

**RIVERINE BIRD RESPONSE TO
HABITAT RESTORATION ON THE LOWER BRIDGE RIVER : 2006
Report**

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EXECUTIVE SUMMARY

The completion of the Terzaghi Dam in 1960 diverted water from the Bridge River to powerhouses located on the Seton Reservoir, leaving approximately 4.1 km of dry river bed below the dam. Feeder streams downstream of the dam contributed some water to the Bridge River, but flows downstream of the dam were much reduced compared to historic volumes and undoubtedly had a negative impact on populations of riverine birds. In August 2000, BC Hydro initiated an average annual release of 3 m³/s, converting the 4.1 km section of dry river bed into potentially usable habitat and increasing the flow of water in the system.

From 1999 to 2000, pre-release riverine bird surveys were performed on approximately 11.8 km of river below the Terzaghi Dam, from the Yalakom River confluence to the dry section 4.1 km below the dam. In 2005 we conducted the first full-length post-release survey on the 15.9 km section from the Terzaghi Dam to the Yalakom River confluence. In this study we repeated the 2005 surveys, performing two pair surveys (May) and three surveys during the brood-rearing stage (July).

Several species of riverine birds used this 15.9 km section during the pre-incubation and brood-raising periods. The most common species observed were Common Mergansers (*Mergus merganser*), Spotted Sandpipers (*Actitis maculatus*), Harlequin Ducks (*Histrionicus histrionicus*), Belted Kingfishers (*Ceryle alcyon*) and American Dippers (*Cinclus mexicanus*).

Numbers of Spotted Sandpipers and American Dippers increased on the 4.1 km previously de-watered section below the Terzaghi Dam, suggesting that riverine birds have steadily adapted to new opportunities presented by the controlled release. Over the 15.9 km river section between the Yalakom River and the Terzaghi Dam, however, overall numbers of riverine birds have not changed, with the exception of Spotted Sandpipers whose numbers have more than doubled, and American Dippers whose numbers appeared to have declined. There also appears to have been a response to the controlled release by American Dippers and Harlequin Ducks to shift their distribution from the higher volume downstream section to the previously low or de-watered section upstream.

Data on benthic invertebrates and small fish were examined from other studies on the Lower Bridge River. No relationships were found between aquatic invertebrates and upstream distance, but small fish did have a higher biomass density upstream compared to downstream. The higher fish biomass in the upstream section may indicate more productive habitat for riverine birds, contributing to their upstream shift.

It proved difficult to obtain data on bird densities on other river systems. While densities of Common Mergansers and Spotted Sandpipers appeared to be higher than normal during the brood period, this must be interpreted cautiously due to high inter-year variation in brood production and the general paucity of data in the literature. Overall,



the Lower Bridge River appears to be a typical breeding area for riverine birds with no exceptional densities.

The controlled release of 3 m³/s has successfully restored the 6 km of riverine bird breeding habitat most severely affected by the construction of the dam. Data from 5 years post-release, however, suggests that while birds have responded to the creation of new habitat 4.1 km below the dam, with the exception of Spotted Sandpipers, their overall numbers have not increased as expected in the 15.9 km between the Yalakom River confluence and Terzaghi Dam. We recommend further surveys should be conducted to determine if this unexpected effect is real or an artefact of small sample size.



TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
 1.0 INTRODUCTION..... 5
 2.0 STUDY AREA..... 6
 3.0 METHODS..... 9
 4.0 RESULTS..... 11
 5.0 DISCUSSION 18
 6.0 RECOMMENDATIONS 20
 7.0 ACKNOWLEDGEMENTS 21
 8.0 REFERENCES..... 22

LIST OF FIGURES

Figure 1 Map of the survey area. 7
 Figure 2 Pre- and post-release water depths at the a) upstream and b) downstream water measuring stations. Refer to Figure 1 for locations of the stations..... 8
 Figure 3 Average number of birds per survey (+ 1 SE) 2 years pre-release and 5 and 6 years post-release during the pair and brood periods. 12
 Figure 4 Average number of birds per survey (+ 1 SE) upstream of Mission Creek. 13
 Figure 5 Distribution of riverine birds pre- and post-release. 14
 Figure 6 Mean (+ 1 SE) number of Trichoptera and Plecoptera collected per trap divided by the number of days the substrate was available. 15
 Figure 7 Mean (+ 1 SE) number of Diptera and Ephemeroptera collected per trap divided by the number of days the substrate was available..... 16
 Figure 8 Total mean biomass (g/100 m²) sampled in Reach 3 and Reach 4. Only Coho Salmon (ages 0+ and 1+ yrs), Chinook Salmon (ages 0+ and 1+ yrs) and Rainbow Trout/Steelhead (ages 0+ and 1+ yrs) are included. 17
 Figure 9 A comparison of the average (+ 1 SE) maximum density of riverine birds seen on surveys during the pair and brood periods on the Lower Bridge River and other river systems..... 18

LIST OF TABLES

Table 1. Number of individuals of major riverine bird species observed on the 15.9 km survey route from the Yalakom River confluence to Terzaghi Dam in 2006..... 11

LIST OF APPENDICES

Appendix 1 Detailed riverine bird observations from the 2006 survey..... 26
 Appendix 2 List of wildlife species encountered during the Riverine Bird Surveys conducted between May 5th and July 27th, 2006..... 30



Appendix 3 Harlequin Duck densities from other river systems. Text in italics indicate data used in this report. 34

Appendix 4 American Dipper densities from other river systems. Text in italics indicate data used in this report. 36

Appendix 5 Common Merganser densities from other river systems. Text in italics indicate data used in this report. 36

Appendix 6 Belted Kingfisher densities from other river systems. Text in italics indicate data used in this report. 37

Appendix 7 Spotted Sandpiper densities from other river systems. Text in italics indicate data used in this report. 37

LIST OF SCHEDULES

SCHEDULE A FINANCIAL REPORT 38

SCHEDULE B PERFORMANCE MEASURES 39

SCHEDULE C CONFIRMATION OF BCRP RECOGNITION 40



1.0 INTRODUCTION

Hydroelectric operations began on the Bridge River system in 1927 and culminated with the completion of the Terzaghi Dam in 1960. The Terzaghi Dam diverted water from the Bridge River to powerhouses located on the Seton Reservoir, leaving approximately 4.1 km of dry river bed below the dam. Springs and feeder streams downstream of the dam contributed some water to the Bridge River, but flows were much reduced compared to historic volumes and undoubtedly had a negative impact on fish and riverine bird populations.

In August 2000, BC Hydro initiated a permanent flow release at Terzaghi Dam. For the first four years flow was based on an average annual release of 3 m³/s, ranging from a base flow in winter of 2.0 m³/s to 5.0 m³/s during the summer freshet (Wright 2004). On May 1, 2005, discharge was scheduled to switch to an average annual release of 1 m³/s for four years, to be followed by an average annual discharge rate of 6 m³/s for a final four year period. Due to a number of factors, it was decided to maintain the flow at 3 m³/s for the immediate future (Jesse Brown, *pers. comm.*). At the end of the trial periods, a final flow rate will be determined.

From 1999 to 2000, surveys were conducted on the Bridge River to explore the possible impacts of hydroelectric operations on riverine birds, with most of the emphasis being focused on Harlequin Ducks (*Histrionicus histrionicus*; Wright 1998; Wright and Walton 2001a,b). Shorter surveys were also done in 2001 and 2002 on the 4.1 km of previously dewatered river directly downstream of Terzaghi Dam (Wright 2004). This survey was repeated in 2004 (Walton and Heinrich 2004), and a longer survey replicating the surveys of 1999 and 2000 was conducted in 2005 (Walton and Heinrich 2005).

Six breeding seasons have passed since the initiation of the controlled release in August 2000. In this study we examined the sixth year post-release response of riverine birds to increased water flows in the 15.9 km section below the Terzaghi Dam. The main goal of this study was to determine how riverine birds in the breeding season responded to the increased flow by focusing on two sections of the river: the 4.1 km of newly created habitat immediately below the dam, and the 15.9 km section from the dam to the Yalakom River confluence. To achieve this goal, we conducted five riverine bird surveys: two surveys during the pairing period and three surveys during the brood-rearing stage. These results were compared to historic data to assess the effect of the controlled release.

Riverine birds are just a small component of the research collected on the Lower Bridge River through the Bridge Coastal Restoration Program (BCRP). In particular, much attention has been directed to assessing the response of fish populations to the release. In 2005 we observed that some riverine birds appeared to have shifted their distribution further upstream after the release (Walton and Heinrich 2005). To see if this apparent shift could be explained by other data sources, we examined the central database (Jeff Sneep, *unpubl. data*) of the BCRP project and selected two projects we thought relevant to riverine birds: benthic invertebrate sampling and fish biomass estimates.



Finally, we have four years of riverine bird data on the 15.9 km section of the Bridge River from the Terzaghi Dam to the Yalakom River confluence: two years pre-release and two years post-release. How do riverine bird densities on the Lower Bridge River compare to other systems? Is the Lower Bridge River system unique? To answer these questions we undertook a literature review to place densities of riverine birds on the Lower Bridge River in context with other river systems.

2.0 STUDY AREA

Surveys were conducted from the confluence of the Yalakom River to the base of the Terzaghi Dam, a distance of 15.9 km along the Bridge River (Figure 1). Prior to the controlled release on August 1, 2000, the 4.1 km section from Mission Creek to the dam was essentially dry river bed and the river downstream of Mission Creek was fed only by inflowing creeks and springs. The 2 km section from Mission Creek to Aniah Creek (Figure 1) had especially low water levels. Water from the release created pools, riffles and islands, and it flooded much of the river bank vegetation, especially clusters of red alder (*Alnus rubra*), making hiking along the river bank difficult in places. This section occurs in the IDFdk2 (Interior Douglas-fir dry cool zone) biogeoclimatic zone (Meidinger and Pojar 1991).

