Estimation of Catherine Creek Chinook Salmon Reach-Specific Survival During Spring Emigration

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Oregon Department of Fish and Wildlife

Northeast Fish Research

Acknowledgments

ODFW

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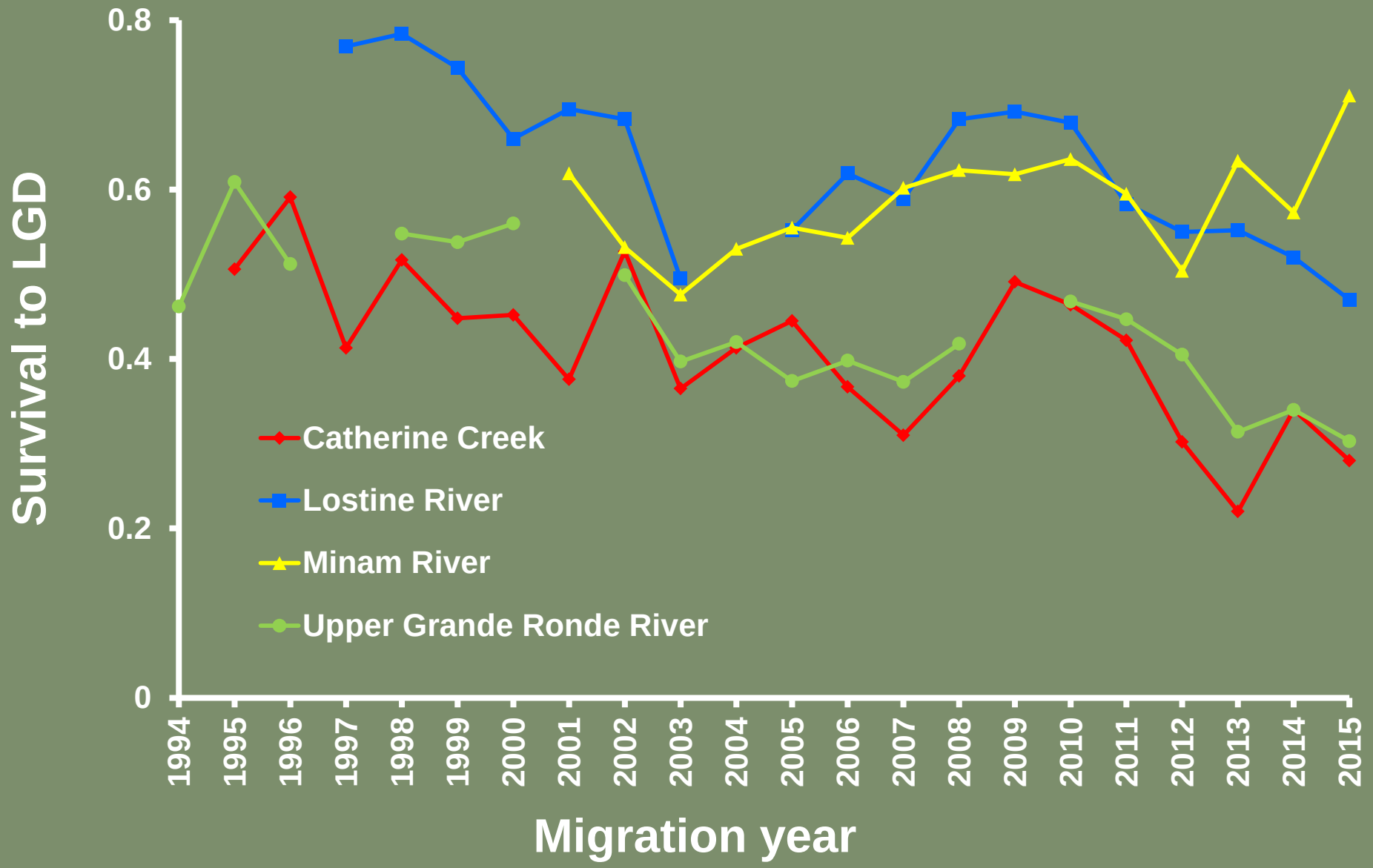
Catherine Creek: Background

- Consistently, late migrant Catherine Creek juvenile Chinook salmon smolts experience lower survival to Lower Granite Dam (LGD) compared to neighboring populations (e.g., Lostine and Minam) within the Grande Ronde River Subbasin.

- Late migrants that successfully migrate through the Grande Ronde Valley exhibit high survival to LGD, indicating that Catherine Creek smolts experience high mortality within the Grande Ronde Valley.

Background – Late Migrant Survival



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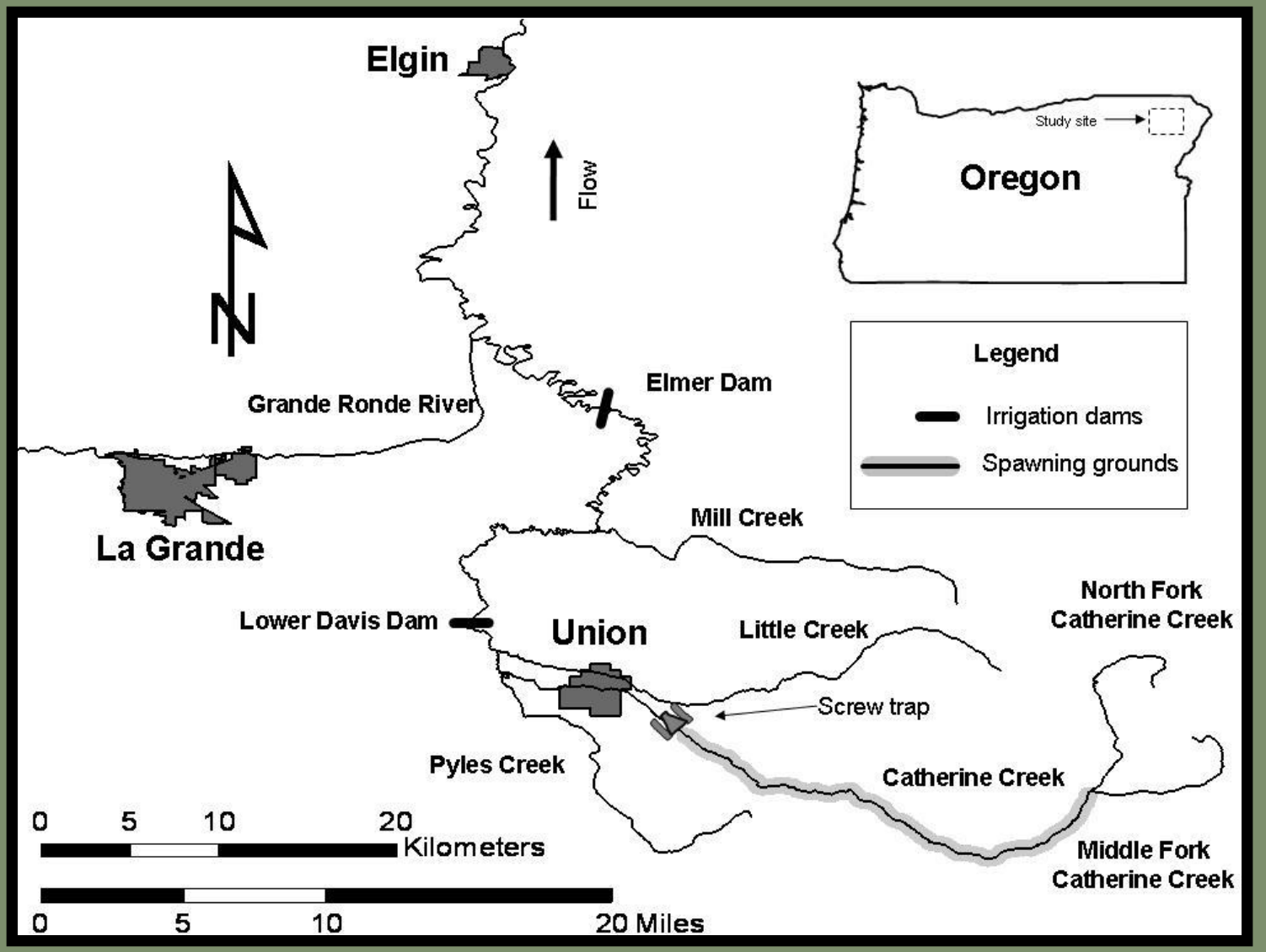
Study Area


Elgin
Flow
N
Study site
Oregon
Legend
Irrigation dams
Spawning grounds
Elmer Dam
Grande Ronde River
La Grande
Mill Creek
North Fork
Catherine Creek
Lower Davis Dam
Union
Little Creek
Screw trap
Pyles Creek
Catherine Creek
Middle Fork
Catherine Creek
0 5 10 20
Kilometers
0 5 10 20 Miles

Objective

1. Estimate reach specific survival for Catherine Creek late migrant juvenile spring Chinook salmon during outmigration

Methods

Spring radiotelemetry

Surgery

- Spring 2011 – 181 fish tagged
- Spring 2012 – 111 fish tagged
- Spring 2013 – 68 fish tagged
- March – May
- Fish weight ≥ 8.5 g
- Continuous duty cycle

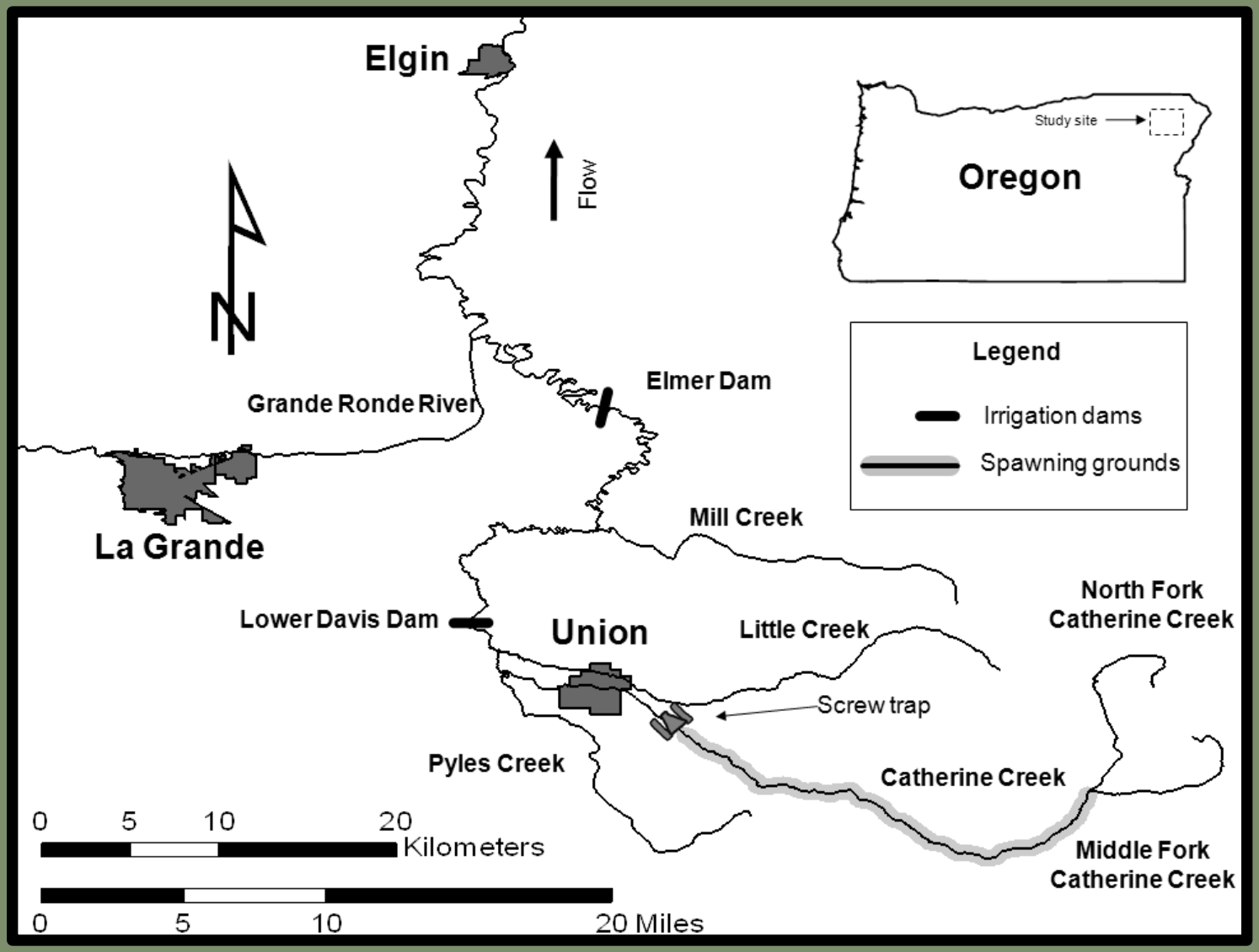
Tracking

- 9 Stationary receivers
- Union to Elgin
- Aerial/Boat tracking

Data Analysis

- Mark-recapture data set
- Cormack-Jolly-Seber model

Methods – Receiver Locations



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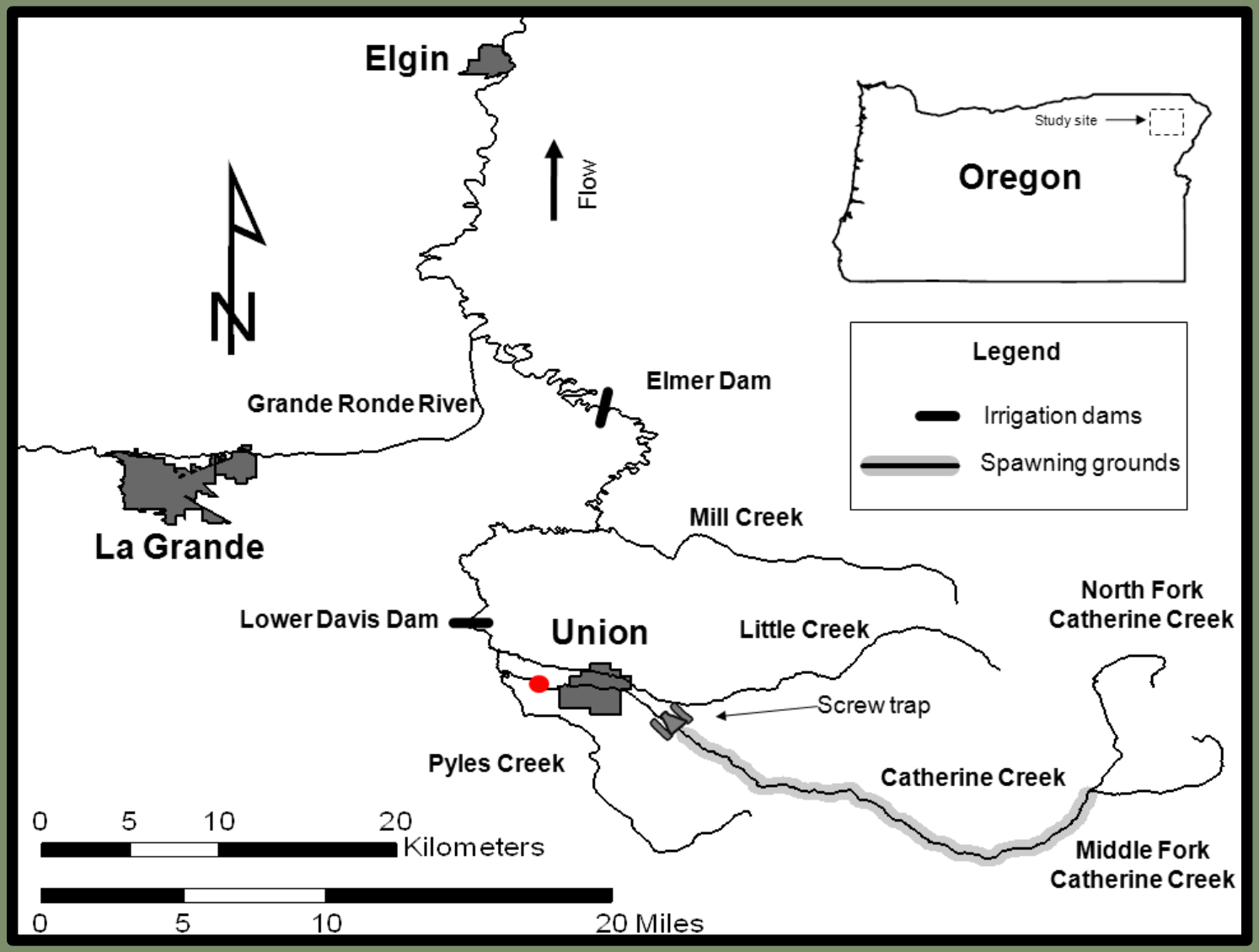

