

## CHANGES IN NUMBERS OF SOME AUTUMN BIRD MIGRANTS IN THE COMOX VALLEY, BRITISH COLUMBIA, CANADA, FROM 1987 TO 2005

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**Abstract:** Regular counts of migrant birds were made in the Courtenay River estuary of British Columbia from 1987 to 2005. Mean numbers of yellowlegs decreased significantly from 1987 to 2005. Mean numbers of Yellow-rumped Warblers were significantly greater in 2002, 2003 and 2005, but the 1996-2005 trend was not significant. Mean annual numbers of Song Sparrows, Golden-crowned Sparrows and Lincoln's Sparrows increased significantly from 1996 to 2005. Mean annual numbers of Yellow-rumped Warblers, Orange-crowned Warblers, Song Sparrows, White-crowned Sparrows and Lincoln's Sparrows were significantly correlated with numbers observed at Rocky Point Bird Observatory near Victoria, B.C., suggesting that our counts of those species were representative of migrating populations on Vancouver Island.

**Key Words:** Shorebirds, warblers, sparrows, migration, survey, Comox Valley, British Columbia, yellowlegs, *Tringa melanoleuca*, *Tringa flavipes*, dowitcher, *Limnodromus scolopaceus*, *Limnodromus griseus*, Killdeer, *Charadrius vociferus*, Yellow-rumped Warbler, *Dendroica coronata*, Orange-crowned Warbler, *Vermivora celata*, Yellow Warbler, *Dendroica petechia*, Common Yellowthroat, *Geothlypis trichas*, Song Sparrow, *Melospiza melodia*, Golden-crowned Sparrow, *Zonotrichia atricapilla*, Lincoln's Sparrow, *Melospiza lincolni*, White-crowned Sparrow, *Zonotrichia leucophrys*, Savannah Sparrow, *Passerculus sandwichensis*.

### INTRODUCTION

The Comox Valley, British Columbia, is recognized internationally as an Important Bird Area (IBA Canada 2004), particularly for its wintering waterbirds, and has been the focus of ornithological work for over a century (Brooks 2006). The Tsolum River and the Puntledge River merge to become the Courtenay River, which flows through the city of Courtenay before emptying into the rich tidal estuary of Comox Harbour adjacent to Courtenay Airpark. As one of the focal points for the city, this area continues to see changes due to industrial and residential development as well as increasing recreational use. The Comox Valley Naturalists Birders Group felt that regular monitoring of birds during autumn migration would help evaluate the impact of those changes. The purpose of this paper is to examine the trends and patterns in numbers of some autumn bird migrants in the Comox Valley.

### METHODS

In 1987 the Comox Valley Naturalists Birders Group began regular counts of birds along the Courtenay River mouth and estuary from the Courtenay Airpark marina (49°40'45"N, 124°58'40"W) for approximately 2 km southeast along what is now a 6-ha park and walkway. The habitat along the original transect was modified by the expansion of the airpark and the dredging of a small tidal lagoon in 1991, and by the subsequent re-establishment of native trees and shrubs adjacent to the airpark. There has also been gradual reduction of forest and scrubland adjacent to the walkway due to development. In 1996, the surveys were expanded to include 25-ha of upland farmland, including hedgerows and marsh, approximately one

kilometre to the east (49°41'00"N, 124°58'12"W). There has been little change in these habitats.

Counts were made by separate groups 3-5 times each week from late August to mid-November to coincide with the autumn migration. Most of the observers conducting the counts participated in all counts for several years, in some cases from 1987 to 2005. Count effort was similar most years, with some variation due to poor weather, but was generally greater from 1987 to 1995, except for 1988. We do not feel that this variation affected the overall results (see Tables for sample sizes each year). However, even with this relative consistency of observers and count effort, there is greater variance inherent in our counts than would be expected in a standardized scientific study. This variance is additive to the natural variance in numbers of birds during the course of migration. We chose, therefore, to be conservative in our analyses.

Many species occurred irregularly during the study or were highly sensitive to stage of the tide. We chose only a few migrating species that occurred consistently and in sufficient numbers for analysis of trends in population (3 species in estuary habitats from 1987-2005 and 9 species in upland habitats from 1996-2005). The numbers of birds observed on each count were generally too small and too variable to confidently establish an annual 'migration window' for each species. Therefore, for each species, we chose a calendar period when the majority of migrants were present and of sufficient duration to accommodate annual variations in the peak of migration. We took an average of all counts made during each species-specific calendar period to calculate an annual mean number per count for each species. By using this method, we likely included more nil observations than we would have if precise

migration windows could have been established, and therefore increased the variance of the estimates, but we also likely reduced the potential bias of selecting annual migration windows too narrowly.

