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POPULATION STATUS OF PACIFIC COAST CANADIAN SANDHILL CRANES ALONG THE LOWER COLUMBIA RIVER, OREGON AND WASHINGTON, USA

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POPULATION STATUS OF PACIFIC COAST CANADIAN SANDHILL CRANES ALONG THE LOWER COLUMBIA RIVER, OREGON AND WASHINGTON, USA

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Abstract: Pacific coast Canadian sandhill cranes (*Grus canadensis rowani*) breed in coastal regions of British Columbia and southeast Alaska and are considered a unique population within the Pacific Flyway. These cranes stage during fall migration along the Lower Columbia River at Sauvie Island Wildlife Area (SIWA), Oregon, Ridgefield National Wildlife Refuge (RNWR), Washington, and on adjacent lands. Peak numbers of cranes congregate here in late September through mid-October, with most of these cranes continuing south to winter in the Central Valley of California. During 2003-2024, we conducted single-day counts annually of cranes during peak fall migration as cranes flew into their evening roosts at SIWA, RNWR, and adjacent lands. We also conducted age-ratio counts at 1 of the primary roost sites on SIWA. Population counts indicated a significant upward trend ($Y = 81.35X + 3425$; $r^2 = 0.45$; $P < 0.001$) from 2003 to 2024, with peak annual counts of over 5,000 individuals in 5 of the past 8 years. The mean annual age ratio (% young in the roost) was 9.4% (SE = 0.4, $n = 22$, 95% C.I. = 8.7-10.2). Together, the population counts and age ratio counts indicate a stable to increasing population for this group of cranes that migrate through the Lower Columbia River in Oregon and Washington. The roost sites are on the public wildlife areas and are protected from threats of development; however, drought or other impacts to the hydrology of the area could threaten roosting habitat. Additionally, these cranes regularly forage on adjacent private agricultural fields; changes in crop plantings or land-use patterns from urban development would reduce the availability of this important foraging habitat for these cranes during fall stopover in this area.

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Key words: age ratios, *Grus canadensis rowani*, Canadian sandhill cranes, Lower Columbia River, Oregon, population status, Ridgefield National Wildlife Refuge, roost counts, Sauvie Island Wildlife Area, Washington.

Sandhill cranes (*Grus canadensis*) congregate and stage during fall migration along the Lower Columbia River on Sauvie Island Wildlife Area (SIWA), Oregon, Ridgefield National Wildlife Refuge (RNWR), Washington, and adjacent private farmlands. The subspecific status of these cranes was originally considered to be lesser sandhill cranes (*G. c. canadensis*), with an estimated 1,000-1,400 lesser sandhill cranes occurring on Sauvie Island during migration (Littlefield and Thompson 1981, Kramer et al. 1983). In 1982, however, Pogson and Lindstedt (1991) observed 893 intermediate-sized cranes at spring stage areas on Sauvie Island, one of the first indications that the cranes migrating through the Lower Columbia River were not entirely if at all lesser nor greater sandhill cranes (*G. c. tabida*) but rather the intermediate-sized Canadian sandhill cranes. In 2001-02, morphometric measurements taken from 8 cranes captured and banded on SIWA and RNWR and subsequent telemetry studies indicated that the cranes observed migrating through the Lower Columbia River in the fall of 2001 and 2002 and tracked subsequently in British Columbia and southeast Alaska were all Canadian sandhills (*G. c. rowani*) (Ivey et al. 2005). Furthermore, since 2002 there has been no evidence or indication of other subspecies of cranes using the Lower Columbia River in fall migration (G. L. Ivey, personal communication). Hence, these cranes staging along the Lower Columbia River are now considered a unique population of Canadian sandhill cranes that breed in coastal parts of British Columbia and southeast Alaska, migrating through the Lower Columbia River of Oregon and Washington each fall (Ivey et al. 2005). Most of these cranes in this coastal population continue south and winter in the Central Valley of California (Littlefield and Ivey 2002, Ivey et al. 2005), while an estimated 1,400 cranes remain and winter on and near SIWA and RNWR (Stinson 2017).

