Fish and avian predation on Salmonids in the Lower Yakima Basin

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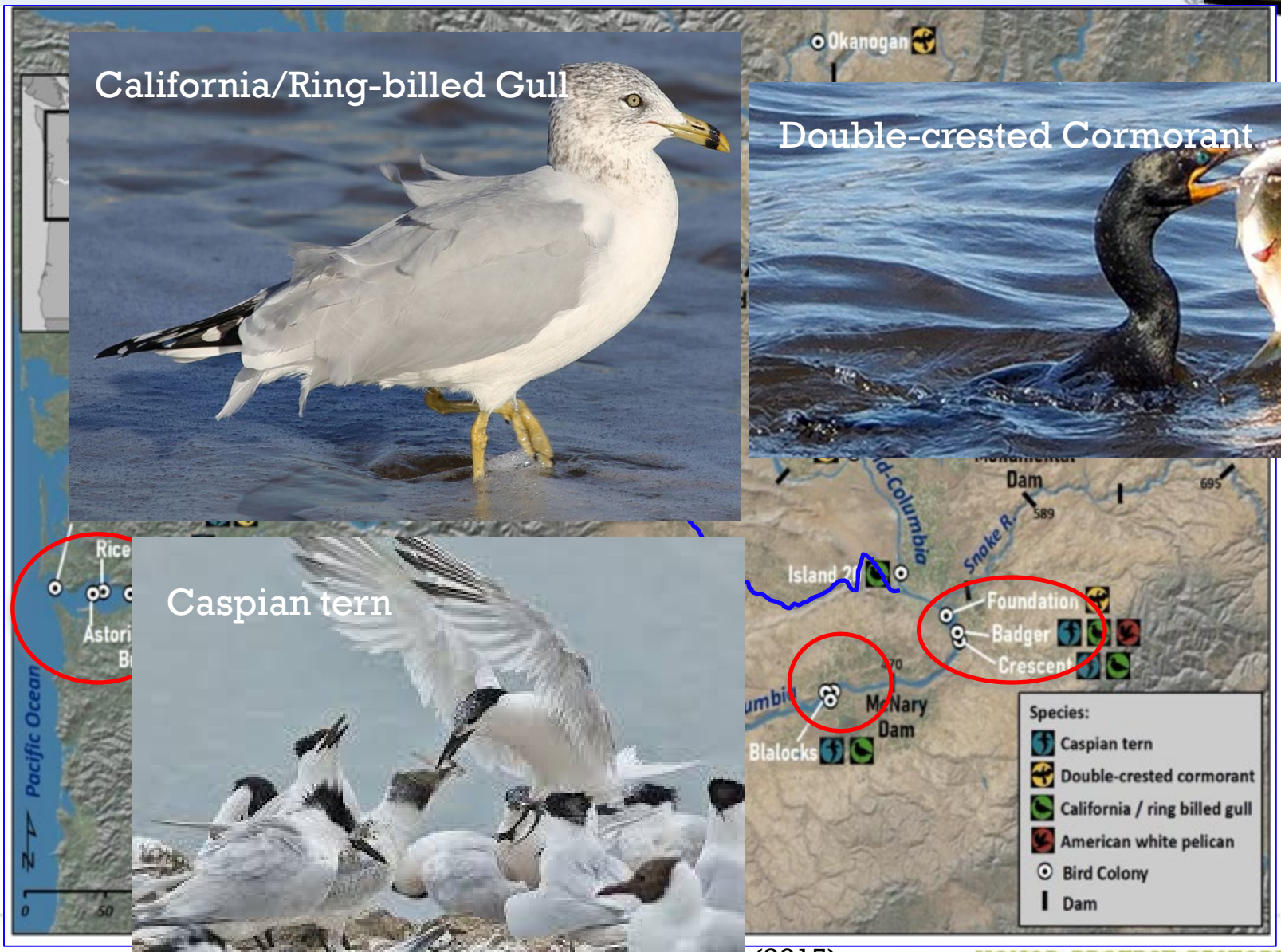
Background (piscivorous birds)

- Predation by piscivorous birds and fish is one of the main contributing factors to declines in anadromous fish abundance
- Avian Predation
  - It is estimated that every year ~35% of the juvenile of spring Chinook salmon in upper Columbia River are consumed (Northwest Power and Conservation Council's website)
  - 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: Avian breeding colonies



(2015)

Background (piscivorous fish)

- Predation on juvenile salmon and steelhead by non-native fish has increased.
  - 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)

