# Fish and avian predation on smolts in the Lower Yakima Basin

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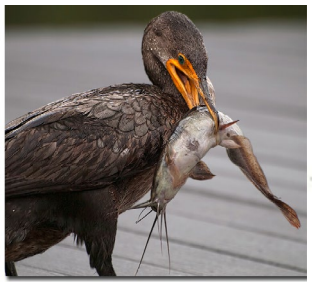
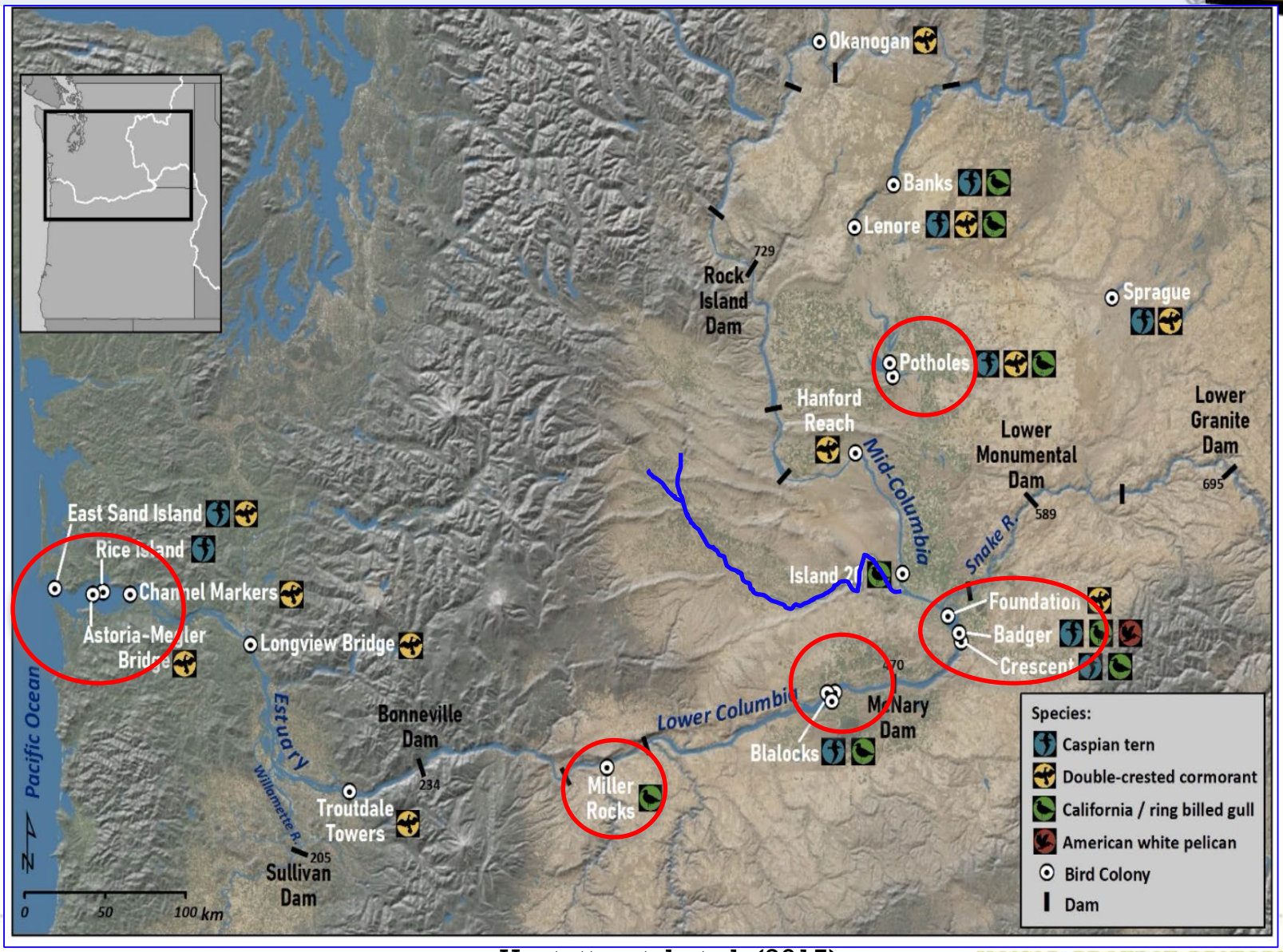
Below Prosser Da

# Background (piscivorous birds)

- Predation by piscivorous birds and fish is one of the main contributing factors to declines in anadromous fish abundance
- Avian Predation
  - Every year ~significant % of the juvenile Upper Columbia River spring Chinook salmon are consumed by avian predation (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: Avian breeding colonies




Hostetteretal et al. (2015)

# Background (piscivorous fish)

- Predation on juvenile salmon and steelhead by predator fish has increased
- lost ~3.8% of the naturally produced Chinook 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)

| Species | Size (Length and weight | Spawning Period & Water Temp. | Number of Eggs/spawner | Daily Food Consumption of Salmonids | References |
|---|---|---|---|---|---|
| **Smallmouth Bass** | 12-20 inches (upto 6 pounds) | May-June; 15-21°C | 2,000-21,000 | Up to 1.2 juvenile salmonids per day | Naughton et al., 2004, Fritts & Pearsons, 2006 |
| **Northern Pikeminnow** | 12-24 inches (upto 8 pounds) | April-June; 12-18°C | 20,000-100,000 | 15-20 juvenile salmonids per day | Poe et al., 1991, Rieman et al., 1991, Vigg et al., 1991 |
| **Channel Catfish** | 16-24 inches (upto 40 pounds) | May-July; 21-30°C | 2,000-20,000 | Up to 1% body weight (>400mm : 0.5 salmomoid/day) | Tabor et al., 1998, Zimmerman, 1999 |
| **Brown Bullhead** | 8-14 inches (2 pounds) | June-July; 21-26°C | 2,000-6,000 | < 1% body weight | Moyle, 2002, Fayram and Sibley, 2000 |
| **Walleye** | 14-28 inches (upto 20 pounds) | April-May; 6-12°C | 50,000-100,000 | Can consume up to 4% of their body weight | 1998, Schoen et al., 2012, Poe et al., 1991 |