In order to evaluate whether our counts were representative of autumn bird migrations on Vancouver Island, we compared our counts with numbers of birds banded from late July to late October at the Rocky Point Bird Observatory (RPBO) near Victoria (Rocky Point Bird Observatory 2006). The comparison is not exact since monitoring began earlier in the migration period at RPBO and, therefore, we would have missed some early migrants. We do not have specific information on breeding or wintering locations for birds that migrate through the Comox Valley. However, we know that some of the warblers and sparrows breed in coastal and interior Alaska, Yukon and British Columbia and that some of the sparrows winter in British Columbia, Washington, Oregon and California. Therefore, to evaluate whether our counts reflected numbers of wintering or breeding birds, we compared our counts with Breeding Bird Surveys

(uncorrected BBS numbers for Alaska, Yukon, B.C.) (Patuxent Wildlife Research Center 2006) and with Christmas Bird Counts (CBC for B.C., Wash., Ore., Calif. combined) (National Audubon Society 2005) for those jurisdictions. We also compared our counts of sparrows with those observed on the local Comox Christmas Bird Count. This method is crude but is the only one available to us without more precise information on the origins and destinations of the birds we observed.

We conducted statistical analyses using MS Excel 2000 Statistical Analysis ToolPak. To examine trends and patterns in mean annual numbers, we fitted plots of the annual means with polynomial curves, because trends in bird numbers are seldom linear or exponential. We evaluated the significance of trends in mean annual numbers through linear regression of the logarithm of the means. We tested differences in means with t-tests assuming unequal variances. We also tested the association of mean annual numbers among species and with other counts through product-moment correlation coefficients.

**Table 1. Mean number ( $\pm$  SE) of yellowlegs, dowitchers and killdeer observed per count, in the Courtenay River estuary in 1987-2005. (Sample size in parentheses)**

Species	Yellowlegs	Dowitchers	Killdeer
Period	Sept. 1-30	Oct. 1-31	Sept. 1 – Oct. 31
1987	14.60 $\pm$ 1.637 (20)	26.27 $\pm$ 2.906 (26)	1.74 $\pm$ 0.787 (46)
1988	8.00 $\pm$ 3.594 (9)	26.62 $\pm$ 6.008 (13)	1.36 $\pm$ 0.587 (22)
1989	5.44 $\pm$ 0.730 (25)	3.19 $\pm$ 0.767 (26)	5.43 $\pm$ 1.055 (51)
1990	4.05 $\pm$ 0.769 (22)	11.20 $\pm$ 2.660 (15)	7.38 $\pm$ 1.572 (37)
1991	0.18 $\pm$ 0.128 (17)	0.00 $\pm$ 0.000 (24)	3.32 $\pm$ 0.974 (41)
1992	2.19 $\pm$ 0.646 (21)	13.96 $\pm$ 1.770 (24)	8.27 $\pm$ 1.130 (45)
1993	2.00 $\pm$ 0.508 (20)	5.08 $\pm$ 1.266 (25)	5.36 $\pm$ 1.022 (45)
1994	1.17 $\pm$ 0.345 (18)	4.74 $\pm$ 1.005 (19)	6.86 $\pm$ 2.620 (37)
1995	0.86 $\pm$ 0.402 (22)	3.83 $\pm$ 0.924 (24)	4.24 $\pm$ 0.860 (46)
1996	2.07 $\pm$ 0.474 (14)	5.80 $\pm$ 1.554 (20)	4.91 $\pm$ 0.967 (34)
1997	0.20 $\pm$ 0.092 (20)	39.00 $\pm$ 7.879 (21)	2.61 $\pm$ 0.598 (41)
1998	0.44 $\pm$ 0.203 (16)	3.00 $\pm$ 1.061 (17)	15.82 $\pm$ 3.428 (33)
1999	0.18 $\pm$ 0.128 (17)	2.62 $\pm$ 0.826 (16)	3.42 $\pm$ 1.208 (33)
2000	0.22 $\pm$ 0.101 (18)	5.00 $\pm$ 1.197 (17)	3.97 $\pm$ 0.876 (35)
2001	0.12 $\pm$ 0.085 (16)	0.75 $\pm$ 0.310 (16)	2.25 $\pm$ 0.801 (32)
2002	0.93 $\pm$ 0.462 (15)	3.76 $\pm$ 1.083 (17)	3.91 $\pm$ 0.696 (32)
2003	1.78 $\pm$ 0.630 (14)	10.57 $\pm$ 2.672 (14)	9.57 $\pm$ 1.474 (28)
2004	0.15 $\pm$ 0.104 (13)	7.78 $\pm$ 2.167 (14)	5.44 $\pm$ 1.049 (27)
2005	2.53 $\pm$ 0.550 (17)	2.69 $\pm$ 1.222 (13)	4.93 $\pm$ 1.206 (30)

