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

September 5, 2018

MEMORANDUM

TO: **Council Members**

FROM: **Laura Robinson**

SUBJECT: **Presentation on avian predation on juvenile salmonids in the Columbia River Basin**

BACKGROUND:

Presenter: Dan Roby, U.S. Geological Survey and Oregon State University

Summary: Dan Roby is the Unit Leader – Wildlife for the U.S. Geological Survey - Oregon Cooperative Fish and Wildlife Research Unit and Professor of Wildlife Ecology in the Department of Fisheries and Wildlife at Oregon State University. He received a B.A. (Biology) from Antioch College in 1974, a M.S. (Wildlife Management) from the University of Alaska Fairbanks in 1978, and a Ph.D. (Biology) from the University of Pennsylvania in 1986. Dan has conducted research on the ecology of seabirds in Alaska, Hawaii, Greenland, Newfoundland, South Georgia, China, and Antarctica, as well as throughout the Pacific Northwest region of the U.S. His primary area of research interest is the physiological ecology and conservation biology of birds, with an emphasis on seabirds.

Over the last 23 years, Dan has been involved in research on the impact of avian predation on recovery of ESA-listed salmonids in the Columbia River Basin and non-lethal methods to mitigate those impacts. This monitoring and suppression work was conducted by Oregon State University, U.S. Geological Survey, Real Time Research, and NOAA

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

Fisheries. At the September Council meeting, Dan will provide a summary of their findings and the impact of their work.

Relevance: One of the Council's emerging priorities from the 2014 Fish and Wildlife Program addresses "preserving program effectiveness by supporting expanded management of predators."

Workplan: Addresses the updated Fish and Wildlife Division Workplan: *predation presentations – avian predation*

Background: Avian predation on out-migrating smolts has been identified as a factor that limits the survival of juvenile salmonids (*Oncorhynchus* spp.) in the Columbia River Basin; addressing avian predation concerns is a component of Biological Opinions and Reasonable and Prudent Alternatives (RPAs) associated with the management of the Federal Columbia River Power System. Over the last two decades, numerous avian predation RM&E studies have been conducted to assess the impacts on smolt survival of consumption by Caspian terns (*Hydroprogne caspia*), double-crested cormorants (*Phalacrocorax auritus*), California and ring-billed gulls (*Larus californicus* and *L. delawarensis*), and American white pelicans (*Pelecanus erythrorhynchos*) in the Columbia River Basin. As part of this work, over 50 technical reports and 40 peer-reviewed scientific publications have been written regarding avian predation on juvenile salmonids in the basin and elsewhere, covering a wide range of topics (see www.birdresearchnw.org).

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 rates on smolts by piscivorous waterbirds nesting at four breeding colonies in the Columbia River basin: the largest Caspian tern and double-crested cormorant breeding colonies in the basin; 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 of or eliminating the breeding colonies at each of these four colony sites. Management initiatives implemented at these four colony sites have been primarily non-lethal strategies for Caspian terns (i.e. passive and active nest dissuasion) and primarily lethal strategies for double-crested cormorants (i.e. culling and egg-oiling). As part of the management plans for Caspian terns, the USACE created alternative nesting habitat for terns at various locations outside the Columbia River Basin (i.e. northeastern California, southern Oregon, and San Francisco Bay) to compensate for reductions in tern nesting habitat

on East Sand Island and elimination of tern nesting habitat on Crescent and Goose islands.

As part of this BPA-funded project (Project No. 199702400), and with cost sharing from the USACE's Portland District, the team:
(1) collected monitoring data and helped implement, adaptively manage, and evaluate the Caspian Tern Management Plan for the Columbia River Estuary (2011-2018) and
(2) collected data used to develop the Double-crested Cormorant Management Plan for the Columbia River Estuary (2011-2014).

As part of the work for the Caspian Tern Management Plan, the team:
(1) helped reduce the amount of suitable Caspian tern nesting habitat on East Sand Island from six acres to just one acre, the management target for designated colony area,
(2) restricted Caspian tern nesting on East Sand Island to just the designated colony area using a combination of passive and active tern nest dissuasion techniques, and
(3) monitored the effectiveness of these efforts in
    (a) reducing Caspian tern colony size on East Sand Island from approximately 10,600 breeding pairs in 2008 to approximately 5,000 breeding pairs in 2018;
    (b) increasing emigration rates of Caspian terns from the Columbia River estuary to colony sites located outside the Columbia River basin, including the USACE-constructed colony sites; and
    (c) reducing predation rates on ESA-listed juvenile salmonids by Caspian terns nesting on East Sand Island to some of the lowest rates ever recorded for that colony in 2017.

Despite these successes, a number of critical uncertainties remain (below), and recent developments suggest that predation impacts from piscivorous colonial waterbirds in the Columbia River Basin may be increasing at a time when funding for avian predation RM&E in the Basin is either being eliminated (USACE) or sharply reduced (BPA).

- The Caspian tern colony on East Sand Island, which consisted of about 5,000 breeding pairs in 2018, remains much larger than the target colony size of 3,125 breeding pairs deemed acceptable by NOAA Fisheries
- Caspian terns are returning to nest on Rice Island in increasing numbers; Rice Island was the site of a large Caspian tern colony in the late 1990s, before the colony was relocated to East Sand Island to reduce its impact on smolt survival
- Double-crested cormorants abandoned the East Sand Island colony site in 2017, and increasing numbers are now nesting on the Astoria-Megler Bridge, where impacts to survival of out-migrating smolts are likely higher
- Caspian terns that have been dissuaded from nesting at Crescent and Goose islands in the Columbia Plateau region have mostly

remained in the region, and many are nesting at new sites where predation impacts may be as high or higher than at the original managed colony sites
• USACE-constructed tern islands in interior Oregon and northeastern California have been subject to drought, resulting in underutilization by Caspian terns displaced from managed colony sites
• Continued monitoring and management are needed at Caspian tern colony sites outside the Basin to maximize their potential as alternative colony sites for terns displaced from East Sand Island and the Columbia Plateau region
• System-wide evaluation of the impact of predation by Caspian terns and other piscivorous colonial waterbirds on salmonid survival is needed to assess the efficacy of bird management to restore ESA-listed salmonids

Taken together, these uncertainties indicate that continued system-wide monitoring and evaluation of management implemented during the last decade to reduce impacts of avian predation is warranted if adaptive management is to be implemented and the intended benefits to survival of juvenile salmonids realized.

