Summary of Double-crested Cormorant Colony Monitoring in the Columbia River Estuary, 2020 and 2021—DRAFT REPORT

Oregon Department of Fish and Wildlife

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By M. James Lawonn

Author contact information:
James Lawonn
Oregon Department of Fish and Wildlife
North Coast Watershed District Headquarters
4907 3rd St.
Tillamook, Oregon 97141
matthew.j.lawonn@odfw.oregon.gov

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Oregon Department of Fish and Wildlife
4034 Fairview Industrial Dr. SE
Salem, OR 97302

Cover: Aerial photo of a portion of the Longview Bridge double-crested cormorant colony, taken on June 25, 2020. Photograph courtesy U.S. Army Corps of Engineers.

Introduction

Predation of juvenile fish by double-crested cormorants is a potential limiting factor for various runs of imperiled salmonids in the Columbia River basin (Roby et al. 2021). However, double-crested cormorants themselves may be much less abundant in the Pacific Region than historically (Wires and Cuthbert 2006) and have experienced a sharp decline in their abundance across the Pacific Flyway in recent years (USFWS 2020). This decline was an expected consequence of U.S. Army Corps of Engineers (USACE) management of the East Sand Island colony in the Columbia River estuary, which formerly supported up to about 40% of the regional population (USACE 2015). Continued monitoring of double-crested cormorant colonies within the Columbia River estuary is important to help assess the overall effectiveness of management at reducing predation on salmonids (Roby et al. 2021), and to ensure the population of cormorants across the flyway remains sustainable (Pacific Flyway Council 2013). Here I present results of recent colony surveys within the Columbia River estuary. These surveys add to a long-term dataset that extends to 1979, when the first regional survey of double-crested cormorants was conducted (Carter et al. 1995).

Methods

I analyzed aerial images of historical or new double-crested cormorant colonies taken in the Columbia River estuary during the presumed peak of colony abundance during 2020 and 2021. I followed Simenstad (2011) and considered the estuary to extend from the mouth of the river to the uppermost extent of tidal influence at Bonneville Dam (river kilometer [RKM] 234). Images were provided by USACE staff and were taken by Civil Air Patrol (CAP) as part of a USACE monitoring effort for piscivorous birds. Photographs were taken by CAP personnel using a handhand digital camera (Nikon D7200) and telephoto lens from a small propeller-driven airplane. I used the computer program GIMP to analyze photographs of cormorant colonies. I manually marked each active nest on digital images, then tallied the marks using an automated procedure (i.e. code script). I assumed that historical colony sites within the estuary that were not photographed did not support nesting. For the Astoria-Megler Bridge colony in 2020, ODFW staff counted most nests from a boat, but supplemented this survey with nests counted from aerial images. Information for additional colonies was provided by USACE personnel and is summarized here to provide a complete summary of breeding activity in the estuary for 2020 and 2021.

Results and Discussion

I identified 29 historical colony or subcolony sites in the Columbia River estuary and one previously unreported site adjacent to The Dalles Dam (Fig. 1a, 1b; Tables 1, 2). Active double-crested cormorant nests were detected at 20 of these sites within the Columbia River estuary and the site adjacent to The Dalles Dam during 2020 and 2021. In 2020, 5,924 pairs nested in the estuary at 19 sites (Table 3). The majority nested on the Astoria-Megler Bridge, which supported 5,081 breeding pairs, while other estuary sites supported 843 pairs. In addition, an estimated 35 pairs nested on The Dalles Dam transmission towers. In 2021, 1,023 pairs nested at 17 estuary sites (Table 3); however, this total does not include pairs breeding at the Astoria-Megler Bridge, which supported thousands of nesting pairs (M.

J. Lawonn pers. obs.) and East Sand Island, which supported potentially hundreds (USACE unpubl. data). Survey results for these colonies are anticipated from the contractor for Bonneville Power Administration (Real Time Research, Bend, Oregon) and from USACE, the entities associated with this work, respectively. The Dalles Dam transmission towers supported an estimated 65 breeding pairs in 2021.

Double-crested cormorant abundance at estuary colonies besides East Sand Island has increased substantially in recent years (Fig. 2). Most of this increase has occurred at sites within the mixing and freshwater zones of the estuary (Fig 1a, 1b). Colonies within these zones are potentially problematic because cormorants associated with them tend to consume a larger proportion of salmonids in their diet compared with those on East Sand Island, which lies farther downriver in the marine zone (Cramer et al. 2021). The difference in the cormorant diet among zones appears to be associated with higher availability of alternative, non-salmonid food sources lower in the estuary, in areas dominated by marine waters (Collis et al. 2002).