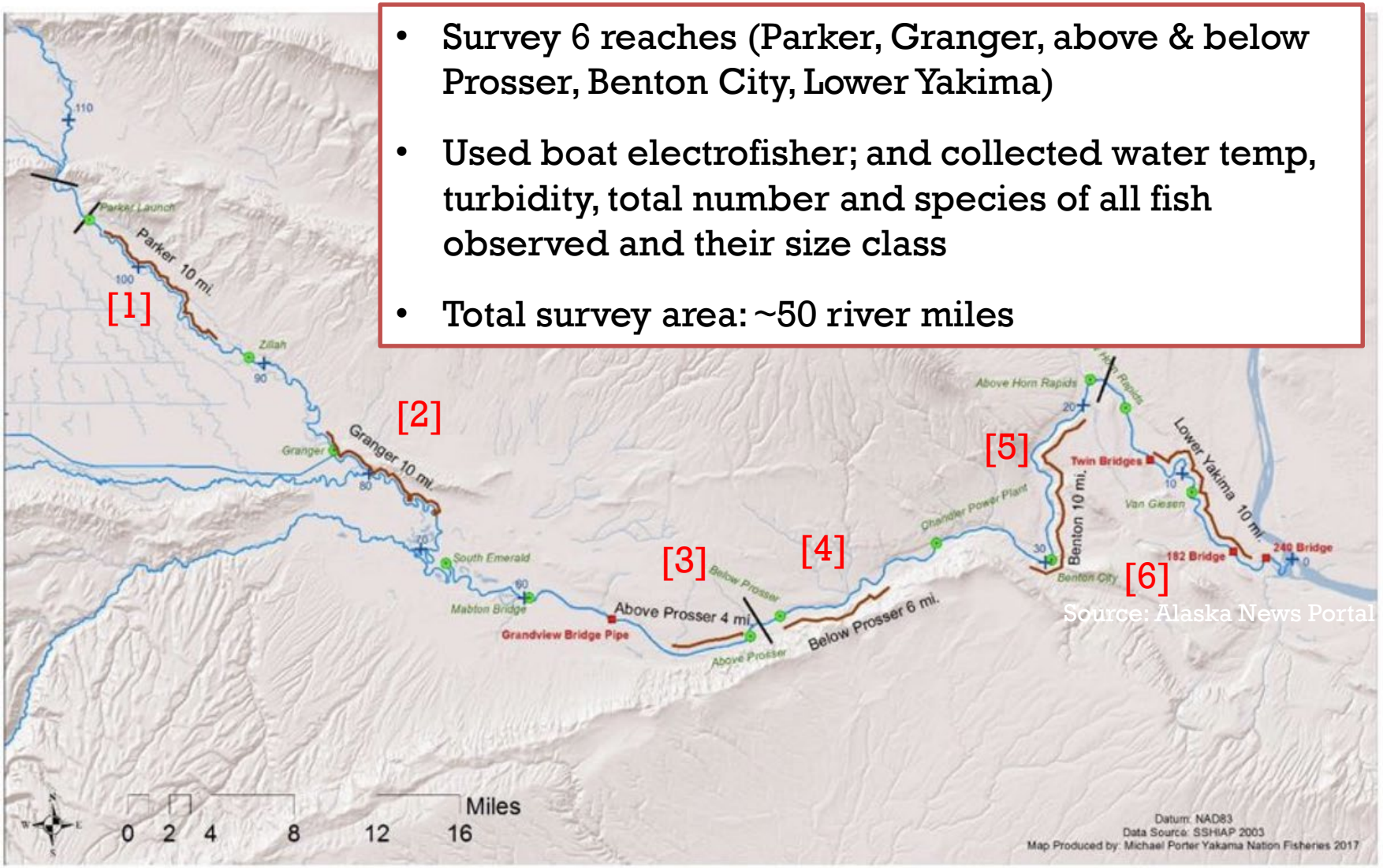
# Objectives

- To understand the impacts of predators on salmon and steelhead smolts in the Yakima river basin; specifically, we determine:
  - The abundance and distribution of both fish and avian predators in the Yakima River.
  - Diet preference by species, location and timing
  - Salmonid consumption rates by predators basin-wide
- Share the findings with regional and state managers; and also to develop the predation management plan

# Methodology

- Fish predation: fish sampling 2018-2023

- 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

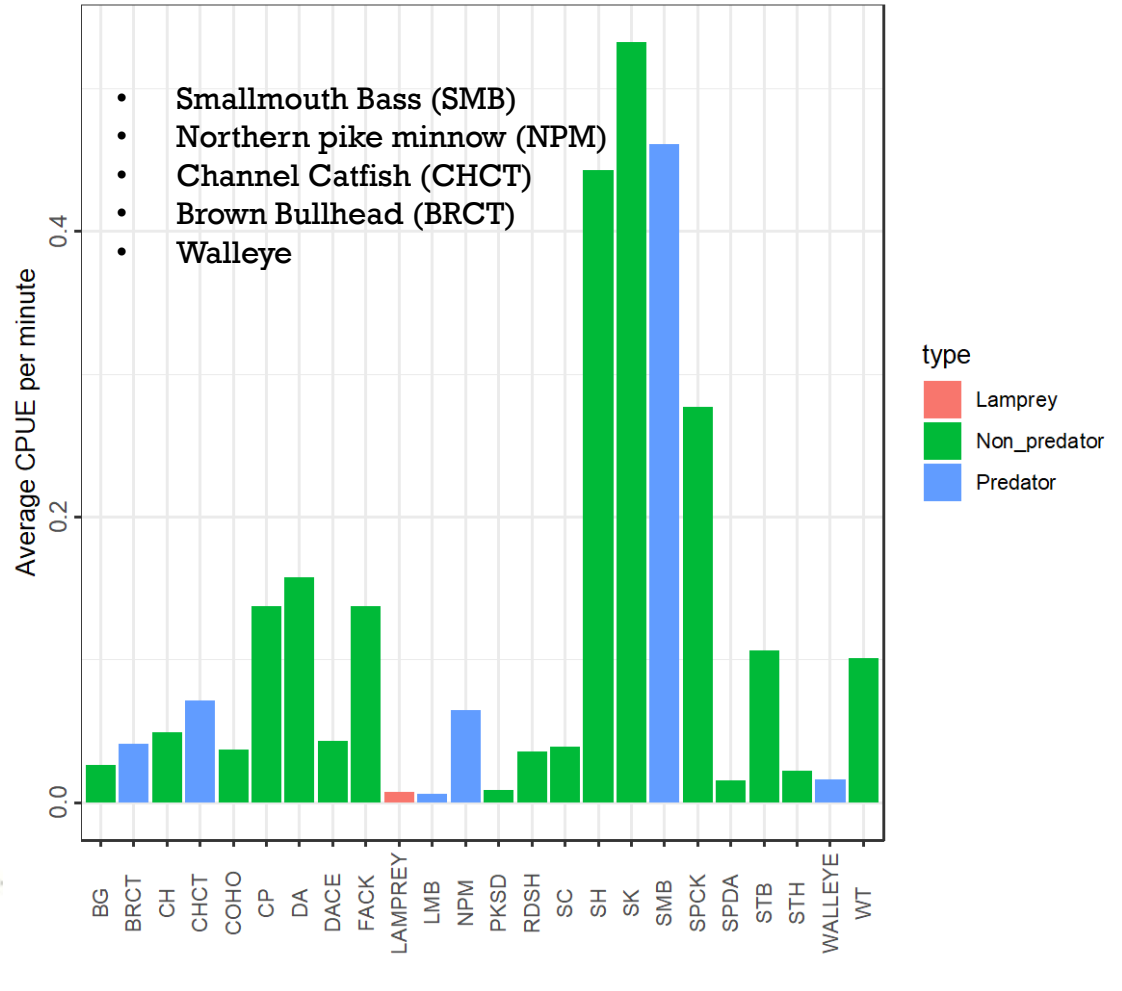



Source: Alaska News Portal

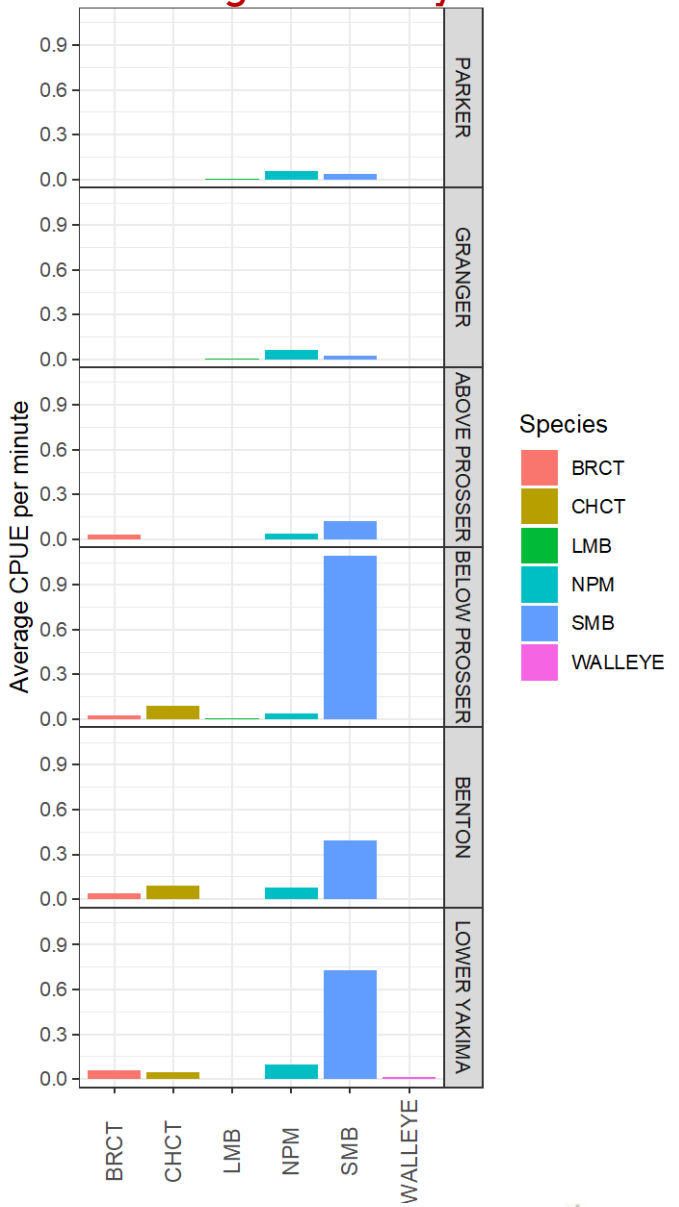
# Results: Predatory fish density by species

