

# Predation on Smolts in the Lower Yakima Basin and comparisons with Upper Columbia and Snake Rivers

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# Background



- Predation by piscivorous birds and fish is one of the main contributing factors to declines in anadromous fish abundance
- Avian Predation
  - Every year ~35% of the juvenile Upper Columbia River spring Chinook salmon are consumed (NPCC)
  - Fall Chinook mortality over the 2008-2019 outmigrations period to Bonneville Dam ranged from 7.3% to 29.1% (Payton et al, 2023)
  - Returning adult steelhead would increase 2-3 fold if only Caspian tern impacts were eliminated (Evans et. al. 2019)



# Background

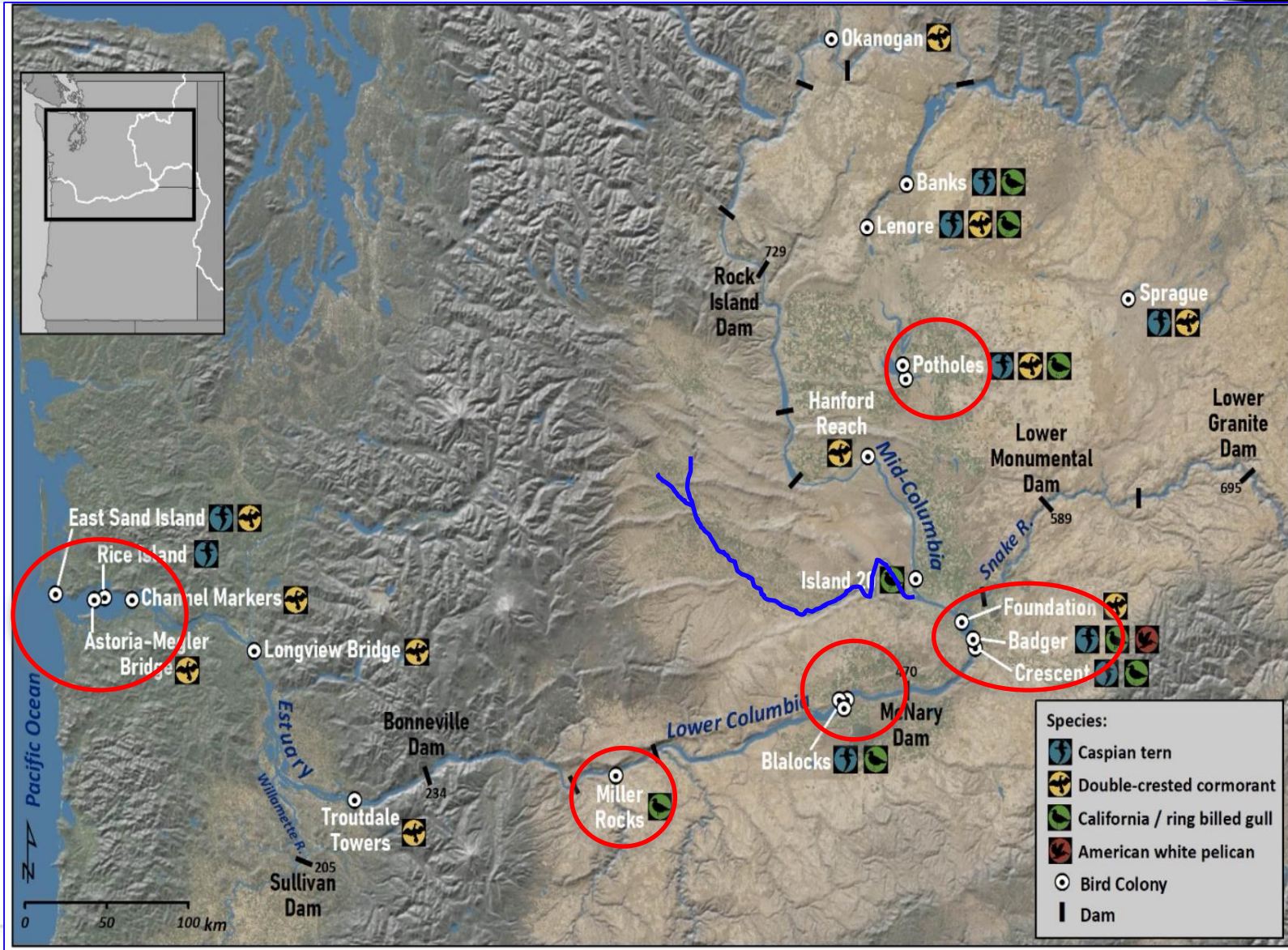


- Predation on juvenile salmon and steelhead by non-native fish has increased.
  - Smallmouth bass consumed 0.38 smolts/bass/day (Anglea, 1997) ; lost ~3.8% of the naturally produced Chinook cohort just in the Lower Granite Reservoir (Sontag 2013)
  - Walleye were responsible for 1/3 of the annual predation loss in the Columbia River (McMahon and Bennett 1996)
  - Channel catfish (>400mm) consumed 0.5 salmonid prey/predator/day (Vigg et al. 1991)





# Background: Avian breeding colonies



Hostetter et al. (2015)

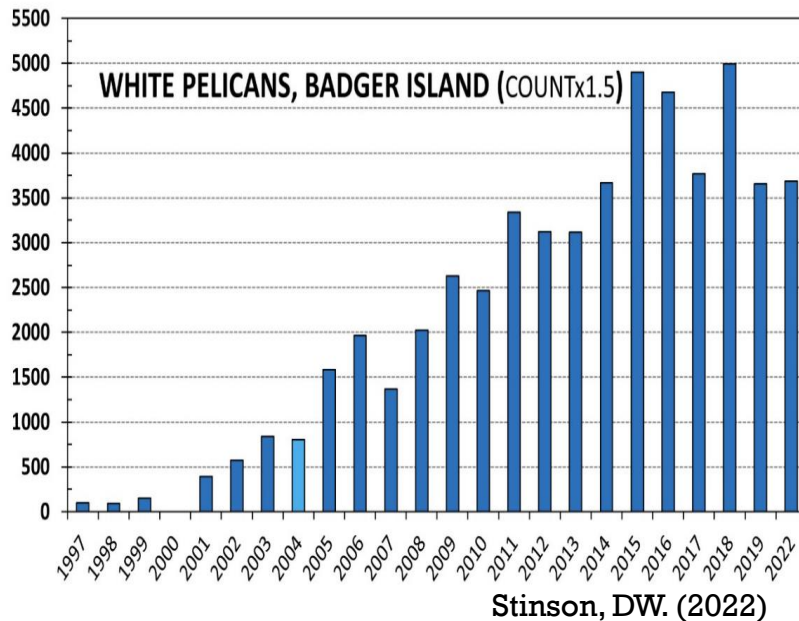
HONOR. PROTECT. RESTORE.

# Background: Pelican populations

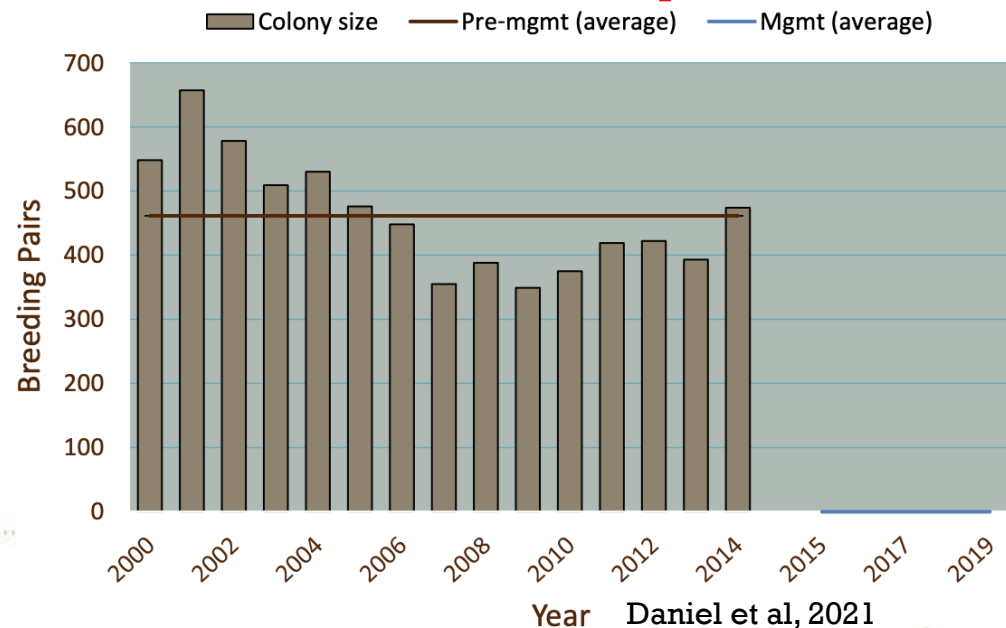


- White pelicans are opportunist and generalist foragers
- Pelicans tend to forage in shallow areas where prey are most abundant.
- 1.2-1.8 kg of prey per day by an adult pelican (Anderson 1987)
- A colony the size of ~3,700 adults would equate to 4,440-6,660 kg of prey consumed per day