The size of the Astoria-Megler Bridge colony has continued to increase (Fig 2). In 2020 this colony supported 86% of all double-crested cormorant breeding pairs in the Columbia River estuary and was likely the largest colony within the Pacific Flyway. Although cormorant predation rates on salmonids have not yet been empirically verified for the Astoria-Megler Bridge colony, it seems likely that this colony's impact on salmonids is considerable because of its position within the mixing zone of the estuary. Predation impacts associated with this colony in recent years possibly approach or exceed rates formerly observed at the East Sand Island colony (Cramer et al. 2021).

Although perhaps less conspicuous than the recent growth of the Astoria-Megler Bridge colony, double-crested cormorant abundance at small or intermediate-sized colonies (i.e. those supporting fewer than 500 breeding pairs) has increased about four-fold since 2010 (Fig. 3), although this increase has not been uniform across all estuary sites (Fig. 4). Most of these colonies lie within the freshwater zone of the estuary, where per-cormorant predation rates on salmonids are assumed to be far higher compared with East Sand Island (Collis et al. 2002, Cramer et al. 2021). While aggregate abundance at these colonies is considerably lower than previous abundance at East Sand Island or current abundance at the Astoria-Megler Bridge, these colonies could nevertheless contribute to considerable predation mortality on juvenile salmonids. For example, available data suggest per-cormorant predation rates on salmonids may be five or more times higher at colonies in the freshwater zone compared with East Sand Island (Cramer et al. 2021). Given observed abundance at freshwater zone colonies in 2021, this would translate to a degree of predation equivalent to about 5,000 or more pairs on East Sand Island.

Continued monitoring of estuary colony sites is necessary to make informed decisions regarding management of piscivorous birds across the Columbia River basin, as well as fulfill regional double-crested cormorant population monitoring needs (Pacific Flyway Council 2013). However, funding for future monitoring is uncertain for colonies that have recently supported the vast majority of double-crested cormorant breeding activity in the estuary. These colonies include the Astoria-Megler Bridge, most or all navigation markers, and other colonies besides those administered by USACE. Collaboration among federal agencies and regional sovereigns is likely necessary for long-term monitoring of double-crested cormorants in estuary to continue.

