

2020

Columbia Wetlands Waterbird Survey



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Executive Summary

The Columbia Wetlands Waterbird Survey (CWWS) is a five-year (2015-2019) coordinated bird count that incorporated the efforts of more than 230 volunteer citizen-scientists. Volunteers collected baseline data on bird populations and bird diversity in the wetlands during migratory periods. The utilization of local active citizen-science volunteers proved to be an important strategy in the design of the study. By providing a citizen-science role, local residents became engaged with wildlife and local landscapes, which can help direct personal decisions leading to sustainable outcomes for the wetlands.

It is expected that this project will contribute significantly to the future management of the Columbia Wetlands ecosystem, as the CWWS documented 163 bird species that utilize this habitat, with 30 at-risk bird species. Single day bird counts determined that American coot, American wigeon, and mallard are the most common bird species in the wetlands during spring and fall bird migration. Aerial surveys documented that the Columbia Wetlands provides significant habitat to swans, and an osprey inventory determined that there are at least 60 osprey nests in the valley; 43 nests (71.7% of the total count) were observed to have some level of osprey activity in 2019. Three areas in the wetlands were determined to be important resting and feeding areas during migration as evidenced by the consistent high bird concentrations present at those locations. With the reported trend of decreasing global bird populations, this paper amongst other recommendations, suggests protecting these high valued habitat areas by designating them as refuges.

In addition to the important data collection and citizen-science engagement, this community-based project provided multiple opportunities to engage the local human population and visitors, all in the interests of enhancing and maintaining this unique ecosystem with its significant biodiversity values. A major outcome of this project is to use the data to nominate the Columbia Wetlands as a candidate area to be incorporated within the 'Important Bird and Biodiversity Area' (IBA) program. A decision on the IBA outcome is pending.

Columbia Wetlands Waterbird Survey 2015-2019

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1.0 Introduction

1.1 Background

The Columbia Wetlands is identified as an essential habitat component of the Pacific Flyway, which in North America, is the westernmost primary migratory bird corridor of which there are four (Wilson, 2010). This ecosystem plays an important role as migration stopover habitat for birds (Kaiser, McKelvey & Smith, 1977), providing a refuge where birds can fuel up and rest during the necessary long migratory flights requiring substantial amounts of energy. The Columbia Wetlands ecosystem has long been thought to provide important habitat to birds, but prior to the data collection of the Columbia Wetlands Waterbird Survey (CWWS), a project of Wildsight Golden, very little data had been recorded documenting composite bird populations and specific bird species distribution in the wetlands during bird migration.

A new study published in September 2019 estimates that 2.9 billion birds of various species have disappeared in Canada and the United States since 1970 – a population decrease of 29 per cent (Rosenberg et al., 2019). According to BirdLife International (2018), about one in eight bird species is threatened with global extinction due to factors such as: expansion of agriculture, logging operations, invasive species, hunting, and climate change. Climate change is expected to have broad and negative impacts across Bird Conservation Region 10 which includes the Northern Rockies (where the Columbia Wetlands are located) and particularly in alpine and wetland habitats where fluctuating water levels occur due to severe weather events (Environment Canada, 2013). The Columbia Wetlands and its habitat value to birds and other wildlife species continue to be under stress from a number of these identified threats; particularly relating to direct habitat losses, invasive species, transportation and utilities infrastructure, recreational pressure, climate change and other cumulative effects (Mahr, 2017).

Anthropogenic pressures are substantial in the Columbia Valley and agriculture is of concern. Land clearing removes trees needed by cavity-nesting waterfowl. Livestock grazing adds nutrients to water, promotes invasive species introduction, removes wetland vegetation, and results in trampling of riparian and emergent vegetation (Harrison et al., 2010), required by waterbirds for nest building material and food (Environment Canada, 2013). In one paper, Kaiser, McKelvey & Smith (1977) reported that a slough in Brisco had deteriorated to eutrophic status as a result of agricultural and domestic effluent. Surrounding land use pressures from increasing rural, urban and industrial developments result in cumulative pressures on birds.

Levels of non-motorized recreational use are increasing in specific locations (e.g. Althalmer to Radium, Fairmont), which are problematic for sensitive bird species. Several studies (e.g. (Korschgen & Dahlgren, 1992; Hockin et al., 1992; Korschgen, George & Green, 1985; Liddle & Scorgie, 1980; York, 1994) have reported a wide range of potentially detrimental behavioural patterns for waterbirds in response to recreationists, such as reduced foraging and resting periods; increased flushing, flight times and energy expenditure by birds reducing overall energy intake; increased nest abandonment and egg loss; discouragement of late-nesting pairs from breeding; disruption of pair bonds and parent-offspring bonds; reduced use of feeding, resting and breeding sites; repeat disturbances eventually cause ducks to nest elsewhere or not at all (Korschgen & Dahlgren, 1992). Birds are sensitive to human disturbance wherever they are present during critical phases of nesting and relocation during migration; both critical times influencing survival and procreation of bird species.

1.2 The value of IBA designation

With the documented decline and increasing threats to bird populations, protecting remaining habitats identified as being important or significant to birds is of paramount importance at this time.

“In order to conserve nature effectively, it is necessary to identify those places most important for biodiversity and therefore conservation action. Important Bird and Biodiversity Areas—IBAs—constitute the largest and most comprehensive global network of sites that are significant for the global persistence of biodiversity” (Birdlife International, 2018).

Identifying and conserving IBAs is a critical measure to safeguard migratory flyways, directing the importance and awareness to the value of nature. Although non-regulatory, conveying IBA status to a valuable and fragile ecosystem is desired at a community level as it implies the necessity for conservation planning and stewardship. The IBA program is increasingly being viewed as a framework for not only bird conservation, but for overall biodiversity preservation (Couturier, 2012). The IBA framework is now being adopted as a global standard for identifying and designating the world’s biodiversity hotspots, known as ‘Key Biodiversity Areas’ (KBAs). The IBA status, when assigned, additionally brings innovative economic opportunities to the identified sites, including increased tourism related to birding. Tourism related to IBA designation generates awareness and engagement in bird conservation activities.

Wildsight (an environmental non-governmental organization from southeastern British Columbia) made an application to nominate the Columbia Wetlands into the IBA program in 2014. While the Columbia wetlands was widely recognized as providing important habitat for birds (BC FLNRORD, n.d.; Environment Canada, 2014; Harrison et al., 2010; Kaiser, McKelvey & Smith, 1977), the application was not supported due to insufficient data. In adjudicating that application, Bird Studies Canada (BSC) and BC Nature (IBA program coordinators in Canada and BC respectively) stated that in the absence of recent supporting data to show that thresholds for IBA criteria had been met or exceeded, the application could not be approved. Subsequent to the 2014 application, several agencies including BSC, BC Nature, Canadian Wildlife Service, Canadian Intermountain Joint Venture, and Ducks Unlimited Canada, have encouraged Wildsight to collect the data necessary to resubmit the nomination of the Columbia Wetlands for IBA status. Bird Studies Canada stated that at least five years of consecutive data collection was needed before they would be able to make a decision regarding possible IBA designation.

The Columbia Wetlands Waterbird Survey (CWWS) protocol was conceived and managed by the author of this paper, a consulting biologist to Wildsight Golden. The project was initiated in 2015 with the intention of collecting five years of consecutive bird data. The major goals of this project were:

1. Design of a study incorporating a citizen-science opportunity for Columbia Valley residents,
2. Promote increased appreciation and recognition for birds and the Columbia Wetlands by providing diverse educational opportunities, and;
3. Collect baseline data on bird populations to support IBA designation for the Columbia Wetlands.

2.0 Study Area

The Columbia Wetlands (UTM: 0534506; 5650169) are located in southeastern British Columbia, in the Rocky Mountain Trench located between the Rocky Mountains and the Purcell Mountain Range. The CWWS study area extends from Canal Flats to Donald (Figure 1). Survey stations cover approximately 39% of the study area; the entire Columbia Wetlands complex. The Columbia Wetlands are part of the traditional territory of the Ktunaxa Nation, Secwepemc First Nation, Shuswap First Nations Band and Metis Nation Columbia River. Approximately half of the wetlands lie within the Regional District of East Kootenay (RDEK) Areas F and G, the other half are located within the Columbia Shuswap Regional District (CSRD) Area A. A number of communities are located adjacent to the wetlands, including

Fairmont, Invermere, Radium, Brisco, Spillimacheen, Parson, Nicholson and Golden.

Subsequent to an earlier nomination made by Wildsight, the Columbia Wetlands were identified as a Ramsar site under the Ramsar Convention in 2005. Ramsar status recognizes this ecosystem as a wetland with international significance. The Ramsar Convention’s mission recommends and encourages “the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world” (Ramsar, 2014).

Conservation parcels exist within the Columbia Wetlands along the Upper Columbia River floodplain, owned by The Nature Trust (TNT) of BC and The Nature Conservancy of Canada. A further 21.2% is private land which includes the First Nation Reserve Lands (BC Hydro, 2014). The TNT properties are leased to, and managed by Environment and Climate Change Canada’s Canadian Wildlife Service. Approximately 60.1% of the Columbia Wetlands has been designated as a Wildlife Management Area (WMA) (BC Hydro, 2014), with the provincial government (Ministry of Forests, Lands, Natural Resource Operations and Rural Development) as the land managers. By definition, a WMA is an area of land designated under section 4(2) of the *Wildlife Act* for the benefit of regionally to internationally significant fish and wildlife species or their habitats. While the WMA status is an important conservation designation, according to the IUCN Protected Areas Categories — the WMA designation (i.e. Managed Resource Protected Area) offers the lowest form of protection for a conservation area (IUCN, 2017).

The use of land-based motorized recreational vehicles is prohibited in the Columbia Wetlands; there may be no person in the wetlands with any conveyance that has ten horsepower or more (Phase II Ventures, 2019). The wetlands receive additional levels of protection through a three-part set of boating regulations that were enacted by Transport Canada Marine Safety and Security. The first two regulations amending vessel operation in the Columbia Wetlands came into effect in 2016, and are described as:

- 1) *A prohibition on the operation of power-driven vessels and vessels driven by electrical propulsion in the wetlands of the Columbia River.*
- 2) *A prohibition on towing persons on water skis, surfboards, or other similar equipment in the main channel of the*

Columbia River, at any time.[An exception has been made for trappers holding a provincial licence who require access to the wetlands year round and to the main channel during the seasonal closure. These persons operate small boats with small motors and their industry association is intensively aware of wildlife issues in the area. An exception has also been made for persons engaged in subsistence hunting and trapping (Department of Transport, 2009)].

In 2016, the final piece of the three-part Transport Canada boating regulations came into effect.

This regulation prohibits vessel operation on the main channel of the Columbia River, and its tributaries within the floodplain, to a motor with an engine power of 15 kilowatts or less (Department of Transport, 2016).

The wetlands provide important habitat for a number of migratory and resident birds (many of which are imperilled), as well as for several other wildlife species, including several considered to be at-risk, e.g. painted turtle (*Chrysemys picta*), American badger (*Taxidea taxus*), and several bat species (*Myotis spp.*). The Columbia Wetlands is located in the southern interior mountains planning area under the auspices of the Canadian Intermountain Joint Venture (CIJV) operating under the North American Waterfowl Management Plant, a bird habitat-based joint venture stretching across Canada, the United States and Mexico. The goal of the CIJV is to incorporate scientific principles and partnerships to implement habitat based conservation projects that will sustain healthy populations of migratory birds (Harrison et al. 2010). The CWWS has over time compiled a substantial database on a number of the CIJVs priority birds, including American wigeon (*Mareca Americana*), green-winged teal (*Anas crecca*), hooded merganser (*Lophodytes cucullatus*), lesser scaup (*Aythya affinis*), mallard (*Anas platyrhynchos*) and trumpeter swan (*Cygnus buccinator*).

Columbia Wetlands Waterbird Survey 2015-2019

wildlight golden Columbia Wetlands Waterbird Survey

The Columbia Wetlands Waterbird Survey (CWWS) was implemented in Spring 2015 and aims to run for at least 5 consecutive years. It is a project that uses citizen-scientists to gather important scientific data. Our hope is that this data will be useful for a variety of conservation purposes including possible Important Bird Area (IBA) designation for the Columbia Wetlands.

The main goals of the CWWS are to:

- a) collect baseline data currently lacking on our birds;
- b) initiate a coordinated bird count utilizing citizen-scientists during both spring and fall waterbird migrations;
- c) create a long-term volunteer opportunity for Columbia Valley residents;
- d) build increased appreciation and recognition for birds and their critical habitat in the Columbia Wetlands.

- Legend
- Community
 - Survey Site
 - Wetland
 - Provincial Park
 - National Park
 - Industrial Area
 - Private Land
 - Agricultural Land Reserve
 - Survey Area
 - Private Conservation Land
 - National Wildlife Area
 - Columbia Wetlands
 - Wildlife Management Area
 - East Site Columbia Lake
 - Wildlife Management Area



Map Produced by: Jan Pindroch
 Saskatchewan Research Centre
 Datum: North American 1983
 Projection: UTM Zone 11N
 July, 2016

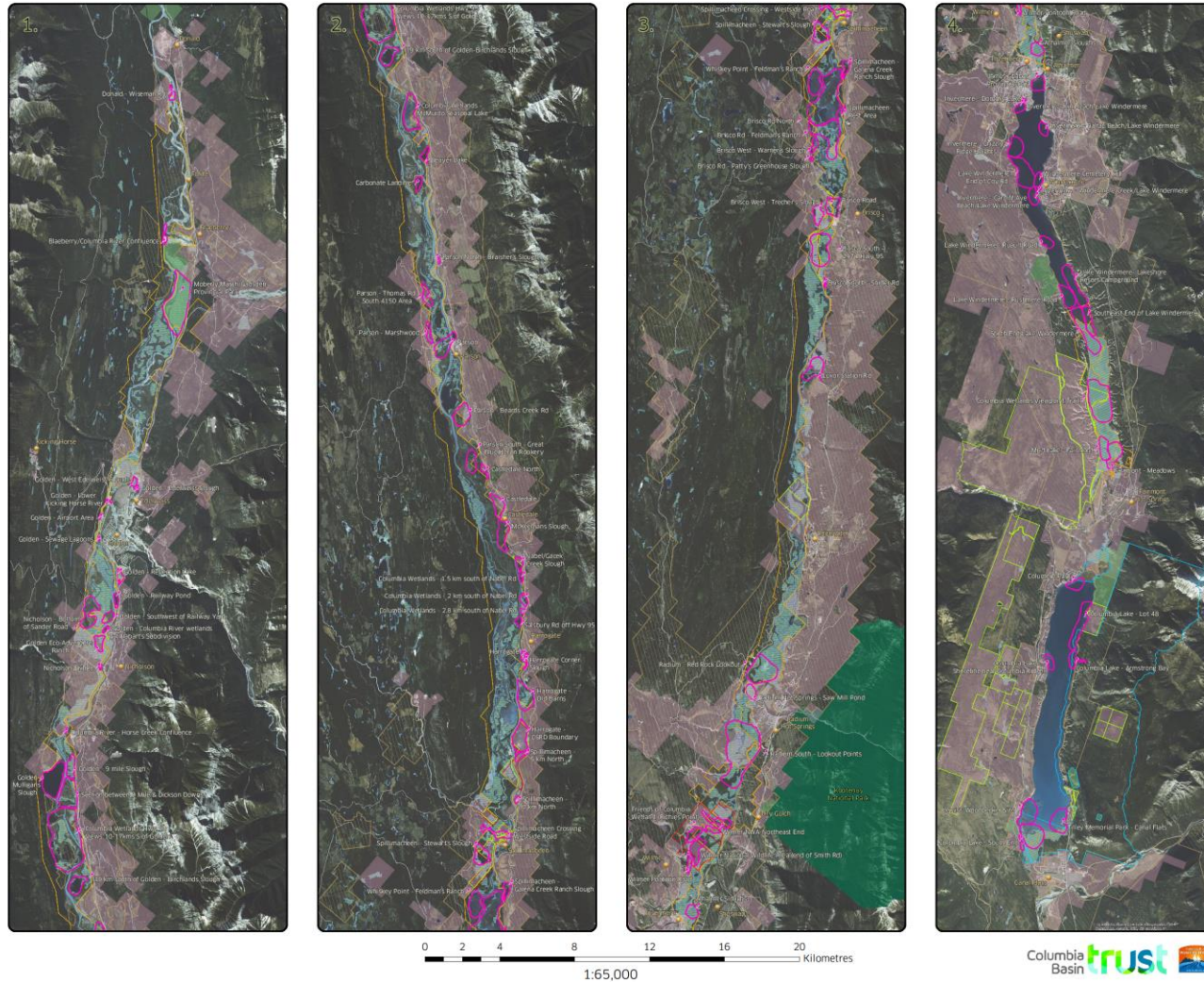


Figure 1. The Columbia Wetlands Waterbird Study Area, outlining survey station polygons and major land designations.

3.0 Methods

3.1 Survey stations

The CWWS is a coordinated bird count utilizing citizen-scientists (number of volunteer participants varied from season to season) to simultaneously survey 115 survey stations in the Columbia Wetlands on specific survey dates during spring and fall migration. Surveys were scheduled to occur during peak waterfowl migration periods (spring and fall), to ensure maximal bird count in the chosen survey area. Due to the inaccessible nature of many potential survey stations within the Columbia Wetlands, the chosen survey stations were selected based on a number of factors including: accessibility, potential habitat suitability for waterbirds, local knowledge of bird clustering, private land owner permission, and known eBird data.

The CWWS survey stations encompassed a diversity of habitat types of variable sizes within the Columbia Wetlands including marshes, shallow water wetlands, adjacent agricultural fields, the Columbia River main stem and side channels. Typically, CWWS survey areas were viewed from a single viewing location, although some stations required travelling a short distance (50 meters to 2 kilometers) by car or on foot. Many survey stations were located alongside Highway 95 or Westside Road, whereas other stations required use of forestry roads (e.g. Radium Mill Pond) or walking on foot (e.g. Moberly Marsh, Fairmont Meadows). Survey stations were located at varying distances to one another. In most scenarios, volunteers lived within a relatively short distance to the stations they monitored, helping facilitate consistent monitoring to count waterbirds (Badzinski et al., 2005). Survey station descriptions including directions had been prepared and forwarded to volunteers ahead of survey dates. Spatial digital polygons for each survey station were generated on Google Earth Pro (Version 7.3.0.3832) and pdf maps were emailed to enrolled volunteers. These spatial maps were included in packages prepared for volunteers prior to the surveys, to ensure a clear understanding of areas to be covered during waterbird surveys.

3.2. Volunteer training and recruitment

In pursuit of fostering a conservation ethic in people of all ages and variable birding ability, specific efforts were made to encourage individuals of all ages and birding expertise to participate. Volunteer bird surveyors were recruited utilizing poster distribution, press releases in local newspapers, public presentations, social media, email newsletters, partnering organizations websites, word of mouth, radio interviews, magazine articles, birding fieldtrips, and Wings Over the Rockies festival guide. All CWWS volunteers were strongly encouraged to attend pre-survey workshops (training modules); a study program to enable participants to attain competence in the identification of the waterbird species most likely to be encountered during waterbird surveys.

The pre-survey workshop outlined the CWWS project goals and objectives, the CWWS survey protocol, the field datasheet that was to be used to record data, the process of online data entry using eBird, and the various techniques for counting flocks. The focus of each of these workshops was to teach identification techniques for target waterbird species. The Program Biologist of the CWWS developed this study guide to aid volunteers in the identification process, entitled ‘Columbia Wetlands Waterbird Survey: Waterbird Identification Guide.’ The guides were printed and distributed to each of the volunteer bird surveyors. Participants were encouraged to become familiar with, at a minimum, at-least all the birds in the supplied guide. Waterbirds have been defined by the Ramsar Convention as “species of bird that are ecologically dependent on wetlands” (Wetlands International, 2017). Experienced birders were assigned to monitor birds at survey stations where birds were expected to be present in highest abundance, whereas the more novice birders were appointed to survey stations with fewer birds expected, or they were partnered with birders designated by the CWWS project as experienced.

3.3 Survey protocol

During year one of the CWWS (2015), the optimal timing for surveys was chosen (i.e. peak abundance of migrant waterbird species present in the Columbia Wetlands), based upon local knowledge of the area by experienced resident birders. Following research and discussion, the following survey dates were chosen: April 24, April 29, May 4, and September 29, October 5, October 15, October 25. In the remaining years of survey effort (2016-2019) these chosen survey dates remained consistent; three bird counts occurred in the spring (April 3, 10, 16) and three counts during the fall (September 29, October 5, October 15). The bird surveys occurred on those specific dates regardless of weather conditions on the appointed date. Surveys took place from 0800-1100 hrs on each of the three spring survey dates, and from 1000-1300 hrs during the fall surveys to accommodate for recurrent early morning fog, a consistent condition often encountered in the fall. If a surveyor had multiple stations to cover, they needed to ensure that they were at their last survey station by either 1100 hrs in the spring or 1300 hrs in the fall, and counted and identified all birds at their final count.

The survey time varied at each survey station dictated by a number of factors, including: the familiarity with optical equipment, size of survey station, level of individual birding skill, and the time required to identify, count, and record the varying numbers of waterbirds present. All volunteers were instructed to remain at a survey station for the amount of time needed to count and identify all birds present. Each survey station was scanned for a minimum of five minutes, even if birds were not present. To avoid double counting of birds flying from one survey station to an adjacent station, the CWWS coordinated volunteers to attend specific survey stations simultaneously. Based on size of survey stations, expected flock sizes, station proximity and surveyor experience, some surveyors monitored several individual survey stations within a single three-hour survey period — predetermined prior to survey dates. Once at a survey station, all

surveyors were required to use either a pair of binoculars and/or spotting scope with tripod enabling the identification of waterbirds to a distance of at least 500 meters or to the edge of the wetland (whichever was closer). To ensure uniformity of this protocol, the CWWS acquired 13 sets of high optical gear (spotting scope/tripod), lent to those surveyors requiring the need of this equipment.

At each individual station, surveyors recorded total counts for each bird species present. While waterbird species were the focus of the CWWS, all bird species were identified at each station to the best of each observer's ability using both visual and aural detection techniques. Some of the stations required surveying birds at long distances; an expected impediment to positively identify birds to a species level. For unknown species, it was recommended that volunteers make best efforts to get as close as possible to assigning specific bird species names. As an example, if a volunteer believed that they were identifying either a horned or eared grebe but were unable to determine with certainty what specific species was being observed (due to marked similarity in non-breeding plumage) — those birds would be counted and recorded as 'horned/eared grebe'.

Birds that were flying overhead were not counted, unless those birds were observed to be directly related to use of wetland habitat (hunting, resting, feeding, or drinking). Not counting birds flying overhead also avoided double counting as those individual birds or flocks could potentially land at another individual's survey station and subsequently be counted twice. In addition to bird data, surveyors also recorded weather conditions, visibility, human activity, and other notable points of interest to the observer.