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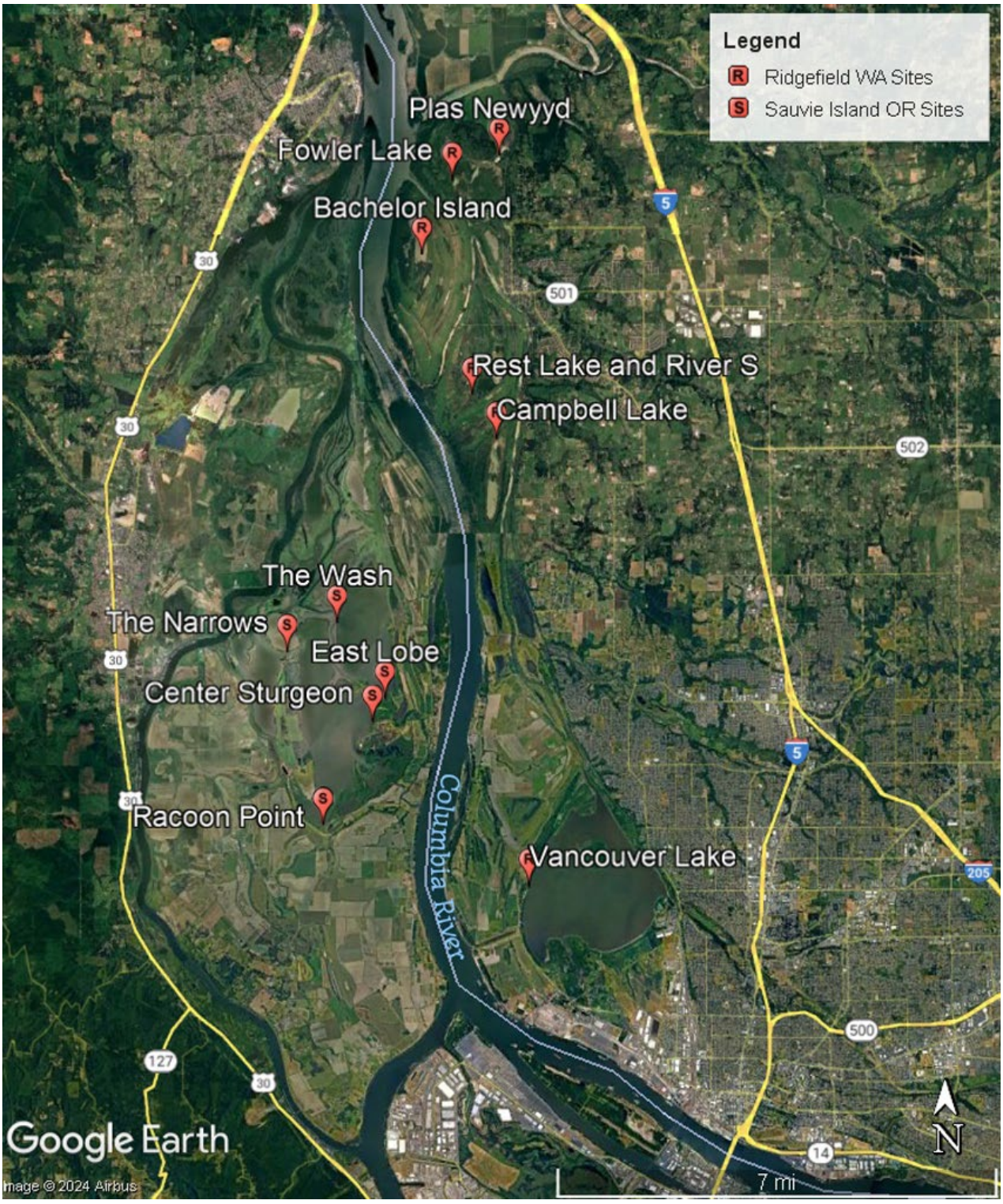

Fig. 1. Roost site locations used by Canadian sandhill cranes along the Lower Columbia River at Sauvie Island Wildlife Area, Oregon, and Ridgefield National Wildlife Refuge and adjacent lands in Washington, 2003-2024.