Acknowledgements

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FIGURES AND TABLES

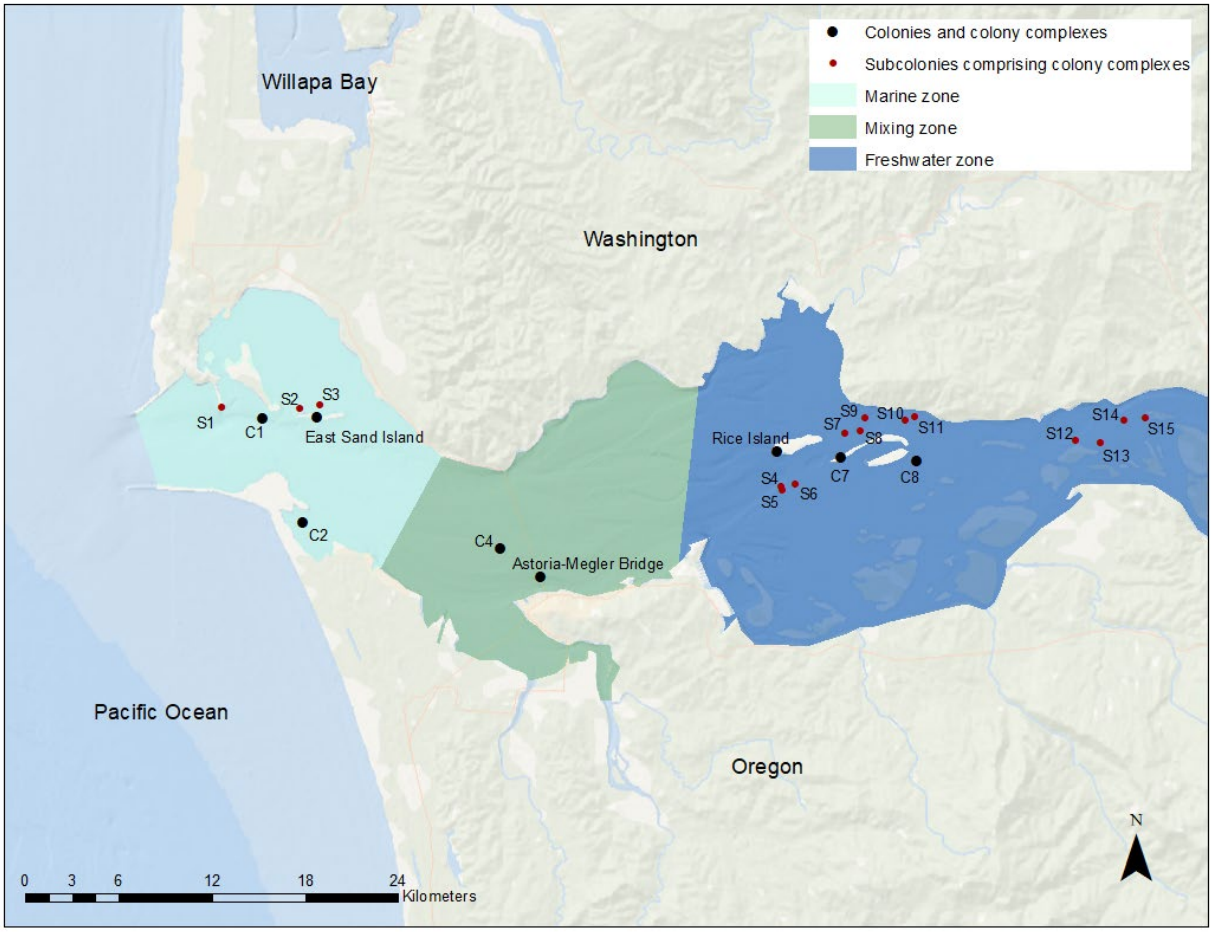

Figure 1a. Location of double-crested cormorant colonies and subcolonies along the lower 55 km of the Columbia River estuary relative to salinity zones based on Simenstad et al. (1990) as modified by Anderson et al. (2004). Colony and sub-colony labels refer to colony names or ID codes in Tables 1 and 2.

