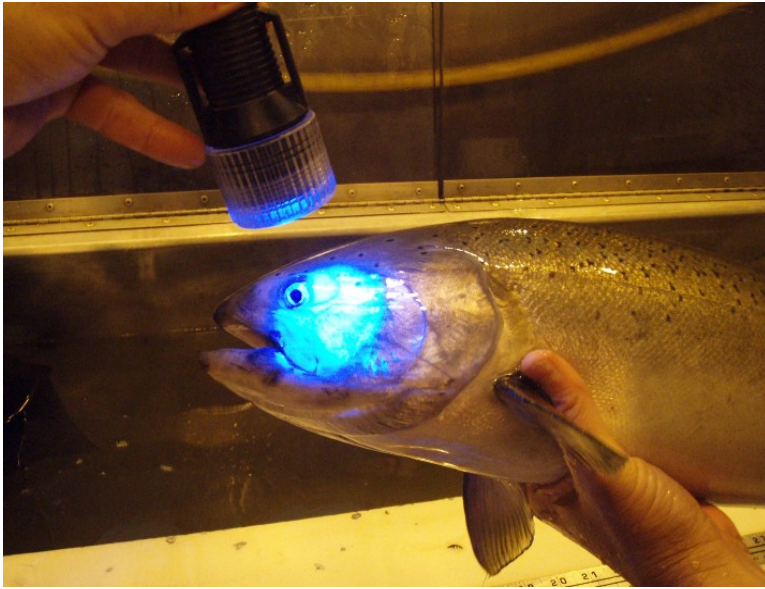


Response of a spawning population of Spring Chinook salmon to flow alteration in a regulated system.



Steve Corbett, Mary Moser, Andrew Dittman, Darran May, Donald Larsen



National Oceanic
and Atmospheric
Administration

National Marine
Fisheries Service



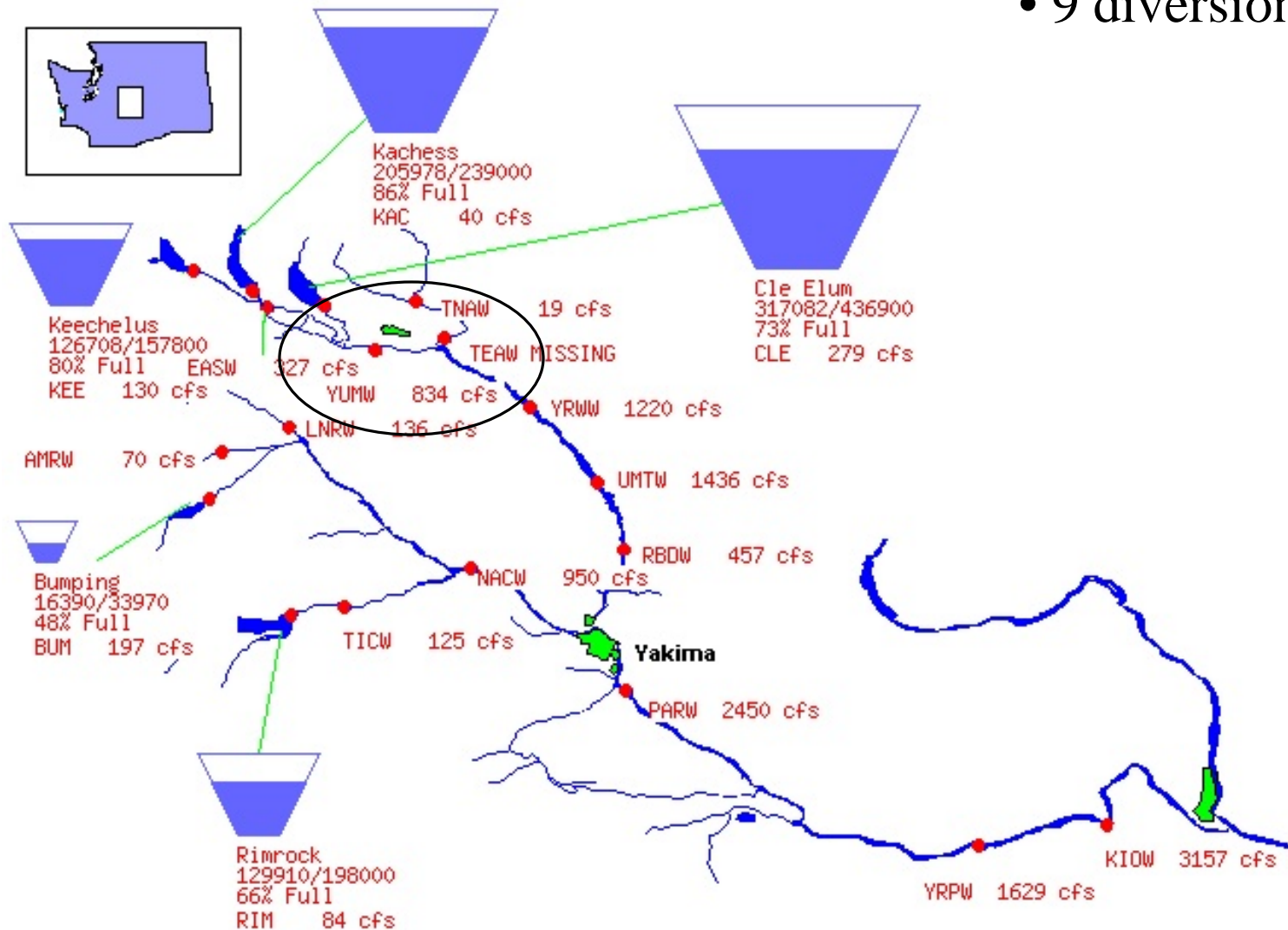
Outline

- Introduction
- Study area
- Objectives
- Methods- tagging and tracking
- Results related to flow alteration
- Activities in 2009



Yakima Basin

02/02/2009



- 5 storage reservoirs
- 9 diversion dams

Radio Telemetry Objectives

- Test homing to acclimation sites
- Determine holding sites and final spawning locations
- Estimate passage time at diversion dam
- Gain insight to pre-spawn mortality
- Compare final tag locations with results from carcass survey
- Measure behavioral response to annual flow alteration event



Radio Tagging

- Collected and tagged at Roza Dam
- May 30-June 11, 2008

119 Adult Spring Chinook

Wild n=30	Clark Flat n=29	Jack Creek n=31	Easton n=29

- 60-93 mm total length
- 4-5 years of age
- Transported 7 km upstream and released



