Investigation and application of weighted proportion hatchery origin spawner in the Wenaha River

Emily Treadway *ODFW & OSU*

Seth White *OSU*

Ian Tattam *ODFW*

Jim Peterson *OSU*

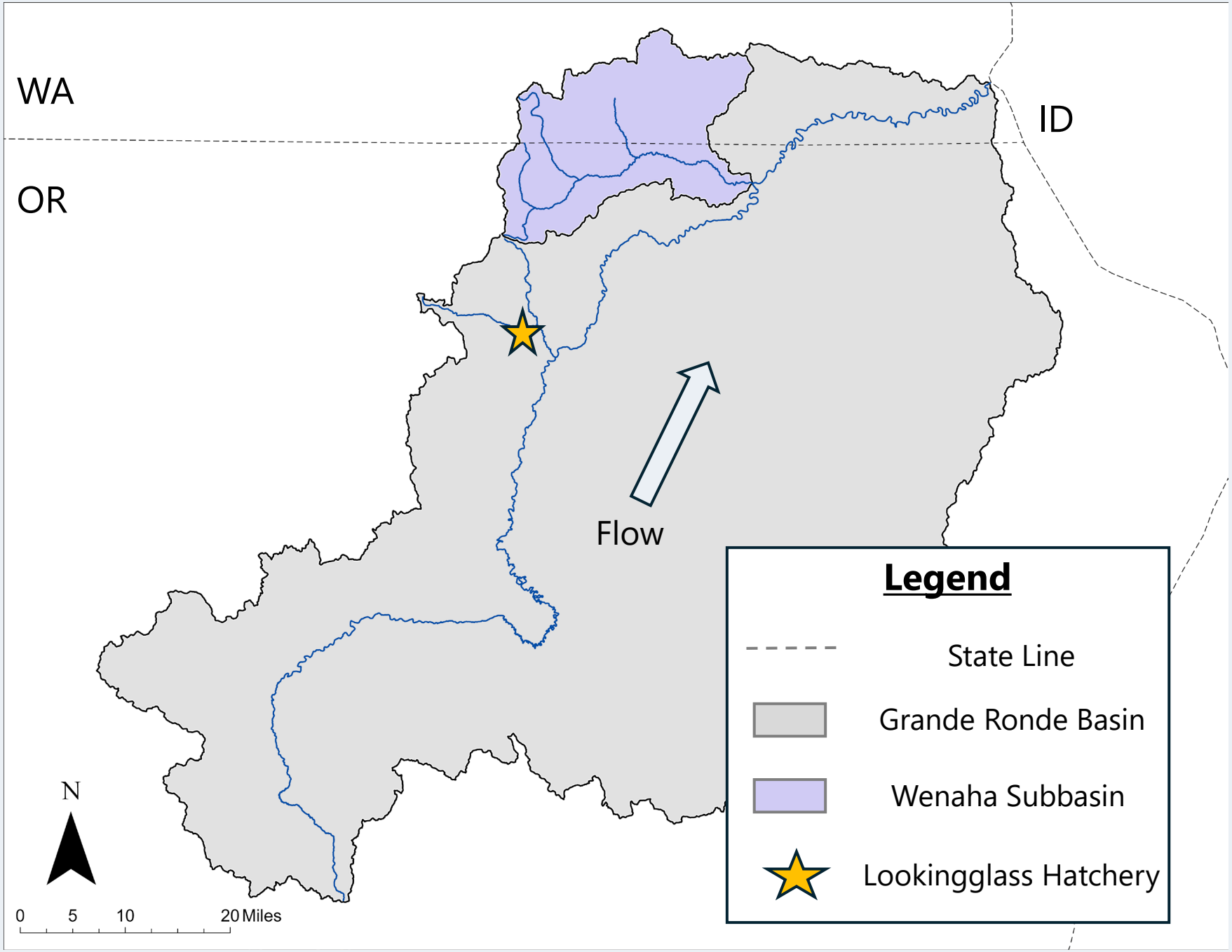
Joseph Feldhaus *ODFW*

Oregon State University

OREGON Fish & Wildlife

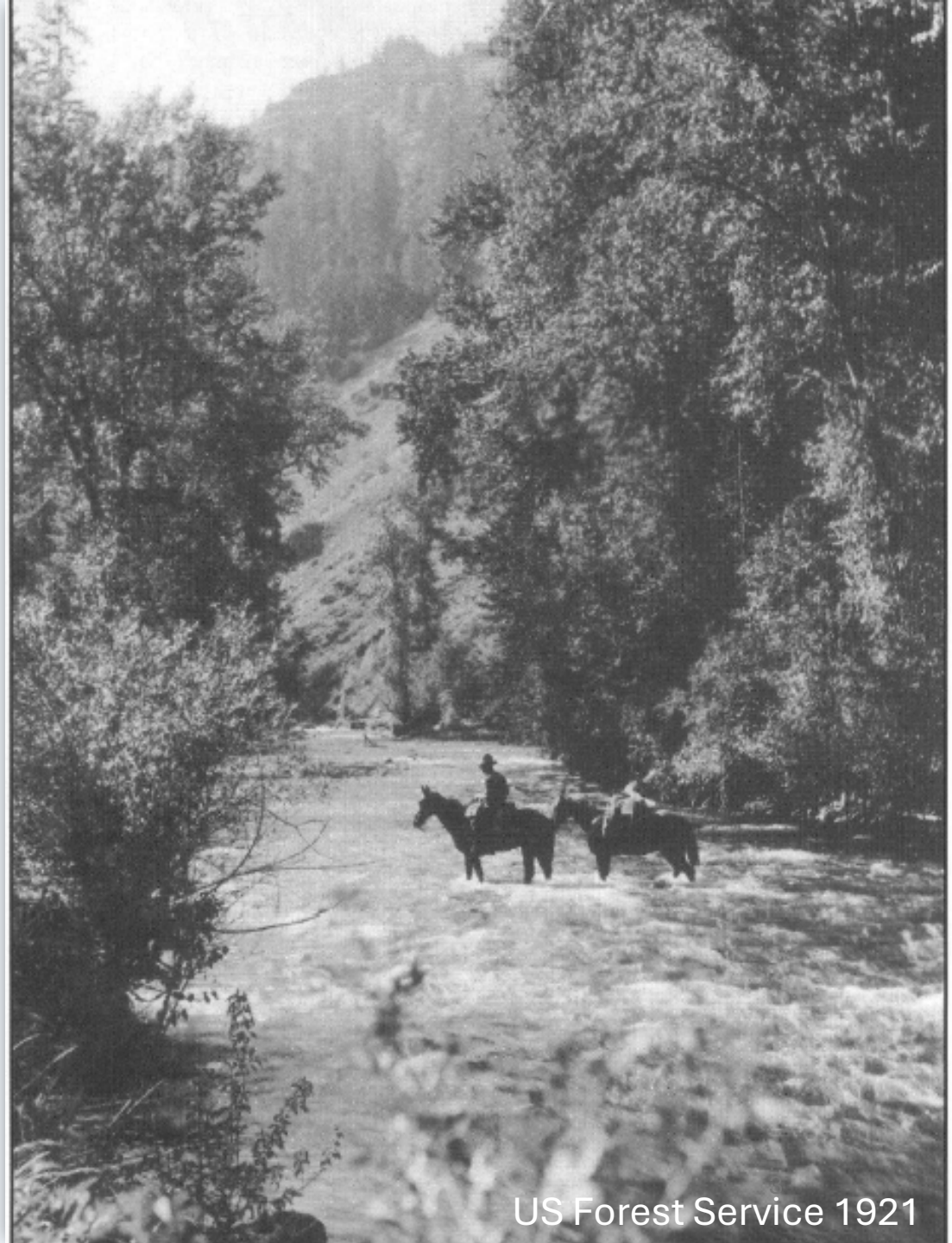
LOWER SNAKE RIVER COMPENSATION PLAN *Hatchery Program*

Grande Ronde Basin



Wenaha River

- Wild & Scenic River – Wild Spring Chinook
- Hatchery Supplementation - Hatchery Strays
  - HGMP allowable threshold
- Annual Monitoring
  - Logistically challenging
  - Low sample size



