



Waterbird Counts on the West Arm of Kootenay Lake, British Columbia, 1974 – 2013

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Abstract

Waterbird counts were conducted along the West Arm of Kootenay Lake, British Columbia, during late autumn in 35 of the past 40 years (1974, 1975, 1977 – 1993, 1997 – 1999, 2001 – 2013). The counts encompassed accessible shoreline from Balfour in the northeast, downstream approximately 35 km to Taghum in the southwest. More than 30 people have participated in the count since its inception in 1974. Results are provided for 31 waterbird species, including 23 species of waterfowl, two loons, five

grebes, and the American Coot. Numbers of four species declined: American Wigeon, Canvasback, Redhead, and American Coot (Figure 1). Numbers of Greater Scaup and Western Grebe also likely decreased. Canada Goose and Barrow's Goldeneye increased, whereas Mallard increased through most years of the count but declined after 2002. Some species demonstrated no obvious trend over time, whereas others were reported too infrequently or their numbers were too low to detect appreciable change.



Figure 1. Between 1974 and 2013, numbers of American Coot declined in the West Arm of Kootenay Lake, BC. Each year of a count, however, a flock was recorded at the Nelson waterfront in late autumn and winter. *Photo by Alistair Fraser.*

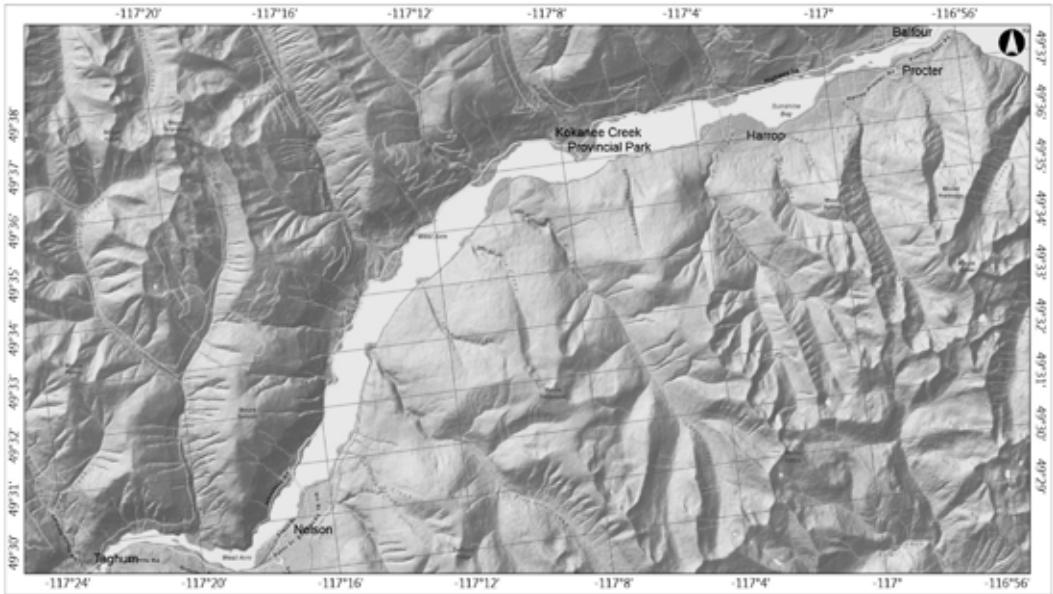


Figure 2. The West Arm of Kootenay Lake is located in the West Kootenay region of southeastern British Columbia. The study area extends approximately 35 km from Balfour in the northeast to Taghum in the southwest.

Introduction

The West Arm of Kootenay Lake (Figure 2) does not freeze in winter, making it an important staging and wintering area for waterbirds in the West Kootenay region of British Columbia. The presence of concentrations of waterbirds on the West Arm during the nonbreeding season has attracted the attention of naturalists since at least the 1940s. At that time, local newspaper editor H. H. Currie began reporting his observations to the public through regular newspaper articles and to government officials through correspondence with J.A. Munro, Federal Migratory Bird Officer (Merilees 2014). He published 28 articles on birds and other wildlife in the Nelson area between 1944 and 1948. For example, Currie (1948) reported that the three most numerous waterfowl species in Nelson in the winter of 1946/47 were Greater Scaup (Figure 3), Mallard, and Redhead, and that together their numbers totaled about 900 birds (see Appendix 1 for scientific names of species mentioned in the text). Campbell et al. (1990) included high counts and noteworthy records for some species

of waterbirds for the 1970s and 1980s but did not include complete survey results for the West Arm.