- The Lower Yakima River contains large numbers of piscivorous fish

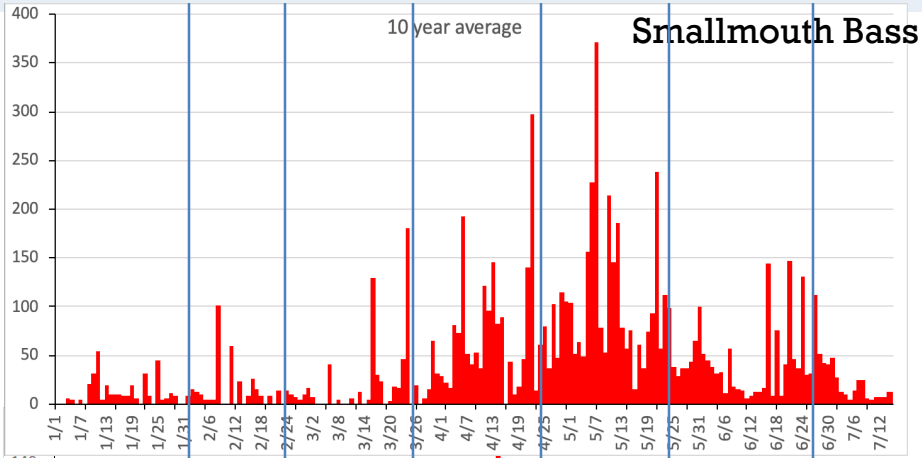
## A. Average CPUE

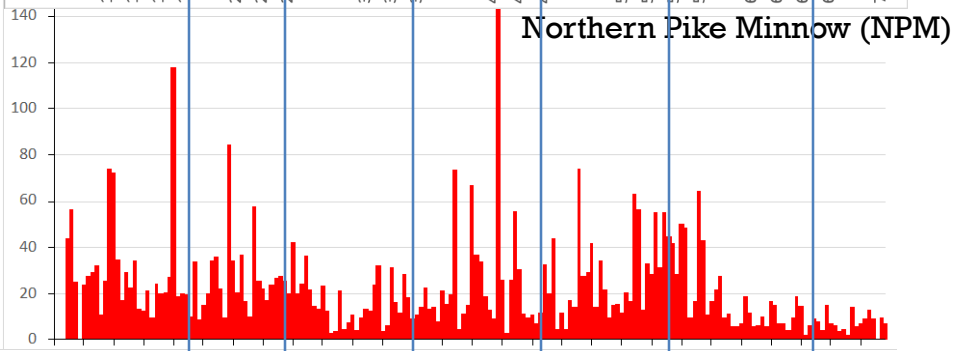


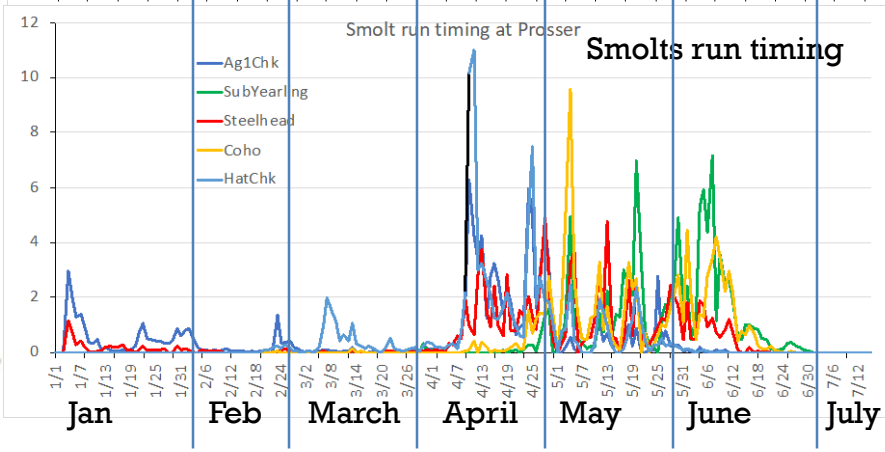

## B. Average CPUE by location

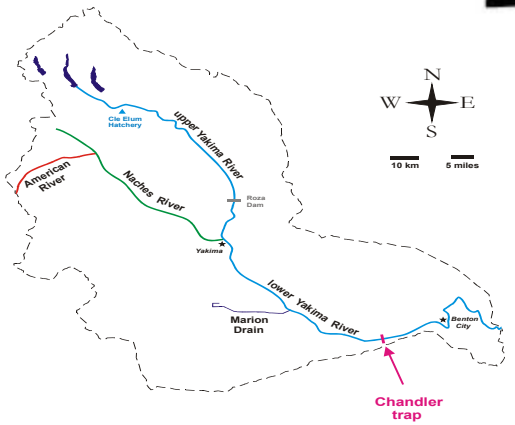


# Results: Daily counts at Prosser

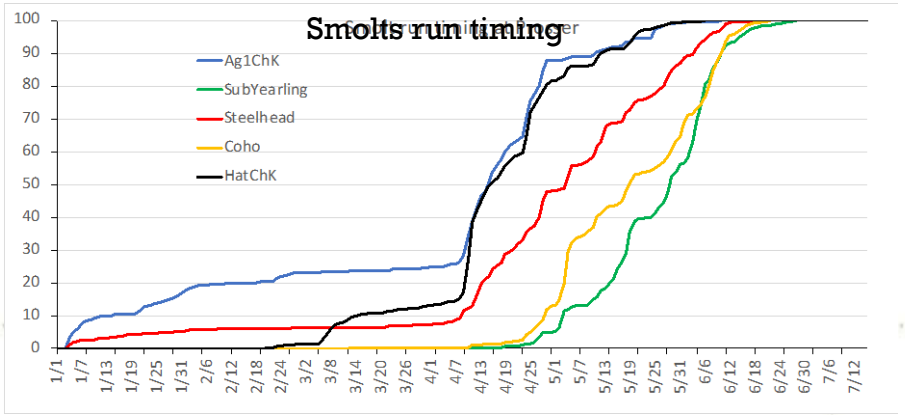


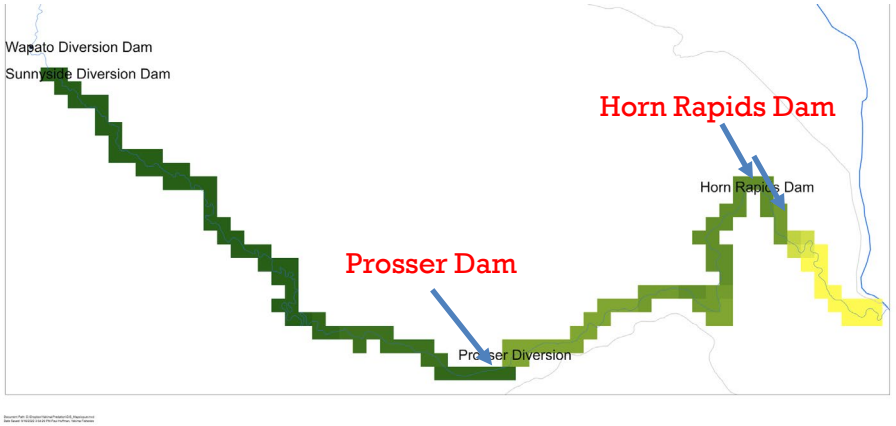

- Daily counts are expanded on the assumption that entrainment and survival rates in the Canal are similar to the Spring Chinook.
- Bigger fish are not included in the count data as the screen size for sampling allows only for smaller fish sizes.