## Badger Island: Nesting colony of American white pelicans



## Crescent Island: Caspian terns



# Objectives



- ❖ Objectives of the study are to determine:
  - Smallmouth Bass predation vulnerability area (heat map) for the Yakima Basin
  - Comparative evaluation of predation rate on Yakima, Snake and Upper Columbia juvenile Chinook and Coho based on bird colony tag recoveries
  - Effects of water temperature and river flows on avian predation
- ❖ Ongoing avian predation management
- ❖ Future Plans

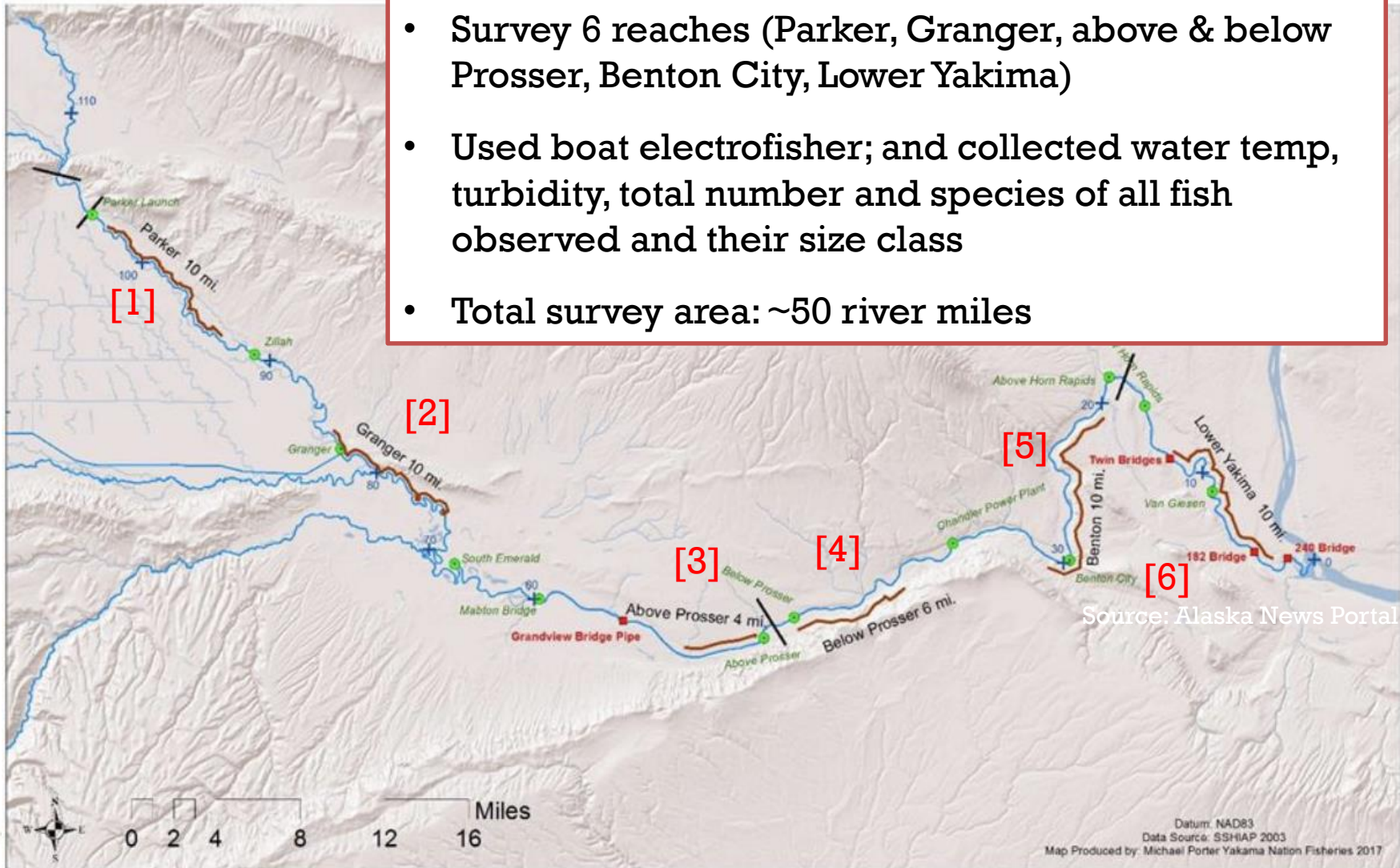


# Methodology



- Fish predation: fish sampling 2018-2021

- Survey 6 reaches (Parker, Granger, above & below Prosser, Benton City, Lower Yakima)
- Used boat electrofisher; and collected water temp, turbidity, total number and species of all fish observed and their size class
- Total survey area: ~50 river miles



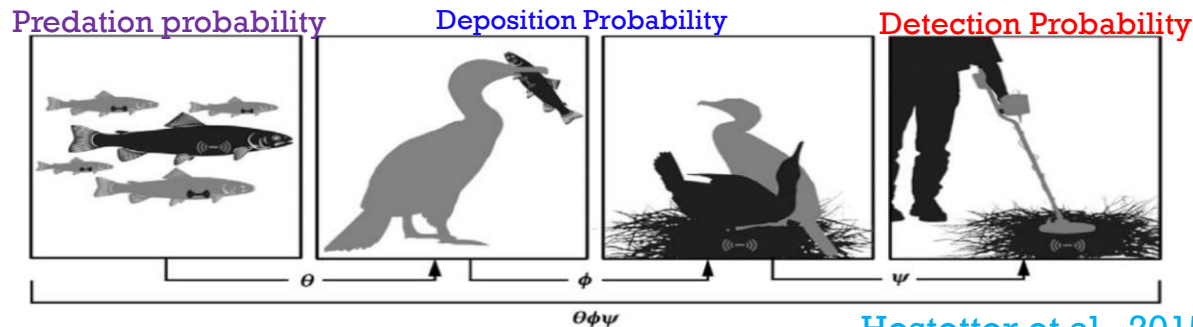
## Avian predation

- Compiled all PIT tag releases and recoveries from nesting colonies on Islands from 2008 to 2022 for hatchery chinook (spring/summer/fall) and coho
  - Total Predation rate

$$Pred_{Tot} = \frac{Pred_{PIT}}{(\phi\psi)}$$

Minimum Predation rate

Adjusting by the probability that a consumed PIT tag was subsequently deposited on that colony (i.e., deposition probability,  $\phi$ ) and later detected by researchers following the nesting season (detection Prob,  $\psi$ )



