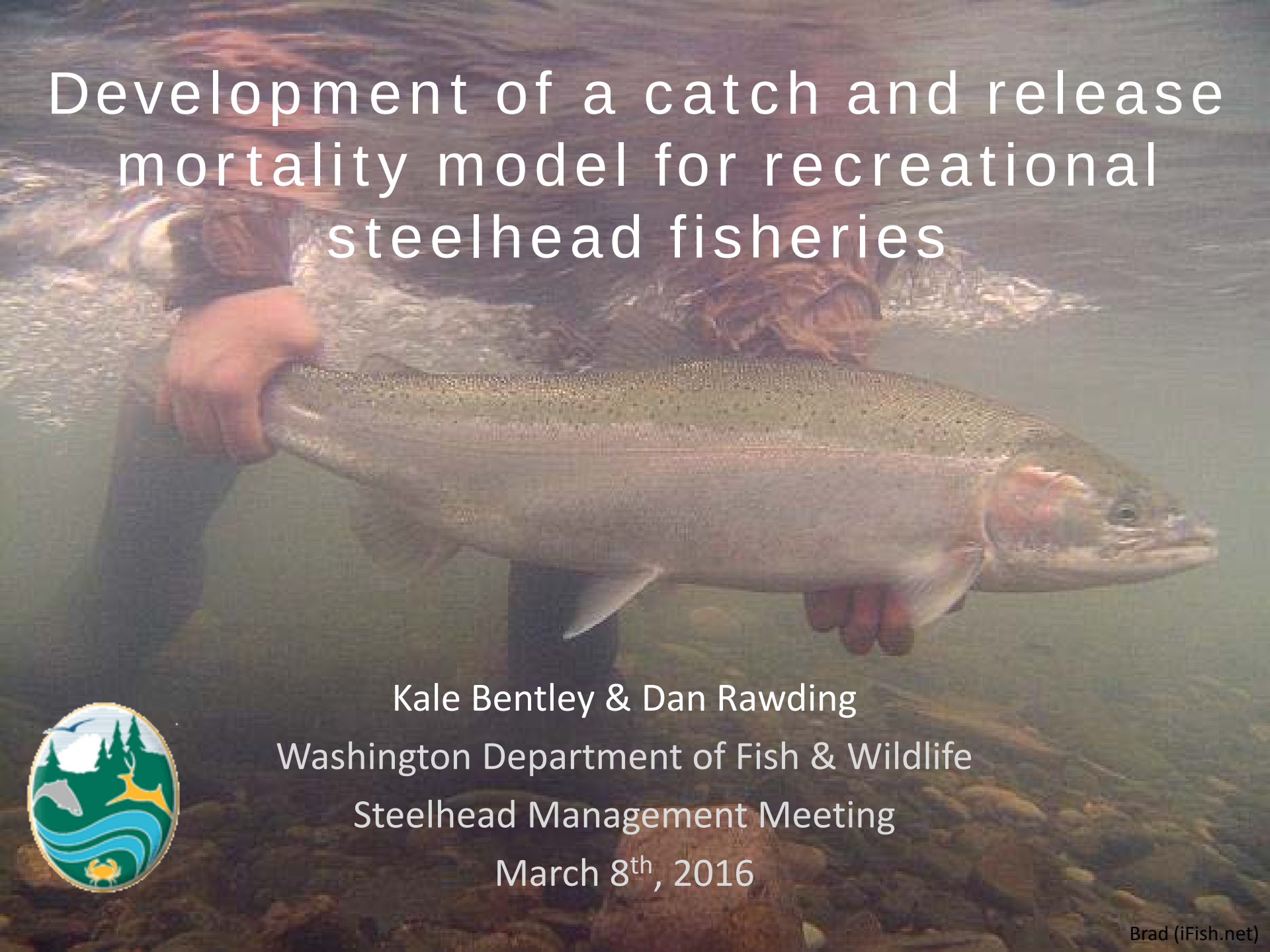
Development of a catch and release mortality model for recreational steelhead fisheries



Kale Bentley & Dan Rawding

Washington Department of Fish & Wildlife

Steelhead Management Meeting

March 8th, 2016

Brad (iFish.net)

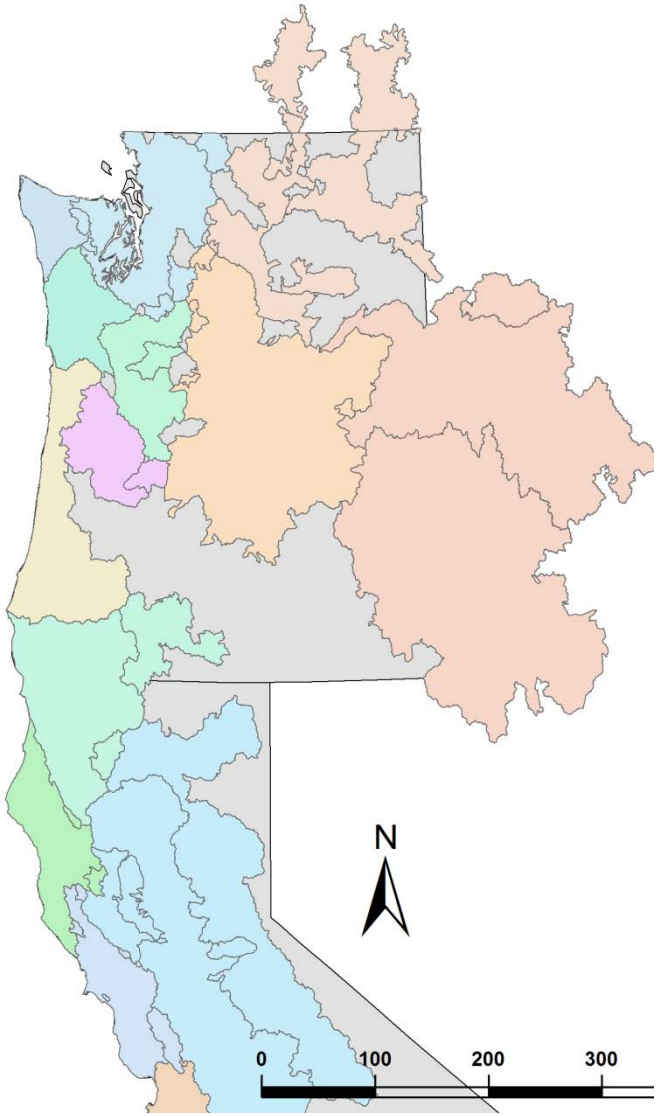
Economic Impact of Recreational Fisheries

WA State Steelhead Economic value

Scott and Gill (2008)