3.4 Data management

Subsequent to data being transcribed on hard copy data forms, all volunteers were encouraged to enter the data that they had collected in the field into the eBird Canada database maintained by the Cornell Lab of Ornithology. If they did not, hard copy forms were entered into eBird by CWWS project staff. Once submitted into the eBird database, all CWWS data was reviewed by CWWS staff and/or by an eBird reviewer. To maintain data integrity, any data uncertainties (e.g. entries of rare birds or high counts) were followed up on by CWWS staff and/or eBird reviewers, with the volunteer(s) who recorded the observation. All 2015-2019 CWWS data arising from spring and fall ground-based surveys were additionally transcribed into a standard template as defined by the British Columbia Provincial Government and subsequently submitted to the provincial data warehouse for species and ecosystems; British Columbia Species Inventory Information System (SPI). These 2015-2019 SPI datasets are available online through the provincial SPI data warehouse.

3.5 Aerial surveys

Tundra swan (*Cygnus columbianus*) and trumpeter swan species have historically been observed to migrate through the Columbia Wetlands ahead of the peak waterfowl migration window. Following the recording of previous swan counts from aerial surveys conducted in 1977, the trumpeter swan species was thought to hold potential to trigger IBA status for the Columbia Wetlands. In follow-up of this outcome, CWWS aerial surveys occurred from 2016-2019 in attempts to count the number of swans during their peak period of migration through the wetlands. The timing of the aerial swan surveys was scheduled to occur during periods of highest concentrations of swans reported by local observers and CWWS staff.

- On March 23, 2016, a fixed-wing aircraft was utilized for the swan survey. The flight began in Invermere at 0912 hrs and ended in Invermere at 1312 hrs; the survey began at the north end of Columbia Lake and extended north to Donald.
- On on March 26, 2017, a helicopter was utilized as there were no fixed-winged aircraft available in the region at that time. The survey began in Golden at 1425 hrs and ended at the north end of Columbia Lake at 1525 hrs.
- The April 9, 2018 survey lasted from 1046 hrs until 1141 hrs, which was undertaken in a fixed wing aircraft. This flight departed from Invermere and headed south with the swan count beginning at the south end of Columbia Lake terminating in Golden. A ground-based count was undertaken from the south end of Columbia Lake to count any swans present there, as the aerial survey did not cover the south end of that lake.
- The April 8, 2019 survey went from 1036 hrs until 1141 hrs, and departed from Invermere, following the same flight plan as the previous year (north end of Columbia Lake to Golden). As in the previous year, a ground-based observation team was assigned to the south end of Columbia Lake to count any swans present, as the aerial survey again did not cover the south end of that lake.

It was not possible to differentiate Tundra Swans from Trumpeter Swans from their air due to the similarities between species and due to the far viewing distance to the birds. In all four years of aerial survey effort, an observation team of three-four people was utilized in addition to the pilot. Two surveyors counted all swans off their respective side of the aircraft and the number of swans seen at each location was recorded, along with the GPS coordinates. All data was entered into an excel database and locations were recorded onto a Google Earth Pro .kmz file.

3.6 Osprey surveys

Osprey (*Pandion haliaetus*) inventories were undertaken to count the number of osprey nests in the valley, in addition to determining the occupancy and use of those nests. To locate nests, a poster was designed and distributed throughout the Columbia Valley to solicit the input of local residents to identify location of known nests (Appendix 1). A press release announcing this effort was distributed to local newspapers and disseminated through social media. The Columbia Wetland and adjacent land base were surveyed by vehicle and visually scanned by observers identifying all of the nests that could be spotted in Canal Flats, Fairmont, Windermere, Invermere, Radium, Brisco, Spillimacheen, Horse Creek, Golden, as well as along Highway 95 South, and the off roads connected to this major transportation route.

The first of three rounds of nest observations were undertaken between May 6 and May 23, 2019; with the majority of nest observations occurring on May 6 and 7, 2019. The second group of nest observations were undertaken between July 25 and August 4, with the majority of observations being recorded between July 26 and 27. This second round of observations was determined to be the best windows to count early-hatched young preparing to fledge (leave the nest). Observations continued for a time frame of at least five minutes at each nest, as this is the amount of time between rest periods that chicks are thought to move about, with detection of movement being the most useful parameter to determine nest occupancy (Moore & Arndt, 2016). The final visit took place between August 6 and 26, with the majority of observations recorded on August 15 and 16, 2019. Most of the observations were recorded by the CWWS program biologist, although volunteers completed surveys at some specific nesting locations.

4.0 Results and Outcomes

As noted earlier, it is important to emphasise that while the waterbird species (waterfowl in particular) were the focal species of this project, volunteer surveyors were encouraged to record all of the birds that they could identify both aurally and visually at each survey station. Some volunteers had a more proficient birding expertise and thus, were able to more accurately count and identify a greater number of species including song birds or passerines. In total, 163 different bird species (not including additional taxa such as gull species) were identified during the five year CWWS project. A complete species list is documented in Appendix 2.

There were 115 survey stations used in total over the duration of the CWWS; of which the name and locations for all survey stations can be found in Appendix 3. During the initial year of this project in 2015, there were approximately 60 survey stations utilized. In 2016, there were 84 stations in spring, and 86 in the fall. In 2017, there were 97 stations during spring surveys, and 103 survey stations used in the fall. In spring 2018 there were 105 stations, and 106 used during fall surveys. During 2019, 102 survey stations were used in the spring, and 103 during fall of

2019. Due to unforeseen circumstances (e.g. volunteer illness, private property limitations), not all survey stations had bird surveys completed on each of the survey dates, or during each survey season.

A report entitled ‘Columbia Wetlands Waterbird Survey 2015-2017 Progress Report,’ was completed in December 2017, and reported in detail the results of the 2015-2017 waterbird surveys. To avoid repetition of that preliminary paper and its described results, this subsequent report will list only specific results of the 2018-2019 years of survey effort. In formulation of general conclusions and recommendations however, this paper will encompass information relating to all five years of collected data.

4.1 Columbia Wetlands Waterbird Survey 2018

4.1.1 Spring surveys in 2018

A total of 79 surveyors participated in waterbird surveys in the spring of 2018, with 310 surveys/checklists completed over the three survey dates (See Table 1). There were 48,266 individual birds counted during the three dates. The highest single day count occurred on April 16 when 19,925 individual birds were recorded on 104 checklists and 99 different species recorded (Table 1). The highest count for an individual species was for mallard at 4,817 individuals on April 10 (Appendix 4). The second highest species count was also for 4,023 mallard on April 16. (Appendix 4). The third highest count for an individual species also occurred on April 3, again for mallard with 3,438 individuals on April 3. A large number of birds were not identified to species level, for instance, 3,141 individual birds were recorded as unknown duck species on April 16.

The highest overall abundance of birds was recorded at ‘Brisco Rd North’, the large, shallow open-water wetland patches located between Brisco and Spillimacheen (0546084; 5633382). This area contains several large open water bodies as seen in Figures 2 and 3. On April 16th, 3,140 individual birds were sighted in a concentrated area; an estimate of 1,896 of these birds were recorded as unknown dabbling duck species seen in large rafts located 1.8-2.7 kilometers away from the observation point. There were also 704 mallard, 150 American coot (*Fulica americana*), 140 American wigeon, 125 northern pintail (*Anas acuta*), as well as 12 additional species seen at ‘Brisco Rd North’ on this date. The second highest account also occurred at Brisco Rd North on April 10 with 1,604 individual birds and 23 species. Appendix 4 provides data on the number of each individual species identified during each spring CWWS survey date.

4.1.2 Fall surveys in 2018

During the 2018 fall waterbird surveys, 105 volunteers participated on three survey dates. This was the highest amount of volunteer participation that the five-year CWWS project received (Table 1). In total 57,057 birds were recorded on 307 checklists over the three survey dates. This was the highest count over a three-day survey period during the five study years. The CWWS also had the highest single day count of the five year study period on October 15 with 20,575 individual birds recorded at 102 survey stations (see Table 1). The highest count for an individual species during the five-year project also occurred on October 10 with 6,495 American coots (Table 2) (Appendix 5). The second most abundant bird was American wigeon with 6,113 individual birds on October 15. The third highest count for an individual species was American coot with 4,892 individuals on September 29.

Similar to the 2018 spring counts, the survey station with the highest concentration of migratory birds was again at ‘Brisco Rd North,’ where 3,488 individuals were recorded on October 15; 1,292 were identified as American wigeon; 1,008 as dabbling duck species; 410 American coot; with 13 other species and two taxa (teal species, gull species). This was the fourth highest overall count recorded from a single survey station over the duration of the project (Table 3). The second highest concentration of birds during the fall 2018 surveys was also on October 15 with 2,728 birds at ‘Golden-Mulligan’s Slough’. The third highest was also on October 15 at the ‘South End Lake Windermere’ with 2,302 individual birds (17 species). Large concentrations of American coot and American wigeon frequently viewed from the ‘South End Lake Windermere’ during fall counts can be seen in Figures 4 and 5.

Table 1. Number of species, individual birds, volunteers and checklists submitted during each survey date (2015-2019).

Date	No. of Species	No. of Birds	No. of Checklists	No. of Volunteers
2015-04-24	70	5,870	62	32
2015-04-29	77	4,974	62	29
2015-05-04	82	4,047	57	35
Totals	104	14,891	181	41
2015-09-29	43	6,618	52	20
2015-10-05	63	14,086	55	27
2015-10-15	55	11,159	55	29
2015-10-25	53	6,479	60	35
Totals	83	38,342	222	63 (includes class of 20 kids)
2016-04-03	65	9,260	83	56
2016-04-10	71	9,971	86	58
2016-04-16	70	6,713	79	54
Totals	90	25,944	248	77
2016-09-29	63	13,968	78	49
2016-10-05	60	16,597	85	52
2016-10-15	63	20,822	85	57
Totals	79	51,387	248	76
2017-04-03	66	8,417	100	61
2017-04-10	69	7,871	94	63
2017-04-16	74	10,273	96	60
Totals	91	26,561	290	82
2017-09-29	81	16,884	95	51
2017-10-05	87	16,431	95	50
2017-10-15	77	17,507	95	63
Totals	94	50,822	287	85
2018-04-03	67	11,845	104	60
2018-04-10	83	16,496	102	64
2018-04-16	99	19,925	104	63
Totals	88	48,266	310	79
2018-09-29	93	16,492	105	73
2018-10-05	87	19,990	100	55
2018-10-15	82	20,575	102	65
Totals	89	57,057	307	105
2019-04-03	78	8,285	101	63
2019-04-10	96	8,626	101	67
2019-04-16	93	8,666	99	69
Totals	94	25,577	301	92
2019-09-29	76	11,892	101	57
2019-10-05	94	15,750	102	66
2019-10-15	86	13,453	102	61
Totals	90	41,095	305	97

Table 2. The ten highest species counts during the 2015-2019 CWWS.

Date	Species	No. of individuals
2018-10-05	American coot	6,495
2018-10-15	American wigeon	6,113
2017-09-29	American coot	5,070
2018-09-29	American wigeon	4,842
2018-04-10	mallard	4,817
2016-10-05	American wigeon	4,785
2018-10-15	American coot	4,385
2017-10-15	American wigeon	4,369
2018-04-16	mallard	4,023
2016-09-29	mallard	3,989



Figure 2. Brisco Rd North survey area as seen from the air during an aerial survey on October 10, 2017.

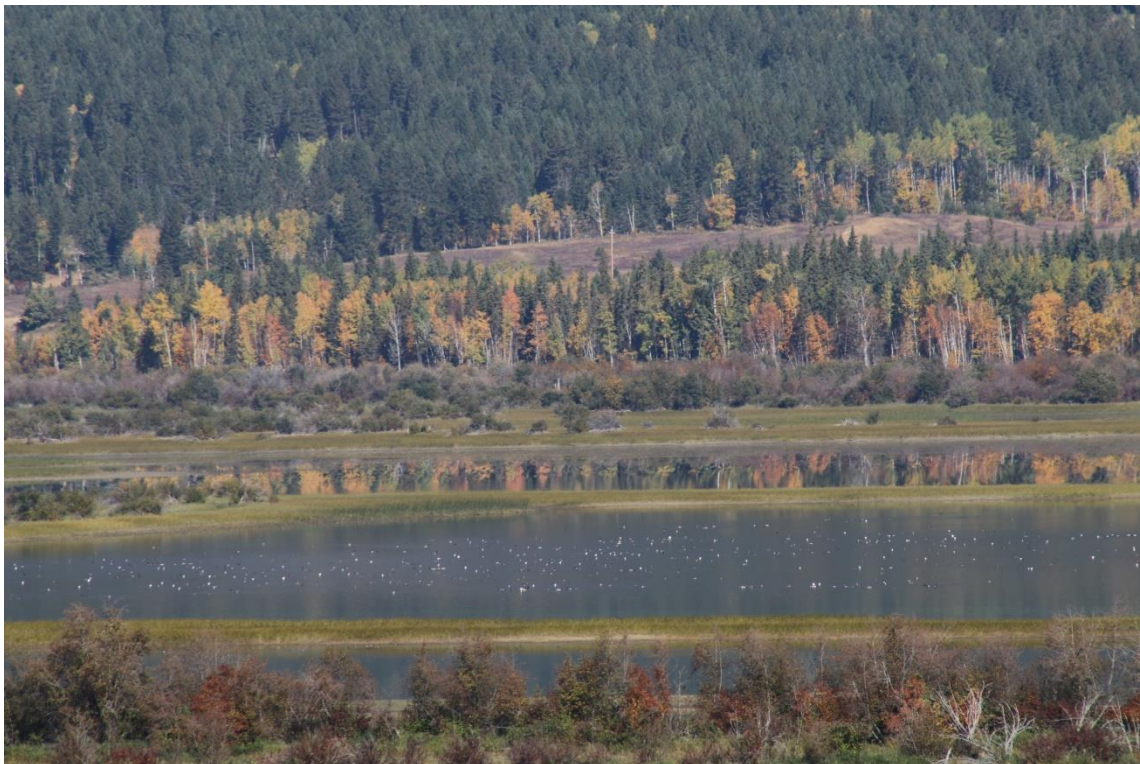


Figure 3. Brisco Rd North showing part of large bird concentration present as viewed from focal point at survey station on October 5, 2017.

Table 3. Survey stations with highest bird abundance during the 2015-2019 study period.

No.	Survey Station (n=115)	Total # of Individuals	Total # of species	Date
1	Columbia NWA (Wilmer Unit) - Richies Point	4,601	18	Oct 15/2016
2	South End Lake Windermere	4,587	17	Sept 29/2017
3	Columbia NWA (Wilmer Unit) - Richies Point	3,593	6	Oct 5/2015
4	Brisco Rd North	3,488	18	Oct 15/2018
5	Brisco Rd North	3,140	21	Apr 16/2018
6	South End Lake Windermere	2,955	9	Oct 15/2017
7	Golden-Mulligans Slough	2,728	7	Oct 15/2018
8	South End Lake Windermere	2,582	23	Oct 5/2016
9	South End Lake Windermere	2,505	20	Oct 5/2017
10	Columbia NWA (Wilmer Unit) - Richies Point	2,372	13	Sept 29/2017
11	South End Lake Windermere	2,302	17	Oct 15/2018
12	Columbia NWA (Wilmer Unit) - Richies Point	2,299	14	Oct 5/2017
13	Brisco Rd North	2,183	18	Oct 15/2019
14	Friends of Columbia Wetland (Richies Point)	2,178	16	Oct 5/2019
15	Fairmont--meadows	2,144	13	Sept 29/2016
16	South End Lake Windermere	2,120	15	Oct 5/2018
17	Friends of Columbia Wetland (Richies Point)	2,097	17	Oct 15/2019
18	Friends of Columbia Wetland (Richies Point)	2,070	15	Sept 29/2019
19	Columbia NWA (Wilmer Unit) - Richies Point	1,983	11	Sept 29/2015
20	Brisco Rd North	1,982	4	Oct 15/2016
21	Brisco Rd North	1,978	20	Oct 5/2018
22	Columbia NWA (Wilmer Unit) - Richies Point	1,972	26	Apr 16/2018
23	South End Lake Windermere	1,924	16	Oct 5/2019
24	Golden-Mulligans Slough	1,888	7	Oct 15/2016
25	Columbia NWA (Wilmer Unit) - Richies Point	1,888	14	Sept 29/2016
26	Brisco Rd North	1,839	9	Sept 29/2017
27	South End Lake Windermere	1,827	9	Sept 29/2019
28	Lake Windermere--Rushmere Road	1,817	19	Apr 16/2017
29	South End Lake Windermere	1,811	21	Oct 15/2016
30	Columbia NWA (Wilmer Unit) - Richies Point	1,793	13	Sept 29/2018



Figure 4. Large concentration of American coot and American wigeon as seen from the South end of Lake Windermere on October 10, 2018.



Figure 5. Large concentration comprised primarily of American coot and American wigeon as seen from the South end of Lake Windermere on October 10, 2018.

4.1.3 Aerial swan survey in 2018

During the aerial survey, a large concentration of trumpeter/tundra swans was seen in the wetlands complex between Brisco and Spillimacheen, estimated at 180 individuals. There was also a large concentration of swans located at the Columbia National Wildlife Area - Wilmer Unit; that flock size was estimated to be 140 individuals. The total count for trumpeter/tundra swans on April 9, 2018 was 915 individuals; specific flock sizes and their respective locations can be found in Appendix 6.

4.1.4. Outreach and communication activities in 2018

In 2018, the CWWS developed, printed and distributed a four-page newsletter that described the CWWS project assisting in increasing awareness relating to volunteer opportunities, bird species at risk, and bird conservation issues and efforts. Previous to fall and spring surveys, posters were designed and distributed throughout the Columbia Valley to promote opportunities to participate in surveys and free training sessions. Additional communication strategies were utilized relating to the promotion of volunteer opportunities and survey results, including: eBlast materials, website content on the Wildsight website, information in Wildsight newsletters (WildTimes), information article in the Wings Over the Rockies festival guide, information in Kootenay Conservation Program and Columbia Mountains Institute e-newsletters, and press releases for local newspapers. A total of seven articles were published in The Golden Star and The Columbia Valley Pioneer relating to the CWWS activities (Appendices 7 and 8). There were 161 elementary school-aged children assembled for birding watching field trips, who along with 13 supervising adults participated in these field trips for instruction in wetlands ecology and bird identification. Two additional educational bird walks were also offered and provided to the public.

In addition to field trips, this project was promoted throughout its five-year lifecycle with public presentations, event booths and ongoing training opportunities. Training modules to teach volunteers about bird identification, along with major goals of the CWWS, were presented annually on two separate occasions prior to each survey period — each of which included both field training and classroom training sessions. A CWWS educational booth was erected at Golden's Farmers Markets on four occasions, as well as at the Wings Over the Rockies gala event in Invermere, and at the premises of Tourism Golden on Highway 1. Presentations on the CWWS were delivered to the Columbia Wetlands Stewardship Partners Annual General Meeting, Wildsight's Columbia River Field School, Akisqnuq Chief and Council meetings, and students of a sustainable tourism program offered through the College of the Rockies, Golden campus. All of these presentations focused on the goals of the CWWS project, results accumulated to date and the importance of citizen-science involvement and bird identification methodology.

4.2 Columbia Wetlands Waterbird Survey 2019

4.2.1 Spring surveys in 2019

The CWWS coordinated a total of 92 people to participate in spring 2019 waterbird surveys to count 25,577 birds (Table 1). There were 301 surveys/checklists completed over the three survey dates. All of the survey dates were similar in terms of total number of birds counted, with 8,285 recorded on April 3; 8,626 birds on April 10; and 8,666 birds on April 16 (Table 1). On all three dates, the most abundant species was mallard; April 3 with 2,015 individuals; April 10 with 1,939; and April 16 with 1,614 individuals (Appendix 4). The survey station/checklist that had the highest bird count in spring 2019 occurred on April 10 at ‘Brisco Rd North’ where 953 individual birds were sighted; 349 of these were American wigeon with 299 mallard, 172 duck species, 11 other species as well as trumpeter/tundra Swan, and gull species. The second highest bird count occurred at ‘Lake Windermere--Lakeshore Resort Campground’ with 861 individuals on April 16.

4.2.2 Fall surveys in 2019

During the 2019 fall waterbird surveys, 90 volunteers participated on three survey dates and in total, 41,095 birds were recorded on 305 checklists. The highest single day count in 2019 occurred on October 10 with 15,750 birds, recorded at 102 survey stations (see Table 1). The highest count for an individual species occurred on October 10 with 3,577 American coot (Table 2) (Appendix 5). The second highest species count was for American wigeon with 3,405 individual birds on October 10. The third highest count for a species was for American wigeon with 3,160 individuals on October 15. Appendix 5 provides further data on the number of each individual species counted on each of the fall CWWS survey dates.

The survey station with the highest bird concentration was recorded on October 15 at ‘Brisco Rd North’ with 2,183 birds (Table 3); 978 were American wigeon with 522 mallard, 12 other species with two additional taxa (e.g. duck species). The second highest bird concentration during fall 2019 was at ‘Friends of Columbia Wetland (Richies Point)’ (also known as Columbia National Wildlife Area – Wilmer Unit) with 2,178 individuals on October 5; 1,016 American wigeon and 816 American coot with 12 other species and two additional taxa. The third largest concentration of birds was also seen at ‘Friends of Columbia Wetland (Richies Point)’ (again, also known as Columbia National Wildlife Area – Wilmer Unit), on September 29 with 2,070 birds: 1,035 were American wigeon and 620 were recorded as American coot; 11 additional species were present with 2 other taxa.

4.2.3 Aerial swan survey in 2019

The largest concentration of swans was observed in the Harrogate area with 84 trumpeter/tundra swans. The total count for trumpeter/tundra swans during the 2019 aerial survey was 669 individuals; specific flock sizes and their respective locations can be found in Appendix 9. A summary table for all of the aerial swan surveys completed during the duration of the CWWS project is seen in Table 4.

Table 4. Total counts for trumpeter/tundra swans during 2016-2019 aerial swan surveys.

Date	No. of swans
March 23, 2016	756
March 26, 2017	621
April 9, 2018	915
April 8, 2019	669

4.2.4 Osprey inventory in 2019

There were a total of 60 osprey nests identified and located in the Columbia Valley in 2019. A complete list of locations and observations are listed in Appendix 10. Of the 60 nests, 43 nests (71.7% of located nests) were observed to have some level of osprey activity in 2019; from nest building alone, to fledgling stage. Of the active nests located, 31 of those nests produced chicks that are assumed to have survived to fledgling stage. Eight of the 60 nests were located in trees; one was on a cell phone tower; whereas 51 of the nests were located on top of hydroelectric poles, most of which were located along Highway 95 South.

