November 7, 2023

MEMORANDUM

TO: **Council Members**

FROM: **Patty O'Toole, Kate Self**

SUBJECT: **Astoria-Megler Bridge Double-Crested Cormorant Value Engineering Study**

BACKGROUND:

Presenter: John Raasch, Oregon Department of Transportation
Rod Thompson, Oregon Department of Transportation
Paul Benton, Oregon Department of Transportation
Rebecca Burrow, Oregon Department of Transportation
James Lawonn, Oregon Department of Fish and Wildlife
Art Martin, Oregon Department of Fish and Wildlife

Summary: Representatives from ODOT and James Lawonn (ODFW) will provide a brief overview of the recently finalized Value Engineering Study conducted to evaluate the effects of double-crested cormorant colony nesting on the Astoria-Megler Bridge and potential solutions. The purpose of this study was to address the following problem statement: *What is the best strategy to deal with damage to the bridge caused by cormorants?* ODOT will explain the structural and safety impacts to having the colony nesting on the bridge. James will review the biology of the cormorants and their effect on migratory juvenile salmonids in the study area. The speakers will also highlight the proposed solution of luring a certain number of double-crested cormorants back to East Sand Island. In the near future, the full VE report will be available and staff will provide a copy.

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.

Workplan: Fish and Wildlife Division work plan 2023; Program Planning and Coordination.

Background: Following a November 2022 presentation by James Lawonn of ODFW on the Status of Double-crested Cormorants in the Columbia River Estuary and Implications for Survival of Out-migrating Juvenile Salmon, the Council sent a letter to the Oregon and Washington Departments of Transportation in January 2023 requesting a joint presentation to learn about their efforts to address the structural damage and human safety issue and help the two agencies provide resources to manage the colony (Attachment 1). The Oregon and Washington Departments of Transportation responded with an invitation for Council staff to participate on the Study team for the upcoming Value Engineering (VE) study (Attachment 2). It should be noted that the Council also sent a letter to regional managers in June 2023 urging them to take a coordinated approach to solving this issue (Attachment 3).

In June 2023, the VE study, sponsored by the Oregon Department of Transportation (ODOT) and facilitated by Value Management Strategies, Inc. (VMS), was conducted to address the presence of double-crested cormorants (DCCOs) located on the Astoria-Megler Bridge which spans the Columbia River and connects the states of Oregon and Washington. The VE study organized a multi-disciplinary team featuring subject matter experts who represent federal, state, and regional organizations and Tribal Nations to identify potential solutions to mitigate the impacts caused by the DCCO colony on the bridge and to the traveling public. The purpose of this VE study is to address the following problem statement: *What is the best strategy to deal with damage to the bridge caused by cormorants?* The presence of DCCOs near the Astoria-Megler Bridge have posed ongoing challenges regarding maintenance, structural integrity, and public safety. If the situation continues, it is anticipated that bridge inspection and maintenance costs will increase, and public safety risks will be posed.

Why are the birds on the bridge? The double-crested cormorant (*Nannopterum auritum*) colony on East Sand Island in the Columbia River estuary grew dramatically during the 1990s and early 2000s, prompting concerns about predation on juvenile salmonids from ESA-listed runs. Implementation of a major management plan by the U.S. Army Corps of Engineers during 2015–2020 substantially reduced predation by individuals breeding on East Sand Island, however thousands of

individuals previously associated with this colony dispersed to colony sites farther upriver, most notably the Astoria-Megler Bridge. This dispersal was especially problematic because individuals breeding at upriver sites have far higher per capita predation rates on juvenile salmonids compared to individuals breeding on East Sand Island. This difference is caused by a continuum in abundance of marine forage fishes, in which abundance is highest near the mouth of the river, where East Sand Island is located, and progressively declines upriver. As a result, double-crested cormorants breeding upriver of East Sand Island have fewer alternative sources of food, and therefore consume more salmonids as a proportion of their diet.

Oregon Department of Fish and Wildlife (ODFW) estimates estuary-wide DCCO predation on ESA-listed steelhead to be approximately 12% in 2022. Because of the recent redistribution of double- crested cormorants, estuary-wide predation rates may be unchanged or higher than the period prior to management. In addition, guano from the colony is accelerating corrosion of the Astoria-Megler Bridge, causing an estimated $1M in damage annually.

More Info:

- US Army Corps of Engineers, Portland District Website -- Cormorant Management
- NPCC November 21, 2022 -- Double-crested Cormorants Relocating Upriver Increases Predation of Salmon
- NPCC May 18, 2020 -- Avian Predation: A River System Out Of Balance

Attachment 1 – January 2023 Council Letter to ODOT and WSDOT

Attachment 2 – March 2023 ODOT/WSDOT response to Council

Attachment 3 – June 2023 Council Letter to ODOT/WSDOT

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

January 11, 2023

Mr. Kris Strickler, Director
Oregon Department of Transportation
355 Capitol Street NE, MS 11
Salem, OR, 97301-3871

Mr. Rodger Millar, Secretary
Washington State Department of Transportation
11018 NE 51st Cir.
Vancouver, WA, 98682

Sent via electronic mail

Dear Mr. Strickler and Mr. Millar:

The Northwest Power and Conservation Council is an interstate compact agency of Idaho, Montana, Oregon, and Washington, authorized in the 1980 Power Act to ensure the region's power supply while mitigating the impact of hydropower dams on fish and wildlife in the Columbia River Basin.

The Council's Columbia River Basin Fish and Wildlife Program includes measures to protect salmon and steelhead from predation by marine mammals, piscivorous fish, and birds. Fish-eating birds, including Caspian terns, double-crested cormorants, and gulls consume a significant number of juvenile salmon and steelhead during their annual outmigration down the Columbia River to the Pacific Ocean. In November, the Council was updated on new data regarding the impact of double-crested cormorants in the estuary reach of the Columbia River, from Bonneville Dam to the Pacific Ocean, with alarming conclusions.

The presentation emphasized the shift of the double-crested cormorants' breeding colony from East Sand Island to the Astoria-Megler Bridge and upriver locations over the past several years. This shift, a result of actions by the U.S. Army Corps of Engineers to reduce the number of cormorants on the island, is especially problematic because their breeding and foraging at upriver sites is estimated to have far higher per capita predation rates on juvenile salmonids compared to breeding on East Sand Island. Because the abundance of marine forage fishes

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

Bill Edmonds
Executive Director

503-222-5161
800-452-5161

progressively declines upstream, double-crested cormorants breeding on the bridge and locations upstream consume more salmonids. Estimates of estuary-wide predation rates from 2015 – 2020 are much higher since the Corps' actions to reduce their numbers on East Sand Island.

We understand that management of the expanded breeding colony on the Astoria-Megler Bridge is a concern for your agencies, and we want to learn more about your concerns so we can assist and support your efforts. For example, it has come to our attention that the presence of the colony is accelerating corrosion of the Astoria-Megler Bridge, causing significant structural damage. In addition, there are human safety issues regarding bird strikes on the roadway that need to be alleviated.

The Council meets monthly in open public sessions to address important Columbia River fish and wildlife issues. We would appreciate a joint presentation from your respective transportation agencies at one of our meetings to learn about your efforts to address the structural damage and human safety issue and help your agencies provide resources to manage the colony.

Please contact Patty O'Toole, fish and wildlife division director (potoole@nwcouncil.org) at your earliest convenience to discuss a presentation.

Thank you for your willingness to work with the Council on this important issue.

Sincerely,

Council Chair

cc:

- Colonel Dorf, USACE
- Michael Tehan, NOAA
- Dr. Kim Kratz, NOAA
- Judy Gordon, USFWS
- Samuel Penney, NPT
- Kathryn Brigham, CTUIR
- Gerald Lewis, YN
- Johnathan Smith, Sr., CTWSRO
- DR Michel, UCUT
- Scott Hauser, USRT
- Kelly Susewind, Director, WDFW
- Curt Melcher, Director, ODFW
- Ed Schriever, Director, IDFG
- Sonny Chickering, ODOT, Region 2 Manager
- Carley Francis, WSDOT, Southwest Region Administrator

Oregon Department of Transportation

Washington State Department of Transportation

March 31, 2023

Mr. Guy Norman, Chair
Northwest Power and Conservation Council
851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348

Subject: Astoria-Megler Bridge Cormorants

Dear Mr. Norman,

Thank you for the Northwest Power and Conservation Council's letter (January 11, 2023) regarding the issues associated with the shift of the double-crested cormorant breeding colony in the Columbia River estuary from East Sand Island to the Astoria-Megler Bridge. On behalf of the Oregon Department of Transportation (ODOT) and the Washington State Department of Transportation (WSDOT), we appreciate the Council's interest in working collaboratively to address these issues.

As noted in your letter, the shift of the double-crested cormorant colony to Astoria-Megler Bridge is reducing the life expectancy of the paint coating protecting the steel trusses, inhibiting safety inspections of the bridge, and creating safety conflicts with motorists. ODOT manages the Astoria-Megler Bridge in cooperation with the Washington Department of Transportation (WSDOT). In response to the cormorant issues, ODOT and WSDOT will be conducting a Value Engineering Study this summer to develop solutions intended to reduce the number of cormorants using the Astoria-Megler Bridge. The Value-Engineering Study will consist of a facilitated multidisciplinary team meeting over four days to develop a range of potential actions to reduce cormorant use of Astoria-Megler Bridge.

ODOT would like to invite the Council to provide a representative to serve on the Study team or stakeholder panel. ODOT will also coordinate with WSDOT to provide a joint presentation at a monthly Council meeting later this year. Per your letter, we will coordinate these requests with Patty O'Toole, Council Fish and Wildlife Division Director. The joint presentation would likely occur this fall after completion of the Value Engineering Study. This will allow ODOT and WSDOT to provide the Council with an overview of both the problems associated with the cormorant colony on Astoria-Megler and the potential solutions arising from the Value Engineering Study.

If you would like additional information, please contact Rod Thompson, ODOT State Environmental Engineering and Natural Resources Manager at (971)-701-0129 or rod.thompson@odot.oregon.gov.

Sincerely,

John Raasch,
ODOT State Environmental Manager

Ahmer Nizam,
WSDOT Environmental Services Director

Cc:
Kris Strickler, ODOT Director

Mac Lynde, ODOT Delivery and Operations Division Administrator
Sonny Chickering, ODOT Region 2 Manager
Ray Bottenburg, ODOT State Bridge Engineer
Carley Francis, WSDOT SW Regional Administrator
Mike Kimlinger, ODOT Chief Engineer (Interim)
Devin Reck, WSDOT Southwest Region Assistant Region Administrator
Angie Haffie, WSDOT Southwest Region Environmental Services Manager
Michael Tehan, NOAA Fisheries
Dr. Kim Kratz, NOAA Fisheries
Judy Gordon, USFWS
Curt Melcher, Director, ODFW
Kelly Susewind, Director, WDFW
Ed Schriever, Director, IDFG

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

June 29, 2023

Colonel Aaron L. Dorf
Deputy Commander, Northwestern Division
US Army Corps of Engineers
1201 NE Lloyd Blvd., STE 400
Portland, OR 97232

Roland Springer
Deputy Regional Director
Bureau of Reclamation
230 N Collins Rd., STE 7
Boise, ID 83702

Scott Armentrout
Executive Vice President, Environment, Fish and Wildlife
Bonneville Power Administration
PO Box 3621
Portland, OR 97208

Judy Gordon
Assistant Regional Director, Pacific Region
U.S. Fish & Wildlife Service
911 NE 11th Avenue
Portland, OR 97232

Michael Tehan
Assistant Regional Administrator, West Coast Regional Office
National Oceanic and Atmospheric Administration
1201 Northeast Lloyd Blvd., STE 1100
Portland, OR 97232

Hello,

On behalf of the Northwest Power and Conservation Council, I'm writing to share our concern about the shift of the double-crested cormorants' breeding colony from East Sand Island to the Astoria-Megler Bridge and other upriver locations.

The Northwest Power and Conservation Council (Council) asks for the continued engagement of your collective federal agencies on this issue, in coordination with the states

of Oregon and Washington and basin tribes. Predation by double-crested cormorants is a major source of smolt mortality for many ESA-listed species as they migrate through the estuary.

The Council is an interstate compact agency of Idaho, Montana, Oregon, and Washington, authorized in the 1980 Northwest Power Act to ensure the region's power supply while mitigating the impact of hydropower dams on fish and wildlife in the Columbia River Basin.

The Council's 2014 Columbia River Basin Fish and Wildlife Program includes measures to protect salmon and steelhead from predation by marine mammals, piscivorous fish, and birds. The Council's program recognizes that the construction and operation of the Columbia-Snake River hydrosystem, as well as the disposal of dredge material in the lower Columbia River and estuary, have altered historical habitats and created new habitats.

These altered habitats support a wide range of predatory species, including native and non-native fish species: Birds such as Caspian terns; double-crested cormorants; several gull species; mergansers and pelicans; and marine mammals such as California and Steller sea lions.

Fish-eating birds are especially problematic in the lower Columbia River and estuary, consuming a significant number of juvenile salmon and steelhead during their annual outmigration to the Pacific Ocean. This migration from fresh to the marine environment, as part of their life cycle, is an important physiological phase for anadromous salmonids in the basin.

At our June meeting, the Council discussed the latest information and strongly recommends:

- Broad participation in discussions on efforts to address the number of cormorants nesting on the Astoria-Megler bridge and the overall population of cormorants in the lower Columbia River and estuary. We encourage sustained participation and coordination among the relevant federal agencies, such as the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the National Marine Fisheries Service, the Bureau of Reclamation, the Bonneville Power Administration, and the states of Oregon, Washington, and Idaho, basin tribes, and other relevant participants.

- Development and implementation of a coordinated and systematic plan to ensure that problems are not created elsewhere when addressing the cormorants nesting on the Astoria-Megler Bridge.

In addressing the overall population of cormorants in the estuary and lower Columbia River, the Council recommends:

- Management of the cormorant population should consider both limiting recruitment and reducing the number of breeding birds using existing lethal take established

through the Migratory Bird Treaty Act for managing conflicts in the Pacific Flyway or new lethal take issued to the states of Oregon and Washington under the treaty.

- A coordinated approach to establishing management objectives for both cormorant abundance and distribution, balancing protections under the Migratory Bird Treaty Act with reductions in predation of Columbia River anadromous fish.

  Using a science-based adaptive management process to achieve management objectives, along with a monitoring program to evaluate progress.

Thank you for your attention to this important issue.

Sincerely,

Council Chair

Jeff Allen

Cc:

Sonny Chickering, ODOT
Carley Francis, WSDOT
Kelly Susewind, WDFW
Curt Melcher, ODFW
Jim Fredericks, IDFG
Aja DeCoteau, CRITFC
DR Michel, UCUT
Scott Hauser, USRT
Council Members, Northwest Power and Conservation Council
Bill Edmonds, Northwest Power and Conservation Council
Patty O'Toole, Northwest Power and Conservation Council

Astoria-Megler Bridge Double-Crested Cormorant Value Engineering Study

Presented by:

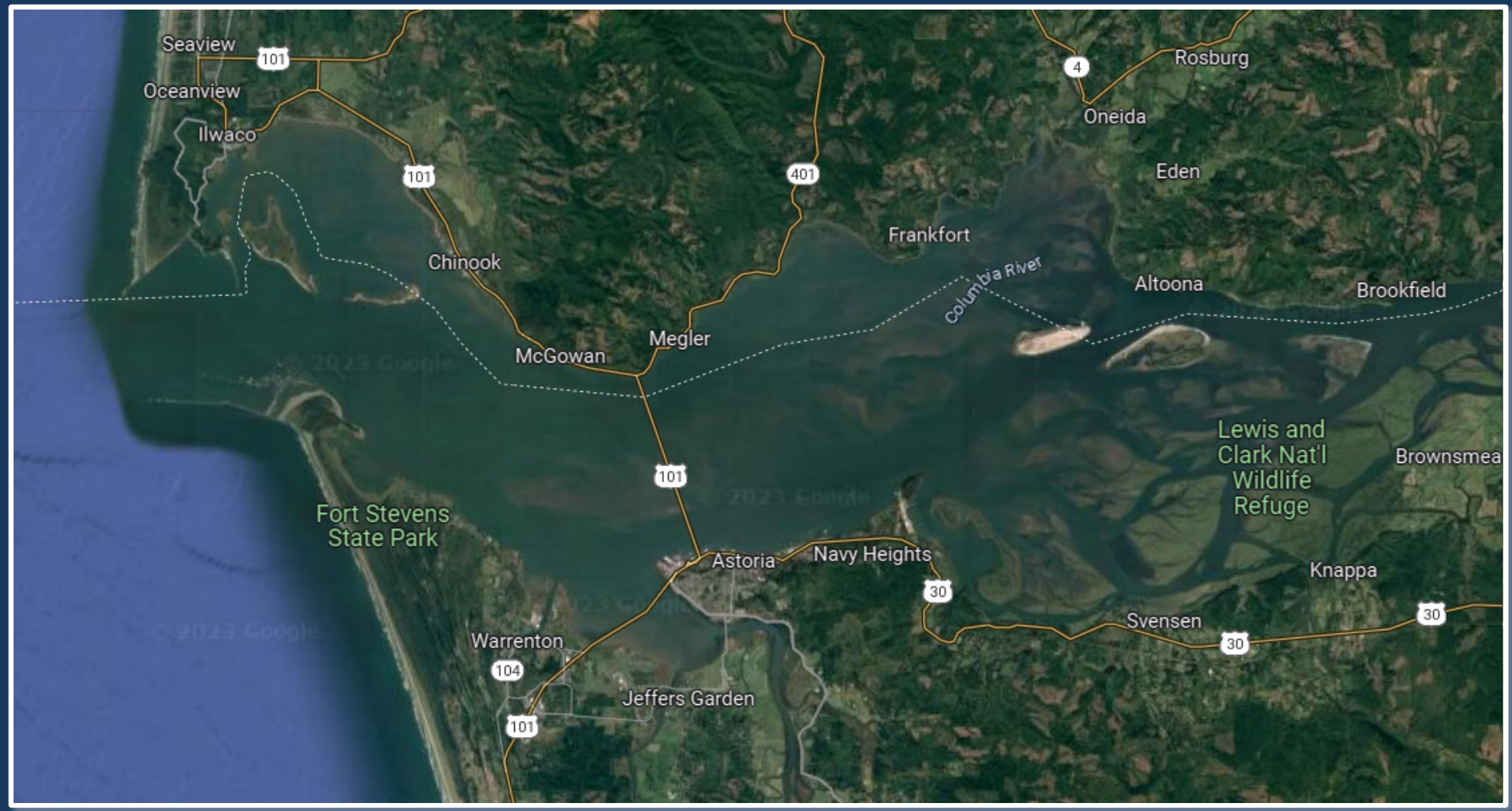
- Rebeca Burrow, ODOT State Bridge Preservation & Design Engineer
- James Lawonn, ODFW Avian Biologist/Avian Predation Coordinator
- Paul Benton, ODOT Terrestrial Biology Program Coordinator

Agenda

- Bridge Description
- Impacts on the Bridge
- The Birds
- The Fish
- The VE Study
- Next Steps

Vicinity and Bridge Description

- Location



Bridge Description

WA End Trusses

Desdemona Sands Spans

Deck Trusses and Girders

Main Span

Oregon Approach Ramp

Problem Statement

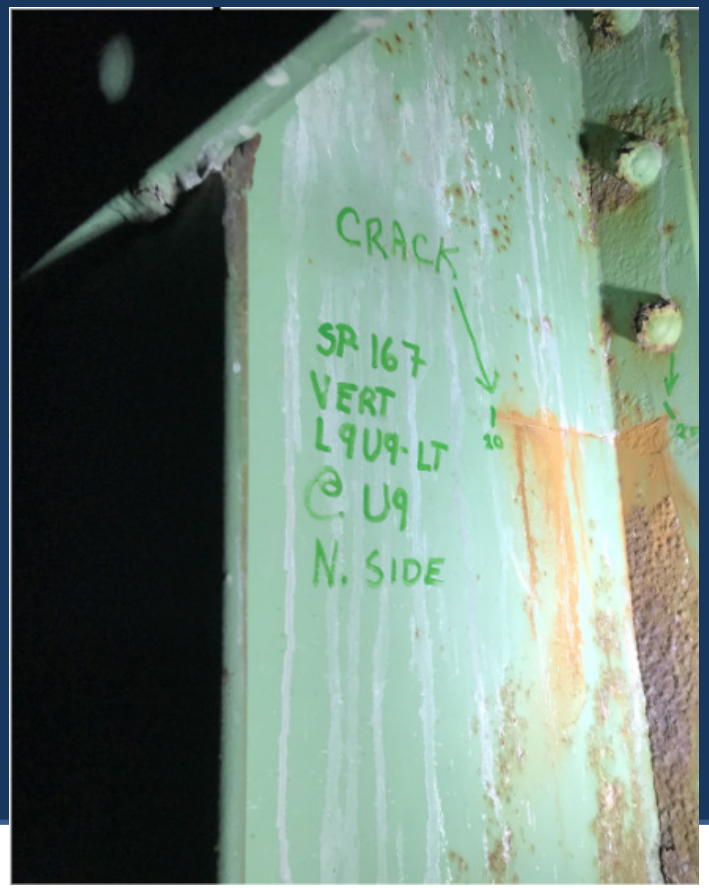
Inspection

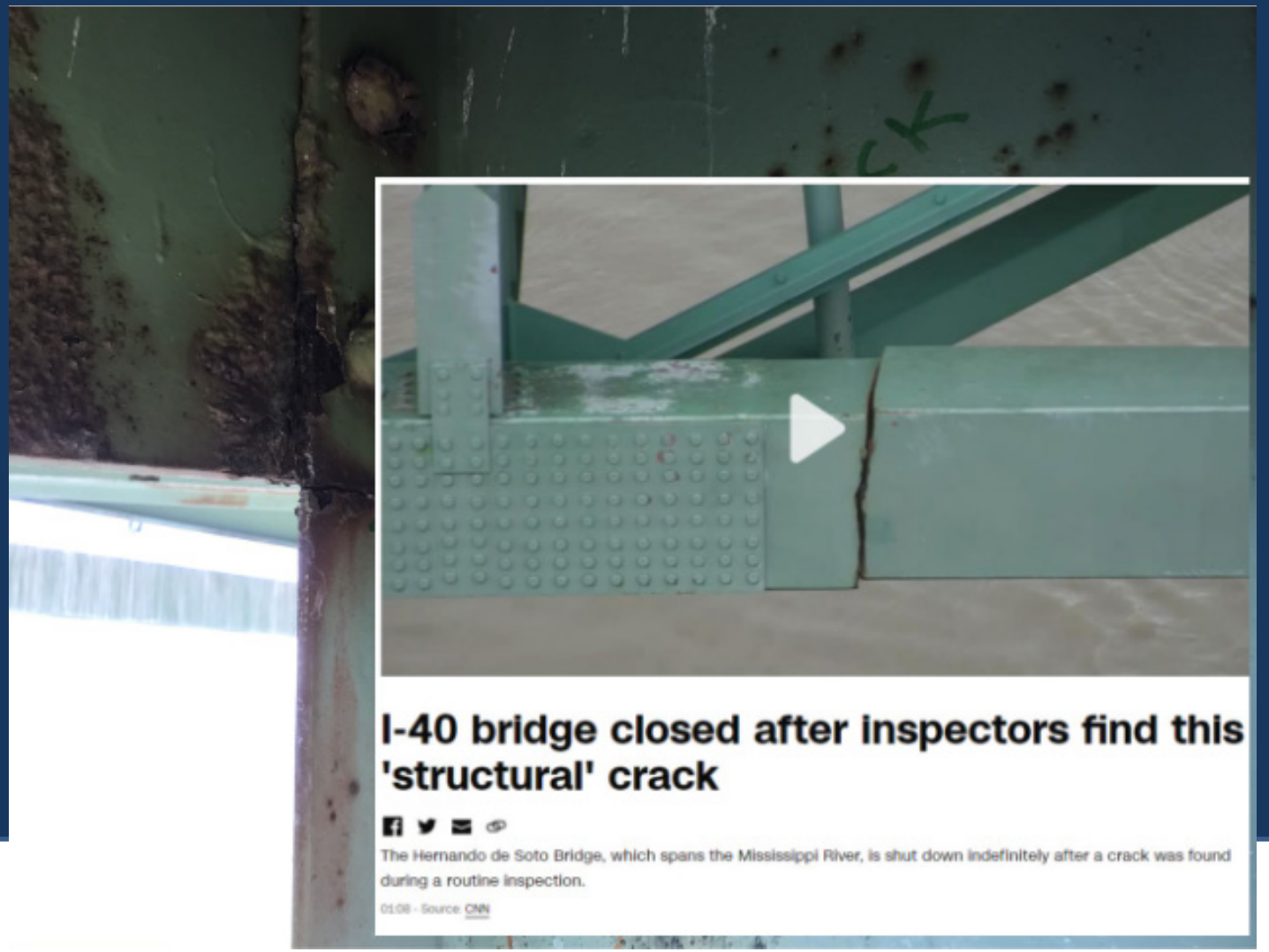
COLUMBIA RIVER (ASTORIA-MEGLER) - BR# 07949A - HWY 9 - MP: 0.00

EXAMPLE OF INITIAL CRACK AT GIRDER CROSS BRACE WELD

"This means switching from an 'early detection small defect approach' to a 'large defect critical repair approach' of inspection."

Inspection


CRACK
SR 167
VERT
L9U9-LT
@ U9
N. SIDE


I-40 bridge closed after inspectors find this 'structural' crack
The Hernando de Soto Bridge, which spans the Mississippi River, is shut down indefinitely after a crack was found during a routine inspection.
01:08 - Source: CNN

Painting

- **Pre-birds - the steel was on a cycle to be painted ~every 20 years**
  - Coating system is 3-Coat Zinc-Epoxy-Urethane
  - 3 year construction warranty
  - Painted in multi-year phases – Total 12 years
- **Now**
  - Cycle is predicted to be less
  - Expectations – More steel repairs, longer project durations, higher costs
  - Containment set-up before nesting season – complicates schedule

Painting – What its like

- All painting requires taking at least 1 lane
- Equipment includes: Air Handling, Full Containment, Lead Treatment, Sand Blasting
- Personnel:
  - Paint Contractors
  - ODOT Inspectors
  - 3rd Party Inspectors
- Cleaning in 2 phases:
  - Removal of solids with shovels/brushing
  - Power Washing
- When bird waste removal is included:
  - Add 16 days per span
  - Containment must collect all waste and water for Hazmat
  - Workers wear full Tyvek suits and respirators

Maintenance

5-10 birds a day are getting struck by vehicles on the bridge at peak periods

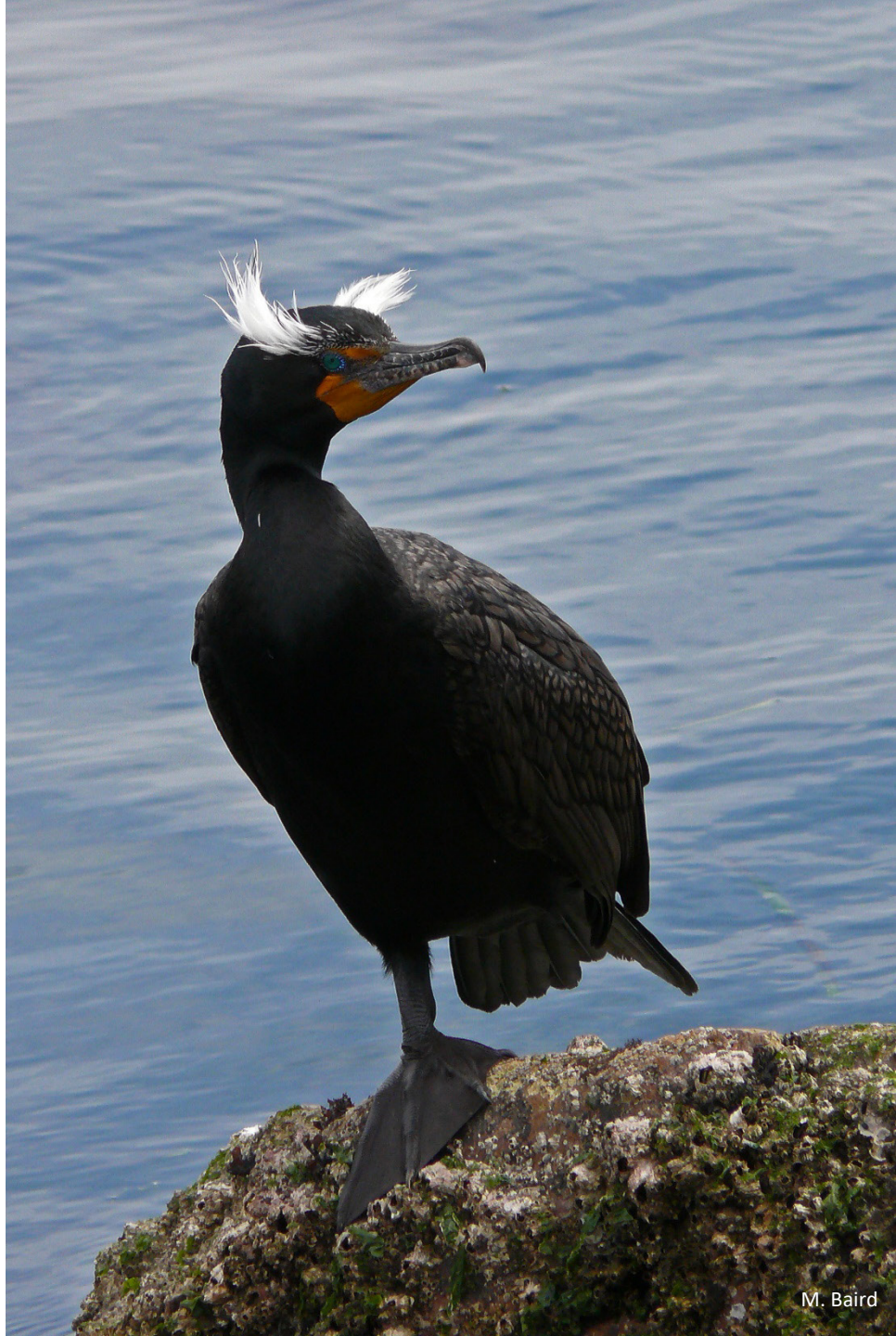
ODFW has received numerous calls from the public regarding road-struck cormorants over the last 3-4 years. My personal observations, notes from the public, and the seasonality of road-strikes (July-August, mostly) suggest most of them are indeed hatch-year birds.

ODOT is also responsible for replacing lights on the bridge fenders in support of navigation (calls from USCG)

Birds also roost on fender lighting and solar panels

Double-crested cormorant (DCCO)

- Native colonial waterbird
- ~23% of regional population nested in Columbia River estuary in 2021
- Most of diet in estuary non-salmonids



DCCO attracted to estuary by abundant food

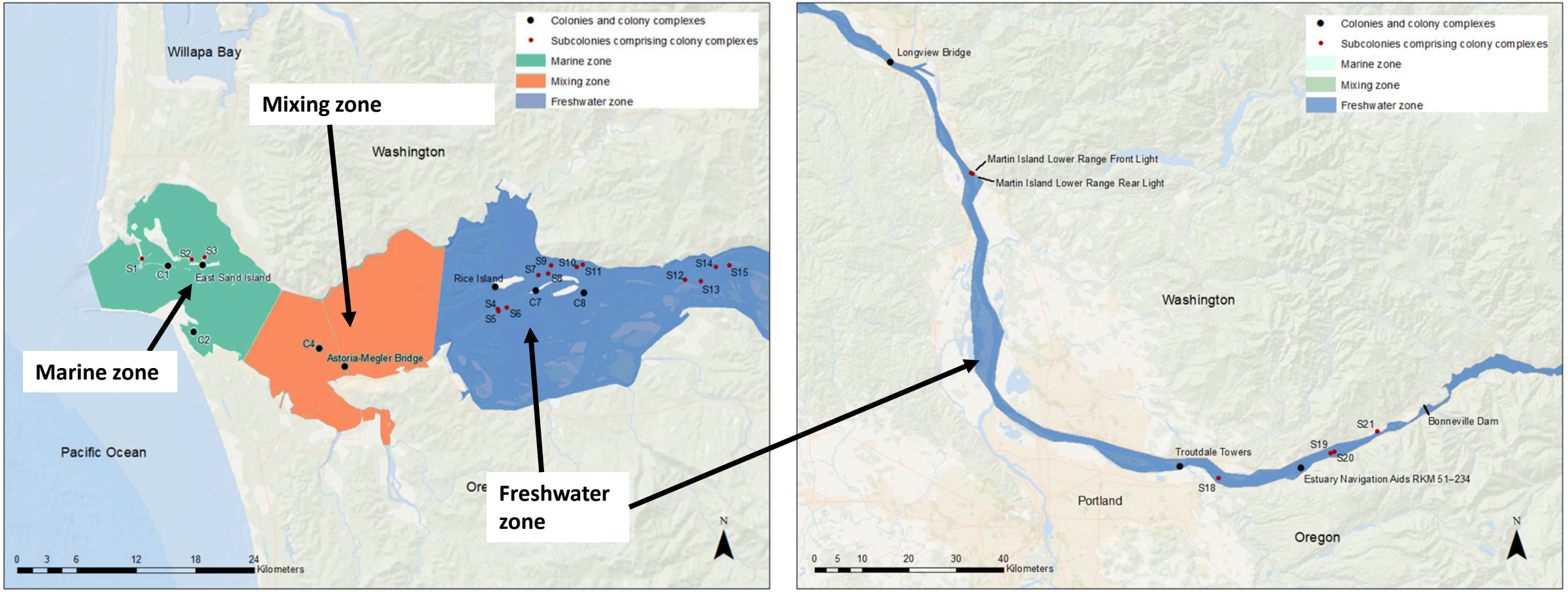
- Marine fish predominate in lower estuary.
- Salmonids abundant in spring/early summer.

Shester/Oceana

All known colony sites in estuary are human-made/modified habitats

- 11 colonies and colony complexes (29 breeding sites total)
- Abundant natural habitat (e.g. mature trees) could support colonies in future.

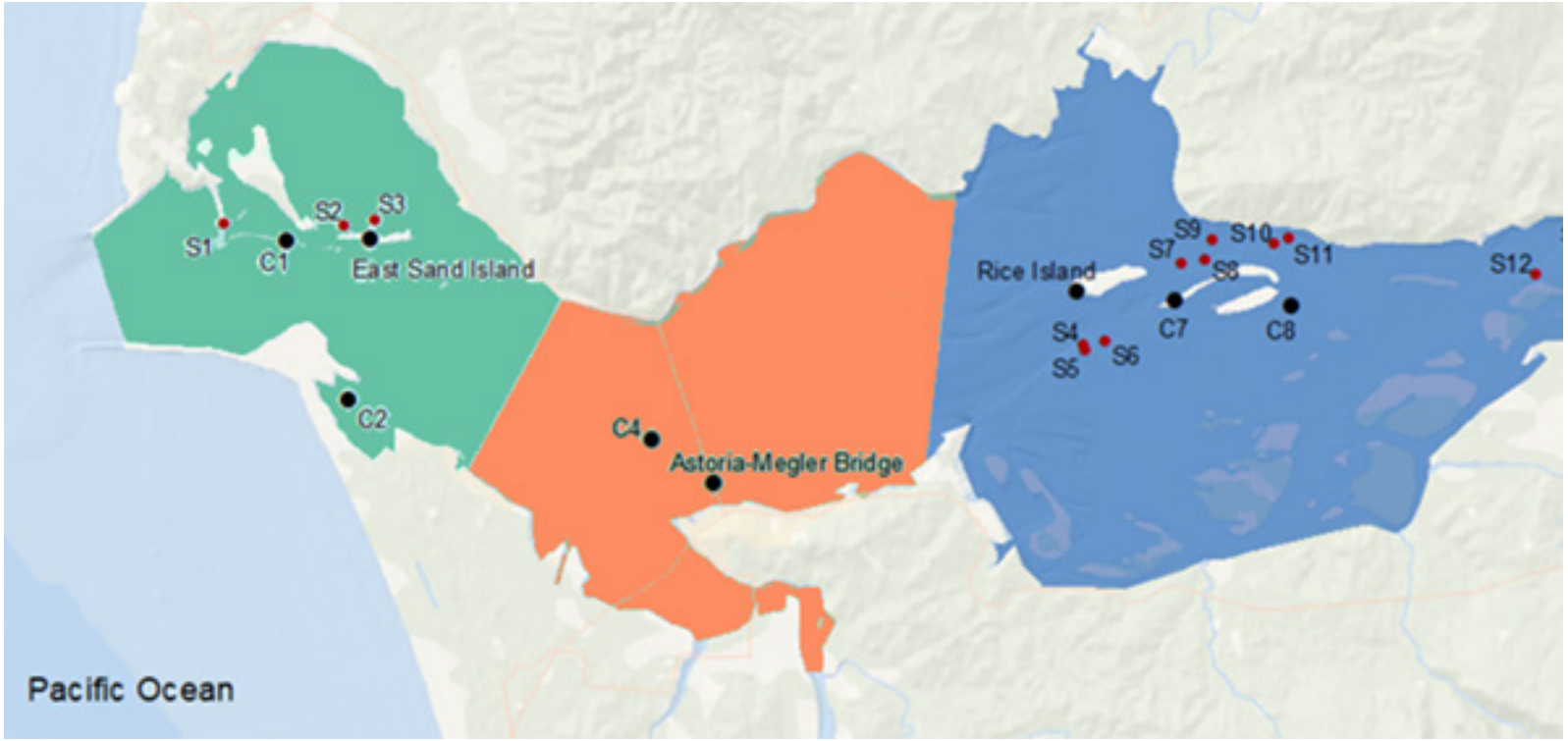
Three salinity zones in the estuary



Per cormorant impacts higher as salinity declines

Proportion salmonids in avian diet

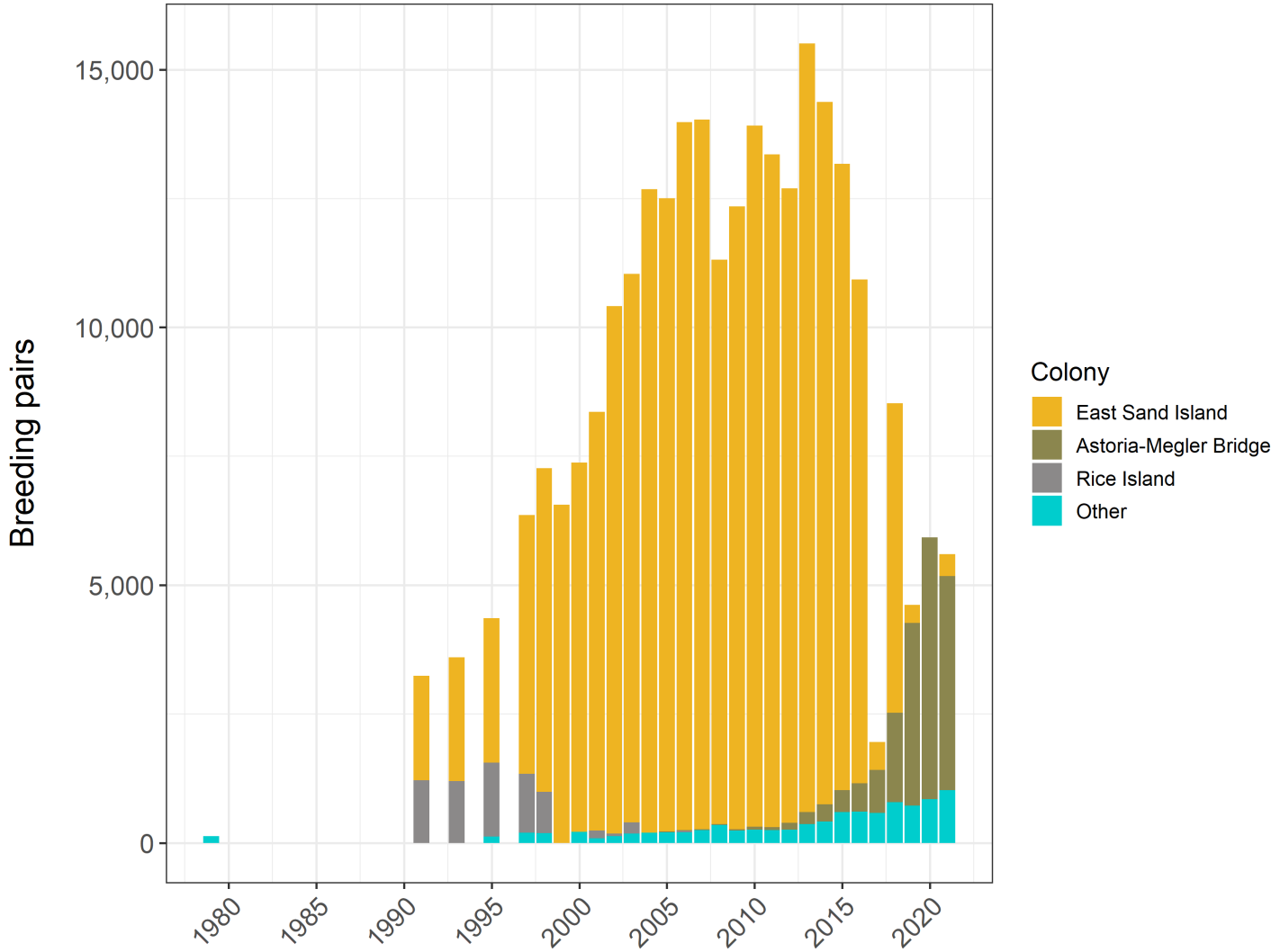
Less → **More**



OREGON Fish & Wildlife

Recent changes in abundance and distribution

- DCCO emigrated from East Sand Island to upriver colonies, mostly associated with management.
- Astoria-Megler Bridge currently supports most breeding individuals.
- Other colonies mostly upriver of Astoria-Megler Bridge.



