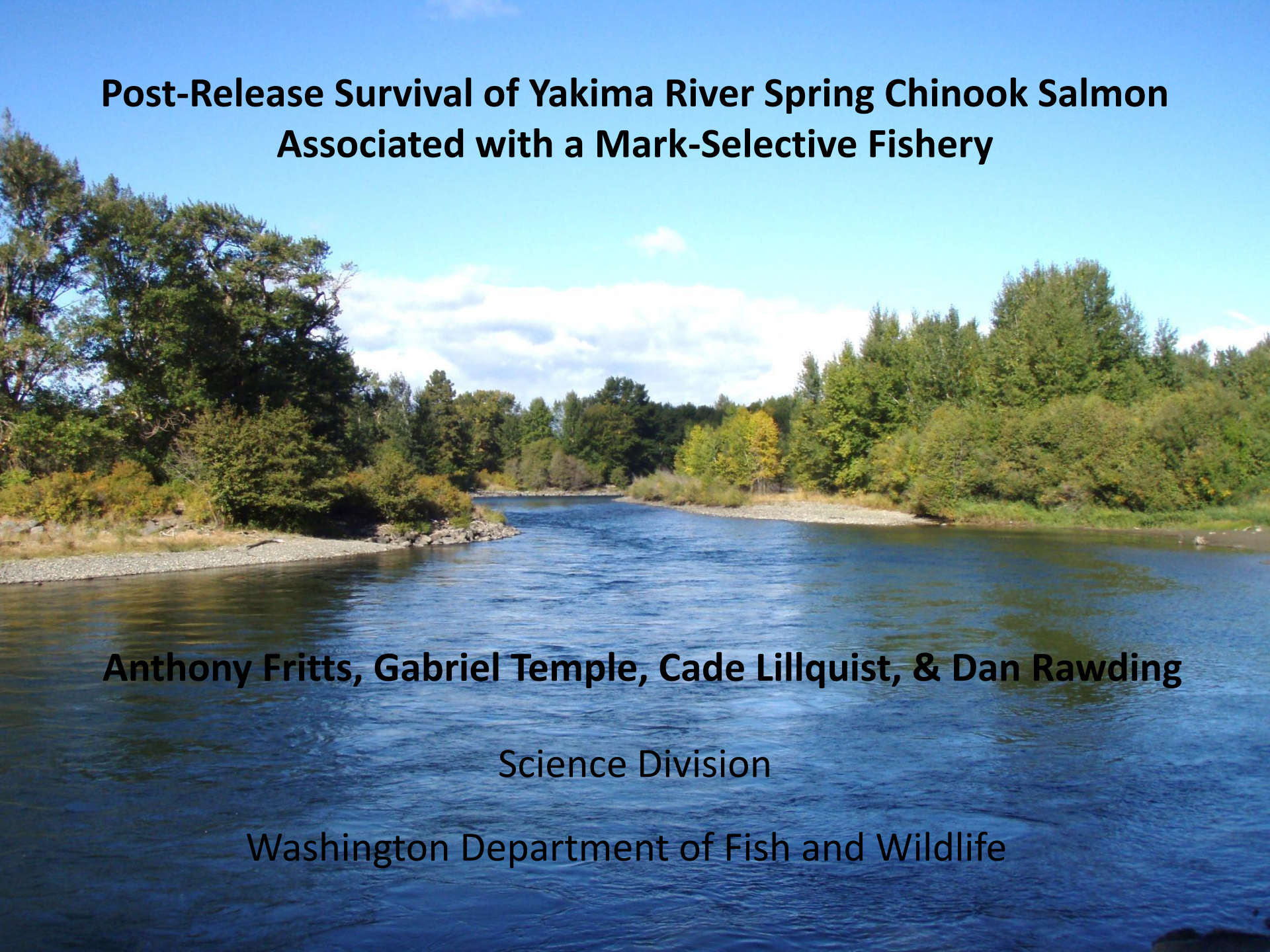
Post-Release Survival of Yakima River Spring Chinook Salmon Associated with a Mark-Selective Fishery