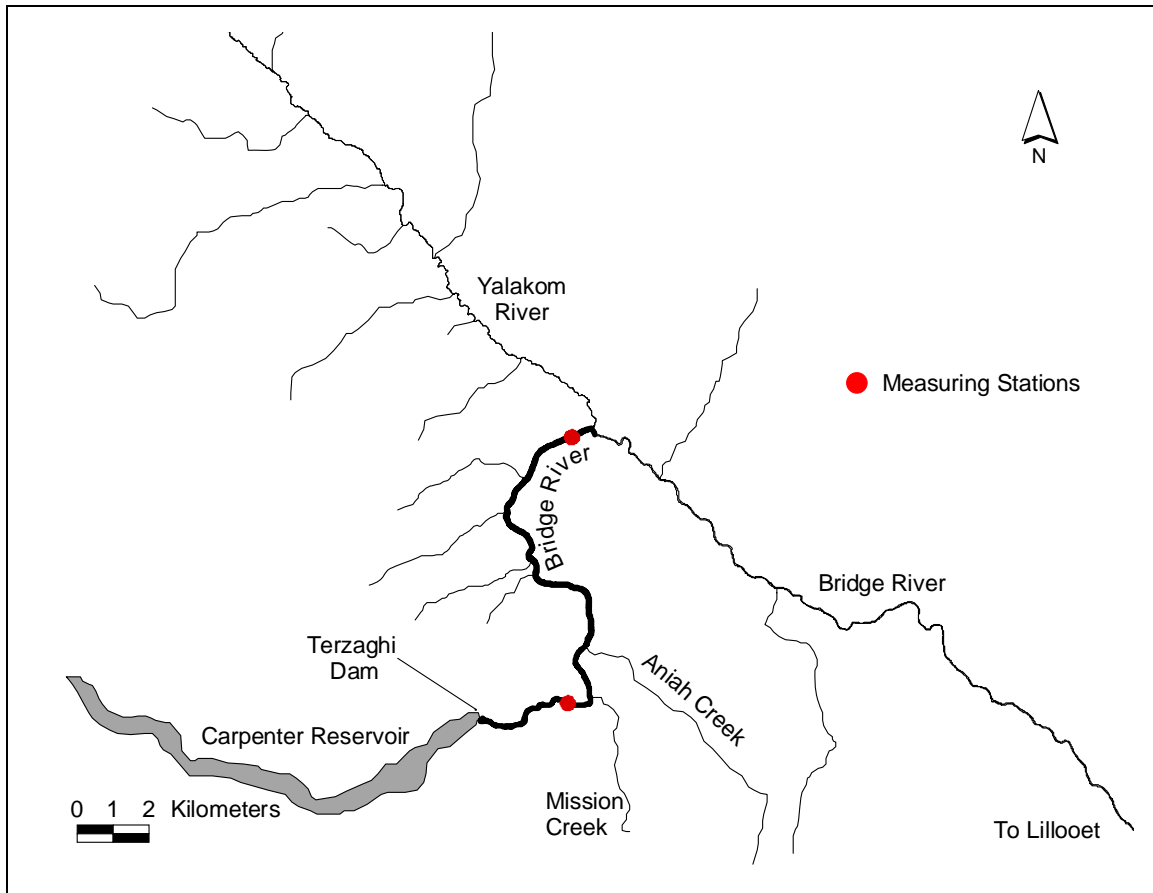


Figure 1 Map of the survey area.

The bold line indicates the 15.9 km survey area from the Yalakom River confluence to the Terzaghi Dam. Faint lines indicate major creeks. Red dots denote locations of the upstream and downstream water measuring stations.

Water conditions pre- and post-release were assessed at two measuring stations: the upstream station at the upstream extent of the pre-release water, and the downstream station above the confluence of the Yalakom River. Water depth is shown in Figure 2. Flows were highly variable prior to the release in August 2000, especially in 1999, a year of higher than normal flows, and in 1997, when a spill occurred (Jeff Sneep, *unpubl. data*). Post-release water depths emulate the general seasonal pattern, but within year variation is minimal. In June, water depths are approximately 3 times greater in the upstream station and 2 times greater in the downstream station than in pre-release conditions.

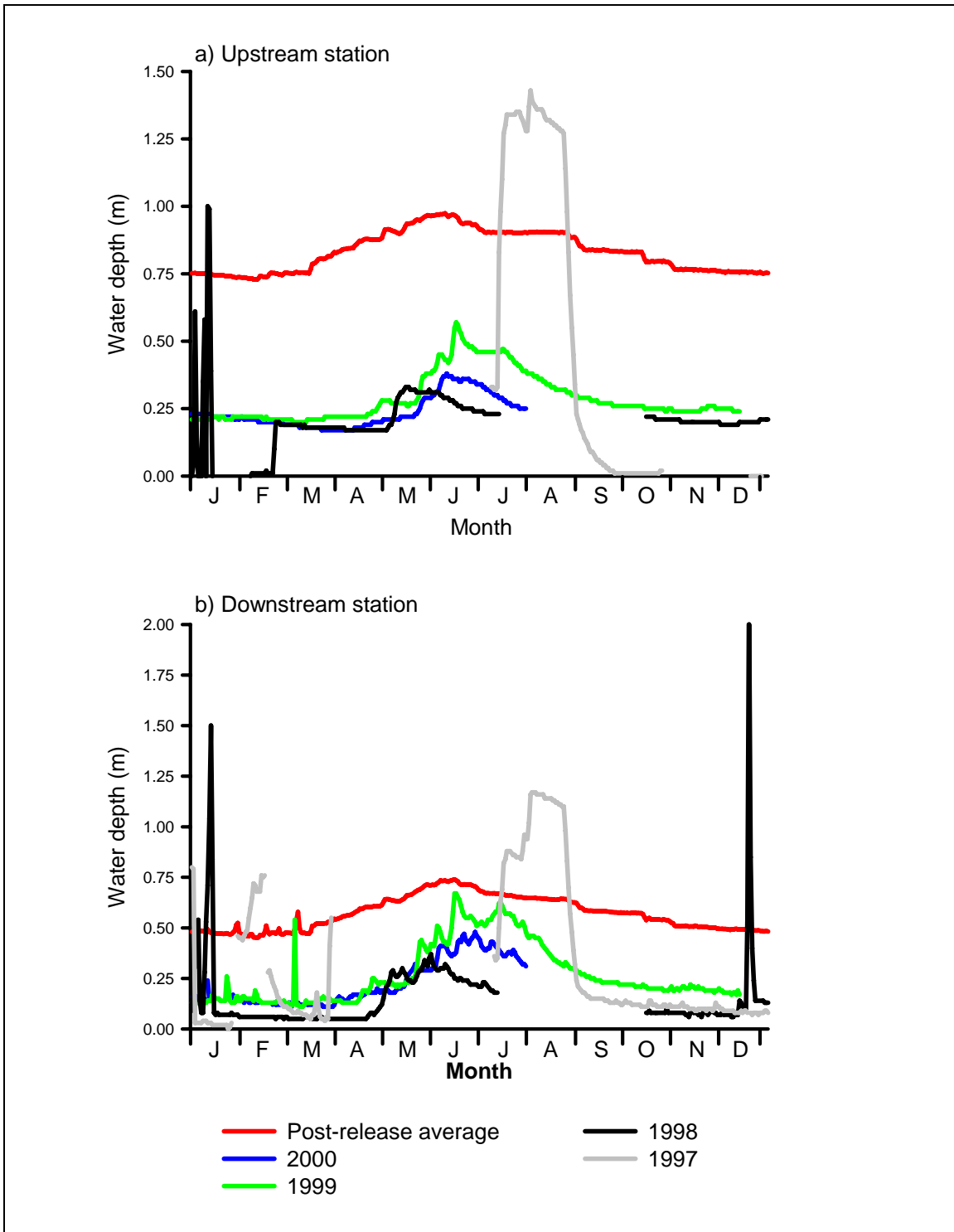


Figure 2 Pre- and post-release water depths at the a) upstream and b) downstream water measuring stations. Refer to Figure 1 for locations of the stations.



3.0 METHODS

Surveys were conducted by two teams of two observers hiking in an upstream direction along the western river bank to maximize bird detections. In 2004, surveys covered the approximately 6 km below Terzaghi Dam; in 2005 and 2006, the survey was extended another 9 km. The first team began at the Yalakom River confluence and the second team began approximately 1.2 km downstream of Aniah Creek. Teams alternated routes among surveys to guard against observer bias. Techniques follow those proposed by the Resources Inventory Standards Committee (RISC 1997). Teams carried binoculars to assist with identification. Visual coverage was complete except for portions of channels on the opposite side of four small islands (approximately 250 m). Bird locations were fixed by GPS (Garmin E-trex, accuracies ranged from $\pm 7\text{m}$ to $\pm 35\text{m}$) and marked on field maps. These were later plotted to correspond with TRIM features. Final bird locations are presented in Appendix 1. (Note that in 2006 we changed our survey lengths to reflect distances hip-chained in the field by fisheries crews. Our previous 1999/2000 distance, measured on a TRIM map, changed from 11.0 to 11.8 km, and our previous dewatered section length increased from 4.0 to 4.1 km.)

We performed 5 surveys in total: 2 breeding pair surveys and 3 brood surveys. Surveys began between 8:00 – 9:00 a.m. and finished by 4:00 p.m. Pair surveys in 2006 were conducted on May 5 and May 23, and brood surveys began on June 28 and were repeated on July 14 and July 27. Documentation of all mammals, birds, and herptiles observed during the surveys are appended to this report (see Appendix 2).

In 1999 and 2000 (Wright and Walton 2001a,b), pair and breeding surveys were conducted on the Bridge River from the Yalakom River confluence to the upstream extent of the watered area, roughly 800 m upstream of Mission Creek. Data from this section were compared directly to the survey results in 2005 and 2006, including the extra 4.1 km of river upstream to Terzaghi Dam surveyed post-release. We included the previously de-watered section in the comparison because we assumed that no riverine birds used this section prior to the release in August 1, 2000 and numbers could safely be interpreted as zeros. Surveys of the de-watered section on July 27 and August 3, 1999 supported this assumption (Ken Wright, *unpubl. data*), although 2-3 Spotted Sandpipers may have been using the de-watered section. Pre-release data were compared from the following ground survey dates: in 1999 (May 4, 18; June 30, July 15) and in 2000 (May 6, 20; June 28, July 15, 29). The third brood survey scheduled for the end of July 1999 was cancelled due to widespread brood failure from the unusually high freshet (Wright and Walton 2001a).

In 2001 and 2002, Ken Wright surveyed the previously dry 4.1 km section from Mission Creek to Terzaghi Dam (Ken Wright, *unpubl. data*), and we repeated this survey in 2004 (Walton and Heinrich 2004). We compared these earlier data to the same 4.1 km stretch surveyed in 2005 and 2006. Only data from similarly dated survey sessions were used.