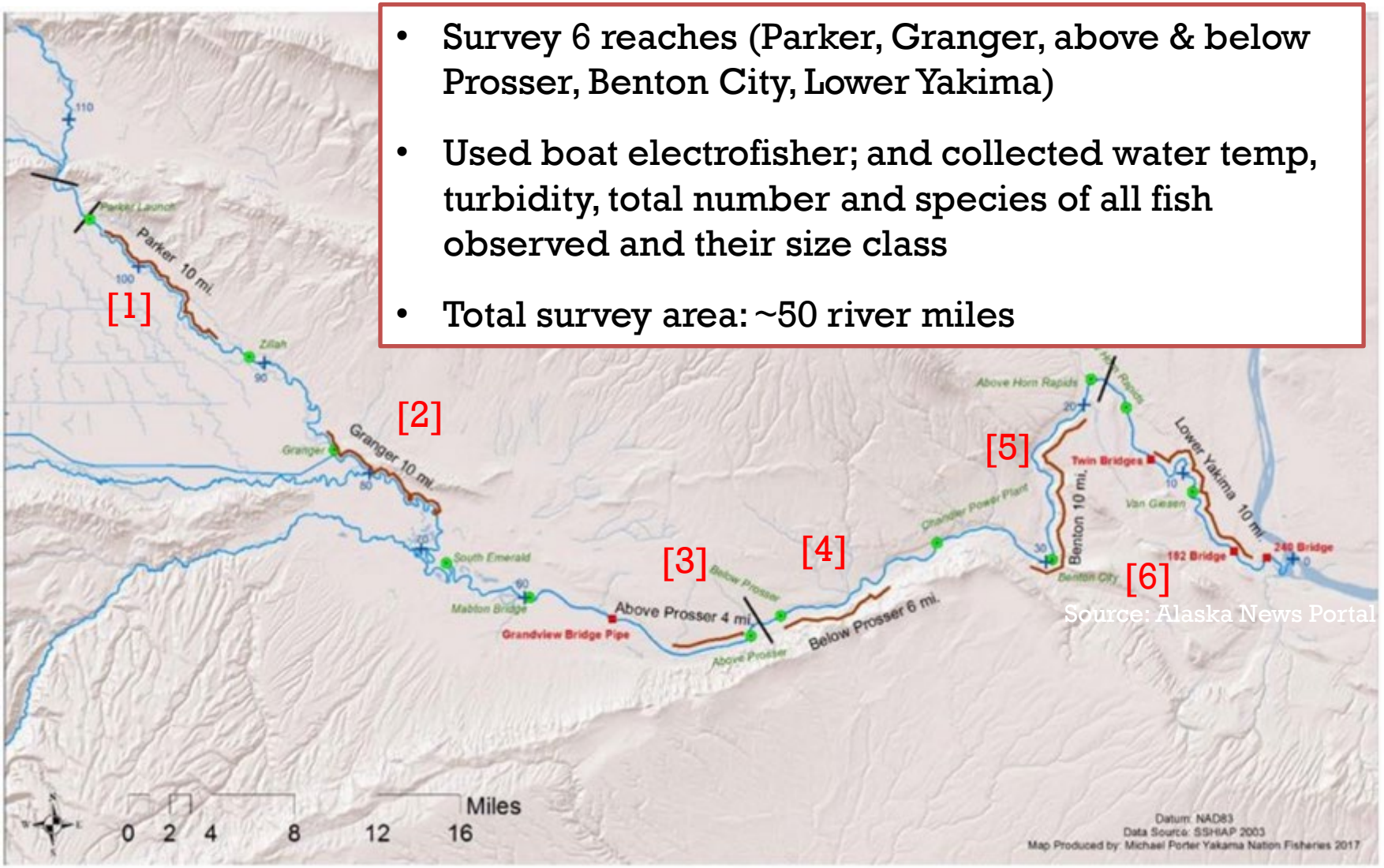
Objectives

- To understand the impacts of predators on salmon and steelhead smolts in the Yakima river basin, more specifically, we determine:
  - The total population or density of both fish and avian predators in the Yakima River (abundance and distribution).
  - Diet preference by species, location and timing
  - Salmonid consumption rates by predators basin-wide
- Provide regional and state managers with empirical data and also to develop a Predation management plan

Methodology

- Fish predation: fish sampling 2018-2024

- 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

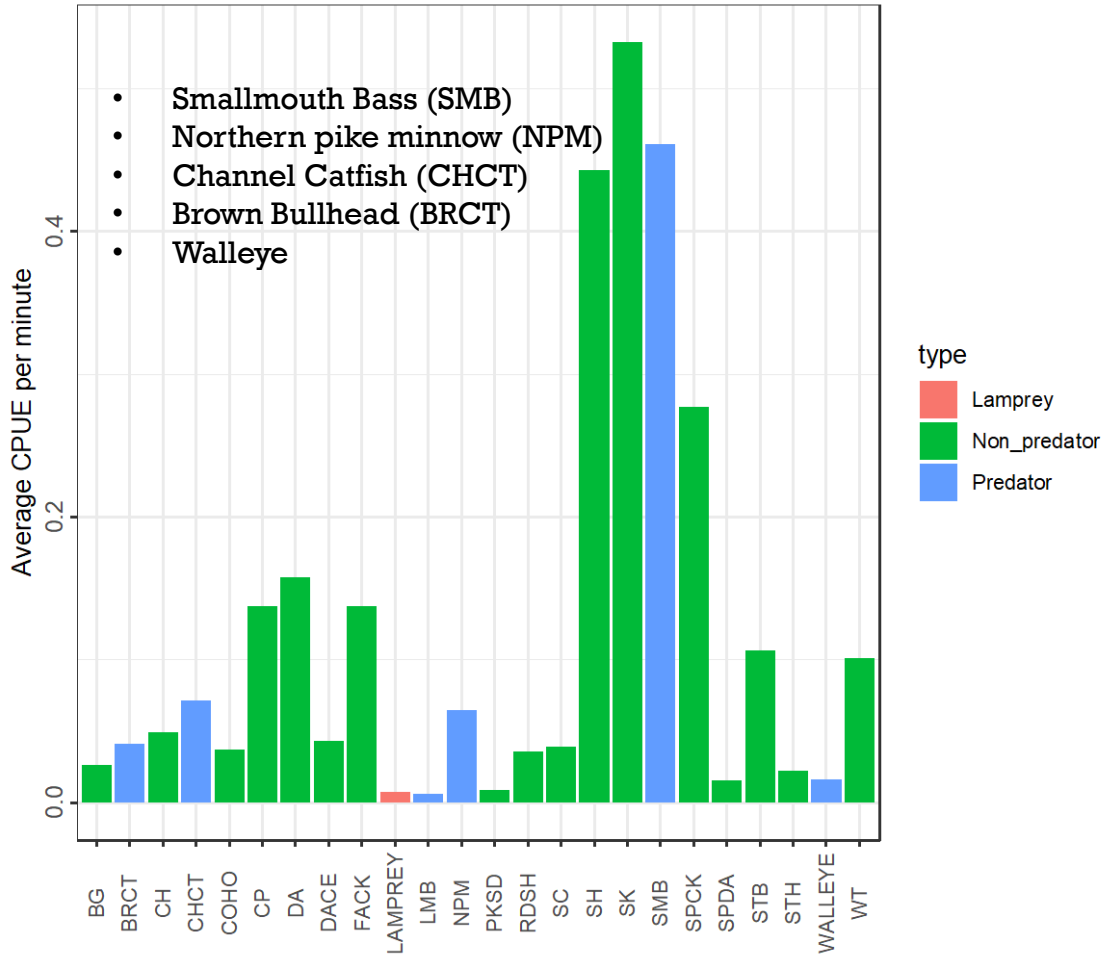


Source: Alaska News Portal

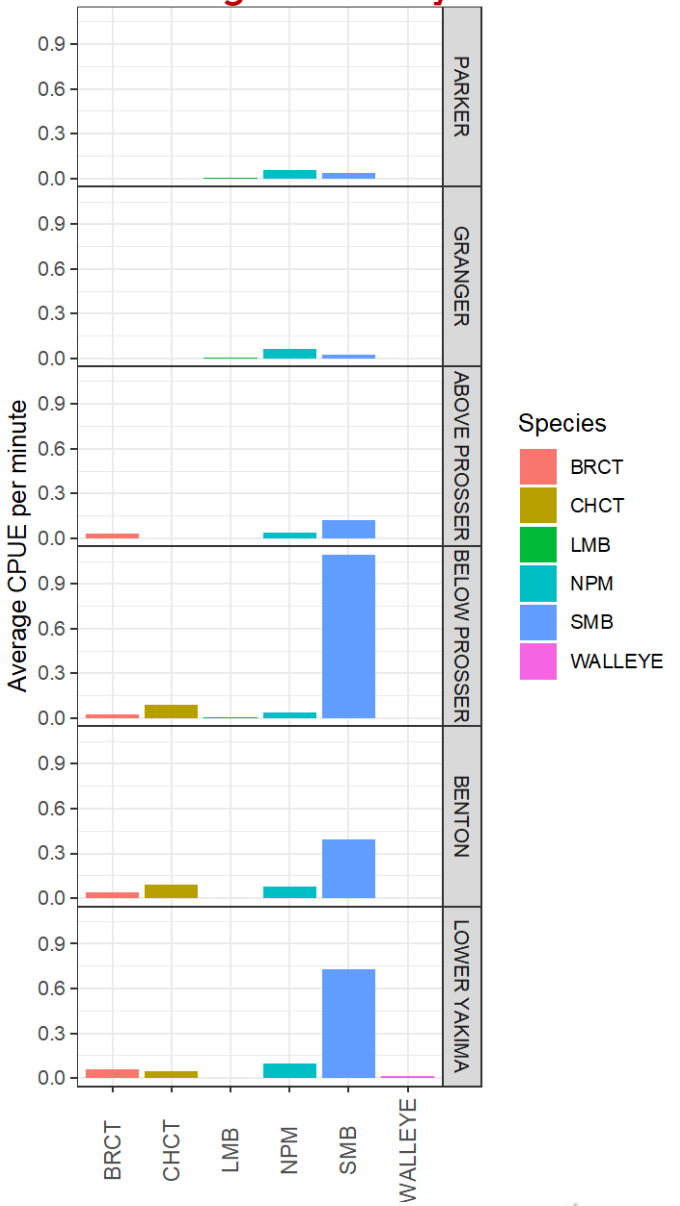
Results: Predatory fish density by species