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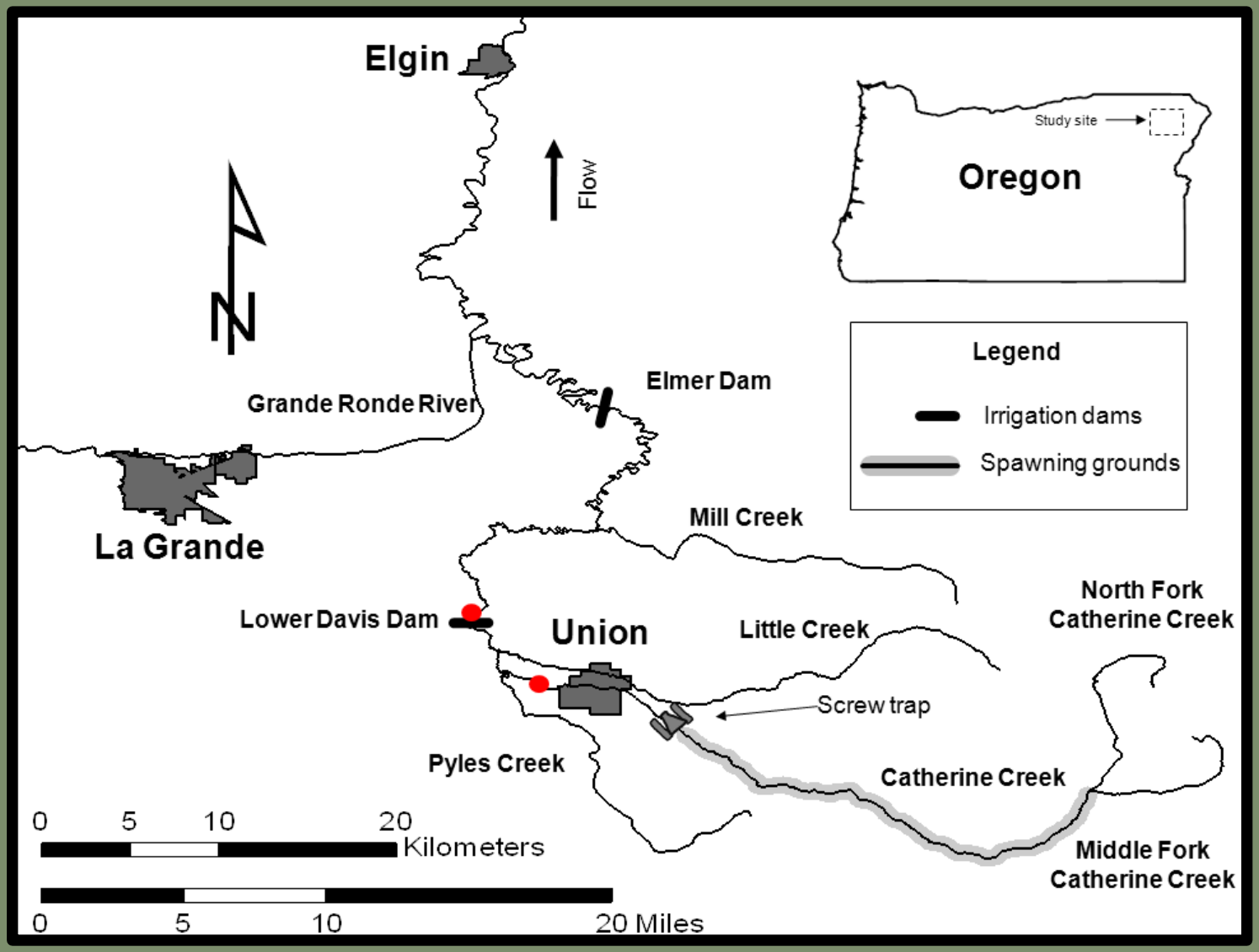

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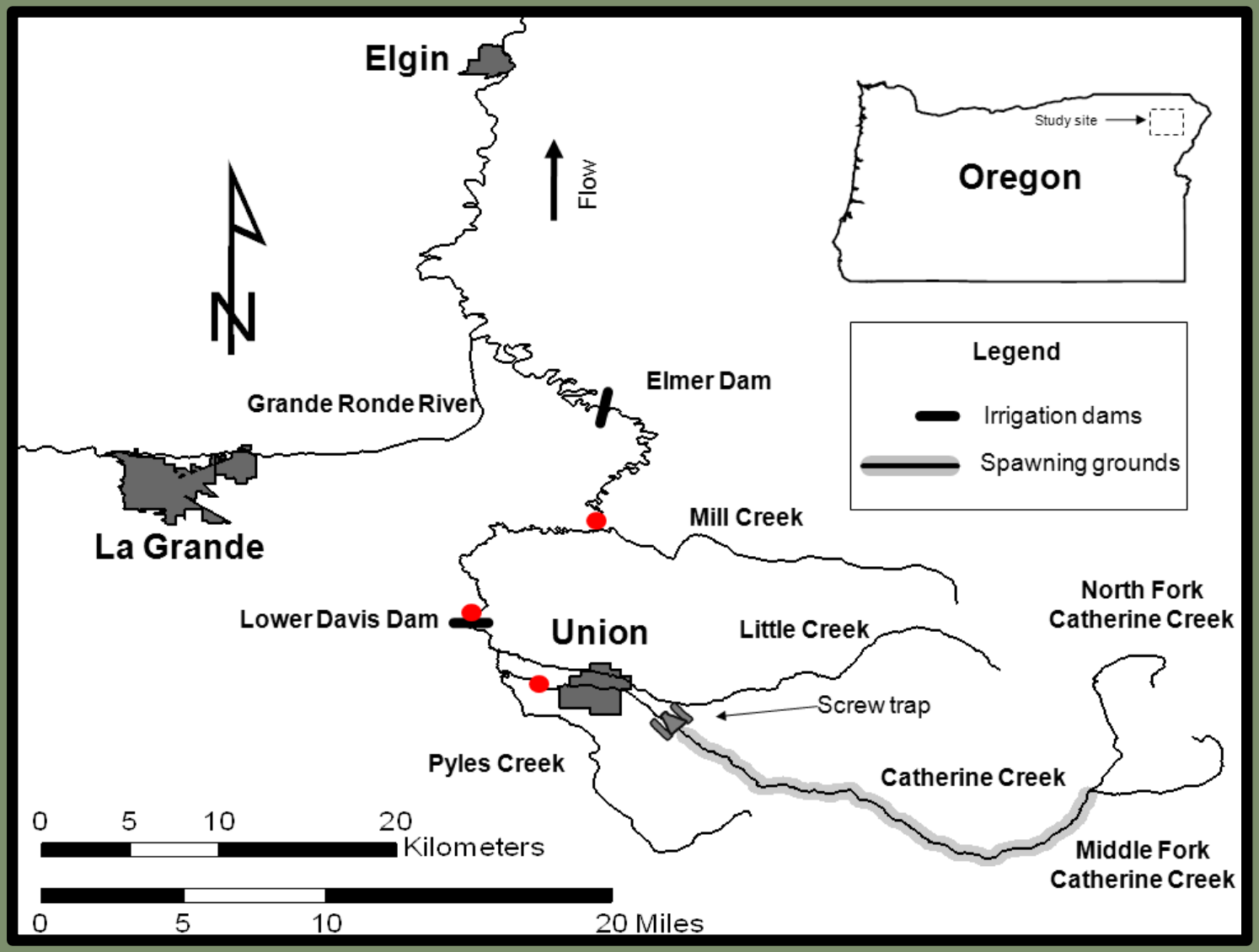

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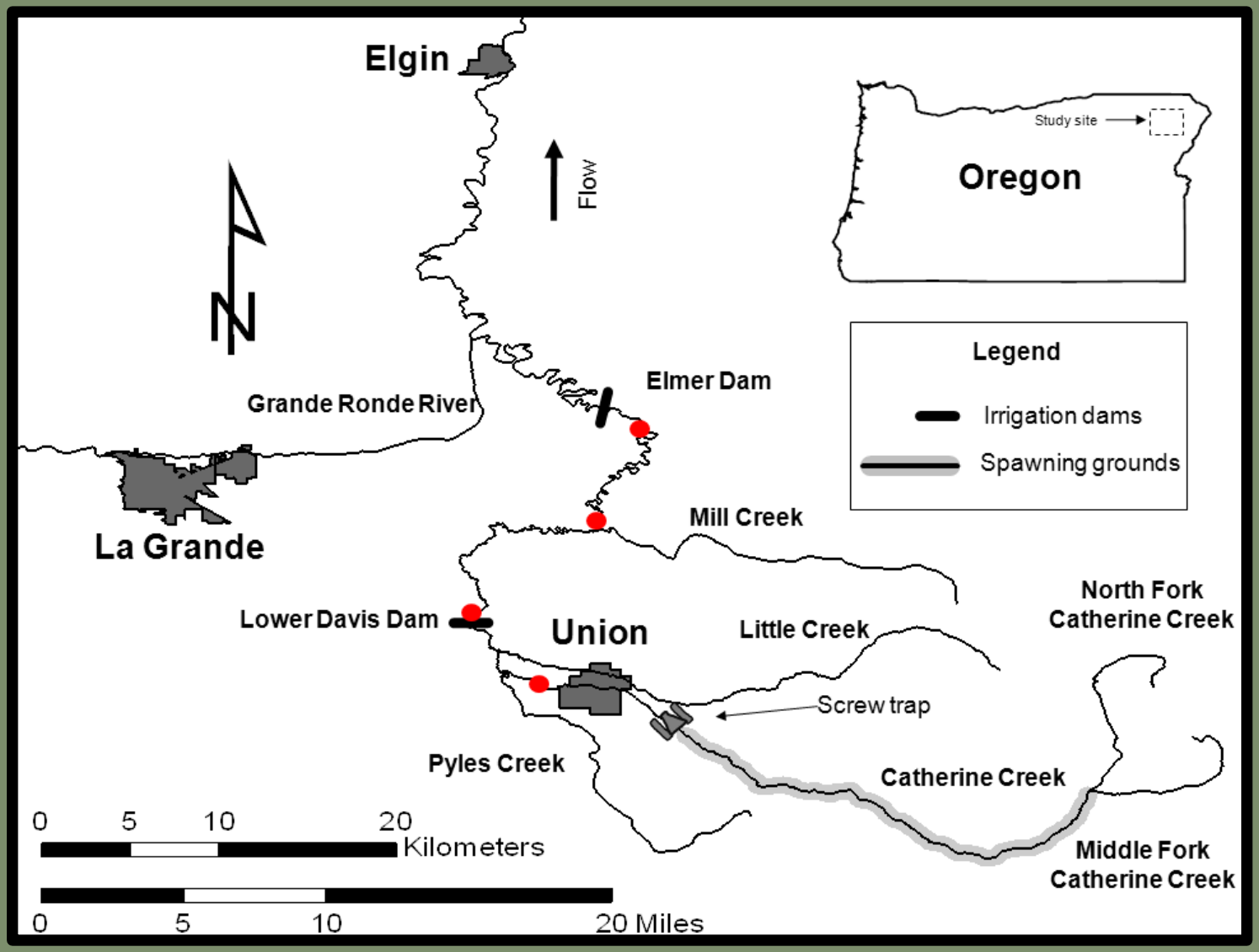

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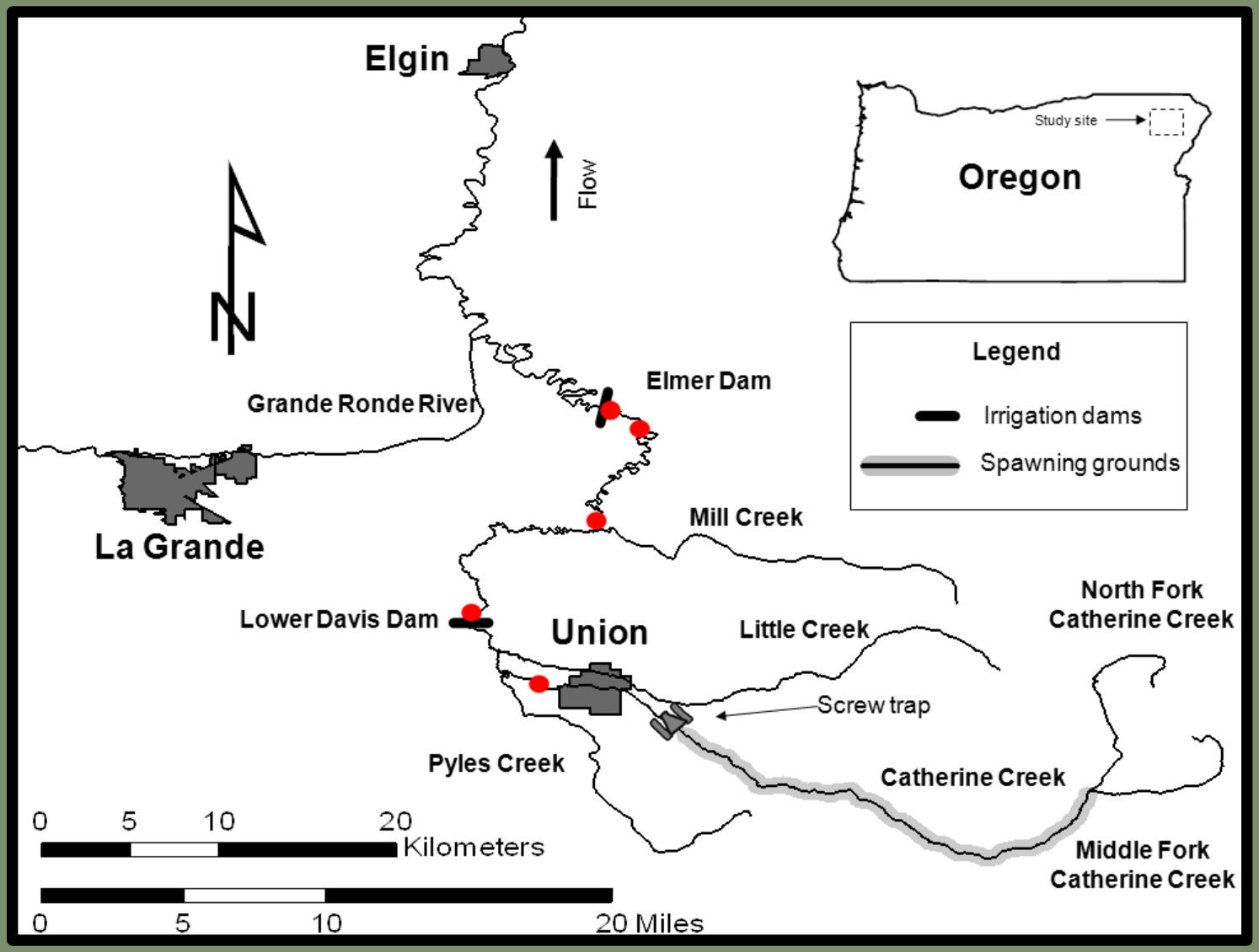

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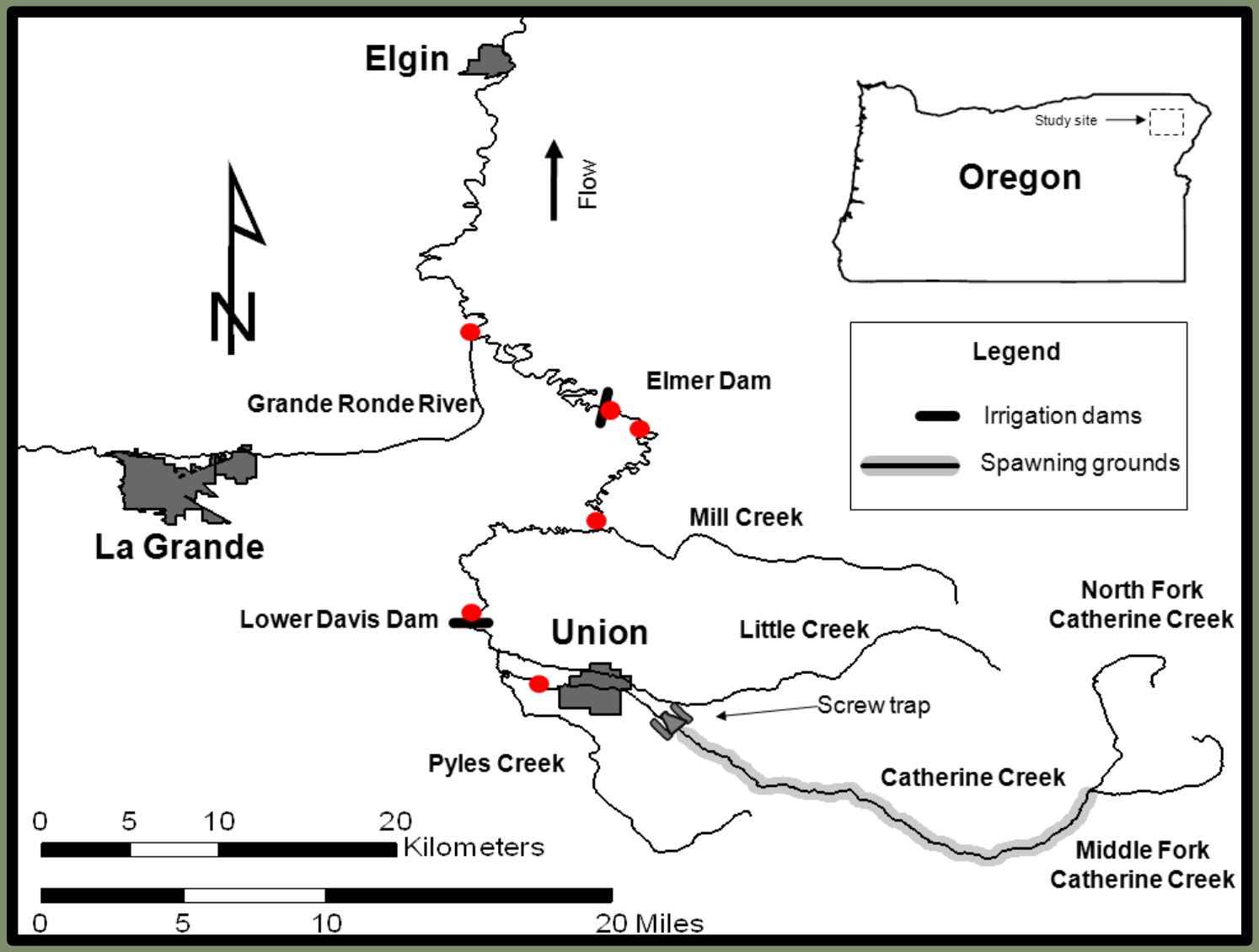