Hostetter et al., 2015

**RTR**  
REAL TIME RESEARCH

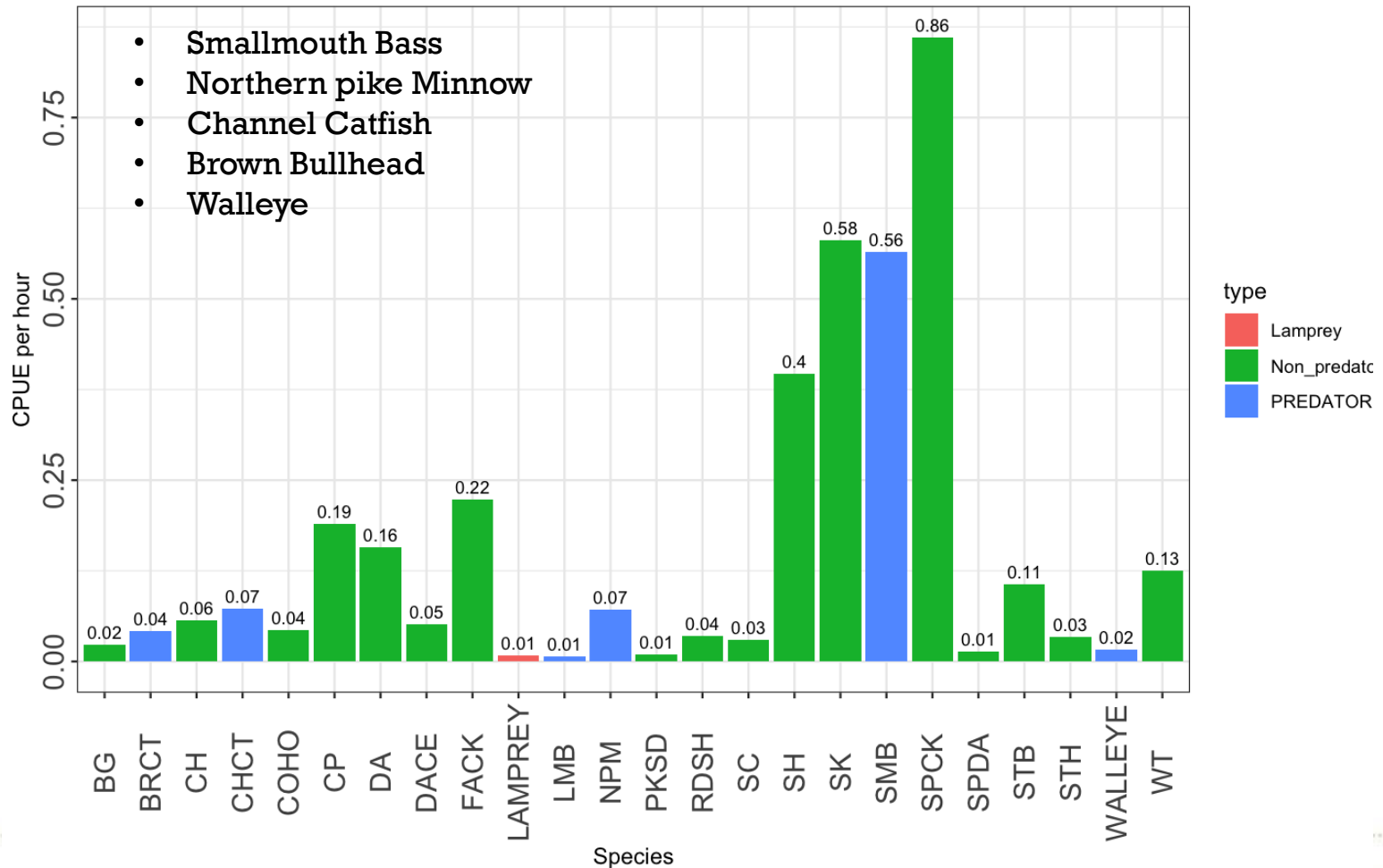
HONOR. PROTECT. RESTORE.