- The Lower Yakima River contains large numbers of piscivorous fish

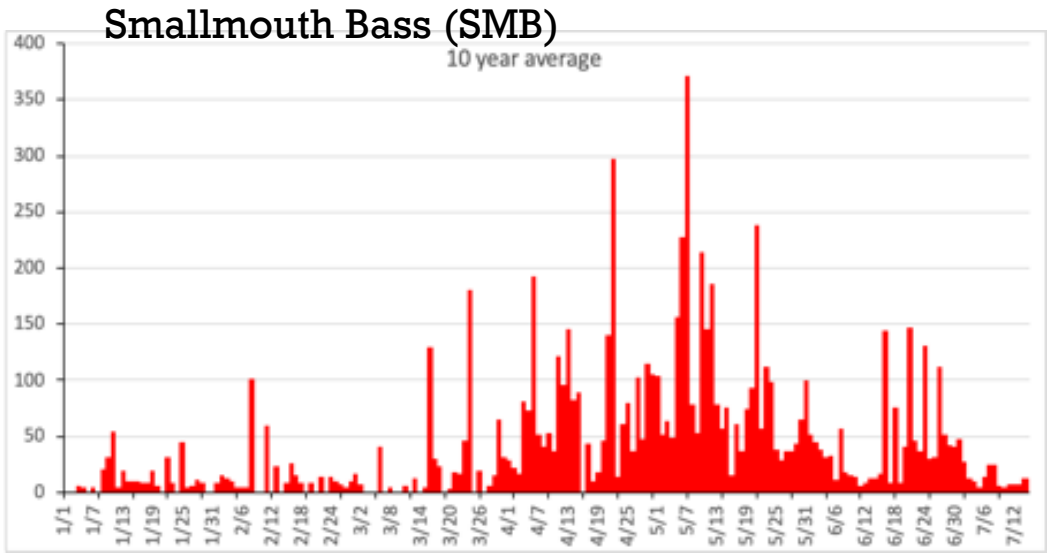
A. Average CPUE

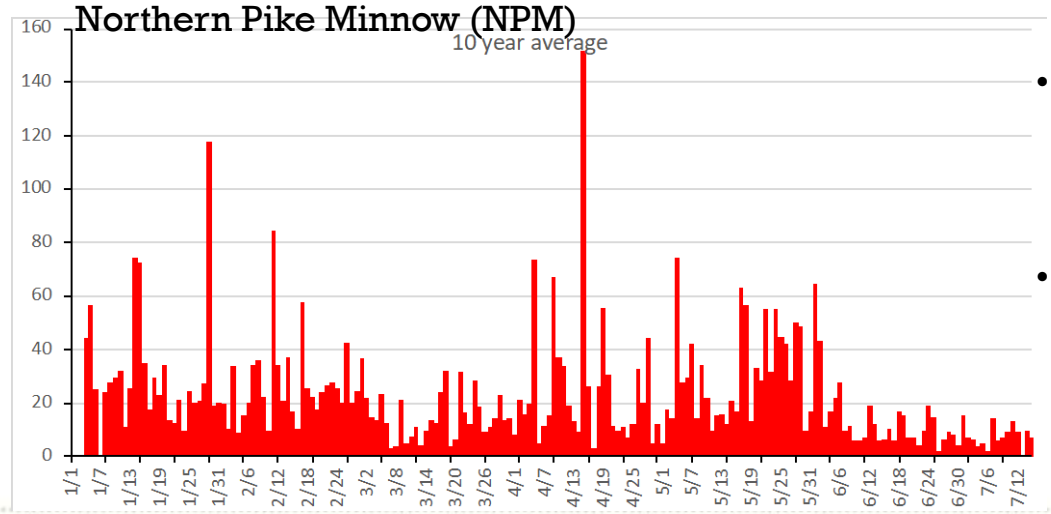


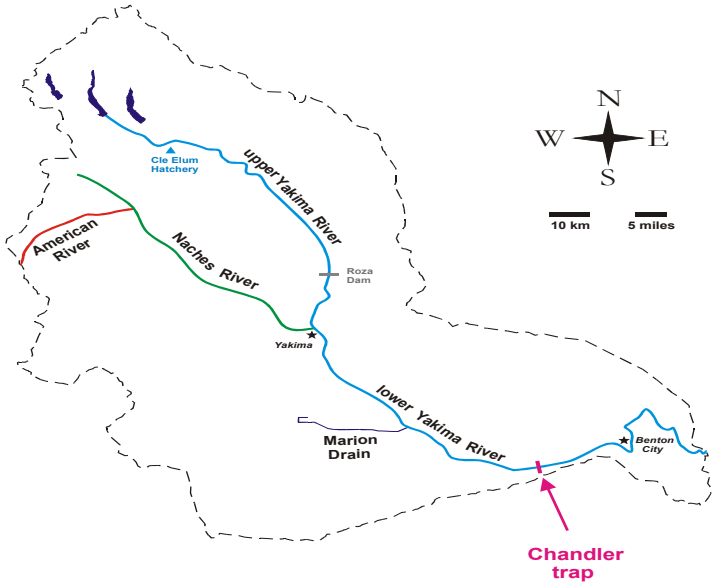
B. Average CPUE by location



Results: Daily counts at Prosser





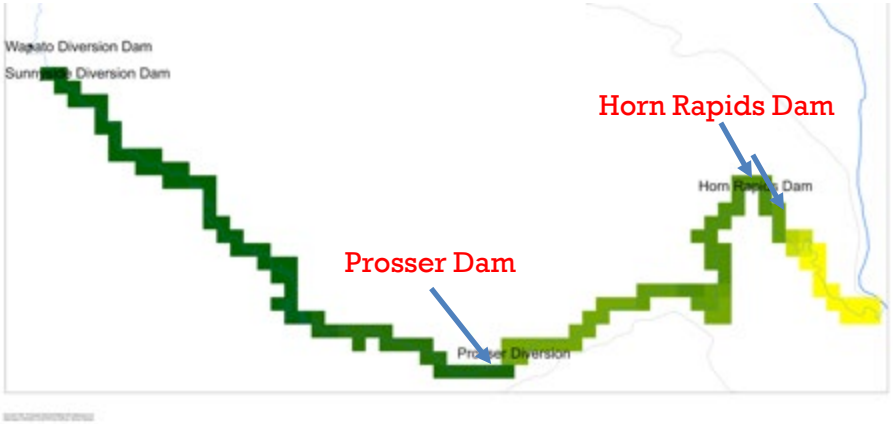


- Daily counts are expanded on the assumption that entrainment and survival rates in the Canal are similar to those of Spring Chinook.
- Bigger fish are not included in the count data as the screen size for sampling allows only for smaller fish sizes.

