Northwest **Power** and **Conservation** Council



August 6, 2024

**MEMORANDUM**

**TO:** **Council Members**

**FROM:** **Windy Schoby, Fish and Wildlife Policy Analyst- Idaho**
**Stacy Horton, Fish and Wildlife Policy Analyst- Washington**
**Kate Self, Fish and Wildlife Program Scientist**

**SUBJECT:** **Avian Predation on Salmon and Steelhead in the Columbia River Basin- An update on lessons learned, successes, and emerging issues.**

## BACKGROUND:

Presenter: Allen Evans, Scientist with Real Time Research, Inc.

Summary: Allen Evans has been involved with studies of avian predation on ESA-listed salmonids in the Columbia River Basin for over two decades. Evans will provide a brief history of the avian predation RM&E that Oregon State University, Real Time Research, and U.S. Geological Survey have conducted and will summarize the implementation of three avian predation management plans; assess the efficacy of each plan in achieving management goals and will highlight lessons learned and emerging issues.

Relevance: One of the Council's emerging priorities from the 2014 Fish and Wildlife Program calls for "preserving program effectiveness by supporting expanded management of predators." The 2020 Fish and Wildlife Program Addendum also highlights the concern about the impacts of avian predators on Columbia River salmon and steelhead and calls for adequate

funding to implement activities to reduce avian predation on juvenile salmon and steelhead.

Background: To address concerns about the impact of avian predation on the survival of smolts, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers (USACE), and their management partners developed and implemented three separate management plans to reduce predation on smolts by piscivorous colonial waterbirds nesting at four breeding colonies in the Columbia River basin: the largest Caspian tern and double-crested cormorant breeding colonies in the world (those on East Sand Island in the Columbia River estuary), and the two largest Caspian tern colonies in the Columbia Plateau region (those on Crescent Island in McNary Reservoir and on Goose Island in Potholes Reservoir).

The primary goal of these management initiatives was to reduce predation rates (proportion of available smolts consumed) on ESA-listed salmonid populations by reducing the size or eliminating the colonies identified in management plans. As part of the management plans, adaptive management actions have been conducted at various other colony locations where birds that were displaced from the managed colonies have relocated to nest.

The primary objectives of the study Evans will report on were to evaluate the efficacy of management actions to reduce predation on smolts by terns and cormorants and to assess the magnitude of predation by other, unmanaged predator species and colonies, including predation by California gulls, Ring-billed gulls, and American white pelicans.

Specifically, the project goals were to:

(1) locate and estimate the size of tern, cormorant, gull, and pelican colonies that were within foraging range of smolts in the middle Columbia River, lower Snake River, lower Columbia River, and Columbia River estuary.

(2) estimate colony-specific and cumulative (all colonies combined) predation rates on smolts as part of a system-wide evaluation of predation.

(3) evaluate the efficacy of tern and cormorant management plans to reduce predation.

(4) identify emerging predation issues and make recommendations for adaptive management.

Some of the lessons learned that will assist in adaptive management include:

1. Predation/consumption rates on salmonid smolts by piscivorous waterbirds are highly variable, depending on predator species, colony location, colony size, and year and that not all predator species and colonies pose a threat to smolt survival in the CRB.

2. Predation on smolts by Caspian terns on East Sand Island, Crescent Island, and Goose Island have been reduced as result of management actions. Target goals regarding colony sizes and predation rates have been achieved at several, but not all, tern colonies.

3. Management of double-crested cormorants on East Sand Island in the lower estuary has increased the size of cormorant colonies in the upper estuary, where cormorants have higher per capita (per bird) predation impacts on smolts. Adaptive management will be necessary to reduce predation by cormorants in the upper estuary to achieve the goals of the cormorant management plan.

4. Although management actions have successfully reduced predation at some tern and cormorant colonies, the cumulative or system-wide effects of avian predation/consumption (predation by all predator species and colonies combined) remains a substantial source of smolt mortality in the CRB, particularly for steelhead smolts.

5. Since management of Caspian terns in the estuary started in 2008, the Pacific Flyway population of terns has decreased by more than 50%. Adaptive management may now be necessary to ensure the long-term viability of terns, including providing new and improved nesting opportunities for terns outside of the basin.

Taken together, results suggest that continued system-wide avian predation RM&E, coupled with adaptive management actions, will be necessary to achieve the goals and objective of management plans and to address emerging predation issues and concerns in the future.