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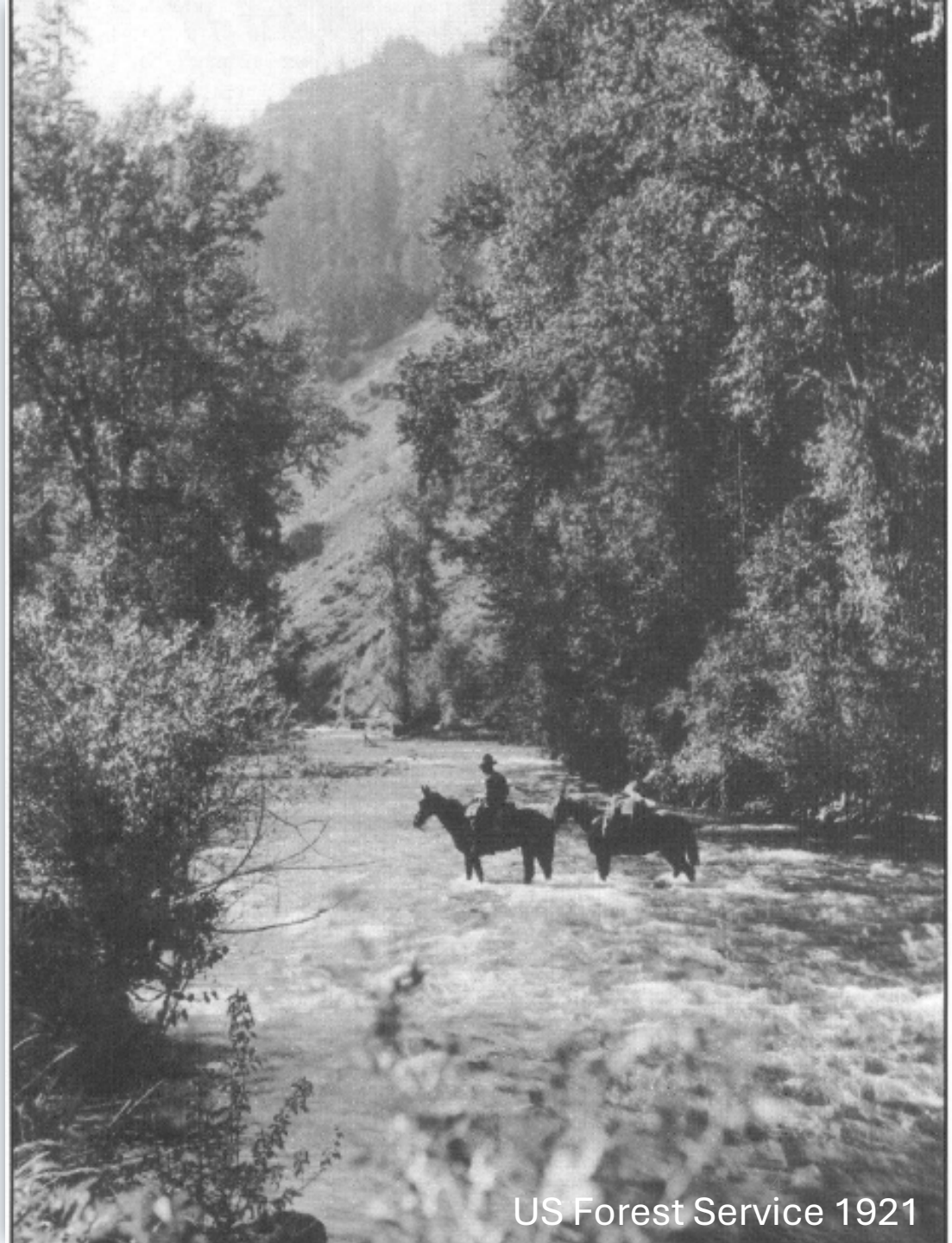
proportion hatchery origin spawner - pHOS

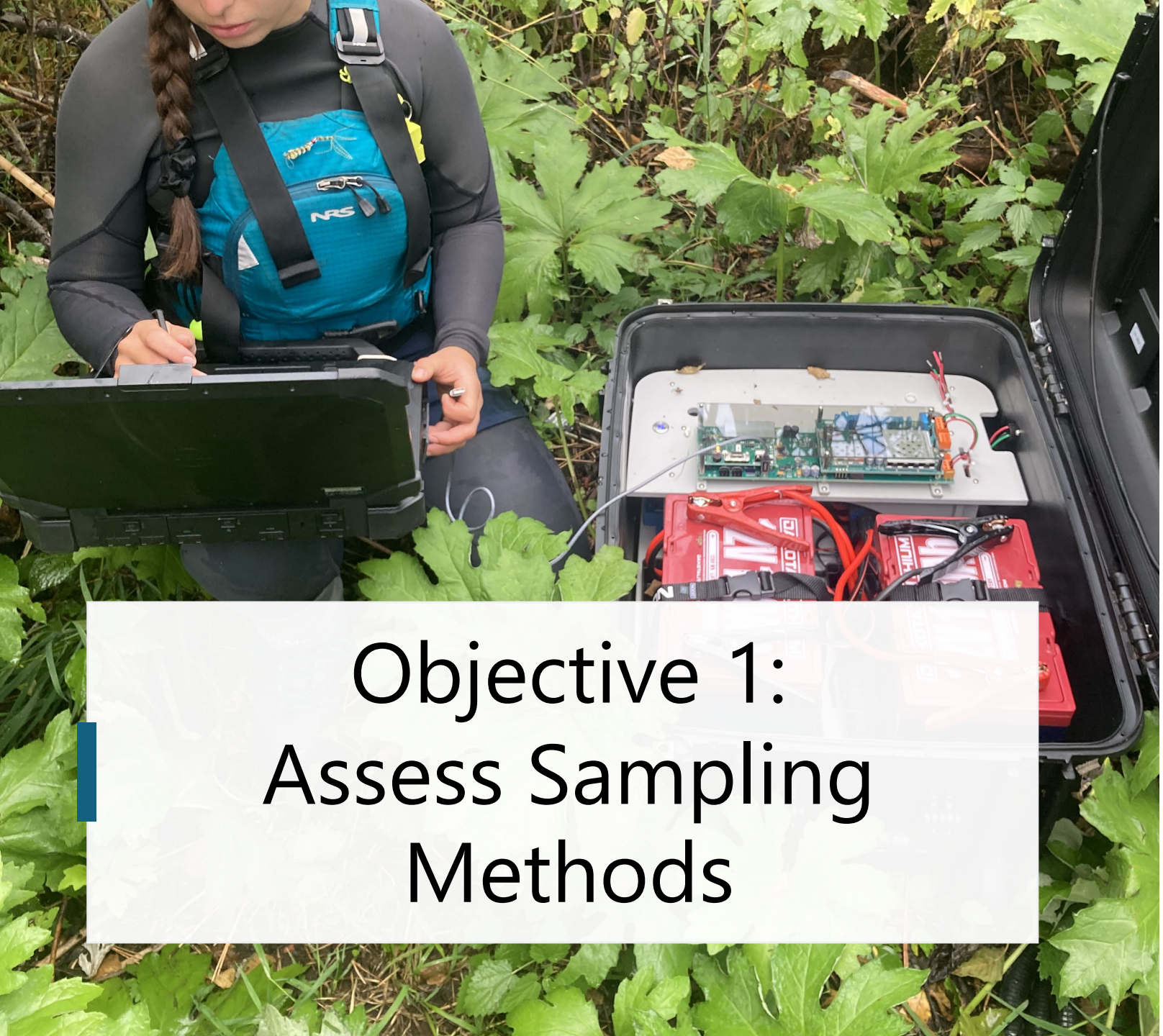


US Forest Service 1921

Objectives

1) Assess field methods to report **proportion of hatchery origin spawners** (**pHOS**) in a data poor, logistically challenging system.