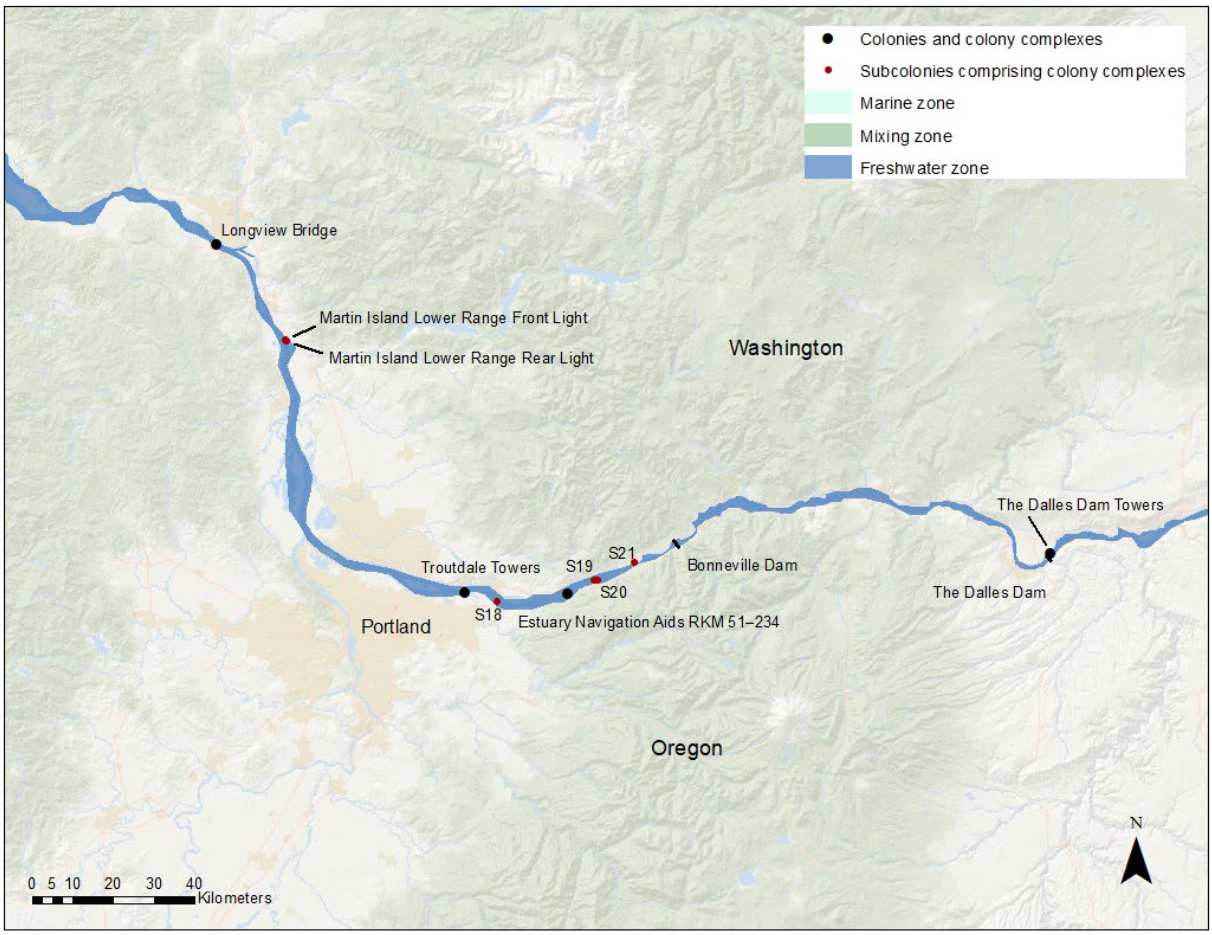

Figure 2b. Location of double-crested cormorant colonies and subcolonies from river km 55 upstream to the forebay of The Dalles Dam. Salinity zones based on Simenstad et al. (1990) as modified by Anderson et al. (2004). Colony and sub-colony labels refer to colony names or ID codes in Tables 1 and 2.

