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ABUNDANCE, DISTRIBUTION, AND DISSUASION EFFORTS OF CASPIAN TERNS (*Hydroprogne caspia*) and DOUBLE CRESTED CORMORANTS (*Phalacrocorax auritus*) ON RICE, MILLER, AND PILLAR ISLANDS OF THE COLUMBIA RIVER: 2019 SEASON SUMMARY REPORT

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SUMMARY

To satisfy the requirements of several Biological Opinions that direct the U.S. Army Corps of Engineers to monitor the abundance and distribution of colonial piscivorous water birds on Rice, Miller, and Pillar Islands in the Columbia River Estuary, the Fisheries Field Unit conducted monitoring and dissuasion efforts at these sites between 16 April and 23 July, 2019. The objective of the work is to dissuade birds from the primary island of nesting interest, Rice Island. Here, we report that the dissuasion efforts were largely successful this season, and no Caspian Tern (*Hydroprogne caspia*) eggs were observed on Rice Island this season. The abundance of and the number of tern nest scrapes was lower than the previous year. The maximum number of terns observed this year was 275 on one day, more than 50% less than the previous year's daily maximum of 605 terns. The distribution of the terns was slightly different on Rice Island than this season, likely as a result of the extensive dissuasion materials and re-vegetated sites historically preferred by terns. The abundance and distribution of Double-Crested Cormorants (*Phalacrocorax auritus*), another colonial piscivorous water bird species found to significantly impact salmonid stocks, was also monitored and was observed within the historic observation estimates. Low numbers were recorded daily at the water's edge of Rice and Pillar Islands and higher numbers were recorded in the main Columbia River channel on pile dikes. Placement of new dredge material in the bowl at Rice Island will create favorable habitat for terns and therein will create a challenge to next season's dissuasion and monitoring effort.

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BACKGROUND

Long term evaluation of Caspian Terns (CATE; *Hydroprogne caspia*, formerly *Sterna caspia*) and Double-Crested Cormorants (DCCO; *Phalacrocorax auritus*) in the Columbia River estuary has revealed that high concentrations of the birds can lead to significant impacts to some endangered salmonid stocks (Evans et al. 2012, 2019, Adkins et al. 2014). In response to the increased presence and abundance of these bird species in the Columbia estuary, NOAA Fisheries issued a biological opinion in 1999 requiring the U.S. Army Corps of Engineers (USACE) to dissuade colonial water birds (i.e. CATE and DCCO) from nesting on USACE managed and operated lands in the estuary. These avian associated requirements of the 1999 Biological Opinion (BiOp) have been reissued in every BiOp since and have led to complex management efforts to balance the impacts of avian predators on ESA listed salmonids while preserving the integrity of the avian populations in the Pacific Flyway (NOAA 1999, 2005, 2012).

Formed in 1984, the primary colony for CATE had historically been Rice Island, state-owned island in Oregon and Washington on which the USACE has a lease agreement for access and use as a placement site for dredged materials. In 2000 the CATE colony on Rice Island was successfully moved to East Sand Island (ESI) near the mouth of the Columbia River. The dissuasion and hazing methods developed to move the colony from Rice Island to ESI have since been employed to continually deter re-colonization of Rice Island and the nearby deposition sites at Pillar Rock Island and Miller Sands Island (NOAA 2005, Figure 1). Continued monitoring and dissuasion is required to ensure that CATE and DCCO do not attempt to recolonize these upper estuary locations.

At the request of the USACE Portland District Operations Division Channels and Harbors section, the USACE Fisheries Field Unit (FFU) operationalized a monitoring and dissuasion effort on Rice, Miller, and Pillar Islands in 2019. The objective of the effort was to deter CATE and DCCO interest in these sights and insure no CATE or DCCO successfully reproduced on these islands. Using the methods developed by Real Time Research™ and with personal communications and support from independent contractors, the OSU-USGS avian research cooperative unit, and various USACE personnel, the FFU deployed an extensive array of dissuasion materials on Rice Island and recorded CATE abundance and breeding activity on Rice, Miller, and Pillar Island. This report documents the monitoring and dissuasion efforts from 16 April, 2019 through 23 July, 2019.