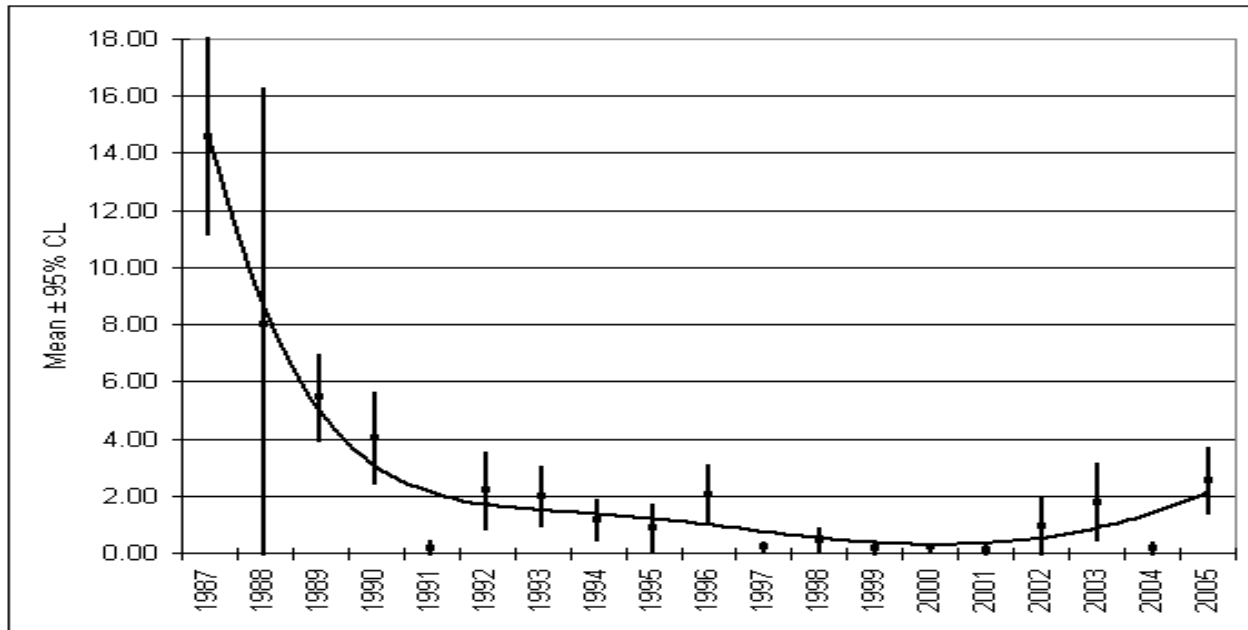


Figure 1. Mean number ( $\pm$  95% CL) of yellowlegs (Greater and Lesser combined) observed in September in the Courtenay River estuary in 1987-2005.

## RESULTS

### Shorebirds:

Mean numbers of yellowlegs (*Tringa melanoleuca* and *T. flavipes* combined\*) in September decreased steadily from 1987 to the late 1990s and only recently have shown a small recovery (Table 1, Figure 1). A linear regression of the log mean numbers of yellowlegs from 1987 to 2005 showed a significant negative relationship with year ( $t = -2.93$ ,  $P < 0.05$ ). Mean numbers of dowitchers\* (*Limnodromus scolopaceus* and *L. griseus* combined) may have declined from 1987 to the late 1990s similarly to yellowlegs, but not significantly (Table 1). Mean numbers of dowitchers were greater in 1987, 1988 and 1997 than in other years, but showed no particular pattern otherwise. Killdeer (*Charadrius vociferus*) mean numbers varied among years without a specific trend (Table 1). Mean numbers of yellowlegs and dowitchers were depressed in 1991 when there was active construction of the lagoon at the Airpark, but returned to 'normal' in the following years.