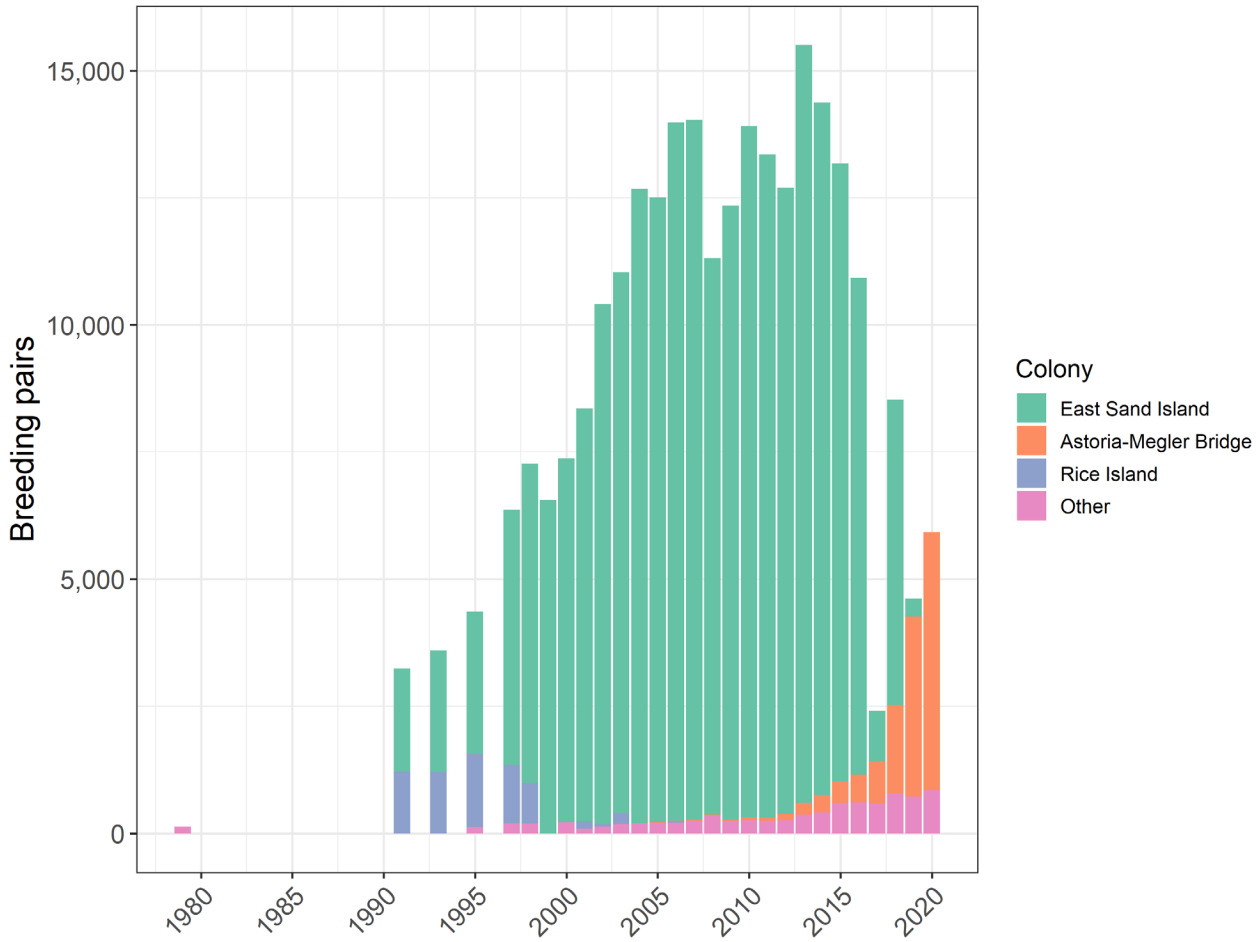

Figure 3. Number double-crested cormorant breeding pairs nesting within the Columbia River estuary, 1979–2020. Data summarized herein, in Lawonn (2021), and in Roby et al. (2021).