More information:

Avian Predation Synthesis Report

Avian Predation in the Columbia River Basin 2023 Annual Report

Caspian Tern Management Plan

Double Crested Cormorant Management Plan

Inland Avian Predation Management Plan

# Avian Predation on Salmon and Steelhead in the Columbia River Basin: An Update on Lessons Learned, Successes, and Emerging Issues

Northwest Power and Conservation Council

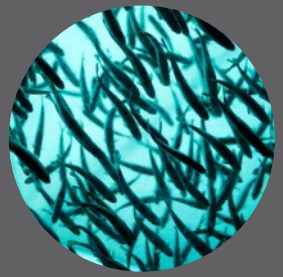
August 13, 2024

OSU Oregon State University

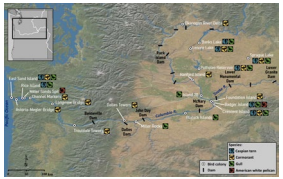
RTR REAL TIME RESEARCH

# BACKGROUND





# AVIAN PREDATION IN THE COLUMBIA BASIN

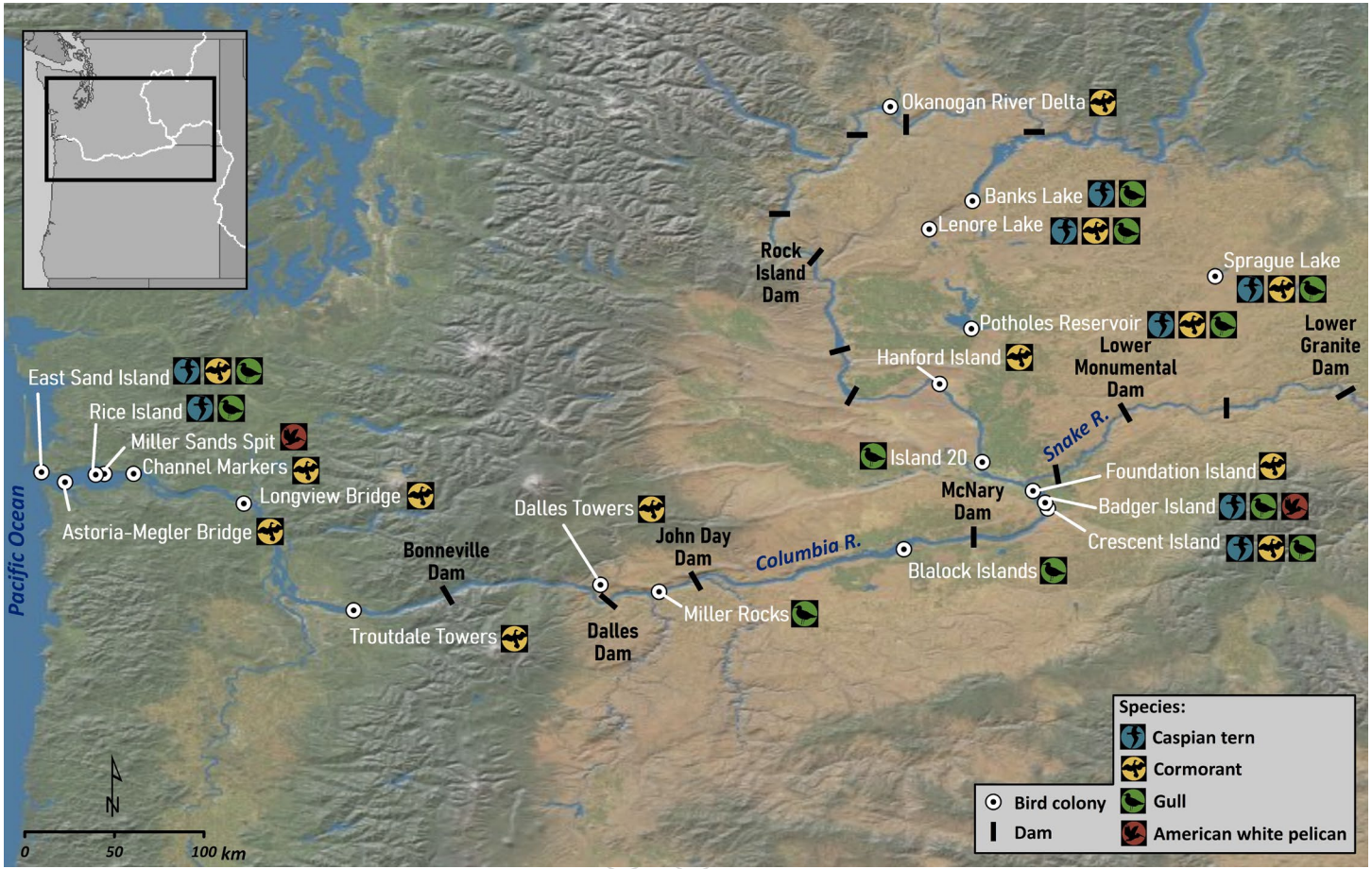


Breeding colonies of fish-eating waterbirds are widespread in the Columbia Basin and the nesting season overlaps with the smolt out-migration period.

Primary species include Caspian Terns, Double-crested Cormorants, California and Ring-billed gulls, and American White Pelicans.

Several other fish-eating waterbird species and colonies exists. Colonies are often smaller in size, and predation concerns more localized.

# AVIAN PREDATION IN THE COLUMBIA BASIN



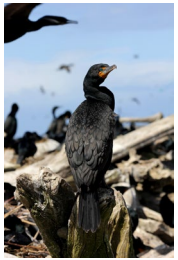
# CASPIAN TERN PREDATION IN THE COLUMBIA BASIN

Multiple breeding sites in the Columbia Basin. Inland colonies smaller than those in the estuary. The largest colony in the world was formerly on East Sand Island; Pacific Flyway population in decline (Emerging Issue).

Caspian terns have one the highest per capita (per bird) impacts on smolt survival.