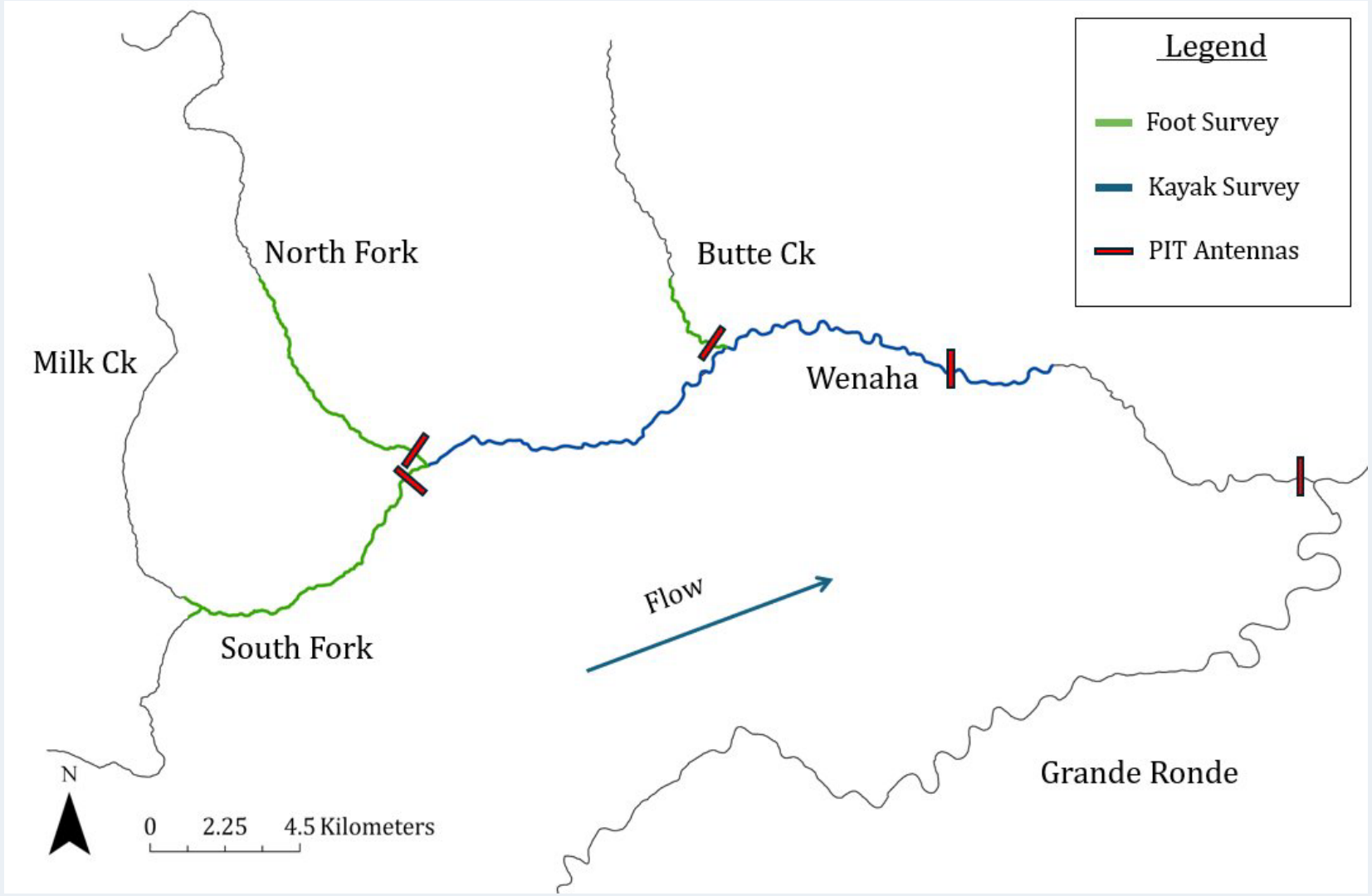
2) Quantify the spatial and temporal segregation of hatchery and natural origin Chinook Salmon on the Wenaha River spawning grounds (**weighted pHOS**).



Objective 1: Assess Sampling Methods

Methods

- ODFW framework
  - Redds and carcasses
  - Increased frequency
- PIT antennas
- Snorkeling
- Live Adults



Data Collected

Method	Adult Chinook
Snorkel	0 adult observations

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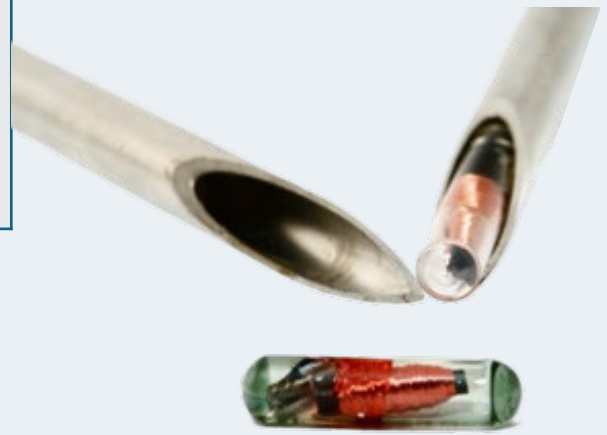
PIT Antennas	28 NO tags 2 UNK tags



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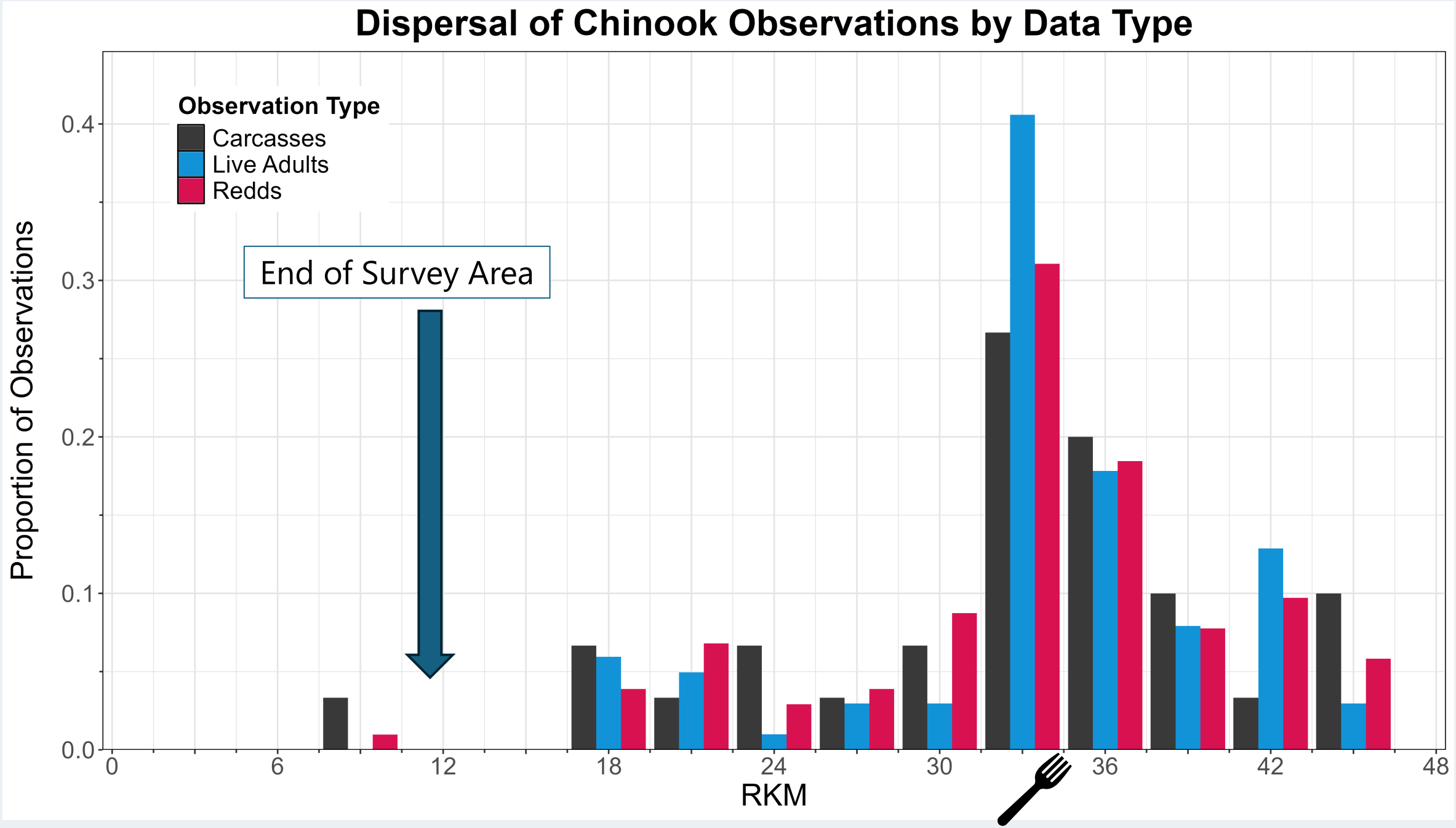
Snorkel	0 adult observations
PIT Antennas	28 NO tags 2 UNK tags
Live Adults	1 HO 43 NO 57 UNK
Carcasses	3 HO 21 NO 6 UNK*


