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Front Cover: A female, interior Western Screech-owl (Megascops kennicottii macfarlanei) roosting in a western redcedar (Thuja plicata) along the Shuswap River near Cherryville, 2007 July 19. This bird contributed to the Davis and Cannings study (see page 19). Photo by Dick Cannings.
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Trends in bird populations in the Comox Valley, British Columbia, Canada, from 1976 to 2006

Arthur M. Martell

Comox Valley Naturalists Society, Box 3222, Courtenay, B.C. V9N 5N4; e-mail: amartell@shaw.ca

Abstract: Changes in numbers of birds in the Comox Valley, British Columbia, from 1976 to 2006 were examined based on two counts each year, conducted in May and December, in the Comox Christmas Bird Count circle. A total of 44 species of coastal birds (coast/wetland habitat) and 58 species of upland birds (forest/woodland, scrub/successional, grassland and suburban/urban habitats) were reported sufficiently frequently for analysis. The trends are discussed in relation to the North American Breeding Bird Survey counts and to climate change.

Coastal birds showed a much greater tendency to population decrease and a lesser tendency to population increase than upland birds. Coastal birds tended to be significantly more abundant in winter than in spring and 34% of the species showed significant positive trends and 25% of the species showed significant negative trends on one or both counts. Harlequin Duck showed a significant decline in spring but not in winter. However, the numbers in both seasons decreased from 1976 to the mid-1990s and then increased. Western Grebe showed significant declines on both counts; examination of the annual numbers showed a great variability among years on both counts, but clear declines to the late 1990s and a possible slight recent recovery in numbers. Bald Eagle showed significant, steady increase in numbers on both counts.

Almost half of the species of upland birds (46%) showed significant positive trends on one or both counts and only 10% showed significant negative trends. Differences by migration status were pronounced, with only 19% of 16 neotropical migrants showing significant positive trends compared with 57% of 42 short-distance migrants and residents combined; the proportion of species showing significant decreasing trends was similar (12% and 10%, respectively). Most of the species of upland birds that showed an increasing trend are species that concentrate in winter (sparrows, blackbirds, urban/suburban birds). Bewick’s Wren, aerial foragers (Violet-green Swallow, Barn Swallow) and finches (Purple Finch, Evening Grosbeak) showed significant negative trends and are of particular concern.

Key words: Comox Valley, population trends, Christmas Bird Count, spring migration, climate change, waterfowl, waterbirds, shorebirds, landbirds, Harlequin Duck, Histrionicus histrionicus, Western Grebe, Podiceps occidentalis, Bald Eagle, Haliaeetus leucocephalus, Bewick’s Wren, Thryomanes bewickii, Violet-green Swallow, Tachycineta thalassina, Barn Swallow, Hirundo rustica, Purple Finch, Carpodacus purpureus, Evening Grosbeak, Coccothraustes vespertinus.

Introduction

The Comox Valley, British Columbia, is recognized internationally for its Important Bird Areas (IBA Canada 2004), particularly for wintering waterbirds, and has been the focus of ornithological work for over a century (Brooks 2006). The Comox Valley Naturalists Society (formally the Comox-Strathcona Natural History Society) began conducting a Christmas Bird Count (National Audubon Society 2005) in the area in 1961 and began conducting a Spring Bird Count in 1976 using the same count circle. This paper examines the trends in numbers of some bird species in two seasons over a 31-year period from 1976 to 2006.

The landscape of the Comox Valley has changed considerably over time due to residential and industrial development as well as increasing recreational use, and those changes are reflected in bird populations using the Valley. The human population of the three major communities in the Comox Valley (Comox, Courtenay, Cumberland) increased steadily from 14,789 to 36,838 from 1976 to 2006 (B.C. Ministry of Labour and Citizens’ Services 2007). The Comox Valley has been rapidly losing its sensitive ecosystems. From 1992 to 2002, at least 5% of the sensitive ecosystems were lost and at least 30% of modified ecosystems such as older second growth forests (60-100 yrs) and seasonally flooded agricultural fields disappeared (B.C. Ministry of Environment. 2005). Based on the change in population, the total loss of those habitats since 1976 would be over twice that observed from 1992 to 2002. Vermeer (1994) noted the importance of the Courtenay River estu-
ary to waterbirds and that the estuary had suffered much from development and pollution. He cautioned that if the environmental perturbations continued, waterbird populations may decline and urged that frequent monitoring be done.

Methods

I examined changes in numbers of birds in the Comox Valley based on two counts conducted each year in the same count area in a similar manner. The Comox Christmas Bird Count (CBC) began in 1961, with only four participants, and a Spring Bird Count (SBC) using the same count circle, began in 1976. For consistency, I chose to use only the data collected from 1976 to 2006. The Comox CBC circle is centered on the old Comox Post Office (49°40'26"N, 124°55'39"W) and has the standard diameter of 24.1 km (15 mi). The count circle is divided into 12 count areas and 11 teams normally conduct the count from early morning to late afternoon following a relatively standard pattern to cover the entire count circle. The median date (and range) for the SBC was May 3 (April 29-May 7) and for the CBC was December 20 (December 17-24). The median (and range) of participants for the SBC was 34 (24-48) and for the CBC was 42 (27-54). The number of participants increased from 1976 to 1996 for both counts but the number of teams remained the same each year and, consequently, the number of team hours was relatively stable, although the exact number of team hours was not calculated each year. Many of the participants took part in both counts each year.

A total of 215 species was recorded during the SBC. For analysis, I chose only those 96 species recorded at least 90% of the time over the 31 counts in order to minimise “zero” observations. A similar approach to the CBC added 6 species. The CBC was not conducted in 1996; I estimated numbers for that count to be the average of those observed from 1994 to 1998. I also included Wood Duck in the analyses; although it was not recorded until 1988, it was recorded regularly since then.

I conducted statistical analyses using MS Excel 2000 Statistical Analysis ToolPak. I evaluated the significance of trends in annual numbers through log-transform linear regression: \( \ln (n + 0.23) \), where “\( n \)” is the annual number and 0.23 is the constant recommended by Collins (1990). In order to evaluate the difference in the relative proportions of the populations counted on the SBC and the CBC, I calculated a mean and range of numbers observed on each count. I used only the shorter 1997 to 2006 count period to minimize the effect of long-term trends on numbers. I tested the significance of the differences in means by t-test assuming unequal variances on log-transformed data \( [\ln (n + 0.23)] \). This was done to help evaluate the relative biological importance of differences in trends between counts; differences in means were considered to reflect differences in the populations.

In order to examine patterns in temporal trends related to life history, each species was assigned a migration status (neotropical migrant, short-distance migrant, year-round resident) and a primary habitat (coast/wetland, forest/woodland, scrub/successional, grassland, suburban/urban) based on Downes and Collins (2007), Sauer et al. (2005), DeGraaf and Rappole (1995) and Campbell et al. (1990a, 1990b, 1997, 2001). Each species was also assigned to a primary foraging guild based on Ehrlich et al. (1988). Differences among the number of species in each of these classes were measured by \( \chi^2 \) test.

Results

For ease of presentation, results for birds associated with coast/wetland habitat (hereafter, coastal birds) are presented...
Table 1. Birds of coastal and wetland habitats: trend (% change per year) in numbers from 1976 to 2006 and the 1997-2006 mean number (range in parentheses) on the SBC and the CBC.

<table>
<thead>
<tr>
<th>Species</th>
<th>Trend</th>
<th>Mean (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SBC</td>
<td>CBC</td>
</tr>
<tr>
<td>Waterfowl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brant</td>
<td>-2.4</td>
<td>400 (3-1009)</td>
</tr>
<tr>
<td>Canada Goose</td>
<td>8.3***</td>
<td>55 (12-111)</td>
</tr>
<tr>
<td>Trumpeter Swan</td>
<td>7.7***</td>
<td>2 (0-6)</td>
</tr>
<tr>
<td>Wood Duck</td>
<td>13.6***</td>
<td>10 (4-22)</td>
</tr>
<tr>
<td>American Wigeon</td>
<td>5.3</td>
<td>98 (12-224)</td>
</tr>
<tr>
<td>Mallard</td>
<td>5.3***</td>
<td>232 (130-392)</td>
</tr>
<tr>
<td>Northern Shoveler</td>
<td>4.2</td>
<td>60 (0-441)</td>
</tr>
<tr>
<td>Northern Pintail</td>
<td>-3.2*</td>
<td>9 (0-24)</td>
</tr>
<tr>
<td>Green-winged Teal</td>
<td>9.2**</td>
<td>61 (7-345)</td>
</tr>
<tr>
<td>Greater Scaup</td>
<td>-4.5</td>
<td>119 (32-318)</td>
</tr>
<tr>
<td>Scaup total</td>
<td>-6.2**</td>
<td>119 (32-319)</td>
</tr>
<tr>
<td>Harlequin Duck</td>
<td>-1.6*</td>
<td>120 (75-195)</td>
</tr>
<tr>
<td>Surf Scoter</td>
<td>1.7</td>
<td>1160 (217-2898)</td>
</tr>
<tr>
<td>White-winged Scoter</td>
<td>-3.2*</td>
<td>315 (60-1199)</td>
</tr>
<tr>
<td>Black Scoter</td>
<td>-0.7</td>
<td>67 (4-194)</td>
</tr>
<tr>
<td>Long-tailed Duck</td>
<td>2.0</td>
<td>29 (2-137)</td>
</tr>
<tr>
<td>Bufflehead</td>
<td>0.3</td>
<td>95 (14-181)</td>
</tr>
<tr>
<td>Common Goldeneye</td>
<td>-8.9**</td>
<td>8 (0-24)</td>
</tr>
<tr>
<td>Common Merganser</td>
<td>1.7</td>
<td>119 (50-194)</td>
</tr>
<tr>
<td>Red-breasted Merganser</td>
<td>3.4*</td>
<td>192 (50-484)</td>
</tr>
<tr>
<td>Waterbirds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific Loon</td>
<td>-6.0</td>
<td>23 (0-48)</td>
</tr>
<tr>
<td>Common Loon</td>
<td>-1.0</td>
<td>48 (24-90)</td>
</tr>
<tr>
<td>Horned Grebe</td>
<td>-3.7*</td>
<td>25 (1-55)</td>
</tr>
<tr>
<td>Red-necked Grebe</td>
<td>1.7</td>
<td>34 (5-81)</td>
</tr>
<tr>
<td>Western Grebe</td>
<td>-9.3***</td>
<td>68 (1-230)</td>
</tr>
<tr>
<td>Double-crested Cormorant</td>
<td>0.8</td>
<td>10 (2-40)</td>
</tr>
<tr>
<td>Pelagic Cormorant</td>
<td>-5.5**</td>
<td>9 (2-17)</td>
</tr>
<tr>
<td>American Coot</td>
<td>-5.1</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>Bonaparte’s Gull</td>
<td>-6.6***</td>
<td>212 (79-531)</td>
</tr>
<tr>
<td>Mew Gull</td>
<td>1.0</td>
<td>129 (41-299)</td>
</tr>
<tr>
<td>Herring Gull/Thayer’s Gull</td>
<td>-2.5</td>
<td>22 (1-90)</td>
</tr>
<tr>
<td>Glaucous-winged Gull</td>
<td>-1.1</td>
<td>766 (285-1212)</td>
</tr>
<tr>
<td>Pigeon Guillemot</td>
<td>1.2</td>
<td>13 (4-31)</td>
</tr>
<tr>
<td>Marbled Murrelet</td>
<td>5.0</td>
<td>15 (1-39)</td>
</tr>
<tr>
<td>Shorebirds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black-bellied Plover</td>
<td>-0.3</td>
<td>21 (5-35)</td>
</tr>
<tr>
<td>Greater Yellowlegs</td>
<td>6.2**</td>
<td>9 (1-28)</td>
</tr>
<tr>
<td>Black Turnstone</td>
<td>-1.1</td>
<td>12 (0-73)</td>
</tr>
<tr>
<td>Sanderling</td>
<td>5.6</td>
<td>19 (0-94)</td>
</tr>
<tr>
<td>Western Sandpiper</td>
<td>4.4</td>
<td>152 (0-538)</td>
</tr>
<tr>
<td>Dunlin</td>
<td>0.1</td>
<td>427 (45-1359)</td>
</tr>
<tr>
<td>Other Coastal Birds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Blue Heron</td>
<td>1.4</td>
<td>67 (32-94)</td>
</tr>
<tr>
<td>Osprey</td>
<td>2.6</td>
<td>4 (1-7)</td>
</tr>
<tr>
<td>Bald Eagle</td>
<td>4.7***</td>
<td>148 (77-242)</td>
</tr>
<tr>
<td>Northwestern Crow</td>
<td>-1.7</td>
<td>381 (257-501)</td>
</tr>
<tr>
<td>Belted Kingfisher</td>
<td>1.5</td>
<td>16 (7-27)</td>
</tr>
</tbody>
</table>

1 Significance of trend: *P < 0.05, **P<0.01, ***P<0.001
2 Missing values indicate no observations or too many nil values for analysis
3 Significantly greater values in bold; P<0.05
4 Trend from 1988 to 2006 only because Wood Duck was not observed prior to 1988.
5 Includes Greater Scaup, unidentified scaup and Lesser Scaup, which are uncommon and were not consistently identified by observers.
6 Herring Gull and Thayer’s Gull combined because they were not consistently identified by observers.

Separately from those associated with forest/woodland, scrub/successional, grassland and suburban/urban habitats (hereafter, upland birds). A total of 44 species of coastal birds (Table 1) and 58 species of upland birds (Table 2) were reported sufficiently frequently for analysis. Coastal birds showed a significantly greater tendency for population declines than upland birds on the CBC (χ² = 6.96, df = 2, P = 0.031; Figure 1) but not on the SBC. The presentation of results will focus on species of particular importance in the Comox Valley and those showing the greatest trends, and will include short, species-specific discussion as appropriate. Scientific names of the species are presented in an appendix.
Table 2. Birds of upland habitats: trend (% change per year) in numbers from 1976 to 2006 and the 1997-2006 mean number (range in parentheses) on the SBC and the CBC.

<table>
<thead>
<tr>
<th>Species</th>
<th>Trend</th>
<th>Mean (Range)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SBC</td>
<td>CBC</td>
</tr>
<tr>
<td><strong>Neotropical Migrants</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Band-tailed Pigeon</td>
<td>-0.8</td>
<td>82 (35-131)</td>
<td>1 (0-5)</td>
</tr>
<tr>
<td>Rufous Hummingbird</td>
<td>0.7</td>
<td>92 (70-135)</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>Pacific-slope Flycatcher</td>
<td>9.3***</td>
<td>34 (2-59)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Cassin's Vireo</td>
<td>2.2</td>
<td>7 (2-17)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Tree Swallow</td>
<td>-3.4</td>
<td>32 (11-70)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Northern Rough-winged Swallow</td>
<td>-1.6*</td>
<td>299 (199-522)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Barn Swallow</td>
<td>-4.6***</td>
<td>71 (16-114)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Orange-crowned Warbler</td>
<td>-0.2</td>
<td>130 (74-235)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Yellow Warbler</td>
<td>4.3</td>
<td>33 (3-51)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Black-throated Gray Warbler</td>
<td>7.3*</td>
<td>20 (4-48)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Townsend's Warbler</td>
<td>3.3</td>
<td>26 (5-65)</td>
<td>0 (0)</td>
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<tr>
<td>MacGillivray's Warbler</td>
<td>0.4</td>
<td>8 (0-21)</td>
<td>0 (0)</td>
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<tr>
<td>Wilson's Warbler</td>
<td>7.4***</td>
<td>57 (33-96)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Chipping Sparrow</td>
<td>-2.2</td>
<td>16 (6-32)</td>
<td>0 (0)</td>
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<tr>
<td><strong>Short-distance Migrants</strong></td>
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<td>Turkey Vulture</td>
<td>7.8***</td>
<td>24 (4-41)</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>Red-tailed Hawk</td>
<td>1.7</td>
<td>5 (2-7)</td>
<td>8 (4-13)</td>
</tr>
<tr>
<td>Merlin</td>
<td>8.4***</td>
<td>7 (3-11)</td>
<td>4 (1-9)</td>
</tr>
<tr>
<td>Killdeer</td>
<td>-0.2</td>
<td>38 (26-57)</td>
<td>50 (3-160)</td>
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<tr>
<td>Red-breasted Sapsucker</td>
<td>-7.4***</td>
<td>17 (5-27)</td>
<td>3 (0-7)</td>
</tr>
<tr>
<td>Northern Flicker</td>
<td>2.3**</td>
<td>56 (29-79)</td>
<td>72 (36-102)</td>
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<td>Brown Creeper</td>
<td>0.2</td>
<td>9 (1-16)</td>
<td>12 (6-21)</td>
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<tr>
<td>Golden-crowned Kinglet</td>
<td>0.4</td>
<td>64 (21-162)</td>
<td>383 (250-630)</td>
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<tr>
<td>American Robin</td>
<td>1.4</td>
<td>2 (0-9)</td>
<td>24 (3-67)</td>
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<tr>
<td>Yellow-rumped Warbler</td>
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<td>871 (626-1093)</td>
<td>180 (81-408)</td>
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<tr>
<td>Spotted Towhee</td>
<td>3.3***</td>
<td>185 (141-254)</td>
<td>218 (118-366)</td>
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<td>Savannah Sparrow</td>
<td>0.8</td>
<td>152 (63-438)</td>
<td>1 (0-7)</td>
</tr>
<tr>
<td>Fox Sparrow</td>
<td>-3.8</td>
<td>6 (0-14)</td>
<td>68 (21-155)</td>
</tr>
<tr>
<td>Song Sparrow</td>
<td>1.6**</td>
<td>183 (125-234)</td>
<td>222 (157-318)</td>
</tr>
<tr>
<td>White-crowned Sparrow</td>
<td>-0.4</td>
<td>66 (29-112)</td>
<td>18 (3-48)</td>
</tr>
<tr>
<td>Golden-crowned Sparrow</td>
<td>-0.9</td>
<td>69 (18-131)</td>
<td>94 (48-209)</td>
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<td>Dark-eyed Junco</td>
<td>4.0</td>
<td>47 (3-311)</td>
<td>1139 (674-2299)</td>
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<tr>
<td>Red-winged Blackbird</td>
<td>2.8***</td>
<td>212 (175-274)</td>
<td>220 (88-484)</td>
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<tr>
<td>Brewer's Blackbird</td>
<td>1.5*</td>
<td>75 (41-125)</td>
<td>390 (116-684)</td>
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<tr>
<td>Brown-headed Cowbird</td>
<td>-1.9*</td>
<td>37 (15-69)</td>
<td>1 (0-4)</td>
</tr>
<tr>
<td>Purple Finch</td>
<td>-2.8*</td>
<td>51 (32-79)</td>
<td>40 (5-148)</td>
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<tr>
<td>Pine Siskin</td>
<td>-0.4</td>
<td>446 (33-848)</td>
<td>1332 (30-3754)</td>
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<tr>
<td>American Goldfinch</td>
<td>0.7</td>
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<td>12 (0-57)</td>
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<td>148 (91-230)</td>
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<td>2302 (1103-3593)</td>
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<td>179 (86-282)</td>
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<td>42 (0-97)</td>
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1 Significance of trend: *P <0.05, **P<0.01, ***P<0.001; Missing values indicate no observations or too many nil values for analysis
2 Significantly greater values in **bold**, P<0.05
Coastal birds tended to be significantly more abundant in winter (CBC) than in spring (SBC) (Table 1). Over a third of the species (34%) showed significant positive trends and a quarter of the species (25%) showed significant negative trends on one or both counts.