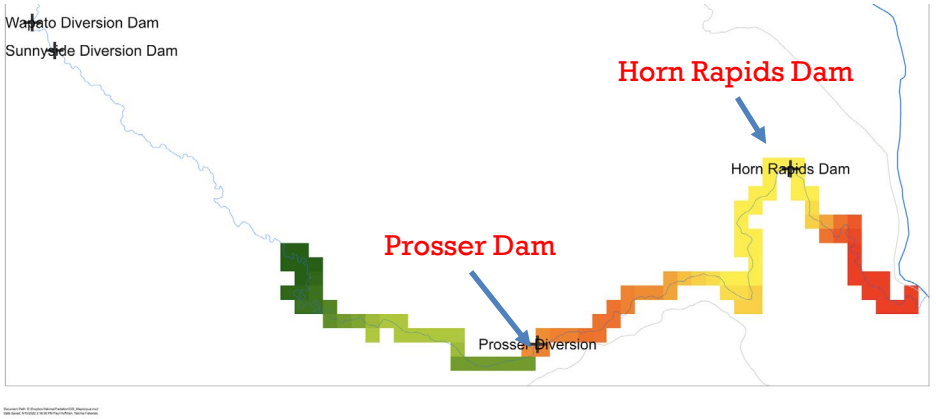
# Results: Fish predation heat map

## Smallmouth Bass

May




June




CPUE

30

15

1

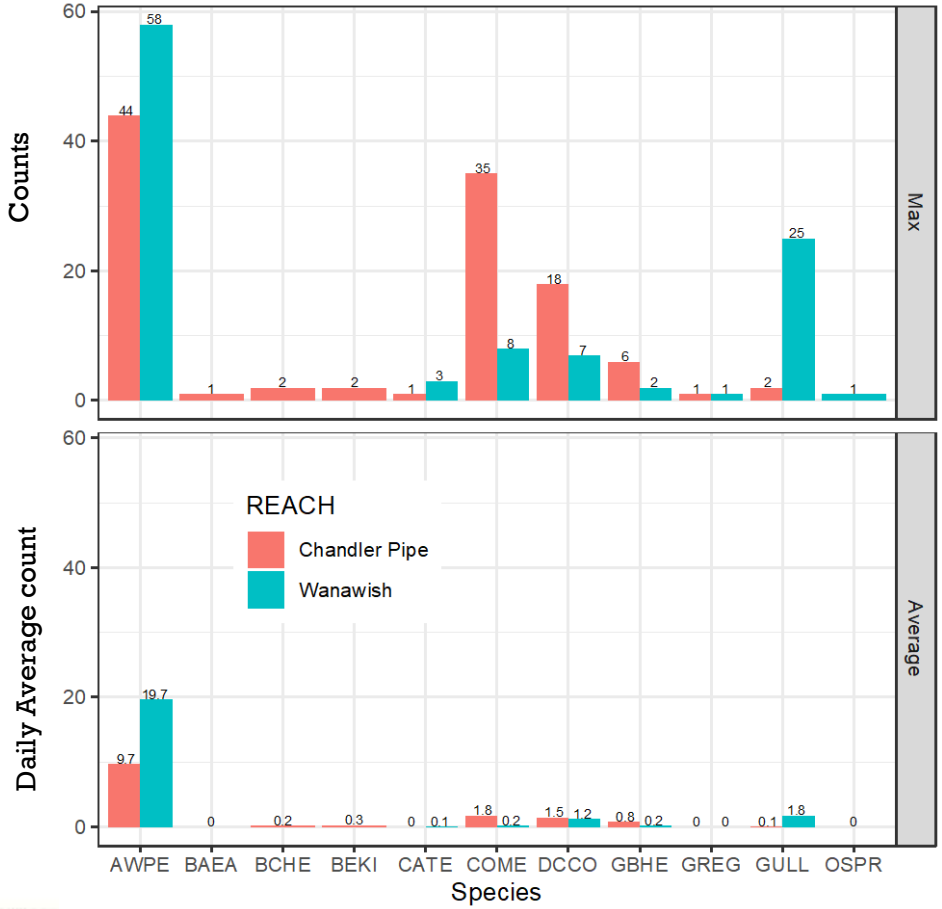
# Hotspot Surveys: Yakima River bird counts

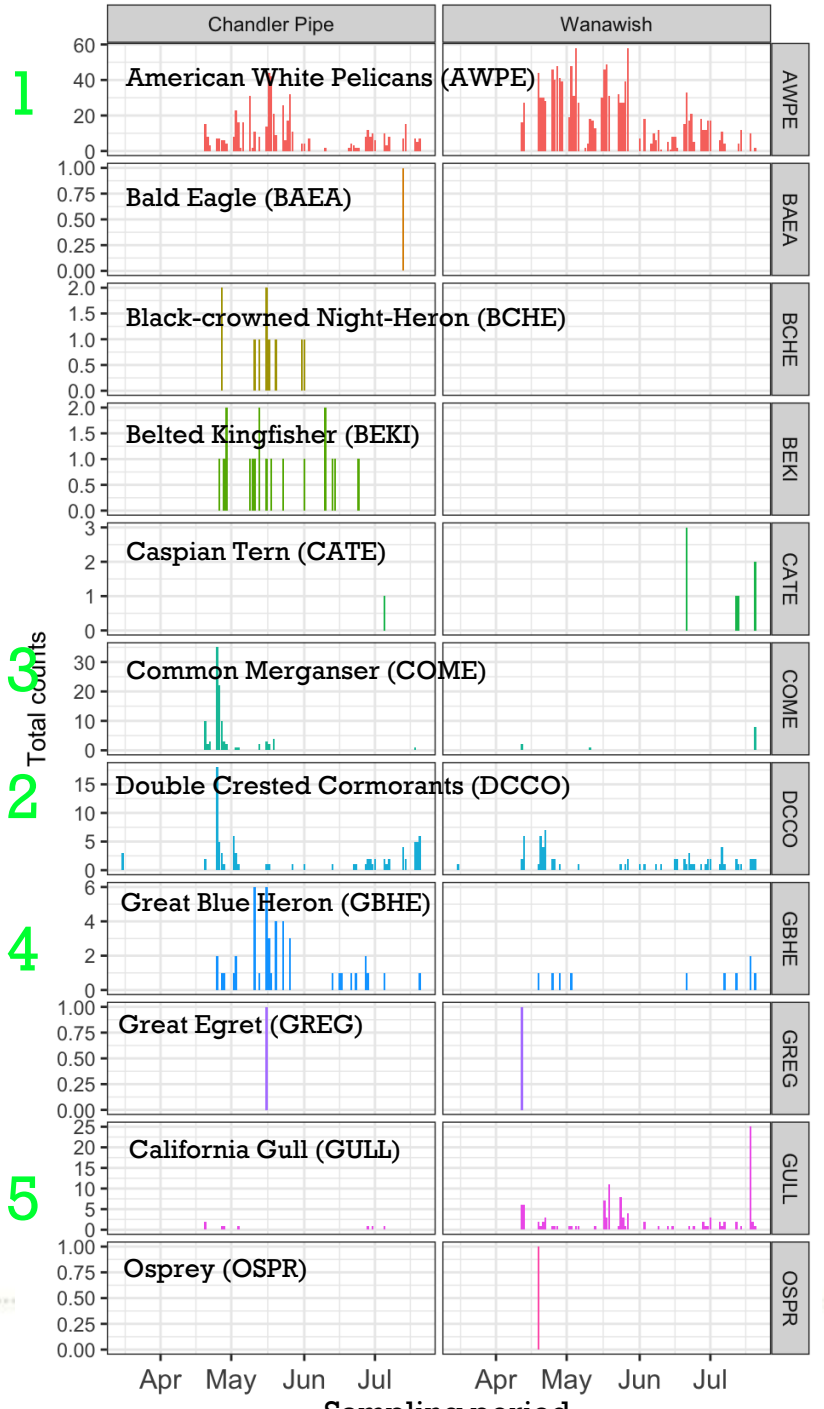
- Hotspot survey occurred from mid-March through June with 4-6 hrs./day and we usually surveyed 3 to 5 times/week, however more focus on Chandler outfall and Wanawish Dam
- Counts of pelican and other avian predator species
- Weekly flight over the Yakima River Basin (2024)