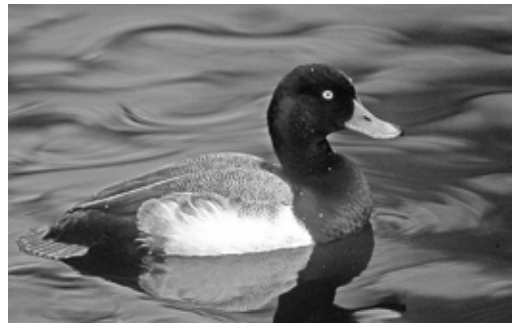


Figure 3. Seventy years ago the West Arm of Kootenay Lake was recognized as an important waterbody for migrating and wintering waterbirds. At that time, Greater Scaup was one of several significant species identified. *Photo by R. Wayne Campbell.*

In 1974, a small group of friends from the West Kootenay Naturalists' Association initiated the West

Arm Waterbird Count as a way to share their mutual interest in birds and to track duck populations in the late autumn period. The group initially included Hazel (Street) Cannings, Jim Street, Madge and Jack Hollington, Maurice (Figure 4) and Veronica Ellison, and Margaret Cathcart.

In the mid-1980s, when some counters were no longer able to participate, Chuck and Clare Romerdahl, Linda Van Damme, and Gary Davidson joined so the same territory could be covered each year. The 1990s brought further changes when health issues caused the original group to dissolve. In 1997, Linda Van Damme resurrected the count by recruiting members of the Nelson Naturalists' Association. Following Van Damme's move to Creston in 2003, Rita Wege, then Janice Arndt coordinated the count. By that time it was clear that abundance of some species had changed since the count was initiated. Long-term data sets have great value for assessing bird trends over time.



Figure 4. Maurice Ellison, a passionate birder from Trail, was one of the group of seven to initiate the West Arm Waterbird Count. *Photo by Linda M. Van Damme.*

Methods

The area covered by the West Arm Waterbird Count (also known as the “duck count”) included Balfour, Harrop, Procter, Kokanee Creek Provincial Park, Nelson waterfront, Taghum, and lake-view and access points along Highway 3A on the West Arm (see Figure 2). During the early years participants met along the Nelson waterfront then split into two groups: one group traveled south to check the Kootenay River en route to Taghum and the other group north along the waterfront, the Kootenay Forest Products mill site and the railway tracks to Troupe. After an early lunch, the participants separated again to check the West Arm north to Balfour. Before the north shore became so developed there were many more viewing places accessible.

In recent years, counters spread out in three or four teams to cover an assigned portion of the study area. Count dates ranged from 17 November to 17 December during the 1970s, whereas all counts since 1978 fell between 23 November and 12 December; 29 of 35 counts were conducted during the two-week period from 23 November to 6 December.

Weather conditions were inconsistently recorded. Similarly, observer and team effort data were not recorded for all years. However, concentrations of waterbirds tended to be recorded in predictable locations each year. Definitions for status designations are: *Accidental* – species seen once during the study period; *Casual* - species reported two or three times during the study period; *Rare* – species not seen every year and usually fewer than five individuals observed per year when reported; *Uncommon* – species seen most years and usually fewer than 30 individuals per year; Figure 5); *Common* – species present most years, often in large numbers; and *Very Common* – species reported annually, usually in large numbers.