Of note, there was a single report of a vehicle collision with an osprey fledgling near a nest in Parson (UTM: 520568, 5661842). There was also a recorded incident with two deceased chicks found at a single pole nest located in the Town of Golden (UTM: 502028, 5682396). The Golden Fire Department with the available resident ladder truck cooperated on this second account to remove the dead chicks from the nest. During the chick removal by the fire department, an adult osprey was observed flying towards the nest with a fish in its bill. The chick carcasses were subsequently delivered to the ‘Little Mittens Animal Rescue Association,’ and the resident permitting officer transferred the bodies to Cranbrook for a necropsy (Allanah Knapp, personal communication, August 2019). Results of the necropsy were not available at time of this report.



Figure 6. Pair of adult osprey seen copulating at a nest located on top of a hydro pole near Harrogate.

4.2.5 Outreach and communication in 2019

Multiple venues of CWWS educational activities and outreach events took place in 2019 including:

- CWWS presentations (including outcomes and results) delivered at the:
 - Wildsight Golden Annual General Meeting
 - Field trip tour for the Technical Committee of the Columbia Valley Local Conservation Fund
 - British Columbia Field Ornithologists Annual General Meeting
 - Wildsight's Columbia River Field School
 - Columbia Mountains Institute Researchers Forum
 - Columbia Wetlands Stewardship Partners Annual General Meeting
- Seven in-class and field training sessions for volunteers of the project were provided to those whom wanted to advance their bird identification skills.
- Five guided bird walks offered to the public.
- CWWS educational booths at two separate Golden Famer's Markets during the summer.
- Landowner outreach visits with subsequent installation of ten nesting boxes (designed for cavity nesting waterfowl) were erected on private property in the Columbia Valley; the properties were either within or directly adjacent to the Columbia Wetlands. Nest boxes were provided by the Windermere Rod and Gun Club, mounted on cedar posts and erected in locations where habitat was limited, according to Best Practices for installation [e.g. pole/post mount (not tree), predator guard in place, nesting cavity six feet off the ground] (Bailey & Bonter, 2017; Ducks Unlimited Canada, n.d.).



Figure 7. Nest box installed at Dorothy Lake in Invermere for cavity nesting waterfowl.

4.3 Bird species at risk in the Columbia Wetlands

There are 30 at-risk bird species that utilize habitat of the Columbia Wetlands. At-risk birds recorded during the 2015-2019 waterbird surveys are as follows: tundra swan, surf scoter (*Melanitta perspicillata*), double-crested cormorant (*Phalacrocorax auritus*), American white pelican (*Pelecanus erythrorhynchos*), American bittern (*Botaurus lentiginosus*), eared grebe (*Podiceps nigricollis*), horned grebe (*Podiceps auritus*), western grebe (*Aechmophorus occidentalis*), great blue heron (*Ardea herodias herodias*), rough-legged hawk (*Buteo lagopus*), long-billed curlew (*Numenius americanus*), California gull (*Larus californicus*), peregrine falcon (*Falco peregrines*), and bank swallow (*Riparia riparia*). At various times through the course of the study each of these species was detected over the study years as illustrated in Table 5.

Additional at-risk bird species known to occur in the Columbia Wetlands through eBird records, but that were not detected during the CWWS (likely due to the timing window of surveys) include: common nighthawk (*Chordeiles minor*), Lewis's woodpecker (*Melanerpes lewis*), short-eared owl (*Asio flammeus*), barn swallow (*Hirundo rustica*), bobolink (*Dolichonyx oryzivorus*), rusty blackbird (*Euphagus carolinus*), evening grosbeak (*Coccothraustes vespertinus*), olive-

sided flycatcher (*Contopus cooperi*), caspian tern (*Hydroprogne caspia*), Swainson's hawk (*Buteo swainsoni*), broad-winged hawk (*Buteo platypterus*), black swift (*Cypseloides niger*), white-throated swift (*Aeronautes saxatalis*), American avocet (*Recurvirostra Americana*), and red-necked phalarope (*Phalaropus lobatus*). Table 6 documents these at-risk bird species along with their corresponding designations for at-risk status under provincial, federal (under Species at Risk Act (SARA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and under the International Union for Conservation of Nature (IUCN).

Table 5. Species at risk and their number of detections during the 2015-2019 CWWS.

Year	GBHE		HOGR		EAGR		WEGR		HOGR/EAGR		BKSW		AWPE		TUSW		LBCU		CAGU		AMBI		SUSC		RLHA		DCCO		PEFA		
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	
2015	22	20	6	7	2	0	4	8	1	0	3	0	2	0	3	4	0	1	0	5	1	0	0	1	0	0	0	0	0	0	0
2016	20	28	4	4	0	3	0	7	0	3	0	0	0	0	7	1	0	0	1	4	1	0	0	1	1	0	0	0	0	0	
2017	16	26	0	5	0	1	0	8	0	6	0	0	0	0	7	2	0	1	2	3	0	0	0	0	0	5	0	0	0	1	
2018	18	28	1	9	0	5	0	9	0	11	0	0	0	0	11	1	0	0	4	3	0	0	0	0	0	0	0	0	0	0	
2019	9	14	2	8	0	1	0	17	1	6	0	0	0	1	15	3	0	0	3	4	0	0	0	0	0	1	0	2	0	0	

Note: GBHE = great blue heron; HOGR = horned grebe; EAGR= eared grebe; BKSW = bank swallow; AWPE = American white pelican; TUSW = Tundra swan; LBCU = long-billed curlew; CAGU = California gull; AMBI = American bittern; SUSC = surf scoter; RLHA = rough-legged hawk; DCCO = double-crested cormorant; PEFA = peregrine falcon.

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Table 6. Bird species-at-risk in the Columbia Wetlands.

English name	Scientific name	Provincial	BC List	SARA Status	COSEWIC status	IUCN Red List Category	IUCN population trend	CWWS recorded
Western Grebe	<i>Aechmophorus occidentalis</i>	S1B,S2N (2015)	Red	1-Special Concern (2017)	Special Concern (2014)	Least Concern	decreasing	yes
Horned Grebe	<i>Podiceps auritus</i>	S4B (2015)	Yellow	1-Special Concern	Special Concern(2009)	Vulnerable	decreasing	yes
Eared Grebe	<i>Podiceps nigricollis</i>	S3B (2015)	Blue	n/a	n/a	Least Concern	unknown	yes
Tundra Swan	<i>Cygnus columbianus</i>	S3N (2015)	Blue	n/a	n/a	Least Concern	unknown	yes
Great Blue Heron	<i>Ardea herodias herodias</i>	S3? (2017)	Blue	n/a	n/a	Least Concern	increasing	yes
American Bittern	<i>Botaurus lentiginosus</i>	S3B (2015)	Blue	n/a	n/a	n/a	n/a	yes
Rough-legged Hawk	<i>Buteo lagopus</i>	S3N (2015)	Blue	n/a	Not-at-Risk (1995)	Least Concern	stable	yes
Barn Swallow	<i>Hirundo rustica</i>	S3S4B (2015)	Blue	1-Threatened (2017)	Threatened (2011)	Least Concern	decreasing	yes
Bank Swallow	<i>Riparia riparia</i>	S4B (2015)	Yellow	1-Threatened (2017)	Threatened(2013)	Least Concern	decreasing	yes
Long-billed Curlew	<i>Numenius americanus</i>	S3B (2015)	Blue	1-Special Concern (2005)	Special Concern (2011)	Least Concern	decreasing	yes
Surf Scoter	<i>Melanitta perspicillata</i>	S3B,S4N (2015)	Blue	n/a	n/a	Least Concern	decreasing	yes
American White Pelican	<i>Pelecanus erythrorhynchos</i>	S1B (2015)	Red	Not-at-risk (1987)	n/a	Least Concern	increasing	yes
California Gull	<i>Larus californicus</i>	S2S3B (2015)	Blue	n/a	n/a	Least Concern	decreasing	yes
Peregrine Falcon	<i>Falco peregrinus anatum</i>	s2? (2011)	Red	1-Special Concern (2012)	Not-at-Risk (2017)	Least Concern	increasing	yes
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	S3S4 (2015)	Blue	n/a	Not-at-Risk (1978)	Least Concern	increasing	no
Bobolink	<i>Dolichonyx oryzivorus</i>	S3B (2015)	Blue	1-Threatened (2017)	Threatened (2010)	Least Concern	decreasing	no
Common Nighthawk	<i>Chordeiles minor</i>	S4B (2015)	Yellow	1-Threatened (2010)	Special Concern (2018)	Least Concern	decreasing	no
Caspian Tern	<i>Hydroprogne caspia</i>	S3B (2015)	Blue	n/a	Not-at-Risk (1999)	Least Concern	increasing	no
Rusty Blackbird	<i>Euphagus carolinus</i>	S3S4B (2015)	Blue	1-Special Concern (2009)	Special Concern (2017)	Vulnerable	decreasing	no
Swainson's Hawk	<i>Buteo swainsoni</i>	S2B (2015)	Red	n/a	n/a	Least Concern	stable	no
Lewis's Woodpecker	<i>Melanerpes lewis</i>	S2S3B (2015)	Blue	1-Threatened (2012)	Threatened (2010)	Least Concern	decreasing	no
Black Swift	<i>Cypseloides niger</i>	S2S3B (2015)	Blue	1-Endangered (2019)	Endangered (2015)	Least Concern	decreasing	no
White-throated Swift	<i>Aeronautes saxatalis</i>	S3S4B (2015)	Blue	n/a	n/a	Least Concern	decreasing	no
American Avocet	<i>Recurvirostra americana</i>	S2S3B (2015)	Blue	n/a	n/a	Least Concern	stable	no
Red-necked Phalarope	<i>Phalaropus lobatus</i>	S3S4B (2015)	Blue	n/a	Special Concern (2014)	Least Concern	decreasing	no
Broad-winged Hawk	<i>Buteo platypterus</i>	S3?B (2015)	Blue	n/a	n/a	Least Concern	increasing	no
Short-eared Owl	<i>Asio flammeus</i>	S3B,S2N (2015)	Blue	1-Special Concern (2012)	Special Concern (2008)	Least Concern	decreasing	no
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	S5 (2015)	Yellow	1-Special Concern (2019)	Special Concern (2016)	Vulnerable	decreasing	no
Olive-sided Flycatcher	<i>Contopus cooperi</i>	S3S4B (2015)	Blue	1- Threatened (2010)	Special Concern (2018)	Near Threatened	decreasing	no
Prairie Falcon	<i>Falco mexicanus</i>	S1 (2018)	Red	n/a	Not-at-Risk (1996)	Least Concern	increasing	no

Note - those species detected during the 2015-2019 Columbia Wetlands Waterbird Survey (CWWS) are indicated in the last column; other at-risk species are known of occurring in the Columbia Wetlands through eBird records.

4.4 General observations between 2015-2019 survey years

Greater-white fronted geese were only observed during fall 2017 and fall 2019 (Appendices 4 and 5). An observation of cackling geese (5 individuals) was reported on only one survey date; September 29, 2017. Double-crested cormorant were not seen during spring surveys, but single individuals were detected during fall 2019 at two locations, both on October 5. American white pelican were observed on three survey dates: May 4, 2015 when 16 individuals were seen at two locations; a single pelican was seen on September 29, 2019 and October 5, 2019. The single American white pelican was recorded on two dates in 2019 (likely the same individual), as it was injured, later captured and euthanized at the Invermere Veterinary Clinic. Black-necked stilt (*Himantopus mexicanus*) were seen during the spring only, on four survey dates: April 29, 2015; May 4, 2019; April 16, 2018; April 16, 2019. Red-breasted merganser (*Mergus serrator*) were seen on seven survey dates, a rare visitor to the Columbia Wetlands. Cinnamon teal (*Spatula cyanoptera*) was infrequently encountered, as was barrow's goldeneye (*Bucephala islandica*). Gadwall (*Mareca strepera*) were rarely detected during spring surveys, but more frequently encountered during fall survey dates. Surf scoter and white-winged scoter (*Melanitta deglandi*) were seen four times each respectively over the five-year study period; both of these species are considered to be rare visitors to the Columbia Wetlands. Eurasian Wigeon (*Mareca penelope*), a non-native species, was detected on six survey dates during 2015-2019 waterbird surveys. There was one long-tailed duck (*Clangula hyemalis*) observed over the duration of the project, this rare encounter was from Moberly Marsh in Burges James Gadsden Provincial Park on April 29, 2015. Long-billed dowitcher (*Limnodromus scolopaceus*) were not seen during spring surveys, but were frequently encountered during fall surveys. All other shorebird species were also infrequently detected (Appendices 4 and 5).

There were relatively small numbers of the following species detected during the duration of the CWWS: ruddy duck (*Oxyura jamaicensis*), greater scaup (*Aythya marila*), lesser scaup, blue-winged teal (*Spatula discors*), canvasback (*Aythya valisineria*), and redhead (*Aythya americana*). Whereas there were relatively large numbers of the following species encountered during waterbird surveys in all years of survey effort: American coot, Canada goose (*Branta canadensis*), American wigeon, mallard, northern pintail, and green-winged teal.

The following diving ducks species were also observed to be relatively common during all waterbird survey years: ring-necked duck (*Aythya collaris*), common goldeneye (*Bucephala clangula*), hooded merganser, common merganser (*Mergus merganser*), and bufflehead (*Bucephala albeola*). Trumpeter and/or Tundra swans were seen during each survey date, but Trumpeter swan were likely the more prevalent of the two species, as described previously. The highest swan count during the ground-based surveys was with 872 individual swans on April 3, 2018; 197 were trumpeter swan, 52 were identified as Tundra swan, and 623 could not be

identified to species level (trumpeter/tundra swan), generally because they were too far away and the two species are very similar in appearance (Appendix 4).

Five species of grebe were detected in the Columbia Wetlands: eared grebe, horned grebe, pied-billed grebe (*Podilymbus podiceps*), red-necked grebe (*Podiceps grisegena*) and western grebe (Figures 8 and 9); three of which are at-risk species. The grebe species detected most frequently were the pied-billed grebe and red-necked grebe. The highest count for a grebe was for the western grebe with 295 individuals seen at 13 different survey stations on October 5, 2019; 224 of those 295 were seen on the open water of Lake Windermere as observed from the Baltac Beach survey station. Peak migration for grebe species tends to occur slightly after the CWWS survey dates in both spring and fall; grebe species counts are anticipated to be higher if survey dates were adjusted to be slightly later during both the spring and fall.

The highest overall three-day seasonal count was during the fall of 2017 with 50,822 individuals. The highest single-day count was on October 15, 2018 with 20,575 birds; the second highest single day count was on April 16, 2018 with 19,925 individuals. The fall surveys usually produced higher counts than the spring surveys. With the exception of the first surveys in 2015 (given the lower amount of survey effort), the average fall count was 16,697 individuals and the average spring count was 10,529 birds. American wigeon, mallard and American coot were the species detected in highest abundance for bird species present in the Columbia Wetlands ecosystem during spring and fall bird migration periods (Table 2).

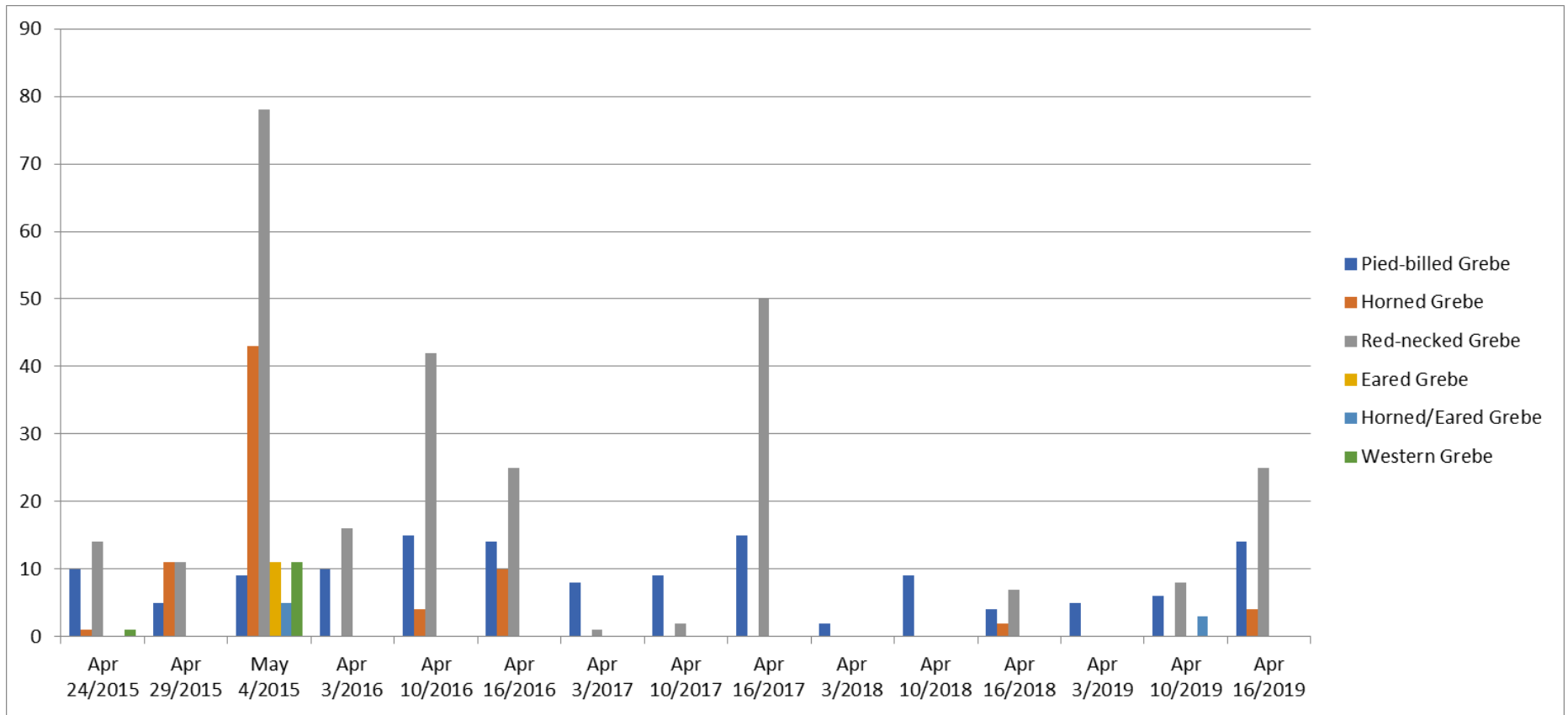


Figure 8. Grebe species distribution in the Columbia Wetlands across 2015-2019 survey dates during spring bird migration.

Columbia Wetlands Waterbird Survey 2015-2019

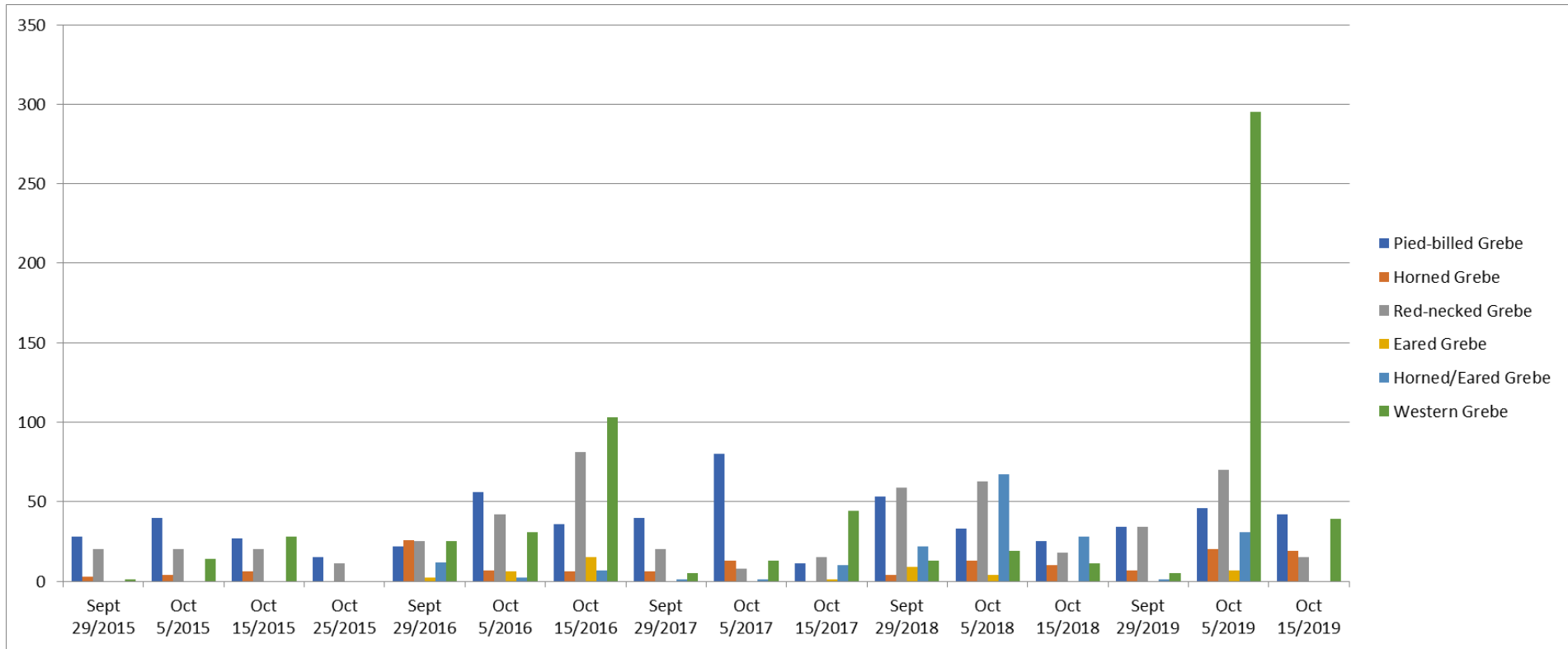


Figure 9. Grebe species distribution in the Columbia Wetlands across 2015-2019 survey dates during fall bird migration.

5.0 Discussion

5.1 Waterbird populations of note in the Columbia Wetlands

Throughout the years of CWWS survey effort, bird counts were considerably higher during the fall with an average of 16,697 individuals, compared to an average of 10,529 birds during spring counts. This is understandable as the fall counts include the surviving young of the year's hatch. An additional consideration relating to spring migration is that spring migrants tend to pass through quickly on their way to the breeding grounds; whereas during the fall, migrants tend to linger, rest and forage for food which is needed to accumulate energy reserves before heading south for winter (Entech Environmental Consultants, 1978).