# Results: Predatory fish density by species



- The Lower Yakima River contains large numbers of piscivorous fish

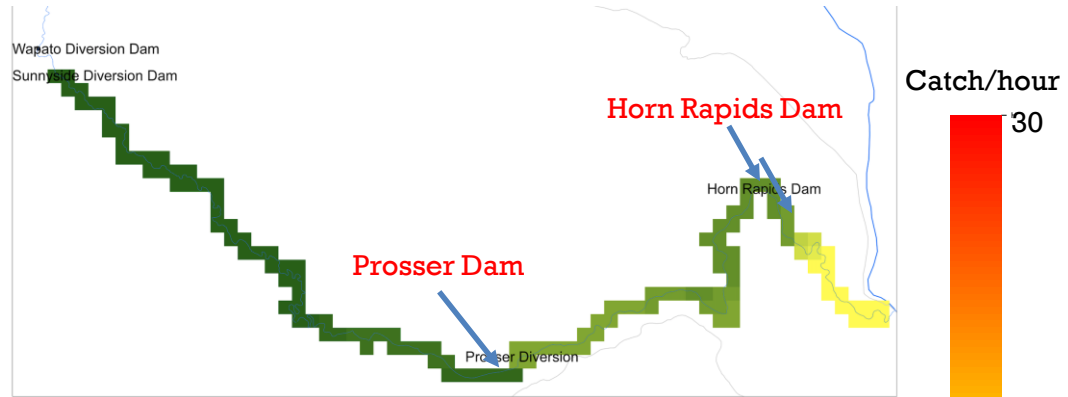


# Results: Fish predation heat map

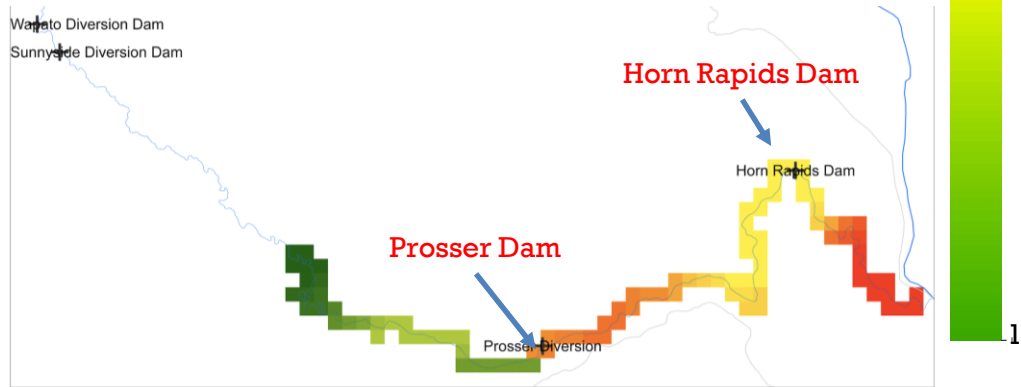


## Smallmouth Bass

May

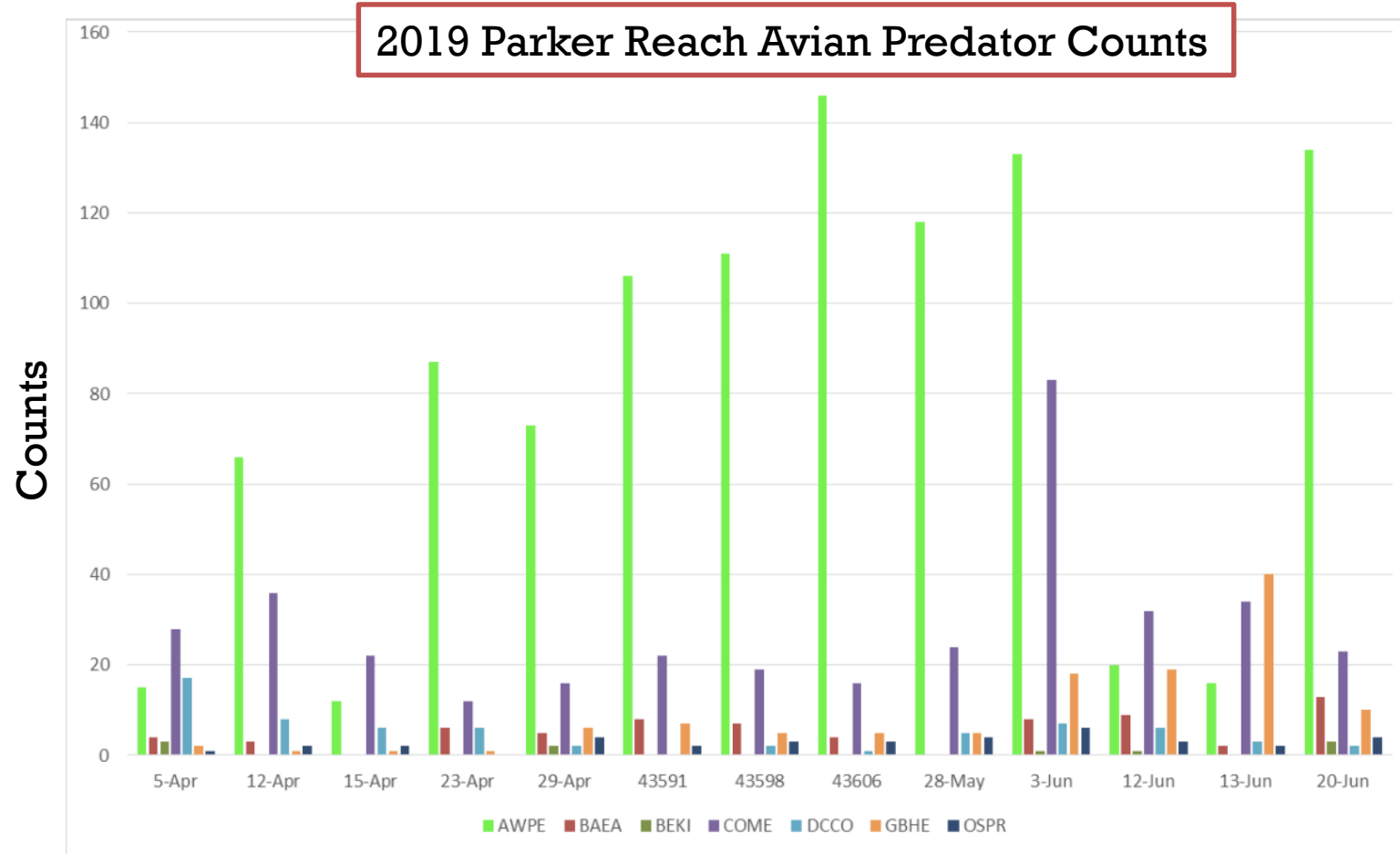


June





# Results: Yakima River bird counts

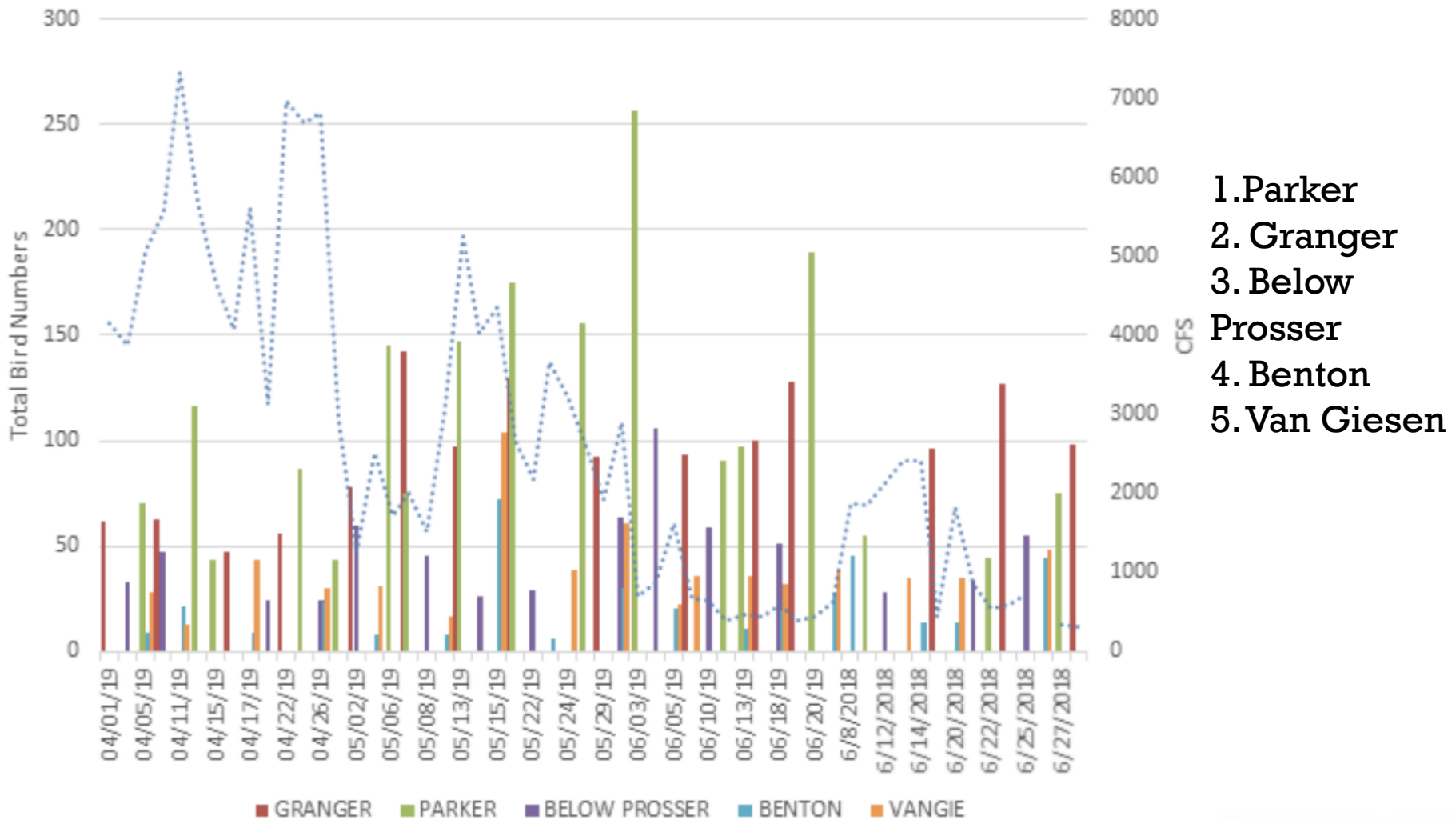


American White Pelicans (AWPE), Osprey (OSPR), Great Blue Heron (GBHE), Common Merganser (COME), and Belted Kingfisher (BEKI), and Double Crested Cormorants (DCCO) were observed within all six reaches