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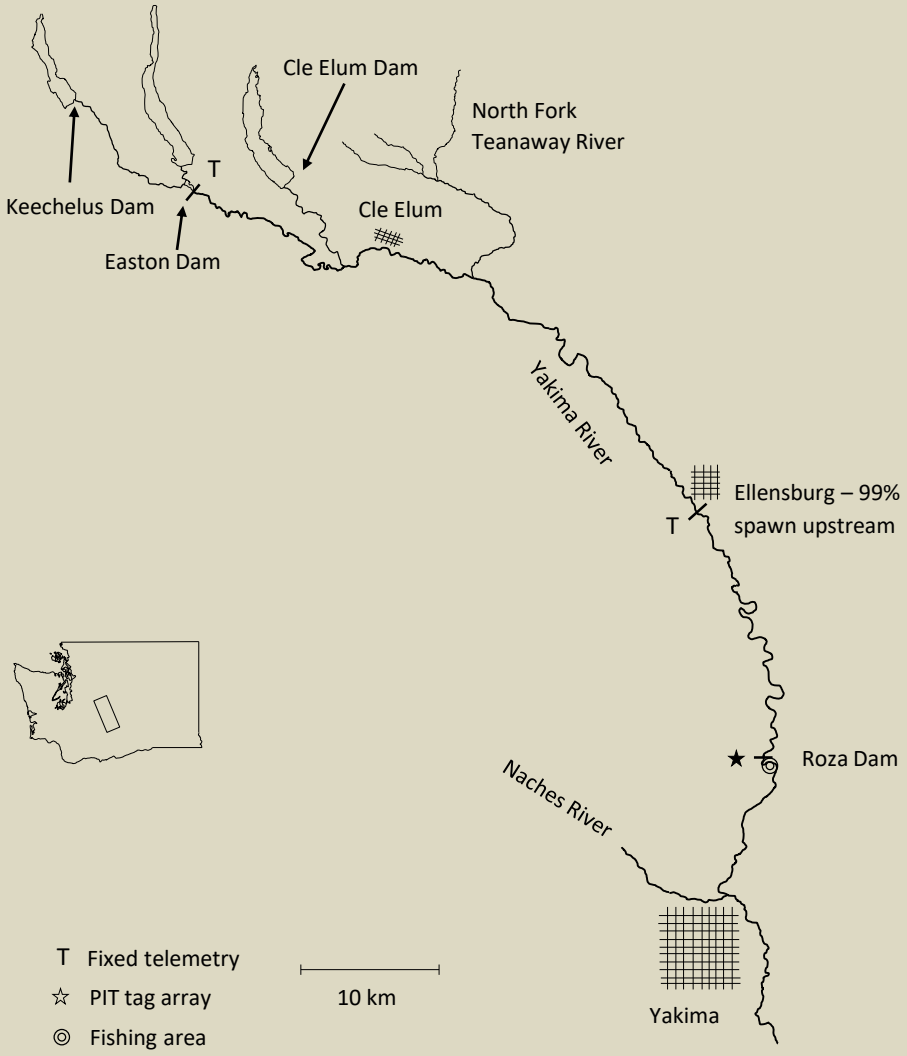
Mark-Selective Fisheries

- Allow for harvest of abundant hatchery-origin stocks while reducing impact on natural-origin
- Assumes high survival of C&R fish
- Fisheries often must be monitored to ensure take of ESA listed fish is not exceeded
- Requires estimate of mortality

Mortality Estimates

- Wide range of mortality estimates (6-69%) for anadromous salmonids (Muoneke and Childress 1994)
- Many potential variables can affect this (species, life stage, water temp, gear, play time, hook location, air exposure, …)
- Relatively few studies in freshwater MSF

Study Site


Cle Elum Dam
North Fork
Teanaway River
T
Keechelus Dam
Cle Elum
Easton Dam
Yakima River
Ellensburg – 99%
spawn upstream
T
Roza Dam
Naches River
Yakima
T Fixed telemetry
☆ PIT tag array
◎ Fishing area
10 km

Fishery

- Open from Union Gap to RR bridge below Roza Dam (34 km), generally from mid-May to mid-July
- Creel surveys indicate 75% of effort and 98% of catch occurs in upper 6.5km
- One single-point barbless hook, ¾” or less from point to shank, bait and knotted nets ok
- Majority drift eggs under bobbers
- HO retention only