Caspian terns disproportionally consume steelhead relative to salmon smolts; consumption rates can exceed 20% of available steelhead by some colonies.

# DOUBLE-CRESTED CORMORANT PREDATION IN THE COLUMBIA BASIN



Multiple breeding sites in the Columbia Basin. The largest colony was formerly on East Sand Island in the estuary. Largest colony is now on the Astoria-Megler Bridge in the estuary (Emerging Issue).

Diet composition is highly variable depending on colony location (freshwater versus marine).

Cormorants consume smolts in proportion to their availability, with colony-specific impacts more similar amongst salmonid species compared with terns.

# GULL PREDATION IN THE COLUMBIA BASIN

Multiple gull species and breeding sites in the Columbia Basin. The most abundance species, numerically, in the Basin.

Omnivorous with a diverse diet. Steal fish from other birds and disproportionately forage for fish near dams and other areas where smolts concentrate.

Consumption rates on smolts are highly variable, depending on colony size and location (0% to more than 10% of available smolts).

# AMERICAN WHITE PELICAN PREDATION IN THE COLUMBIA BASIN

Few breeding sites in the Columbia Basin. Some evidence numbers are increasing. Largest colony is on Badger Island in McNary Reservoir.

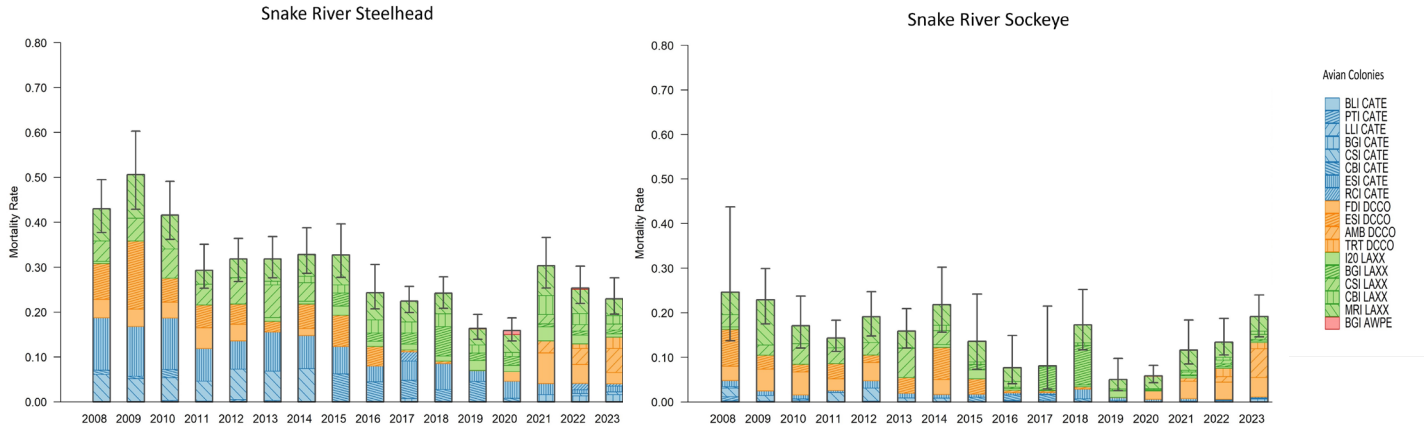
Consumption rates on yearling smolts generally low (< 1%) but predation on subyearling Chinook and fish in tributaries (Yakima R., Umatilla R.) can be substantial (> 10%). Limited research compared to terns, cormorants, and gulls.