Dispersal of Chinook Observations by Data Type
Observation Type
Carcasses
Live Adults
Redds
End of Survey Area
Proportion of Observations
0.0
0.1
0.2
0.3
0.4
0
6
12
18
24
30
36
42
48
RKM

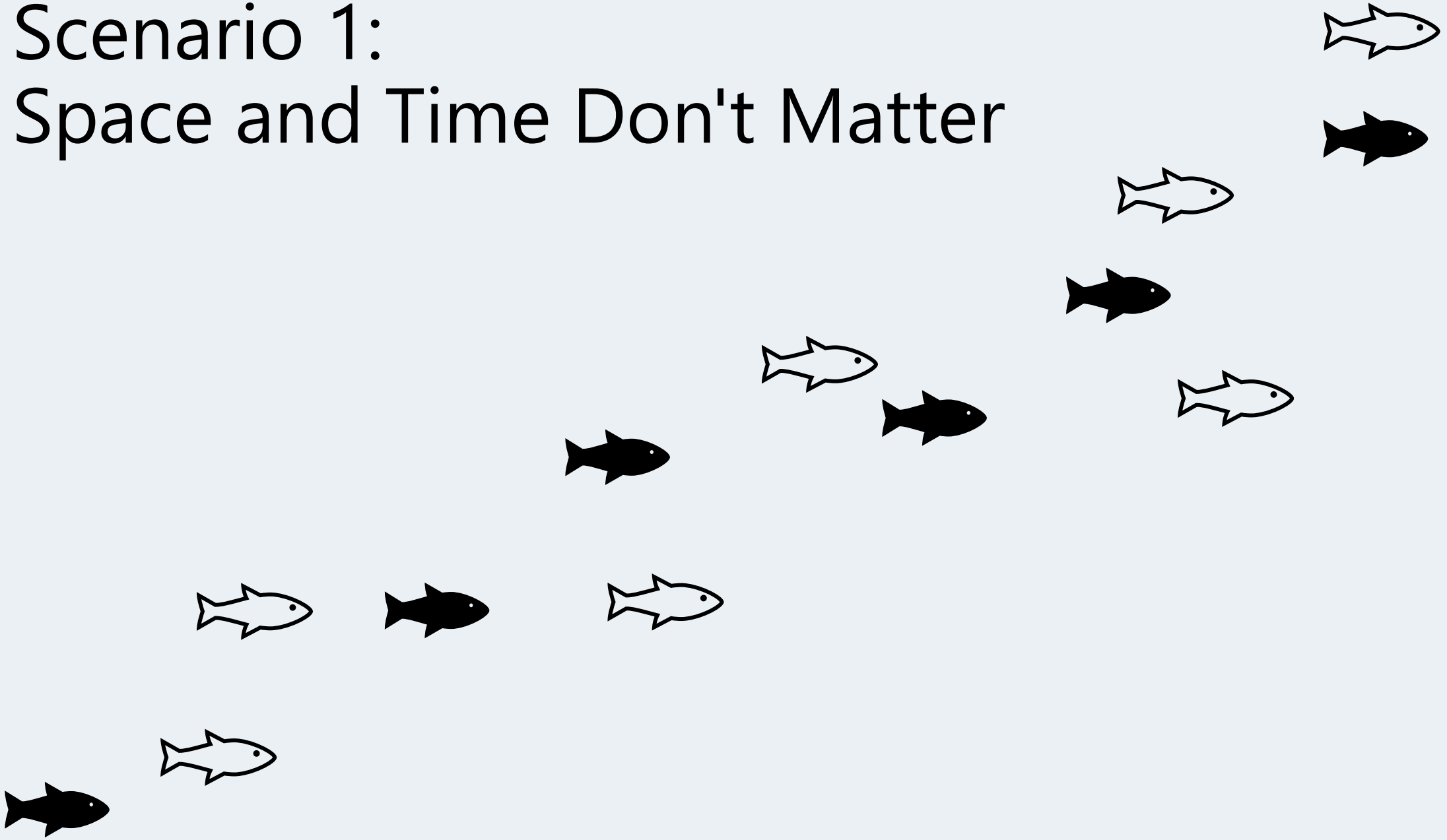
Objective 2: $pHOS_w$

Weighted Proportion Hatchery Origin Spawner

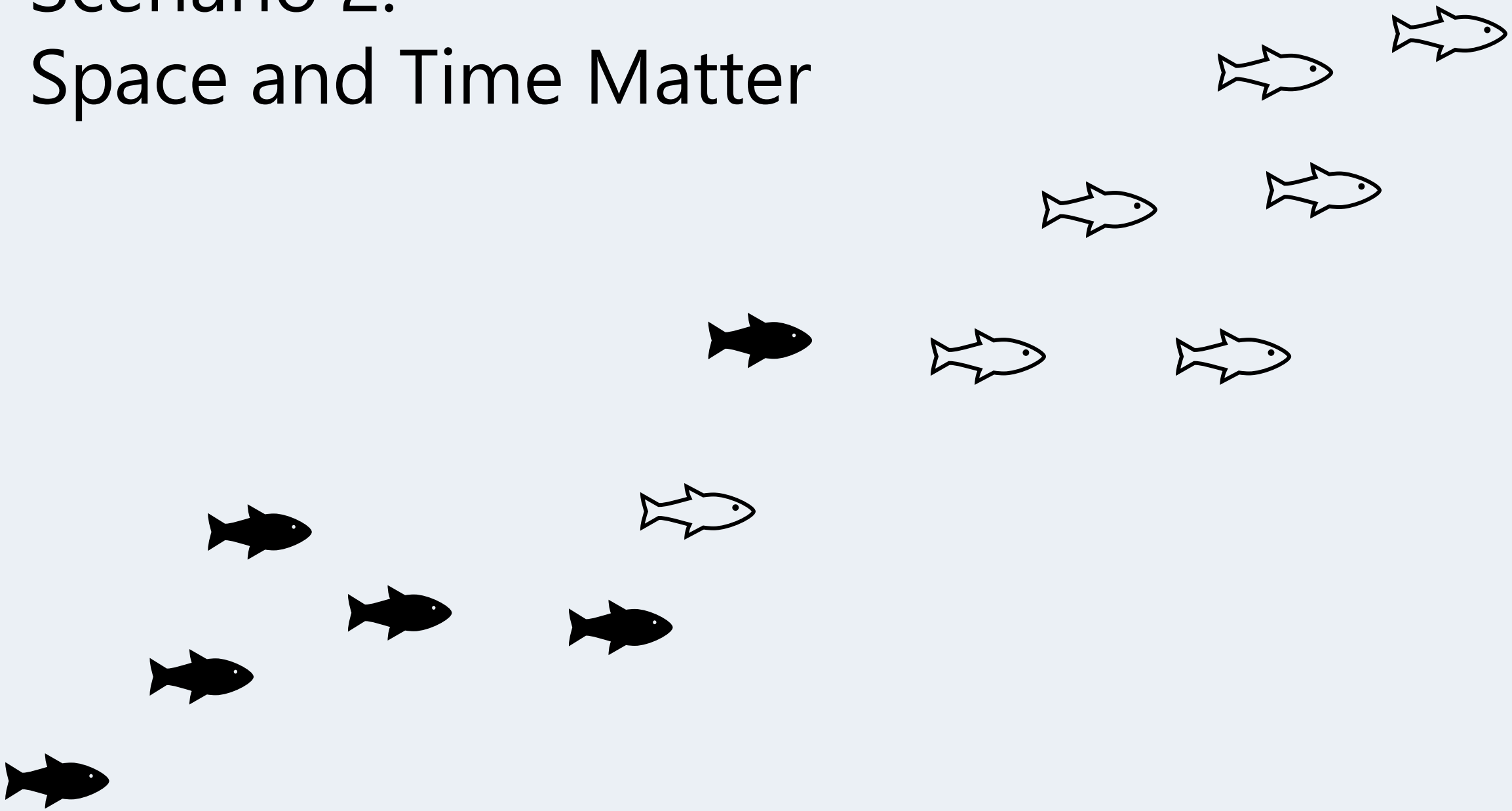
$$pHOS = \frac{\text{Total \# HO}}{\text{Total \# Fish}} = 20\%$$