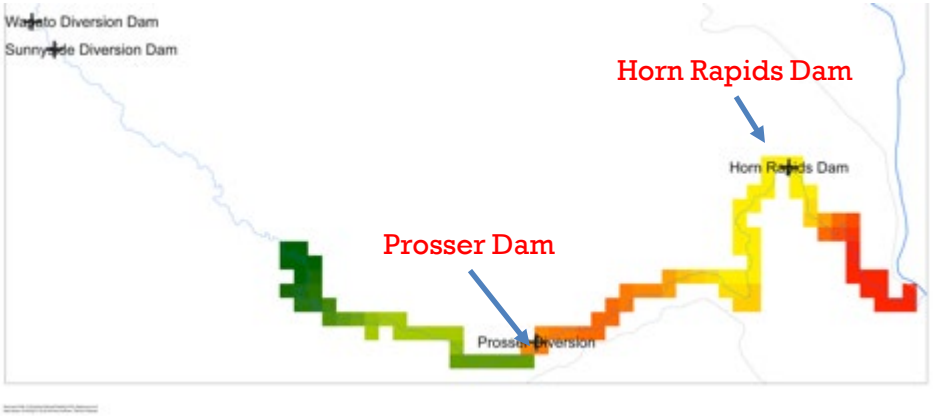
Results: Fish predation heat map

Smallmouth Bass

May



June



Catch/hour

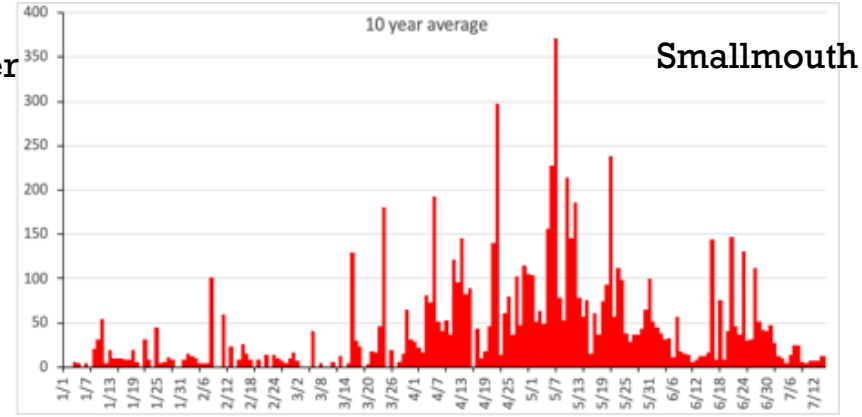
30

15

1

Results: # of salmonids fish lost from Piscivorous fish (fish predator)

At Prosser



Smallmouth Bass (SMB)

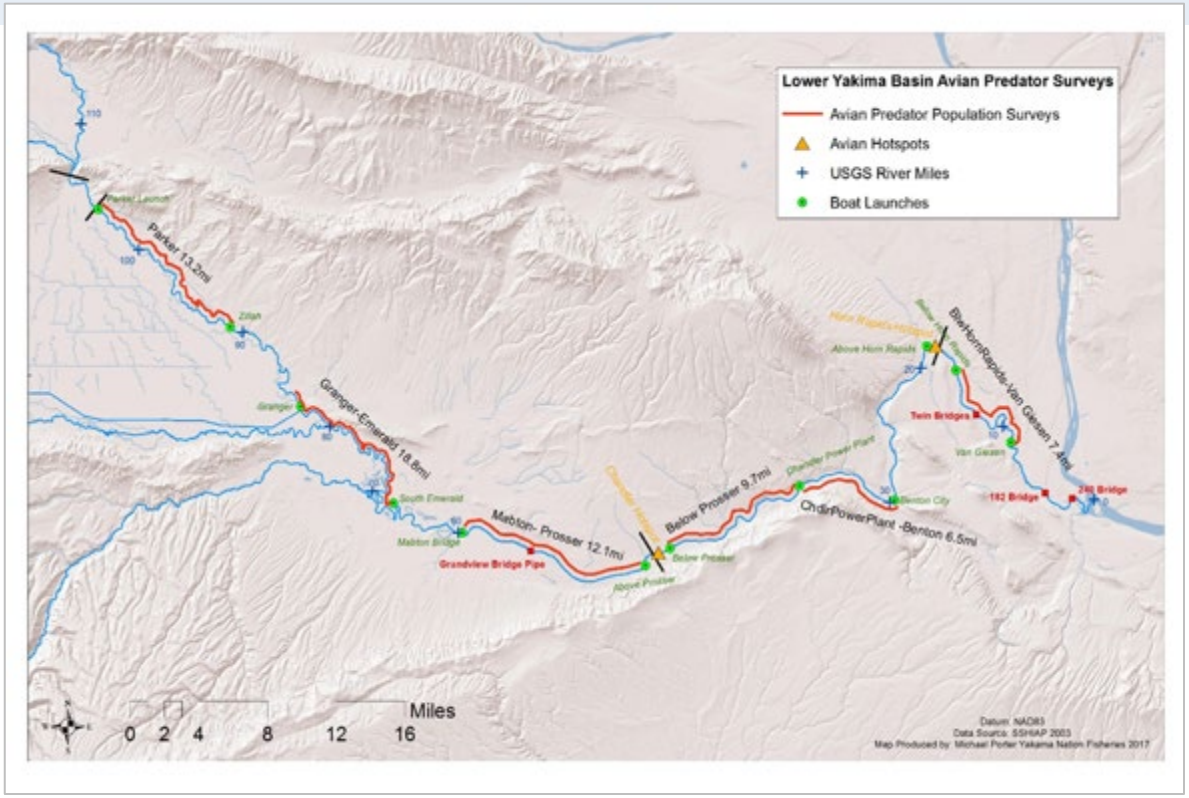
Species	Max. Weight (pound)	Average Consumption	Food consumption (pounds) From	to	Number of smolt/pound	Number of salmonid fish consumed Min.	Max.	Predation Fish Populaiton	Number of salmonids consumed
Smallmouth Bass	6	~3% of body weight per day	0.18		21	3.78		400	1512
Northern Pikeminnow	8	~3–5% of body weight	0.24	0.4	21	5.04	8.4	100	504
Channel Catfish	40	1–6% body weight/day	0.4	2.4	21	8.4	50.4	50	420
Brown Bullhead	2	~2–4% of body weight /day	0.04	0.08	21	0.84	1.68	50	42
Walleye	20	~2–4% of body weight /day	0.4	0.8	21	8.4	16.8	50	420