### Warblers:

Both Yellow-rumped Warblers (*Dendroica coronata*) and Orange-crowned Warblers (*Vermivora celata*) have recently increased in mean numbers, while Yellow Warblers (*Dendroica petechia*) and Common Yellowthroats (*Geothlypis trichas*) varied in mean numbers since 1996 without a specific trend (Table 2). None of these four

species of warblers showed a significant relationship between log mean number and year from 1996 to 2005. Mean numbers of Yellow-rumped Warblers, however, were significantly greater in 2002, 2003 and 2005 ( $\bar{x} = 12.15 \pm 1.89$ ) than in other years ( $\bar{x} = 1.71 \pm 0.247$ ) ( $t = -5.48$ ,  $df = 47$ ,  $P < 0.001$ ).

Mean numbers of warblers were compared among species but there were no significant correlations. Mean numbers of Yellow-rumped Warblers ( $r = 0.80$ ,  $P < 0.01$ ) and Orange-crowned Warblers ( $r = 0.64$ ,  $P < 0.05$ ) showed a significant correlation with numbers at RPBO, but neither was significantly correlated with numbers from BBS.

### Sparrows:

All four species of sparrows that we analysed varied in annual mean numbers but differed in pattern. Mean numbers of Song Sparrows (*Melospiza melodia*) increased steadily from 1996 to 2002 and then decreased (Figure 2, Table 3). A linear regression of the log mean numbers of Song Sparrows from 1996 to 2005 showed a significant positive relationship with year ( $t = 2.50$ ,  $P < 0.05$ ). Mean numbers of Song Sparrows were not significantly correlated with mean numbers of other sparrows.

Mean numbers of both Golden-crowned Sparrows (*Zonotrichia atricapilla*) (Figure 3, Table 3) and Lincoln's Sparrows (*Melospiza lincolnii*) (Table 3) increased steadily from 1996 to 2005. Linear regressions of the log mean numbers of both species showed significant positive relationships with year ( $t = 7.98$ ,  $P < 0.0001$  and  $t = 5.09$ ,  $P < 0.001$ , respectively). Mean numbers of White-crowned Sparrows (*Zonotrichia leucophrys*) declined from 1996 to 1999/2000 and then increased to 2005 (Figure 4, Table 3),

\*Yellowlegs and dowitchers were not consistently identified to species; however, based on other observations, the majority of yellowlegs were likely Greater Yellowlegs and the majority of the dowitchers were likely Long-billed Dowitchers.

but the relationship between log mean number and year was not significant. Mean numbers of Savannah Sparrows (*Passerculus sandwichensis*) varied from 1996 to 2005 (Table 3) but the relationship between log mean number and year was not significant.

Mean numbers of Golden-crowned Sparrows were significantly correlated with mean numbers of Lincoln's Sparrows ( $r = 0.88$ ,  $P < 0.001$ ), White-crowned Sparrows ( $r = 0.80$ ,  $P < 0.01$ ) and Savannah Sparrows ( $r = 0.69$ ,  $P < 0.05$ ). Other relationships between species of sparrows were not significant. Mean numbers of Song Sparrows ( $r = 0.85$ ,  $P < 0.01$ ), White-crowned Sparrows ( $r = 0.87$ ,  $P < 0.001$ )

and Lincoln's Sparrows ( $r = 0.74$ ,  $P < 0.02$ ) were significantly correlated with numbers at RPBO, but other species were not. Mean numbers of species of sparrows that we observed were not significantly correlated with numbers from BBS. Mean numbers of Golden-crowned Sparrows were significantly correlated with Christmas Bird Counts ( $r = 0.84$ ,  $P < 0.01$ ), but mean numbers of other species of sparrows were not. Golden-crowned Sparrow was also the only species of sparrow significantly correlated with numbers observed on the Comox CBC ( $r = 0.82$ ,  $P < 0.01$ ).

**Table 2. Mean number ( $\pm$  SE) of warblers observed per count, in the Courtenay River estuary in 1996-2005.**  
(Sample size in parentheses)

