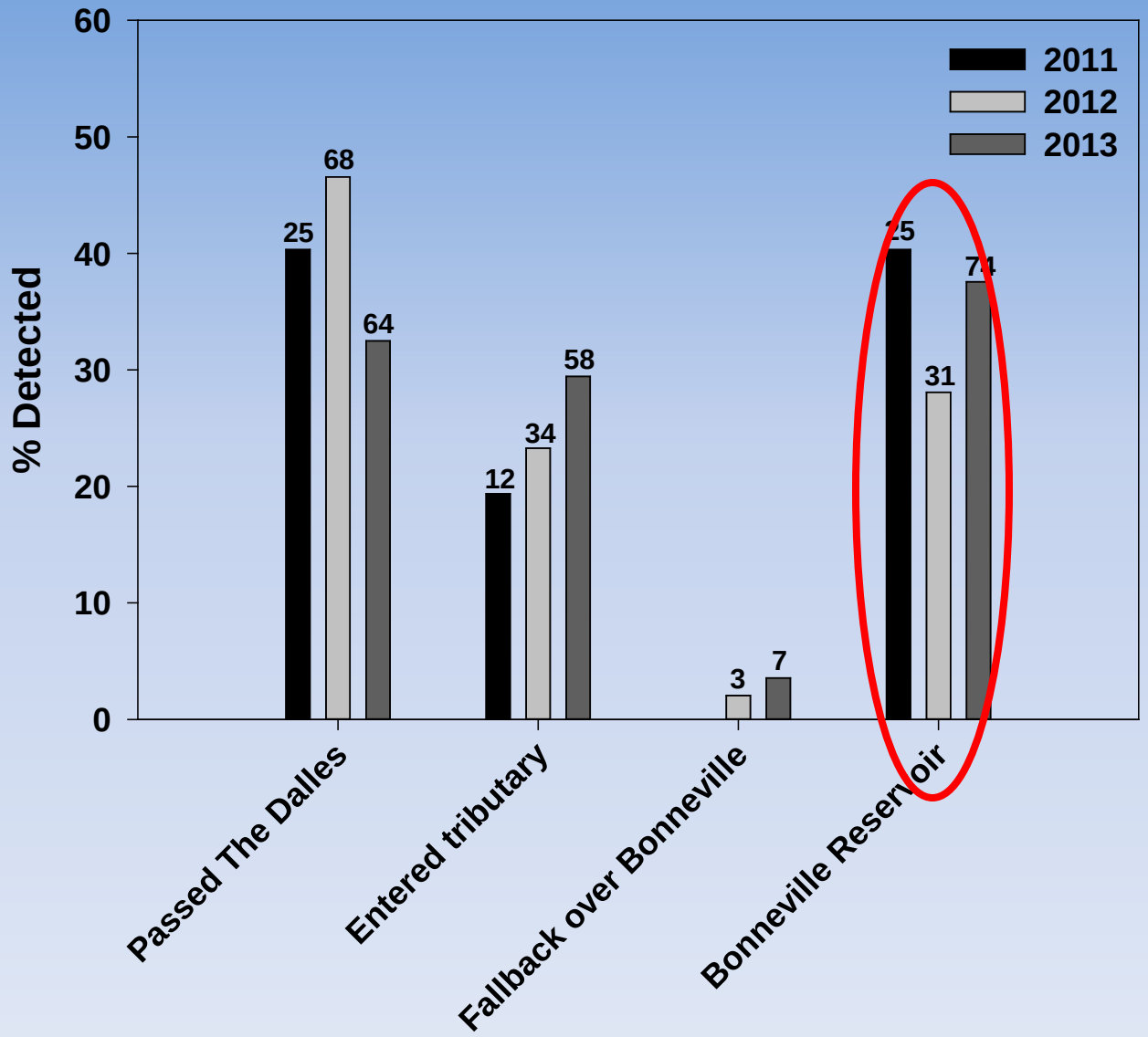
Final Fates – Reservoir Release



Fish last detected in BON Reservoir

All Reservoir released fish

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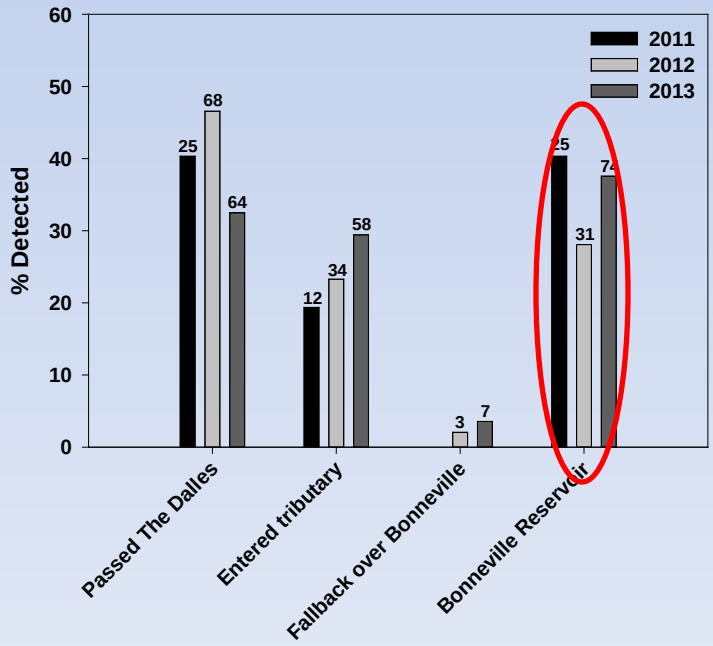
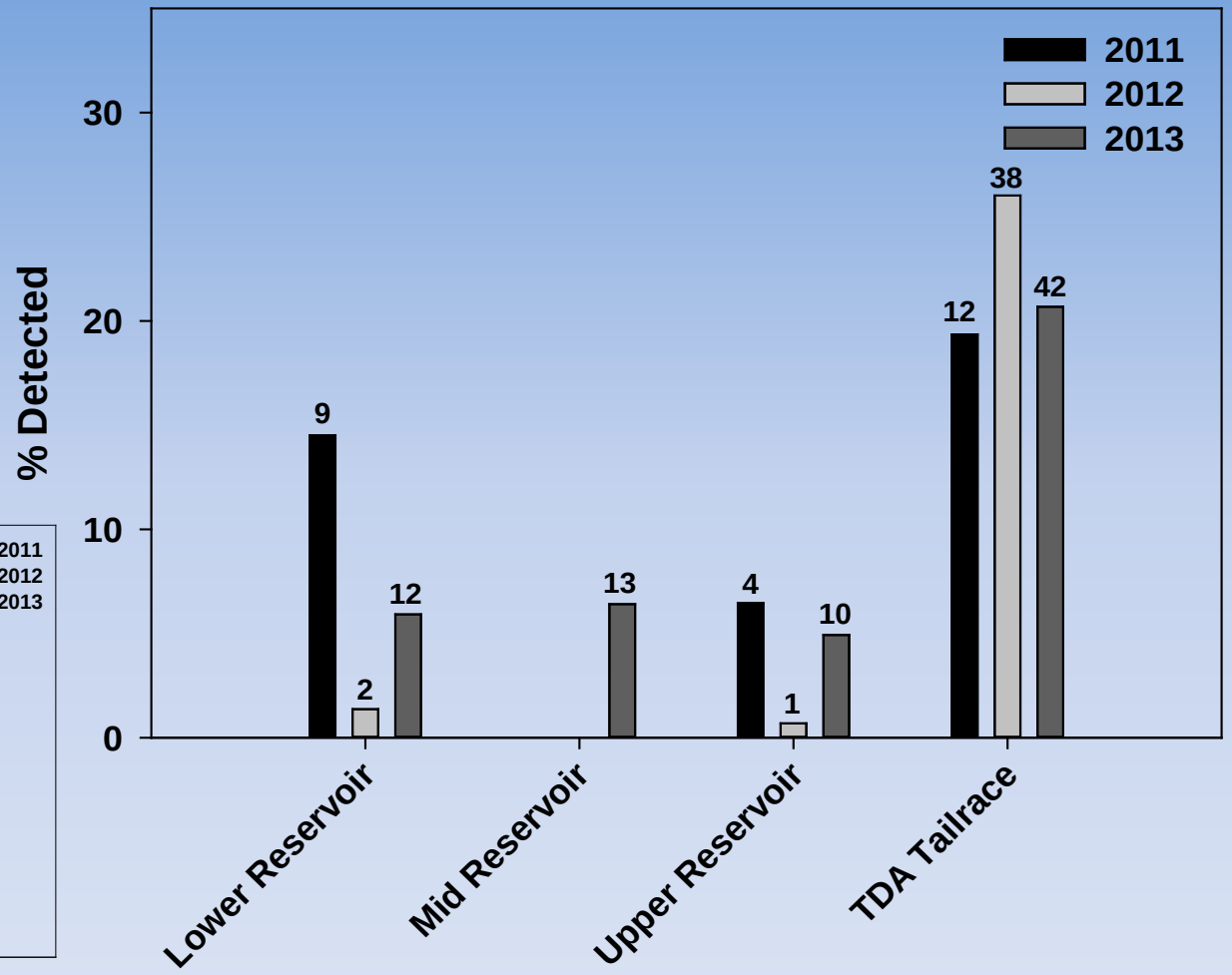
Final Fates – Reservoir Release





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Reservoir Release Summary

- Within-reservoir migration rates consistently very high
- Dam-to-dam escapement similar between years
- ~80% of lamprey reach The Dalles Dam tailrace each year
- ~30-50% have unknown final fate at end of fall
  - 4-17% enter tributaries in following spring, most after overwintering in dam tailraces

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Objectives

- Monitor behavior and determine fate of adult Pacific lamprey above Bonneville Dam
  - Reservoir behavior
  - Distribution and fate
  - Tributary entry
- Monitor behavior and determine fate of adult Pacific lamprey below Bonneville Dam
  - Fate after release
  - Downstream movements?