# Results: Yakima River bird counts

## Sampling Year 2022

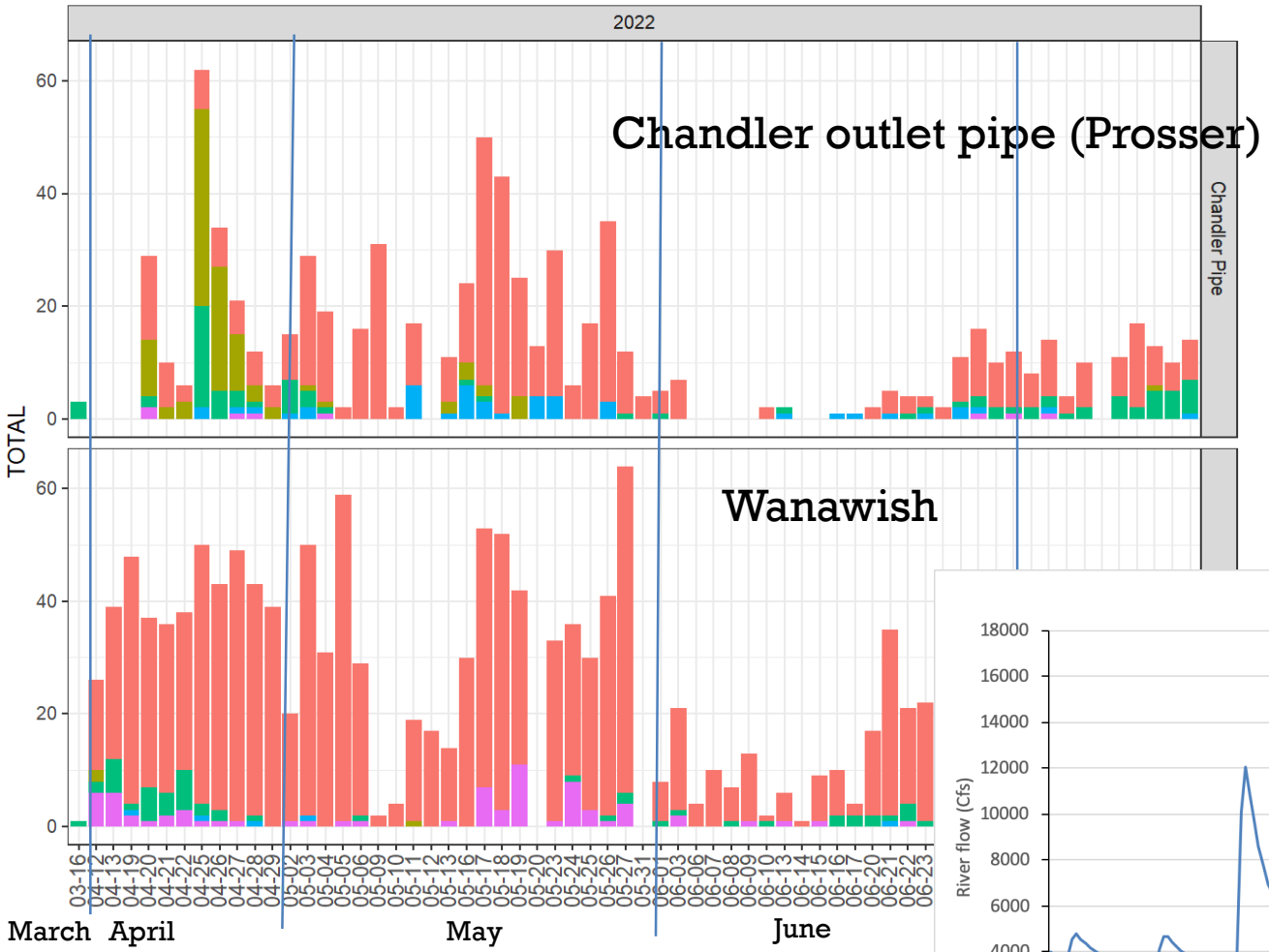
### Max. number of bird observed in a day during the sampling period