As noted earlier, the highest single day count was on October 15, 2018 with 20,575 birds. However, the waterbird surveys were only able to cover approximately 39% of the contiguous Columbia Wetlands ecosystem and it can be safely assumed that more birds were present in the entire ecosystem on this date; a statement that would also apply to all the other waterbird survey dates. The CWWS also conducted an aerial survey on October 8, 2017 that documented an estimated 7,156 birds at 216 inaccessible locations of the Columbia Wetlands, which were areas not covered by regular ground-based survey stations (Darvill, 2017). Previously it was reported that many more birds and possibly several hundred thousand birds travel through the Columbia Wetlands during the entire migration period (Entech Environmental Consultants, 1978). After a series of 15 aerial surveys completed by the Canadian Wildlife Service in 1976-1977, Kaiser, McKelvey & Smith (1977) reported that, “[the Columbia Wetlands] is probably the most important migration corridor in British Columbia and competes with the coast in its ability to hold and feed large numbers of birds at critical moments during their annual migrations.”

The Columbia Wetlands hold important populations of mallard, American wigeon and American coot; the most abundant species' recorded during all study years. The aerial surveys conducted by Kaiser, McKelvey & Smith (1977) stated that mallards were the most common duck in the Columbia Valley during all seasons, and that “extremely large numbers of wigeon are seen during migration,” especially on large water bodies such as Lake Windermere. The CWWS data however records that higher numbers of American coot and wigeon were present when compared to mallard, but there were also large numbers of unidentified duck species that could have considerably added to any of the species counts had birds been identified to species level.

Also of note, the American coot population may have decreased in the Columbia Wetlands in recent years. Kaiser, McKelvey & Smith (1977) reported large flocks of American coot at the Columbia National Wildlife Area - Wilmer Unit (also known as Friends of Columbia Wetland (Richies Point in the CWWS), and at large open water bodies between Brisco and Golden, but that the largest concentrations were found at the south end of Lake Windermere. On October 5,

1977 there were 20,902 American coot recorded in the contiguous study area (Kaiser, McKelvey & Smith, 1977). In comparison, the highest count for coot during the CWWS project, was also on October 5, 2018, but with only 6,495 American coots (1,860 of which were reported from South End Lake Windermere). Again, a significant point to note is that the CWWS only covered about 39% of the ecosystem, whereas the 1977 aerial surveys covered the entire ecosystem. Notwithstanding, the numbers of coots are significantly lower in this five-year survey when compared to data in the 1977 report.

Kaiser, McKelvey & Smith (1977) reported that the Columbia Wetlands provided habitat for important concentrations of swans; 1,200 swans were observed during aerial surveys on March 28, 1977. While the CWWS did not have swan counts as high as this, survey effort during 2016-2019 was limited to one aerial survey per year. The 2016-2019 aerial swan data that was collected supports the conclusion that the Columbia Wetlands are of important habitat value to swans. Kaiser, McKelvey & Smith (1977) also reported high numbers of redhead, and that “in the spring of 1977, there was a spectacular influx of blue-winged and cinnamon teal.” The CWWS did not identify high numbers of these three species.

Meriless (1976) reported that there were 46 osprey nests detected along the Columbia Wetlands in 1976, whereas the CWWS detected 60 nests in 2019 and it is likely that they were additional tree nests that went undetected in less accessible areas (e.g. wetlands between Radium and Brisco). The increase in osprey nests over the past 44 years likely owes in part to the effort that BC Hydro has employed erecting numerous nesting poles along Highway 95 South, especially between Golden and Spillimacheen. Beebe (1974) reported that “ospreys were extremely abundant along the Columbia River, where the highest density in British Columbia has been reported.” It is unknown if the Columbia Valley still has the highest nesting density of osprey in BC.

5.2 Areas with highest bird abundance during migration

Data from this project supports the premise that waterbirds during bird migration are not distributed equally throughout the Columbia Wetlands. The CWWS results indicate that specific areas are more important than others in terms of habitat value provided to waterbirds during periods of bird migration. Lake Windermere and Columbia Lake appear to provide the most important habitat to grebe species during migration, especially for horned grebe, red-necked grebe and western grebe (Darvill, 2019). Previous research documented that most of the American coots and diving ducks of the Columbia Wetlands are found on Lake Windermere and Columbia Lake; whereas most of the dabbling ducks and geese are found evenly distributed amongst the Columbia River marshes (Entech Environmental Consultants, 1978). This is somewhat in contradiction to the results of the CWWS project in that the highest concentration of coots were detected at the south end of Lake Windermere, but specific survey stations

(‘Columbia National Wildlife Area - Wilmer Unit’ also known as ‘Friends of Columbia Wetland (Richies Point),’ ‘South End Lake Windermere,’ and ‘Brisco Rd North’ repeatedly had the highest overall waterbird counts. All three of these wetland habitat areas are similarly identified as large patches of shallow open water. These three areas consistently had high concentrations of birds during migration, they are distant enough from the shoreline for birds to feed undisturbed (Evans & Day, 2002) from humans and predators with ample supplies of food (submerged aquatic vegetation and invertebrates). Recognizing these areas as a safe haven for migratory birds, these three areas are of particular interest for conservation purposes.

The Wilmer Unit of the Columbia National Wildlife Area (NWA) is already protected under federal legislation. The Canadian Wildlife Service manages this area and maintains it “as wetland habitat for the primary benefit of migrating waterfowl with secondary benefits for other wetland-dependent wildlife, fish, and plant species, especially those species considered rare, threatened, or endangered” (Environment and Climate Change Canada, 2017). Human activities including recreational boating and hunting are not permitted in the NWA. The south end of Lake Windermere is also protected (to some degree) in that the far southern end of Lake Windermere is within the boundaries of the Columbia Wetlands Wildlife Management Area (WMA). The ‘Brisco Rd North’ survey station is also largely blanketed with the WMA designation, although there are individual private land parcels within this wetland complex.

While the WMA status is important for conservation in these areas, the WMA management plan does allow for recreational activities as well as hunting. As mentioned previously, several studies (e.g. Korschgen & Dahlgren, 1992; Hockin et al., 1992; Korschgen, George & Green, 1985; Liddle & Scorgie, 1980; York, 1994) have reported a wide range of potentially detrimental behavioural patterns for waterbirds in response to recreationists, whether intentional or not, including:

- multiple flushing and extended flight times resulting in increased energy expenditure by birds
- reduction of energy intake activities, including lost foraging opportunities and fewer resting periods
- lowered productivity during nesting
- increased incidences of nest abandonment and egg loss
- discouragement of breeding in late-nesting pairs as recreational traffic increases in spring
- disruption of pair bonding and parent-offspring bonds
- reduced use of feeding, resting and breeding sites

Repetitive disturbances eventually cause ducks and other nesting species to nest elsewhere or not at all (Korschgen & Dahlgren, 1992).

Hunting also affects bird distribution, abundance and behaviour (Casas, Mougeor, Vinuela & Bretagnolle, 2009; Fox & Madsen, 1997; Sokos, Birtsas, Connelly & Papaspyropoulos, 2013). Behavioural responses of birds to hunting activities include increased flight times and less time spent foraging, feeding and resting, which increases the amount of energy required for bird survival (Casas, Mougeor, Vinuela & Bretagnolle, 2009). Madsen (1998) showed that waterfowl hunting caused waterfowl species to be displaced, which resulted in a waterfowl community that was species-poor.

Published research documents have shown that hunting-free refuges can help mitigate the behavioural disturbances caused to birds through hunting activities (Casas, Mougeor, Vinuela & Bretagnolle, 2009) benefiting numerous bird species including species at risk as well as additional species experiencing population declines. Freedom of disturbance to birds is an important measure of establishing effective waterfowl management in designated nature conservation areas (Fox & Madsen, 1997). Establishing refuges, Migratory Bird Sanctuaries, or reserves of some kind that are protected from human use and resulting impacts is likely an important conservation tool to help mitigate and reduce recognized stressors within the two identified geographical components of the WMA that are documented to have high concentrations of birds during migration. Creating human-free refuges can create a nucleus of migratory bird activity, in a region or ecosystem (i.e. Columbia Wetlands) that also provides opportunities for hunters (Giroux & Bédard 1988). “Refuge creation is an efficient management tool to improve the conservation value and biodiversity of wetlands of importance to waterfowl (Madsen, 1998). Buffer zones between refuge and hunting areas can also be a useful management tool for preventing displacement of birds caused by hunting disturbance outside of refuges (Holm, Laursen & Clausen, 2011).

The three most important areas documenting consistent abundant numbers of high bird populations during migration should be considered as potential refuges or Migratory Bird Sanctuaries. Given social values and subsistence harvesting needs, it is recognized that any adaptive management strategy to protect migratory bird populations in the Columbia Wetlands that encompasses the concept of establishing a bird sanctuary or reserve, would need to be carefully weighed and measured with varying levels of government, multi-stakeholder group input, and multidisciplinary experts (Sokos, Birtsas, Connelly & Papaspyropoulos, 2013).

5.3 How the Columbia Wetlands may satisfy IBA criteria

Bird Studies Canada has been working in partnership with BirdLife International to identify and document those sites that are vital to the conservation of the world’s birds (Moore & Couturier, 2011). There are a number of criteria for identifying IBAs within Canada. Based on the data

collected within the five year CWWS study and through additional research, the Columbia Wetlands meet the following criteria, and as such qualify for designation as an IBA:

1. Trumpeter swan – The regional threshold for this species is 340 individuals. While the aerial swan survey completed during the 2016-2019 study years was unable to differentiate between trumpeter and tundra swans, the majority of swans seen during surveys are assumed to be trumpeter swans given that they are the most common swan species seen in the Columbia Wetlands during CWWS ground-based surveys and according to eBird records. Total single-day counts during aerial surveys were as follows: 2016 = 756 swans; 2017 = 621 swans; 2018 = 915 swans; and 2019 = 669 swans (Table 4).
2. Horned grebe – This species is listed as ‘Vulnerable’ by the International Union for the Conservation of Nature (IUCN) and is classified as a globally threatened bird. The threshold for an IUCN Red List species categorized as ‘Vulnerable,’ is 10 pairs or 30 individuals (Moore & Couturier, 2011). As of September 24 2019, there were 265 species occurrences for horned grebe in the Columbia Wetlands as listed in the eBird database, several of which exceed the threshold of 30 individuals (Appendix 11). This species was not often detected during the CWWS because this species tends to migrate through the wetlands subsequent to the spring and fall waterbird survey dates.
3. Pied-billed grebe – The threshold for this species is 1000-1200 individuals. While the CWWS did not detect large numbers of pied-billed grebes during migration, the Columbia Wetlands Marsh Bird Monitoring Project (CWMBMP) did detect relatively high numbers of this species in the Columbia Wetlands during the breeding season, over the four years of survey effort (Darvill & Westphal, 2020). The four-year (2016-2019) CWMBMP operated in collaboration with Canadian Wildlife Service, and led to the following population estimates produced through scientifically robust methods of data extrapolation. In 2016 it was estimated there were 1,187 (95% confidence interval (CI) = 838-1,682) pied-billed grebe in the Columbia Wetlands; 792 (95% CI = 577-1,086) in 2017; 1,006 (95% CI = 689-1,468) in 2018; and 887 (95% CI = 633-1,243) in 2019 (Darvill & Westphal, 2020).
4. “Significant numbers of birds congregating during migration” – The CWWS was able to survey approximately only 39% of the Columbia Wetlands ecosystem with the overall congregation assumed to be far greater than CWWS reported counts. Even with this limitation, some single day counts in this narrowed field either exceeded or approached the threshold of 20,000 birds. [20,822 birds were counted on October 15, 2016; 17,507 birds were counted on October 15, 2017; 19,925 birds were counted on April 16, 2018; and 20,575 birds were counted on October 15, 2018 (Table 1)].

5. Lewis's Woodpecker – The threshold for this species is 10-12 individuals. There is a colony of four nesting pairs in the Fairmont area, as well as 1-3 more Lewis's Woodpecker pairs nesting at the southwest end of Columbia Lake near Canal Flats.
6. The Columbia Wetlands holds exceptional species diversity, with at least 237 bird species recently documented (Leighton, 2006); 30 of which are at-risk bird species present during the breeding season, and/or during periods of migration (Table 5).

5.4 How this project is important for conservation in the Columbia Valley

The primary goal of the CWWS was to collect bird data during spring and fall migration, to support nomination of the Columbia Wetlands being incorporated into the IBA program. Several additional benefits have come as a result of the CWWS project. The CWWS has throughout the five year study engaged a large portion of Columbia Valley residents in discussion relating to the value of wetlands habitat and conservation efforts — through the use of public education opportunities offered in the RDEK Electoral Areas F and G, CSRD Area A, the District of Invermere, Village of Radium Hot Springs, Village of Canal Flats, Brisco, and the Town of Golden.

The project involved efforts of 230 citizen scientist volunteers and a class of Grade 8 students; all participating in waterbird surveys during at least some portion of the 2015-2019 project. This involvement resulted in each individual's potential growth regarding insight into biological systems, species identification, and environmental awareness and stewardship, which could lead to a career path geared towards conservation efforts (Cartwright, Cvetkovic, Graham, Tozer & Chow-Fraser, 2013). By providing this active citizen-science opportunity, volunteers were directly engaged with wildlife and local landscapes encouraging the development of sustainable personal decisions relating to general and specific conservation actions referable to the wetlands.

The CWWS data has provided valuable data assisting other agencies in their planning activities, including:

- Revisions to the Columbia Wetlands Wildlife Management Area Management Plan, helping to further strengthen the habitat conservation values of that plan as they relate to birds.
- Partnerships and information provided to local communities, regional and national groups, and with several additional organizations that have a considerable effect on waterbird and wetland conservation, e.g. CWWS data informed the Columbia Wetlands Conservation Action Framework (Mahr, 2019), as well as 2019-2020 revisions to the Steamboat-Jubilee Mountain Official Community Plan in the RDEK.

- Assisting in the maintenance of international Ramsar responsibilities by addressing one of the three pillars under the Convention’s mission; “working towards wise use of all wetlands”. To achieve this, the Convention recommends contracting parties to develop programs covering wetlands inventory, monitoring, research, training, education and public awareness (Ramsar, 2014).
- Assistance in maintaining and fulfilling WMA responsibilities by monitoring avian populations.
- While not the intent of this project, the CWWS data should prove useful in assisting with the assessment of priority bird populations within the Canadian Intermountain Joint Venture.

6.0 Conclusion and Recommendations

Throughout the five-year CWWS study, a significant amount of data on waterbirds has been collected. There is now documentation to show which specific species are found in the highest concentrations during periods of bird migration in the Columbia Wetlands. There are also data sets relating to swan migration through this habitat, and observed numbers of occupied osprey nests in the Columbia Valley. Critical areas of high migratory bird abundance were identified within the wetlands associated with specific areas of high habitat value. One cannot endeavour to achieve responsible habitat-based actions or recommendations without knowledge of what potential habitat areas are most worthy of conservation. This paper identifies these areas of critical value and the specific habitat threats impacting upon them, for which the following management recommendations and strategies are outlined:

- Designate the Columbia Wetlands as an ‘Important Bird and Biodiversity Area’, and sequentially as a ‘Key Biodiversity Area’.
- It is strongly recommended that the British Columbia provincial government [land managers of the Columbia Wetlands Wildlife Management Area (CWWMA)] work with the federal government (Environment and Climate Change Canada’s Canadian Wildlife Service) and interested stakeholders to conduct necessary measures to assign refuge or Migratory Bird Sanctuary designation to the two areas located within the WMA determined to consistently contain the highest bird concentrations during migration. These two locations are located at the south end of Lake Windermere and the wetland complex located between Brisco and Spillimacheen, known as ‘Brisco Rd North’ in this study. (The third area with high bird concentration is already protected as part of the Columbia National Wildlife Area). This will provide a safe haven and refuge for migrating birds within the WMA, but will not limit

human use and activities from the remaining vast portions of the Columbia Wetlands complex.

- It is recommended that all private land parcels located within the 'Brisco Rd North' survey area be identified and slated for purchase as conservation properties to expand and conserve bird habitat within the Pacific Flyway of the unique Columbia Wetlands ecosystem.

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9.0 Appendices

Appendix 1. Poster seeking information on osprey nest locations.



Wanted! Osprey Nest Locations

We are looking for reports of osprey nest locations that are found anywhere in the Columbia Valley, except those on hydro poles along Highway 95 South, or on the roads that intersect the Columbia Wetlands, such as Parson Crossing or Brisco Rd.

Please email program biologist racheldarvill@gmail.com to report your sightings, or call 250-344-5530.

Information on osprey nest abundance and occupancy will be used as part of the application to nominate the Columbia Wetlands as an Important Bird and Biodiversity Area (IBA).

wildsight
Golden

Regional District of East Kootenay | vancouver foundation 75 | BRITISH COLUMBIA | Wings over the Rockies | The McLean Foundation | Columbia Wetlands | Columbia Basin trust | CSRD

Appendix 2. Bird species list for birds encountered during the 2015-2019 CWSWS.

Species Name	Scientific Name	Species Name	Scientific Name
Cackling Goose	<i>Branta hutchinsii</i>	Ring-billed Gull	<i>Larus delawarensis</i>
Snow Goose	<i>Anser caerulescens</i>	*California Gull	<i>Larus californicus</i>
Snow/Ross's Goose	n/a	Herring Gull	<i>Larus argentatus</i>
Greater White-fronted Goose	<i>Anser albifrons</i>	gull sp.	n/a
Canada Goose	<i>Branta canadensis</i>	Great Horned Owl	<i>Bubo virginianus</i>
goose sp.	n/a	Great Gray Owl	<i>Strix nebulosa</i>
Trumpeter Swan	<i>Cygnus buccinator</i>	Northern Pygmy Owl	<i>Glaucidium gnoma</i>
*Tundra Swan	<i>Cygnus columbianus</i>	Barred Owl	<i>Strix varia</i>
Trumpeter/Tundra Swan	n/a	Belted Kingfisher	<i>Megaceryle alcyon</i>
Wood Duck	<i>Aix sponsa</i>	Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>
Blue-winged Teal	<i>Spatula discors</i>	Downy Woodpecker	<i>Dryobates pubescens</i>
Cinnamon Teal	<i>Spatula cyanoptera</i>	Hairy Woodpecker	<i>Dryobates villosus</i>
Blue-winged/Cinnamon Teal	n/a	Downy/Hairy Woodpecker	n/a
Northern Shoveler	<i>Spatula clypeata</i>	Northern Flicker	<i>Colaptes auratus</i>
Gadwall	<i>Mareca strepera</i>	Pileated Woodpecker	<i>Dryocopus pileatus</i>
Eurasian Wigeon	<i>Mareca penelope</i>	woodpecker sp.	n/a
American Wigeon	<i>Mareca americana</i>	American Kestrel	<i>Falco sparverius</i>
Mallard	<i>Anas platyrhynchos</i>	Merlin	<i>Falco columbarius</i>
Northern Pintail	<i>Anas acuta</i>	*Peregrine Falcon	<i>Falco peregrinus</i>
Green-winged Teal	<i>Anas crecca</i>	falcon sp.	n/a
teal sp.	n/a	diurnal raptor sp.	n/a
dabbling duck sp.	n/a	Say's Phoebe	<i>Sayornis saya</i>
Canvasback	<i>Aythya valisineria</i>	Northern Shrike	<i>Lanius borealis</i>
Redhead	<i>Aythya americana</i>	flycatcher sp.	n/a
Ring-necked Duck	<i>Aythya collaris</i>	Canada Jay	<i>Perisoreus canadensis</i>
Greater Scaup	<i>Aythya marila</i>	Steller's Jay	<i>Cyanocitta stelleri</i>
Lesser Scaup	<i>Aythya affinis</i>	Clark's Nutcracker	<i>Nucifraga columbiana</i>
Greater/Lesser Scaup	n/a	Blue Jay	<i>Cyanocitta cristata</i>
*Surf Scoter	<i>Melanitta perspicillata</i>	Black-billed Magpie	<i>Pica hudsonia</i>
White-winged Scoter	<i>Melanitta deglandi</i>	American Crow	<i>Corvus brachyrhynchos</i>
Long-tailed Duck	<i>Clangula hyemalis</i>	Common Raven	<i>Corvus corax</i>
Bufflehead	<i>Bucephala albeola</i>	crow/raven sp.	n/a
Common Goldeneye	<i>Bucephala clangula</i>	Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Barrow's Goldeneye	<i>Bucephala islandica</i>	Tree Swallow	<i>Tachycineta bicolor</i>
Common/Barrow's Goldeneye	n/a	Violet-green Swallow	<i>Tachycineta thalassina</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>	Tree/Violet-green Swallow	n/a
Common Merganser	<i>Mergus merganser</i>	*Bank Swallow	<i>Riparia riparia</i>
Red-breasted Merganser	<i>Mergus serrator</i>	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
Common/Red-breasted Merganser	n/a	swallow sp.	n/a
merganser sp.	n/a	Black-capped Chickadee	<i>Poecile atricapillus</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>	Mountain Chickadee	<i>Poecile gambeli</i>
duck sp.	n/a	chickadee sp.	n/a
waterfowl sp.	n/a	Red-breasted Nuthatch	<i>Sitta canadensis</i>
Ruffed Grouse	<i>Bonasa umbellus</i>	nuthatch sp.	n/a
Dusky Grouse	<i>Dendragapus obscurus</i>	Brown Creeper	<i>Certhia americana</i>
Spruce Grouse	<i>Falcipennis canadensis</i>	Pacific Wren	<i>Troglodytes pacificus</i>