OREGON Fish & Wildlife

Annual predation rates on ESA-listed salmonids, Astoria-Megler Bridge, 2022

ESU/DPS	Predation rate
SR Sockeye	6.6% (1.7-14.7)
SR Sp/Su Chinook	4.9% (2.6-8.1)
UCR Sp Chinook	5.2% (2.0-10.3)
SR Fall Chinook	3.1% (2.1-7.9)
SR Steelhead	7.2% (3.5-12.0)
UCR Steelhead	8.6% (3.2-15.1)
MCR Steelhead	7.4% (2.1-15.5)

T. Lawes

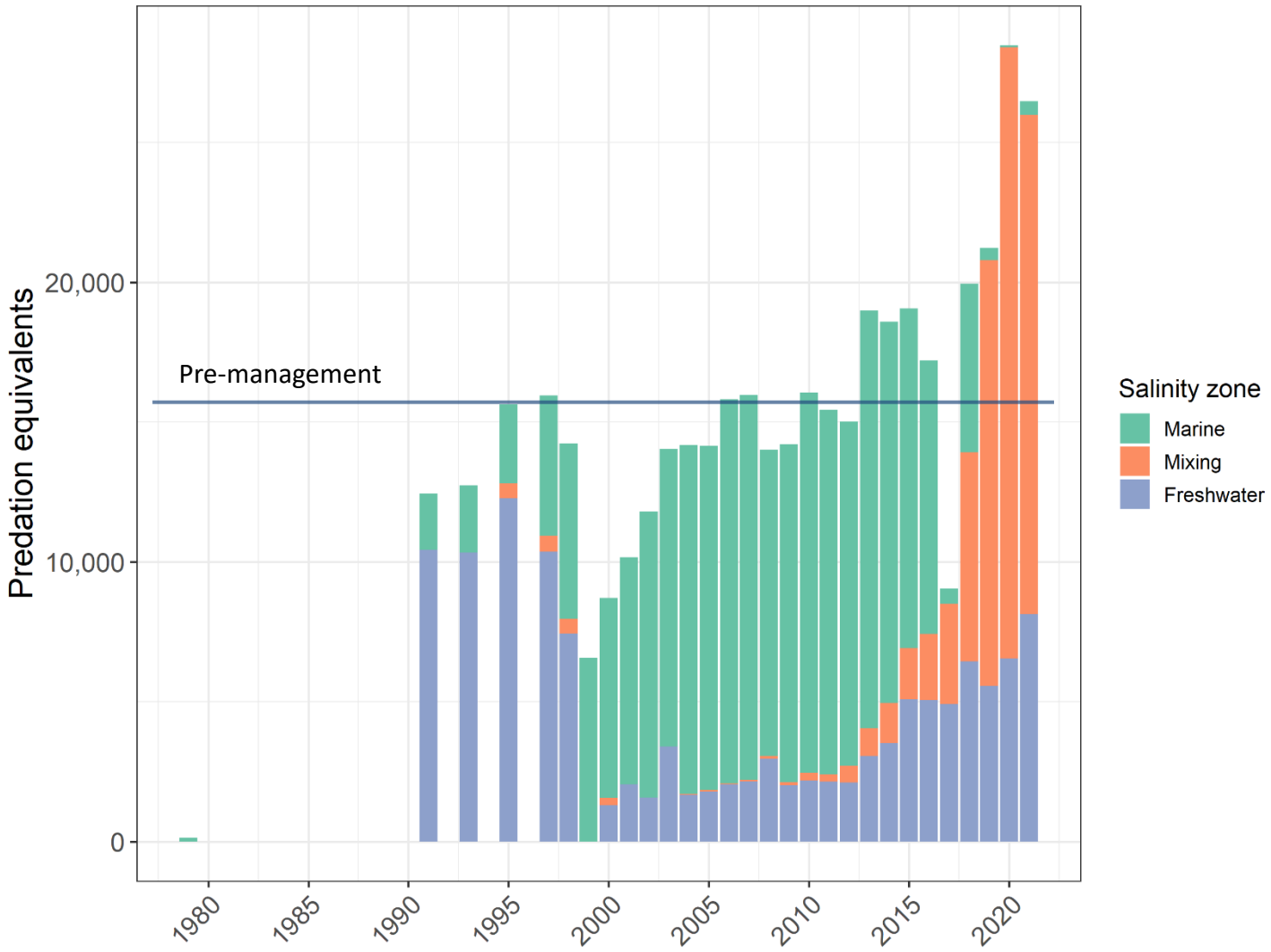
Predation of LCR Chinook unknown for bridge colony, but presumed high

ESU/population	Predation rate, East Sand Island DCCO colony
LCR Chinook	27% (2007-2014)
Big Creek Hatchery Tule Chinook	41% (2002-2012)

T. Lawes

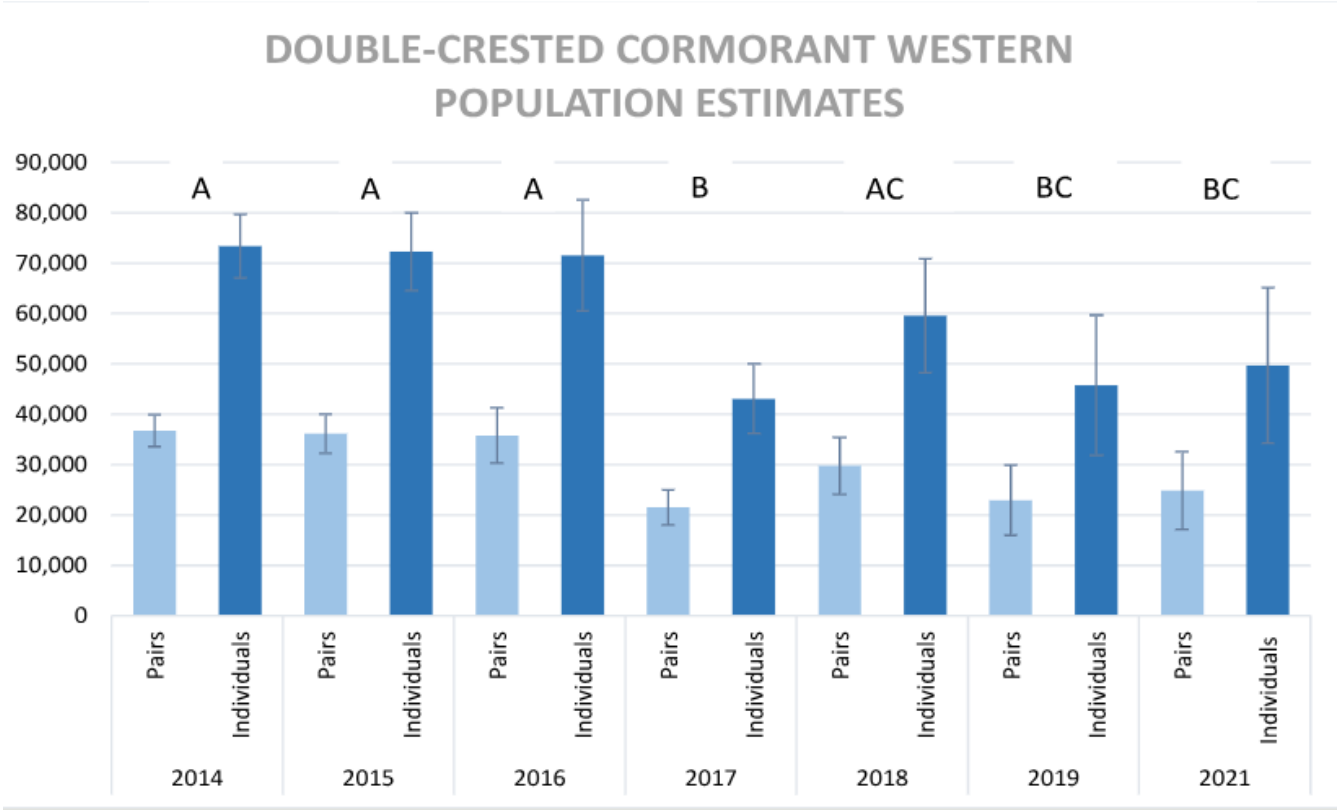
ODFW: estimated estuary-wide predation worse than prior to management

- ODFW estimates estuary-wide DCCO predation on ESA-listed steelhead ~12% in 2022.
- Other work suggests estuary-wide DCCO predation on steelhead was at least ~10% in 2022 (Evans et al. 2023).
- Colonies besides the Astoria-Megler Bridge could be responsible for ≥25-42% of predation in the estuary, but more research needed.



Regional population of double-crested cormorants has declined

- USFWS has management authority
- Managed for no net loss of regional population
- “Take” constrained by size of regional population



Astoria-Megler Bridge Value Engineering Study – June 26th-29th

- 4 Day Virtual Study held over the Microsoft Teams virtual meeting platform
- Facilitated by Value Management Strategies, Inc.
- Attended by over 40 individual representing Tribal Nations, Inter-Tribal Fish Commission, non-profits, State and Federal Agencies, and Consultants

VMS®
Value Management Strategies, Inc.

Astoria-Megler Bridge Value Engineering Study – Team Members

Oregon Department of Transportation

Cowlitz Indian Tribe

WSDOT

OREGON Fish & Wildlife

USDA APHIS

YAKAMA NEZ PERCE WARM SPRINGS UMATILLA

U.S. FISH & WILDLIFE SERVICE DEPARTMENT OF THE INTERIOR

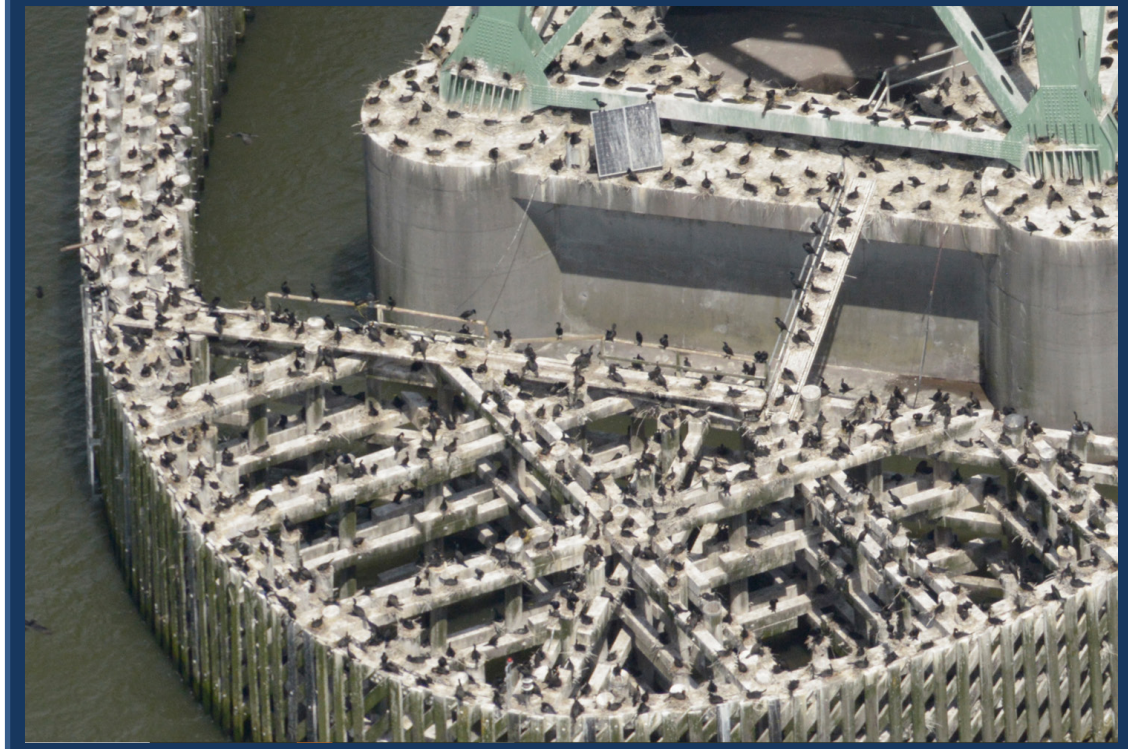
WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Oregon State University

VMS Value Management Strategies, Inc.

ANIMAL SOLUTIONS WILDLIFE REMOVAL

Astoria-Megler Bridge Value Engineering Study – Interested Parties



US Army Corps of Engineers®

Confederated Tribes and Bands Yakama Nation Treaty of 1855

Oregon Department of Transportation

Oregon Fish & Wildlife

Washington Department of Fish and Wildlife

Northwest Power and Conservation Council

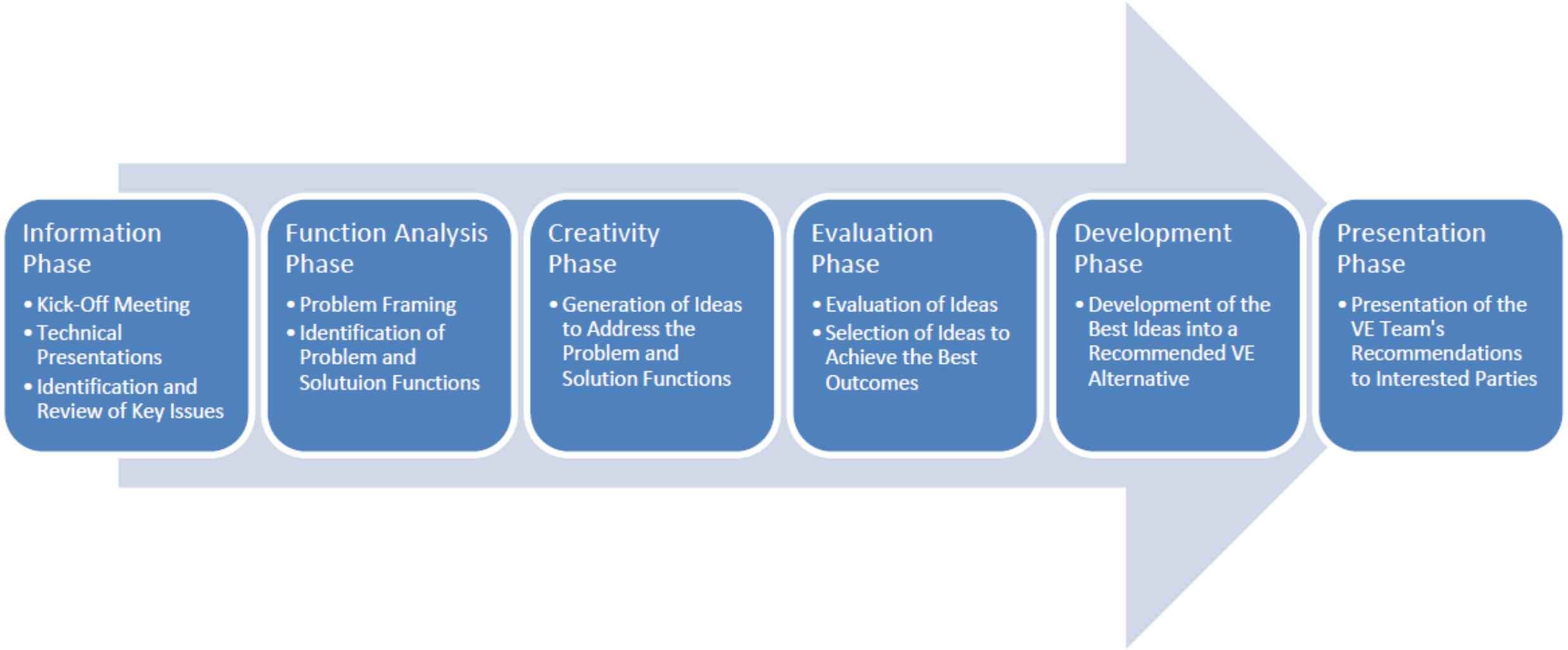
Willamette Riverkeeper

National Oceanic and Atmospheric Administration NOAA U.S. Department of Commerce

Audubon Society of Portland Founded in 1902

USDA APHIS

Value Engineering Study – Process

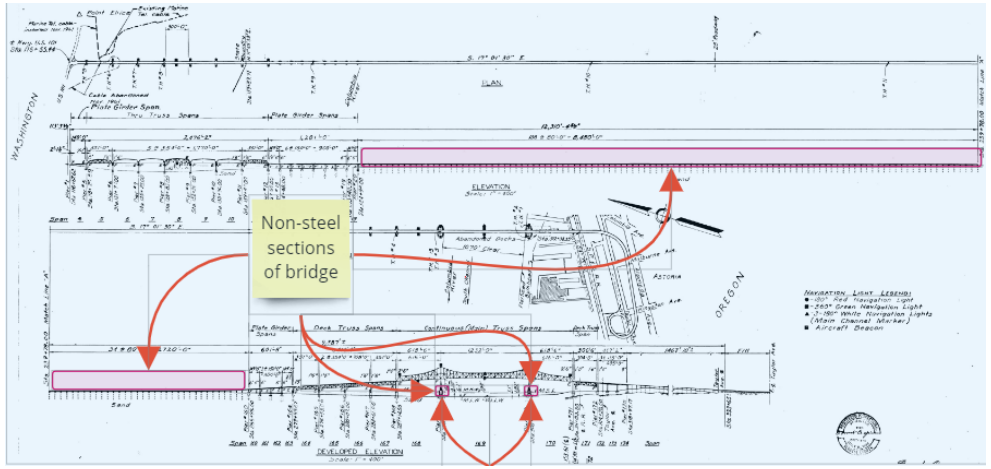


Problem Statement: What is the best strategy to deal with damage to the bridge caused by cormorants?

Value Engineering Study – 3 Alternatives Advanced

VE Alternative 1: Create Habitat on East Sand Island

VE Alternative 2: Alternative Habitat Considerations



VE Alternative 3: Create Habitat on the Astoria-Megler Bridge

Value Engineering Study – Recommendations

The team unanimously recommends:

Take immediate action to address the impacts to safety on the Astoria-Megler Bridge.

Deter double-crested cormorants from using the Astoria-Megler Bridge.

Attract and reestablish the double-crested cormorant colony at East Sand Island.

Prevent the redistribution of double-crested cormorants upriver of the Astoria-Megler Bridge that would be displaced by management activities.

Create a funded, full-time position(s) to coordinate the effort between the dozens of agencies and entities involved.

Identify and allocate the funding needed to support this effort.

Value Engineering Study – East Sand Island - Five Main Actions

- The Push - Deter double-crested cormorants from nesting on Astoria-Megler Bridge and other colony sites of management importance with passive exclusion and active harassment
- The Pull – Social attraction and habitat enhancement at East Sand Island to attract displaced cormorants back to East Sand
- Monitoring cormorant dispersal within the basin and predation rates
- Adaptive Management to deter nesting at additional estuary colony sites
- Evaluation whether cormorant management improved outcomes for salmonids

Cost Estimation to Implement Recommendations

- Year 1-4: $18.4M
- Year 1:
  - $6M in one-time costs
  - $3.1M in recurring costs
- Year 2-4
  - $3.1M in annual costs
- Year 4+
  - If successful in push/pull efforts from bridge to East Sand Island, lowest possible figure moving forward is $400K (monitoring, nominal amount of hazing and cleaning)

Value Engineering Study – Next Steps

1. Prepare and distribute draft report for the VE Team to review and provide feedback on.

2. Prepare Final Report for distribution and review by state and federal agencies, tribes, and interested parties.

3. Convene a meeting with key entities to develop a consensus on a path forward.

4. Establish an IGA between USACE and other state, tribal, and federal agencies to determine how East Sand Island could be used to reestablish a DCCO colony on it.

5. Further develop and refine the details related to the various strategies identified in this report.

6. Identify funding to support the strategies.

7. Commence actions in support of implementation of the recommendations.

Astoria-Megler Bridge Double-Crested Cormorant Value Engineering Study

Questions?

Final Value Engineering Study Report

Astoria-Megler Bridge
Double-Crested Cormorant Study

Oregon Department of Transportation

Project No. B37331

November 2023

Prepared by

Value Management Strategies, Inc.

Value Management Strategies, Inc.

Date: November 8, 2023

To: Peter Kennedy, ODOT VE Program
Oregon Department of Transportation

Subject: Final Value Engineering Study Report (VMS No. 3170-012)
Astoria-Megler Bridge Cormorant Study, Project No. B37331

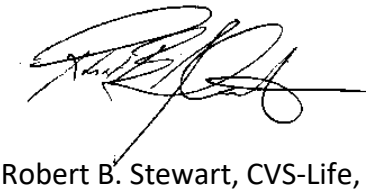
Dear Mr. Kennedy:

Value Management Strategies, Inc. is pleased to submit this Final VE Study Report for the referenced project. This report summarizes the events of the virtual study conducted June 26-29, 2023, via the Microsoft Teams virtual meeting platform for ODOT.

It was a pleasure working with ODOT on this project. If you have any questions or concerns regarding this report, please contact me at (503) 957-9642 or rob@vms-inc.com.

Sincerely,

VALUE MANAGEMENT STRATEGIES, INC.



Robert B. Stewart, CVS-Life, FSAVE, PMP, PMI-RMP
VE Study Team Leader

Copy: (PDF) Addressee
(PDF) Rebecca Burrow, ODOT
(PDF) Ray Bottenburg, ODOT

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EXECUTIVE SUMMARY

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FINAL

A Value Engineering (VE) study, sponsored by the Oregon Department of Transportation (ODOT) and facilitated by Value Management Strategies, Inc. (VMS), was conducted to address the presence of double-crested cormorants (DCCOs) located on the Astoria-Megler Bridge which spans the Columbia River and connects the states of Oregon and Washington.

The purpose of this VE study was to organize a multi-disciplinary team that features subject matter experts who represent numerous federal, state, and regional organizations to identify potential solutions to mitigate the impacts caused by the DCCO colony on the bridge and to the traveling public. A virtual VE study was conducted June 26-29, 2023, using the MS Teams® and Miro® virtual meeting software applications. This *Executive Summary* provides an overview of the project, key findings, and the alternatives developed by the VE team.

SUMMARY OF CURRENT SITUATION

The Astoria-Megler Bridge connects the cities of Astoria, Oregon, and Point Ellice near Megler, Washington. Its construction played a significant role in improving transportation and fostering economic growth in the region.

After several decades of planning, construction of the Astoria-Megler Bridge commenced in 1962. The project faced numerous engineering challenges due to the strong river currents, the unstable riverbed, and the harsh coastal environment. Engineers had to design a bridge that could withstand these environmental factors while providing safe passage for vehicles. The bridge's construction utilized innovative engineering techniques to overcome these obstacles. It is recognized as the longest continuous truss bridge in North America. This design choice was crucial to both maintaining navigability for large ships and avoiding interference with marine traffic.

On July 29, 1966, the Astoria-Megler Bridge was officially opened to the public which marked a significant milestone for the region's history. The bridge spans approximately 4.1 miles (6.6 kilometers) from Astoria to Point Ellice thereby making it not only the largest continuous truss bridge in North America, but also one of the longest continuous truss bridges in the world. Since its completion, the Astoria-Megler Bridge has played a vital role in connecting communities from both sides of the river. It serves as a vital transportation link and carries thousands of vehicles daily such as cars, trucks, and recreational vehicles. The bridge has significantly reduced travel times between Oregon and Washington which has stimulated economic development and promoted tourism in the area.

Between 1989 and 2015, the size of the DCCO colony on East Sand Island (located downriver from the Astoria-Megler Bridge) grew from about 100 pairs to more than 15,000 pairs (approximately 40% of the western population). Impacts on the survival of ESA listed juvenile salmonids (especially steelhead) are of concern to NMFS and regional fish managers. Following major DCCO culling and exclusion efforts at East Sand Island in 2015, many of the DCCOs have relocated from East Sand Island to the Astoria-Megler Bridge, a location where a higher percentage of salmonids are available for the birds to eat.

The DCCOs, a species of colonial waterbird, has had a notable impact on the Astoria-Megler Bridge. These birds have established a significant presence in the vicinity of the bridge. One of the primary impacts of the cormorants is their nesting behavior. They have chosen the bridge's piers and beams as ideal locations for nesting and roosting. This behavior poses several challenges and concerns. The accumulation of bird droppings can lead to structural corrosion and deterioration of the bridge's materials over time. Additionally, the nesting materials impede the ability of bridge engineers to inspect the steel members for defect which is a process that occurs every two years. Finally, the cormorants do pose a risk to motorists on the bridge. In particular, fledglings are routinely struck by vehicles during nesting season.

To mitigate these issues, authorities have implemented various measures to deter the cormorants from nesting on the steel sections of the bridge. Efforts have included the installation of deterrent devices and hazing activities to discourage the birds from perching and nesting. These measures aim to protect the bridge's integrity and ensure the safety of the traveling public; however, without a "pull" to induce the cormorants to relocate to another site and significant reinforcement by human hazers, these efforts have not been biologically sufficient to deter nesting on all the steel sections of the bridge.

The presence of DCCOs near the Astoria-Megler Bridge have thus posed ongoing challenges regarding maintenance, structural integrity, and public safety. If the situation continues, it is anticipated that bridge inspection and maintenance costs will increase, and public safety risks will be posed.

PROBLEM STATEMENT

The purpose of this VE study is to address the following problem statement: *What is the best strategy to deal with damage to the bridge caused by cormorants?*

While it is acknowledged that ODOT's primary concern pertains to public safety in relation to the continued use of the Astoria-Megler Bridge, there are also concerns regarding the ESA-listed juvenile salmonids that comprise a substantial portion of the DCCO diet. Additionally, the conservation status of DCCOs located in the Columbia River Estuary is a major concern. In light of this, solutions developed to address the problem statement above must be mindful of balancing the impacts to both listed juvenile salmon and the DCCOs in the region.

KEY ISSUES

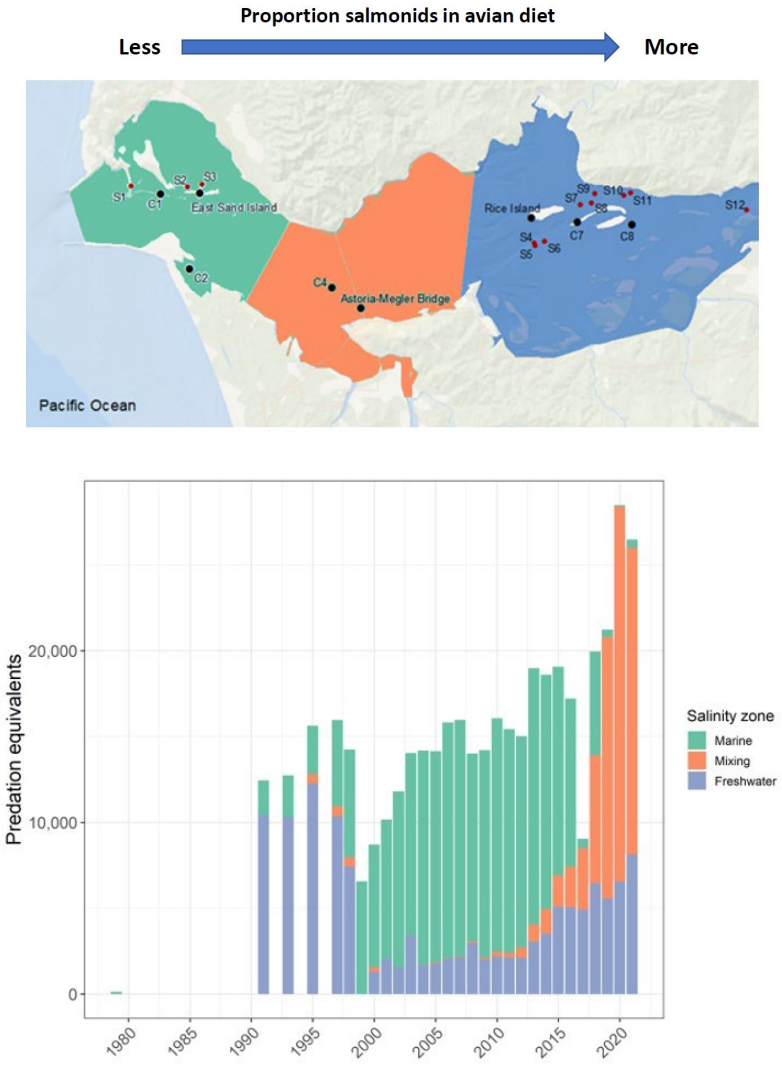
The information listed below summarizes the key issues that have precipitated the need to find a solution to this problem.

Impacts to Bridge Safety:

- Safety inspections mandated by the National Bridge Inspection Statute (NBIS, 23 CFR 650) require a clear view of steel surfaces, and debris associated with DCCOs conceals the steel surfaces, making them uninspectable unless the bridge is washed immediately before inspection.
- There has been an increase in corrosion due to fecal material and salt water.
- DCCO waste is a biohazard to maintenance workers.
- There has been an increase in the frequency of bridge maintenance and exposure of workers.
- DCCOs are road hazards to motorists.
- DCCOs interfere with navigational lights and equipment which poses a safety risk to watercraft.

Impacts to ESA-Listed Salmonids:

As stated previously, per-capita predation rates by the Astoria-Megler Bridge DCCO colony, along with potential growth of this colony, may pose a greater threat to salmonid restoration than the previous colony colony at East Sand Island. The figures below show the marine, mixing, and freshwater zones, and the relative predation rates over time. As DCCO have relocated from East Sand Island to the Astoria-Megler Bridge and other colonies, per capita predation rates have increased substantially. The Oregon Department of Fish and Wildlife (ODFW) estimates total estuary-wide DCCO predation on these runs to have been about 12-14% during the same year.

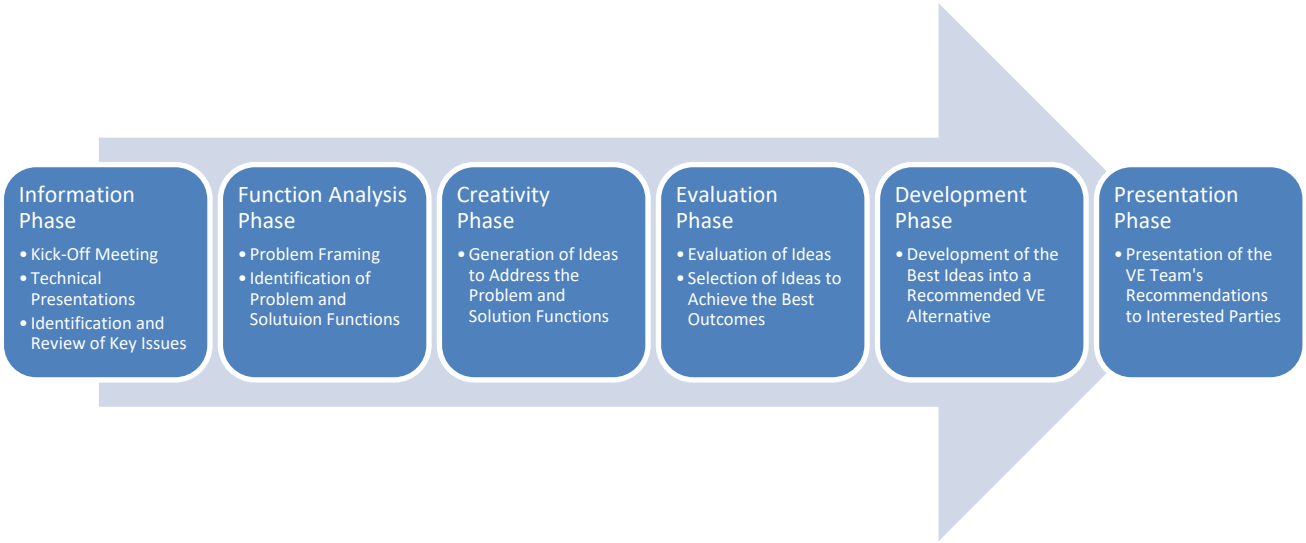


Impacts to Double-Crested Cormorants:

- Emphasize the use of non-lethal methods.
- DCCO fledglings are being struck on the bridge.
- Known formerly used peregrine nesting site located on the bridge is to be avoided.
- Brandt's cormorants, a federal Species of Concern, may be pulled to East Sand Island, which would be a reliable breeding location in the estuary.

VE STUDY PROCESS

The Value Engineering Study was conducted over a four-day period and involved the participation of over 40 individuals who represented 22 different entities. The process details contained below are summarized in the following infographic:



Overview of the Value Engineering Study Process

RECOMMENDATIONS

The VE team unanimously recommends the following actions:

- Take immediate action to address the impacts to safety on the Astoria-Megler Bridge.
- Use a "Push-Pull" approach, i.e., "Push" DCCOs from the Astoria-Megler Bridge and "Pull" them to East Sand Island.
- Deter DCCOs from using the Astoria-Megler Bridge (this is the "Push").
- Attract and reestablish the DCCO colony at East Sand Island as per the recommended VE Alternative located in the *VE Alternatives* section of the report (this is the "Pull").
- Prevent the redistribution of DCCOs upriver of the Astoria-Megler Bridge that would be displaced by management activities.
- Create a funded, full-time position(s) to coordinate the effort between the dozens of agencies and entities involved.
- Identify and allocate the funding needed to support this effort.

NEXT STEPS

The VE team has identified the next steps following the publication of this report:

1. Submit this Final Report for distribution and review by state and federal agencies, tribes, and interested parties.
2. Convene a meeting with key entities to develop a consensus on a path forward.
3. Establish an intergovernmental agreement (IGA) between the United States Army Corps of Engineers (USACE) and other state, tribal, and federal agencies to determine how East Sand Island could be used to reestablish a DCCO colony.
4. Further develop and refine the details related to the various strategies identified in this report.
5. Identify funding to support the strategies.
6. Commence actions in support of implementation of the recommendations.

VE TEAM

VE Study Team

Name	Organization	Title
Ray Bottenberg	ODOT	Bridge Section Mgmt.
Orren Jennings	ODOT	Bridge Engineer
Dan McFadden	ODOT	Bridge Maintenance
Paul Benton	ODOT	Biology
Rod Thompson	ODOT	Environmental
Angie Haffie	WSDOT	Environmental
Dalton Fry	Cowlitz Indian Tribe	Tribal Representative
Christina Donehower	Cowlitz Indian Tribe	Tribal Representative
Blaine Parker	CRITFC	Tribal Representative
James Lawonn	ODFW	Biologist
Joe Buchanan	WDFW	Biologist
Michelle McDowell	USFWS	Biologist
Jennifer Urmston	USFWS	Biologist
Matthew Alex	APHIS	
Dan Roby	OSU	Professor (retired)
Kate Self	NPCC	
Steve Osmek	Animal Solutions, LLC	
Rob Stewart	VMS, Inc.	VE Study Facilitator
Grace Hagen	VMS, Inc.	Assistant VE Facilitator

Key Project Contacts

Name	Organization	Title
Rebecca Burrow	ODOT	Bridge Preservation
Peter Kennedy	ODOT	VE & Risk Program Manager

ODOT invited the following Tribes and entities to participate in the VE Study:

- Chinook Indian Nation
- Columbia River Inter-tribal Fish Commission
- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Grand Ronde Community of Oregon
- Confederated Tribes of Siletz Indians
- Confederated Tribes of the Warm Springs Reservation of Oregon
- Confederated Tribes of the Umatilla Indian Reservation
- Cowlitz Indian Tribe
- Nez Perce Tribe
- Shoalwater Bay Indian Tribe

The Confederated Tribes and Bands of the Yakama Nation, the Columbia River Inter-tribal Fish Commission, and the Cowlitz Indian Tribe responded that they would like to participate on the VE Study panel.