Waterfowl
Most species of waterfowl were significantly more common, or as common, in winter than in spring; Brant, Wood Duck and Northern Shoveler were exceptions. Canada Goose, Trumpeter Swan and most dabbling ducks showed significant positive trends; the notable exception was Northern Pintail, which showed a significant decline. Scaup total (almost exclusively Greater Scaup) showed a significant decline in spring but not in winter when they were significantly more common. That decline, therefore, may be due to timing of spring migration rather than an overall change in populations. Populations of many species of sea ducks in North America are in decline, including White-winged Scoter, but Common Goldeneye and Red-breasted Merganser are considered to be increasing and Bufflehead does not show a trend (North American Waterfowl Management Plan 2004).

Wood Duck was not recorded on the counts prior to 1988, then increased significantly, but appears to have stabilized since the late 1990s. The Courtenay & District Fish & Game Protective Association constructed a large number of nest boxes in the mid-1980s but did not provide long-term maintenance. Similarly, numbers of Wood Duck in the Fraser River lowlands increased dramatically in the 1970s due to construction of nest boxes, but declined in the 1980s due to inadequate maintenance of those boxes (Campbell et al. 1990a).

One-third of the sea ducks showed a significant negative trend and only two species (Bufflehead, Red-breasted Merganser) showed a significant positive trend. White-winged Scoter and Common Goldeneye showed significant declines in spring but not in winter when they were significantly more common. Those declines, therefore, may be due to timing of spring migration rather than an overall change in populations. Populations of many species of sea ducks in North America are in decline, including White-winged Scoter, but Common Goldeneye and Red-breasted Merganser are considered to be increasing and Bufflehead does not show a trend (North American Waterfowl Management Plan 2004, 2007).

Harlequin Duck showed a significant decline in spring but not in winter. However, the numbers in both seasons decreased from 1976 to the mid-1990s and then increased (Figure 2). Smith et al. (2000) noted that Harlequin Duck populations should be watched carefully because demographic parameters and strong site fidelity make them susceptible to unnoticed population declines. The Comox Valley is a particularly important area for Harlequin Duck (Campbell et al. 1990a, Badzinski et al. 2008).

Waterbirds
Over a third (36%) of the species of waterbirds showed a significant negative trend and only three (Red-necked Grebe, Double-crested Cormorant, Glaucous-winged Gull) showed a significant positive trend. The positive trend for Double-crested Cormorant is consistent with that observed in other parts of the Strait of Georgia (Vermeer and Devito 1989). Nesting Glaucous-winged Gull in the southern Strait of Georgia increased from 1960 to 1986 (Vermeer et al. 1989) but then decreased to 1999, possibly due to increased frequency of colony disturbance, particularly by Bald Eagle (Sullivan et al. 2002).

Pacific Loon showed a significant negative trend in winter, largely due to high counts in 1977, 1981, 1982 and 1983 (1585, 734, 458 and 638, respectively), while counts in other years averaged only 78 (median 44, range 0-470). The decline, therefore, may be more likely due to differences in winter distribution than to general changes in the population. The significant negative trends for Horned Grebe and Pelagic Cormorant were shown only in spring, when

with the general trends in southwestern British Columbia (Campbell et al. 1990a).
numbers were significantly smaller than in winter, and may be more related to timing of spring movements than to changes in population.

Western Grebe showed significant declines on both counts. This is consistent with the trend seen on British Columbia CBCs from 1976 to 2006 (National Audubon Society 2005). Examination of the annual numbers showed a great variability among years on both counts, but clear declines to the late 1990s and a possible slight recent recovery in numbers (Figure 3). Results from the British Columbia Coastal Waterbird Survey (BCCWS) also suggest a recent increase after 90-95% decline over the past 30 years (Badzinski et al. 2008). In contrast, Burger (1997) examined pooled CBC data from 25 coastal sites in British Columbia for the period 1957 to 1994 but reported no evidence of a decline in the overall wintering population, although he noted a considerable year-to-year variation in local wintering populations. The variation in numbers observed on the Comox counts, therefore, may reflect variation in wintering areas rather than a general decline. Continentally, Western Grebe populations are considered to be stable (Kushlan et al. 2002). The coastal water of the Comox Valley has been considered an important area for Western Grebe (Burger 1997, Dawe et al. 1998).

Bonaparte’s Gull showed a significant negative trend in spring that was influenced by particularly high counts prior to 1985. Migration through the Comox Valley is in late April and early May (Dawe et al. 1998) so variation could be due to timing of migration or location of food, or both. North American Breeding Bird Survey (BBS) counts show a strong decrease from 1968 to 2006, but this is also influenced by particularly high counts in the late 1970s (Downes and Collins 2007).

**Shorebirds**

Black-bellied Plover and Dunlin showed significant positive trends in winter and Greater Yellowlegs showed a significant positive trend in spring, although numbers recorded were small. Continental populations of Black-bellied Plover and Dunlin are considered to be declining and Greater Yellowlegs show mixed, non-significant trends (Morrison et al. 2001) but West Coast populations were not included in that analysis. The decrease reported in autumn numbers of yellowlegs in the Comox Valley (Martell and Sedgwick 2007) was not reflected in spring numbers. The autumn count was conducted on only a portion of the SBC circle but reflected a number of counts over a month period (September) rather than a single day. Because Greater Yellowlegs were migrating at the time of the SBC, the increase may be related to timing of spring movements rather than to changes in population.

**Other coastal birds**

Bald Eagle showed significant, steady increase in numbers on both counts and numbers did not differ significantly between winter and spring counts (Figure 4). Blood and Anweiler (1994) reported that populations on the south coast of British Columbia had stable or increasing populations since the 1960s and the BBS for coastal British Columbia shows a significant increase (Downes and Collins 2007). Contrary to these observations, the BCCWS showed a recent significant decrease in numbers (Badzinski et al. 2008). The increase in Bald Eagle is likely a recovery from previous decline caused by environmental contaminants.

Northwestern Crow numbers declined significantly on the CBC and declined steadily, but not significantly, on SBC (Figure 5). Based on BBS counts, Verbeek and Butler (1999) found a significant range-wide increase from 1966 to 1979 and no significant change from 1980 to 1995. They found results from the CBC difficult to interpret and suggested that changes in local abundance might reflect shifts in distribution rather than population changes. Similarly, an undocumented change in roosting areas could account for the changes observed on the Comox counts rather than a true population decline, but I have no supporting evidence.

**Upland birds**

Upland birds varied in abundance with migration status. The 16 species of neotropical migrants were present only in...
spring. The 17 species of residents tended to be more abundant or as abundant in winter as in spring, while the 25 species of short-distance migrants were present in both seasons but varied in relative abundance (Table 2). Almost half of the species of upland birds (46%) showed significant positive trends on one or both counts and only 10% showed significant negative trends. Differences by migration status were pronounced, with 19% of 16 neotropical migrants showing significant positive trends compared with 57% of 42 short-distance migrants and residents combined; the proportion of species showing significant decreasing trends was similar (12% and 10%, respectively). However, upland birds did not show any significant differences in trends by migration status, primary habitat or primary foraging guild.

**Neotropical migrants**

Three of 16 species of neotropical migrants (Pacific-slope flycatcher, Black-throated Gray Warbler, Common Yellowthroat) showed significant positive trends and two species (Violet-green Swallow, Barn Swallow) showed significant negative trends, but most species (69%) did not show a significant trend. The BBS counts for coastal British Columbia for the period 1986 to 2006 also showed no significant trend for most (75%) of these 16 species of neotropical migrants; only one species (Chipping Sparrow) showed a significant increase and three species (Tree Swallow, Barn Swallow, Orange-crowned Warbler) showed a significant decrease (Downes and Collins 2007). The decline in swallows is consistent with the recent decline in aerial foragers reported for eastern North America (Birds Ontario 2007). However, because many neotropical migrants were only passing through the Comox Valley at the time of the SBC, differences in numbers could relate to timing of migration as well as to changes in numbers in the population. Although this appears to be true for Pacific-slope flycatcher, Black-throated Gray Warbler, Common Yellowthroat and Barn Swallow, which are more abundant in the month following the SBC than the month before, it does not appear to be the case for Violet-green Swallow whose numbers are as high before as following the SBC.2

**Short-distance migrants**

Most of the 25 species of short-distance migrants (52%) showed significant positive trends on one or both counts and only three species (Brown-headed Cowbird, Purple Finch, Evening Grosbeak) showed significant negative trends; 36% of the species showed no significant trend. In contrast, the BBS counts for coastal British Columbia for the period 1986 to 2006 showed no significant trend for most (84%) of these 25 species of short-distance migrants; no species showed a significant increase and four species (Killdeer, Dark-eyed Junco, Pine Siskin, American Goldfinch) showed a significant decrease (Downes and Collins 2007).

Many of the short-distance migrants are species that move to the Comox Valley in winter from other areas, as reflected in the differences in mean numbers between the SBC and the CBC, while others are essentially absent in winter but arrive in spring, such as Turkey Vulture and Brown-headed Cowbird. Because of this, the significant trends shown by Turkey Vulture and Brown-headed Cowbird may be due to variation in spring arrival date rather than to a change in numbers in the population. Turkey Vulture appears to be more abundant following the SBC than before.2

Red-tailed Hawk and Merlin each showed a steady, significant positive trend. Although numbers are small, the increase was similar to that shown by Bald Eagle, and may also reflect populations recovering from previous declines caused by environmental contaminants. Red-breasted Sapsucker and Northern Flicker also showed significant positive trends.

All six species of wintering sparrows (Spotted Towhee, Fox Sparrow, Song Sparrow, White-crowned Sparrow, Golden-crowned Sparrow, Dark-eyed Junco) showed significant positive trends. The only sparrows not to show a significant trend were Chipping Sparrow, a neotropical migrant, and Savannah Sparrow, primarily a spring migrant. This suggests either a significant increase in all wintering populations or an increased concentration of wintering birds in the Comox Valley. Similarly, Red-winged Blackbird and Brewers Blackbird winter in large numbers in the Comox Valley and each showed a significant positive trend.

In contrast, Purple Finch and Evening Grosbeak each showed a significant negative trend. Spring numbers for Purple Finch decreased sharply in the early 1990s (mean number was 101 for 1976-1992 and 51 for 1993-2006) but winter numbers were relatively stable throughout. It is not clear what may have caused the sharp decrease in the early 1990s. Purple Finch also showed a significant negative trend.

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2 Unpublished data from counts made in the Comox Valley from late-March to late-May 2005 to 2007.
in fall migration in central California from 1979 to 1999 (Ballard et al. 2003). Evening Grosbeak numbers were extremely variable with peaks usually every three to five years, but recently numbers have remained low. Evening Grosbeak was virtually absent on the CBC from 1995 to 2004 and were low on the SBC from 1999 to 2006. Some of these fluctuations are likely related to its nomadic and erratic nature although recent extensive spruce budworm outbreaks in the interior of the province could account for the reduced numbers on the coast (Campbell et al. 2001). Cannings (2007:15-19) noted that in the interior of British Columbia, Evening Grosbeak was more common in winter than in summer in the 1960s but that the reverse was true by 1995. He also noted that they became scarcer in both seasons beginning in 2000. He suggests that the changes may have been due to the outbreak in spruce budworm from 1978 to the late 1990s. Evening Grosbeak has shown serious declines across North America (National Audubon Society 2007; Butcher and Niven 2007).

**Residents**

Most of the 17 resident species (65%) showed significant positive trends on one or both counts and only Bewick's Wren showed a significant negative trend; 29% of the species showed no significant trend. In contrast, the BBS counts for coastal British Columbia for the period 1986 to 2006 showed no significant trend for most (88%) of these 17 species of residents; no species showed a significant increase and only two species (Bewick's Wren, European Starling) showed a significant decrease (Downes and Collins 2007).

Common Raven showed a significant positive trend on both SBC and CBC. Common Raven has varied in numbers in the Comox Valley in the past. It was uncommon there from 1916 to 1932 but became more common from 1933 to 1937 (Pearse 1938). The increase observed in this study may be part of a longer term trend.

Bewick's Wren was the only resident species to show a significant negative trend (Figure 6). The trend was significant only on the SBC, possibly due to increased detectability of birds in spring. Bewick's Wren showed a significant decrease on BBS in coastal British Columbia from 1986 to 2006 (Table 3) and also showed a significant negative trend in fall migration in central California from 1979 to 1999 (Ballard et al. 2003).

Many of the resident species that showed a significant positive trend are urban (Rock Pigeon, European Starling, House Finch) and suburban (Downy Woodpecker, Pileated Woodpecker, Steller's Jay, Chestnut-backed Chickadee, Bushtit, Red-breasted Nuthatch) birds often found at backyard feeders. Many of these species forage in flocks in winter and, likely as a result, are recorded in greater numbers on the CBC than on the SBC.

Ringed-necked Pheasant, an introduced species, showed a significant positive trend on both counts. An examination of the annual numbers, however, showed a pattern of increase from the mid-1980s to a peak in the mid-1990s and then a decline. This pattern is suggestive of an introduction in the mid-1980s. Ring-necked Pheasant were introduced to the Comox Valley in 1955 (Campbell et al. 1990b) but I did not find any record of later introductions.

**Discussion**

**Long-term trends**

**Count methodology**

The methodology used for Christmas Bird Counts is subject to a number of biases that compromise analyses, such as differences in observer skill, circle coverage, number of participants and weather. Interpreting the results of CBC counts, therefore, requires a good understanding of the history of the count, who participated, how those participants

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<td>Common Raven</td>
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<td>American Goldfinch</td>
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Table 3. Comparison of trends detected by the North American Breeding Bird Survey (BBS) for the Northern Pacific Rainforest (BCR 5), British Columbia (Downes and Collins 2007) and by the Comox SBC and CBC. Species with significant (P<0.05) trends on the BBS are listed.
behaved, and how circle coverage changed (Droege 2008). The counts used in this study were conducted each year by many of the same observers following a similar approach and covering the count circle in a similar manner, which should minimize at least some of the inherent biases. It is usually recommended that data be adjusted for ‘party hours’ because both the number of participants and teams have often varied over time (Butcher et al. 1990). In this study, the number of teams and hours spent in the field were relatively constant, although the number of participants increased. The number of party hours was, therefore, similar each year and the numbers counted were not adjusted.

Timing of counts
The Spring Bird Count was conducted at a time when spring migration was still underway and when winter birds were still dispersing. Consequently, trends in numbers of some species could be due either to actual changes in populations or to timing of movements. The decreasing trends observed for some waterfowl (Scaup, White-winged Scoter, Common Goldeneye) and waterbirds (Horned Grebe, Pelagic Cormorant) could have been due to earlier movements from winter concentrations and the increasing trends in Bonaparte’s Gull and Greater Yellowlegs could have been due to earlier arrival dates. Likewise, the increasing trends observed for some neotropical migrants (Pacific-slope Flycatcher, Black-throated Gray Warbler, Common Yellowthroat) and Turkey Vulture could have been due to earlier arrival dates. Unpublished data from counts made in the Comox Valley from late-March to late-May 2005 to 2007 show that many neotropical migrants and some short-distance migrants are still in migration when the SBC is conducted; numbers are much greater in the month following the SBC than in the month preceding the SBC. However, for most coastal and upland birds the trends observed appear to reflect differences in population size.

Comparison with BBS
In order to see if the Comox counts reflected the BBS counts, I compared significant trends observed on the BBS for coastal British Columbia (Northern Pacific Rainforest) with those observed on the Comox counts (Table 3). Of the 14 species with significant BBS trends, only 4 species (Bald Eagle, Common Raven, Barn Swallow, Bewick’s Wren) were significant on the SBC counts, and all matched the direction of the BBS trends. The Comox counts may have reflected breeding populations for these species. Two additional species (Eurasian Starling, Dark-eyed Junco) were significant on the CBC counts but showed a different direction of trend from the BBS. The Comox counts likely reflected wintering counts for these species. The remaining 8 species showed significant trends on the BBS but were not significant on the Comox counts. Differences in trends observed on the Comox counts compared with the BBS may be due to difference in the populations being monitored (cf. Francis and Hussell 1998). The BBS is not well represented in or near the Comox Valley, and the BBS is largely restricted to roadside habitats. Also, several of the species monitored on the Comox counts breed outside of coastal British Columbia and are not well represented on the BBS on their breeding range.

