

Salmonid Recolonization of the Elwha River following Dam Removal



Dam photos courtesy of John Gussman

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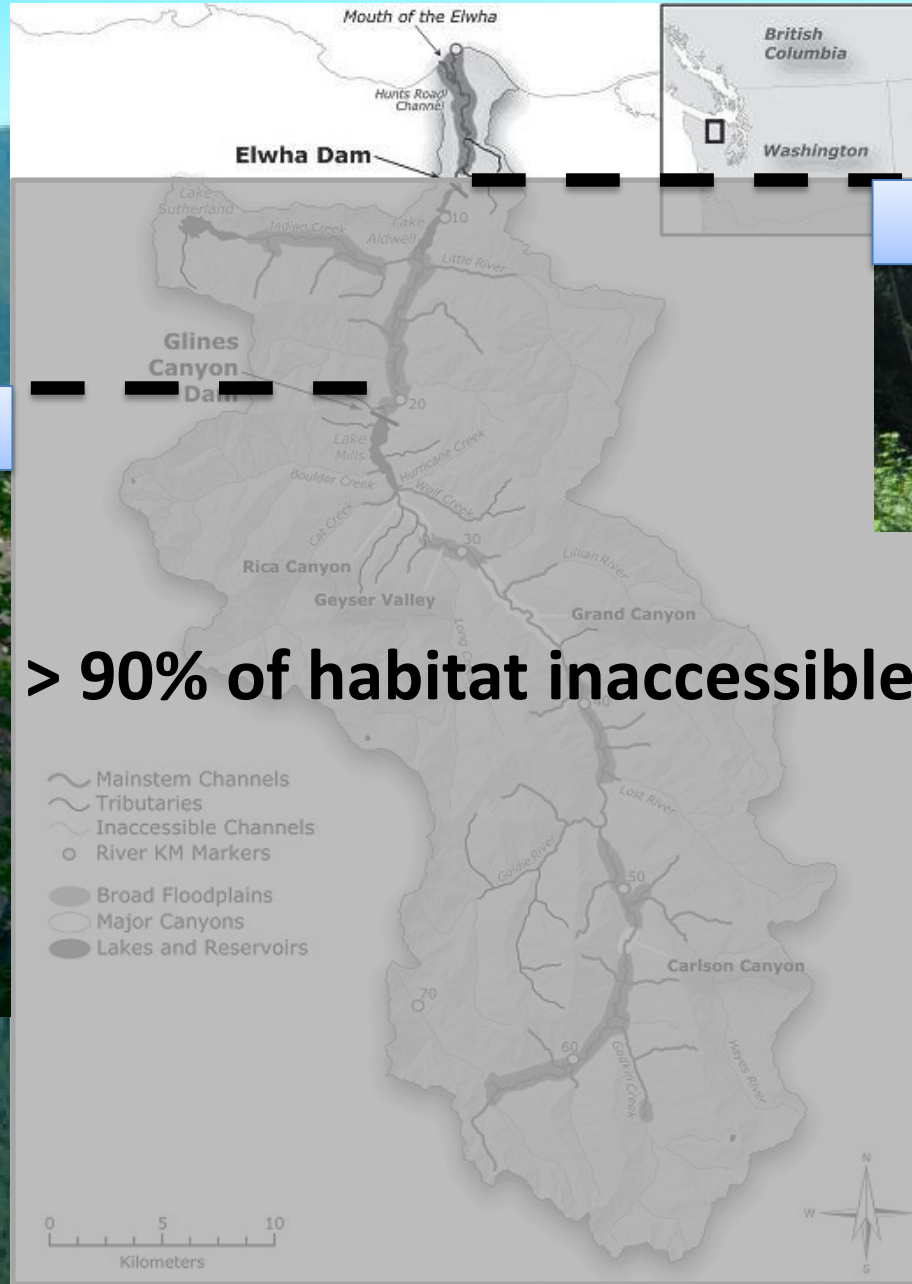
¹USFWS, Lacey, WA; ²NMFS, Seattle, WA; ³USGS, Seattle, WA; ⁴WDFW, Olympia, WA; ⁵NPS, Port Angeles, WA; ⁶Lower Elwha Tribe, Port Angeles, WA; ⁷NOAA Fisheries, Lacey, WA; ⁸TU, Port Angeles, WA; ⁹K Denton and Associates LLC

Outline

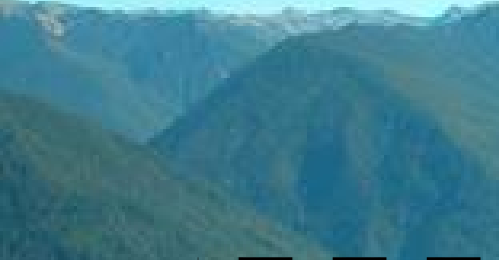
- Background
 - Elwha basin
 - Population status
 - Sediment issue
 - Hatchery issue
- Monitoring Methods
- Species by Species Account
 - Historic hatchery releases
 - Pre-dam status
 - Recovery strategy
 - Results
- Summary



The Elwha River Basin



Elwha Dam

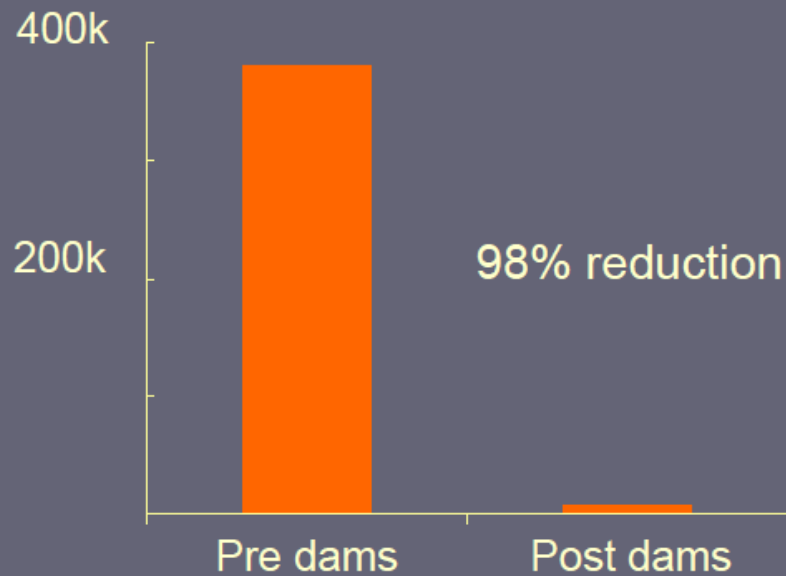


Glines Canyon Dam

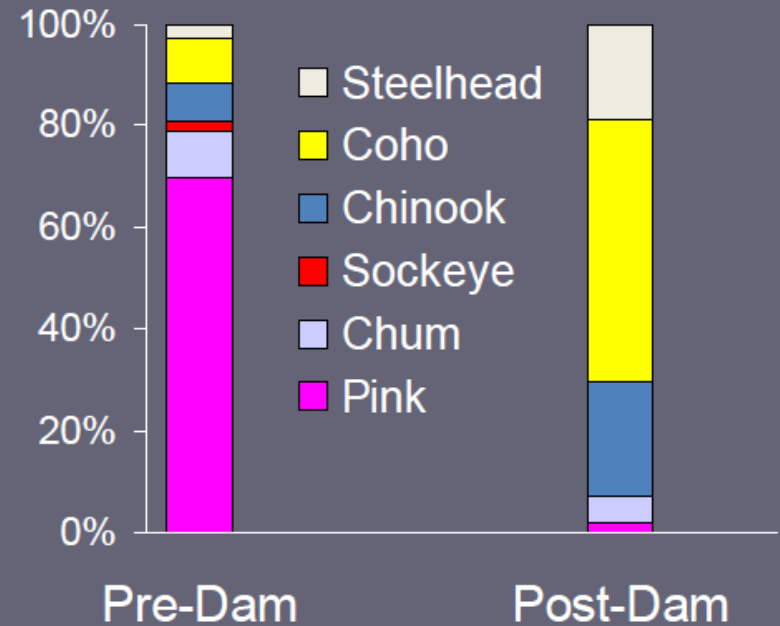


Impacts to Elwha River salmon populations

Total population decline



Shift in species composition



All native populations are very low in abundance

Sediment Concerns

~ 21 million m³ of sediment accumulated in reservoirs

- ~54% fine, ~46% coarse

Predictions

- ~40-60% expected to be released
- Suspended-sediment > 10,000 ppm
- Temporary deposition of fines in pools
- More floodplain dynamics
- Bed aggradation in lower river
- Beach formation in the estuary



History of Hatchery Releases in the Elwha

- Federal Fisheries Bureau
 - “Auxiliary” Hatchery
 - 1911-1914
 - Produced 257,000 salmon fry in 1912
 - ~70,000 eggs collected 1913-1914
- Elwha Hatchery – 1914-1922
 - 23 million eggs collected
 - Chinook, Chum, Coho, Pink Steelhead
- Trout fry plants – 1914-1922
 - Lake Sutherland and Elwha



Elinor Chittenden in 1907, before Elwha Dam was built.

History of Hatchery Releases in the Elwha

- Dungeness Hatchery 1930's – 1970's
 - Reared Elwha eggs and returned fry to the river
- ONP trout stocking – 1942 - 1975
- Elwha Rearing Channel – 1976-present
 - Elwha Chinook eggs reared off-station returned for release – age 0 & 1
- Lower Elwha Tribal Hatchery – 1976-present
 - New facility finished – 2010
 - Winter steelhead, coho, chum, pink

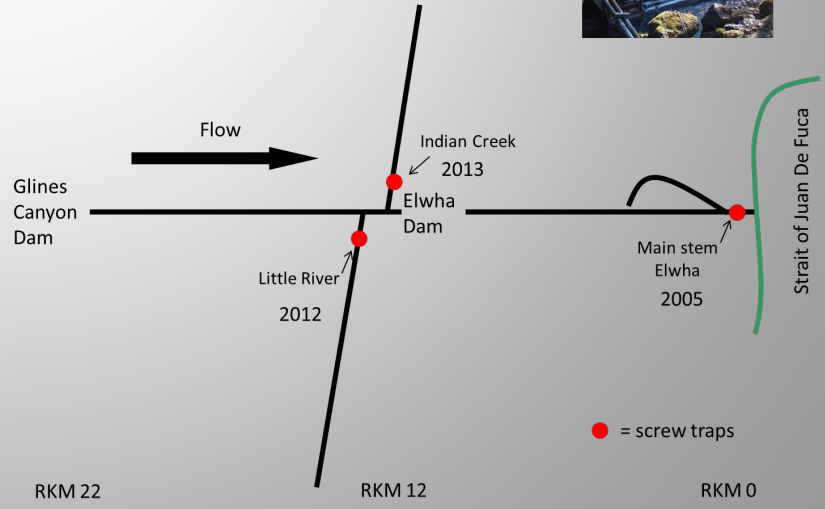


Methods Summary

- Abundance
 - SONAR
 - Redd surveys
 - Snorkel
- Distribution
 - Redd surveys
 - Telemetry
 - Snorkel
- Productivity
 - Smolt traps