Capable of consuming adult salmon and steelhead; recent research indicates predation on adult Sockeye Salmon can be substantial, with consumption rates upwards of 8% of the run arriving at Bonneville Dam and more than 40,000 fish consumed (Emerging Issue).

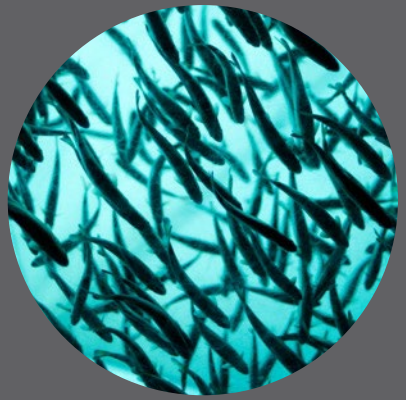
# SYSTEM-WIDE EFFECTS OF AVIAN PREDATION ON SALMONIDS

Many salmonid populations are subject to predation by multiple avian predator species (terns, cormorants, gulls, and pelicans) from several different breeding colonies during out-migration.

Cumulative effects of avian predation on smolt survival can be substantial, accounting for more than 50% of all smolt losses during out-migration in some years.



# MANAGEMENT PLANS



# IMPETUS FOR CURRENT MANAGEMENT

Caspian terns and double-crested cormorants nesting on East Sand Island (ESI) in the estuary depredated up to 25 million smolts annually, or roughly 15% of the surviving out-migrants prior to management.

Caspian terns nesting on Crescent and Goose islands in the Columbia Plateau region consumed annually from 5% to 30% of out-migrating smolts from some listed steelhead populations prior to management.

Management of terns and cormorants to reduce their impacts on smolts was called for in regional planning documents.

# AVIAN PREDATION MANAGEMENT PLANS

## CASPIAN TERNS

East Sand Island, Columbia River Estuary

## DOUBLE-CRESTED CORMORANTS

East Sand Island, Columbia River Estuary

## CASPIAN TERNS

Goose and Crescent islands, Columbia Plateau Region

## GULLS & PELICANS

No federal or state plans; Management of gulls on Miller Rocks Island in the Columbia Plateau region by the Yakama Nation

# TERN MANAGEMENT PLAN FOR THE COLUMBIA RIVER ESTUARY

## REDUCE SIZE OF ESI COLONY

From about 10,000 to 3,125 breeding pairs using passive & active nest dissuasion

## CREATE ALTERNATIVE HABITAT

For tern nesting outside Columbia Basin and attract terns to nest there

## CONDUCT MONITORING

To measure action effectiveness and inform adaptive management decisions

## ADAPTIVE MANAGEMENT

To prevent terns from nesting outside of main colony on East Sand Island and elsewhere in estuary

# CORMORANT MANAGEMENT PLAN FOR THE COLUMBIA RIVER ESTUARY

## REDUCE SIZE OF ESI COLONY

From about 15,000 to 5,600 breeding pairs nesting on East Sand Island

## CULLING ANG EGG OILING

Culling adults and oiling eggs (Phase I)

## REDUCE NESTING HABITAT

By converting nesting habitat to intertidal wetland (Phase II)