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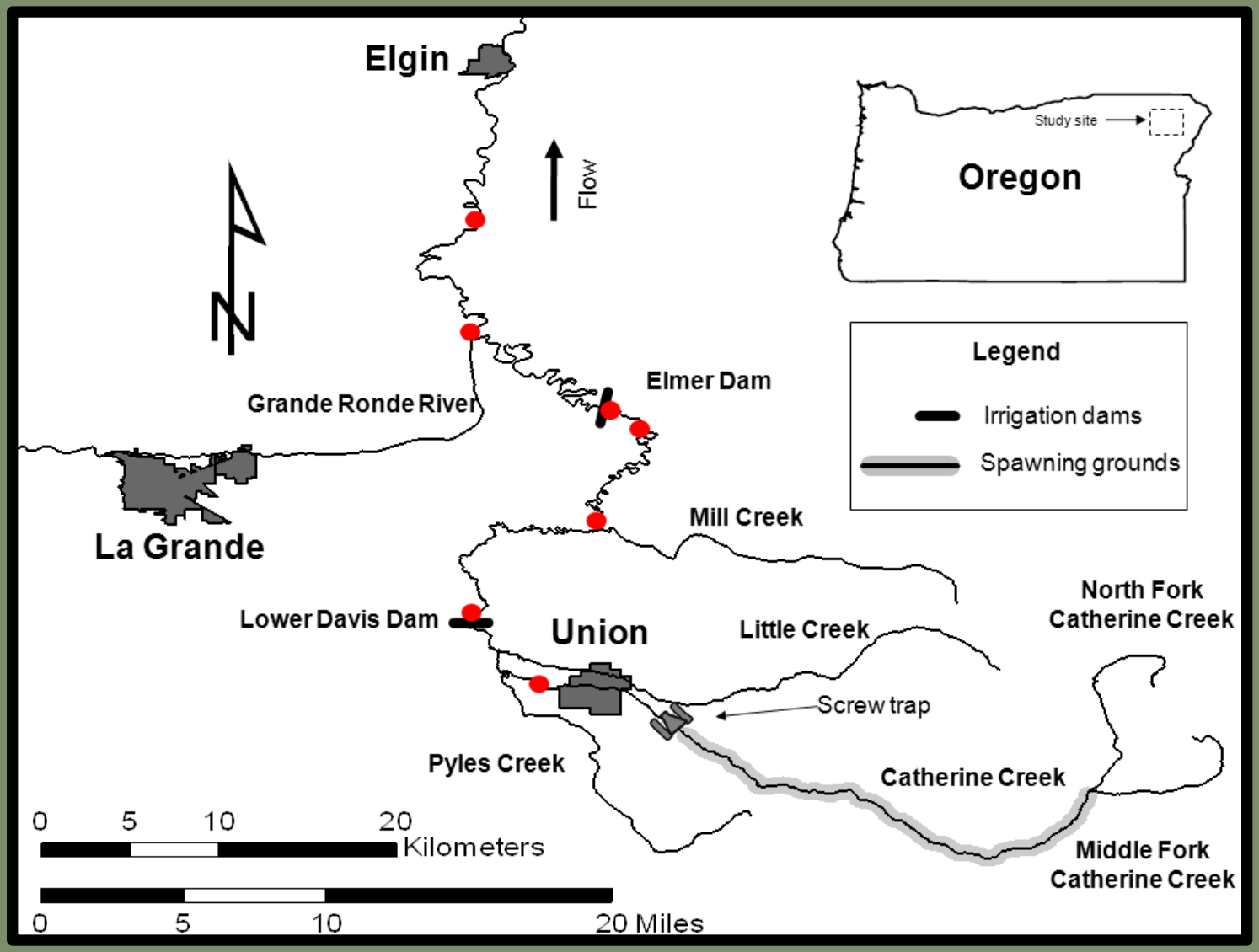

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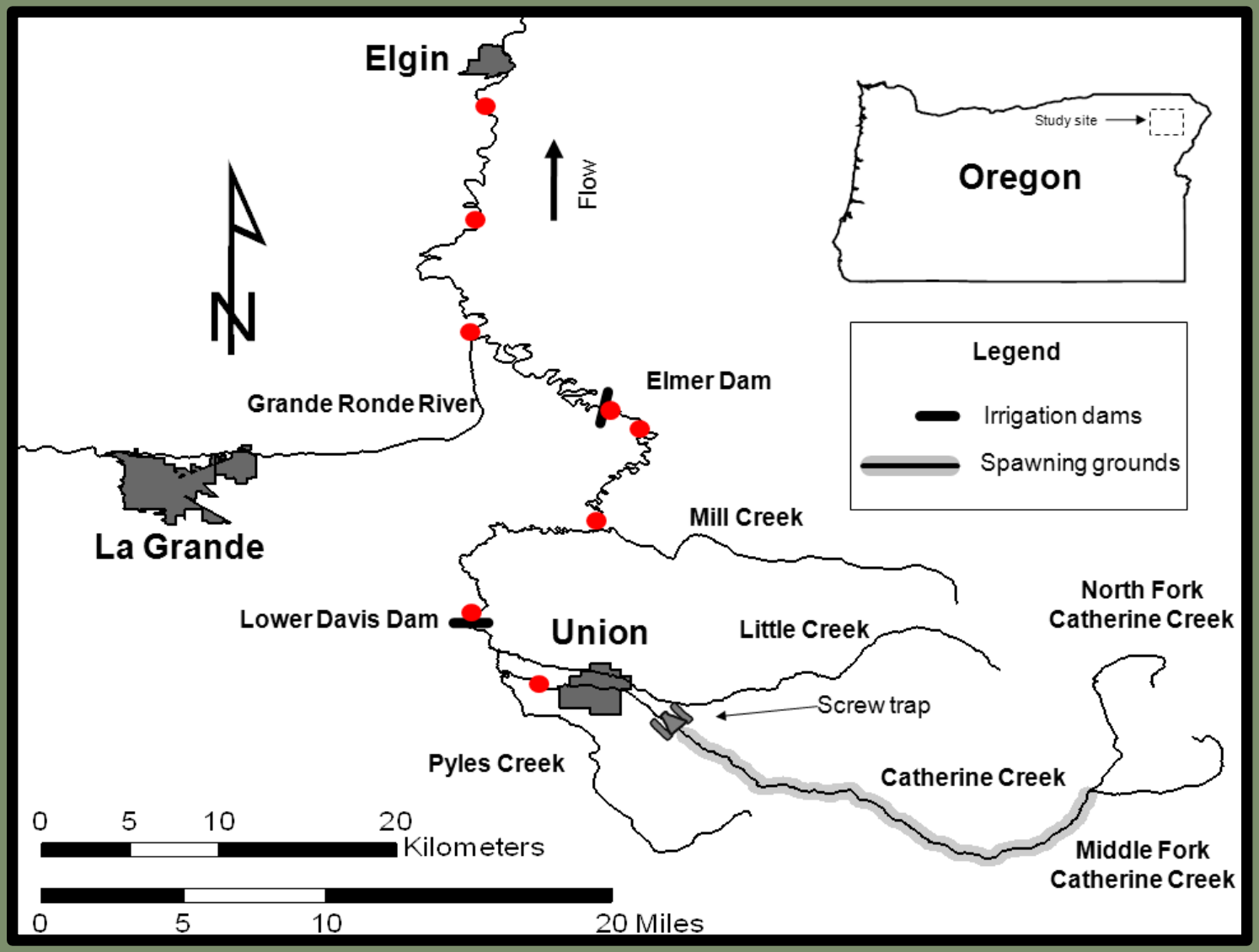


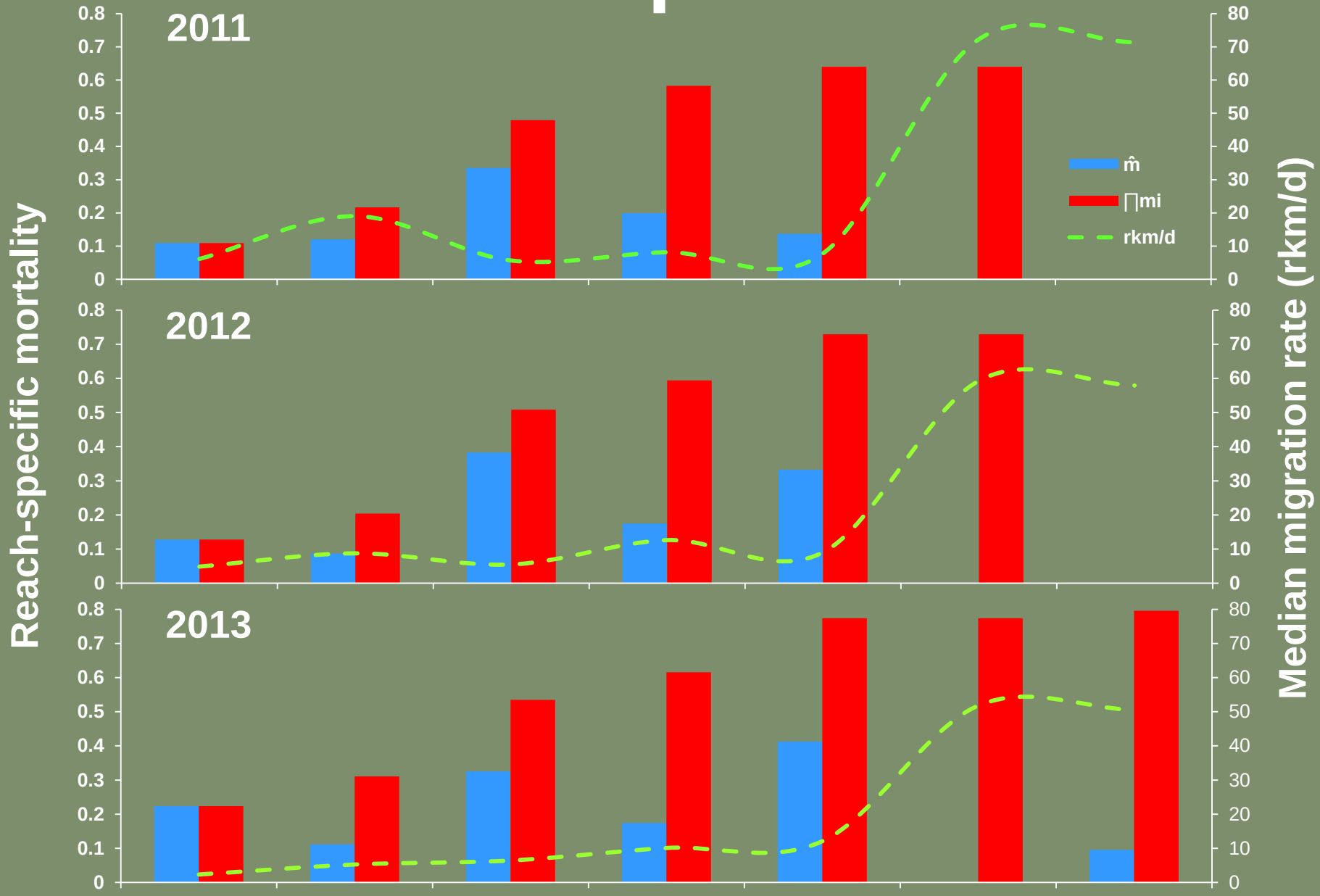
Results-Raw Data

Receiver Site	Unique Detections			Detection Efficiency		
	2011	2012	2013	2011	2012	2013
Pyles Creek	152	94	49	0.93	0.98	0.93
Davis Dam	140	86	45	0.99	0.98	0.97
Mill Creek	86	52	30	0.94	0.98	0.96
Elmer Dam	70	42	24	1.00	1.00	0.93
CC Mouth	51	21	14	0.86	0.72	0.93
Imbler	52	29	13	0.88	0.97	0.93
Indian Creek	59	29	10	N/A	N/A	N/A

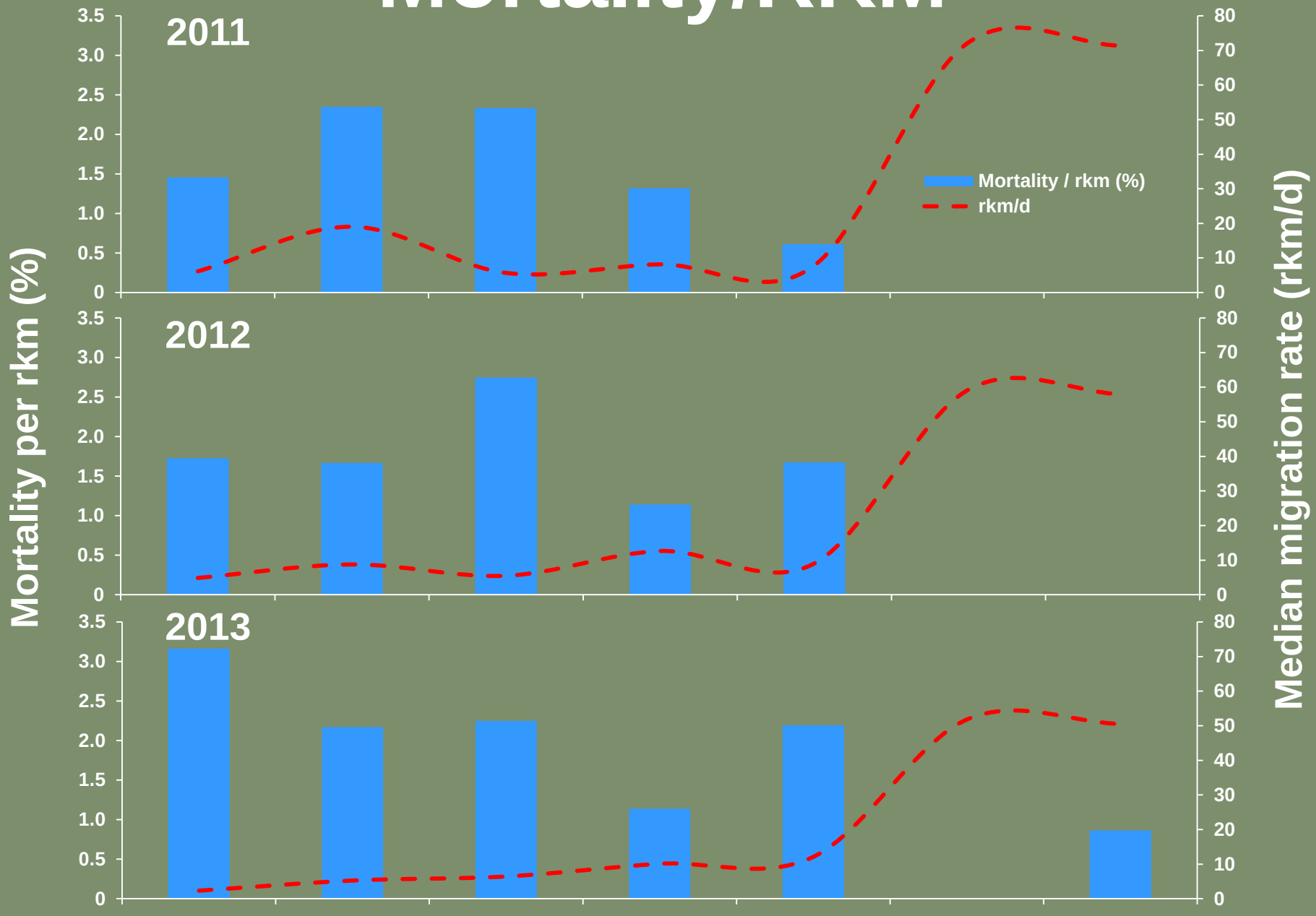
Bird Predation		
Year	# Detected	% Detected
2011	17	9.4%
2012	6	5.4%
2013	8	11.8%