VE ALTERNATIVES

VE ALTERNATIVES

The results of this study are presented as individual alternatives to the current state of the DCCO colony located on the Astoria-Megler Bridge. Each alternative consists of a discussion of technical details and considerations such as the act of implementation, cost, and the time to implement. (Please refer to the *Idea Evaluation* section of this report for an explanation of how the VE team selected these ideas to develop as VE alternatives).

VE ALTERNATIVES

The VE team recommends implementing VE Alternative 1, which would relocate the existing DCCO colony at the Astoria-Megler Bridge to East Sand Island. VE Alternatives 2 and 3 were also explored and are detailed in this section, but these are not recommended. However, these alternatives could potentially be pursued, if necessary, and are included for both future reference and to share the VE team's thoughts on these options.

Alternative No. and Description
VE Alternative 1: Create habitat at East Sand Island
VE Alternative 2: Create habitat at multiple locations (i.e., Trestle Bay, Snag Island, Grays Harbor)
VE Alternative 3: Create habitat on the Astoria-Megler Bridge

RECOMMENDED VE ALTERNATIVE – Create Habitat at East Sand Island

Part 1: Develop Strategy, Monitor DCCO

Discussion of Technical Details:

Guiding Objectives

1. Ensure that any harm associated with the double-crested cormorants on the Astoria-Megler Bridge are either reduced or eliminated.
2. Ensure that estuary-wide predation on ESA-listed salmonids does not exceed the equivalent of 5,380-5,939 breeding pairs on East Sand Island. This range was chosen to meet fish survival objectives established for double-crested cormorant management in the Columbia River estuary. It is expected that non-ESA listed stocks would also similarly benefit.
3. Ensure the western population of double-crested cormorants continues to be sustainable.

A sustained management effort of primarily non-lethal techniques (with limited lethal reinforcement) could be implemented to reduce the abundance of double-crested cormorants on the Astoria-Megler Bridge colony. Said effort should seek to reduce other colonies that exist upriver of East Sand Island while also minimizing the dispersal of double-crested cormorants to undesired areas.

Five main actions would be necessary for this effort to succeed:

1. First, double-crested cormorants would need to be deterred from nesting on the Astoria-Megler Bridge and other colony sites of management importance. Deterrence methods could include the deployment of passive exclusion such as netting, bird wires, and/or other physical deterrents. The use of such exclusion techniques would be limited to those that do not adversely affect the structural integrity of the Astoria-Megler Bridge or other structures used by cormorants for nesting. Along with passive exclusion, workers operating from boats (or on the colonies themselves) would harass, or "haze," cormorants prior to the breeding season. These persons would continue harassment as needed through the duration of the breeding season. Harassment could involve use of water cannons, handheld lasers, pyrotechnics, predator effigies, and/or other techniques. Some lethal removal of adult birds could be necessary to reinforce other methods.
2. Second, social attraction techniques would be used to attract cormorants displaced from the Astoria-Megler Bridge, and other colonies, back to East Sand Island. This action would be expected to increase the efficacy of deterrence activities and reduce the likelihood of cormorant dispersal to undesired locations. Management of bald eagle and gull disturbances could also be a component of social attraction on East Sand Island.
3. Third, monitoring the status of double-crested cormorants would be necessary to evaluate both the degree of double-crested cormorant dispersal within the basin and the general effect of management on the regional population. In addition, annually monitoring predation rates at double-crested cormorant colony sites in the estuary would be necessary to ensure that management reduces predation impacts on salmonids.
4. Fourth, adaptive management would likely be necessary to deter nesting at additional estuary colony sites, because it is probable at least some individuals would disperse to undesired locations, including some locations already occupied by DCCOs.

5. Finally, to the extent possible, managers would evaluate whether the double-crested cormorant management improved outcomes for salmonids. Such evaluation would ideally be based on changes to salmonid survival rates, but it could also be derived from a community-based modelling approach informed by research on food web dynamics in the estuary and plume. New research on food web dynamics would likely be needed for the latter modelling approach.

Monitoring necessary for ensuring the guiding objectives are met include the following:

1. The Astoria-Megler Bridge should be monitored annually to assess the effects of the colony on bridge use and maintenance. Annual assessments will also fully inspect bridge components to maintain worker safety and worker access.
2. Double-crested cormorant surveys should occur annually throughout the entire length of the Columbia River basin, with an emphasis on the estuary, to document potential dispersal or growth of other colony sites.
3. Annual estimates of predation rates on juvenile salmonids should occur on an estuary-wide level to document changes in predation impacts on fish.

Adaptive management is a crucial component of any proposed management plan to ensure that benefits are realized for the bridge, salmonids, and birds. There is a substantial degree of uncertainty about near-term outcomes of management. Undesired outcomes would ideally be addressed in a timely manner. For example, if cormorant dispersal to the freshwater zone occurs, early detection and rapid response would reduce the risk of establishment of new colony sites that could lead to costly, and possibly protracted, management interventions.

Implementation Considerations:

<u>Challenges and Responses</u>

1. The ability for managers to 1) access East Sand Island, and 2) deploy preferred management techniques is unclear.
    - A real estate agreement will be necessary for non-Corps workers to access the island.
    - Coordination among regional managers will be necessary to develop effective management techniques.
    - The management techniques will need to be approved by the Corps.
    - The Corps will likely need to update their current National Environmental Policy Act (NEPA) documentation to include new management techniques.
2. It is difficult to estimate the predation rates associated with some freshwater zone colonies.
    - Many cormorants in the freshwater zone nest at colonies that are not currently monitored for predation impacts.
    - Many of these colonies occur at navigation markers or other sites associated with the river channel. This makes the recovery of PIT tags used to derive predation estimates difficult or impossible.
3. Migratory bird permits will be required for lethal take associated with management at the Astoria-Megler Bridge and will need to meet regulatory requirements.
    - Long processing times can be associated with obtaining these permits.

4. Coordination across jurisdictions would be necessary for this recommendation to be successful.
    - Given the multiple jurisdictions and agencies involved, it is currently unclear which parties would be responsible for implementation, monitoring, and adaptive management.
5. Capacity is a challenge.
    - Additional staff, including contractors, will be needed to develop and implement the full Columbia River Estuary strategy plan.
6. The response by double-crested cormorants to management cannot be known with certainty.
    - It is possible that population growth in the freshwater zone could occur despite efforts to socially attract DCCO to sites west of the A-M Bridge. This could require substantial management effort to address.
    - If social attraction of DCCO to desired sites is unsuccessful, it is possible that their estuary-wide abundance could decline substantially which could reduce overall abundance of the western population.
    - Long term on-colony staff at East Sand Island will be necessary to implement and monitor social attraction techniques, serve as a deterrent for bald eagles and gulls, and inform the type of adaptive management required.
7. There is mixed public support for management plans that have lethal take of DCCO as a technique.
    - A communication strategy will need to be developed and implemented to inform stakeholders and the public.
8. There is litigation risk due to both lethal reinforcement as a management technique and the potential of dispersing DCCO upriver to areas that may be more difficult to manage. Depending on ruling, this could slow or stop the timeline for implementation and/or increase costs associated with litigation.
    - Communicating with stakeholders during project planning may reduce misinterpretation that can lead to litigation.
    - Fully documenting all decision making will be required for this project.
9. Because the estuary and the Astoria-Megler Bridge are highly attractive locations for DCCO, adaptive management may be needed in perpetuity to address issues associated with the bridge and predation on salmonids.
10. Sources of funding for management have not been clearly identified.

Cost Considerations:

There is a high degree of uncertainty related to the costs of management at the bridge and the estuary. A major reason for this uncertainty is that the response of cormorants to different levels of management effort and various management techniques is unclear. For example, the range of possible deterrence options for the bridge vary considerably in price; and the effectiveness of these options is uncertain. Therefore, the cost of deterrence alone could shift depending on the response of cormorants to the type(s) of deterrence selected. The same kind of "compounding" uncertainty related to cost could likewise be a factor for other components of management. Nevertheless, preliminary estimates are provided here as a starting point for further discussion.

The overall cost for this plan is estimated to be at least $18.4 million for the first four management years ($6 million in one-time costs and $3.1 million in annual costs). The $3.1 million annual costs may decrease over time as DCCO fidelity to East Sand Island increases and as the efficacy of deterrence improves at the Astoria-Megler Bridge and other sites where displaced birds may attempt to relocate.

After the first four management years, because the Columbia River estuary is a highly attractive site for DCCOs, monitoring and management will likely be required in perpetuity to prevent the reuse of the bridge and other undesired sites for nesting. Therefore, even under the very best of circumstances a minimum $0.4 million will be required annually following the initial four-year management period to continue the monitoring and deterrence efforts on the Astoria-Megler Bridge and other colony sites. If relocation of DCCOs to East Sand Island is not successful, annual costs for monitoring and deterring cormorant use of undesired sites in the estuary will be substantially greater than $0.4 million annually.

The $6 million in one-time costs breaks down as: $1 million to purchase and equip a fire boat for hazing, $2.25 million to install catwalks on the bridge to facilitate hazing, $1 million to install ladders on the bridge to facilitate hazing, $1 million to install bird netting on the bridge, and $0.75 million to install bird wire or “daddi long legs” on pier caps of the bridge. The $3.1 million in annual costs breaks down as: $0.15 million for cleaning of the bridge, $0.875 million for operating the fire boat, $0.48 million for hazing at the bridge, $0.5 million for social attraction on East Sand Island, $0.3 million for a status assessment of the regional double-crested cormorant population (ideally conducted prior to plan implementation), $0.4 million for monitoring within the Columbia River basin, and $0.4 million for deterring the use of other colony sites.

Time Considerations:

Given the need for both substantial funding and coordination across various governmental and tribal entities and compliance with federal and state environmental laws and regulations, it is likely that recommended actions would begin no sooner than 2024 or 2025. Adaptive management and monitoring would likely be needed in perpetuity across the estuary to ensure that objectives related to fish and bird conservation are met and sustained.

Part 2: Create Habitat

Discussion of Technical Details:

Develop a Cormorant Colony Restoration Plan for East Sand Island that:

1. Evaluates habitat on ESI for the best 1-acre colony site and avoids the CATE colony.
2. Establishes the boundaries of the nesting area (approx. 1 acre). Consider a larger area initially so that the colony has room to establish, then tighten the boundary.
3. Establishes a privacy fence around the nesting site to allow for monitors.
4. Enhances habitat as needed to optimize habitat for nesting DCCO colony; helps cap size of DCCO colony at 5,000 nesting pairs (or include in the plan a discussion on colony size).

5. Includes pilot study and an experiment to provide various designs of overhead protection from eagles and gulls in the habitat that can become scalable (if successful) to provide additional protection to colony nest site.
6. Details such as social attractions to promote colony formation: decoys, vocalization, tires, and sticks to mimic nests.
7. Include resident colony monitors and adaptative management plan for colony establishment and the management of colony size (e.g., reducing area of privacy fence and hazing DCCO outside of the fence, which is a proven approach on ESI with previous management plans).
8. Include an Implementation, Monitoring, and Adaptive Management Plan

The plan should be developed in coordination with USACE and other agencies.

Technical Considerations:

Eagle and Gull Management: consider how to reduce or minimize eagle impacts to the colony.

Eagles using the western jetty, dozens in total, have been observed early in nesting season.

Potential location of nesting site on East Sand Island; polygon is 1.5 acres in size.

Implementation Considerations

- Agreements with USACE will need to be developed for work on East Sand Island to attract the DCCO colony and having resident colony monitoring.
- Policy discussion which requires political and jurisdictional compromise.
- Funding issue: Who pays for this? Perhaps BPA through the Northwest Power or possible working with the Columbia Basin Collaborative to advocate for multi-party funding.

- Implementation issue: Who develops and implements the plan? Identify a qualified agency to take led on implementation. Work needs to be completed by someone with experience working with DCCO colonies.
- If possible, restoration should be completed the season prior to commencing Astoria-Megler Bridge hazing and deterrent efforts (late September-October of previous year).
- Would this require a new EIS on the USACE part or do EIS objectives still apply? Would ODOT need to complete the NEPA analysis?
- Does Implementation need to occur within the parameters of the EIS for ESI?
- USFWS and ODFW permits should work on DCCO colony on ESI.
- Real estate to be negotiated with USACE for access and assurances that the work can occur onsite.

Cost Considerations:

What would the major costs include for this element? How might this element be funded? ODFW has developed a cost estimate for implementation and monitoring and management.

1. Coordination to create habitat and to fit into work on AMB (push/pull). This is expected to take 2+ years and be multi-agency involvement.
2. Development of Restoration Plan
3. Implementation: ODFW has developed Cost Estimate, 0.5 m for social attraction
4. Monitoring Management in perpetuity: ODFW has developed Cost Estimate

Time Considerations:

1. Coordination: ongoing, expected to take 2+ years
2. Development of Restoration Plan: 1 year
3. Habitat Enhancement/Fencing: 3 months
4. Monitoring and Adaptive Management: Resident monitoring will be required for a minimum of 4 years (ideally 6 to 7 years) when colony is moving to ESI from AMB. Resident monitoring includes people living on ESI and monitoring the colony daily during breeding season. Once the colony has fully moved, drone or aerial surveys can track colony stability for several years after colony moves.

Function State = less than 5,000 and more than 1,000 breeding pairs for 2+ years consecutive years.

Total timeframe for implementing= 7 to 10 years.

Part 3: Manage DCCO

Technical Details:

An appropriate DCCO management strategy for the bridge would likely consist of the following measures:

1. Remove all old nests and associated "crust" before the nesting season (between September to March). Such a nest removal program should be evaluated, and waivers or exceptions will be sought for NPDES related to washing debris into river. More frequent cleaning will benefit water quality (i.e., less concentration of material washed into the river) and will further reinforce deterrence. This approach is currently only feasible via a snooper truck. The use of a boat mounted water jet would more easily facilitate this debris removal process.
2. Active nest removal (i.e., removal of nests containing eggs or chicks to the extent possible prior to hatching) during the nesting season (April through August) will be needed to deter DCCOs from reestablishing a colony on the bridge. The degree of active nest removal would be set by the Columbia River DCCO Plan and required permits. It is anticipated that hazing measures would reduce the likelihood of having to remove nests both during and post construction. As a reference point, the recent ODOT painting contract was permitted to remove up to 1,500 active nests annually; however, no active nests were required to be removed due to active hazing activities.
3. Additional reinforcement of hazing activities may be required which could involve some lethal take of adult DCCO. The degree of adult DCCO takes would be set by the Columbia River DCCO Plan and required permits. A previous draft plan had indicated 200-500 adult DCCOs as a reference point. The actual number would need to be delineated as part of the regional plan. The more aggressive the hazing program is, the more likely there will be limited adult DCCO takes needed to reinforce deterrence. Much of this will depend on the number of individuals involved in hazing activities. Increased human presence tends to have a strong deterrent effect; however, this increases labor requirements.

Implementation Considerations:

1. Identify funding for capital and annual costs.
2. Identify which entity will be responsible for managing hazing activities (both from bridge and by boat). This could potentially be a contracted service.
3. Need to secure an intergovernmental agreement between Oregon and Washington to modify the bridge.
4. Develop a design for the bridge appurtenances (assume 12-months once from the time funding is secured).
5. Create contract for the construction of appurtenances (2-3 months to advertise, bid, and award).
6. Need to pursue National Pollutant Discharge Elimination System (NPDES) permits.
7. Obtain agreements and permits from USFWS and both Oregon and Washington for active nests and adult DCCO takes.
8. Obtain NEPA permits.
9. Develop a public outreach and communication plan related to DCCO management on the bridge.

10. Verify that water pulled from around the Astoria-Megler Bridge is of sufficiently low salinity to avoid damaging the structure when using high pressure water spray for hazing and nest removal. Initial info indicates that this should not be an issue.

Cost Assumptions:

1. One-time cost to purchase a fire boat is approximately $1 million. (For example, consider a Grandsea 17m Aluminum Fast Monohull Fire Fighting Boat/Fire Boat for sale on Alibaba.com)
2. One-time cost to install catwalks assumes new steel catwalks located under the deck trusses = 2,250 LF @ $1,000/LF =$2,250,000.
3. One-time cost to install ladders to provide access for hazing activities throughout select bridge areas assumed $1,000,000.
4. One-time cost to install bird netting at select locations (for the approx. 4,000 LF Washington spans) on the underside of the deck assumed = 4,000 LF x 44 LF = 176,000 SF x $5/SF = $880,000 (assume $1 million).
5. One-time cost to install bird wire or "daddi long legs" on top of the pier caps along the "Desdemona Sands" section. Assume 150 bents x $5,000/bent = $750,000.
6. Annual cost of bridge cleaning assumes removal of old nesting material and debris occurs annually between September and March. Previously, cleaning occurred every two years in conjunction with inspection cycles. Typical cleaning crew would consist of a snooper truck, water tender, collection truck. Assume 8 - 10 maintenance workers approximately 3 weeks = 1,200 hours to cover the steel span. Assume $80/hour = approximately $100,000. Assume $150,000/year for equipment costs.
7. Annual cost to crew, maintain, and operate a fire boat = assume a 3-person crew at $100/hour = 2,080 x 3 x $100 = $624,000/year. Assume $250,000 for fuel and maintenance. Total annual O&M =$875,000.
8. Annual cost to perform active hazing throughout the year on the bridge. Assume four-person crew at $80/hour x 4 x 1,500 hours/each = $480,000/year.
9. Annual cost for social attraction on East Sand Island assumed $500,000.
10. Annual cost for status assessment of regional DCCO population assumed $400,000.
11. Annual Cost for monitoring within the Columbia River basin assumed $400,000.
12. Annual cost for deterring the use of other colony sites assumed $400,000.

Total Initial Costs: $5,000,000 for bridge appurtenances and $1,000,000 for a boat = $6,000,000

Annual Recurring Costs = $150,000/year for cleaning; $875,000 for boat O&M, $480,000/year for bridge based hazing activities = $1,500,000/year

<u>Funding</u>

Assume ODOT/WSDOT do not currently have a funding source available to pay for bridge appurtenances.

The annual recurring costs for bird hazing activities could potentially be covered by the Columbia Basin Collaborative.

Time Considerations:

Astoria-Megler Bridge is currently in a painting cycle of the deck trusses and plate girders of the Oregon side. This painting will be completed on the South Deck Truss at the end of October 2023. The next painting cycle for the bridge would begin in January 2023. This provides a 6-year window to work on any bridge related modifications before the next painting cycle. Between 2024 and 2030, there will be three bridge inspection cycles which requires the removal of DCCO nests and cleaning of the structure (2024, 2026, 2028, and 2030).

The preference is to conduct inspections during May and June which is also the heaviest nesting times.

Depending on when the new habitat is created, assume the following sequence of activities. Also, assume the habitat is ready by April 2026:

1. Apply for an NPDES waiver, or exemption, to allow for the washing of DCCO debris into river.
2. In August of 2024, following bridge inspection, conduct pilot bird netting and/or other deterrence measure (i.e., bird wires or daddi long legs) programs to evaluate different netting systems and configurations (if needed).
3. In August of 2025, start cleaning old nests. Pressure wash and install bridge appurtenances (netting, catwalks, ladders, and other physical deterrence measures). Assume 18-months to complete installation. Acquire hazing boat. Hire and train crew. Begin developing an operational plan. Consider working with Wildlife Services (USDA) to help develop this program.
4. Commence hazing activities in March 2026 when new habitat is ready.

Part 4: Deter DCCO

Technical Details:

A combination of bird netting and hazing, by both boats and personnel, on the bridge could be implemented.

Bird netting would include anchors attached to the steel structural members that could be periodically removed to support inspections. The netting could also be removed seasonally to deal with concerns related to ice build-up during the winter season. Access portals could be considered to try and maintain the netting in place. Doing so would require ODOT bridge inspections and maintenance operations to be changed to accommodate this different type of access.

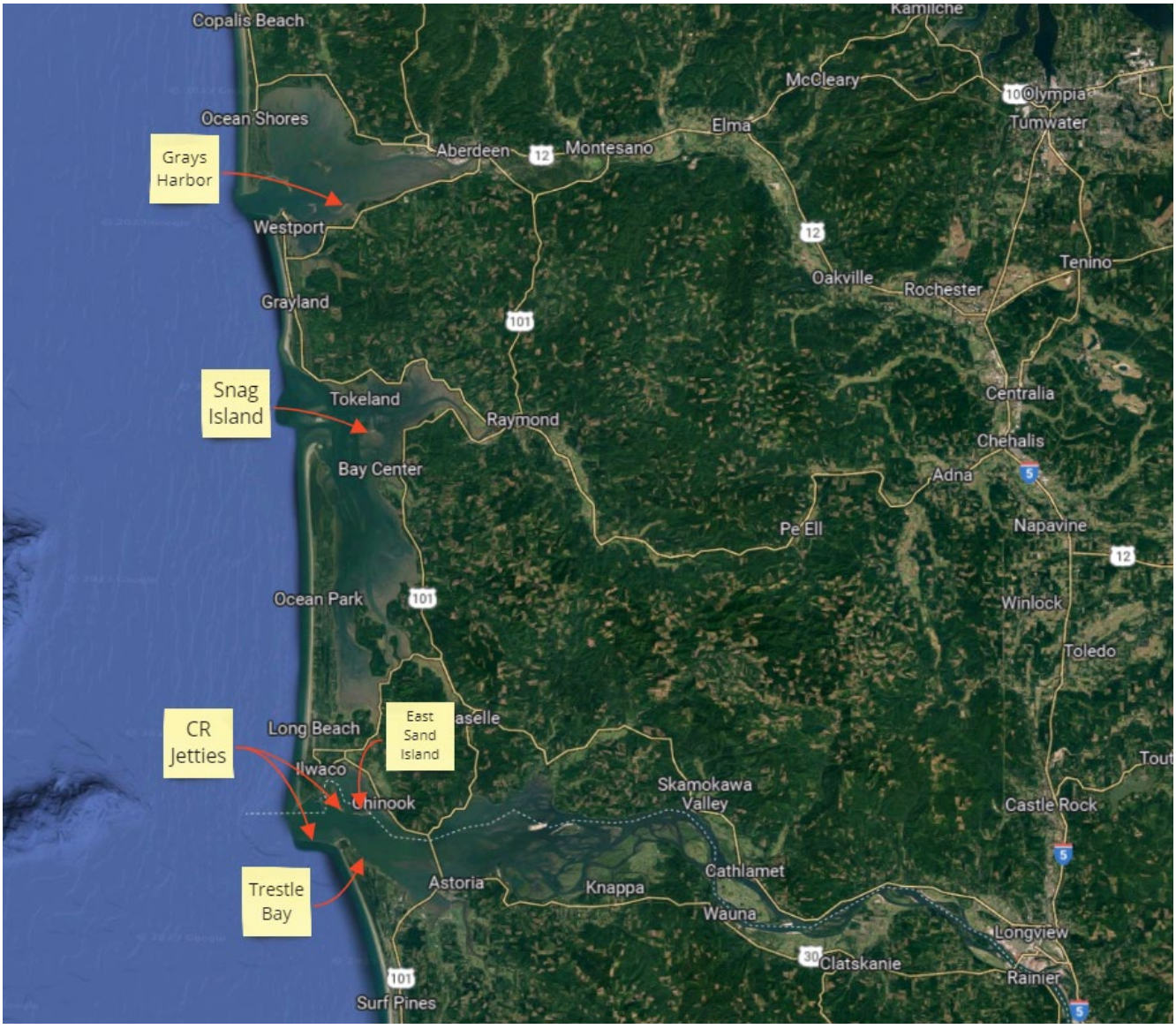
There are concerns about the efficacy of netting. There is a potential for birds to find gaps in the netting and establish nests behind the netting. Weather resistance is another challenge. A pilot program is recommended to test a few alternative deterrence solutions, such as "Birdzoff," or other proprietary systems.

Non-lethal hazing could include a combination of human harassment, water spraying via boats, the use of pyrotechnics, lasers, drones, paintball markers, etc. This can be weighed against the cost of netting or installed deterrence.

If a boat hazing operation is considered using water jets, weekly hazing between March through the end of August would be required. This would likely require the acquisition of a dedicated boat and crew to perform waterborne hazing operations 6 months a year. Installation of a catwalk under specific areas of deck trusses would allow personnel to actively harass birds as needed. This approach will require some kind of waiver, or exception to NPDES, to permit the washing of DCCO nesting material and feces into the Columbia River.

Some lethal removal of adult birds may be necessary to reinforce deterrence efforts.

HABITAT CONSIDERATIONS



Create Strategy

Discussion of Technical Details:

A finite number of possible sites were looked at for CATE. These sites were looked at for CATE and may be some of the better choices for DCCO.

Common to all potential sites: impacts by bald eagles; may need overhead protection. Additional efforts needed for attraction; increase time from site prep to when it would be ready for DCCO.

Willapa Bay – Snag Island (Ellen Sand)

- Pros: Gets DCCO out of the Columbia Estuary to an area where there are fewer listed salmonid stocks.
- Cons: Willapa Bay has commercial fisheries, has had issues keeping outlet open, features a world-class Chinook fishery.
- Already a preserve, owned and operated by DNR. This increases complications for manipulation; may need an EIS due to all the activities that would need to occur to establish this as a DCCO nesting site and due to the resources currently in the bay. Willapa Bay has ESA salmonids and the Chinook fishery.
- All sand and it would need to be built up with armoring to protect the newly constructed island. Plus, it needs habitat structure and nesting substrate.

Willapa Bay – Gun Powder Island

- Pros: Gets DCCO out of the Columbia Estuary to an area where there are fewer listed salmonid stocks.
- Cons: Willapa Bay has commercial fisheries, has had issues keeping outlet open, features a world-class Chinook fishery.
- All sand and it would need to be built up with substantial armoring to protect the newly constructed island. Plus, it needs habitat structure and nesting substrate.
- In an exposed area at the mouth at the bay.
- Will likely require an EIS.

Grays Harbor (3 potential areas that have been evaluated for CATE)

1. East and West Sand Island
    - Pros: West Sand Island is the better candidate. It has invasive weeds that need to be treated, has had CATE in the past, express interest in improving habitat for CATE, and it is a preserve. Cormorants are present in the bay, but no colony formations exist on the islands. Well established small colonies are on the channel markers south of the island. There is evidence of ESI cormorants using Grays Harbor and Willapa Bay before mitigation, so they do see these islands. West Sand Island is about 20 acres in size. Potentially, there is no ESA Salmonid predation issue (no listed stock); there is mostly chum salmon; salmon go out at a small size and are mostly ignored.
    - Cons: Gulls nest on West Sand Island
    - Area includes a DNR preserve, so it may be limited on habitat manipulation and may need to use natural materials.
    - Haul out will be required for Harbor seals and pupping site which attracts bald eagles. The area has had high counts for May over the last 10 years (combining both islands) and averages 20 eagles. Likely, these are resident birds due to the abundance of bald eagle habitat around the harbor. If CATE proposal moves forward, there would likely need to be some kind of mitigation for eagles. It is not likely to get approval for artificial structures to protect DCCO nest; this would likely be left up to the resident monitors.

2. Catie Island (at the mouth of Johns River)
    - Pros: 55 acres with lots of trees and shrubs and well-established small colonies on the channel markers
    - Cons: Assessed during low tide and coyotes were observed visiting the island during low tide. Racoons likely would visit as well.

3. Whitcomb Flat
    - Pros: The island is growing larger and has higher elevations and over 3+ acres of vegetation. Strong currents might help keep people for disturbing. Also, this is a DNR preserve so same caveats would apply. 1,000+ cormorants have been observed using the area (perhaps prospecting and foraging). There are well established small colonies on the channel markers.
    - Cons: Haul out will be required for Harbor seals and pupping site which attracts bald eagles. There is a strong current, so resident colony monitoring would be challenging.

Columbia River Estuary

1. Trestle Bay
    - Pros: It is in the marine zone. There is a history of nesting DCCO, up to 131 nesting pairs on the trestle, with the latest known nesting activity involving 16 pairs in 1992. Created land would not have competing interest or ownership complications.
    - Cons: It is unclear how one acre of habitat for nesting DCCOs could be provided at this site given limited existing nesting habitat. Potential ideas for supplemental habitat include building a nesting island, or docking barges within the bay that DCCOs could nest upon. Artificial structure may be unsightly. There is no memory of nesting in this location. We would be trying to use social attraction to get birds to a new site with no history that it is a safe place to nest. There is uncertainty regarding the success of getting a colony to establish. To increase certainty, we would want to establish some nesting attempts before trying to push the entire colony.

2. Jetty A
    - Pros: This is more viable that Jetty North and South because cormorants have nested on the nearby navigation marker in the past. It is in the marine zone.
    - Cons: This is connected to land, but terrain reduces predation as it lacks habitat. There is a working jetty that is maintained which may interfere with any habitat that has been enhanced. This would likely be owned by USACE, so it may need the same coordination as ESI. It would need substantial habitat enhancement.

3. West Sand Island
    - Pros: This is in the marine zone and is a large island. USACE owns it, so it would need the same coordination as ESI.
    - Cons: Predators are on the island and close to land; there is no history of colonial water bird nesting

Cost Considerations:

The cost for social attraction should be similar to ESI, but there is an increased cost with creating the habitat for alternative sites. This increases risk in both establishing habitat and successfully attracting DCCO.

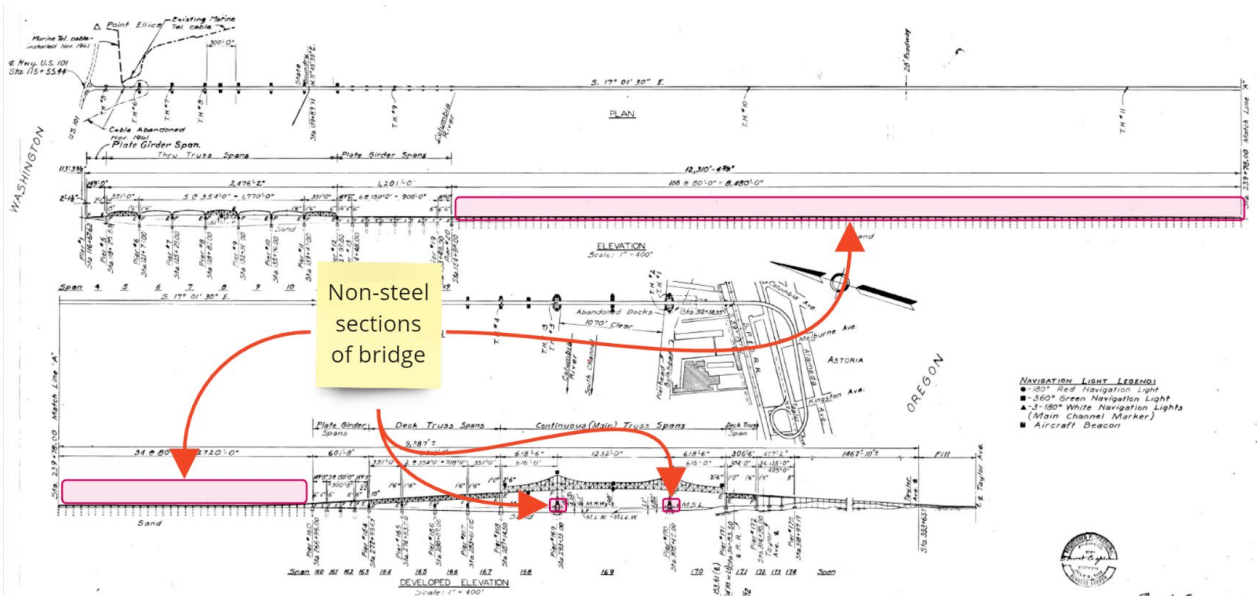
Snag Island would need dredged material, armoring to protect for erosion, and cap with suitable substrate for nesting plus do everything else identified for ESI.

A recent USACE project located in Chesapeake Bay, which included the development of a 3.4-acre bird island for colonial birds located in a similar environment, was approximately $9.4 million. Assume that the development of a 1-acre bird island would be approximately $3 million in cost to construct.

EXPLORATION OF HABITATS ON ASTORIA-MEGLER BRIDGE

The VE Team explored the idea of developing specific areas on Astoria-Megler Bridge to support the DCCO colony. The areas of the greatest concern are the steel segments of the bridge where inspection and painting activities are required. The team evaluated locations on the bridge that are not steel and discussed the attractiveness of these locations. There are only two locations that are not predominately steel that could support DCCO habitat. These include:

- The base of Piers 169 and 170 located beneath the main span of the bridge.
- The "Desdemona Sands" segment consisting of concrete piers and deck between Piers 20 and 159.



Potential DCCO habitat locations on the Astoria-Megler Bridge

The Base of Piers 169 and 170

Piers 169 and 170 currently support the main span of the Astoria-Megler Bridge. They are protected by fender structures and flank the main navigation channel. These locations are currently popular nesting areas for DCCOs as noted in the photo.

The VE Team calculated that each of these locations could support about 3,000 nests for a total of 6,000 (which exceeds the size of the current colony). The fender structure includes wooden structural members that offer numerous protected nesting areas at various levels above the river.

- 242 feet x 126 feet = 30,000 SF / 9 SF = 3,000 nests

There are numerous concerns with trying to keep DCCOs isolated to these two piers.

- First, this location invites DCCOs to the most critical area of the bridge that is susceptible to impacts from DCCOs (the main steel span of the bridge).
- Second, it also locates the DCCOs closer to ESA-listed fish. Hazing efforts will be occurring above the fenders.
- Third, the DCCOs currently impact the navigation lights and solar panels located on the fenders; this potentially adversely impacts the safety of watercraft.

For these reasons, it is not recommended that DCCOs be allowed to continue to nest in this location.

Desdemona Sands

This segment of the Astoria-Megler Bridge is approx. 11,000 feet long and consists of a series of concrete deck spans supported on concrete columns. There are nesting opportunities on top of each concrete bent cap as illustrated in the photograph below. The VE team calculates that this segment could support approximately 2,000 nests. The VE team assumes there are 150 bent caps at Desdemona Sands segment @ 125 SF per bent = 18,750 SF / 9 SF = 2,000 nests

This location is close to the water and is accessible by watercraft. The team has concerns regarding the attractiveness of this location for DCCO nesting.

While these areas could be considered, maintaining the DCCO colony at Astoria-Megler Bridge will continue to create impacts to the bridge and to listed juvenile salmonids. For these reasons, these locations are not recommended.

RACI MATRIX

The VE Team spent time thinking about how the many interested entities involved in the future of the DCCO colony in the Columbia River Estuary might be related to the implementation and management of any of the VE Alternatives discussed in this report. To this end, the VE team created a RACI Matrix to provide some initial thoughts on the various roles, responsibilities, and levels of involvement for the various elements required to effectively deal with this issue. The RACI Matrix provided on the following page identifies various interested parties and cross-references their potential level of involvement related to the major types of activities that would be required to implement an effective DCCO management strategy.

RACI refers to:

- Responsible: entity that performs the related activities.
- Accountable: entity that oversees those responsible and/or ensures related activities are completed.
- Consulted: entity whose input or feedback is explicitly required.
- Informed: entity who is kept apprised of the status of related activities.

Individual team members representing their organizations provided their initial thoughts on the appropriate level of involvement for the various activities. The team made assumptions for some entities that were not involved in this exercise to provide some initial suggestions regarding the appropriate levels of involvement (noted using black post-its). Also included were thoughts on potential funding responsibilities. The attached matrix should be viewed as a starting point for engaging in discussions with the various organizations.

RACI Matrix


Functions
ODOT
ODFW
WSDOT
WDFW
USACE
USFWS
FHWA
USDA APHIS-WS
NOAA / NMFS
BPA
USCG
Tribes
CRITFC
NPCC
CBC
Audubon
Humane Society
Willamette River Keeper
Undesignated Third-Party
Public
OSU / RTR
Develop Strategy
Adapt Strategy
Create / Manage Habitat
Monitor DCCO
Manage/ Deter DCCO (Estuary)
Manage/ Deter DCCO (Bridge)
Monitor Fish (Predation)
Maintain Bridge
Legend
Level of Involvement
Definition
Examples
R
A
C
I
RACI
$
Possible Funding Entity
Regulatory Oversight (permits and approvals)

PROJECT INFORMATION

VE STUDY INFORMATION

INFORMATION PROVIDED TO THE VE TEAM

The following presentations and supporting documentation were provided to the VE team for their use during the study:

- ODOT Presentation
- ODFW Presentation
- USACE Presentation
- Dr. Daniel Roby's Presentation
- USFWS Presentation
- CBC DCCO Receommendations
- CBC Presentation

This information is unique and is included in this section as reference material.