Counts of sandhill cranes at known staging areas during peak fall migration is one measure used to monitor the status of sandhill crane populations (Gerber et al. 2020). Age ratio counts at fall staging areas is a second parameter used to track annual recruitment and productivity of migratory birds, including sandhill cranes (Fronczak and Rigby 2019).

The objective of our study was to determine the status of this population of sandhill cranes. From 2003 to 2024, we monitored these cranes along the Lower Columbia River by conducting single-day counts annually of cranes during peak fall migration at their evening roost sites on SIWA, RNWR, and adjacent private lands. From 2003-2023, we also conducted annual age ratio counts of sandhill cranes at one of the primary roost sites on SIWA. We used these 2 measures, the annual fall single day counts and annual age ratio counts of cranes at these sites, to assess the status of this population of cranes that migrate through the Lower Columbia River in Oregon and Washington.

STUDY AREA

The 4,673-ha SIWA spans the northern half of Sauvie Island (10,000 ha) at the confluence of the Columbia and Willamette Rivers and the Multnomah Channel in Multnomah and Columbia Counties, Oregon. The 2,085-ha RNWR lies along the floodplain of the Columbia River amidst interwoven channels and lakes in Clark County, Washington. Both SIWA and RNWR have an elevation of 1-3 m above sea level. Cranes routinely moved back and forth across the Columbia River between these 2 sites. Cranes also used private agricultural lands on the southern half of Sauvie Island, east of Scappoose along the Multnomah Channel in Oregon and Squaw Islands, Vancouver Bottoms, and Woodland Bottoms in Washington. Habitats used included foraging areas, primarily corn, barley, and potato fields, pastures, and wetlands (Ivey et al. 2005). Roost sites were shallowly flooded lake bottoms. On SIWA, Sturgeon Lake (1,262 ha) was the primary roosting area. At Sturgeon Lake, cranes typically roosted in 4 or 5 locations within the various lobes, bays, and mudflats, viewable from 5 distinct locations: The Wash, The Narrows, Raccoon Point, East Lobe, and Center Sturgeon (Fig. 1). At RNWR, there were 4 distinct roost locations: Campbell Lake, Bachelor Island, Rest Lake-River S, and Fowler Lake, and a fifth site was also counted at nearby Vancouver Lake, a Clark County Park. Since 2016, cranes have also roosted and were counted at 1 site on private ground, Plas Newyyd Farm, located near RNWR.

Roost site water levels at both SIWA and RNWR are affected by tidal pulses from the Pacific Ocean, water releases from the upstream dams on the Columbia and Willamette Rivers, and annual precipitation. Depending on water levels, the precise area of use by cranes within these roost sites varied on any given day. Although there was some subtle shifting in the use of roost sites at Ridgefield NWR from 2003 to 2023 due to more favorable cropping plantings, specifically corn, at Cranes Landing nearby to Vancouver Lake, the pattern of use at SIWA was stable, and overall the areas and sites of use at both SIWA and RNWW were similar and predictable on a year-to-year basis. Typical roost sites had expansive areas of exposed wet mudflats adjacent to shallowly filled lake bottoms estimated to be typically 0-25 cm in depth. The vegetation adjacent to the roosting areas was primarily riparian, including black cottonwood (*Populus trichocarpa*), Oregon ash (*Fraxinus latifolia*), and Oregon white oak (*Quercus garryana*). The mudflats and lake bottoms were adequately expansive so that the cranes were able to congregate away from the edge of the lake, and overall the riparian and canopy vegetation along the shoreline did not seem to deter or otherwise influence the behavior of the cranes as they flew into the roost sites.