Reach-specific Ŝ

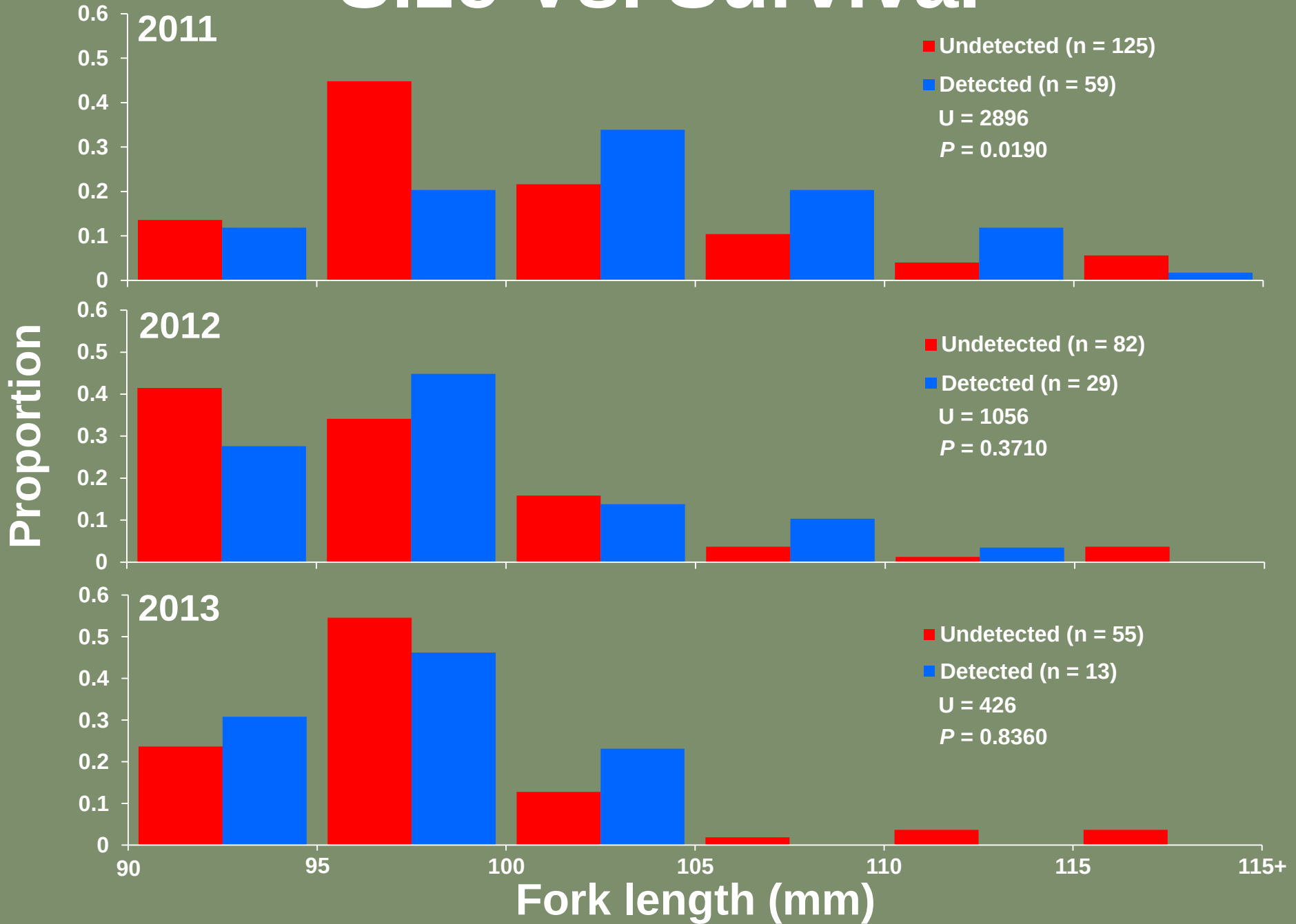
Reach-specific M̂

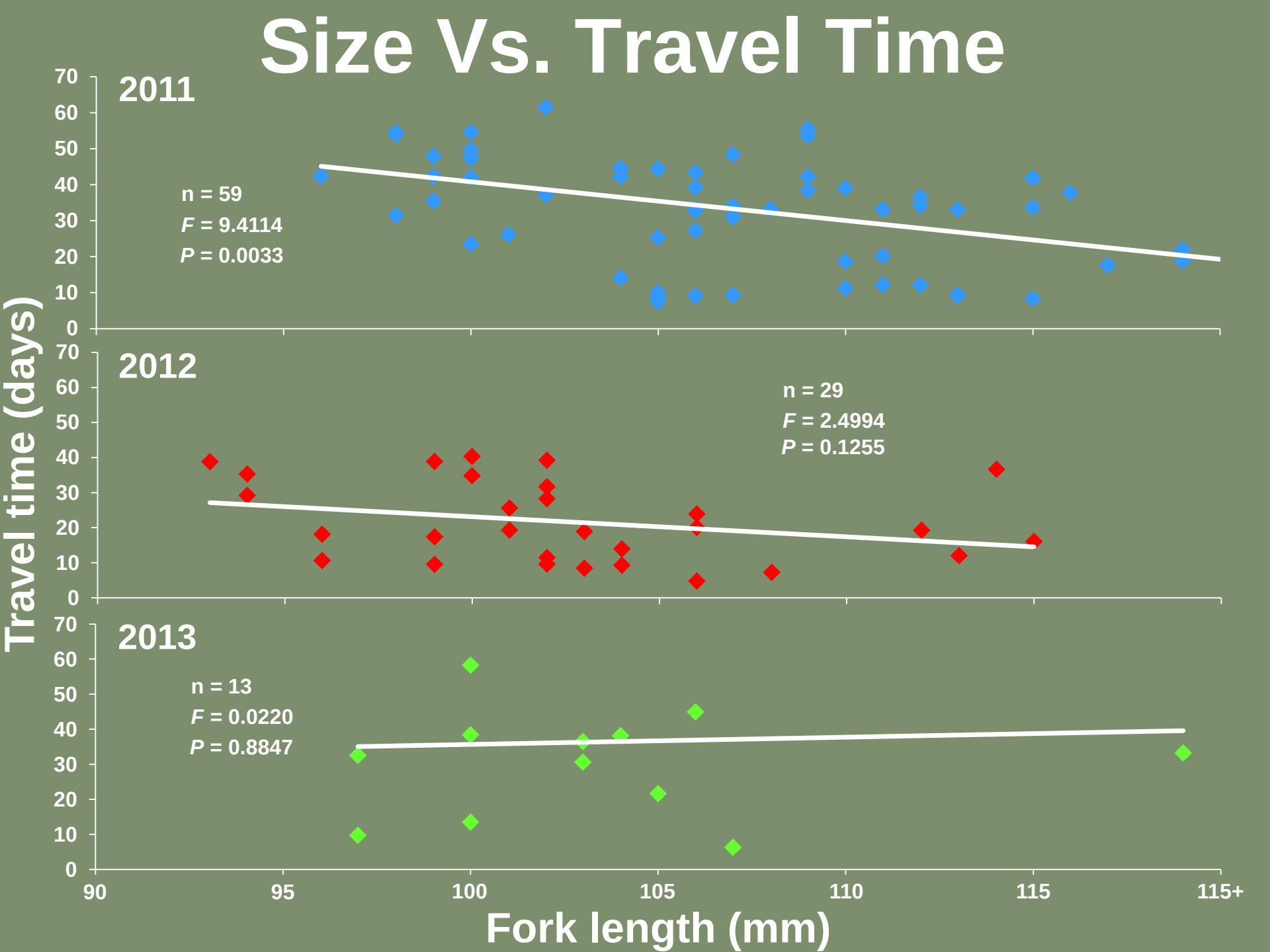


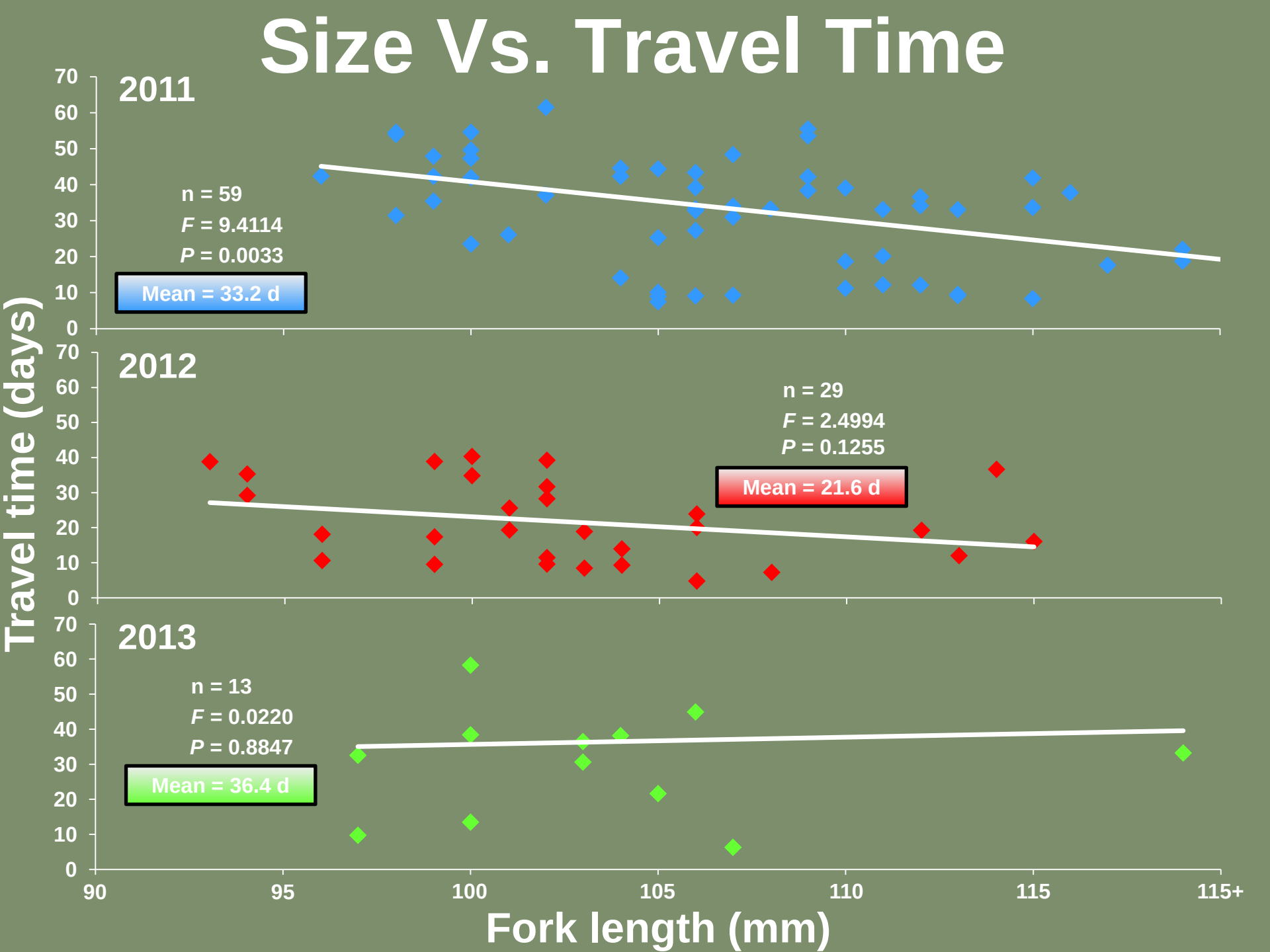
Mortality/RKM



Size Vs. Survival




Size Vs. Travel Time
2011
n = 59
F = 9.4114
P = 0.0033
2012
n = 29
F = 2.4994
P = 0.1255
2013
n = 13
F = 0.0220
P = 0.8847
Travel time (days)
0
10
20
30
40
50
60
70
90
95
100
105
110
115
115+
Fork length (mm)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2012
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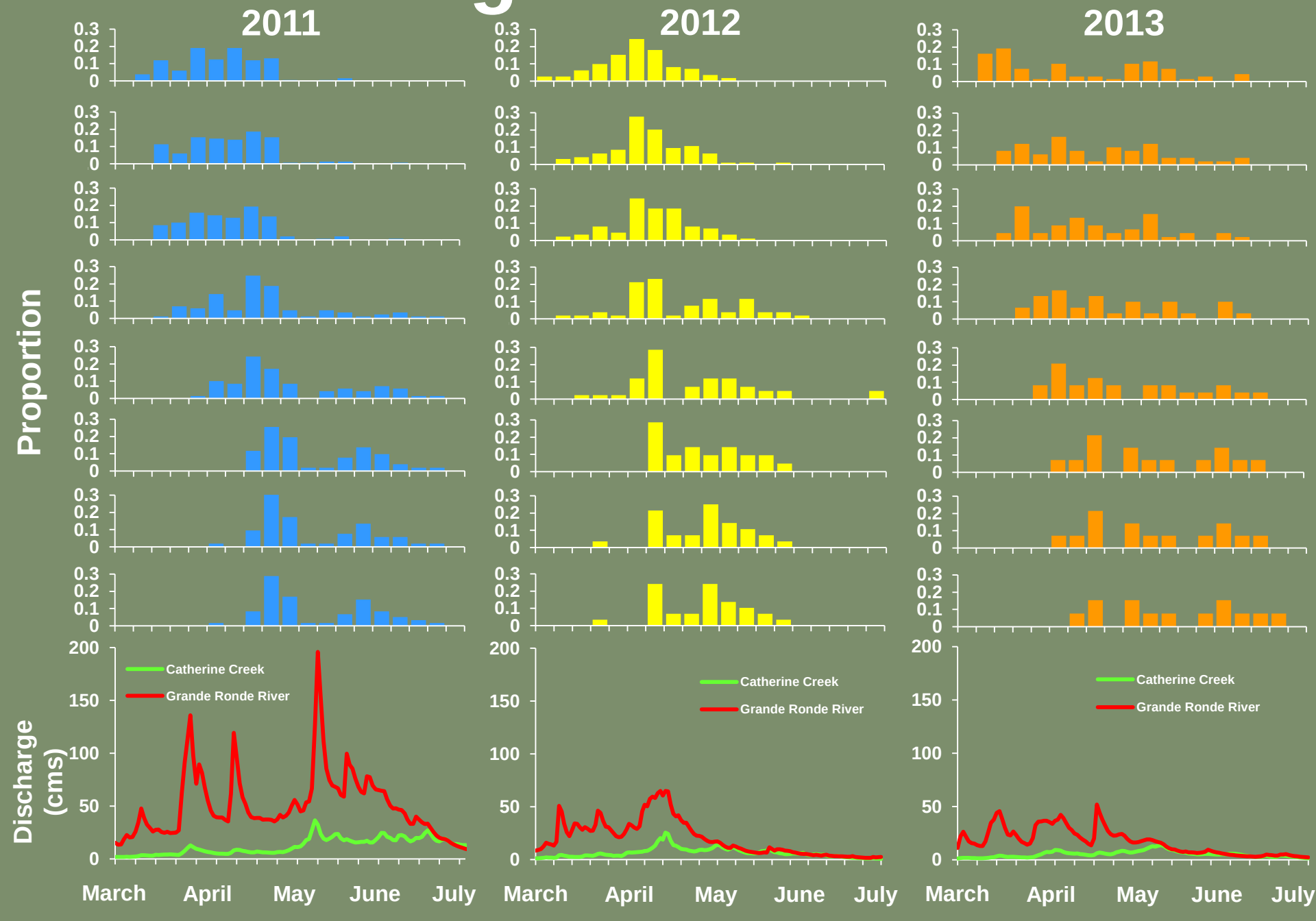
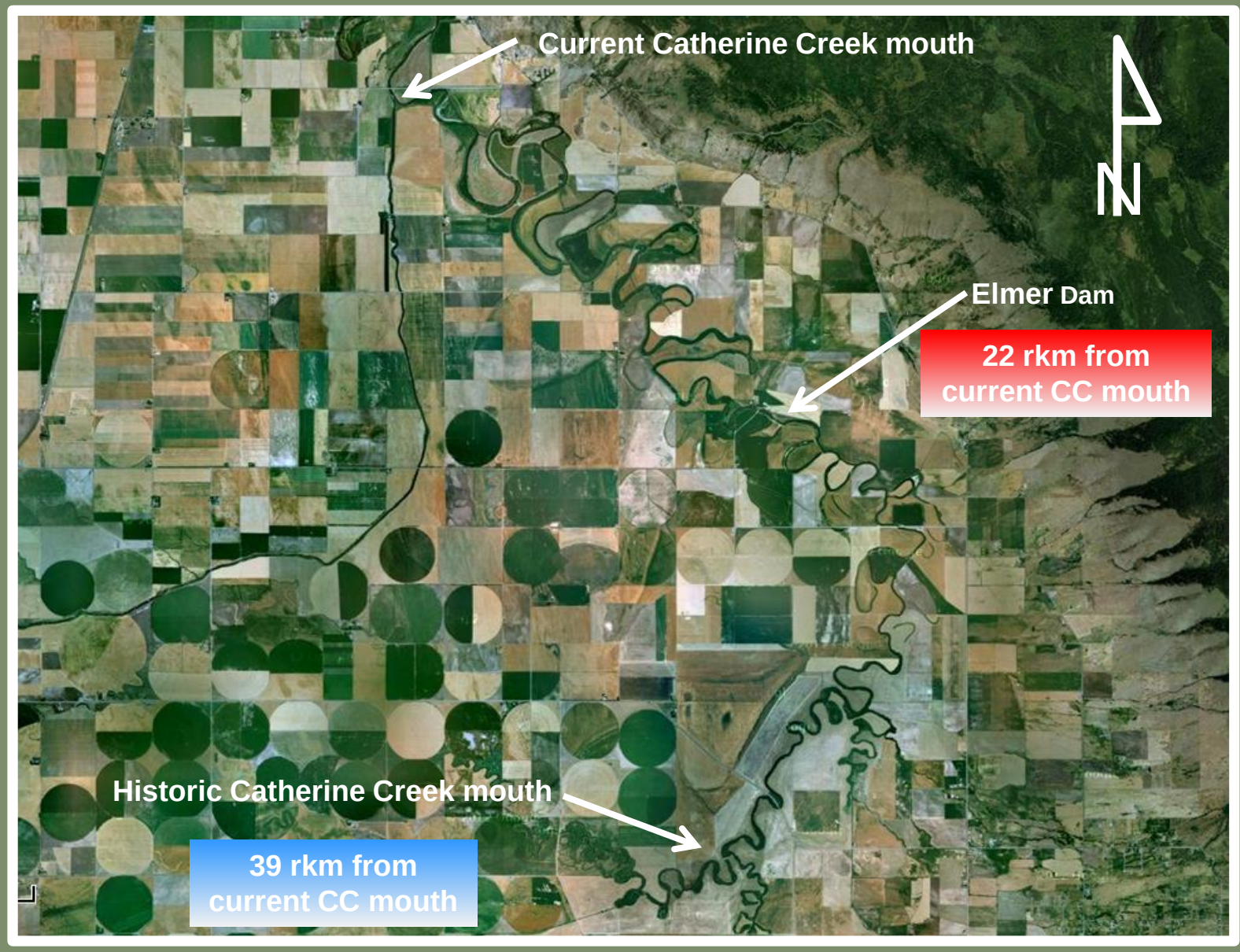
F = 2.4994
P = 0.1255
Mean = 21.6 d
2013
n = 13
F = 0.0220
P = 0.8847
Mean = 36.4 d
Travel time (days)
0
10
20
30
40
50
60
70
90
95
100
105
110
115
115+
Fork length (mm)

Discharge Vs. Detections



Why The Gap In Detections?