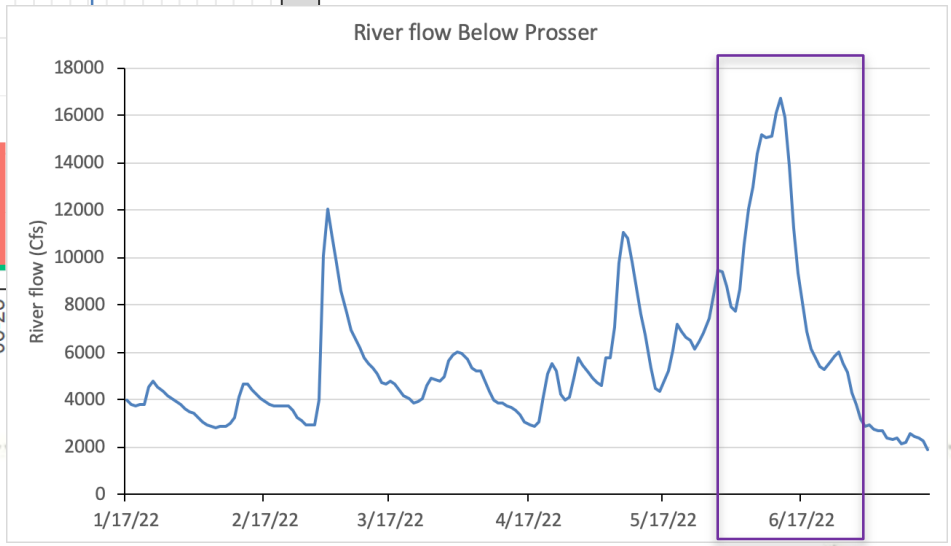



# Results: Yakima River bird counts

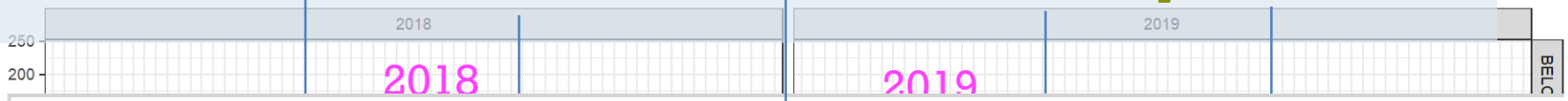
Sampling year 2022




- Pelican and Cormorants and Great blue heron were the dominating species

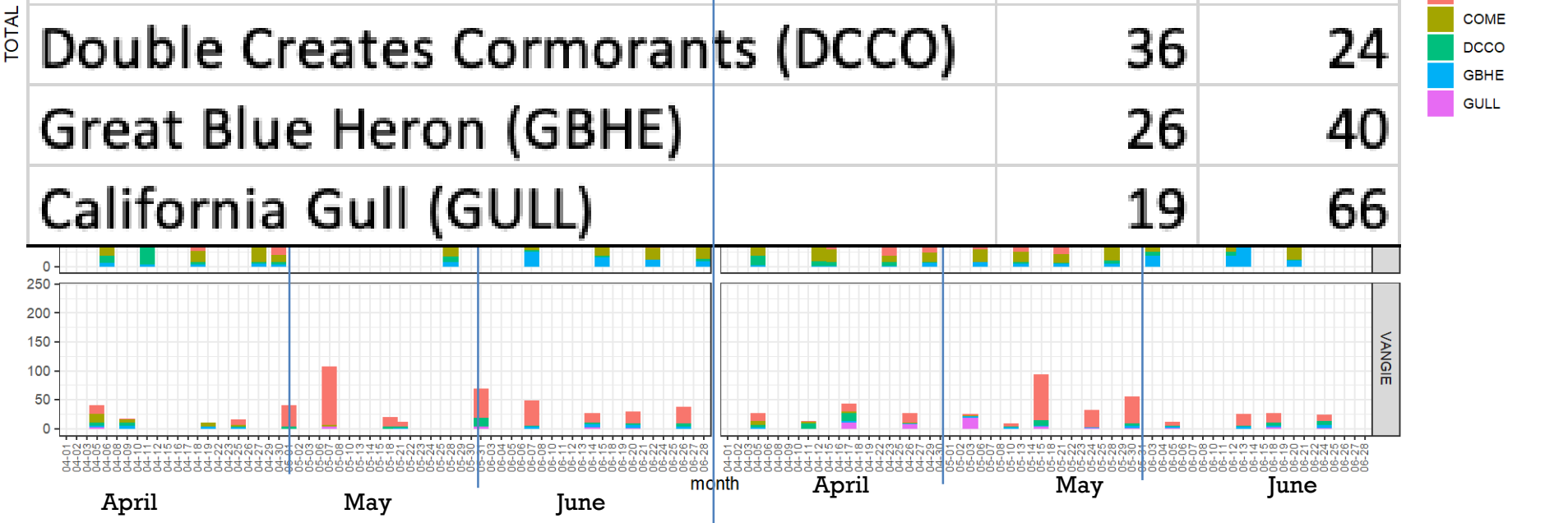



# Results: Yakima River bird counts by reach



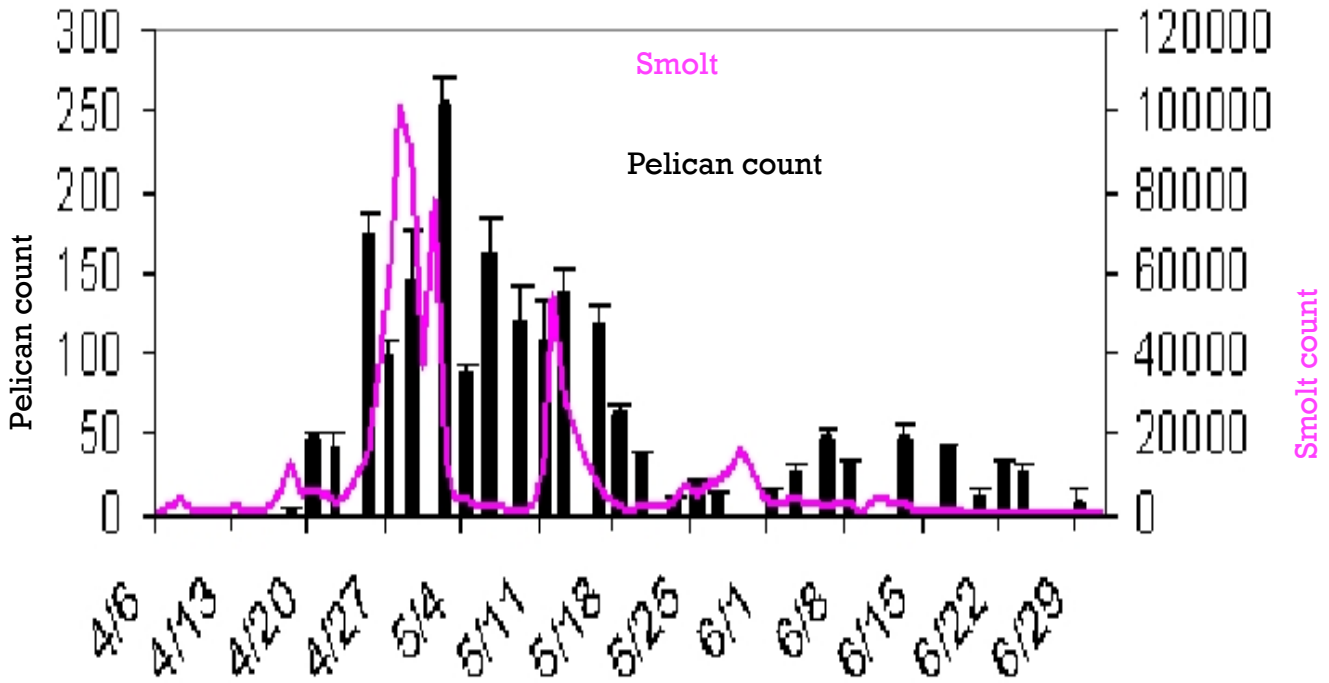

## Maximum count in a day during the sampling period

| Species | 2018 | 2019 |
|---|---|---|
| American Pelican (AWPE) | 112 | 146 |
| Common Merganser (COME) | 61 | 83 |
| Double Creates Cormorants (DCCO) | 36 | 24 |
| Great Blue Heron (GBHE) | 26 | 40 |
| California Gull (GULL) | 19 | 66 |



# Results: Predator bird and Salmon Smolt

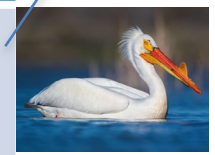
A. Daily pelican counts in Yakima river and smolt outmigration at Prosser

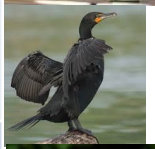


# Results: Yakima River bird counts

| 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 |

A colony the size of ~3,700 adults & 22 yearlings /pounds would equate to 162,800-488,400 smolts/day

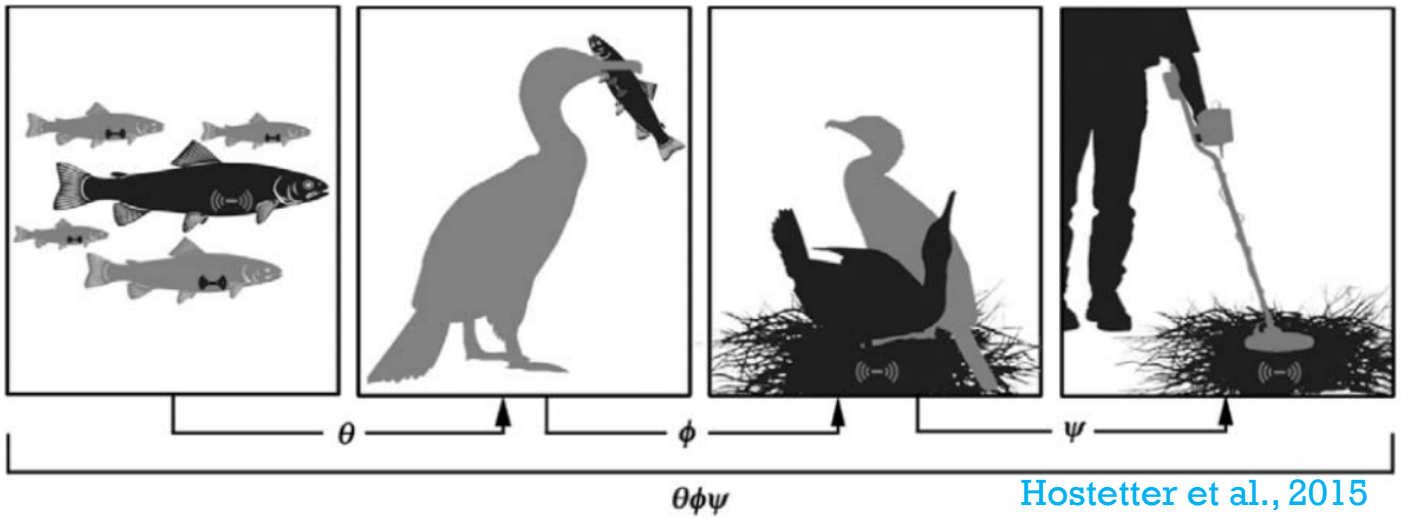




# Results: McNary smolt detection and avian predation

| Species | Annual mean Release (N) | Detection at McN | Detection % | 3MILIS | RICHIS | FOUNDI | BADGEI | CRESIS | JDPI | CBLAIS | MLRSNI | 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 |