Benthic invertebrate data were gathered from the central BCRP database (Jeff Sneep, *unpubl. data*). Data were collected at a station by placing three mesh baskets containing small rocks as a substrate on the river bottom for approximately 6 weeks. At the end of this period traps were gathered and any animals using the substrate were collected and identified. We considered the following aquatic invertebrates to be prey for our insectivores and summarised counts at the level of Order: Trichoptera (caddisflies), Ephemeroptera (mayflies), Plecoptera (stoneflies) and Diptera (flies). Five sampling stations overlapped with our survey area at distances of 1.4, 5.4, 8.3, 11.5 and 14.9 km upstream from the Yalakom River confluence (all stations are designated as Reach 3, except for the last station which is considered Reach 4). The two uppermost traps are upstream of Mission Creek. Data were available for these stations from 1996 to 2003 and we used collection time periods that overlapped with our riverine bird surveys (e.g., August and September collections were excluded). Because the length of time traps lay on the river bottom sometimes varied, we standardised the data by dividing the number of invertebrates counted on a trap by the number of days a trap was available as a substrate. We averaged values for the three traps at each station in a year to get a station average, and then we calculated the average pre-release and post-release value for each station.

Fish populations on the Lower Bridge River were sampled using a multi-pass fish removal system (Carle and Strube 1978) in which an area of approximately 100 m² of river is sectioned off with nets and then electro-fished in three passes. At each pass fish were collected and measured. We used summary data from this study (Jeff Sneep, *unpubl. data*) that totalled fish biomass for Coho Salmon (*Oncorhynchus kisutch*), Chinook Salmon (*Oncorhynchus tshawytscha*) and Rainbow Trout/Steelhead (*Oncorhynchus mykiss*). Other species of fish were collected, but these three species contributed the majority of the biomass and we assumed that they provided a reasonable representation of the amount of fish available as prey for riverine birds. To exclude fish considered too large to be used as prey, we arbitrarily removed most fish with fork lengths exceeding 15 cm by excluding any rainbow trout assigned ages of 2+ and 3+ years. By convention, sampling sites were categorized as Reach 3 (Yalakom River confluence upstream to the end of the previously de-watered section above Mission Creek) and Reach 4 (upstream from Reach 3 to the Terzaghi Dam).

We performed a literature review to place the densities of riverine birds observed on the Lower Bridge River in the context of other river systems. Where survey distances were available, we arbitrarily chose 1.5 km as the minimum distance required to obtain a reasonable density estimate. We excluded surveys of shorter distances to avoid having isolated “hot spots” artificially inflating density estimates. We only included data collected during the pair period (spring) or brood period (summer). The density of adult birds was reported during the pair period and the density of all birds (adults plus juveniles) was reported during the brood period. Where more than one survey occurred in a year within a survey period, we used the maximum number of birds recorded for our density measure.



4.0 RESULTS

Table 1 presents the major riverine species observed during the 5 surveys in 2006. Detailed data and location coordinates for each observation are documented in Appendix 1. Other riverine species observed include Bald Eagles (*Haliaeetus leucocephalus*), Ospreys (*Pandion haliaetus*), Barrow's Goldeneye (*Bucephalus islandica*), a Hooded Merganser (*Lophodytes cucullatus*), a Mallard (*Anas platyrhynchos*), a Solitary Sandpiper (*Tringa solitaria*) and Great Blue Herons (*Ardea herodias*).

Numerically, Spotted Sandpipers (*Actitis maculatus*) were the most abundant species, followed by Common Mergansers (*Mergus merganser*). Harlequin Ducks, American Dippers (*Cinclus mexicanus*) and Belted Kingfishers (*Ceryle alcyon*) also used this section during the breeding season. All species except Belted Kingfishers and Harlequin Ducks were observed with young in 2006.

Table 1. Number of individuals of major riverine bird species observed on the 15.9 km survey route from the Yalakom River confluence to Terzaghi Dam in 2006. Values are totals of adults and juveniles combined. Numbers in parentheses indicate the number of juveniles observed.

Survey Type	American Dipper	Harlequin Duck	Spotted Sandpiper	Belted Kingfisher	Common Merganser	Total
<u>Pair</u>						
May 05	3	0	0	1	18	22
May 23	5	1	23	2	21	52
<u>Brood</u>						
June 29	9 (3)	6 (0)	18 (0)	0 (0)	21 (10)	54 (13)
July 14	7 (1)	4 (0)	21 (0)	2 (0)	19 (19)	53 (20)
July 27	4 (2)	8 (0)	18 (2)	3 (0)	14 (14)	47 (18)
Total	28 (6)	19 (0)	80 (2)	8 (0)	93 (43)	228(51)

The response of riverine birds to the release on the 15.9 km section from the Terzaghi Dam to the Yalakom River confluence is presented in Figure 3. The most obvious change in use is by Spotted Sandpipers, whose numbers have doubled since the release. American Dipper numbers, conversely, appeared to have decreased, especially during the pair surveys. No trend was obvious for Belted Kingfishers, although numbers observed during the brood surveys show a decline. The more mobile Common Mergansers and Harlequin Ducks show an increase in numbers during the brood period, but between and within year variation is high.

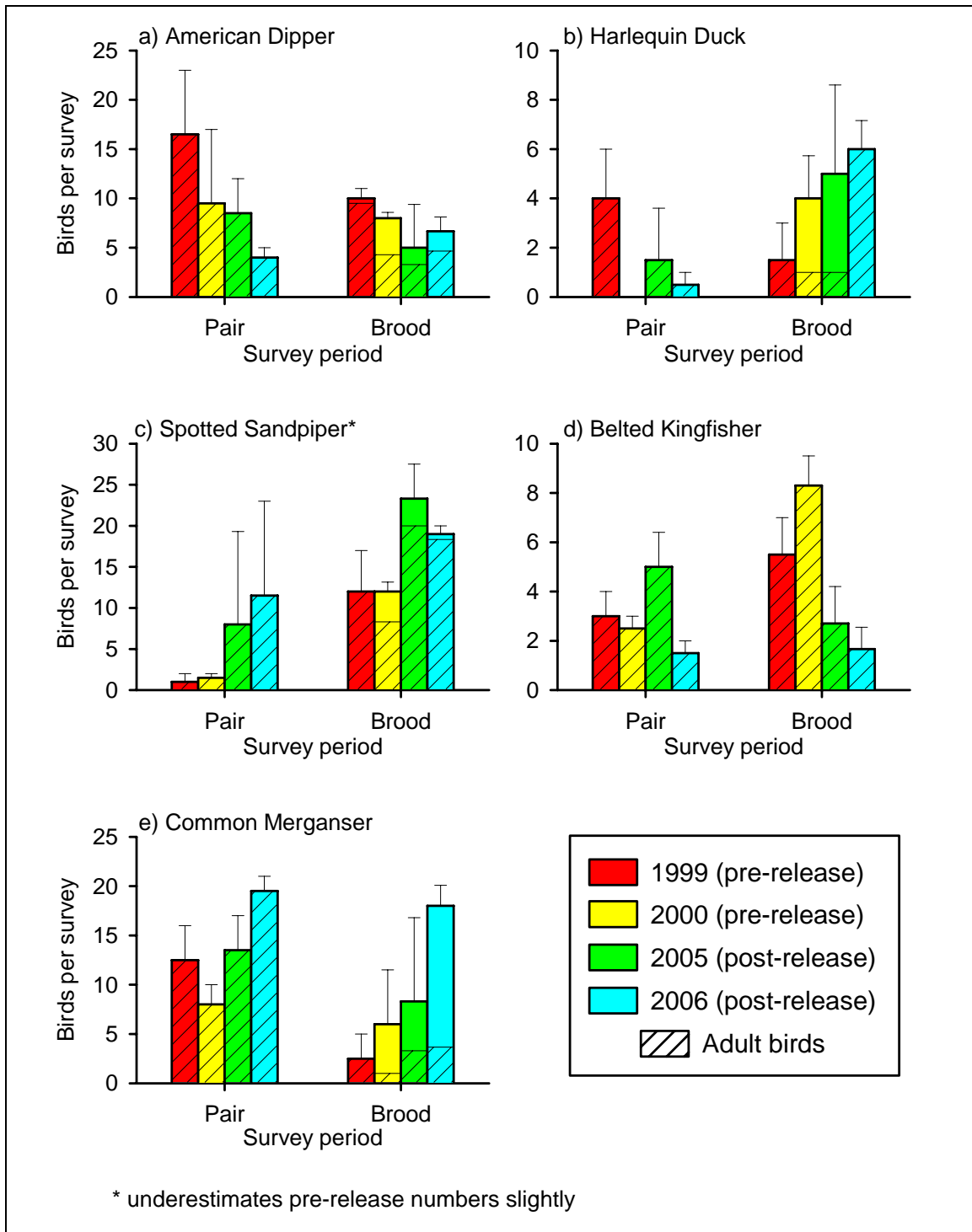


Figure 3 Average number of birds per survey (± 1 SE) 2 years pre-release and 5 and 6 years post-release during the pair and brood periods. Data include observations from the Yalakom River confluence to the Terzaghi Dam (see Methods). Adults and juveniles are included in totals; the average number of adults is indicated by cross-hatching.



Survey results from 2005 and 2006 were compared to previous post-release data for the 4.1 km previously dewatered section (Figure 4). Spotted Sandpiper numbers have generally increased, most dramatically in the brood period. Trends were not as clear for American Dippers, Harlequin Ducks, Belted Kingfishers and Common Mergansers. Potential increases for Harlequin Ducks and Common Mergansers, in particular, could have been masked by high year-to-year variability in juvenile numbers. No Harlequin Duck young were recorded in 2006.

