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

November 8, 2022

MEMORANDUM

TO: **Council Members**

FROM: **Mark Fritsch**

SUBJECT: **Status of Double-crested Cormorants in the Columbia River Estuary and Implications for Survival of Out-migrating Juvenile Salmon**

BACKGROUND:

Presenter: James Lawonn, Oregon Department of Fish and Wildlife
Tom Skiles, Columbia River Intertribal Fish Commission
Lynne Krasnow, NOAA Fisheries

Summary: James will provide a brief overview of recent changes in abundance and distribution of double-crested cormorants in the Columbia River estuary and discuss implications for survival of salmonids listed under the Endangered Species Act (ESA). The speakers will highlight potential predation impacts at colonies upriver of East Sand Island, including at the Astoria-Megler Bridge. Tom and Lynne will participate to answer questions.

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 Caspian terns on Columbia River salmon and steelhead and calls for adequate funding to implement activities to reduce avian predation on juvenile salmon and steelhead.

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Workplan: Fish and Wildlife Division preliminary work plan 2022; Program Implementation; and Pursue implementation of 2014 Program and 2020 Program Addendum, including Council Program priorities.

Background: 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. 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
- *James M. Lawonn,* Abstract: *"Status of Double-crested Cormorants in the Columbia River Estuary and Implications for Survival of Out-migrating Juvenile Salmonids"* (see Attachment 1)

Attachment 1

Lawonn, M. James[1]

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Status of Double-crested Cormorants in the Columbia River Estuary and Implications for Survival of Out-migrating Juvenile Salmonids

The double-crested cormorant (*Nannopterum auritum*) is a locally common, piscivorous (fish-eating) bird native to the Pacific Northwest whose abundance in the Columbia River estuary has grown substantially since the early 1980s. Although not an original cause of declines in salmon and steelhead (genus *Onchorynchus*; collectively, salmonids) in the Columbian River basin, predation of juvenile fish by double-crested cormorants potentially impedes recovery of basin salmonids listed under the federal Endangered Species Act (ESA). Estuary-wide abundance of double-crested cormorants grew from 131 breeding pairs when the estuary was first surveyed in 1979–1980 to an average 13,337 breeding pairs during 2004–2014, the period of peak double-crested cormorant abundance in the estuary. To address predation on ESA-listed salmonids associated with the expanded local double-crested cormorant population, the U.S. Army Corps of Engineers (Corps) implemented a management plan during 2015–2020 to reduce breeding abundance on East Sand Island, a human-modified island near the mouth of the Columbia River estuary that supported an average 12,982 breeding pairs during 2004–2014, about 97% of all nesting pairs within the estuary. Following the active phase of management under the East Sand Island management plan, abundance of double-crested cormorants nesting on East Sand Island declined to an average 1,694 breeding pairs during 2018–2021, although the average during 2019–2021 was only 258 pairs. Concurrent with management at East Sand Island, the colony located on the Astoria-Megler Bridge, located 12 km upstream of East Sand Island, grew from 333 breeding pairs in 2014, to a peak of 5,081 pairs in 2020, before declining slightly to 4,151 pairs in 2021. The aggregate total at other estuary colony sites grew from 414 pairs to 1,023 pairs during 2014–2021. Overall, the estimated abundance of double-crested cormorants across the Columbia River estuary was 5,599 breeding pairs in 2021, 42% of abundance during 2004–2014. However, along with this decline in abundance, the distribution of double-crested cormorants nesting within the estuary shifted dramatically from the marine zone in the lower estuary to areas farther upriver, where salmonids constitute a much larger proportion of the double-crested cormorant diet. Only about 3% of estuary-wide breeding abundance occurred upriver of the marine zone during 2004–2014, compared to 89% in 2021. Associated with this spatial shift, estuary-wide double-crested cormorant predation potentially increased relative to the pre-management period. In 2021, estimated double-crested cormorant predation on steelhead across the estuary was equivalent to 26,479 pairs on East Sand Island, about 169% of average predation during 2004–2014. Available evidence suggests implementation of the East Sand Island management plan was a pre-eminent causal factor in the redistribution of double-crested cormorants across the estuary, although management also coincided with other stressors that contributed to reduced double-

crested cormorant fidelity to this colony. Management of the Astoria-Megler Bridge and possibly other estuary colony sites will be necessary if managers wish to reduce estuary-wide double-crested cormorant predation to the equivalent of 5,380–5,939 breeding pairs on East Sand Island, a goal suggested in various federal documents related to hydrosystem management.

Status of Double-crested Cormorants in the Columbia River Estuary and Implications for Survival of Outmigrating Juvenile Salmonids

T. Lawes

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Double-crested cormorant (DCCO)

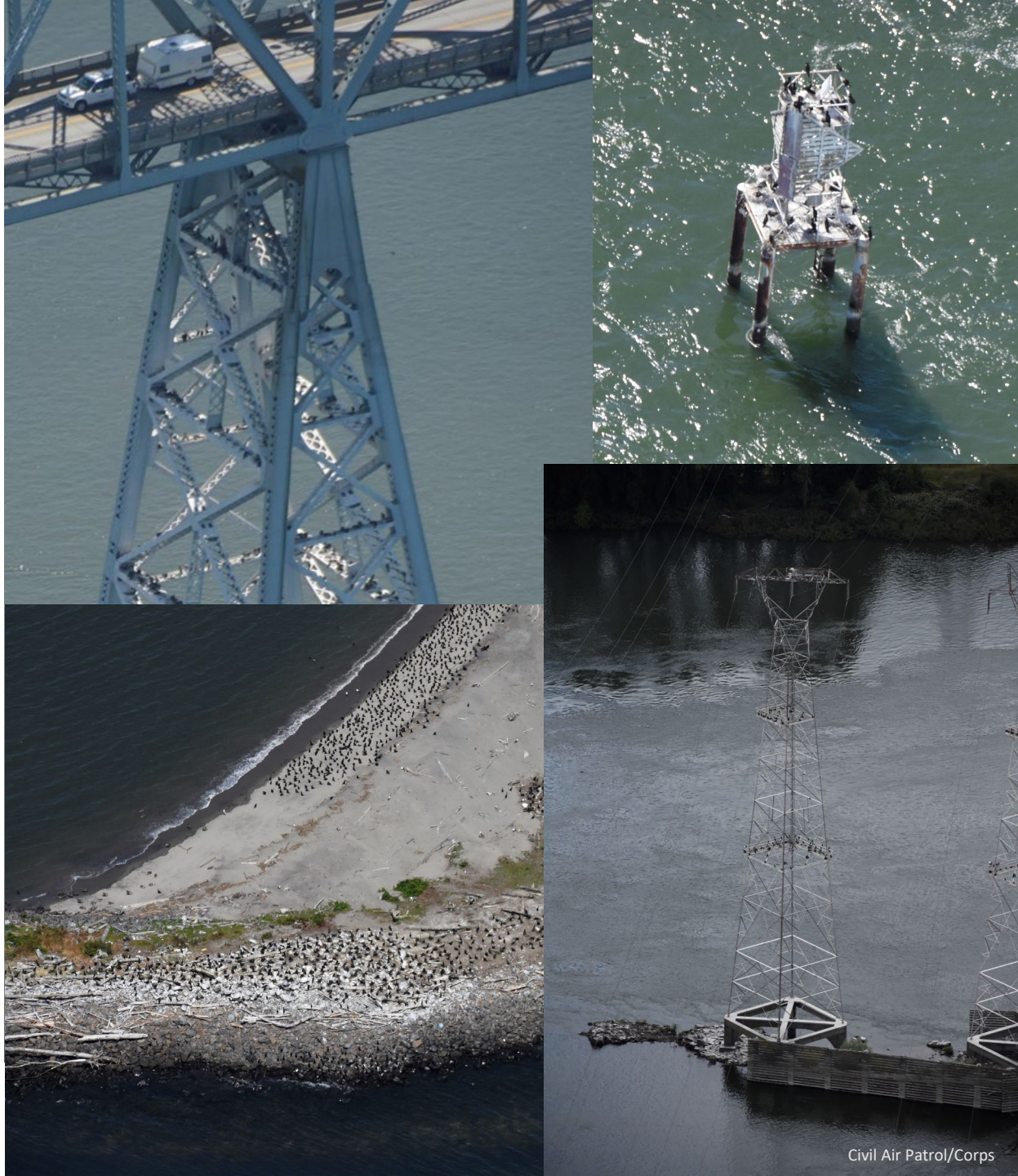
- Native colonial waterbird
- Short-range commuter/high energy demands
- Protected under federal Migratory Bird Treaty Act in 1972
- Most of diet in estuary non-salmonids