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- Travel time is high throughout Catherine Creek, and low in the Grande Ronde River
- Mortality per RKM is relatively high throughout Catherine Creek, while very low in the Grande Ronde River

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Estimation of Grande Ronde River Chinook Salmon Reach-Specific Survival During Spring Emigration

Grande Ronde River: Background

- Consistently, late migrant Grande Ronde River juvenile Chinook salmon smolts experience lower survival to Lower Granite Dam (LGD) compared to neighboring populations (e.g., Lostine and Minam) within the Grande Ronde River Subbasin.

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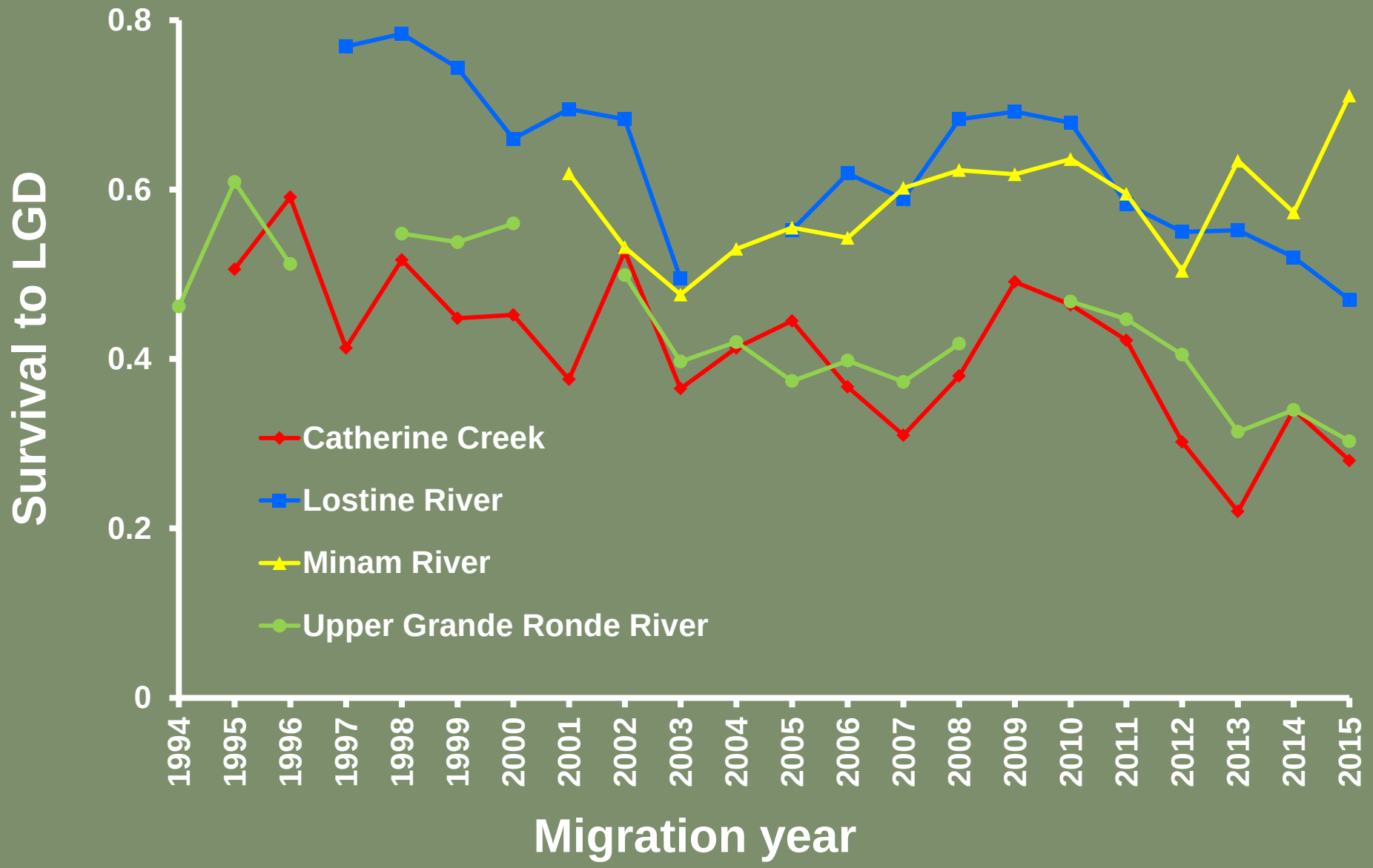

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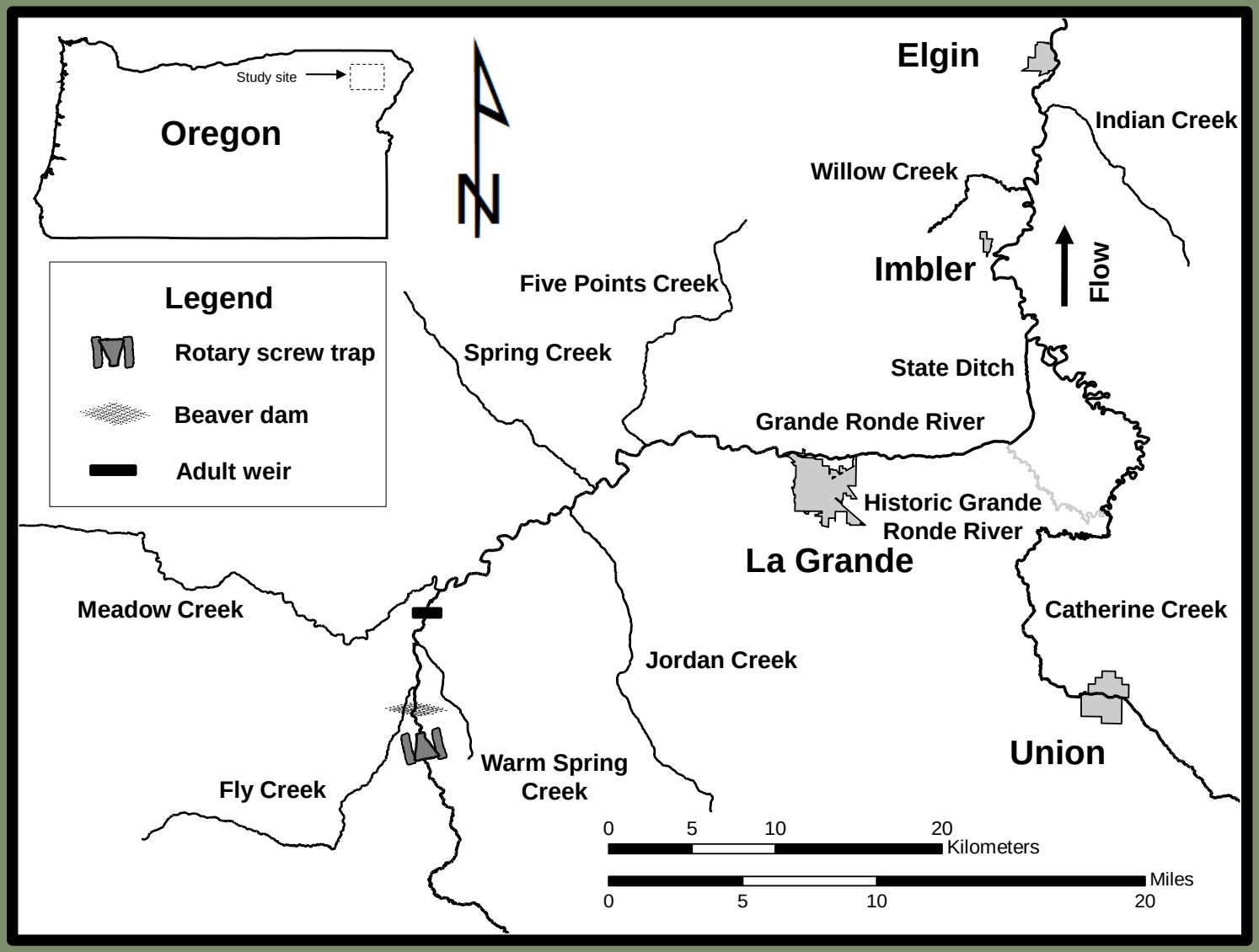

Study site
Oregon
N
Legend
Rotary screw trap
Beaver dam
Adult weir
Elgin
Indian Creek
Willow Creek
Imbler
Flow
Five Points Creek
Spring Creek
State Ditch
Grande Ronde River
Historic Grande Ronde River
La Grande
Meadow Creek
Catherine Creek
Jordan Creek
Union
Warm Spring Creek
Fly Creek
0 5 10 20
Kilometers
Miles
0 5 10 20

Objective

1. Estimate reach specific survival for Grande Ronde River late migrant juvenile spring Chinook salmon during outmigration

Methods

Spring radiotelemetry

Surgery

- Spring 2015– 200 fish tagged
- March – May
- Fish weight ≥ 8.5 g
- Continuous duty cycle
- 9-cm trailing antenna

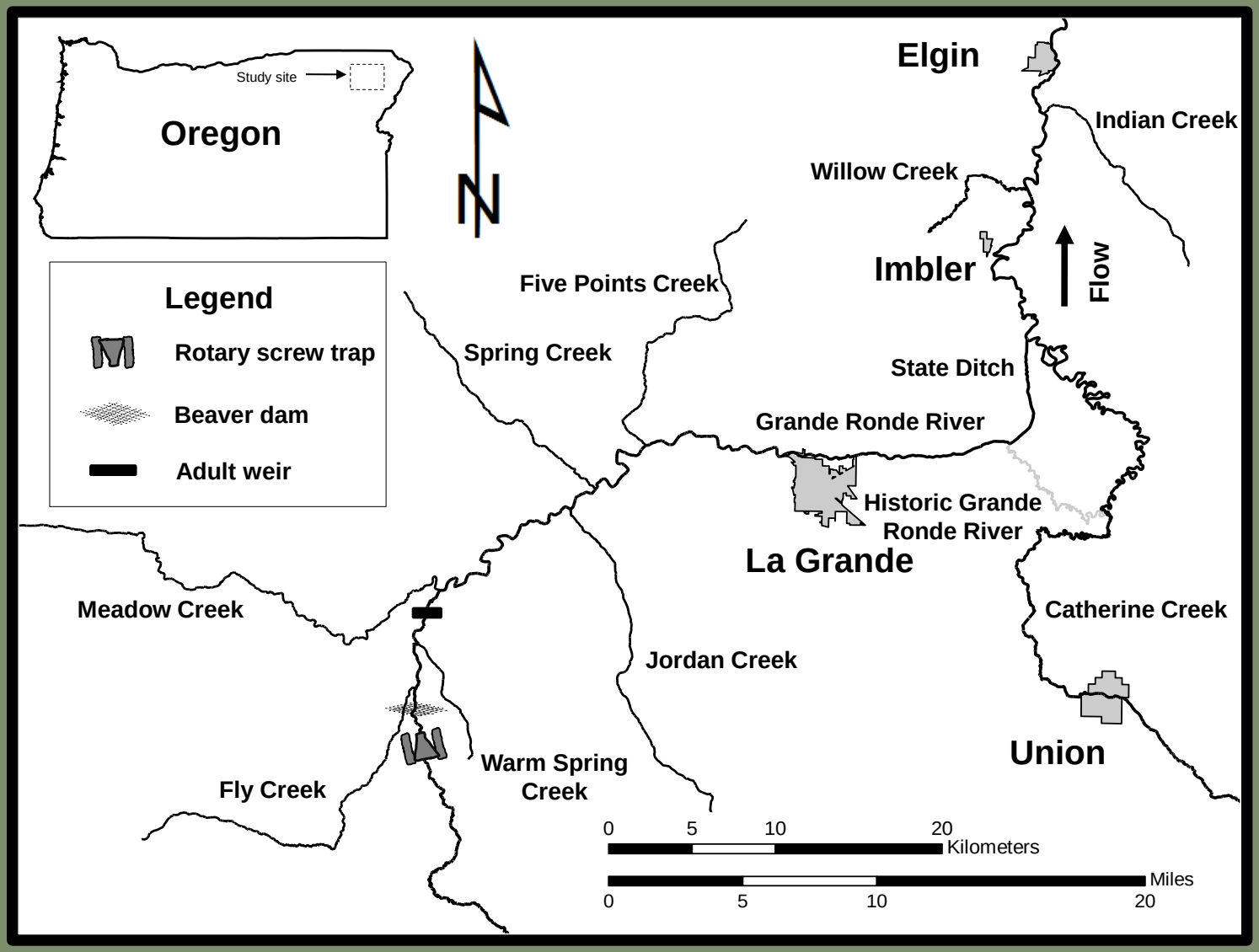
Tracking

- 9 Stationary receivers
- Starkey to Elgin
- Boat tracking (Heron rookery)

Data Analysis

- Mark-recapture data set
- Cormack-Jolly-Seber model

Methods – Receiver Locations



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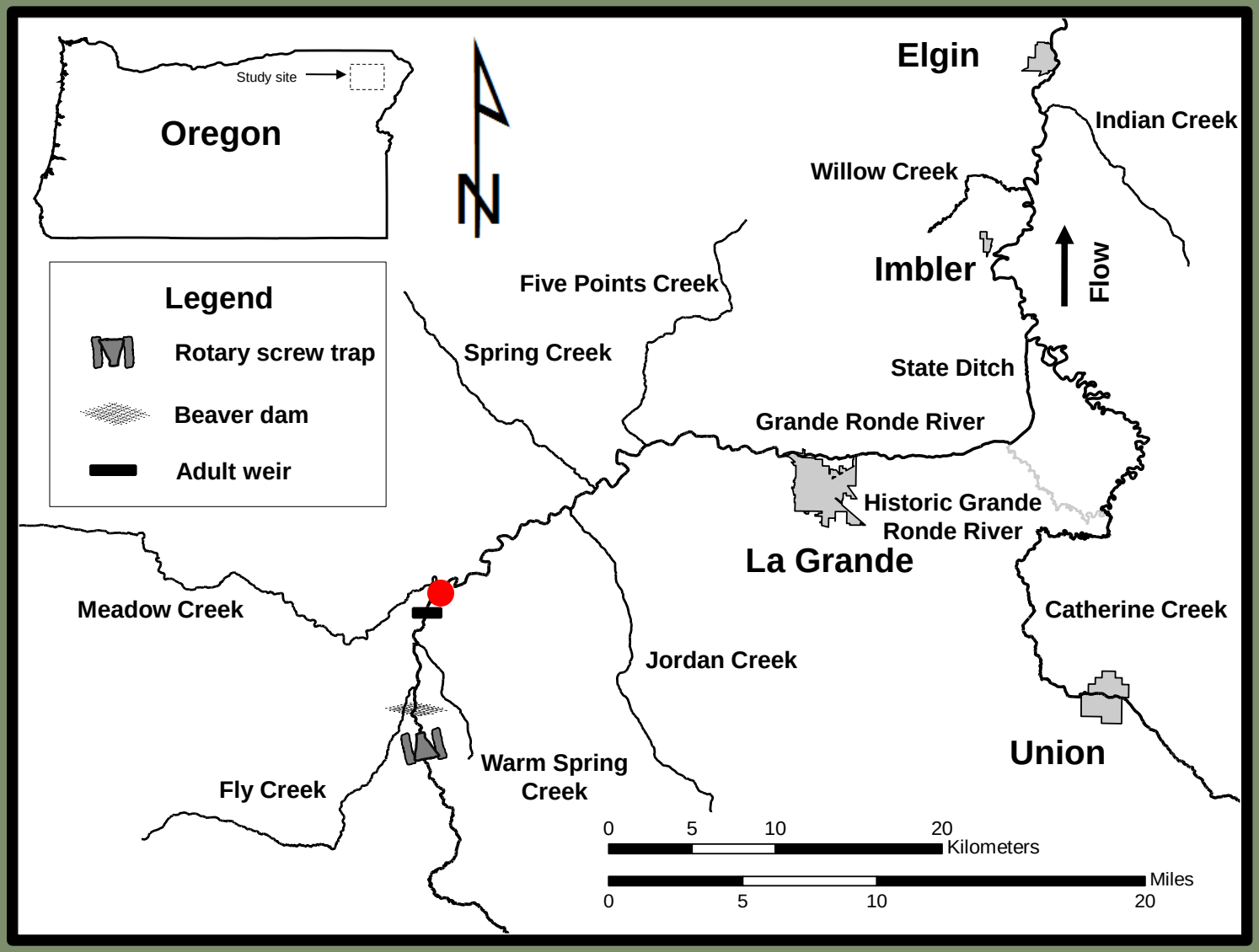