Predation probability  Deposition Probability  Detection Probability




Hostetter et al., 2015

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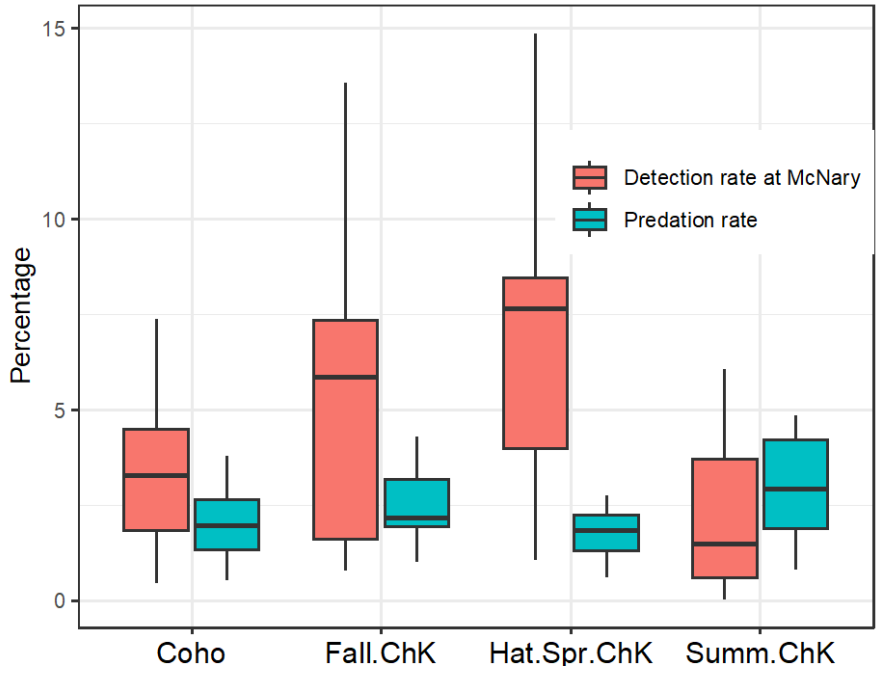
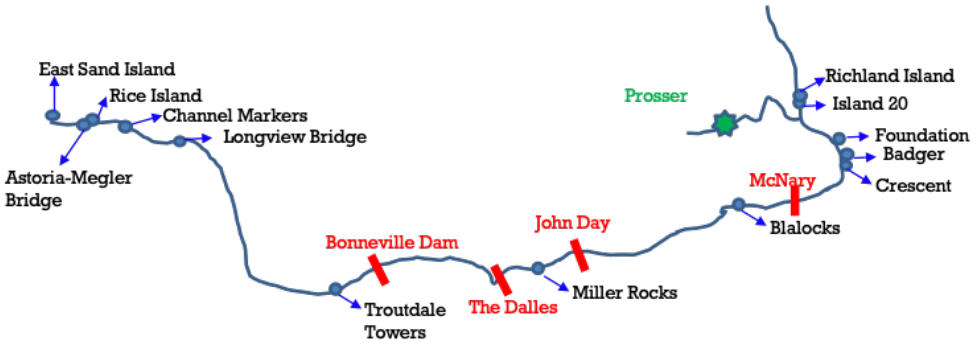
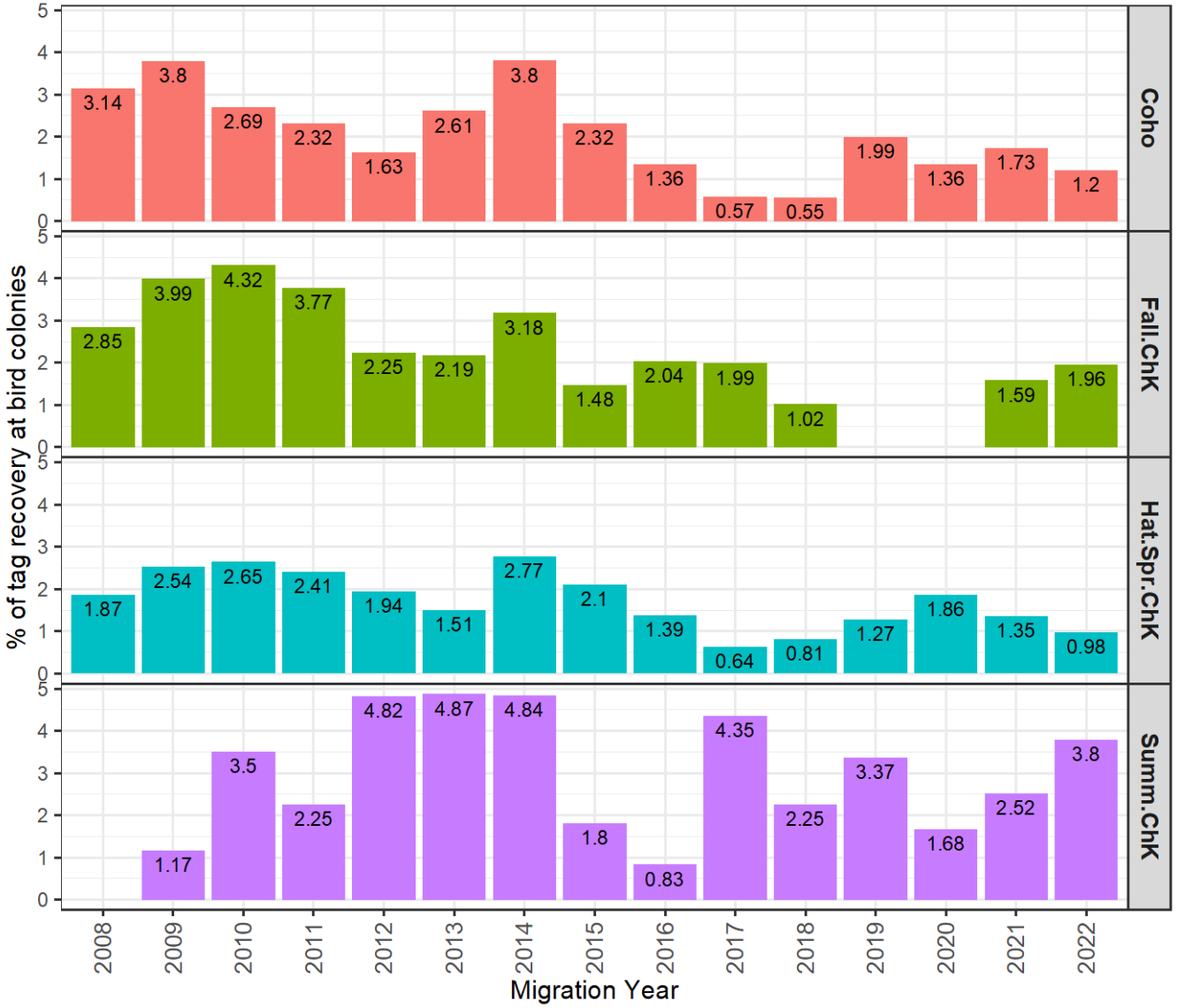
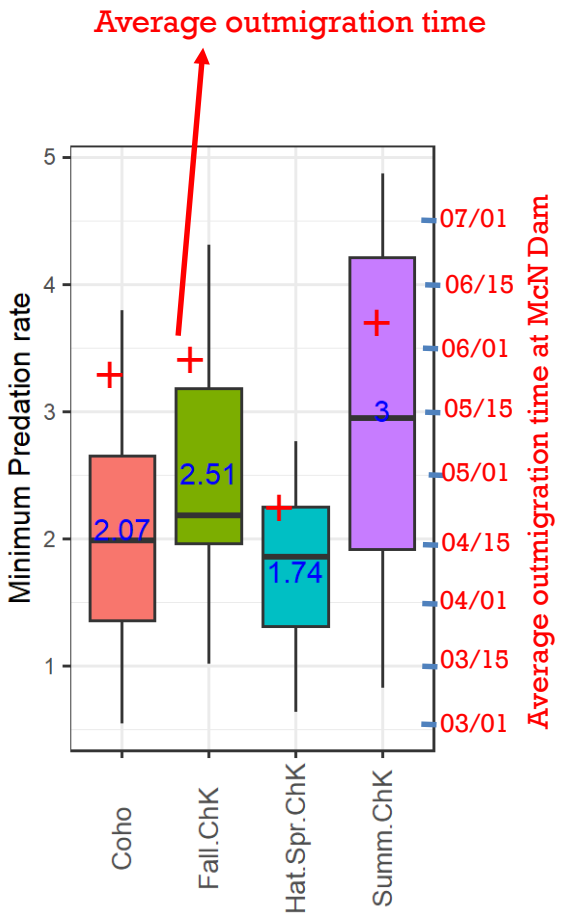


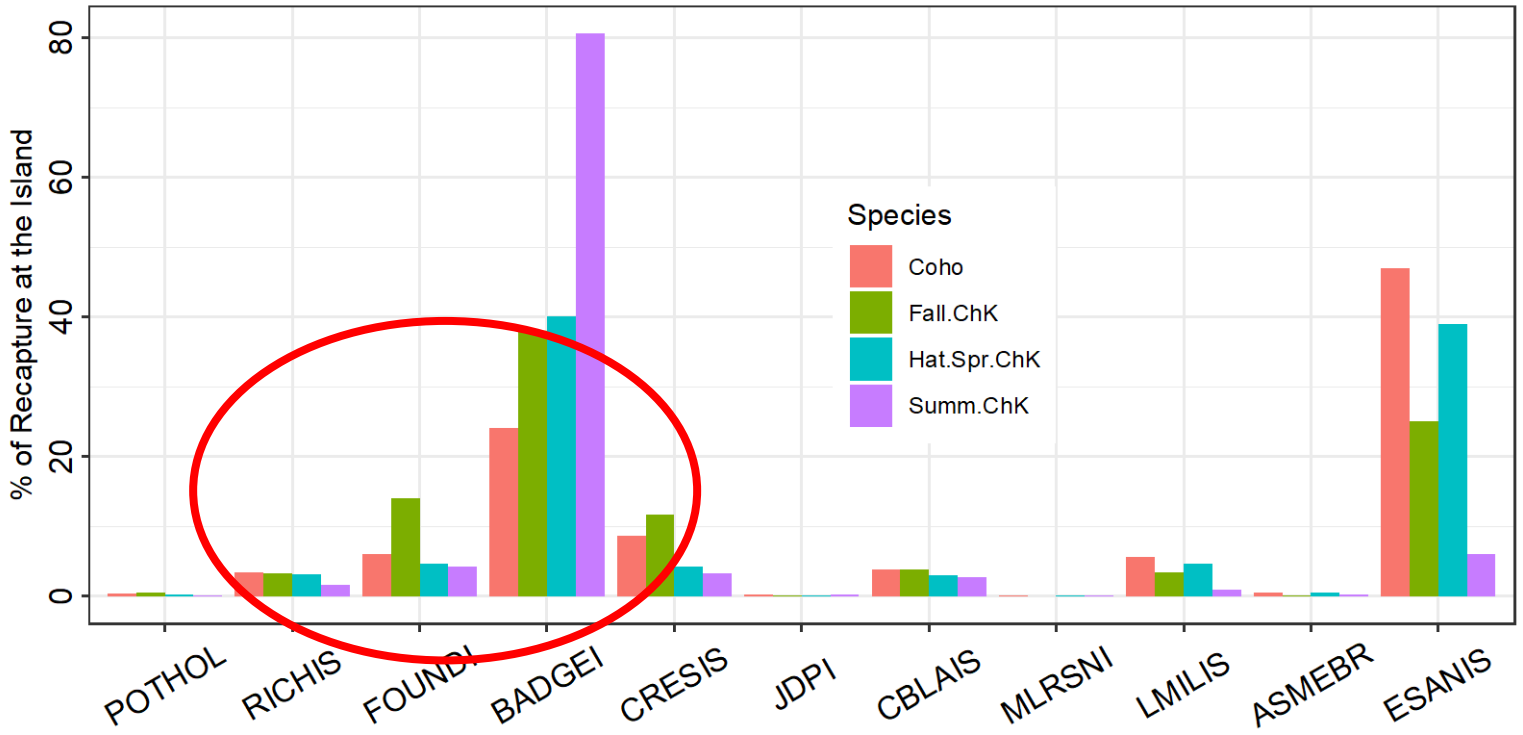
# Results: Colony predation rate by outmigration year