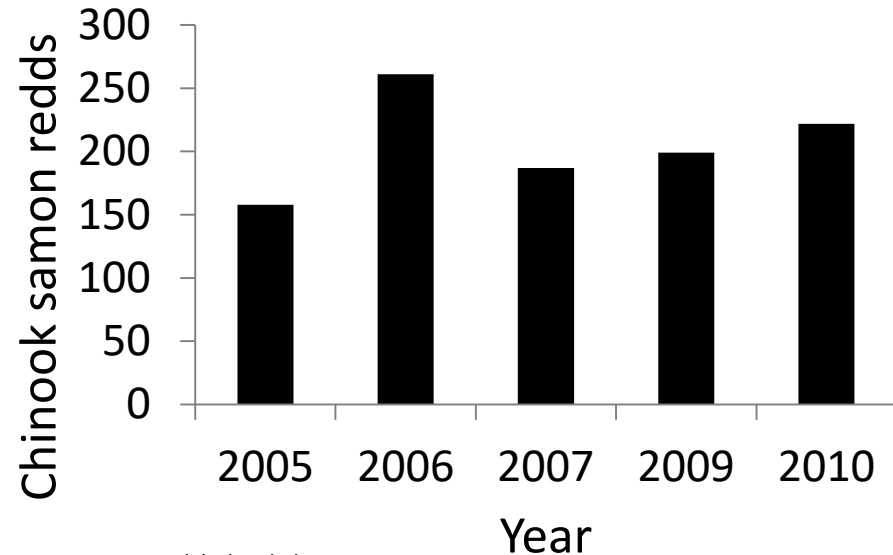
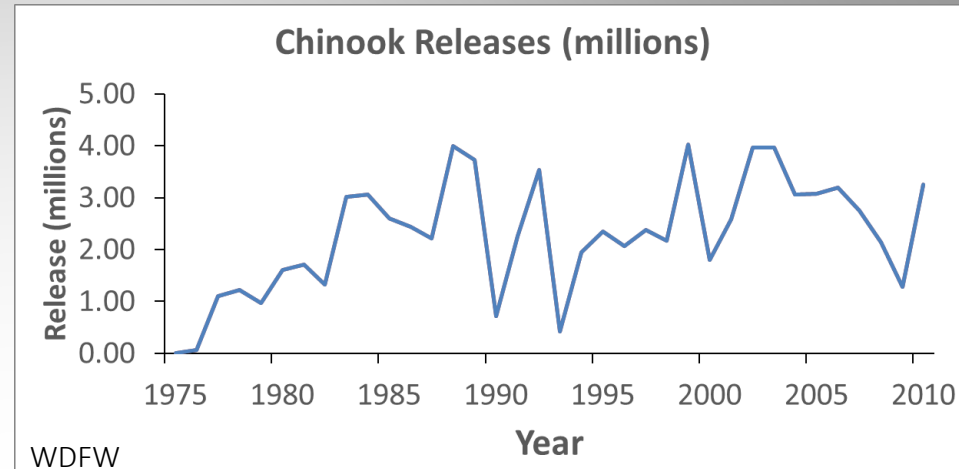
Elwha River screw trap locations



• = screw traps

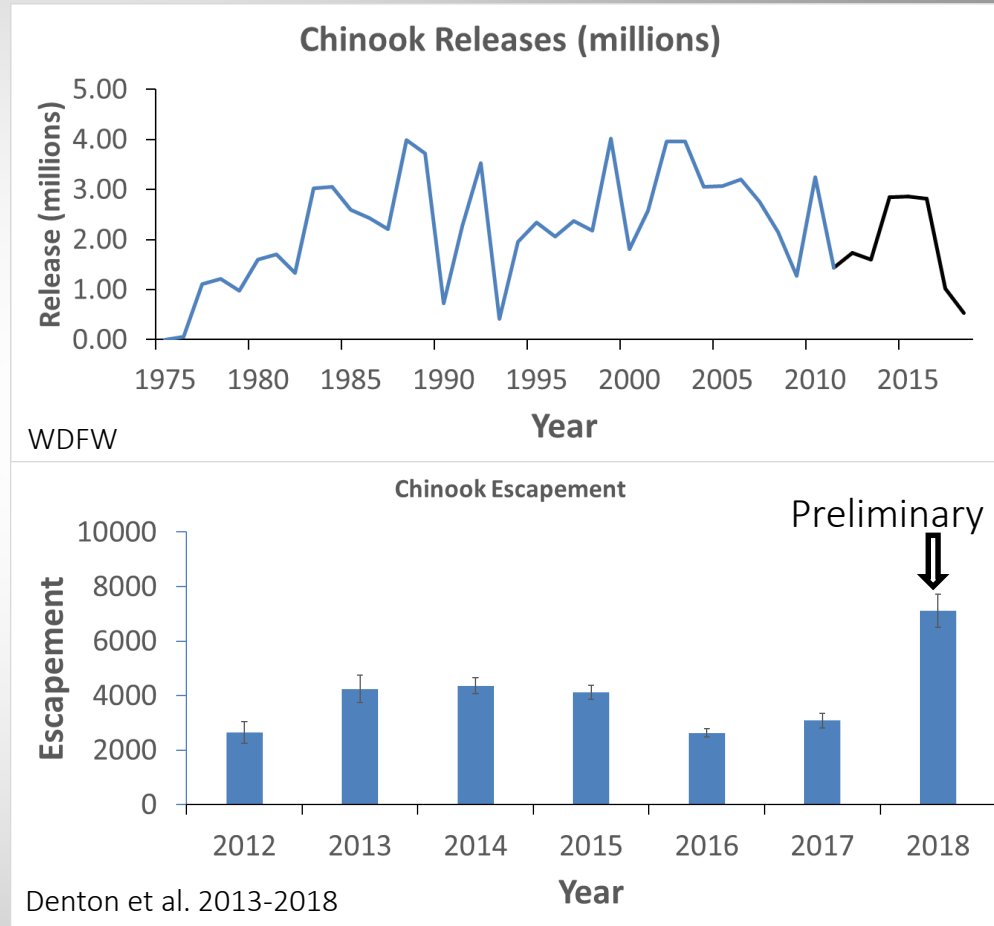
Chinook: Before Dam Removal

- Historic hatchery releases
 - Average release – 2.3 million (0.06-3.96)
- Pre-dam status
 - ~2,000
- Recovery strategy
 - On-station release of 0+ & 1+ leading to adult colonization

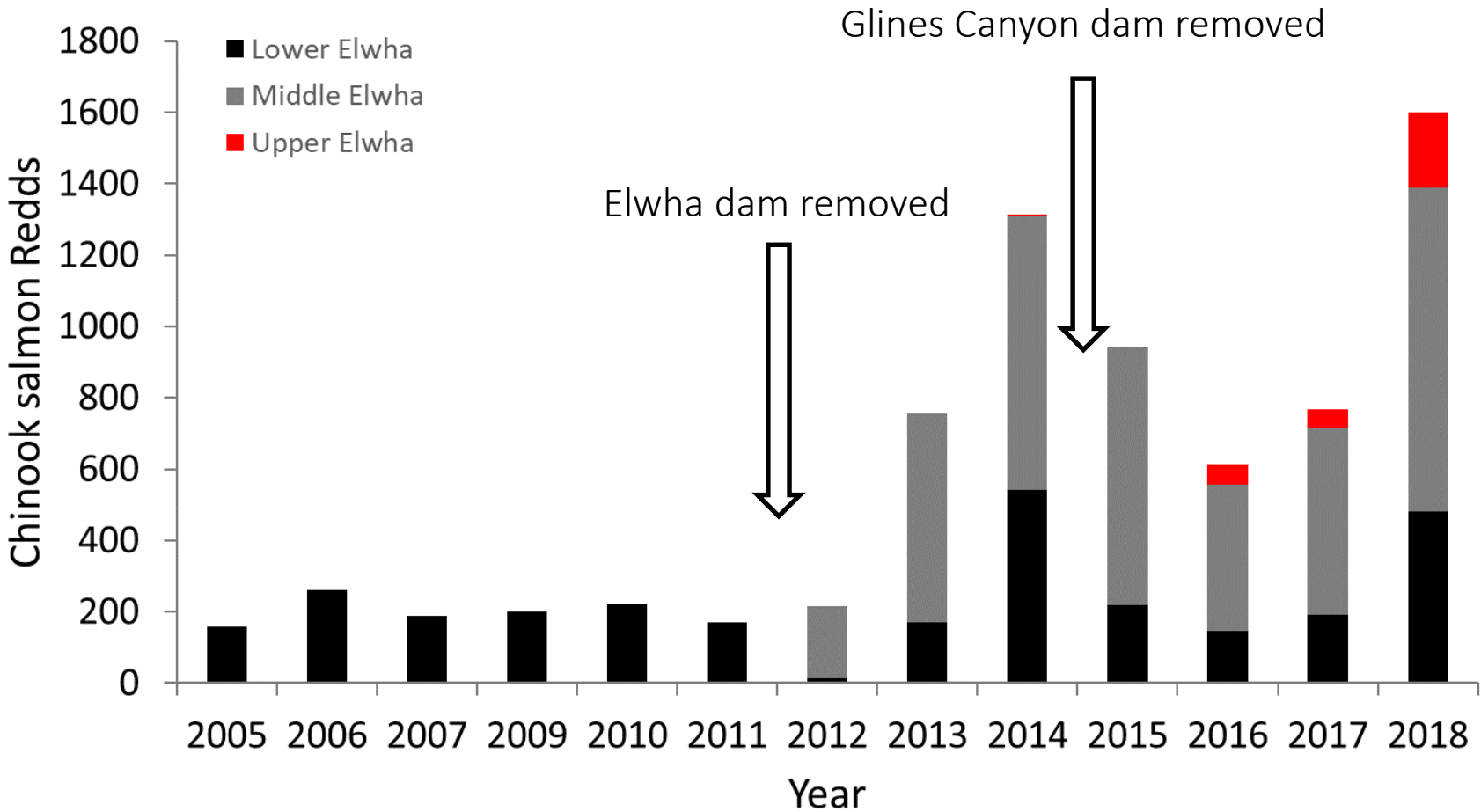


Chinook: After Dam Removal

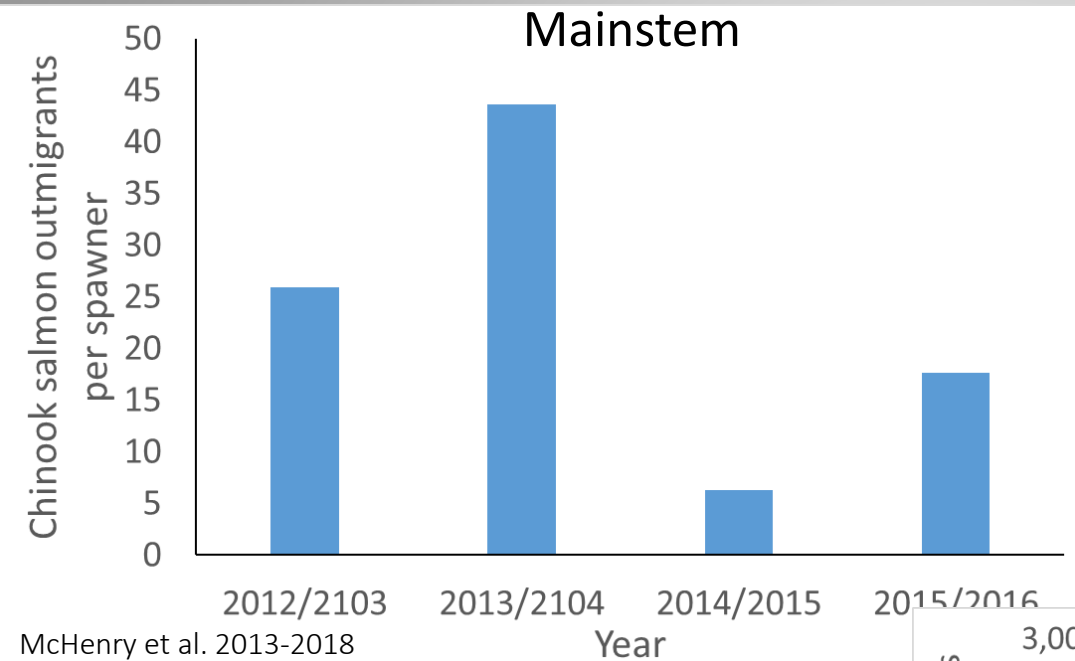
- Hatchery releases
 - Goal – 2.7 million
 - Average 1.86 million (0.53-2.85)
- Adult escapement
 - Average 4,024 (2,628-7,107)