6*0.03=0.18

0.18*21=3.78

03.78*400=1512

Hotspot Surveys: Yakima River bird counts



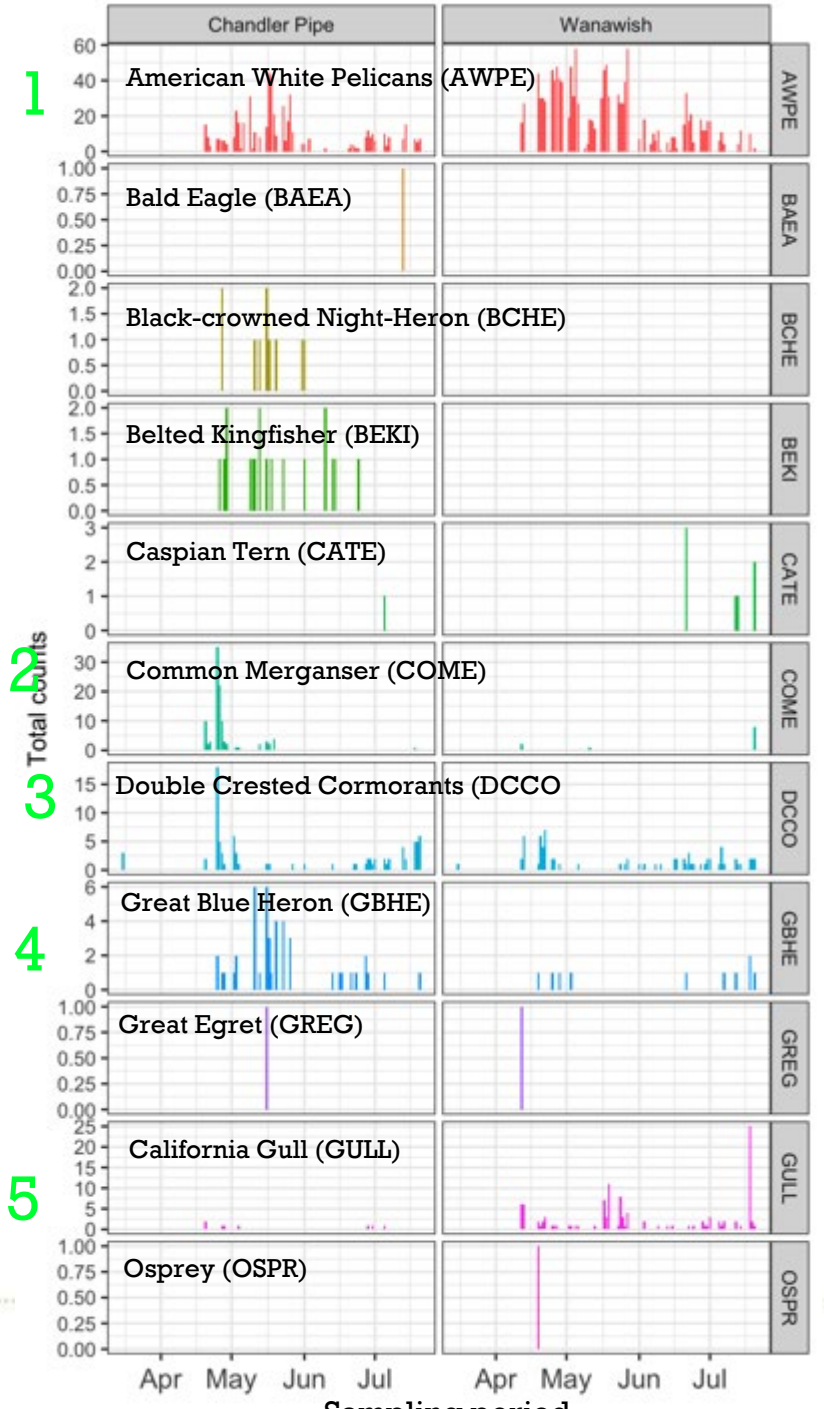
- Every week observation in each hotspot for about 4- 5 hours from March to end of July, however more focus on Prosser and Wanawish Dam
- Counts of pelican and other avian predator species
- Weekly flight over the Yakima River Basin (2024 and 2025)

Results: Yakima River bird counts

Sampling Year 2024

Daily Maximum count in the sampling period

Location	Chandler Pipe	Wanawish
AWPE	44	58
BAEA	1	0
BCHE	2	0
BEKI	2	0
CATE	1	3
COME	35	8
DCCO	18	7
GBHE	6	2
GREG	1	1
GULL	2	25
OSPR	0	1



Results: Yakima River bird counts by reach

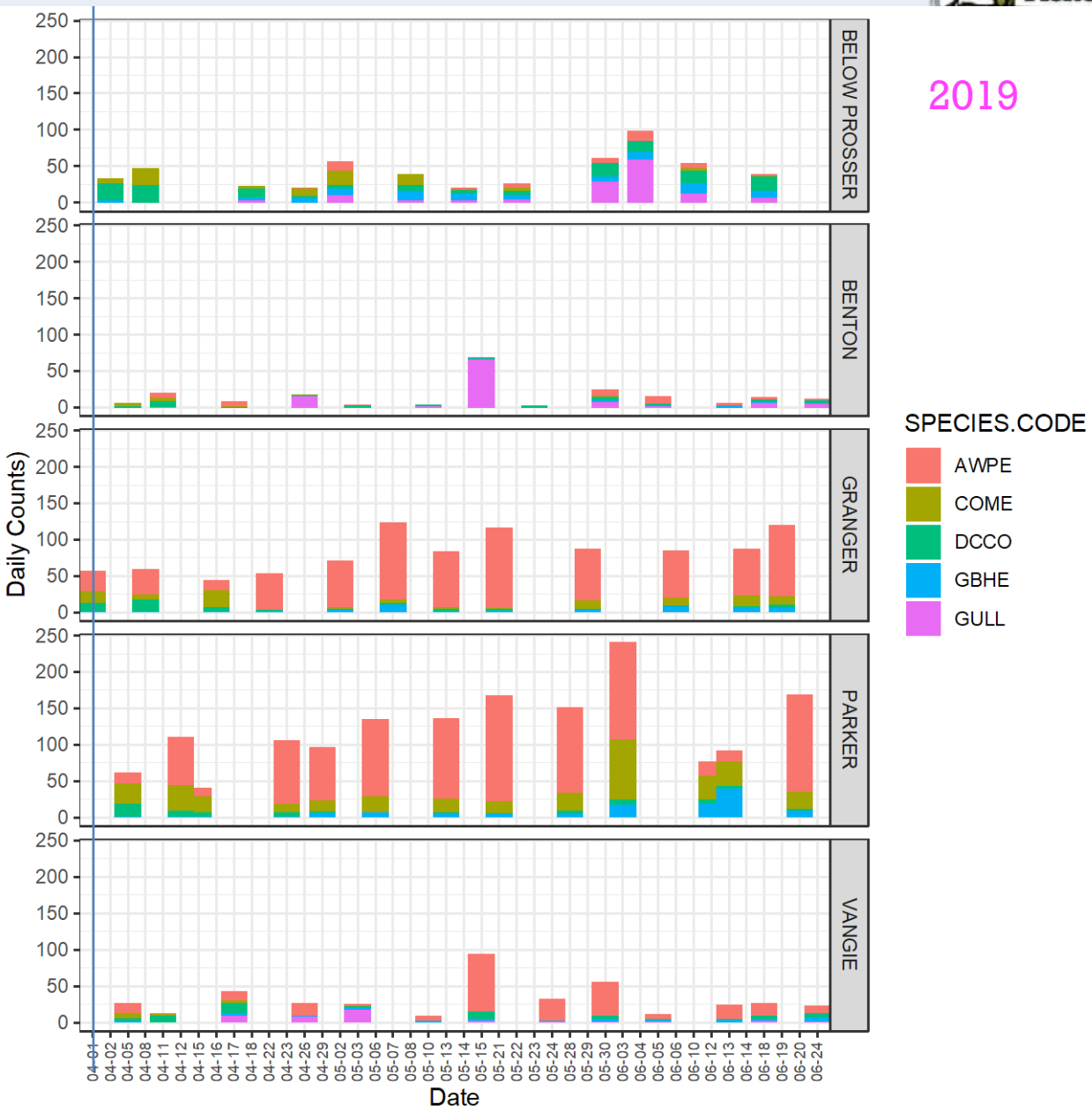
Below Prosser

Benton

Granger

Parker

Vangie



2019

SPECIES.CODE
AWPE
COME
DCCO
GBHE
GULL

Results: Yakima River bird counts

Species	Primary Diet	Estimated daily Food Consumption Rate
American White Pelican (AEPW)	Fish, crustaceans, amphibians	~2-6 pounds per day
California Gull (GULL)	Fish, insects, small mammals, garbage	Highly variable; scavenger, opportunistic feeder
Common Merganser (COME)	Fish, crustaceans, aquatic insects	~0.5-1 pound per day
Double-crested Cormorant (DCCO)	Fish, crustaceans, amphibians	~1-2 pounds per day
Great Blue Heron	Fish, small mammals, reptiles, amphibians	~1-2 pounds per day