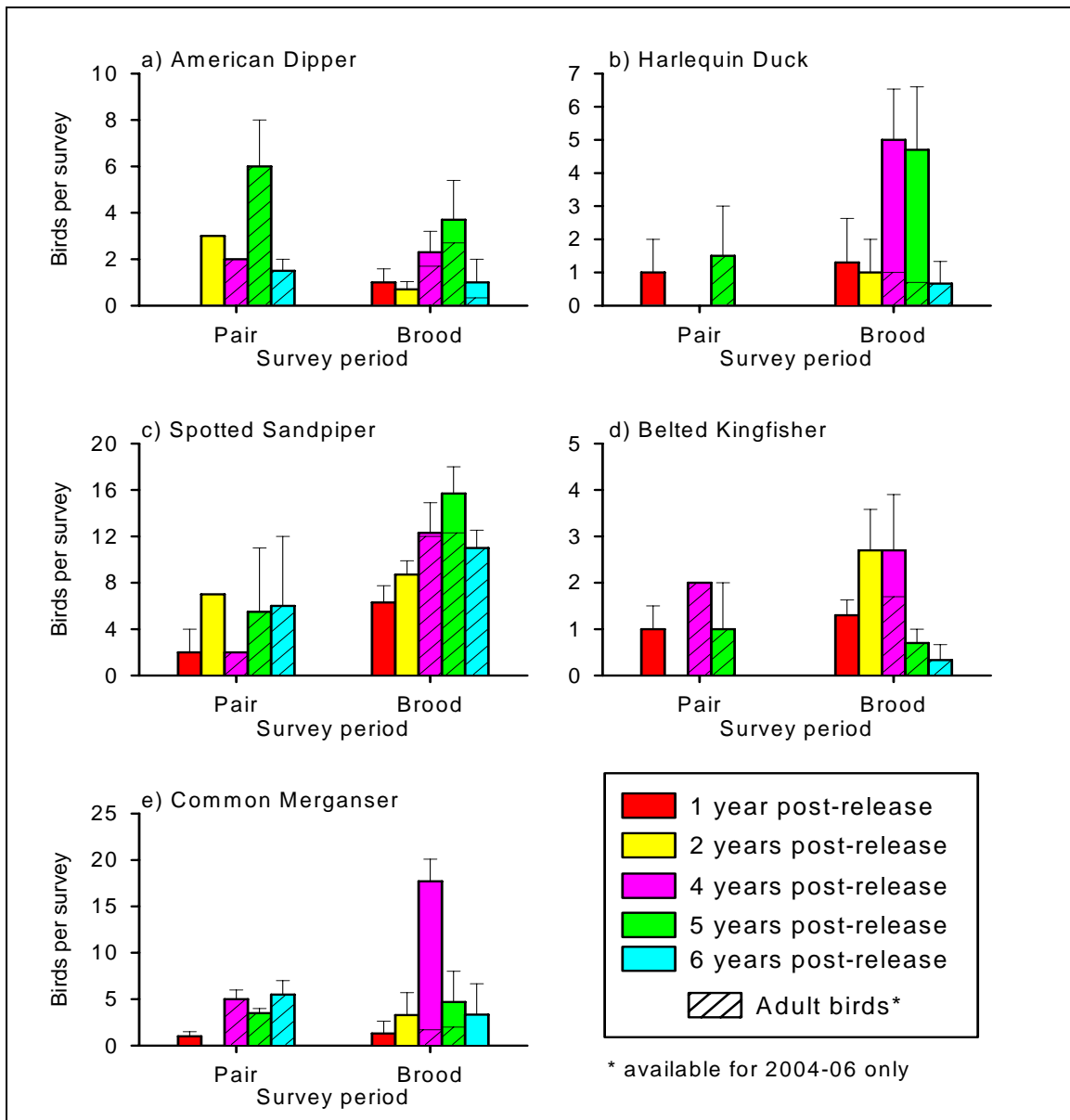


Figure 4 Average number of birds per survey (± 1 SE) upstream of Mission Creek. Adults and juveniles are included in the totals; the average number of adults is indicated by cross-hatching (only available for 2004 to 2006).



Prior to the release, Aniah Creek, located approximately 6 km downstream from Terzaghi Dam, provided a natural break between the low or de-watered sections upstream and the 9.9 km of more substantial river downstream. The effect of the release on the distribution of birds upstream and downstream of Aniah Creek is presented in Figure 5. Dippers and Harlequin Ducks have shifted their use to the upstream section while Spotted Sandpipers generally have increased everywhere, but proportionately more upstream. Belted Kingfishers showed no shift in distribution and Common Mergansers demonstrated no obvious preference.

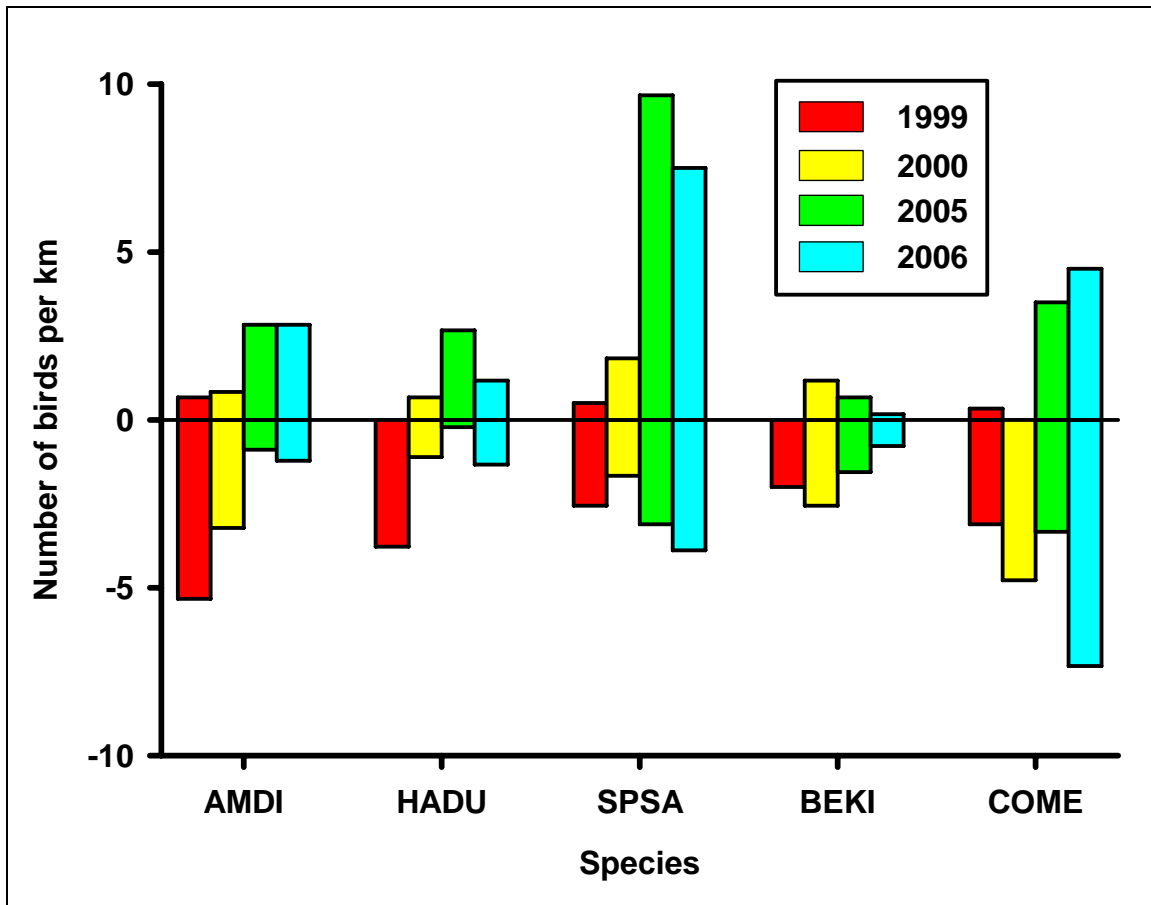


Figure 5 Distribution of riverine birds pre- and post-release.

Values are the total number of birds observed per km on all 5 surveys. Negative values indicate densities of birds recorded in the 9.9 km section downstream of Aniah Creek; positive values indicate densities of birds observed in the 6 km section upstream of Aniah Creek. AMDI = American Dipper; HADU = Harlequin Duck; SPSA = Spotted Sandpiper; BEKI = Belted Kingfisher; COME = Common Merganser.



Figures 6 and 7 present the pre-release and post-release average number of benthic invertebrates collected at increasing distances upstream from the Yalakom River confluence. The most striking aspect of these figures is the amount of inter-year variation present, particularly for Trichoptera and Plecoptera during the brood period (Figures 6b, 6d). No upstream or downstream trends are obvious, except for Plecoptera collected during the brood period, which show an apparent decline in numbers with increasing upstream distance (Figure 6d). Plecoptera also appear to show an overall decline in numbers post-release (Figure 6c,d), while Ephemeroptera show a slight decline post-release only during the pair period (Figure 7). Trichoptera, conversely, generally increased post-release during the brood period (Figure 6b).

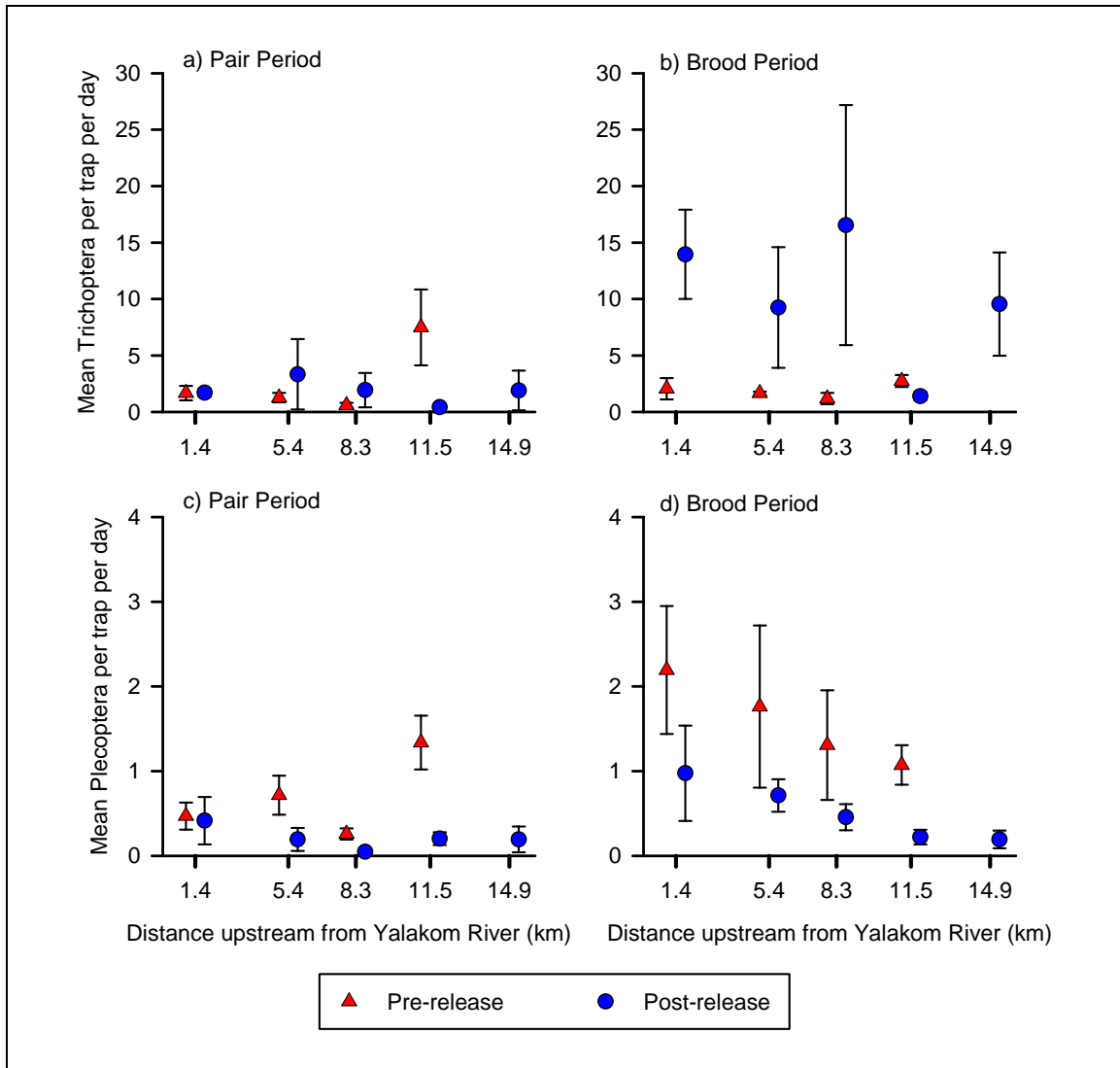


Figure 6 Mean (\pm 1 SE) number of Trichoptera and Plecoptera collected per trap divided by the number of days the substrate was available.