METHODS

Roost Site Counts

We coordinated a cooperative monitoring effort to track the population of migratory sandhill cranes during fall along the Lower Columbia River in Oregon and Washington. We did this by conducting single-day counts annually of sandhill cranes at all known roost sites during peak fall migration on SIWA, Oregon and on and near RNWR, Washington. Peak fall migration typically occurred within the first 2 weeks of October. Observers were discretely stationed at known roosting locations on SIWA, RNWR and adjacent private lands between 1700-1900 hours. The distance from observers to roosting cranes ranged from 0.1 km to 1.2 km. The observers used binoculars and spotting scopes to count cranes and were typically stationed 1.6 km or more apart, communicating with each other when necessary to ensure that cranes were not double counted. Where

possible, observation points with backlight sunlight were used to facilitate ability to view cranes from a greater distance. Cranes flying into, landing, and remaining at the roost sites were tallied, with a final count taken as daylight faded, around 1900 hours. Cranes were most often observed landing on the mudflats and sandbars, and then gradually moving into the adjacent shallow waters as dark descended. The counts for the roost sites on SIWA and for all sites on and near Ridgefield NWR were summed to provide a total count of roosting cranes for each year.

We used linear regression to evaluate trend in population counts over time and applied the Durbin-Watson statistic to test for autocorrelation (IBM SPSS Statistics for Windows, Version 27.0 Armonk, NY, USA; IBM Corp.).

Age Ratio

We also conducted annual age ratio counts of sandhill cranes at The Wash, a roost site on Sturgeon Lake, SIWA (Fig. 1). During 2003-2024, this roost site supported approximately 31% (n = 63,134) of all cranes roosting on SIWA, and 21% (n = 94,254) of all cranes roosting on both SIWA and RNWR. We selected this site because The Wash was consistently one of the main fall roost sites used by cranes on SIWA and because this site allowed us to discreetly view and age roosting cranes closely without disturbing them. In addition, this observation site faces east, and the late afternoon and early evening sunlight was at our backs, facilitating our ability to readily distinguish between adult and young of the year cranes. Young of the year cranes were typically observed with tawny grey-brown-orange plumage, lacking the distinct red crown of adults, and were readily identified with good lighting (Lewis 1979).

Single-day age ratio counts occurred between 20 September and 20 October each year, coinciding with the large aggregations of migrating cranes. We conducted the single-day age ratio counts in the early evening, between 1730 and 1900 hours, positioning ourselves at a vantage point along the shoreline in an opening amongst the cover of Oregon Ash. We used a Questar 40x scope. Cranes were within 75 m to 600 m from the vantage point. All single-day age ratio counts were conducted by M. Stern.

For each count, upon arrival at the observation point, we scanned and counted both the number of cranes in the flock, and the number young in the flock. As more cranes flew into the roost site, we repeated the process. We continued this repetition of scanning and re-scanning the entire flock and counting young within the roosting cranes until light faded. The single-day age ratio count for a specific evening was the last, most complete count. We conducted 5-7 single-day age ratio counts annually; in 1 year we conducted 4 counts, and in 2 years we conducted 9 counts. Typically we aged at least 1,000 individual cranes each year except in 2016 and 2023 when we aged 850 and 723, respectively.

For each year, we totaled together each of the single-day age ratio counts (no. young observed/total no. cranes aged), determining a total value for the percentage of young observed within the flocks for that year (% = total no. young observed/total no. cranes aged). We then used these annual age ratio values (n = 22) to derive a mean for the annual percentage of young in the flocks (2003-2024) and the associated standard error and 95% confidence levels (IBM SPSS Statistics for Windows, Version 27.0, Armonk, New York, USA; IBM Corp.).