# Results: Yakima River bird counts by reach



Avian Predator total by Reach

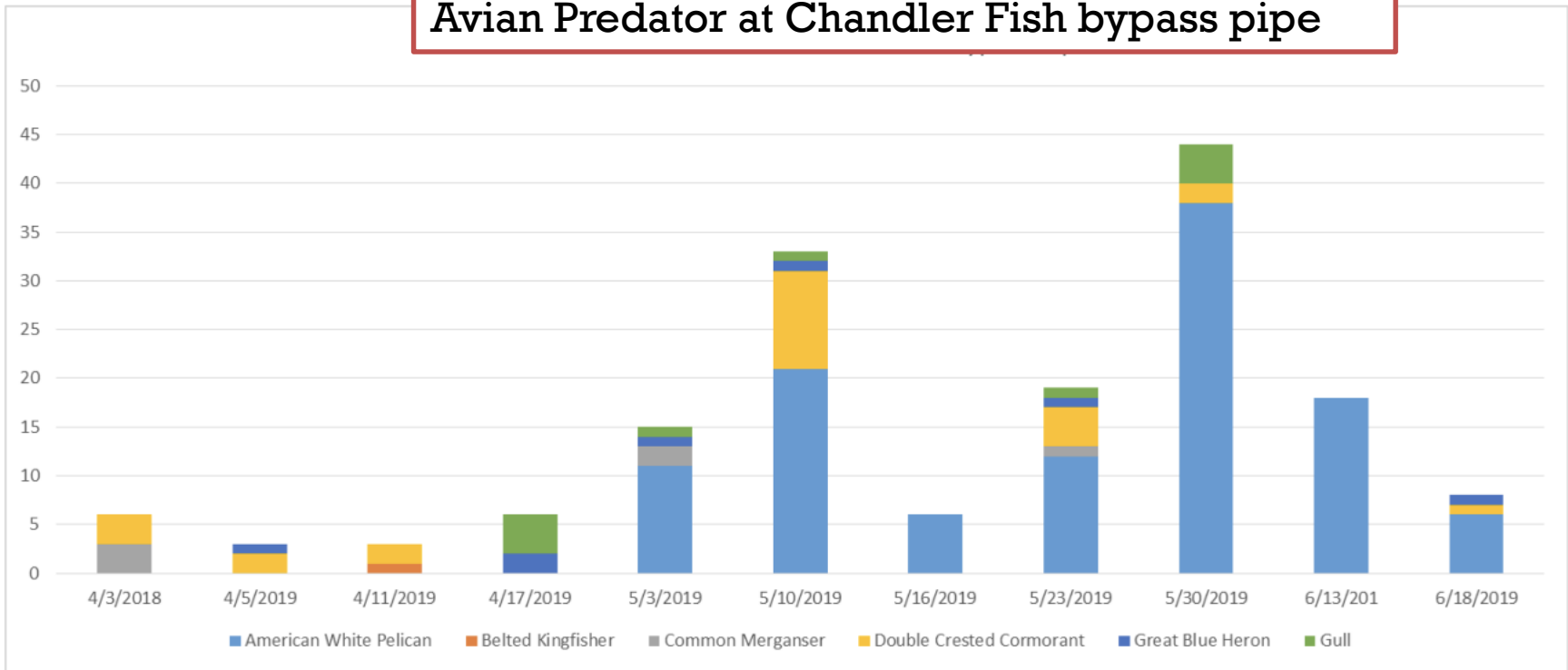




# Results: Yakima River bird counts at Chandler Fish Bypass Pipe



Avian Predator at Chandler Fish bypass pipe

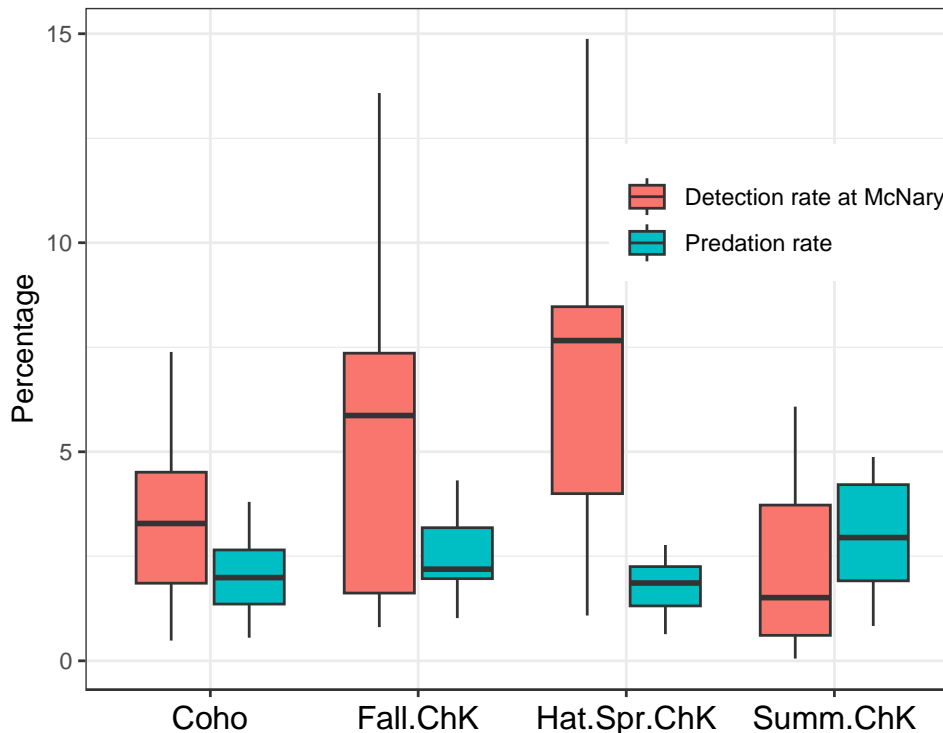


Highest in May and the majority was American White Pelican

# Results: McNary smolt detection and avian predation

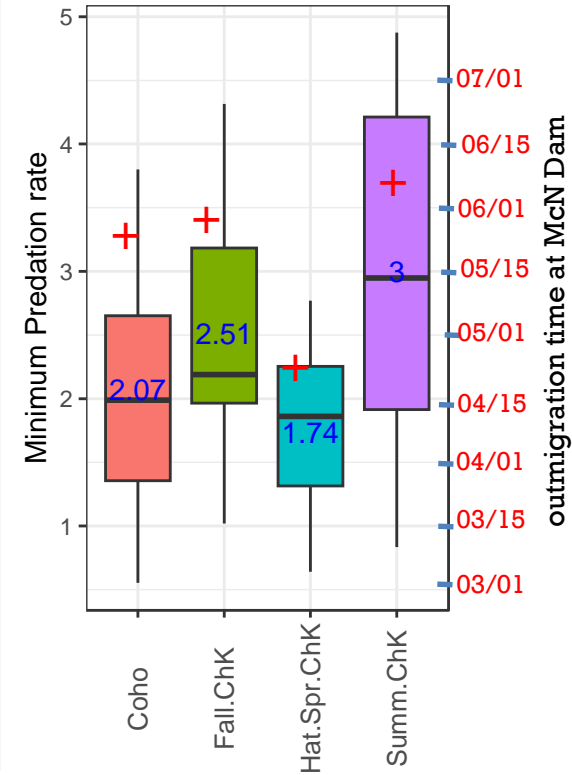
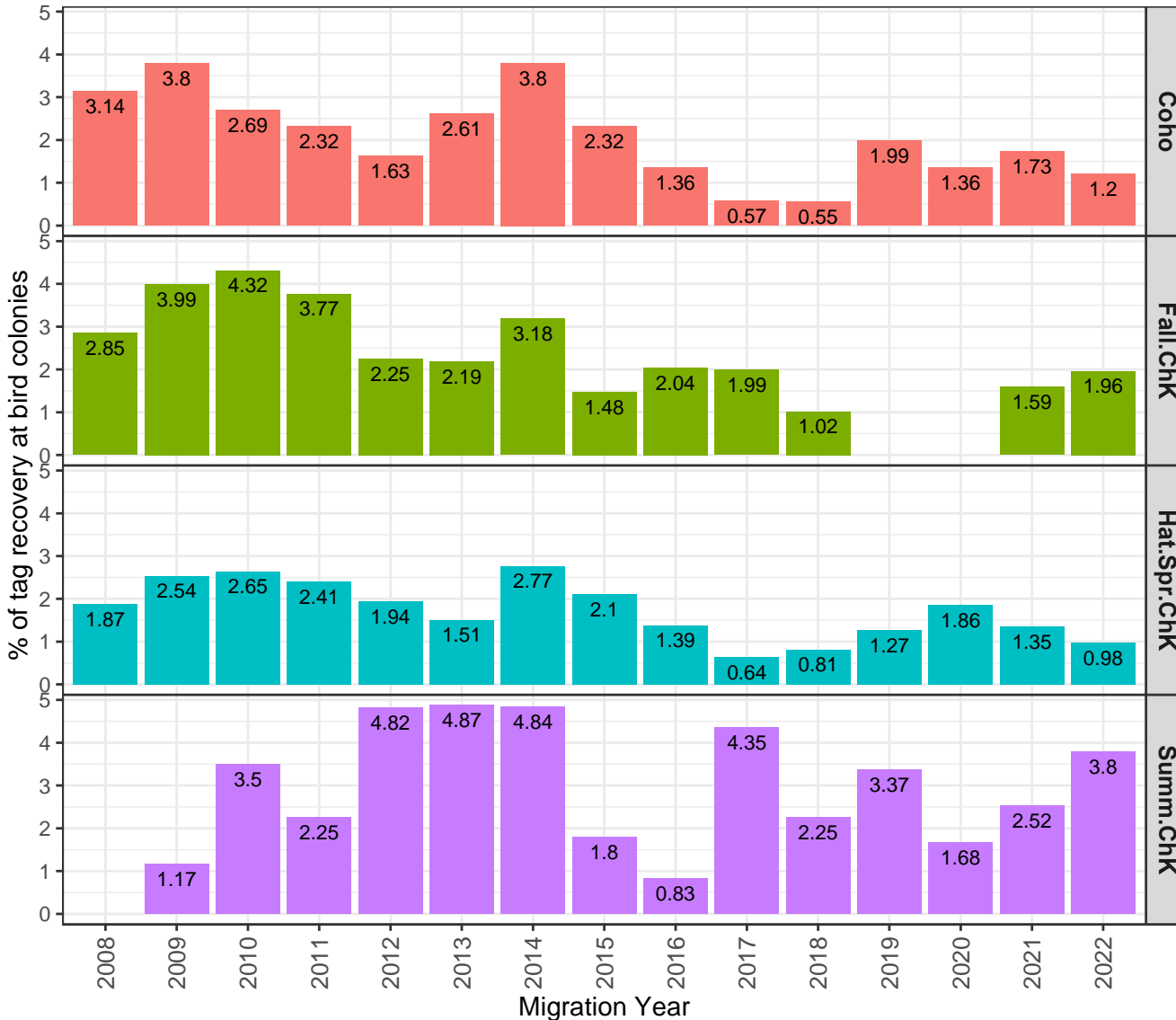


Species	Annual mean Release (N)	Detection at McNary		Predation at various sites														Total at Bird colonies	
		Detection at McNary	Detection %	3MILIS	RICHIS	FOUNDI	BADGEI	CRESIS	JDPI	CBLAIS	MILRSNI	LMILIS	ASMEBR	ESANIS	POTHOL	Total at Bird colonies	Recaptured % at bird colonies		
Coho	19143	713	3.72	13	24	95	35	1	16	0	24	3	186	2	399	2.08			
Fall Chinook	26816	1645	6.13	1	25	101	272	121	2	27	2	29	3	179	7	715	2.67		
Summer Chinook	34249	812	2.37	0	17	46	813	57	3	29	2	11	14	61	4	1008	2.94		
Spring Chinook	44467	2939	6.61	2	25	36	311	54	2	24	3	36	10	302	6	775	1.74		