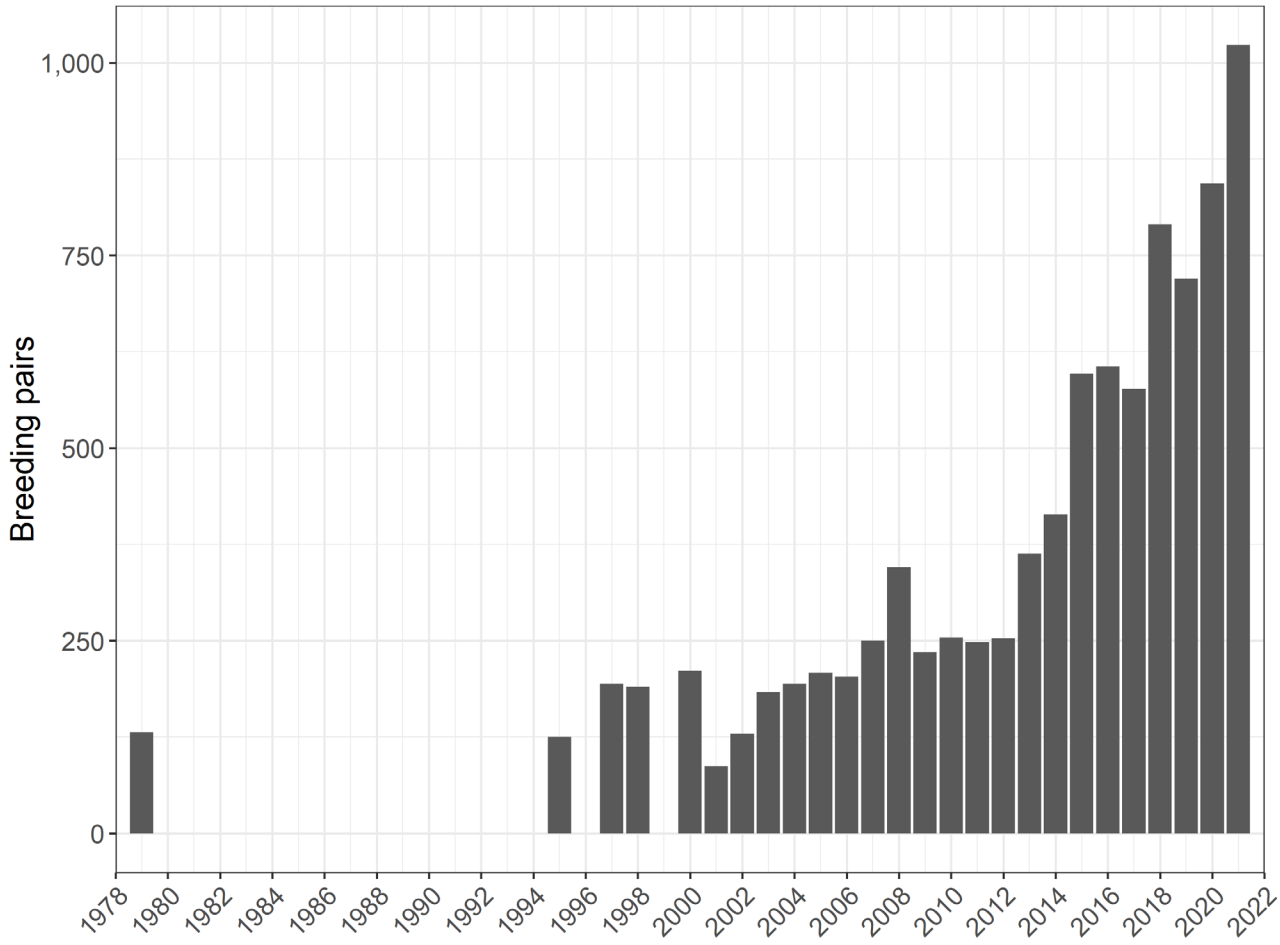

Figure 3. Aggregate number double-crested cormorant breeding pairs nesting in the Columbia River estuary during 1979–2021 at sites besides large historical colonies at Rice and East Sand islands and the Astoria-Megler Bridge. Data summarized herein, in Lawonn (2021), and in Roby et al. (2021).