Astoria-Megler Bridge Double-Crested Cormorant Management

Presented by:

Rebecca Burrow,
ODOT Bridge Preservation

Support from:

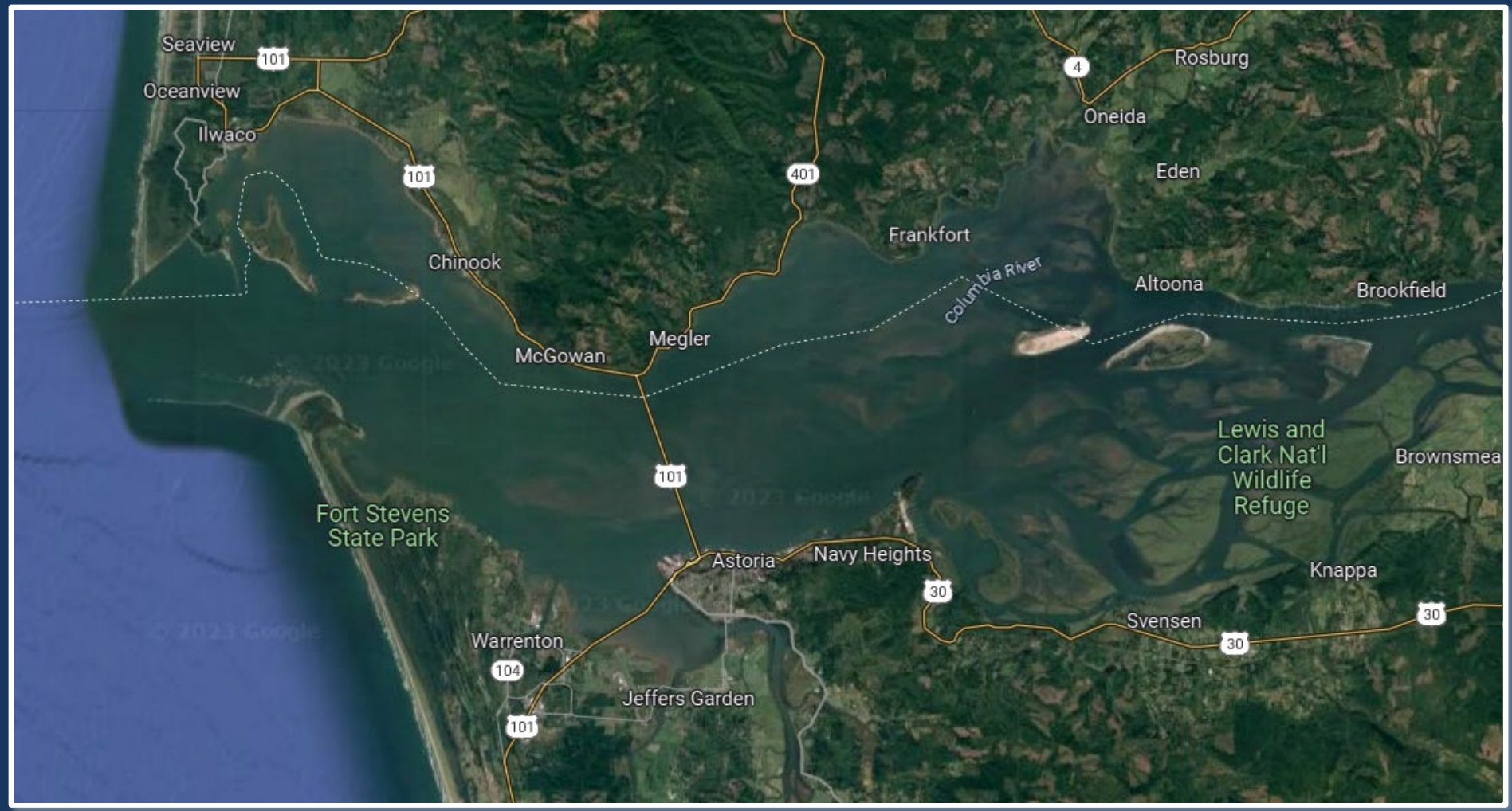
- Dan McFadden, ODOT District Bridge Maintenance
- Ray Bottenberg, ODOT State Bridge Engineer

Agenda

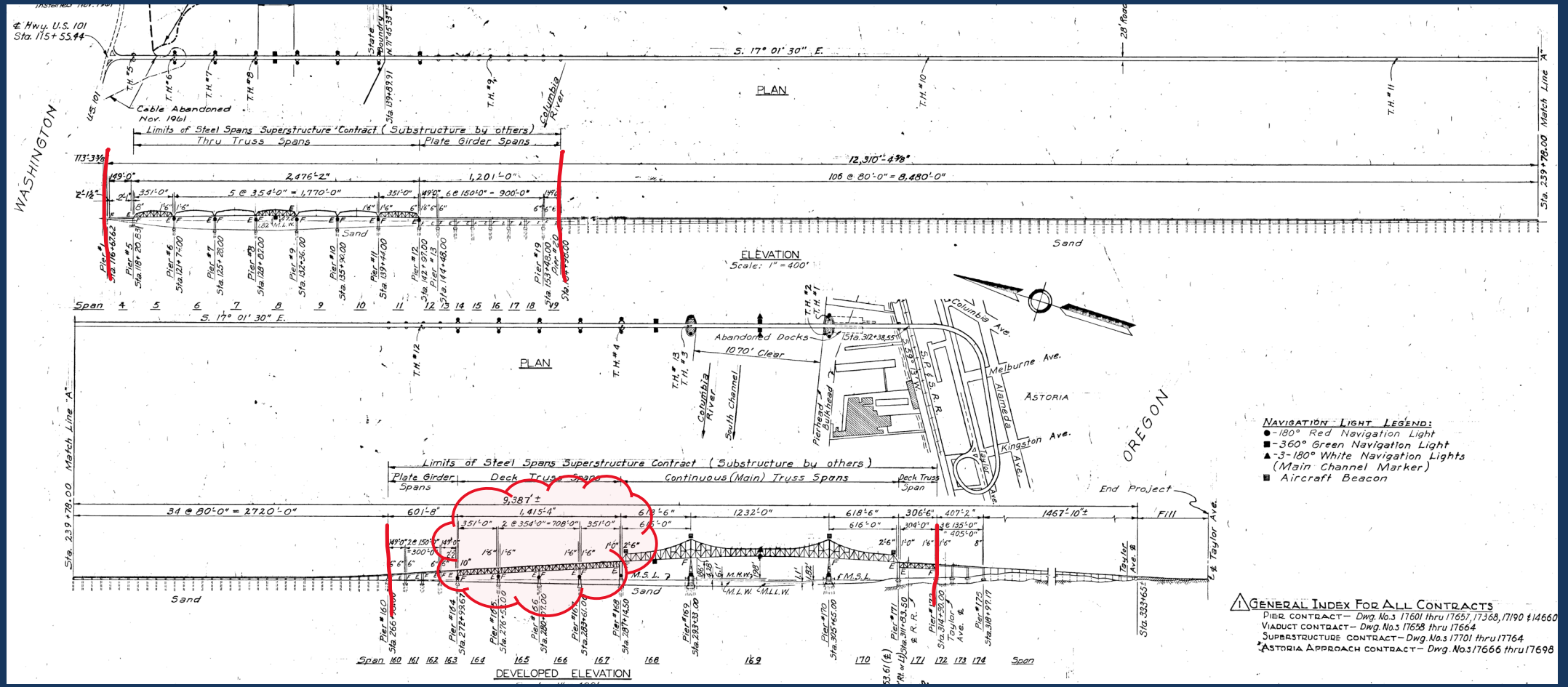
- Bridge Description
- Problem Statement
- Inspection - Access
- Preservation - Paint
- Future Needs and Costs

Vicinity and Bridge Description

- Location



Bridge Description



WA End of the Bridge

Desdemona Sands Spans

Deck Trusses and Girders

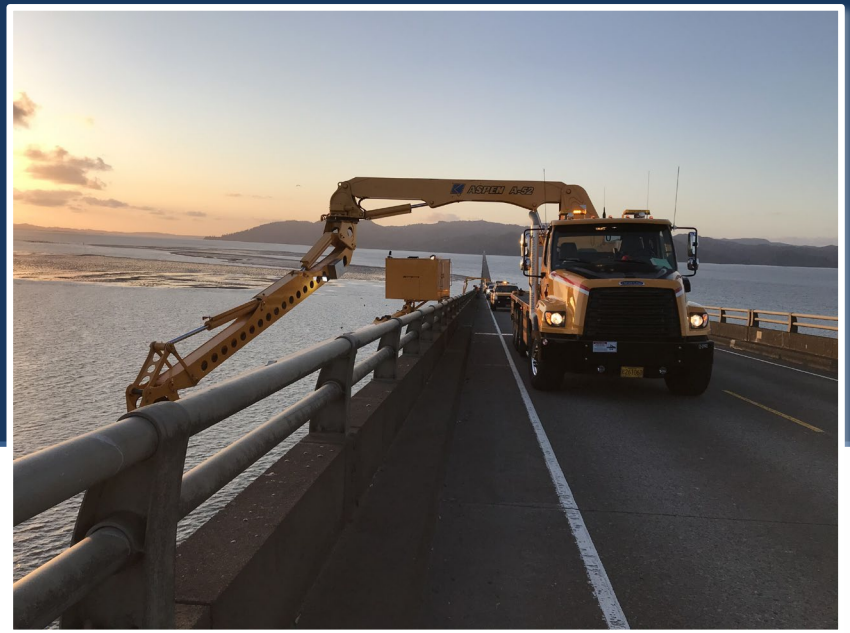
Main Span

Oregon Approach Ramp

Problem Statement

Inspection

- Every 2 years at minimum
- Fracture critical elements inspected at “arms reach”
- Access by: Climbing, Manlift, Snooper, Barge, Divers



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Inspection

COLUMBIA RIVER (ASTORIA-MEGLER) - BR# 07949A - HWY 9 - MP: 0.00

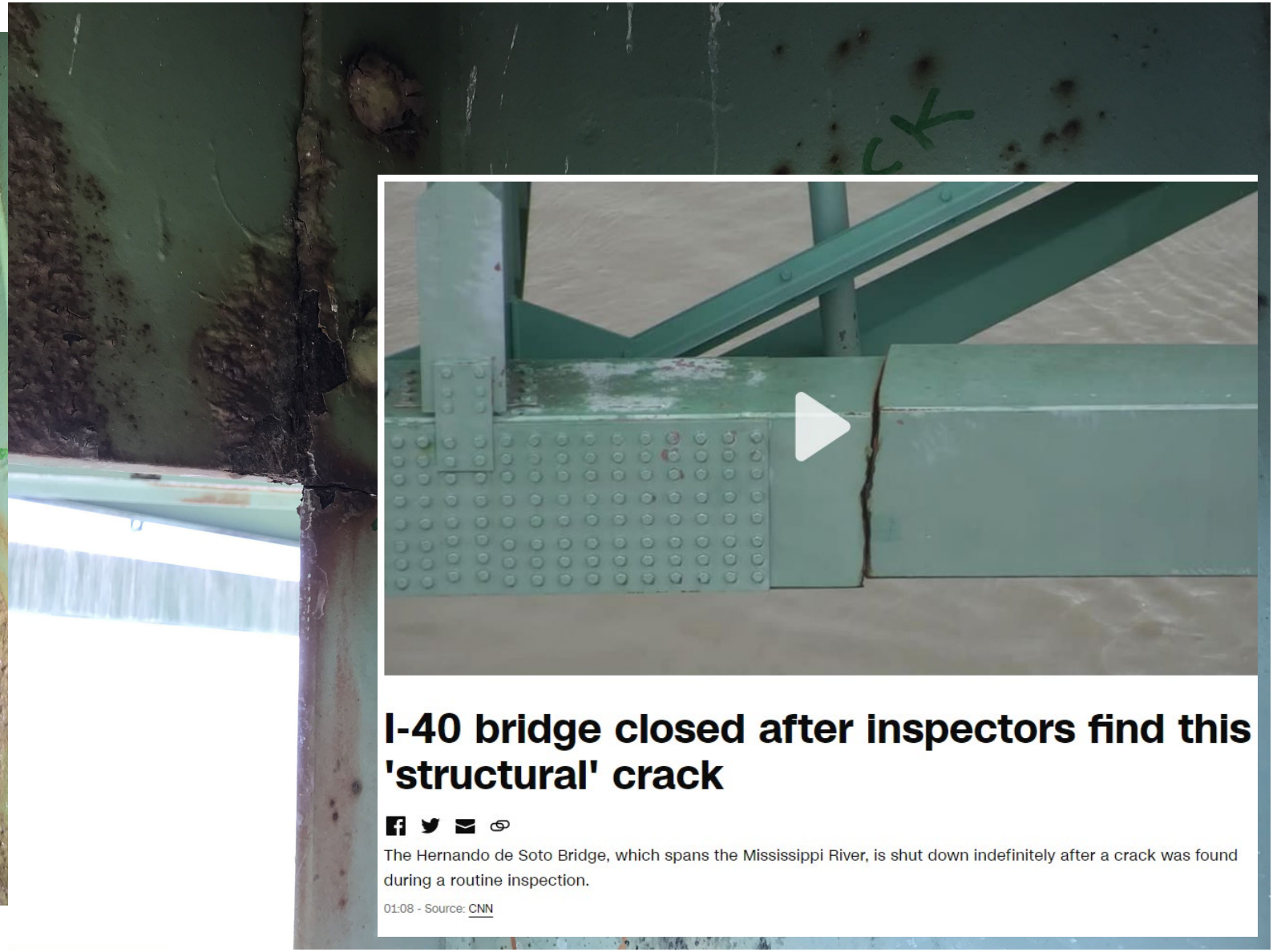
E COLUMBIA RIVER (ASTORIA-MEGLER) - BR# 07949A - HWY 9 - MP: 0.00

CLOSE-UP OF INITIAL CRACK AT CROSS BRACE WELD

"This means switching from an 'early detection small defect approach' to a 'large defect critical repair approach' of inspection."

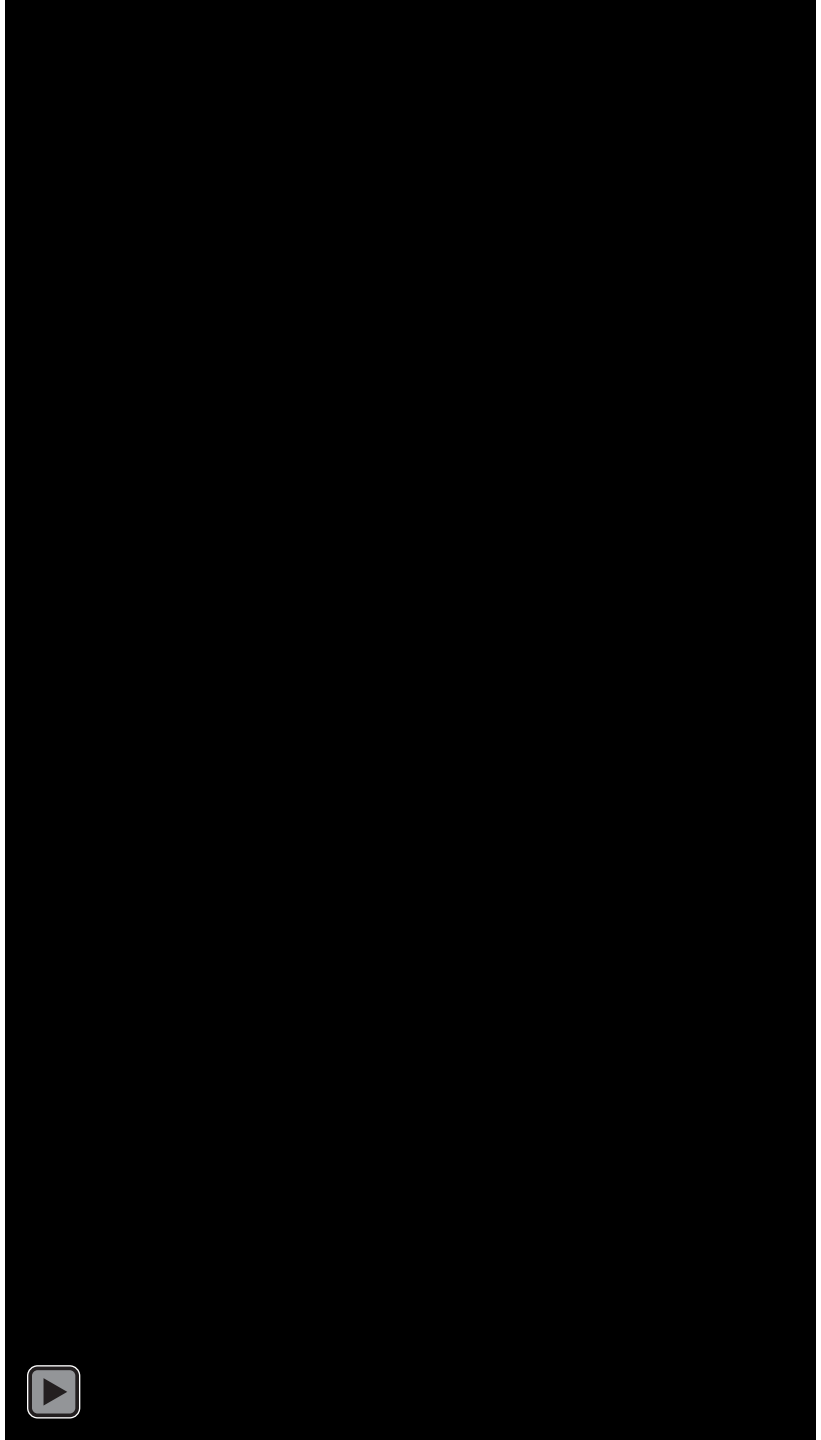
41

Inspection



42

Inspection



Inspection

Preservation

- **Pre-birds - the steel was on a cycle to be painted ~every 20 years**
  - Coating system is 3-Coat Zinc-Epoxy-Urethane
  - 3 year construction warranty
  - Painted in multi-year phases – Total 12 years
- **Now**
  - Cycle is ???
  - Expectations – More steel repairs, longer project durations, higher costs
  - Containment set-up before nesting season – complicates schedule

Painting – What its like

Painting

- All painting requires taking at least 1 lane
- Equipment includes: Air Handling, Full Containment, Lead Treatment, Sand Blasting
- Personnel:
  - Paint Contractors
  - ODOT Inspectors
  - 3rd Party Inspectors
-

Bird Waste Removal

- Cleaning in 2 phases:
  - Removal of solids with shovels/brushing
  - Power Washing
- When bird waste removal is included:
  - Add 16 days per span
  - Containment must collect all waste and water for Hazmat
  - Workers wear full Tyvek suits and respirators

Upcoming Projects

- Deck Overlay on Oregon Ramp
  - 2025 - ~$20M
- Repairs, Bearing Replacement and Preservative Treatment to Desdemona Sands Spans
  - 2030-2033 - ~$10M
- Paint the WS Trusses
  - Due in 2032 - ~$30M
- Deck Repairs
  - ???

Update from Bridge Maintenance

Dan McFadden

What have we tried?

- Take Permit
  - Not consistent year to year
  - Risk for contractor
  - Doesn't address waste build up, only localized birds
- Falcon Sounds
  - Did not appear to make a difference

The status of double-crested cormorants in the Columbia River estuary and considerations for management of the Astoria-Megler Bridge colony

James Lawonn
Avian Biologist/Avian Predation Coordinator
Oregon Department of Fish and Wildlife
matthew.j.lawonn@odfw.oregon.gov

Lynne Krasnow
Senior Fish Biologist
National Oceanographic and Atmospheric Administration
lynne.krasnow@noaa.gov

T. Lawes

Double-crested cormorant (DCCO)

- Native colonial waterbird
- ~23% of regional population nested in Columbia River estuary in 2021
- Most of diet in estuary non-salmonids


M. Baird

DCCO attracted to estuary by abundant food

- Marine fish predominate in lower estuary.
- Salmonids abundant in spring/early summer.

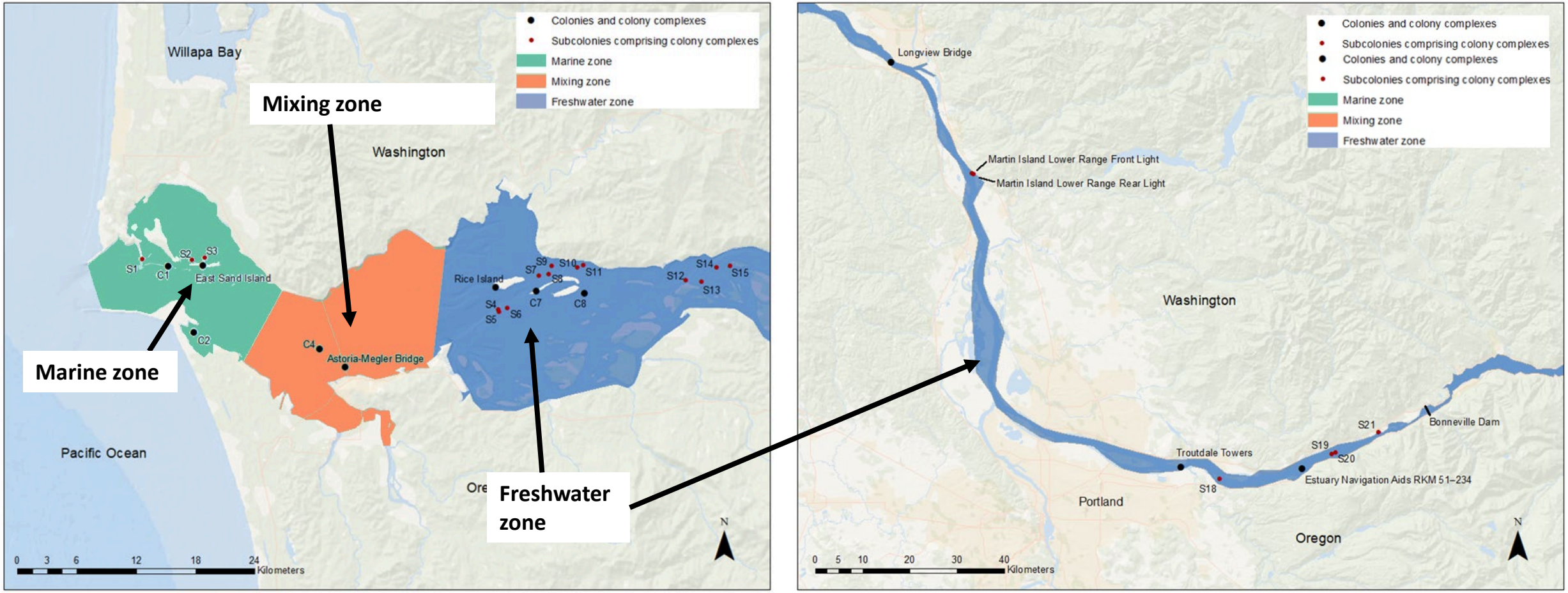
Shester/Oceana

All known colony sites in estuary are human-made/modified habitats

- 11 colonies and colony complexes (29 breeding sites total)
- Abundant natural habitat (e.g. mature trees) could support colonies in future.

USACE

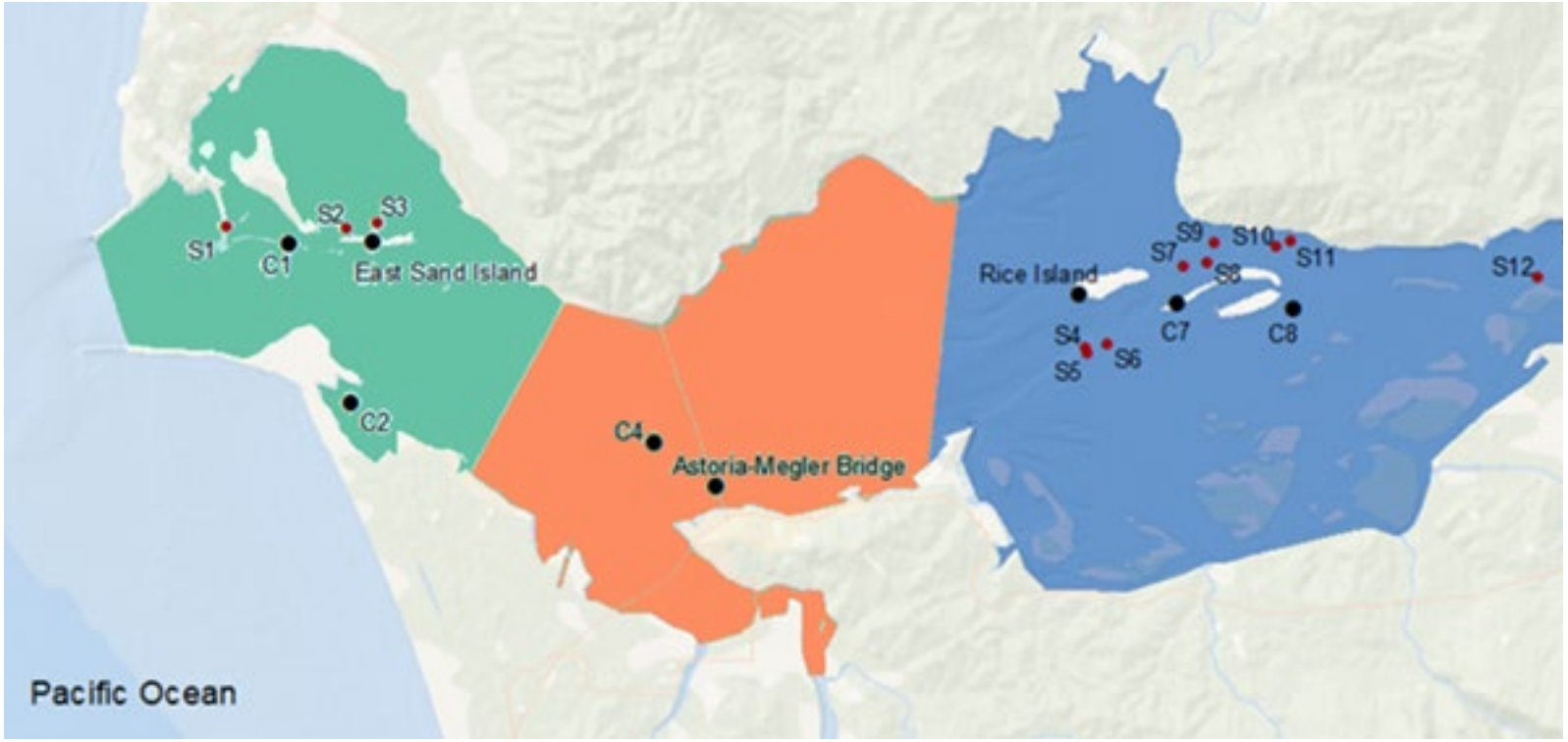
Three salinity zones in the estuary



Per cormorant impacts higher as salinity declines

Proportion salmonids in avian diet

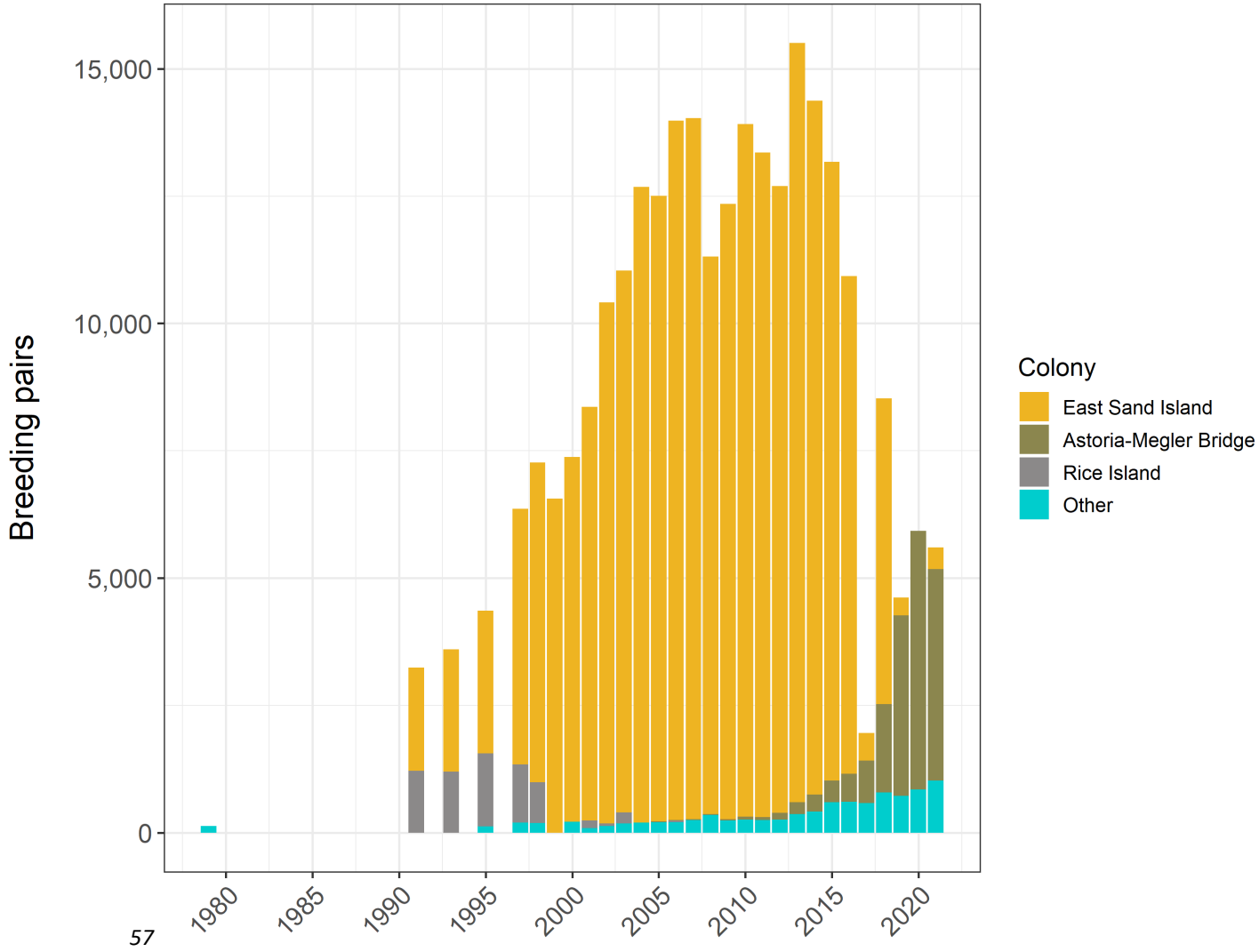
Less → **More**



* Collis et al. 2001, Collis et al. 2002, Roby et al. 2002, Cramer et al. 2021, Evans et al. 2022

Recent changes in abundance and distribution

- DCCO emigrated from East Sand Island to upriver colonies, mostly associated with management.
- Astoria-Megler Bridge currently supports most breeding individuals.
- Other colonies mostly upriver of Astoria-Megler Bridge.



Annual predation rates on ESA-listed salmonids, Astoria-Megler Bridge, 2022

ESU/DPS	Predation rate
SR Sockeye	6.6% (1.7-14.7)
SR Sp/Su Chinook	4.9% (2.6-8.1)
UCR Sp Chinook	5.2% (2.0-10.3)
SR Fall Chinook	3.1% (2.1-7.9)
SR Steelhead	7.2% (3.5-12.0)
UCR Steelhead	8.6% (3.2-15.1)
MCR Steelhead	7.4% (2.1-15.5)


T. Lawes

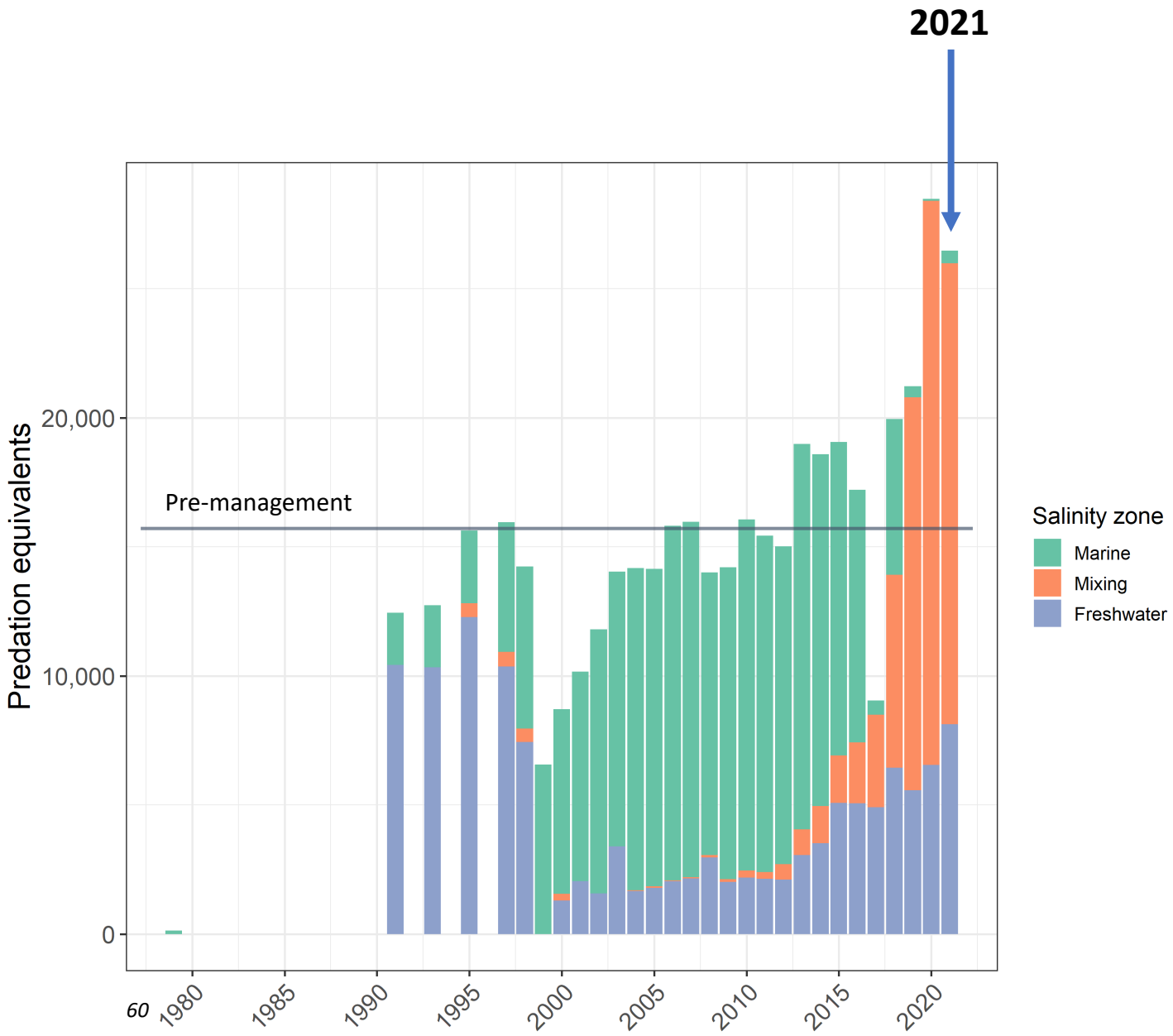
Predation of LCR Chinook unknown for bridge colony, but presumed high

ESU/population	Predation rate, East Sand Island DCCO colony
LCR Chinook	27% (2007-2014)
Big Creek Hatchery Tule Chinook	41% (2002-2012)

T. Lawes

ODFW: estimated estuary-wide predation worse than prior to management

- ODFW estimates estuary-wide DCCO predation on ESA-listed steelhead ~12% in 2022.



4 essential components of any credible management plan

1. **Dissuasion**: “push” birds from where we don’t want them
2. **Social Attraction**: “pull” birds to where we do want them
3. **Monitoring**: evaluate response of birds and fish
4. **Adaptive Management**: adjust management techniques and effort based on outcomes

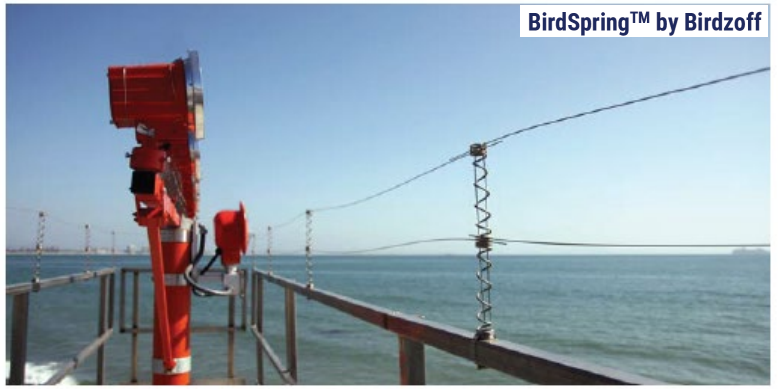
4 essential components of any credible management plan

1. **Dissuasion**: “push” birds from where we don’t want them
2. **Social Attraction**: “pull” birds to where we do want them
3. **Monitoring**: evaluate response of birds and fish
4. **Adaptive Management**: adjust management techniques and effort based on outcomes

T. Lawes

Dissuasion: push birds from bridge

- **Passive exclusion would be ideal.**
  - Anti-perch wires, wire grids, netting, UV LED
  - Requires maintenance
  - Possible engineering constraints



Dissuasion: push birds from bridge

- **Active dissuasion may also be necessary**
  - Pyrotechnics, high pressure water, handheld laser
  - Needs near-continuous effort to be effective
  - Substantial nest take possible

Dissuasion: keep displaced birds from nesting at undesired sites

- Focus on freshwater zone
- Ideally passive exclusion
- Large amount of unused habitat present in freshwater zone

Adaptive Management

1. DCCO could move to unforeseen locations (e.g. mature trees, especially on islands)
2. Social attraction on East Sand Island might not work.
3. Non-lethal methods may not be sufficiently effective.
4. Salmonid survival might not improve after DCCO are managed.


T. Lawes

Conclusions

- Dispersal to freshwater sites is a possible outcome of management.
- Combining dissuasion with social attraction would improve likelihood of reducing abundance on Astoria-Megler Bridge, while also minimizing dispersal risk.
- Adaptive management likely necessary in perpetuity, perhaps across the entire estuary.

A. Andersson/ODFW

Questions?