## CONDUCT MONITORING

To measure action effectiveness and inform adaptive management decisions

# TERN MANAGEMENT PLAN FOR THE COLUMBIA PLATEAU

## ELIMINATE TERN COLONIES

At Goose and Crescent islands using passive and active nest dissuasion

## CREATE ALTERNATIVE TERN HABITAT

For tern nesting outside Columbia Basin and attract terns to nest there

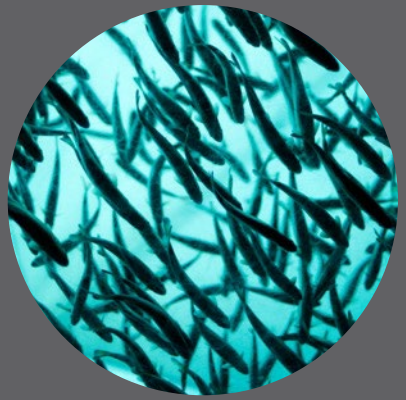
## CONDUCT MONITORING

To measure action effectiveness and inform adaptive management decisions

## ADAPTIVE MANAGEMENT

If terns relocate to other colonies in the Columbia Plateau, manage as necessary and possible

# MANAGEMENT SUCCESS AND LESSONS LEARNED



# TERN MANAGEMENT PLAN FOR THE COLUMBIA RIVER ESTUARY

## COLONY SIZE REDUCED

Less than 3,000 pairs starting in 2020; colony was just 524 pairs in 2023 (Emerging Issue)

## ALTERNATIVE HABITAT USED

Terns relocated to nesting sites outside of Basin, but sites under-utilized

## PREDATION IMPACTS REDUCED

About a 70% reduction in impacts on steelhead smolts (in 2022)

## HIGH FIDELITY TO ESTUARY

Persistent nesting attempts by terns elsewhere in the estuary, impacts largely unknown; continued adaptive management needed

# CORMORANT MANAGEMENT PLAN FOR THE COLUMBIA RIVER ESTUARY

## CULLING ANG EGG OILING

Over 5,000 adult cormorants culled and eggs from 7,000 nests oiled

## HABITAT MODIFICATIONS

Amount of available nesting habitat on East Sand Island was reduced in 2019

## COLONY MOSTLY ABANDONED

Large dispersal events from East Sand Island occurred following management

## DISPERSAL TO UPPER ESTUARY

Astoria-Megler Bridge colony has grown more that 10-fold, from 300 breeding pairs to over 5,100 pairs (in 2023), plus increases at other nesting sites (Lewis and Clark Bridge, Troutdale Towers); impacts to smolt survival are now higher (Emerging Issue)

# TERN MANAGEMENT PLAN FOR THE COLUMBIA PLATEAU

## COLONY SIZE REDUCED

Little-to-no nesting at Goose Island, colony at Crescent Island initially eliminated but now re-established

## DECLINE IN TERN POPULATION

46% decline in the regional breeding population of terns (as of 2023)

## PREDATION IMPACTS REDUCED

Reduction on steelhead predation achieved at some but not all colonies; greatest benefit to UCR steelhead

## HIGH FIDELITY TO REGION

Crescent Is. colony re-formed, persistent nesting attempts at Goose Island and other sites; adaptive management needed and has been successful in some cases (like in 2023)

# TERN MANAGEMENT PLAN FOR THE COLUMBIA PLATEAU

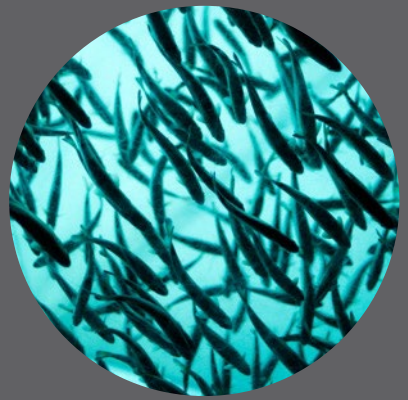
## RM&E DISCOVERS NEW COLONY

A basin- or system-wide aerial survey located an incipient tern colony in Potholes Reservoir in May of 2024

## ADAPTIVE MANAGEMENT IMPLEMENTED

U.S. Bureau of Reclamation via APHIS passively dissuaded terns from the island within 72 hours

# EMERGING ISSUES



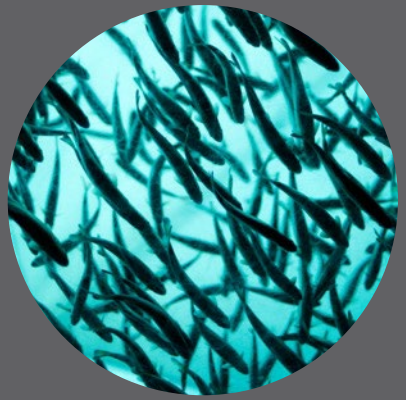
# EMERGING ISSUES

**Status of Caspian terns in the Pacific Flyway:** ESI colony reduced to just 524 pairs in 2023, well below the target colony size of 3,125 pairs. Colony has failed to produce young in recent years and the colony has been affected by avian influenza. Pacific Flyway population has declined by more than 50% (as of 2021).