Survey	Hatchery Spawners	Wild Spawners
Sec A, survey 1	3	8
Sec B, survey 1	1	5
Sec C, survey 1	0	12
Sec A, survey 2	5	4
Sec B, survey 2	0	2
Sec c, survey 2	1	9

Scenario 1:
Space and Time Don't Matter



Scenario 2:
Space and Time Matter



INFORMATION REPORTS

NUMBER 2019-08

FISH DIVISION

Oregon Department of Fish and Wildlife

Estimating the weighted proportion of hatchery-origin spawners, $pHOS_w$.

Matt Falcy 2019

$$pHOSw = \sum_{i=1}^{I} \sum_{t=i}^{T} \left(\frac{H_{i,t}}{H_{i,t} + W_{i,t}} \right) * \left(\frac{W_{i,t}}{\sum_{i}^{I} \sum_{t}^{T} W_{i,t}} \right)$$

Weighted proportion hatchery origin spawner

	Hatchery Spawners	Wild Spawners	$pHOS_{it}$
Sec A, survey 1	3	8	0.05
Sec B, survey 1	1	5	
Sec C, survey 1	0	12	
Sec A, survey 2	5	4	
Sec B, survey 2	0	2	
Sec C, survey 2	1	9	

=3/11 * 8/40

$$pHOS_W = \sum_{i=1}^{I}\sum_{t=1}^{T}\left(\frac{H_{i,t}}{H_{i,t}+W_{i,t}}\right)\left(\frac{W_{i,t}}{\sum_i^I \sum_t^T W_{i,t}}\right)$$

Weighted proportion hatchery origin spawner

	Hatchery Spawners	Wild Spawners	$pHOS_{it}$
Sec A, survey 1	3	8	0.05
Sec B, survey 1	1	5	0.02
Sec C, survey 1	0	12	
Sec A, survey 2	5	4	
Sec B, survey 2	0	2	
Sec C, survey 2	1	9	

=1/6 * 5/40

$$pHOS_W = \sum_{i=1}^{I}\sum_{t=1}^{T}\left(\frac{H_{i,t}}{H_{i,t}+W_{i,t}}\right)\left(\frac{W_{i,t}}{\sum_i^I \sum_t^T W_{i,t}}\right)$$

Weighted proportion hatchery origin spawner

	Hatchery Spawners	Wild Spawners	$pHOS_{it}$
Sec A, survey 1	3	8	0.05
Sec B, survey 1	1	5	0.02
Sec C, survey 1	0	12	0
Sec A, survey 2	5	4	
Sec B, survey 2	0	2	
Sec C, survey 2	1	9	

=0/12 * 12/40

$$pHOS_W = \sum_{i=1}^{I}\sum_{t=1}^{T}\left(\frac{H_{i,t}}{H_{i,t}+W_{i,t}}\right)\left(\frac{W_{i,t}}{\sum_i^I \sum_t^T W_{i,t}}\right)$$

Weighted proportion hatchery origin spawner

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Sec C, survey 1	0	12	0
Sec A, survey 2	5	4	0.05
Sec B, survey 2	0	2	
Sec C, survey 2	1	9	

=5/9 * 4/40

$$pHOS_W = \sum_{i=1}^{I}\sum_{t=1}^{T}\left(\frac{H_{i,t}}{H_{i,t}+W_{i,t}}\right)\left(\frac{W_{i,t}}{\sum_i^I\sum_t^T W_{i,t}}\right)$$

Weighted proportion hatchery origin spawner

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Sec C, survey 1	0	12	0
Sec A, survey 2	5	4	0.05
Sec B, survey 2	0	2	0
Sec C, survey 2	1	9	

=0/2 * 2/40

$$pHOS_W = \sum_{i=1}^{I}\sum_{t=1}^{T}\left(\frac{H_{i,t}}{H_{i,t}+W_{i,t}}\right)\left(\frac{W_{i,t}}{\sum_i^I \sum_t^T W_{i,t}}\right)$$

Weighted proportion hatchery origin spawner

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Sec A, survey 1	3	8	0.05
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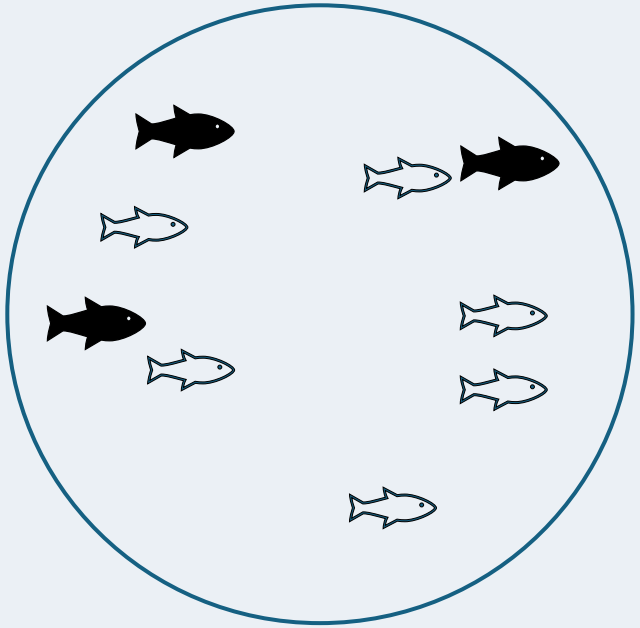
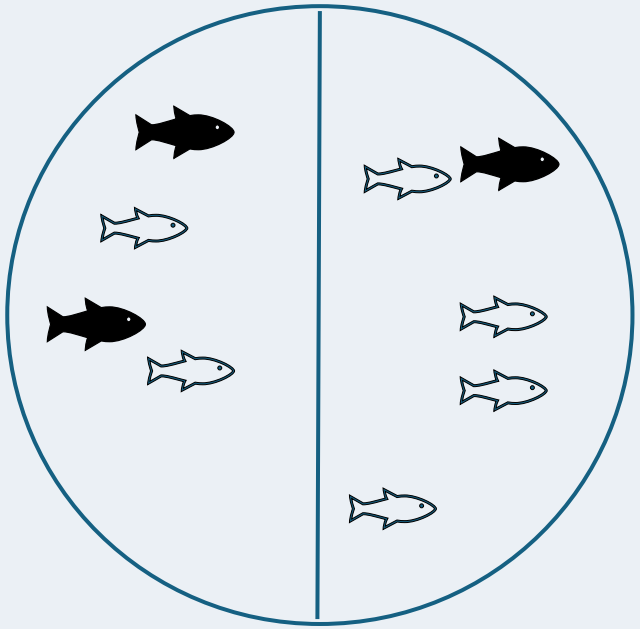
Sec C, survey 1	0	12	0
Sec A, survey 2	5	4	0.05
Sec B, survey 2	0	2	0
Sec C, survey 2	1	9	0.023