T. Lawes

James Lawonn
Avian Biologist/Avian Predation Coordinator
Oregon Department of Fish and Wildlife
matthew.j.lawonn@odfw.oregon.gov

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OVERVIEW:
USACE DOUBLE-CRESTED CORMORANT PREDATION MGMT. ACTIONS AND MONITORING ON EAST SAND ISLAND

Sean Tackley
USACE Northwestern Division
June 26, 2023
ODOT Astoria-Megler Bridge VE Study

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OUTLINE

- Background
- Overview of East Sand Island (ESI) Double-Crested Cormorant (DCCO) Mgmt. Plan/EIS
- 2020 Columbia River System (CRS) ESA Commitments
- Current status (actions, monitoring)

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BACKGROUND – DCCO ON EAST SAND ISLAND

- 1989-2015: DCCO colony size grew from 100 pairs to >15,000 pairs (~40% of western population). Impacts on survival of ESA-listed juvenile salmonids (especially steelhead) of concern to NMFS and regional fish managers
- 2008 Federal Columbia River Power System (FCRPS) BiOp; 2010 and 2014 supplementals:
  - RPA 46: *"The FCRPS Action Agencies will develop a cormorant management plan (including necessary monitoring and research) and implement warranted actions to reduce cormorant predation in the estuary to Base Period levels (no more than 5,380 to 5,939 nesting pairs on East Sand Island)."*
  - RPA 67: *"The Action Agencies will monitor the cormorant population in the estuary and its impacts on outmigrating juvenile salmonids and develop and implement a management plan to decrease predation rates, if warranted."*

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BACKGROUND - AUTHORITIES

- WRDA 1996 - Section 511(c)
  - Authorizes USACE to reduce avian predation on ESA-listed salmon on dredged material placement islands in the Columbia River estuary.
  - Caps research and development work (research and monitoring, experimentation with methods for relocating colonies, etc) at $1M.

- WRDA 1986 – Section 906(b)
  - July 2007 – ASA(CW) approves use of this authority to implement actions.

- WRDA 2007 - Section 511(c), as amended by Section 5025
  - Increased spending cap for research and development to $10M (currently at ~$9M).
  - Clarified Congress' intent to include predation reduction implementation.
  - No specified cap on implementation spending (subject to availability of funding).

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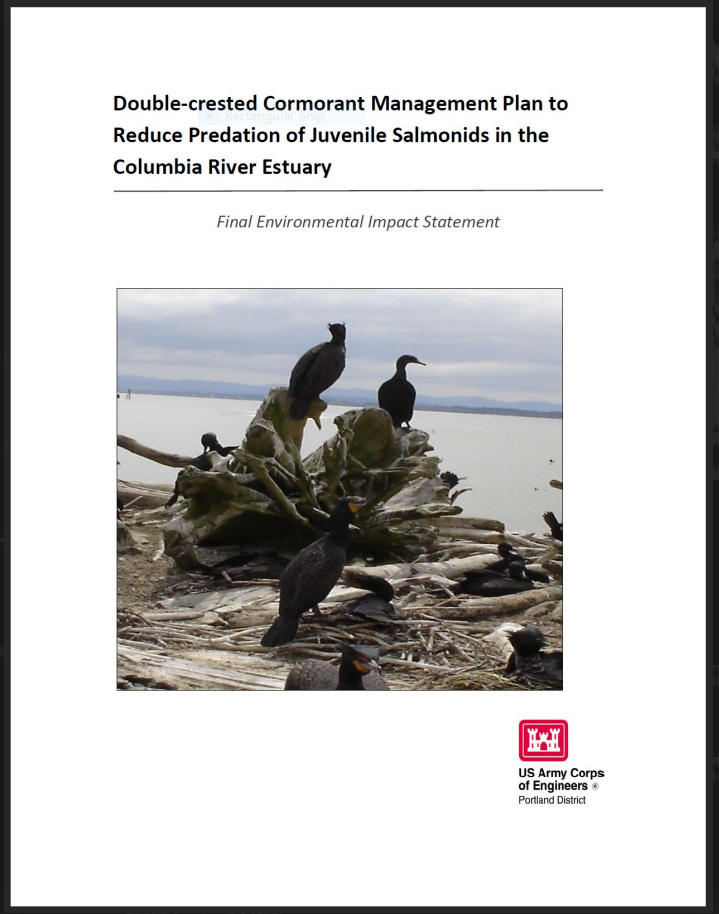
USACE DCCO PREDATION MANAGEMENT PLAN

- Completed EIS/ROD in March 2015
  - USFWS, ODFW, and WDFW were cooperators
  - Public comments were extensive; ranged from supportive to strong opposition to lethal methods
- Management Target:
  - *"Actions would be considered successful when the average 3-year peak colony (East Sand Island) size estimate does not exceed 5,380 to 5,939 nesting pairs while no (lethal) management actions are conducted." (pg. 22, 2015 DCCO FEIS).*
  - **Note:** NMFS analysis assumed this number of pairs would reduce predation rates to baseline conditions: 3.6% on steelhead, and 1.1% on yearling Chinook.



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USACE DCCO PREDATION MANAGEMENT PLAN

- Preferred Alternative (Alt. C1) included both lethal and non-lethal components to achieve goal of no more than 5,380 to 5,939 nesting pairs on ESI.
- Robust monitoring on ESI and estuary, engagement with an Adaptive Management Team (AMT) during implementation phase to inform adaptive management decisions.
- Phase 1 (2015-2019):
  - Culling (over water), egg oiling, hazing for 4 years to achieve colony size target for ESI
- Phase 2 (2019-2020*):
  - *"Terrain modification to inundate the western portion of East Sand Island and preclude nesting, combined with continued monitoring and hazing efforts, supported with limited egg take, as needed. No management actions would be taken to ensure a minimum colony size."*

Phase 2 terrain modifications

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USACE DCCO PREDATION MANAGEMENT PLAN

Phase 2 Monitoring: *"Actions would be considered successful when the average 3-year peak colony (East Sand Island) size estimate does not exceed 5,380 to 5,939 nesting pairs while no (lethal) management actions are conducted." (pg. 22, 2015 DCCO FEIS).*

- Monitor DCCO on ESI annually for colony size and response to management, as necessary
- Monitor DCCO in the Columbia River Estuary annually for colony size and response to management, as necessary
- Evaluate DCCO predation rates of juvenile salmonids, as necessary

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2020 COLUMBIA RIVER SYSTEM – ESA COMMITMENTS

2020 CRS Proposed Action (p. 2-93 – 2.94) and Clarification Letter Highlights:

- Continue to implement DCCO Management Plan
- Continue monitoring and other "status quo" actions in (at least) 2020
- Pending results of Synthesis Report, *"work with the Services through the Regional Forum workgroup(s) (e.g., FPOM) to determine need for and scope of future Action Agency-sponsored double-crested cormorant management and monitoring on East Sand Island and the larger Columbia River estuary."*

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2020 COLUMBIA RIVER SYSTEM – ESA COMMITMENTS

2020 CRS NMFS Biological Opinion Highlights (p. 1403-1404):

- Reasonable and Prudent Measure: *The Corps…shall continue to implement the…Double-crested Cormorant Predation Management Plan at East Sand Island in the Columbia River estuary…to reduce smolt predation rates.*
- Terms and Conditions: *Action Agencies shall continue to evaluate the effectiveness of the proposed management plans in reducing smolt predation rates by:*
  - *…the Action Agencies shall reassess the need to continue to fund PIT-tag recoveries, PIT detection probabilities, and other activities…shall coordinate decisions…with NMFS and the regional comanagers that participate in the Regional Forum FPOM Workgroup.*
  - *The Action Agencies shall consider the recommendations in the final Avian Predation Synthesis Report and assess whether there are additional actions that could be taken, within their authorities, to further reduce salmon and steelhead mortality from avian predation.*

CURRENT OUTCOMES

- Overall reduction in DCCO on ESI and in estuary and achieved reductions in predation rates on ESI for some stocks, *but*…
- Repeated colony abandonment episodes during implementation due to an unknown combination of human disturbance and eagle and gull predation on DCCO nests.
- Increased size of colony at Astoria-Megler Bridge; dispersal to other locations (e.g. channel markers).
- Peak DCCO colony size estimate for ESI in 2022 was 2,317 individuals; no successful breeding, continuing trend.
- Habitat remains available on ESI, but Astoria-Megler Bridge colony is now primary colony in Estuary.

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CURRENT STATUS: ACTIONS AND MONITORING

- DCCO habitat continues to be available on ESI
- Continue monitoring the DCCO colony on ESI to estimate peak colony size
- Annually sow PIT tags on the colony site to facilitate predation rate estimates (funding determined annually – last estimates generated in 2020)
- Should colony size exceed 5,939, Corps would consider non-lethal hazing/dissuasion, consistent with Management Plan (pending funding availability)
- Continue to discourage avian predators that are found nesting at an upland disposal site (Rice Island and others as needed), per 2012 NMFS BiOp for the O&M of the Federal Navigation Channel
- Continue to work with BPA and Reclamation on reviewing synthesis report recommendations, identifying additional actions within authorities. Additional and ongoing coordination with NMFS and region to come.

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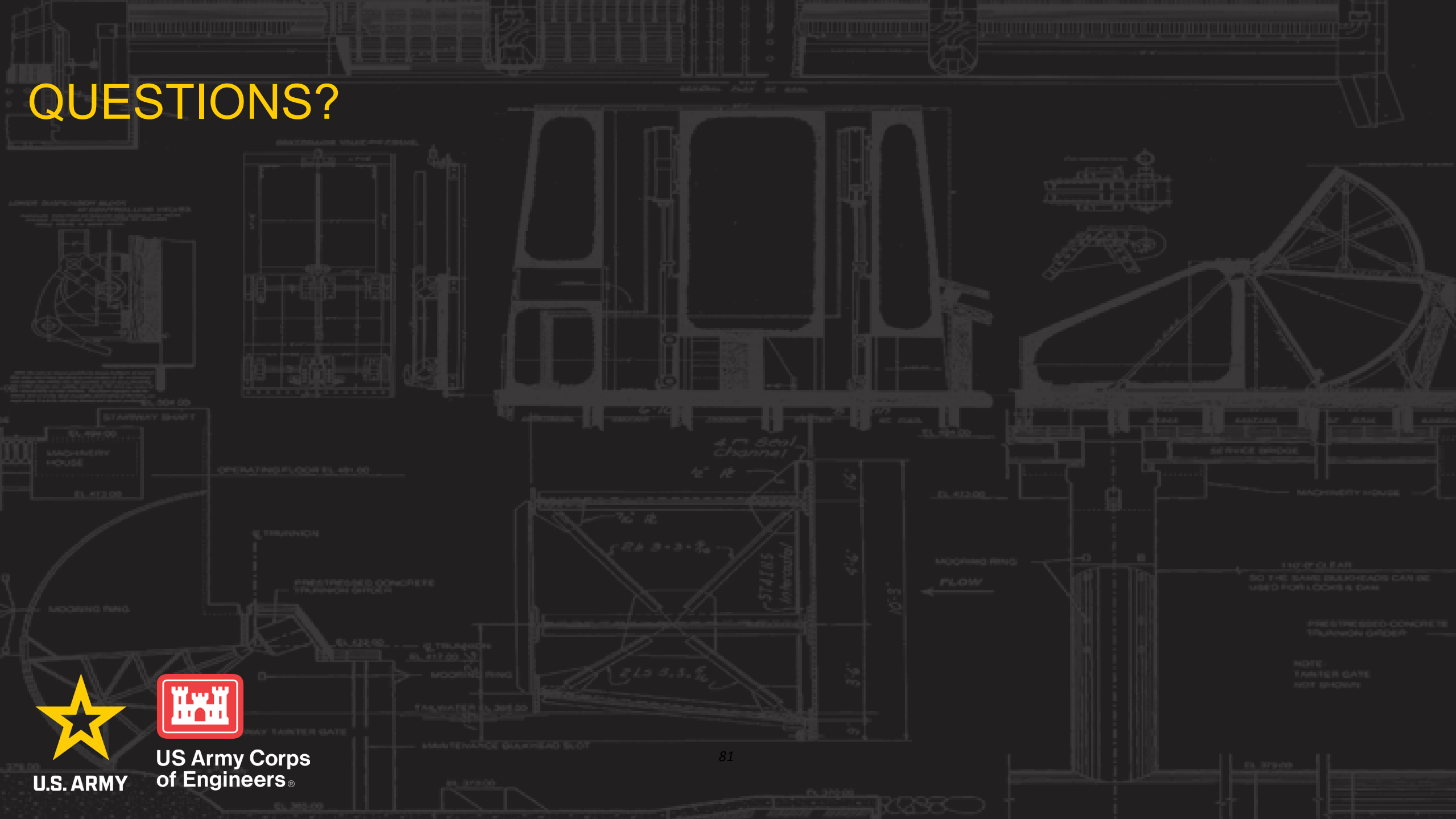
QUESTIONS?



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Social Attraction and Monitoring for Restoring the East Sand Island Cormorant Colony

Astoria-Megler Bridge Value Engineering Study

26 June 2023

Dan Roby
Department of Fisheries, Wildlife, and Conservation Sciences
Oregon State University

Collaborators

Don Lyons, Yasuko Suzuki, Tim Lawes, Pete Loschl, and Kirsten Bixler

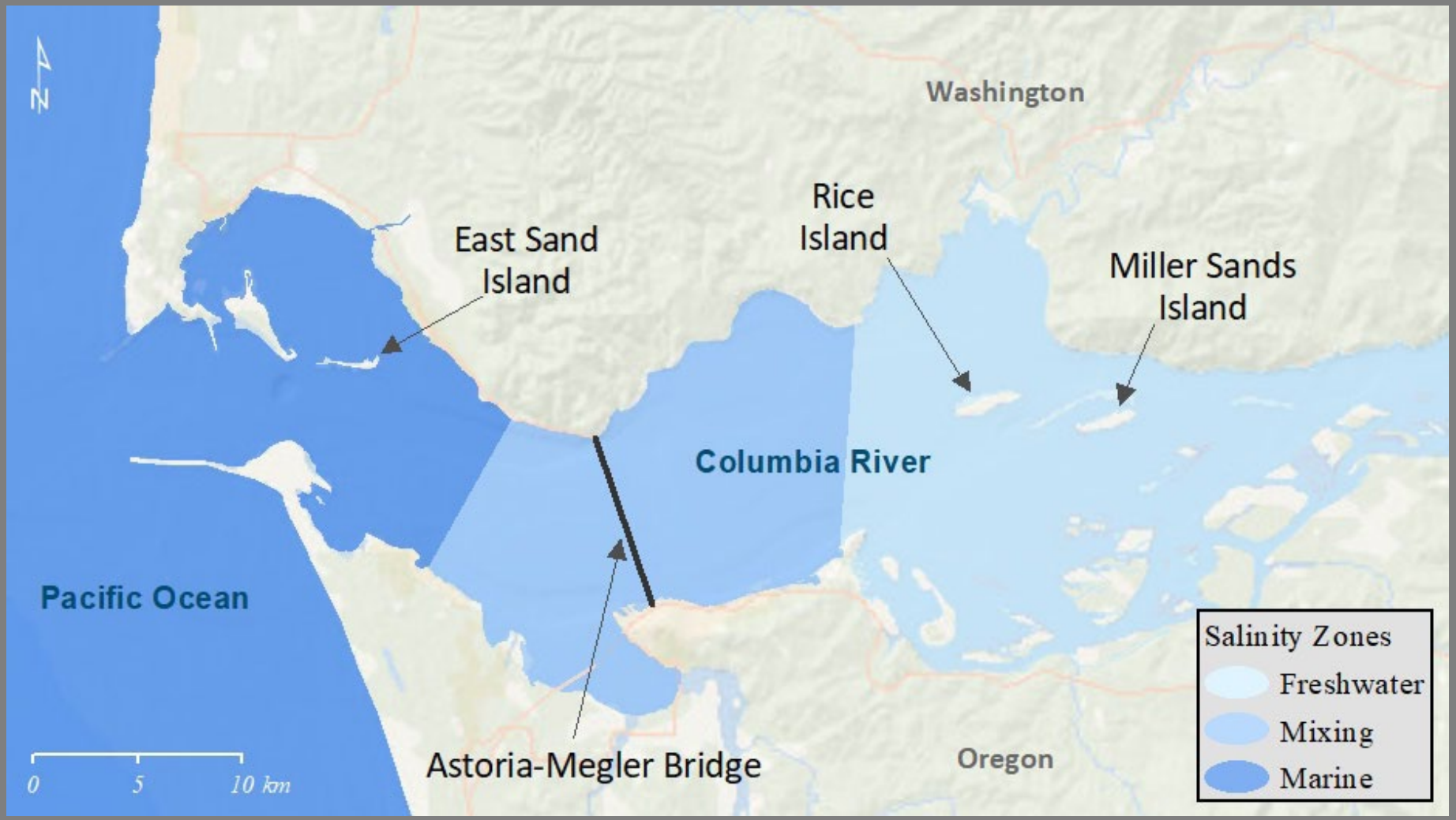
Department of Fisheries, Wildlife, and Conservation Sciences
Oregon State University
Corvallis, Oregon, USA

Allen Evans, Ken Collis, and Nate Banet

Real Time Research, Inc.
Bend, Oregon, USA

East Sand Island Cormorant Colony Pre-Management

When the East Sand Island cormorant colony was abandoned roughly one third of the breeding pairs moved 15 km upstream to the Astoria-Megler Bridge, where a small colony of cormorants was already present



Proven Methods for Restoring a Cormorant Colony on East Sand Island:

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Habitat Enhancement and Social Attraction at the former colony site

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- Modified nesting substrate

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- Cormorant decoys

Proven Methods for Restoring a Cormorant Colony on East Sand Island:

Habitat Enhancement and Social Attraction at the former colony site

- Modified nesting substrate
- Cormorant decoys
- Audio playback systems of cormorant vocalizations


East Sand Island: adjacent to former colony

Habitat enhancement and social attraction on other islands in the Columbia Estuary (before)

Habitat enhancement and social attraction on other islands in the Columbia Estuary (before)

Rice Island
(history of successful nesting
by double-crested cormorants)

Habitat enhancement and social attraction on other islands in the Columbia Estuary (before)

Rice Island
(history of successful nesting by double-crested cormorants)

Miller Sands Spit
(history of unsuccessful nesting attempts by double-crested cormorants)

Habitat enhancement and social attraction on other islands in the Columbia Estuary (after)

Rice Island
(history of successful nesting
by double-crested cormorants)

Habitat enhancement and social attraction on other islands in the Columbia Estuary (after)

Rice Island
(history of successful nesting by double-crested cormorants)

Miller Sands Spit
(history of unsuccessful nesting attempts by double-crested cormorants)

Conclusions

1. Experiments on East Sand Island, Rice Island, and Miller Sands Spit in the Columbia River Estuary have demonstrated that cormorant breeding colonies can be restored at former colony sites using nesting substrate enhancement and social attraction techniques.

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2. Restoring the now abandoned East Sand Island cormorant colony using nesting substrate enhancement and social attraction techniques has good prospects for success.

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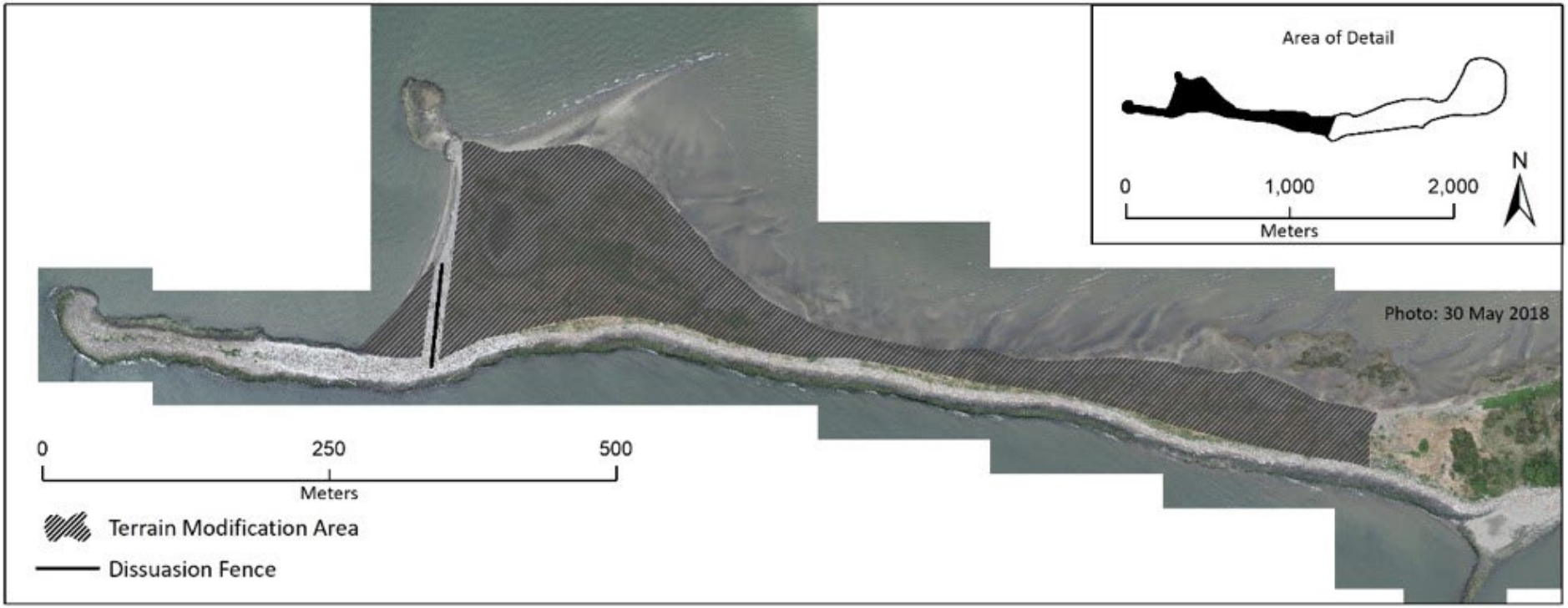
2. Restoring the now abandoned East Sand Island cormorant colony using nesting substrate enhancement and social attraction techniques has good prospects for success.

3. Restoring the East Sand Island cormorant colony concurrent with dissuading cormorants from nesting on the Astoria-Megler Bridge would enhance the efficacy of dissuasion and help avoid cormorants dispersing further up-river and nesting on other anthropogenic structures (e.g., channel markers, Lewis & Clark Bridge, Troutdale Transmission Towers)

Monitoring a Restored East Sand Island Cormorant Colony

Close monitoring by resident colony monitors of nesting attempts by cormorants on East Sand Island



Lawes et al. 2021

Successful colony restoration requires identifying and managing factors that limit colony size and nesting success at the social attraction site

Eagle and gull predation on cormorant nests is an impediment to cormorant colony restoration on East Sand Island

Eagle and gull predation on cormorant nests is an impediment to cormorant colony restoration on East Sand Island

Resident colony monitors on East Sand Island would deter eagle predation

Monitor cormorant predation rates on juvenile salmonids by recovering smolt PIT tags on the cormorant breeding colony

Conclusions

1. Close monitoring of the restored cormorant colony by resident colony monitors will identify factors hindering colony restoration and enhance prospects for successful restoration.

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Conclusions

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3. The presence of resident colony monitors will help deter eagle predation on the cormorant colony and enhance prospects for colony restoration.

4. By monitoring the deposition of smolt PIT tags on the cormorant colony predation rates on ESA-listed salmonid stocks in excess of 2% can be detected and trigger timely adaptive management.


Thank You!
Questions?

Backup Slides

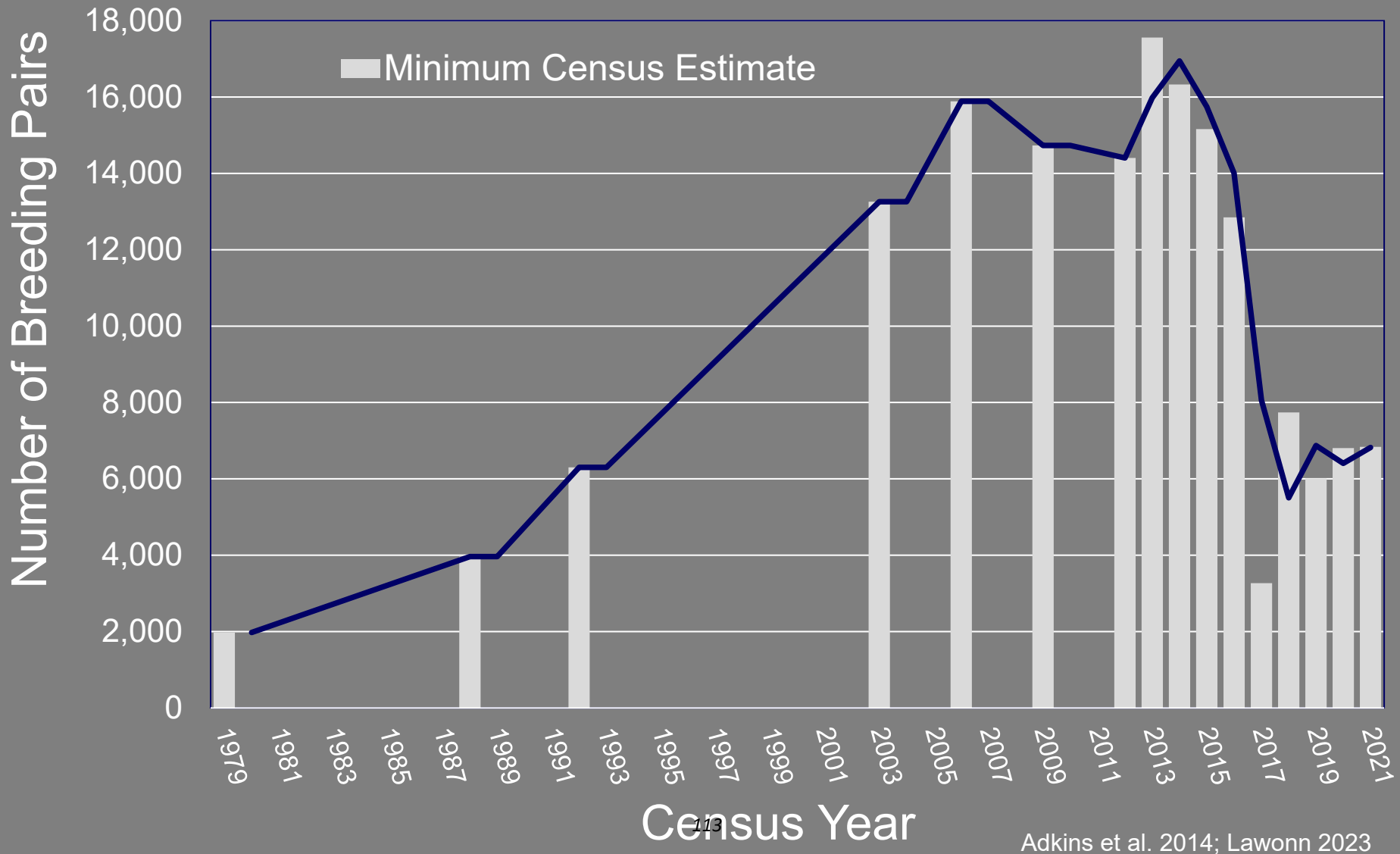
Estimated per capita (per breeding pair) predation rates (95% credible interval) on Snake River (SR) and Upper Columbia River (UCR) salmonid populations (ESUs/DPSs), with runs of spring (Sp), summer (Su), and Fall fish, by double-crested cormorants nesting at the Troutdale Transmission Towers in the lower Columbia River, the Astoria-Megler Bridge in the Columbia River estuary, and East Sand Island in the lower Columbia River estuary. Estimates from East Sand Island are those of Roby et al. (2021) and represent average annual estimates prior to management actions on East Sand Island during 2003-2014. Estimates from Troutdale Towers and Astoria-Megler Bridge in 2022 are those of Evans et al. (2023) .

ESU/DPS	Troutdale Towers, 2022	Astoria-Megler Bridge, 2022	East Sand Island, 2003-14
SR Sockeye	0.0126% (0.0036–0.0271)	0.0016% (0.0004–0.0036)	0.0003% (0.0002–0.0004)
SR Sp/Su Chinook	0.0069% (0.0036-0.0124)	0.0012% (0.0007–0.0020)	0.0004% (0.0004–0.0005)
UCR Sp Chinook	0.0047% (0.0011–0.0104)	0.0013% (0.0005–0.0025)	0.0003% (0.0002–0.0004)
SR Fall Chinook	0.0019% (0.0001–0.0058)	0.0008% (0.0001–0.0019)	0.0003% (0.0002–0.0003)
SR Steelhead	0.0081% (0.0035–0.0144)	0.0018% (0.0008-0.0030)	0.0006% (0.0005–0.0007)
UCR Steelhead	0.0091% [111] (0.0034–0.0176)	0.0021% (0.0008–0.0037)	0.0005% (0.0005–0.0006)

Estimated predation rates (95% credible interval) on Snake River (SR), Upper Columbia River (UCR), and Middle Columbia River (MCR) salmonid populations (ESUs/DPSs), with runs of spring (Sp), summer (Su), and Fall fish, by double-crested cormorants nesting on East Sand Island (ESI), the Astoria-Megler Bridge (AMB), and the Troutdale Transmission Towers (TTR). Estimates from ESI are those of Roby et al. (2021) and represent average annual estimates prior to management actions during 2003-2014. Estimates from AMB and TTR are those of Evans et al. (2023) during 2022.

ESU/DPS	East Sand Island	Astoria-Megler Bridge	Troutdale Transmission Towers
SR Sockeye	4.2% (3.3–5.3)	6.6% (1.7-14.7)	4.4% (1.2–9.5)
SR Sp/Su Chinook	4.6% (4.1–5.3)	4.9% (2.6-8.1)	2.4% (1.3–4.3)
UCR Sp Chinook	3.8% (3.2–4.6)	5.2% (2.0-10.3)	1.7% (0.4–3.6)
SR Fall Chinook	2.7% (2.3–3.2)	3.1% (2.1-7.9)	0.7% (0.1–2.0)
SR Steelhead	7.2% (6.3–8.5)	7.2% (3.5-12.0)	2.8% (1.2–5.0)
UCR Steelhead	6.3% (5.5–7.2)	8.6% (3.2-15.1)	3.2% (1.2–6.1)
MCR Steelhead	7.5% (6.3–9.3)	7.4% (2.1-15.5)	3.2% (0.8–7.0)

Double-crested Cormorant breeding population in Oregon



Adkins et al. 2014; Lawonn 2023

Double-crested Cormorant breeding colonies in the Pacific Flyway population

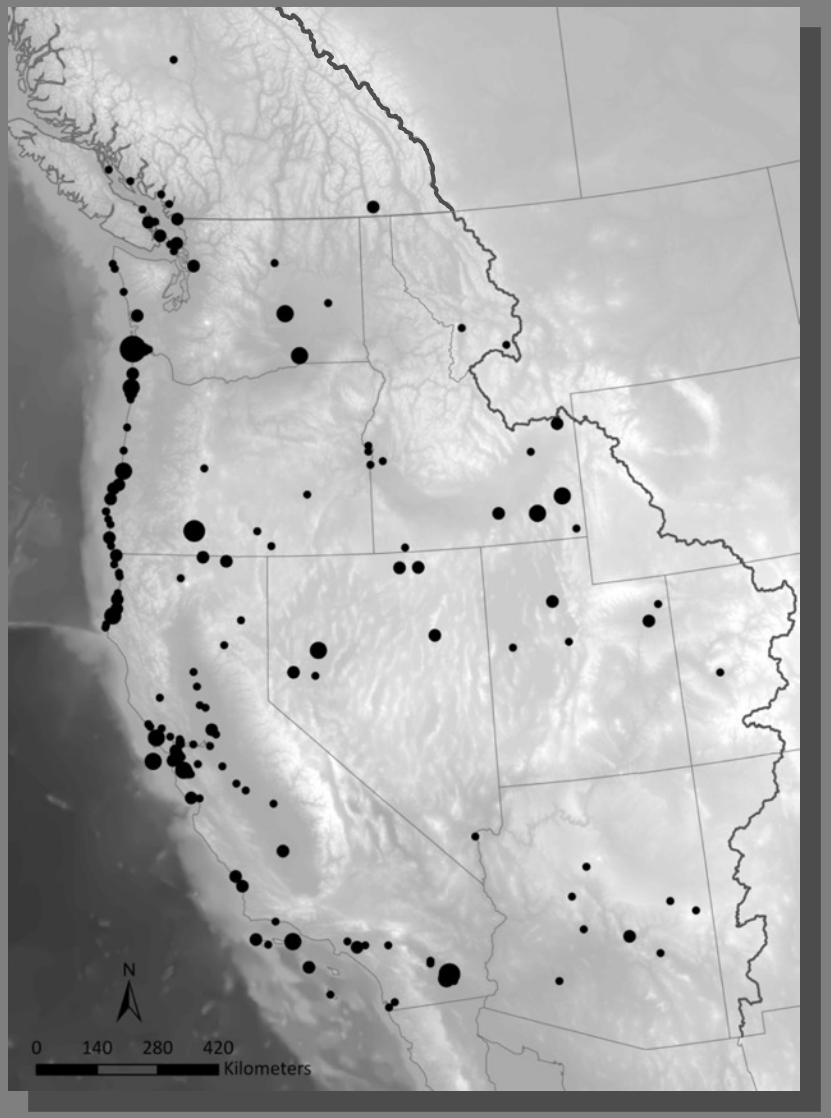
- Bounded by:

- Continental Divide to the east

- Pacific Ocean to the west

- southern British Columbia to the north

- U.S.-Mexico border to the south



Adkins et al. (2014) J. Wildl. Manage.