More Info:

- Dan Roby's August 2018 presentation to the ISRP for the Research Projects Progress Review

Avian Predation on Juvenile Salmonids in the Columbia River Basin

Update for
The Northwest Power and Conservation Council

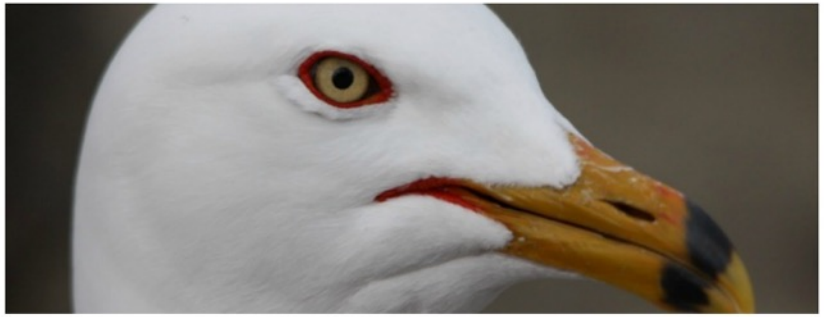
Eugene, Oregon
September 11, 2018

OSU Oregon State University
RTR REAL TIME RESEARCH
USGS science for a changing world

Piscivorous Colonial Waterbirds in Columbia Basin

Caspian tern

Several gull species



American white pelican

Double-crested cormorant

- All are native species of migratory birds
- All are protected under the Migratory Bird Treaty Act (1918)

Background

- Avian predation research program initiated in 1997 on Caspian terns nesting in the Columbia River estuary
- Breeding colonies of piscivorous waterbirds are widespread in the Columbia Basin, but much of the research and management has focused on the Columbia River estuary
- Nesting season largely overlaps with the smolt out-migration period
- Smolt consumption rates vary markedly by bird species, breeding colony, and year
- RM&E on avian predation funded by multiple agencies
- BPA has been the sole consistent funding source for avian predation RM&E in the Basin since 1997

Pre-management Impacts of Avian Predation

- Avian predation has been a major source of smolt mortality for multiple ESA-listed salmonid populations in the Columbia Basin
- Caspian terns and double-crested cormorants nesting on East Sand Island depredated up to 25 million smolts annually, or roughly 15% of surviving out-migrants to the estuary
- Caspian terns nesting on the Columbia Plateau depredated from 5% to 30% of out-migrating smolts from some steelhead populations annually
- Gulls from some colonies on the Columbia Plateau may be consuming similar or greater numbers of smolts compared to Caspian terns from managed colonies on the Plateau; impact of gulls on smolt survival in the Columbia Basin still uncertain

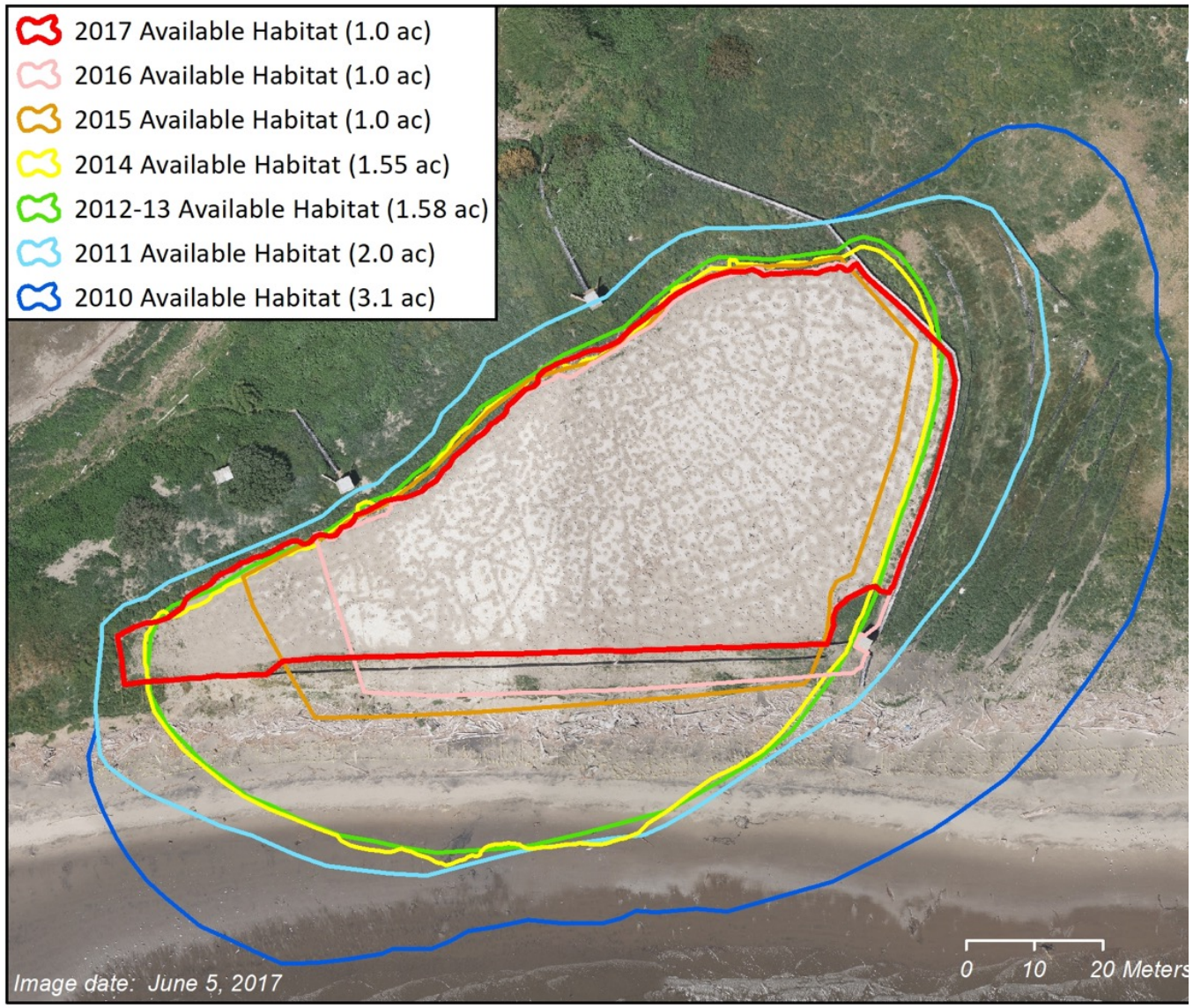
Avian Predation Management Plans in the Basin

- **Caspian terns nesting on East Sand Island in the Columbia River estuary**: funded by BPA and USACE-Portland District
- **Caspian terns nesting on Goose and Crescent islands in the Columbia Plateau region:** funded by USACE-Walla Walla District, BOR, and Grant County PUD/PRCC
- **Double-crested cormorants nesting on East Sand Island in the Columbia River estuary:** funded by USACE-Portland District
- Gulls and American white pelicans currently unmanaged