Summary statistics are provided for species that were recorded in more than half of the 35 counts: count range (low and high counts) and average count for all years. No counts were conducted in 1976, 1994, 1995, 1996 or 2000. Graphs are shown for species with counts that exceeded 10 birds in at least one year. Information from the Nelson Christmas Bird Count (CBC) (1985, 1997 – 2013; National Audubon Society 2010a), the West Kootenay Winter Bird Count (held in January 1994 – 2004; unpublished data) and



Figure 5. Five of the six species of grebes that occur in British Columbia have been recorded in the West Arm of Kootenay Lake, including the uncommon Pied-billed Grebe. *Photo by R. Wayne Campbell.*

personal records (unpublished data) was examined to determine whether duck count results were a good predictor of the incidence and abundance of

overwintering birds. Results from the current study were compared with the Christmas Bird Count (CBC in BC., 1974 – 2013; National Audubon Society 2010b) and the North American Waterfowl Management Plan (NAWMP continent-wide, 1970 – 2006; NAWMP 2007). Abundance of waterbirds on the West Arm was compared to other areas within the West Kootenay region (National Audubon Society 2010b, Davidson 2011, Van Damme 2012).

Results

Results of counts for each species are summarized in Table 1. Twelve species were recorded on only one, two, or three counts of the 35 surveys. Several species, including American Wigeon (Figure 6), Canvasback, Redhead (Figure 7), and American Coot were recorded in much greater numbers in the early years of the counts than in recent years. Numbers of Greater Scaup and Western Grebe also appeared to have declined but the trend is not as obvious. Canada Goose and Barrow's Goldeneye



Figure 6. American Wigeon was recorded in higher numbers during some of the early years of the waterbird count. *Photo by Alistair Fraser.*

Table 1. Summary of results of the West Arm Waterbird Count for 31 species, 1974–2013.

Species ¹	Status ²	Counts ³	Low ⁴	High ⁵	Avg ⁶	Comments ⁷
Canada Goose	Very Common	32	4	325	139	Increased over most of the count period (Figure 8).
Trumpeter Swan	Accidental	1	1	1		A single record, 23 November 1982.
Tundra Swan	Casual	2	1	3		One bird, 1 December 1990; three birds, 28 November 1998.
Wood Duck	Accidental	1	1	1		A single record, 1 December 2007.
Gadwall	Uncommon	20	1	28	3	With the exception of 15 in 1985 and 28 in 1992, counts were always less than 10; no obvious trend (Figure 8).
American Wigeon	Common	35	5	725	103	Declined. Highest count of 725 occurred on 2 December 1977; no counts exceeded 100 after 1988 (Figure 8).
Mallard	Very Common	35	8	545	215	Increased from 1985 to 2002. Counts of over 300 recorded for all years from 1997 through 2007, followed by a decrease in recent years (Figure 8).
Green-winged Teal	Casual	2	1	4		Four birds, 1 December 1990; one, 30 November 1997.
Canvasback	Rare	15	1	60	6	Declined. All counts of more than 10 birds occurred prior to 1985 (Figure 8).
Redhead	Rare	26	1	662	54	Declined. Like Canvasback, highest numbers of Redhead were recorded in the 1970s and early 1980s (Figure 8).
Ring-necked Duck	Uncommon	18	1	31	5	Unclear trend. More counts of over 10 birds in second half of study period (Figure 8).
Tufted Duck	Accidental	1	2	2		Two recorded, 30 November 1991.
Greater Scaup ⁸	Common	33	8	730	164	Likely declined. Large numbers of "Scaup spp." reported in the first five years were assumed to be Greater Scaup. High counts from 1974 to 1991 were greater than those since 1991 (Figure 8).
Lesser Scaup ⁸	Casual	3	1	8		A single Lesser Scaup was reported on 24 November 1991; eight on 27 November 2004; and two on 2 December 2012.
Harlequin Duck	Accidental	1	1	1		One record, 8 December 1979.
Long-tailed Duck	Accidental	1	1	1		One record, 2 December 2006.
Bufflehead	Common	35	2	162	68	Numbers fluctuated widely most years, but there was no obvious trend (Figure 8).
Common Goldeneye	Common	35	6	195	68	Numbers reported on the count fluctuated, but with no obvious trend (Figure 8).
Barrow's Goldeneye	Uncommon	32	1	38	13	Numbers apparently increased (Figure 8).
Hooded Merganser	Uncommon	24	1	7	2	Small numbers were present most years. There was no indication of an increase or decrease over time.
Common Merganser	Uncommon	34	1	70	11	Apart from an isolated high count of 70 in 1998, numbers were fairly consistent over time (Figure 8).
Red-breasted Merganser	Accidental	1	1	1		One record, 29 November 2003.
Ruddy Duck	Accidental	1	1	1		One record, 1 December 1993.
Pacific Loon	Accidental	1	1	1		One record, 1 December 2012.
Common Loon	Rare	16	1	6	1	Reported more frequently during the second half of the study period, though in very low numbers.
Pied-billed Grebe	Uncommon	27	1	18	5	Not reported during the first eight counts, but seen each year from 1983 to 2013. Could now be wintering more commonly in the area, or possibly overlooked during the early years (Figure 8).
Horned Grebe	Common	35	2	199	56	One of only five species recorded on every count. There was no obvious trend in numbers (Figure 8).
Red-necked Grebe	Uncommon	25	1	9	2	Recorded in small numbers in most years.
Eared Grebe	Casual	2	1	1		Single individuals reported on 7 December 1980 and 1 December 1993.
Western Grebe	Common	31	1	94	23	Likely declined. During early years, counts occasionally reached 100, whereas in some years it was absent. After 1986, counts did not exceed 50 and were more often 25 or fewer (Figure 8).
American Coot	Very Common	34	9	1265	275	Unrecorded during the first count year, but subsequently reported in high numbers through 1985. Declined and stabilized at a lower level (Figure 8).