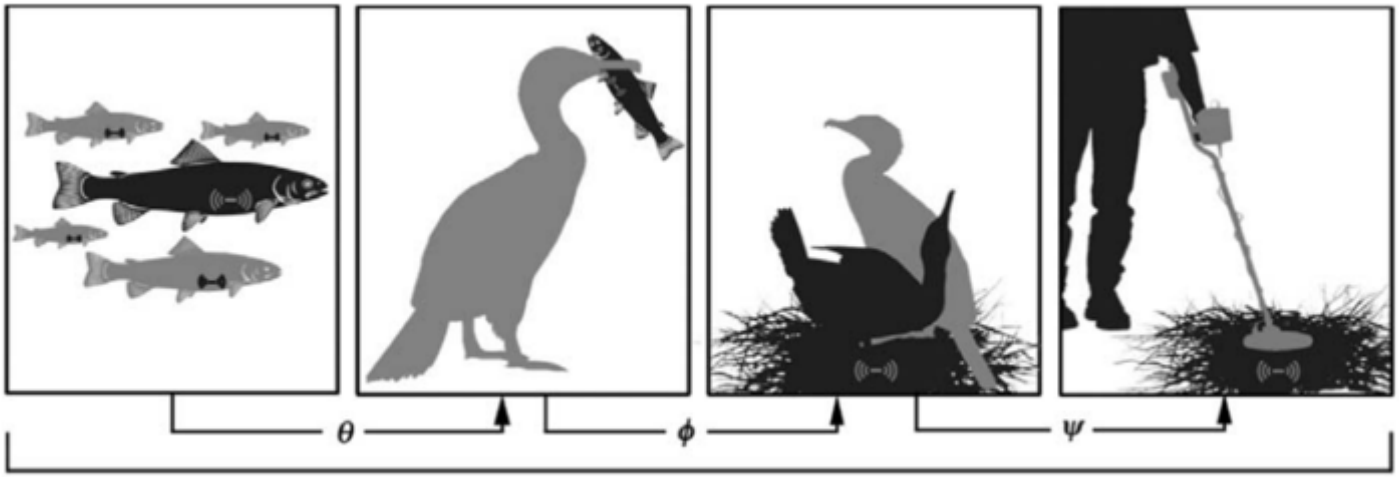




Results: McNary smolt detection and avian predation

Species	Mean Annual PIT tag Release (N)	Detection at McN	Islands												Predation rate (%) [Assuming 0.67 %depos. rate and 0.89 % detection
			3MILIS	RICHIS	FOUNDI	BADGEI	CRESIS	JDPI	CBLAIS	MLRSNI	LMILIS	ASMEBR	ESANIS	POTHOL	Total at Bird colonies	
Coho	19143	713		13	24	95	35	1	16	0	24	3	186	2	399	3.49
Fall Chinook	26816	1645	1	25	101	272	121	2	27	2	29	3	179	7	715	4.81
Summer Chinook	34249	812	0	17	46	813	57	3	29	2	11	14	61	4	1008	5.18
Spring Chinook	44467	2939	2	25	36	311	54	2	24	3	36	10	302	6	775	3.05

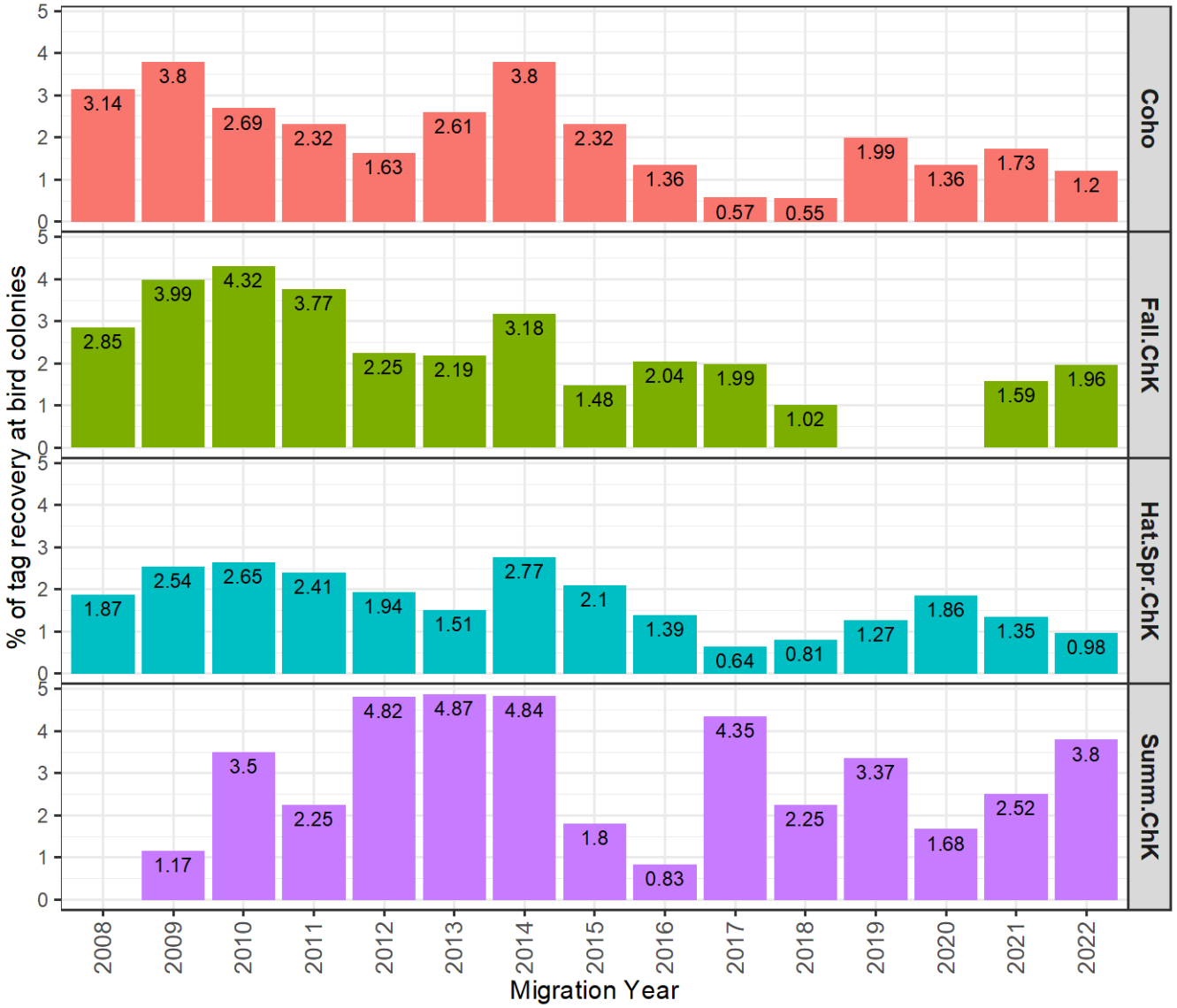
Predation probability Deposition Probability Detection Probability