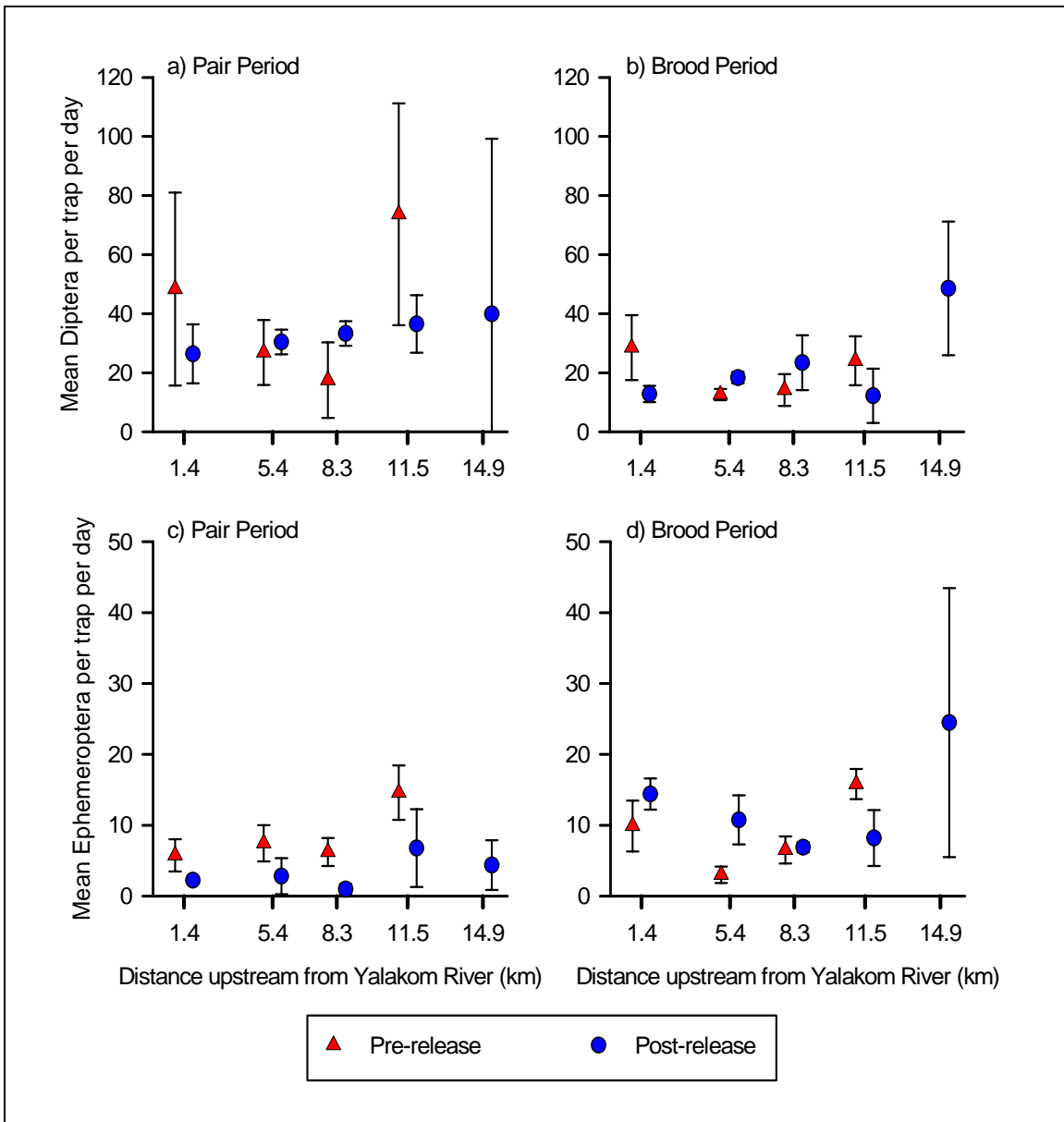


Figure 7 Mean (\pm 1 SE) number of Diptera and Ephemeroptera collected per trap divided by the number of days the substrate was available.

The total mean biomass of young Coho Salmon, Chinook Salmon and Rainbow Trout sampled in Reach 3 and Reach 4 is presented in Figure 8. After the release in 2000, overall mean biomass in the system increased, mostly driven by occupation of the newly created habitat in Reach 4. Biomass density was higher in Reach 4 compared to Reach 3, and biomass density underwent a noticeable decline in Reach 3 after the release.

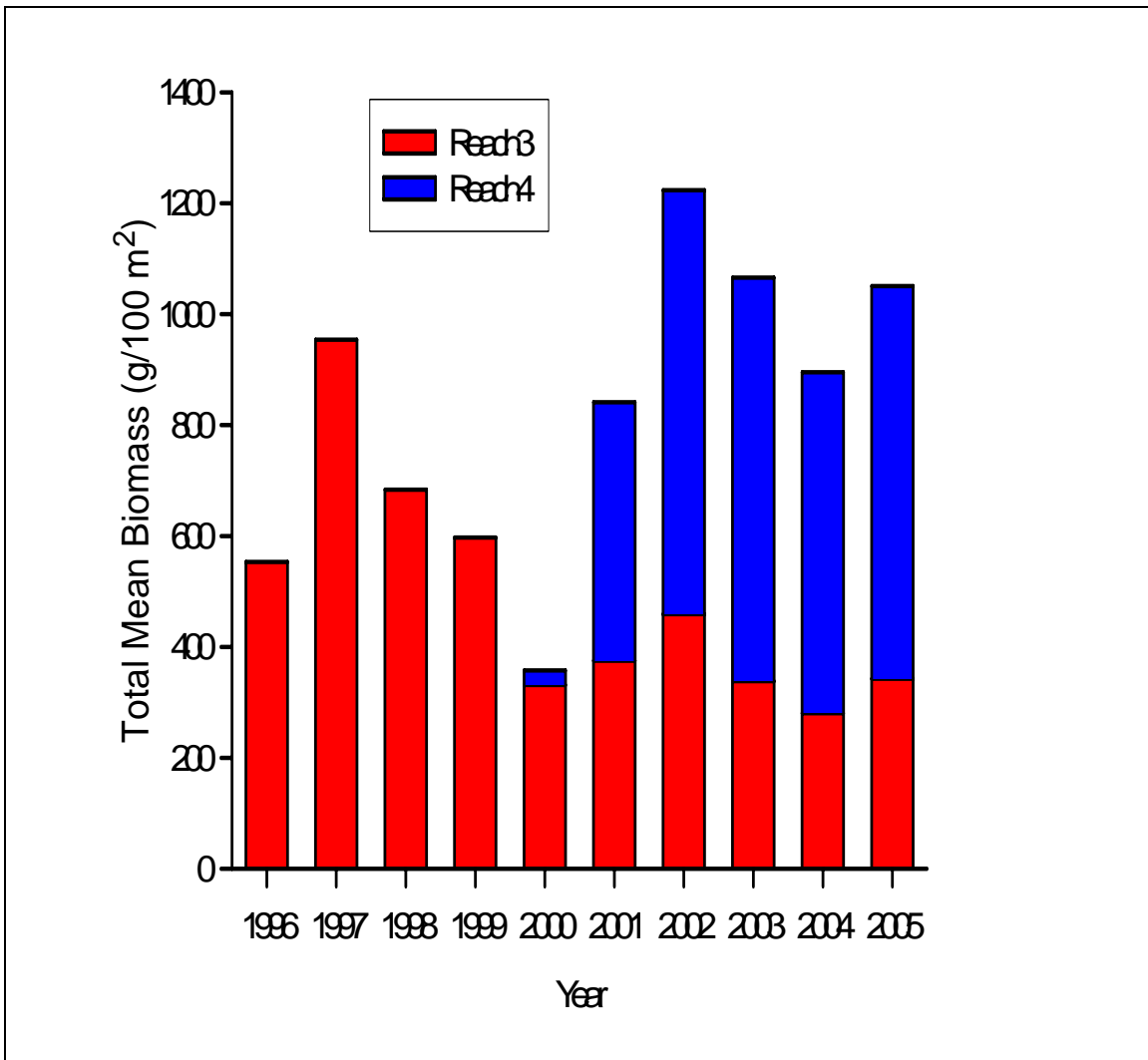


Figure 8 Total mean biomass (g/100 m²) sampled in Reach 3 and Reach 4. Only Coho Salmon (ages 0+ and 1+ yrs), Chinook Salmon (ages 0+ and 1+ yrs) and Rainbow Trout/Steelhead (ages 0+ and 1+ yrs) are included.

A comparison of riverine bird densities on the Lower Bridge River with other river systems is presented in Appendices 3-7. Figure 9 presents a summary of these data. In general, riverine bird densities on the Lower Bridge River are similar to other systems across broad geographic areas. Harlequin Duck densities are comparatively lower on the Bridge River during the pair period, but Spotted Sandpipers and Common Merganser densities are much higher than observed elsewhere during the brood period.