Caspian Tern Management Plan in the Columbia River Estuary

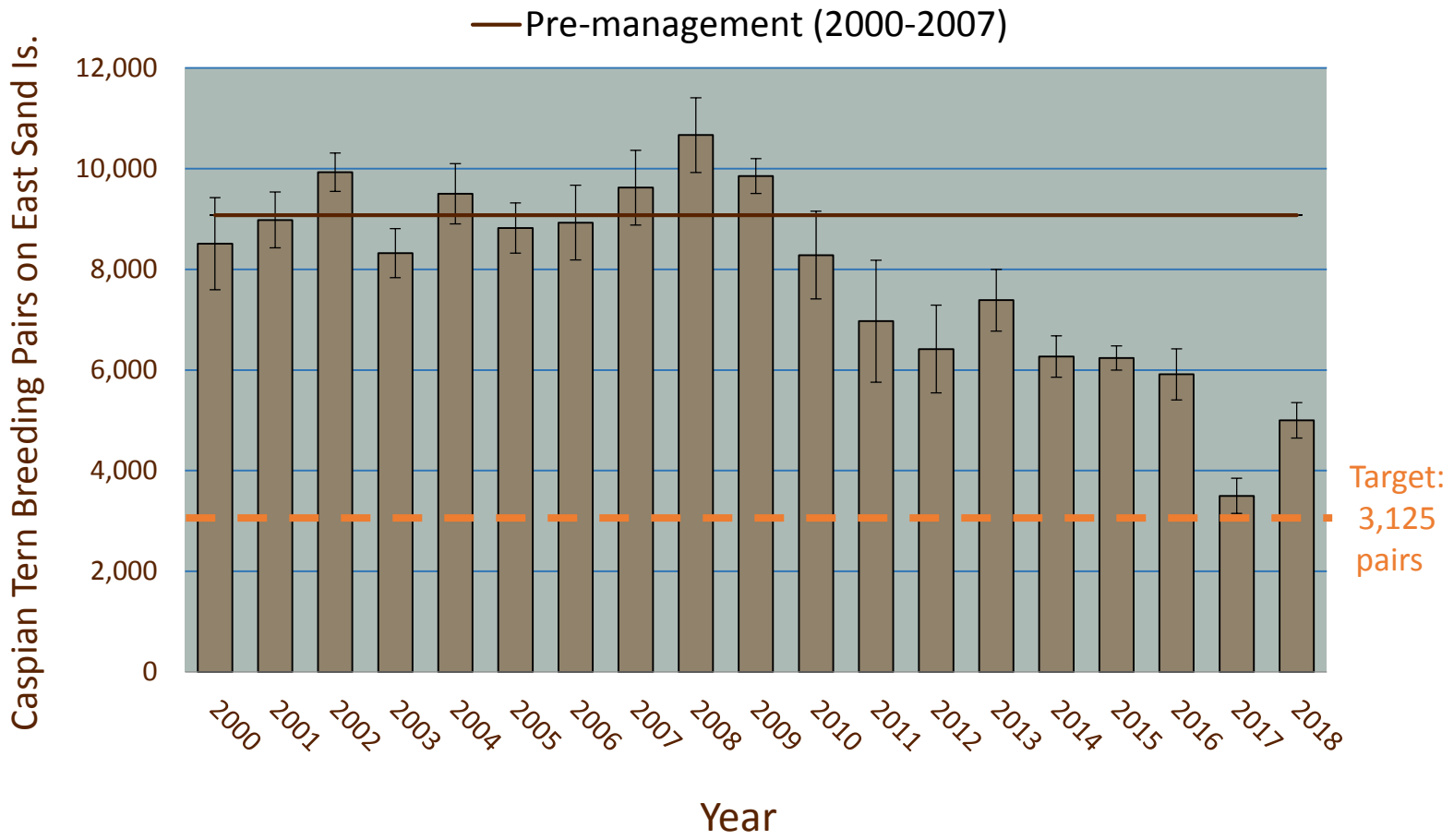
- Move Caspian tern colony from Rice Island to East Sand Island to reduce reliance on juvenile salmonids
- Reduce tern colony size on East Sand Island from 9,400 breeding pairs to 3,125 pairs by reducing available tern nesting habitat on East Sand Island
- Prevent terns from nesting elsewhere in the estuary
- Create alternative tern nesting habitat (islands) outside the Basin and use social attraction to lure nesting terns to islands
- Monitor action effectiveness inside and outside the Basin and practice adaptive management
- Funding from BPA for Avian Predation mostly used for RM&E and implementation of the Caspian Tern Management Plan in the Columbia River Estuary

Reduction in Tern Colony Area on East Sand Island



Area of Caspian tern nesting habitat reduced from 6 acres in 2007 to 1 acre in 2015

Tern Colony Size on East Sand Island



Passive & Active Nest Dissuasion in the Columbia River Estuary

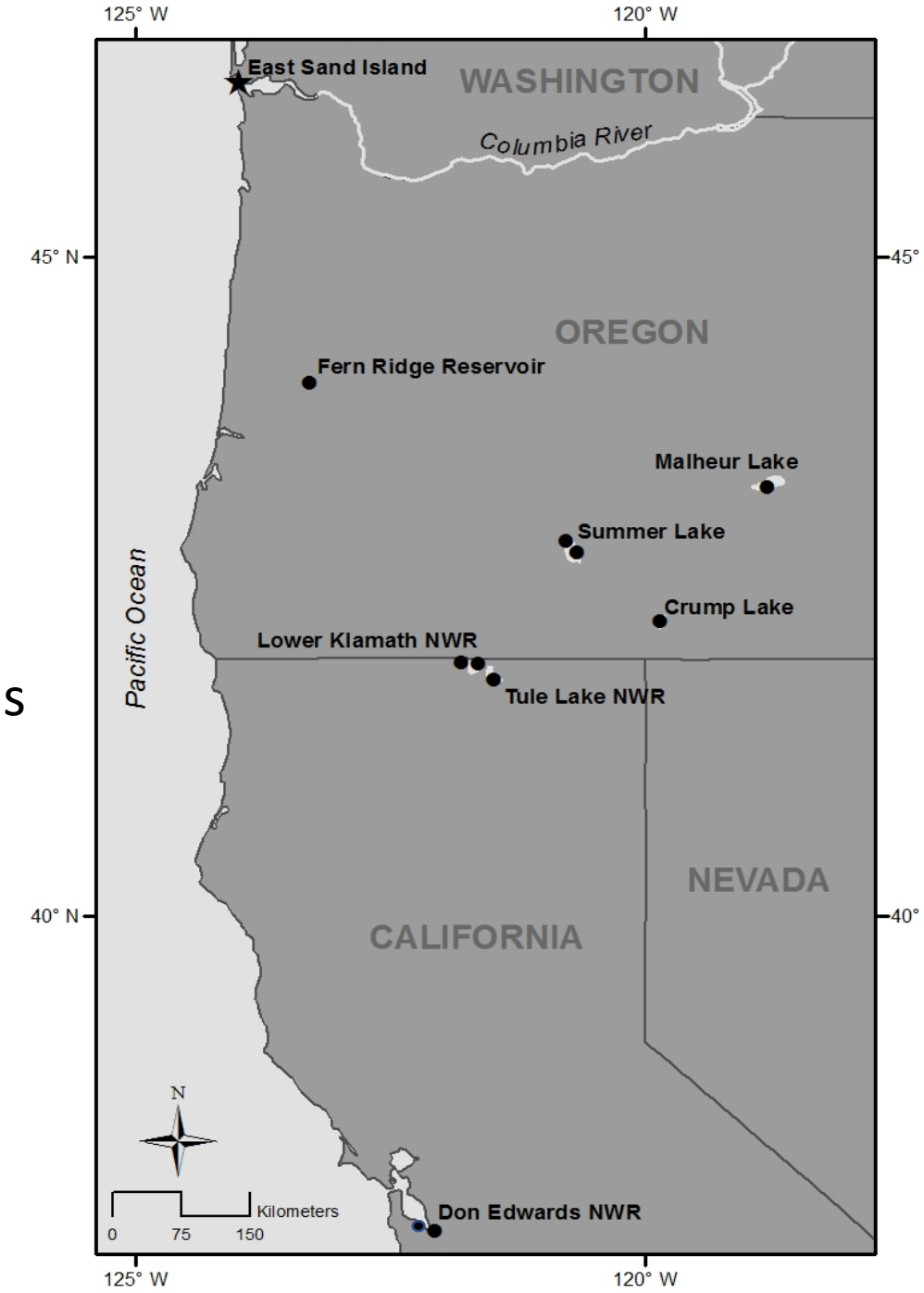
Installing passive Caspian tern nest dissuasion materials on Rice Island