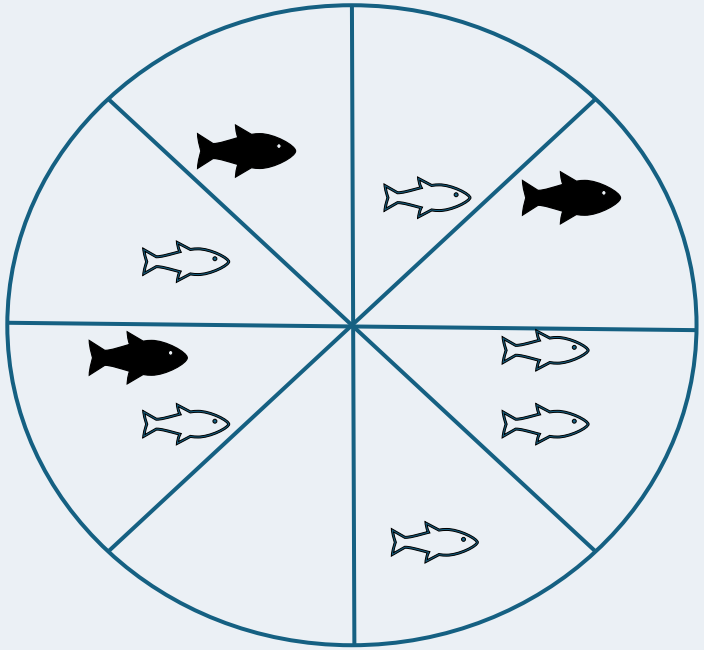
=1/10 * 9/40

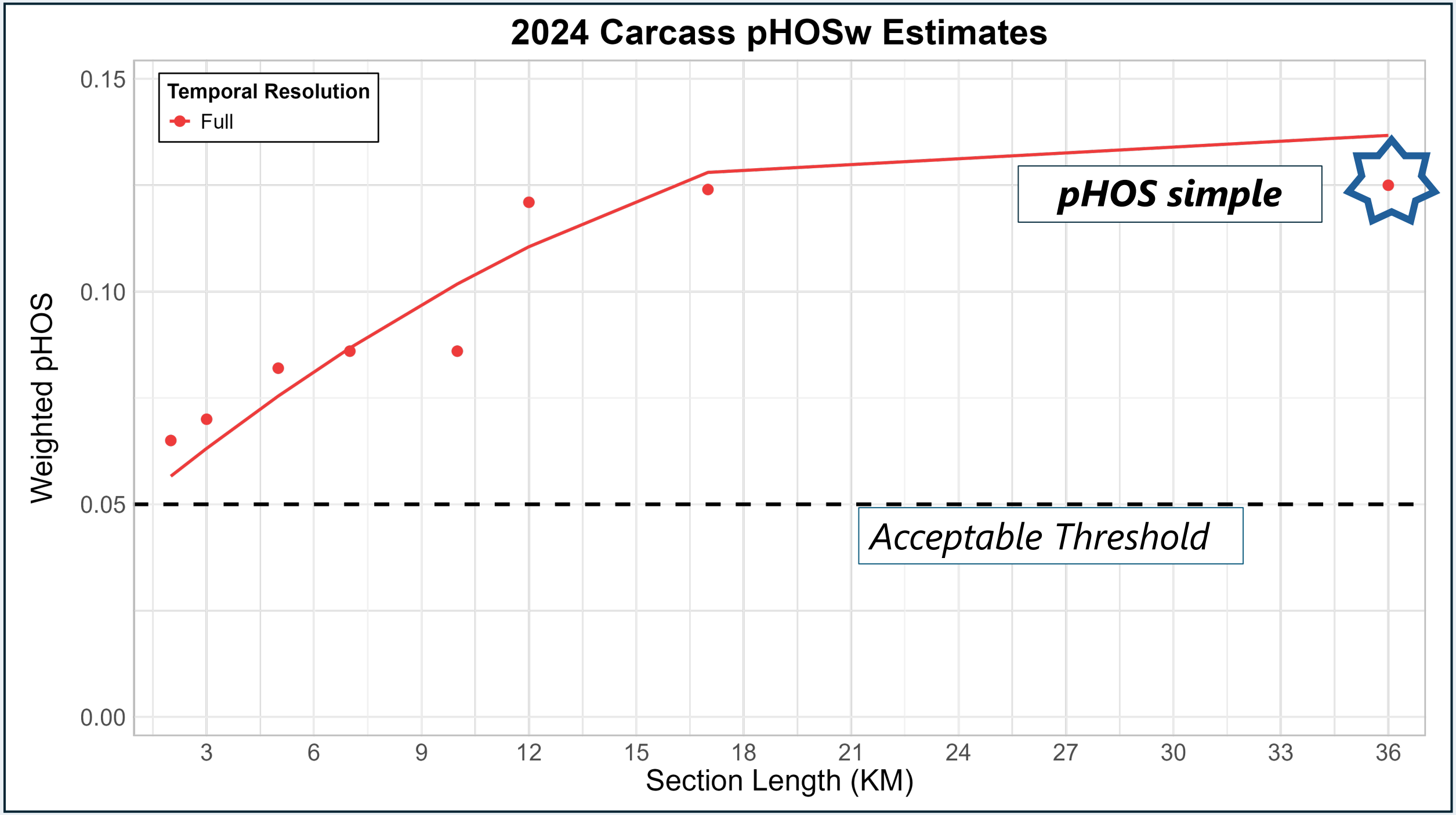
pHOSw = 14.3%

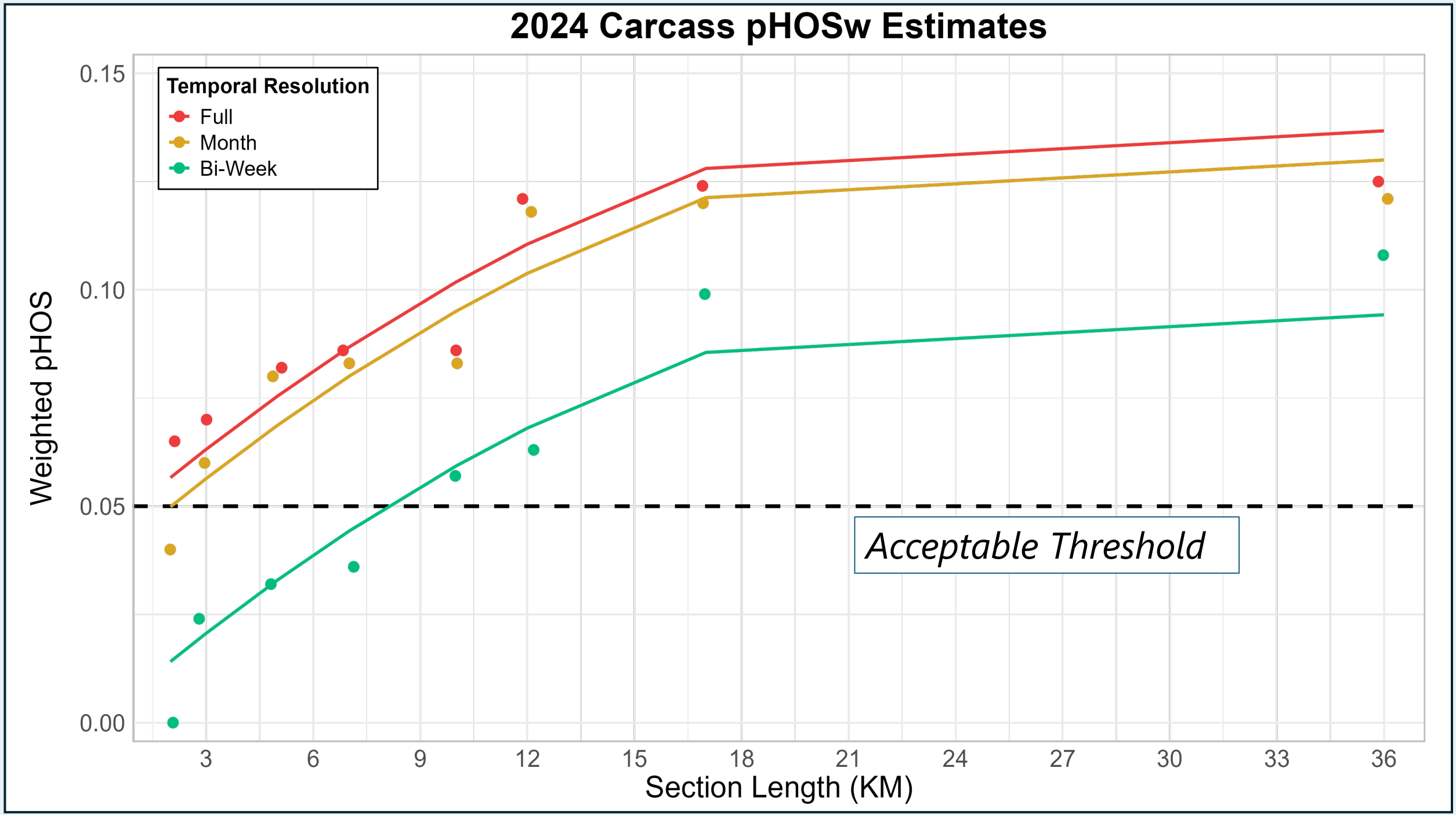
What are the effects of different spatial and temporal scales?