Radio Transmitter Characteristics

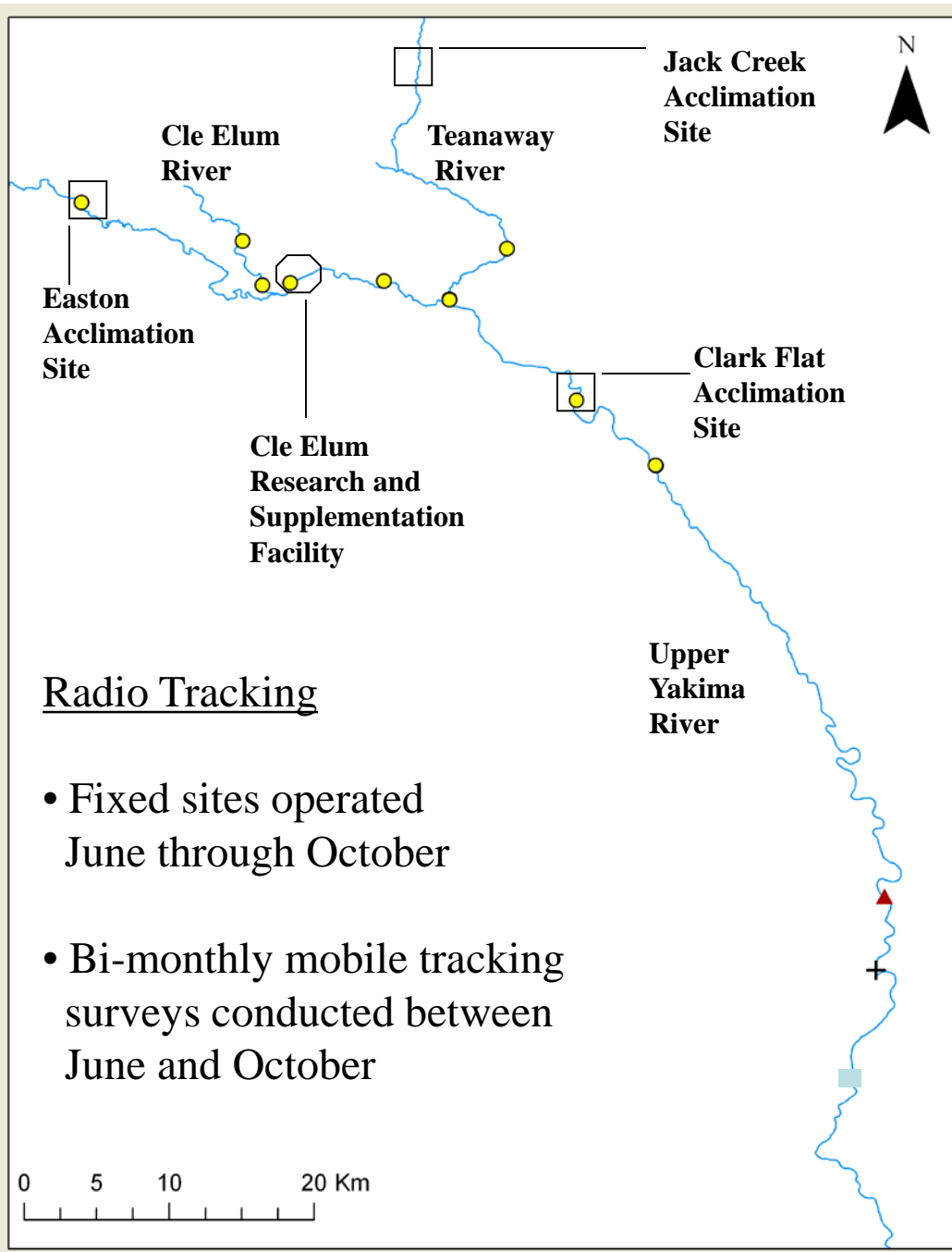
- Transmitter weight < 4% of total body weight

- Transmitter implanted intragastrically via esophogus

- Band of surgical tubing 2 mm thickness

Length	6.0 cm
Diameter	1.6 cm
Antenna length	12.0 cm
Weight in air	29 g
Theoretical life	210 d
Battery type	3.7 V lithium
Frequencies	9, 30.170 MHz to 30.250 Mhz