¹See Appendix 1 for current scientific names.

²See text for explanation of status designations.

³Number of counts species recorded in 35 total waterbird surveys.

⁴Lowest number recorded on a single count.

⁵Highest number recorded on a single count.

⁶Average number recorded on total counts.

⁷Notations to clarify count results.

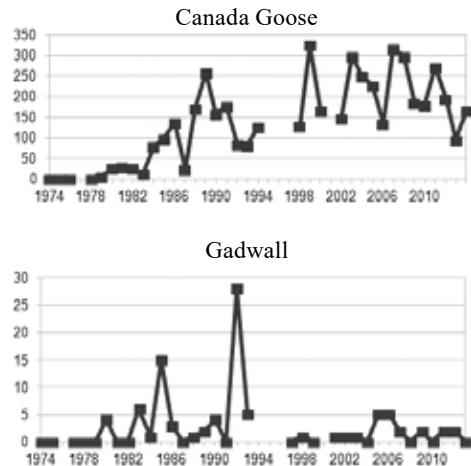
⁸Identification of the two scaup species is an ongoing challenge for many people. Lesser Scaup often occurs in small numbers on the West Arm during the winter (unpubl. data) and was likely more regular than suggested by the results of this study.



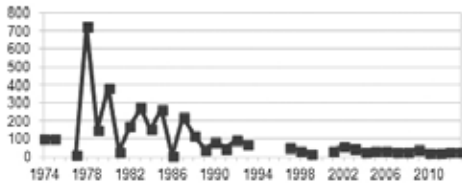
Figure 7. From the late 1970s through the mid-1980s, populations of Redhead (top centre) reached a maximum of 662 birds but in later years the highest count was nine birds and these were often found mingled in large flocks of Greater Scaup. *Photo by Alistair Fraser.*

numbers increased over the past 40 years. Mallards increased through 2002 but subsequently decreased. Trends are difficult to detect for regularly occurring species found in consistently low numbers, such as Gadwall, Hooded Merganser, Common Merganser, Common Loon, Pied-billed Grebe, and Red-necked Grebe, but these are assumed to have been relatively stable over the study period. The remaining species, Bufflehead, Common Goldeneye, Ring-necked Duck, and Horned Grebe, occurred on at least half of the counts, but numbers fluctuated substantially from year to year (Figure 8).