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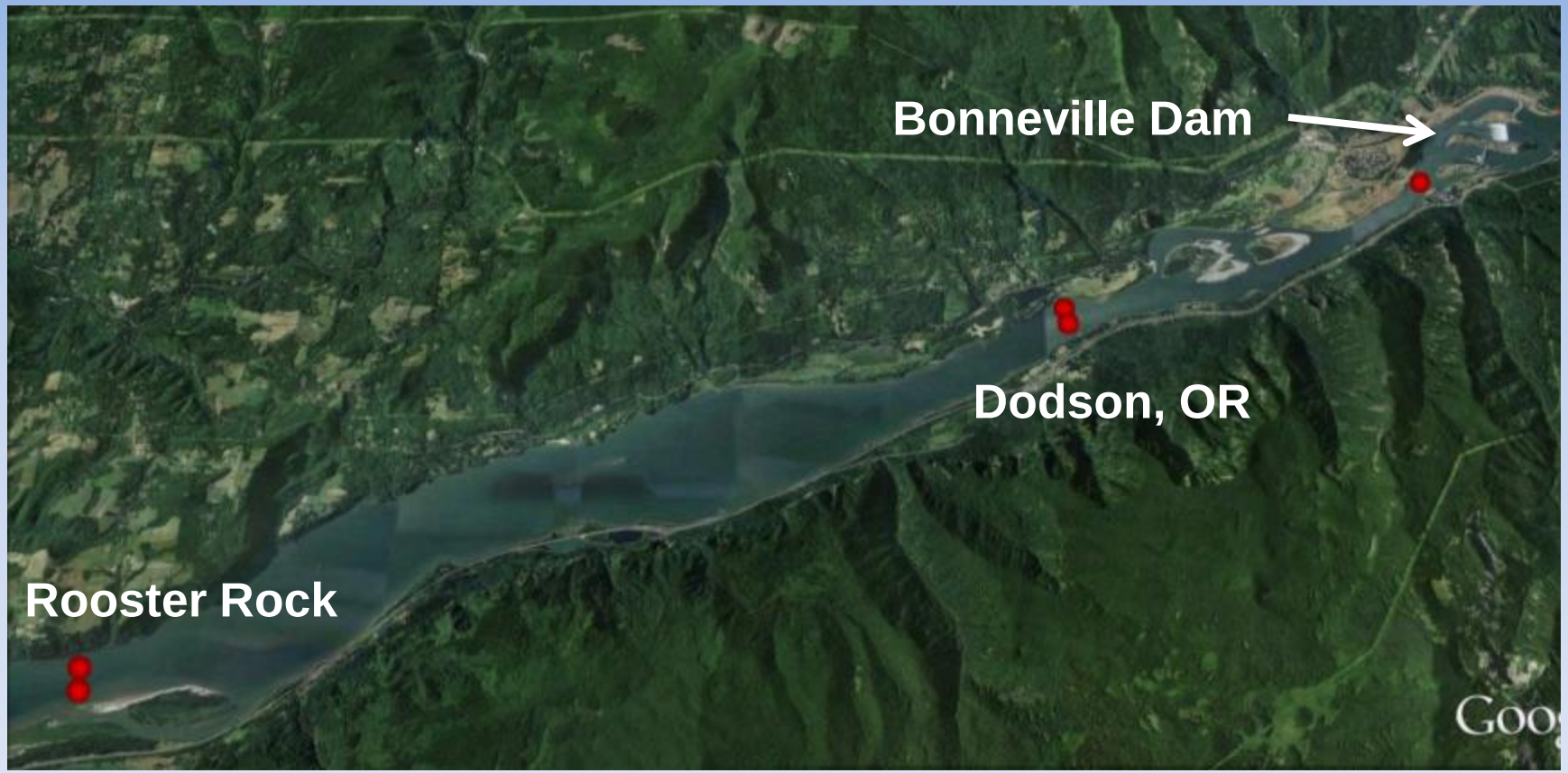