Balancing Act: Recreational & Conservation

Steelhead Distinct Population Segments



Catch and Release (C&R) Fisheries

- C&R allows for some catch of wild steelhead
- But C&R fish still susceptible to mortality
- Fisheries with ESA-species must monitor impacts

Monitoring C&R Fishery Impacts

$$Sport\ Fishery\ Impact\ Rate(SFIR) = \frac{C\&R\ Mortalities}{Run\ Size} \times 100$$

$$C\&R\ Mortalities = Catch \times Hooking\ Mortality\ Rate$$

$$Hooking\ Mortality\ Rate = \frac{\#\ died}{\#\ caught}$$

Independent study

Literature value(s)

C&R mortality:
0 – 11%

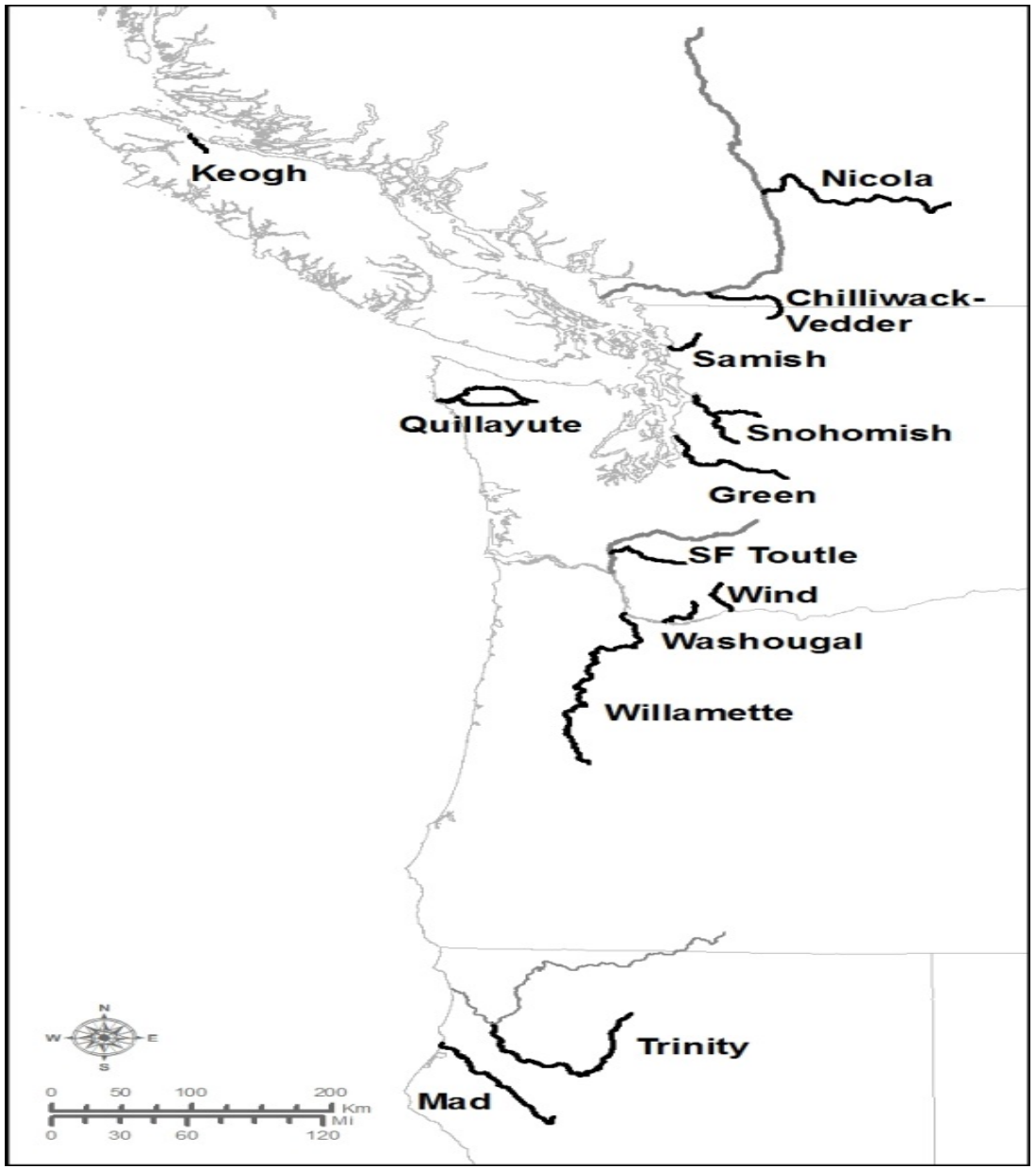
Goal of Study

Develop a predictive C&R mortality model for recreational steelhead fisheries

C&R Assessment Framework

- Q1. What are the most important factors that effect steelhead C&R mortality?
- Q2. How can we incorporate these factors into a predictive model?
- Q3. What are the results when we apply this predictive model to WA fisheries?
- Q4. What is the influence of fishing regulations on C&R hooking mortality?