Chinook Distribution



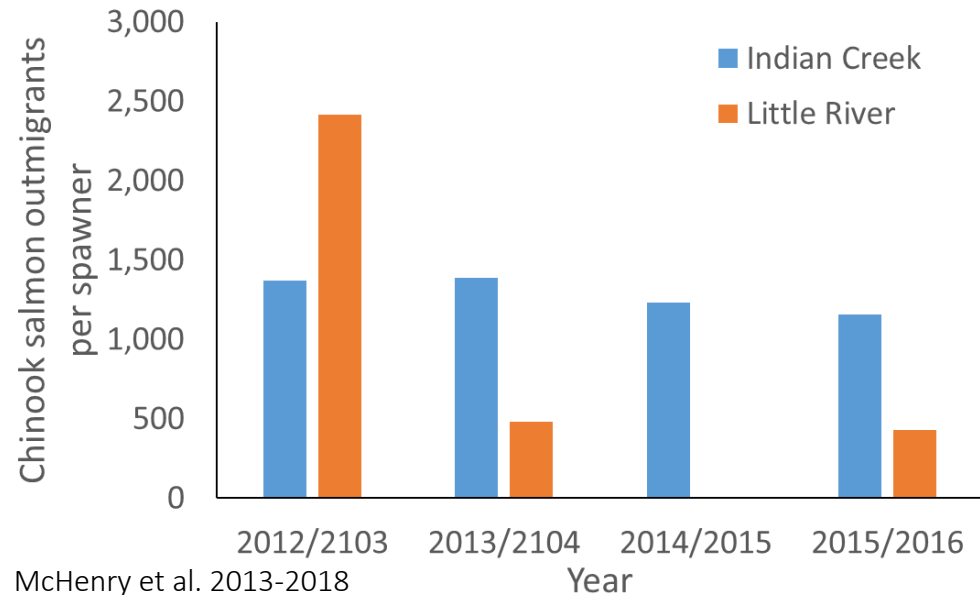
Chinook Productivity: Juveniles



Productivity expected to result in population growth
200 juveniles/spawner

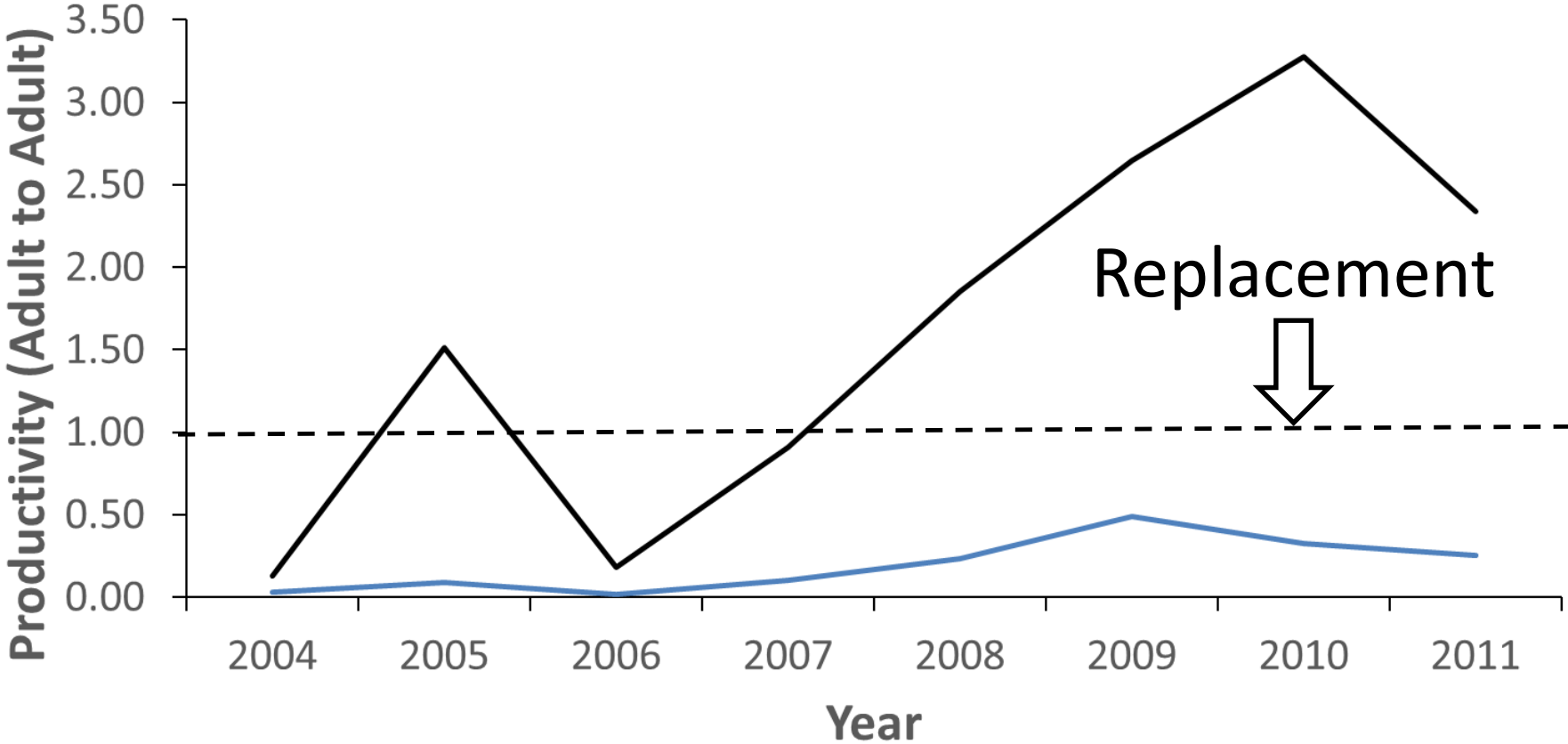
McHenry et al. 2013-2018

Instability of mainstem sediments likely cause



McHenry et al. 2013-2018

Chinook Productivity: Adult to Adult

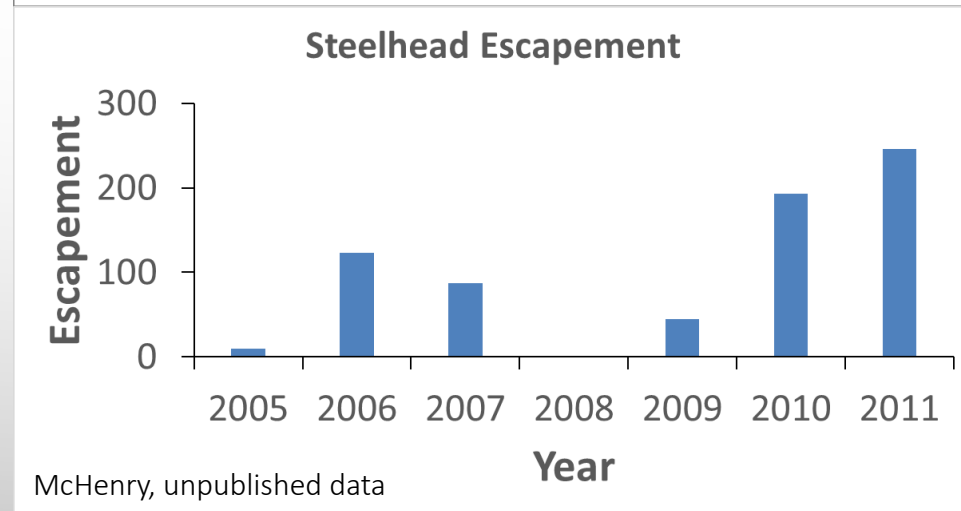
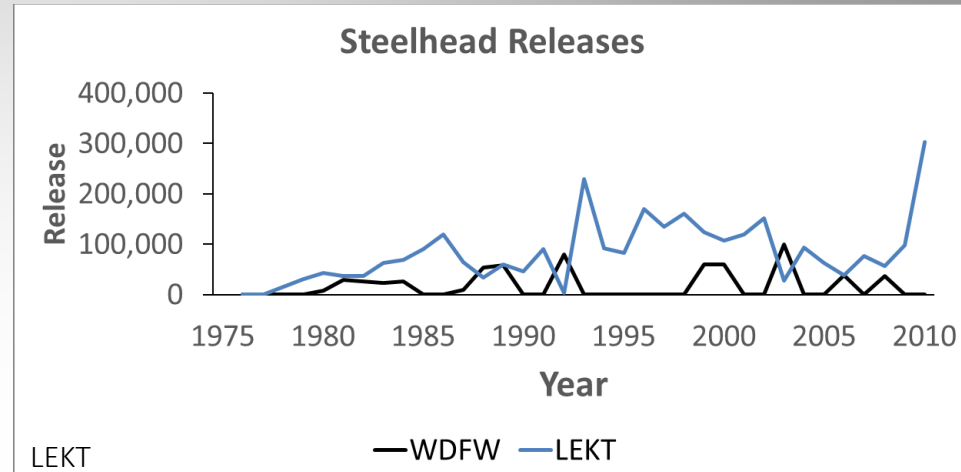