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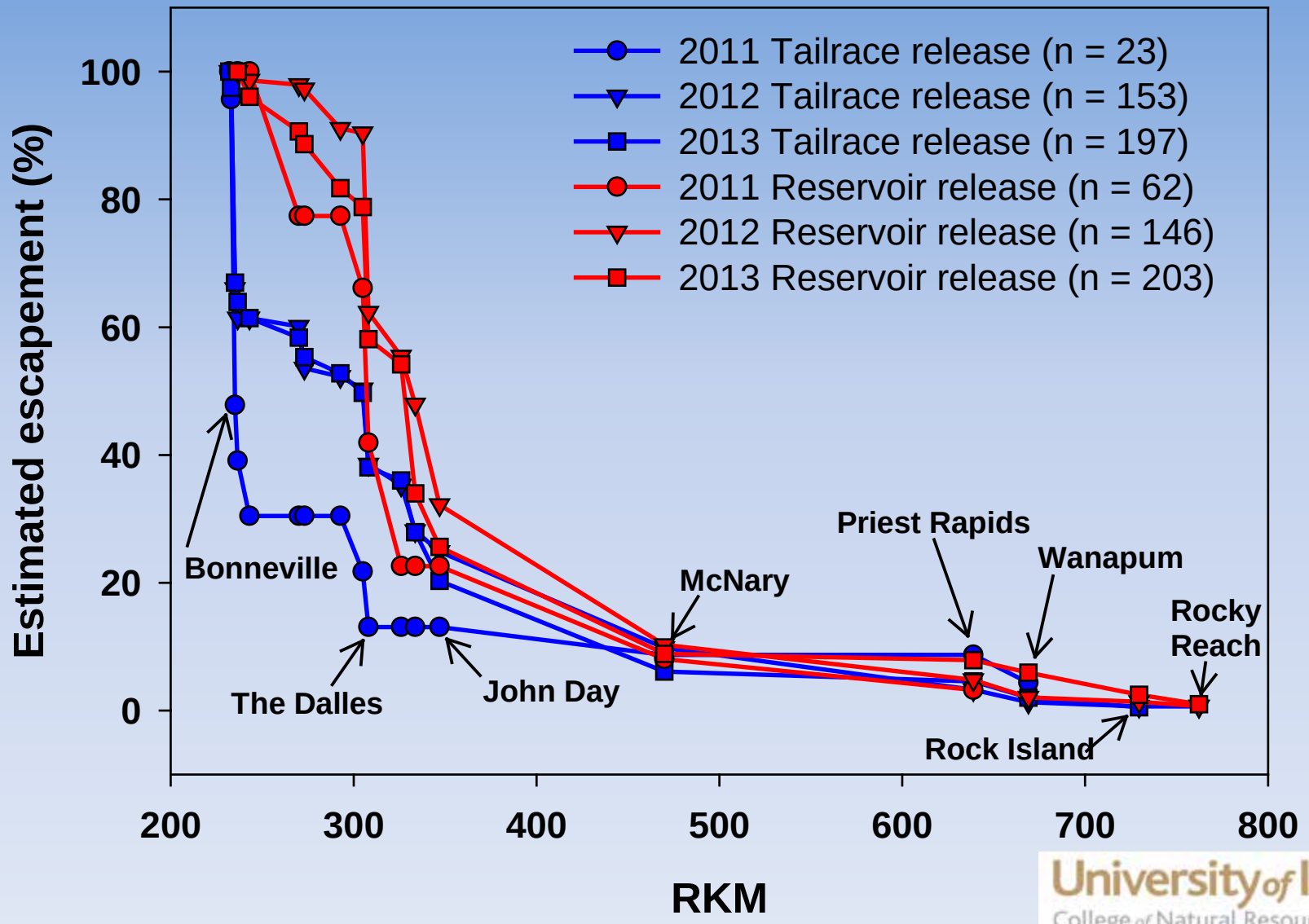
Escapement Estimates