Radio Telemetry Fixed Site
n=9

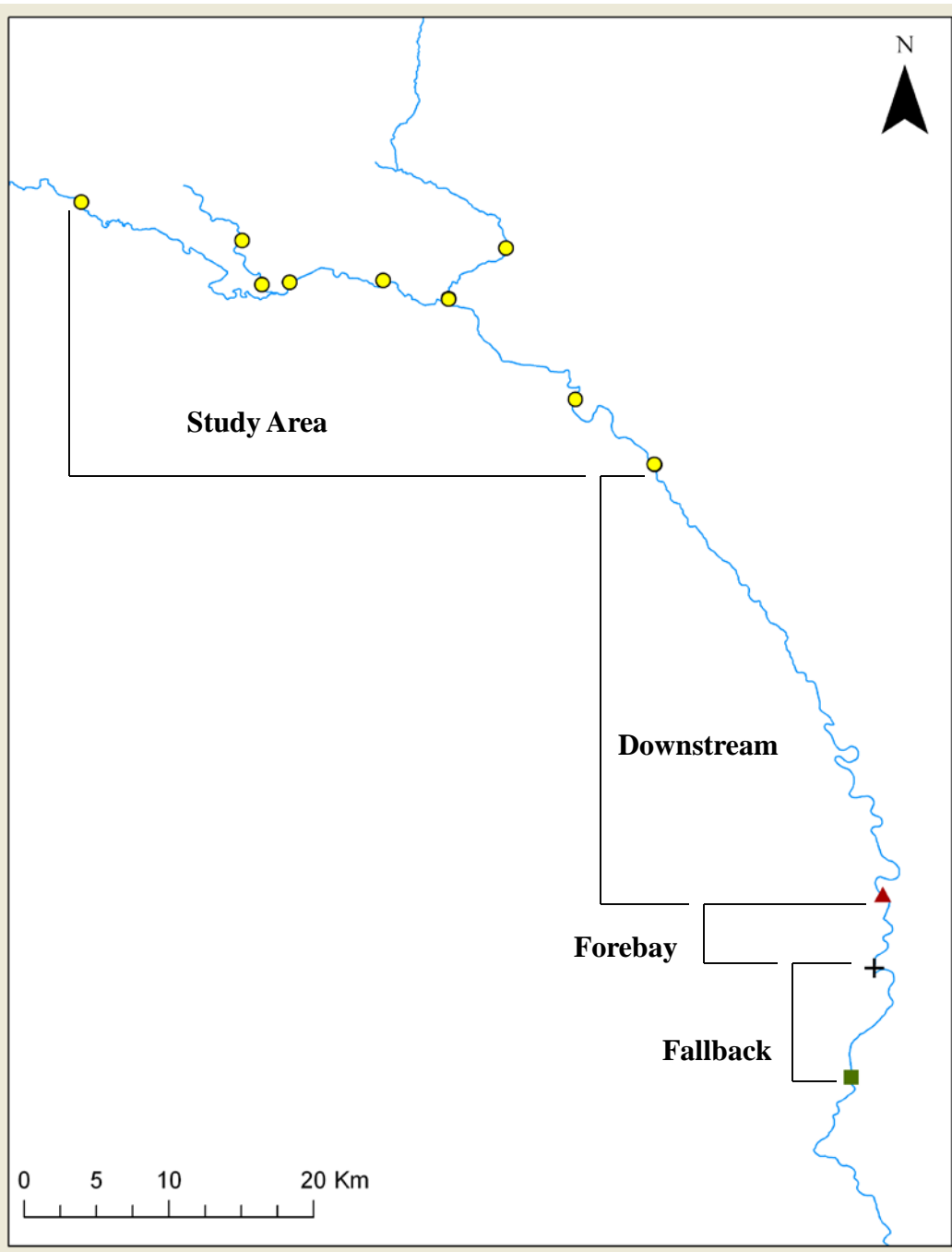


Release Site
Big Pines Recreation Area



Roza Dam





Radio Telemetry Fixed Site
n=9



Release Site
Big Pines Recreation Area

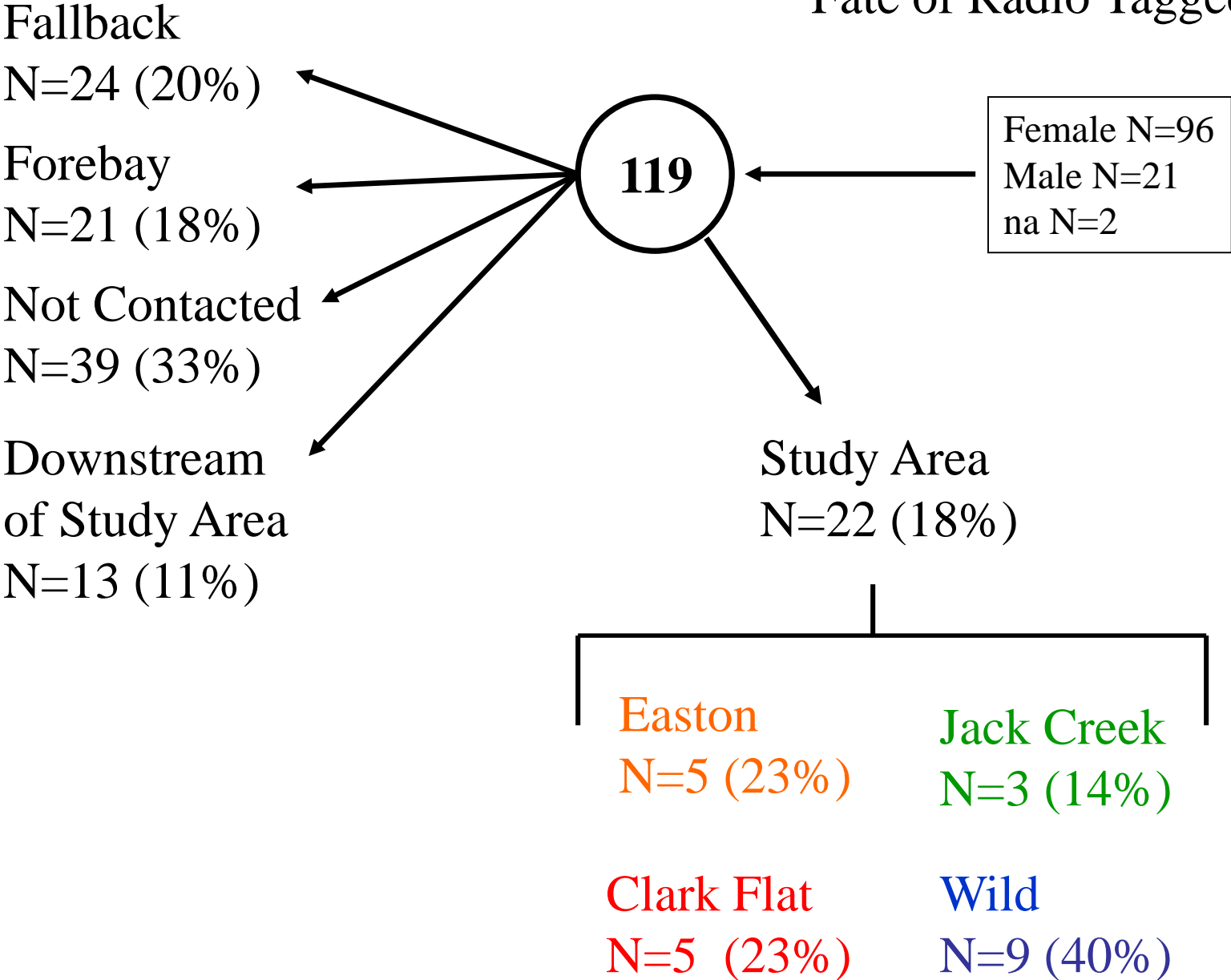


Roza Dam

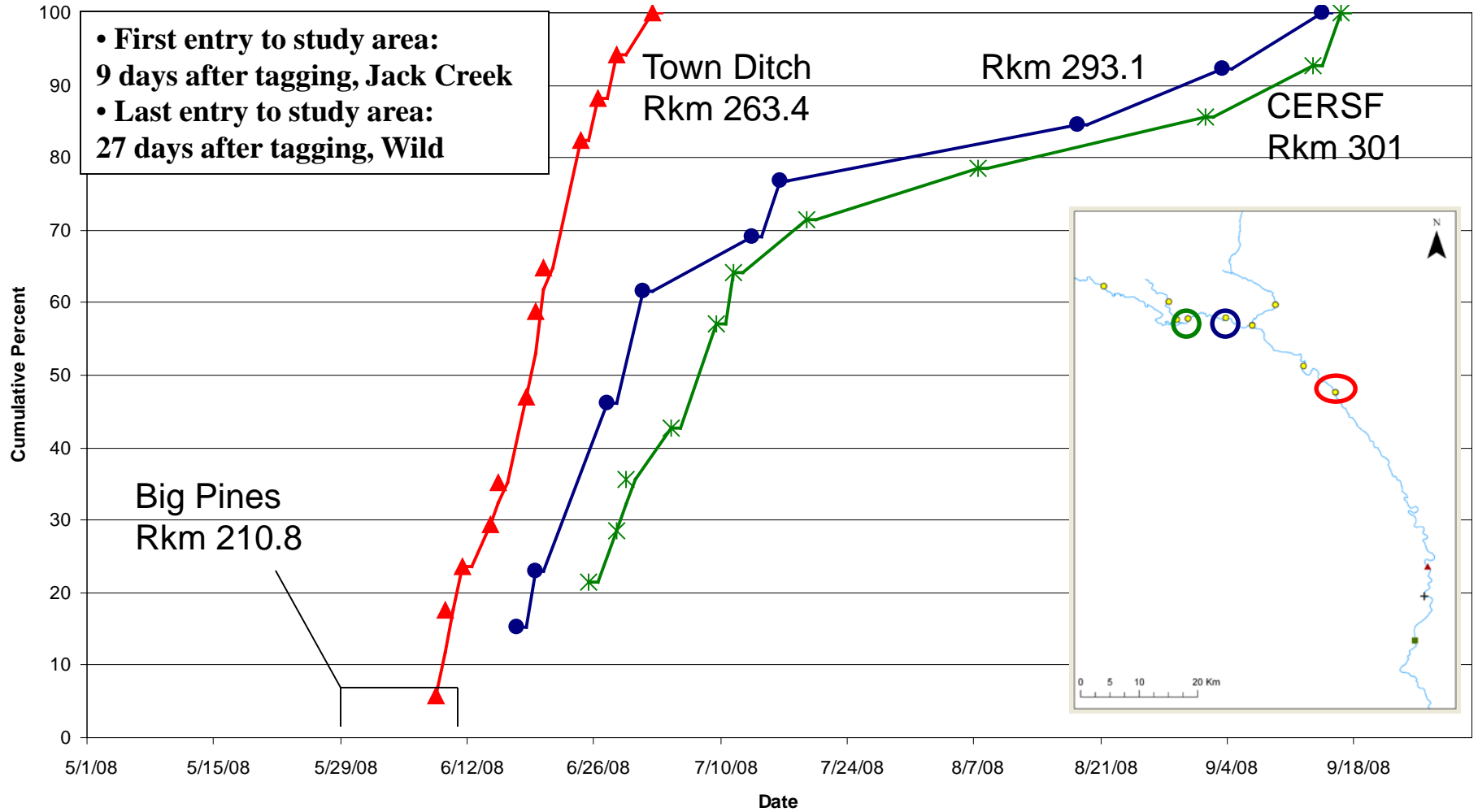


Selah Bridge

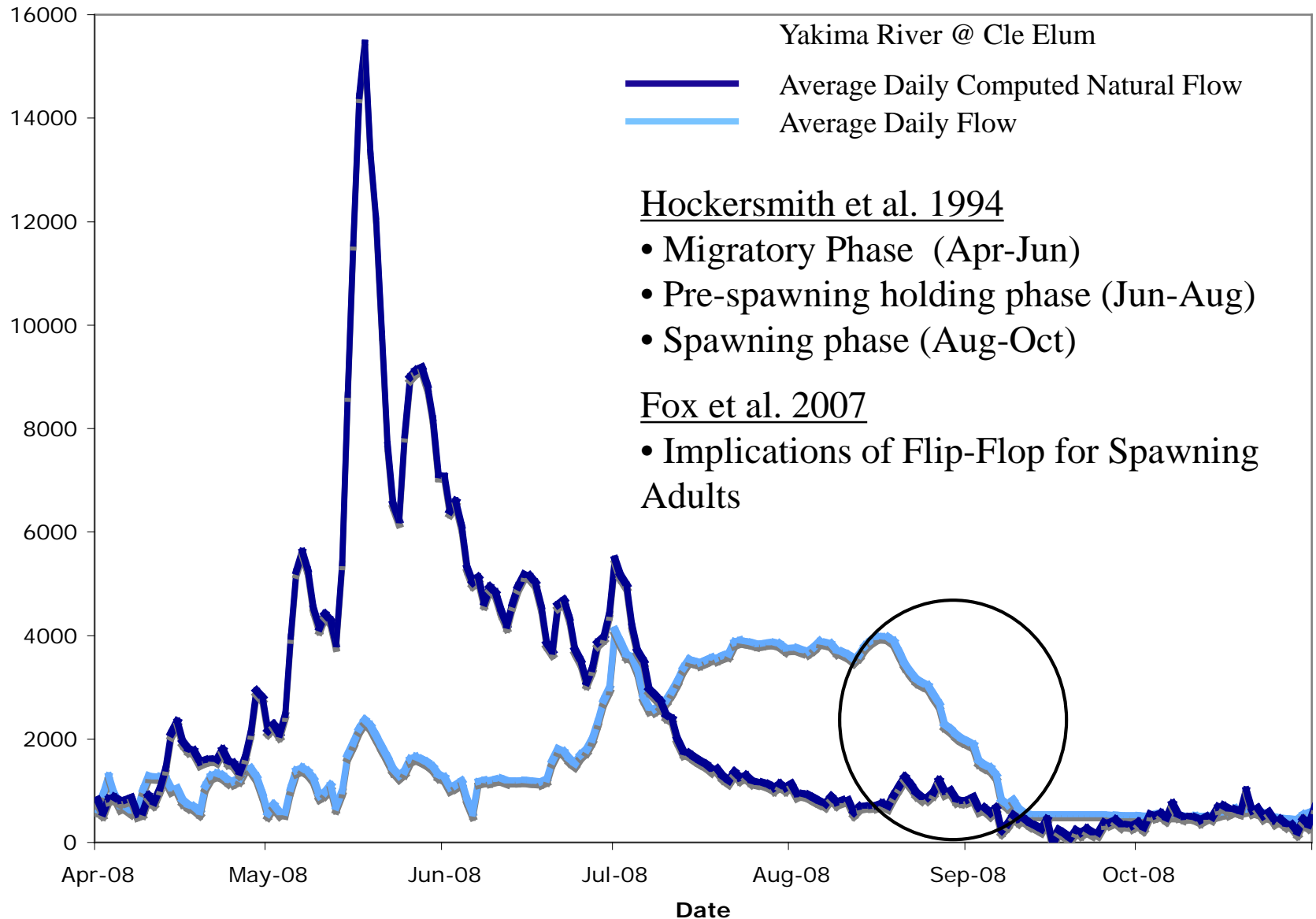
Fate of Radio Tagged Fish



Fixed Site Passage - Cumulative Percent




Altered vs. Natural Hydrographs



Flow Alteration : “Flip Flop”

- Annual flow alteration event
- Late August to early September
- Result of court ruling Yakama Nation v. BOR, 1980
- Purpose:
Balance needs of irrigation with spawning salmon

Strategy:

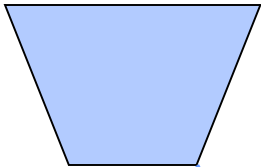
- Flows out of Cle Elum Reservoir decreased
- Flows out of Rimrock Reservoir increased
- Spawning occurs lower in channel
  less flow required to cover redds
- Prevent redds from being dewatered

Began in 1982

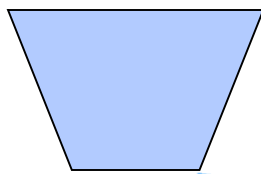
Upper Yakima Basin Flow Dynamics

August 18 - September 12, 2008

Lake Kachess



Lake Cle Elum

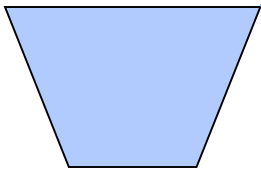


Cle Elum River

3619 cfs
to
241 cfs



Lake Keechelus

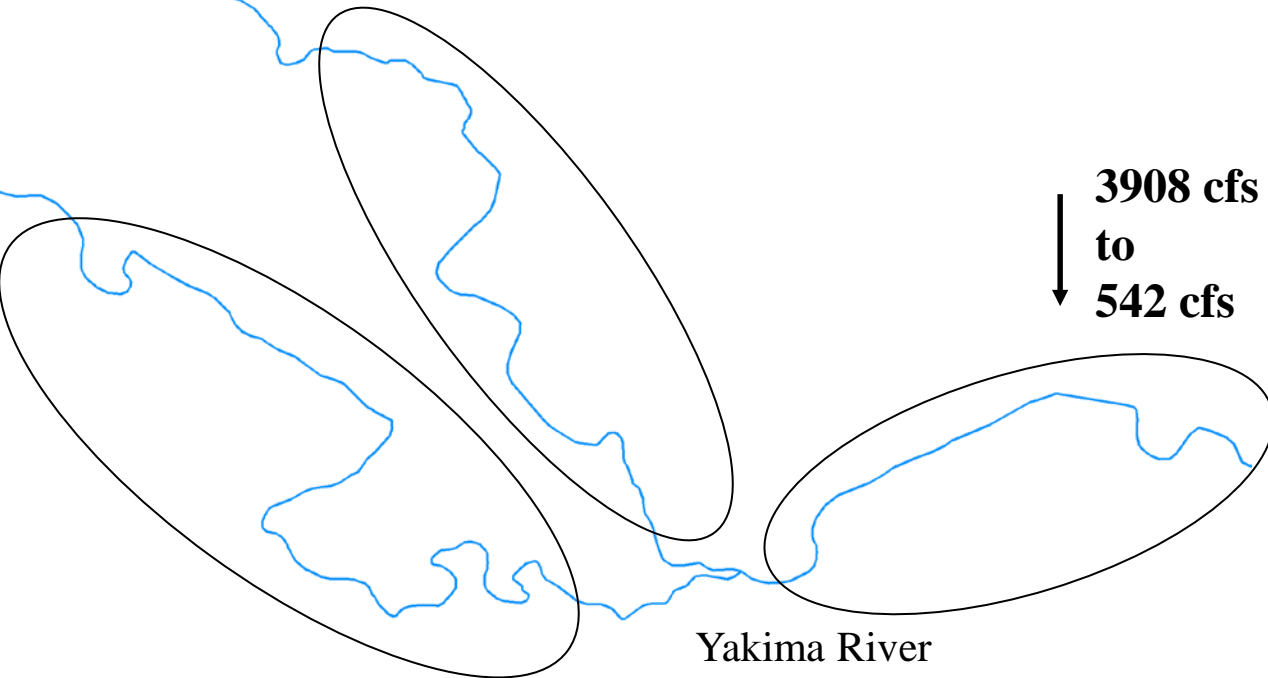


296 cfs
to
234 cfs

3908 cfs
to
542 cfs



Yakima River



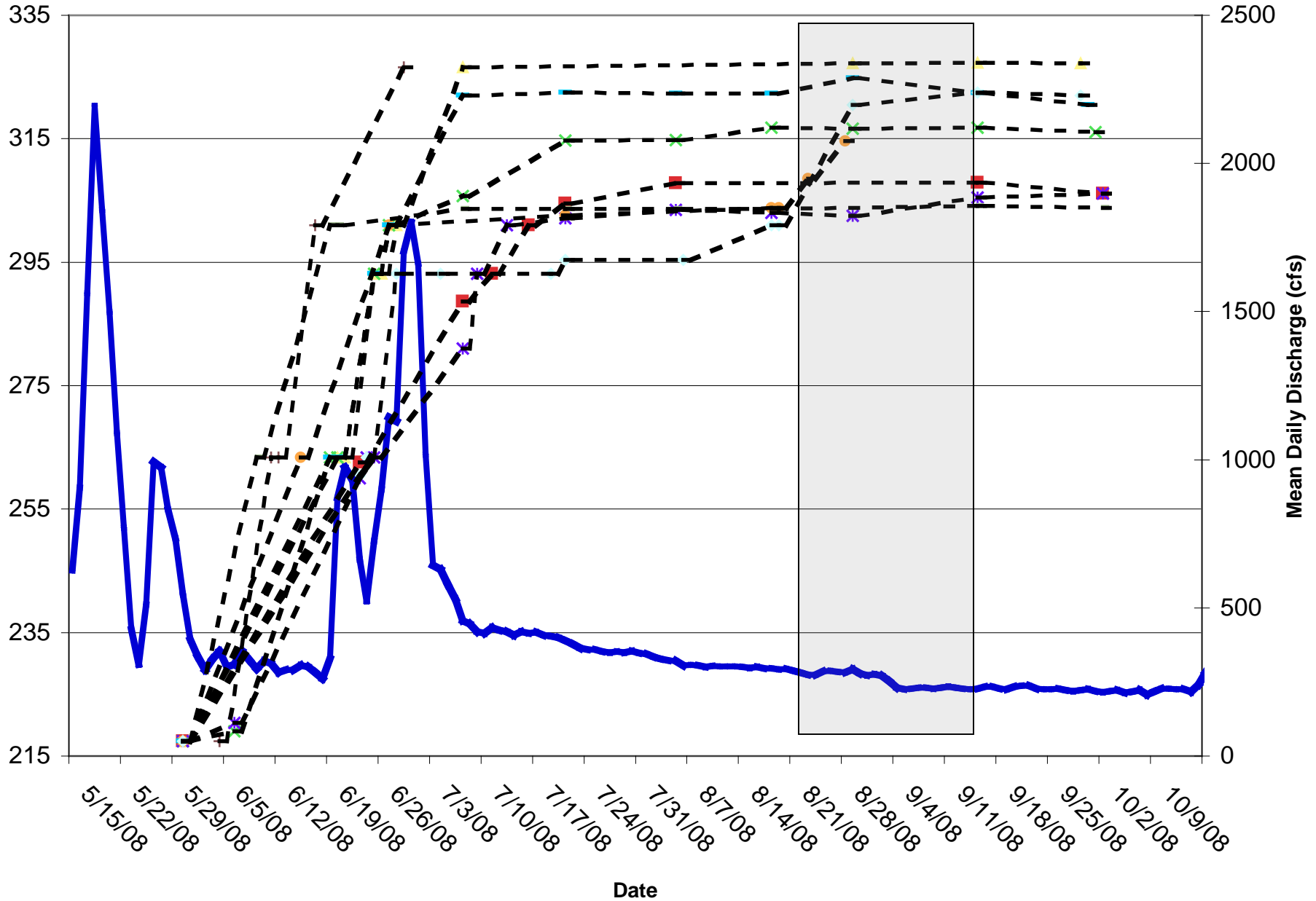
N



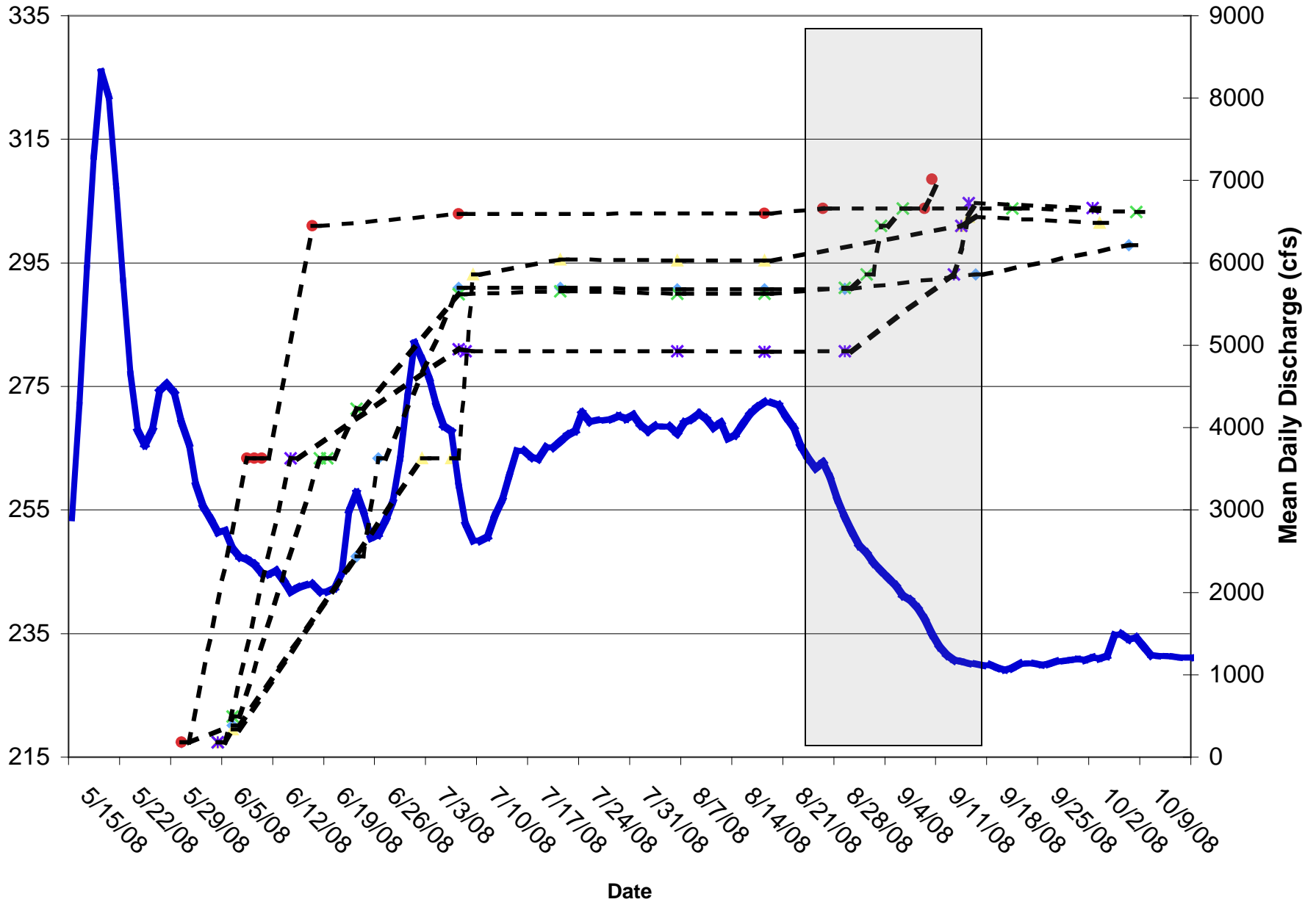