RESULTS

Sandhill cranes staging in the fall along the Lower Columbia River in Oregon and Washington typically used 9 roost sites at SIWA and RNWR, plus 1 at Vancouver Lake, a county park, and a second on private lands, both nearby to RNWR. The cranes were predictable and consistent in the use of roost sites from year to year. On any given day, however, there was some variation in specific location of use within roost sites depending on water levels. In the fall single-day counts of cranes numbered 2,993-5,868 at SIWA and RNWR together (Table 1). Typically, a majority (67%, n = 94,254) of the counted cranes each year occurred on SIWA. Notably, in the past 8 years, there were 5 annual counts of over 5,000 cranes each, with the highest count of 5,868 cranes occurring in 2017. Overall, crane numbers for both areas combined from 2003-2024 indicated a significant upward trend (Fig. 2; $Y = 81.35X + 3425$; $r^2 = 0.45$; $P < 0.001$). No autocorrelation was detected in the linear regression at $P = 0.05$ (Durbin-Watson statistic = 1.701, greater than the upper critical value of 1.429 in test table; n = 22).

Table 1. Numbers of Canadian sandhill cranes counted at roost sites along the Lower Columbia River at Sauvie Island Wildlife Area in Oregon, and Ridgefield National Wildlife Refuge (NWR) and adjacent lands in Washington, 2003-2024.

Year	Total cranes counted	Sauvie Island Wildlife Area	Ridgefield NWR and adjacent lands
2003	4,041	2,021	2,020
2004	4,221	3,062	1,159
2005	3,536	2,142	1,394
2006	4,155	3,009	1,146
2007	4,056	2,658	1,398
2008	3,278	2,380	898
2009	2,993	2,252	741
2010	3,932	3,109	823
2011	4,174	2,330	1,844
2012	3,791	2,033	1,758
2013	3,351	2,345	1,006
2014	5,040	3,017	2,023
2015	3,695	3,056	639
2016	4,894	2,862	2,032
2017	5,868	4,015	1,265
2018	5,352	3,569	1,783
2019	4,545	3,011	1,534
2020	4,416	2,716	1,700
2021	5,103	3,278	1,825
2022	5,183	3,764	1,419
2023	4,746	3,183	1,563
2024	5,635	4,477	1,158

Table 2. Age ratio counts of Canadian sandhill cranes at The Wash on Sauvie Island Wildlife Area, Oregon 2003-2024.

Year	Total no. cranes aged	No. young cranes counted	No. counts	% Young in fall flock
2003	1,592	131	6	8.2
2004	1,020	112	5	11.0
2005	1,108	118	9	10.6
2006	1,465	144	6	9.8
2007	2,185	210	5	9.6
2008	1,720	122	6	7.1
2009	1,516	137	6	9.0
2010	1,849	162	6	8.8
2011	1,101	91	5	8.3
2012	1,165	109	5	9.4
2013	1,716	171	5	10.0
2014	1,162	86	6	7.4
2015	1,430	193	6	13.5
2016	850	101	5	11.9
2017	1,348	111	7	8.2
2018	1,183	136	6	11.5
2019	1,755	126	5	7.2
2020	2,617	157	9	6.0
2021	1,968	167	5	8.5
2022	1,364	148	7	10.9
2023	723	84	4	11.6
2024	1,103	94	5	8.5
TOTAL	31,940	2,910	129	9.1
Mean	1,452		5.9	9.4
SE	102		1.1	0.39
95% C.I.				8.7-10.2

For the age ratio counts conducted at The Wash between 2003 and 2024, we aged an average of 1,452 + 102 individual cranes annually. The mean annual rate of recruitment (percent of young in the fall flight) of young sandhill cranes at The Wash was 9.4% (SE = 0.4, n = 22, 95% C.I. = 8.7-10.2), ranging from 6.0% to 13.5% (Table 2).