— Natural Spawners — Natural + Hatchery Spawners

Anderson, unpublished data

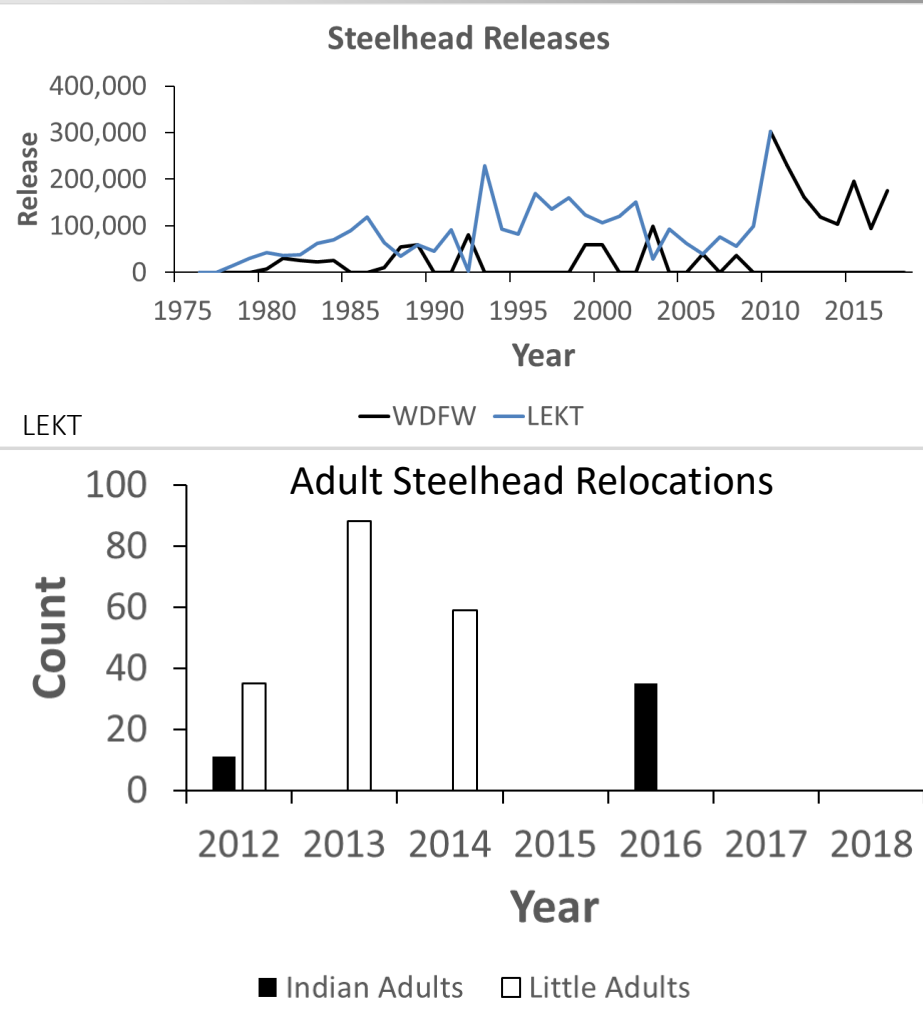
Winter Steelhead: Before Dam Removal

- Historic hatchery releases
 - Average – 101k (0-302k)
- Pre-dam status
 - ~300
- Recovery strategy
 - Captive brood
 - On-station release leading to adult colonization
 - Returns from outplanted adults

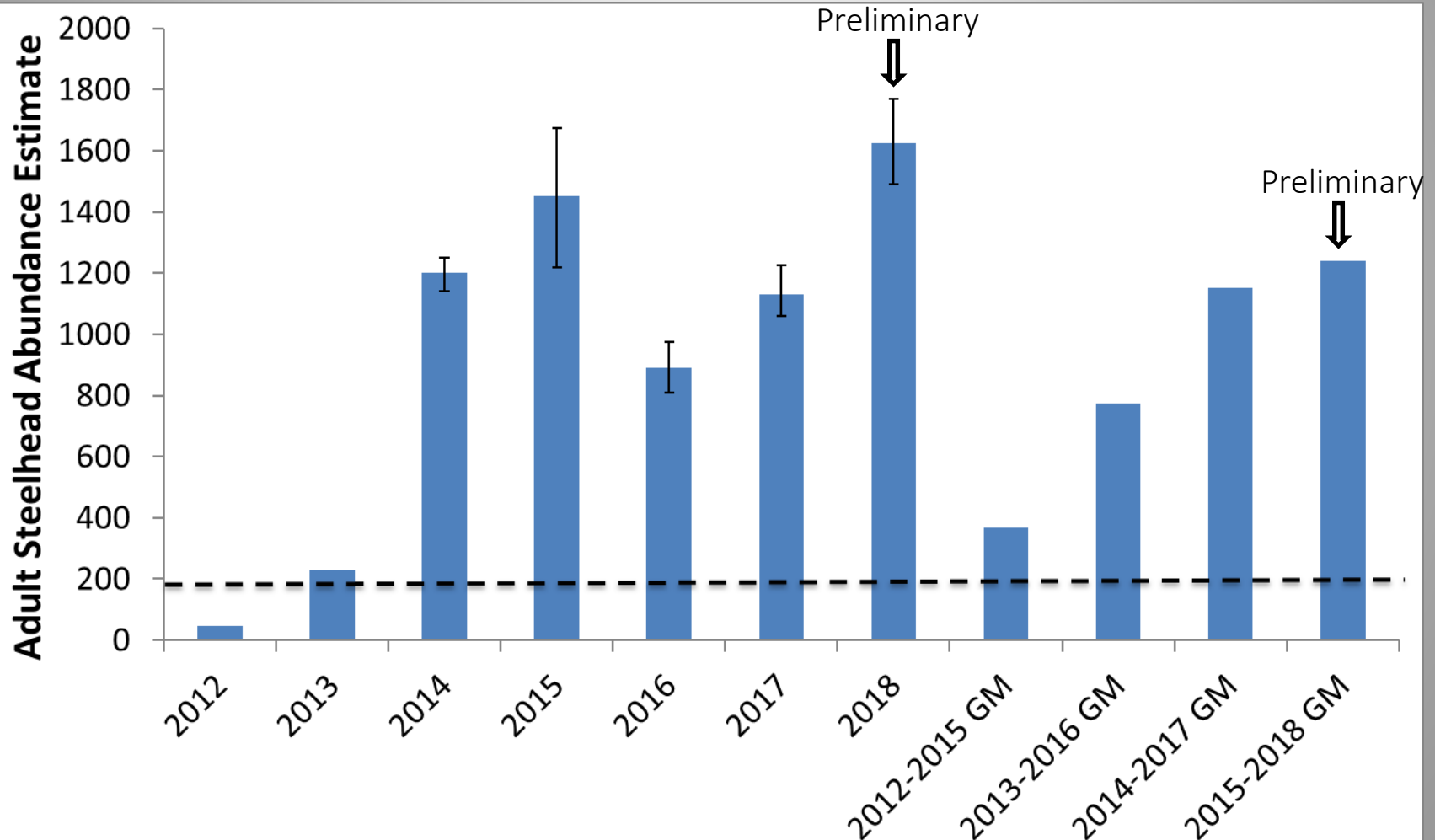


Winter Steelhead: After Dam Removal

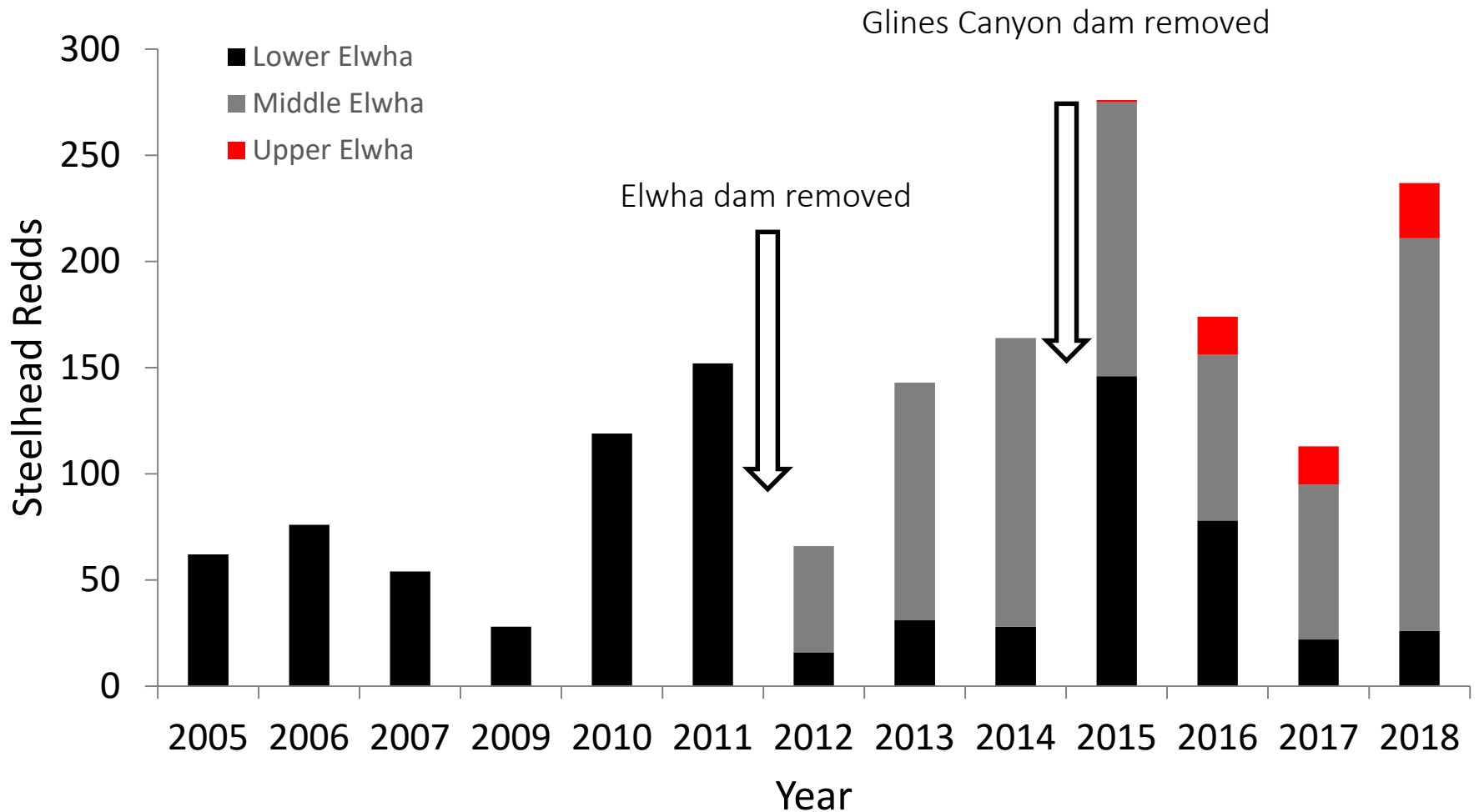
- Hatchery Releases
 - Goal – 175k (2+ smolts)
 - Average – 154k (94k-194k)
 - Adult relocations
 - Indian Cr
 - 2 of 7 years
 - Little River
 - 3 of 7 (first 3)