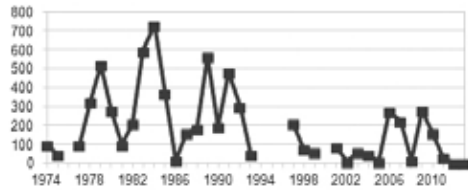
Figure 8. Fluctuations in yearly numbers for 16 species of waterbirds recorded during 35 West Arm Waterbird Counts, 1974 to 2013. Note that scale varies by species.



American Wigeon



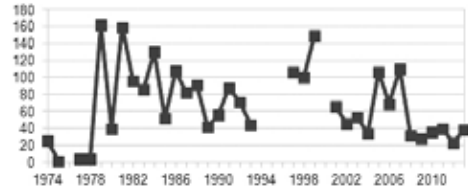
Greater Scaup



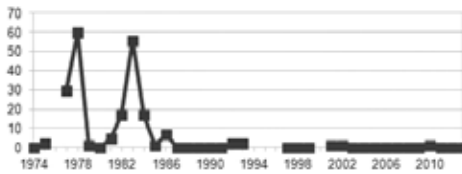
Mallard



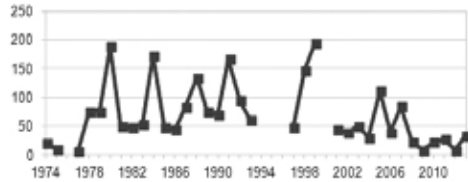
Bufflehead



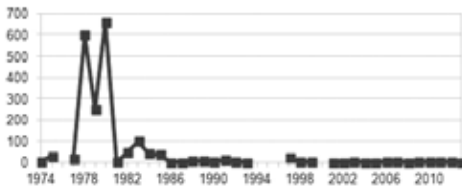
Canvasback



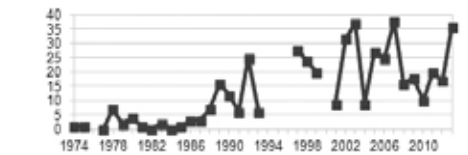
Common Goldeneye



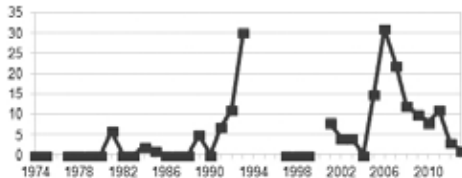
Redhead



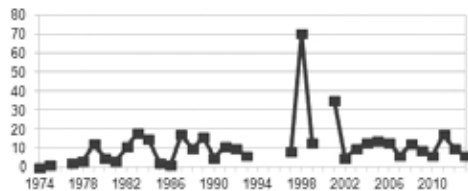
Barrow's Goldeneye

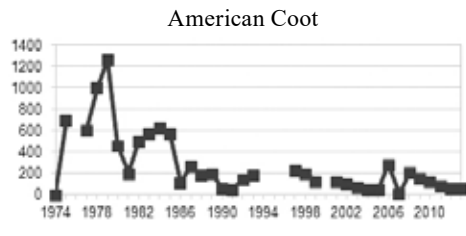
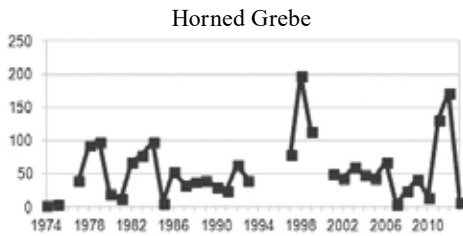
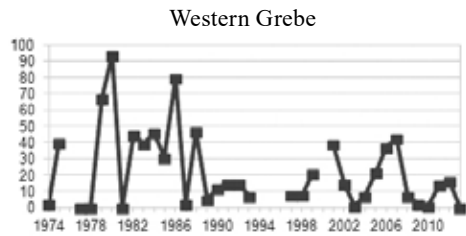
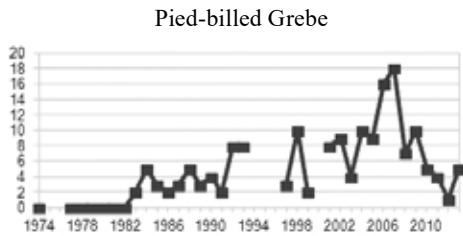