Study Area

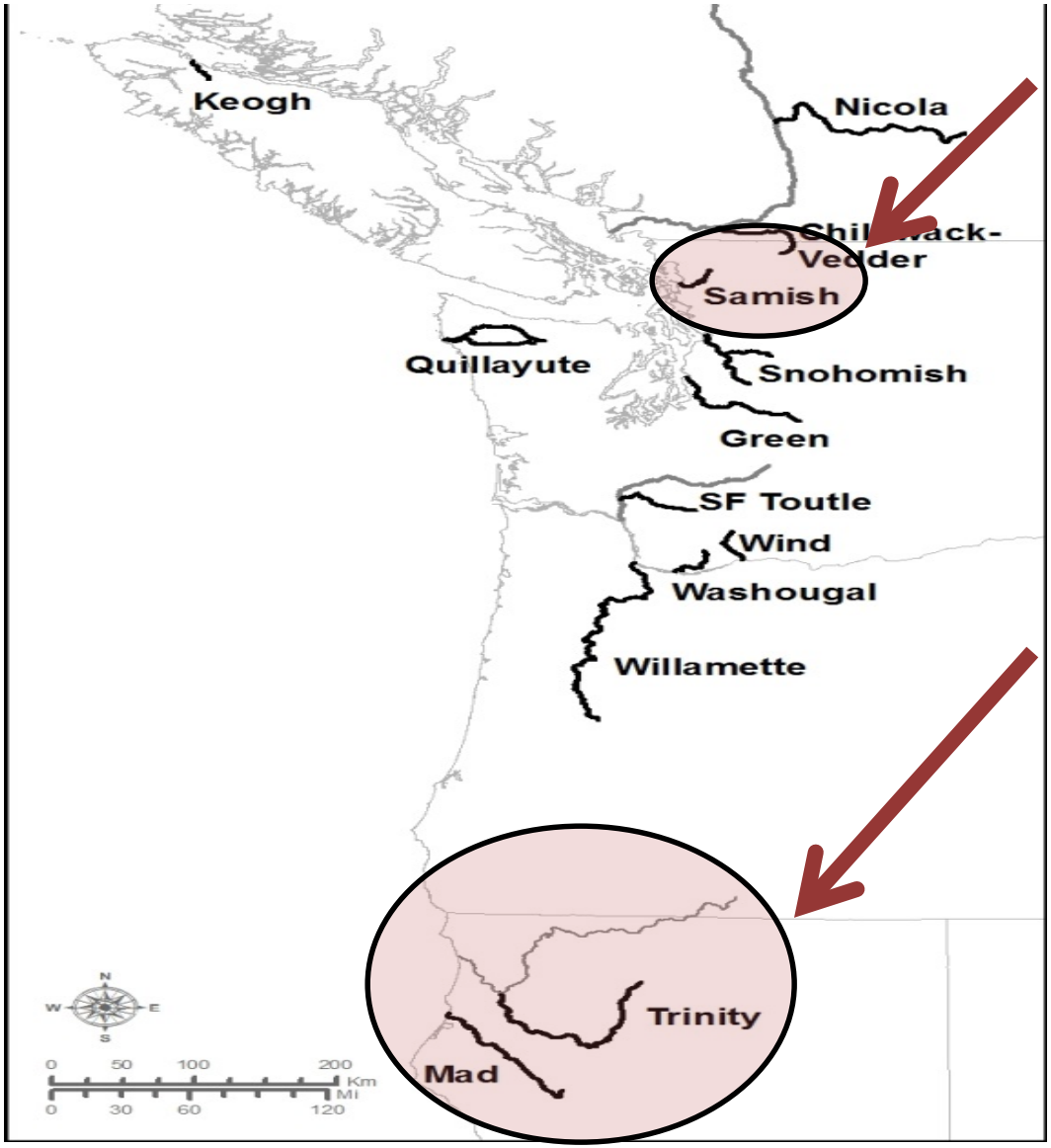

Keogh
Nicola
Chilliwack-
Vedder
Samish
Quillayute
Snohomish
Green
SF Toutle
Wind
Washougal
Willamette
Trinity
Mad
N
W
E
S
0 50 100 200
Km
0 30 60 120
MI

Q1. What are the most important factors that effect steelhead C&R mortality?

C&R Literature Suggests…

- Water temperature
- Hooking location (critical v. non-critical)
- Angling duration (time from hooked to landing)
- Hook type (single/treble, barbed/un-barbed)
- ~~Air exposure~~

Q1. What are the most important factors that effect steelhead C&R mortality?



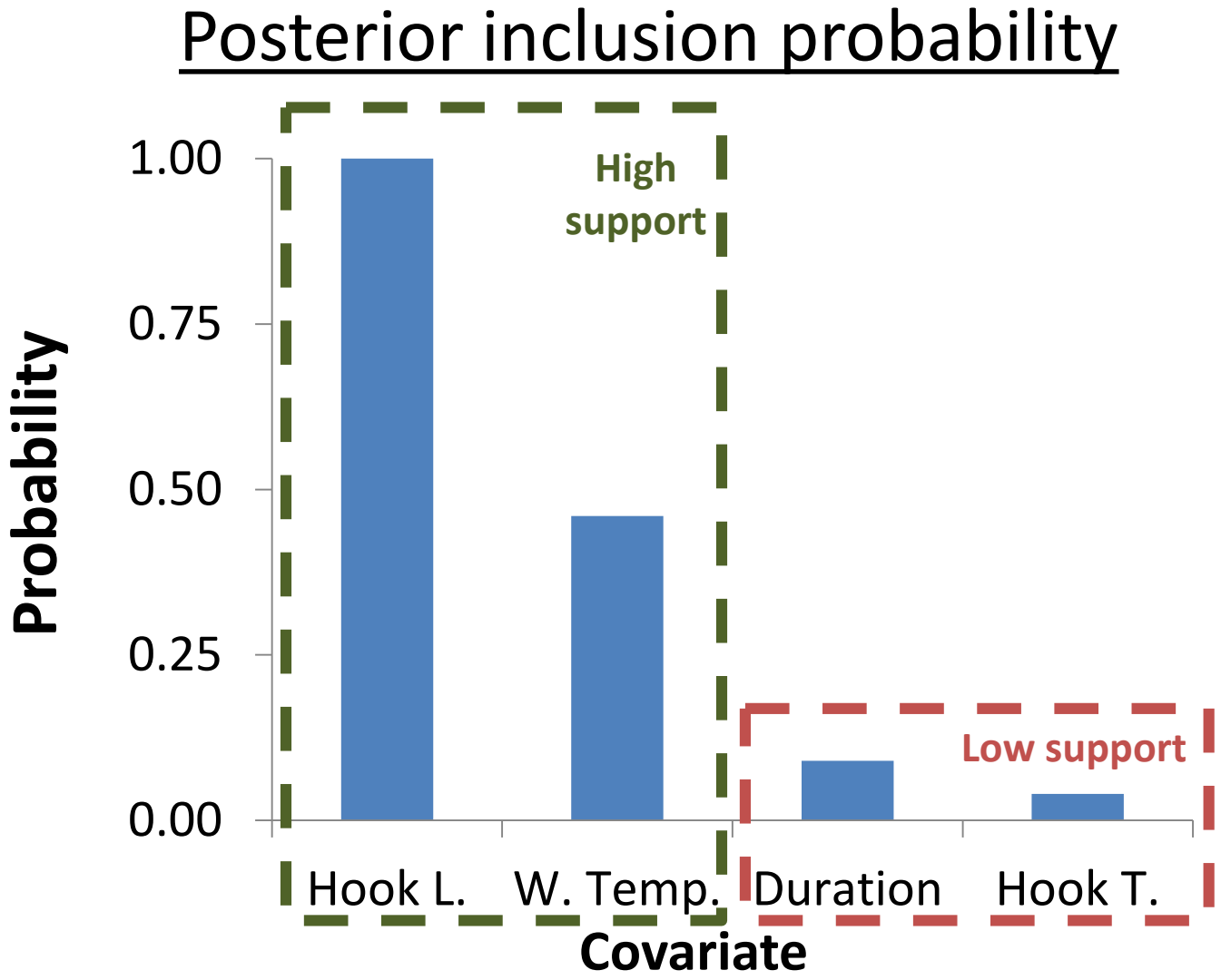
Ashbrook et al. (*in press*)

- C&R 54 winter steelhead
- Water temperatures: 2 - 12°C
- Radio tagged fish and followed to spawning