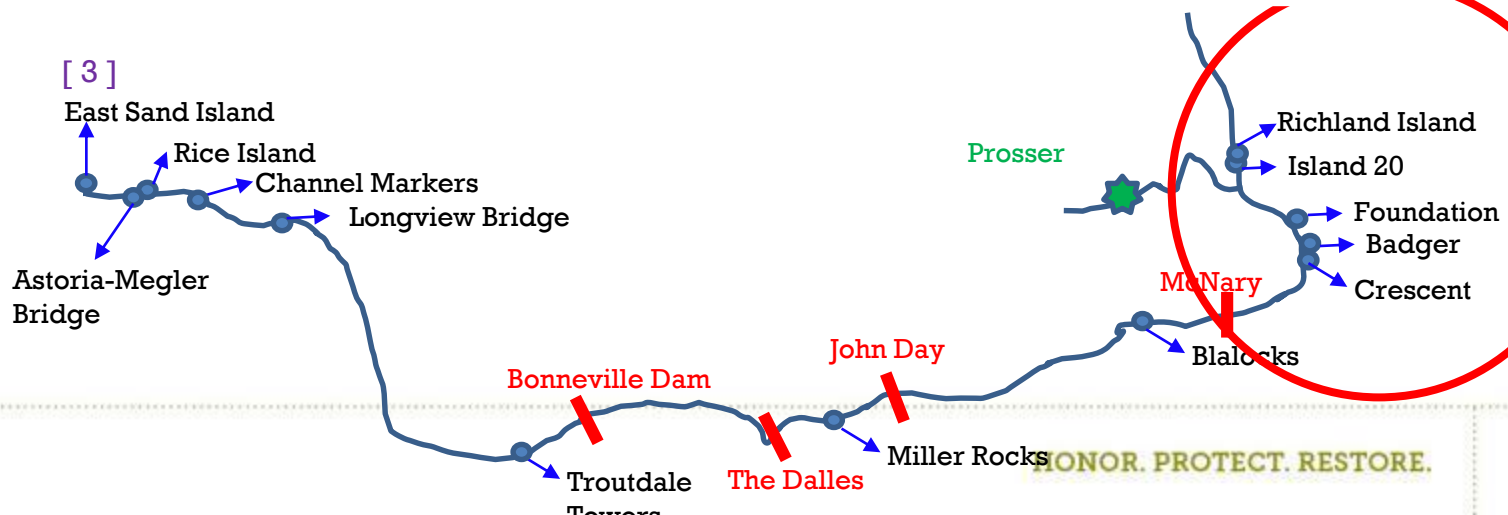
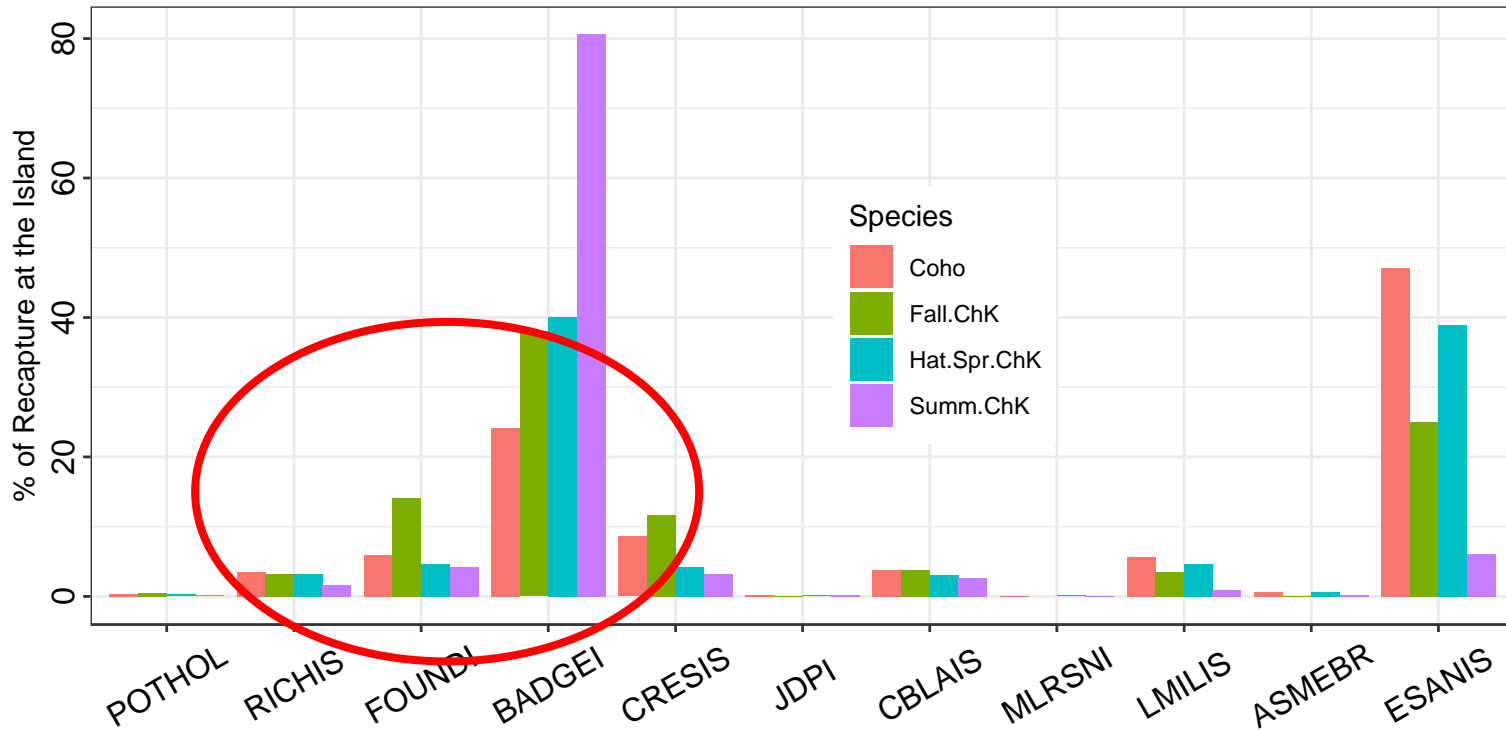




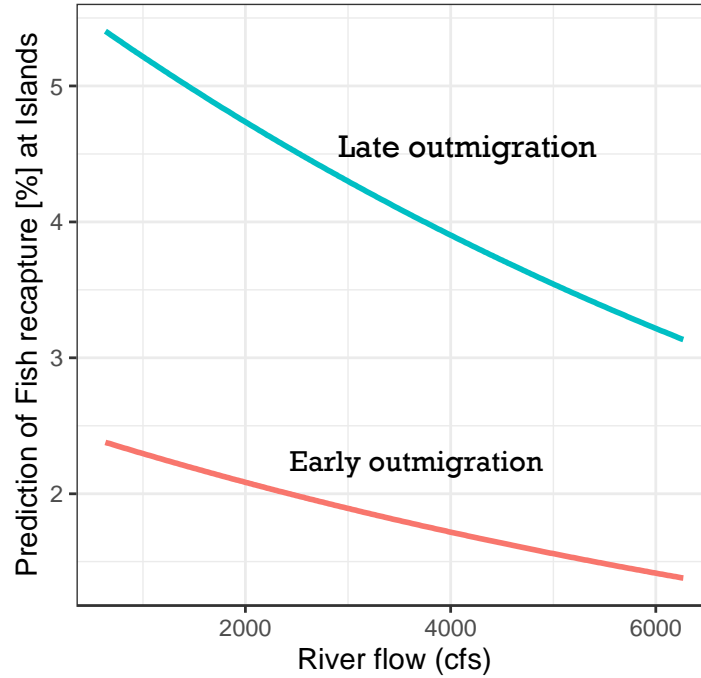
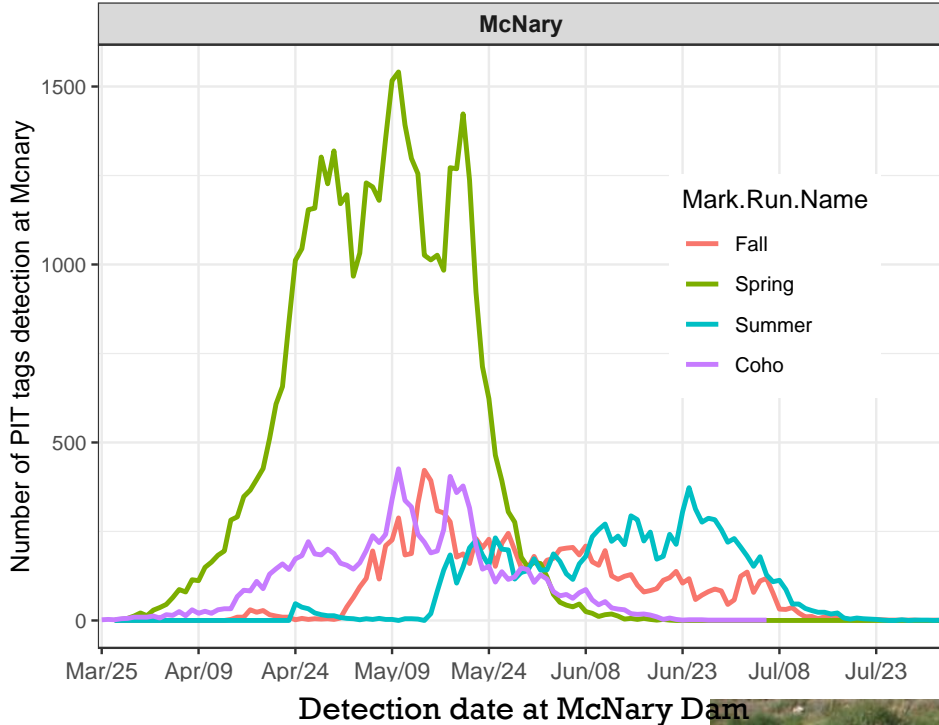
# Results: Colony predation rate by outmigration year