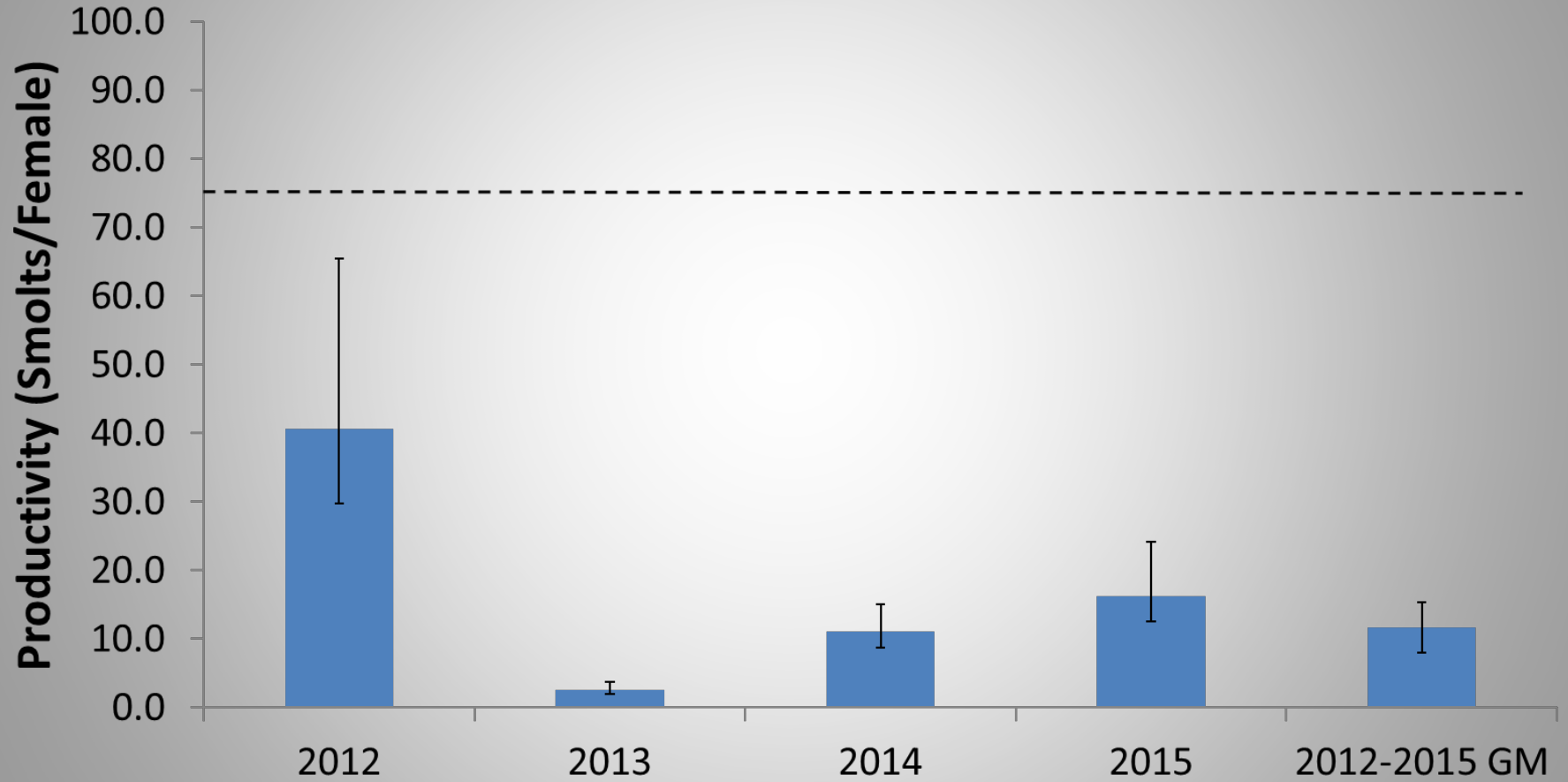
Winter Steelhead Abundance: After Dam Removal



Winter Steelhead Distribution

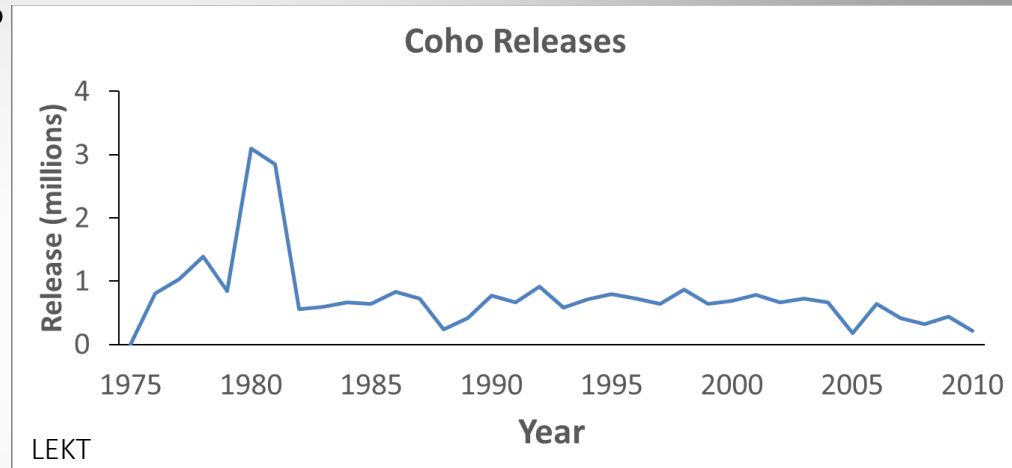


Winter Steelhead Productivity: Juveniles



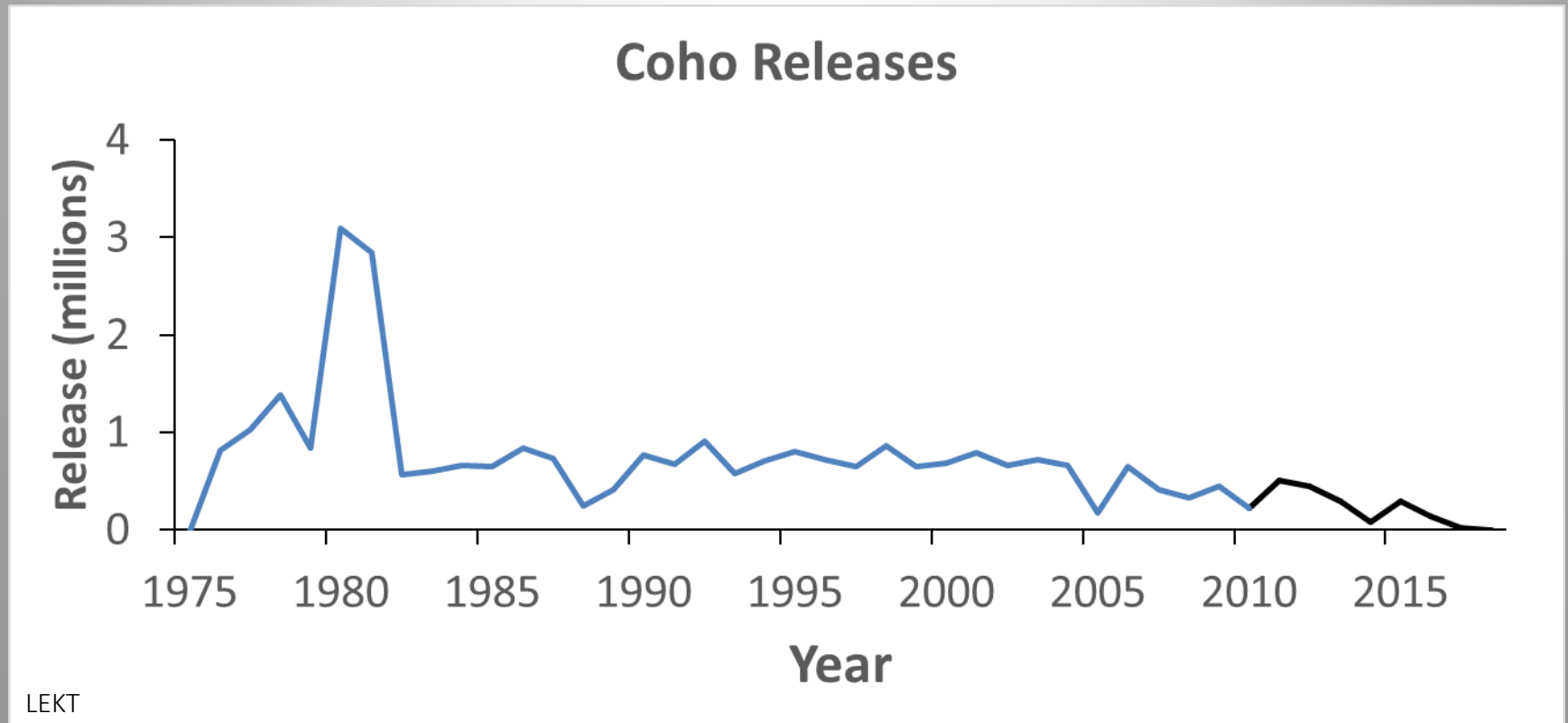
Coho: Before Dam Removal

- Historic hatchery releases
 - ~771k (0 – 3.1 million)
- Pre-dam status
 - ~2,000
- Recovery strategy
 - On-station release leading to adult colonization
 - Adult relocations



Coho: After Dam Removal

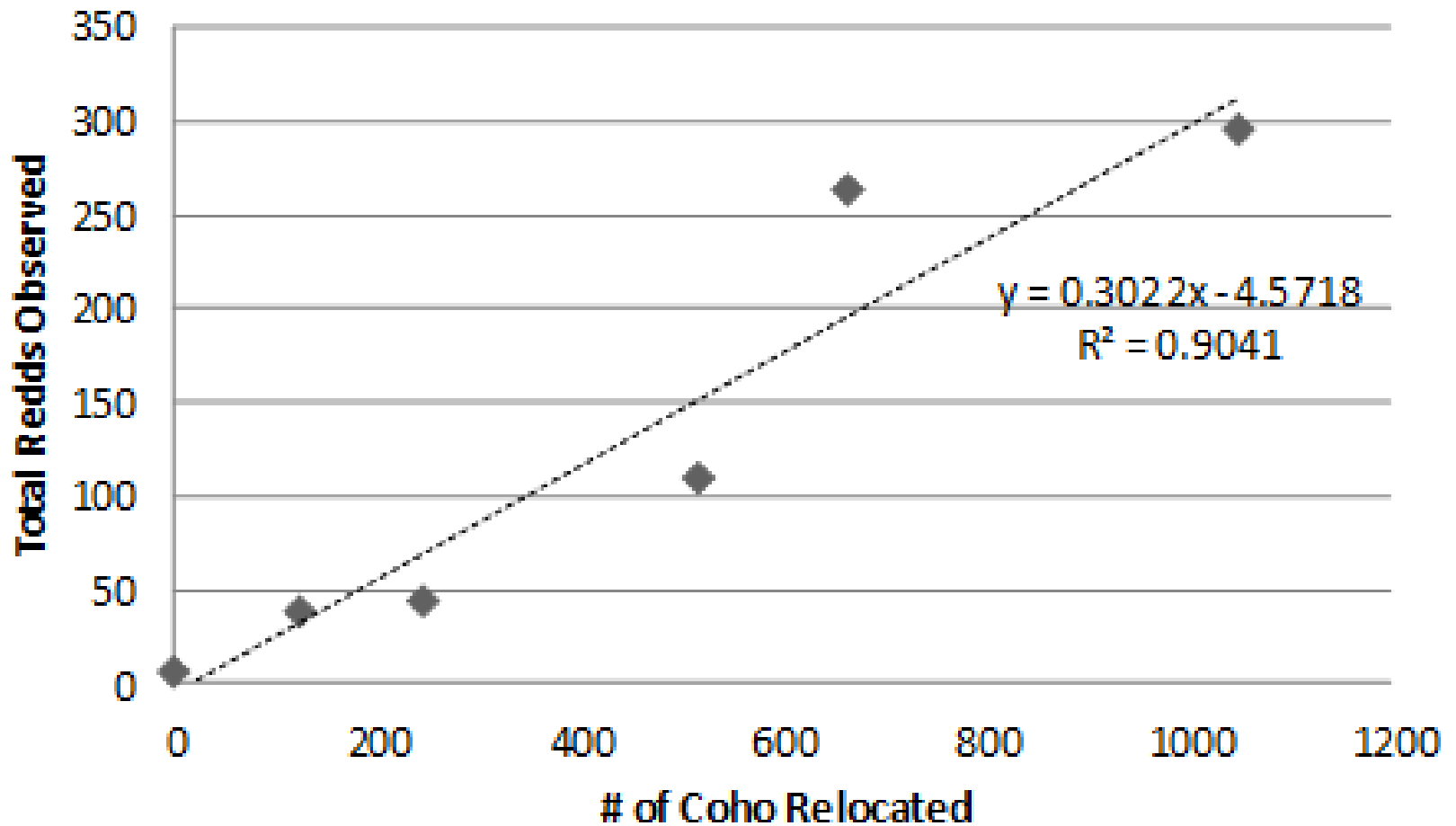
- Hatchery Releases
 - Juveniles – Ave ~253k
 - Adults relocations – Ave 412 (0 – 1,038)