Species	Yellow-rumped Warbler	Orange-crowned Warbler	Yellow Warbler	Common Yellowthroat
Period	Sept 15 – Oct 15	Sept 1 – 30	Sept 1 – 30	Sept 1 – 30
1996	0.95 $\pm$ 0.554 (19)	0.21 $\pm$ 0.155 (14)	0.36 $\pm$ 0.248 (14)	0.21 $\pm$ 0.214 (14)
1997	2.50 $\pm$ 0.841 (18)	0.80 $\pm$ 0.749 (20)	0.60 $\pm$ 0.438 (20)	4.45 $\pm$ 1.776 (20)
1998	1.38 $\pm$ 0.569 (16)	0.44 $\pm$ 0.182 (16)	0.12 $\pm$ 0.085 (16)	0.50 $\pm$ 0.376 (16)
1999	3.06 $\pm$ 0.710 (17)	1.94 $\pm$ 0.764 (17)	1.35 $\pm$ 0.437 (17)	5.82 $\pm$ 1.852 (17)
2000	2.24 $\pm$ 0.650 (17)	0.28 $\pm$ 0.109 (18)	0.72 $\pm$ 0.360 (18)	1.33 $\pm$ 0.333 (18)
2001	0.31 $\pm$ 0.176 (16)	0.06 $\pm$ 0.063 (16)	0.50 $\pm$ 0.258 (16)	3.19 $\pm$ 1.330 (16)
2002	8.25 $\pm$ 2.442 (16)	0.73 $\pm$ 0.431 (15)	4.80 $\pm$ 1.789 (15)	1.67 $\pm$ 0.607 (15)
2003	12.28 $\pm$ 3.524 (14)	1.07 $\pm$ 0.774 (14)	0.43 $\pm$ 0.228 (14)	1.71 $\pm$ 0.722 (14)
2004	1.47 $\pm$ 0.668 (15)	1.77 $\pm$ 0.681 (13)	1.15 $\pm$ 0.919 (13)	0.23 $\pm$ 0.122 (13)
2005	15.94 $\pm$ 3.664 (16)	2.00 $\pm$ 0.695 (18)	1.17 $\pm$ 0.573 (18)	2.61 $\pm$ 0.627 (18)

**Table 3. Mean number ( $\pm$  SE) of sparrows observed per count in the Courtenay River estuary in 1996-2005.**  
(Sample size in parentheses)

Species	Song Sparrow	Golden-crowned Sparrow	Lincoln's Sparrow	White-crowned Sparrow	Savannah Sparrow
Period	Sept 20 – Nov 10	Sept 20 – Nov 10	Sept 1 – 30	Sept 20 – Nov 10	Sept 1 – Oct 31
1996	6.35 $\pm$ 1.134 (31)	1.90 $\pm$ 0.492 (31)	0.21 $\pm$ 0.155 (14)	2.16 $\pm$ 0.566 (31)	11.59 $\pm$ 2.117 (34)
1997	13.28 $\pm$ 1.484 (36)	2.50 $\pm$ 0.643(36)	0.85 $\pm$ 0.460 (20)	1.36 $\pm$ 0.397 (36)	19.22 $\pm$ 3.550 (41)
1998	11.48 $\pm$ 1.679 (29)	1.34 $\pm$ 0.416 (29)	0.75 $\pm$ 0.622 (16)	1.03 $\pm$ 0.380 (29)	6.58 $\pm$ 1.450 (33)
1999	12.28 $\pm$ 1.460(29)	2.14 $\pm$ 0.377 (29)	2.24 $\pm$ 0.774 (17)	0.17 $\pm$ 0.100 (29)	12.33 $\pm$ 2.679 (33)
2000	17.90 $\pm$ 1.396 (30)	3.77 $\pm$ 0.608 (30)	2.67 $\pm$ 0.844 (18)	0.17 $\pm$ 0.136 (30)	9.06 $\pm$ 1.578 (35)
2001	20.68 $\pm$ 2.060 (28)	7.36 $\pm$ 1.252 (28)	1.00 $\pm$ 0.532 (16)	1.32 $\pm$ 0.395 (28)	16.47 $\pm$ 4.050 (32)
2002	27.44 $\pm$ 2.987 (27)	7.92 $\pm$ 1.138 (27)	3.27 $\pm$ 1.205 (15)	2.85 $\pm$ 0.603 (27)	7.03 $\pm$ 1.452 (32)
2003	23.80 $\pm$ 2.334 (25)	11.32 $\pm$ 1.285 (25)	3.57 $\pm$ 1.283 (14)	2.44 $\pm$ 0.507 (25)	26.57 $\pm$ 4.336 (28)
2004	14.04 $\pm$ 1.657 (24)	12.25 $\pm$ 1.243 (24)	3.23 $\pm$ 1.494 (13)	3.96 $\pm$ 0.968 (24)	24.04 $\pm$ 3.732 (27)
2005	16.46 $\pm$ 1.779 (24)	17.96 $\pm$ 2.446 (24)	7.11 $\pm$ 2.000 (18)	3.75 $\pm$ 0.730 (24)	22.71 $\pm$ 3.703 (31)