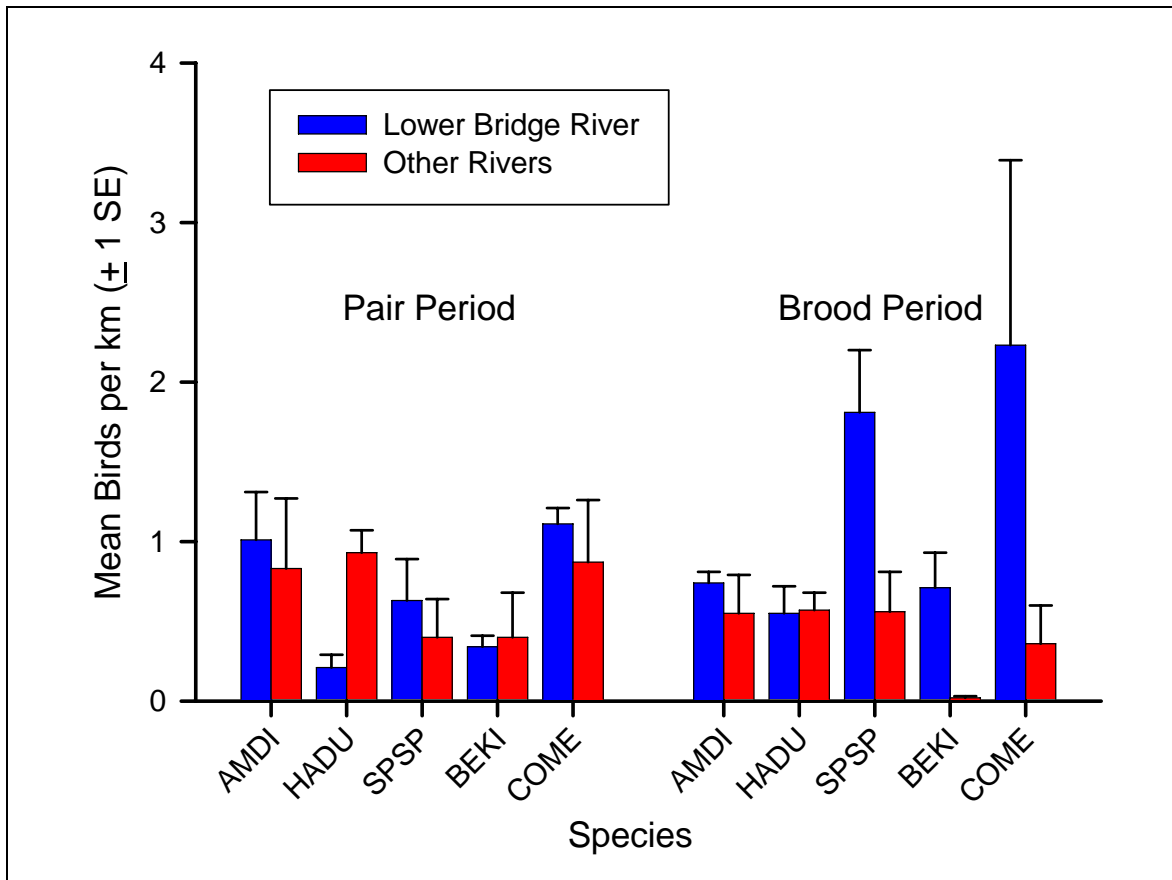


Figure 9 A comparison of the average (± 1 SE) maximum density of riverine birds seen on surveys during the pair and brood periods on the Lower Bridge River and other river systems.

5.0 DISCUSSION

All five major riverine bird species used the 15.9 km section below Terzaghi Dam to the Yalakom River confluence for at least part of their breeding stages. Only one nest (Spotted Sandpiper) was observed during the surveys, but Belted Kingfisher, Spotted Sandpiper and American Dipper nests are difficult to find and there were undoubtedly others present. Previous work (Wright and Goudie 2000; Wright and Walton 2001a) suggested that some Harlequin Ducks nested on the Yalakom River and moved their young to the Bridge River for brood-rearing. Common Mergansers, a cavity-nesting species, probably nested along our survey route where trees with appropriate cavities were available.

The creation of 4.1 km of new river habitat increased the total number of riverine birds observed on the system. Surveys in 1999 and 2000 covered approximately 11.8 km, from the Yalakom River confluence to the upstream extent of the water. Considering only the five most common riverine species, on these surveys a total of 144 birds (1 juvenile) and



131 birds (21 juveniles) were observed in 1999 and in 2000, respectively (note that 1999 totals do not include a third brood survey). After the release, surveys were extended another 4.1 km to the Terzaghi Dam, and we observed a total of 206 birds (42 juveniles) and 177 birds (51 juveniles) in 2005 and 2006, respectively. Much of this increase is due to the increase in Spotted Sandpiper numbers (Figure 3). Surprisingly, Walton and Heinrich (2004) recorded a total of 188 birds (92 juveniles) in the 6 km below Terzaghi Dam in 2004. Part of this disproportionate increase can be explained by high inter-year variability in brood production (especially for Common Mergansers), but there appears to have been a shift in distribution for some species from the downstream section to the previously low or de-watered section below Terzaghi Dam (Figure 5). American Dippers and Harlequin Ducks, in particular, seem to have shifted their use to the upstream river section, particularly for brood rearing.

To attempt to explain this upstream shift in distribution, we examined the relative availability of aquatic invertebrate and small fish prey (Figures 6-8). Dippers and Harlequin Ducks feed mostly on aquatic macroinvertebrates, although they have been observed eating small fish (Kingery 1996; Robertson and Goudie 1999). Common Mergansers are piscivores, but they will also eat larger aquatic invertebrates (Mallory and Metz 1999). Benthic invertebrates did not show a positive relationship with increasing upstream distance (Figures 6 and 7), but fish biomass density was higher in the upstream section and there was some evidence to suggest that fish may have also shifted some of their distribution upstream (Figure 8). The relatively higher fish presence in the upper section does not by itself explain the shift by Dippers and Harlequin Ducks upstream, but it may indicate more productive habitat upstream which could attract the birds. The use of fish biomass as a correlation between bird numbers and distribution is further confounded by the fact that the multi-pass electro-fishing is biased towards capturing fish with swim bladders. Bottom fish such as sculpins (Family Cottidae) do not have a swim bladder and when electro-shocked, simply sink to or remain on the bottom, never being caught and/or sampled. Although these cottids may make up a significant portion of riverine bird diets, they would be severely under-represented in the fish biomass samples. The lack of any relationship of upstream distance with benthic invertebrate numbers was not unexpected because we do not believe five stations are adequate to sample the 15.9 km of river along the survey route. More intensive sampling would be necessary to answer this question conclusively. Of course, food availability may not be the only factor driving the upstream shift of Dippers and Harlequin Ducks: birds may simply prefer the rockier, less vegetated shoreline further upstream where they may detect predators more easily.

Literature values for riverine bird densities proved difficult to collect. Studies often reported the number of birds observed but neglected to include the survey distance clearly or whether tributaries were included in the overall distance. Data for Common Mergansers, Spotted Sandpipers and Belted Kingfishers in particular, species not restricted to rivers, proved to be even scarcer. The comparative lower density of Harlequin Ducks during the pair period in Figure 9 supports the observation that the Bridge River is more of a brood-rearing river than a nesting river for Harlequin Ducks (Wright and Goudie 2000; Wright and Walton 2001a); when the brood period is



considered, the density of Harlequin Ducks on the Bridge River compares favourably with a large geographic area (Appendix 3). Spotted Sandpipers, Belted Kingfishers and Common Mergansers appeared to have much higher densities during the brood period on the Bridge River than on other systems (Figure 9), but these results must be interpreted cautiously due to high inter-year variability in brood production and the paucity of data in the literature for these species on rivers (Appendices 5-7). Most data for these three species comes from the Lillooet area. Overall, the Lower Bridge River appears to be a typical system for riverine birds during the breeding season, with no exceptional densities indicating a unique breeding area.

Spotted Sandpipers have benefited most from the new habitat created by the controlled release (Figures 3-5), doubling their pre-release numbers. Over the 15.9 km section, Harlequin Ducks, Common Mergansers and Belted Kingfishers did not show any obvious increase, although Harlequin Ducks did appear to shift their distribution upstream and Common Merganser numbers were higher in the brood period after the release, perhaps due to an overall increase in fish biomass density in the system (Figure 8). American Dippers, on the other hand, appeared to have declined in numbers since the release (Figure 3). This may reflect a real deterioration in overall Dipper habitat caused by the release but it may also be an artefact of small sample size or of difficulties in detecting Dippers in the more vegetated shoreline after the release.

The numbers of juvenile Spotted Sandpipers, Belted Kingfishers and, to some extent, American Dippers, may have been underestimated in the brood surveys. These birds were often observed very briefly, not allowing enough time for positive age classification. Belted Kingfishers, in particular, were usually observed in flight and their juvenile count will be under-represented.

Comparing absolute numbers of riverine birds among years should be done carefully because broad factors unrelated to the study area can influence breeding success. For example, in 1999 most broods failed due to severe flooding (Wright and Walton 2001a). Again in 2006, Harlequin Ducks failed to raise broods (we observed adult females in groups on the Bridge River at the end of June, suggesting widespread nest failure, possibly from flooding on the Yalakom River). Only with repeated monitoring can the effects of aberrant years be removed and general trends detected.

6.0 RECOMMENDATIONS

Overall, the controlled release has had positive effects on riverine bird breeding habitat in the 6 km most severely affected by dam construction. All five major riverine bird species use this area for at least one stage of their breeding period and evidence suggests that bird use has been increasing each year post-release. The impact is not as clear on the 15.9 km section between the Terzaghi Dam and the Yalakom River confluence. With the exception of Spotted Sandpipers, bird numbers have not changed substantially overall, although Dippers and Harlequin Ducks have shifted their use to the upstream section and Dipper numbers may be declining.



We recommend that surveys should be repeated from the Yalakom River confluence to the Terzaghi Dam **at least every two years**. Ideally, given the relatively small cost and effort, surveys should be repeated annually to allow long-term trends to be discerned from the inherent high year-to-year variation in the system. If the controlled release changes from the current average of 3 m³/s, repeated surveys are essential. Of particular concern is the apparent decline in American Dipper numbers.