Coho: Adult Relocation Locations 2011-2016



Redds Observed vs Coho Relocations

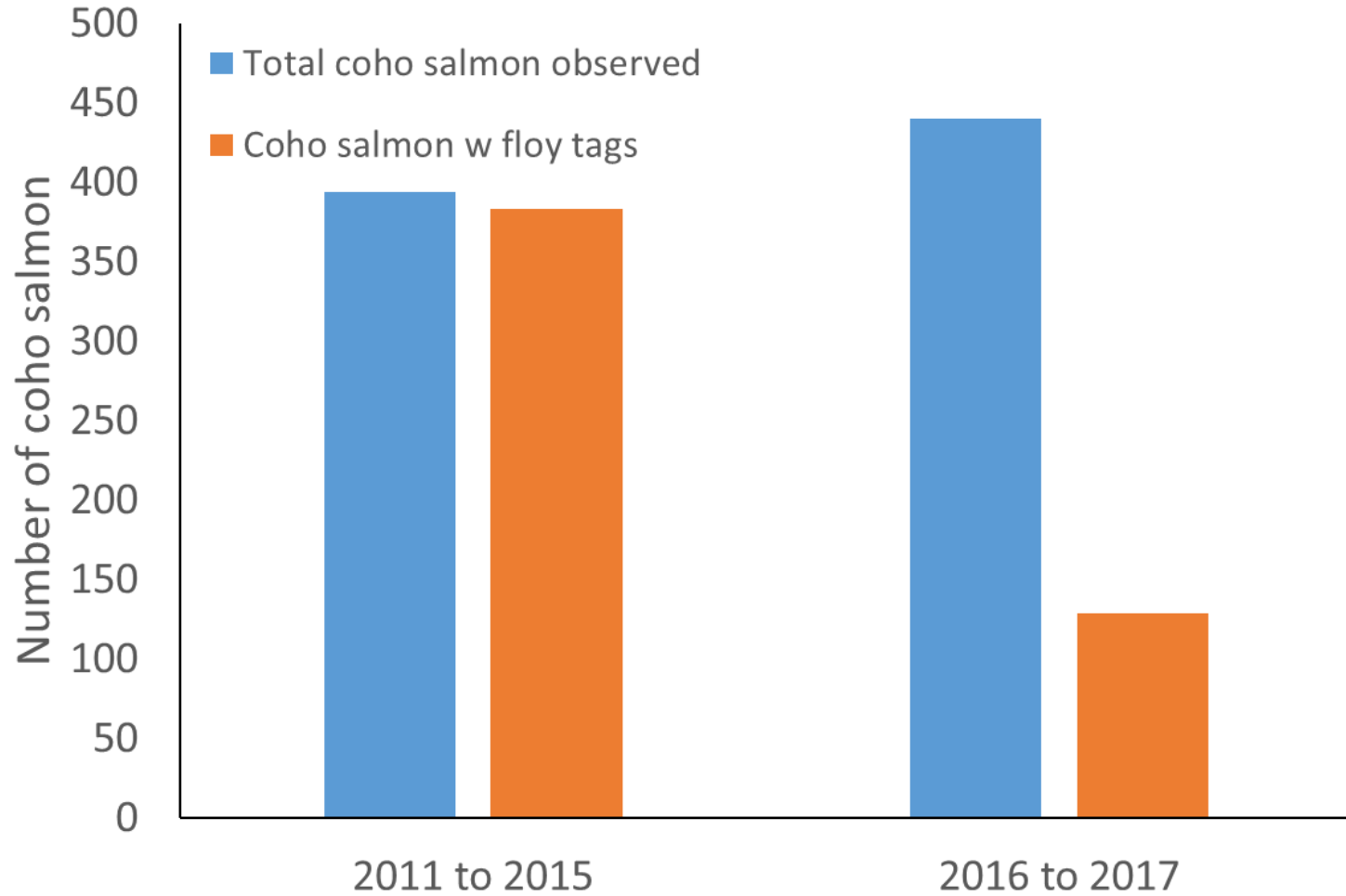


McHenry et al. In press

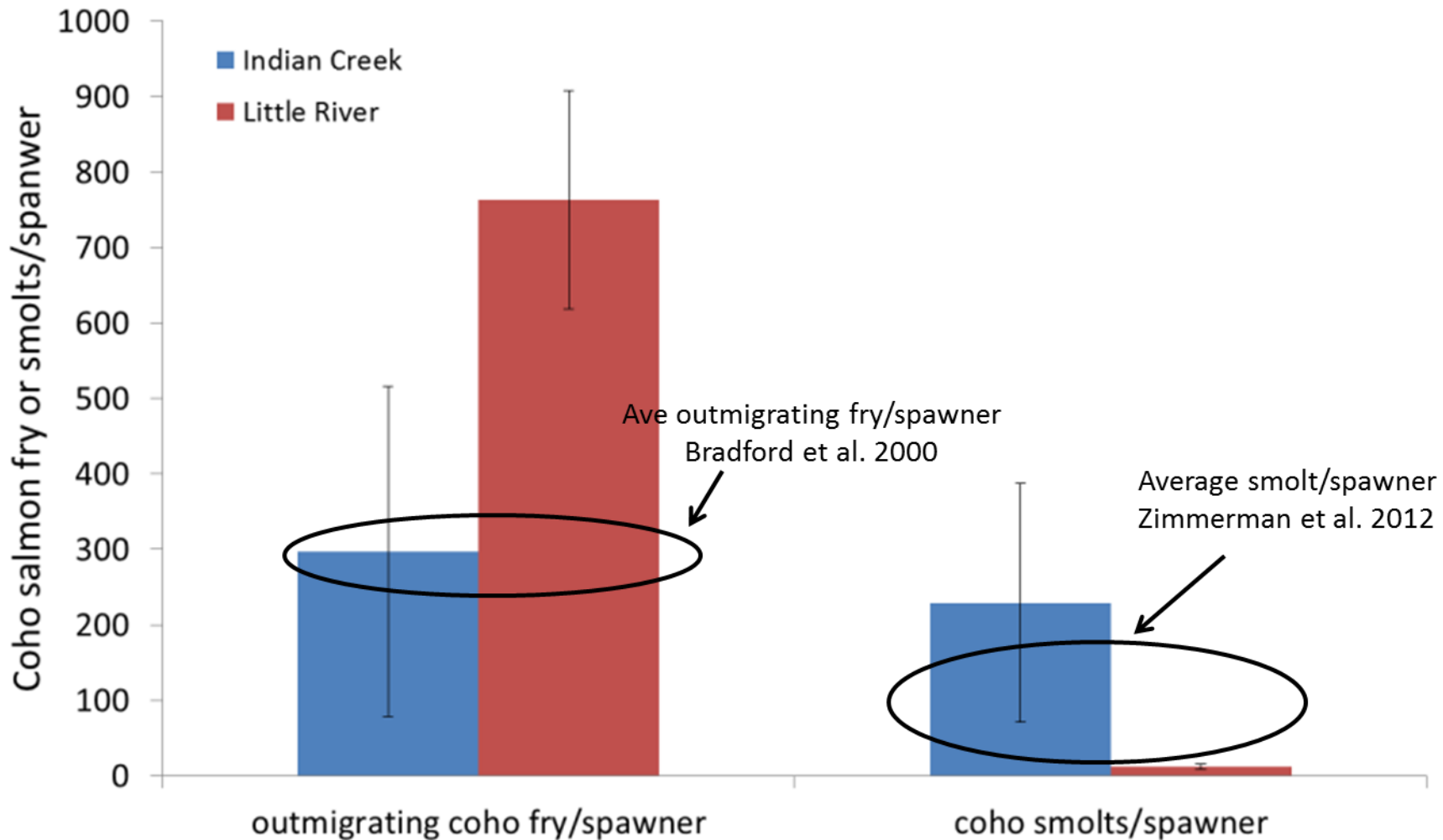


Washington
Department of
**FISH and
WILDLIFE**

Coho Abundance: Origin



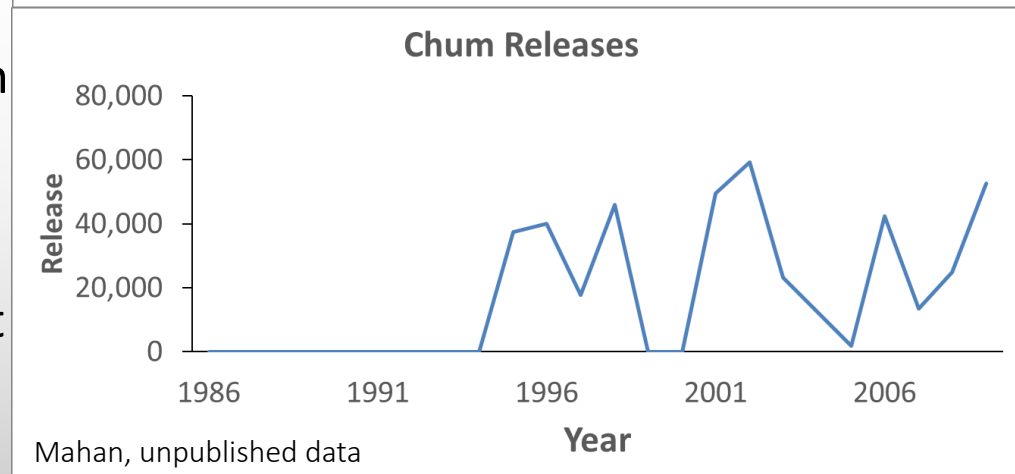
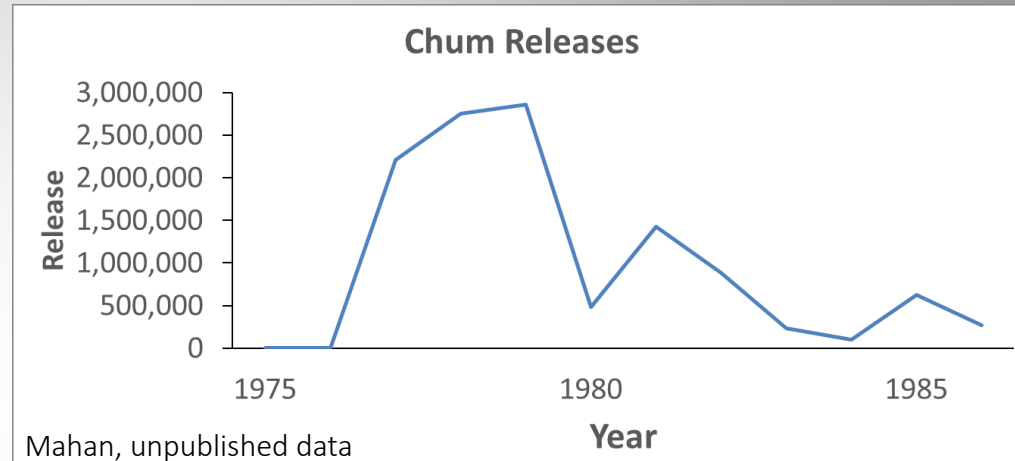
Juvenile Coho Salmon Productivity: Little River and Indian Creek