DISCUSSION

Results for this study designed to monitor the population status of fall migratory Canadian sandhill cranes along the Lower Columbia River, RNWR and SIWA indicated an upward trend in crane numbers from 2003 to 2024 (Table 1, Fig 2). Anecdotal records from the late 1970s noted 1,000-1,400 cranes staging on Sauvie Island during migration (Littlefield and Thompson 1981, Littlefield and Ivey 2002), which is considerably fewer than what we subsequently observed in our study 20 to 45 years later. Previous single-day annual counts of sandhill cranes during fall migration at SIWA and RNWR (1991-2002) ranged from 1,242 to 4,273 (Table 3) (U.S. Fish and Wildlife Service, unpublished data), which is more than what was reported in the late 1970s but less than what we observed during 2003-2024. Overall, the numbers of cranes counted during these 3 different and distinct points in time support the conclusion that the population of cranes staging along the Lower Columbia River have been increasing over the past 40+ years. Littlefield and Ivey (2002) noted that any apparent increases or changes in these numbers between 1991 and 2002 may have been due to differences in survey effort. By 2003, in contrast to earlier population counts, survey methods employed had been refined for effort and overall consistency, with the results supporting our conclusion that this population is stable or increasing.

The fall population counts during 2003-2024 displayed annual variability (Fig. 1); this may reflect at least in part the limitation of the annual single-day count methodology. Specifically, while the annual single-day counts are conducted during the period of peak migration, it is possible that in any given year some cranes may have left early or arrived late, leading to under-counting cranes. Also, it is possible on any given day that some cranes may have used other secondary roost sites that we were not aware of, again leading to under-counting cranes in the area. It is also possible that cranes arriving at roost sites at dusk could have been missed and or potentially counted at more than 1 site. Nonetheless, recognizing the limitations of this survey method, the annual counts from 2003 to 2024 indicate a stable or upward trending population status.

Age ratio counts at major fall staging areas are a useful index and surrogate to estimate annual recruitment (Cowardin and Blohm 1992). The average annual recruitment of 9.4% young in the fall population of cranes at The Wash on SIWA was similar to values for annual recruitment reported for other populations of sandhill cranes in North America. The age ratio counts reported here are for one of the primary roost sites which accounted for approximately 21% of all cranes counted during each annual fall census. We acknowledge that age ratio counts may vary among roost sites within a given area (Fronczak and Rigby 2019), and it is possible that the fall age ratio counts at other roost sites at SIWA and RNWR may be different than what is reported here from this 1 site. We also acknowledge that multiple single-day age ratio counts taken at the same site in the same year may include "aging" some of the same cranes more than once. However, the number of cranes observed and "aged" each time varied and was influenced by multiple factors: a) the tidal pulse from the Pacific Ocean and the flow levels in the Columbia and Willamette River all contribute to differing water levels in Sturgeon Lake on a given sampling event, which affected where cranes congregated in the lake bottom and the proximity to the observer; b) proximity of recently harvested corn fields may influence which roost sites cranes use on a given evening; c) disturbance at the foraging sites may further distribute and redistribute cranes as they select an evening roost site; d) the positioning of cranes in the flock at the roost site, including whether cranes are spread out and easily observed/aged or alternatively bunched up in dense groups and not readily aged; e) weather, including sunlight, which can affect the distance at which cranes can be accurately aged; and f) cloud cover, which may affect the timing of arrival at the roost sites (clear sunny days cranes seem to arrive closer to sunset; dark cloudy days cranes arrive earlier). Also, rarely but sometimes disturbance at the roost from potential predators such as bald eagles (*Haliaeetus leucocephalus*) and coyotes (*Canis latrans*) caused further movement and mixing of cranes at the roost site. Overall, there was a constant shuffling of these factors so that the conditions and opportunity to age cranes varied among single-day sampling events, leading to different numbers of cranes and different individuals of cranes being viewed and aged on a given evening. The interplay of these factors and resultant variability in the cranes being aged on any given sampling event helped to ameliorate the concern about the potential for multiple counts of the same individuals at the same site in the same year.