Annual predation rates on ESA-listed salmonids, East Sand Island, 2000–2014

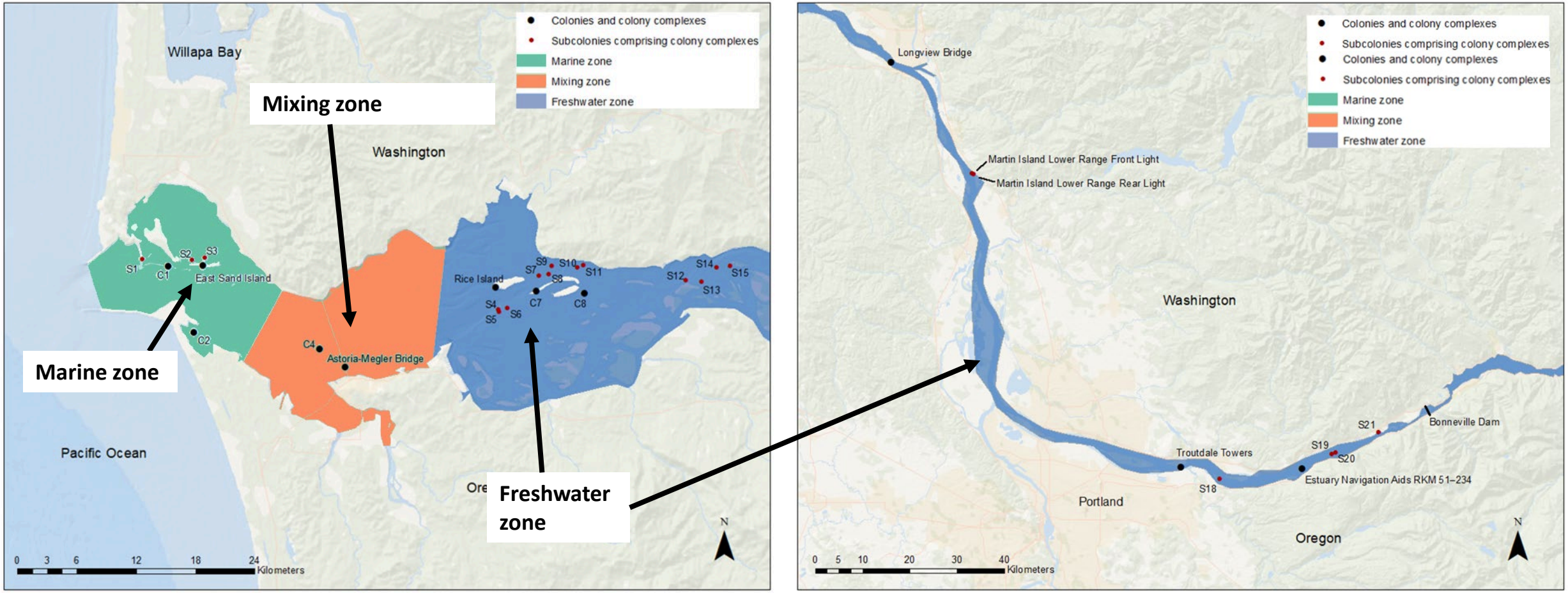
Snake, Upper and Middle Columbia runs	1-17%
Lower Columbia runs	2-51%

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

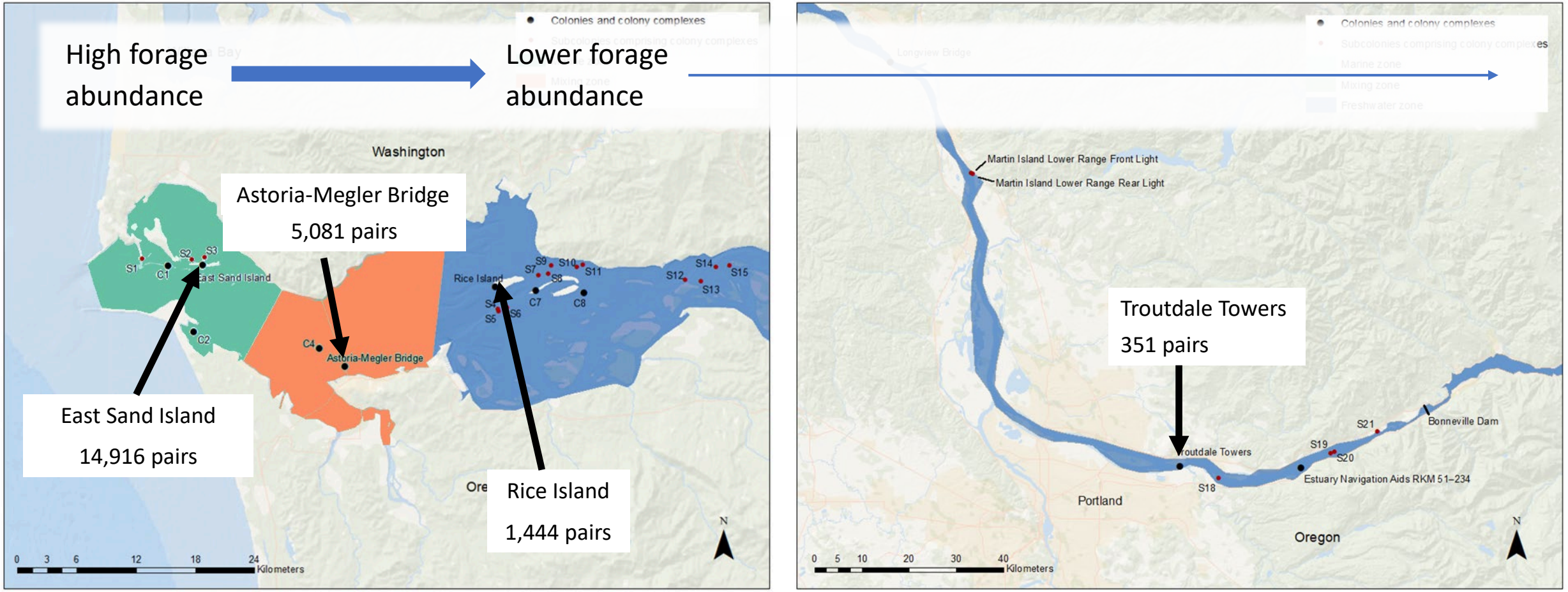
- 11 colonies and colony complexes
- Including subcolonies, 29 breeding sites total



Peak historical abundance highest in marine zone, but most colony sites farther upriver