**Double-crested cormorant predation in the estuary:** Predation in the upper estuary (AMB and other sites {Lewis & Clark Bridge, Troutdale Towers}) is now greater than that of predation by birds that formerly nested on ESI in the lower estuary.

**American white pelican predation:** Increasing numbers of pelicans in the Columbia Basin over the last two decades. Predation on smolts and adult Sockeye Salmon can be substantial in some years.

# SUMMARY



# CASPIAN TERN PREDATION REDUCED AT MANAGED COLONIES

## SMOLT IMPACTS REDUCED

East Sand Island impacts reduced by 70% on steelhead smolts
Goose Island impacts reduced by 90% on UCR steelhead

## STRONG FIDELITY TO REGION

Some colonies have recently reformed (Crescent Island) and terns continue to attempt to nest at historical breeding sites in the region

## ADAPTIVE MANAGEMENT NEEDED

To reach management objectives and to maximize the benefits to smolts from managing avian predators

## STATUS OF FLYWAY POPULATION A CONCERN

To ensure long-term viability of terns in the region, a larger colony at ESI may now be warranted, as well as increases in the size and productivity of terns at other, alterative colony sites in the Pacific Northwest

# PREDATION BY DOUBLE-CRESTED CORMORANTS HAS INCREASED

## SMOLT IMPACTS REMAIN SIGNIFICANT

Dissuasion of cormorants on ESI reduced the colony as intended by the Plan, but displaced cormorants relocated to colonies in the upper estuary and predation impacts are now higher than those that occurred prior to management.

## ADAPTIVE MANAGEMENT NEEDED

To reach management objectives, predation by cormorant nesting in the upper estuary should be reduced and the colony at ESI re-established to the size identified in the Plan (about 5,400 – 5,900 pairs).

# PREDATION BY GULLS AND PELICAN IS A GROWING CONCERN

## CONSUMPTION RATES VARY

Per capita consumption rates by gulls and pelicans are lower than those of terns and cormorants, but predation can be substantial, particularly for colonies located near dams, diversion sites, tributaries, and other areas where smolts congregate

## PELICANS CONSUME ADULT SALMONIDS

Adult Sockeye Salmon and other larger-sized fish. Predation on adult Sockeye Salmon substantial in some years

## PREDATION IMPACTS ARE LESS UNDERSTOOD

Data on colony sizes, connectivity, and predation impacts are less understood compared with terns and cormorants

## LIMITED OR NO MANAGEMENT

No basin-wide management plans for gulls and pelicans

# RM&E with ADAPATIVE MANAGEMENT

System-wide RM&E is needed to fully evaluate the effects of avian predation on smolt survival and to evaluate the efficacy of bird management actions to reduce predation.

Not all avian species and colonies pose a threat to smolt survival and identifying new colonies and estimating predation impacts is important to both fisheries and wildlife managers.

Avian predation occurs over large spatial-scales and colonies are inter-connected. Adaptive management is critical to the success of management plans.