Passive & Active Nest Dissuasion in the Columbia River Estuary

Passive Caspian tern nest dissuasion materials installed on East Sand Island

Corps-Constructed Tern Islands Outside of Basin

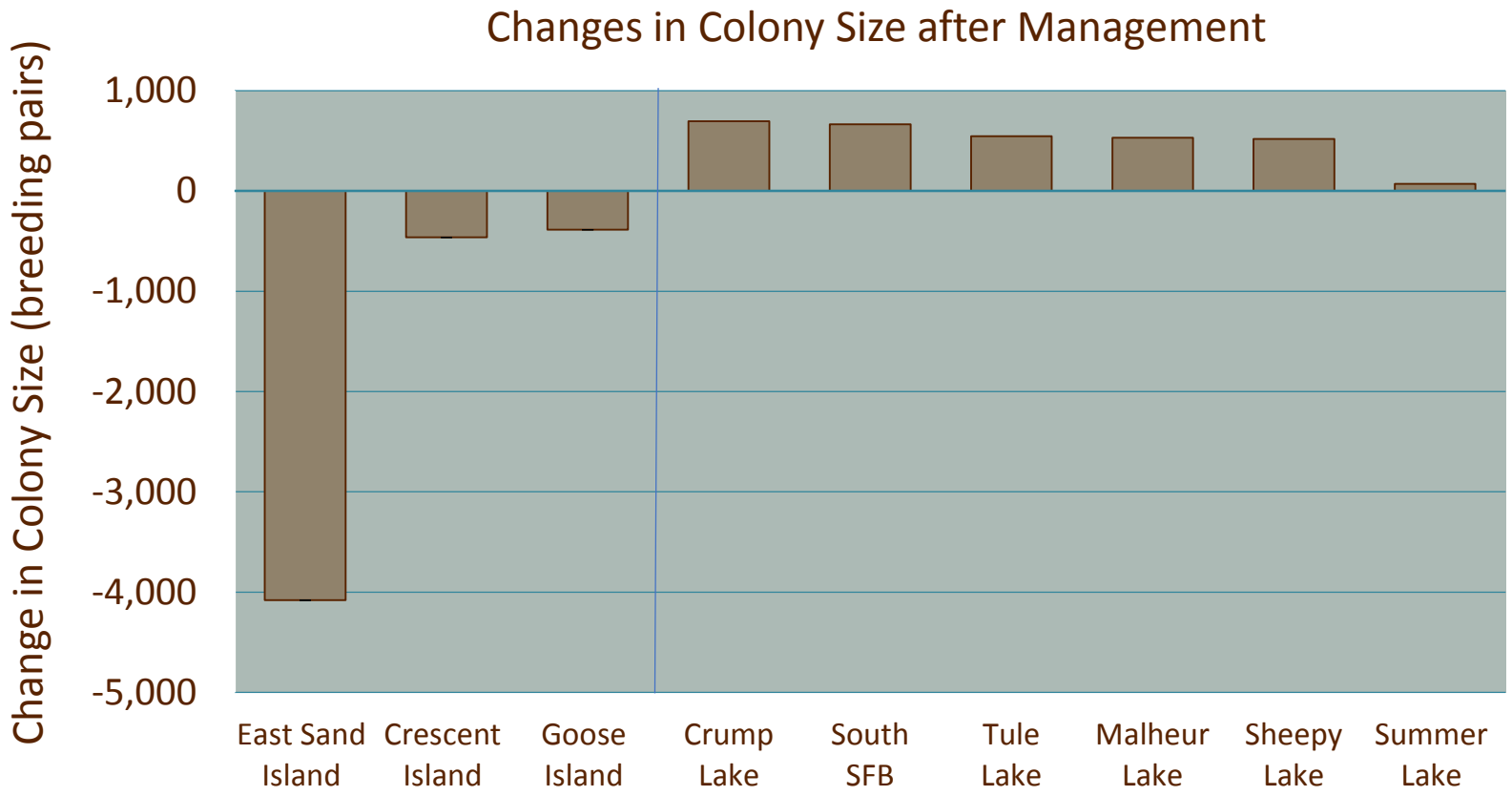
- 14 islands built at 8 different sites during 2008-2015
- 7 islands at 7 sites currently used by nesting Caspian terns
- many terns nesting on new islands are from the colony on East Sand Island



Social Attraction Outside Basin

Caspian tern decoys at Tule Lake Tern Island, Tule Lake NWR

Changes in Tern Colony Size



Changes in Tern Predation Rates on Smolts

Salmonid ESU/DPS	Pre-management Period	Management Period
SR Sockeye	**1.5%** (0.9-2.2)	**1.4%** (1.0-1.8)
SR Spr/Sum Chinook	**4.8%** (4.3-5.4)	**1.5%** (1.3-1.8)*
UCR Spr Chinook	**3.9%** (3.4-4.6)	**1.6%** (1.3-2.0)*
SR Fall Chinook	**2.5%** (2.2-3.0)	**0.8%** (0.6-0.9)*
UWR Spr Chinook	**2.5%** (1.9-3.3)	**1.0%** (0.6-1.4)*
SR Steelhead	**22.2%** (20.3-24.8)	**9.5%** (8.4-10.8)*
UCR Steelhead	**17.2%** (15.7-19.3)	**9.0%** (7.9-10.3)*
MCR Steelhead	**14.9%** (13.1-17.6)	**9.3%** (7.9-10.8)*