0 1 2 4 Kilometers



Did not experience flow alteration, n=9



Experienced flow alteration, n=5



Did not experience
flow alteration

RA084

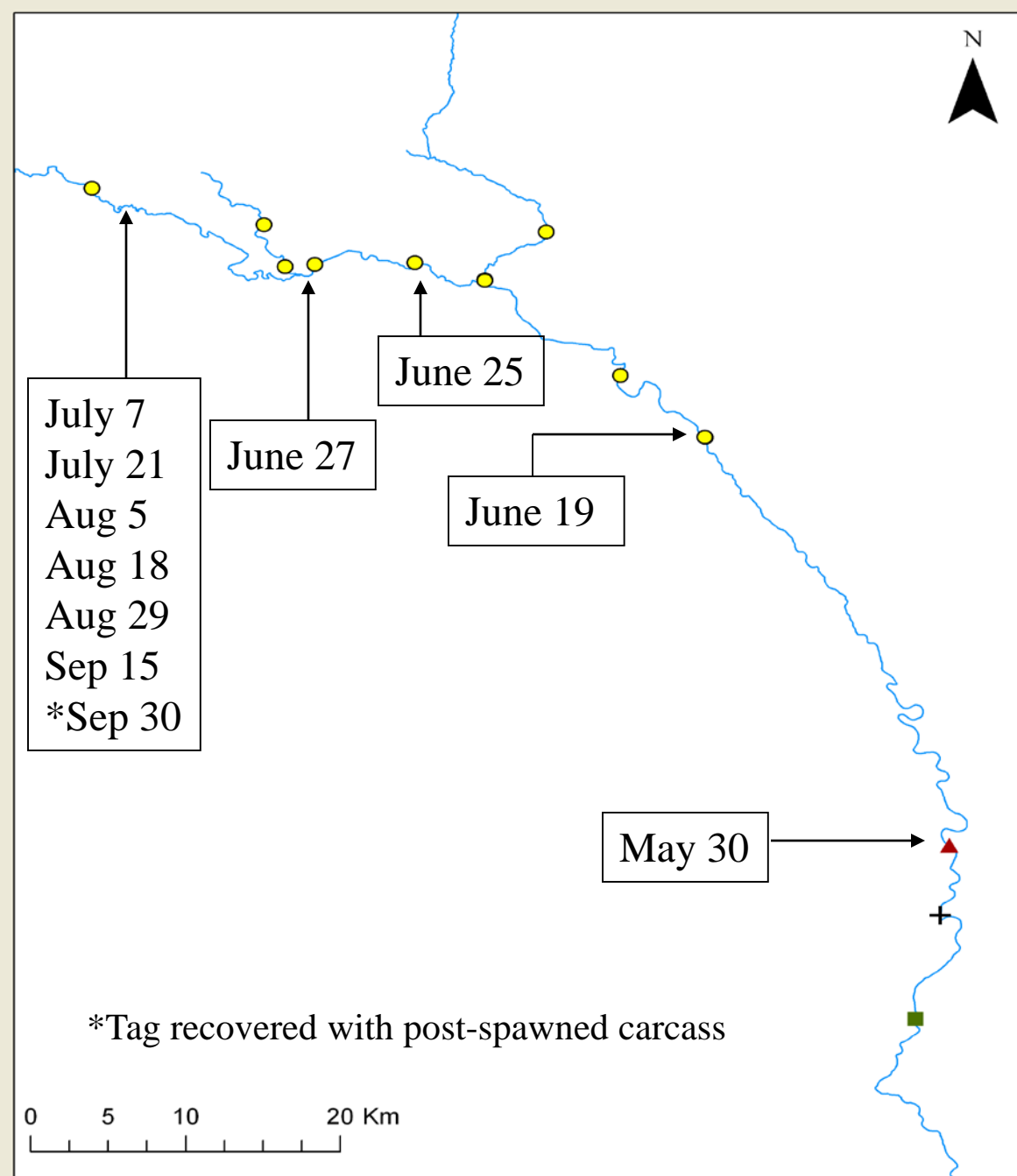
Origin: Wild

Female

70 cm

Total distance of
upstream migration = 103 km

of relocations = 10

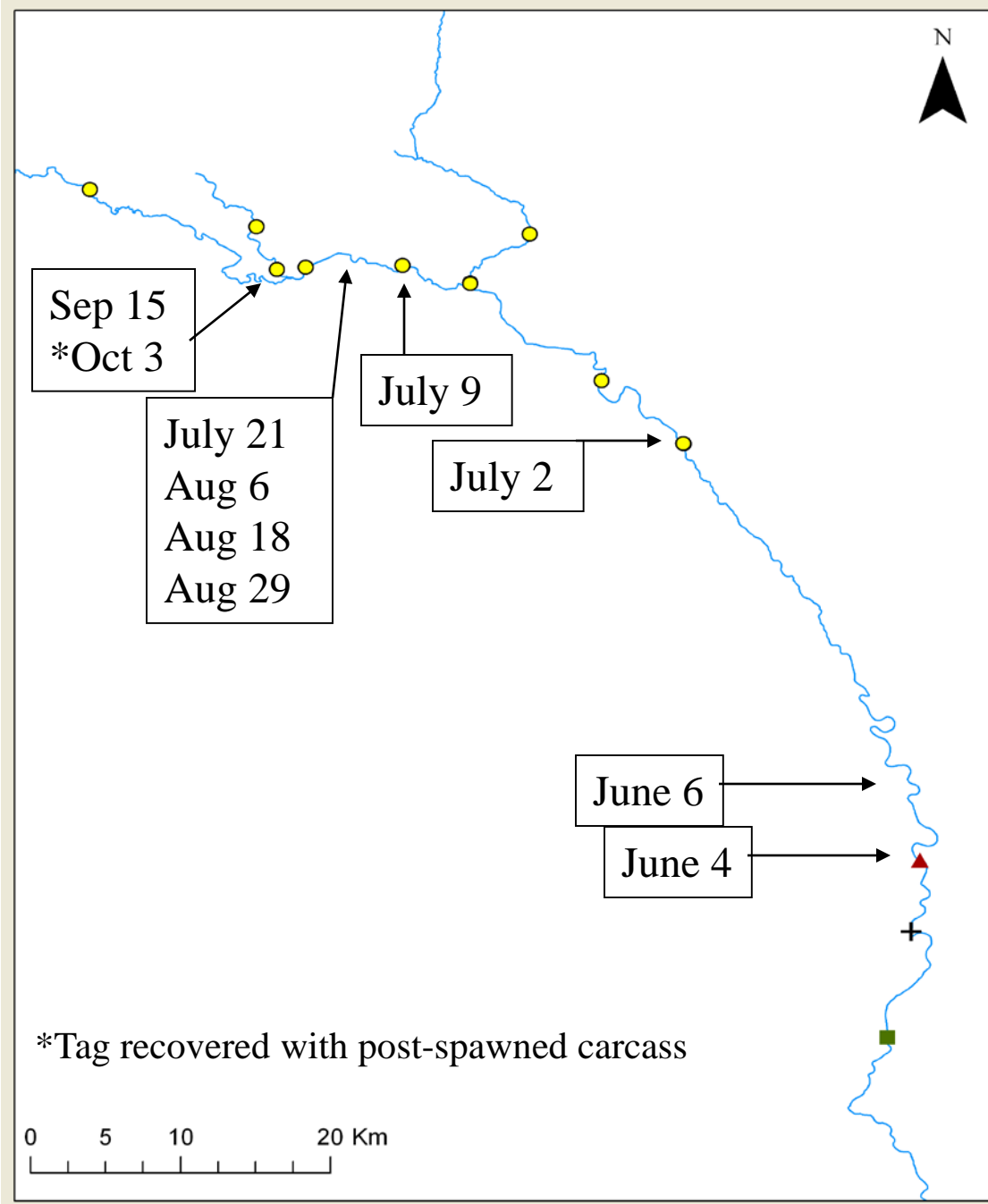


Experienced flow alteration

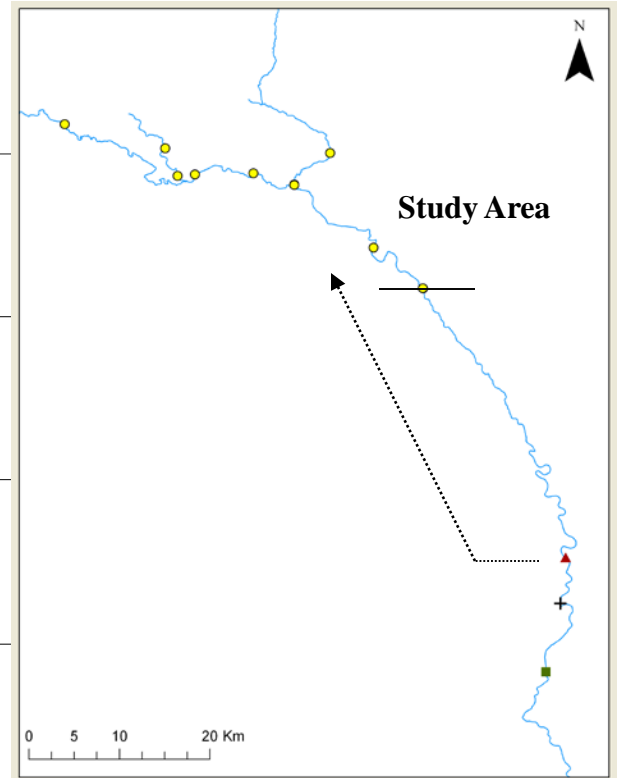
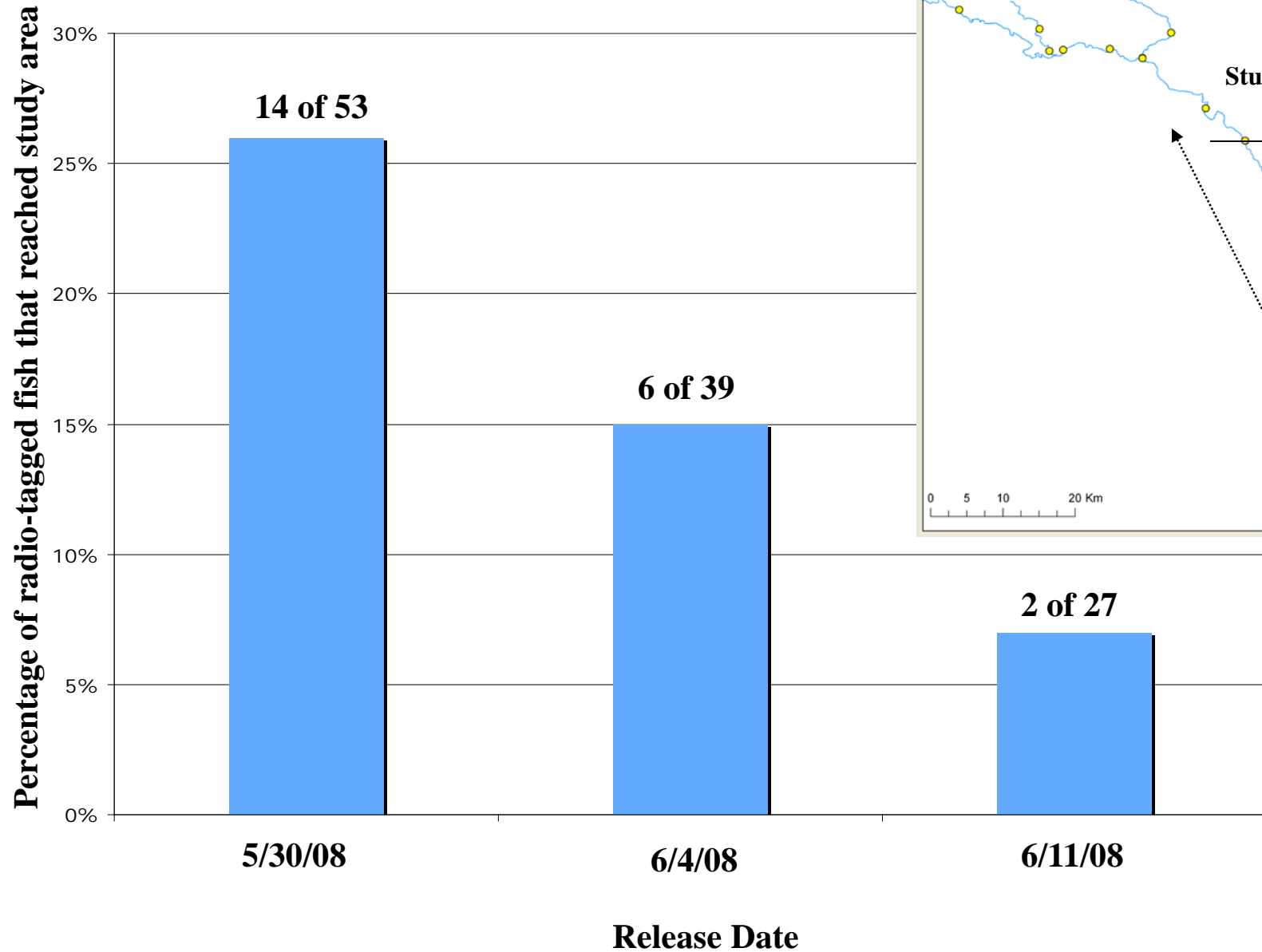
RA212
Origin: Clark Flat
Female
63 cm

Total distance of
upstream migration = 85 km

of relocations = 10



Effect of Release Date



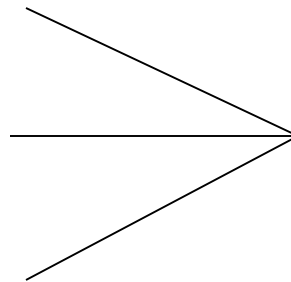
Activities in 2009

- Test of tag attachment method
- Provide insight to 2008 results
- Guide actions in 2010

Esophageal Implant

External Attachment

Untagged Control



Tag Retention,
Survival

Conclusions

- Final locations of radio-tagged fish occurred where carcass/redd survey results show highest densities.
- Homing/straying assessment requires data from larger sample size.
- Evidence that flow reduction prompts fish to move upstream.
- Some fish migrate upstream of confluence with Cle Elum River and thus do not experience Flip-flop.
- Majority of spawners are migrating upstream during artificially low flows in June and artificially high flows in July and August.
- More research needed to determine best tag attachment method.

Acknowledgements



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and Atmospheric
Administration

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Fisheries Service



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Joe Hoptowit

Gerald Lewis

Vernon Bogar

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Scott Kline

Ellensburg Water

Larry Brown

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Northwest Fisheries Science Center

Passage at Town Ditch Diversion Dam

- Dual antenna array, ~1 km
- Low 1 hr. 24 minutes
- High 4 days 1 hour 17 minutes
- Mean 1 day, 3 hours, 3 minutes