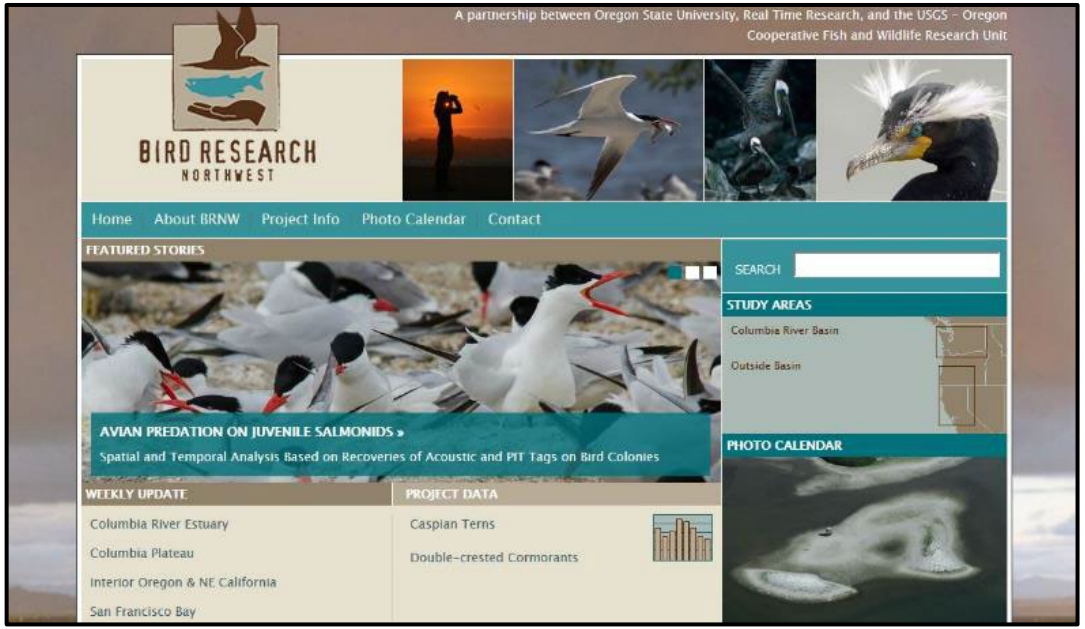
# MORE INFORMATION

***Bird Research Northwest***

Annual Reports to BPA and other funders

Peer-reviewed manuscripts

Project updates




www.birdresearchnw.org

# ACKNOWLEDGEMENTS


## PRINCIPLE INVESITAGORS

Allen Evans (RTR, Co-PI) & Dr. Rachael Orben (OSU, Co-PI)
Dr. Dan Roby (OSU & USGS, retired) & Ken Collis (RTR, retired)

## FUNDING

BPA & Grant County PUD (via the PRCC); USACE and BOR (previously)