* Significant difference post-management

Summary

- Habitat management in the Columbia River estuary has resulted in a 50% decline in numbers of breeding Caspian terns using the estuary
- Management has resulted in major reductions in Caspian tern predation rates on ESA-listed salmonid smolts in the Columbia River estuary
- Alternative colony sites for Caspian terns have been provided outside the Columbia Basin and are being used by terns displaced from East Sand Island
- Thousands of terns are using these Corps-constructed colony sites (islands) in some years
- Demographic models of the Caspian tern population indicate that the Pacific Flyway population is resilient to current management initiatives in the Columbia Basin

Critical Uncertainties for Caspian Tern Plan in Estuary

- Caspian terns have strong fidelity to East Sand Island; further reduction in area of nesting habitat needed to reach target of 3,125 breeding pairs (5,000 pairs in 2018)
- Increasing numbers of Caspian terns are utilizing the upper Columbia River estuary, where predation rates on salmonid smolts are much higher
- Corps-constructed tern islands in interior Oregon and northeastern California have been subject to drought, resulting in underutilization

Critical Uncertainties for Caspian Tern Plan in Estuary

- Continued monitoring and management are needed at out of Basin sites to maximize their potential as alternative colony sites for terns displaced from East Sand Island

- System-wide monitoring of tern population size, nesting distribution, nesting success, and movements is needed to assess action effectiveness and allow adaptive management

- System-wide evaluation of the impact of predation by Caspian terns and other piscivorous colonial waterbirds on salmonid survival is needed to assess the efficacy of bird management to restore ESA-listed salmonids

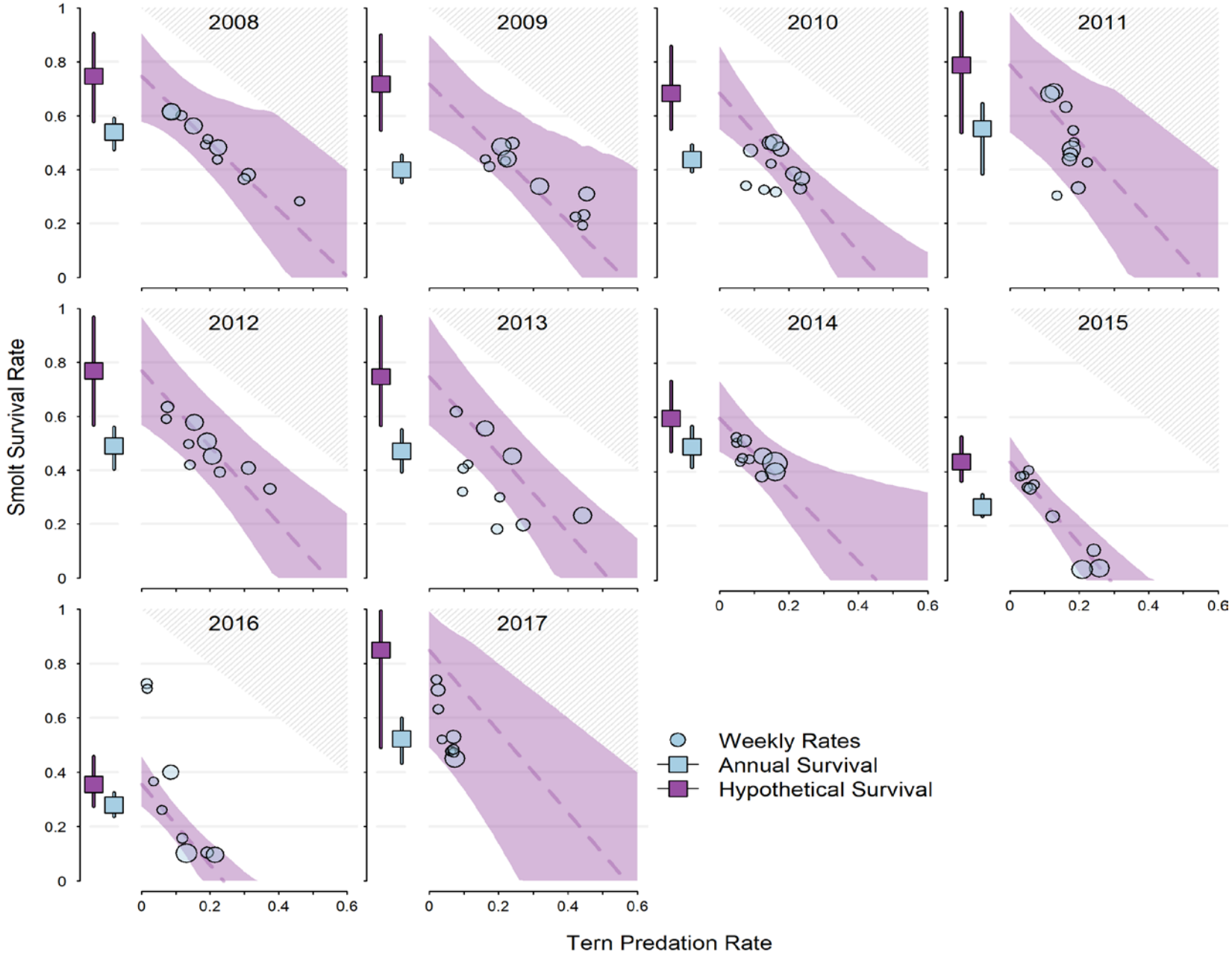
    - To what extent is avian predation additive mortality vs. compensatory mortality?

    - To what extent does reducing avian predation rates on juvenile salmonids increase adult return rates?