Trends
Even setting aside those species that were likely affected by timing of migration or movements, coastal birds showed a much greater tendency to population decrease and a lesser tendency to population increase than upland birds. Because of the traditional importance of the Comox Valley to waterfowl and waterbirds, the declines, especially for Harlequin Duck and Western Grebe, are a concern and reinforce the need to monitor those populations.

 Declines have been documented for many species of neotropical migrants (Rappole and McDonald 1994, Robbins et al. 1989). However, Francis and Hussell (1998) found that in Ontario many species that were declining appeared to have increased and showed a positive trend from 1961 to 1997. Most of the species of upland birds that showed an increasing trend on the Comox counts are species that concentrate in winter (sparrows, blackbirds, urban/suburban birds) and their predators (Red-tailed Hawk, Merlin). Those increases are despite the significant loss in habitat due to development. The decreasing trends for Bewick’s Wren and aerial foragers (Violet-green Swallow, Barn Swallow) are unexplained but deserve continued monitoring and investigation.

Climate change
Many of the recent changes in bird populations and the timing of migration have been suggested to relate to recent changes in climate and to climate warming (Price and Root 2005). Earlier arrivals, earlier breeding dates and changes in distributions have been seen (ibid.). In addition, the average latitude of occurrence is shifting northward and has the potential for a 32% gross, 16% net, loss of species of neotropical migrants in the Pacific Northwest (ibid.). A trend towards earlier arrival dates has been reported in northeastern United States (Butler 2003), Manitoba (Murphy-Klassen et al. 2005) and British Columbia (Bunnell and Squires 2005). Short-distance migrants have shown higher incidences of advancing arrival dates compared with other groups (Butler 2003, Murphy-Klassen et al. 2005). In Manitoba, waterfowl appeared to be more sensitive to the effects of warming trends than other species (Murphy-Klassen et al. 2005).

Coastal British Columbia has warmed at a rate equivalent to 0.5°C to 0.6°C per century, or at roughly the same rate as the global average. Spring across most of British Columbia is now warmer, on average, than it was a century ago. On the coast, spring temperatures have increased by 0.8°C. (B.C. Ministry of Water, Land and Air Protection
Trends in Comox Valley bird populations - Martell

The Comox Valley has shown statistically significant trends for 1950 to 2001 in annual minimum and average temperature, as well for spring, summer and autumn minimum temperature; increases are primarily observed in the spring season (Environment Canada 2005).

Long-term changes in climate could, therefore, have affected the abundance of some species on both the SBC and the CBC, although the effect would be expected to be greater on the SBC, which was conducted when many species were on migration. A long-term increase in temperature could advance the timing of migration and produce either an increase or a decrease in numbers observed depending on when the count occurred relative to the peak of migration for that species. That may account for the trends observed in Bonaparte’s Gull, Greater Yellowlegs and some neotropical migrants (Pacific-slope Flycatcher, Black-throated Gray Warbler, Common Yellowthroat) and Turkey Vulture. Likewise, climate warming may have caused earlier movements from winter habitats in Scaup, White-winged Scoter, Horned Grebe and Pelagic Cormorant. Long-term changes in climate could also affect the quality of winter habitats, causing birds to change winter concentration areas over time. Although there is no direct evidence of that in the Comox Valley, such an effect could explain the trends observed in Pacific Loon, Western Grebe and many wintering upland birds (sparrows, blackbirds, urban and suburban birds).

Conclusion

Long-term counts of birds in the Comox Valley permitted detection of significant trends in the numbers of many coastal and upland birds in an area that traditionally has been important for wintering birds and has undergone considerable change due to development. The availability of both a spring as well as a winter count was important in understanding the dynamics of many species, even though the spring count was conducted during migration. Counts like these, conducted by dedicated amateur birders over time, are important in documenting the trends in local areas and compliment broader national and regional surveys.

Acknowledgements

I am indebted to the many members of the Comox Valley Naturalists Society who took part in the Christmas Bird Counts and Spring Bird Counts over the years. I would particularly like to thank Rob Butler and Neil Dawe for their review of the paper. The manuscript also benefited from comments from M. Drever, T. Dickinson, K. Martin and an anonymous reviewer.

Literature cited


Appendix: Scientific names of species mentioned in the article.

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Appendix continued ▶
Appendix continued: Scientific names of species mentioned in the article.

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<td>Yellow Warbler</td>
<td>Dendroica petechia</td>
<td>House Sparrow</td>
<td>Passer domesticus</td>
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Extraordinary concentration of wintering
American Dippers in the Coast Range, British Columbia

Russ A. Walton1,3 and Kenneth G. Wright2

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2 360 St. Paul Street West, Kamloops, B.C. V2C 1G4
3 Corresponding author

Abstract: We examined the seasonal fluctuations in numbers of American Dippers (Cinclus mexicanus) on three watercourses near Lillooet, British Columbia. Monthly surveys were carried out between December and August over three consecutive years (2000-2002) on a 10.6 km survey route. Dipper densities peaked in winter, achieving maximum densities of 10.8 birds per km of stream channel in December. Summer densities were up to 50-fold lower, ranging from 0.2 to 0.5 birds per km. All three watercourses were influenced by hydroelectric generation facilities but birds avoided the least natural watercourse, using the power canal only when numbers in the survey area exceeded 90 individuals. Our study indicates that this area is an important wintering ground for dippers and it demonstrates the importance of using multi-season surveys for assessing true habitat value for resident and migratory birds.

Key words: American Dipper, Cinclus mexicanus, winter density, season, riverine bird surveys, Coast Mountains, British Columbia

Introduction

The American Dipper (Cinclus mexicanus) belongs to the Cinclidae, a family of aquatic passerines specially adapted to turbulent mountain rivers and streams (Kingery 1996). These adaptations include a low metabolic rate, a high oxygen-carrying capacity of the blood and a very dense plumage that is impermeable to water and is maintained by regular bouts of preening. Dippers feed on aquatic macroinvertebrate larvae such as caddisflies and mayflies and they also opportunistically consume fish roe (Morrissey et al. 2004; Obermayer et al. 1999) and even small fish (Burcham 1904).

In most portions of its range the dipper is considered a resident species; as long as a stream supports patches of open water and an adequate food supply, it can remain throughout the year. As a rule, dipper densities are considerably higher in winter on suitable unfrozen watercourses than during the breeding season (Morrissey et al. 2004; Kingery 1996). Distinct altitudinal migrations have been found between the breeding and wintering grounds (Morrissey et al. 2004; Kingery 1996). Long-range latitudinal migrations have been speculated for some northern populations (Campbell et al. 1997), but this has not been confirmed.

In this paper we report on seasonal surveys of dippers near Lillooet, British Columbia.

Methods

Surveys were carried out near the town of Lillooet (50°41’N, 121°55’W), in the southern interior of British Columbia (Figure 1). Lillooet lies within the climatic rain shadow of the Coast Mountains and experiences low an-
nual precipitation levels. The following three watercourses were surveyed: Seton River, Cayoosh Creek, and BC Hydro’s Seton Canal (a hydroelectric power canal). These watercourses are all regulated by hydroelectric generation facilities.

Flowing out of Seton Lake Reservoir, the Seton River runs for 4.8 km before merging with the Fraser River (Fig. 1). Stream habitat consists of short riffles and cascades separated by long glides. On Cayoosh Creek, we surveyed upstream from the Seton River confluence for 2.3 km, at which point the creek becomes confined in a narrow gorge. Cayoosh Creek is characterized by a continuous riffle with only a few glide and pool sections. Riparian vegetation along the Seton River and Cayoosh Creek consists of a well-developed border of black cottonwood (*Populus trichocarpa*) with patches of red alder (*Alnus rubra*), red-osier dogwood (*Cornus stolonifera*), and willow (*Salix* sp.). Situated adjacent to the Seton River, the concrete-lined Seton Canal flows for 3.5 km to the Seton Generating Station beside the Fraser River. With a low gradient, the canal mimics a long deep glide. Constructed in 1956, the canal is devoid of riparian vegetation and lacks the natural instream habitat features that characterize the other two watercourses.

We conducted four surveys in 2000, seven in 2001, and four in 2002. For all surveys, one or two observers hiked upstream along the banks of each watercourse following established techniques for surveying dippers (Resources Inventory Committee 1998). Equipped with 8 X 30 binoculars, observers detected dippers by carefully scanning both shorelines and instream habitat features such as rocks and ice. The maximum distance between scans was 50 m. Dippers typically only flushed short distances (<50 m) in response to the observers’ approach. To avoid double counting, birds were carefully monitored until they were either parallel or downstream of the observers. Based on the conspicuous nature of dippers and their tendency to fly when disturbed, we feel that our numbers reflect a reasonable estimate of dipper numbers on these watercourses.

We plotted bird densities for each month for which data were available. We performed a repeated-measures ANOVA to compare numbers in the different reaches. To put our results in a broader context, we reviewed literature containing similarly collected data from other rivers across western North America for surveys that were at least two km in length.

### Results

We conducted a total of fifteen surveys between 2000 May and 2002 December. The seasonal pattern is consistent over the three years (Figure 2). In winter months (December to March) dipper numbers were up to 50 times higher than during the breeding season, reaching a peak of 10.8 birds per km in 2002. Dipper densities were very low during our five May and June surveys, and we did not observe any dippers during four surveys in July and August. Dippers used the three river sections differently ($F_{2,9,18} = 8.825, P < 0.003$). For all seasons combined, Cayoosh Creek had the highest density of dippers (8.1 birds/km), followed by the Seton River (4.4 birds/km). The Seton Canal (0.8 birds/km) was only used when dipper numbers exceeded 90 individuals in the study area. The Seton River area supports an unusually high density of wintering dippers, matched only by dipper densities in the Chilliwack watershed (Table 1).

### Discussion

Seasonal fluctuation in the abundance of dippers in the Seton River is consistent with that documented in other southern British Columbia watersheds (Morrissey *et al.* 2004; Campbell *et al.* 1997; Cannings *et al.* 1987; King *et al.* 1973). These reports showed that dipper numbers increased from October until January, and most birds dispersed to breeding areas by mid-March. Our data show that dipper numbers in the Seton River area follow the same pattern, with peak numbers in December and January. Lacking autumn surveys, our densities may underestimate the wintering population, since Morrissey *et al.* (2004) found November to be the peak month on the Chilliwack River.

The surprising aspect of our results was not the seasonal shift in dipper numbers, but the extraordinarily high densities of birds in winter compared to the breeding season, with winter densities over 50 times greater. Morrissey *et al.* (2004) found similar peak winter densities (7.2–11.6 birds per km) but increases in winter were only five times higher than summer densities. Dawson (1923) reported winter densities of 9.0 dippers/km on the Chelan River in

![Figure 2. Seasonal densities of dippers at the Seton study area for 2000, 2001 and 2002. Densities are totalled for all three watercourses.](image-url)
Table 1. Maximum densities of American Dippers in summer and winter. Only studies which surveyed 2 km or more of stream channel are included.

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Linear distance surveyed (km)</th>
<th>Summer density (birds/km)</th>
<th>Winter density (birds/km)</th>
<th>Source</th>
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<td>Seton River, Lillooet, B.C.</td>
<td>2002</td>
<td>10.6</td>
<td>0.5</td>
<td>10.8</td>
<td>This study</td>
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<td>Seton River, Lillooet, B.C.</td>
<td>2001</td>
<td>10.6</td>
<td>0.2</td>
<td>9.5</td>
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<td>Chiliwack River, B.C.</td>
<td>1999-2002</td>
<td>16</td>
<td>2.1 ± 0.3</td>
<td>9.8 ± 1.4</td>
<td>Morrissey et al. (2004)</td>
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<td>Bridge River, B.C.</td>
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<td>40</td>
<td>0.4</td>
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<td>Squamish/Cheakamus Rivers, B.C.</td>
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<td>1.2</td>
<td>King et al. (1973)</td>
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<tr>
<td>Gardiner River, Wyo.</td>
<td>1922</td>
<td>10</td>
<td>1.0</td>
<td>7.5</td>
<td>Skinner (1922)</td>
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<tr>
<td>Chelan River, Wash.</td>
<td>1921</td>
<td>3</td>
<td>–</td>
<td>9.0</td>
<td>Dawson (1923)</td>
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<td>Boulder Creek, Colo.</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.7</td>
<td>Price and Bock (1983)</td>
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<tr>
<td>Rattlesnake Creek, Mont.</td>
<td>1956</td>
<td>21.7</td>
<td>1.2</td>
<td>1.9</td>
<td>Bakus (1959)</td>
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1 Means (± 1 SE) are reported. Summer densities are from early July.
2 Helicopter survey conducted by the authors in March. Probably an underestimate of maximum winter density.
3 Cited in Campbell et al. (1997).

Washington, but this was only over a 3 km stretch and summer densities were not reported. Skinner (1922) reported a density of 7.5 birds/km on the Gardiner River in Yellowstone National Park, Wyoming, and densities may have been even higher in severe winters along the Park’s low-elevation geothermal rivers (Terry McEneaney, Yellowstone National Park ornithologist, pers. comm.). The highest recorded density is a report of 35 birds observed on a 1 km section of the Okanagan River, 230 km southeast of our study area (Cannings et al. 1987). However, this observation was over a very short distance and was linked to a specific geographical feature in a location where natural low-elevation watercourses are scarce. Like the Chiliwack River, the Seton River area supports an unusually high concentration of dippers in winter. Unlike the Chiliwack River, however, the Seton River supports very low densities of dippers during the breeding season, suggesting its main significance is as a wintering ground.

Why does this area support such a high wintering concentration? One unusual feature of the Seton area is the close proximity of three watercourses which support different habitats. All three watercourses are controlled by hydroelectric facilities upstream. In Colorado, Price and Bock (1983) noted that birds used streams kept ice-free by hydroelectric plants in winter. For the most part, the Seton watercourses do not completely ice over in winter. The Seton power canal, the least “natural” watercourse, was only used when densities on the site were very high, and when part of Cayoosh Creek was frozen. This observation suggests that dippers show a preference for more natural reaches.

High densities of dippers might also be related to winter food availability. The Seton River supports a high concentration of spawning salmon, and dippers undoubtedly exploit the highly nutritious salmon eggs in autumn and winter (Morrissey et al. 2004; Obermeyer et al. 1999). The presence of thousands of salmon carcasses may also serve as a form of nutrient enrichment, stimulating the macroinvertebrate community (Wipfli et al. 1998).

Campbell et al. (1997) suggested that some dippers may migrate from more northern parts of British Columbia, similar to migration patterns documented for the White-throated Dipper (Cinclus cinclus) in Europe (Kingery 1996). To date, no long-distance migrations have been recorded for the American Dipper. The work of Morrissey et al. (2004) on the Chiliwack River suggests that altitudinal migrations are most typical. With overall numbers increasing from 0-5 birds in summer to 95-115 birds in winter, the Seton area may draw dippers from more than one watershed. Regardless of their source, this relatively unimportant summer breeding habitat becomes a very important wintering area for dippers. The disparity between summer and winter densities points to the importance of conducting multi-season surveys when assessing habitat value for resident species. Based on summer surveys alone, this area would have been incorrectly classified as marginal dipper habitat.

Acknowledgements

We are very grateful to Vivian Birch-Jones, Kristal Bodaly, Stuart Jackson, Fraser Lang, Jeff O’Kelly, Karl Heinz Mascher, Maria Mascher, Sophie-Anne Weimar and Ian Routley for assisting us in the field. This study was partly funded by BC Hydro and benefited in numerous ways from the input of Ed Hill. Ed Hill, John Sprague and two anony-
amous reviewers kindly reviewed the manuscript and pro-
vided many helpful suggestions. This paper is dedicated to
the memory of Fraser Lang, friend and colleague. He is
sorely missed.

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Diet of Western Screech-Owls in the interior of British Columbia

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Abstract: During 2006 and 2007, we radio-located Western Screech-Owls (\textit{Megascops kennicottii macfarlanei}) at roost sites along the Shuswap River, British Columbia, Canada. Between March and November, we collected regurgitated pellets at these roosts and analysed them for content. Screech-owls had a diverse diet that included small mammals, birds, fish and insects. Female owls included more mammals in their diet than males did, and males included more insects than females did. We speculate that differential niche utilization may reduce intersexual competition for food resources within this endangered species.

Key words: Western Screech-Owl, \textit{Megascops kennicottii macfarlanei}, diet, intersexual competition, niche separation.

Introduction

The interior Western Screech-Owl (\textit{Megascops kennicottii macfarlanei}) is an endangered species (COSEWIC 2002) that occurs in lowland areas of south-central British Columbia. Screech-owls have a varied diet: beetles, crickets and grasshoppers, snails, fish, birds, voles, mice, shrews, pocket gophers and bats have been found in the diet of screech-owls in previous studies (Munro 1929; Earhart and Johnson 1970; Smith and Wilson 1971; Marks and Marks 1981; Rains 1997; Cannings and Angell 2001). Understanding the composition of the diet of Western Screech-Owls can be useful for conservation programs because it will aid in identifying habitat factors that may affect abundance and distribution of food resources for this endangered species.

Methods

From 2005 to 2007, we captured and radio-tagged screech-owls as part of a study on the general ecology of the species. We used radiotelemetry to locate owls at daytime roosts and returned to these sites at a later date to search for regurgitated pellets and prey remains. Samples were collected, frozen and analysed later for contents.