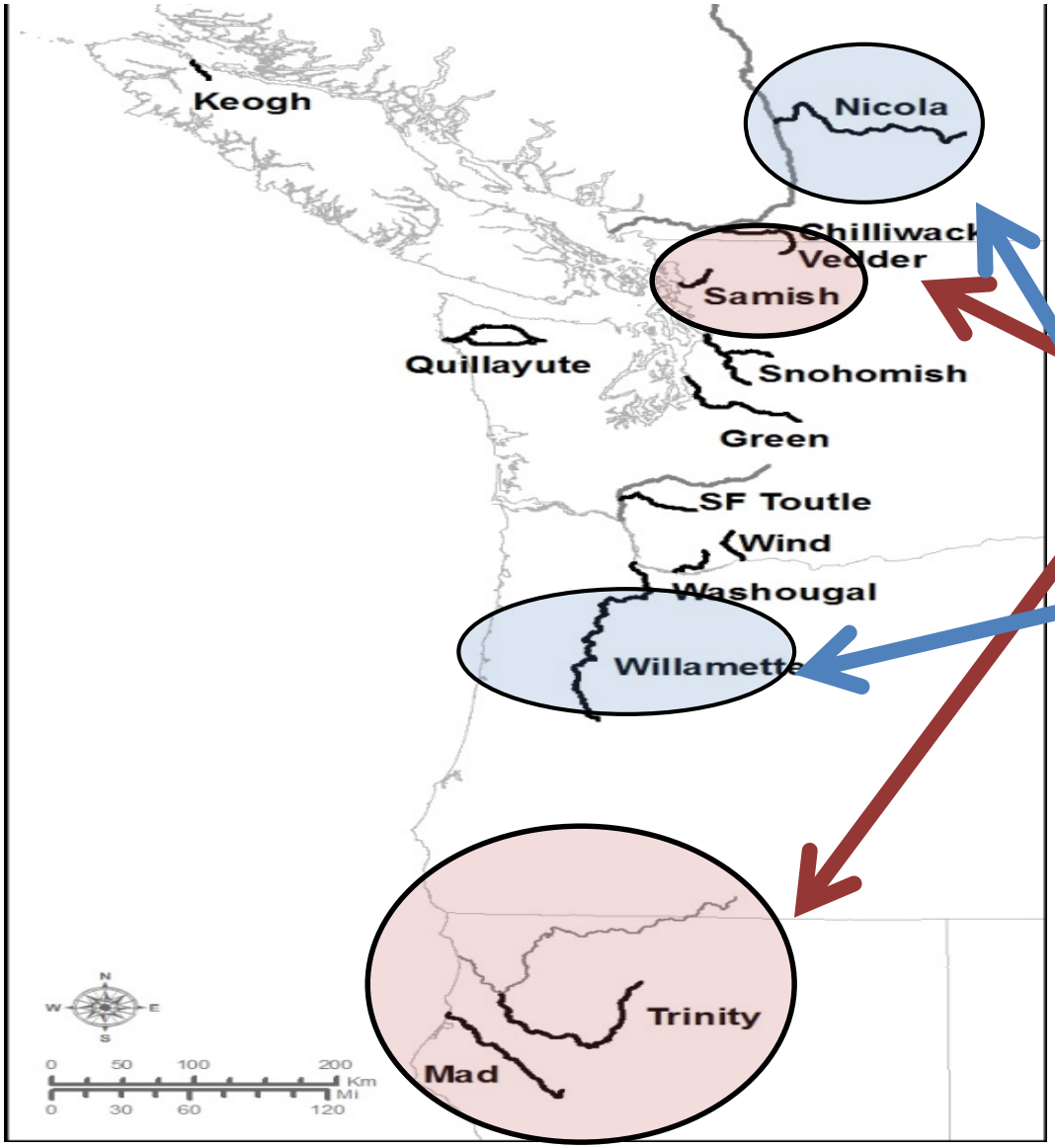
Taylor and Barnhart (1996)

- C&R 126 summer steelhead
- Water temperatures: 14 - 25°C
- Block netted pool after release and snorkeled >36 after release to record mortalities

Q1. What are the most important factors that effect steelhead C&R mortality?



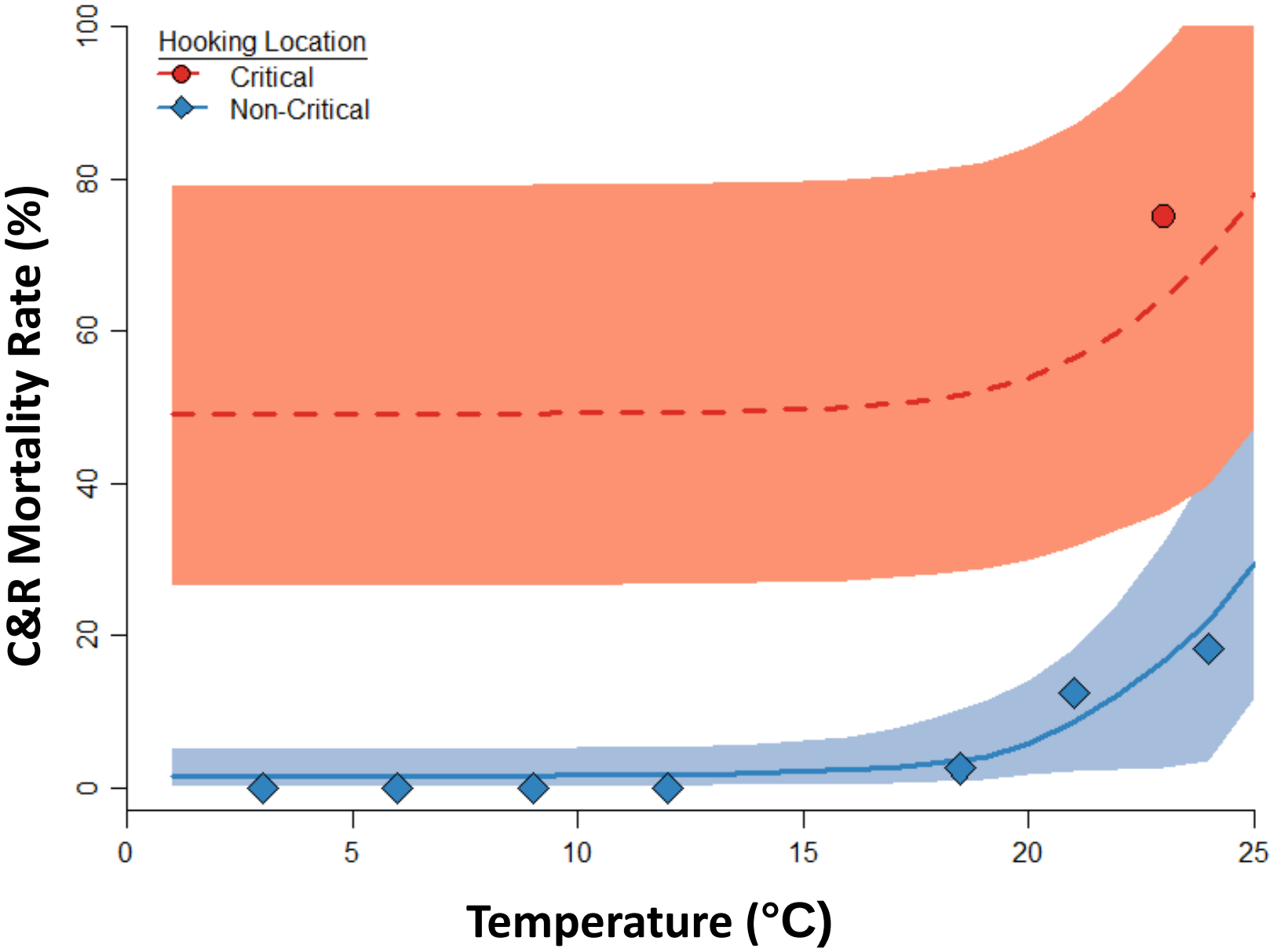
Q2. How can we incorporate hook location and temperature into a predictive C&R mortality model?