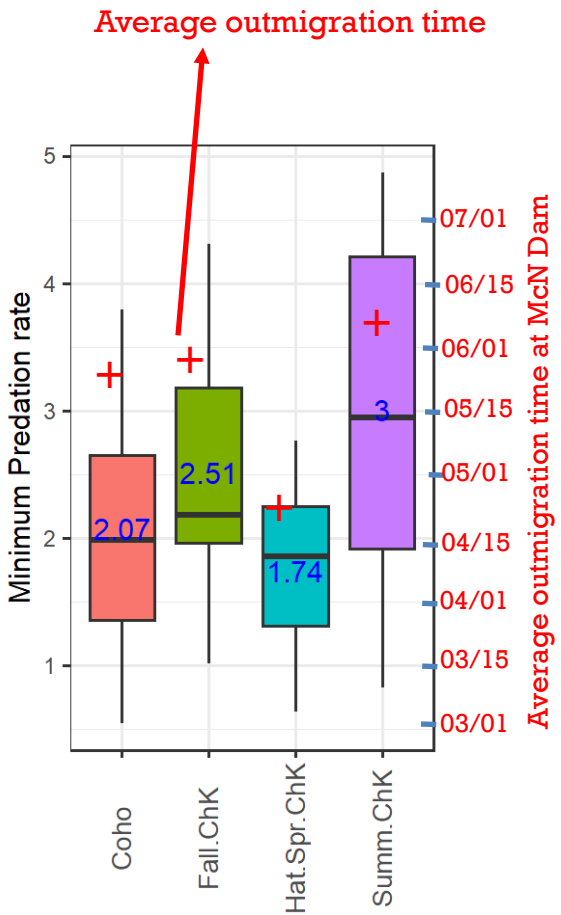


Hostetter et al., 2015

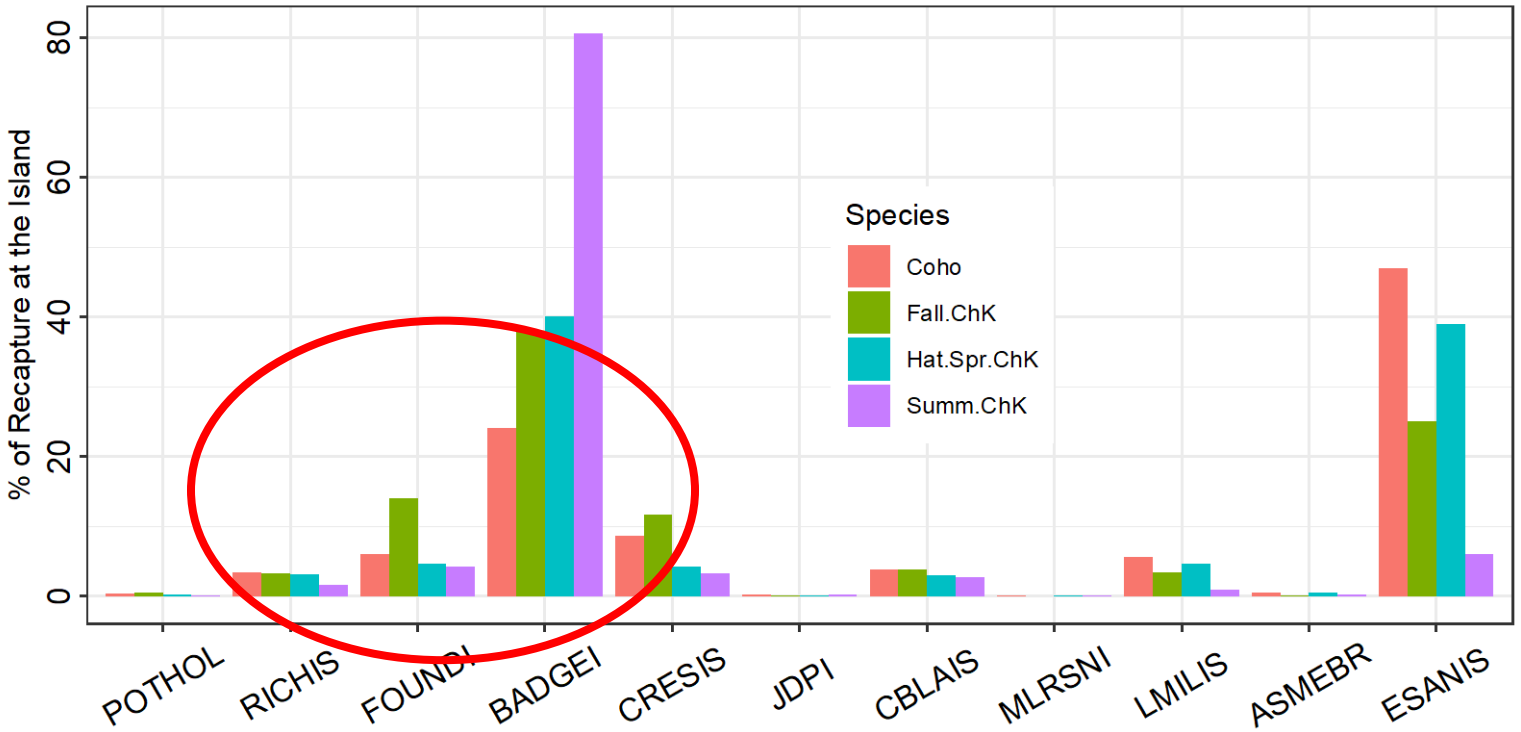
RESTORE.

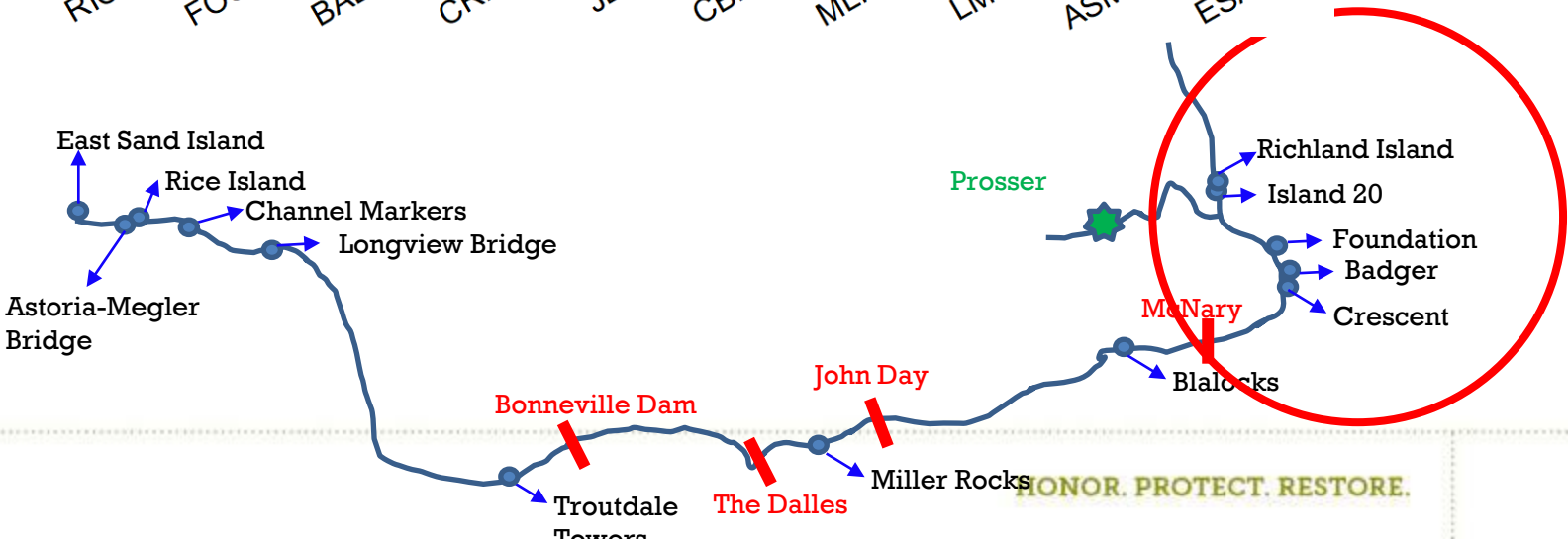
Results: % of total recaptured PIT tags in Islands by outmigration year (raw predation%)