METHODS

Surveys and Dissuasion

Installation of dissuasion materials began on 12 March, 2019 and resulted in an array of 4.58 acres of ropes and flagging outlined in Figure 2. Materials and methods of flagging and passive dissuasion are identical to the previously employed contract work on the islands (Harper and Collis 2018). This included metal T-posts supporting twisted polypropylene rope that had yellow "Caution" tape woven through it in three foot segments to create a visual distraction and harassment array of material. The flagging was placed in the same locations as years previous but in a more extensive array to cover almost all of the area used by CATE in 2018. The upper berm of Rice Island had existing T posts from previous years which enabled rapid deployment of materials and allowed a more extensive array to be established on the upper berm area which has historically been a preferred nesting location (Figure 2).

To assist with enumeration, trail cameras were deployed on Rice Island to capture CATE abundance when biologists were not present. Three cameras were deployed, but as previously documented by contractors doing similar work, the cameras were not sufficient to fully enumerate all birds on the island (Harper and Collis 2018). However, the images did provide benefit to detect bird presence on the island, thereby providing presence-absence data with general trends of abundance.

Active hazing walks and bird monitoring began on 16 April and consisted of every other day monitoring until 1 May when the intensity of the monitoring and hazing effort increased to daily efforts on Rice Island. Monitoring was conducted within one hour of sunrise every monitoring day. Some afternoon monitoring efforts were made to assess bird behavior in the late afternoon and evening hours. Miller and Pillar Islands were initially assessed on a daily basis to establish baseline data (Table 1). Finding minimal CATE interest at Miller and Pillar Islands (i.e. average of 15.6 birds daily), the sites were surveyed every other day with the condition that if CATE presence at Rice Island increased substantially (i.e. doubling in abundance on any given day) then the Miller and Pillar Islands would be monitored in the same day. This occurred once on May 14th when CATE abundance spiked to 275 birds. However, no CATE were documented at the other islands.

When priority areas of CATE nesting interest were identified outside of the established dissuasion array on Rice Island, supplemental T-posts, ropes and flagging were deployed to dissuade and prevent CATE from successfully colonizing the location.

All abundance data were collected by FFU biologists using 10 x 42 field glasses from boat and ground based observation surveys. To enhance inter-count reliability, boat based surveys of Miller and Pillar Islands were conducted using the same transects in the water and the same observation points established before season and marked on the boats GPS navigation system. If CATE were documented on Miller or Pillar Islands observations crews were trained to make land-fall and sample the site where birds were present to look for nesting activity. Rice Island observations were a combination of boat-based and on-the-ground sampling. Again, systematic survey transects of the island were established prior to the arrival of the CATE and were sampled each monitoring day for replication and consistency purposes.

Nest fill data were collected by enumerating the number of nests encountered on the sampling transects. All nests were filled with sand after enumeration to avoid double counting. To further avoid double counting, observers stayed within the designated boundaries of the transects and therein reduced the number of boot prints on the island that can change with wind to resemble a nest scrape.

All data were recorded on handheld devices using the ArcGIS Collector Application®. This application allows GPS points and polygons to be geospatially recorded with associated data of bird abundance and nest scrape distribution (Figure 2).

Figure 1. Aerial image of Rice, Miller, and Pillar Islands (left to right).

Figure 2. View of dissuasion materials placed on Rice Island as of 23 July, 2019. A total of 4.58 acres of dissuasion were deployed (yellow polygons).