We separated each raw pellet using fine forceps and spread the contents under a dissecting microscope. Using the key of Nagorsen (2002) and reference collections, we identified individual prey items to species where possible, and to genus or other taxonomic levels when this could not be accomplished.

We occasionally collected multiple pellets at a single site and grouped these pellets into a single sample. Because pellets found at a single roost site could be of multiple ages or from untagged owls, the provenance of the pellet or confidence in the dates of use may be reduced. We did not assign date or sex of owl to pellets that were collected > 2 weeks after the roost site was identified, nor to pellets collected from sites used by both male and female radio-tagged owls.

For each pellet sample, we recorded the prey species present and the minimum number of individuals of each prey species. We then grouped prey species into four broad taxonomic groups: insects, fish and molluscs, birds and mammals. Fish and molluscs were combined because of low sample sizes and presumed ecological similarities. We compared the diet composition between sexes by assessing the frequency of occurrence of each of the four taxonomic groups in the pellets. We used Chi-square goodness-of-fit test and Bonferroni-adjusted \(Z\)-tests to compare the frequency that each group occurred in the pellets collected from each sex. We set the acceptable Type I error rate at 0.05.
Results

Number of pellets collected varied throughout the year. Pellets were easiest to find prior to nesting, which occurred in April. Pellets were often very difficult to locate because of their small size (most < 2 cm long) and cryptic coloration. Pellets were found only between March and November; despite considerable search effort we did not find pellets at roosts during winter. We collected and analysed 75 samples of regurgitated pellets, with some samples containing multiple pellets. Individual pellets often contained multiple prey items.

We identified 219 prey items in the 75 samples, for an average of 2.9 prey items per sample (SD = 2.8). The largest number of prey items in one sample was 16 found in 3.5 pellets, which were mostly beetles (14 of 16 items). Beetles were the most common prey item (100 or 45.7%) followed by species of voles (Microtus) as a group (46; 21%). Not all prey items could be identified to the species level, since most specimens were badly broken with missing teeth or bones, some of which were critical to species identification. For example, Microtus samples were often not identified to species, although most of them were likely M. pennsylvanicus.

The frequency of occurrence of four taxonomic groups was significantly different ($\chi^2 = 7.88$, df = 3, $P = 0.049$; Table 1) between the diets of males and females (Figure 1). Males consumed significantly more insects than did females, whereas females consumed more mammals than did males (Bonferroni-adjusted Z-tests, $P < 0.05$).

We observed few noticeable differences in the seasonal occurrence of the different species of prey (Figure 2). However, beetles were used as soon as they became available at the end of March, peaked in use in

| Table 1. Frequency of occurrence of prey items found in pellets collected from Western Screech-Owls along the Shuswap River, British Columbia, 2006 and 2007. The number of items of a category found in a single sample is not indicated. N = 75 pellet samples |
|-----------------|----------------|----------------|----------------|
| **Sex of owl** | **Female** | **Male** | **Unknown** |
| **Insects** | 14 | 21 | 2 |
| Beetle (Coleoptera: most or all Carabidae) | | | |
| Cricket/grasshopper (Orthoptera) | 2 | 2 | 0 |
| Undifferentiated insects | 2 | 4 | 0 |
| **Molluscs** | 0 | 1 | 0 |
| Snail | | | |
| **Fish** | 0 | 4 | 0 |
| Undifferentiated fish | | | |
| **Birds** | 4 | 1 | 0 |
| Ruffed Grouse (Bonasa umbellus) | | | |
| Killdeer (Charadrius vociferus) | 1 | 0 | 0 |
| American Robin (Turdus migratorius) | 1 | 0 | 0 |
| Cedar Waxwing (Bombycilla cedrorum) | 0 | 1 | 0 |
| Undifferentiated bird | 4 | 5 | 1 |
| Egg shell | 0 | 1 | 0 |
| **Mammals** | 6 | 0 | 1 |
| Shrew (Sorex spp.) | | | |
| Bat (Chiroptera) | 0 | 0 | 1 |
| Red Squirrel (Tamiasciurus hudsonicus) | 1 | 0 | 0 |
| Northern Pocket Gopher (Thomomys talpoides) | 2 | 0 | 1 |
| Meadow Vole (Microtus pennsylvanicus) | 10 | 9 | 2 |
| Undifferentiated vole (Microtus spp.) | 9 | 6 | 1 |
| Deer Mouse (Peromyscus maniculatus) | 6 | 5 | 1 |
| Undifferentiated rodent | 4 | 4 | 0 |
| **Total** | 66 | 64 | 10 |

Figure 1. Frequency of occurrence of four taxonomic groups in pellets (n = 75) collected from Western Screech-Owls along the Shuswap River, British Columbia, 2006 and 2007.

Figure 2. Frequency of occurrence of four taxonomic groups in pellets (n = 75) collected from Western Screech-Owls along the Shuswap River, British Columbia, 2006 and 2007.
April, and gradually declined in frequency in the pellets through autumn.

Discussion

Composition of the diet of Western Screech-Owls in the Shuswap River drainage was similar to that reported elsewhere within the range of the *macfarlanei* subspecies. Insects and small mammals were the primary components of their diet, although a wide variety of other species were consumed in minor amounts. Composition of the pellets varied; 50.2% contained insects, 38.9% mammals and 7.9% of the items were birds. Interestingly, our results are different from those of Smith and Wilson (1971) whose 67 pellets collected during winter in Utah yielded a total of 80 prey items of which 23.8% were insects, 24.9% were mammals and 51.3% were birds. One would expect diets to be different between our study and Smith and Wilson’s (1971) study because of differences in the seasons of collection and ecological settings; very little snow cover occurred in the Utah study area (D. Smith, Southern Connecticut State University, personal communication).

While proportions varied, few prey species found in this study had not been detected in the diet of screech-owls or other small owls elsewhere. This observation suggests that screech-owls in our study area did not use a different suite of prey species than found in other areas. Our detection of a red squirrel in a pellet was the only diet item that has not been reported in other studies (Cannings and Angell 2001).

It is unclear how important birds are in the diet of Western Screech-Owls because they comprised such a small component of the prey items that we identified. Although unidentified bird bones were found in 10 pellet samples in this study, all prey items from birds that were identified to species consisted of feathers that we had collected on the ground beneath roosts. We found remains of a Cedar Waxwing, American Robin and Killdeer and 4 adult Ruffed Grouse under roosts. We cannot be sure that these feathers were of prey eaten by screech-owls; it is possible that the remains were left by another raptor. However, birds were a recognized diet item in other studies (e.g., Marks and Marks 1981; Rains 1997; Cannings and Angell 2001). Although Ruffed Grouse are large for this small owl, screech-owls do occasionally take large prey; adult cottontails (*Sylvilagus* spp.) were found 3 times in a screech-owl nest box in Idaho (Cannings and Angell 2001).

We observed substantial differences between diets of male and female screech-owls which has not been noted previously. Male screech-owls consumed more small prey items (fish and insects) than females, whereas females ate more small mammals than did males. Differential niche utilization within a common territory may reduce intersexual competition for food resources (Selander 1966). Differential niche utilization by sexes is not unexpected by Western Screech-Owls due to their sexual size dimorphism; male screech-owls in this study were much smaller (\( \bar{X} = 191 \) g, SD = 12.0, \( n = 6 \)) than females (\( \bar{X} = 242 \) g, SD = 34.2, \( n = 10 \)). In addition to segregation of food resources, we also found that the male and female owl of one breeding pair used different parts of the territory outside of the breeding season, which may further reduce intersexual competition for food resources.

Our results are consistent with the findings of Smith and Wilson (1971), who concluded Western Screech-Owls are relatively opportunistic predators, taking the most easily attainable prey. It is unlikely that lack of suitable prey contributes to the low population numbers and endangered status of this species. Prey species that owls consumed occur in a wide variety of habitats. However, exposure to predation by larger owls may affect the types of habitats that owls can safely exploit in order to acquire these prey resources.

Acknowledgements

We would like to thank the following funding agencies: the Bridge-Coastal Restoration Program of BC Hydro, the Government of Canada Habitat Stewardship Program for Species at Risk, the Forest Science Program of the Forest Investment Account, the World Wildlife Fund and Environment Canada through the Endangered Species Recovery Fund, Tolko Industries Ltd. and the B.C. Ministry of Environment. We thank assistants R. Noble, A. Hahn, H. van Oort, B. Harrower for helping to collect the field data and all the wonderful landowners who allowed this work to take place. We thank R. Weir, M. Phinney and an anonymous reviewer for comments on an earlier draft.
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Unusual colour of eggs of a female western Yellow-breasted Chat in the south Okanagan valley, British Columbia, Canada

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Abstract: In 2006 and 2007, there was a deviant colour in four clutches of eggs of one female Yellow-breasted Chat (Icteria virens auricollis). The eggs lacked the characteristic distinct brownish spots. This was the only occurrence among the eggs in 265 nests inspected from 2001 to 2007 in the south Okanagan valley, British Columbia, Canada. Eggs of the same female had normal brown spots in 2005. The observations of nests were part of a survey of breeding success and habitat needs in this endangered population of chats.

Key words: Yellow-breasted Chat, Icteria virens auricollis, egg colour, protoporphyrin

Yellow-breasted Chat (Icteria virens auricollis) eggs are described as white or cream with brown, reddish brown or chestnut red marks (Ehrlich et al. 1988; Stokes and Stokes 1996; Baicich and Harrison 1997). In nest inspections during the period 2001 through 2007, of 265 nests and 634 chat eggs in the south Okanagan valley our findings were consistent in this description except for two clutches in one territory in 2006 and two clutches in one territory in 2007. On 2006 May 29, a chat nest was found containing two chat eggs and two Brown-headed Cowbird eggs (Molothrus ater). The chat eggs were all white, with no brown spots. The pair successfully raised two chats and one Cowbird. The chicks fledged on June 15. The male and female were both colour-banded. This pair had a second brood and the nest was located on 2006 June 25. Once again, the chat eggs were all white with no brown spots. On this occasion the pair successfully raised four chats and one Cowbird. During 2007, the same banded female occupied a territory adjacent to her 2006 territory. On 2007 June 28 her nest was located containing four eggs. Three eggs were white while one egg had a few very dull brownish spots. This nest failed at the nestling stage but a re-nest was located on July 19 containing four white chat eggs. Three chicks hatched and successfully fledged on August 02. In 2005, the same colour-banded female was in a territory adjacent to her 2006 territory and the eggs in 2005 had the normal brownish spots.

At present we cannot account for the lack of spots on the eggs. However, the occurrence of spots on her eggs in the preceding year suggests the lack of spots had an environmental rather than genetic basis. The brown spots in songbird eggs are caused by the deposition of the brown pigment protoporphyrin (Moreno and Osorno 2003; Gosler et al. 2005; Higham and Gosler 2006). The pigmented spots indicate thinner areas in the shell and the protoporphyrin helps to strengthen weaker areas in the egg shell (Gosler et al. 2005). These pigmented spots may be laid down within the female during egg formation. When cells in a particular area of the shell surface are low in calcium, protoporphyrin may be added to make up for the shortage (Gosler et al. 2005). In Great Tits (Parus major), pigmented spots indicated thinner areas in the egg shell and females in areas with low calcium soils laid thinner, more speckled eggs (Gosler et al. 2005).

Chats are mainly insectivores during the breeding season (Bent 1953) with no records of consuming shells or calcareous grit as a calcium source as in some passerines (Mayoh and Zach 1986; St. Louis and Breebaart 1991; Graveland 1996; Graveland and van der Wal 1996). However, chats feed on berries when available (Bent 1953; Ehrlich et al. 1988). Saskatoon berries (Amelanchier alnifolia) are a source of calcium (Mazza 2004) and are available in June (Turner 1997). Chats have been observed feeding on Saskatoon berries in the south Okanagan valley (unpublished data) and Saskatoon berries might be a concentrated source of calcium for the egg-laying females later in the season during second broods or re-nests. In the case of this chat female in the south Okanagan valley, the first eggs were in the nest in May which is before Saskatoon berries are available; the eggs had no spots which suggests another source of calcium, as yet undetermined.
Feeding observations of the western Yellow-breasted Chat in the south Okanagan valley
British Columbia, Canada during a seven-year study period.

René McKibbin and Christine A Bishop

Abstract: We observed a breeding female Yellow-breasted Chat (*Icteria virens auricollis*) eating rose petals, in the south Okanagan valley of British Columbia, Canada. We also observed nestlings and fledglings being fed Saskatoon berries. These foods could be appropriate sources of required nutrients, particularly calcium, carbohydrates and iron as well as antioxidants. The observations were made during a research program in 2001 – 2007, on the breeding success and habitat needs of the western population of the species, which is endangered in Canada.

Key words: Yellow-breasted Chat, *Icteria virens auricollis*, rose petals, Saskatoon berries

During the summer, adult Yellow-breasted Chats (*Icteria virens auricollis*) feed mainly on small invertebrates as well as fruits and berries when they are available (Ehrlich *et al.* 1988; Stokes and Stokes 1996). The stomach contents of chats analyzed at different times of the year contained a variety of insects, fruit, berries and multiflora rose (*Rosa multiflora*) seeds (Howell 1932; Graber *et al.* 1983; Rosenberg *et al.* 1991; Hess *et al.* 2000). In the south Okanagan valley, British Columbia, Canada, on 2002 June 10, a female chat was observed consuming wild rose (*Rosa* spp.) petals. She moved through the wild rose patch, picking and consuming one petal at a time for about two minutes before she disappeared into the

Literature cited


thick rose patch. This behaviour was observed two days before the female started laying eggs.

There are not many reports of birds consuming petals or of the nutritional value of rose petals. A flock of Alpine choughs was observed plucking petals and petals of _Crocus albiﬂorus_ (Glutz von Boltzheim _et al_. 2000). There seemed to be no extra nutritional value in consuming petals but the benefit might have been in the relatively high content of carotenoids (Glutz von Boltzheim _et al_. 2000). Rose petals are rich in antioxidants (Schieber _et al_. 2005; Vinokur _et al_. 2006) and antioxidants are important for their health benefits (Halliwell _et al_. 1995; Tsao 2006). Rose petals also contain calcium (Bass _et al_. 2003) and carbohydrates (Ichimura _et al_. 1999) and rose petals may therefore contain important nutritional value for the egg-laying female.

In another case of plant consumption, during 2006, while banding a chat nestling, a purplish stain was noticed on its bill. This stain was the same as the stains observed in adults when eating Saskatoon berries (Amelanchier alnifolia). Although an adult was not observed during that time feeding a Saskatoon berry to the nestling, the distinct purple stain on the nestling’s bill suggests that the diet of the nestlings may include occasional berries. This was confirmed on two occasions during 2007. On July 02 a male was observed feeding berries to a fledgling and on July 17 another male was observed carrying berries to his nest which contained four, nine-day-old chicks. Saskatoon berries have good nutritional value (Mazza 2004). They contain a variety of vitamins and minerals including zinc, manganese, calcium, magnesium, copper and vitamin A, B, C and E and are especially an excellent source of iron (Mazza 2004). Saskatoon berries also contain protein, fat and fibre and are a rich source of flavonoids (Mazza 2004). Saskatoon berries are available in June (Turner 1997) and are therefore available to chats mainly during the nestling stage or for the egg-laying female during second broods or re-nests.

Chat nestlings are mainly fed adult and larval insects (Ehrlich _et al_. 1988; Schadd 1995). Birds need calcium more than any other mineral during egg-laying and skeleton growth (Klasing 1998). However, arthropods in general are not an exceptionally high source of calcium (Graveland and van Gijzen 1994; Taliaferro _et al_. 2001). Saskatoon berries, being a source of calcium (Mazza 2004), might contribute to the calcium needs of the egg-laying female later in the breeding season and can also add important nutritional value to the diet of the growing nestling.

**Literature cited**


Observations on the longevity and fecundity of the western Yellow-breasted Chat in the south Okanagan valley, British Columbia, Canada.

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Abstract: A breeding male Yellow-breasted Chat (Icteria virens auricollis) lived for at least six years and showed fidelity to territory during those years. A female lived for at least five years and was found on the same study site for three of the five years. The male successfully fledged 22 chats at a fecundity rate of 3.14 while the female fledged nine chats at a fecundity rate of 2.25. The observations arose from annual colour-banding of chats during a survey starting in 2001 in the south Okanagan valley, British Columbia, Canada. The British Columbia population of the western subspecies of chat is endangered.

Key words: Yellow-breasted Chat, Icteria virens auricollis, longevity

Longevity records are important to provide basic life-history information on species that are not well studied (Boal et al. 2006) and can provide data for species survival programs (Chaney et al. 2003). Longevity changes with body size and larger species tend to live longer (Hill 1950; Lindstedt and Calder 1976). Bird species with smaller clutch sizes (two to three eggs) also tend to live longer than species with larger clutch sizes (three to six eggs) (Cody 1966; Ehrlich et al. 1988; Martin et al. 2006). The Yellow-breasted Chat (Icteria virens auricollis) weighs between 22 and 27 g and usually lays between three and six eggs (Eckerle and Thompson 2001) and although there are other factors that affect longevity, the small body size and larger clutch size of the chat might indicate a relatively shorter life span for this species.

However, there are few longevity data available on passerines including chats. One record indicated the minimum age of a chat banded at Point Pleasant, W.Va. and recaptured at Marietta, Ohio to be eight years 11 months (Klimkiewicz et al. 1983). Similarly, maximum age for other wood warblers include eight years 11 months for the Yellow Warbler (Dendroica petechia) (Klimkiewicz et al. 1983), 11 years and six months for the Common Yellowthroat (Geothlypis trichas) (Klimkiewicz et al. 1983), seven years for the Yellow-rumped Warbler (Dendroica coronata) (Klimkiewicz et al. 1983) and nine years eight months for the Black-throated Blue Warbler (Dendroica caerulescens) (Klimkiewicz and Futcher 1989). In the south Okanagan, we have been colour-banding chats since 2001 and therefore we cannot determine ages of banded individuals for longer than six years. But, during 2006, two colour-banded chats were observed, one male and one female, that had been banded in 2001. The male was banded on 2001 June 05 as an after-hatch-year and is therefore at least six years old. He weighed 26.5 g. The female was banded as a nestling on 2001 June 14 and by the end of the 2006 study season she was five years 1.5 month old. She came from a nest containing three nestlings and she had the greatest mass of the nestlings. Her mass was 16.9 g while her two siblings weighed 16.0 and 14.0 g.