7.0 ACKNOWLEDGEMENTS

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8.0 REFERENCES

- Alsop, J.A. III. 2002. Birds of Canada. Dorling Kindersley Limited. Toronto ON. Canada. 687pp.
- Campbell R.W., A.K. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, M.C. Mcnall and G.E. John Smith. 1990a. Birds of British Columbia, Volume 1 of 4, Introduction, Loons through waterfowl. UBC Press with Environment Canada (Canadian Wildlife Service) and British Columbia Ministry of Environment, Lands and Parks. University of British Columbia, Vancouver, BC. 514pp.
- Campbell R.W., A.K. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, M.C. Mcnall and G.E. John Smith. 1990b. Birds of British Columbia, Volume 2 of 4, Non-passerines, Diurnal Birds of Prey Through Woodpeckers. UBC Press with Environment Canada (Canadian Wildlife Service) and British Columbia Ministry of Environment, Lands and Parks. University of British Columbia, Vancouver, BC. 635pp.
- Campbell R.W., A.K. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, M.C. Mcnall and G.E. John Smith. 1997. Birds of British Columbia, Volume 3 of 4, Passerines, Flycatchers Through Vireos. UBC Press with Environment Canada (Canadian Wildlife Service) and British Columbia Ministry of Environment, Lands and Parks. University of British Columbia, Vancouver, BC. 693pp.
- Carle, F. L., and M. R. Strub. 1978. A new method for estimating population size from removal data. *Biometrics* 34: 621-630.
- Cassirer, E. F., and C. R. Groves. 1991. Harlequin duck ecology in Idaho: 1987-1990. Natural Heritage Section, Nongame and Endangered Wildlife Program, Idaho Department of Fish and Game. 93pp.
- Cassirer, E. F., and C. R. Groves. 1990. Distribution, habitat use and status of harlequin ducks (*Histrionicus histrionicus*) in northern Idaho, 1990. Cooperative Challenge Cost Share Project, Clearwater and Idaho Panhandle National Forests and Idaho Department of Fish and Game. 54pp.
- Cassirer E. F. and C.R. Groves. 1989. Breeding Ecology of Harlequin Ducks (*Histrionicus histrionicus*) on the Kaniksu National Forest, Idaho. Idaho Dept. of Fish and Game, Natural Heritage Section, Non-Game and Endangered Wildlife Program. Bureau of Wildlife, Boise, Idaho. 55pp.
- Eder T. and D. Pattie. 2001. Mammals of British Columbia. Lone Pine Publishing. Vancouver, BC. Canada. 296pp.



- Ehrlich P. R., D.S. Dobkin and D. Wheye. 1988. *The Birder's Handbook: A field Guide to the Natural History of North American Birds*. Simon and Schuster Inc. New York New York. 785pp.
- Esler D., R. Ydenberg, J. Bond, and S. LeBourdais. 2005. *Variation in Harlequin Duck Distribution and Productivity: The Roles of Habitat, Competition, and Nutrient Acquisition A Final Report to the BC Hydro Bridge-Coastal Fish and Wildlife Restoration Program (BCRP) for Fiscal Year 2003-04 (Year 2 of a 3-year project)*.
- Esler D., R. Ydenberg, J. Bond, and S. LeBourdais. 2004. *Variation in Harlequin Duck Distribution and Productivity: The Roles of Habitat, Competition, and Nutrient Acquisition A Final Report to the BC Hydro Bridge-Coastal Fish and Wildlife Restoration Program (BCRP) for Fiscal Year 2003-04 (Year 1 of a 3-year project)*.
- Fairman L.M., D.L. Genter, and C. Jones. 1989. *Results of the 1989 Survey for Harlequin Ducks (*Histrionicus histrionicus*) on the Kootenai National Forest and the Flathead National Forest, Montana. Preliminary Report to the USDA Forest Service, Montana. Montana Natural Heritage Program. Helena Montana. 16pp.*
- Gregory, P.T. and R.W. Campbell. 1984. *The Reptiles of British Columbia. British Columbia Provincial Museum Handbook. Victoria, B.C.*
- Hendircks P. and J. D. Reichel. 1998. *Harlequin duck Research and Monitoring in Montana:1997. Report to ASARCO Inc. Troy, Montana. Montana Natural Heritage Program. Helena Montana. 33pp.*
- King D. G., A. Grass and K. Summers. 1973. *Observations of the Dipper in the Skagit Valley of British Columbia. Murrelet 54: Pp16 – 19.*
- Kingery, H. E. 1996. *American Dipper (*Cinclus mexicanus*). In The Birds of North America, No. 229. (A. Poole and F. Gills, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologist's Union, Washington, D.C.*
- Machmer M. 2001. *Salmo River Harlequin Duck Inventory, Monitoring and Brood Habitat Assessment. Report prepared for the Columbia Basin Fish and Wildlife Compensation Program in cooperation with Salmo Stream Keepers Society. Pandion Ecological Research Ltd. Nelson BC. 54pp.*
- Mallory, M. and K. Metz. 1999. *Common Merganser (*Mergus merganser*). In The Birds of North America, No. 229. (A. Poole and F. Gills, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologist's Union, Washington, DC.*
- Meidinger, D. and J. Pojar. 1991. *Ecosystems of British Columbia. B.C. Ministry of Forests, Victoria, B.C. Special Report Series 6:330pp.*



- Paton D. 2000. Harlequin Duck Surveys of the Oldman River Basin in 2000. Alberta Sustainable Resource Development , Fisheries and Wildlife Management Division. Alberta Species at Risk Report No. 20. Edmonton Alberta. 46pp.
- Rescan, 2006. Galore Creek Bird Studies Baseline Report:2004-2005. Rescan Tahltan Environmental Consultants (Proj. #758-2). Nova Gold Inc.
- Resource Inventory Committee. 1997. Measuring components of British Columbia's biodiversity: Riverine Bird Inventory Manual. Wildlife Branch, Victoria, British Columbia.
- Robertson I. 1999. Surveys of Water Associated Birds on the Peace River Downstream of the W.A.C. Bennett Dam. In: British Columbia Birds (McNicholl M. ed.) Vol. 9, 1999. British Columbia Field Ornithologists. Pp 3- 10.
- Robertson, I. and R.I. Goudie. 1999. Harlequin Duck (*Histrionicus histrionicus*). In The Birds of North America, No. 466. (A. Poole and F. Gills, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologist's Union, Washington, D.C.
- Smith C. M. 2001. Harlequin Duck Research in Kananaskis Country in 2000. Alberta Sustainable Resource Development , Fisheries and Wildlife Management Division. Alberta Species at Risk Report No. 15. Edmonton Alberta. 43pp.
- St. John A. 2002. Reptiles of the Northwest. British Columbia to California. Lone Pine Publishing. Vancouver, BC. Canada. 272pp.
- Walton, R. and R. Heinrich. 2004. Monitoring the response of riverine birds on the Bridge River to the Terzaghi Dam flow release: 2004 Report. Report to Bridge Coastal Restoration Program (BC Hydro).
- Walton, R. and R. Heinrich. 2005. Riverine bird response to habitat restoration on the Lower Bridge River: 2005 Report. Report to Bridge Coastal Restoration Program (BC Hydro).
- Wright, K.G. 1998. A Preliminary survey of Harlequin Duck broods and other riverine birds on the Bridge and Yalakom Rivers, British Columbia. Harlequin Conservation Society report to BC Hydro Power Supply Environmental Services, Burnaby, British Columbia.
- Wright, K.G. 2004. Monitoring of Harlequin Ducks and other riverine birds on the Bridge and Seton Rivers: 2001 Report. Report to BC Hydro Power Supply Environmental Services, Burnaby, British Columbia.
- Wright, K.G., and R.I. Goudie. 2000. Harlequin Duck (*Histrionicus histrionicus*) ecology and hydroelectric operations on the Bridge River, British Columbia: 1998 Report.



Harlequin Conservation Society report to BC Hydro Power Supply Environmental Services, Burnaby, British Columbia.

Wright, K.G., and R.A. Walton. 2001a. Habitat use, nesting ecology and distribution of Harlequin Ducks on the Bridge River System, British Columbia: 1999 Report. Harlequin Conservation Society Report to BC Hydro.

Wright, K.G., and R.A. Walton. 2001b. Harlequin Duck distribution, abundance and nesting on the Bridge and Seton River Systems, British Columbia: 2000 Report. Harlequin Conservation Society Report to BC Hydro.

**APPENDIX 1****Appendix 1 Detailed riverine bird observations from the 2006 survey.**

Coordinates are UTM Zone 10, NAD 83. Species codes: AMDI = American Dipper; BAEA = Bald Eagle; BAGO = Barrow's Goldeneye; BEKI = Belted Kingfisher; COME = Common Merganser; GBHE = Great Blue Heron; HADU = Harlequin Duck; MALL = Mallard; OSPR = Osprey; SOSA = Solitary Sandpiper; SPSA = Spotted Sandpiper.

Date	Survey	Species	M	F	Unknown Sex	Adult Group Size	Brood Size	Easting	Northing
5-May-06	1st Pair	COME	1	1	0	2	0	558218	5629169
5-May-06	1st Pair	COME	1	0	0	1	0	557854	5626917
5-May-06	1st Pair	COME	1	1	0	2	0	557410	5627061
5-May-06	1st Pair	AMDI	0	0	1	1	0	557005	5626927
5-May-06	1st Pair	SOSA	0	0	1	1	0	555850	5626289
5-May-06	1st Pair	COME	0	1	0	1	0	555034	5626474
5-May-06	1st Pair	BAGO	1	3	0	4	0	558087	5634946
5-May-06	1st Pair	COME	1	5	0	6	0	558062	5634939
5-May-06	1st Pair	COME	0	1	0	1	0	557559	5634697
5-May-06	1st Pair	COME	0	1	0	1	0	556383	5633567
5-May-06	1st Pair	COME	1	1	0	2	0	555839	5632787
5-May-06	1st Pair	AMDI	0	0	1	1	0	555738	5632396
5-May-06	1st Pair	COME	1	1	0	2	0	555789	5632277
5-May-06	1st Pair	AMDI	0	1	0	1	0	556466	5631429
5-May-06	1st Pair	BEKI	0	0	1	1	0	556466	5631429
23-May-06	2nd Pair	SPSA	0	0	2	2	0	558212	5634968
23-May-06	2nd Pair	COME	0	2	0	2	0	558237	5634977
23-May-06	2nd Pair	COME	1	3	0	4	0	558161	5634962
23-May-06	2nd Pair	MALL	1	1	0	2	0	558111	5634953
23-May-06	2nd Pair	COME	3	2	0	5	0	558046	5634929
23-May-06	2nd Pair	BEKI	0	0	1	1	0	556501	5633868
23-May-06	2nd Pair	SPSA	0	0	1	1	0	556017	5633182
23-May-06	2nd Pair	SPSA	0	0	1	1	0	555980	5633089
23-May-06	2nd Pair	BEKI	0	0	1	1	0	555855	5632808
23-May-06	2nd Pair	SPSA	0	0	1	1	0	555760	5632516
23-May-06	2nd Pair	COME	0	1	0	1	0	556447	5631644
23-May-06	2nd Pair	SPSA	0	0	2	2	0	556451	5631637
23-May-06	2nd Pair	SPSA	0	0	1	1	0	556621	5630617
23-May-06	2nd Pair	HADU	0	1	0	1	0	557214	5630438
23-May-06	2nd Pair	SPSA	0	0	1	1	0	556870	5630470
23-May-06	2nd Pair	SPSA	0	0	2	2	0	558125	5630062
23-May-06	2nd Pair	BAEA	0	0	1	1	0	555436	5626331
23-May-06	2nd Pair	OSPR	0	0	1	1	0	555436	5626331
23-May-06	2nd Pair	SPSA	0	0	1	1	0	555193	5626454