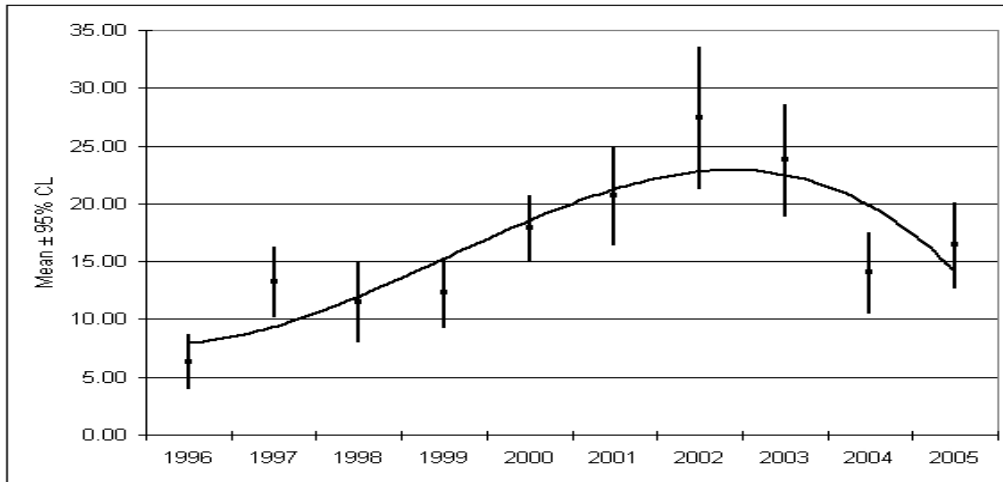


Figure 2. Mean number ( $\pm$  95% CL) of Song Sparrows observed September 20 to November 10 in the Courtenay River estuary in 1996-2005.

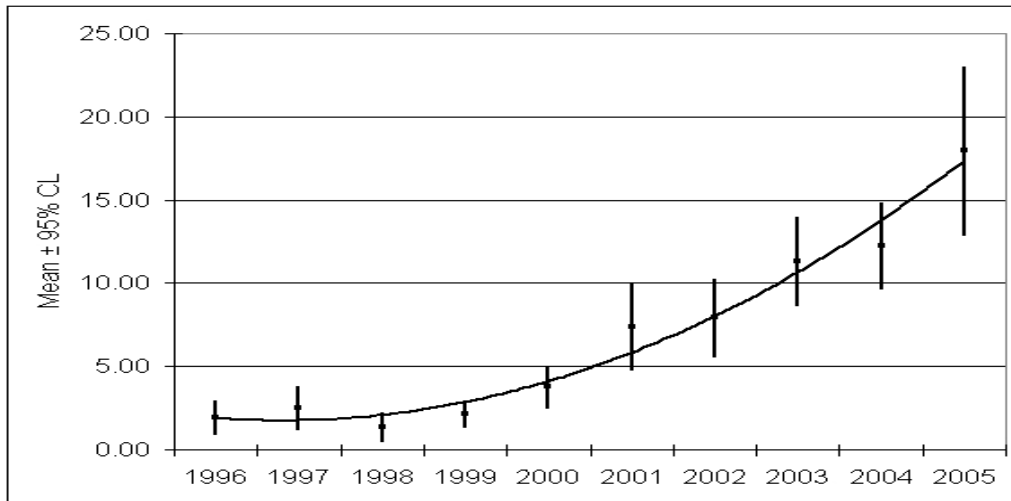


Figure 3. Mean number ( $\pm$  95% CL) of Golden-crowned Sparrows observed September 20 to November 10 in the Courtenay River estuary in 1996-2005.