During 2002, the colour-banded male returned to the same study site where he was banded and from 2003 to 2006 he has shown territory fidelity by breeding in the same territory each year. From 2002 to 2006, this male has successfully fledged 22 chats at a fecundity rate of 3.14. In 2006, he had a double brood with three nestlings fledging on June 16 and another three nestlings fledging on July 15. One of his 2003, one of his 2004, three of his 2005 and two of his 2006 nestlings have since returned to breed in our study site. One of the 2006 nestlings that returned was from the second brood.

The more elusive colour-banded female was not seen every year since 2001 but she was observed during 2003, 2004 and 2006. During these years she showed site fidelity by breeding in the same study site each year. This female has successfully fledged nine chats at a fecundity rate of 2.25. During 2004 and 2006, her nest was parasitized by Brown-headed Cowbirds (Molothrus ater) and in addition to fledging her own young, she also fledged one Cowbird in 2004 and two in 2006. None of her offspring has yet been observed in our study area.
First confirmed sighting of Whooping Cranes in British Columbia

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Abstract: Two Whooping Cranes (Grus americana) that were observed along the Fraser River between Prince George and McBride in 2003, between June 30 and August 28, represent the first confirmed occurrence in the province.

Key words: British Columbia, extralimital occurrence, Whooping Crane, Grus americana

In Wood Buffalo National Park (WBNP), the population of Whooping Cranes (Grus americana) has expanded recently to occupy areas outside of the park. All known nesting in the last 75 years has occurred within Wood Buffalo National Park or within 12 km of its northern boundary (Johns et al. 2005). Whooping Cranes are, however, occasionally reported from locations that are outside of their normal summering, migration and wintering areas. Many of these reports are of mistaken identity due to unfamiliarity with the species, distance from the birds, or difficulty in identifying flying birds.

It is not uncommon for Whooping Cranes to summer in southern Saskatchewan and occasionally, in Manitoba and Alberta (CWS files). These areas are all south of the Whooping Crane breeding area in WBNP. The colour-banding of 134 juveniles between 1977 and 1988 provided an opportunity to identify the ages of those cranes summering south of the nesting area. In all cases, the summering birds were subadults that were one or two years of age. Whooping Cranes are usually breeding by age five, but can breed as early as age three. Most of the summering birds were observed as singles, occasionally as
pairs and rarely as three birds. Most of the birds summering south of the breeding area are usually seen in subsequent years in Wood Buffalo National Park, the remainder presumably died as they were never seen again in either summer or winter.

The main Whooping Crane migration corridor in Canada is through central Saskatchewan and northeastern Alberta, about 600 kilometres east of British Columbia (Johns 1992). In a review of all reports of Whooping Cranes on file with the Canadian Wildlife Service (CWS) (3700 records), there were no confirmed or probable sightings in British Columbia prior to 2003. There have, however been unconfirmed reports of Whooping Cranes in the province (Campbell et al. 1990; CWS files). These unconfirmed sightings have been reported from the areas listed in Table 1. In all of these instances, birds thought to be Whooping Cranes were seen once or twice but never stayed long enough to be confirmed and no photographs were obtained.

The first confirmed occurrence of Whooping Cranes in British Columbia occurred during the summer of 2003, when a pair of cranes summered along the Fraser River between Prince George and McBride (Figure 1). Note that two of the previous unconfirmed sighting locations were from the same localities as in this report.

### Sighting locations in 2003

#### Prince George

On June 30, at 10:30 Pacific Daylight Time, a pair of Whooping Cranes was observed and photographed near Prince George by Victor and Terri Bopp (Figure 2). The location was 30 km north of downtown Prince George, B.C., 300 metres northwest of the junction of Salmon Valley and La Casse Roads. The weather was overcast but there was excellent flat lighting.

#### Salmon River mouth

On July 06, Mr. Tim Antill observed two Whooping Cranes on a sandbar in the Fraser River, near the mouth of the Salmon River.

#### Dome Creek

On about August 10, Mr. Rick Zammuto received a second-hand report of big white birds seen in the vicinity of Dome Creek.

#### McBride

On August 21 or 22, Mr. Doug Trask observed a pair of Whooping Cranes in a hay field adjacent to the Fraser River near McBride. There is some evidence that the cranes may have been seen in an adjacent field as early as August 14. On August 25, he again observed the birds in the same hay field and, at that time, also observed a smaller, darker crane with them, that was initially thought to be a young crane.

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Table 1. Areas of unconfirmed sightings for Whooping Cranes in British Columbia.

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Number of birds</th>
<th>Activity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort Nelson</td>
<td>1955 September</td>
<td>6 &amp; 30</td>
<td>--</td>
<td>Birds of B.C.</td>
</tr>
<tr>
<td>Alexandria</td>
<td>1962 April 25-26</td>
<td>6</td>
<td>in a prairie</td>
<td>Birds of B.C.</td>
</tr>
<tr>
<td>Alkali Lake</td>
<td>1967 March 23-25</td>
<td>1</td>
<td>in a field</td>
<td>Birds of B.C.</td>
</tr>
<tr>
<td>Okanagan Lake</td>
<td>1976 August 13</td>
<td>1</td>
<td>flying</td>
<td>Birds of B.C.</td>
</tr>
<tr>
<td>Big Lake</td>
<td>1982 September 11</td>
<td>9 &amp; 17</td>
<td>in a clearcut</td>
<td>Birds of B.C.</td>
</tr>
<tr>
<td>Nita Lake</td>
<td>1985 September 10</td>
<td>4</td>
<td>flying</td>
<td>Birds of B.C.</td>
</tr>
<tr>
<td>Quesnel</td>
<td>1995 August 15</td>
<td>1</td>
<td>flying</td>
<td>CWS files</td>
</tr>
<tr>
<td>Prince George</td>
<td>1998 March 15</td>
<td>7</td>
<td>flying</td>
<td>CWS files</td>
</tr>
<tr>
<td>Dome Creek</td>
<td>2000 October 29-30</td>
<td>1</td>
<td>flying</td>
<td>CWS files</td>
</tr>
<tr>
<td>Cranbrook</td>
<td>2002 early May</td>
<td>1</td>
<td>flying</td>
<td>CWS files</td>
</tr>
<tr>
<td>Williams Lake</td>
<td>2005 March 14 or 15</td>
<td>2</td>
<td>in a field</td>
<td>CWS files</td>
</tr>
</tbody>
</table>

1 Campbell et al. 1990

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Figure 1. Locations of Whooping Crane sightings along the Fraser River of British Columbia in 2003.
On August 26, the birds were observed and photographed by Elsie, Glen and Jerry Stanley (Figure 3). The Stanleys identified the smaller crane as an adult Sandhill Crane.

On August 26 or 27, the birds were seen flying in the same vicinity by Jan Gibbs.

The birds were last seen on August 28.

Given the number of birds and the time sequence we have concluded that all of these sightings were of the same pair of cranes. Judging by the photos both birds appear to be one-year-old subadults (Figure 2, Figure 3). The heads and necks of both birds appear to be a dirty white colour. This ‘dirty’ appearance results from the remnants of rusty brown feathers of the juvenile plumage that had yet to moult into the white neck and head of an adult. In addition, the red patch on the head and black moustache stripe are not as distinct as in a mature bird, indicating that these birds were in their second summer.

Since the birds were subadults, it is likely that they would have returned to their natal area in WBNP as they reached breeding age (Johns et al. 2005).

The winter 2007/08 population of Whooping Cranes from WBNP stands at 266 birds. The flock is growing at a rate of 4.7% per year. To date all known nests of the cranes from the WBNP flock have been within 55 km of their natal territory (Johns et al. 2005). With this in mind it is unlikely that this species will be breeding far from their traditional nesting grounds in WBNP in the near future. As the population grows it is likely that more Whooping Cranes will continue to summer in locations other than WBNP. It is possible that subadult Whooping Cranes might again summer in B.C. at some time in the future.

Acknowledgments

The authors thank all those who provided sighting information on these birds.

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Red Crossbills forage for salt within the intertidal zone

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Abstract: In 2007 August, a flock of Red Crossbills \( (Loxia\ curvirostra) \) was observed extracting and eating crystallized sea salt that had been deposited in a knot of a weathered tree trunk within the intertidal zone in North Vancouver, British Columbia.

Key words: Red Crossbill, \( Loxia\ curvirostra \), forage, salt, intertidal, North Vancouver, British Columbia, Maplewood Flats Bird Sanctuary.

This note documents Red Crossbills \( (Loxia\ curvirostra) \) foraging on salt crystals in the upper intertidal zone along the coast of southern British Columbia. Many species of the Fringillidae family, especially the cardueline finches, are attracted to salts (Lindsay, 1921; Aldrich, 1939; Marshall, 1940; Meade, 1942). The salt-foraging behaviour of Red Crossbills is well documented at several anthropogenic sources, most notably road salts along highways (Meade 1942; Bennetts and Hutto 1985; Van Tighem and Gyug, 1984; Adkisson, 1996; Woods and Munro 1996; Campbell et al. 2001). Surprisingly, there is limited information on crossbills using naturally occurring salt sources.

On 2007 August 08 at approximately 11:45 Pacific Standard Time, a group of Red Crossbills was observed gathering on a weathered tree trunk located in the upper intertidal zone in North Vancouver, British Columbia (Figure 1). Upon closer inspection, the birds were seen to be extracting and eating crystallized salt that had been deposited in a large knot on the tree trunk. The salt was a product of seawater evaporation following repeated soaking during cycles of high winter tides.

The observation that Red Crossbills are reluctant to flush when feeding on a natural salt source confirms that they do not easily abandon such sources once located. This foraging behaviour can expose the species to danger when they feed on roads. Meade (1942) was the first to document mass kills of Red Crossbills along roadways. He estimated “that there were at least a thousand birds killed” in one incident in 1941. Van Tighem and Gyug (1984: 158) reported “Many crossbills are killed on the TCH [Trans Canada Highway] during winters. Flocks land repeatedly on the road surface to pick gravel or salt off the road surface and are hit by vehicles.”

The year 2007 was an irruptive one for Red Crossbills on nearby Vancouver Island and the species was much more abundant than in the previous few years (Stewart 2007). Campbell et al. (2001) state “irruptive movements of Red Crossbills, in which very large numbers of birds move in or
out of large geographic areas, occur in response to available food supply”. The Bird Checklist from The Conservation Area at Maplewood Flats (WBTBC 2006) indicates that Red Crossbills are “seen there on an average of less than once a year” and the Maplewood Flats Bird Sanctuary is “somewhat out of normal range”.

Acknowledgements

My thanks to Andrew Stewart for his keen interest in this observation and for encouraging me to write this article. My thanks also to both anonymous reviewers for their valuable input.

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Sighting of apparent Whooper Swan on Vancouver Island, British Columbia

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Abstract: A possible Whooper Swan (Cygnus cygnus) was photographed in flight in the Comox Valley, Vancouver Island, British Columbia, in January of 2008. It had been part of a group of Trumpeter Swans (Cygnus buccinator) feeding in a field. It appeared to be an adult or sub-adult bird with extensive yellowish markings on the bill, similar to those of a Whooper Swan. However, it had yellowish or yellow-grey legs instead of the usual black. Photographs were sent to various ornithologists in Europe and North America who are familiar with whooper and/or North American swans. Opinions were divided; some identified it as a Whooper Swan while others said it was not. Some suggested it might be a hybrid with whooper parentage. Diagnosis as a leucistic Trumpeter Swan was ruled out by expert opinion and failure to conform to any known colour variant. I conclude that the bird was most likely a Whooper Swan with leucistic legs and feet. It is possible that the bird was a domestic escapee although that is less likely in the western parts of North America. Three previous records of Whooper Swans have been published and apparently accepted for British Columbia.

Key words: Whooper Swan, (Cygnus cygnus), Trumpeter Swan, (Cygnus buccinator), range, accidental, distribution, occurrence, hybrid, leucism, escapee.

The purpose of this note is to document, for future reference, the sighting of an unusual swan.

On 2008 January 22, at approximately 14:00 Pacific Standard Time, I approached a group of Trumpeter Swans (Cygnus buccinator) for the purpose of photography. Mrs. Joni Shuttleworth of Qualicum Beach, B.C. accompanied me. The location was the Farquharson Farm in the Comox Valley, just east of the town of Courtenay, on Vancouver Island, British Columbia. The exact location was at 49° 41' 40" N, 124° 58' 44" W, which is east of the northerly part of Courtenay, 1.3 km east of the Courtenay River. The Farquharson farm is large, has fields seasonally planted in corn and pumpkins and is noted for flocks of wintering Trumpeter Swans.

I parked my car about 150 m from a flock of approximately ten adult and three juvenile swans, and proceeded a few metres closer on foot in order to photograph the birds. I stopped approaching because the swans started calling loudly and walking away. Some swans took flight. When I looked around to see if any were flying within camera range, I saw a lone swan flying towards me. I was fortunate to get twelve photographs of this swan in flight before it disappeared south-westerly into the sun. One of the pictures was a clear side view at a close range of about 20 m (Figure 1). The day was sunny and favourable for photography. Mrs. Shuttleworth also observed this swan and the photographing of it. We were in the field for about 25 minutes. I did not pursue additional pictures of the flock on the ground, in order to avoid further disturbance.

The bird was approximately the size of a Trumpeter Swan. When I examined the photographs a few days later, the bird appeared to have mostly white plumage suggestive of a swan in its second year, largely moulted into adult plumage with some brown young-of-the-year feathers still showing. It was evident that the bill was largely yellowish or yellow-grey with a black tip (Figure 1), which did not fit the pattern for any North American swan but according to various field guides, was consistent with the pattern for Whooper Swans (Cygnus cygnus), a Eurasian species. The photograph showed a bird with pale yellow to yellow-grey legs and feet, not the expected black of adult North American swans and Whooper Swans. Although the tail appears dark in Figure 1, that is apparently a shadow effect; other photographs showed white tail feathers. Because it took about a month for the tentative identification and a belated realization that this might be a rare bird, I did not try to find the bird again, nor was I able to give local birders an immediate alert.

The extensive pattern of yellow on the bill, appearing yellow-grey towards the base, combined with the black tip (Figure 1), is a pattern characteristic of Whooper Swans. In particular, Whooper Swans have yellow extending forward in a “v” shape on the side of the upper bill, with black above and below, and a small yellow “v” extending forward on the smaller lower bill (Sibley 2000; Brazil 2003). That pattern is evident in Figure 1 inset. Whooper Swans do not show...
any black at the base of the bill, nor did the swan seen near Courtenay. Whooper Swans have black at the tip and on the top surface of the bill, extending towards the base but falling far short of reaching the base, and show some variation in the pattern at the rear of that black portion (Brazil 2003). The pattern of black seen in Figure 1 appears to conform to that of a Whooper Swan on the top surface of the bill, but it is difficult to ascertain this since the bird is viewed from slightly below. Juvenile Trumpeter Swans have flesh-coloured bills, but the bill is “always black at the base” (Sibley 2000) which is not the case with the swan seen near Courtenay.

The yellowish or yellow-grey colour of the feet and legs is a puzzling feature. Although juvenile Trumpeter Swans have light-coloured feet and legs, the adults have black ones as do adult Whooper Swans. Brazil (2003:84) states that “among Whooper Swans in Iceland birds with mottled brownish and pale feet have been seen.” This is further discussed below.

On the presumption that this might be another record of a Whooper Swan in British Columbia, I carried out further investigation which is reported below.

**Range and occurrence of Whooper Swans**

The Whooper Swan generally breeds in northern Europe and Asia, with one record from Attu on the Aleutian Islands, and winters in southern Europe and east Asia as far south as China. It is also known to winter in small numbers in the Aleutian Islands (Campbell *et al.* 2001; Brazil 2003). It is considered an uncommon local winter visitant in the western and central Aleutian Islands of Alaska where it occurs in family groups or small flocks from early November through mid-April (Kessel and Gibson 1978), or more rarely in the Pribilof Islands before early May (Armstrong 1995).

Whooper Swans have occasionally been reported as far south as California. A Whooper Swan was well-documented in the company of Trumpeter Swans near Ferndale, Washington, in the northwestern part of the state, about 70 km south of the Canadian border in February and March of 2007 (VNHS 2007). Most North American field guides mention the Alaskan occurrence, and note rare or casual presence elsewhere in the western part of the continent, although some of these are considered suspect, or escapees (National Geographic 1999).

In British Columbia, the Whooper Swan is “Accidental in the Georgia Depression and Coast and Mountains ecoregions; accidental in the Southern Interior Ecoregion” (Campbell *et al.* 2001). The species is included in the recent checklist of 500 birds found in B.C. (Campbell *et al.* 2007) as a species that does not breed in the province. Three sightings in B.C. up to 2000 are described by Campbell *et al.* (2001) as follows. The first B.C. record was 1997 November 11, when “knowledgeable birdwatchers discovered an adult Whooper Swan among a flock of 26 adult and juvenile Trumpeter Swans in a bay near Port Hardy on northern Vancouver Island. The flock had departed early the following day. This sighting is noteworthy because on 23 October 1977, 2 Whooper Swans were found among a flock of 26 Trumpeter Swans at Cordova in southcoastal Alaska (Kessel and Gibson 1978).” Campbell *et al.* (2001) further report that in 1996, from July 25 to 27, “a single adult Whooper Swan was present in Seal Bay, in the Comox-Courtenay area ... (Innes 1997). It was photographed on 26 July ... and later confirmed” by an authoritative person. “In the Southern Interior, an adult and juvenile were present on Mamit Lake, 16 km south of Logan Lake, from 7 to 17 November 1999” (*loc. cit.*).