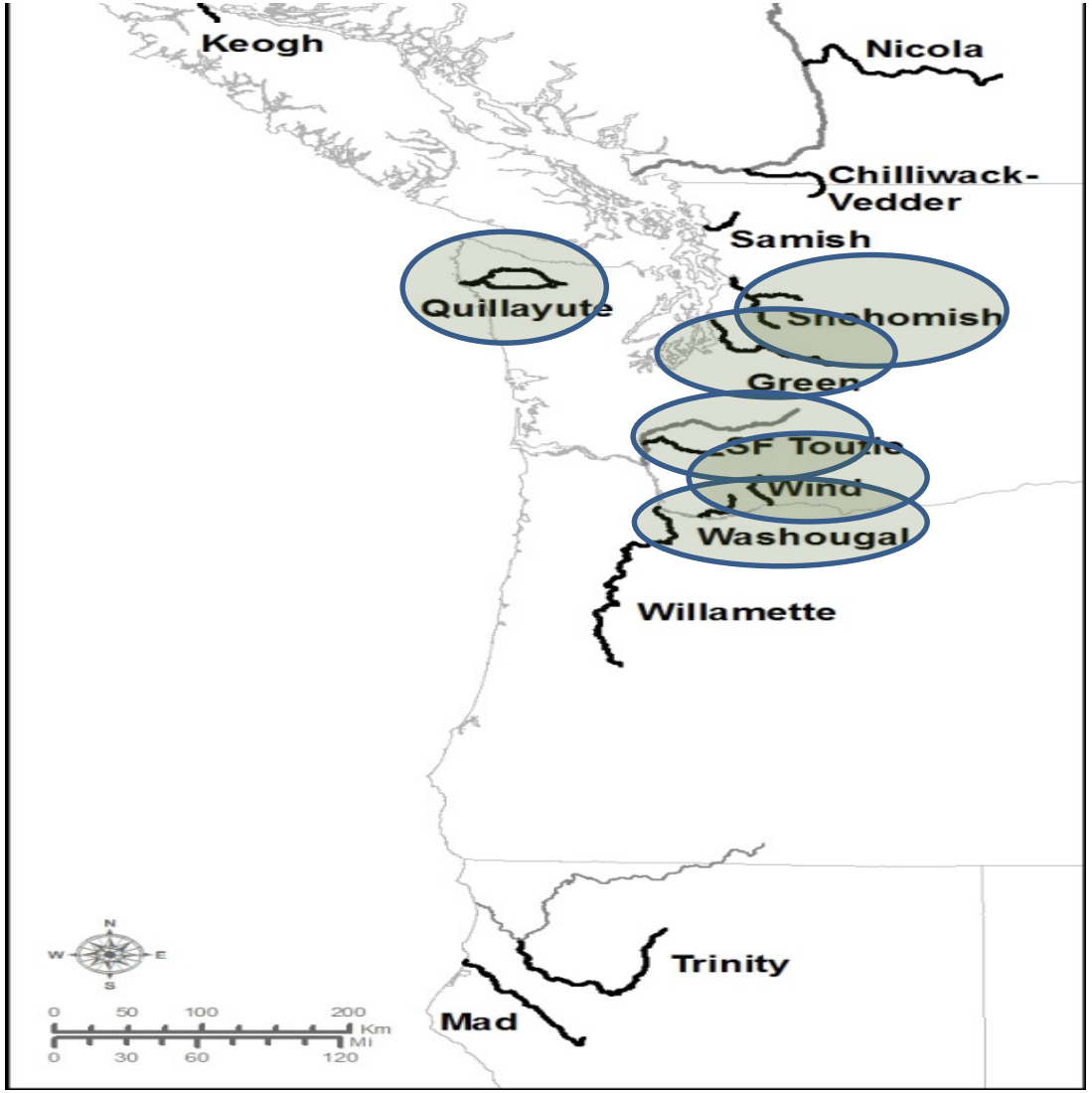
Steelhead C&R datasets

Chinook C&R datasets
(used as priors for hook location in Bayesian model)

Q2. C&R Hooking Mortality Model



Q3. What are estimates of C&R Mortality for WA steelhead fisheries



Estimating Fishery C&R Mortality (FCRM)

- (1) Calculate proportion of steelhead that were critically or non-critically hook location by month (q_{ij})

- (2) Estimate mortality using mean water temperature by month using predictive model (m_{ij})

- (3) Fishery Catch & Released Mortality is weighted monthly mortality

$$FCRM = \sum m_{ij} q_{ij}$$

Q3. Estimated C&R Mortality for WA Steelhead Fisheries

Population - Race	Year	Temperature (°C)	Fishery Regulations	N	FCRM (%)	95% CI
SF Toutle - winters	2011-12	2.7 - 4.4	Selective	80	4.6	1.7 - 9.7
	2012-13	2.8 - 5.1	Selective	87	4.4	1.6 - 9.1
	2013-14	3.7 - 6.4	Selective	49	1.6	0.1 - 5.2
Washougal - winters	2011-12	4.7 - 7.0	General/Selective	136	1.9	0.4 - 5.6
	2012-13	4.3 - 7.0	General/Selective	118	2.0	0.4 - 5.7
	2013-14	4.6 - 7.2	General/Selective	91	1.6	0.2 - 5.2
Wind - summers	2014	6.4 - 12.4	Selective	10	1.6	0.2 - 5.3
	2015	7.2 - 12.4	Selective	24	5.3	1.5 - 13.9
Puget Sound - winters	1992-93	6	General	1404	7.4	1.5 - 12.1
	1992-93	6	Selective	616	5.4	2.8 - 9.6

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General Regulations – no gear restrictions. Most anglers use bait and barbed hooks. Released steelhead are to remain in water.