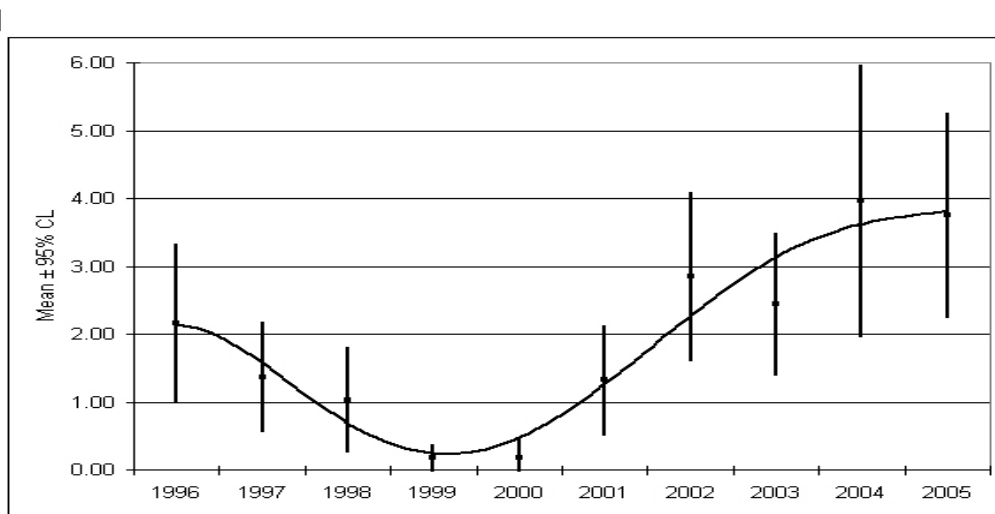


Figure 4. Mean number ( $\pm$  95% CL) of White-crowned Sparrows observed September 20 to November 10 in the Courtenay River estuary in 1996-2005.

## DISCUSSION

We observed a significant decrease in mean numbers of yellowlegs from 1987 to 2005, although numbers counted were small. Overall in North America, populations of Greater Yellowlegs have shown mixed, non-significant trends and Lesser Yellowlegs have shown some significant declines (Morrison *et al* 2001) but West Coast populations were not included in that analysis. The decline in mean numbers we observed may reflect an actual decrease in numbers or may reflect a reduced residency time for migrants. Butler *et al.* (2003) suggested that a shorter stay of migrant shorebirds is due to recent increases in numbers of migrant raptors, such as migrant Peregrine Falcons (*Falco peregrinus*) that have increased in numbers in the Strait of Georgia (Ydenberg *et al.* 2004). Butler noted that shorebirds avoided small areas that could be dangerous in favour of safe, open sites. This may also have been the case in our area, but we observed raptors too infrequently to evaluate the relationship.

There were significant correlations in our mean numbers, with the numbers observed at RPBO, for Yellow-rumped Warblers, Orange-crowned Warblers, Song Sparrows, White-crowned Sparrows and Lincoln's Sparrows. This suggests that our counts of those species were representative of migrating populations on Vancouver Island. However, our mean numbers of other species of warblers and sparrows were not significantly correlated with those at RPBO. In fact, numbers of Savannah Sparrows declined significantly at RPBO from 1996 to 2003 (Christie 2004) while the apparent small increase which we observed, proved to be non-significant. The absence of correlation may reflect differences in migration routes, migration timing or habitat between the two sites, but we could not determine the most likely cause.

We did not find any significant correlations in our observed mean numbers of warblers or sparrows with numbers from BBS. This may be because we do not have sufficient information on the specific breeding areas of the migrants we observed, or because the BBS for those breeding areas is not representative. Many species in Alaska are not adequately monitored by BBS due to the low density of routes and the lack of long time-series (Boreal Partners in Flight Working Group 1999). Orange-crowned Warblers show declining population trends in B.C. and Alaska while Yellow-rumped Warblers are possibly increasing (Sauer *et al.* 2005; Rocky Mountain Bird Observatory 2005). None of the four species of sparrows show significant BBS trends in B.C. and Alaska (Sauer *et al.* 2005), although populations of Savannah Sparrows and White-crowned Sparrows are possibly declining (Rocky Mountain Bird Observatory 2005). Likewise, with the exception of Golden-crowned Sparrows, we did not find any significant correlations in mean numbers of sparrows we observed, with numbers from CBC. Again, we lack sufficient information on the specific wintering areas of the migrants we observed.

The species of warblers we observed did not show any significant trends in annual mean numbers. The significant increase in mean numbers of Yellow-rumped Warblers in 2002, 2003 and 2005 could have been due to differences in migration route or could reflect improved breeding success and/or early survival, but we could not determine which was more likely.