**Survey of expert opinions**

Upon the realization that this was an unusual swan I posted the best photograph (Figure 1) on a web-based dis-
Discussion

I conclude that this bird was not a Trumpeter Swan because it did not fit any known colour variant of the species. McEneaney (2005) published a specific study on rare colour variants of Trumpeter Swans. He found nine variants of adults or sub-adults, with legs of black (normal), yellow, orange, pink, grey, grey-pink or grey-yellow. The grey-yellow colour would seem to fit the colour of the bird near Courtenay. Seven of the trumpeter variants had all-black bills. The only variant with a light-coloured bill had an all-pink bill and pink legs. One other variant had small yellow lores but with black legs. None of those variants of the Trumpeter Swan fit the bird described here. The statement of Mitchell, given above, also indicates that a Trumpeter Swan with light legs would have a black bill. Accordingly, the bird was not likely to have been a leucistic Trumpeter Swan because the colours of bill and legs did not match any previous pattern seen in the above-mentioned extensive sightings of the species.

The bill pattern does not fit that of the smaller Tundra Swan, neither the sub-species in North America nor the one in Eurasia. This is supported by the rather definite opinion of Mitchell, given above, that this was not a North American species.

The possibility of a Trumpeter Swan with mud must be considered. However it seems unlikely that the feet and legs would be so completely and precisely covered, yet without any apparent mud on the nearby feathers. It seems even more unlikely that only the basal parts of the bill, and not the distal parts, would have a mud coating that imitated the general pattern of Whooper Swans, and further, that the mud would extend exactly to the line where the

Some individuals identified the bird as a Whooper Swan. Mr. Tony Stratham of the British Museum of National History Bird Club and Honorary Secretary of the British Ornithologists’ Club concluded: “... after some discussion and research the collective opinion here is that your swan is/was a Whooper Swan. Thanks to your excellent photograph we do not think that mud could be so clearly delineated on the bill to be masking a different bill.”

Mr. Brian Morrell, Learning Manager of the Wildfowl and Wetland Trust, Caerlaverock Wetland Centre, in Dumfriesshire, Scotland stated: “I’m certain that it is a Whooper Swan, the bill can’t be anything else and occasionally they have pale legs. I have consulted Richard Hesketh, one of our top Swan experts at WWT, and he concurs.”

Mr. Joseph Morlan of the California Bird Records Committee confirmed by email that “it looks like a Whooper Swan (Cygnus cygnus) which is a rarity in North America”, and indicated, “I am aware of three other sighting of the Whooper Swan in British Columbia”.

Another professional did not support designation as a Whooper Swan. Dr. Mark Brazil, author of a book on this species (Brazil 2003), offered the following opinions. “I am not convinced that it is a Whooper. What ever is affecting its bill pattern is also affecting the leg and foot colouring – some lack of pigment that is neither normal with adult Whoopers [nor] with immatures. I imagine that any identification as Whooper so far has been dependent on the amount of yellow on the bill, but both the colour and extent are abnormal. Furthermore the overall shape of the head/bill look atypical ... my impression of head shape is that it fits one of the North American species, perhaps Trumpeter with some pigmentation issues.”

However, another authority on swans ruled out North American species. Carl Mitchell of the U.S. Fish and Wildlife Service is a leading expert on Trumpeter Swans (Mitchell 1994). He “was initially of the opinion that it was a Whooper Swan, but I do not have much personal experience with that species and am willing to concede the point to others with more extensive knowledge. It is definitely not a Trumpeter, Tundra, or Mute swan [emphasis added]. Therefore, if it is not a Whooper Swan, it must be a hybrid of some sort, presumably with some Whooper Swan genes.” Mitchell added that Trumpeter Swans “do occasionally have yellow tarsi, but I have never seen a leucistic swan with anything other than a black bill.”

Mitchell circulated photos to some of his acquaintances who were familiar with swans, and received six opinions in addition to people mentioned above. Among those people, opinions again varied. Two who had published research on Whooper Swans thought it was not a whooper, based on the extent of yellow on the bill and the yellow tarsi. They suggested it was one of the native North American swans, but Mitchell said that opinion was “untenable”. The four people working with Tundra and Trumpeter swans thought it might be a Whooper Swan or a hybrid of some kind.
bill met the facial feathers, again without any apparent mud on the feathers.

In spite of a lack of consensus among various birding authorities, I conclude that this bird was likely a Whooper Swan, because of its size, the extensive yellow on its bill, and its failure to fit usual field marks of North American species. A likely presumption is that this was a Whooper Swan with leucistic legs, a condition which is documented among the related Trumpeter Swans by the work of McEneaney (2005) and the opinion of Mitchell, described above.

There is a possibility that this bird was a hybrid with a Whooper Swan as one parent. Hybrids can occur (Sibley 1938), although Brazil (2003:88) says of the Whooper Swans in North America “...as yet I have found no evidence of them hybridising with Trumpeters.”

It cannot be said whether the bird was wild or an escapee from some person interested in breeding waterfowl. However, escapees are considered more likely to occur in eastern parts of North America, with wild Whooper Swans more likely in the west. Brazil (2003:227) states that “in general, birds seen in western North America are assumed to be wild, whereas those on the east coast are more suspect.”

Acknowledgements

The author is indebted to Mr. Joseph Morlan of California, Mr. Tony Stratham in England and Mr. Brian Morrell and Mr. Richard Hesketh in Scotland, all with affiliations mentioned in the text. I thank Carl D. Mitchell of the U.S. Fish and Wildlife Service, and Dr. Mark A. Brazil, until recently a professor at Rakuno Gakuen University in Hokkaido, Japan. Dr. John B. Sprague, Salt Spring Island, B.C. gave guidance on the technical writing and provided references, and Barbara Whyte aided in the writing of this report. Also greatly appreciated are helpful comments from R.A. Buhler and an anonymous reviewer.

Literature Cited


Book reviews


A note from Fred Zwickel in early October 2004 brought me the welcome news that “our book is finally out.” I ordered a copy a few days later and wrote to John Sprague to suggest that he request a review copy from NRC Press. He did so, and invited me to review the book if they sent a review copy. As one of the “many … students and colleagues” to whom the book is dedicated (p. iv) and whose research is incorporated into this book (p. x), I declined unless a review copy was not available. As much of the research summarized in the book was conducted in B.C., however, B.C. Birds should include a review of it, and I agreed to undertake such a review if no review copy was forthcoming, with my bias stated clearly. As John had no reply whatsoever, this is that review. As Zwickel was not only my Ph.D. supervisor, but also shared a study area with me, I could not help but be biased either against or in favour of the book before it was even written. My favourable bias is based not only on my experience with him as a diligent and hard-working field researcher with an excellent publishing record and amiable personality, but also on my familiarity with a wide array of grouse and other ornithological literature. My high expectations were, in fact, exceeded, as some topics in the book are covered even more thoroughly than I presumed. That my favourable assessment is not based merely on bias, but also on merit, however, is indicated by the Wildlife Society’s awarding the book their prestigious 2005 Wildlife Publications Award for Outstanding Monograph (Anonymous 2005).

The book consists of a few introductory sections (dedication, preface, abstract, acknowledgements, etc.), 20 chapters grouped into five parts, a postscript, references, two appendices, a glossary and an index. Each chapter is further divided into several sections or topics ranging in length from a single paragraph to several pages, often divided into further sub-sections. Most chapters also contain one or more “end notes” expanding on specific details.

The first part includes three short chapters outlining the taxonomic position of “Blue Grouse” [considered by the authors as closer to the “prairie” grouse than to “forest” grouse], describing the approach taken to studying the birds and to organizing the book, and outlining the “principal” studies and study areas. Emphasis in the book is on field studies, supplemented with data from aviary and laboratory studies, museum skins and specimens from hunters. A map shows 24 principal study areas throughout the range of “Blue Grouse” in Alberta, B.C. and ten U.S. states. A table lists these study areas, as well as locations of significant laboratory studies, locations of hunter sampling sites and the principal researchers at each study site. The accompanying text provides thumbnail sketches of the history and scope of each overall study, as well as general habitat features of the study areas. These include both the studies led by the authors and studies of colleagues from publications, unpublished reports, theses and personal communications. Although many observations and brief studies are incorporated into the text of appropriate sections of the book, its emphasis is on major studies, dating from those of C. David Fowle on Vancouver Island and Leonard Wing in Washington in the 1940s through those of Bendell, Zwickel and their associates and students from the 1950s through the 1980s on Vancouver and adjacent islands.

The second part consists of four “background” chapters on taxonomy and distribution, evolution, history and “the physical environment.” These chapters cover details of the nomenclatural history (including ten aboriginal names), historical and present distribution (including extirpations and the fate of several introduced populations), fossil history, taxonomic history, probable relationships, pre-historical and early historical observations (including archeological evidence) and physical and vegetational features of habitats occupied by each race, both during the breeding season and during non-breeding periods. An interesting distributional detail is that Sooty Grouse appear to be incapable of sustaining flight for more than 2 km., excluding them from many islands unless introduced. Evidence is presented suggesting that an historical record of Dusky Grouse in the Black Hills of South Dakota likely referred instead to an area of Wyoming. Recognition by the American Ornithologists’ Union of two species instead of one (Banks et al. 2006) very soon after the book was published did not provide the flaw in the book that may seem apparent initially, as the authors grouped the eight recognized races/subspecies into coastal and interior groups that correspond with the two currently recognized species. They not only outline physical and behavioral differences between the two species (McNicholl 2006), but throughout the book identify clearly to which of the eight race(s) [or even population(s)], each detail of anatomy, behaviour or “life history” under discussion applies. Thus, readers should have no trouble determining to which species any particular detail applies.
The third part (“Form and Function”) consists of seven chapters on anatomy, physiology, growth, food, energetics, genetics and related topics. Each of these topics is addressed in considerable detail by age, gender, population, race and/or season, where known. Details are amplified by black-and-white or colour photographs, graphs and tables, where appropriate. Information gaps are identified (such as relative scarcity of data on mass at higher elevations, especially away from Vancouver Island). An anatomical mystery is why the pectinations (“snowshoes”) on Blue Grouse [important when wintering at high elevation] are smaller than those of ptarmigan, Ruffed and Spruce grouse, all of which are lighter. Greater use of higher parts of trees by Blue Grouse is suggested as a possible explanation. Sections on growth include details on growth of various organs and behavioral aspects of growth. The thoroughness of the book is exemplified by the inclusion of different types of droppings and what can be learned from them, as well as changes with age and season in different sizes, types and hardness of grit ingested.

Three chapters on behaviour form the book’s fourth part. The first, “behaviour per se, describes basic postures, mobility, display patterns, maintenance behaviour, and sociality of Blue Grouse generally and of different age/gender classes (adult males, yearling males, hens with and without broods) in relation to season and social factors. This chapter includes data on vocalizations (from chicks still in their eggs to adults) in relation to other aspects of behaviour and season. The second chapter covers seasonal use of space in relation to habitat, cover, roost sites, feeding sites, presence of broods and other factors. The third covers movements and use of space, including aspects of migration, dispersal, site fidelity, home range and territoriality in relation to age, gender and season.

Part 5 is composed of three chapters on population variables (density on and off the breeding range, age structure by gender and in relation to other variables, survival by age class and gender, longevity and production levels), predators (known and suspected predators by age/sex class, seasonal patterns of predation and various aspects of predation dynamics on clutches) and disease (in wild and captive birds), parasites (external and internal, with details on life cycles, prevalence, vectors, intermediate hosts and other dynamics) and physical anomalies (integumentary and skeletal). As with all previous sections, these topics are discussed in considerable detail. A two-page appendix catalogues further details on specific physical anomalies.

The book ends with a postscript—essentially an abstract reiterating the overall contents, a list of references, two appendices [an 11-page one on statistical tests used to test statements demarcated in the text and the aforementioned one on physical anomalies], a four-page glossary and a four-page index.

I found little of substance to criticize in the book. “Subspecific hybridization” (page 21) is more correctly termed “integration,” but the former provides a nice, compact definition of the latter, and “intergrades” is used on the following page. Birds are not actually “born” (pages 212 and 213); they hatch. Sharp-tailed Grouse is referred to as Sharp-winged Grouse on page 120. The nest with little lining mentioned on page 98 is depicted in Figure 7.11, not 7.12. The obsolete species names Marsh Hawk (page 235) and Bobwhite Quail (page 166) are used for Northern Harrier and Northern Bobwhite respectively at least once each. Spelling is generally that of English-speaking countries other than the U.S. (behaviour, colour), but the U.S. spelling of “gray” is used throughout. Neither is incorrect, but this is an odd mixture of the two systems. On the whole, proof-reading of the text appears to have been thorough, with few “typos” and grammatical flaws noted. However, several references cited are missing from the reference list –Albright (1984) on page 169, Bauer (1960) in Table 18.21, Doerr et al. (1982) on page 211, Ellesworth (1966) on page 143, Johnsgard (1973) twice on page 29, Koskimies (1958) on page 77, Lewis and Taylor (1967) on page 4, Musselhi (1962) on page 108, Pelren (1996) in Table 17.11, Redfield (1974) on page 217 and Ricklefs (1983) on page 113. I suspect that some of these were mismatches between publication dates or authorship, rather than actual omissions.

The book provides not only a thorough compilation and discussion of what is known to date about numerous aspects of Dusky and Sooty grouse biology, but also outlines much of what is still not known or only poorly known, thus identifying areas in need of further documentation and study. Some of the text on anatomical, physiological, nutritional, energetic and genetic aspects of Dusky and Sooty grouse biology will be heavy reading for readers not well versed on those topics, but judicious use of end notes and the appendices has removed most technical details from the main text and most of the rest of the text should provide an easy read for most naturalists who frequently read books on behaviour, ecology and natural history of birds. The price may deter some readers from buying a copy. Although thorough and detailed, this book is not, in fact, the long-planned monograph that I anticipated, but rather a contribution towards it (pages vii and 250). Given the high quality of this contribution, I look forward to that monograph even more eagerly.

**Literature Cited**


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Birds of Washington is the first reference work on the status and distribution of Washington birds since 1953. It describes in considerable detail the status and abundance, trends and changes of species and populations as of the year 2000. The work is based on contributions by 47 authors and reflects participation over the years by many hundreds of enthusiasts in Christmas Bird Counts, Breeding Bird Surveys, Breeding Bird Atlas surveys, Westport pelagic trips, as well as less systematic bird watching activities.

This is an important reference work for libraries, wildlife agencies and professional ornithologists working in Washington and adjacent areas. It is not a bird-finding guide, and might not have a high priority for purchase by the average birder in B.C.

Introductory chapters describe bird habitats, explain the maps on seasonal distribution and outline the conservation issues that have affected bird populations in Washington. They describe the evolution of field ornithology in the state, and summarize the sources of information and methods used for analyzing and interpreting the data.

Of particular interest is the summary of key changes in status and distribution since 1950. In that period, the population of Washington State has increased from 2.4 million to 5.6 million. This growth has been accompanied by urban and suburban expansion, clear-cutting of forests, filling of wetlands, and ploughing of grasslands. Understandably these changes have had major effects on the status and distribution of many bird species. Indeed, over one half of Washington’s bird species have changed in status or population over the past half century. Many of the changes are suggested by limited studies or comparisons with non-quantified statements in historical references. However, 50 or more species have changed dramatically and unquestionably over time. Somewhat surprisingly, about half are species that have increased for various reasons as a result of their being adaptable to human actions, though many if not all such increases were unintentional. The remaining species decreased for various reasons, including habitat loss, range contraction and changes in marine environments.

The main body of the book, comprising 340 pages, contains the species accounts for 483 Accepted Species, four Accidental Introductions that have not yet become established and eight species on the Hypothetical List. For most Accepted Species, there is a statement on the present status in Washington, how common it is, at which times of year and in which regions of the state. For species that vary in occurrence over the year, a bar chart shows known ranges of dates and variations by month, usually for the west and east. Maps show distribution for selected species, using shades of grey to indicate seasons. Further information is provided on subspecies, habitats, occurrence including apparent changes since 1950, conservation issues and noteworthy records. For casual vagrants and other very rare species, the normal range of the species is described together with the records accepted by the Bird Records Committee.

The final sections of the book are a comprehensive list of references, an appendix with a tabulated list of regular species’ habitat associations, brief biographies of the 47 authors and an index of the birds.

I found remarkably few typographical errors. There are inconsistencies for some species in the presentation of the data between the initial summary statement, the bar chart, the map and the more detailed occurrence information. For some species it is difficult to distinguish the shades of grey used in the maps to show regional distributions by season.

My own limited knowledge of the status and distribution of Washington birds is not sufficient to detect errors in much of the information or interpretation. My notes did include the following points. The book is intended to describe the status and abundance as of the year 2000, but many more recent records are included, some up to late 2004. Solander’s Petrel is included in the Accepted Species, even though the record was neither accepted nor rejected by the Bird Records Committee. The status of Band-tailed Pigeon states that it occurs only in lowlands, even though its habitat is described as low and mid-elevation forests. Field identification of birds in the Audubon’s and Myrtle Warbler groups is considered not possible. Finally, there are errors in some references to the occurrence of rarities in B.C., for example the statement that no Painted Buntings have occurred in B.C. as of 2000 (one was photographed in 1995).