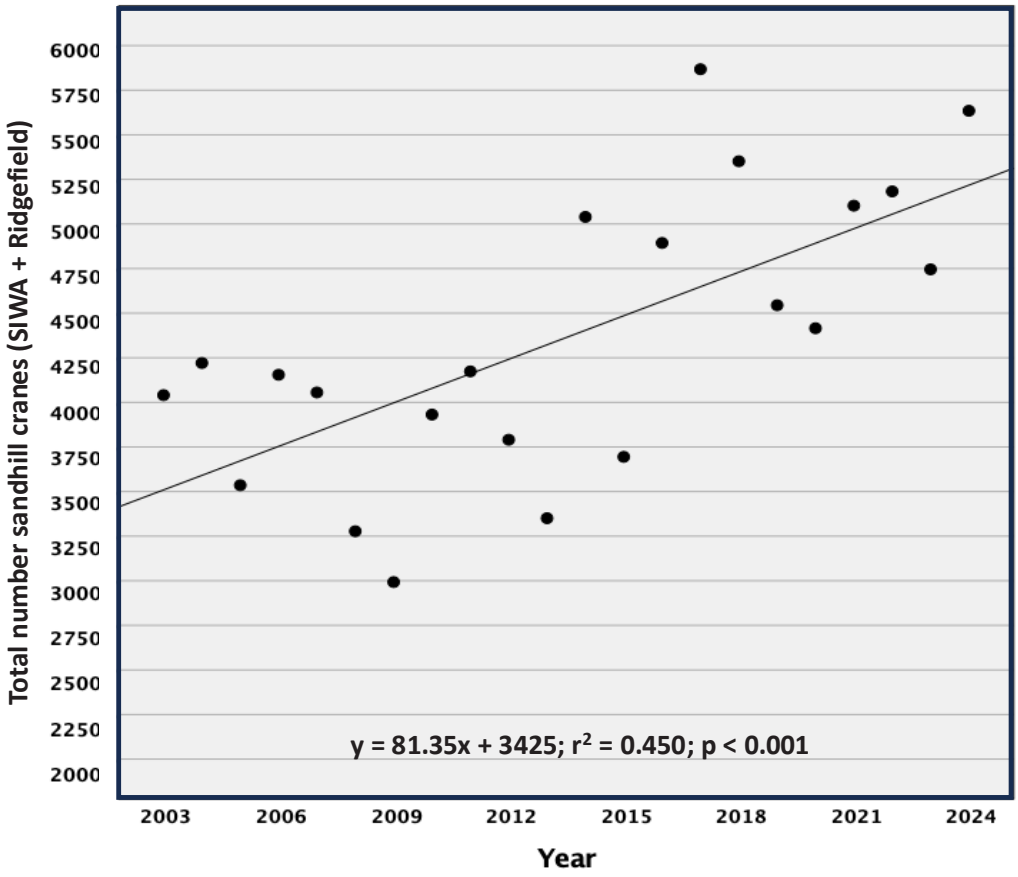

Fig. 2. Population counts of Canadian sandhill cranes at fall roost sites along the Lower Columbia River at Sauvie Island Wildlife Area (SIWA), Oregon, and at Ridgefield National Wildlife Refuge and adjacent lands (Ridgefield), Washington, 2003-2024.

Table 3. Numbers of Canadian sandhill cranes counted at roost sites along the Lower Columbia River at Sauvie Island Wildlife Area in Oregon, and Ridgefield National Wildlife Refuge (NWR) and adjacent lands in Washington, 1991-2002 (U.S. Fish and Wildlife Service, unpublished data).

Year	Total cranes counted	Sauvie Island Wildlife Area	Ridgefield NWR and adjacent lands
1991	3,234	2,368	866
1992	1,218	887	331
1993	3,033	2,592	441
1994	2,335	1,920	415
1995[a]	2,097	1,271	826
1995[a]	3,862	2,640	1,222
1996	3,615	2,440	1,175
1997	3,216	1,895	1,321
1998	4,273	3,281	992
1999	3,046	1,629	1,417
2000	3,994	2,265	1,729
2001	4,084	1,875	2,209
2002[a]	3,503	3,168	335
2002[a]	4,193	2,250	1,913

[a] In 1995 and 2002, the annual population counts were conducted twice, on 2 different evenings.