# Results: Predation rate by colony



# Results: Later outmigrants at lower flows are more vulnerable to avian predation



Water Temp: not sig  
 River flow: - & sig  
 Migration timing: - & sig



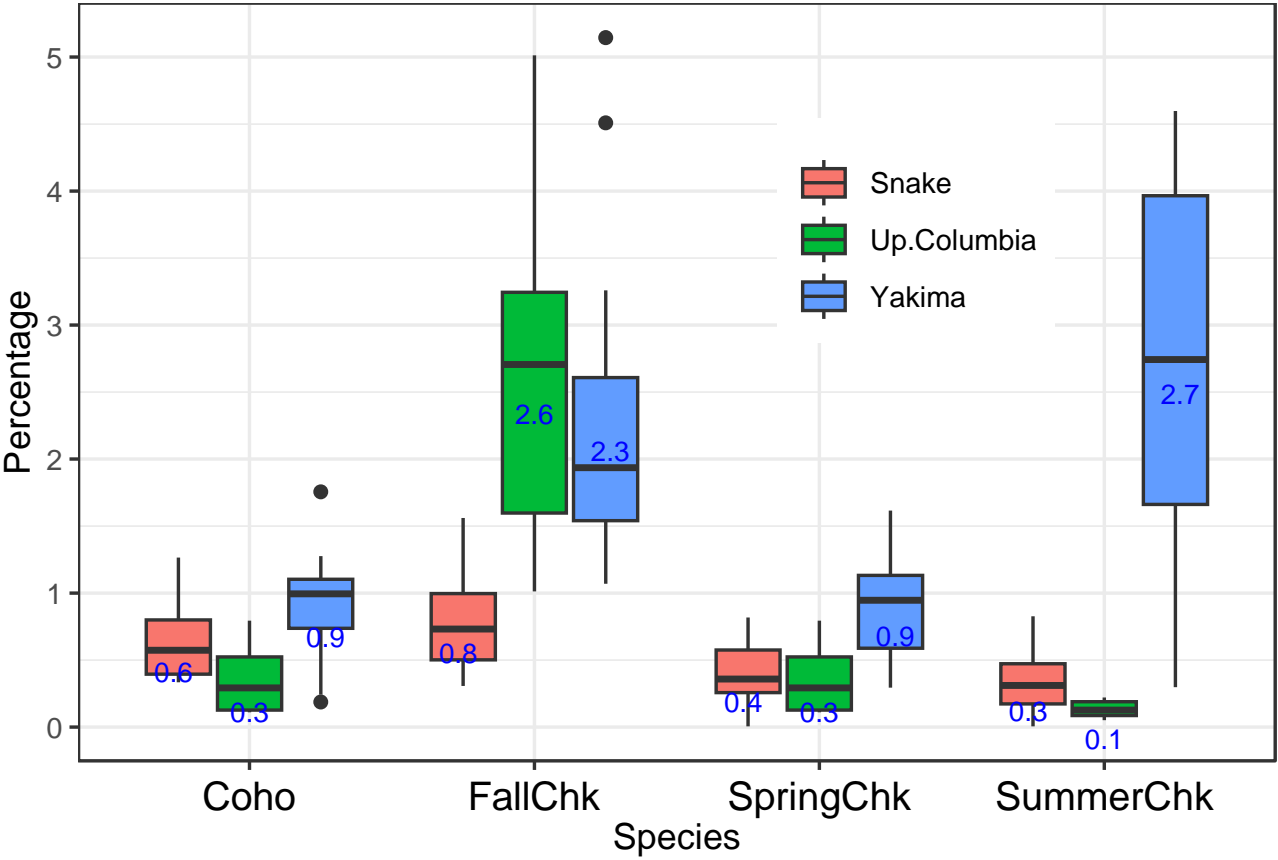
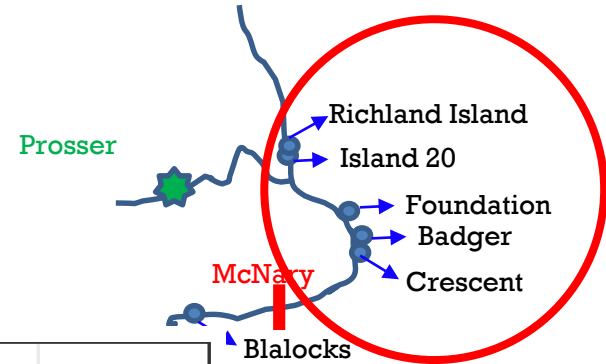
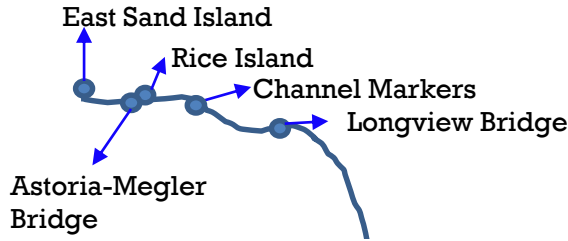
	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	-1.9076755	1.5372372	-1.241	0.2220
RiverFlow	-0.0002136	0.0001052	-2.031	0.0491 *
waterTemp	0.0002755	0.0580717	-0.005	0.9962
julian_detectionatMcn	0.0344200	0.0070522	4.881	0.0000182 ***