This book will be an important source of information for anyone interested in the status and distribution of any or all bird species occurring in a state bordering B.C., and how and possibly why these have changed in the past 50 years. It will also be of interest to many of B.C.’s birders, wildlife biologists and conservationists seeking a broader, regional context for information about the status and distribution of species in our province.

Roger A. Foxall, 13880 18A Avenue, Surrey, B.C. V4A 9M1

Wow! If this book can be judged by its cover it will be a good one. A Snowy Owl in full stop-action flight against a frozen background is spectacular as an eye-catching opener to this stunning book. At 23 x 29 cm, this is no pocket guide but rather a book to be savoured in an easy chair with a good cup of brew.

The aesthetics continue inside with bright paper used to set off the pictures which are top quality. Photos vary in size up to full page with most being one-third of a page to half a page and very enjoyable. The layout is relaxing with lots of white space, crisp text and a reproduction quality of the highest order. Pagination is what I would call creative in that not all pages are numbered but the position is consistently midway down the page on the outer margins and all of the topics listed in the table of contents are numbered on the appropriate pages so you can find your way around the book easily. For bibliophiles, the book is a pleasure to handle and read, as a good publication should be.

But what of the content? To begin with, Wayne Lynch has a direct and readable style that translates stuffy science into a book for many levels. He packs an enormous amount of science and owl biology into informative and elegant prose. There are some tables of weights, measurements, clutch sizes and incubation periods but don’t expect to study charts, graphs and complex tables of statistics and staccato tidbits of science findings. Do plan to sit back and read the chapters to learn something in almost every sentence. No words are wasted and you will want to keep reading. A decent index is provided if you wish to arrow in on a specific topic. The eight chapters cover the expected broad subjects of anatomy, special adaptations, diet, breeding behaviour, family life, growth, habitats, behaviour and conservation. But there is much much more tucked into the pages. There are sections on identification and distribution as well. Range maps appear to be generally accurate but a few such as the one showing the distribution of Hawk Owl curiously omits the southern portions of the B.C. interior. The map for Snowy Owl seems to show the extent of typical winter wanderings but the colour makes it appear as if the bird breeds as far south as the northern USA.

The Flammulated Owl range map does not quite capture the extremes of the range for this species in B.C. and perpetuates the erroneous notion that it is only found in the Okanagan region. The breeding range for the Northern Saw-whet Owl is shown to be much more extensive than in the Sibley guide, so the reader will have to decide who really provides the most up-to-date information on this particular topic. Personally, I seldom use such maps except as a very general guide, so the discrepancies are minor points at best.

I don’t believe that the mapping differences suggest that there are serious faults with the science and facts being relayed throughout the text. Lynch has accessed some top people during preparation and he provides a sound list of references that are usefully organized according to the chapters of the book – a nice touch. I did not attempt to verify the thousands of facts and statements contained in the text as one must assume that the biologists who reviewed the text before printing would have detected serious errors. In the chapter discussing adaptations of the eyes and ears, I would have enjoyed some illustrations to reveal the secrets of design that can be hard to visualize from descriptions but overall, the book does not suffer from a lack of visual material.

This is much more than another pretty coffee table book about owls. It functions very well as that but provides much for the intellect in an eminently readable style. This is a book for every birder’s library as well as people just casually fascinated by owls. You need to be a little dedicated to put out $44.95, but the price is not unreasonable. The amount of solid reference information alone justifies the price, and the photographs just keep you coming back to browse the book again and again. You will be engaged by this book just as the faces of its subjects have engaged people for thousands of years.

Rick Howie, 4898 Spurraway Road, Kamloops, B.C. V2H 1M6


This book has a threefold purpose: (a) to make available the basic information on 100 species at risk that will allow anyone interested in protecting birds to understand the main dangers to their survival AND to get involved in protecting them; (b) to present the material in layman’s terms while providing links to authoritative additional scientific material; and (c) to provide information on the main North American agencies, organizations, and programs working for the welfare of birds. It is a very useful, but not cheering, book.

The scope is larger than the title indicates, but this is a strength. The emphasis is on birds that spend at least part of their lives in North America; however, the necessary inclusion of migratory and pelagic species results in information
from Mexico, the Caribbean, some Pacific islands, and Latin American countries.

The number of species was chosen as “a manageable, memorable number”, and the selection criteria seem excellent; 80 species are ones that all official lists of species at risk record as in most danger, and the remaining 20 are species of “high priority … and showing steep population decline”. There are no colour pictures or graphics, but the layout and drawings are very clear. Since most readers will have field guides, the additional cost of colour here would not seem warranted.

The writing style is generally clear and uncluttered by jargon or scientific terminology inappropriate for a book aimed at lay readers. There are a few egregious spelling errors that jump out, such as ‘overexploitation’ and ‘overextent’, but these are not numerous. I did wonder, however, whether the title’s first word was intended to refer to an individual birder, as it does in Birder’s, or to all birders, as in Birders’!

The introductory sections provide a thorough and logically organized summary of the main topic. ‘Birds as indicators’, ‘The state of North American bird populations’, ‘Major conservation issues …’ and ‘The state of bird conservation’ are excellent accounts of why anyone concerned about the state of nature should worry about birds. It does not talk down to the reader, but gives details that the lay person may not appreciate.

Since the book’s author is American, there is an understandable emphasis on U.S. government agencies and non-government conservation organizations involved in this work, with less detail given on ones in Canada or Mexico. For example, many U.S. federal government departments are listed, but Environment Canada is the only Canadian federal agency mentioned as concerned with bird conservation. The Canadian Wildlife Service is not mentioned until the section on Canada, which was written by a Canadian. Surprisingly, Partners in Flight doesn’t appear in the list of programs though it’s mentioned often, and I did not see any mention of the Canadian COSEWIC.

The last opening section ‘What you can do’ is an excellent three-page summary of ways people can help including a list of ‘A few good ideas –’ with a short list of additional written material. The opening ‘Birds as indicators’ also mentions a number of organizations through which lay people can help with bird conservation projects. I applaud the authors for including these suggestions and information as an excellent antidote to the helplessness many people feel in the face of these problems.

The ‘Species accounts’, the main part of the book, are clearly laid out and cover Status and distribution, Ecology, Threats, Conservation action, Conservation needs, and References. Each species account includes a drawing of the species with a map giving details relevant to that species in shades of grey: year-round range, winter range, breeding range or former range, and so forth.

Each species is covered in three to four pages, a compact, easily perused amount. The occasional use of terms such as “statistically significant” (or not) is the only quibble I would have on style; lay people aren’t likely to know what is meant especially when linked, as in the example of the American Golden Plover, with the comment that populations had dropped in some areas of the UK and Western Europe by 50%, but that this was ‘statistically insignificant’. The comment that the behaviour of the birds makes it hard to know why populations in one area have dropped would perhaps have been sufficient.

I have not had an opportunity to compare the material in this book with Bird Studies Canada’s online Endangered bird species 2007. There may be some overlap, but having two sources of such information is not a bad thing.

My main concern about the Handbook is that its intended audience, the general public or at least the part somewhat concerned about and interested in birds, will not be the one to read it to any great extent. Though written in an appropriate style for the lay person, its size and the large amount of text uninterrupted by graphics is likely to deter most people other than the already converted. For the latter, however, this is an extremely useful and informative, if rather depressing, book and I would recommend it on those grounds alone.

Eva Durance, 1120 Jonathan Dr., Penticton, B.C., V2A 8Z6

Spotted Owls: shadows in the old-growth forest, by Jared Hobbs, with text by Richard Cannings.

In an image-rich world it is easy to undervalue the efforts of photographers or videographers as they capture wildlife subjects on film. It is only when you attempt it yourself that you realize how difficult the process really is. Spotted Owls combines the masterful images of Jared Hobbs, with the superbly-crafted text of Richard Cannings. Separately the contributions would be noteworthy; together they provide us with a unique glimpse into the world of this elusive owl species. Hobbs, a professional biologist and photographer, worked with the Canadian Spotted Owl Recovery team, attempting to determine the population size in the owls’ most
northerly territory. The photographs in this book are the culmination of ten years of efforts in documenting the Spotted Owl from British Columbia to Arizona. Cannings, also a professional biologist, birder, author, and western representative of Bird Studies Canada, is well-known for his natural history publications.

For the past three decades the Spotted Owl has come to symbolize the struggle to save wild places in the western region of North America. The beginnings and the context of this struggle are laid out by Eric Forsman in the foreword to the book. It was Forsman who first raised the alarm, noticing the impact of forestry practices on the future survival of this species.

The book itself consists of an introduction followed by three chapters which lay out the biology and natural history of the Spotted Owl. In the introduction, Cannings looks at the origins of the Spotted Owl, including descriptions of the three recognized subspecies: Northern, Californian, and Mexican. He then describes the owl’s biology, emphasizing similarities and differences with other competing owl species.

The first chapter surveys the “world of the Spotted Owl” focusing on its habitat, prey, competition and predation. As a forest-based nocturnal predator the Spotted Owl is well-adapted to hunting, sleeping and nesting in extensive stands of large trees. The owls’ requirements for significant amounts of old-growth forest, with ample prey density, as well as sheltered roosting and nesting sites, determines its likelihood of survival as a species.

The second chapter, ‘Spotted Owls through the Seasons,’ outlines the owls’ “year” beginning in late February or early March with mating, through to post-breeding dispersal of juvenile birds during the Fall months. In a few short pages Cannings paints a picture of the family life of these elusive birds.

The final chapter examines both the current and future challenges facing the Spotted Owl throughout its traditional territories.

The text of each chapter is interspersed with a variety of photographs. In addition, at the end of a chapter there are a dozen or more pages comprised solely of Hobb’s stunning photographs. These galleries of images include photographs of other owl species, other species which interact with the Spotted Owl, and finally landscapes depicting the natural world of this elusive bird. For more photographs by Hobbs you can visit his website at http://hobbsphotos.com

While this work is not a scientific treatise per se, neither is it solely a coffee table fixture. The photographs and the text “need” each other and together they create a dynamic interaction of word and image. Cannings’ words, in his introduction, succinctly summarize the purpose of the book: “Spotted owls have a fascinating story to tell, a story that can teach humans important things about our own species and our relationship with the world” (p.14). May we learn …

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Acknowledgements and editor’s comments

There is a healthy selection of papers in this volume, starting with the major analysis by Art Martell from decades of sightings by the Comox valley birders. Beyond that there is a variety of shorter papers and notes, from familiar species to a rarity and a possible rarity. I thank the authors for their good work.

Also in this volume is the revised set of guidelines for authors, prepared by me and the four members of the Editorial Board. They are long and detailed, but the headings make it easy to home in on the information desired. These guidelines will not need to be printed in every volume because they are on the BCFO website.

All notes and papers in the journal have been reviewed by one member of the Editorial Board, one external reviewer chosen for his/her qualifications, and by me. The review process means that our articles are rated as first-line and peer-reviewed. The reviews always lead to improvements in the manuscripts, and authors seem grateful for the advice. Thanks for reviews go to Editorial Board members Dr. Mary J. Taitt, who has been serving since 1992, Ken H. Morgan, since 1995, and recent members Dr. Neil F. Bourne and R.A. (Andy) Buhler.

External reviewers of papers from volumes 16, 17 and 18 were published in volume 16 but I failed to list one person, so the impressive complete list is given here, with many thanks for reviewers’ work and judgement. They are from B.C. unless otherwise noted: Dr. Jennifer M.E. Balke (Denman Island), Dr. David A. Boag (Brentwood Bay), Dr. Alan Brelsford (Vancouver), Dr. Gayle Brown (Nanaimo), Dr. Peter Candido (Vancouver), Dr. Tom Dickinson (Kamloops), Wendy Easton (Delta), Cameron D. Eckert (Whitehorse, Yukon), Bryan R. Gates (Victoria), Tony Greenfield (Sechelt), Arthur M. Martell (Courtenay), Rick McKelvey (Penticton) Mark Phinney (Dawson Creek), Andrew C. Stewart (Victoria), Dr. K.G. Taylor (Kamloops) and Bruce Whittington (Ladysmith). In this distinguished group, there are seven government biologists, five university professors and researchers, two naturalists, one corporation biologist and one consulting wildlife veterinarian; some of them are retirees. Thanks also go to Carl D. Mitchell of the U.S. Fish and Wildlife Service in Wayan, Idaho, for collecting opinions from his colleagues about the swan described in this volume.

Neil Dawe once again shepherded this volume through production. That is a time-consuming job with many a frustrating glitch between the electronic file and the printer’s machinery. Production requires many technological and judgemental skills and Neil has them in abundance.

The people who reviewed books are also thanked, and their names can be seen with their reviews. We appreciate the books, videos and audio disks which are sent to us from the publishers.

More papers and notes are being submitted recently, and several people have played a part. Andrew C. Stewart and Kevin Slagboom put the articles onto our web-site quickly, which means that people searching the internet will find them, spreading the information and increasing the visibility of both the journal and the authors. Andy and Martin McNicholl have written to many colleagues, soliciting papers. The research grants from BCFO have also been instrumental in securing publications. Professional members of BCFO are contributing papers.

The journal has existed for 18 years and this is volume 18, meeting the original policy of an annual volume. I have edited six of those 18 volumes, and with the help of others, have brought the journal from three years behind, to right on schedule. That is what I set out to do, and so with publication of this volume I am retiring. It has been a lot of work (1,100 hours, mostly during 4 years, for an average of 8.3 full-time-equivalent weeks per year). But it has been gratifying. The journal is clearly getting stronger and it will have a bright future with a new editor.–John B. Sprague
Guidelines for authors

Submitting manuscripts

Submissions are preferred as an electronic file from a commercial word-processing program. If a manuscript is submitted on paper, it should be typed, double- or triple-spaced in a single column.

Authors can speed up the editing process by careful proof-reading of their manuscripts before submission. Especially, make sure that all citations in the text are included in the list of literature cited, and vice versa, and that spellings of author names and publication dates are correct and match. Proof-reading of the list of literature should be done more than once, since you as author are the person with the cited references in hand. It is dismaying, and not very effective, to have errata published later.

Manuscripts should be sent to the editor, whose name and contact points are given in the latest volume of the journal and in the society’s website (www.bcfo.ca). The editor will acknowledge manuscripts as promptly as other duties allow.

Topics for manuscripts

*British Columbia Birds* is the journal of record for rarities, range expansions, behaviour, life history, and general status of wild birds in B.C. Like regional journals elsewhere, it can publish new observations based on a few birds or even one bird. It can publish verifications of previous work, because such information can be valuable and might not find space in international research journals.

Suitable topics include distribution, abundance, extralimital occurrences, studies of status, banding, identification, plumage variation, moult, behaviour, feeding, breeding, habitat, ecological relationships, reviews or history and biography of ornithology.

Process of review and publication

One member of the editorial board, one qualified outside person and the editor will review all submissions except for book reviews or reports of the Bird Records Committee. Reviewer comments will be sent to the author for consideration. The editor will accept the re-submitted manuscript if the comments have been adequately dealt with either by rebuttal or revision. The editor reserves the right to make final minor changes in format or wording but these must meet with the author’s approval. The editor will assist new authors in achieving a suitable format. Papers will be available on the BCFO website (www.bcfo.ca) soon after the print version is published.

General considerations of style

Writing style should aim at direct, simple sentences. Because your work was done in the past, use the simple past tense to describe the methods and results. The simple present and future tense can be used in the Discussion. Active tense and first person are usually suitable (“The dog chased the cat”) rather than “In the case of the canine, it was frequently observed to be in pursuit of the feline individual”).

Technical terms should be defined clearly or avoided if simpler language will suffice. If an abbreviation or acronym is to be used, it must be defined the first time (e.g. “... the American Birding Association (ABA) which ...”).


Use Canadian spelling (e.g. behaviour, colour, grey, through, etc.). The exceptions are in official names (e.g. Clay-colored Sparrow) and in listing titles of publications that originally used U.S. spelling. Set your word-processor with "English (Canada)" as the default and document language, or failing that, "English (UK)"). Spell-checkers are of great assistance in catching certain typographic errors, but follow with your own visual proofreading before submission.

Standard sequence of sections

The journal publishes full papers, short papers and notes. Most full papers should be organized according to the classical guidelines given below, with the fonts shown. Short papers and notes would usually follow a simpler format suited to their content, and it might be appropriate to mix some parts of methods, results and discussion. The formats of book reviews and reports of the Bird Records Committee will be set by their authors.

**Title**: A short, catchy title is usually best. It should encourage the reader to engage with the paper. Use lower case except upper case for initial letter of the first word, and initial letters of bird names and other proper nouns.

**Author(s)**: Full name(s), affiliation(s), with mailing and email address for at least the author designated as the contact person.

**Abstract**: The abstract should be short enough to be discovered and should start with that. Normally, the abstract need to say little or nothing about what was done, since that is usually clear from the findings.

**Key words**: Provide 8 to 10 key words; select the most appropriate ones that future researchers might use to find your paper when searching the Internet. Use specific, relevant terms with a wide range, not just a repeat of words used in the title.

**Introduction**: Clearly state the technical objective(s) of your work. If it is scientific investigation with a hypothesis, state the hypothesis. To put your work into context, provide a brief review of the previous state of knowledge.

**Methods**: The Methods and Results tell what you did to increase our knowledge of the topic. The description of methods should be detailed enough that someone else could replicate your work. Describe in detail the experimental or sampling design(s), the procedures and any statistical methods used. For special equipment or computer software, document the manufacturer and model.

**Results**: Lead the reader through your results so that s/he can understand clearly what you found. Be concise. Refer precisely to parts of the data in tables or figures; do not require the reader to search through a table to find which line of numbers supports your statement. Explain the findings but *do not discuss* them here; this is a fine distinction but must be maintained.