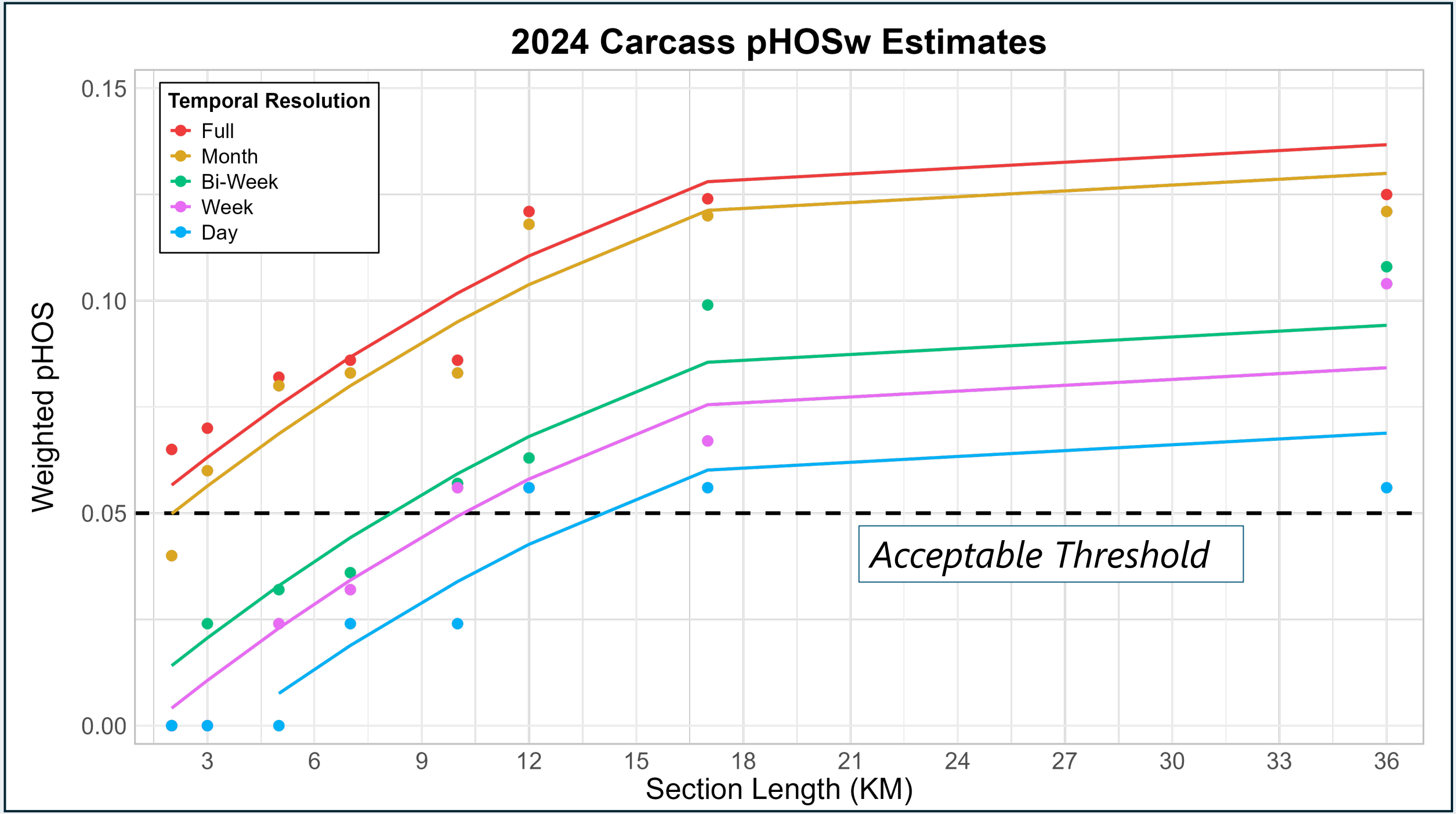







2024 Carcass pHOSw Estimates
Temporal Resolution
Full
pHOS simple
Acceptable Threshold
Weighted pHOS
0.15
0.10
0.05
0.00
3
6
9
12
15
18
21
24
27
30
33
36
Section Length (KM)


2024 Carcass pHOSw Estimates
Temporal Resolution
Full
Month
Bi-Week
Weighted pHOS
0.15
0.10
0.05
0.00
Acceptable Threshold
3
6
9
12
15
18
21
24
27
30
33
36
Section Length (KM)


2024 Carcass pHOSw Estimates
Temporal Resolution
Full
Month
Bi-Week
Week
Day
0.15
0.10
0.05
0.00
Weighted pHOS
Acceptable Threshold
3
6
9
12
15
18
21
24
27
30
33
36
Section Length (KM)

Spatial & Temporal Scale Selection

What is $pHOS_w$ saying?

How well do you know your system?