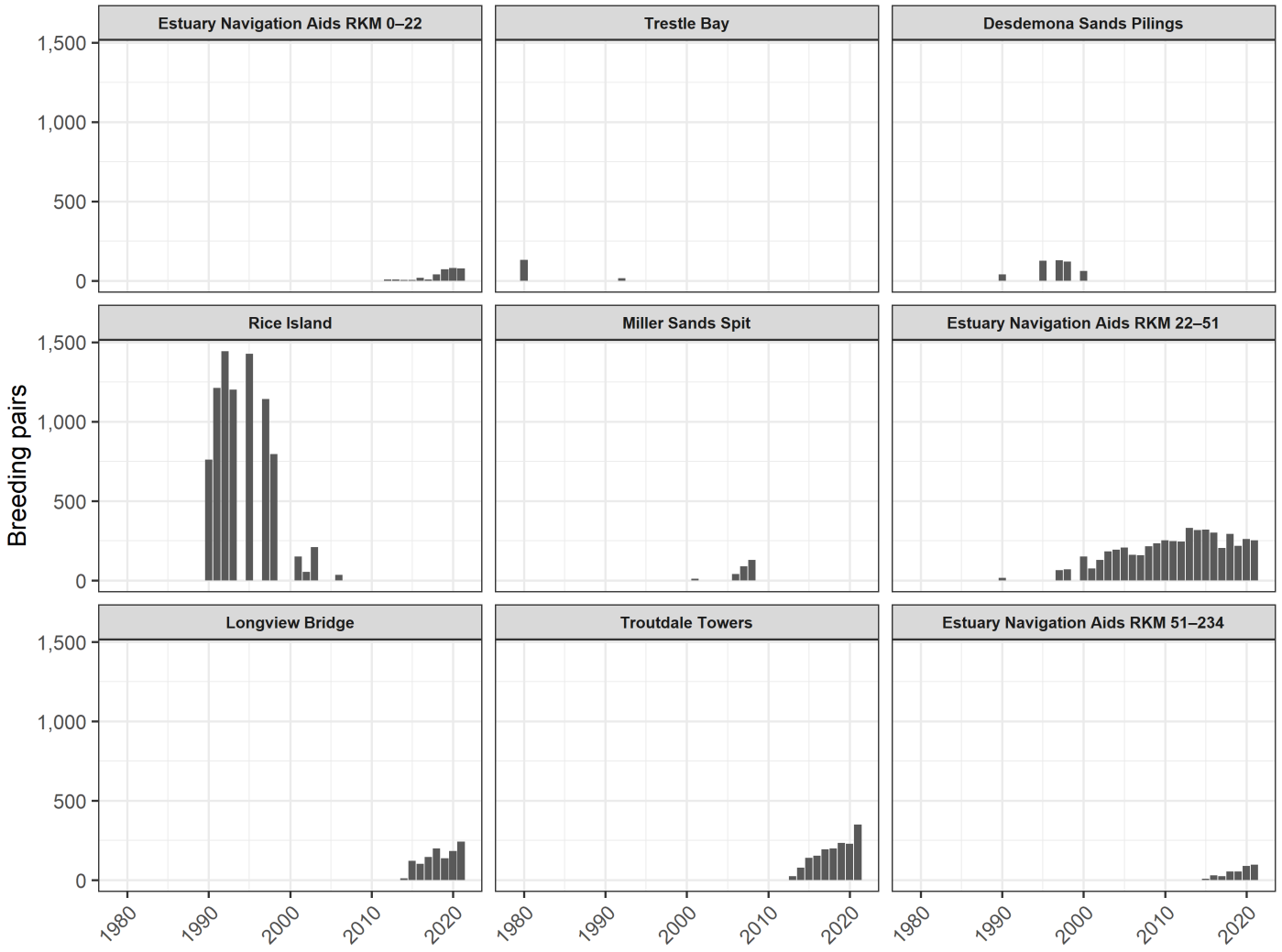

Figure 4. Number double-crested cormorant breeding pairs nesting in the Columbia River estuary during 1979–2021 at colony sites besides East Sand Island and the Astoria-Megler Bridge. Data summarized herein, in Lawonn (2021), and in Roby et al. (2021).

Table 1. Location of double-crested cormorant colonies and colony complexes in the Columbia River estuary and adjacent to The Dalles Dam during 1979–2021. Colony sites obtained from Lawonn 2021 and Roby et al. 2021.

ID	Colony name	Latitude	Longitude	Notes
C1	Estuary Navigation Aids RKM 0–22	46.261940	-124.013859	Colony complex comprising 3 navigation aids along the stretch of river from the Columbia River mouth to the Astoria-Megler Bridge (ca. river km 21.6). Each sub-colony is located on an individual navigation aid.
C2	Trestle Bay	46.220000	-123.990833	Historic colony site located on abandoned trestle used for construction of South Jetty (CREST 1984).
C3	East Sand Island	46.262190	-123.982252	Colony site has varied across years, but generally located near center to west end of island.
C4	Desdemona Sands Pilings	46.209722	-123.876389	Colony site located on pilings from historical Desdemona Sands Lighthouse. Probably unsuitable for nesting since at least early 2010s (Adam Peck-Richardson, Oregon State University, pers. comm.).
C5	Astoria-Megler Bridge	46.198015	-123.853266	Breeding concentrated within 1.5 km of south terminus, but occurs on all portions of the bridge's approx. 6 km extent.
C6	Rice Island	46.248694	-123.716442	Historical colony site at west tip of island.
C7	Miller Sands Spit	46.246084	-123.679441	Historical colony site at west tip of island.
C8	Estuary Navigation Aids RKM 22–51	46.244692	-123.635143	Colony complex comprising 12 navigation aids along the stretch of river from Astoria-Megler Bridge upstream through river km 51. Each sub-colony is located on an individual navigation aid. This complex comprises all navigation aids from "Miller Sands Navigational Aids" and "Upper Estuary Navigational Aids" in Adkins et al. (2010).
C9	Longview Bridge	46.104545	-122.961960	Colony located on two main piers of bridge.
C10	Troutdale Towers	45.567872	-122.412055	Colony located on cluster of five power transmission towers.
C11	Estuary Navigation Aids RKM 51–234	45.565447	-122.182918	Colony complex comprising 6 navigation aids along stretch of river from river km 51 to Bonneville Dam (ca. river km 234). Each sub-colony is located on an individual navigation aid.

C12	The Dalles Dam Towers	45.617148	-121.134697	Colony located on power transmission towers adjacent to The Dalles Dam. First observed in 2018 (J. Day, USACE, pers. comm.)

Table 2. Location of constituent navigation markers for double-crested colony complexes in the Columbia River estuary, 1979–2021. Colony sites obtained from Lawonn et al. 2021 and Roby et al. 2021.