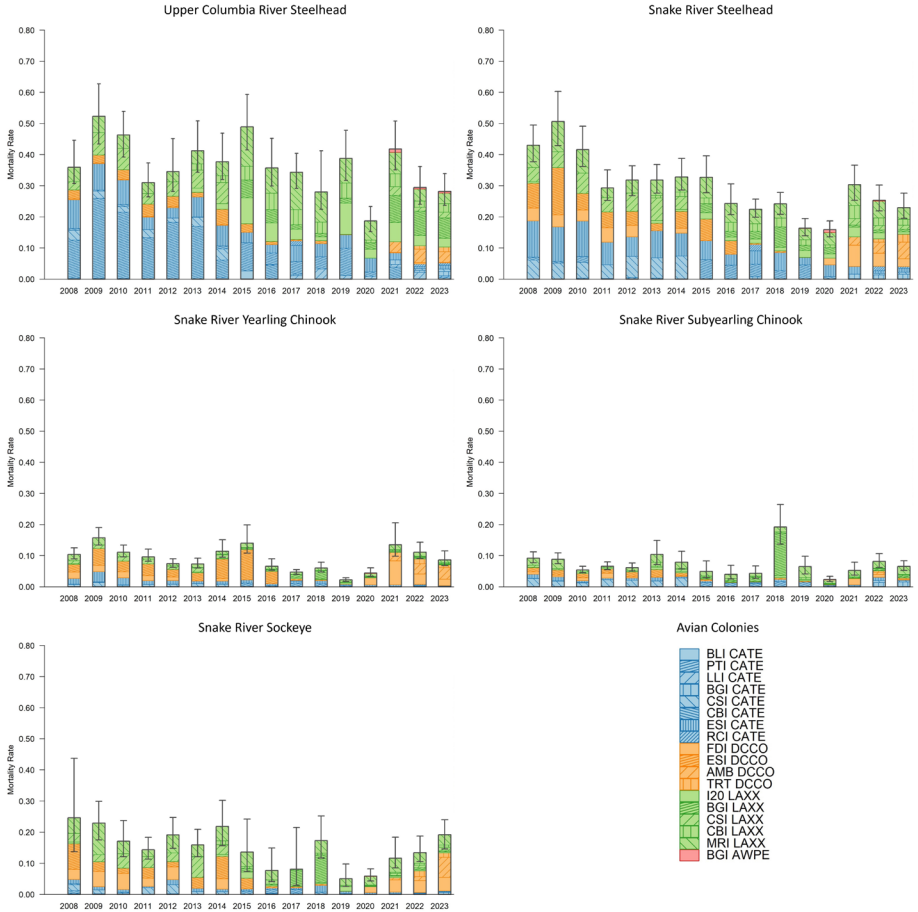
## COOPERATORS

USFWS, BOR, USACE, ODFW, WDFW, and NOAA Fisheries

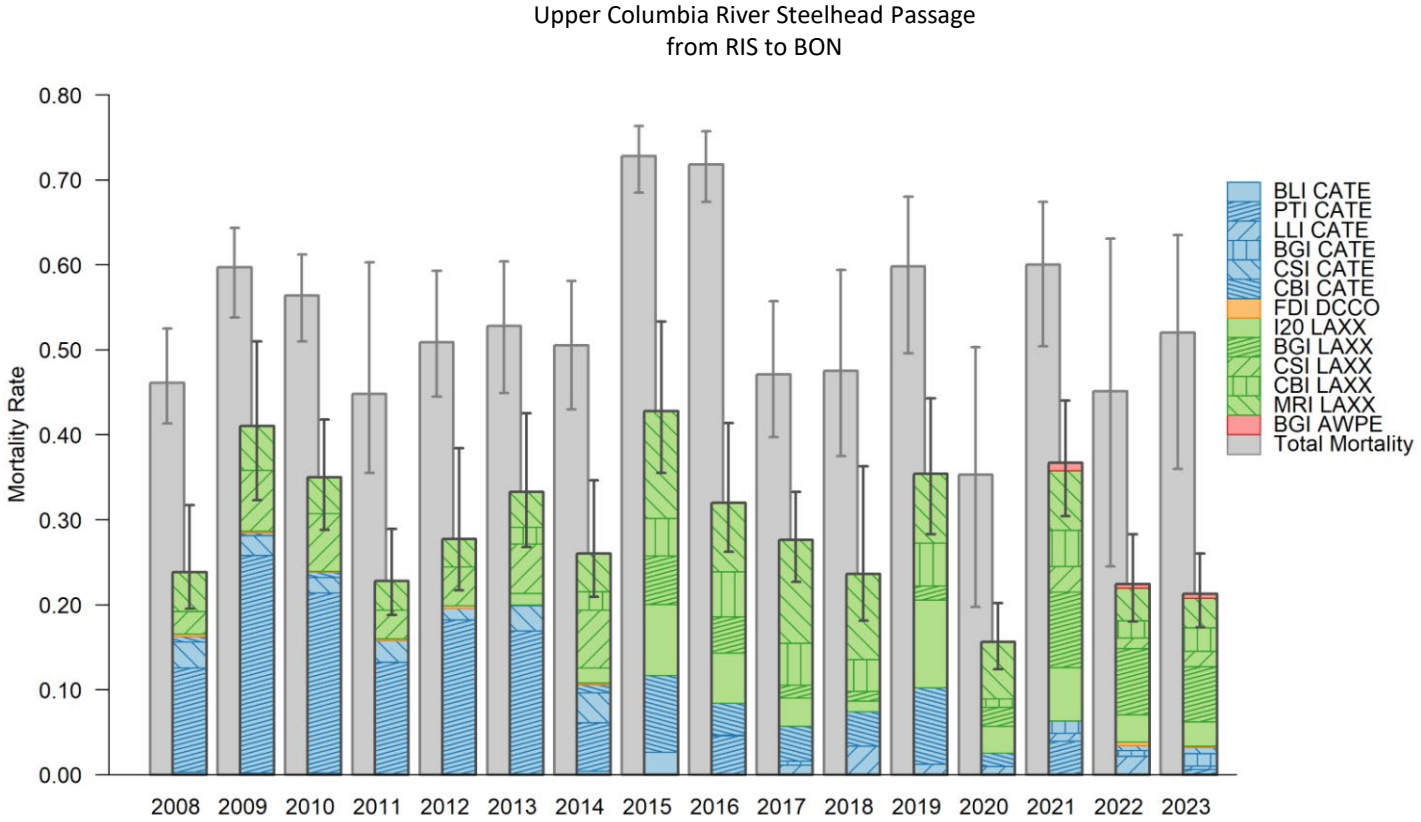

# THANK YOU

## QUESTIONS?

# SYSTEM-WIDE EFFECTS OF AVIAN PREDATION ON SALMONIDS



# ADDITIVE EFFECTS OF PREDATION



# ADDITIVE EFFECTS OF PREDATION