**Discussion**: Discuss the meaning and significance of your results and compare them with other information in the literature. Describe the patterns of agreement but also point out areas that differ from what has been previously described. This should also be the section to examine inconsistencies or novel aspects of your findings. Finally, draw your conclusions and discuss the implications and current status of knowledge resulting from your work. Extensive reviews of existing literature should be put into a separate, labelled section.

**Literature cited**: See Citation formats below.

**Acknowledgments**: Include your short thanks to people or organizations that provided any significant assistance to your work.

**Appendix**: Some papers may need this as a place to archive detailed data. Format is flexible.

Species names for birds

The title of the paper should use the full English (common) name of a bird but not the scientific (Latin) name. The scientific name, in italics, should be included in the *Abstract* and in the list of *Key words*. The text of the paper should give the full English name and scientific name of each species on first mention. Thereafter, only the English name would normally be used. All names and taxonomic order should follow the latest edition of the *American Ornithologists’ Union* Check-list of North American birds, and supplements as published in the journal *Auk*. The check-list can also be found online at http://www.aou.org/checklist/index.php3.

The current names and taxonomic order of the bird species reported in British Columbia by 2007 are listed in *Wildlife checklists of British Columbia*. The birds of *British Columbia*, a copy of which can be obtained through http://www.wildlifebc.org.

Full English names should be capitalized (e.g. American Tree Sparrow), but partial names should not (tree sparrow). In hyphenated species names, the second word is written in lower case (e.g., Red-eyed Vireo), except for hyphenated group names, which are both capitalized (e.g. Northern Pygmy-Owl). When two or more species are grouped under a collective name, the latter should appear in lower case (e.g., Brewer’s, Red-winged and Yellow-headed blackbirds). A shortened English name may be defined and used after first mention in the text (e.g. "... Northern Rough-winged Swallow (hereafter rough-winged swallow...)". If names are cumbersome or repeated frequently, an abbreviation can be defined and used, for example: "...Northern Rough-winged Swallow (hereafter r-w swallow...)". The journal does not use the upper-case, four-letter abbreviations.

Geographic abbreviations and descriptions

If abbreviations are used for provinces and states, they should be the standard geographic ones for international understanding, not the two-letter codes of the post office. For the provinces and territories, the abbreviations are: B.C., Alta., Sask., Man., Ont., Que., N.B., N.S., N.B., NF., Yukon, NWT and Nunavut. Periods are used if there are two initials (B.C.) but not if there are more than two (PEI). The journal uses the traditional geographic abbreviations for U.S. states: Ala., Ariz., Ark., Calif., Colo., Conn., D.C., Del., Fla., Ga., Ill., Ind., Kan., Ky., La., Me., Md., Mass., Mich., Minn., Miss., Mo., Mont., Neb., Nev., N.H., N.J., N.M., N.Y., N.C., N.D., Okla., Ore., Pa., R.I., S.C., S.D., Tenn., Tex., Va., Wash., W.Va., Wis., Wyo. Abbreviations are not used for Alaska, Hawaii, Idaho, Iowa, Ohio and Utah.

For directions, the journal uses southeast, northwesterly, etc. without hyphens. *Pacific Northwest* is a useful description of part of the lower 48 states in USA. It does not accurately describe the position of B.C. in North America or in Canada, and should be avoided in references to the province.

**Dates and times**

When dates are tabulated or listed, the large-scale system should be used (e.g. 2007-June-02 or 2007 June 02). This follows Canadian Standard CAN Z234-4 and the International Organization for Standardization (ISO 8061:1998). If that format results in an awkward sentence, alternatives can be used (e.g. returning on June 3rd, I found ...). The 24-hour clock should be used for times (18:00, not 6:00 p.m. and not 18:00 hours) and the time zone indicated at first mention (Mountain Daylight Time, Mountain Standard Time, Pacific Daylight Time or Pacific Standard Time).

**Measurements**

All measurements should be in metric units. Use the official Canadian and International spellings and abbreviations: millimetre (mm), centimetre (cm), metre (m), kilometre (km), millilitre (mL), litre (L), gram (g), kilogram (kg), tonne (write in full for clarity), and...
Guidelines for authors

year, day, hour, minute (yr, d, h, min) as defined by the Canadian Standards Association, ISO, or the useful guide at http://ess.nrcan.gc.ca/pubs/scipub/guide/system/index_e.php.

Tables and figures
Tables and figures are desirable to illustrate findings. Photographs and drawings are welcome, especially to illustrate habitats, rarities, plumage, actions or postures. Colour can be used if it clearly improves the presentation.

The captions of tables and figures should be clear, concise, and complete; a table or figure should never be able to stand on its own.

Tables and figures should be submitted as separate files, not inserted into the text. Figure captions should be on a separate page just before the figures. For manuscripts on paper, each table and figure should be on a separate page.

Figures should be submitted as digital images preferably, although original artwork or photographs will be accepted. Original drawings will be reduced in size for publication so should be large enough to permit reduction to the size they will appear in print, but in no case should they be larger than 21 x 28 cm (8.5 x 11 inches).

Create figures that are as close as possible to the size they will appear in the printed version of British Columbia Birds, which has a two-column format. A one-column figure should be 8.5 cm wide (3.35 in); a one-and-one-half column figure should be 13 cm wide (5.13 in), and a two-column figure should be 17.6 cm wide (6.93 in). Crop figures tightly so that the significant part of the image spans the width of the page or column.

All figures must be sharp, of good contrast, and of sufficient resolution so that when printed, there is no pixellation. Colour images must still be effective if converted to a greyscale image. A minimum of 300 dpi is required for photographs and 600 dpi for line art (e.g., line drawings, maps) at their printed size. Photographs are preferred in the TIFF image format although the JPEG image format will also be accepted. If submitting photographs, JPEG images do not compress them further from the original image.

Line drawings, graphs, and maps can be submitted in TIFF, EPS (Encapsulated PostScript), or WMF (Windows Meta File) format. Graphs or charts prepared from software programs such as Excel can be submitted as separate files in the format of the original software version.

Ensure that the type size of any text is appropriate for the scale of the figure at its printed size and try to use the same size text throughout. Preferred fonts are sans serif, such as Arial (not serif fonts, such as Times New Roman). Avoid using light text on dark background

Tables should be prepared using the Table option of the word processing program; tabulated columns should not be used. Normally, the only horizontal lines should be at the top and bottom of the headings and the bottom of the table; there should be no vertical lines. Columns of numbers should be aligned on the decimal. Text and numbers should be centred within the rows. The title should precede the table and each table must be numbered consecutively.

Cover illustrations
The editor invites submission of cover illustrations for consideration, and they will normally be reproduced in colour. They should relate to an article in the issue and should represent general scientific, regional, or historical interest. A brief, informative caption is required, complete with the date and location of the image subject. Collages are possible.

Citations in the text
Authors should place their findings into the context of relevant literature. In the text, citations should take the following forms: "...Smith (1993) made no mention of singing...", "...but no eggs were evident (Jones 1958)". Accordingly, the only information cited in the text is the name(s) of the author(s) and date of publication. An exception is when a direct quotation is included in the text, in which case the page of the quotation should be included (e.g., McNicholl et al. 1990b:204).

The same technique can be used to identify the page number of a particular item such as a photograph, in a book or other publication. If authorship is by an organization with a long name, and it is cited several times, the name may be abbreviated, e.g. (USFWS 2005), and explained in the list of Literature cited in the following fashion: USFWS [U.S. Fish and Wildlife Service] 2005, etc.

Cite both authors of two-author publications (Brown and Green 1976), but only the senior author of three or more (White et al. 1993). If there are two or more references for one statement, write them chronologically, separated by a semi-colon (Campbell 1911; Bell 1917), except that all references by a single author should be listed together at the date of the earliest publication (Fisher 1950; Edwards 1984, 1986) except that all references by a single author should be listed together at the date of the earliest publication (Fisher 1950; Edwards 1984, 1986) except that all references by a single author should be listed together at the date of the earliest publication (Fisher 1950; Edwards 1984, 1986). When there are two or more references by the same author(s), list the name(s) in each reference, do not use dashes or ditto marks. For joint authorship, start with the surname and initials of the senior author, then use initials first for the co-author(s).

Format for references
The section Literature cited follows the text of the paper. There you will list alphabetically, all references cited in the text and no others. Each citation must include the name(s) of all authors, with surname and initials (e.g., Campbell, R. W., not Campbell, R. Wayne). If there are two or more references by the same author(s), list the name(s) in each reference, do not use dashes or ditto marks. For joint authorship, start with the surname and initials of the senior author, then use initials first for the co-author(s).

After the name(s), a single space is followed by the date of original publication and a period. After another space, list the title with the exact words and punctuation of the original, in lower case except that upper case is used for the first letter of the title, and the first letter of species names and proper nouns. (Possible exception: initial-letter capitalization of species names should be exactly that used in the original). If the original title of a cited article is in a divergent style (e.g. ALL CAPITALS, or First Letter of Each Word capitalized), reformat it according to the style of British Columbia Birds for improved readability. Errors in titles should not be corrected, but may be noted by inserting [sic] after the error or by inserting the omission within square brackets.

a. Serial publications
If the reference was published in a serial (journal, magazine or newsletter), the name of the serial is written in italics (or underlined to indicate italics). Abbreviate British Columbia in serial names (B.C.), but in the practice of this journal is to write all other words in full. After another space, give without spaces the volume number, a colon and the page number(s) for start and end of the reference. Do not include the issue number unless each issue in a volume is paginated independently, as is the case in most newsletters and magazines. Most scientific journals are paginated by volume, making the issue number redundant.


b. Books or portions of books
If the reference is a full book, give author(s), date, title (in italics), then the name of the publisher and the city of publication. Province or state is not required for most major cities in Canada or USA, but if uncertain follow with the province, state or country. Total number of pages in the book can be useful guidance for readers, but is optional.
If the title is a chapter or section in a book, follow the title of the chapter with page numbers of that chapter, then the editor(s) of the book in the following manner: p. 123-134 in J.B. Smith (ed.), or p. 123-134 in J.B. Smith and K.C. Jones (eds). Follow with italicized title of the book, the publisher and city of publication.

c. Conference papers
For papers in conference proceedings, add the name, geographic location and dates of the conference, and if given, the editor, date of publication and publisher. In general, give as much information as possible, since conferences can be difficult to track down.
d. Reprinted materials
In the unusual case that a citation was from a reprint, it is desirable to add the reprint information in parentheses after the original reference.
e. Materials from the Internet
Normally, citations should not be made of material on an individual person’s website. Indication should be given of the date that information was accessed since most websites change with time.
f. Unpublished information
For an unpublished document or personal communication, give all the useful information that is available, so that if desired, a reader could hope to find the source of information, whether it was an organization or a person.
Guidelines for authors


Reviews of books and audio-visual materials
Authors or publishers of books or electronic information on birds relevant to British Columbia are encouraged to send a copy for review in British Columbia Birds. Non-Canadian publishers should indicate on the customs form that the item is a “Free review copy” so that customs duties, taxes and handling fees are not incurred. The publication will be reviewed by a BCFO member who has demonstrated expertise in the topic. The review will be published in the next volume of the journal. The item reviewed is normally kept by the reviewer.

The review starts with complete details of the item as shown in examples below. The nature of the text in the review is variable, as shaped by the reviewer. A picture of the cover accompanies the review.


Commonly noted errors in word usage
The following is a list of wording difficulties that are sometimes encountered. Avoiding them will speed up the editing. Much additional guidance can be seen at http://ess.nrcan.gc.ca/pubs/scipub/guide/.

a. Meanings
Words and/or abbreviations below are italicized for clarity, but are NOT italicized in the journal.
Access has been a noun, but is becoming used as a verb, especially in relation to computer files.
Accidental describes a bird that has been recorded only once in the province. Casual refers to two to six records. The journal equates vagrant with accidental. Rare describes a species that occurs in low numbers, but annually. If other terms are used, they should be defined.
Affect is a verb, meaning “to influence” (“temperature affects the speed of reaction”).
Effect is a noun (“had a major effect on ...”) but is also, more rarely, a verb meaning “to cause to happen” (“this will effect a change in the ...”).
Albinism refers to the complete absence of all pigment. Birds lacking some pigment are leucistic, not “partially albinoistic.” Leucistic even applies to birds that completely lack pigment in their feathers, but have pigmented eyes, feet and/or bills. Leucistic has had diverse and contradictory meanings, and an author using the word should explain his/her interpretation.

Birds are animals, so “birds and animals” is incorrect, and should be replaced with “birds and other animals”.
The word ecosystem should be carefully treated. Usually the proper word is “community” as in “plant community.” Ecosystem should be reserved to emphasize its wide meaning which includes substrate, medium, and energy, as well as primary producers, herbivores, carnivores and decomposers. e.g. is from the Latin exempli gratia and means “for example,” i.e. represents Latin id est, and means “that is to say” (“the bird is seldom seen, i.e. secretive”).

An estuary should be the tidal mouth of a large or moderate-sized river where seawater is appreciably diluted. The word should not be applied to every rivulet that runs across a beach.

Birds hatch from eggs (rather than being born). Impact is usually a noun meaning powerful effect. In writing, it should not be used as a verb (except in relation to wisdom teeth); instead use affect or had an effect.
Less refers to measurable amounts (“there is less water here”). Fewer means a countable number (“there are fewer ducks here”). There cannot be 2 or 3 times fewer, or ten times less. Once the reduction gets to one times, zero has been reached. Acceptable wording would be “one-third of”, “one-tenth as much” or “ten-fold less”.
Percentage is a noun (“... the percentage of fertile eggs ...”). For an adjective, use per cent (“... the per cent fertilization was ...”). A change from 10 to 30 is a 200% increase, not 300%.
Protocol is a very fixed set of procedures, set by formal agreement of some organization. Method is almost always more appropriate.

Toxic is a poison that is manufactured by an organism. Often the poison is strong (e.g. the agent of paralytic shellfish poison). Toxic is an adjective.
Poisonous is a proper word for poisonous chemicals in general. If length and width and weight and wingspan and measured, they are variables, not parameters. The latter word has special meaning in mathematics but otherwise signifies “limits,” “guidelines by which one judges,” “rules,” or “standards.” Parameters is a buzz-word that is almost always used wrongly in wildlife and technical circles.

Waterfowl is the English name of the Family Anatidae (ducks, geese and swans) and does not include loons, grebes, tube-noses, pelicaniform birds, herons, cranes, rallids, shorebirds, jaegers, gulls, terns, skimmers or alids. The collective term for waterfowl with one or more of the other group(s) could be water birds, waterbirds, or marine birds if they are on seawater.

b. Redundancies
Since all history is in the past, “past history” is redundant and therefore grammatically incorrect.

Often refers to time, and therefore “oftentimes” and “often times” are redundant.

Since unique means “single in kind,” such modifiers as “most unique” or “very unique” are redundant, and therefore grammatically incorrect.

In the case of “... , it is interesting that ... , it is noteworthy that ... can usually be deleted with no loss.
c. Sentence structure
Use between two things but among three or more things. (e.g. “Keep this between you and me. Do not share it among the group members.”). Times spans “between then AND now,” “from 1900 TO 1950;” “during 1900-1950;” or, better, “during the period 1900 TO 1950” or “during the period 1900 THROUG 1950”.

Make certain that only modifies the word intended. For example, “some species have only been seen once” indicates that these species have been seen, but not heard or photographed, whereas the author more likely intended to say that they had been observed only once, not two or more “times” (some species have seen only once).

Strings of modifiers. Some biologists are prone to write strings of nouns turned into modifiers, ahead of the real noun. Watch out for these and put them into English. Here is a real example: “... food availability based density/growth relationship hypothesis ...” Hypothesis is the real noun among the six. Perhaps this means a hypothesis on the relation between amount of food and the growth or abundance of some creature?

Hyphens are related to the item above on multiple modifiers. Use hyphens when two or more words modifying a noun are essential to each other, and the absence of a hyphen could lead to misunderstanding (“one-coloured wings”). Hypenate all the appropriate modifiers (“the 17-year-old goose” not “the 17 year old goose”). Choose carefully, “a few more highly-coloured birds” is different from “a few more highly-coloured birds”. Be especially careful to hyphenate when two or more nouns are used as modifiers (“the food-web diversity increased ...”). The hyphens in official English names of birds are often grammatically odd but must be used.

d. Singular (and plural)
Brant (Brant). Killdeer (Charadrius) teal (teal). However, options exist for plurals of some names such as albatross(es) and seawater(s). Alga (algae, with algae as the adjective). Antenna (antennae), bacterium (bacteria), criterion (criteria), fungus (fungi), hypothesis (hypotheses), larva (larvae), nucleus (nuclei), phenomenon (phenomena), stimulus (stimuli), thesis (theses).

When using any of the three following terms, make the verbs and other relevant words agree: “datum is...” (“data are...”); “index is...” (“indices are...”); “medium is...” (“media are...”).

“Many” is the proper word for poisonous chemicals in general. Often the sentence also contains numerals of 10 or greater (“there were four robins, six towhees, and 12 siskins”). However, numerals are used with a decimal (“1.5 times as fast”), with units of measurement (“8 kg”) or with mathematical results (“an average of 3 per day”).

Freshwater is an adjective (“freshwater marshes”) but as a noun it means “fresh water” (this “species favours fresh water”). However, seawater is both an adjective and a noun.

The past tense of the verb lead is led, not lead.

For further information, or to clarify situations not covered in these pages, please consult the Globe and Mail style book or contact the current editor of British Columbia Birds, whose identity and addresses are listed in the latest volume of the journal, and also on the website www.bcfo.ca.

Back Cover: A portion of the Walton-Wright study area, 3 km southwest of Lillooet, 2008 June 13, which supports some of the highest-known winter densities of the American Dipper (see page 15). Seton River is in the foreground with Cayoosh Creek at the upper left. BC Hydro’s Seton Canal and salmon spawning channels can also be seen. Photo by Ken Wright.