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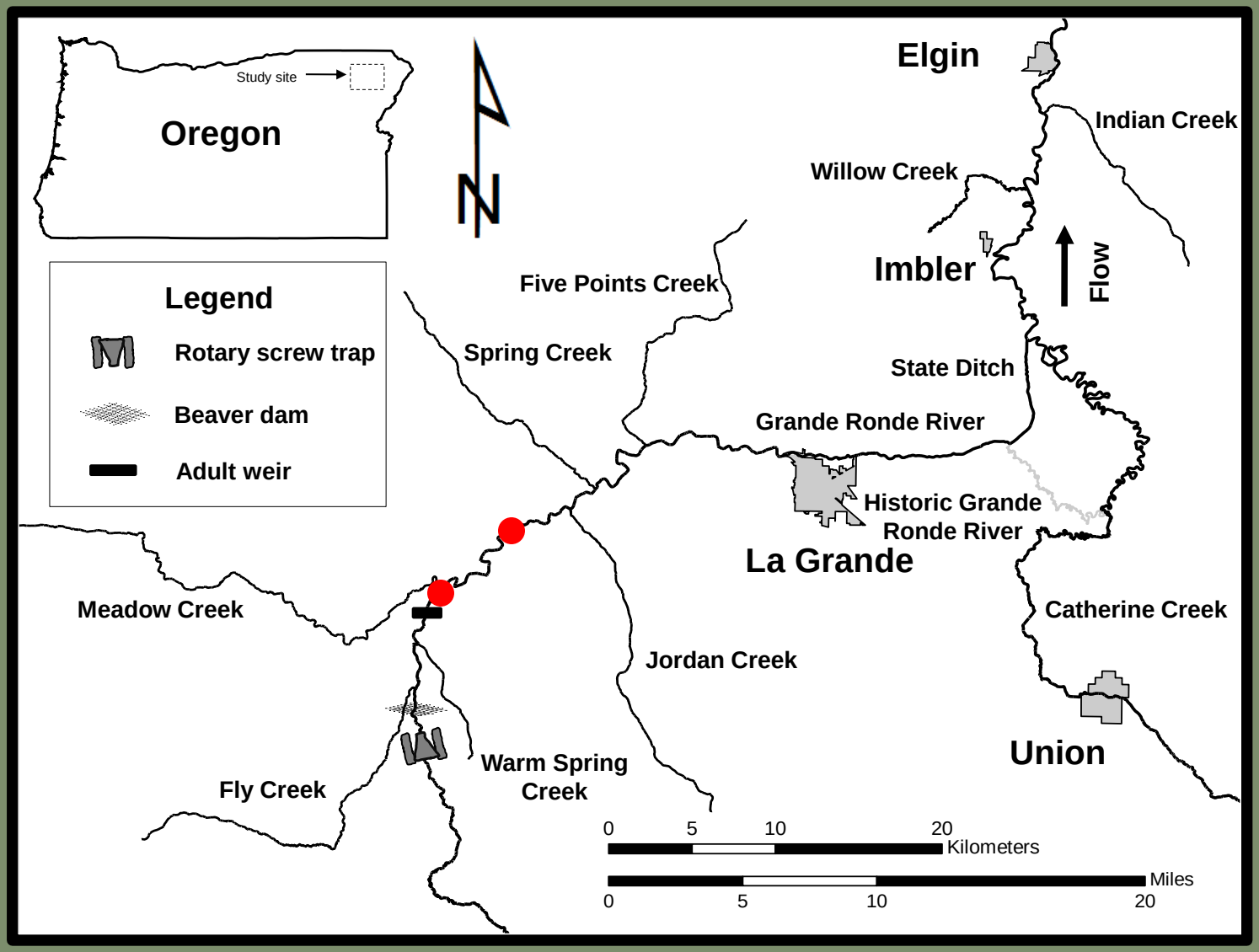

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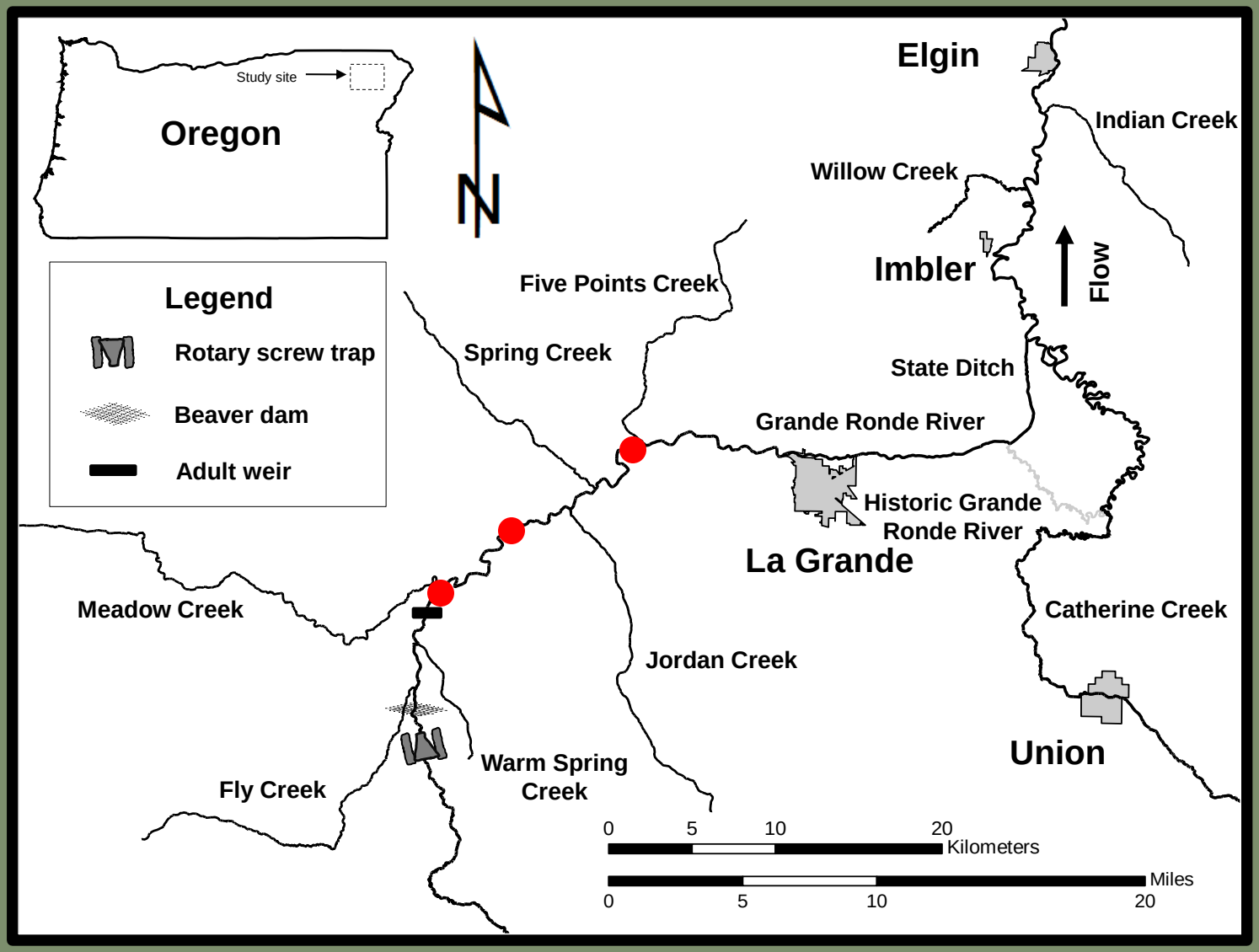

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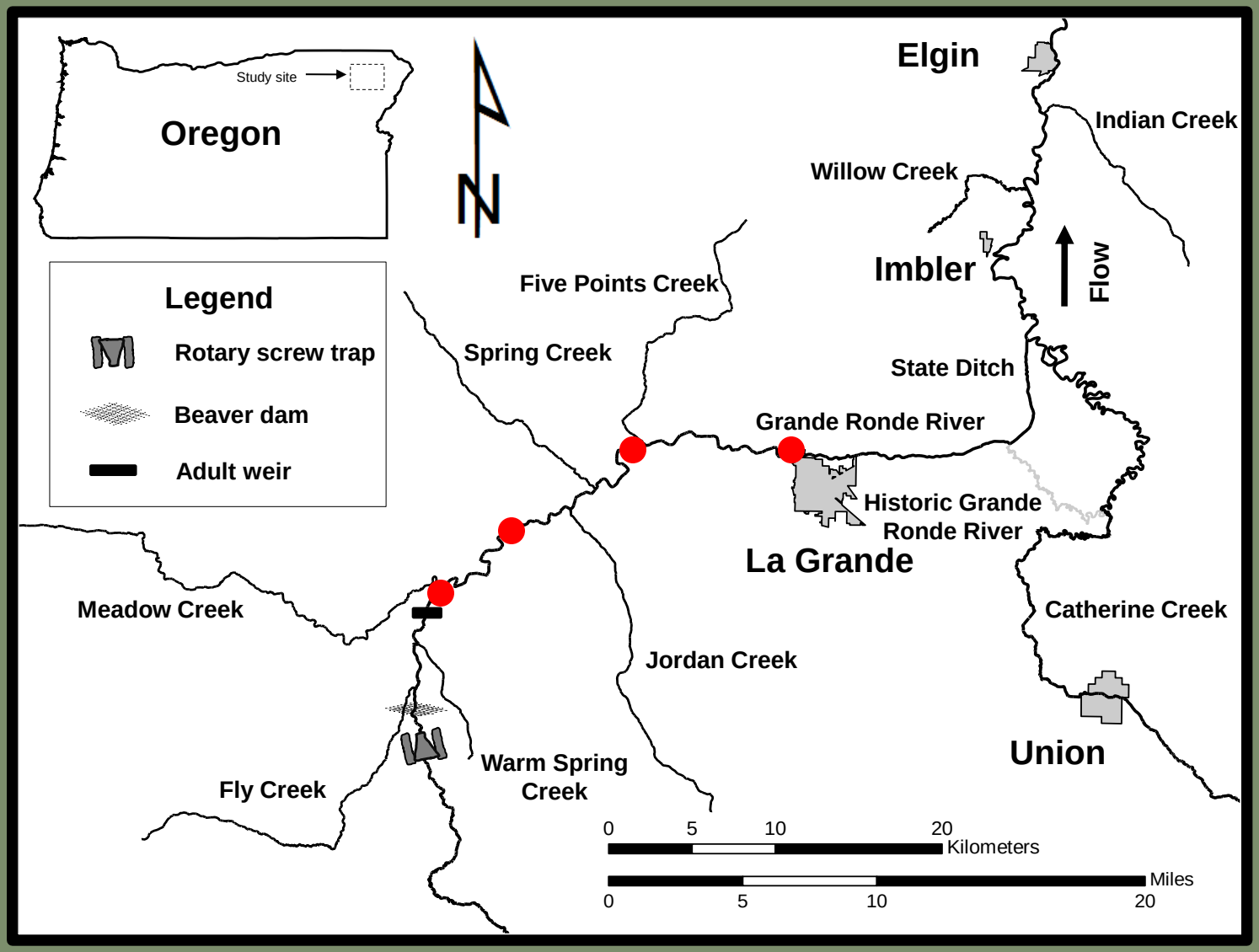

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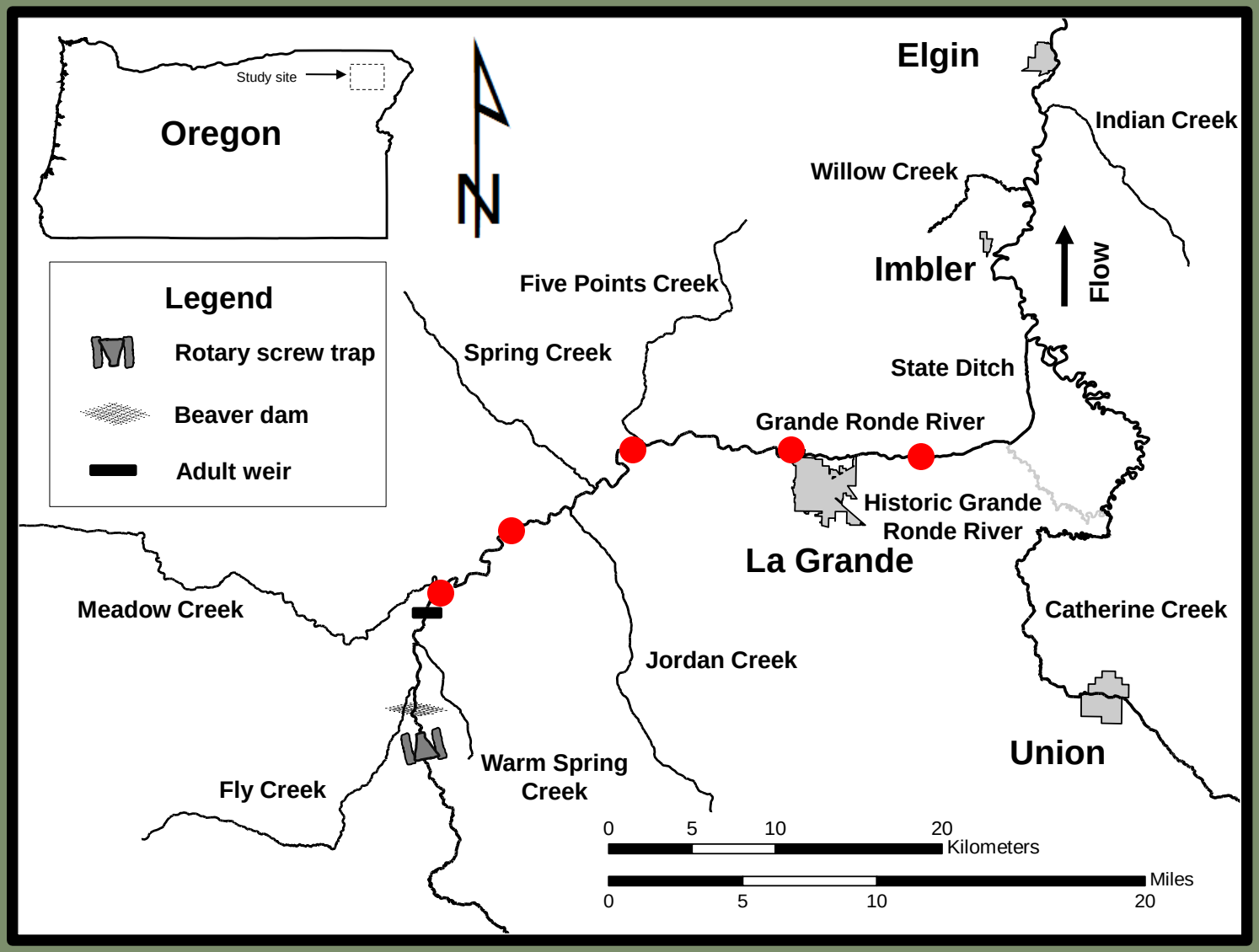

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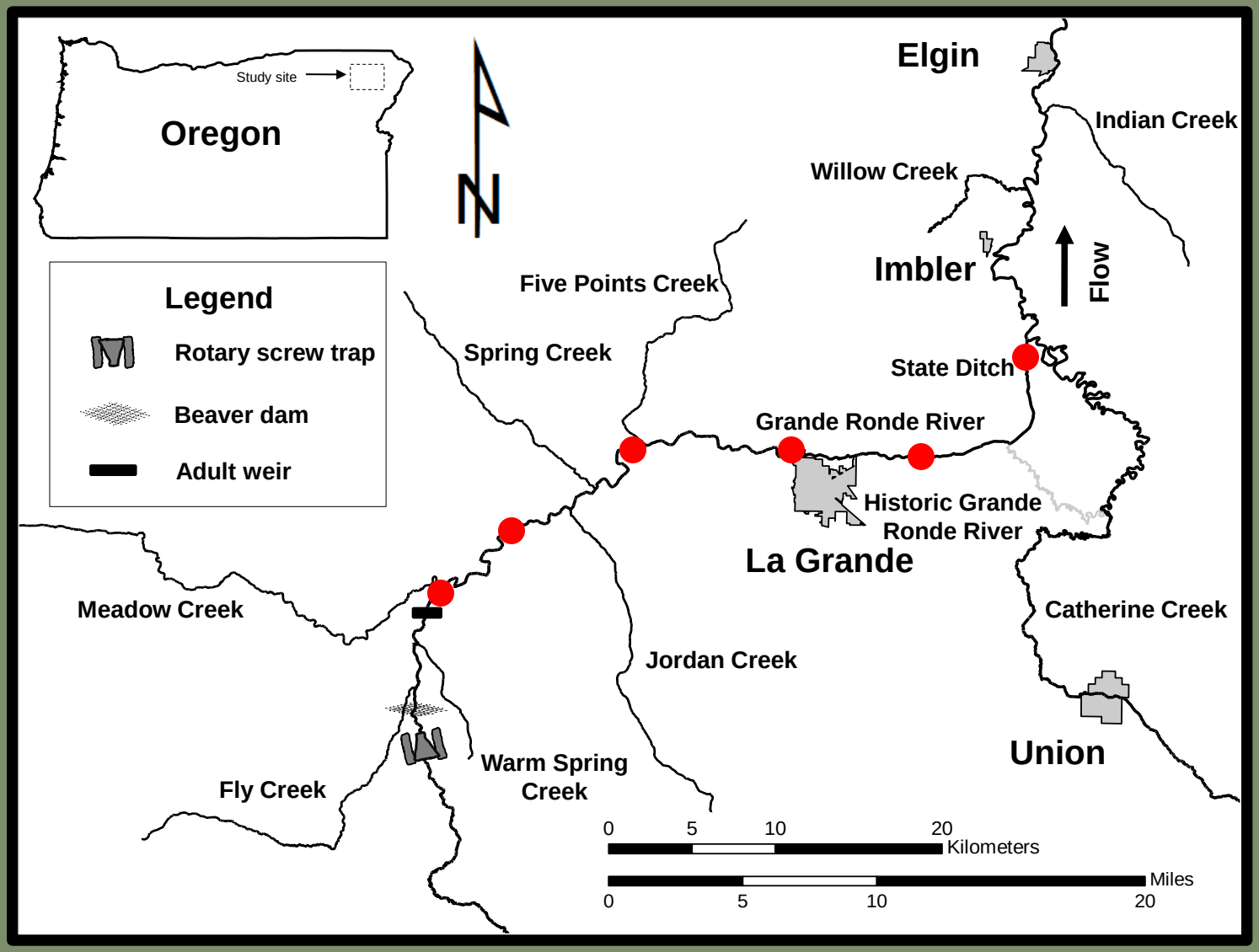