Wanawish Dam



# Results: Tag recoveries among three basins release fish



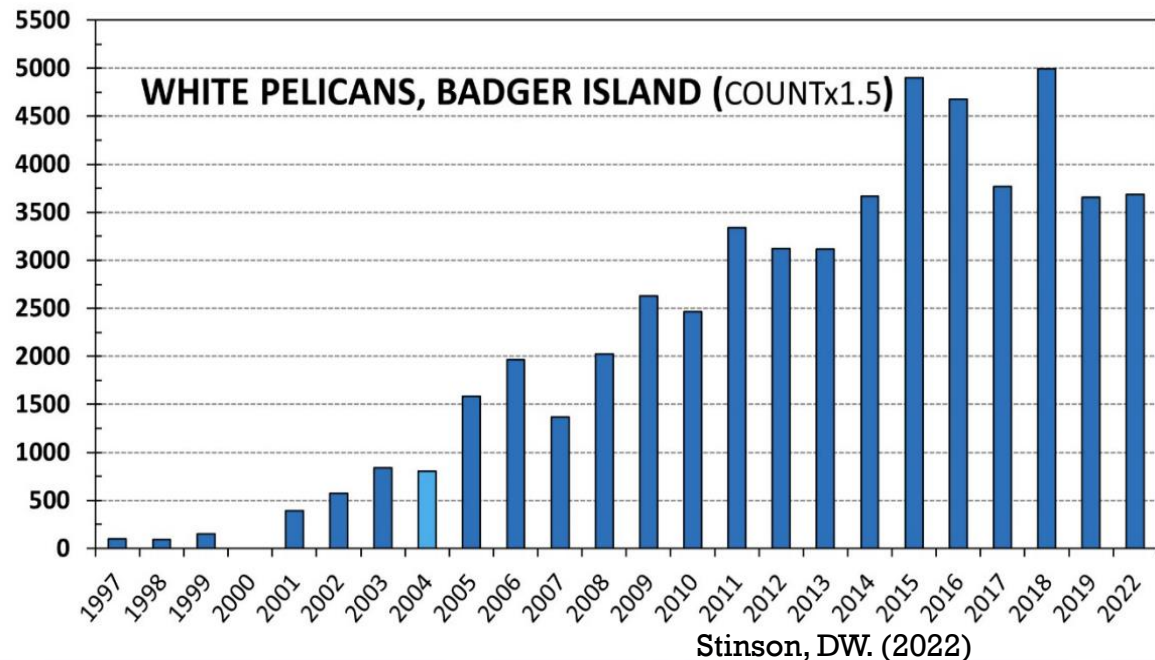
- Over the outmigration years 2008-2022, greater percentages of Yakima spring chinook, summer chinook and coho tag releases were recovered on islands near the confluence of the three drainages compared to Snake or Upper Columbia tags.
- For fall chinook, Upper Columbia tags were recovered at the highest percentage of total release, followed by Yakima tags.

# American White Pelican



## Western Population

- 20+ active colonies, ~50,000 birds & stable
- Badger Island colony distribution
- Estimated Badger Island population
  - Breeding Pairs
    - ~3,700 x 1.5 ~5,550
  - Juveniles
    - >1,000?







MRS Hatchery

Thorp

Ellensburg

Kittitas

Holmes

Edgemont

Boylston

Rye

Doris

Rosa Dam

Pomona

Selah

Cleed

West Valley

Yakima

Union Gap

Moxee

Parker

Donald

Wapato

Harrah

White Swan

Zillah

Loppenish

Granger

Sunnyside

Satus

Grandview

Mabton

Byron

Chandler

Whitstran

Prosser

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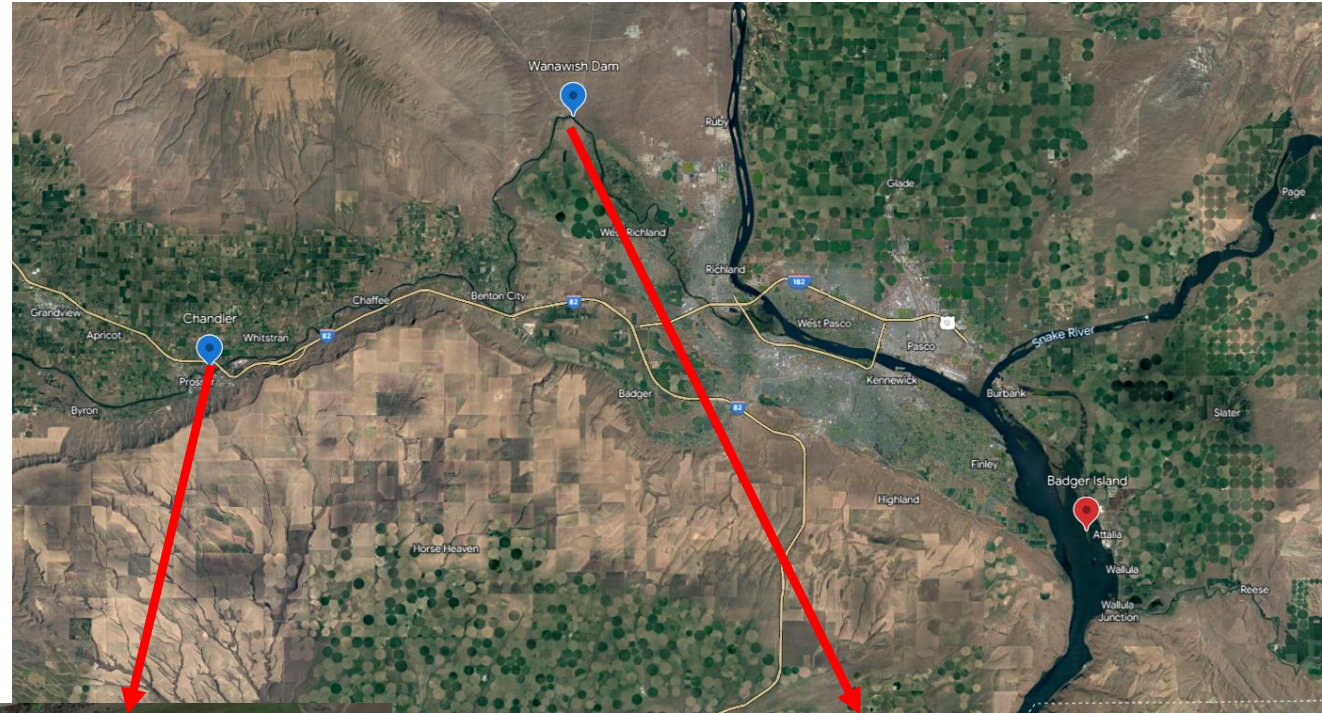


# Yakima River American White Pelican



## 2022 & 2023 Hotspot Observations & Hazing

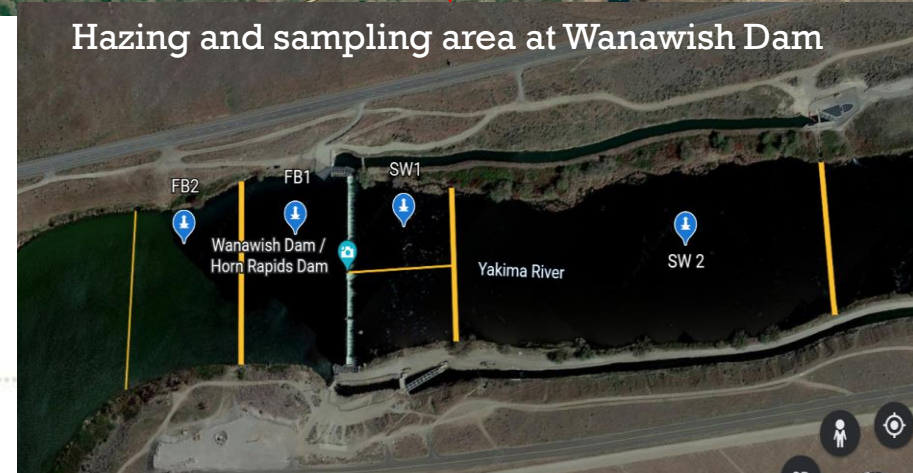
- Where
- When
- Frequency
- Methods
- Hazing Techniques
- Response



Hazing and sampling area below Prosser Dam



Hazing and sampling area at Wanawish Dam





# Yakima River American White Pelican Scientific Collection Permit



## Purpose

- Collect empirical data and better understand the impacts of pelican predation on salmon and steelhead smolts in the Yakima River basin

## Objectives

- Determine diet preference by species, location, and timing
- Determine abundance and distribution
- Estimate salmonid consumption rates basin wide
- Understand the ability to detect PIT tagged fish consumed by juveniles
- Provide regional and state managers with empirical data to develop a recovery and management plan



# Yakima River American White Pelican Scientific Collection Permit



## Methods

- Timeframe: March 20<sup>th</sup> – June 30<sup>th</sup> in 2024-2026
- Weekly aerial flights to estimate abundance & distribution
- GPS collar 10 adults and 10 juveniles
- Lethally take ~8-12 pelicans/week for 12 weeks to obtain complete stomach samples
  - Date, time, location, sex, maturity, flow, turbidity...
- Diet analysis: bones
- Estimate PIT tag deposition rates on Badger Island



# Yakima River American White Pelican Scientific Collection Permit



## Permit Status

- February: Submitted SCP to FWS
- March: Meeting with the confederated tribes of the Umatilla, Nez Perce, and Warm Springs and WDFW, ODFW, IDFG
- Summer: FWS working on EA
- December: Permit issued

## Collaboration

- Confederated Tribes of the Umatilla





# Acknowledgments



Thanks to all who assisted the predation team with field activities and a special thanks to those on the team who provide years of invaluable knowledge and expertise in the field.

- Sara Sohappy, Jamie Bill, & Peter Mamizuka Jr.