Ring-necked Duck



Common Merganser





Discussion

Relationship of duck count results with winter status on the West Arm

Most species that were found regularly during the count in late November or early December were present in comparable numbers in late December and into January (National Audubon Society 2010a; unpublished data). The most notable exceptions were Horned Grebe, which consistently decreased over December, and Greater Scaup, which over-wintered in large numbers each year but in some years, had not yet begun to arrive by the count date. Numbers of some additional species such as Ring-necked Duck (Figure 9), Bufflehead, and Common Goldeneye may not yet be stable when the count is begun in late autumn, and their movements are not as predictable from one year to the next as are those of Greater Scaup and Horned Grebe.

Comparisons with Christmas Bird Count surveys

Count results did not match well with continental trends reported by NAWMP (2007). However, there were patterns similar to those found by CBCs within the province (National Audubon Society 2010b). For example, CBC recorded increases for Canada Goose and decreases for Canvasback, Western Grebe (Figure



Figure 9. Ring-necked Duck was reported in greater numbers after 2000 than during the early years of the West Arm Waterbird Count. The late autumn count may not be indicative of populations as arrival of migrant and wintering Ring-necked Ducks vary from year-to-year. *Photo by Alistair Fraser.*

10), and Greater Scaup, as did our count. Numbers of Redhead and American Coot on CBCs declined as they did in the present study. American Wigeon numbers declined on both the duck count and the CBC. Mallard appeared to increase, then decrease, during the current study; no trend was reported on CBCs. Barrow's Goldeneye appeared to increase on the West Arm; CBC numbers for the province have remained relatively stable.



Figure 10. During the 35-years of surveys in the West Arm, numbers of Western Grebe steadily declined as was reported for other areas of the interior of British Columbia. *Photo by Alistair Fraser.*

Significance of West Arm in West Kootenay region

The West Arm supports regionally significant numbers of at least nine species of waterbirds that were assessed as *Common* or *Very Common* in the West Kootenay region (Table 1). In particular, American Wigeon, Greater Scaup, and Western Grebe were reported more often and in higher numbers on the West Arm than in Nakusp, Trail, Castlegar, or Creston (National Audubon Society 2010b, Davidson 2011, Van Damme 2012).

Biological production in Kootenay Lake

Bird distributions are highly influenced by availability of food and, hence, the winter ranges of aquatic birds are closely tied to the aquatic environment. Kootenay Lake has been the subject of considerable biological monitoring. Although the West Arm differs in various aspects from the “main” lake, the following points of discussion on the

limnology of Kootenay Lake apply to the study area as well as to the larger lake environment (Northcote 1973, Daley et al. 1980, Binsted and Ashley 2006).

Biological production at the bottom of the food chain is influenced primarily by nutrient loading (phosphorous and nitrogen inputs) and less by lake level and water flows. Each of these factors in Kootenay Lake has undergone significant alterations over the past 60 years. In the 1950s, Cominco opened a fertilizer plant in Kimberley, which artificially elevated phosphorous levels in Kootenay Lake by way of the St Mary’s and Kootenay rivers. Peak fertilization from this source occurred in the mid-1960s, prior to pollution controls implemented at the plant in the late 1960s. Nutrients entering the lake from the Kootenay River were further reduced in the 1970s by completion of Libby Dam in 1973 and by the closure of the fertilizer plant in 1977. Duncan Dam was completed in 1967 on the Duncan River, the second-largest tributary of Kootenay Lake after the Kootenay River.

Dams impact downstream aquatic environments in several ways, including disrupting flow of nutrients (whether natural or artificial), altering the timing of peak flows, moderating extremes of water level fluctuations, releasing deep water rather than surface water and affecting temperature and turbidity, all of which influence production. Specific impacts on the West Arm included higher winter flows, which prevented ice formation, and lower early-summer water levels, which reduced the area of shallow water along the shoreline that supports aquatic plants.