The species of sparrows that we observed showed different patterns in annual mean numbers (see Figs. 2-4). Golden-crowned Sparrows and Lincoln's Sparrows showed highly significant positive trends in mean numbers from 1996 to 2005. Mean numbers of Golden-crowned Sparrows were also significantly correlated with those of Lincoln's Sparrows, White-crowned Sparrows and Savannah Sparrows. This does not appear to be due to similarities in migration timing since Lincoln's Sparrows peaked in mid-September, Savannah Sparrows peaked at the end of September and Golden-crowned Sparrows and White-crowned Sparrows did not peak until after mid-October. It is possible that these species were responding to a local improvement in migration stopover habitat, but this appears unlikely because the habitats we monitored were either stable or declined in apparent quality during our study. The correlations do not appear to be related to breeding habitat either, since different habitats are preferred by different species, from patchy tree-line coniferous forest (Golden-crowned Sparrow) to shrubby forests and bogs (Lincoln's Sparrow) and grasslands at both low and high elevations (Savannah Sparrow) (Sinclair *et al.* 2003). Perhaps these species were showing a positive response to a general improvement in environmental conditions, resulting in improved breeding success and/or early survival, even though results from Breeding Bird Surveys are equivocal.

The purpose of this paper was to examine the trends and patterns in annual numbers of some autumn bird migrants in the Comox Valley. We found some significant differences in the pattern of annual mean numbers among related species and, for some species, found significant trends in annual mean numbers. For some species, our observations appear to be representative of autumn bird migration on Vancouver Island. We hope that these observations by the Comox Valley Naturalists Birders Group will prove useful for bird conservation.

## ACKNOWLEDGEMENTS

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## LITERATURE CITED

- Boreal Partners in Flight Working Group 1999. Landbird conservation plan for Alaska biogeographic regions: version 1.0. U.S. Fish and Wildlife Service, Anchorage, Alaska. 116 p.  
[www.absc.usgs.gov/research/bpif/conservation.pdf](http://www.absc.usgs.gov/research/bpif/conservation.pdf). Accessed 2006 August 18.
- Brooks, E. 2006. The pioneer birdmen of Comox. Booklet, Comox Valley Naturalists Society and Comox Archives & Museum Society. Box 3222, Courtenay, B.C. 20 p.
- Butler, R.W., R.C. Ydenberg and D.B. Lank 2003. Wader migration on the changing predator landscape. *Wader Study Group Bull.* 100:130-133.
- Christie, K.S. 2004. Trends in abundance of migratory songbirds at Rocky Point Bird Observatory, southern Vancouver Island, British Columbia.  
[www.islandnet.com/~rpbo/rptrends\\_kc.pdf](http://www.islandnet.com/~rpbo/rptrends_kc.pdf). Accessed 2006 August 11.
- IBA Canada 2004. Important bird areas of Canada.  
[www.ibacanada.com](http://www.ibacanada.com). Accessed 2006 August 24.
- Morrison, R.I.G., Y. Aubry, R.W. Butler, G.W. Beyersbergen, G.M. Donaldson, C.L. Gratto-Trevor, P.W. Hicklin, V.H. Johnston and R.K. Ross 2001. Declines in North American shorebird populations. *Wader Study Group Bull.* 94:34-38.
- National Audubon Society 2005. Christmas Bird Count.  
[www.audubon.org/bird/cbc/index.html](http://www.audubon.org/bird/cbc/index.html). Accessed 2006 March 10.
- Rocky Mountain Bird Observatory 2005. Partners In Flight species assessment database.  
[www.rmbo.org/pif/pifdb.html](http://www.rmbo.org/pif/pifdb.html). Accessed 2006 August 8.
- Rocky Point Bird Observatory 2006. Bander in Charge final reports. [www.islandnet.com/~rpbo/](http://www.islandnet.com/~rpbo/). Accessed 2006 August 11.
- Sauer, J.R., J.E. Hines and J. Fallon 2005. The North American Breeding Bird Survey, results and analysis 1966 - 2005. Version 6.2. 2006. U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, Md.  
[www.mbr-pwrc.usgs.gov/bbs/bbs.html](http://www.mbr-pwrc.usgs.gov/bbs/bbs.html). Accessed 2006 August 12.
- Sinclair, P.H., W.A. Nixon, C.D. Eckert and N.L. Hughes 2003. Birds of the Yukon Territory. UBC Press, Vancouver, B.C.. 595 p.
- USGS [U.S. Geological Survey], Patuxent Wildlife Research Center 2006. North American Breeding Bird Survey. USGS, Patuxent Wildlife Research Center.  
[www.pwrc.usgs.gov/bbs/](http://www.pwrc.usgs.gov/bbs/). Accessed 2006 March 10.
- Ydenberg, R.C., R.W. Butler, D.B. Lank, B.D. Smith and J. Ireland 2004. Western sandpipers have altered migration tactics as peregrine falcon populations have recovered. *Proc. R. Soc. Lond. B.* 271: 1263-1269.