Pess, unpublished data

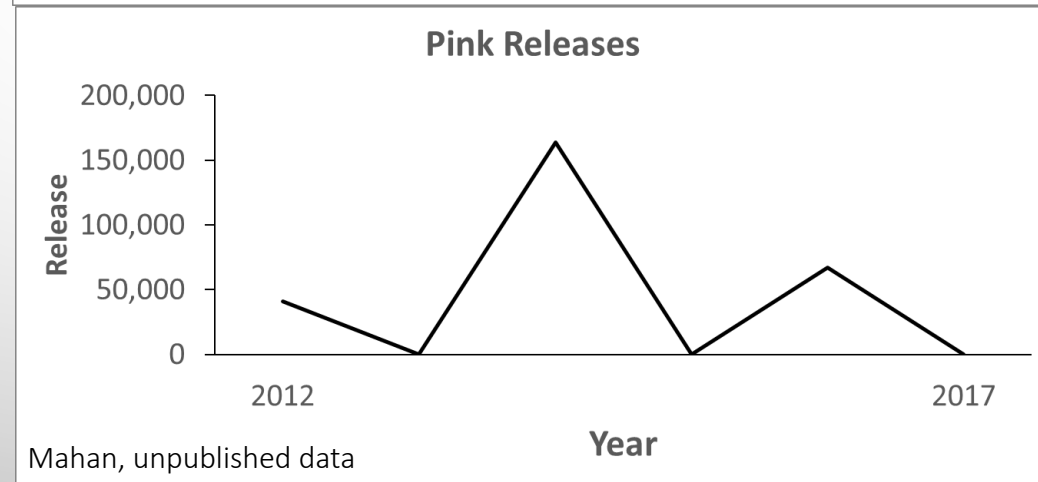
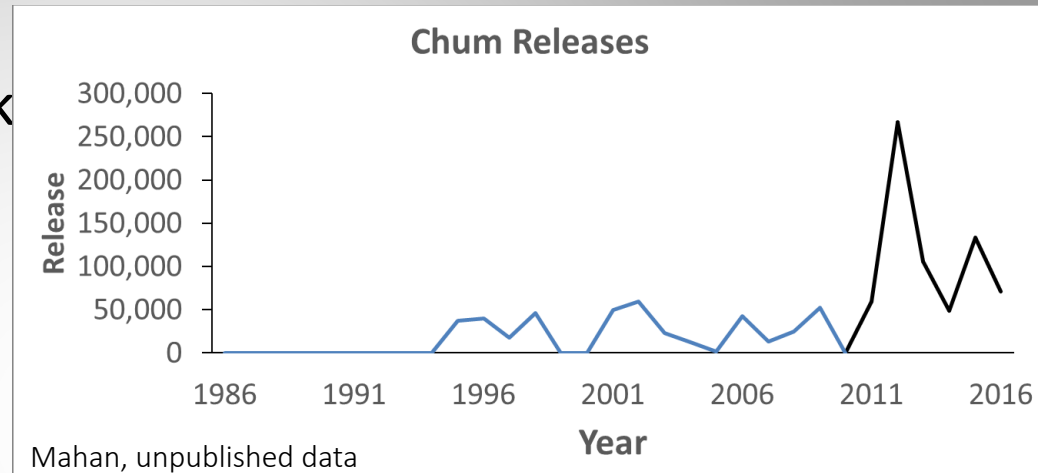
Chum & Pink Salmon: Before Dam Removal

- Historic hatchery releases
 - Chum – average 340k
 - Pink - none
- Pre-dam status
 - Both ~ 100
- Recovery strategy
 - Chum - On-station release with adult colonization
 - Pink – captive brood, On-station release leading to adult colonization

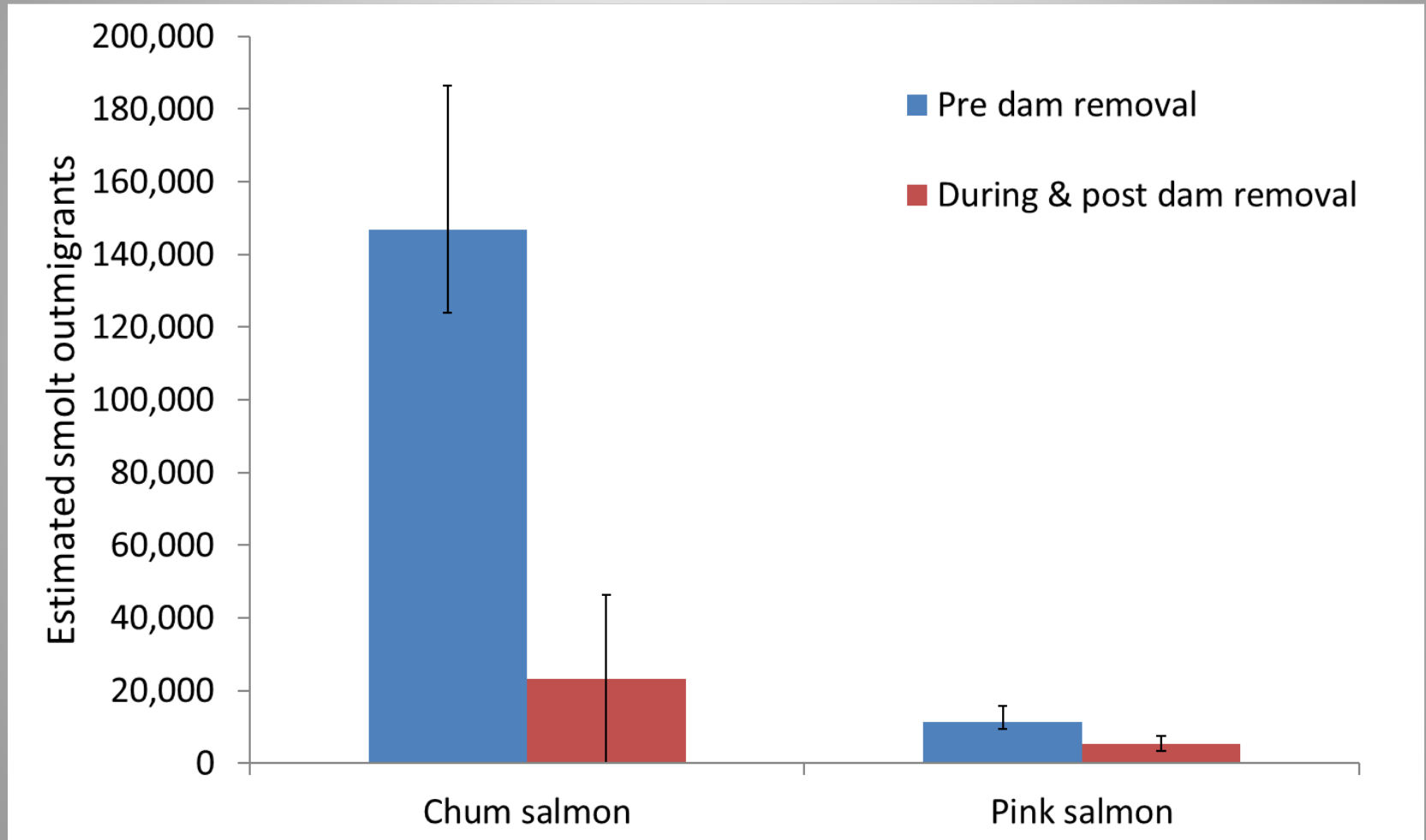


Chum & Pink Salmon: After Dam Removal

- Hatchery Releases
 - Chum smolts – Ave. – 98k
 - Chum adults
 - 11 adults relocated 2016
 - Pink – Ave. – 90k
- Abundance
 - No data
- Distribution
 - Limited data, observed upstream of Elwha in 2015 but not 2016-2018



Chum & Pink Salmon Productivity: After Dam Removal



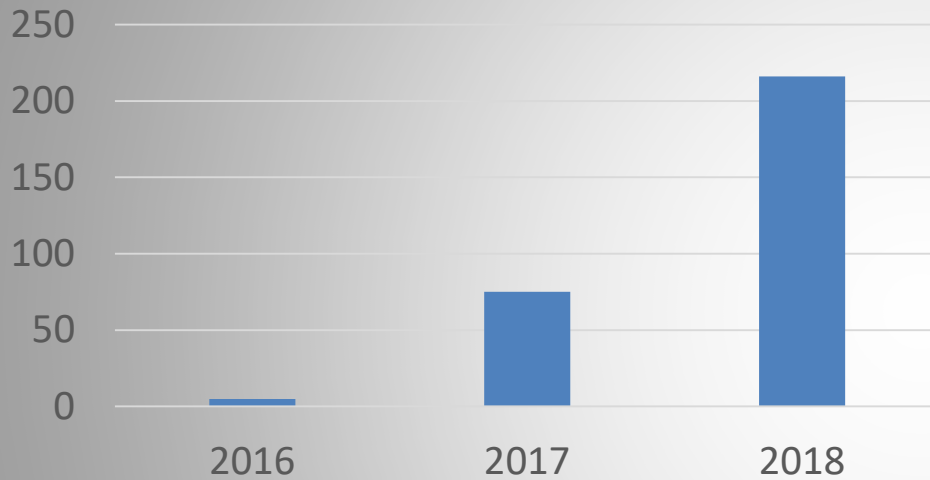
Summer Steelhead

- Historic hatchery releases
 - Average 19k, 1968-2000
(Duda et al. 2018)
 - Mix of stocks
- Pre-dam status
 - ~50
- Management strategy
 - Natural recolonization
 - Spontaneous anadromy from resident *O. mykiss*