Methods-Tagging

- Radio-tag & PIT tag adults caught below Roza using portable electronarcosis
- Collected data on play time, hook location, bleeding severity, water temp, flow
- 80% of treatment fish were caught by recreational anglers
- Tagged equivalent number of HO adults at RAMF

Methods-Tracking

- Used fixed sites and mobile (road & raft) to track fish throughout the summer
- Snorkel to determine if holding fish are alive
- Tracked until all fish were dead at the end of spawning

Tracking

- Median travel time below Roza to Ellensburg was 12 days (range 4 -119 days)
- Median travel time from RAMF to Ellensburg was 5 days (range 1 – 84 days)
- Calculated survival of fish that migrated upstream of Ellensburg fixed array – counted non-migratory fish that survived below Roza at least 12 days as recaptures
- Could not confirm spawning status for many fish because of predation/scavenging, inability to retrieve carcass – decided to limit assumptions and increase sample size by using Sept. 1

Analysis

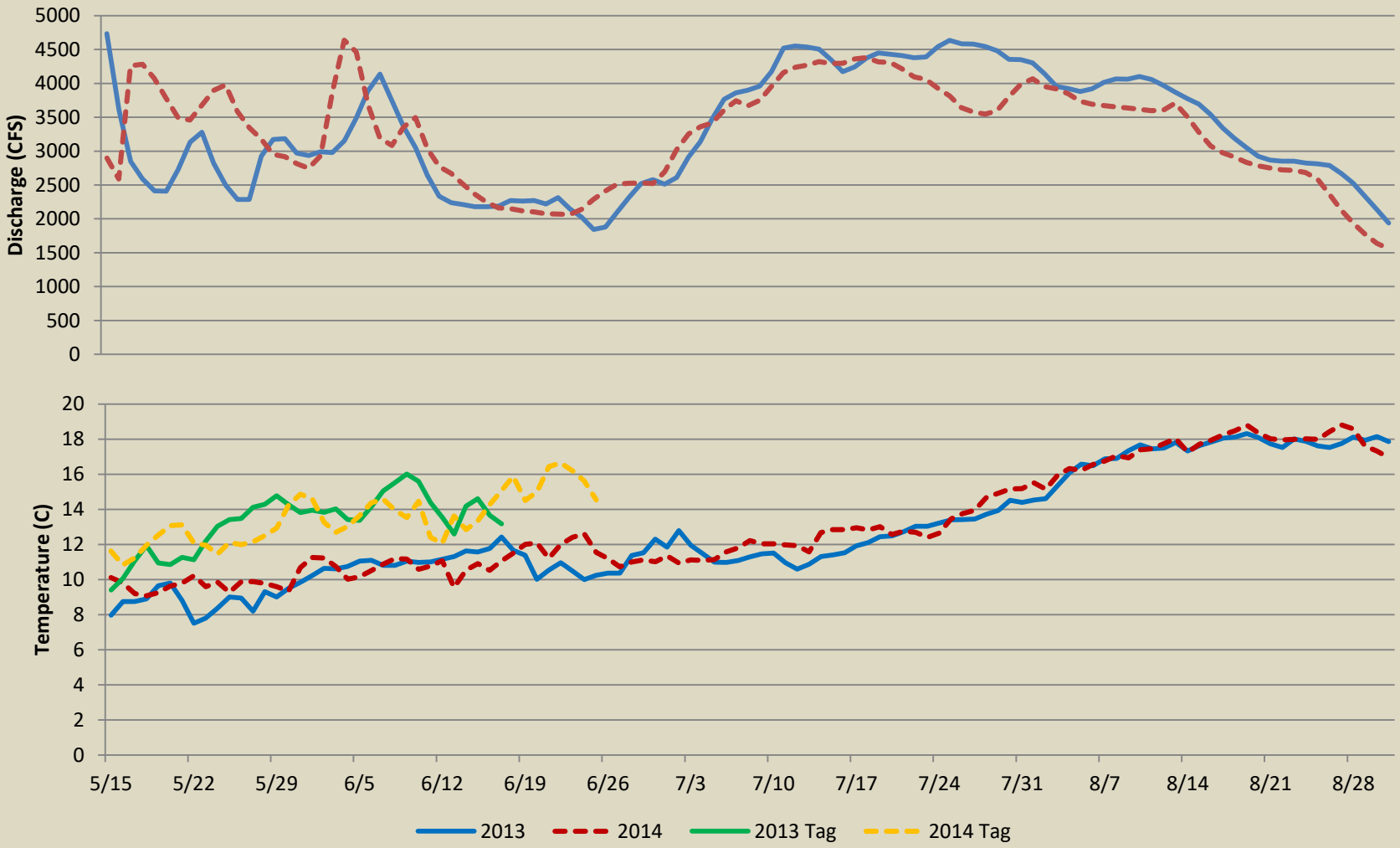
- Relative recovery method was used where survival is the proportion of treatment group recovered divided by the proportion of control group recovered
- No difference in recovery rate of the control group between years so we pooled the data
- Recoveries defined as fish that migrated upstream of Ellensburg* and fish that were visually confirmed alive or moved upstream after Aug. 31
- Used multiple logistic regression to examine the factors influencing survival (hook location, bleeding severity, stream discharge, year, water temp)