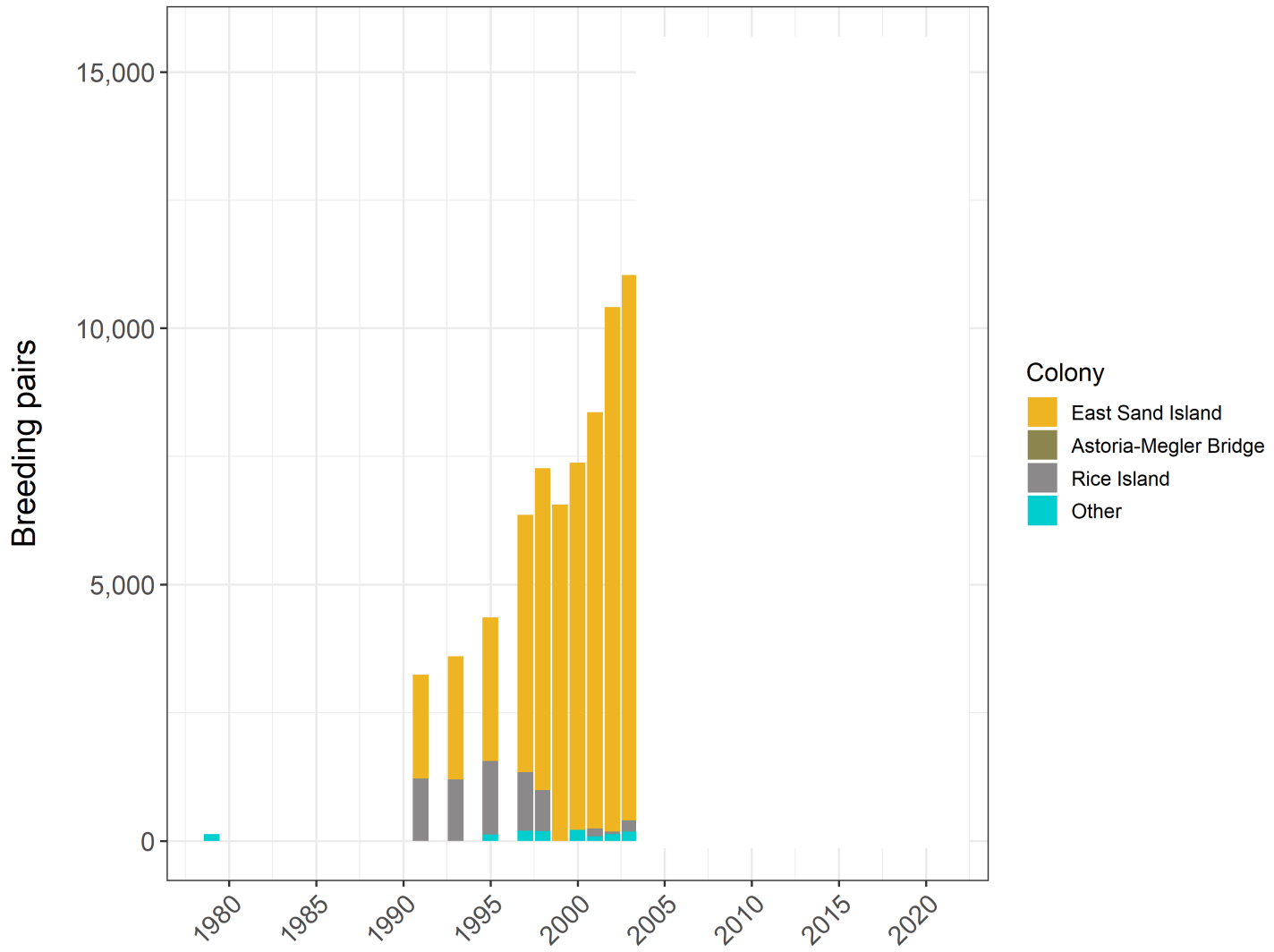


Maximum colony size constrained by access to marine forage



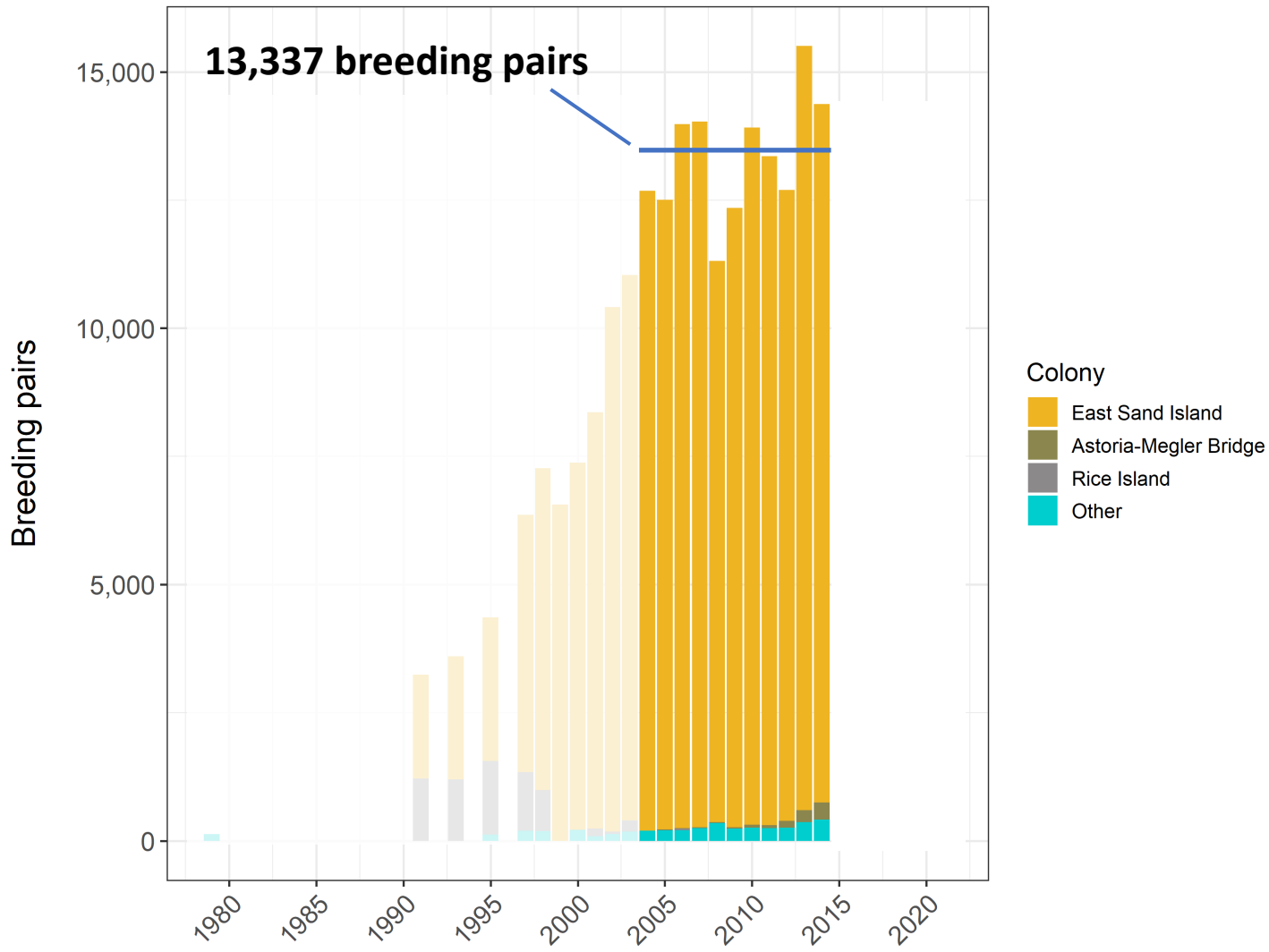
Growth period: 1979–2003

- High prey availability
- Low/increasing bald eagle abundance
- Most nesting in marine zone