Brandt's Cormorant

Pelagic Cormorants

Mark-Recapture-Recovery

(Measuring Avian Predation Rates Using Smolt PIT Tags)

Hostetter et al. 2017

Double-crested Cormorant Management

Astoria-Megler Bridge – VE Study

June 26, 2023

U.S. Fish and Wildlife Service
Migratory Bird Program
Conserving America's Birds

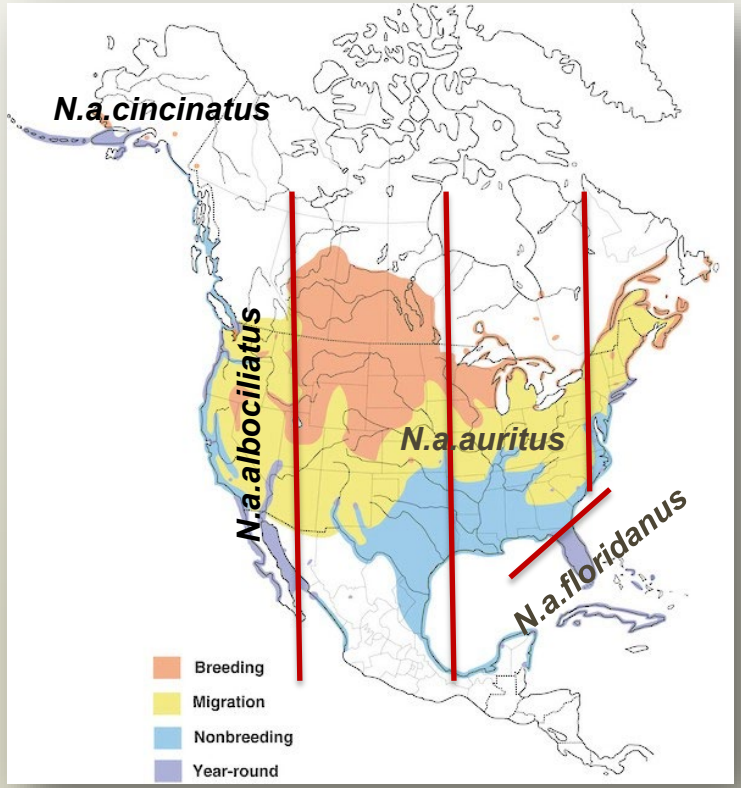
Presentation Overview

- **Cormorant Background**
  - Cormorant biology
  - Cormorant population trends (MBTA)
  - Impacts of DCCO populations
- **History of cormorant management**
  - How we manage migratory birds
  - Depredation Orders (DOs) and Permits
    - DOs were vacated
- **Western Population Management (2015 EIS)**
- **Management of Conflicts Associated with DCCO (2020 EIS)**
- **Cormorant Management Techniques**

Cormorant Background

General Biology

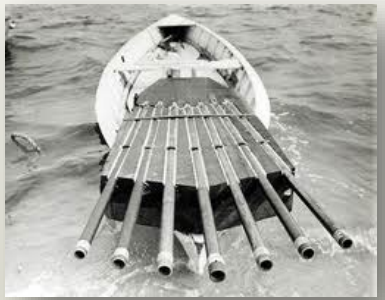
- Primary nesting in Canada & Great Lakes; year-round nesting in FL
- Winter in SE States from the Gulf of Mexico to Atlantic coast
- Opportunistic feeders; selecting fish from 2-40 cm
- Nests on ground, in trees or human-made structures; high site fidelity
- First eggs laid 2-4 wks after arrival; 1-4 eggs



Cormorant Background

Nineteenth Century Declines

1800s – Unregulated killing and overharvest were the norm



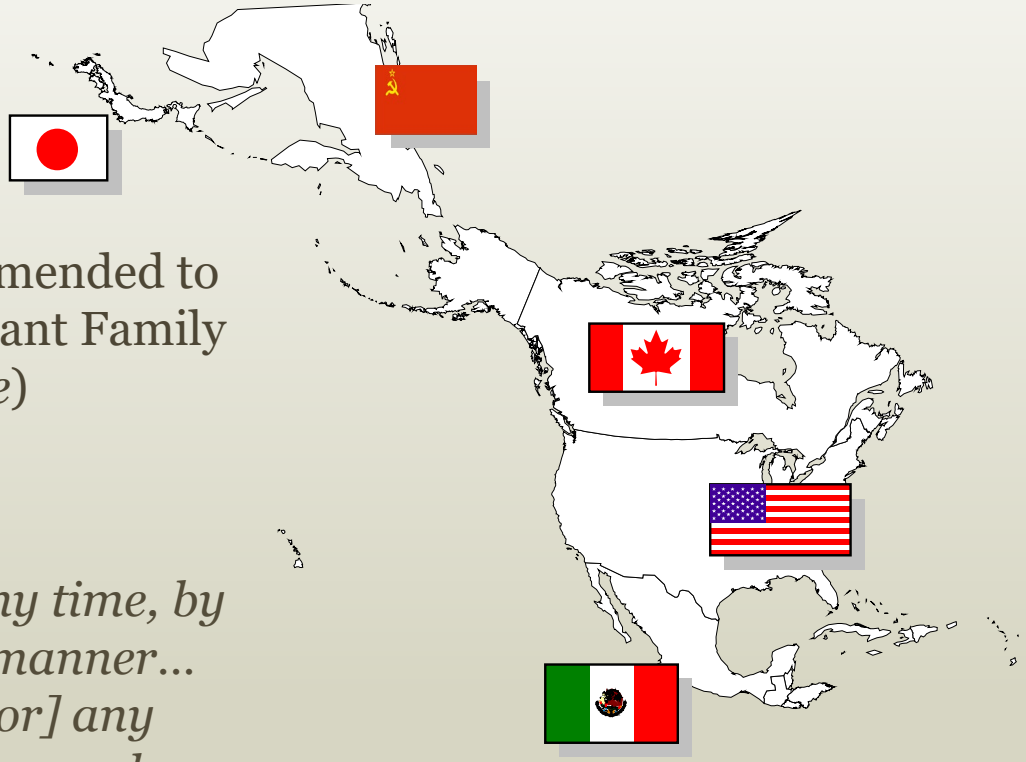
Cormorant Background

Population Recovery then Twentieth Century Declines

- 1950's DDT era; DCCO completely disappeared from some areas (MI) and drastically declined in most
- DCCO placed on Audubon's "Blue" list (*species experiencing significant pop decline and range reduction*)
- DCCO placed on most state & provincial endangered species lists
- 1972 - DDT banned

Cormorant Background

Migratory Bird Treaty Act

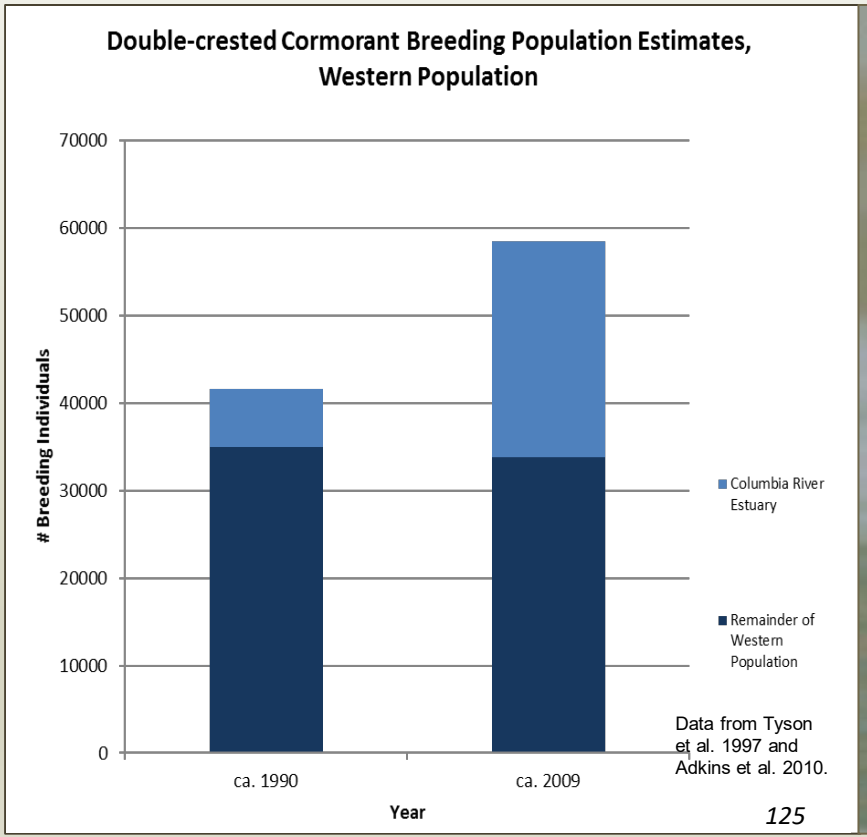


- 1972 - MBTA was amended to include the Cormorant Family (*Phalacrocoracidae*)

Prohibits taking *"at any time, by any means or in any manner… any migratory bird, [or] any part, nest, or egg of any such bird."*

Cormorant Background

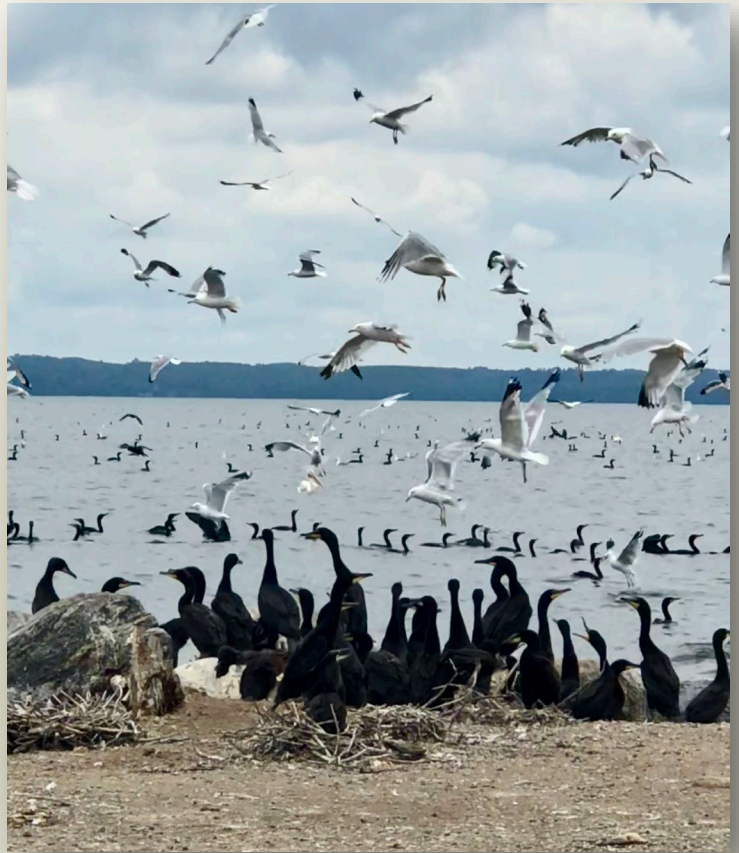
Population Recovery



Cormorant Background

Implications of Population Recovery

- Biological
  - Effect on other bird populations
  - Real and perceived effect on fish populations
- Social
  - Constituent complaints (anglers, commercial, wildlife viewers)
  - Cultural/spiritual significance of the species to Tribes
- Economic
  - Real and perceived loss to communities
  - Ecological goods and services



History of Cormorant Management

How We Manage Migratory Birds

Depredation Permits:

- Issued for a specific number of individuals from a specific site by specified individuals (short-term).

Depredation Order:

- Used when goal is to reduce economic loss associated with depredation (localized)

Control Order:

- Used when goal is population reduction; not necessarily related to economic loss

Conservation Order:

- Special action used to control one wildlife population for the conservation benefit another species and/or habitat

History of Cormorant Management

Aquaculture Depredation Order (1998) - Vacated

Purpose:

- To reduce depredation of aquaculture stock by DCCO at private fish farms and State and Federal fish hatcheries.

Application:

- Applied to commercial freshwater aquaculture facilities and to State and Federal fish hatcheries in 13 Midwestern, Eastern, and Southern states.

History of Cormorant Management

Public Resources Depredation Order - Vacated

Purpose:

- To reduce the occurrence of adverse impacts to public resources (fish, wildlife, plants, and their habitats) caused by double-crested cormorants.
- Implemented via the 2003 EIS
- 5 yr - extensions in 2009 and 2014

Application:

- Applied to all lands and freshwaters in 24 states in the Midwest, East and South.

History of Cormorant Management

Depredation Permits

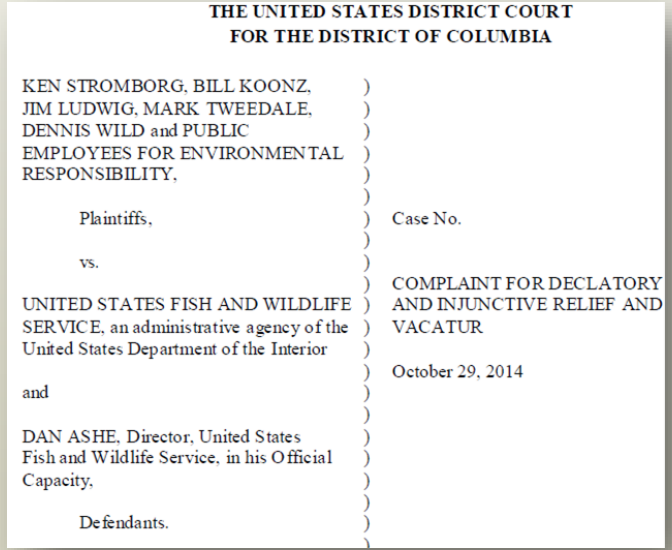
- Permits authorize the take to reduce damage caused by birds or to protect human health and safety or personal property.
- Permits are intended to provide short-term relief until long-term solutions can be implemented.
- FWS works with WS to determine the scope of the problem (WS Form 37)

History of Cormorant Management

DOs were Vacated

- Concern regarding high take of DCCO without adequate NEPA review

- 2014 EA failed to address:
  - How suppression measures impacted fish populations
  - Controversial nature of the issue
  - Degree of precedence
  - Effects on environment (lead, lack of take oversight, effect on co-nesting species)



THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

KEN STROMBORG, BILL KOONZ, JIM LUDWIG, MARK TWEEDALE, DENNIS WILD and PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY,

Plaintiffs,

vs.

UNITED STATES FISH AND WILDLIFE SERVICE, an administrative agency of the United States Department of the Interior

and

DAN ASHE, Director, United States Fish and Wildlife Service, in his Official Capacity,

Defendants.

Case No.

COMPLAINT FOR DECLATORY AND INJUNCTIVE RELIEF AND VACATUR

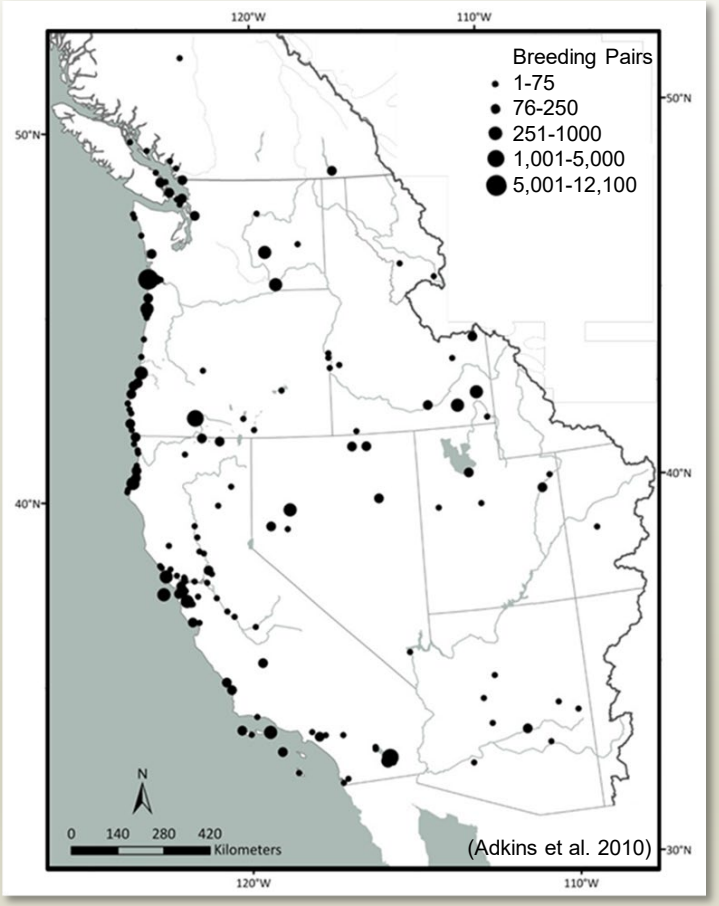
October 29, 2014

- Lacked an adequate "Range of Alternatives"

Western Population Management

Pacific Flyway States (minus Alaska)

1. Human health and safety
2. T/E or species of high conservation concern
3. Aquaculture
4. Property damage
5. Agency managed fisheries (*new – Special DCCO permit*)



Western Population Management

Pacific Flyway Plan

**A Framework for the Managem
Cormorant Depredation on Fi
Pacific Flyw**

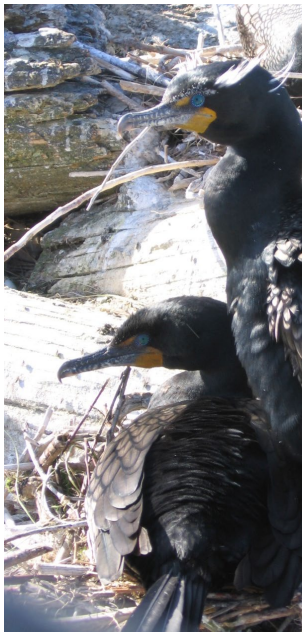


Photo by Bird Research Northwest (BRNW)

**A Monitoring Strategy for t
Double-crested Cormorants**

Photo: East Sand Island – Bird Research Northwest

Double-crested Cormorant Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary

Final Environmental Impact Statement

US Army Corps of Engineers
Portland District

Western Population Management

Management Plan – not vacated

> FWS evaluated the long term population trend of the western DCCO population, which FWS notes is "the determining factor for sustainability and whether a population will potentially become threatened." FWS_00001596. FWS concluded that with the requested culling, particularly considering the "well-monitored and adaptive management framework," the long term population trend demonstrates that the western population will remain sustainable.

- Evaluated long term population trend
- Monitoring
- Adaptive management framework

Western Population Management

Long-term Solution, Habitat Modification

*rds

Photo: Utah Division of Wildlife Resources

Western Population Management

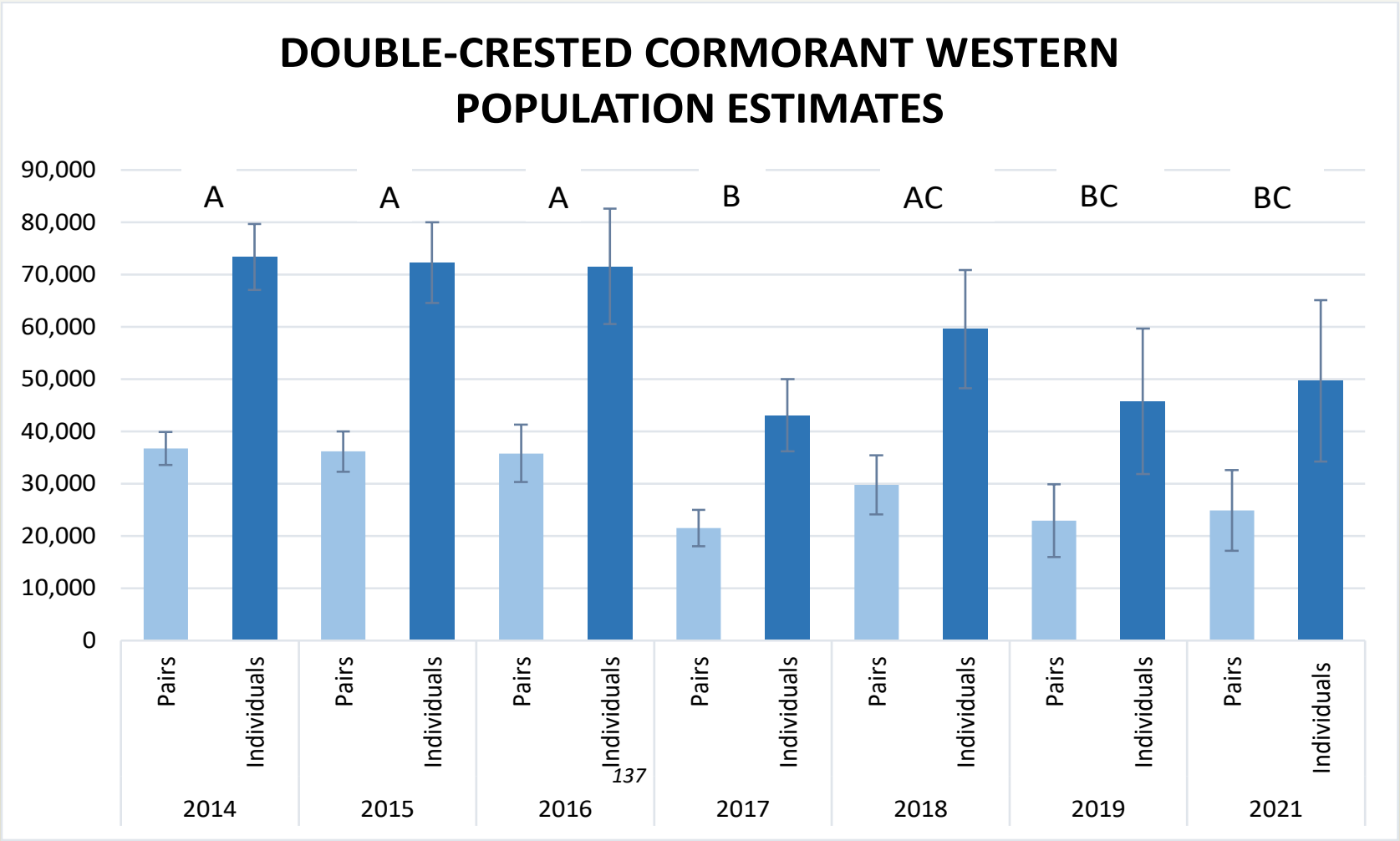


Photo: Oregon Department of Fish and Wildlife

Weste gement

Pacific Flyway Plan

A Framework for the
Cormorant Depred
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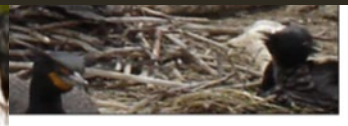
4,539 max allowable take

Photo by Bird Research No



US Army Corps of Engineers
Portland District

Cormorant Management Techniques

Integrated Wildlife Damage Management Approach

- No one “silver bullet”
- Combination of:
  - Nonlethal measures (Habitat/resource modification, harassment)
  - Lethal removal, for reinforcement
- Population monitoring and research

Photo: Idaho Department of Fish and Game

Questions??

- https://www.fws.gov/regulations/cormorant

Michelle McDowell
U.S. Fish and Wildlife Service
Pacific Region
Migratory Birds and Habitat Program
Portland, OR
503-863-7693 Cell
michelle_mcdowell@fws.gov

Predation Work Group Recommendation: Management of Double-crested Cormorants in the Columbia River Estuary

Prepared by the following for consideration by the Columbia Basin Collaborative Predation Workgroup:

Primary author: M. James Lawonn, *Oregon Department of Fish and Wildlife*
Contributors: Lynne Krasnow, *National Marine Fisheries Service*
Michelle McDowell, *U.S. Fish and Wildlife Service*
Tom Skiles, *Columbia Intertribal Fish Commission*
Sean Tackley, *U.S. Army Corps of Engineers*
Jennifer Urmston, *U.S. Fish and Wildlife Service*

1. **Problem Statement:** The abundance of double-crested cormorants nesting upriver of East Sand Island in the Columbia River estuary has grown dramatically in recent years, causing concern for the recovery of imperiled salmonid runs. Most of this growth occurred during 2015–2020, coincident with implementation of a federal management plan for the nearby East Sand Island colony (ESI management plan), where 97% of double-crested cormorants within the estuary nested during 2004–2014 (pre-management period). During 2020 and 2021, however, the colony associated with the Astoria-Megler Bridge supported most breeding individuals in the estuary, although substantial numbers also occurred at a variety of other sites, mostly upriver of East Sand Island (Lawonn 2023a, 2023b). Although the intent of the ESI management plan was to reduce double-crested cormorant predation of juvenile salmon and steelhead (salmonids) listed under the federal Endangered Species Act (ESA), increases in predation associated with colonies besides East Sand Island have substantially offset the recent management-caused reduction in predation at the East Sand Island colony (Evans et al. 2022). This result is somewhat paradoxical because the abundance of double-crested cormorants in the Columbia River estuary has declined about 56% since implementation of the ESI management plan. However, per capita predation of salmonids is far higher at the upriver locations where most double-crested cormorants currently nest compared to East Sand Island. This is because salmonids make up a far larger share of the cormorant diet at upriver locations because there are fewer alternative sources of prey nearby compared with the marine zone of the estuary, where East Sand Island is located. As a result, predation by double-crested cormorants may now be equivalent to, or even substantially higher than, the pre-management period (Lawonn 2023a).

2. **Work Group developing the action:** *Predation Work Group*

3. **Summary of action:** A sustained management effort using primarily non-lethal techniques could be implemented to reduce double-crested cormorant abundance on the Astoria-Megler Bridge colony and other colonies that lie upriver of East Sand Island, while minimizing double-crested cormorant dispersal to undesired areas. Five main actions would be necessary for this effort to succeed. First, double-crested cormorants would need to be deterred from nesting on the Astoria-Megler Bridge and other colony sites of management importance. Deterrence methods could include deployment of passive exclusion such as netting, bird wires, or other physical deterrents, although the use of such exclusion techniques would be limited to those that do not adversely affect the structural integrity of the Astoria-Megler Bridge or other structures used by cormorants for nesting. Along with passive exclusion, workers operating from boats or on the colonies themselves would harass, or "haze", cormorants prior to the breeding season, and continue harassment as needed through the duration of the breeding season. Harassment could involve use of water cannons, handheld lasers, pyrotechnics, predator effigies, or other techniques. Second, social attraction techniques would be used to attract cormorants displaced from the Astoria-Megler Bridge and other colonies back to East Sand Island. This action would be expected to increase the efficacy of deterrence activities and reduce the likelihood of cormorant dispersal to undesired locations. Management of bald eagle and gull disturbances could also be a component of social attraction on East Sand Island. Third, monitoring the status of double-crested cormorants would be necessary to evaluate double-crested cormorant dispersal within the basin, as well as the effects of management on the regional population. In addition, annually monitoring predation rates at double-crested cormorant colony sites in the estuary would be necessary to ensure that management reduces predation impacts on salmonids. Fourth, adaptive management would likely be necessary to deter nesting at additional estuary colony sites because it is probable at least some individuals would disperse to undesired locations. Finally, to the extent possible, managers would evaluate whether double-crested cormorant management improved outcomes for salmonids. Such evaluation would ideally be based on changes to salmonid survival rates following management but could also be derived from a community-based modelling approach informed by research on food web dynamics in the estuary and plume. New research on food web dynamics would likely be needed for the latter modelling approach.

4. **Is this part of an existing program or new program?** This action would be part of a new program.

5. **Benefit: (link to matrices)**

a. **What benefit will the action provide?** If successful, the action would reduce double-crested cormorant predation on most or all ESA-listed salmonids in the basin, since all outmigrants must pass through the estuary to reach the ocean. Although monitoring does not currently occur at all double-crested cormorant colonies in the estuary, available data suggest estuary-wide predation rates on various ESA-listed runs are currently at least as high as associated with East Sand Island during the pre-management period (Evans et al. 2022), when estimates of average annual predation rates at the East Sand Island colony ranged from 1.8% to 27.5% for various ESA-listed runs (Lawes et al. 2021). Lawonn (2023a, 2023b) suggest that current estuary-wide predation rates could be substantially higher than during the pre-management period, perhaps by about a factor of 1.7.

   Management would ideally reduce estuary-wide predation to an equivalent of no more than 5,380–5,939 breeding pairs on East Sand Island, the level envisioned by the National Marine Fisheries Service in their 2008 Biological Opinion related to hydrosystem operation. This target reflects a 4.5- to 4.9-fold reduction in double-crested cormorant predation compared to estimated predation impacts in 2021 (Lawonn 2023b).

b. **What data support this?** A comprehensive analysis of estimated predation impacts following implementation of the ESI management plan is provided in Lawonn (2023a, 2023b). A recent analysis of predation rates for the double-crested cormorant colony on the Astoria-Megler Bridge is presented in Evans et al. (2022), and a synthesis of double-crested cormorant impacts on salmonids is presented in Roby et al. (2021).

6. **Entities that would implement that action:** It is unknown what entities would implement this action. Current and potential colony sites are administered by a variety of local, state, and federal entities, and some potential sites may be owned by private entities. A high degree of coordination across jurisdictions would be necessary for this action to be successful. Fish and wildlife management responsibilities are also shared by multiple agencies. Parties that may be involved include:

   - Bonneville Power Administration – Operates and maintains transmission towers, including those located near the confluence of the Sandy River and the mainstem Columbia River, and The Dalles Dam. These are current double-crested cormorant colony sites.
   - Columbia River basin tribes and Columbia River Inter-Tribal Fish Commission representatives.

- National Marine Fisheries Service – Federal agency responsible for management of anadromous salmonids under the Endangered Species Act and the Magnuson–Stevens Fishery Conservation and Management Act.
- Oregon Department of Fish and Wildlife – State agency responsible for managing fish and wildlife.
- Oregon Department of Transportation (ODOT) - Maintains the Astoria-Megler Bridge under an agreement with the State of Washington.
- U.S. Army Corps of Engineers (USACE) - Manages East Sand Island (a double-crested cormorant colony site) and implemented the management plan, *Double-crested Cormorant Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary* (USACE 2015).
- U.S. Coast Guard (USCG) – Regulates/advises on activities or modifications that could affect navigation near the Astoria-Megler Bridge and manages aids to navigation (e.g. buoys and channel markers) that are used for nesting by double-crested cormorants.
- U.S. Fish and Wildlife Service – USFWS responsibilities include the conservation and management of double-crested cormorants, which are included on the list of protected migratory birds under the Migratory Bird Treaty Act.
- Washington Department of Transportation – Manages Longview Bridge under an agreement with the Oregon Department of Transportation. The Longview Bridge is a current double-crested cormorant colony site.
- Washington Department of Fish and Wildlife – State agency responsible for managing fish and wildlife.

7. **Timing:** Given the need for substantial funding and coordination across various governmental and tribal entities and compliance with federal and state environmental laws and regulations, it is likely that recommended actions would not begin until at least 2024 or 2025.

8. **How long will it take to implement action?** A redistribution of double-crested cormorants from the Astoria-Megler Bridge and other colony sites to East Sand Island will likely take at least four years. Thereafter, a reduced level of management will be necessary in perpetuity to maintain deterrence infrastructure and actively manage individuals attempting to nest at undesired locations. Monitoring will need to occur in perpetuity to guide adaptive management.

9. **How long until fish populations benefit from action?** Benefits for salmonid populations could be realized during the first return years associated with reduced double-crested cormorant predation on outmigrating juvenile salmonids.

10. **Stock(s) benefited by the action and magnitude of benefit for each stock(s):** Recent work suggests average annual double-crested cormorant predation rates associated with the East Sand Island colony prior to implementation of the ESI management plan (2004–2014) were about 7.4%, 7.6%, and 6.6% for Middle Columbia River, Snake River, and Upper Columbia steelhead surviving to Bonneville Dam, respectively (Roby et al. 2021). However, based on analyses in Lawonn (2023a), an estimated 17% of estuary-wide predation occurred at colonies besides East Sand Island during these years. For the purpose of this recommendation, we accounted for predation associated with these other colonies, and estimated that average annual estuary-wide predation rates during 2004–2014 were 8.9%, 9.2%, and 8.0% for Middle Columbia River, Snake River, and Upper Columbia steelhead, respectively. Reducing estuary-wide predation to the equivalent of 5,380–5,939 breeding pairs on East Sand Island would be estimated to reduce annual double-crested cormorant predation rates across the estuary to at least 3.4%, 3.5%, and 3.0% for Middle Columbia River, Snake River, and Upper Columbia River steelhead, an estimated 62% reduction in predation compared to the pre-management period, and an estimated 78% reduction in predation compared to 2021.

    Although not highlighted in the Columbia Basin Partnership Task Force's phase 2 report, available information suggests double-crested cormorant predation rates on juvenile Lower Columbia River Chinook and Lower Columbia River Coho are considerably higher compared to other ESA-listed runs in the basin, with predation rates averaging about 27% and 15% on these runs, respectively, for sampled years associated with the East Sand Island colony (Roby et al. 2021). Both of these ESA-listed runs may be expected to benefit substantially from double-crested cormorant management. Based on predation rates presented in Roby et al. (2021), management may also be likely to benefit Snake River Spring Chinook, Snake River Fall Chinook, Upper Columba River Spring Chinook, Upper Willamette River Spring Chinook, Snake River Sockeye, and Lower Columbia River Steelhead.

    In addition to potential benefits to fish, this plan would be expected to have substantial additional benefits. The guano associated with the double-crested cormorant colony on the Astoria-Megler Bridge is currently causing substantial damage to the coating that protects the metal portions of the bridge. This damage is estimated to potentially exceed $1 M annually (Oregon Department of Transportation, unpubl. data). In addition, vehicular

collisions with cormorants constitute a potential safety concern for traffic. Both of these harms would be alleviated by the recommended action.

11. **Estimated cost:** The overall cost for this plan is estimated to be at least $9.5 M over four management years, with a recurring cost of up to or greater than $0.4 M annually thereafter. An estimated $2.6 M will be needed prior to and during the first year of implementation: $1 M dedicated for deterring double-crested cormorant use of the Astoria-Megler Bridge, $0.5 M for social attraction on East Sand Island, $0.3 M for a status assessment of the regional double-crested cormorant population (ideally conducted prior to plan implementation), $0.4 M for monitoring within the Columbia River basin, and $0.4 M for deterring use of other colony sites, as needed. Costs may decline in future years as double-crested cormorant fidelity to East Sand Island increases and as the efficacy of deterrence improves at the Astoria-Megler Bridge and other sites where displaced birds may attempt to relocate. Nevertheless, the estimated cost for the second through fourth year of implementation is $2.3 M annually. Because the Columbia River estuary is a highly attractive site for double-crested cormorants, monitoring and management will likely be required in perpetuity to prevent reuse of the bridge or other undesired sites for nesting. Therefore, an estimated $0.4 M will be required annually following the initial four-year management period to continue monitoring and deterrence efforts on the Astoria-Megler Bridge and other colony sites, as needed. If relocation of double-crested cormorants to East Sand Island is not successful, annual costs for monitoring and deterring cormorant use of undesired sites in the estuary could be substantially greater than $0.4 M annually. Because of substantial uncertainty inherent in the estimates above, they should be considered minimum estimates.

12. **Uncertainties related to the action:** There are three main uncertainties related to management. First, it is unclear the extent to which predation by double-crested cormorants or other predators reduces life-cycle scale abundance of anadromous salmonids in the Columbia River basin (ISAB 2016). Losses to double-crested cormorants during the juvenile life stage might be ameliorated by improved survival later in life, especially if double-crested cormorants preferentially consume the least fit individuals (ISAB 2016).

    Second, the role of predators in maintaining the structure of biological communities, even communities altered by humans, is often poorly understood (ISAB 2016). For example, depending on their colony sizes, double-crested cormorants can consume hundreds to even thousands of tons of forage fish in the Columbia River estuary annually, the vast majority of which are non-salmonids (Lawes et al 2021). Reductions in double-crested cormorant abundance could therefore substantially alter the local food web and predator community,

which could result in counterintuitive and unintended consequences for juvenile salmonids, as suggested by a wide body of research related to predator-prey dynamics across a variety of taxa (Holt and Lawton 1994, Sih et al. 1998, Yodzis 2001, Bruno and O'Connor 2005, Harvey and Karieva 2005, Weise et al. 2008, Abrams 2009, Ellis-Felege et al. 2012).

Finally, the likelihood that management will substantially reduce estuary-wide double-crested cormorant predation is uncertain, at least at the estimated minimum cost of implementing this recommendation. The Independent Science Advisory Board (2016) suggests predator management is best suited to local scale and temporary conflicts (i.e. hotspots) rather than persistent conflicts that occur across a wide geographical area. This is because of the high cost and biological uncertainty related to predation management conducted at large scales. Nevertheless, this recommendation seeks to manage cormorant predation across a wide area because isolated colony-specific management would likely cause dispersal of displaced cormorants to new areas of the estuary unless prevented, which would move the predation issue rather than resolve it.

There are several examples of uncertainties related to such large-scale management:

1) Double-crested cormorants nested at 20 discrete sites in the Columbia River estuary in 2021. The cost of managing these sites could be substantially higher than estimated if the relatively less expensive passive dissuasion techniques recommended here are unsuccessful.

2) Bald eagle disturbance of the East Sand Island colony has been an important contributing factor to recent breeding failures there, and may reduce the likelihood of future nesting at that location. If eagles or other factors prevent renesting at East Sand Island despite social attraction efforts, deterring use of other colony sites will be more difficult and costly because of the lack of a viable alternative breeding site for displaced individuals.

3) The focus on non-lethal management may not be as effective or cost-effective as desired, and lethal take may therefore need to be incorporated at a larger scale than anticipated.

Despite the uncertainties listed in this section, however, available information suggests substantial risk to salmonids from ESA-listed runs as a result of double-crested cormorant predation across the Columbia River estuary (Lawes et al. 2021, Roby et al. 2021, Evans et al 2022, Lawonn 2023a, 2023b). We therefore recommend carefully designed and implemented management with adequate effectiveness monitoring and adaptive

management to address this risk. This recommendation is further supported by recent work by the Independent Science Advisory Board (ISAB 2021). They reviewed two studies that considered the effects of avian predation on interior Columbia Basin steelhead and concluded that the most prudent conclusion from a management perspective is that, despite the uncertainties, these predators have some level of effect on adult returns. Finally, the double-crested cormorant colony on the Astoria-Megler Bridge is causing substantial costs related to infrastructure maintenance and even human safety risks, which appear likely to be resolved with management at that site, despite uncertainties related to benefits for salmonids.

13. **Regulatory processes or policies associated with the action:** Agencies implementing the recommended actions would have to comply with relevant federal and state environmental laws and regulations, such as the National Environmental Policy Act (NEPA), ESA, MBTA, and the Bald and Golden Eagle Protection Act. If double-crested cormorants can be managed using non-lethal techniques, environmental reviews are expected to be less complex than if lethal techniques are used.

14. **Potential challenges:** The high abundance of prey (juvenile salmonids, marine forage fish, and other species) in the Columbia River estuary is a major draw for double-crested cormorants and will likely continue to make the estuary an attractive nesting location. There are 11 historical nesting colonies or colony complexes in the estuary, and individuals would likely disperse among these sites if management is not appropriately coordinated. In addition, unused potential nesting habitat is present within the estuary at a variety of locations, suggesting management-related dispersal could be a persistent problem. Finally, potential colony sites are administered by a variety of local, state, federal, and private entities; coordination across jurisdictions would be necessary for this recommendation to be successful. Furthermore, given the multiple jurisdictions and agencies involved, it is currently unclear which parties would be responsible for implementation, monitoring, and adaptive management.

15. **Adaptive management (describe how this will be incorporated into to action):** We envision several reasons for adaptive management:

    1) Double-crested cormorant distribution and abundance in the estuary are not responding as anticipated.

    2) Estuary-wide predation rates are not responding as anticipated.

3) Ideally changes to measures of survival across the life cycle would be used to assess project success and whether a change in management actions would be necessary. However, given the degree of variability in annual marine survival, human activities, and environmental conditions, these changes would be extremely difficult, perhaps impossible, to assess empirically.

A detailed adaptive management plan that outlines roles and responsibilities of the implementing parties would need to be developed. Examples of adaptive responses include adjusting management effort at the Astoria-Megler Bridge and upriver sites in response to cormorant use, and potential management of colony disturbances at East Sand Island.

16. **Best Management Practices (BMPs):** The working group recommends development of a formal set of best practices and guiding principles for predator management that can be used to guide future work. The following are examples of potential BMPs:
    - Managers should identify clear objectives and develop evaluation criteria for avian management to measure progress toward meeting these objectives.
    - Predation should be managed at the appropriate spatial scale.
    - Managers should plan, coordinate, and budget for adaptive management.
    - Managers should conduct effectiveness monitoring that directly measures results against management objectives.
    - Potential non-lethal management options should be evaluated before implementing lethal methods, as appropriate.

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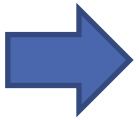
Columbia Basin Collaborative

Jim McKenna
State of Oregon

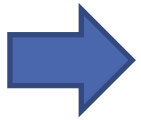
Columbia Basin Collaborative

Context

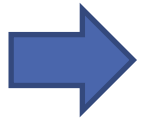
Columbia Basin Partnership Task Force
Establish goals



4-State Agreement
Joint commitment to collaboration and actions to advance goals



Columbia Basin Collaborative
Vehicle for collaboration, action recommendations and implementation



Recommendations for Action
Achieve goals, durable framework for collaboration and communication

Columbia Basin Collaborative

Vision

- Commits to identify and support integrated strategies and actions that have potential to achieve the quantitative and qualitative goals of the CBPTF;
- Acknowledges, respects, and protects tribal cultural values, consistent with treaty/non-treaty tribal rights, and promotes the trust responsibilities of the federal government to tribes;
- Appreciates and addresses the needs of the regional economies, including but not limited to fishing, agriculture, transportation, recreation, port operations, and state and tribal fisheries; and
- Recognizes the importance of a future regional power system, that includes conservation measures, hydropower, solar, wind and potentially other energy sources, and that is reliable, affordable, and furthers decarbonization without undue sacrifice of natural landscapes and the environment.

Columbia Basin Collaborative

Guiding Principles

- Regional Scope
- Focused on outcomes
- Nimble and opportunistic
- Effective
- Inclusive
- Knowledgeable
- Timely

Columbia Basin Collaborative

What is the value-added of the CBC?

1. Break through implementation barriers for important actions

- There are many actions that the region could take to advance salmon and steelhead, yet for one reason or another, they aren't happening or haven’t achieved their goals/objectives.
- The CBC will examine implementation barriers- and seek to break through those barriers to get actions on the ground.
- Without the collective force of regional sovereigns and stakeholders, these actions may not get to implementation.

Columbia Basin Collaborative

What is the value-added of the CBC?

2. Take a regional, basin-wide approach

- There are many processes and forums in the region that are providing benefits to salmon and steelhead, but salmon populations are in need of more help then is currently available. The CBC will identify gaps and opportunities to expand current actions and to implement additional actions to advance the goals of the Columbia Basin Partnership.
- The CBC will focus on populations from the entire basin and biological impacts from all phases of their life cycle.
- The CBC will consider biological, social, economic, cultural, and ecological outcomes and feasibility of implementing specific actions.

Columbia Basin Collaborative

What is the value-added of the CBC?

3. The CBC is intended to be a broad scoped forum that brings into play all the other processes in the basin to learn and discover opportunities to further advance actions; through existing forums or through new implementation paths (including additional funding opportunities)

Columbia Basin Collaborative

What is the value-added of the CBC?