RESULTS

Abundance and Distribution:

A total of 47 days of monitoring and dissuasion were conducted this season on Rice Island. On 28 of these days, sampling was completed on Miller and Pillar Islands. The average daily abundance estimate of CATE on Rice Island was 52.2 ± SD 63.3 birds (Table 2). The distribution of CATE on Rice Island were similar to previous years wherein, four sites had repeated CATE observations, three of these are historically used sites and one was new. The historical sites were: 1) the western rim that overlooks the bowl, 2) the west shoreline above high water, and 3) the north shoreline above high water (Figure 2). The latter two sites are known loafing sites that bird's use at low tide. The fourth site is on the south aspect of the island near the entry point that crews use to access the islands. In response to a high count of 275 CATE at this location on 14 May, 0.07 acres of dissuasion was installed which successfully kept birds deterred from using the area (Figure 2). The most scrape activity was observed on the western rim and received two additional arrays of dissuasion to deter the activity at the site.

No CATE eggs were observed on Rice Island this season, but a daily average of 17.2 ± SD 28.8 scrapes were recorded (Table 3). Scrapes were documented in the four sites described above and seem to be associated with bird activity in the area. No pattern to the distribution or timing of scrape appearance were noted aside from nest scrapes being present in the early hours of the morning and in locations that were not heavily dissuaded. This indicated that CATE were using the island as a roost in the evening or early morning period, however trail cameras and nest scrape data did not suggest higher nighttime abundance than the birds documented every morning. For contrast to previous reports of this work on Rice Island, the raw observation data are listed in Supplementary Table 1.

The abundance and distribution monitoring of DCCO on Rice, Miller, and Pillar yielded generally low numbers ($n < 200$) on Miller and Rice Islands. There was an increase of DCCO on the western wrack line of Rice Island for a two week period of between May 1 and 15 (i.e. ≤ 1000 birds), and another increase towards the end of July again on the western edge of island below high water (≤ 800 birds). No nests or nesting behaviors were observed on any of the three islands of interest. The majority of the DCCO observed near the three island of interest were on the northern pilings of Pillar Island and the eastern pilings off of Rice Island. At these sites we documented an average of 354 ± S.D. 275.9 DCCO of the 28 days we have observed.

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MARCH

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

APRIL

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

MAY

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

JUNE

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

JULY

M	T	W	T	F	S	S
1	2	3	4	5	6	7

8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Table 1. Calendars days of active hazing and monitoring during the 2019 field season. Grey = mobilization and de-mobilization of dissuasion materials. Yellow = Rice Island only days. Orange = Rice, Miller, and Pillar Island surveys.

		CATE ABUNDANCE		
Site	*n* days monitored	$\bar{x} \pm$ S.D.	Range	*n* days = 0
Rice Island	47	52.2 ± 63.3	0 - 275	7
Miller Island	28	00.1 ± 0.05	0 - 2	26
Pillar Rocks	28	16.5 ± 39.3	0 - 145	24

Table 2. Abundance monitoring data for Caspian Tern abundance on Rice, Miller, and Pillar Islands in the Columbia River Estuary between 16 April and 27 July, 2019.

		CATE SCRAPES		
Site	*n* days monitored	$\bar{x} \pm$ S.D.	Range	*n* days = 0
Rice Island	47	17.2 ± 28.8	0 - 156	24
Miller Island	28	N/A	N/A	N/A
Pillar Rocks	28	N/A	N/A	N/A

Table 3. Abundance monitoring data for Caspian Tern nest scrapes on Rice, Miller, and Pillar Islands in the Columbia River Estuary between 16 April and 27 July, 2019.

DISCUSSION

The management objective of CATE and DCCO dissuasion from Rice, Miller, and Pillar Islands was largely successful this year. Abundance and nesting attempts on Rice Island were suppressed by the active and passive dissuasion effort and no CATE eggs were found. Moreover, no DCCO were observed above the shoreline in the study area.