Peak abundance: 2004–2014

- Abundance probably limited by food
- Bald eagle abundance growing/high, especially on East Sand Island
- 97% of breeding in marine zone



East Sand Island Management Plan: 2015–2020

- National Marine Fisheries Service management alternative (RPA 46)
- U.S. Army Corps of Engineers document
- Decrease local population through culling and egg-oiling, then restrict habitat by modifying the island

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

Management Plan Implementation

- 2015–2017: 5,576 adults culled and 6,181 nests destroyed
- Colony abandonment on East Sand Island in May, 2016, shortly after egg-oiling
- Bald eagle disturbances 2017–2021
- Habitat restricted on East Sand Island beginning 2018
- AM Bridge: high productivity and no colony disturbance by managers or eagles
- Details: Lawes et al. (2021), Lawonn (2022)

Individuals relocated to new colonies upriver

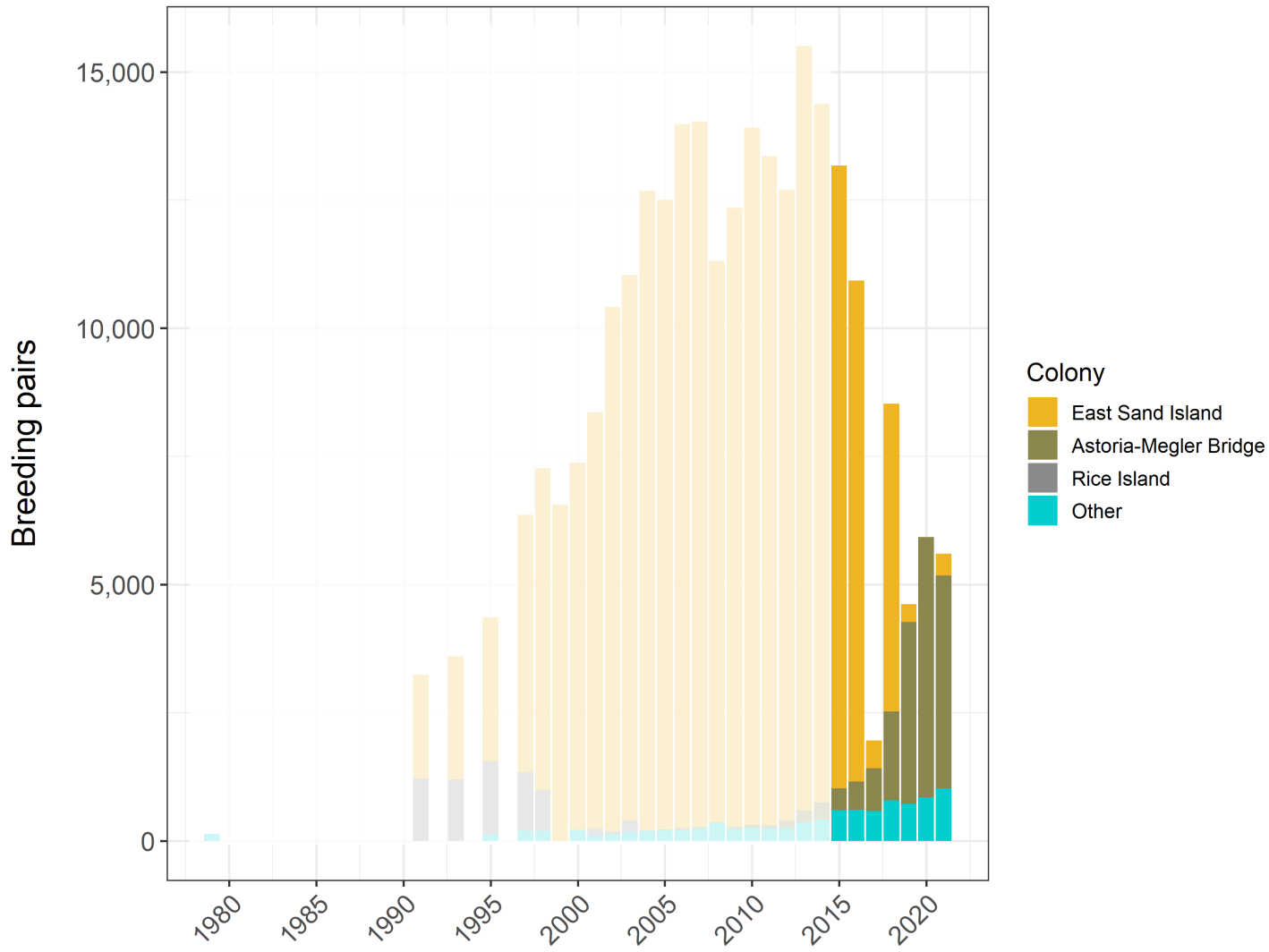
No clear plan for adaptive management at most colony sites

- The Corps claimed authority to manage only 2 colonies besides East Sand Island
- Research showed that DCCO displaced by management would primarily disperse to colonies not administered by the Corps (USACE 2015, Peck-Richardson 2017)

Colony name	Salinity zone
Estuary Navigation Aids RKM 0–22	Marine
Trestle Bay	Marine
East Sand Island	Marine
Desdemona Sands Pilings	Mixing
Astoria-Megler Bridge	Mixing
Rice Island	Freshwater
Miller Sands Spit	Freshwater
Estuary Navigation Aids RKM 22–51	Freshwater
Longview Bridge	Freshwater
Troutdale Towers	Freshwater
Estuary Navigation Aids RKM 51–234	Freshwater

Decline and shift in distribution: 2015–2021

- DCCO displaced from East Sand Island
- High eagle abundance
- Abundance constrained at upriver colonies by available food