Summer Steelhead

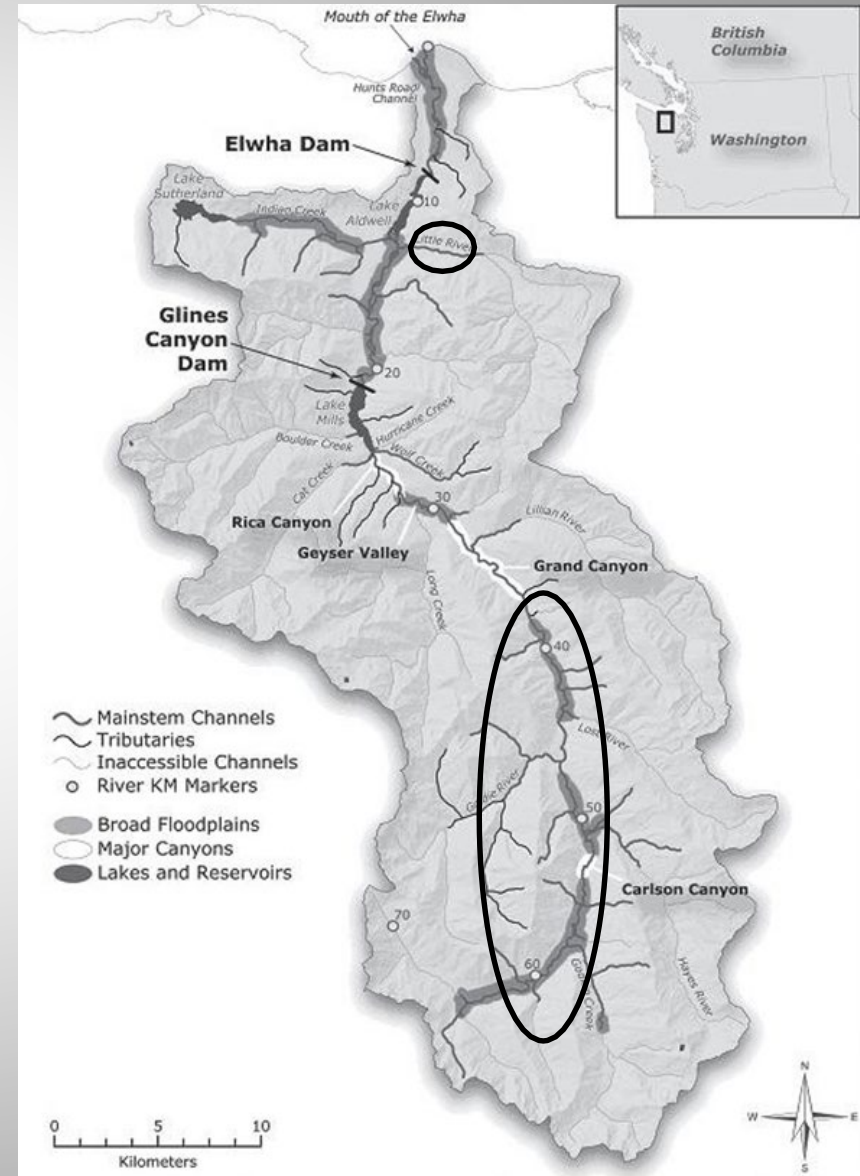
Number of summer steelhead observed



Brenkman, unpublished data

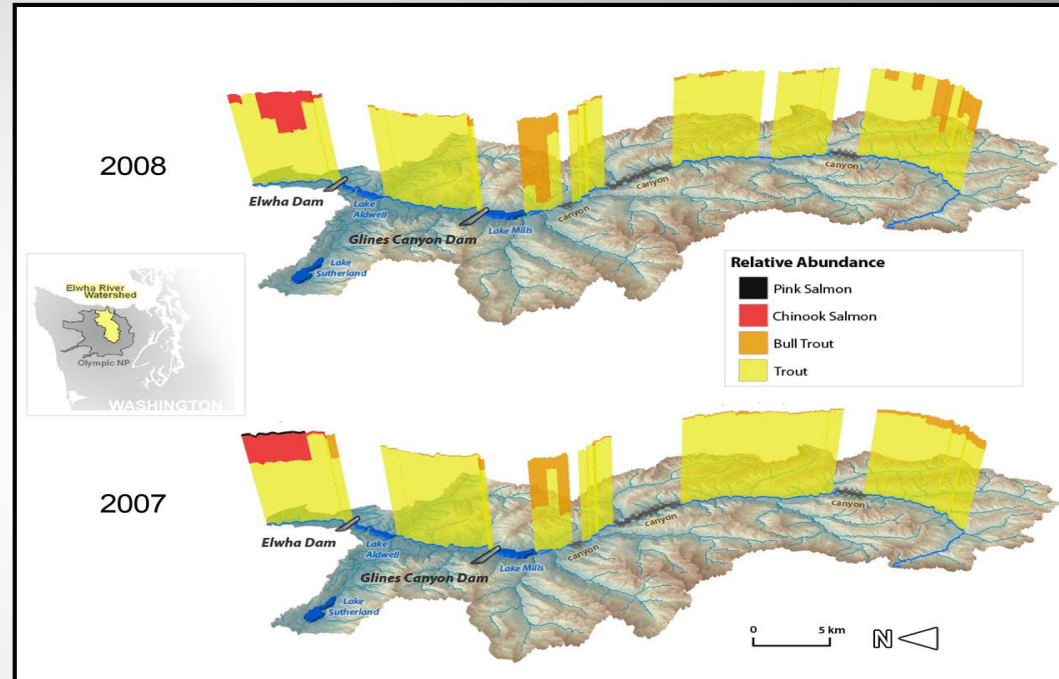


J. McMillan



Bull Trout

- Historic hatchery releases
 - None
- Pre-dam status
 - ~200
- Recovery strategy
 - Natural recolonization
 - Spontaneous anadromy from resident fish

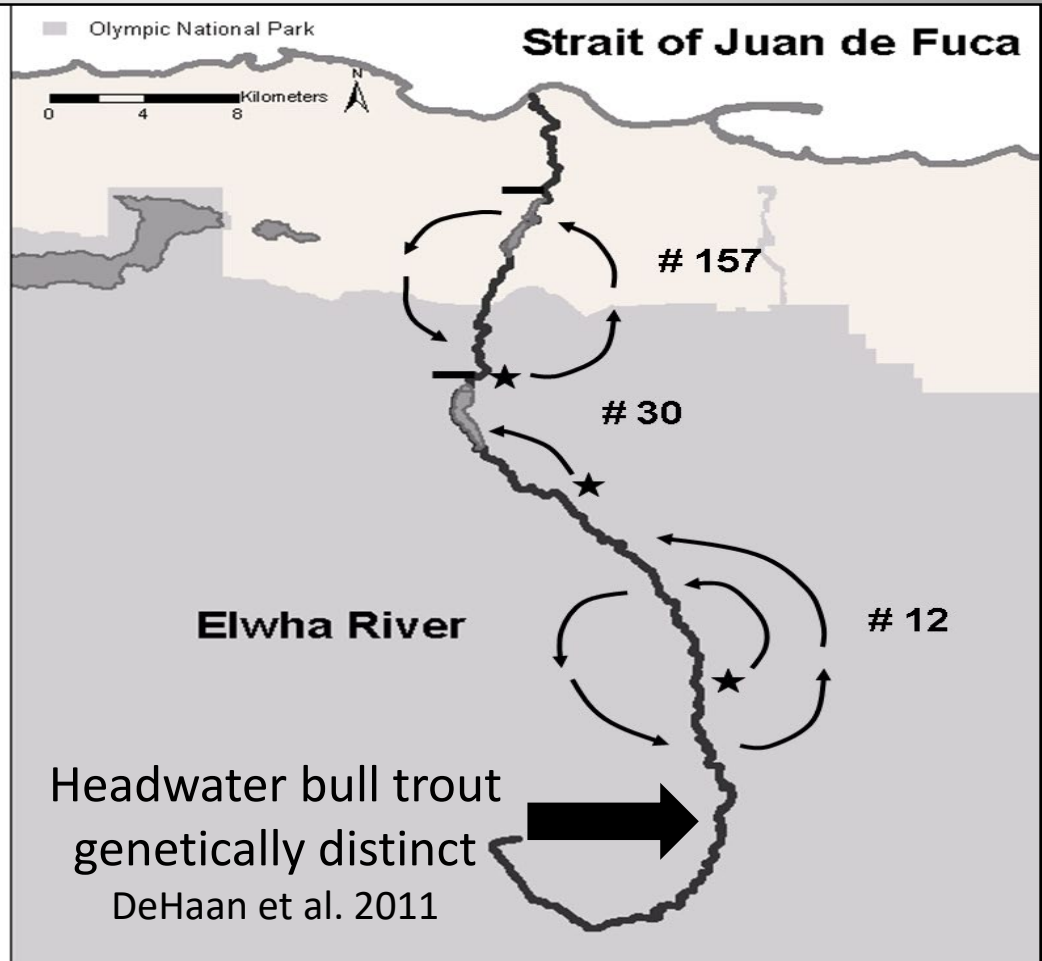


Brenkman et al. 2012

Radio-tagged bull trout migration: Pre-Removal

No upstream migrations through canyons!

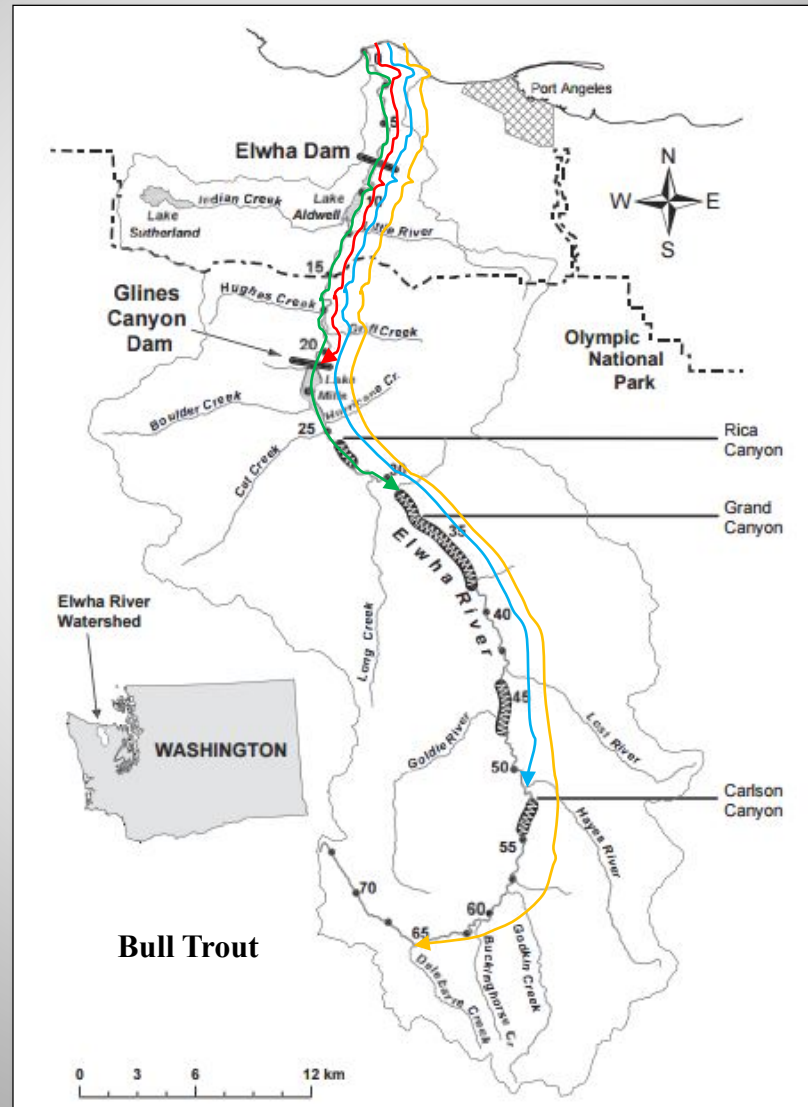
Movements of Radio Tagged Bull Trout Between August 2005 and April 2006



Benefits of Reconnecting Habitat

Upstream and Downstream

Radio-tagged
bull trout
migration:
Post-Removal



2014 →

2015 →

2016 →

2017 →

Fitness Benefits of Habitat Reconnection

Pre-removal



Post-removal



Hoh River



Summary

- On-station release - adult colonization
 - Chinook
 - Positives – adult abundance, distribution
 - Negative – low productivity, but improving
 - Chum and Pink
 - Low adult abundance, poor distribution, poor productivity



Summary

- On-station release - adult colonization AND adult relocation
 - Winter steelhead
 - Positives - Adult abundance, distribution
 - Negative – low productivity, but improving
 - Coho
 - Positive - adult abundance, distribution, and productivity



Photo by John McMillan

Summary

- No hatchery intervention – source population upstream
 - Summer steelhead
 - Positive - adult abundance and distribution
 - Unknown – productivity and source
 - Bull trout
 - Positive – distribution, migration and life history patterns, fitness, reconnected isolated segment
 - Neutral – adult abundance similar to pre-dam removal



Thank you



Questions?



Photo courtesy S. Brenkman, ONP