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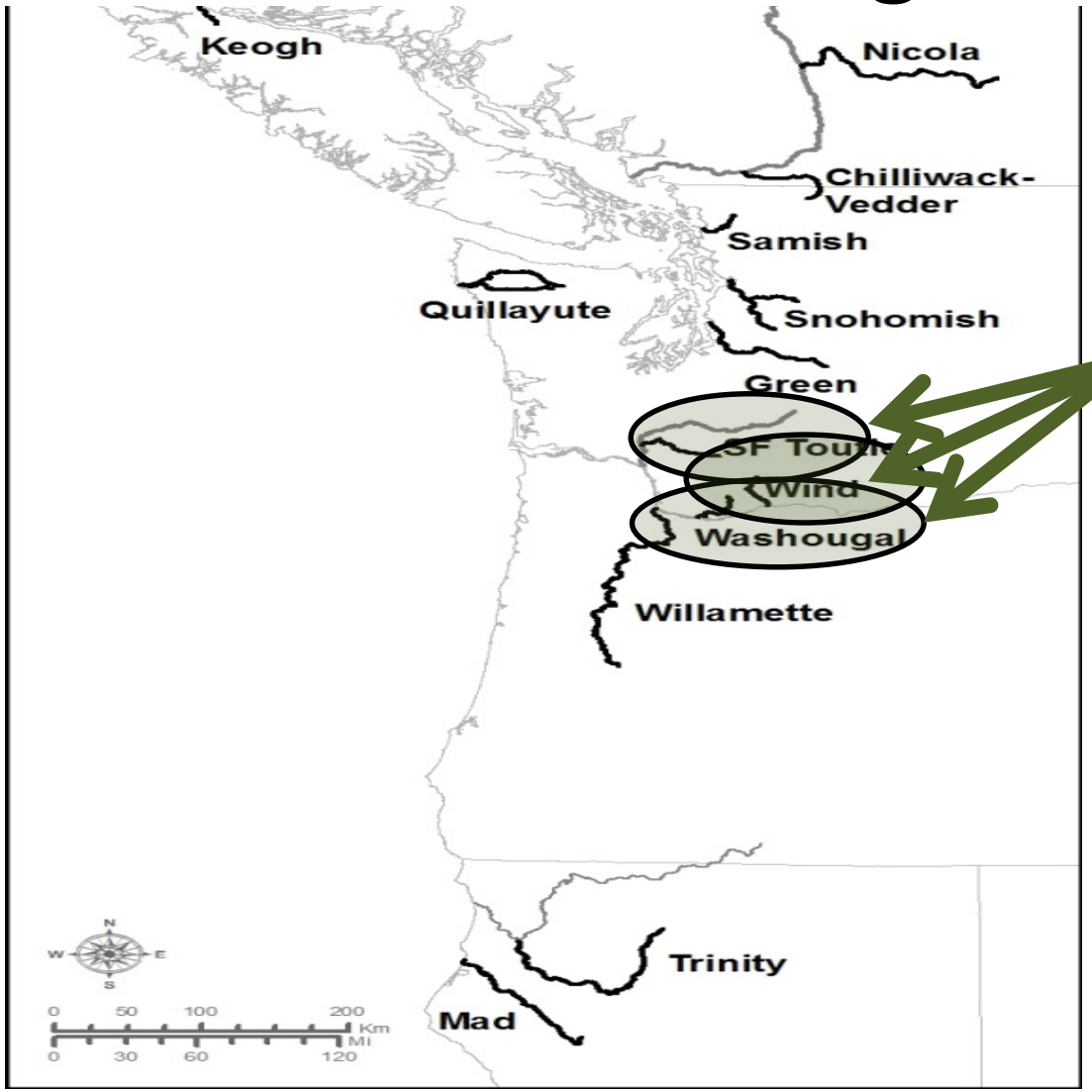
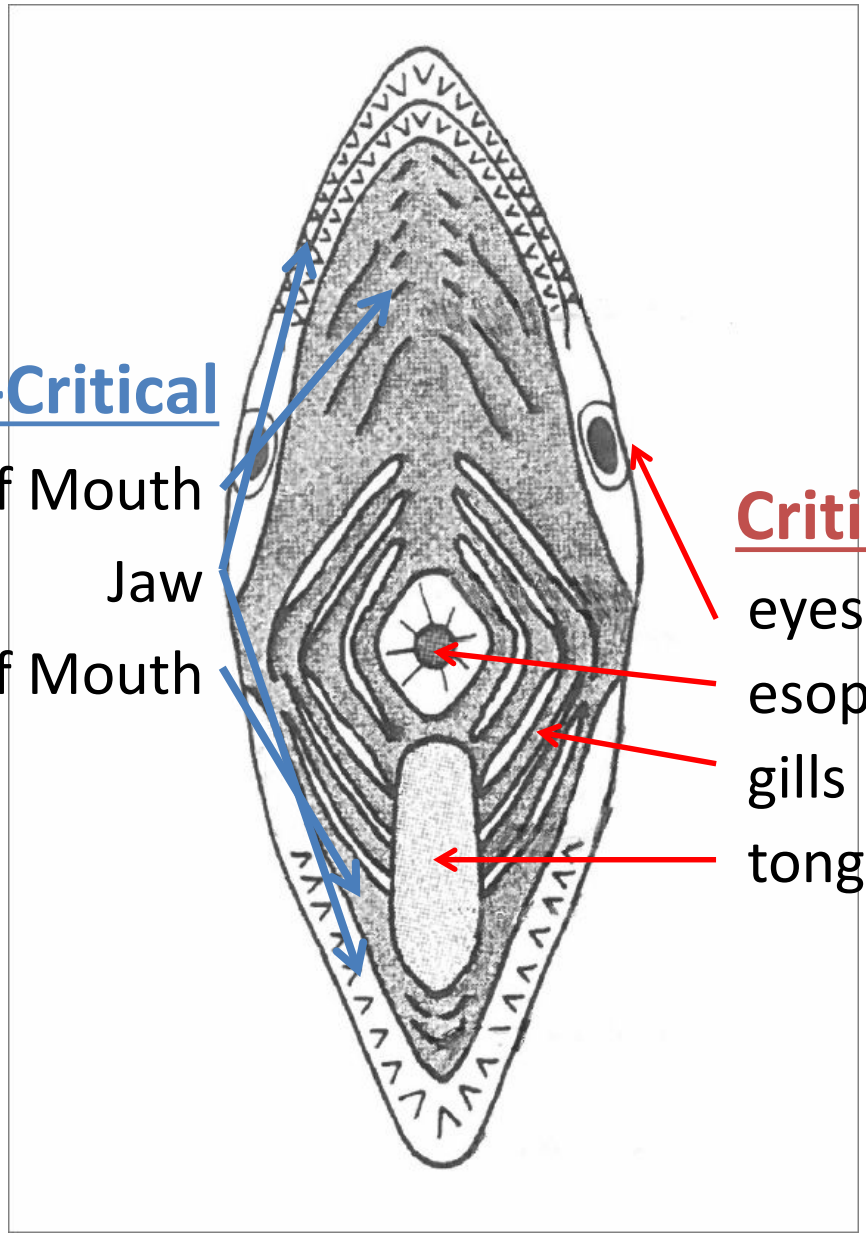
Q4. What is the influence of gear-type on C&R hooking mortality?