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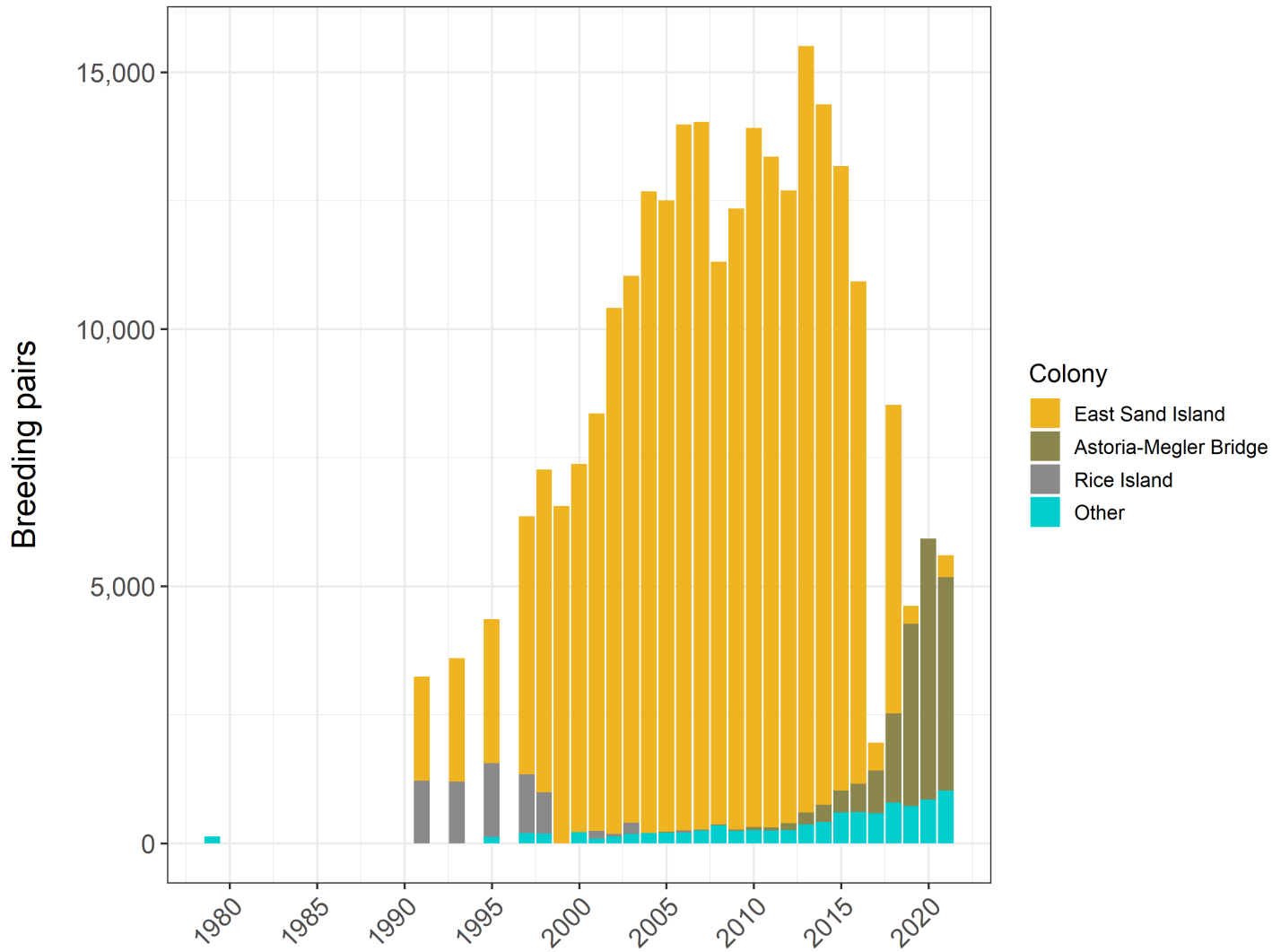
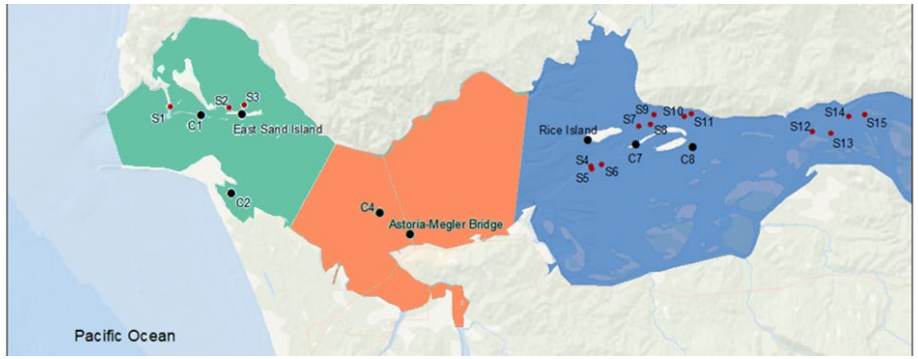
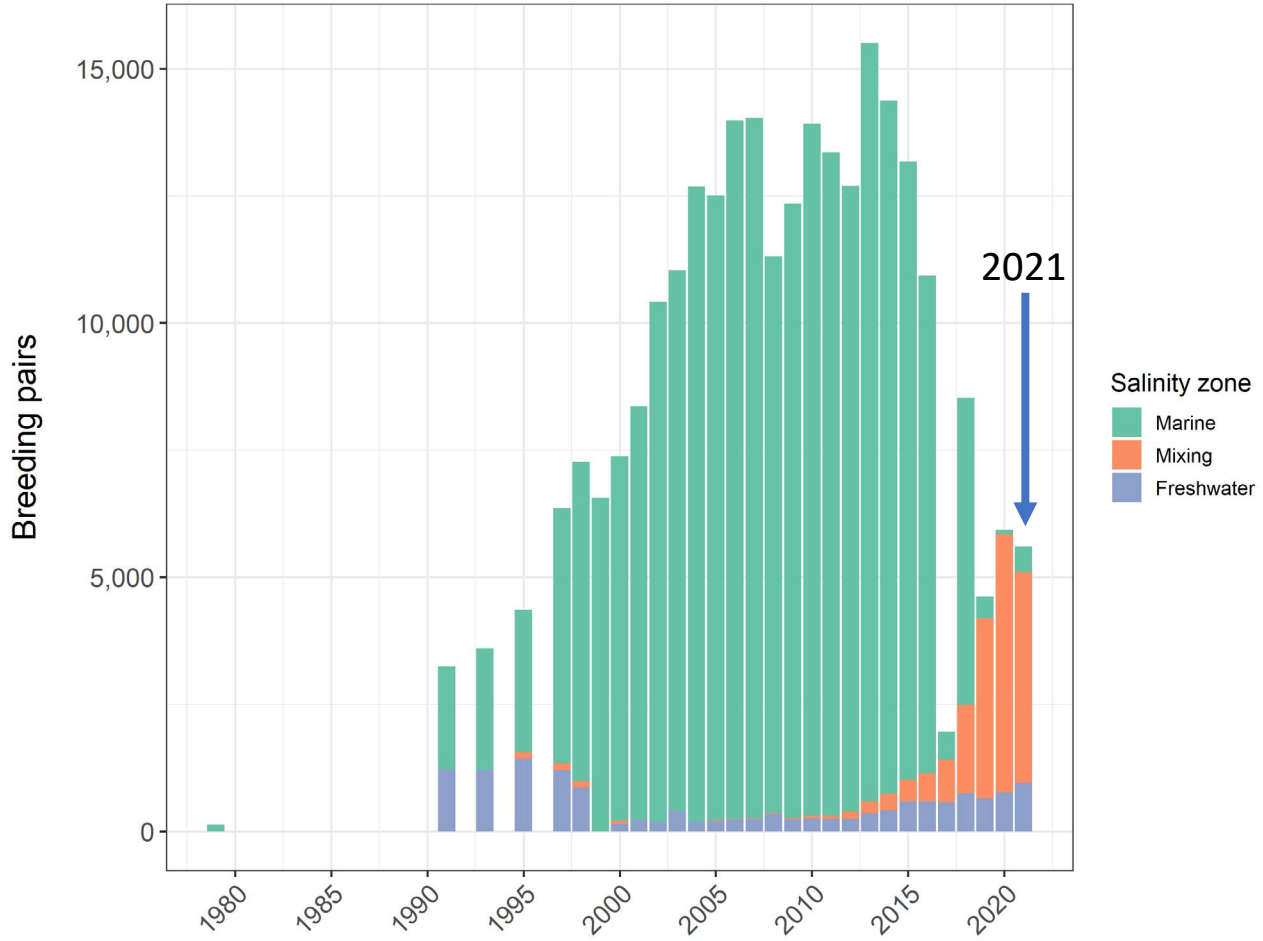


Change in distribution: salinity zones

Salinity zone	% change cf. pre-management period
Marine zone	-96%
Mixing zone	5,029%
Freshwater zone	349%