grouse sp.	<i>n/a</i>	Marsh Wren	<i>Cistothorus palustris</i>
Wild Turkey	<i>Meleagris gallopavo</i>	wren sp.	<i>n/a</i>
Common Loon	<i>Gavia immer</i>	American Dipper	<i>Cinclus mexicanus</i>
*Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Golden-crowned Kinglet	<i>Regulus satrapa</i>
*American White Pelican	<i>Pelecanus erythrorhynchos</i>	Ruby-crowned Kinglet	<i>Regulus calendula</i>
*American Bittern	<i>Botaurus lentiginosus</i>	kinglet sp.	<i>n/a</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Western Bluebird	<i>Sialia mexicana</i>
*Horned Grebe	<i>Podiceps auritus</i>	Mountain Bluebird	<i>Sialia currucoides</i>
Red-necked Grebe	<i>Podiceps grisegena</i>	bluebird sp.	<i>n/a</i>
*Eared Grebe	<i>Podiceps nigricollis</i>	Townsend's Solitaire	<i>Myadestes townsendi</i>
*Horned/Eared Grebe	<i>n/a</i>	Varied Thrush	<i>Ixoreus naevius</i>
*Western Grebe	<i>Aechmophorus occidentalis</i>	American Robin	<i>Turdus migratorius</i>
grebe sp.	<i>n/a</i>	Gray Catbird	<i>Dumetella carolinensis</i>
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	American Pipit	<i>Anthus rubescens</i>
Mourning Dove	<i>Zenaida macroura</i>	Lapland Longspur	<i>Calcarius lapponicus</i>
Rock Pigeon	<i>Columba livia</i>	Cedar Waxwing	<i>Bombycilla cedrorum</i>
Sora	<i>Porzana carolina</i>	Bohemian Waxwing	<i>Bombycilla garrulus</i>
*Great Blue Heron	<i>Ardea herodias</i>	House Finch	<i>Haemorhous mexicanus</i>
Turkey Vulture	<i>Cathartes aura</i>	Purple Finch	<i>Haemorhous purpureus</i>
Osprey	<i>Pandion haliaetus</i>	Northern Waterthrush	<i>Parkesia noveboracensis</i>
Golden Eagle	<i>Aquila chrysaetos</i>	Orange-crowned Warbler	<i>Oreothlypis celata</i>
Northern Harrier	<i>Circus hudsonius</i>	Yellow-rumped Warbler	<i>Setophaga coronata</i>
Cooper's Hawk	<i>Accipiter cooperii</i>	Townsend's Warbler	<i>Setophaga townsendi</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Wilson's Warbler	<i>Cardellina pusilla</i>
Sharp-shinned/Cooper's Hawk	<i>n/a</i>	warbler sp. (Parulidae sp.)	<i>n/a</i>
Northern Goshawk	<i>Accipiter gentilis</i>	American Goldfinch	<i>Spinus tristis</i>
Accipiter sp.	<i>n/a</i>	Chipping Sparrow	<i>Spizella passerina</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>	European Starling	<i>Sturnus vulgaris</i>
Golden/Bald Eagle	<i>n/a</i>	Snow Bunting	<i>Plectrophenax nivalis</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Fox Sparrow	<i>Passerella iliaca</i>
*Rough-legged Hawk	<i>Buteo lagopus</i>	American Tree Sparrow	<i>Spizelloides arborea</i>
buteo sp.	<i>n/a</i>	Dark-eyed Junco	<i>Junco hyemalis</i>
hawk sp.	<i>n/a</i>	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
Virginia Rail	<i>Rallus limicola</i>	White-throated Sparrow	<i>Zonotrichia albicollis</i>
American Coot	<i>Fulica americana</i>	Vesper Sparrow	<i>Pooecetes gramineus</i>
Sandhill Crane	<i>Antigone canadensis</i>	Savannah Sparrow	<i>Passerculus sandwichensis</i>
Black-necked Stilt	<i>Himantopus mexicanus</i>	Song Sparrow	<i>Melospiza melodia</i>
Killdeer	<i>Charadrius vociferus</i>	Lincoln's Sparrow	<i>Melospiza lincolni</i>
Semipalmated Sandpiper	<i>Calidris pusilla</i>	Swamp Sparrow	<i>Melospiza georgiana</i>
*Long-billed Curlew	<i>Numenius americanus</i>	Spotted Towhee	<i>Pipilo maculatus</i>
peep sp.	<i>n/a</i>	sparrow sp.	<i>n/a</i>
Baird's Sandpiper	<i>Calidris bairdii</i>	Common Yellowthroat	<i>Geothlypis trichas</i>
Wilson's Snipe	<i>Gallinago delicata</i>	Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Solitary Sandpiper	<i>Tringa solitaria</i>	Western Meadowlark	<i>Sturnella neglecta</i>
Spotted Sandpiper	<i>Actitis macularius</i>	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>	Brown-headed Cowbird	<i>Molothrus ater</i>
Pectoral Sandpiper	<i>Calidris melanotos</i>	Brewer's Blackbird	<i>Euphagus cyanocephalus</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	blackbird sp.	<i>n/a</i>
Wilson's Phalarope	<i>Phalaropus tricolor</i>	Pine Grosbeak	<i>Pinicola enucleator</i>
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Cassin's Finch	<i>Haemorhous cassinii</i>
Lesser Yellowlegs	<i>Tringa flavipes</i>	Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>
Greater/Lesser Yellowlegs	<i>n/a</i>	finch sp.	<i>n/a</i>
Tringa sp.	<i>n/a</i>	Common Redpoll	<i>Acanthis flammea</i>
Scolopacidae sp.	<i>n/a</i>	Red Crossbill	<i>Loxia curvirostra</i>

large shorebird sp.	<i>n/a</i>	White-winged Crossbill	<i>Loxia leucoptera</i>
shorebird sp.	<i>n/a</i>	Pine Siskin	<i>Spinus pinus</i>
Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>	Western Tanager	<i>Piranga ludoviciana</i>
		passerine sp.	<i>n/a</i>

**Those species listed with an asterisk are listed as species-at-risk.*

Appendix 3. CWWS survey station names and their geographical coordinates.

Site Name	Easting	Northing
Donald--Wiseman Rd	489320	5702860
Blaeberry/Columbia River Confluence	493980	5696781
Moberly Marsh/Gadsden Prov. Park	496580	5695183
Weir home - Hwy 1 - 1.5 km N of Golden	500833	5686526
Golden -- Anderson Rd	500748	5685695
Golden--West Edelweiss Slough	501185	5685410
Golden--Edelweiss Slough	501574	5685406
Golden--Kicking Horse Drive walking route	500744	5684251
Golden--lower Kicking Horse River	500804	5683908
Golden -- Airport Area	501031	5683082
Golden -- Sewage Lagoons	501733	5682101
Golden--Reflection Lake	503730	5681520
Golden--Railway Pond	504423	5680523
Golden--Southwest of Railway Yard	505096	5679537
Golden--Habart's Subdivision	505266	5678671
Nicholson--Bottom of Sander Road	503838	5677652
Nicholson Bridge	506078	5676895
Columbia River--Horse Creek Confluence	506977	5673100
Golden--9 mile Slough	508664	5671814
Section between 9 mile & Dickson Downs	509634	5670884
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	510957	5669474
19 km south of Golden-Birchlands Slough	513006	5668064
Golden--Mulligans Slough	507643	5670294
Columbia Wetlands -- McMurdo seasonal lake	515652	5666148
Beaver Lake	517898	5664224
Carbonate Landing	518243	5662998
Parson North--Braisher's Slough	521587	5660644
Parson -- Madden Road lookout	520046	5662748
Parson--Thomas Rd South 4150 area	522268	5658396
Parson--Marshwood	523717	5657110
Parson	525092	5657693
Parson - Wells Landing	526708	5654597
Parson--Beards Creek Rd	528238	5655457
Parson -- 5.6 km south	529683	5654443
Parson -- 6.0 km south	530007	5654175
Parson South--Great Blue Heron Rookery	529824	5654363

Castledale North	530929	5653677
Castledale	532621	5652946
McKeemans Slough	533662	5652149
Nabel/Gacek Creek Slough	535505	5651192
Columbia Wetlands--1.5 km south of Nabel Rd	536053	5650624
Columbia Wetlands--2 km south of Nabel Rd	536895	5649835
Columbia Wetlands--2.8km south of Nabel Rd	537334	5649165
Salsbury Rd off Hwy 95	537674	5648630
Harrogate	538755	5647403
Harrogate Corner Slough	539028	5647270
Harrogate - Ben Hynes Loop Rd	538945	5647759
Harrogate - Ben Hynes Loop Rd Quarry	539535	5646471
Harrogate--old barns	540420	5646138
Harrogate--CSRD Boundary	541587	5644461
Spillimacheen --5 km North	542310	5643514
Spillimacheen --2 km North	543588	5641273
Spillimacheen Crossing--Westside Road	544347	5639427
Spillimacheen--0.7 km South	544857	5639073
Spillimacheen--Stewart's Slough	543344	5637923
Spillimacheen--Galena Creek Ranch Slough	546125	5637575
Spillimacheen Rest Area	547660	5635241
Whiskey Point--Feldman's Ranch	544652	5635773
Brisco Rd North	546084	5633382
Brisco Rd--Feldman's Ranch	546773	5633038
Brisco west--Warner's Slough	547512	5632483
Brisco Rd - Patty's Greenhouse Slough	547706	5632129
3.6 km north of Brisco Store	549249	5633473
2.5 km north of Brisco Store	550351	5632619
0.7 km north of Brisco Store	550358	5631909
Brisco west--Trecher's Slough	549884	5630634
Brisco Road	550230	5631108
Rockaboo Ranch	548818	5631234
Brisco South - 2971 Hwy 95	552128	5629529
Brisco South--Snider Rd	552677	5627688
Luxor Station Rd	555689	5623633
NCC Luxor Linkage conservation property	556643	5621919
Edgewater Elementary School	560928	5616250
Radium--Red Rock Lookout	562502	5609260
Radium Hot Springs--Saw Mill Pond	564095	5608185
Radium South--Lookout Points	566420	5606368

Dry Gulch - Old Coach Trail	567823	5602198
1km North of Wilmer NWA - pullout	565456	5601790
Friends of Columbia Wetland (Richies Point)	565911	5600974
Wilmer National Wildlife Area (end of Smith Rd)	566728	5599495
Wilmer Pontoon Road	567240	5598807
Athalmer Sloughs	568927	5597788
Athalmer bridge - Pete's Marina	569526	5596332
James Chabot Provincial Park	569330	5596005
Invermere--Dorothy Lake	569101	5594510
Invermere--Kin Beach/Lake Windermere	569095	5594379
Invermere--Lakeview Meadows/Lake Windermere	570298	5594260
Invermere--Baltac Beach/Lake Windermere	570748	5593653
Off Baltac Road--Lake Windermere	571272	5593421
Private Beach Area Baltac Road	571045	5593558
Windermere Cemetery Hill	571394	5590993
Invermere--Cardiff Ave Beach/Lake Windermere	571529	5590359
Invermere--Windermere Creek/Lake Windermere	571533	5590015
Invermere--Grizzly Ridge Heights	569121	5592081
Lake Windermere--End of Coy Rd	570100	5590763
Lake Windermere--Ruault Road	572625	5587673
Lake Windermere--Lakeshore Resort Campground	575004	5586649
Lake Windermere--Rushmere Road	574620	5585343
Southeast End of Lake Windermere	576287	5585082
South End Lake Windermere	576054	5583970
700m north of Mud Lake - Fairmont	578997	5578850
Columbia Wetlands Viewpoint Trail	577610	5580679
Mud Lake--Fairmont	579159	5578413
Fairmont Meadows to Lakeshore Resort canoe route	580246	5577665
Fairmont--meadows	580258	5577755
Columere Park	580366	5571414
Columbia Lake - north end marsh	581716	5573360
Columbia Lake -- Rockbeach	581432	5571629
Columere Park Boat Launch	580493	5571409
Columbia Lake--Lot 48	581643	5569871
Columbia Lake -Shoreline near Columbia Ridge	580589	5566703
Columbia Lake-Armstrong Bay	582049	5567396
Lewis's Woodpecker Site	581834	5558978
Tilley Memorial Park--Canal Flats	584276	5559075
Columbia Lake--South end	582499	5557440

Columbia Wetlands Waterbird Survey 2015-2019

Appendix 4. Species counts during each survey date of the spring 2015-2019 CWWS

Species Name	Apr 24/2015		Apr 29/2015		May 4/2015		Apr 3/2016		Apr 10/2016		Apr 16/2016		Apr 3/2017		Apr 10/2017		Apr 16/2017		Apr 3/2018		Apr 10/2018		Apr 16/2018		Apr 3/2019		Apr 10/2019		Apr 16/2019		
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	
Snow Goose	-	-	-	-	-	-	-	-	3	1	14	1	17	2	10	2	53	6	-	-	-	-	58	4	-	-	-	-	-	-	
Snow/Ross's Goose	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	
Canada Goose	380	40	425	40	421	33	798	64	838	67	640	59	1,245	79	956	78	811	73	1,917	71	1,415	78	1,072	81	1,278	81	1,188	82	1,027	83	
goose sp.	1	1	5	1	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trumpeter Swan	23	6	5	3	15	4	32	10	29	9	14	4	72	12	69	13	57	18	197	13	105	23	35	11	73	21	80	21	100	22	
*Tundra Swan	2	1	-	-	7	2	39	6	14	2	-	-	14	5	8	2	15	2	52	8	11	2	2	1	32	9	60	4	16	5	
Trumpeter/Tundra Sw	7	2	1	1	6	4	37	6	9	5	13	4	316	22	94	18	40	13	623	19	562	28	273	22	221	18	201	18	51	13	
Wood Duck	32	8	34	8	44	7	47	13	58	13	47	8	7	4	63	14	36	13	15	6	18	6	49	15	31	5	30	8	48	11	
Blue-winged Teal	2	1	-	-	1	1	7	1	-	-	-	-	-	-	-	-	-	-	-	-	3	1	5	1	2	1	-	-	6	1	
Cinnamon Teal	17	7	46	10	30	11	-	-	-	-	5	2	-	-	-	-	2	1	-	-	4	1	9	1	-	-	-	-	1	1	
Blue-winged/Cinnam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	1	-	-	-	-	-	-	-	-	
Northern Shoveler	94	9	382	13	79	7	19	4	17	4	74	9	8	4	43	9	18	3	1	1	69	9	493	26	2	1	16	6	25	10	
Gadwall	8	3	38	5	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	5	
Eurasian Wigeon	-	-	-	-	-	-	-	-	2	1	-	-	1	1	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	
American Wigeon	817	16	308	16	280	23	1,954	29	1,994	31	900	22	1,333	38	1,226	29	1,376	23	1,284	27	2,473	46	1,877	48	997	30	946	31	623	29	
Mallard	727	48	495	48	514	49	1,991	71	1,394	70	1,225	64	1,863	65	1,225	72	1,342	70	3,438	47	4,817	88	4,023	90	2,015	74	1,939	82	1,614	86	
Northern Pintail	170	12	89	9	142	2	113	9	247	15	205	14	75	9	122	9	41	5	807	13	995	25	880	22	114	12	209	8	165	12	
Green-winged Teal	322	14	399	14	70	9	97	6	492	14	486	13	66	9	197	14	392	16	132	8	227	18	676	25	67	10	259	16	322	23	
teal sp.	-	-	-	-	-	-	31	3	-	-	2	1	-	-	-	-	-	-	-	-	8	1	-	-	3	1	-	-	-	-	
dabbling duck sp.	594	2	90	1	-	-	4	2	430	5	102	6	186	6	156	6	129	7	583	5	63	4	59	3	182	3	44	5	219	7	
Canvasback	2	1	-	-	-	-	2	2	4	1	4	1	-	-	-	15	2	-	-	1	1	3	2	-	-	2	1	--	-	-	
Redhead	39	4	12	3	28	3	24	4	14	3	8	1	4	1	17	2	10	3	1	1	169	4	64	7	-	-	13	3	7	1	
Ring-necked Duck	412	18	294	18	137	18	185	14	307	22	297	22	98	9	321	18	298	25	15	5	409	18	753	26	71	12	141	12	217	16	
Greater Scaup	-	-	2	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lesser Scaup	8	4	29	3	14	2	10	4	174	4	184	6	66	5	8	3	49	9	30	1	41	3	47	3	37	4	21	3	108	3	
Greater/Lesser Scaup	-	-	-	-	-	-	131	2	11	1	-	-	3	1	91	7	5	1	10	4	120	3	163	8	10	2	34	3	20	1	
Long-tailed Duck	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bufflehead	130	26	119	21	302	27	71	21	168	28	175	29	58	17	125	33	291	39	59	11	125	23	168	36	124	20	96	26	228	41	
Common Goldeneye	96	17	43	14	71	13	370	28	238	34	103	18	297	25	230	35	199	40	223	25	473	32	881	36	233	26	214	31	213	32	
Barrow's Goldeneye	-	-	2	1	-	-	10	4	2	1	6	2	32	4	18	6	7	2	10	3	5	2	-	-	9	4	16	6	14	4	
Common/Barrow's G	-	-	-	-	-	-	1	1	10	3	18	4	8	1	5	2	2	1	-	-	-	-	7	1	9	1	4	2	4	2	
Hooded Merganser	88	18	94	22	108	21	115	32	114	21	66	14	55	13	137	27	123	31	71	14	121	28	132	32	82	26	121	35	135	29	
Common Merganser	89	12	21	5	84	12	467	27	300	29	238	14	456	25	255	31	181	29	112	17	346	32	429	32	204	18	334	30	406	36	
Red-breasted Mergar	2	1	-	-	3	2	-	-	-	-	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Common/Red-breast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-
merganser sp.	-	-	2	1	7	1	-	-	1	1	4	1	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-	11	1	-	-
Ruddy Duck	1	1	14	2	16	3	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
duck sp.	515	3	31	2	70	3	325	8	32	5	206	4	268	11	304	6	732	10	1,419	10	1,510	12	3,141	19	97	5	272	7	427	13	
waterfowl sp.	3	2	639	10	354	8	688	7	313	15	159	18	296	7	383	11	397	11	7	1	38	2	161	5	3	1	18	3	-	-	

Appendix 4 (con't). Species counts during each survey date of the spring 2015-2019 CWWS.

Species Name	Apr 24/2015		Apr 29/2015		May 4/2015		Apr 3/2016		Apr 10/2016		Apr 16/2016		Apr 3/2017		Apr 10/2017		Apr 16/2017		Apr 3/2018		Apr 10/2018		Apr 16/2018		Apr 3/2019		Apr 10/2019		Apr 16/2019		
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	
Ruffed Grouse	-	-	2	2	1	1	-	-	5	4	3	2	3	2	3	3	4	3	1	1	3	2	1	1	-	-	1	1	4	4	
Dusky Grouse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	
grouse sp.	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	1	1	1	-	-	-	-	1	1	-	-	-	-	-	-	
Wild Turkey	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1		
Common Loon	20	12	16	8	15	10	17	8	18	12	14	11	10	5	9	7	24	14	1	1	1	1	22	15	-	-	10	8	39	22	
*American White Pe	-	-	-	-	16	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*American Bittern	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pied-billed Grebe	10	7	5	4	9	4	10	8	15	9	14	9	8	4	9	7	15	9	2	2	9	5	4	4	5	2	6	5	14	9	
*Horned Grebe	1	1	11	1	43	4	-	-	4	3	10	2	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	4	2	
Red-necked Grebe	14	6	11	5	78	8	16	7	42	13	25	10	1	1	2	1	50	11	-	-	-	-	7	3	-	-	8	7	25	11	
*Eared Grebe	-	-	-	-	11	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
*Horned/Eared Greb	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	
*Western Grebe	1	1	-	-	11	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
grebe sp.	-	-	1	1	-	-	2	1	-	-	1	1	-	-	-	-	1	1	-	-	2	1	1	1	-	-	3	2	-	-	
Eurasian Collared Dc	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mourning Dove	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	3	2	
Rock Pigeon	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-		
Sora	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
*Great Blue Heron	41	11	22	6	44	17	38	9	48	12	81	9	15	4	40	9	36	9	27	1	56	8	52	13	34	4	38	5	31	5	
Turkey Vulture	12	3	1	1	1	1	-	-	1	1	-	-	1	1	6	4	1	1	2	1	4	2	1	1	1	1	--	-	4	3	
Osprey	18	10	22	13	22	15	1	1	11	7	10	9	4	2	29	17	28	18	2	2	12	10	21	12	1	1	13	12	24	16	
Golden Eagle	-	-	2	1	1	1	2	2	-	-	-	-	-	1	1	-	-	1	1	2	2	-	-	-	-	-	-	-	-	-	
Northern Harrier	1	1	5	4	1	1	-	-	7	6	5	5	2	2	5	5	6	5	2	2	1	1	6	5	3	3	4	4	6	5	
Cooper's Hawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	
Sharp-shinned Hawk	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sharp-shinned/Coope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	
Northern Goshawk	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	
Bald Eagle	22	13	45	22	33	19	35	19	34	19	34	18	63	31	77	39	63	27	46	25	64	30	76	45	91	40	66	38	66	37	
Golden/Bald Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1	1	-	-	2	2	--	-	1	1	
Red-tailed Hawk	2	2	2	2	4	4	6	3	2	2	1	1	6	6	10	8	9	6	5	4	8	5	8	8	2	2	5	4	2	2	
*Rough-legged Hawk	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
buteo sp.	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	
hawk sp.	-	-	-	-	1	1	2	2	-	-	1	1	4	4	3	2	2	2	2	2	2	1	1	6	6	2	2	4	4	3	3
Virginia Rail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	
American Coot	775	11	166	9	246	8	869	9	1593	12	539	9	273	3	360	9	2,226	19	-	-	730	10	2,344	21	562	4	460	3	993	8	
Sandhill Crane	3	1	2	2	5	2	4	3	4	3	4	3	5	3	6	4	6	4	4	4	2	6	4	8	5	6	3	1	1	14	10

Appendix 4 (con't). Species counts during each survey date of the spring 2015-2019 CWWS.

Species Name	Apr 24/2015		Apr 29/2015		May 4/2015		Apr 3/2016		Apr 10/2016		Apr 16/2016		Apr 3/2017		Apr 10/2017		Apr 16/2017		Apr 3/2018		Apr 10/2018		Apr 16/2018		Apr 3/2019		Apr 10/2019		Apr 16/2019	
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size
Black-necked Stilt	-	-	1	1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	3	-	-	-	-	4	1
Killdeer	3	1	6	3	18	12	12	5	9	6	17	10	7	4	11	8	12	8	15	5	41	15	40	12	16	9	13	8	5	4
Semipalmated Sandpiper sp.	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Baird's Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	-	-	-	-	-	-
Wilson's Snipe	3	3	2	2	2	2	-	-	2	1	-	-	-	-	-	-	2	1	-	-	-	-	6	1	-	-	1	1	1	1
Solitary Sandpiper	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Sandpiper	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semipalmated Plover	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greater Yellowlegs	4	1	5	1	1	1	-	-	4	2	2	2	-	-	2	1	-	-	-	-	-	-	4	1	-	-	-	-	-	-
Lesser Yellowlegs	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	-	-	6	1	-	-
Tringa sp.	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
shorebird sp.	1	1	-	-	5	2	-	-	1	1	-	-	1	1	-	-	-	-	6	1	3	2	-	-	-	-	-	-	-	-
Bonaparte's Gull	--	-	80	2	15	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring-billed Gull	1	1	8	1	28	3	17	2	9	3	-	-	35	2	18	2	10	3	-	-	1	1	46	3	-	-	13	2	2	1
*California Gull	-	-	-	-	-	-	1	1	-	-	-	-	1	1	6	1	-	-	40	1	22	2	22	3	-	-	118	2	1	1
Herring Gull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
gull sp.	-	-	14	1	25	3	36	3	9	1	13	2	2	2	53	6	40	5	6	1	26	8	131	15	12	4	312	8	27	4
Great Horned Owl	-	-	-	-	-	-	1	1	2	2	1	1	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Great Gray Owl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Barred Owl	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belted Kingfisher	4	4	6	5	14	8	6	5	3	3	11	9	1	1	3	3	5	5	1	1	4	4	9	8	13	10	14	12	5	5
Red-naped Sapsucker	-	-	2	2	6	4	-	-	2	1	3	1	-	-	2	2	6	3	-	-	-	-	-	-	3	3	2	1	7	4
Downy Woodpecker	-	-	2	1	-	-	-	-	7	5	-	-	1	1	1	1	4	3	1	1	4	3	1	1	6	4	1	1	5	4
Hairy Woodpecker	-	-	-	-	1	1	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	2	2	2	5	5
Downy/Hairy Woodpecker	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	2	1	-	-
Northern Flicker	5	4	5	4	9	7	37	21	42	21	30	22	46	27	63	29	60	28	20	17	51	34	59	33	61	39	50	31	49	28
Pileated Woodpecker	1	1	4	2	1	1	11	8	6	4	5	3	12	7	8	4	7	4	3	3	2	2	3	3	4	4	9	7	5	4
woodpecker sp.	--	-	2	1	4	4	4	4	7	6	10	8	1	1	-	-	2	2	1	1	1	1	2	2	4	4	6	6	7	6
American Kestrel	3	1	6	3	5	3	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	3	3	-	-	-	-	1	1
Merlin	2	1	-	-	1	1	1	1	4	3	1	1	2	2	3	1	-	-	-	-	2	2	4	4	2	2	1	1	2	2
diurnal raptor sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Say's Phoebe	-	-	-	-	-	-	1	1	2	2	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern Shrike	-	-	-	-	-	-	-	-	1	1	-	-	1	1	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-
flycatcher sp.	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 4 (con't). Species counts during each survey date of the spring 2015-2019 CWWS.