For comparison purposes, a mean annual rate of recruitment for greater sandhill cranes (*G. canadensis tabida*) at Malheur National Wildlife Refuge (NWR), Oregon of 8.0-10.0% was consistent with a stable population (Littlefield and Ryder 1968). However, between 1970 and 1989 annual recruitment at Malheur NWR was 6.7% (Littlefield 1995), corresponding with a 29% decline in the number of breeding pairs (236 to 168). In the Rocky Mountain Population of greater sandhill cranes, annual recruitment over 21 years averaged 8.1% (3.4-12.1%) (Drewien et al. 1995). More specifically in the Rocky Mountain Population, during 1972-1984 a mean annual rate of 9.6% was associated with a period of increasing population. During 1985-1992, an annual recruitment rate of 5.5%-6.1% was associated with a stable or slightly decreasing population (Drewien et al. 1995). Elsewhere, annual recruitment rates in 2013-2015 for the Eastern Population of greater sandhill cranes were 11.3% (95% C.I. = 10.5-12.2) (Fronczak and Rigby 2019) and was associated with a population increasing in numbers and an expanding range. The annual recruitment rate of 9.4% (95% C.I. = 8.7-10.2) reported here is consistent with and within the range of reported age ratio values from other populations of cranes in North America that are stable and/or increasing.

Overall, the annual recruitment value presented here is one indicator of the status of the coastal population of Canadian sandhill cranes in the Pacific Flyway and is consistent with and corroborates the upward trend in population numbers observed in the annual single-day fall population counts at roost sites on SIWA, RNWR and adjacent lands (2003-2024). Together, these 2 parameters—age ratio values and annual population counts—support the conclusion that the population status of Canadian sandhill cranes that migrate through the Lower Columbia River region in Oregon and Washington each fall is stable to increasing.

MANAGEMENT IMPLICATIONS

Fortunately, most of the roost sites used by Canadian sandhill cranes during fall migration along the Lower Columbia River in Oregon and Washington are on state and federal wildlife areas that are both protected and secured. These wildlife areas are managed for waterfowl and wildlife, which is entirely compatible with the needs of this population of cranes. The state and federal wildlife areas also provide important foraging habitats for cranes immediately adjacent to the roost sites which are also secure for the foreseeable future.

The primary threat to the roost sites in these wildlife areas is any potential change in hydrology that would affect the water levels in the roosting areas. Specifically, extended drought conditions leading to low water levels during the fall months could both diminish the suitability of the roosting areas and may also lead to the encroachment of weeds and other wetland vegetation including wapato (*Sagitaria latifolia*) onto the mudflats, decreasing the quality of the shallowly flooded lake bottom habitat.

In addition to using wildlife areas, these cranes also forage extensively on privately owned agricultural fields adjacent to the state and federal wildlife areas. The quality of these private agricultural lands could be diminished by changes in cropping such as planting of nursery stock, which does not provide suitable foraging habitat in place of corn, barley, and other food crops. Also, these private lands are adjacent to 2 large urban areas, Portland, Oregon and Vancouver, Washington, where growth pressures and changes in land-use could foster urban/industrial development and a corresponding reduction in the availability of food crops and associated foraging opportunities for cranes on nearby private lands.

In conclusion, there appears to be adequate habitat and carrying capacity to support this increasing population of Canadian sandhill cranes. Future changes in land-use on adjacent private lands, however, could limit or even reduce food resources and habitat, impacting the current carrying capacity of these Lower Columbia region for cranes staging here during fall migration. The implementation of working land conservation easements would be one strategy that could ensure that ongoing agricultural practices were compatible with and beneficial to the foraging habitat needs of cranes in this area. It will be important to monitor the status of these important habitat parameters particularly in the light of climate change and increasing pressures for urban and industrial growth from the nearby communities.

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