Results-Tagging

Group	Tagged	Regurgitated	HC	Tag Failure	Retained	Study Fish
2013 T	70	7	1	0	0	62
2013 C	88	10	0	0	0	78
2014 T	115	4	0	2	0	109
2014 C	123	4	0	1	2	116

- Tagged May 23-Jun 25, 2013 and May 17 – Jun 27, 2014

River Conditions



Survival Estimates

From Fishery to spawning grounds				
Group	Released	Recaptured	Survival	95% CI
Control	195	179		
Treatment	173	143	0.90	0.83 – 0.97

From Fishery to spawning (September 1)				
Group	Released	Recaptured	Survival	95% CI
Control	194	155		
Treatment	171	120	0.88	0.77 – 0.98

Factors

Factor	Deviance	Df	LRT	P-value
Intercept	208.41			
Bleeding	178.38	2	30.03	<0.001
Flow	174.60	1	3.77	0.052
Year	172.38	1	2.23	0.136
Temp	171.31	1	1.06	0.303

Factor	Deviance	Df	LRT	P-value
Intercept	208.41			
Hook Location	187.75	4	20.66	<0.001
Flow	183.78	1	3.96	0.047
Year	183.31	1	0.47	0.493
Temp	182.43	1	0.89	0.347

Bleeding

Bleeding Severity	Released	Recaptured	Mortality Rate	95% CI
0 (none)	77	65	0.00	-0.182 – 0.069
1 (moderate)	74	51	0.14	-0.008 – 0.283
2 (severe)	20	4	0.75	0.530 – 0.970
Control	194	155		

Hook Location

Hook Location	Released	Recaptured	Mortality Rate	95% CI
Jaw	135	102	0.05	-0.06 – 0.17
Eye	16	13	0.00	-2.67 – 0.23
Tongue	6	2	0.58	0.11 – 1.06
Gills	10	2	0.75	0.44 – 1.06
Esophagus/Stomach	4	1	0.70	0.16 – 1.22
Control	194	155		

Hook Location

Hook Location	This Study	95% CI	Lindsay et al.	95% CI
Jaw	0.05	-0.06 – 0.17	0.02	-0.07 – 0.11
Eye	0.00	-2.67 – 0.23	0.00	-0.56 – 0.43
Tongue	0.58	0.11 – 1.06	0.18	-0.10 – 0.46
Gills	0.75	0.44 – 1.06	0.82	0.73 – 0.91
Esophagus/Stomach	0.70	0.16 – 1.22	0.67	0.52 – 0.82

- Similar to Willamette spring Chinook study
- They applied their estimates to creel survey data
- Could be useful for a year-specific estimate on Yakima River fishery and potentially other similar fisheries

Summary

- Hooking mortality was same or similar to the 10% rate often used for management purposes
- Most mortality was early which agrees with other studies with little additional mortality through summer holding
- Bleeding and hook location were informative factors that could potentially be used to model mortality
- Applying our 12% mortality estimate to creel estimates of NO encounters for the previous 10 years yields a mean yearly impact of 1.0% of the upper Yakima River NO spring Chinook population

Acknowledgements

- Mark Johnston and his crew (Yakama Nation) at RAMF tagged fish at Roza and provided helpful suggestions to improve the study
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