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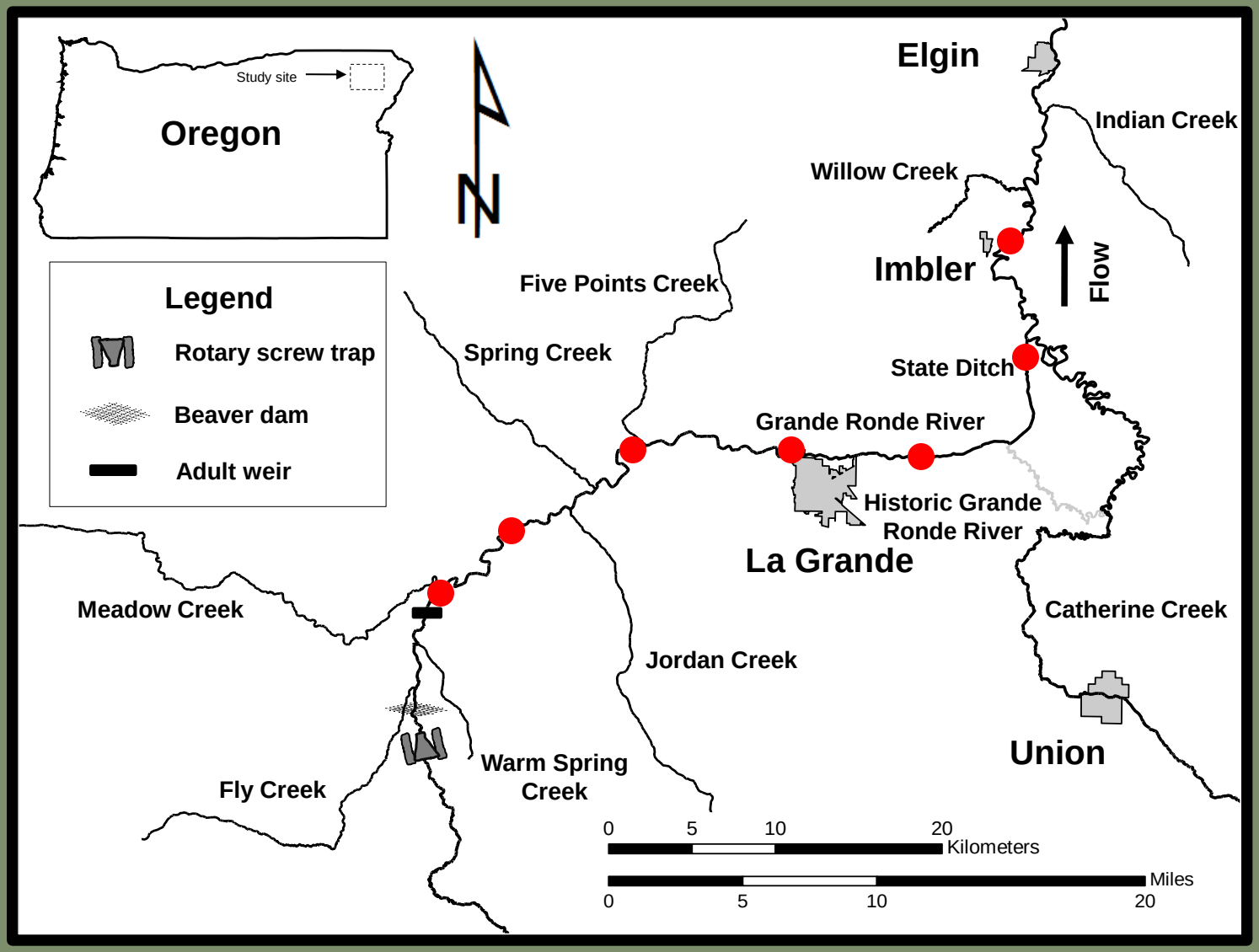

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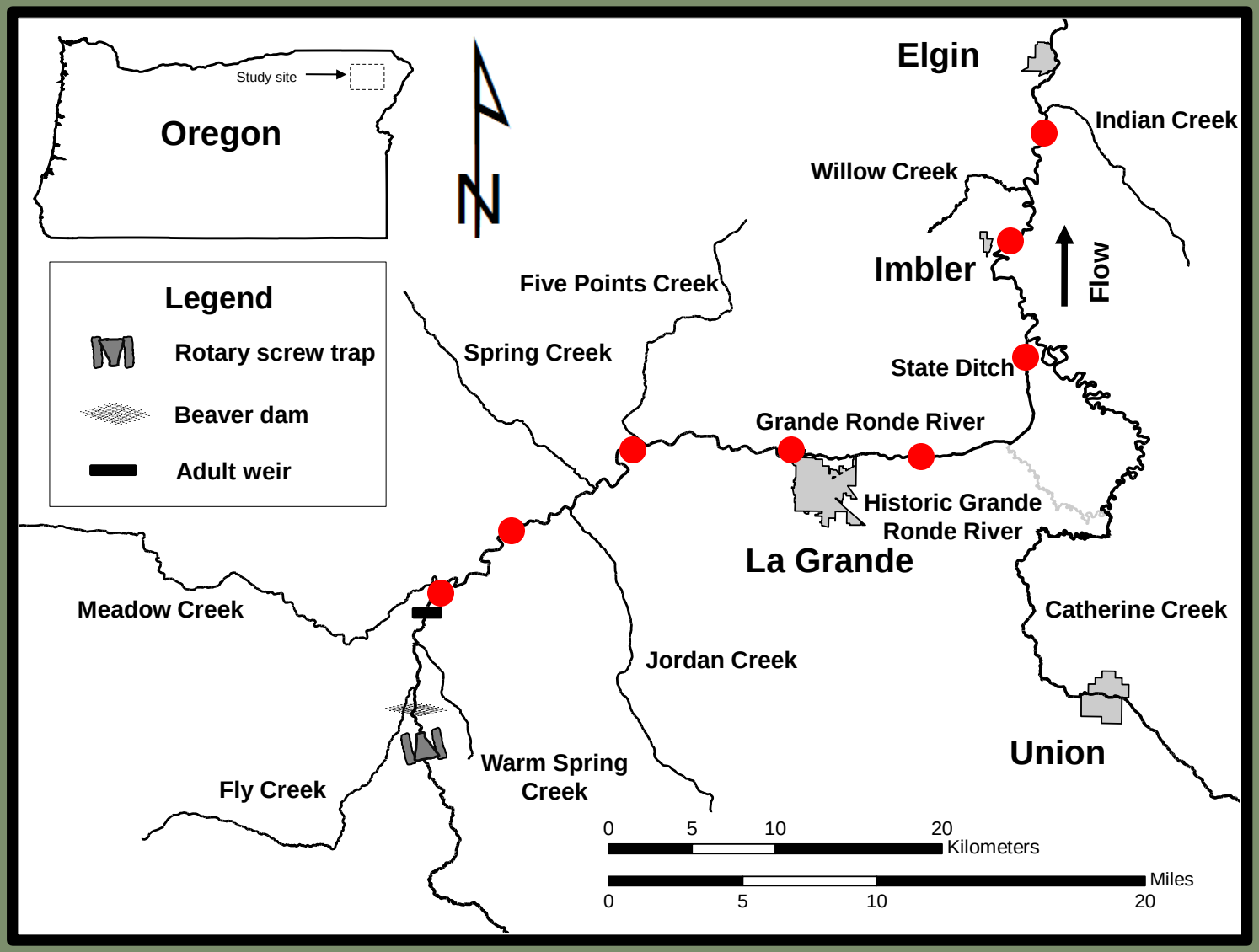

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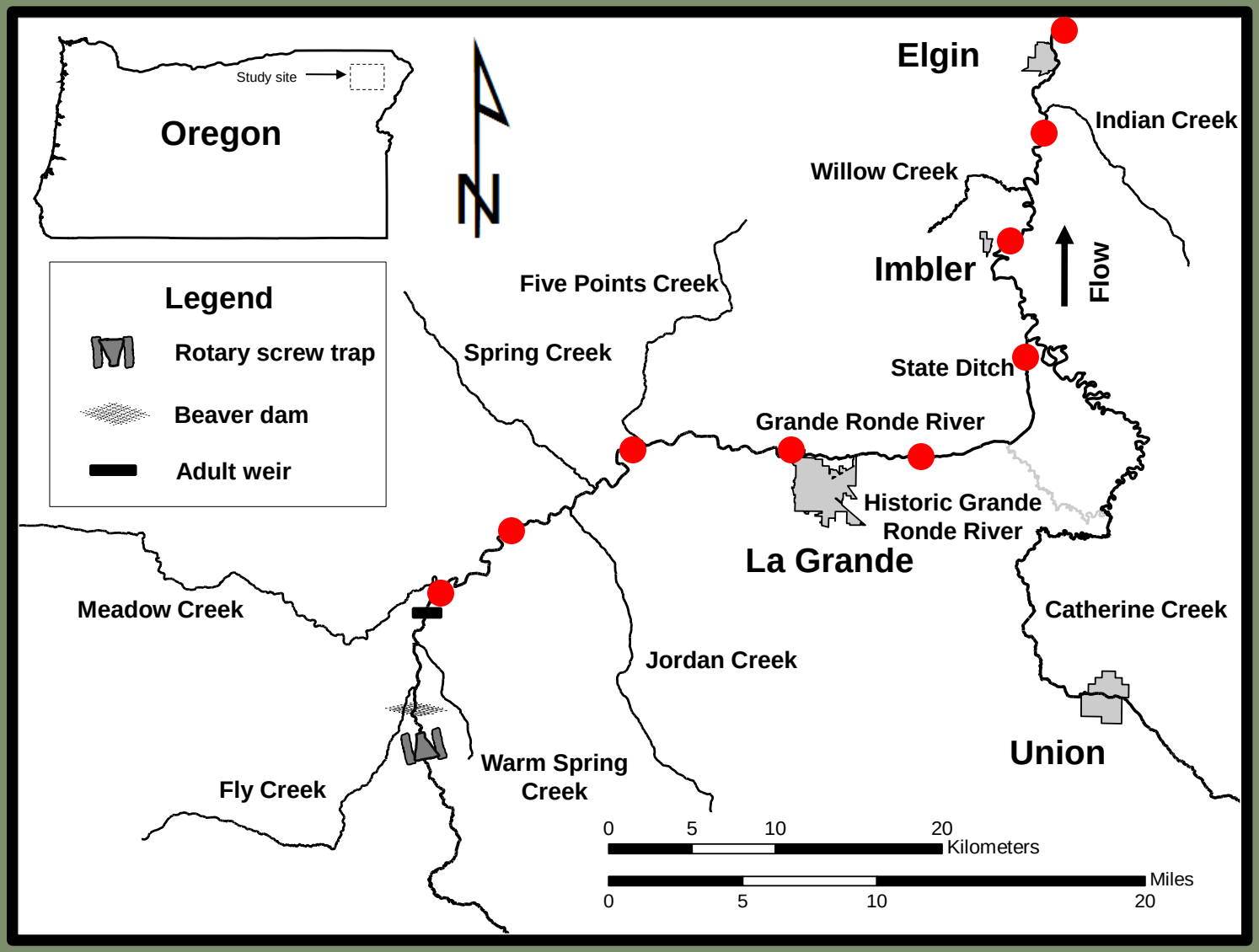
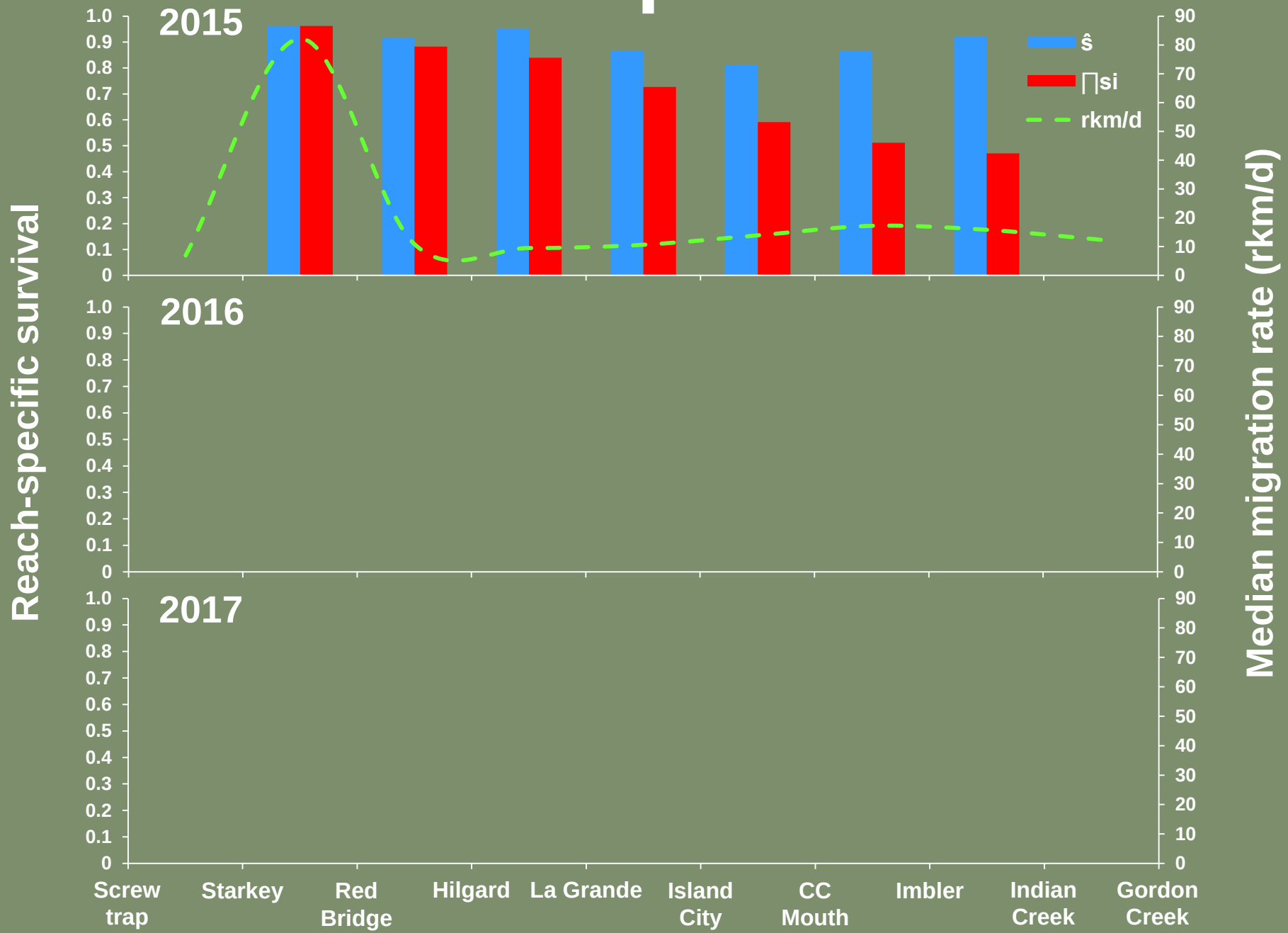


Results-Raw Data

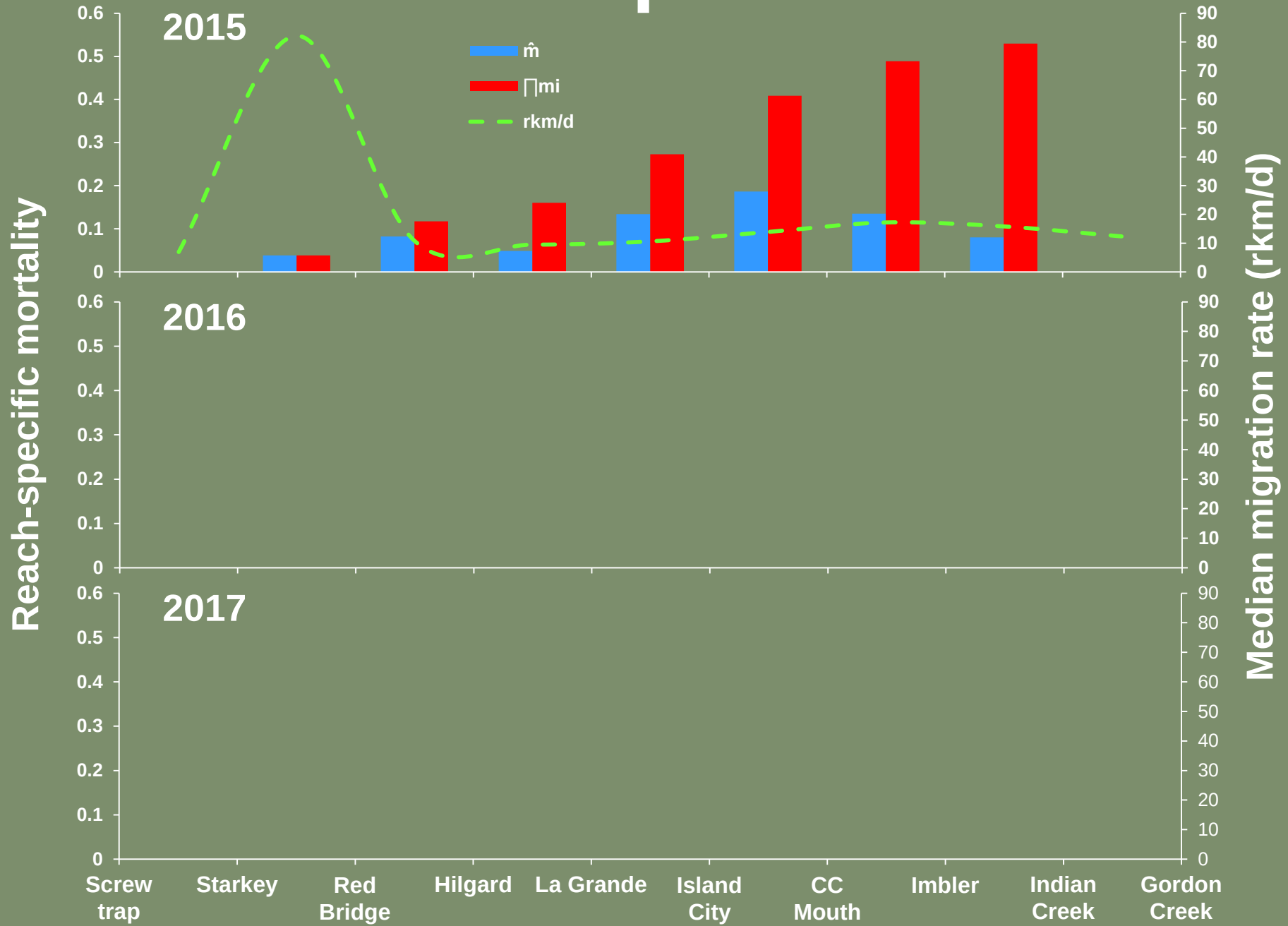
Receiver Site	Unique Detections			Detection Efficiency		
	2015	2016	2017	2015	2016	2017
Starkey	152	–	–	N/A	–	–
Red Bridge	145	–	–	0.99	–	–
Hilgard	134	–	–	0.99	–	–
La Grande, OR	125	–	–	0.97	–	–
Island City, OR	110	–	–	0.99	–	–
CC mouth	87	–	–	0.96	–	–
Imbler, OR	75	–	–	0.96	–	–
Indian Creek	71	–	–	1.00	–	–
Gordon Creek	65	–	–	N/A	–	–