Steelhead creel surveys

- **hooking location**
- **gear-type**

Hook Locations



Non-Critical

Roof of Mouth

Jaw

Floor of Mouth

Critical

eyes

esophagus

gills

tongue

Gear-Type

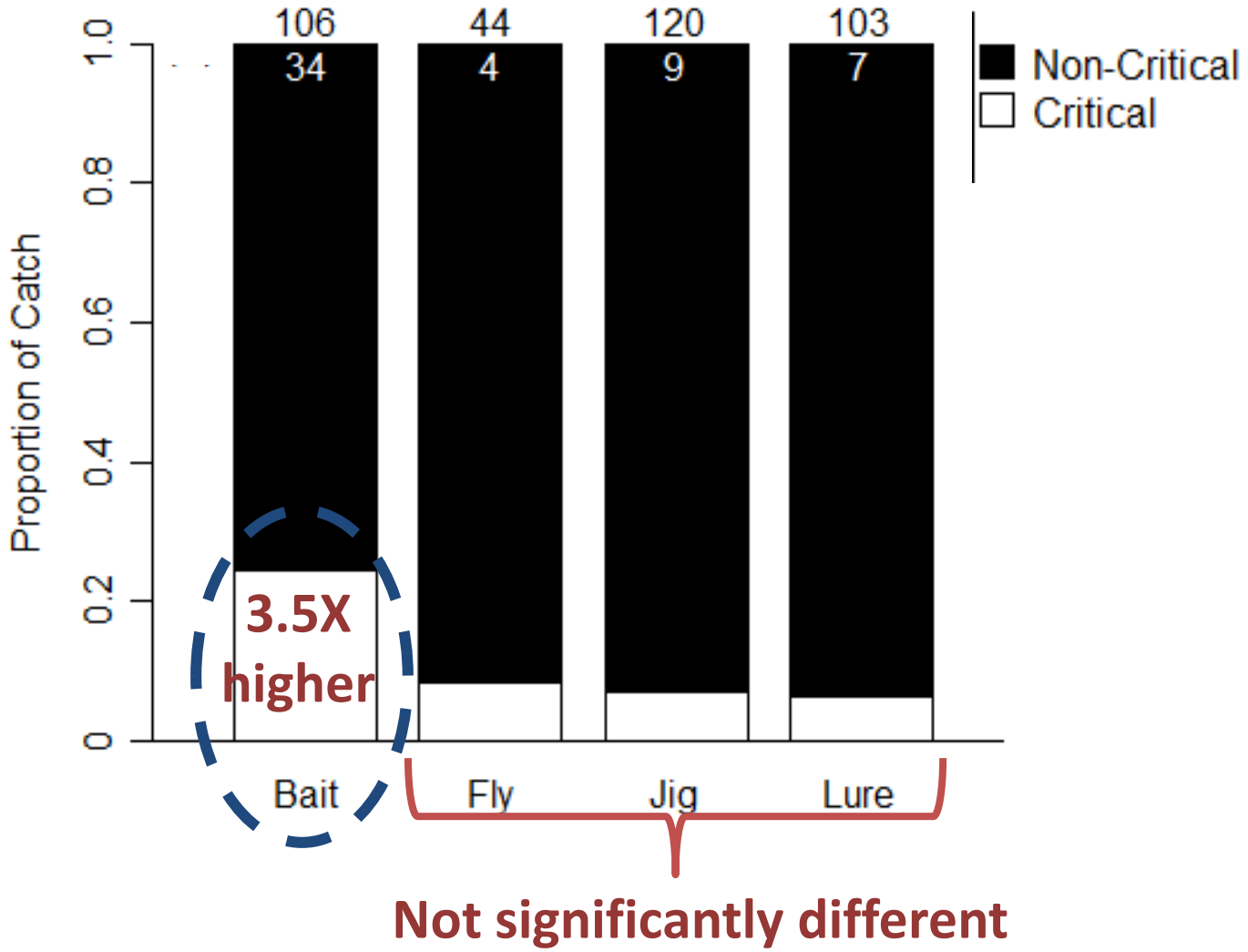
Fly

Lure

Jig

Bait

Q4. Hook Location by Gear Type (summer steelhead in lower Columbia R.)



Summary and Conclusions

- Developed a predictive model to estimate steelhead C&R mortality
- Regulations that reduce/limit contact with critical sites will reduce C&R mortality

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- Model applicability

O. mykiss Diversity

Population-Specific Consequences of Fisheries-Related Stressors on Adult Sockeye Salmon*

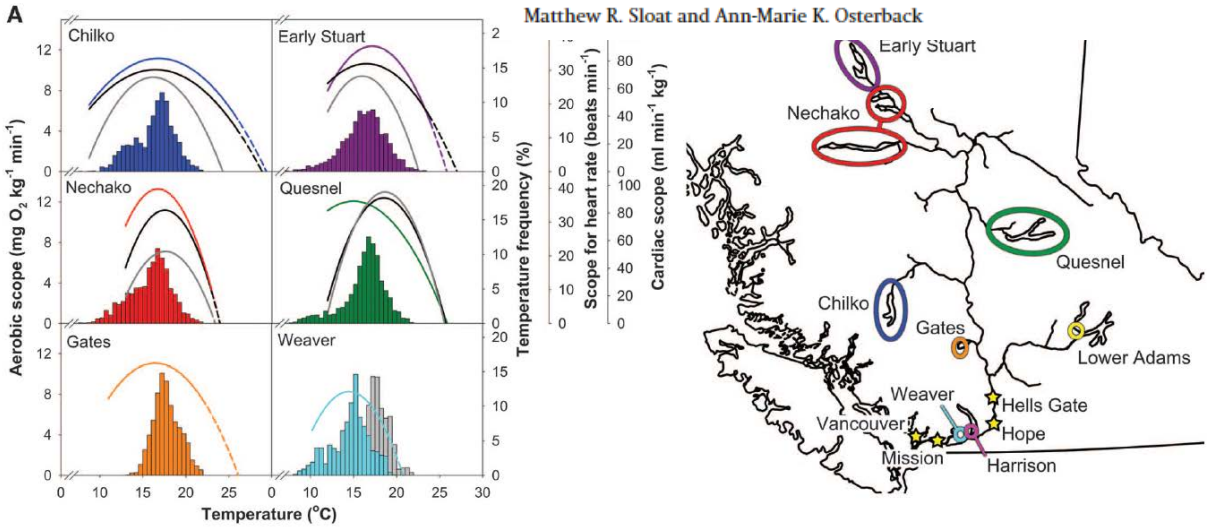
M. R. Donaldson[1,†]
S. G. Hinch[1]
G. D. Raby[2]
D. A. Patterson[3]
A. P. Farrell[4]
S. J. Cooke[2]