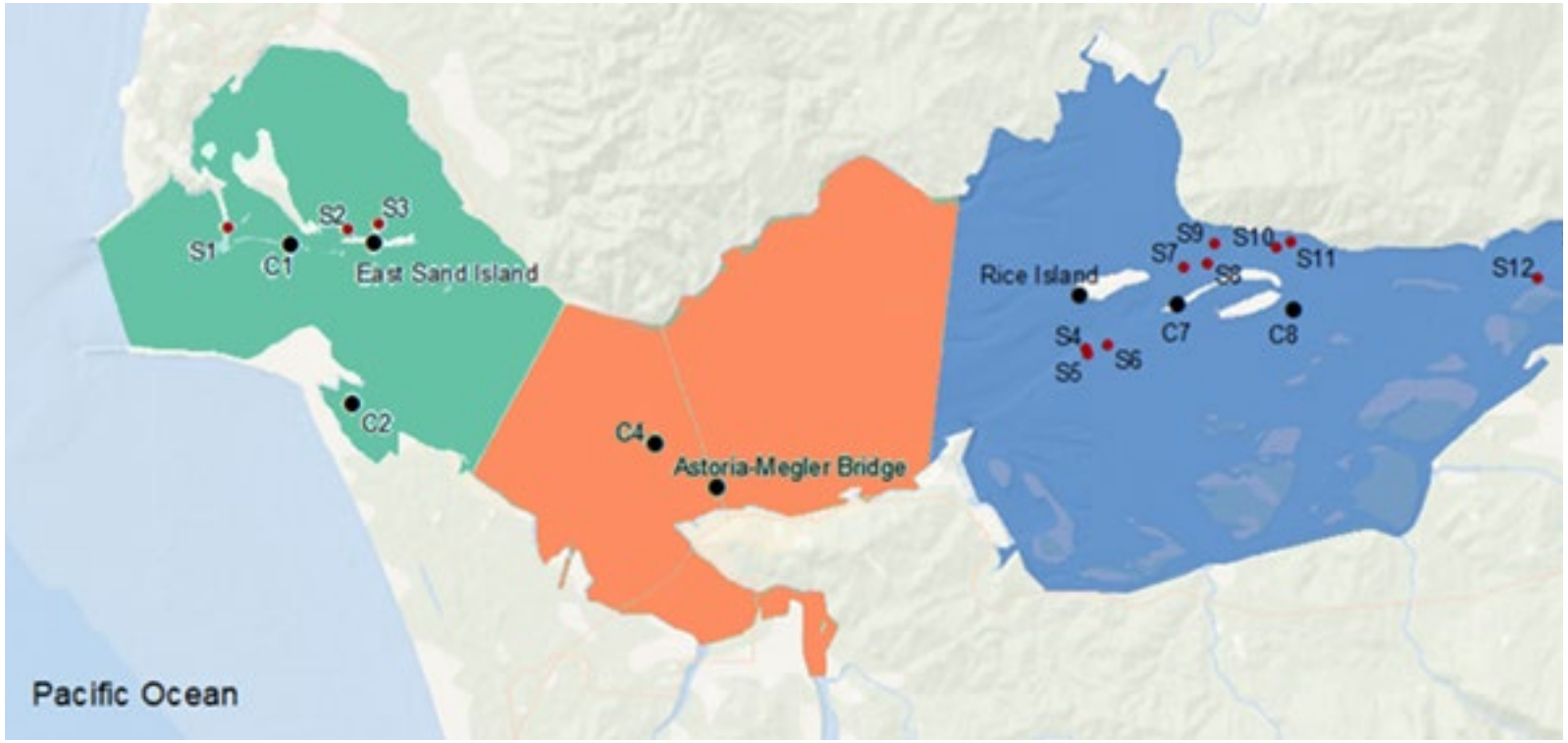




Birds breeding at colonies upriver of East Sand Island consume more salmonids as a proportion of their diet*