By the 1980s, nutrient inputs to Kootenay Lake from its tributaries were lower than natural, pre-1950 levels. This had a huge effect on biological production in the lake, the most obvious result being the dramatic decline in Kokanee (*Oncorhynchus nerka*; Figure 11). Further details on the history and effects of nutrient inputs to Kootenay Lake are discussed by Northcote (1973), Daley et al. (1980) and Binsted and Ashley (2006). The Kootenay Lake nutrient addition program was initiated in 1992 and continues to the present, adding phosphorous and nitrogen to the system in prescribed amounts that compensate for some of the loss of nutrients behind the dams; however, nutrient levels do not approach those released from the fertilization plant in the 1950s and 1960s (Schindler et al. 2014).



Figure 11. Changes in biological production have resulted in a decline of Kokanee in Kootenay Lake and may have impacted numbers of waterbirds in the West Arm. *Photo by Alistair Fraser.*

Many of these changes occurred before the first waterbird count in 1974. However, several species were found in the early years in numbers that are much higher than any seen in the past 30 years on the West Arm: American Wigeon (725 in 1978), Canvasback (60 in 1978), Redhead (662 in 1980), and American Coot (1265 in 1979). Daley et al. (1980) stated that though the major reductions in nutrient flow occurred around the early 1970s, physical and chemical time lags would mean their effects would continue into the mid-1980s. The trends in numbers for these four species seem to coincide with the expected decline in productivity due to decreased nutrients in Kootenay Lake. Less dramatic declines for Greater Scaup and Western Grebe could also be related to these changes, though these two species appeared to be less sensitive to these factors.

Additional considerations

Factors other than changes to the aquatic environment of Kootenay Lake also likely influenced waterbird numbers. Western Grebe has undergone both a significant decrease in its continental population and a detectable shift of its wintering distribution (Wilson et al. 2013). As discussed above, wide year-to-year fluctuations in numbers of Ring-necked Duck, Bufflehead (Figure 12), and Common Goldeneye were likely due in part to flocks still moving in December (see Figure 8). Reported numbers for these species may reflect the dates on which the counts were conducted, before or after major movements into or out of the West Arm in any given year, and the timing of weather events (e.g., Cannings et al. 1987). Greater Scaup numbers typically increased throughout December, whereas Horned Grebe declined.

Supplemental feeding of birds at places like the Nelson waterfront and Balfour ferry terminal could explain the increase in Mallard within the study area (Figure 13). Highest numbers of Canada Goose occurred in the 10 years following the completion of the soccer fields adjacent to the Nelson waterfront, possibly reflecting the availability of grass throughout much of the winter at that location. Barrow's Goldeneye was the third of only three species whose numbers apparently increased; it increased substantially over the previous 15 years in Castlegar, less than 30 km



Figure 12. Although recorded every year of the West Arm Waterbird Count, numbers of Bufflehead fluctuated greatly between years. *Photo by Alistair Fraser.*

from the study area (Arndt 2014).

As with any volunteer survey, identification challenges may reduce reliability of count data. The problem of misidentifying the two scaup species has already been discussed. Other potential difficulties in

identification in non-breeding plumages included Red-necked Grebe vs. Horned Grebe, Red-necked Grebe vs. Western Grebe, female Common Goldeneye vs female Barrow's Goldeneye (Figure 14), and female Red-breasted Merganser vs female Common Merganser.



Figure 13. At several locations along the West Arm, feeding ducks is a popular family activity and is also enjoyed by local naturalists. Mallard numbers, however, may have been locally elevated on the West Arm counts by supplemental feeding, such as at the Balfour ferry landing. *Photo by Linda Van Damme.*