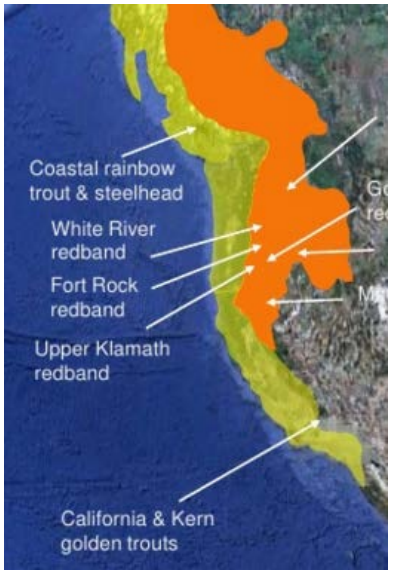
Differences in Thermal Tolerance Among Sockeye Salmon Populations

Erika J. Eliason,[1*] Timothy D. Clark,[1,2,3] Merran J. Hague,[4] Linda M. Hanson,[2] Zoë S. Gallagher,[1] Ken M. Jeffries,[3] Marika K. Gale,[3] David A. Patterson,[4] Scott G. Hinch,[3] Anthony P. Farrell[1,2]

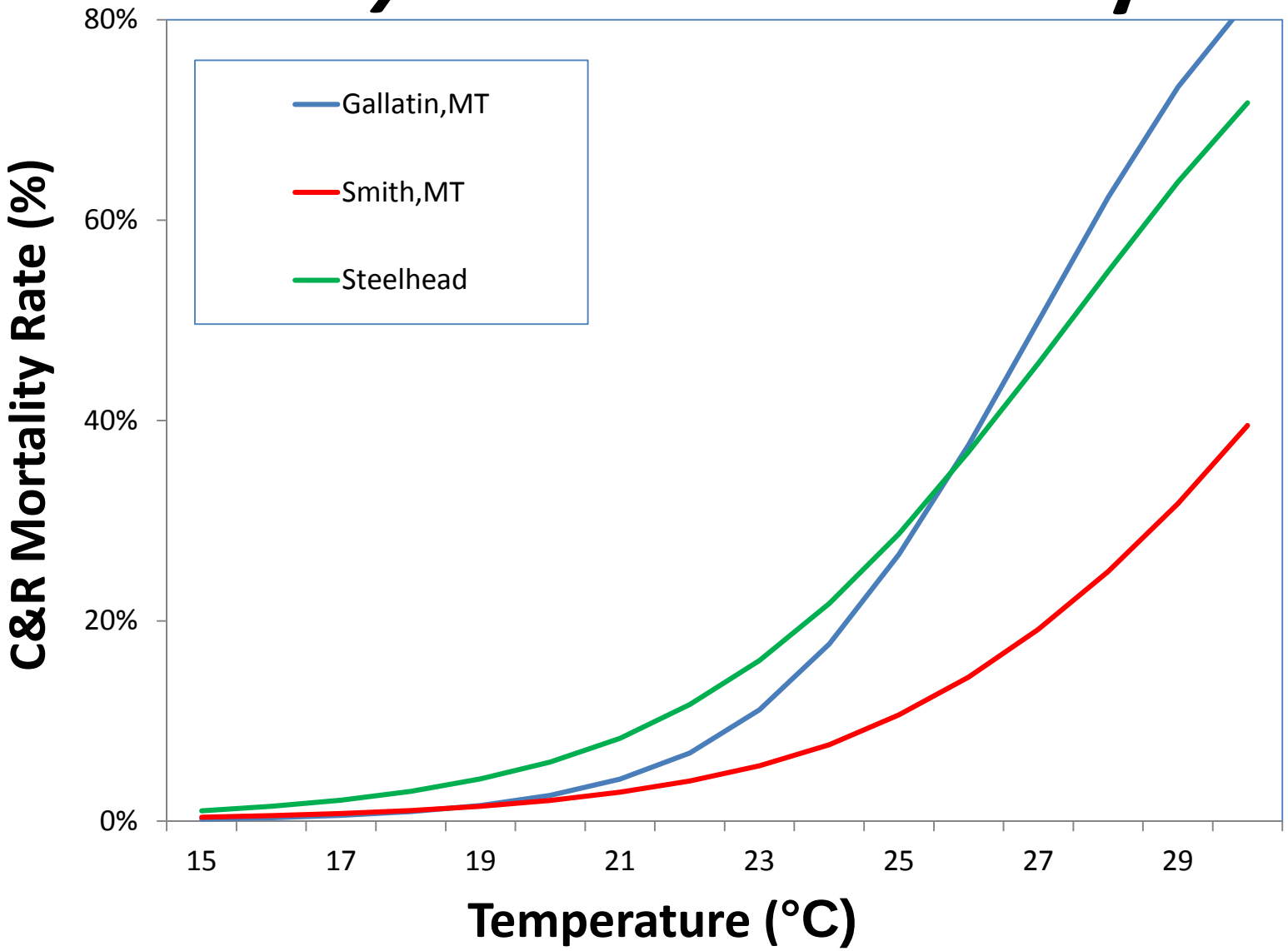
Maximum stream temperature and the occurrence, abundance, and behavior of steelhead trout (*Oncorhynchus mykiss*) in a southern California stream

Matthew R. Sloat and Ann-Marie K. Osterback





O. mykiss C&R Mortality



Summary and Conclusions

- Developed a predictive model to estimate steelhead C&R mortality
- Regulations that reduce/limit contact with critical sites will reduce C&R mortality
- Model applicability:
  - Appropriate for winter steelhead and is a reasonable start for some coastal summer steelhead
  - Need additional data for interior and northern summer steelhead


Questions?