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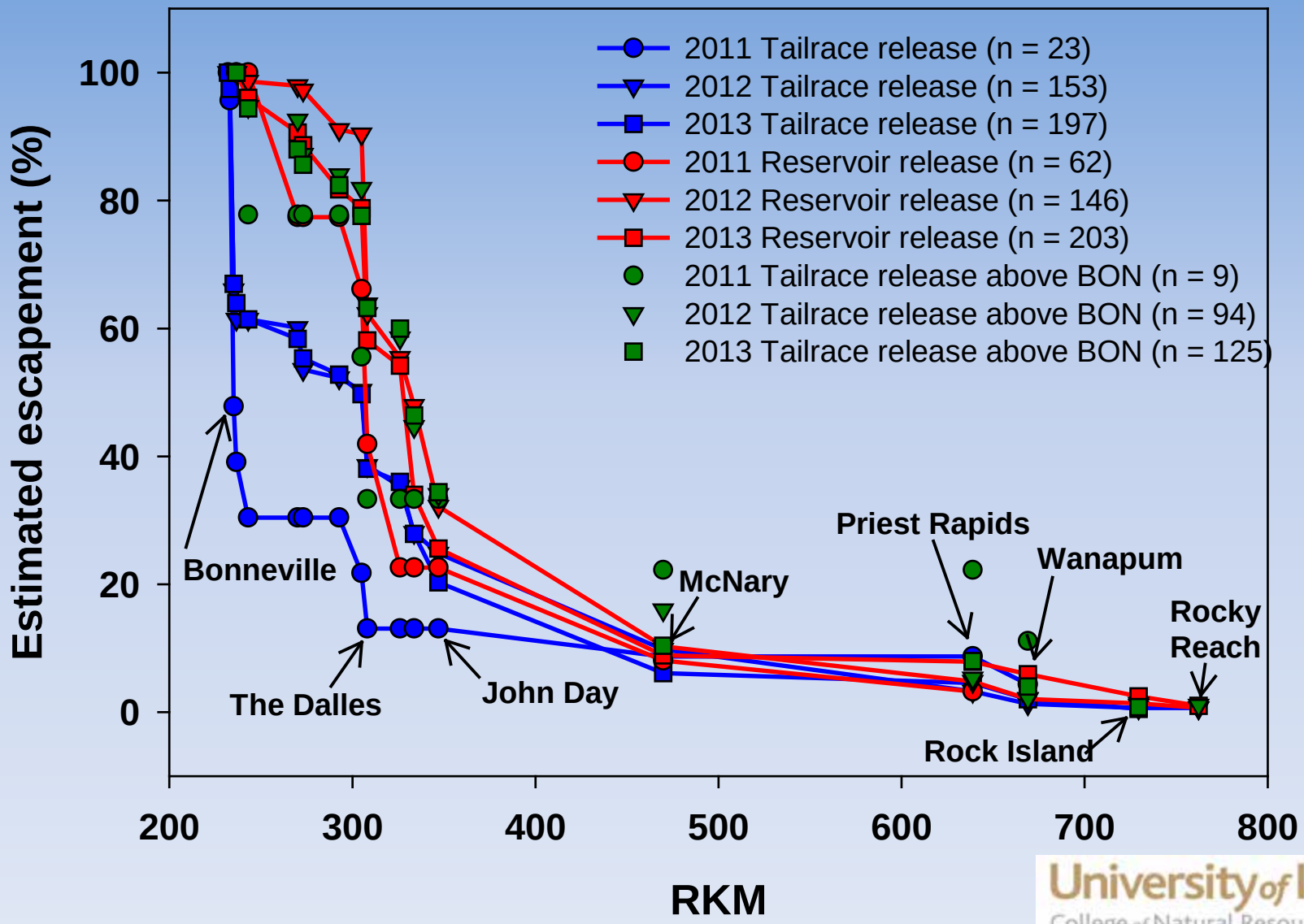
Escapement Estimates