Relative to the monitoring conducted last year, both CATE abundance and nesting attempts were far below the numbers reported last year (Harper and Collis, 2018). Here we present a simple contrast of last years data to our data but emphasis that direct comparison may not be justified. Previous years monitoring efforts sampled several times each day, did not walk designated transects, and filled scrapes continuously throughout the day. Thus, nest scrapes filled in the morning could have been reinitiated by the same bird in the afternoon (a behavior noted several times this year) which in turn, would effectively double the daily count of nest scrapes. However, withstanding the differences in sampling design, the raw data of bird counts and scrapes indicate far fewer CATE on Rice Island this year. For instance, between 19 April and 13 July, 2018 there were a total of 17,731 nest scrapes with a daily average of 340.8 ± SD 261.3 scrapes per day. During the 2019 season, between 16 April and 23 July we recorded 808 nest scrapes with a daily average of 17.2 ± SD 28.8 scrapes per day. The maximum number of CATE on any given day throughout the season in 2018 was 605 birds, and for the 2019 season we recorded a maximum daily count of 275 birds.

The distribution of CATE on Rice Island is somewhat different from previous years monitoring efforts, in that, the upper berm and north bowl that have been heavily used in the past are not of interest to the CATE this year. This is likely the result of the extensive dissuasion materials and encroachment of vegetation to these sites making them unsuitable for nesting habitat. The recent placement by the Dredge Oregon on the bowl of Rice Island in August of this year did not impact the upper berm and we anticipate that this location will largely be unsuitable habitat, due to vegetation encroachment, for CATE next season. However, the placement of dredge material in the bowl of Rice Island will create more available habitat and require concerted effort to dissuade the entirety of the bowl in coming years.

The objective of the USACE was to ensure no DCCO attempted to nest on Rice, Miller, or Pillar Islands. This objective was accomplished and no DCCO were seen in the upland portions of any of these islands. All DCCO observations were below the high water mark. DCCO abundance and distribution appear to be similar to what has been discussed previously

with the Avian Management Team. However, depauperate reporting of DCCO abundance in these location makes contrast to previous years difficult at this time. That said, personal communication with researchers from other studies suggest that the abundance and distribution of DCCO above Rice Island on the pylons and navigation markers is similar to the last several years.

The placement of new dredge material in the bowl at Rice Island will create a challenge to next season's monitoring and dissuasion efforts. Collaboration with the Dredge Oregon crew resulted in terrain modification on the bowl area that will still allow bowl access for FFU personnel and might offer the opportunity to employ new dissuasion and monitoring techniques. Such techniques are actively being investigated. One primary alteration to the passive dissuasion effort that will be pursued next year will be the use of biodegradable ropes and flagging materials to limit the possibility of non-degradable materials entering the water. Any and all such changes will be presented to the Avian Management Team for consideration before implementation.

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Supplementary Table 1. Raw data for Rice Island Caspian Tern monitoring during the 2019 season. Dates not presented were not sampled.

Date	*n* CATE	*n* nest fill
4/16/2019	0	0
4/17/2019	0	0
4/18/2019	0	0
4/19/2019	0	0
4/23/2019	86	0
4/24/2019	0	156
4/25/2019	55	38
5/1/2019	60	0
5/3/2019	25	0
5/4/2019	33	15
5/5/2019	61	1
5/6/2019	55	0
5/7/2019	0	8
5/8/2019	7	0
5/9/2019	0	0
5/10/2019	15	0
5/11/2019	12	0
5/12/2019	34	40
5/13/2019	80	80
5/14/2019	275	103
5/15/2019	0	0
5/16/2019	193	5
5/17/2019	175	123
5/18/2019	85	0
5/19/2019	191	0
5/20/2019	150	40
5/21/2019	95	18
5/22/2019	58	38
5/23/2019	45	5
5/25/2019	28	40

5/26/2019	35	10
5/28/2019	35	9
5/29/2019	57	38
5/30/2019	42	1
5/31/2019	32	8
6/1/2019	16	32
6/2/2019	16	0
6/3/2019	1	0
6/4/2019	17	0
6/6/2019	25	0
6/7/2019	43	0
6/8/2019	11	0
6/13/2019	33	0
6/16/2019	30	0
6/30/2019	13	0
7/10/2019	206	0
7/23/2019	25	0