Preliminary Analyses

Caspian Tern Predation and Smolt Survival for Upper Columbia River Steelhead

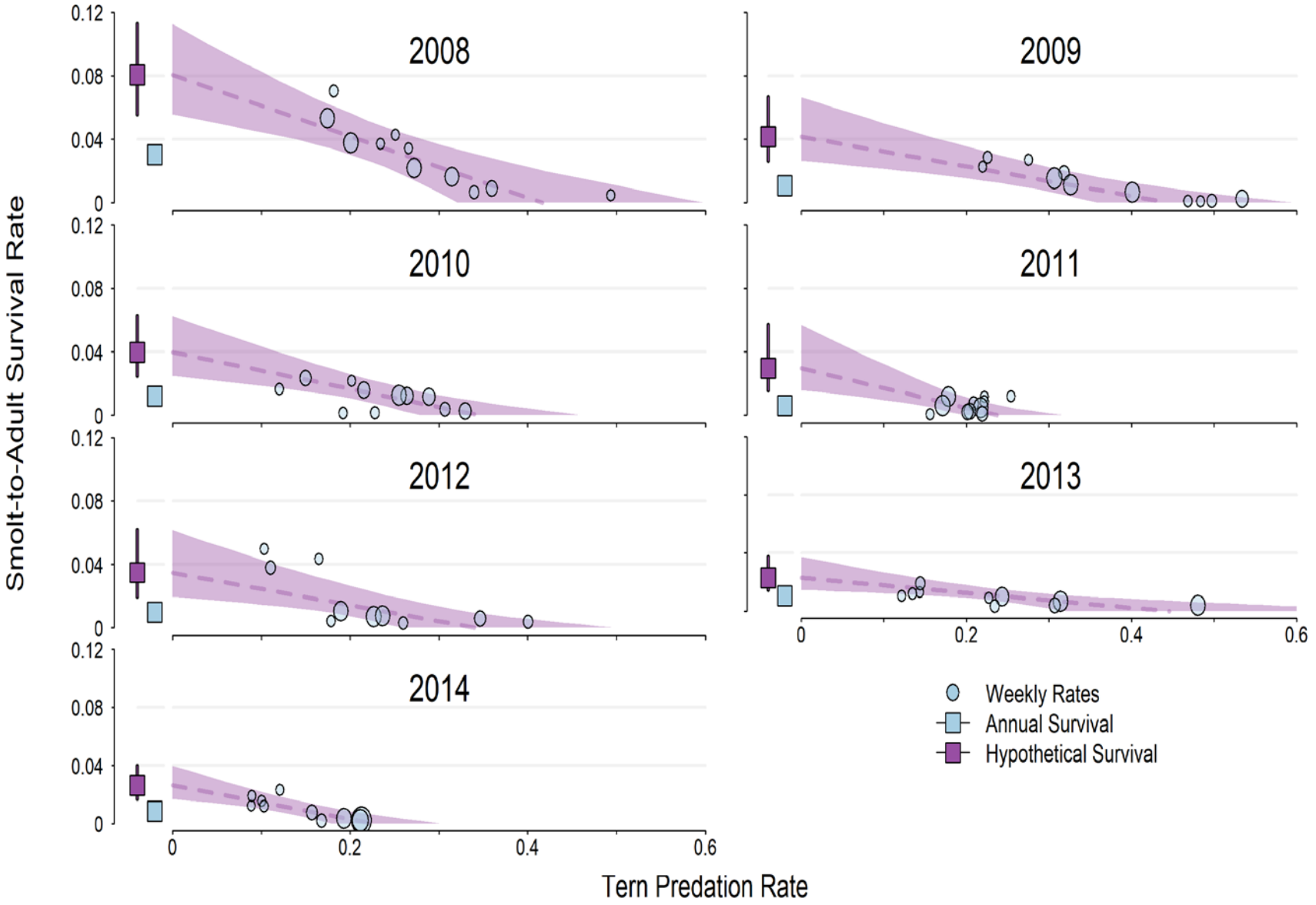
Survival from Rock Island Dam (as smolts) to Bonneville Dam (as smolts)



Preliminary Analyses

Caspian Tern Predation and Adult Survival for Upper Columbia River Steelhead

Survival from Rock Island Dam (as smolts) to Bonneville Dam (as adults)



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USACE – Portland District

USACE – Walla Walla District

Grant County Public Utility District

Priest Rapids Coordinating Committee

Collaborators:

NOAA Fisheries

U.S. Fish and Wildlife Service

Oregon Dept. of Fish and Wildlife

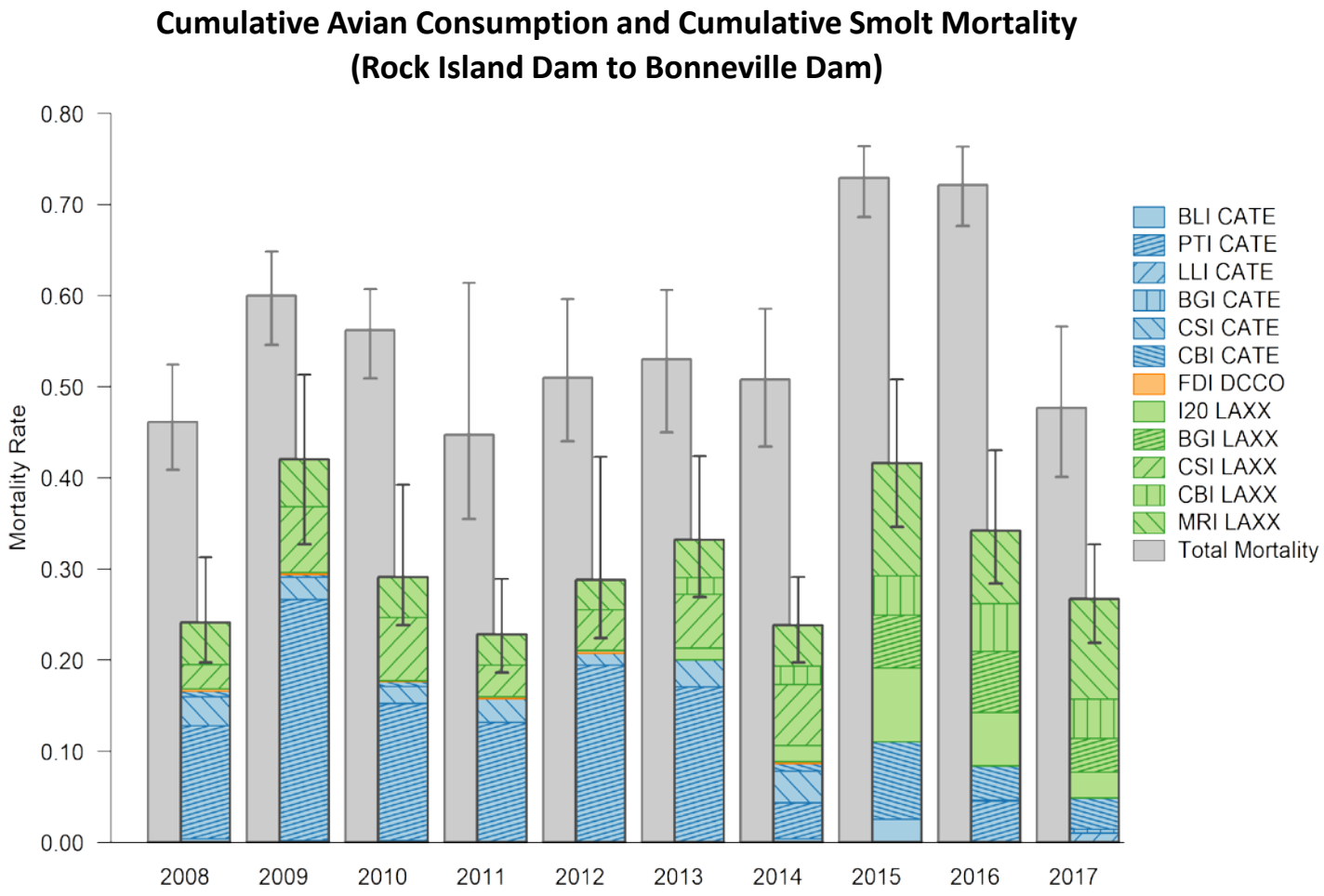
Washington Dept. of Fish and Wildlife

Pacific States Marine Fisheries Commission

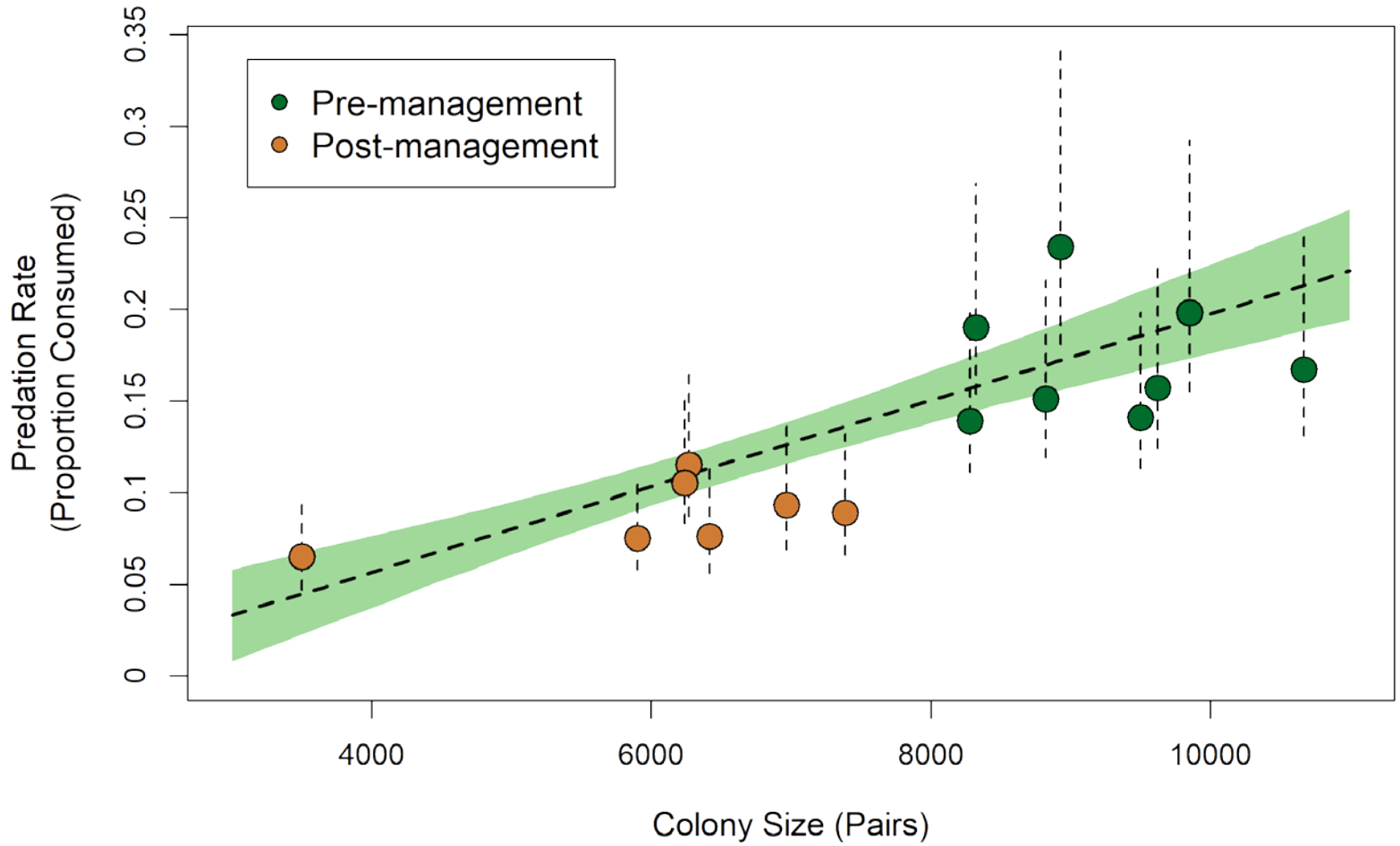

Questions?