4. Power of collective voices to get results on the ground

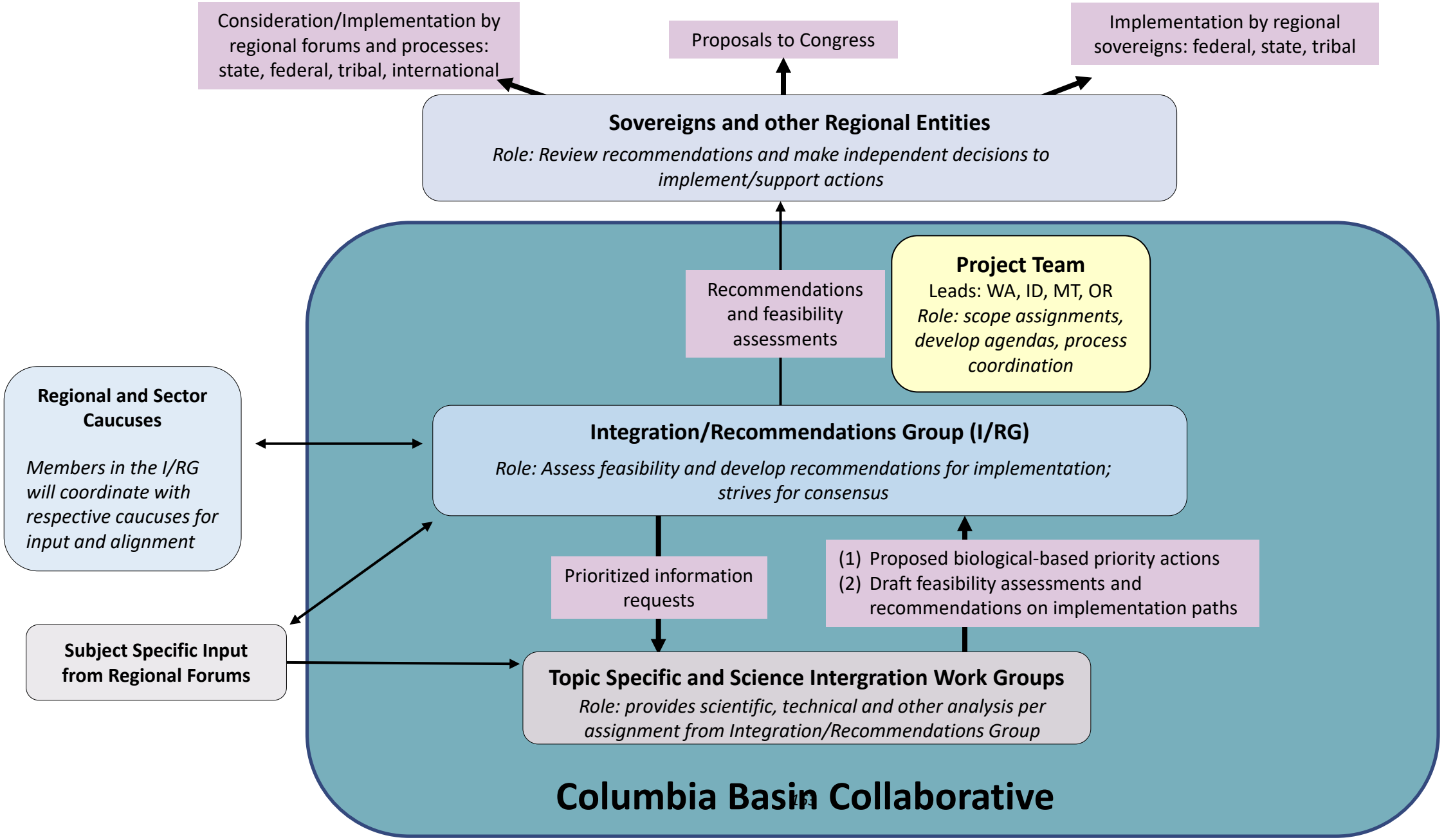
- Expedited actions to promote implementation through existing authorities
- Outcome based
- Unified recommendations that can be acted upon
- Creative, durable solutions that can withstand political pendulum swings

Columbia Basin Collaborative

Approach

- Develop collaborative framework
- Identify actions necessary to advance CBP goals
- Assess social, cultural, economic and ecological considerations associated with those actions
- Develop recommendations for actions to advance CBP goals that also address social, cultural, economic and ecological considerations
- Remain nimble and opportunistic
- Provide communication and education on relevant issues

A regional approach to achieving the Columbia Basin Partnership goals



Work Groups

- Estuary/Tributary Habitat
- Hatcheries/Harvest
- Hydrosystem/Blocked areas
- Predation
- Science Integration Work Group

*Listed alphabetically, order does not represent priority.

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Thank You!

PROJECT ANALYSIS

PROJECT ANALYSIS

SUMMARY OF ANALYSIS

The following analysis tools were used to study the project:

- Key Project Issues
- Interested Party Issues
- Function Analysis

KEY PROJECT ISSUES

The following summarizes key issues and concerns associated with the project.

- **Stewardship**: ODOT does not have the funding to maintain its bridges. If an excessive amount of funding is spent on one bridge, there will be other bridges requiring attention that will not be addressed.
- **Post-Dispersal Movement**: Upriver movement of dispersed DCCO is a concern. It is unknown whether other land/structure managers in the basin would respond with passive or active tools and who would be responsible for monitoring.
- **Social Attraction**: Social attraction of DCCO to ESI will be crucial to reduce dispersal risk to colonies in the freshwater zone. However, ESI is administered by USACE, and the extent of their future cooperation is currently unclear.
- **Tribal Considerations**: The Cowlitz and Yakama tribes are stewards of the lower Columbia River Basin. Salmon in the area are a mainstay of their diet and are integral to their culture. The salmon are also ecologically and economically important.
- **Monitoring**: Long-term follow-up monitoring of both ESI and the Astoria-Megler bridge is needed; realistic budgets and timelines must allow for this.
- **Safety**: The safety of the bridge, staff, and traveling public is paramount. The ability to appropriately conduct maintenance and inspections on the bridge is essential for public safety.

INTERESTED PARTY ISSUES

The various interested parties involved in the VE study were invited to share their issues, concerns, and opportunities related to the study subject. The following is a list of the issues identified for each organization that participated.

ODOT

- Bird exclusion netting was considered but not allowed for the current painting project. The concern is that other protected species might be captured. See article entitled, "Caltrans to Remove Bird-killing Nets at Highway Project, Vows to Use Safer Methods" at https://www.biologicaldiversity.org/news/press_releases/2014/caltrans-01-16-2014.html.
- Long-term solutions are needed to remove nesting opportunities permanently from the bridge.
- It seems that there is sound or light that can be used to discourage nesting. That would be a low-cost approach to the deck truss spans that seem to be the most popular nesting location. This is in the middle of the bridge and should not disturb any people.
- Stewardship is a big issue. Oregon does not have the funding to maintain its bridges. If an excessive amount of funding is spent on one bridge, there will be other bridges that have needs that will not be addressed.
- If the cormorants can increase or decrease exponentially, why is the take number fixed?
- If there are fewer than 4,539 cormorants taken in the western states in any year, can the difference be applied to future years?
- The bridge gives the cormorants an advantage that they never had regarding eating fish when they only had natural nesting sites.
- What is the maximum population that the Astoria-Megler Bridge can support?
- Are there any innovative methods of dissuasion that would avoid putting netting, bird spikes, etc., on the bridge?
- How much dissuasion would be required on upstream assets, or on surrounding forests, to get the birds to move downstream?
- Is an NPDES permit possible for ODOT, like WSDOT?
- What is the updated predation numbers after the population shifted to Astoria-Megler Bridge?
- Could a Conservation Order be an appropriate part of a backup plan? Reference Michelle McDowell's presentation.
- Bridge is historic and changing the "look" would need SHPO.
- Vehicle collision hazards with DCCO should not be underestimated.
- "Generational Habituation," coined by Jeremy E. Guinn, United Tribes Technical College in Bismarck, North Dakota, provides encouragement for DCCO colonies to be relocated elsewhere. See article at https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1124&context=hwi#:~:text=Generational%20habituation%20begins%20when%20a%20juvenile%20imprints%20on,areas%20that%20once%20were%20considered%20suboptimal%20nesting%20habitat.

Columbia River Inter-Tribal Fish Commission

- It is critical that this a collaborative effort.
- Fish protection is paramount for the region especially considering that billions of dollars have been spent on recovery.
- Consider building additional habitat on the jetties for DCCOs as an additional attraction for other cormorant species.
- The sooner the engineering parameters to exclude birds are understood, the more helpful it will be to build a removal and exclusion process.
- What kind of take restrictions will the Service permit to help address the removal of nests and birds during the work season to minimize delays to the overall process?
- Funding is a huge issue. Who is going to pay for this?
- No expansion of upriver colonies is hard line. In fact, upriver needs to be consolidated with the Astoria-Megler colony to provide the maximum protection for salmon and steelhead.

USFWS

- What are the long-term plan and methods? It is essential to know what the end game is.
- Dan Roby's sharing of the social attraction DCCO studies was very helpful.
- More discussion of ESI colony monitors and methods to prevent bald eagle/gull predation is requested.
- USFWS will share the 2022 authorized take numbers with Rob Stewart.
- Once management starts, continual hazing/nest removal will be needed.
- The 2020 National FEIS nest conversion for take is (n * 0.63).
- Focusing on nonlethal measures needs to be the highlight. Lethal will just be for reinforcement.
- What are the bridge access points? More will need to be added (e.g., catwalks/work decks).
- A large enough budget and workforce will be needed prior to implementation.
- Removing old nests and new starts is needed.
- Access for hazing is needed on the bridge.

USACE

- Dan Roby mentioned that the presence of monitors on ESI would affect/deter bald eagle/gull predation activity on the colony. Would this be a long-term need or short-term (less than 3 years)? How long just to get a colony re-established, assuming that strategy is proposed?
    - Dan Roby response: Regarding the role that colony monitors can have in limiting eagle disturbance to and predation of an incipient seabird colony, National Audubon's Seabird Restoration has documented that bald eagles have avoided seabird colonies on islands with resident colony monitors; as soon as the monitors leave the island at the end of the season, eagles forage on the island. Seabird colony monitors in the Baltic Sea region have noted the same pattern in behavior of white-tailed sea eagles (a close relative of bald eagles).
- Are stakeholders prepared to respond if birds start appearing upriver?

- For the VE team to consider: Upriver movement of dispersed DCCO is a concern. How would other land/structure managers in the basin be prepared to respond with passive or active tools? Who would be responsible for monitoring? All of this takes planning, budgeting, permitting, etc., so this is just a practical consideration.
- Technical question: Based on what we have learned and available habitat on ESI, what is the likelihood that social attraction and/or habitat enhancements could result in an ESI colony size greater than 5,939 nesting pairs and the need (consistent with the USACE's management plan) for non-lethal hazing or other measures in the future? Long-term sustainability should be considered, given limited O&M funding.
- Sustainable costs to the approach should be discussed.

Willamette River Keeper/Humane Society

- Bob Sallinger is representing three groups on this VE study: 1) Humane Society of US, 2) Willamette Riverkeeper, and 3) Bird Conservation Oregon.
- So far, this feels very focused on salmon; but I think we also need more information about cormorant populations especially given the level of decline, ongoing hazing in the Pacific NW, and the unknowns regarding when/where the remainder of the ESI population went, etc.
- Note potential peregrines nesting on A-M Bridge. Any management plan should account for them and potential impacts that management may have.
- I have received lots of reports about dead cormorants on the A-M bridge. I went out a couple of years ago and counted over 90 carcasses on the bridge in a single day. Most were toward the north end of the bridge.
- Think the compensatory mortality discussion needs further attention especially if lethal control is considered.
- We are concerned about the fact that Dan Roby has not been allowed on the island since the initiation of the removal project. Important to have credible third-party researchers.
- Context here is important. Corps has lost multiple lawsuits over past the two decades related to impacts of dams on salmon. Focus on cormorants comes off as a diversion under these circumstances.
- Strongly supportive of recolonization of ESI/Strongly opposed to lethal control.
- Note level of interest in this issue. The 2015-2017 control effort drew international attention (and opposition)
- Lethal control activities in 2015-17 were viewed by many as deeply inhumane (shooting with shotguns into groups of cormorants).
- Concerned that three largest colonies in the west (ESI, Klamath, and Salton Sea) have all winked out and that the current largest is the A-M Bridge.
- Note that many groups felt that the thresholds in the most recent Bi-Op were too high in the Western Region. Going close to the full limit will be controversial.
- Are we only concerned here about native wild salmon? How much are hatchery salmon driving this either overtly or behind the scenes?
- Important to recognize that the current problem was created by prior control efforts. Some of the opposition to the ESI project was based on concern that DCCO would go further up the estuary and increase impacts on listed species. That concern turned out to be valid.

- See here for video that describes my perspective on past management: https://www.youtube.com/watch?v=qL4xecmqIkg
- TOP ISSUES: 1) Support re-establishment on ESI 2) Oppose lethal control 3) Health of cormorant populations need to be on par with other considerations.
- Appreciate initial frame of addressing the bridge, the fish, and the birds; I like this multi-dimensional framing.

ODFW

- Predation by double-crested cormorants (DCCO) associated with the Astoria-Megler Bridge is having major predation impacts on juvenile salmonids.
- Significant breeding habitat exists on non-metal portions of the bridge. If ODOT actions are only limited to the metal portions, overall DCCO abundance on the bridge may not appreciably decline.
- Social attraction of DCCO to East Sand Island (ESI) will be crucial to reduce dispersal risk to colonies in the freshwater zone. However, ESI is administered by the Corps, and the extent of their future cooperation is currently unclear.
- Dispersal of DCCO to freshwater zone colonies is a side-effect of management. Such dispersal may be difficult and costly to manage.
- Management actions are needed by a variety of entities that may have differing objectives/mandates.
- Funding for social attraction and dissuasion at alternative colony sites is needed.
- Sufficient take permitting will be necessary at potentially many colony sites. It would be ideal if these permits could be issued on an estuary-wide level rather than a colony-specific level. That way, managers can be nimble in their approach to adaptive management.
- Long term-monitoring of the regional DCCO population is necessary. Effective monitoring may require modification of existing monitoring plan.
- Cooperation/cooperation with entities who administer alternative colony sites will be essential to prevent colonization of undesired sites.
- Adaptive management (and associated funding and permitting) will likely be required in perpetuity.
- From a fish survival point-of-view, management would ideally occur on an estuary-wide level, not a colony-specific level.
- What level of DCCO predation is acceptable for the region?
- Will pelagic cormorants on the bridge also be managed?
- Side-benefits for Brandt's cormorants which currently nest on the bridge but in lower numbers than previously on ESI.

NOAA

- Jim McKenna mentioned proposals for predation management in front of the CBC. It is worth mentioning that for the one re. DCCO on the bridge, James was primary author with help from me, Michelle (FWS), Sean (USACE), and Dan (OSU).

Cowlitz Tribe

- The Cowlitz People have always been stewards of the lower Columbia River Basin, and we will continue working to protect and restore healthy, harvestable fish and wildlife populations.
- Salmon are a mainstay of the diet and integral to Cowlitz culture. They are also ecologically and economically important.
- We have concerns about impacts to ESA-listed salmonids including from cormorant predation.
- There is uncertainty associated with cormorant management. Past actions at East Sand Island had some unintended consequences. Monitoring and adaptive management will be essential.
- We need a thoughtful management approach that does not jeopardize the conservation status of the Double-crested Cormorant population (or the status of co-nesting species like Brandt's Cormorants and Pelagic Cormorants).
- We recognize there are bridge safety concerns and maintenance challenges due to a large cormorant colony on the bridge.
- A robust monitoring program (both of cormorants and of predation impacts) should be an integral part of any management effort.
- Who will pay for cormorant management and monitoring?

Audubon Society

- Agree the best course of action is for recolonization of ESI, recognizing human safety concerns on the bridge
- Long-term follow-up monitoring of both ESI and AM bridge needed, with realistic budgets and timelines to allow for this
- Have there been any assessments of how displacement of DCCO might affect outer coastal
- colonies of PECO+BRCO?
- Is eagle/gull predation an issue on the bridge as well as ESI? Might impact recolonization of
- ESI if predation rates are much higher there than on the bridge
- Deterrence and attraction will need to be used jointly, with an opposition to lethal
- management
- Would recolonization of ESI affect in any way the Caspian Terns in the area?
- Multi-species management approach, salmon/DCCO but also other cormorants, terns,
- predator dynamics should b e considered

WSDOT

- Safety of the bridge, staff, and travelling public is paramount.
- There is a DCCO colony on the Lewis and Clark bridge in Longview. Don't want to push more birds toward this bridge. Coordinated response may be needed.
- Coordination among multiple agencies and stakeholders will be a significant effort. There may be funding challenges within individual organizations to put time/resources toward the effort.

Yakama Tribe

- I would agree with the idea that any dissuasion at the A-M Bridge needs to be accompanied by work to attract birds back downstream.
- The number and scope of management issues with the A-M Bridge caused by the DCCOs was eye-opening for me.
- Flexibility and adaptive management. A combination of less restrictive permitting and creative adaptive management in the form of enticing the birds back to the marine part of the Estuary. The agencies responsible for permitting and action on this issue will likely need to find more flexibility to deal with this Gumby-like issue.
- All the presentations we saw this morning were excellent, and being new to this issue, I feel fairly up to speed.

APHIS

- NEPA
- Staffing: daily presence March-September
- Bird response to management: effectiveness, dispersal
- Accessibility for management personnel on AMB
- Dangerous working conditions in Estuary: tides/weather
- Multiple areas of boating/hazing operations
- Safety protocols and procedures
- Management impacts to vehicle traffic, boaters, Astoria boardwalk
- Focused on the 'push' off the bridge
- Greater resiliency of DCCO on AMB vs East and Island
- Management challenges on a large project site with limited access, 4-mile bridge

FHWA

- Safety of the traveling public and maintenance inspections staff is our primary concern
- Maintenance and inspection access must be adequate to meet NBIS requirements

FUNCTION ANALYSIS

The Value Team analyzed the functions of the project to identify those areas that offered the greatest opportunity for value improvement. In VE, a function is articulated using a verb and a noun. These two-word function statements describe what the project elements do and why they do them. The VE team leverages these function statements later in the Creativity Phase to generate other ways of achieving the same functions differently.

To perform Function Analysis, the team started with the following problem statement: *"What is the best strategy to deal with damage to the bridge that is caused by DCCOs?"* The VE team agreed upon a set of functions that reflect four different general categories of potential solutions/responses to the current situation:

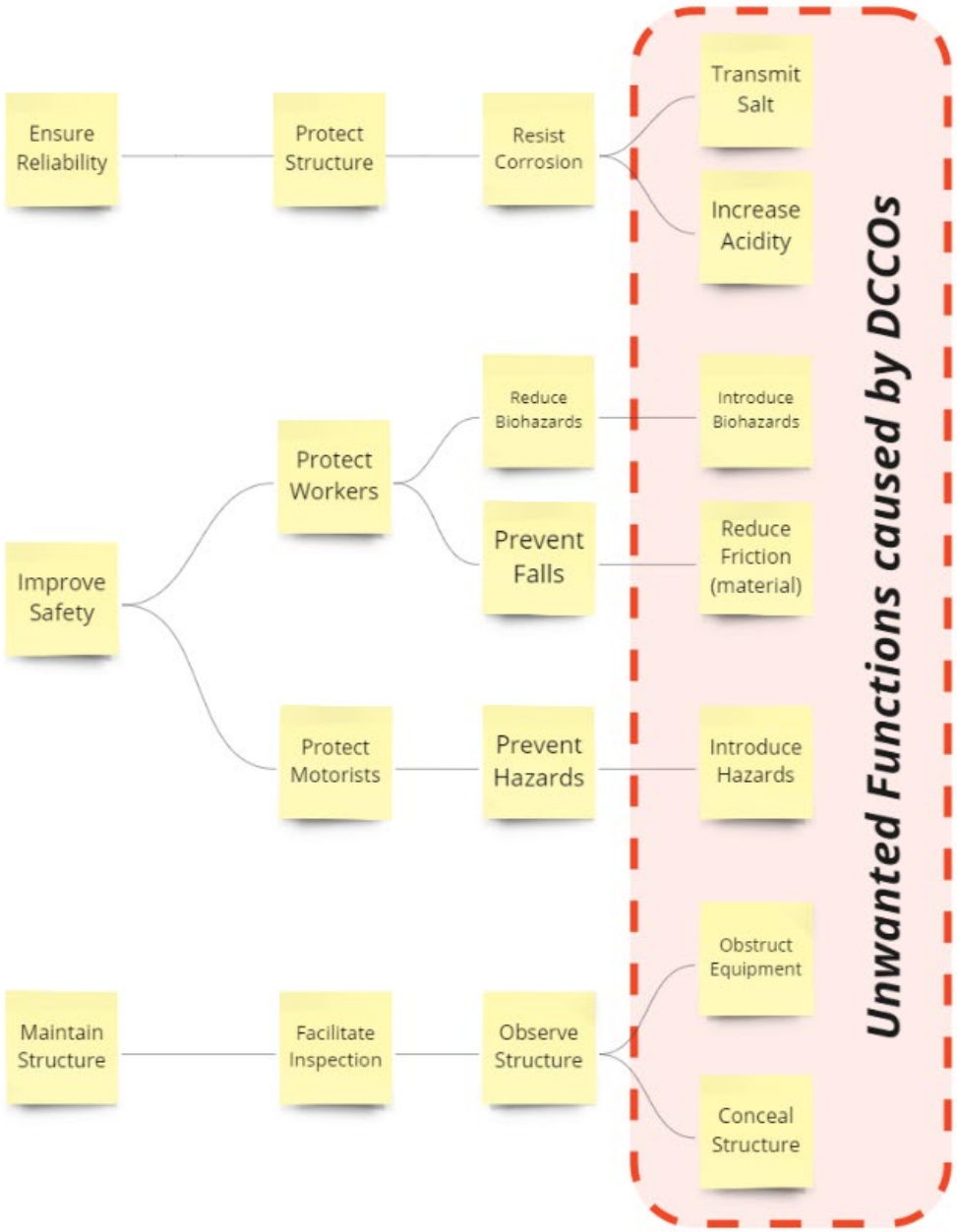
- Manage Birds
- Deter Birds
- Create Habitat
- Protect Structure

These functions were used as brainstorming topics.

Further, the team also identified the functions that support the objectives of ODOT in supporting a safe, reliable transportation system via the Astoria-Megler Bridge. The function logic illustrated on the following page provided additional clarity to the participants regarding how DCCOs are impacting the Astoria-Megler Bridge in different ways.

Functions of Potential Solutions

Functions of ODOT Project Goals



IDEA EVALUATION

IDEA EVALUATION

INTRODUCTION

A total of 187 ideas were generated during the Creativity Phase of the VM Job Plan. Using Miro, a virtual whiteboard, VE team members individually selected the ideas they wanted to consider for development. Then the VE team collectively considered each of these ideas and narrowed down the final list. During the Evaluation Phase, 41 ideas were elevated forward into the Development Phase as having strong potential for improving project value. These ideas were then grouped to create a recommended VE alternative.

INITIAL IDEA EVALUATION

This section includes a list of all the ideas generated by the team during the Creativity session organized by function. During the evaluation process, individual VE team members were asked to select from the 187 ideas the ones they thought would support either good or moderate outcomes for the bridge, cormorants, and listed salmonids.

These selected ideas were then reviewed by the team and from them a list of consensus ideas emerged in support of good and moderate outcomes. Of specific note was the fact that several common features emerged; namely, idea CH-2, which supports the notion of drawing the double-crested cormorants back to East Sand Island, was identified by many VE team members as supporting good outcomes for the bridge, cormorants, and listed salmonids.

In addition to the individual team member evaluations, a summary of the team's consensus ideas supporting good and moderate outcomes is also provided in this section.

Kanban

Manage Birds | 13

- MB-1 Harass with human presence.
- MB-2 Reduce estuary-wide abundance of cormorants
- MB-3 relocation of all freshwater DCCO's to marine zone
- MB-4 cull birds until they leave the bridge
- MB-5 Non-lethal hazing; pyrotechnics, paintball markers, propane cannons, lasers, high pressure water spray
- MB-6 Add temporary work deck during nesting season to provide access for personnel conducting hazing activities
- MB-7 Add permanent catwalk to aid hazing, maintenance on Astoria and/or WA side
- MB-8 Oil eggs
- MB-9 attract Eagles and Gulls to the bridge, increase predators
- MB-10 Allow for lethal take of adults even when active nests present (like currently occurs for gulls associated with CR dams)
- MB-11 Harass with drones
- MB-12 Night time harassment of roosting birds on AMB
- MB-13 Increase access for humans, add permanent catwalk.

Manage Birds | 13

- MB-14 Increase access for humans, add permanent work platforms.
- MB-15 Remove all old nests and associated "crust" before the nesting season.
- MB-16 Remove all new nest starts (prior to egg laying).
- MB-17 Use falconry abatement to harrass.
- MB-18 Electrify the bridge, send intermittent pulses of electricity
- MB-19 Boat-based shooting with shotguns to reinforce non-lethal hazing
- MB-20 Remove active nests (with eggs), under permit.
- MB-21 Remove active nests (with chicks), under permit. Chicks sent to a wildlife rehabilitator.
- MB-22 Use lethal take of adults, if permittable.
- MB-23 abandon bridge and let the birds have it
- MB-24 Remove eggs/nests with vacuum vehicles from above
- MB-25 If the Cormorants can increase or decrease exponentially, why is the take number fixed?
- MB-26 If there is less than 4,539 Cormorants taken in the western states in any year, can the difference be applied to future years?

Manage Birds | 11

- MB-27 Use human hazing and removal of nests, to proven methods, to prevent colony formation on the bridge.
- MB-28 Conduct year around harassment to reduce comfort level for perching
- MB-29 Full time monitoring of population to better understand numbers and how solutions might impact population
- MB-30 Keep in mind management strategies that can be sustained for the lifetime of the bridge. Not a one and done solution.
- MB-31 Reduce the size of the minimal viable population size for the western population of DCCOs
- MB-32 Remove nests and allow nesting material to be put back in river for cost, labor savings
- MB-33 Drones outfitted with pyro launchers, paintball markers
- MB-34 Culling with rifles of adults that begin nesting on the bridge
- MB-35 Use P-14 surfactants on small groups
- MB-36 Do we need to worry about restricting nesting on the 140-some concrete piers between the OR an WA high spans?
- MB-37 The bridge gives the Cormorants an advantage that they never had in regard to eating fish when they only had natural nesting sites.

Kanban

Manage Birds | 9

MB-38 Identify the maximum population that the A-M bridge can support?

Comments: Current estimates are that there is physical space to accommodate about 10,000 pairs

MB-39 greater flexibility from USFWS to lethally manage birds in the estuary during efforts to move them to marine zone

MB-40 Updated predation numbers after the population shifted to A-M bridge?

MB-41 Quantify risk of where/number of birds that will move upstream vs East Sand if removed from bridge

MB-42 Monitor and exclude upriver colonies from DCCO use

MB-43 exclude birds from key areas where personnel need to access and inspections need to occur and the let the colony have the rest of bridge structure for nesting

MB-44 giant cats

MB-45 Train monkeys to keep cormorants from landing on AMB

MB-46 It seems like some ideas on this topic could also be places in the section below ("deter"). Might require a bit more discussion to clarify.

Manage Birds | 11

MB-47 Ensure a good communication and action plan for when DCCO nest/disperse to unwanted places

MB-48 Costewardship of ESI to ensure preserving bird colonies is a priority

MB-49 Is an NPDES permit possible for ODOT, similar to WSDOT?

MB-50 Could a Conservation Order be an appropriate part of a backup plan? Ref. Michelle McDowell's presentation

MB-51 10 cent toll to use bridge to help pay for bird control and exclusion efforts

MB-52 Service and avian NGO's to fund

MB-53 Effigies of USDA Personnel shooting birds

MB-54 Allow for more lethal take of DCCO (nests and adults)

MB-55 Separate AM-B Plan; do a separate biological analysis compared to National Plan.

MB-56 increase the speed limit on the bridge to increase bird strikes.

MB-57 Intensive multi-year management on AMB vs long term maintenance on DCCO colonies in estuary

Manage Birds | 12

MB-58 Pull to ESI - socially attract with structure/decoys/sound system

MB-59 Add colony monitors to ESI

MB-60 Disturb bald eagles and gulls on ESI

MB-61 2 boats working in conjunction on OR and WA side of bridge to prevent birds from avoiding hazing areas

MB-62 Seek local population control

MB-63 Find the long term solution versus on-going intensive management

MB-64 Protect the pelagic cormorants, avoid/minimize effects of DCCO management

MB-65 rubber snake effigies

MB-66 Need a detailed timeline for the bridge work to sync with other operations to move/exclude birds

MB-67 Open more ESI acreage to be available for DCCO during (productive) colony reestablishment

MB-68 Ensure DCCO do not invade Caspian Tern (CATE) colony; colony monitors needed

MB-69 Work with fisheries managers to ensure good marine forage fish stocks

Kanban

Manage Birds | 6

MB-70 Work to limit climate change effects; DCCO colonies are drying up in South of AMB. This limits the overall western population size.

MB-71 Tacking onto MB-70, Work to limit climate change effects across typically arid portions of flyway, where some colonies are encountering effects of drought.

MB-72 Conduct semi-weekly aerial surveys of the Columbia River estuary when cormorants are being managed on the bridge to detect where and how many cormorants are nesting elsewhere in the estuary.

MB-73 Trap and relocate birds

MB-74 Remove chicks from nests

MB-74 Create banding program of chicks to support population monitoring

Kanban

Create Habitat | 11

CH-1 Create suitable habitat on the bridge https://mtc.ca.gov/news/cormorants-flock-nesting-platforms-new-east-span

CH-2 Restore cormorant colony on East Sand Island using habitat enhancement and social attraction.

CH-3 create nesting habitat on north and south jetties

CH-4 Create alternative nesting habitat for DCCOs outside the Columbia River estuary.

CH-6 Deploy resident colony monitors on East Sand Island to identify and manage factors limiting colony restoration.

CH-7 Consider annual resident colony monitors as a long-term measure

CH-8 Increase the quality of ESI nesting habitat in the center of the island where its the widest

CH-9 Haze bald eagles that are depredating cormorants and their nest contents on East Sand Island.

CH-10 Nitros

CH-11 Lethally control those gulls that are nesting within the restored DCCO colony and depredating nest contents

CH-12 Dissuade DCCOs from expanding or establishing new colonies up-river of the A-M Bridge.

Create Habitat | 9

CH-13 Build a pier downstream in the marine area

CH-14 Consider administering East Sand Island as a National Wildlife Refuge. This would not only facilitate restoration of cormorants, but would also facilitate management of a regionally important Caspian tern colony and California brown pelican roosting site.

CH-15 remove all dams in the Columbia River Basin to improve salmon recovery

CH-16 install floating island in the marine portion of the estuary with DCCO nesting habitat

CH-17 Consider how defensible a new colony location would be. ESI currently not very defensible to avian predators; AMB has no bald eagle predation and limited gull predation

CH-18 Create platforms or islands under or near concrete spans of bridge.

CH-19 Conduct census of Western Population of DCCOs to validate estimates of population size based on Flyway Monitoring Strategy. (Identify new colonies and assess change in size of colonies not included in sample that is monitored in Strategy)

CH-20 Identify potential overlooked habitats. Based on Roby et al. there may be options that haven't been viewed as obvious prior to this but that may work well if explored.

CH-21 Service and avian NGO's to fund new habitat purchases in the Pacific Flyway

Create Habitat | 8

CH-22 Restore cormorant colony on East Sand Island so that the 1,600 pairs of Brandt's Cormorants that formerly nested on ESI and now nest on the A-M Bridge have an alternative colony site when DCCOs are dissuaded from nesting on the Bridge.

CH-23 Use dredge spoils to restore East Sand Island

CH-24 Habitat on the bridge https://mtc.ca.gov/news/cormorants-flock-nesting-platforms-new-east-span

Comments: Similar to CH-1

CH-25 create more small islands for additional colonies to diversify nesting opportunities near the bridge to alleviate concerns if one colony fails.

CH-26 increase monitoring of colonies to be more certain if ~5,000 max nests is accurate

CH-27 Place old tires with sticks in the center in the area on East Sand Island where social attraction is used to attract nesting cormorants back to East Sand Island

CH-28 Place a visual barrier (privacy fence) around the 1-acre area on East Sand Island where the cormorant colony is restored. (limits size of restored cormorant colony and allows close colony monitoring without disturbing cormorants)

CH-29 Create a DCCO plan for the Columbia estuary considering all colonies not just those using bridge.

Kanban

Create Habitat | 8

- CH-30 Build a pier downstream in the marine area
- CH-31 Use dredge spoils to restore East Sand Island
- CH-33 Construct nesting cribs at AMB
- CH-34 Construct nesting cribs at E. Sand Island
- CH-35 Construct nesting cribs on jetties
- CH-36 Construct nesting locations on concrete bridge spans
- CH-37 Discourage perching and nesting at pile dikes
- CH-32 Create long-term colonial waterbird nesting habitat in the Salton Sea (building on CH-4)

Obtain Funding | 4

- OF-1 Work with CBC to obtain funding for DCCO management
- OF-2 Obtain funding from USACE
- OF-4 Obtain funding from states of Oregon and Washington
- OF-3 Obtain funding through NW Power & Conservation Council

Kanban

Deter Birds | 8

DB-1 Install a Birdzoff device on the bridge (Bird Springs)

DB-2 Platforms and dogs: https://www.virginiamercury.com/2020/05/21/this-4b-road-project-had-a-bird-problem-dogs-are-helping-fix-it/

DB-3 Experimental deployment of a variety of deterrents at some bridge sections. Examples include proven physical exclusion such as wires/netting, and also unproven techniques such as UV LED lights.

DB-4 Exclusion devices; gridwire, 45 degree metal slope to prevent perching/nesting, netting

DB-5 multiple pilot studies of different exclusion devices (wires, screens, low voltage, streamers) with lethal take

DB-6 Deterrent Lazer lighting under the bridge

Comments: https://www.aphis.usda.gov/wildlife_damage/reports/Wildlife%20Damage%20Management%20Technical%20Series/Cormorants-WDM-Technical-Series.pdf

DB-7 It seems like if there is sound or light that can be used to discourage nesting, that would be a low-cost approach to the deck truss spans that seem to be the most popular nesting location. This is in the middle of the bridge and should not disturb any people.

DB-8 Utilize fisherman for hazing efforts

Deter Birds | 9

DB-9 Build walkways on bridge to create better access for birds hazing

DB-10 Hazing using trained falcons (although could affect Peregrine Falcons if nesting on bridge)

DB-11 Build catwalk beneath the bridge and the full length of the bridge. (Human hazing is the most effective deterrence for nesting cormorants)

DB-12 Focus on passive deterrence techniques that prevent or deter perching or nest building. (Flagging and other wind activated motion deterrence seem ineffective)

DB-13 Establish a contest for best deterrent devices and test prototypes or set up as Design Build contract to get various deterrent type ideas.

DB-14 Install catwalk on bridge sections that allow for it. This would improve worker access for deterrence.

DB-15 retro-fit bridge so it only has sloped surfaces so the DCCO does not have stable perches or nesting spots

DB-16 If cormorants on bridge are managed, a variety of deterrence actions will be needed for alternative colony sites in the freshwater zone to prevent immigration.

DB-17 Install wind driven sound deterrents devices (i.e., like a deer whistle mounted on a car)

Deter Birds | 10

DB-18 Install fans on deck to deter birds from nesting

DB-19 Sequenced blasts from air nozzles to remove nesting material

DB-20 Lifelike decoys or drones appearing as bald eagles

DB-21 Deter: visual, for example, passive (something that is installed) or active (something that requires activity - person, falcon, etc.)

DB-22 Deter: auditory

DB-23 Deter: structural (things that prevent DCCO landing, uneven surfaces that prevent nesting, covering spaces in some way)

DB-24 Install plastic owls on bridge

DB-25 Long term solutions to remove nesting opportunities permanently from the bridge

DB-26 bird exclusion netting was considered but not allowed for the current painting project. Concern if other protected species might be captured. Caltrans to Remove Bird-killing Nets at Highway Project, Vows to Use Safer Methods (biologicaldiversity.org)

DB-27 Integrate a variety of different dissuasion strategies on the bridge (and other non-desired colony sites) at the same time as implementing social attraction to desired locations

Kanban

Deter Birds | 12

DB-28 exclude/ restrict access to all nesting, roosting locations on the bridge, bridge supports and nearby locations.

DB-29 Establish frequent human activity in and around nesting locations on bridge to deter birds

DB-30 Build outer track on bridge to trolley deturrents

DB-31 High pressure water cannon from barge

DB-32 VRAD Vortex ring Avian Deterrent https://www.youtube.com/watch?v=IyAyd4WnvhU

DB-33 RC propane powered an noise cannon systems

DB-34 Is there a drone option for hazing?

DB-35 How much "dissuasion" would be required on upstream assets, or on surrounding forests, to get the birds to move downstream?

DB-36 Are there any innovative methods of "dissuasion" that would avoid putting netting, bird spikes, etc. on the bridge?

DB-37 Pinwheel station devices

DB-38 Focus on active dissuasion approaches because those have been shown to be more effective.

DB-39 Create public walkway/bikeway under the bridge. Public use could deter DCCO.

Deter Birds | 8

DB-40 Water Sprays or Misting: Using motion-activated sprinklers or misting devices that spray water when cormorants approach can startle them and discourage them from landing or nesting in the area. The unpredictability of the water sprays adds to their deterrent effect.

DB-41 Visual Motion: Devices that mimic the motion of predators, such as spinning or flapping mechanisms, can create the illusion of an active threat and discourage cormorants from settling.

DB-42 Inaudible sound frequency that the birds don't like

DB-43 Temporary work deck used by painting contractor and WS for hazing in 2022-2023

DB-44 Install wire/fladry grids over crib areas (wooden structures protecting piers). These areas support some of the highest cormorant densities on bridge.

DB-45 Install pilot project for innovative deterrent measures

DB-46 Pilot project w bird springs, Dadi-long legs, and 45 degree angle retrofits on different sections.