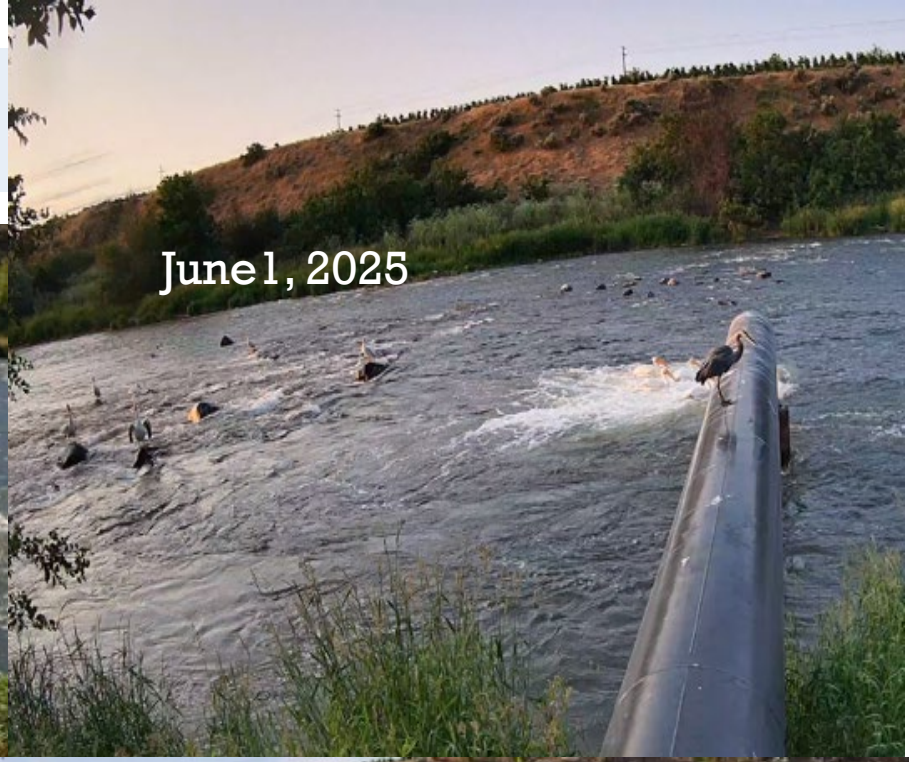


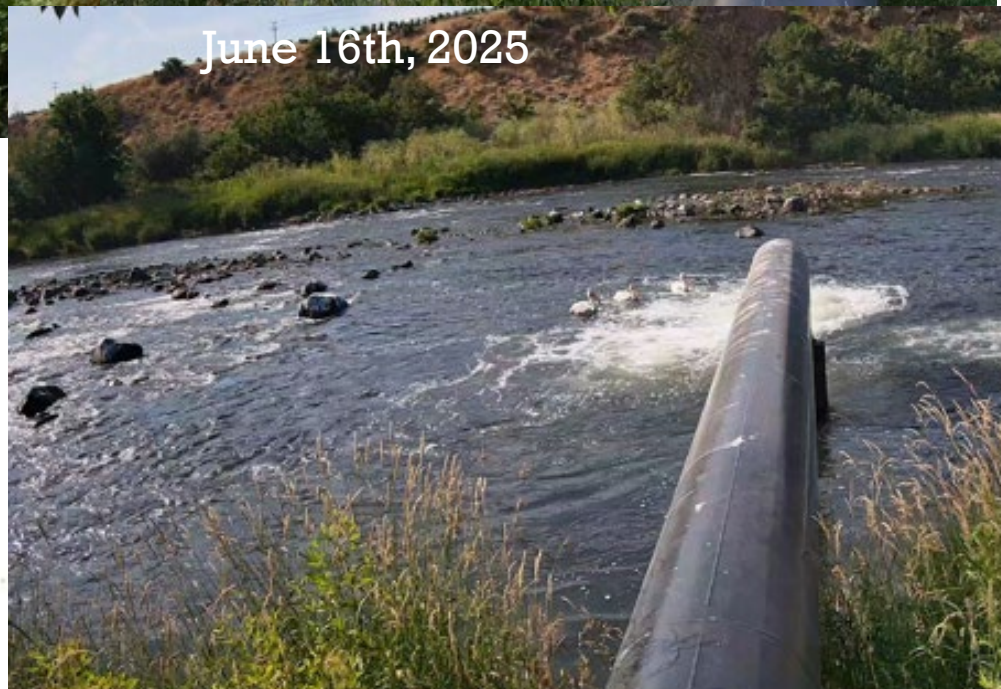
Results: Predation rate by colony





Results: Effect of Flow

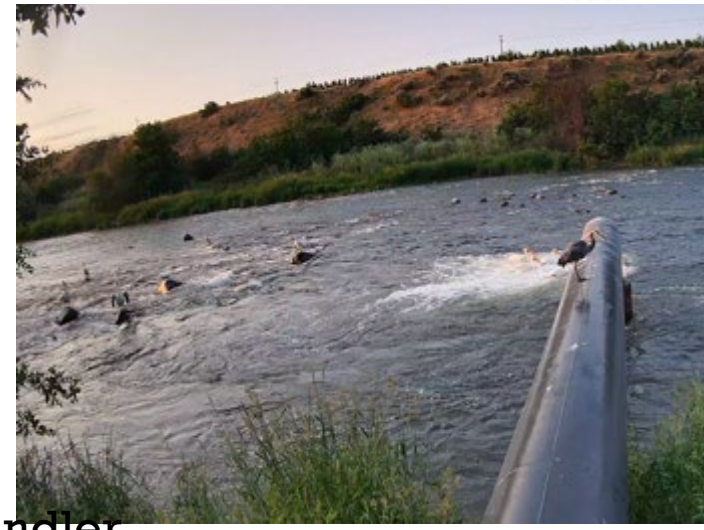




- More birds observed during low flows.
- The outlet at Chandler appears to be a good foraging site for herons, pelicans, and other bird species.
- Rocks are helping for resting.

Results: Chandler Outlet predation

Release Groups (Coho)	# PIT tags	# PITtags recovered in Islands	Avian Predation Rate (%)
Chandler_juvenile_facility (wild/natural)	502	22	5.82
Prosser_eagle	4868	126	3.44
Prosser_RingGold_Eagle	5020	108	2.86
Prosser_YN	5010	101	2.68



- Wild fish that were tagged and released from Chandler experienced higher mortality due to avian predation.

- The rocks were initially placed under the assumption that they would provide habitat for fish, but they are now primarily being used by birds as resting areas. We may need to consider removing them.
- Additionally, fish released from the pipe may have difficulty initiating downstream migration due to the height of the drop. It is recommended to either lower the drop or release the fish in alignment with the river flow rather than perpendicular to it.

Salmonids Predation: Key Considerations

- Significant avian and fish predation observed—**summer Chinook most affected**.
- Identify and map **all fish and avian predator species; and e**stimate **smolt consumption rates** by species.
- Rising temperatures increase predator activity—**develop a fish predation control plan**.
- **Modify Chandler outlet** and **remove nearby boulders** to reduce predation risk.

Acknowledgments

All crews conducting fish sampling and bird observation