Colony complex	ID	Navigation marker (NOAA)	Name in Roby et al. 2021	Latitude	Longitude
Estuary Navigation Aids RKM 0–22	S1	Jetty A Tower	Jetty A Channel Marker	46.265954	-124.037809
	S2	Sand Island Range Front Light	Sand Island Channel Marker #1	46.265832	-123.992948
	S3	Sand Island Range Rear Light	Sand Island Channel Marker #2	46.267293	-123.981073
Estuary Navigation Aids RKM 22–51	S4	Harrington Point Channel 52 Light	Estuary Channel Marker #1	46.234162	-123.714198
	S5	Tongue Point Channel Range Front Light	Estuary Channel Marker #2	46.232948	-123.713511
	S6	Tongue Point Channel Range Rear Light	Estuary Channel Marker #3	46.235152	-123.705794
	S7	Harrington Point Range Front Light	Estuary Channel Marker #4	46.255911	-123.677035
	S8	Harrington Point Range Rear Light	Estuary Channel Marker #5	46.256534	-123.668582
	S9	Miller Sands Dike Light 5	Estuary Channel Marker #6	46.261769	-123.665627
	S10	Miller Sands Dike Light 11	Estuary Channel Marker #7	46.261145	-123.641955
	S11	Miller Sands Range Front Light	Estuary Channel Marker #8	46.262415	-123.636661
	S12	Pillar Rock Lower Range Front Light	Estuary Channel Marker #9	46.252761	-123.543447
	S13	Pillar Rock Lower Range Rear Light	Estuary Channel Marker #10	46.251728	-123.529404
	S14	Pillar Rock Upper Range Front Light	Estuary Channel Marker #11	46.260721	-123.515554
	S15	Pillar Rock Upper Range Rear Light	Estuary Channel Marker #12	46.261706	-123.502956
Estuary Navigation Aids RKM 51–234	S16	Martin Island Lower Range Front Light	Not reported	45.957934	-122.808994
	S17	Martin Island Lower Range Rear Light	Not reported	45.955872	-122.806304
	S18	Washougal Upper Range Rear Light	Not reported	45.551788	-122.339813
	S19	Fashion Reef Lower Range Front Light	Not reported	45.585095	-122.127023
	S20	Fashion Reef Lower Range Rear Light	Not reported	45.586233	-122.119301
	S21	Warrendale Lower Range Rear Light	Not reported	45.613594	-122.037611

Table 3. Number double-crested cormorant nesting pairs at known colonies from the mouth of the Columbia River to The Dalles Dam forebay during the presumed period of peak nest abundance during 2020 and 2021. Survey data from ODFW analysis of aerial photos taken on June 25, 2020, and June 8, 2021, except for footnoted data.

Colony name	2020	2021
Jetty A Tower	23	30
Sand Island Range Front Light	34	23
Sand Island Range Rear Light	24	25
Trestle Bay	0[a]	0[a]
East Sand Island	0[b]	Present[b]
Desdemona Sands Pilings	0[a]	0[a]
Astoria-Megler Bridge	5,081[c]	Present[d]
Rice Island	0	0
Harrington Point Channel 52 Light	0[a]	0[a]
Tongue Point Channel Range Front Light	0[a]	0[a]
Tongue Point Channel Range Rear Light	0[a]	5
Miller Sands Spit	0	0
Harrington Point Range Front Light	43	44
Miller Sands Dike Light 5	5	0[a]
Harrington Point Range Rear Light	50	50
Miller Sands Dike Light 11	0	0[a]
Miller Sands Range Front Light	12	10
Pillar Rock Lower Range Front Light	0[a]	0
Pillar Rock Lower Range Rear Light	27	22
Pillar Rock Upper Range Front Light	55	47
Pillar Rock Upper Range Rear Light	68	75
Longview Bridge	184	242
Martin Island Lower Range Front Light	14	13
Martin Island Lower Range Rear Light	45	51
Troutdale Towers	229	351
Washougal Upper Range Rear Light	0[a]	0[a]
Fashion Reef Lower Range Front Light	10	13
Fashion Reef Lower Range Rear Light	15	22
Warrendale Lower Range Rear Light	5	0
The Dalles Dam Towers	35[e]	65[e]

[a] Aerial photos not taken during CAP survey, presumed inactive

[b] USACE unpublished data

[c] Estimate accounts for nests detected during a boat-based survey on June 2 and analysis of aerial images taken by CAP on June 4

[d] ODFW staff observed thousands of active nests during early June, the typical period of peak colony abundance

[e] Estimated by USACE staff