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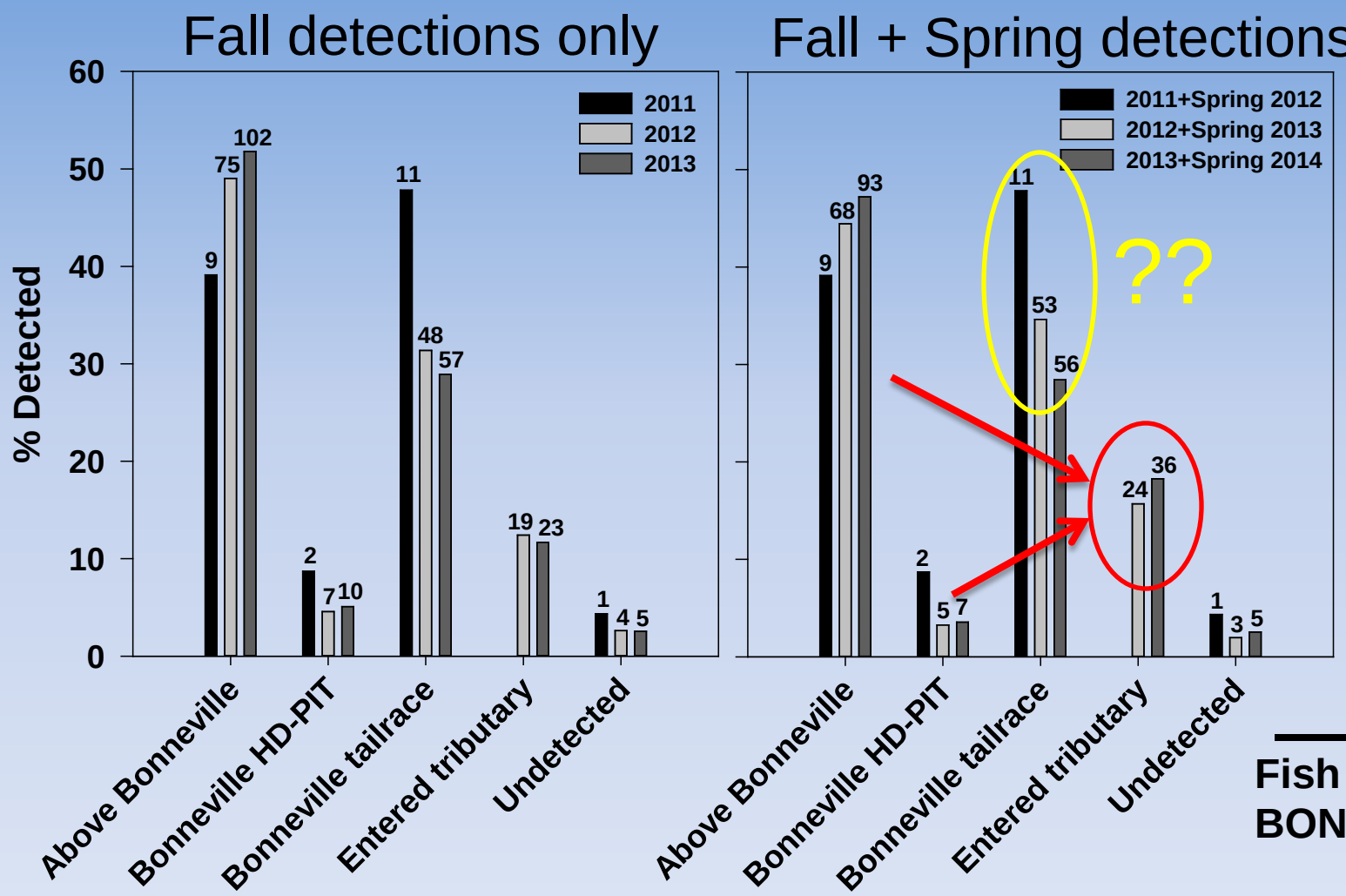
Final Fates – Tailrace Release



2011 – 0%
2012 – 7%
2013 – 9%

Fish last detected in BON reservoir in Fall entering trib in Spring

Fish last detected in BON reservoir in Fall

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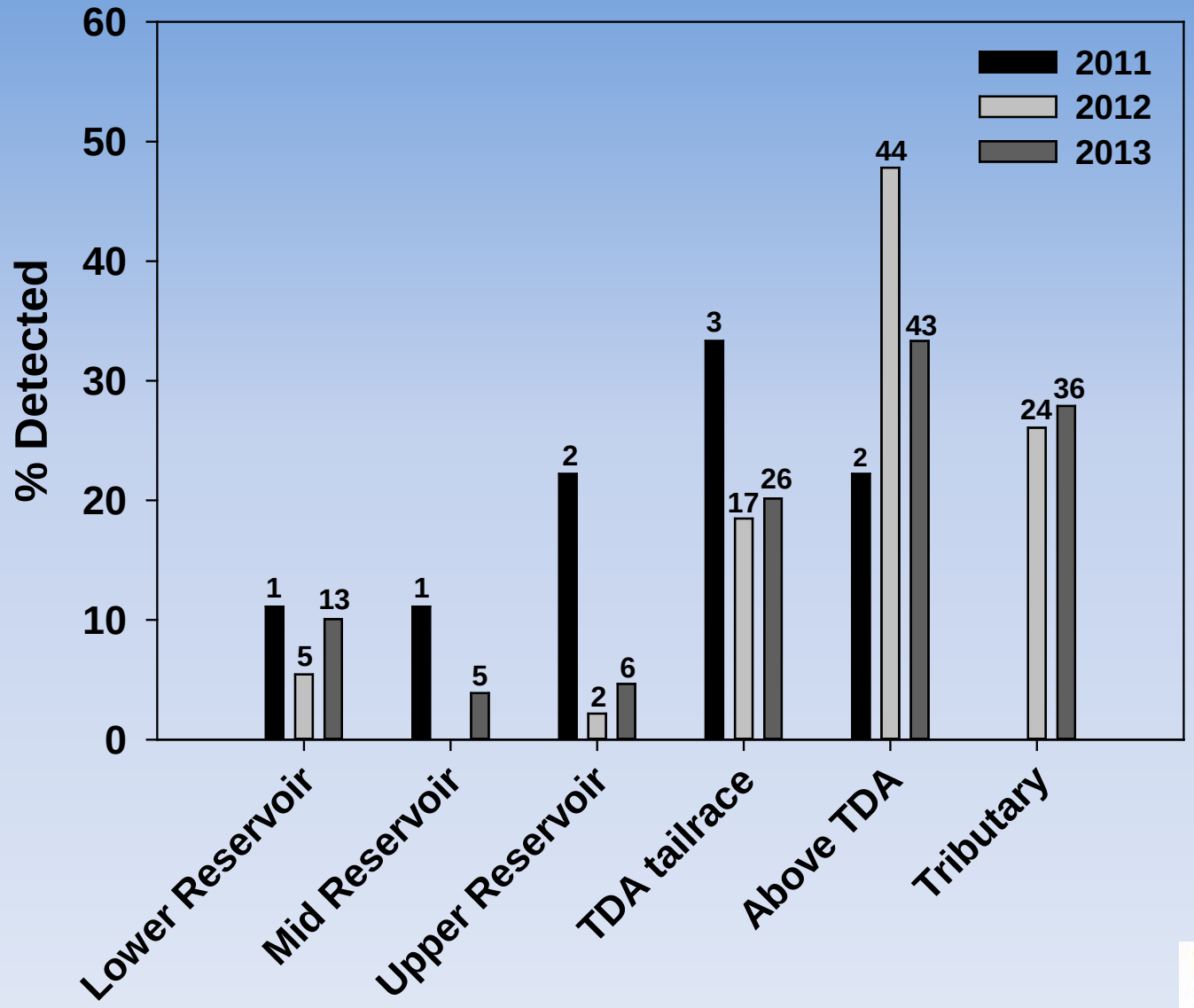
Final Fates – Tailrace Release