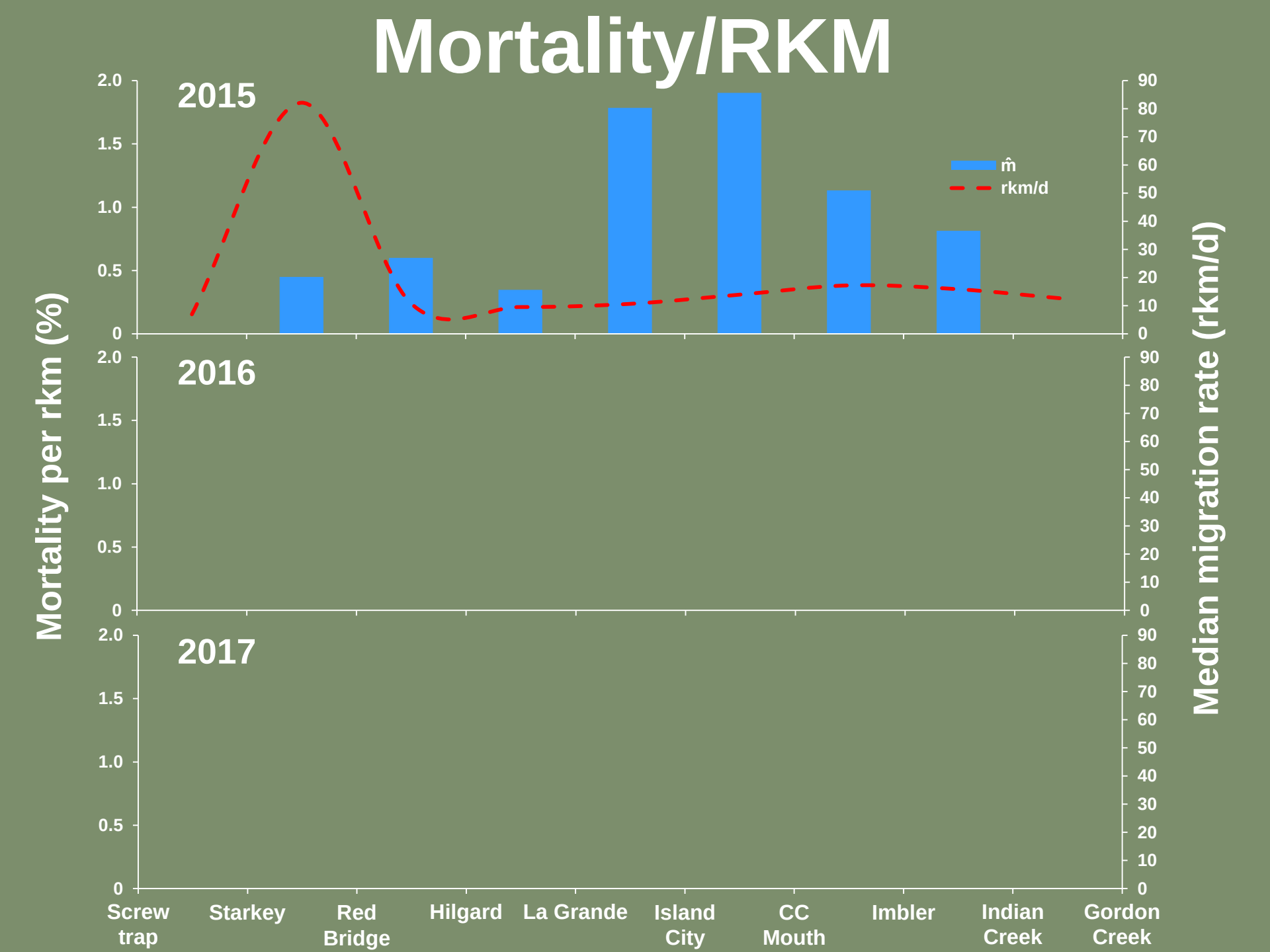
Bird Predation		
Year	Detected (#)	Detected (%)
2015	2	1.0%
2016	–	–
2017	–	–

Reach-specific Ŝ

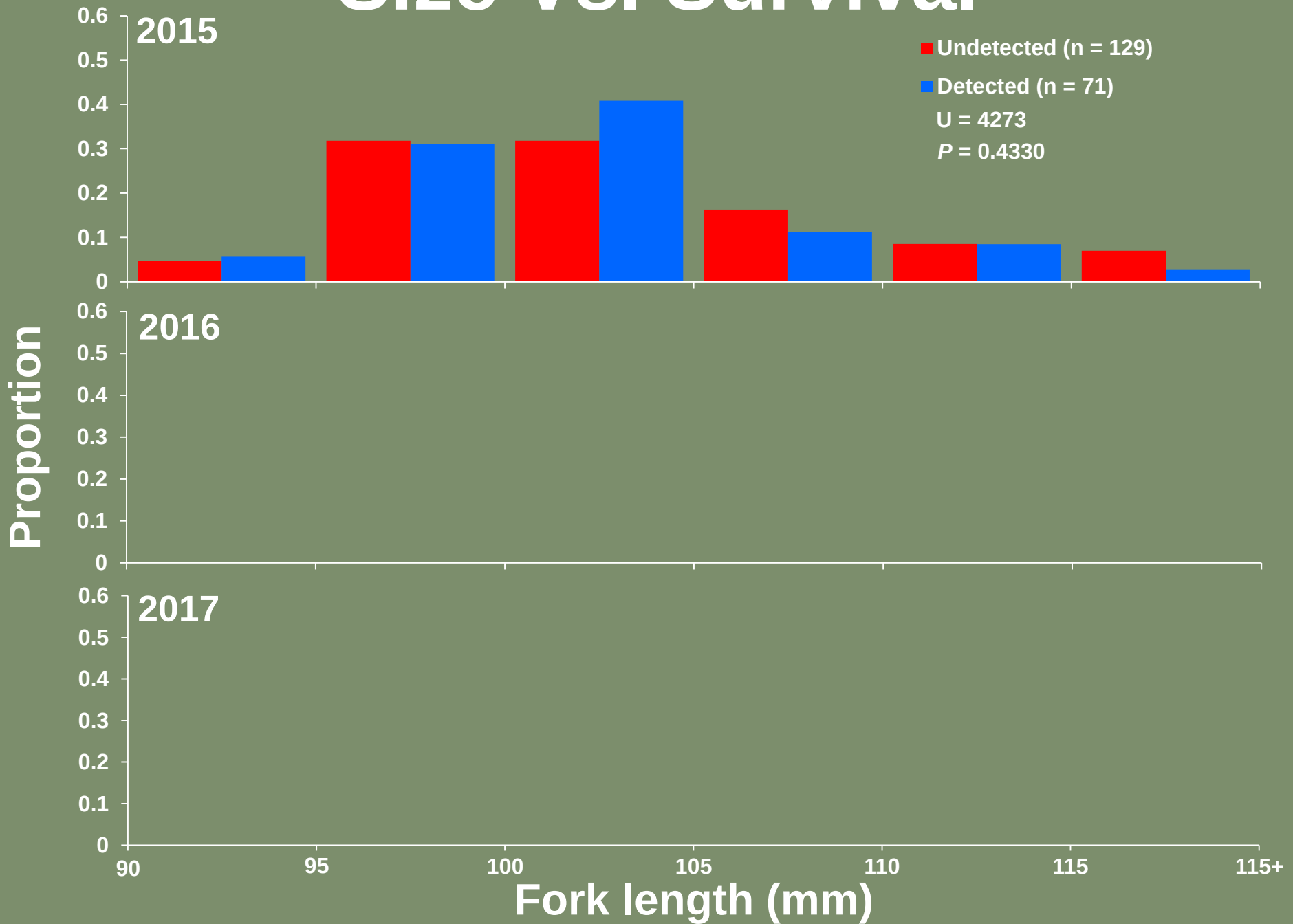


Reach-specific M̂

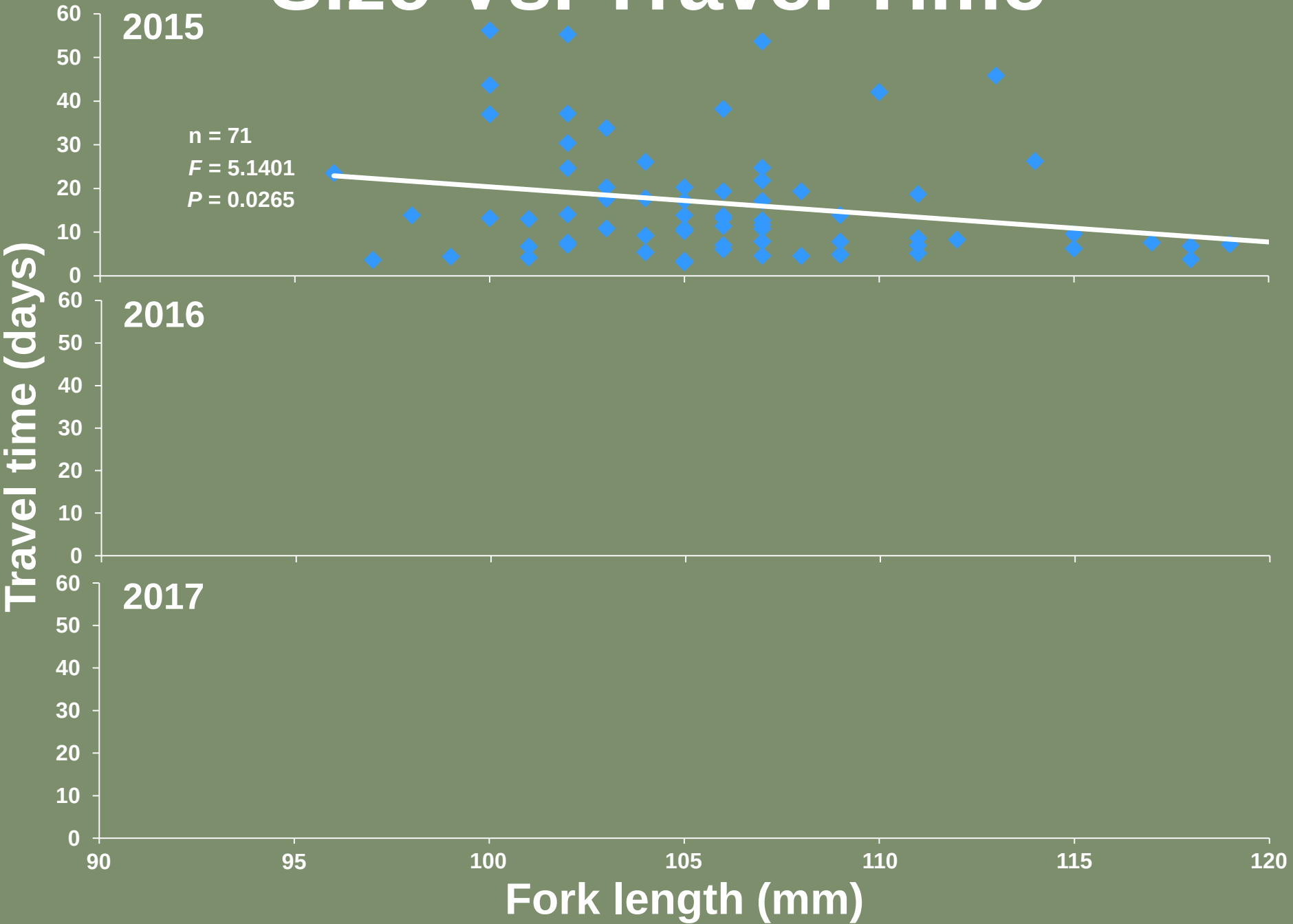



Mortality/RKM
2015
2016
2017
m̂
rkm/d
Mortality per rkm (%)
Median migration rate (rkm/d)
0
0.5
1.0
1.5
2.0
0
10
20
30
40
50
60
70
80
90
Screw trap
Starkey
Red Bridge
Hilgard
La Grande
Island City
CC Mouth
Imbler
Indian Creek
Gordon Creek

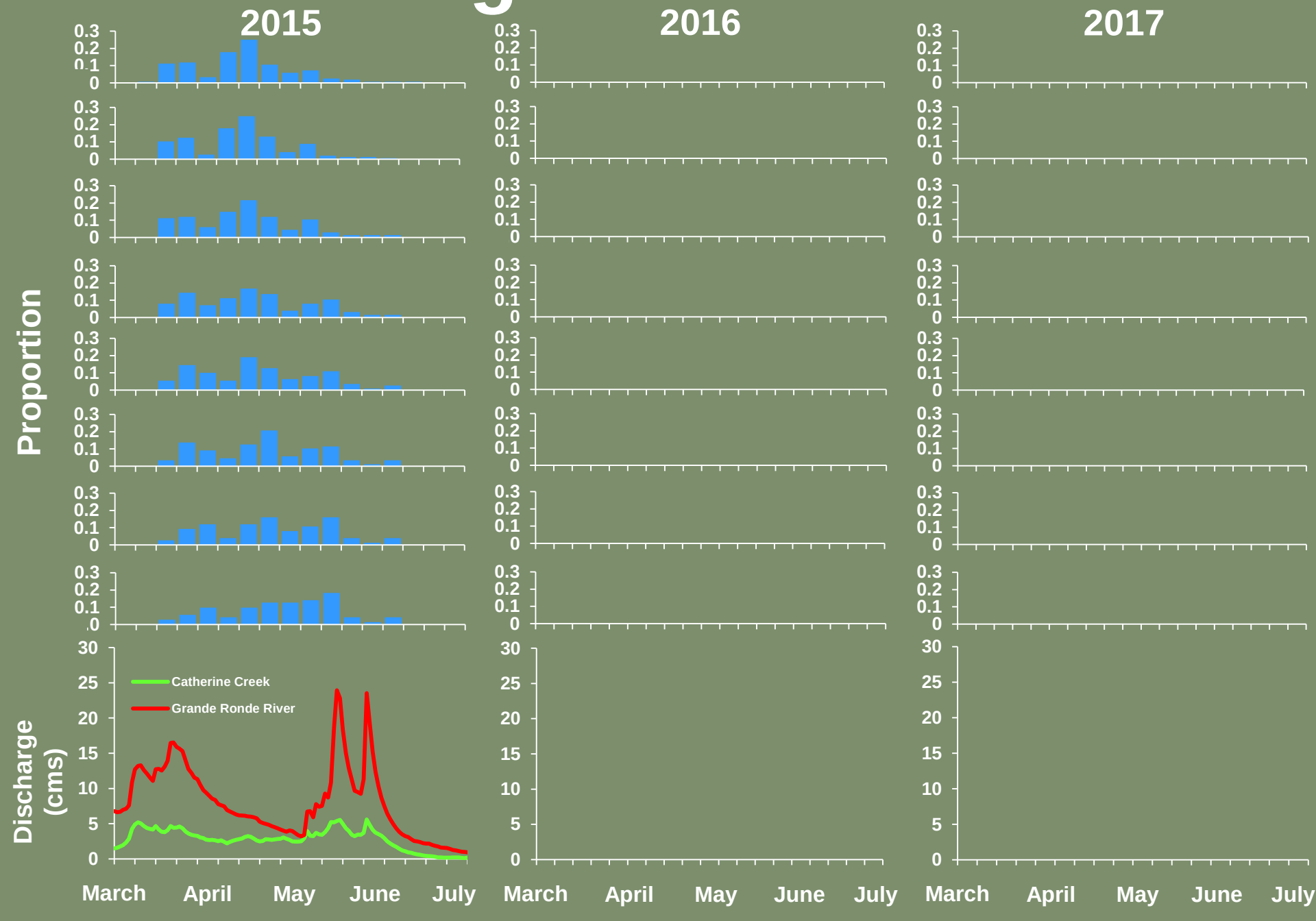
Size Vs. Survival



Size Vs. Travel Time



Discharge Vs. Detections



Summary

- Large naturally produced spring Chinook salmon emigrate significantly faster than those smaller
- Contrary to Catherine Creek, no pause in emigration was observed during peak Grande Ronde River flows
- Travel time is moderate both upstream and downstream of the Catherine Creek mouth
- Mortality per RKM is relatively low upstream of the Grande Ronde Valley, but high throughout the Grande Ronde Valley

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