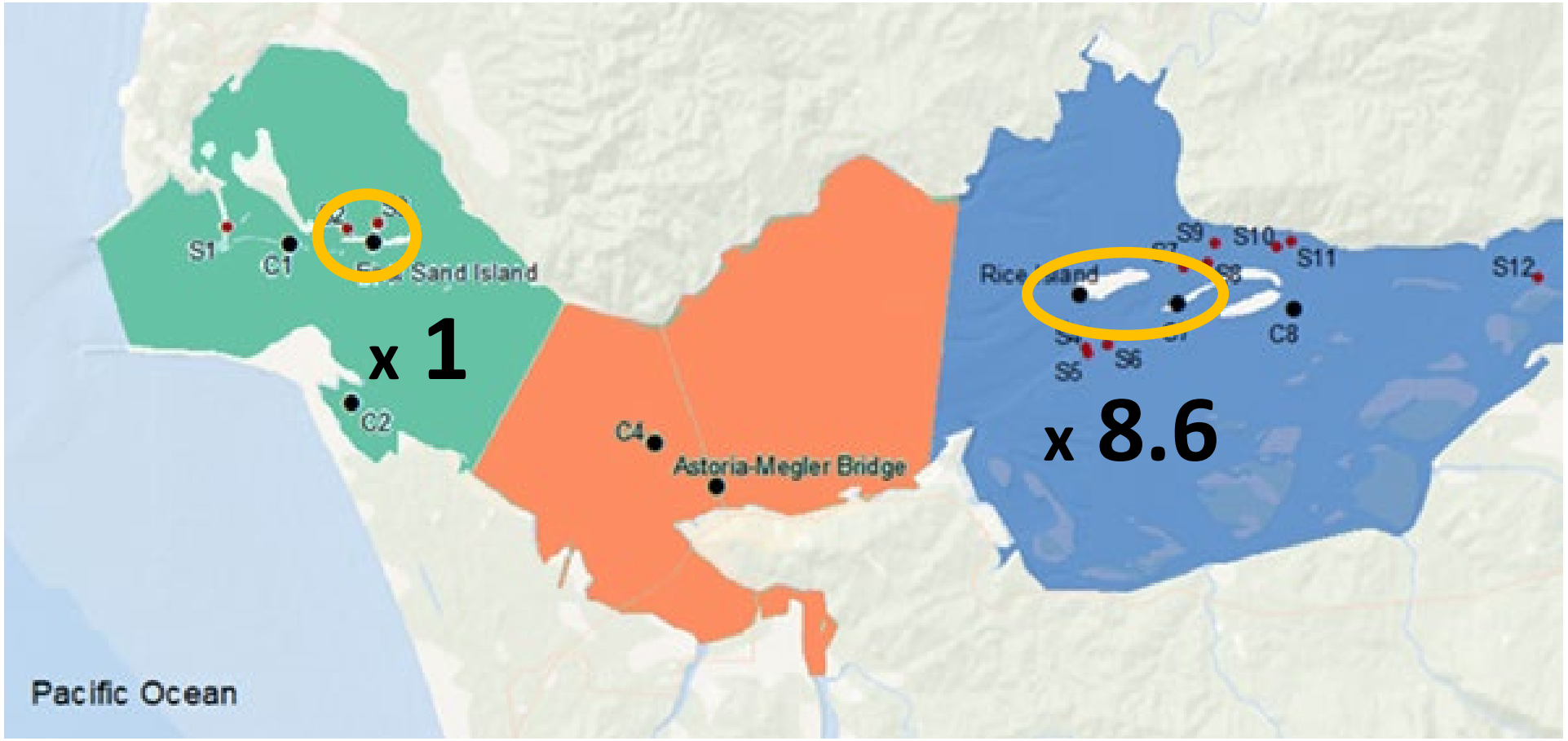
Proportion salmonids in avian diet

Less → **More**



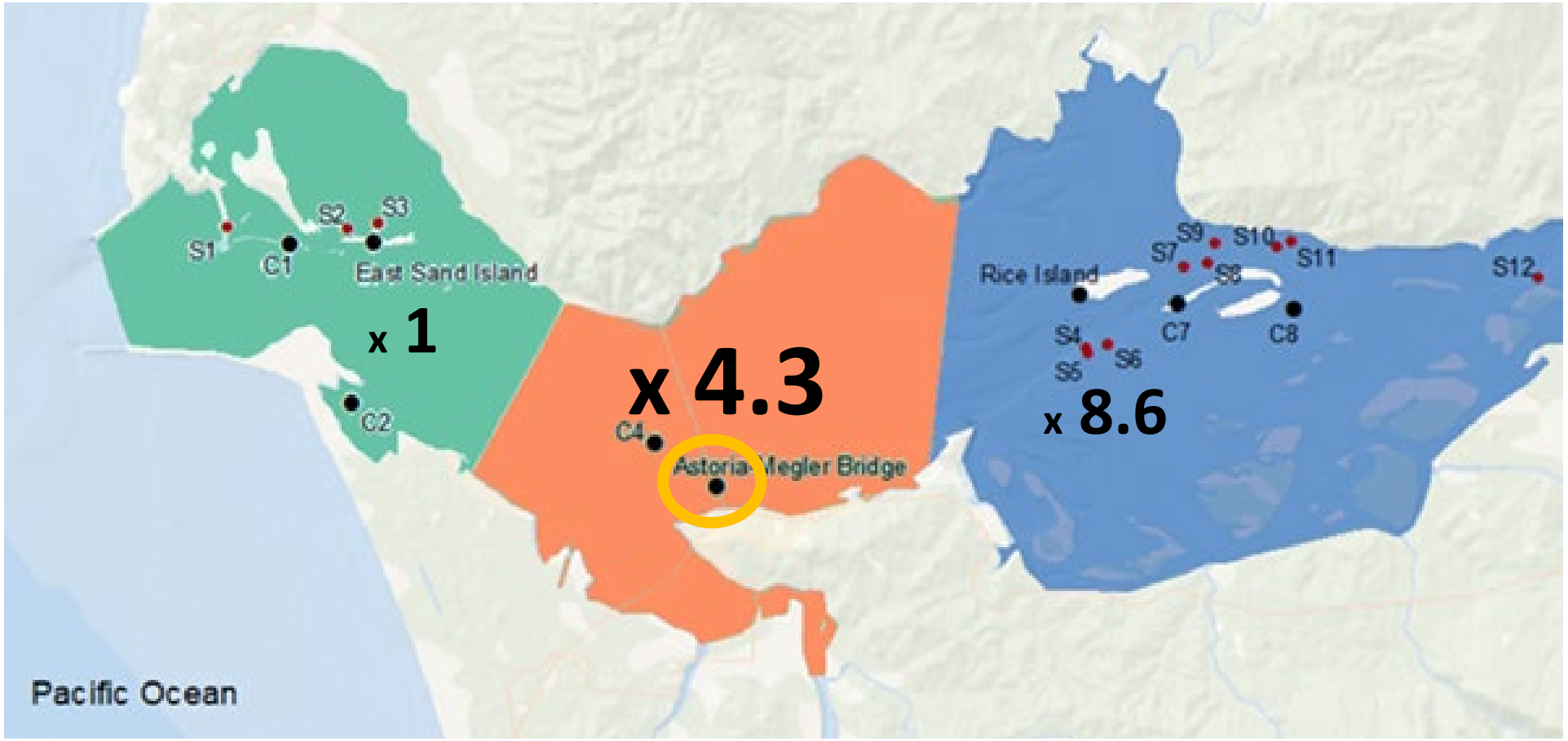
* Collis et al. 2001, Collis et al. 2002, Roby et al. 2002, Cramer et al. 2021, Evans et al. 2022)

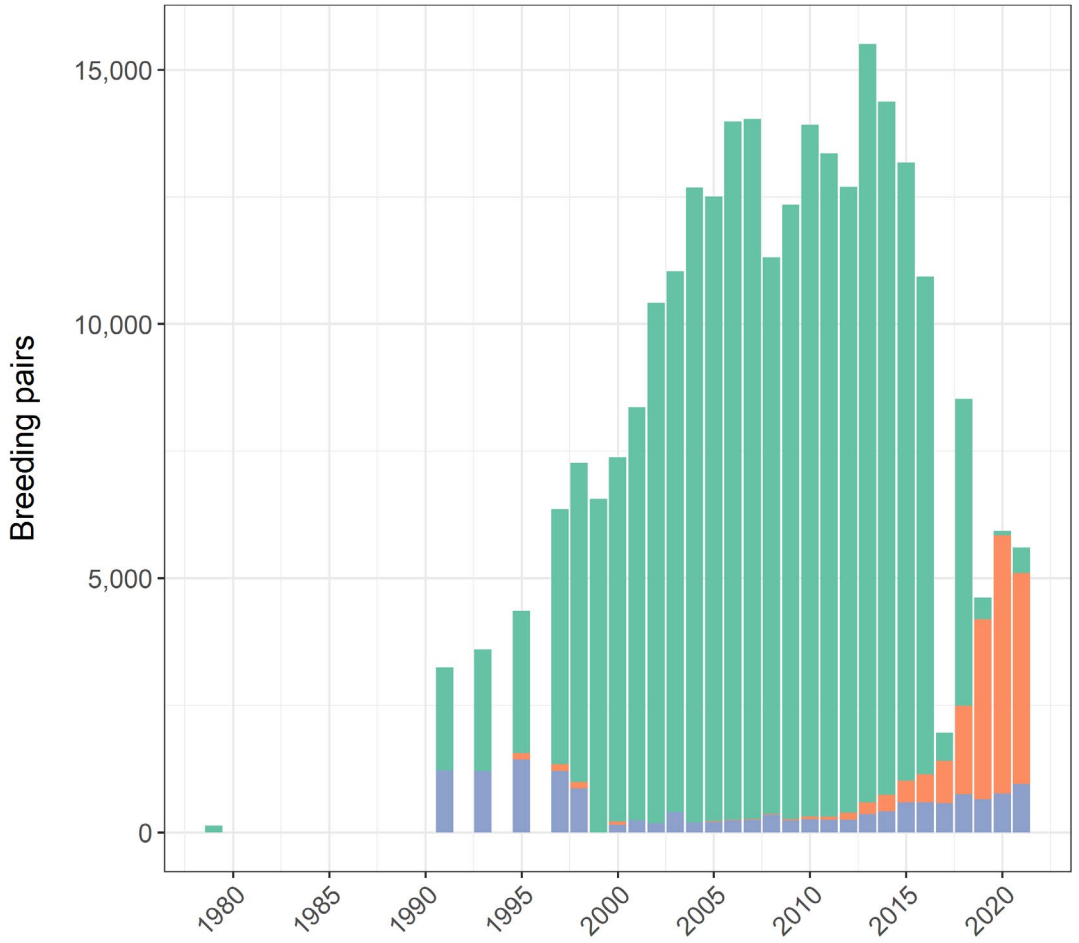
DCCO at freshwater zone colonies consumed 8.6 times more steelhead on a per capita basis than those at East Sand Island*