Species Name	Apr 24/2015		Apr 29/2015		May 4/2015		Apr 3/2016		Apr 10/2016		Apr 16/2016		Apr 3/2017		Apr 10/2017		Apr 16/2017		Apr 3/2018		Apr 10/2018		Apr 16/2018		Apr 3/2019		Apr 10/2019		Apr 16/2019		
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	
Canada Jay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-		
Steller's Jay	1	1	-	-	-	-	3	2	2	1	2	1	-	-	-	-	2	1	3	2	-	-	-	-	3	1	-	-	-	-	
Clark's Nutcracker	3	1	2	1	-	-	1	1	3	1	1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	3	3	4	3		
Blue Jay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-		
Black-billed Magpie	12	5	15	8	16	7	19	9	19	11	23	9	43	14	29	12	26	15	37	16	33	17	27	17	39	22	45	25	29	15	
American Crow	25	8	44	13	62	15	51	13	116	23	113	23	113	33	170	29	137	32	107	20	117	29	115	28	155	38	143	31	144	40	
Common Raven	78	7	16	7	12	6	35	15	31	13	30	10	57	19	39	16	54	20	53	22	21	13	38	18	52	18	48	20	41	17	
crow/raven sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	1	37	3
Northern Rough-wing	10	1	9	3	68	8	1	1	17	3	2	1	-	-	-	-	21	2	-	-	1	1	20	1	-	-	2	1	1	1	
Tree Swallow	20	1	10	3	34	6	114	9	173	16	117	13	60	6	104	10	126	14	-	-	96	9	171	12	181	15	114	13	174	13	
Violet-green Swallow	2	1	-	-	-	-	1	1	24	5	19	4	160	1	35	4	10	4	-	-	2	1	-	-	34	2	24	2	85	5	
Tree/Violet-green Sw	-	-	-	-	-	-	-	-	-	-	-	-	6	1	7	1	4	1	-	-	15	2	8	1	18	2	2	1	50	1	
*Bank Swallow	10	1	12	2	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cliff Swallow	-	-	7	1	10	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
swallow sp.	37	2	42	3	9	3	11	2	43	3	12	3	35	2	146	5	40	6	6	1	20	6	184	9	33	7	24	3	95	7	
Black-capped Chickadee	-	-	1	1	--	-	15	10	17	6	25	8	36	14	27	7	25	10	35	12	31	13	19	12	55	19	35	12	32	17	
Mountain Chickadee	-	-	-	-	--	-	3	1	9	2	11	6	11	6	9	5	14	7	13	6	5	3	2	2	13	5	7	3	13	6	
chickadee sp.	2	2	2	1	4	2	19	8	16	6	12	5	18	5	11	5	20	8	16	5	21	7	8	3	22	5	2	1	9	6	
Red-breasted Nuthatch	-	-	-	-	2	2	19	10	21	10	17	11	40	20	35	19	38	19	7	5	12	9	5	4	18	16	19	10	16	12	
nuthatch sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	
Brown Creeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	
Pacific Wren	1	1	-	-	1	1	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-
Marsh Wren	5	3	8	4	11	3	1	1	4	3	5	4	-	-	6	4	9	5	-	-	-	-	1	1	12	7	11	6	8	4	
American Dipper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
Golden-crowned Kinglet	-	-	-	-	-	-	-	-	-	-	2	1	1	1	-	-	-	-	-	-	4	1	-	-	-	-	-	2	1	-	-
Ruby-crowned Kinglet	12	7	19	7	16	9	1	1	6	5	5	4	3	3	7	2	26	11	-	-	1	1	1	1	-	-	1	1	6	5	
kinglet sp.	-	-	-	-	-	-	-	-	-	-	-	-	5	1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	
Western Bluebird	-	-	-	-	-	-	-	-	-	-	-	-	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	-	-
Mountain Bluebird	1	1	-	-	1	1	-	-	4	3	6	4	21	7	8	4	9	4	-	-	9	2	28	4	11	3	5	4	3	1	
bluebird sp.	-	-	-	-	4	1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	1	1	2	1	-	-	4	1	
Townsend's Solitaire	-	-	-	-	-	-	-	-	-	-	1	1	3	2	-	-	-	-	3	2	1	1	1	1	2	2	1	1	-	-	
Varied Thrush	2	1	-	-	-	-	-	-	-	-	-	-	-	4	4	2	1	6	5	8	7	7	6	2	2	1	1	-	-		
American Robin	1	1	6	5	10	4	55	20	61	21	54	24	93	30	79	32	79	24	43	15	140	40	209	42	80	41	67	35	85	35	

Columbia Wetlands Waterbird Survey 2015-2019

Appendix 4 (con't). Species counts during each survey date of the spring 2015-2019 CWWS.

Species Name	Apr 24/2015		Apr 29/2015		May 4/2015		Apr 3/2016		Apr 10/2016		Apr 16/2016		Apr 3/2017		Apr 10/2017		Apr 16/2017		Apr 3/2018		Apr 10/2018		Apr 16/2018		Apr 3/2019		Apr 10/2019		Apr 16/2019	
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size
American Pipit	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	4	2	-	-	-	-	-	-	-	-	-	-	-	
Cedar Waxwing	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-	-	-	-	-	-	
House Finch	2	1	--	-	-	-	-	-	3	2	2	2	2	1	2	1	-	-	6	3	2	1	1	1	2	1	3	2	-	
Purple Finch	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	
Northern Waterthrush	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Orange-crowned Warbler	-	-	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Yellow-rumped Warbler	1	1	4	2	11	5	-	-	-	-	-	-	-	2	2	5	3	-	-	-	-	1	1	-	-	-	-	-	-	
Townsend's Warbler	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	
Chipping Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	
European Starling	-	-	3	1	-	-	27	2	15	3	4	2	76	2	2	1	19	1	24	3	446	8	234	5	277	7	82	5	22	4
Fox Sparrow	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
American Tree Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-	2	1	-	-	1	1	-	-	
Dark-eyed Junco	3	2	4	2	-	-	23	12	28	13	23	10	31	15	29	11	28	14	77	18	67	24	108	24	55	21	44	17	34	19
White-crowned Sparrow	-	-	39	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	
Vesper Sparrow	-	-	-	-	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Savannah Sparrow	-	-	16	1	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	6	2	
Song Sparrow	17	13	19	13	24	11	56	25	68	23	38	17	78	33	93	31	104	30	44	22	61	28	62	22	72	38	107	45	52	27
Lincoln's Sparrow	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	
Spotted Towhee	-	-	1	1	1	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	
sparrow sp.	-	-	-	-	1	1	-	-	6	1	4	1	2	1	-	-	2	1	-	-	3	2	3	1	-	-	10	2	6	2
Yellow-headed Blackbird	7	3	4	2	29	6	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	
Western Meadowlark	1	1	5	4	7	4	7	5	11	8	7	6	4	4	10	8	10	10	3	2	4	3	5	4	5	4	4	4	6	6
Red-winged Blackbird	62	15	136	23	177	17	89	22	142	25	97	18	122	30	193	35	172	38	136	30	151	37	152	45	172	44	186	48	173	38
Brown-headed Cowbird	20	1	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	1	
Brewer's Blackbird	-	-	4	1	20	2	-	-	-	-	26	2	-	-	2	1	5	2	-	-	-	-	-	-	-	-	1	1	-	-
blackbird sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pine Grosbeak	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2	
Gray-crowned Rosy-finch sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Common Redpoll	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1	-	-	-	6	2	-	-	-	-	-	-
Red Crossbill	-	-	-	-	-	-	-	-	-	-	-	-	5	1	-	-	2	1	-	-	-	-	-	-	-	-	2	1	-	-
White-winged Crossbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	4	8	4	2	2
Pine Siskin	-	-	5	1	2	1	-	-	18	3	1	1	25	5	9	3	15	3	-	-	-	-	-	-	215	29	103	21	139	24
Western Tanager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
passerine sp.	-	-	-	-	-	-	1	1	-	-	-	-	4	2	6	3	5	1	-	-	24	5	115	4	1	1	46	6	12	4

Columbia Wetlands Waterbird Survey 2015-2019

Appendix 5 (con't). Species counts during each survey date of the fall 2015-2019 CWWS.

Species Name	Sept 29/2015		Oct 5/2015		Oct 15/2015		Oct 25/2015		Sept 29/2016		Oct 5/2016		Oct 15/2016		Sept 29/2017		Oct 5/2017		Oct 15/2017		Sept 29/2018		Oct 5/2018		Oct 15/2018		Sept 29/2019		Oct 5/2019		Oct 15/2019		
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	
Semipalmated Plover	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-	-	-	-		
Pectoral Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	11	1	-	-	15	1	12	1	-	-	2	1	-	-			
Long-billed Dowitcher	-	-	-	-	13	1	10	2	10	2	-	-	44	2	52	3	58	2	109	3	45	5	241	8	204	7	9	1	52	5	54	4	
Wilson's Phalarope	-	-	-	-	-	-	-	-	13	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Greater Yellowlegs	-	-	-	-	-	-	-	-	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	
Greater/Lesser Yellowlegs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-	-	-	-	-	-	-	-	-	-	16	1	
Scolopacidae sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	1	
large shorebird sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41	2	-	-	-	-	1	1	
shorebird sp.	-	-	-	-	-	-	-	-	96	3	2	2	-	80	4	34	1	4	1	9	2	3	2	17	3	1	1	14	2	31	4		
Bonaparte's Gull	-	-	-	-	2	1	-	-	-	1	1	7	1	-	-	-	-	-	-	-	1	1	13	1	-	-	1	1	6	2			
Ring-billed Gull	30	3	50	5	151	2	58	3	86	5	129	12	181	8	29	6	115	5	201	8	61	6	19	3	52	6	69	3	11	5	16	4	
*California Gull	-	-	15	2	8	1	13	3	10	2	41	2	35	4	20	2	7	1	8	2	35	3	6	1	5	1	12	2	11	3	1	1	
Herring Gull	-	-	2	1	-	-	2	1	5	2	17	2	18	1	2	1	-	-	8	3	-	-	-	-	-	-	-	-	-	-	-	-	
gull sp.	51	4	109	10	390	11	43	10	124	11	512	16	223	15	44	11	81	18	85	13	97	14	170	18	212	27	117	17	213	21	284	23	
Great Gray Owl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	
Northern Pygmy Owl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	
Belted Kingfisher	3	3	4	4	6	5	8	7	7	6	12	10	12	10	8	7	12	10	1	1	13	10	12	9	14	11	9	8	12	11	5	5	
Red-naped Sapsucker	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Downy Woodpecker	-	-	1	1	-	-	-	-	2	2	2	2	1	1	-	-	-	-	-	3	2	-	-	3	3	-	-	-	-	1	1	-	
Hairy Woodpecker	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1	-	-	-	-	2	2	-	-	
Downy/Hairy Woodpecker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	
Northern Flicker	-	-	7	7	4	4	11	6	7	6	19	18	17	12	8	7	24	20	7	7	16	12	20	14	14	11	9	9	13	8	12	10	
Pileated Woodpecker	1	1	1	1	2	2	2	2	2	1	9	8	-	-	2	2	5	4	2	2	2	2	1	1	3	2	2	2	7	7	2	2	
woodpecker sp.	1	1	2	2	1	1	1	1	1	1	-	-	-	1	1	1	1	-	-	3	3	1	1	-	-	-	-	-	-	1	1	-	
American Kestrel	1	1	-	-	-	-	1	1	-	1	-	-	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-	-	-	-	-	-	
Merlin	-	-	-	-	-	-	-	4	3	-	-	1	1	3	3	-	-	2	2	2	2	2	2	2	-	-	-	2	2	1	1	-	
*Peregrine Falcon	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
falcon sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	
Northern Shrike	-	-	-	-	1	1	-	-	1	1	2	2	1	1	-	-	-	-	1	1	-	-	1	1	1	1	1	-	-	-	-	-	
Canada Jay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1	-	-	
Steller's Jay	-	-	3	2	1	1	1	1	-	-	-	-	1	1	1	1	2	2	2	1	4	1	1	1	1	1	2	1	-	-	3	2	
Clark's Nutcracker	-	-	2	2	3	2	5	3	-	-	-	-	-	1	1	-	-	-	-	-	33	8	15	4	14	7	-	-	-	-	2	1	
Blue Jay	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Black-billed Magpie	6	2	9	7	6	5	14	10	17	12	17	13	13	8	19	14	24	17	18	11	31	22	20	16	31	22	29	23	21	15	25	19	
American Crow	32	9	47	6	41	7	5	5	92	11	18	8	26	5	117	16	79	11	74	13	166	18	196	18	77	14	225	13	201	12	23	9	
Common Raven	2	1	19	7	34	9	45	15	32	10	30	14	15	11	26	12	58	18	33	16	41	19	25	18	28	16	36	16	34	14	33	18	
crow/raven sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	

Columbia Wetlands Waterbird Survey 2015-2019

Appendix 5 (con't). Species counts during each survey date of the fall 2015-2019 CWWS.

Species Name	Sept 29/2015		Oct 5/2015		Oct 15/2015		Oct 25/2015		Sept 29/2016		Oct 5/2016		Oct 15/2016		Sept 29/2017		Oct 5/2017		Oct 15/2017		Sept 29/2018		Oct 5/2018		Oct 15/2018		Sept 29/2019		Oct 5/2019		Oct 15/2019		
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	
Black-capped Chickadee	10	2	6	1	4	3	15	4	19	6	17	5	20	5	22	6	24	9	24	6	41	11	24	10	46	14	17	5	30	11	42	12	
Mountain Chickadee	-	-	7	1	3	2	5	2	7	2	22	5	3	1	3	1	1	1	-	-	11	5	11	4	19	4	2	1	14	5	3	1	
chickadee sp.	-	-	3	3	5	1	8	3	-	-	10	4	-	-	14	7	8	4	1	1	43	5	4	2	10	3	8	1	-	-	8	5	
Red-breasted Nuthatch	-	-	2	2	-	-	-	-	19	8	25	12	12	5	11	8	20	13	-	-	27	15	10	6	21	11	5	3	15	7	19	9	
nuthatch sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	1	1	
Brown Creeper	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Marsh Wren	5	1	6	3	5	2	-	-	2	1	6	2	2	2	5	4	6	3	2	1	7	5	8	5	2	1	1	1	8	4	1	1	
wren sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	
American Dipper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	1	1	
Golden-crowned Kinglet	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	4	1	1	1	-	-	-	-	-	-	
Ruby-crowned Kinglet	-	-	1	1	-	-	-	-	-	-	5	2	-	-	1	1	3	2	-	-	6	1	2	1	-	-	-	-	6	3	-	-	
kinglet sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	-	-	-	-	-	-	
Mountain Bluebird	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	48	3	-	-	-	-	2	1	-	-	
Townsend's Solitaire	2	1	7	6	9	6	13	7	17	7	14	6	6	5	15	8	24	11	5	4	25	12	26	10	32	15	10	6	20	14	21	11	
American Robin	-	-	11	4	9	3	4	2	9	3	10	5	1	1	17	6	15	5	-	-	48	5	100	12	12	7	6	2	15	5	5	1	
Gray Catbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	
American Pipit	-	-	1	1	-	-	-	-	-	-	15	1	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	1	1	-	-	
Lapland Longspur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	1	-	-	-	-	-	-	-	-	-	-	-	-	
Cedar Waxwing	-	-	20	1	-	-	-	-	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	
Bohemian Waxwing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	1	-	-	-	-	-	-	
House Finch	-	-	-	-	1	1	4	2	-	-	-	-	-	-	2	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Orange-crowned Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	
Yellow-rumped Warbler	-	-	1	1	-	-	-	-	-	-	-	-	-	-	3	2	2	2	-	-	11	3	9	2	-	-	13	2	13	4	2	2	
Wilson's Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
warbler sp. (Parulidae)	-	-	-	-	1	1	-	-	4	1	-	-	-	-	1	1	-	-	-	-	3	1	-	-	2	1	-	-	-	-	-	-	
American Goldfinch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	3	1
Chipping Sparrow	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1	1	3	1	-	-	-	-	-	-	-	-	
European Starling	-	-	195	2	200	1	100	1	-	-	-	-	5	1	15	1	28	2	-	-	-	-	-	-	-	-	209	3	15	2	-	-	
Snow Bunting	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
American Tree Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	5	2	-	-	2	1	6	2	
Dark-eyed Junco	4	2	3	2	4	2	1	1	33	8	4	4	12	3	3	2	7	4	2	1	43	10	56	8	15	5	13	8	8	3	27	5	
White-crowned Sparrow	-	-	-	-	-	-	-	-	2	1	1	1	2	1	-	-	8	5	2	1	6	2	-	-	2	1	-	-	6	2	2	1	
White-throated Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1	1	-	-	1	1	-	-	4	1	1	1	
Savannah Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	
Song Sparrow	4	4	12	6	3	3	3	3	3	1	13	5	1	1	6	4	20	8	3	2	13	6	5	3	7	4	7	2	7	3	7	4	
Lincoln's Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	
Swamp Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	
Spotted Towhee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
sparrow sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	-	-	9	2	4	2	-	-	6	3	-	-	10	3	

Columbia Wetlands Waterbird Survey 2015-2019

Appendix 5 (con't). Species counts during each survey date of the fall 2015-2019 CWWS.

Species Name	Sept 29/2015		Oct 5/2015		Oct 15/2015		Oct 25/2015		Sept 29/2016		Oct 5/2016		Oct 15/2016		Sept 29/2017		Oct 5/2017		Oct 15/2017		Sept 29/2018		Oct 5/2018		Oct 15/2018		Sept 29/2019		Oct 5/2019		Oct 15/2019		
	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	Species Count	Sample Size	
Common Yellowthro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2	1	-	-
Western Meadowlark	-	-	-	-	-	-	1	1	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	2	1	2	1
Red-winged Blackbir	58	3	32	3	-	-	1	1	211	2	3	1	-	-	2	2	45	3	1	1	80	3	28	2	8	1	3	1	10	2	10	2	
Brown-headed Cowb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-	-	-	-	-	
Brewer's Blackbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	1	-	-	-	-	-	-	-	-	
blackbird sp.	-	-	-	-	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pine Grosbeak	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-
Cassin's Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	1	-	-	-	-	-	-
Gray-crowned Rosy-	-	-	-	-	-	-	-	-	-	-	-	30	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Common Redpoll	-	-	-	-	-	-	121	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red Crossbill	-	-	-	-	1	1	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pine Siskin	-	-	-	-	-	-	-	-	15	7	2	2	2	2	4	1	9	3	-	-	25	3	1	1	23	5	-	-	-	-	-	-	-
passerine sp.	10	2	9	1	-	-	-	-	1	1	1	1	-	-	2	2	3	2	15	1	26	7	36	7	26	3	-	-	10	4	15	3	

Appendix 6. Data from aerial swan survey completed on April 9, 2018.

General location	Location		No. of swans
	Easting	Northing	
South end Columbia Lake	583453	5558322	2
North end Columbia Lake	581070	5571935	25
Wetlands between Columbia Lk and Lk Windermere	579071	5579392	12
Wetlands between Columbia Lk and Lk Windermere	n/a	n/a	2
Wetlands between Columbia Lk and Lk Windermere	578780	5579902	7
Wetlands between Columbia Lk and Lk Windermere	578649	5580186	6
Wetlands between Columbia Lk and Lk Windermere	578581	5580429	7
Wetlands between Columbia Lk and Lk Windermere	578240	5581002	6
Wetlands between Columbia Lk and Lk Windermere	578026	5581417	4
Wetlands between Columbia Lk and Lk Windermere	578399	5580777	2
Wetlands between Columbia Lk and Lk Windermere	577203	5583230	1
Wetlands between Columbia Lk and Lk Windermere	576860	5583683	2
Wetlands between Columbia Lk and Lk Windermere	577722	5582176	2
South End Lake Windermere	575507	5585147	21
Lk Windermere W of Rushmere Rd	575142	5585547	16
Lk Windermere west of Lakeshore Resort Campground	574749	5586093	50
Lk Windermere west of Lakeshore Resort Campground	574638	5586095	2
Lk Windermere west of Lakeshore Resort Campground	574697	5586150	2
Lk Windermere west of Lakeshore Resort Campground	574325	5586462	2
Lk Windermere just south of Ruault Rd	573749	5587087	6
Lk Windermere east of Grizzly Ridge Heights	570415	5592126	2
Lk Windermere just south of Ruault Rd	574006	5586941	1
Between Lk Windermere, Athalmer slough	569092	5596544	2
Slough east of Wilmer Pontoon Rd Marsh	567706	5598986	140
Lk Windermere west of Baltac Rd	570259	5592828	14
Wetlands slightly ne of Ritchies Pt	566899	5601640	2
Wetlands slightly ne of Ritchies Pt	566849	5601780	2
Radium across from Lookout Pts	564875	5606160	1
In Columbia River just south of Radium saw mill pond	563916	5607819	2
Slough East of Red Rock Lookout	563524	5609672	9
Just south of Radium saw mill pond	564375	5606923	2
Between Edgewater and Radium	562272	5613166	2
Between Edgewater and Radium	562414	5612924	2
Between Edgewater and Luxor	559034	5617871	45
In Columbia River just south of Luxor	557470	5619698	42
Just west of Luxor Linkage	556119	5622024	3
Just north of Luxor Station	554385	5624706	5
Just north of Luxor Station	554471	5624565	3
Just south of 2971 Hwy 95	550930	5628943	5
Between Brisco Rd and Warner's Slough	549122	5632095	9
West of Snider Rd site	552284	5627363	2

West of Feldmann's Ranch	547767	5633595	1
Between Spilli Rest Area, Brisco Rd North sites	546829	5634490	11
Feldman's area, Brisco	547919	5633419	180
In Columbia River west of Spilli Rest area	545875	5635342	17
west of Spilli Rest area	546039	5635363	2
East of Stewart's Slough, Spilli	544234	5638429	78
1.5 km north of Spilli	543168	5640716	11
In Columbia River just south of Stewart's Slough, Spilli	544706	5637652	4
5 km north of Spilli	541157	5643672	70
4 km north of Spilli	541927	5642359	3
Columbia River Harrogate area	539998	5645407	3
2 km south of Nabel Rd	535558	5649857	2
West of Nabel/Gacek Creek Slough area	533949	5650963	2
West of McKeeman's Slough area	533357	5651383	4
West of Nabel/Gacek Creek Slough area	534871	5650439	17
Castledale North Area	529556	5653688	1
Between Parson Beard's Creek North, Wells Landing	527439	5655082	2
5 km south of Parson	568253	5654442	11
1.5 km north of Parson crossing	523512	5658281	6
East of the Smith's place in Parson	523061	5658648	2
SW of Braisher's Slough, Parson	521521	5659992	4
NW of Braisher's Slough, Parson	520188	5661304	3
SW of Timber Inn & Restaurant, Parson	524053	5657842	2
W of Golden, Railway Pond site	504026	5679803	2
Edelweiss area	501592	5685393	5
		Total	915

Appendix 7. Newspaper article in local community newspaper, November 29, 2018.

www.thegoldenstar.net Golden Star Thursday, November 29, 2018 Page A13

Highest counts recorded in waterbird survey

Submitted

The results of the fall 2018 Columbia Wetlands Waterbird Survey (CWWS) are in. With the highest bird counts since the project's inception in 2015, and with the largest number of volunteers participating, this was Wildsight Golden's most successful round of waterbird counts. Taking place during bird migration, 103 citizen-scientists observed birds from 185 survey stations located between Canal Flats and Donald. With each survey period lasting three hours, more than 56,000 birds were counted on three survey dates. The CWWS ground-based survey area is only able to cover about 40 per cent of the Columbia Wetlands, therefore many more birds were likely to be present in the entire wetland ecosystem. The previous CWWS record was made during the fall of 2016 with a count of 51,347 birds.