Backup Slides

System-wide Avian Consumption of Upper Columbia River Steelhead

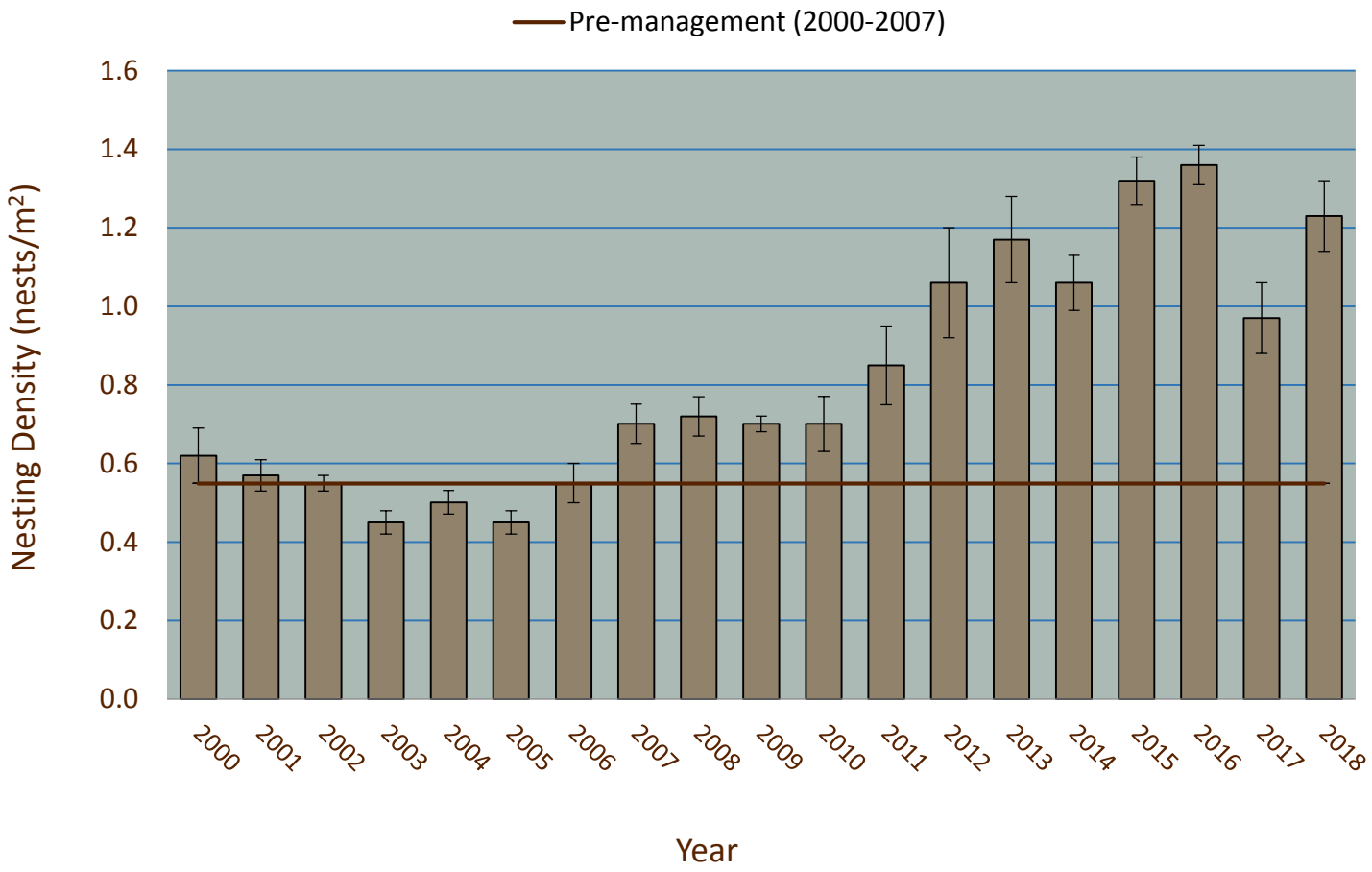


Predation Rates on Upper Columbia River Steelhead

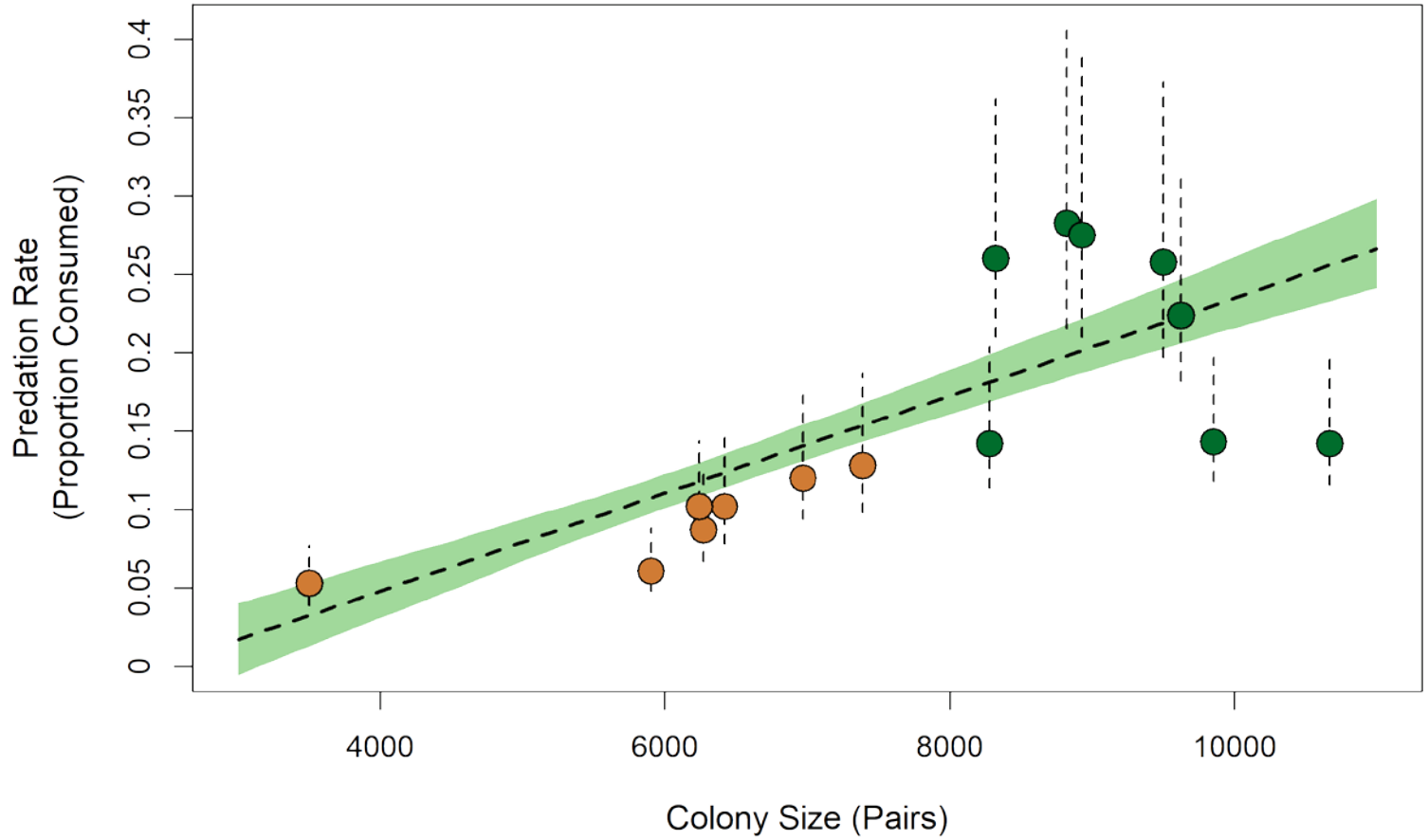


Caspian Tern Colony Locations in the Columbia Basin

Nesting Density



Predation Rates on SR Steelhead



Funding for Caspian Tern Plan RM&E in Columbia River Estuary

	Baseline Research	Management Implementation	Adaptive Management	Action Effectiveness Monitoring
1997-2007	BPA			
2008		BPA, USACE	BPA, USACE	BPA, USACE
2009		BPA, USACE	BPA, USACE	BPA, USACE
2010		BPA, USACE	BPA, USACE	BPA, USACE
2011		BPA, USACE	BPA, USACE	BPA, USACE
2012		BPA, USACE	BPA, USACE	BPA, USACE
2013		BPA, USACE	BPA, USACE	BPA, USACE
2014		BPA, USACE	BPA, USACE	BPA, USACE
2015		BPA, USACE	BPA, USACE	BPA, USACE
2016		BPA, USACE	BPA, USACE	BPA, USACE
2017		BPA, USACE	BPA, USACE	BPA, USACE
2018		BPA, USACE	BPA, USACE	BPA, USACE
2019		BPA (reduced)	BPA (reduced)	BPA (reduced)

System-wide Avian Predation on Upper Columbia River Steelhead