DB-47 Experimentally deploy UV LED lights

Kanban

Protect Structure | 12

PS-1 Phased cleaning and washing, depending on inspection cycle

PS-2 Stewardship is a big issue. Oregon does not have the funding to maintain the bridges we have. If we spend an excessive amount of funding on one bridge, there will be other bridges that have needs that will not be addressed.

PS-3 Reengineer to exclude DCCO from perching and nesting.

PS-4 Create safe access to crib sections on north and south shipping channel piers for hazing, egg removal

PS-5 Freshwater spray system to keep bridge clean.....

PS-6 Only deter cormorants from metal portions of bridge and areas that require worker access.

PS-7 Install bridge stress monitoring sensors

PS-8 Replace spans birds are nesting on

PS-9 Gain access to more snooper trucks for access and maintenance

PS-10 Construct maintenance bridge adjacent to existing span

PS-11 Self cleaning bridge

PS-12 Run more current through bridge cathodic protection system

Protect Structure | 11

PS-13 Build a tunnel for traffic under the bay, get rid of bridge.

PS-14 wrap deck truss spans in chain link fencing

PS-15 Use water from river for high pressure washing, followed by smaller amount of trucked in water to rinse

PS-16 Create trolley system on outside of bridge for safer access and more effective bird mitigation.

PS-17 Do nothing beyond current practice - continue to maintain bridge more frequently

PS-18 Increase cleaning/ painting cycle period

PS-19 Apply tanglefoot (sticky coating) to keep birds off freshly cleaned structure

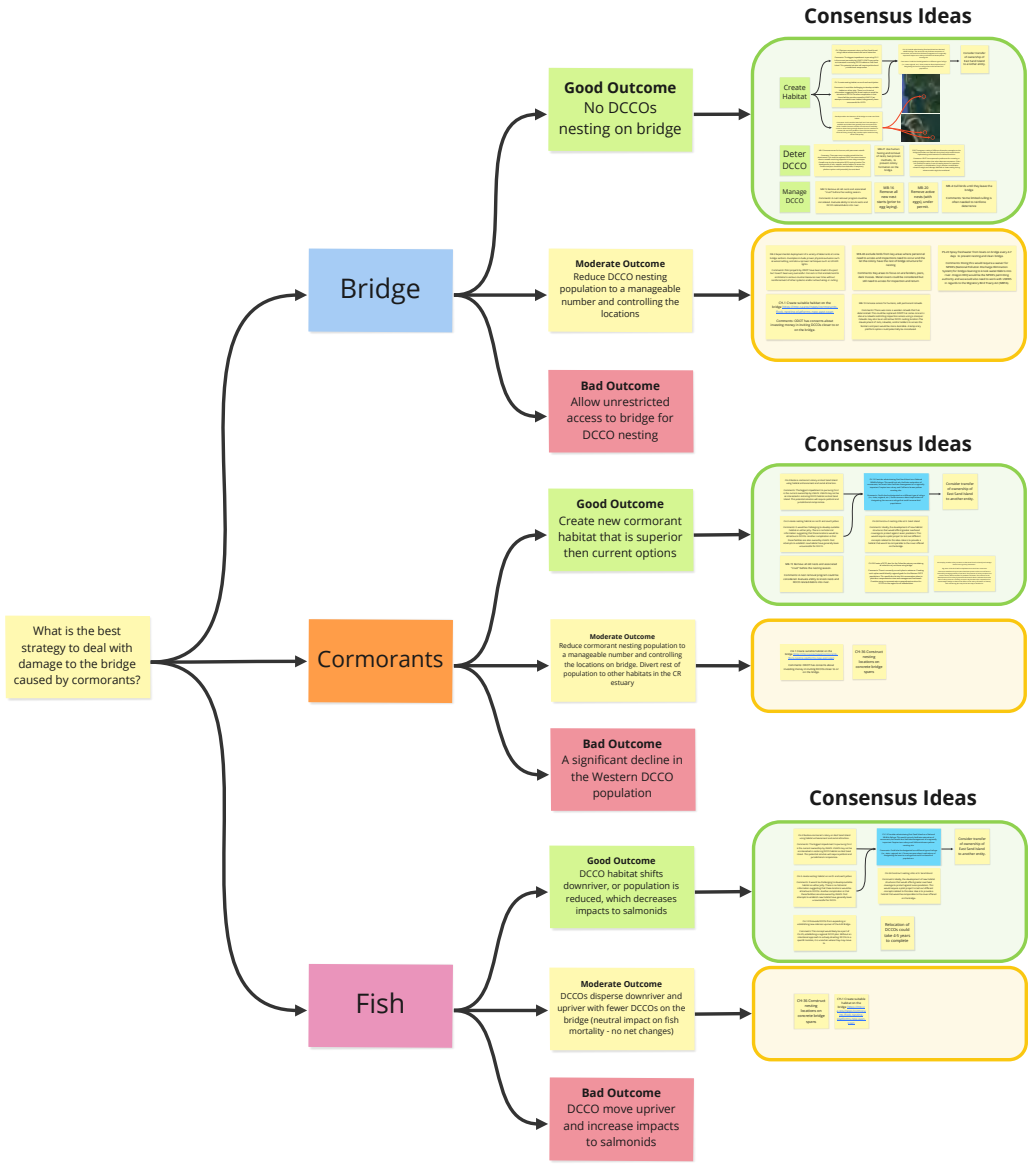
PS-20 Spray freshwater from boats on bridge every 4-7 days to prevent nesting and clean bridge

PS-21 Install visual monitoring system to survey bird behavior and nesting in conjunction with other measures

PS-22 Consider a duplex coating

PS-23 Install sloped sheet metal over fenders to prevent nesting

Idea Evaluation - Summary of Consensus Ideas



Idea Evaluation - Individual VE Team Evaluation of Ideas

Ideas selected to Support Positive Outcomes for the Bridge

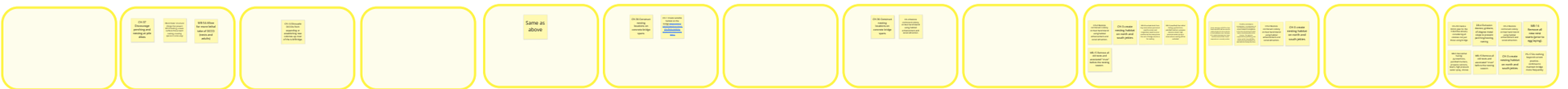
Good Outcomes

Moderate Outcomes

Ideas selected to Support Positive Outcomes for the Cormorants

Good Outcomes

Moderate Outcomes



Ideas selected to Support Positive Outcomes for Listed Salmonids

Good Outcomes

Moderate Outcomes

EVALUATION OF HABITAT OPTIONS

The VE team performed a more detailed evaluation of four potential habitat locations for relocating the DCCOs within the region. The four habitats considered by the team included:

- East Sand Island
- Trestle Bay
- Columbia River Jetties
- Snag Island (Willapa Bay)

These locations are discussed further in the *VE Alternatives* section of this report and are referenced in the diagram below.

Locations Relevant to Potential Alternatives.

The VE team estimated that reestablishing a DCCO colony back at East Sand Island would be the least expensive option. Perhaps more importantly, this option was considered vastly superior to the alternatives in terms of the likelihood of achieving a successful outcome. It would primarily involve employing social attraction strategies to "pull" the DCCOs off the Astoria-Megler Bridge at a cost of approximately $500,000. The other three potential habitats are currently unable to support DCCO habitat and would require significant work to create suitable habitat. The VE team assumed that approximately 1 acre of habitat would be needed to support the current DCCO colony on the Astoria-Megler Bridge. Based on a recent US Army Corps of Engineers (USACE) project that constructed new habitat to support colonial birds in Chesapeake Bay, the VE team assumed a cost of approximately $3 million to construct a "bird island" from suitable fill materials (including sand, rock, and gravel) in these locations. In addition to this cost, social attractions strategies would need to be employed. The VE team therefore assumed the following costs:

- East Sand Island = $500,000 for social attraction
- Trestle Bay, Columbia River Jetties, and Snag Island (Willapa Bay) = $3,500,000 for social attraction and construction of 1 acre of new habitat.

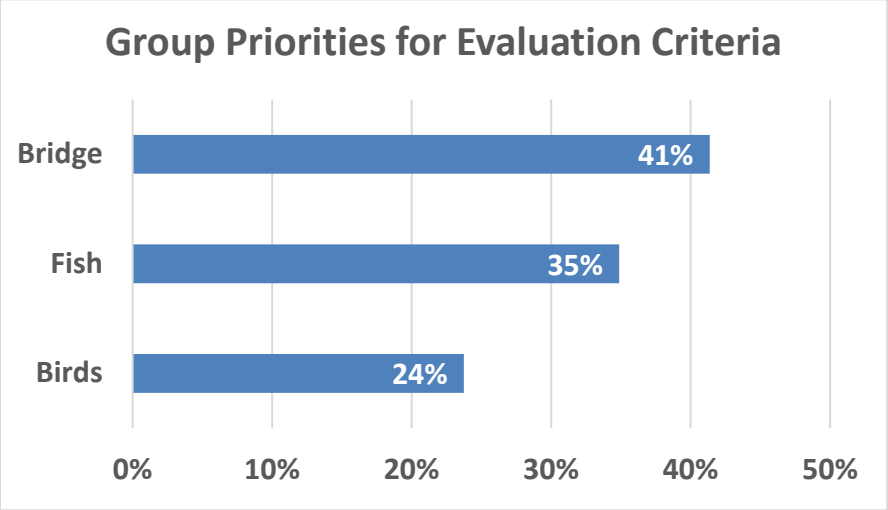
These ratings were a starting point for the refinement process, and as such, should not be taken out of that context. A decision-support software application called OptionLab® was used to synthesize the individual judgments of the VE team members representing different organizations, types of expertise, and areas of interest. The process began by having the participants first evaluate the importance of the following criteria:

- Bridge: Outcomes related to the Astoria-Megler Bridge and the traveling public.
- Birds: Outcomes related to DCCOs (and other cormorants).
- Fish: Outcomes related to listed salmonids.

It was recognized by the participants that a good outcome for one criterion may not necessarily support a good outcome for the others. Participants were asked to prioritize these three criteria based on achieving the following goal for this effort:

"What is the best strategy to deal with damage to the bridge caused by cormorants?"

Using the software, the participants individually rated these criteria. The combined result for the group is illustrated on the chart below.



In summary, the participants generally acknowledged that the impacts caused by DCCOs to the Astoria-Megler Bridge affecting public safety were a priority. Closely following this were concerns for listed juvenile salmonids that also recognized the recent increase in predation attributed to the DCCO colony inhabiting the Astoria-Megler Bridge. Lastly, but still important, were concerns related to the well-being of the DCCOs themselves.

The relative priorities identified above were then used to weight the goodness of the outcomes relative to birds, fish, and the bridge using a 1 to 10 scale, with 10 being optimal. Each location was evaluated both in terms of the goodness of outcomes and the likelihood (probability) of achieving them. These values were then synthesized to create an aggregate score.

The participants shared their unique perspectives regarding the importance of these criteria. The following information provides individual priorities along with additional comments supporting them.

Paul Benton – ODOT

	Local Priority	
Criterion	**Paul Benton**	**Group Avg.**
Birds	20%	24%
Bridge	59%	41%
Fish	20%	35%

Angie Haffie – WSDOT

	Local Priority	
Criterion	**Angie Haffie**	**Group Avg.**
Birds	16%	24%
Bridge	63%	41%
Fish	21%	35%

Subjective Criteria Prioritization Rationale:
As a representative for WSDOT, who co-owns the bridge, our responsibility to the public is providing a safe, reliable, multimodal transportation system and being a responsible steward of taxpayer funds; so, we rank a positive outcome for the bridge as highest criteria. Safety of public and staff is highest. Sustainable fish and bird populations are important; however, we rank fish slightly higher due to the economic ties to viable fish populations.

Dalton Fry – Cowlitz Tribe

	Local Priority	
Criterion	**Dalton Fry**	**Group Avg.**
Birds	23%	24%
Bridge	23%	41%
Fish	54%	35%

James Lawonn – ODFW

	Local Priority	
Criterion	**James Lawonn**	**Group Avg.**
Birds	33%	24%
Bridge	33%	41%
Fish	33%	35%

Subjective Criteria Prioritization Rationale:
These three criteria cannot be viewed in isolation. There are no credible solutions for the bridge issue that will not ultimately be constrained by the tenacity with which birds may continue to try to nest there. As go the birds, go the fish.

Steve Osmek – Animal Solutions

	Local Priority	
Criterion	**Steve Osmek**	**Group Avg.**
Birds	19%	24%
Bridge	33%	41%
Fish	48%	35%

Subjective Criteria Prioritization Rationale:
Declining anadromous fish stocks have far reaching environmental, social, and economic impacts relative to the Astoria-Megler Bridge maintenance issue, and DCCO given this west coast population is most likely stable and perhaps growing.

Rod Thompson – ODOT

	Local Priority	
Criterion	**Rod Thompson**	**Group Avg.**
Birds	33%	24%
Bridge	52%	41%
Fish	15%	35%

Blaine Parker – CRITC

	Local Priority	
Criterion	**Blaine Parker**	**Group Avg.**
Birds	12%	24%
Bridge	50%	41%
Fish	37%	35%

Subjective Criteria Prioritization Rationale:
As a fish biologist for the Columbia River Inter-Tribal Fish Commission, I have been part of this issue since the 1990s. Fish have always been second in priority versus the birds that prey on them. The fish cannot go anywhere but birds can. The birds live in several different states and habitats; so, there is an inherent flexibility for bird populations. The bridge is a key element to the region and needs to be maintained for the region to remain viable for human health/safety, and for environmental and economic concerns.

Michelle McDowell – USFWS

	Local Priority	
Criterion	**Michelle McDowell**	**Group Avg.**
Birds	33%	24%
Bridge	33%	41%
Fish	33%	35%

Subjective Criteria Prioritization Rationale:
All are of most importance:

1. Bridge: Human health and safety
2. Birds: Protected by MBTA; we need to ensure conservation of the species involved
3. Fish: ESA-listed

For me, it is a level playing field. All legal mandates need to be met. There should be a solution that will advance all.

Dan Roby – OSU

	Local Priority	
Criterion	**Dan Roby**	**Group Avg.**
Birds	24%	24%
Bridge	42%	41%
Fish	34%	35%

Subjective Criteria Prioritization Rationale:
The VE study is set up to address the issue of a large and destructive cormorant colony on the bridge; so, the highest priority is the bridge. Fish are an important consideration regarding how to resolve the bridge issue, because ESA-listed stocks are affected. The birds, while important, are not endangered; but the western population of DCCOs is in decline, so a management approach that does not cause further population decline is highly preferable.

Christina Donehower – Cowlitz Tribe

	Local Priority	
Criterion	**Christina Donehower**	**Group Avg.**
Birds	29%	24%
Bridge	24%	41%
Fish	47%	35%

Subjective Criteria Prioritization Rationale:
Prioritized fish above other categories due to the cultural significance of fish and concern for impacts to ESA-listed salmonids

Jennifer Urmston – USFWS

	Local Priority	
Criterion	**Jennifer Urmston**	**Group Avg.**
Birds	36%	24%
Bridge	29%	41%
Fish	36%	35%

Subjective Criteria Prioritization Rationale:
I think it is most important to protect the fish and the birds, but the bridge is also very important. Since the salmonids are listed species, it is very important that we do not make any decisions that would have negative consequences for them. Likewise, cormorants are federally protected and can be vulnerable to steep declines in the face of anthropogenic change. The bridge is still very important, but I think we can be more flexible with the approaches we take. We have less control over how the birds will respond, so that is why I am placing more emphasis on the birds and fish.

Ray Bottenberg – ODOT

	Local Priority	
Criterion	**Ray Bottenberg**	**Group Avg.**
Birds	17%	24%
Bridge	49%	41%
Fish	34%	35%

Dan McFadden – ODOT

Criterion	Local Priority: Dan McFadden	Group Avg.
Birds	0%	24%
Bridge	57%	41%
Fish	43%	35%

Subjective Criteria Prioritization Rationale:
Bridge: My crew and I maintain the bridge that we have seen be destroyed by the birds, and I know what it means to our community.
Fish: I also know what the fish mean to our community financially.
Birds: Birds are of less concern.

Matt Alex – USDA/APHIS

Criterion	Local Priority: Matt Alex	Group Avg.
Birds	26%	24%
Bridge	39%	41%
Fish	35%	35%

Subjective Criteria Prioritization Rationale:
Bridge: Most important due to the potential impacts to human safety.
Fish: Includes T/E fish runs.
Birds: Not currently at risk of population collapse.

After the participants discussed the rationale for prioritizing the criteria, the next step was rating the relative "goodness" of ideas ranging from good, moderate, to bad outcomes for each of the four habitat options related to the three criteria. Provided below is a description of these outcomes related to the bridge, birds, and fish.

Bridge:

- Good: No DCCOs nesting on bridge.
- Moderate: Reduce DCCO nesting population to a manageable number on the bridge and controlling the locations.
- Bad: Allow unrestricted access to bridge for DCCO nesting.

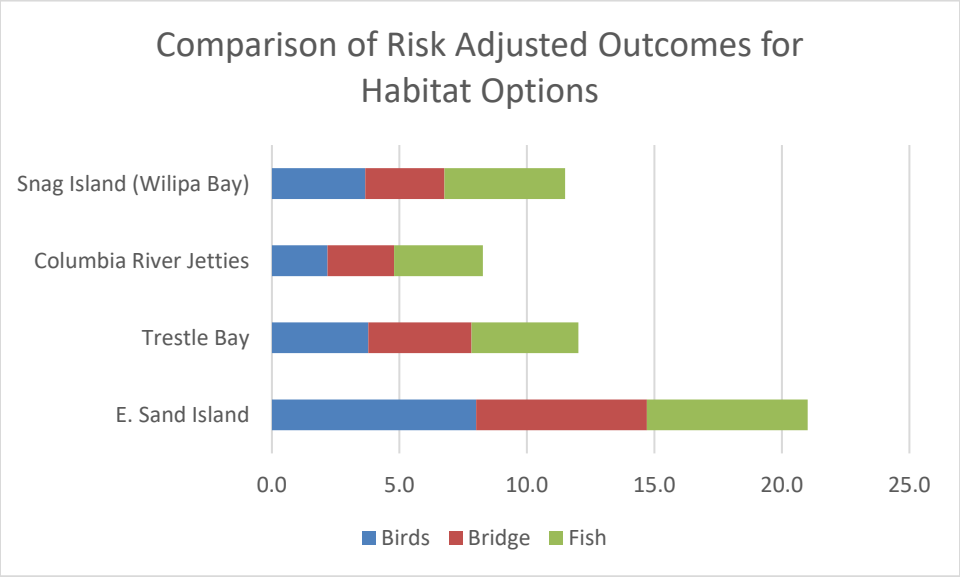
Birds:

- Good: Create new cormorant habitat that is superior then current options.
- Moderate: Reduce cormorant nesting population to a manageable number and controlling the locations on bridge. Divert rest of population to other habitats in the CR estuary.
- Bad: A significant decline in the Western DCCO population.

Fish:

- Good: DCCO habitat shifts downriver, or population is reduced, which decreases impacts to salmonids.
- Moderate: DCCOs disperse downriver and upriver with fewer DCCOs on the bridge (neutral impact on fish mortality, no net changes).
- Bad: DCCO move upriver and increase impacts to salmonids.

Each participant individually rated how "good" they felt each of the stated outcomes above were relative to the four habitat options. Once this activity was performed, participants were asked to identify the relative probabilities of the outcomes occurring for each of the four options. The chart below summarizes the group's aggregated ratings for the risk adjusted outcomes of the four habitat options.



In general, the East Sand Island habitat is significantly better from the standpoint of all three criteria as summarized below:

- **Bridge**: East Sand Island is relatively close to the Astoria-Megler Bridge. "Pushing" DCCOs off the bridge while "pulling" them to nearby East Sand Island is likely to result in the successful relocation of the existing DCCO colony.
- **Birds:** DCCOs previously maintained a thriving colony on East Sand Island. Research indicates that habitats that have been favored in the past by DCCOs are more likely to be attractive to them in the future.
- **Fish**: DCCO predation studies within the Columbia River Estuary suggest that the DCCO colony on the Astoria-Megler Bridge is consuming greater quantities of listed juvenile salmonids than when the colony was located at East Sand Island. Therefore, it is highly probable that moving the DCCO colony downriver will improve juvenile salmonid survival rates.

The participants shared their individual judgments related to how they rated the goodness of outcomes and their related probabilities. The following information summarizes their individual perspectives.

Christina Donehower's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Christina Donehower's Notes	Christina Donehower's Rating	Group Avg. Rating	Christina Donehower's Rating	Group Avg. Rating	Christina Donehower's Rating	Group Avg. Rating	Christina Donehower's Rating	Group Avg. Rating
Birds	Considered ESI best habitat given historical DCCO use.	7.8	8.0	3.5	3.8	1.8	2.2	4.1	3.7
Bridge			6.7		4.1		2.6		3.1
Fish	Want birds to move to more marine sites to reduce predation pressure.	7.1	6.3	4.0	4.2	3.1	3.5	4.4	4.7

Dan Roby's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Dan Roby's Notes	Dan Roby's Rating	Group Avg. Rating	Dan Roby's Rating	Group Avg. Rating	Dan Roby's Rating	Group Avg. Rating	Dan Roby's Rating	Group Avg. Rating
Birds	East Sand Island is known to have the attributes required to support a large productive colony. That is not true for any of the other three sites.	8.2	8.0	3.3	3.8	6.3	2.2	3.2	3.7
Bridge	I am not a bridge expert, but I think that East Sand Island is by far the best strategy for the bridge because it could be accomplished quickly with high likelihood of success.		6.7		4.1		2.6		3.1
Fish	The East Sand Island option would perform by far the best because it is where a large cormorant colony has previously been.	8.2	6.3	4.1	4.2	4.2	3.5	4.8	4.7

Michelle McDowell's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Michelle McDowell's Notes	Michelle McDowell's Rating	Group Avg. Rating	Michelle McDowell's Rating	Group Avg. Rating	Michelle McDowell's Rating	Group Avg. Rating	Michelle McDowell's Rating	Group Avg. Rating
Birds	Good: ESI is a great site. It has habitat for 5,000 pairs. It is in the marine environment and proven to be a great site. Bad: If Trestle, Jetty, or Snag goes bad for the western population, then I am thinking this will tie into outside forces, poor marine forage fish, environmental effects in other parts of the population, etc. East Sand Island has enough habitat and history. With resources, I will be optimistic that something that can be done.	8.9	8.0	3.1	3.8	1.8	2.2	3.0	3.7
Bridge			6.7		4.1		2.6		3.1
Fish			6.3		4.2		3.5		4.7

James Lawonn's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	James Lawonn's Notes	James Lawonn's Rating	Group Avg. Rating	James Lawonn's Rating	Group Avg. Rating	James Lawonn's Rating	Group Avg. Rating	James Lawonn's Rating	Group Avg. Rating
Birds	There are major side benefits to other bird species for habitat enhancement and management at ESI and Snag Island compared to the other two colony sites. Both ESI and Snag Island (I believe) are historical Caspian tern nesting sites. East Sand Island is also a major brown pelican roost site and previously supported a major Brandt's cormorant colony. So, for a given amount of spending, much more value can be derived for the East Sand Island and Snag Island options.	7.9	8.0	2.4	3.8	1.5	2.2	3.6	3.7
Bridge			6.7		4.1		2.6		3.1
Fish	Creation of habitat on East Sand Island is the best option under all scenarios.	9.5	6.3	4.0	4.2	3.5	3.5	3.0	4.7

Jennifer Urmston's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Jennifer Urmston's Notes	Jennifer Urmston's Rating	Group Avg. Rating	Jennifer Urmston's Rating	Group Avg. Rating	Jennifer Urmston's Rating	Group Avg. Rating	Jennifer Urmston's Rating	Group Avg. Rating
Birds	I think East Sand Island is the best choice. The others are kind of gambles in my opinion.	7.3	8.0		3.8	1.6	2.2	3.4	3.7
Bridge			6.7		4.1		2.6		3.1
Fish			6.3		4.2		3.5		4.7

Rod Thompson's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Rod Thompson's Notes	Rod Thompson's Rating	Group Avg. Rating	Rod Thompson's Rating	Group Avg. Rating	Rod Thompson's Rating	Group Avg. Rating	Rod Thompson's Rating	Group Avg. Rating
Birds		8.5	8.0	5.1	3.8	3.4	2.2	4.8	3.7
Bridge			6.7		4.1		2.6		3.1
Fish		4.4	6.3	3.6	4.2	2.4	3.5	4.4	4.7

Ray Bottenberg's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Ray Bottenberg's Notes	Ray Bottenberg's Rating	Group Avg. Rating	Ray Bottenberg's Rating	Group Avg. Rating	Ray Bottenberg's Rating	Group Avg. Rating	Ray Bottenberg's Rating	Group Avg. Rating
Birds			8.0		3.8		2.2		3.7
Bridge	Better prospects on East Sand Island than the other sites.	8.1	6.7	3.2	4.1	2.1	2.6	3.0	3.1
Fish			6.3		4.2		3.5		4.7

Matt Alex's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Matt Alex's Notes	Matt Alex's Rating	Group Avg. Rating	Matt Alex's Rating	Group Avg. Rating	Matt Alex's Rating	Group Avg. Rating	Matt Alex's Rating	Group Avg. Rating
Birds	Fewer variables on ESI versus other locations other than land ownership and eagle issues.	7.8	8.0	3.7	3.8	1.8	2.2	4.3	3.7
Bridge			6.7		4.1		2.6		3.1
Fish			6.3		4.2		3.5		4.7

Dalton Fry's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Dalton Fry's Notes	Dalton Fry's Rating	Group Avg. Rating	Dalton Fry's Rating	Group Avg. Rating	Dalton Fry's Rating	Group Avg. Rating	Dalton Fry's Rating	Group Avg. Rating
Birds		8.1	8.0	3.5	3.8	1.7	2.2	4.3	3.7
Bridge			6.7		4.1		2.6		3.1
Fish		4.9	6.3	4.4	4.2	2.4	3.5	5.2	4.7

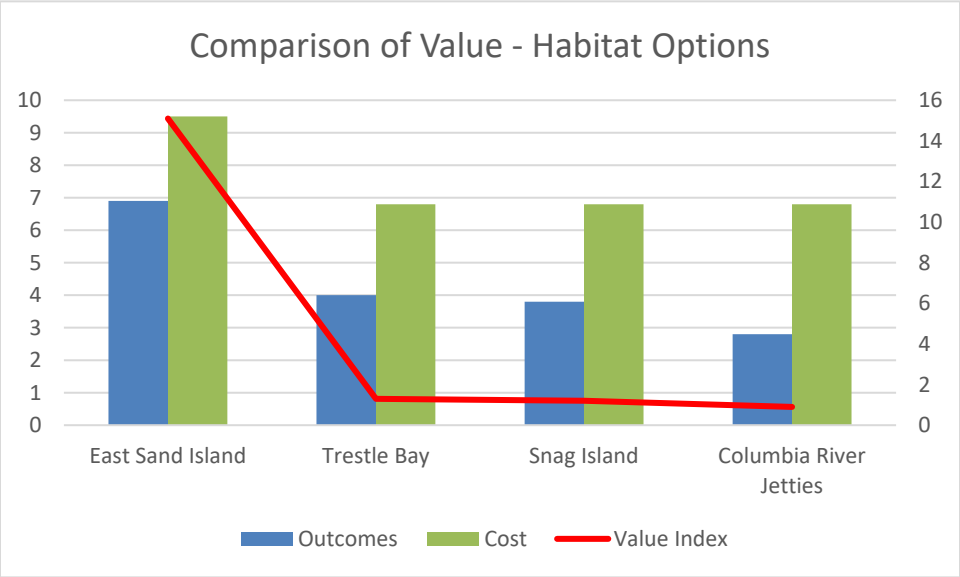
Blaine Parker's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Blaine Parker's Notes	Blaine Parker's Rating	Group Avg. Rating	Blaine Parker's Rating	Group Avg. Rating	Blaine Parker's Rating	Group Avg. Rating	Blaine Parker's Rating	Group Avg. Rating
Birds		8.1	8.0	4.5	3.8	2.2	2.2	4.3	3.7
Bridge			6.7		4.1		2.6		3.1
Fish		2.7	6.3	4.2	4.2	6.9	3.5	9.4	4.7

Angie Haffie's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Angie Haffie's Notes	Angie Haffie's Rating	Group Avg. Rating	Angie Haffie's Rating	Group Avg. Rating	Angie Haffie's Rating	Group Avg. Rating	Angie Haffie's Rating	Group Avg. Rating
Birds	East Sand Island seems to be best option for known history of use. I wonder about potential use at the Willapa site.	8.3	8.0	4.7	3.8	2.1	2.2	3.7	3.7
Bridge			6.7		4.1		2.6		3.1
Fish	Same as for bird section. I think East Sand Island is the location that would have the best outcome due to history of use and fewer birds upstream as predators of the fish.	8.1	6.3	3.6	4.2	2.8	3.5	3.3	4.7

Paul Benton's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Paul Benton's Notes	Paul Benton's Rating	Group Avg. Rating	Paul Benton's Rating	Group Avg. Rating	Paul Benton's Rating	Group Avg. Rating	Paul Benton's Rating	Group Avg. Rating
Birds	ESI is a known quantity.	7.4	8.0	3.3	3.8	1.2	2.2	2.3	3.7
Bridge			6.7		4.1		2.6		3.1
Fish			6.3		4.2		3.5		4.7

Dan McFadden's Ratings		E. Sand Island		Trestle Bay		CR Jetty		Snag Island	
Criterion	Dan McFadden's Notes	Dan McFadden's Rating	Group Avg. Rating	Dan McFadden's Rating	Group Avg. Rating	Dan McFadden's Rating	Group Avg. Rating	Dan McFadden's Rating	Group Avg. Rating
Birds			8.0		3.8		2.2		3.7
Bridge			6.7		4.1		2.6		3.1
Fish			6.3		4.2		3.5		4.7

The relative costs of the four habitat options, as enumerated previously, were then factored into VE team members' evaluations to develop a cost-benefit type analysis. The summary of these outcomes is provided in the chart below.



When the cost of implementing the habitat options is considered, the value of East Sand Island increases exponentially. East Sand Island dominates the other habitat options, as it is most likely to have the best outcome for the bridge, birds, and fish relative to the cost to implement. Based on this analysis, the VE team unanimously agreed to recommend East Sand Island as the best option for moving the DCCO colony that is currently located on the Astoria-Megler Bridge.

VE PROCESS

VE PROCESS

A systematic approach is used in the VE study. The information in this section details the steps of the Value Methodology Job Plan, VE Study Agenda, and participants.

VE STUDY

The Value Methodology (VM) Job Plan is followed to guide the teams in the consideration of project functionality and performance, potential schedule issues, high-cost areas, and risk factors in the design. These considerations are taken into account in developing alternative solutions for the optimization of project value. The Job Plan phases are:

- Preparation Phase
- Information Phase
- Function Analysis Phase
- Creativity Phase
- Evaluation Phase
- Development Phase
- Presentation Phase
- Implementation Phase

The VE study was conducted in a virtual environment using Webex and Miro. Webex is a virtual meeting platform that supports audiovisual communications. Miro is a collaborative whiteboard platform that supports a variety of activities. This platform was used extensively to allow participants to share information visually. It was used explicitly to support the Information, Function Analysis, Creativity, and Evaluation Phases of the VM Process.

1. **Preparation Phase:** The purpose of the Preparation Phase is to identify the value study objectives, participants, dates, and information needed to support the effort. It also includes the initial review of the project information by the Value Team prior to the commencement of the workshop.

2. **Information Phase:** The Information Phase is concerned with developing a better understanding of the project information and transforming that information in different ways to develop meaningful insight relative to opportunities for value improvement.

3. **Function Analysis Phase:** The Value Team analyzed the functions of the project in order to identify those areas that offered the greatest opportunity for value improvement. In VM, a function is articulated using a verb and a noun. These two-word function statements describe what the project elements do and why they do them. The Value Team leverages these function statements later in the Creativity Phase in order to generate other ways of achieving the same functions differently.

4. **Creativity Phase:** The purpose of the Creativity Phase is to generate as many ideas as possible relative to the functions selection at the end of the Function Analysis Phase. The Value Team focused on brainstorming four individual functions. Approximately 187 ideas were generated during the Creativity Phase.

5. **Evaluation Phase:** The Evaluation Phase is focused on judging the ideas generated during the Creativity Phase and identifying the best ideas for potential development. The Evaluation Phase was conducted through team discussion. The compiled list of ideas developed during the Creativity Phase were reviewed as a group and further discussed. Additional comments were captured and decisions made concerning the final list of ideas that the Value Team would carry forward into the Development Phase. Individual ideas were then assigned to the Value Team members.

6. **Development Phase:** During the development phase, each highly rated idea was expanded into a workable solution referred to as a value alternative. Each value alternative includes a description of the baseline and proposed concepts, advantages and disadvantages, a narrative discussing the technical considerations and baseline case, sketches, and cost estimates. The developed alternatives are summarized in the main body of the report following the *Executive Summary*.

7. **Presentation Phase:** A formal presentation as described above was performed on the final day of the study to the various interested parties. This presentation was intended as an informational review of the value study results and recommendations and not a decision meeting.

8. **Implementation Phase**: A *Draft VE Study Report* is prepared after the completion of the workshop. This report summarizes the activities and results of the VE study. Once this report has been reviewed by the VE Team, a *Final VE Study Report* will be issued for review and action by the interested parties.

VE STUDY MEETING ATTENDEES

7/26	7/27	7/28	7/29	Name	Position/Role	Organization	E-mail
X		X	X	Allison Anholt	Portland Audubon	Portland Audubon Society	aanholt@audubonportland.org
X	X	X	X	Angie Haffie	SW Region Env. Services Manager	WSDOT	haffiea@wsdot.wa.gov
X		X	X	Ben Haines		FHWA	benjamin.haines@dot.gov
X		X	X	Bernadette Graham-Hudson		ODF&W	
X			X	Bert Hartman	Bridge	ODOT	bert.h.hartman@odot.oregon.gov
		X		Bill Jablonski		ODOT	william.r.jablonskiI@odot.oregon.gov
X	X	X	X	Blaine Parker	Avian Predation Coordinator	Columbia River Intertribal Council	parb@critfc.org
X		X	X	Bob Sallinger		Humane Society	bob@willametteriverkeeper.org
X		X	X	Brandon Rogers		Yakama Fisheries	rogb@yakamafish-nsn.gov
		X		Chris Magel		NOAA	chris.magel@noaa.gov
X	X	X	X	Christina Donehower	Policy Analyst	Cowlitz Tribe	cdonehower@cowlitz.org
X	X	X	X	Dalton Fry	Director of Resources	Cowlitz Tribe	dfry@cowlitz.org
X	X	X	X	Dan McFadden	Bridge Maintenance Manager	ODOT	dan.e.mcfadden@odot.oregon.gov
X	X	X	X	Dan Roby	Professor (retired)	OSU	daniel.roby@oregonstate.edu
X		X	X	Donnell Fowler	Program Dev Office	ODOT	donnell.m.fowle@odot.oregon.gov
X	X	X	X	Grace Hagan	VE Assistant Team Leader	VMS, Inc.	grace.hagan@vms-inc.com
X	X	X	X	James Lawonn	Avian Predation Coordinator	ODFW	matthew.j.lawonn@odfw.oregon.gov
	X	X	X	Jennifer Urmston		USFWS	jennifer_urmston@fws.gov
X		X		Jim McKenna	Special Advisor to the Director	Oregon DEQ	Jim.mckenna@deq.oregon.gov
X		X	X	Joe Buchanan		WDF&W	joseph.buchanan@dfw.wa.gov
X		X	X	Joe Liebezeit		Portland Audubon Society	jliebezeit@audubonportland.org
		X		Joe Wolf		ODOT	Joe.wolf@odot.oregon.gov
		X	X	John Powell		IDF&G	john.powell@idfg.idaho.gov

VE STUDY MEETING ATTENDEES

7/26	7/27	7/28	7/29	Name	Position/Role	Organization	E-mail
X				John Raasch	State Env Manager	ODOT	John.raasch@odot.oregon.gov
X		X	X	Josh Ashline	Predation Lead	Portland Audubon Society	jashline@audubonportland.org
X	X	X	XX	Kate Self		Northwest Power & Conservation Council	kself@nwcouncil.org
X		X	X	Kevin Christensen		USDA - APHIS	kevin.l.christensen@usda.gov
X		X	X	Lynne Krasnow		Oregon Fisheries, NMFS	lynne.krasnow@noaa.gov
		X	X	Marlene Wagner		WDF&W	marlene.wagner@dfw.wa.gov
X	X	X	X	Matt Alex	USDA Wildlife Services	USDA - APHIS	matthew.j.alex@usda.gov
X	X	X	X	Michelle McDowell		USFWS	michelle_mcdowell@fws.gov
	X			Nicholas De-Brouwer		ODOT	nicolas.de-brouwer@odot.oregon.gov
X		X	X	Orren Jennings	Bridge Maintenance Engineer	ODOT	orren.j.jenningd@odot.oregon.gov
X		X	X	Patty O'Toole	F&W Director	NW Power & Conservation Council	potoole@nwcouncil.org
X	X	X	X	Paul Benton	Terrestrial Bio-Program	ODOT	paul.d.benton@odot.oregon.gov
X	X	X	X	Peter Kennedy	VE Program	ODOT	peter.kennedy@odot.oregon.gov
X	X	X	X	Ray Bottenberg	Bridge Section Mgmt.	ODOT	raymond.d.bottenberg@odot.oregon.gov
X		X	X	Rebecca Burrow	Bridge Preservation	ODOT	rebecca.burrow@odot.oregon.gov
X	X	X	X	Rob Stewart	VE Team Leader	VMS, Inc.	rob@vms-inc.com
X	X	X	X	Rod Thompson	State Env. & Natural Resources	ODOT	rodney.thompson@odot.oregon.gov
X			X	Sean Tackley	Fish Policy Team	USACE	sean.c.tackley@usace.army.mil
X	X	X	X	Steve Osmek		Animal Solutions	animalsolutionsllc@gmail.com
X				Tamira Clark	State and Wildlife Manager	ODOT	tamira.j.clar@odot.oregon.gov