Tailrace released fish last detected in each location

Tailrace released fish that passed BON

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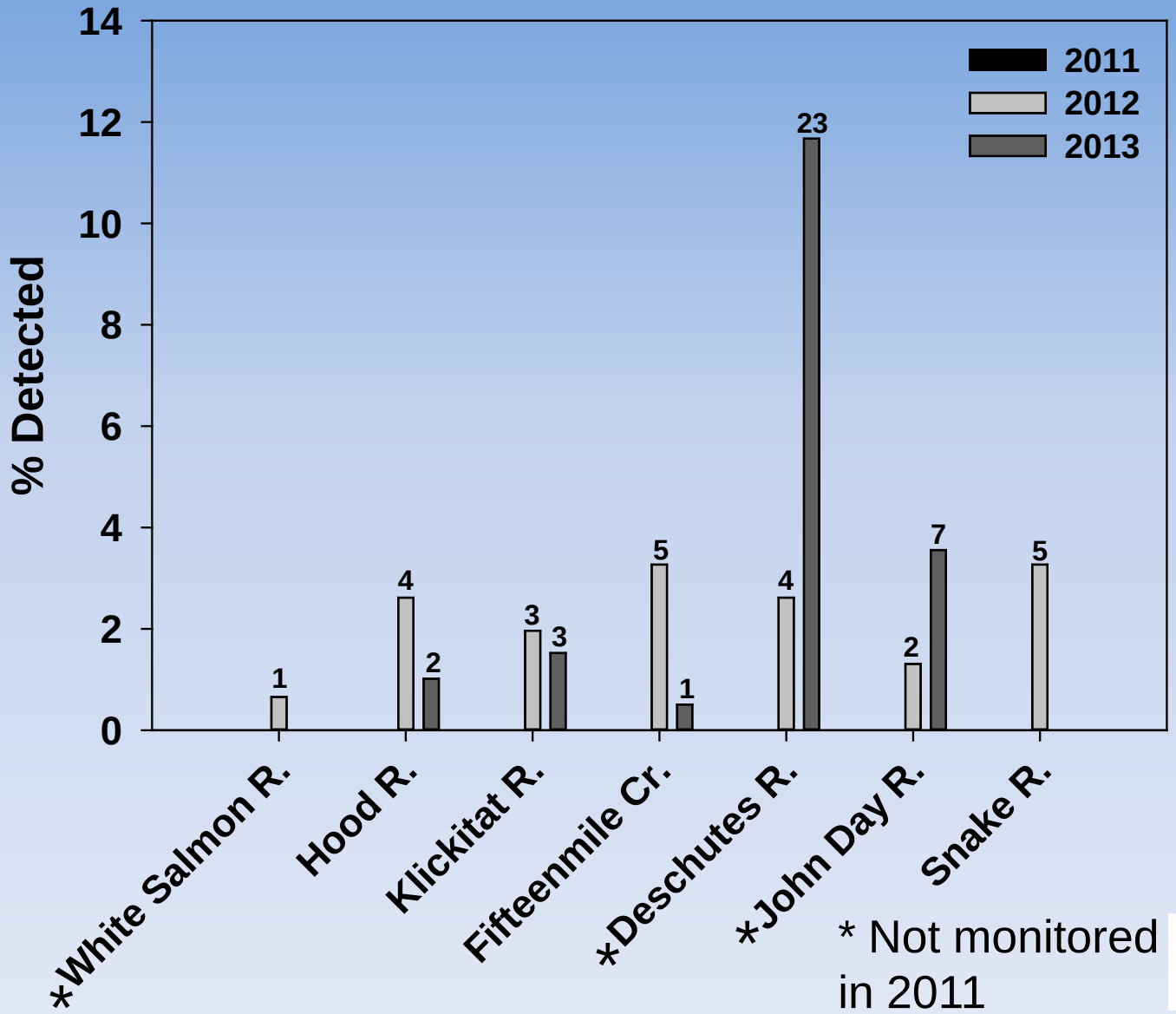
Final Fates – Tailrace Release