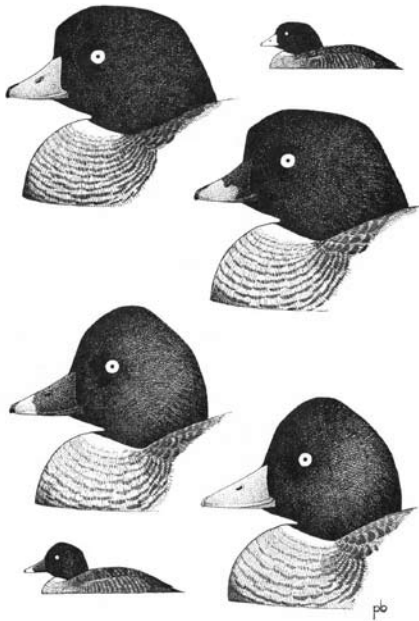


Figure 14. Comparison of the plumages of female goldeneyes. The female Common Goldeneye (side view, bottom) in breeding plumage has a yellow-tipped bill but the rounded and somewhat peaked head and sloping profile of bill with forehead can be used during the nonbreeding season for identification. In the female Barrow's Goldeneye, the bill is mostly yellow during breeding but the top of the head is flatter and the forehead is steeper when not in breeding attire. Reproduced from Ontario Birds (see Di Labio et al. 1997) with permission from artist Peter Burke.

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Appendix 1. Scientific names of birds mentioned in the text and in Table 1.

Canada Goose (<i>Branta canadensis</i>)	Redhead (<i>Aythya americana</i>)
Common Goldeneye (<i>Bucephala clangula</i>)	Ring-necked Duck (<i>Aythya collaris</i>)
Barrow's Goldeneye (<i>Bucephala islandica</i>)	Tufted Duck (<i>Aythya fuligula</i>)
Hooded Merganser (<i>Lophodytes cucullatus</i>)	Greater Scaup (<i>Aythya marila</i>)
Common Merganser (<i>Mergus merganser</i>)	Lesser Scaup (<i>Aythya affinis</i>)
Red-breasted Merganser (<i>Mergus serrator</i>)	Harlequin Duck (<i>Histrionicus histrionicus</i>)
Ruddy Duck (<i>Oxyura jamaicensis</i>)	Long-tailed Duck (<i>Clangula hyemalis</i>)
Pacific Loon (<i>Gavia pacifica</i>)	Bufflehead (<i>Bucephala albeola</i>)
Common Loon (<i>Gavia immer</i>)	Common Goldeneye (<i>Bucephala clangula</i>)
Pied-billed Grebe (<i>Podilymbus podiceps</i>)	Barrow's Goldeneye (<i>Bucephala islandica</i>)
Horned Grebe (<i>Podiceps auritus</i>)	Hooded Merganser (<i>Lophodytes cucullatus</i>)
Red-necked Grebe (<i>Podiceps grisegena</i>)	Common Merganser (<i>Mergus merganser</i>)
Eared Grebe (<i>Podiceps nigricollis</i>)	Red-breasted Merganser (<i>Mergus serrator</i>)
Western Grebe (<i>Aechmophorus occidentalis</i>)	Ruddy Duck (<i>Oxyura jamaicensis</i>)
American Coot (<i>Fulica americana</i>)	Pacific Loon (<i>Gavia pacifica</i>)
Trumpeter Swan (<i>Cygnus buccinator</i>)	Common Loon (<i>Gavia immer</i>)
Tundra Swan (<i>Cygnus columbianus</i>)	Pied-billed Grebe (<i>Podilymbus podiceps</i>)
Wood Duck (<i>Aix sponsa</i>)	Horned Grebe (<i>Podiceps auritus</i>)
Gadwall (<i>Anas strepera</i>)	Red-necked Grebe (<i>Podiceps grisegena</i>)
American Wigeon (<i>Anas americana</i>)	Eared Grebe (<i>Podiceps nigricollis</i>)
Mallard (<i>Anas platyrhynchos</i>)	Western Grebe (<i>Aechmophorus occidentalis</i>)
Green-winged Teal (<i>Anas crecca</i>)	American Coot (<i>Fulica americana</i>)
Canvasback (<i>Aythya valisineria</i>)	

About the Authors

Janice is a birder and wildlife biologist who appreciates the privilege of living and working in the West and East Kootenay areas of British Columbia. Although birds have remained her primary natural history interest since she was a teen, more recent pursuits have expanded to include butterflies, moths, and bees.



Linda continues to explore the Creston valley collecting new information on arrival/departure dates, and other species information to update her 2012 publication *Creston Valley Birds: When and Where to Find Them*.