* Cramer et al. 2021

Estimated value for Astoria-Megler Bridge

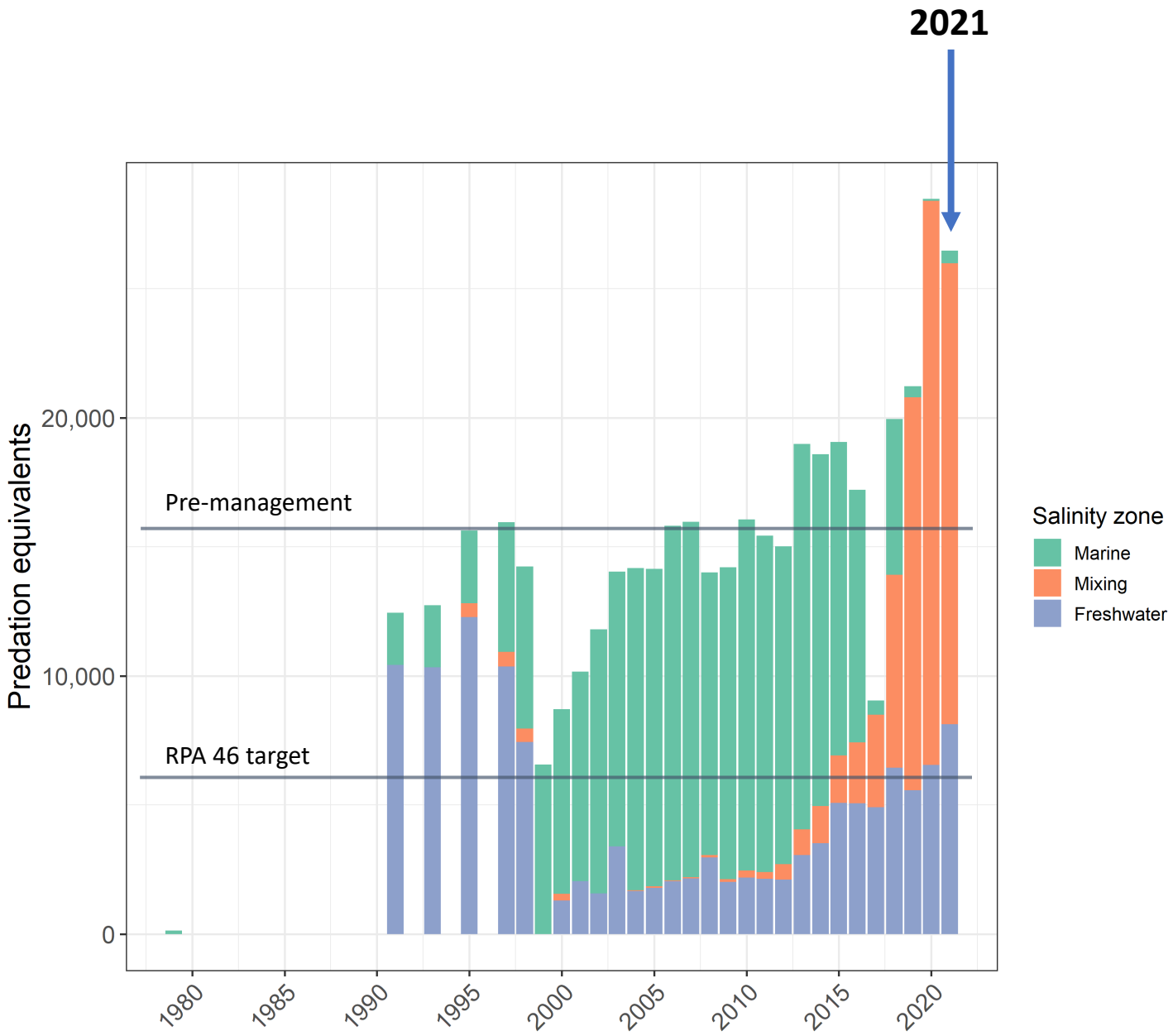




$$X \begin{bmatrix} 1 \\ 4.3 \\ 8.6 \end{bmatrix} =$$

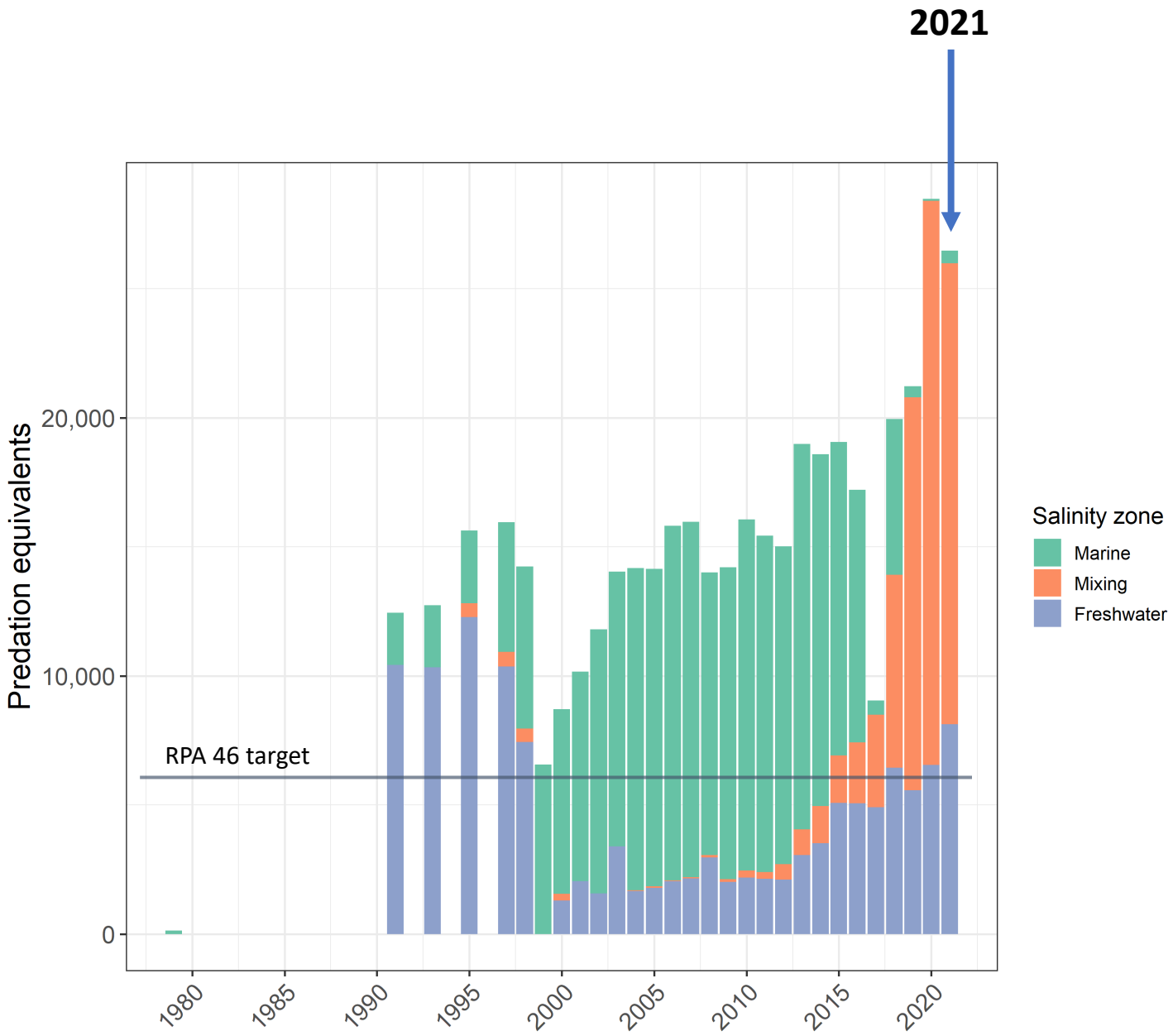
Predation in 2021 was 169% of pre-management level, ≥446% of RPA 46 target

2021 Total	26,479
Pre-management	15,670
RPA 46 target	5,380–5,939



Astoria-Megler Bridge AND several freshwater colonies may need to be managed to meet RPA 46 target

Salinity zone	Predation equivalents
Marine zone	503
Mixing zone	17,849
Freshwater zone	8,127
RPA 46 target	5,380–5,939



Future management?

- Dissuasion at Astoria-Megler Bridge and other target colonies should be paired with social attraction at East Sand Island
- Adaptive management likely necessary in perpetuity
- Possible cost for first 4 years of management ≥ $3 M annually

Final thoughts

- Scientists have an incomplete understanding of estuary and plume food webs. It is therefore unclear how effective DCCO management will be at improving life-cycle survival
- However, even a small or uncertain survival gain for salmonids is potentially important as part of a broad-based recovery strategy
- Careful cost-benefit analysis will be important for future decision-making

Questions?

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