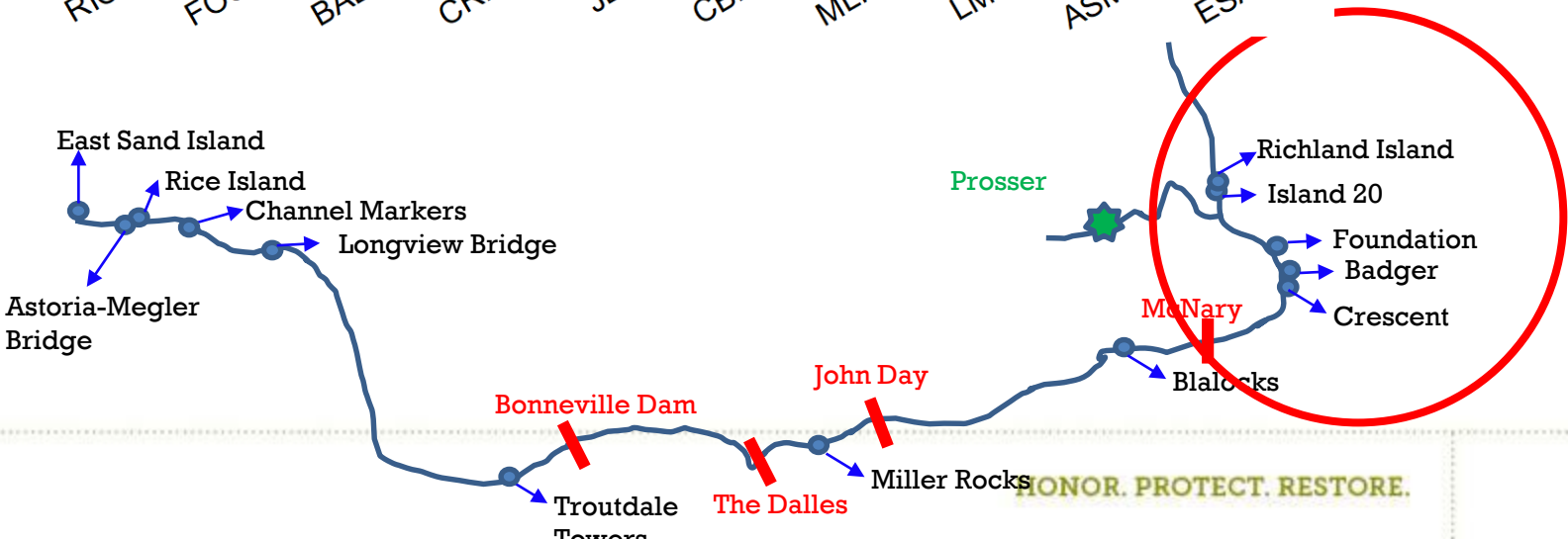


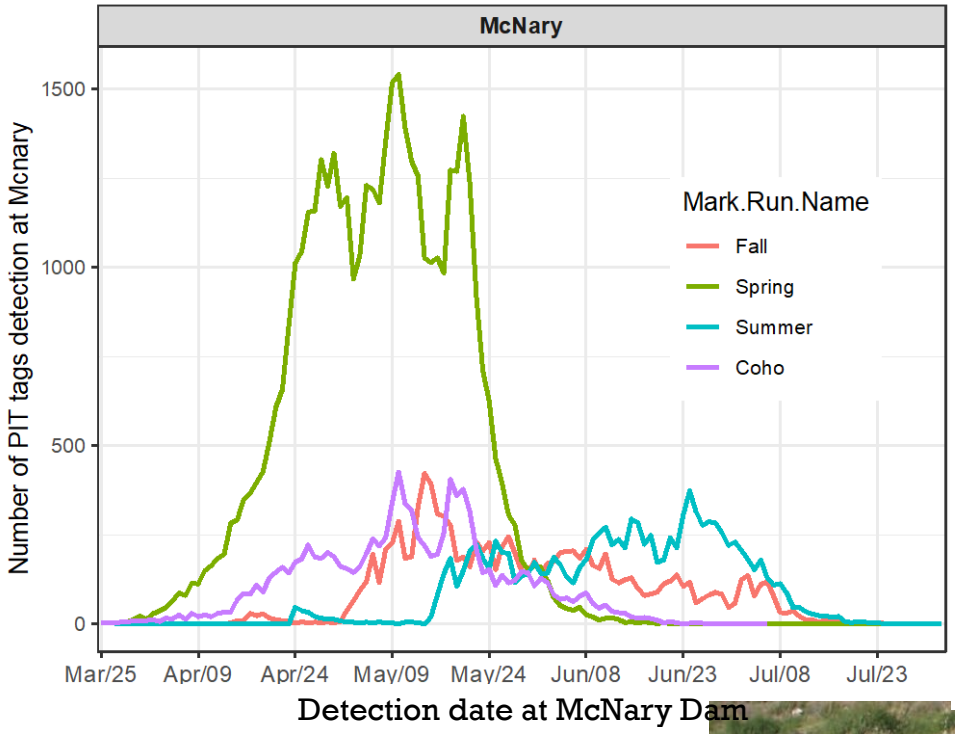

HONOR. PROTECT. RESTORE.

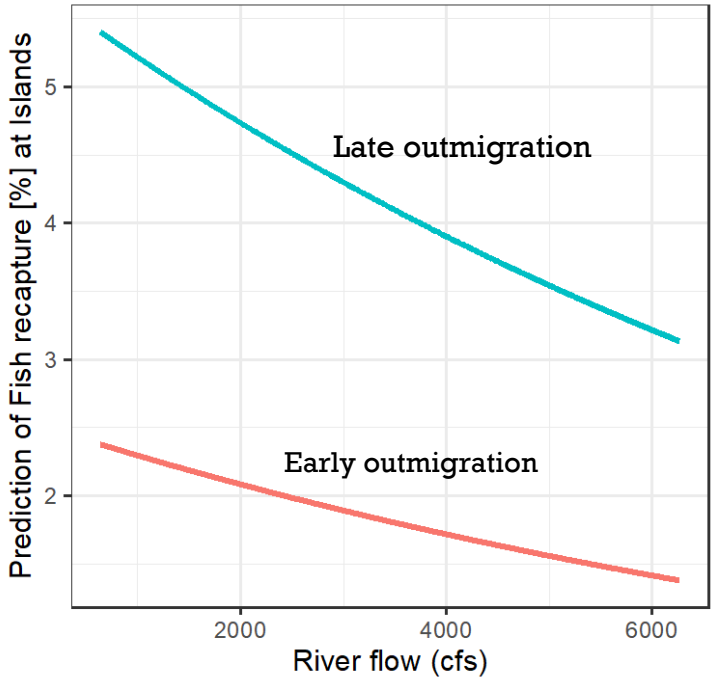
# Results: Predation rate by colony



# 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 | *** |

# Ongoing

- Keep continue hazing in the hotspots
- Since pelicans are numerous and consume a large amount of food, we are trying to estimate the pelicans diet preference and whether it varies by location and timing.

Next talk by Trenton de Boer

- Avian surveys have been conducted this year, with weekly flights over the Yakima River Basin (coordinating with Umatilla).
- RealTime Research is involved in estimating the avian predation rate.
- The predation index (avian and fish predations) will be provided to the USGS for input into their juvenile survival model.

# Acknowledgments

All crews conducting fish sampling and bird observation/hazing