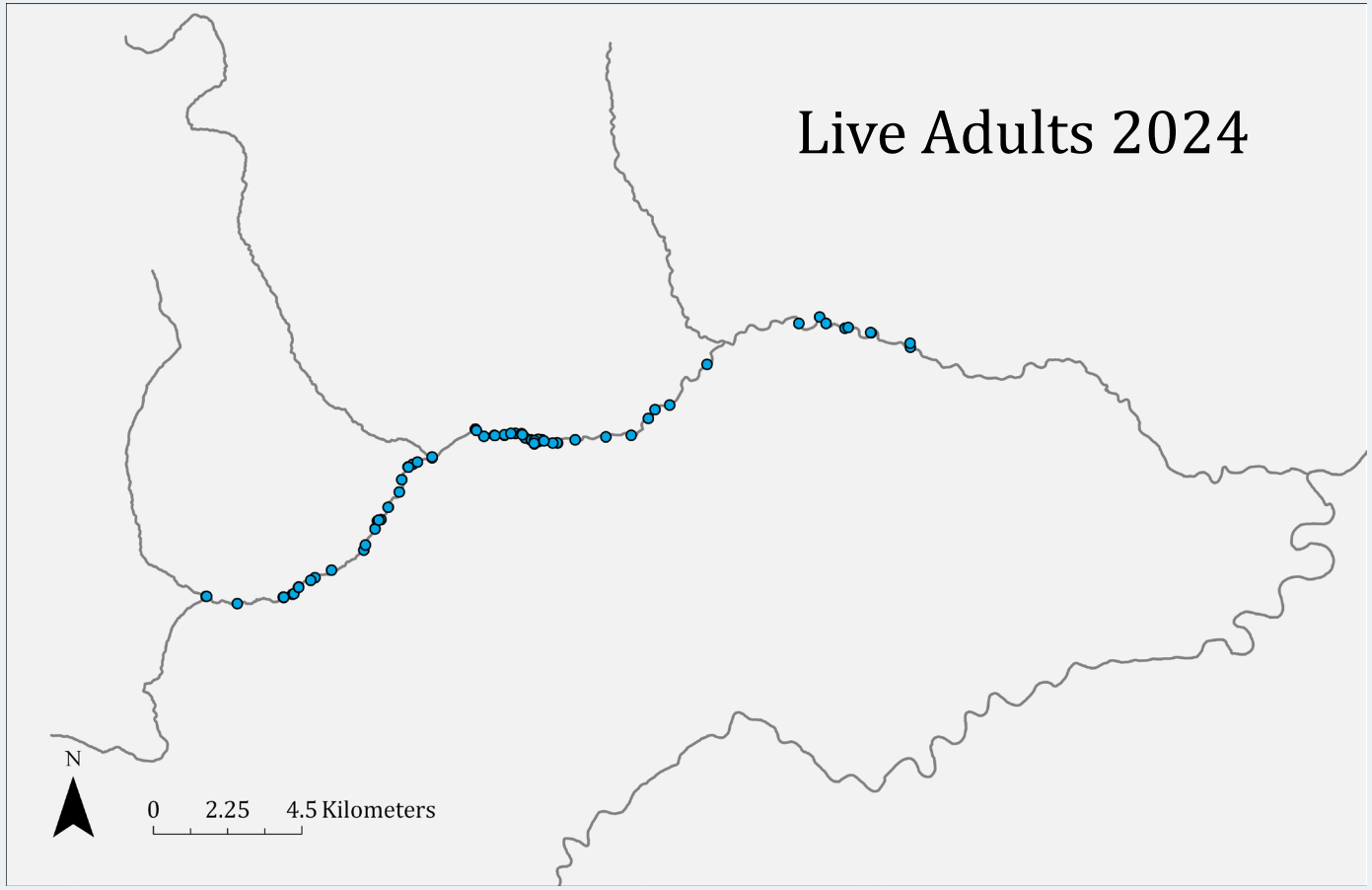
Active spawning window

Individual Range

Natural Breaks

Create breaks in areas with observed gaps

1) hotspot analysis
2) literature review



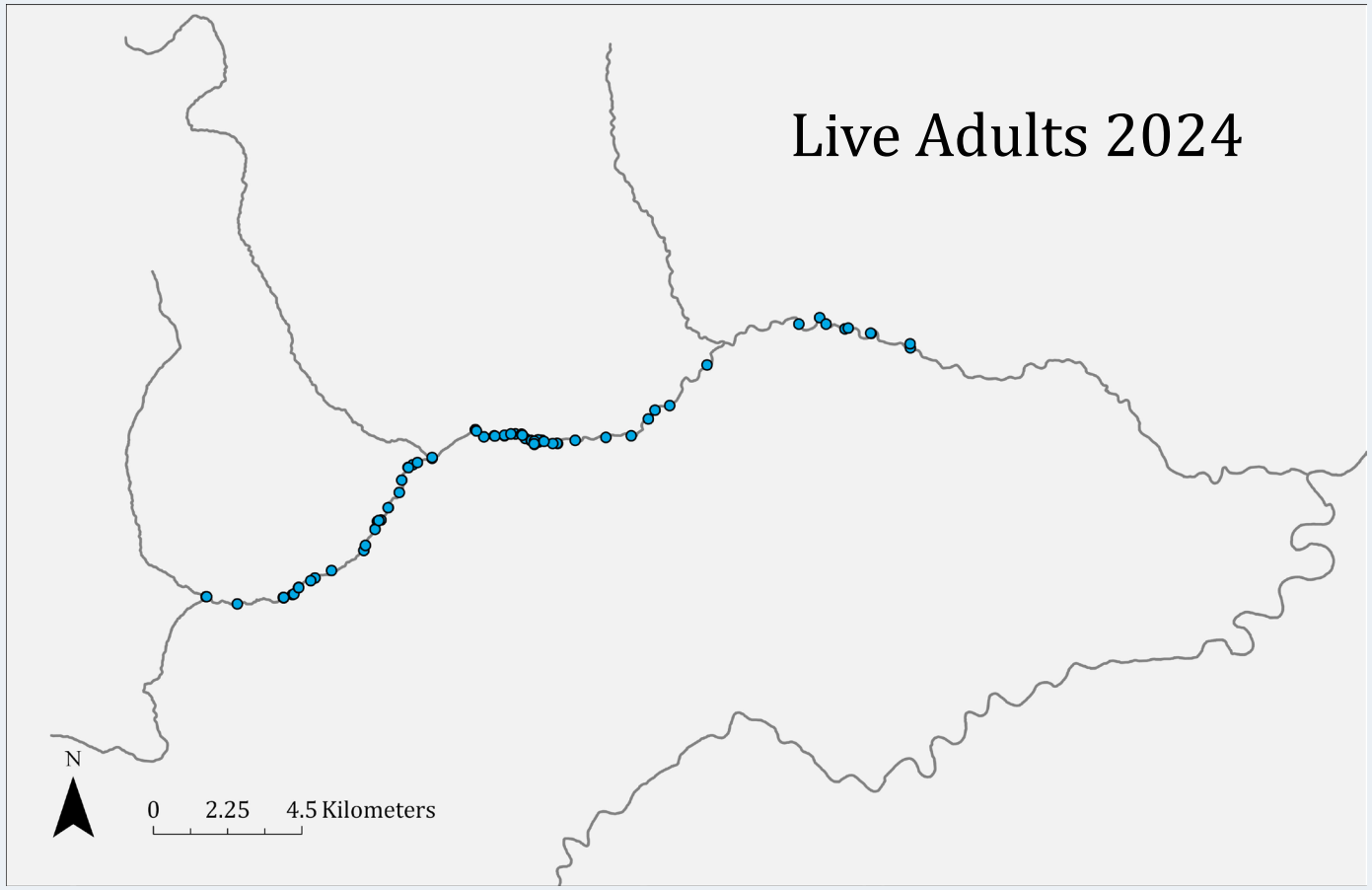
Natural Breaks

Create breaks in areas with observed gaps

1) hotspot analysis
2) literature review

minimum section length
observed natural breaks
historic data

River Specific
Real World Applicable $pHOS_w$



Paddling Forward

- Justifying section designation
- Bayesian approach
- Model proportions of pair types

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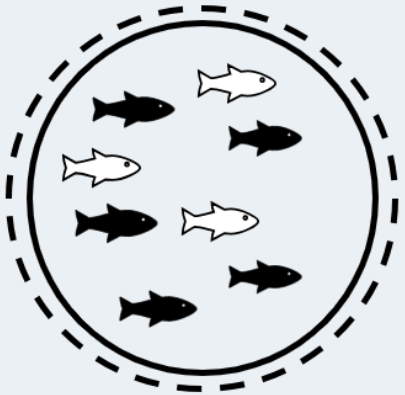
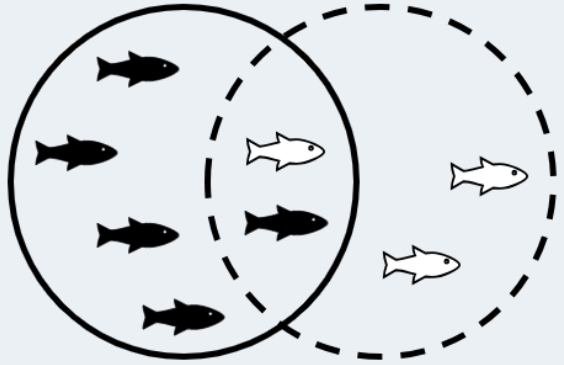
pHOS



pHOSw



Project Outcomes

- Updated survey methods
- Increased ecological knowledge
- Informed estimates and reporting
- $pHOS_w$ beyond the Wenaha River

Thank You (The Village)

Zach Litwiller

Tayler Arnold

Mitch Kimball

Gerrit Buch

Justin Fisk

Phillip Perrine

Joe Dittmer

Mike Greiner

Polly Gibson

Fred Drascic

Jon Ofiara

Brett Howland

Matt Ashjian

Corey Crossley

Brian Ratliff

Kyle Bratcher

Mike Lance

Brian Simmons

Joseph Feldhaus

Seth White


OREGON

Oregon State University

OREGON Fish & Wildlife

LOWER SNAKE RIVER COMPENSATION PLAN
Hatchery Program

THE OREGON HATCHERY RESEARCH CENTER

Fish Behaviorscapes Lab

Thank You,

Questions?

Contact Me: emily.treadway@oregonstate.edu or emily.m.treadway@odfw.oregon.gov