Tailrace released fish last detected in each tributary

All Tailrace released fish

* Not monitored in 2011

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Tailrace Summary

- Escapement similar to reservoir release fish, especially above Bonneville Dam
- Fewer fish entering tributaries in Spring (0-9%); no monitored tributaries in Bonneville Tailrace
- Many fish overwinter in The Dalles and John Day tailraces before entering downstream tributaries

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Missing Lamprey?

- Predation/spawning in The Dalles Dam tailrace?
- Are missing lamprey spawning in Bonneville Reservoir tributaries?
- Extrapolate and estimate entry into unmonitored tributaries

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Tributary Entry?

- 9 known or potential spawning tributaries to Bonneville Reservoir
- How could this change our estimates of final fate and distribution?

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Tributary Entry?

Monitored/observed rate

Tributary	2011-2013 Average Observed Rate	Low	Mid	High
Fifteenmile Cr.	**2.9%**			
Klickitat R.	**5.9%**			
Hood R.	**1.9%**			
White Salmon R.	**0.4%**			
Little White Salmon R.	--			
Wind R.	--			
Herman Cr.	--			
Rock Cr.	--			
Eagle Cr.	--			
Total	**11.1%**			

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Tributary Entry?

Monitored/observed rate

Hypothesize Rate

Tributary	2011-2013 Average Observed Rate	Low	Mid	High
Fifteenmile Cr.	**2.9%**	**2.9%**		
Klickitat R.	**5.9%**	**5.9%**		
Hood R.	**1.9%**	**1.9%**		
White Salmon R.	**0.4%**	**0.4%**		
Little White Salmon R.	--	0.4%		
Wind R.	--	0.4%		
Herman Cr.	--	0.4%		
Rock Cr.	--	0.4%		
Eagle Cr.	--	0.4%		
Total	**11.1%**	**13.1%**		

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Tributary Entry?

Monitored/observed rate

Hypothesize Rate

Tributary	2011-2013 Average Observed Rate	Low	Mid	High
Fifteenmile Cr.	**2.9%**	**2.9%**	**2.9%**	
Klickitat R.	**5.9%**	**5.9%**	**5.9%**	
Hood R.	**1.9%**	**1.9%**	**1.9%**	
White Salmon R.	**0.4%**	**0.4%**	**0.4%**	
Little White Salmon R.	--	0.4%	2.9%	
Wind R.	--	0.4%	2.9%	
Herman Cr.	--	0.4%	2.9%	
Rock Cr.	--	0.4%	2.9%	
Eagle Cr.	--	0.4%	2.9%	
Total	**11.1%**	**13.1%**	**25.6%**	

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Tributary Entry?

Monitored/observed rate

Hypothesize Rate

Tributary	2011-2013 Average Observed Rate	Low	Mid	High
Fifteenmile Cr.	**2.9%**	**2.9%**	**2.9%**	**2.9%**
Klickitat R.	**5.9%**	**5.9%**	**5.9%**	**5.9%**
Hood R.	**1.9%**	**1.9%**	**1.9%**	**1.9%**
White Salmon R.	**0.4%**	**0.4%**	**0.4%**	**0.4%**
Little White Salmon R.	--	0.4%	2.9%	5.9%
Wind R.	--	0.4%	2.9%	5.9%
Herman Cr.	--	0.4%	2.9%	5.9%
Rock Cr.	--	0.4%	2.9%	5.9%
Eagle Cr.	--	0.4%	2.9%	5.9%
Total	**11.1%**	**13.1%**	**25.6%**	**40.6%**

Could account for an additional 2% to 12% of "missing" lamprey in Bonneville Reservoir

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M. Kirk
M. Turner
T. Tillson
C. Boggs
G. Naughton

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K. Ham
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