The overarching goal of the CWWS project is to involve community members in a science initiative and use resulting baseline data to nominate the Columbia Wetlands into the Important Bird and Biodiversity Areas (IBA) program. "After five years of consecutive data collection, we will create a report and subsequent IBA application, which will highlight specific bird species counts that may be high enough to enable the wetlands to be designated as an IBA," stated CWWS Program Biologist Rachel Darvill.

"After our great success this past spring of having the highest spring bird counts to date, it's fantastic to have that followed



The globally-based IBA program. This will show the world that the Columbia Wetlands holds important conservation value and needs to be recognized internationally in terms of its habitat value to birds.

Some of the more interesting results from this past fall include the highest single day count on October 3 with 19,929 individual birds. The highest single day count for an individual species was 6,495 American coots on October 5. Additional high counts included 6,080 American wigeons counted on October 15, 2,806 mallards on October 5, and 241 long-billed dowitchers on October 5. Some counts for provincially-listed at-risk birds were also submitted, including 82 hooded/marek grebes on October 15, 42 great blue herons on September 29, 19 western grebes on October 5, and eight surf scoters on September 29.

The CWWS continues to be an excellent avenue for people to become more familiar with the Columbia Wetlands and the significant biodiversity values found within, and to become more knowledgeable about local bird species. Are you keen to join the fun and participate in the waterbird surveys? If so, next year will be your last chance before we nominate the Columbia Wetlands as an IBA at the end of 2019, using data collected through this project.

There will be free bird identification training sessions and a limited amount of optical equipment for volunteers in need. E-mail CWWS program biologist at rachedarvill@gmail.com to register, or for more details about 2019 survey dates.

The long-billed dowitcher was one of the birds counted in a waterbird count in October. The highest single day count of birds in the Columbia Wetlands Waterbird Survey took place in October.

BY RACHEL DARVILL

Appendix 8. Newspaper article from local community paper, November 21, 2019.

Low counts this fall on Waterbird Survey

Nov 21/19

Submitted

This year Wildsight Golden is wrapping up the Columbia Wetlands Waterbird Survey (CWWS) project. Initiated in 2015, the CWWS is a five-year coordinated bird count where the major goal has been to mobilize and coordinate citizen-scientists to collect baseline data on birds. Volunteers collect data that will be used to nominate the Columbia Wetlands into the 'Important Bird and Biodiversity Area' (IBA) program, a global initiative with over 600 sites across Canada. The IBA sites are considered to be the world's most critical bird (and biodiversity) hotspots.

"By all accounts, I think that this five year project was a smashing success, in large part owing to the dedicated 230 volunteers that have collected a huge amount of data - over 380,000 birds counted," states Conservation Biologist Rachel Darvill. "The CWWS data is already being used in a number of ways to help improve management and conservation of Columbia Wetlands

habitat."

This fall the CWWS had a total count of 41,043 individual birds observed over the three dates at 102 survey stations, with 98 volunteers. With the exception of 2015, which had fewer survey stations and fewer volunteers, this was the lowest fall count that the CWWS experienced. The fall count in 2018 was 57,057 birds, and the fall 2017 count was 50,948 individuals. Reasons for the decline in total number of birds seen in 2019 are unknown. The highest count for an individual bird species was on October 5 with 3,577 American Coots, sighted at 16 survey stations. The second highest single species count was on a October 5 with 3,405 American Wigeons.

Some of the more rare sightings included 10 Greater White-fronted Geese, Snow Geese on all dates, and an American White Pelican that was badly injured and (sadly) ended up being euthanized at a Veterinary Clinic. Two species of owl were seen: Great Gray Owl and North-

ern Pygmy Owl, and nine at-risk bird species were recorded: Western Grebe, Barep Grebe, Horned Grebe, Double-crested Cormorant, Hairy Swain, California Gull, American White Pelican, Great Blue Heron and Rough-legged Hawk. Also of note, we had our highest count for the red-listed Western Grebe with 235 individuals reported at 13 survey stations on October 5.

"The CWWS would not be possible without the dedication of the incredible volunteers in our region, and because of the CWWS data I think that we have a very realistic opportunity of obtaining IBA status for the Columbia Wetlands," states Darvill. "With a recent report stating that 2.9 billion birds have disappeared from North America since 1970, and with 1 million species currently at-risk of extinction on Earth, I think that it's a critical time and opportunity for Wildsight to find and conserve the world's most significant bird and biodiversity hotspots," says Darvill.



The Columbia Wetlands Waterbird Survey found lower counts this year with nine species at risk.

WWSW-2019-19

More details on the fall 2019 results of the CWWS, as well as the entire 2015-2019 project will be forthcoming in a report available

by January 2020. Check out the Columbia Wetlands Waterbird Survey webpage for details and contact information.

Appendix 9. Data from aerial swan survey completed on April 8, 2019.

General location	GPS Coordinates		No. of swans
	Easting	Northing	
South end Columbia Lake	583474	5558359	30
Fairmont Meadows area	579957	5577802	9
Just north of Fairmont Meadows	579898	5578070	10
Mud Lake area	579495	5578877	6
Wetlands south of Lake Windermere	579323	5579030	4
Between Columbia Wetlands Viewpoint trail and Mud Lake	578786	5579709	3
Wetlands south of Lake Windermere	578651	5579891	2
In wetlands south of Lk Windermere	577750	5582123	3
Wetlands south of Lake Windermere	577320	5583089	2
South end Lake Windermere	576251	5584507	13
South end Lake Windermere	575713	5585149	4
Lake Windermere between Lakeshore Resort and Rushmere Rd	575046	5585845	2
South central Lake Windermere	574818	5586059	48
Across from Rault Rd in lake	573269	5587885	2
Northwest of Ruault Rd on Lk Windermere	572721	5588452	1
Windermere	570921	5590977	4
Wilmer area	567569	5599400	2
Wilmer area	567420	5599875	2
North of Richies Pt	566781	5601869	9
North of Richies Pt	566499	5602694	3
Radium area	564365	5607334	1
Radium area	564043	5608321	4
Radium area	563729	5609259	15
Radium area	563402	5610119	7
North of Red Rock Lookout	563095	5610781	3
South of Edgewater	561411	5614617	2
Edgewater	560879	5615553	2
Between Edgewater and Luxor	557555	5619703	2
Luxor area	556586	5621212	23
west of Luxor Station Rd	555312	5623276	2
Brisco	550878	5629478	2
Brisco	550509	5630324	2
East of Rockaboo Ranch, Brisco	549573	5631579	2
North of Brisco at Feldmans	548885	5632866	44
Southwest of Spillimacheen dump	547876	5634256	15
Southwest of Spillimacheen rest area	546689	5635765	6
Just south of Spillimacheen	545399	5637216	2
Just south of Spillimacheen	544617	5638253	2

Just north of Spillimacheen	543442	5640078	1
Just north of Spillimacheen	542954	5641082	4
Just north of Spillimacheen	542376	5641297	11
Between Harrogate and Spillimacheen	541721	5641878	18
Between Harrogate and Spillimacheen	541018	5642954	24
Between Harrogate and Spillimacheen	540711	5643344	7
Harrogate	539708	5644201	84
West of CSRD boundary	539728	5644282	9
West of Harrogate--old barns site	539196	5645112	10
Harrogate	538829	5645575	2
West of Ben Hynes Loop Rd quarry	538498	5646156	3
Harrogate	537247	5647425	6
Harrogate	536799	5647813	4
Northwest of Harrogate	536325	5648335	39
Northwest of Harrogate	535777	5649030	28
Between Nabel and Salsbury Rd	535251	5649552	2
West of McKeeman's Slough	533140	5651362	3
West of McKeeman's Slough	532713	5651739	2
Castledale North area	530790	5652806	3
West of Parson -- 5.6 km south site	528712	5654281	2
West of Beards Cr. Rd.	528429	5654537	2
Beards Creek Rd area	527998	5654755	2
Between Wells Landing and Beards Cr. Rd.	527798	5655004	2
Parson	522694	5658981	2
Between Carbonate Landing and Parson	520497	5661008	2
Between Carbonate Landing and Parson	520208	5661304	7
Carbonate Landing area	518460	5662839	1
Carbonate Landing area	518099	5663218	15
Carbonate Landing area	517983	5663222	2
Slightly NW of Beaver Lake	516855	5664274	41
West of Beaver Lk	515798	5665105	2
About 18 km south of Golden	511121	5668604	2
About 18 km south of Golden	510569	5669067	4
E of Mulligan's Slough	509030	5670728	2
9 Mile Slough	508320	5671537	2
S of Horse Creek Confluence	507268	5672277	2
Nicholson	505707	5677437	7
Habart area	504783	5678574	2
Slightly west of Habart	504501	5678802	13
Total # of Swans			669

Appendix 10. Osprey inventory data from the Columbia Valley osprey survey in 2019.

Nest	Nest location	Northing	Easting	Observation date	Time	Observations at nest	Nest type
1*	Old Mill in Donald	487568	5704145	August 8, 2019	1130	adults seen from a distance	pole
1*	Old Mill in Donald	487568	5704145	August 22, 2019	1210	1 adult, 2 chicks	pole
2*	Bottom of Hartley Road, top of cell tower	498238	5692706	June 3, 2019	n/a	nest building	cell tower
2	Bottom of Hartley Road, top of cell tower	498238	5692706	August 14, 2019	1326	not active	cell tower
3*	13th Street S and 7th Ave in Town of Golden	502028	5682396	May 6, 2019	0919	1 adult, prob on eggs	pole
3	13th Street S and 7th Ave in Town of Golden	502028	5682396	July 21, 2019	1630	2 dead chicks found in nest	pole
3	13th Street S and 7th Ave in Town of Golden	502028	5682396	August 16, 2019	1900	not active	pole
4*	Hwy 95 S, at CP Railway Pond across from Day Road	504896	5679931	May 6, 2019	0912	2 adults on nest, prob on eggs	pole
4*	Hwy 95 S, at CP Railway Pond across from Day Road	504896	5679931	July 31, 2019	1028	2 adults, no chicks seen	pole
4	Hwy 95 S, at CP Railway Pond across from Day Road	504896	5679931	August 19, 2019	1010	not active	pole
5	Hwy 95 S, Champagne Road off Hwy 95S	505039	5679727	August 19, 2019	n/a	not active	pole
6*	Hwy 95 S, near Lou's Feed Store	506900	5676032	May 6, 2019	0908	1 adult, prob on eggs	pole
6*	Hwy 95 S, near Lou's Feed Store	506900	5676032	July 30, 2019	n/a	2 chicks in nest	pole
6*	Hwy 95 S, near Lou's Feed Store	506900	5676032	August 25, 2019	n/a	1 chick	pole
7	Hwy 95 S at Horse Creek North end, Austin Rd	507395	5673513	May 6, 2019	0905	not active	pole
7	Hwy 95 S at Horse Creek North end, Austin Rd	507395	5673513	July 26, 2019	0940	not active	pole
7	Hwy 95 S at Horse Creek North end, Austin Rd	507395	5673513	August 15, 2019	n/a	not active	pole
8*	Horse Creek rock quarry site, beside creek	507213	5673280	June 11, 2019	n/a	occupied	pole
8	Horse Creek rock quarry site, beside creek	507213	5673280	July 31, 2019	1015	not active	pole
8	Horse Creek rock quarry site, beside creek	507213	5673280	August 15, 2019	n/a	not active	pole

9	Hwy 95 S at Horse Creek South end	508317	5672306	May 6, 2019	0903	not active	pole
9	Hwy 95 S at Horse Creek South end	508317	5672306	July 26, 2019	0937	not active	pole
9*	Hwy 95 S at Horse Creek South end	508317	5672306	August 15, 2019	1008	1 chick, 1 adult	pole
10	Hwy 95 S, South of Nine Mile Slough	509511	5671022	May 6, 2019	0858	not active	pole
10	Hwy 95 S, South of Nine Mile Slough	509511	5671022	July 26, 2019	0930	not active	pole
10	Hwy 95 S, South of Nine Mile Slough	509511	5671022	August 15, 2019	n/a	not active	pole
11*	Hwy 95 S, near VGSW colony about 16kms S of Golden	510210	5670318	May 6, 2019	0857	2 adults on nest	pole
11	Hwy 95 S, near VGSW colony about 16kms S of Golden	510210	5670318	July 26, 2019	n/a	not active	pole
11	Hwy 95 S, near VGSW colony about 16kms S of Golden	510210	5670318	August 15, 2019	n/a	not active	pole
12*	Dickson Downs Rd at private property	510846	5669517	May 7, 2019	0956	1 adult, prob on eggs	pole
12	Dickson Downs Rd at private property	510846	5669517	July 29, 2019	n/a	not active	pole
12	Dickson Downs Rd at private property	510846	5669517	August 15, 2019	n/a	not active	pole
13*	~400m W of Hwy 95 S in wetlands near Birchlands Creek	512793	5668243	May 14 2019	n/a	1 adult beside nest	tree
13*	~400m W of Hwy 95 S in wetlands near Birchlands Creek	512793	5668243	July 26, 2019	0946	1 adult, 1 chick	tree
13*	~400m W of Hwy 95 S in wetlands near Birchlands Creek	512793	5668243	August 15, 2019	1027	1 chick	tree
14	Canadian Timberframes	513969	5667201	August 15, 2019	1030	not active	pole
15	West side of Hwy 95 S, McMurdo Slough	515333	5666384	May 7, 2019	1002	CAGO on nest	pole
15	West side of Hwy 95 S, McMurdo Slough	515333	5666384	July 26, 2019	0923	not active	pole
15	West side of Hwy 95 S, McMurdo Slough	515333	5666384	August 15, 2019	0951	not active	pole
16	East side of Hwy 95 S, McMurdo Slough	515360	5666382	n/a	n/a	n/a	pole
16*	East side of Hwy 95 S, McMurdo Slough	515360	5666382	August 6, 2019	n/a	1 adult, 2 chicks	pole
16*	East side of Hwy 95 S, McMurdo Slough	515360	5666382	August 15, 2019	0951	2 adults, 3 chicks	pole
17	Columbia Valley B&B	515760	5665939	August 15, 2019	1000	not active	pole

18*	Hwy 95 S, 1km south of Mons Road	517394	5664998	May 7, 2019	1007	1 adult on nest, didn't appear to be on eggs	pole
18	Hwy 95 S, 1km south of Mons Road	517394	5664998	July 26, 2019	0954	not active	pole
18	Hwy 95 S, 1km south of Mons Road	517394	5664998	August 15, 2019	0945	not active	pole
19*	Hwy 95 S, ~28kms south of Golden	520568	5661842	May 7, 2019	1016	1 adult, prob on eggs	pole
19*	Hwy 95 S, ~28kms south of Golden	520568	5661842	July 26, 2019	1019	1 adults, 2 chicks	pole
19*	Hwy 95 S, ~28kms south of Golden	520568	5661842	August 15, 2019	1119	1 adult, 1 chick	pole
20*	Hwy 95 S, just north of Parson Store	522450	5659924	May 7, 2019	1020	1 adult, prob on eggs	pole
20*	Hwy 95 S, just north of Parson Store	522450	5659924	July 26, 2019	1023	2 chicks	pole
20*	Hwy 95 S, just north of Parson Store	522450	5659924	August 15, 2019	1129	1 fledgling	pole
21*	Hwy 95 S, Timber Inn, Parson	524531	5658477	May 7, 2019	1023	1 adult, prob on eggs	pole
21*	Hwy 95 S, Timber Inn, Parson	524531	5658477	July 26, 2019	1034	1 chick	pole
21*	Hwy 95 S, Timber Inn, Parson	524531	5658477	August 15, 2019	1137	No OSPR seen	pole
22	Hwy 95 S, south of Timber Inn, beside Wilfred's	524988	5658171	n/a	n/a	n/a	pole
22*	Hwy 95 S, south of Timber Inn, beside Wilfred's	524988	5658171	July 27, 2019	n/a	1 adult, no chicks seen	pole
22*	Hwy 95 S, south of Timber Inn, beside Wilfred's	524988	5658171	August 16, 2019	1651	2 adults	pole
23*	Hwy 95 S, South of Parson School	526207	5657242	May 7, 2019	1027	1 adult on nest, prob on eggs	pole
23*	Hwy 95 S, South of Parson School	526207	5657242	July 26, 2019	1047	2 chicks	pole
23*	Hwy 95 S, South of Parson School	526207	5657242	August 15, 2019	1144	No OSPR seen.	pole
24*	Hwy 95 S near Hildegard;s, ~250m above Hwy in field	527816	5655758	May 6, 2019	n/a	1 OSPR on nest	pole
24*	Hwy 95 S near Hildegard;s, ~250m above Hwy in field	527816	5655758	July 26, 2019	1051	1 adult, 2 chicks	pole
24*	Hwy 95 S near Hildegard;s, ~250m above Hwy in field	527816	5655758	August 15, 2019	1158	1 chick seen	pole
25	Hwy 95 S	530941	5653663	May 7, 2019	1033	unoccupied	pole
25	Hwy 95 S	530941	5653663	July 26, 2019	1059	not active	pole

25	Hwy 95 S	530941	5653663	August 15, 2019	1205	not active	pole
26*	Hwy 95 S, Quinn Creek Campground	531948	5653113	May 7, 2019	n/a	1 OSPR on nest	pole
26	Hwy 95 S, Quinn Creek Campground	531948	5653113	July 26, 2019	1101	not active	pole
26	Hwy 95 S, Quinn Creek Campground	531948	5653113	August 15, 2019	1207	not active	pole
27*	Hwy 95 S	534149	5651579	May 7, 2019	n/a	2 OSPR on nest	pole
27*	Hwy 95 S	534149	5651579	July 26, 2019	1106	1 adult, 1 chick	pole
27*	Hwy 95 S	534149	5651579	August 15, 2019	1211	no osprey seen	pole
28*	Hwy 95 S	536073	5650604	May 7, 2019	n/a	1 OSPR on nest	pole
28*	Hwy 95 S	536073	5650604	July 26, 2019	1109	1 adult, 2 chicks	pole
28*	Hwy 95 S	536073	5650604	August 15, 2019	1225	1 fledgling in and out of nest	pole
29*	Hwy 95 S, Ben Hynes Loop Rd	537904	5648337	May 7, 2019	n/a	1 OSPR on nest	pole
29*	Hwy 95 S, Ben Hynes Loop Rd	537904	5648337	July 26, 2019	1116	2 adults, 1 chick	pole
29*	Hwy 95 S, Ben Hynes Loop Rd	537904	5648337	August 15, 2019	1232	1 chick in nest testing wings. 1 adult nearby	pole
30*	Near Westside Rd/Hwy 95 intersection in Spilli, east ~400m	544800	5639788	June 12 2019	n/a	occupied	pole
30*	Near Westside Rd/Hwy 95 intersection in Spilli, east ~400m	544800	5639788	July 29, 2019	n/a	1 Adult, probable chicks	pole
30*	Near Westside Rd/Hwy 95 intersection in Spilli, east ~400m	544800	5639788	August 15, 2019	1248	1 adult, 1 chick	pole
31	Spill xing east end	544566	5639534	May 7, 2019	n/a	CAGO on nest	pole
31	Spill xing east end	544566	5639534	July 26, 2019	n/a	not active	pole
31	Spill xing east end	544566	5639534	August 15, 2019	1252	not active	pole
32*	Brisco Pole Treatment Facility	550969	5630693	May 7, 2019	n/a	1 adult OSPR	pole
32*	Brisco Pole Treatment Facility	550969	5630693	July 26, 2019	1257	2 chicks	pole
32*	Brisco Pole Treatment Facility	550969	5630693	August 15, 2019	1228	2 chicks	pole
33*	Trescher's Field near barn	549912	5630945	May 7, 2019	n/a	1 OSPR	pole

33*	Trescher's Field near barn	549912	5630945	July 26, 2019	1303	1 adult, 2 chicks	pole
33*	Trescher's Field near barn	549912	5630945	August 15, 2019	1438	1 adult, 1 chick	pole
34*	Trescher's Field west, on hydro line	549749	5630689	June 12 2019	n/a	2 adults beside partially built nest	pole
34	Trescher's Field west, on hydro line	549749	5630689	July 26, 2019	1310	not active	pole
34	Trescher's Field west, on hydro line	549749	5630689	August 15, 2019	1441	not active	pole
35*	Radium xing	563761	5608098	May 7, 2019	n/a	2 OSPR	pole
35	Radium xing	563761	5608098	July 26, 2019	n/a	not active	pole
35	Radium xing	563761	5608098	August 15, 2019	1524	not active	pole
36	New nest pole - Athalmer	569469	5596354	August 16, 2019	1031	not active	pole
37	James Chabot Provincial Park	569268	5596096	May 7, 2019	n/a	not active	pole
37	James Chabot Provincial Park	569268	5596096	July 26, 2019	n/a	not active	pole
37	James Chabot Provincial Park	569268	5596096	August 16, 2019	1028	not active	pole
38	West of Rona in Invermere, in field across from houses	568847	5596040	n/a	n/a	n/a	pole
38*	West of Rona in Invermere, in field across from houses	568847	5596040	July 27, 2019	1524	2 adults nearby, 2 chicks	pole
38*	West of Rona in Invermere, in field across from houses	568847	5596040	August 16	1020	no osprey seen	pole
39*	Lake Windermere near Taoya's house	568771	5595570	June 12, 2019	n/a	occupied	tree/pole?
39*	Lake Windermere near Taoya's house	568771	5595570	August 2, 2019	n/a	adults at nest, probable chicks	tree/pole?
39*	Lake Windermere near Taoya's house	568771	5595570	n/a	n/a	n/a	tree/pole?
40	Downtown Invermere, behind arena	569141	5595225	August 16, 2019	1015	Not active	pole
41*	Dorothy Lake	569084	5594499	May 7, 2019	n/a	2 OSPR	pole
41*	Dorothy Lake	569084	5594499	July 26, 2019	1512	1 adult, 2 chicks	pole
41*	Dorothy Lake	569084	5594499	August 16, 2019	1009	No osprey	pole
42*	RDEK offices - Windermere Loop Rd	572650	5593879	May 23, 2019	n/a	1 adult	pole

42*	RDEK offices - Windermere Loop Rd	572650	5593879	July 27, 2019	1542	2 chicks	pole
42*	RDEK offices - Windermere Loop Rd	572650	5593879	August 16, 2019	1039	no osprey	pole
43*	North of Winderbury Nursery	572182	5591459	May 7, 2019	n/a	1 OSPR on nest hunkered dwn	pole
43*	North of Winderbury Nursery	572182	5591459	July 27, 2019	1455	1 adult, 2 chicks	pole
43*	North of Winderbury Nursery	572182	5591459	August 16, 2019	1046	1adult, 1 chick	pole
44*	Behind Winderbury Nursery (Gail's nest)	572223	5590766	May 13, 2019	n/a	occupied	pole
44*	Behind Winderbury Nursery (Gail's nest)	572223	5590766	July 22, 2019	n/a	2 chicks in nest	pole
44*	Behind Winderbury Nursery (Gail's nest)	572223	5590766	August 16, 2019	1200	2 chicks in nest	pole
45*	Akisqnuq Offices - across the street	573056	5590459	May 11, 2019	n/a	2 adult OSPR	pole
45*	Akisqnuq Offices - across the street	573056	5590459	July 27, 2019	1426	1 adult, 1 chick possibly more	pole
45*	Akisqnuq Offices - across the street	573056	5590459	August 16, 2019	1300	1 adult, 1 chick	pole
46*	Windermere Creek mouth	571559	5589936	May 11, 2019	n/a	1 adult OSPR on nest	pole
46*	Windermere Creek mouth	571559	5589936	July 27, 2019	1542	2 adults, 3 chicks	pole
46*	Windermere Creek mouth	571559	5589936	August 16, 2019	1130	2 adults, at least 2 chicks flying in and out of nest.	pole
47	Akisqnuq Lakeshore Resort	575280	5587220	n/a	n/a	n/a	
47*	Akisqnuq Lakeshore Resort	575280	5587220	July 27, 2019	1417	2 adults, 1 chick possibly more	tree
47*	Akisqnuq Lakeshore Resort	575280	5587220	August 16, 2019	1309	2 adults, 1 chick	tree
48	Old tree nest, west side of Hwy	576455	5586835	n/a	n/a	n/a	
48	Old tree nest, west side of Hwy	576455	5586835	July 27, 2019	1355	not active	tree
48	Old tree nest, west side of Hwy	576455	5586835	August 16, 2019	1314	not active	tree
49	~400m N of #3 Rd, on Hwy 95	576820	5586340	May 11, 2019	n/a	not active	tree
49	~400m N of #3 Rd, on Hwy 95	576820	5586340	July 27, 2019	n/a	not active	tree
49	~400m N of #3 Rd, on Hwy 95	576820	5586340	August 16, 2019	1402	not active	tree

50*	#3 Rd at SE Windermere parking area, east side of Hwy 95	577147	5585838	June 12, 2019	n/a	occupied by 2 adults	tree
50*	#3 Rd at SE Windermere parking area, east side of Hwy 95	577107	5585888	July 27, 2019	1345	2 adults, 1 chick possibly more	tree
50*	#3 Rd at SE Windermere parking area, east side of Hwy 95	577107	5585888	August 16, 2019	1321	1 adult, 1 chick	tree
51*	North of Funtasia, west side of Hwy 95	578167	5583967	May 11, 2019	n/a	1 adult OSPR at nest	tree
51	North of Funtasia, west side of Hwy 95	578167	5583967	July 27, 2019	n/a	not active	tree
51	North of Funtasia, west side of Hwy 95	578167	5583967	August 16, 2019	1328	1 adult perched above nest on snag	tree
52	Funtasia mini golf course	581331	5577284	n/a	n/a	n/a	pole
52*	Funtasia mini golf course	581331	5577284	July 27, 2019	1233	1 adult, 2 chicks	pole
52*	Funtasia mini golf course	581331	5577284	August 16, 2019	1336	2 chicks	pole
53	Fairmont Airport	580255	5574882	n/a	n/a	n/a	pole
53	Fairmont Airport	580255	5574882	July 27, 2019	n/a	appears inactive	pole
53	Fairmont Airport	580255	5574882	August 16, 2019	1340	appears inactive	pole
54	Columere marina - Columbia Lake	580325	5571480	May 11, 2019	n/a	no OSPR at nest	pole
54*	Columere marina - Columbia Lake	580325	5571480	July 25, 2019	n/a	2 chicks	pole
54*	Columere marina - Columbia Lake	580325	5571480	August 6, 2019	n/a	2 fledglings	pole
55	Lot 48 Nest 2	581933	5570426	n/a	n/a	n/a	tree
55	Lot 48 Nest 2	581933	5570426	July 31 2019	n/a	not active	tree
55	Lot 48 Nest 2	581933	5570426	August 18, 2019	n/a	not active	tree
56*	Lot 48 Nest 1	582017	5570120	Early May 2019	n/a	occupied	tree
56*	Lot 48 Nest 1	582017	5570120	July 31 2019	n/a	2 adults, probable chicks	tree
56*	Lot 48 Nest 1	582017	5570120	August 18, 2019	n/a	active	tree
57	Pole 53-02 Hydro Line above west side of Columbia Lk	580828	5565189	n/a	n/a	n/a	pole
57	Pole 53-02 Hydro Line above west side of Columbia Lk	580828	5565189	August 4, 2019	n/a	not active	pole

57	Pole 53-02 Hydro Line above west side of Columbia Lk	580828	5565189	August 26, 2019	n/a	not active	pole
58	Pole 54-04 Hydro Line above west side of Columbia Lk	580912	5559630	n/a	n/a	n/a	pole
58	Pole 54-04 Hydro Line above west side of Columbia Lk	580912	5559630	August 4, 2019	n/a	not active	pole
58	Pole 54-04 Hydro Line above west side of Columbia Lk	580912	5559630	August 26, 2019	n/a	not active	pole
59	Pole 53-04 Hydro Line above west side of Columbia Lk	580941	5557777	n/a	n/a	n/a	pole
59*	Pole 53-04 Hydro Line above west side of Columbia Lk	580941	5557777	August 4, 2019	n/a	2 adults at nest	pole
59*	Pole 53-04 Hydro Line above west side of Columbia Lk	580941	5557777	August 26, 2019	n/a	osprey nearby	pole
60*	Canal Flats	585723	5555701	July 31, 2019	n/a	1 adult, 1 chick	pole

*indicates osprey occupancy at nest.

Appendix 11. Horned grebe records in the Columbia Wetlands, taken from eBird online database as of September 24, 2019

Location in eBird	Date	No.
Golden--Reflection Lake	1996-05-07	18
Moberly Marsh/Gadsden Provincial Park	1996-05-10	6
Moberly Marsh Spring Survey Route	1996-05-12	1
Moberly Marsh/Gadsden Provincial Park	1997-10-18	3
Moberly Marsh/Gadsden Provincial Park	1997-10-23	2
Moberly Marsh Spring Survey Route	1999-04-28	4
Moberly Marsh Spring Survey Route	1999-05-14	1
Nicholson	2002-05-11	80
Moberly Marsh/Gadsden Provincial Park	2003-05-09	1
Invermere Area (between Invermere and Radium)	2003-05-10	X
Invermere area (close to Richie's Point)	2004-04-24	X
Invermere Area (between Invermere and Radium)	2005-05-03	X
Radium Hot Springs	2005-05-08	2
Radium Hot Springs--Saw Mill Pond	2006-05-07	2
Radium Hot Springs--Saw Mill Pond	2009-05-01	X
Wilmer National Wildlife Area	2010-05-07	3
Canal Flats - Columbia Lake	2011-05-03	40
Reflection Lake	2011-05-05	1
Golden--Reflection Lake	2011-06-21	X
Friends of Columbia Wetland--Richie's Point	2012-05-06	20
Invermere--Kin Beach/Lake Windermere	2012-05-07	30
Lake Windermere--Westside Rd	2012-05-08	20
Golden--Reflection Lake	2012-07-04	2
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2012-09-12	1
Golden--Railway Pond	2012-09-12	1
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2012-09-19	2
Invermere (south of Kin Beach)	2012-10-08	2
Moberly Marsh Fall Survey Route	2012-11-05	1
Moberly Marsh Spring Survey Route	2013-04-24	1
Moberly Marsh Spring Survey Route	2013-05-01	8
Moberly Marsh Spring Survey Route	2013-05-04	2
Columbia Lake--Lot 48	2013-05-06	4
Invermere--Dorothy Lake	2013-05-08	2
Invermere--Kin Beach/Lake Windermere	2013-05-08	1
Invermere--Grizzly Ridge Heights	2013-05-10	1
James Chabot Provincial Park	2013-05-10	10
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2013-09-17	4
Columbia Wetlands--McMurdo seasonal lake	2013-09-17	8
Golden--Railway Pond	2013-09-17	5
Golden--Railway Pond	2013-10-03	1
Castledale	2014-04-22	1

Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2014-04-22	2
Timber Ridge Rd @ Ridge Place (Invermere)	2014-04-29	2
private residence Hilltop Road	2014-04-30	32
Castledale	2014-05-01	6
private residence Hilltop Road	2014-05-02	11
private residence Hilltop Road	2014-05-03	11
private residence Hilltop Road	2014-05-03	24
Golden--Railway Pond	2014-05-04	16
Golden--Reflection Lake	2014-05-04	18
private residence Hilltop Road	2014-05-04	5
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2014-05-05	10
Golden--Railway Pond	2014-05-05	9
Golden--Reflection Lake	2014-05-05	4
Invermere--Kin Beach/Lake Windermere	2014-05-05	6
Invermere--Sewage Lagoons	2014-05-05	2
Invermere--Windermere Creek/Lake Windermere	2014-05-05	15
Windermere Lake	2014-05-05	120
Invermere Athalmer Wilmer Circuit (east of James Chabot Provincial Park)	2014-05-06	2
Invermere--Windermere Creek/Lake Windermere	2014-05-06	1
Radium Hot Springs--Saw Mill Pond	2014-05-06	3
Baltac Road, Windermere	2014-05-07	2
Columbia Lake Road Overlook	2014-05-07	30
Invermere--Windermere Creek/Lake Windermere	2014-05-07	5
Moberly Marsh Spring Survey Route	2014-05-07	2
Windermere Creek Mouth, Windermere	2014-05-07	1
Moberly Marsh/Gadsden Provincial Park	2014-05-08	1
private residence Hilltop Road	2014-05-08	4
Columbia Lake - North end	2014-05-09	1
Columbia Lake--Lot 48	2014-05-09	1
Golden--Reflection Lake	2014-05-09	2
Invermere (Between Lillian Lake and Eileen Lake)	2014-05-10	1
private residence Hilltop Road	2014-05-10	16
Moberly Marsh Spring Survey Route	2014-05-11	1
Radium Hot Springs--Saw Mill Pond	2014-05-11	4
private residence Hilltop Road	2014-05-12	9
Invermere--Windermere Creek/Lake Windermere	2014-05-13	2
private residence Hilltop Road	2014-05-22	6
private residence Hilltop Road	2014-05-22	2
private residence Hilltop Road	2014-05-23	2
private residence Hilltop Road	2014-05-25	6
private residence Hilltop Road	2014-05-26	4
Moberly Marsh Spring Survey Route	2014-05-30	1
private residence Hilltop Road	2014-05-31	2
private residence Hilltop Road	2014-06-03	1
private residence Hilltop Road	2014-06-04	1

private residence Hilltop Road	2014-06-06	3
private residence Hilltop Road	2014-06-19	2
Columbia Wetlands--McMurdo seasonal lake	2014-09-04	4
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2014-10-03	2
private residence Hilltop Road	2014-10-28	4
private residence Hilltop Road	2014-10-29	2
private residence Hilltop Road	2014-10-30	1
private residence Hilltop Road	2014-11-01	4
private residence Hilltop Road	2014-11-05	3
private residence Hilltop Road	2014-11-08	2
Windermere (Cardiff ave beach area)	2014-11-11	1
Invermere--Baltac Beach/Lake Windermere	2015-04-24	1
Golden--Reflection Lake	2015-04-29	11
Baltac Road, Windermere	2015-05-01	1
Baltac Road, Windermere	2015-05-04	36
Columbia Lake--Lot 48	2015-05-04	4
Invermere--Cardiff Ave Beach/Lake Windermere	2015-05-04	1
Richies Point	2015-05-04	2
Invermere--Windermere Creek/Lake Windermere	2015-05-06	1
Invermere--Baltac Beach/Lake Windermere	2015-05-09	4
private residence Hilltop Road	2015-05-10	1
Golden--Reflection Lake	2015-05-12	1
private residence Hilltop Road	2015-05-13	2
private residence Hilltop Road	2015-05-14	3
private residence Hilltop Road	2015-05-14	2
private residence Hilltop Road	2015-05-14	2
private residence Hilltop Road	2015-05-15	1
private residence Hilltop Road	2015-05-15	2
private residence Hilltop Road	2015-05-16	2
private residence Hilltop Road	2015-05-21	2
private residence Hilltop Road	2015-07-25	3
Blaeberry--north delta (Private Prop)	2015-07-26	1
Golden--Railway Pond	2015-08-22	1
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2015-09-08	3
Golden--Reflection Lake	2015-09-08	3
Beaver Lake	2015-09-24	2
Brisco Road	2015-09-29	1
Brisco west--Trecher's Slough	2015-09-29	2
Beaver Lake	2015-10-05	2
Columbia Wetland Viewpoint Trail	2015-10-05	1
Golden--Mulligans Slough	2015-10-05	1
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2015-10-06	2
private residence Hilltop Road	2015-10-11	2
Invermere--Kin Beach/Lake Windermere	2015-10-12	1
private residence Hilltop Road	2015-10-12	8
private residence Hilltop Road	2015-10-12	1

private residence Hilltop Road	2015-10-13	6
Beaver Lake	2015-10-15	1
Wilmer National Wildlife Area (end of Smith Rd)	2015-10-15	1
Windermere Cemetery Hill	2015-10-15	4
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2015-10-22	1
private residence Hilltop Road	2015-10-26	12
private residence Hilltop Road	2015-11-10	2
private residence Hilltop Road	2016-04-08	3
private residence Hilltop Road	2016-04-09	8
Castledale North	2016-04-10	1
Columbia Lake--Lot 48	2016-04-10	1
Invermere--Baltac Beach/Lake Windermere	2016-04-10	2
private residence Hilltop Road	2016-04-11	9
private residence Hilltop Road	2016-04-15	2
Castledale	2016-04-16	1
Invermere--Baltac Beach/Lake Windermere	2016-04-16	9
private residence Hilltop Road	2016-04-17	8
private residence Hilltop Road	2016-04-17	10
private residence Hilltop Road	2016-04-18	57
private residence Hilltop Road	2016-04-18	29
private residence Hilltop Road	2016-04-26	6
private residence Hilltop Road	2016-04-27	40
private residence Hilltop Road	2016-04-27	30
Columbia Lake--Lot 48	2016-05-01	58
private residence Hilltop Road	2016-05-01	28
Invermere--Kin Beach/Lake Windermere	2016-05-10	6
BC - Roadside Pond, Westside Rd (southwest Lk Windermere)	2016-05-12	4
Columbia Lake--Lot 48	2016-05-12	6
Golden--Reflection Lake	2016-05-13	2
Golden--Reflection Lake	2016-05-13	2
private residence Hilltop Road	2016-05-15	2
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2016-05-23	1
private residence Hilltop Road	2016-05-31	2
private residence Hilltop Road	2016-06-06	4
Columbia Wetlands--McMurdo seasonal lake	2016-08-08	6
Golden--Reflection Lake	2016-08-08	1
private residence Hilltop Road	2016-09-16	22
private residence Hilltop Road	2016-09-18	15
private residence Hilltop Road	2016-09-24	21
private residence Hilltop Road	2016-09-25	10
private residence Hilltop Road	2016-09-26	6
private residence Hilltop Road	2016-09-27	2
Golden--Mulligans Slough	2016-09-29	26
Spillimacheen--Galena Creek Ranch Slough	2016-09-29	100
CWWS - Southeast End Lake Windermere	2016-10-05	1
Golden--Mulligans Slough	2016-10-05	6

private residence Hilltop Road	2016-10-12	1
private residence Hilltop Road	2016-10-13	8
Golden--9-mile slough	2016-10-15	4
Invermere--Kin Beach/Lake Windermere	2016-10-15	2
private residence Hilltop Road	2016-10-16	6
Moberly Marsh/Gadsden Provincial Park	2016-10-26	2
Invermere--Cardiff Ave Beach/Lake Windermere	2016-11-21	1
private residence Hilltop Road	2017-04-17	1
private residence Hilltop Road	2017-04-23	16
Golden--Reflection Lake	2017-04-25	1
private residence Hilltop Road	2017-05-04	19
Moberly Marsh/Gadsden Provincial Park	2017-05-05	2
private residence Hilltop Road	2017-05-07	8
Invermere--Windermere Creek/Lake Windermere	2017-05-08	1
Moberly Marsh/Gadsden Provincial Park	2017-05-18	1
Golden--Reflection Lake	2017-05-24	1
CA-British Columbia-Golden-Reflection Lake Road - 51.285x-116.946	2017-06-19	2
Golden--Reflection Lake	2017-06-19	2
Columbia Wetlands Hwy 95 Views 10-17 km S of Golden	2017-09-11	1
Golden--Reflection Lake	2017-09-11	2
Golden--Reflection Lake	2017-09-11	2
Lake Windermere - boat survey	2017-09-21	1
CWWS - Southeast end of Lake Windermere	2017-09-29	1
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2017-09-29	4
Lakeshore Resort Campground	2017-09-29	1
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2017-10-01	12
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2017-10-05	11
James Chabot Provincial Park	2017-10-05	1
Parson south--Great Blue Heron Rookery	2017-10-05	1
Beaver Lake	2017-10-15	3
Moberly Marsh/Gadsden Provincial Park	2017-10-29	1
Moberly Marsh/Gadsden Provincial Park	2017-10-30	1
private residence Hilltop Road	2017-11-03	1
private residence Hilltop Road	2017-11-06	3
Columbia Lake -- Rockbeach	2018-04-16	2
private residence Hilltop Road	2018-04-19	5
Invermere--Windermere Creek/Lake Windermere	2018-04-23	1
private residence Hilltop Road	2018-04-25	11
Columbia Lake -- Rockbeach	2018-04-26	2
Columbia Lake--Lot 48	2018-04-26	5
private residence Hilltop Road	2018-05-02	35
Moberly Marsh/Gadsden Provincial Park	2018-05-04	6
private residence Hilltop Road	2018-05-08	1
Golden--Reflection Lake	2018-05-09	2
Columere Park	2018-05-10	5
private residence Hilltop Road	2018-05-11	7

private residence Hilltop Road	2018-09-18	4
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2018-09-29	4
Columbia Lake -- Rockbeach	2018-10-02	3
Brisco Rd North	2018-10-05	1
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2018-10-05	4
Golden--9-mile slough	2018-10-05	2
Golden--Reflection Lake	2018-10-05	2
Invermere--Lakeview Meadows	2018-10-05	1
James Chabot Provincial Park	2018-10-05	2
Lake-Windermere--Rushmere Road	2018-10-05	3
Reflection Lake	2018-10-05	2
Columbia Lake -- Rockbeach	2018-10-08	2
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2018-10-11	8
Athalmer Bridge- Pete's Marina	2018-10-15	5
Invermere - Lakeview Meadows	2018-10-15	4
Parson - Wells Landing	2018-10-15	1
CA-BC-Windermere Lake(50.4721, -115.9955)	2018-10-20	1
CWWS-Columbia Lake -Shoreline near Columbia Ridge	2018-10-27	3
Columbia River at Forster's Landing	2019-01-15	2
Athalmer Bridge- Pete's Marina	2019-04-16	2
Invermere--Lakeview Meadows	2019-04-16	2
Golden--Reflection Lake	2019-05-01	1
Golden--Reflection Lake	2019-05-05	17
Golden--Reflection Lake	2019-05-05	7
Invermere--Kin Beach/Lake Windermere	2019-05-06	2
Invermere--Windermere Creek/Lake Windermere	2019-05-06	1
Private beach-Baltac Road	2019-05-06	5
Radium Hot Springs--Saw Mill Pond	2019-05-07	4
Radium Hot Springs--Saw Mill Pond	2019-05-07	18
Radium Hot Springs--Saw Mill Pond	2019-05-08	40
Radium Hot Springs--Saw Mill Pond	2019-05-08	25
Invermere--Cardiff Ave Beach/Lake Windermere	2019-05-09	8
Radium Hot Springs--Saw Mill Pond	2019-05-10	25
Columbia lake CA-BC-East Kootenay F (50.2902,-115.8703)	2019-05-11	38
Radium Hot Springs--Saw Mill Pond	2019-05-12	6
Radium Hot Springs--Saw Mill Pond	2019-05-21	2
Radium Hot Springs--Saw Mill Pond	2019-06-11	1
Radium Hot Springs--Saw Mill Pond	2019-07-09	1
Golden--Reflection Lake	2019-09-08	1
private residence Hilltop Road	2019-09-18	44
Total Number of Horned Grebe		1927