Date	Survey	Species	M	F	Unknown Sex	Adult Group Size	Brood Size	Easting	Northing
23-May-06	2nd Pair	AMDI	0	0	1	1	0	555190	5626451
23-May-06	2nd Pair	AMDI	0	0	1	1	0	558122	5628847
23-May-06	2nd Pair	AMDI	1	1	0	2	0	557996	5628599
23-May-06	2nd Pair	BAEA	0	0	2	2	0	557939	5628555
23-May-06	2nd Pair	COME	1	1	0	2	0	557867	5628482
23-May-06	2nd Pair	BAEA	0	0	2	2	0	558149	5627422
23-May-06	2nd Pair	AMDI	0	0	1	1	0	557793	5626905
23-May-06	2nd Pair	SPSA	1	1	0	2	0	557300	5627081
23-May-06	2nd Pair	COME	0	1	0	1	0	557091	5627039
23-May-06	2nd Pair	COME	1	0	0	1	0	556724	5626923
23-May-06	2nd Pair	SPSA	0	0	3	3	0	556724	5626923
23-May-06	2nd Pair	COME	0	1	0	1	0	556517	5626833
23-May-06	2nd Pair	SPSA	0	0	2	2	0	556517	5626833
23-May-06	2nd Pair	SPSA	0	0	2	2	0	556157	5626368
23-May-06	2nd Pair	SPSA	0	0	2	2	0	555931	5626309
23-May-06	2nd Pair	COME	1	3	0	4	0	555808	5626287
29-Jun-06	1st Brood	COME	0	1	0	1	0	558152	5629571
29-Jun-06	1st Brood	OSPR	0	0	1	1	0	558205	5629381
29-Jun-06	1st Brood	COME	0	1	0	1	0	558207	5629299
29-Jun-06	1st Brood	AMDI	0	0	3	2	1	557944	5628558
29-Jun-06	1st Brood	HADU	0	1	0	1	0	558008	5627774
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	558181	5627134
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	557096	5627050
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	557012	5626929
29-Jun-06	1st Brood	HADU	0	2	0	2	0	556941	5626912
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	556720	5626920
29-Jun-06	1st Brood	AMDI	0	0	2	0	2	556589	5626828
29-Jun-06	1st Brood	SPSA	0	0	3	3	0	556589	5626828
29-Jun-06	1st Brood	AMDI	0	0	1	1	0	555989	5626333
29-Jun-06	1st Brood	SPSA	0	0	2	2	0	555970	5626324
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	558228	5634959
29-Jun-06	1st Brood	COME	0	1	0	1	0	558136	5634959
29-Jun-06	1st Brood	COME	0	1	3	1	3	558070	5634940
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	558022	5634925
29-Jun-06	1st Brood	COME	0	2	0	2	0	557456	5634663
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	557440	5634656
29-Jun-06	1st Brood	COME	0	1	0	1	0	557246	5634580
29-Jun-06	1st Brood	HADU	0	3	0	3	0	556093	5633259
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	555972	5633059
29-Jun-06	1st Brood	AMDI	0	0	1	1	0	555938	5632936
29-Jun-06	1st Brood	AMDI	0	0	2	2	0	555766	5632531
29-Jun-06	1st Brood	COME	0	1	0	1	0	555766	5632531
29-Jun-06	1st Brood	COME	0	1	7	1	7	555890	5632122



Date	Survey	Species	M	F	Unknown Sex	Adult Group Size	Brood Size	Easting	Northing
29-Jun-06	1st Brood	COME	0	1	0	1	0	555918	5632112
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	556174	5631970
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	556482	5631503
29-Jun-06	1st Brood	COME	0	1	0	1	0	556986	5630461
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	555467	5626324
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	555423	5626334
29-Jun-06	1st Brood	SPSA	0	0	1	1	0	555306	5626397
14-Jul-06	2nd Brood	SPSA	0	0	1	1	0	558221	5634960
14-Jul-06	2nd Brood	BEKI	0	0	1	1	0	558172	5634964
14-Jul-06	2nd Brood	AMDI	0	0	1	1	0	558153	5634962
14-Jul-06	2nd Brood	SPSA	0	0	1	1	0	557782	5634808
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	557605	5634709
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	555972	5633031
14-Jul-06	2nd Brood	AMDI	0	0	1	1	0	555869	5632817
14-Jul-06	2nd Brood	SPSA	0	0	1	1	0	555767	5632527
14-Jul-06	2nd Brood	AMDI	0	0	1	1	0	555744	5632375
14-Jul-06	2nd Brood	SPSA	0	0	1	1	0	556481	5631508
14-Jul-06	2nd Brood	BEKI	0	0	1	1	0	556427	5631214
14-Jul-06	2nd Brood	AMDI	0	0	1	0	1	556445	5631196
14-Jul-06	2nd Brood	OSPR	0	0	1	1	0	557370	5630437
14-Jul-06	2nd Brood	COME	0	0	19	0	19	558153	5629554
14-Jul-06	2nd Brood	HADU	0	3	0	3	0	558153	5629554
14-Jul-06	2nd Brood	AMDI	0	0	1	1	0	558204	5629264
14-Jul-06	2nd Brood	AMDI	0	0	2	2	0	557999	5628602
14-Jul-06	2nd Brood	HADU	0	1	0	1	0	557768	5628304
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	557270	5627083
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	556982	5626915
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	556705	5626908
14-Jul-06	2nd Brood	SPSA	0	0	1	1	0	556463	5626809
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	556276	5626527
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	556135	5626363
14-Jul-06	2nd Brood	HOME	0	1	0	1	0	555831	5626297
14-Jul-06	2nd Brood	SPSA	0	0	2	2	0	555161	5626463
27-Jul-06	3rd Brood	SPSA	0	0	1	1	0	558139	5629733
27-Jul-06	3rd Brood	AMDI	0	0	1	0	1	558013	5628614
27-Jul-06	3rd Brood	COME	0	0	4	0	4	557938	5628554
27-Jul-06	3rd Brood	AMDI	0	0	1	1	0	557977	5628582
27-Jul-06	3rd Brood	AMDI	0	0	1	0	1	557935	5628551
27-Jul-06	3rd Brood	HADU	0	3	0	3	0	558033	5627719
27-Jul-06	3rd Brood	AMDI	0	0	1	1	0	558033	5627719
27-Jul-06	3rd Brood	OSPR	0	0	1	1	0	558180	5627139
27-Jul-06	3rd Brood	SPSA	0	0	1	1	0	558182	5627133
27-Jul-06	3rd Brood	SPSA	0	0	2	2	0	558190	5627051



Date	Survey	Species	M	F	Unknown Sex	Adult Group Size	Brood Size	Easting	Northing
27-Jul-06	3rd Brood	COME	0	0	10	0	10	557822	5626907
27-Jul-06	3rd Brood	BEKI	0	0	1	1	0	557822	5626907
27-Jul-06	3rd Brood	GBHE	0	0	1	1	0	557740	5626905
27-Jul-06	3rd Brood	SPSA	0	0	2	2	0	556948	5626911
27-Jul-06	3rd Brood	SPSA	0	0	1	1	0	556693	5626855
27-Jul-06	3rd Brood	SPSA	0	0	1	1	0	555889	5626296
27-Jul-06	3rd Brood	GBHE	0	0	1	1	0	555165	5626463
27-Jul-06	3rd Brood	SPSA	0	0	1	1	0	555154	5626465
27-Jul-06	3rd Brood	SPSA	0	0	2	2	0	558093	5634945
27-Jul-06	3rd Brood	SPSA	0	0	1	0	1	557727	5634759
27-Jul-06	3rd Brood	SPSA	0	0	2	2	0	557379	5634633
27-Jul-06	3rd Brood	GBHE	0	0	1	1	0	556836	5634395



APPENDIX 2

Appendix 2 List of wildlife species encountered during the Riverine Bird Surveys conducted between May 5th and July 27th, 2006.

Mammals (Eder and Pattie 2001)

Common Name	Latin Name	Provincial List	COSEWIC ¹	Identified Wildlife	Bridge R. Status
Black Bear	<i>Ursus americanus</i>	Yellow	NAR	No	Resident
Mule Deer	<i>Odocoileus hemionus</i>	Yellow	N/A	No	Resident
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	Yellow	N/A	No	Resident
Yellow Pine Chipmunk	<i>Tamias amoenus</i>	Yellow	N/A	No	Resident
American Beaver	<i>Castor canadensis</i>	Yellow	N/A	No	Resident

Birds (Alsop 2002, Campbell *et al* 1997a, 1997b and 1997c, and Ehrlich *et al* 1988)

Common Name	Latin Name	Provincia l List	COSEWIC ¹	Identified Wildlife	Bridge R. Status
Great Blue Heron	<i>Ardea herodias</i>	Blue	SC	No	Breeding Migrant
Harlequin Duck	<i>Histrionicus histrionicus</i>	Yellow	N/A	No	Breeding Migrant
Ring-necked Duck	<i>Aythya collaris</i>	Yellow	N/A	No	Breeding Migrant
Hooded Merganser	<i>Lophodytes cucullatus</i>		N/A	N/A	Breeding Migrant
Common Merganser	<i>Mergus merganser</i>	Yellow	N/A	No	Resident
Hawks, Eagles and Ospreys (Acipitridae)					
Osprey	<i>Pandion haliaetus</i>	Yellow	NAR	No	Breeding Migrant
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Yellow	NAR	No	Resident
Golden Eagle	<i>Aquila chrysaetos</i>	Yellow	NAR	No	Resident
Red-Tailed Hawk	<i>Buteo jamaicensis</i>	Yellow	NAR	No	Resident
Falcons (Falconidae)					
American Kestrel	<i>Falco sparverius</i>	Yellow	N/A	No	Breeding Migrant
Merlin	<i>Falco columbarius</i>	Yellow	NAR	No	Breeding Migrant
Grouse, partridges and pheasants (Phasianidae)					
Ruffed Grouse	<i>Bonansa umbellus</i>	Yellow	N/A	No	Resident
Sandpipers and Phalaropes (Scolopacidae)					
Spotted Sandpiper	<i>Actitis Macularia</i>	Yellow	N/A	No	Breeding Migrant
Hummingbirds (Trochilidae)					
Rufous Hummingbird	<i>Selasphorus rufus</i>	Yellow	N/A	No	Breeding Migrant



Common Name	Latin Name	Provincia l List	COSEWIC 1	Identified Wildlife	Bridge R. Status
Kingfishers (Alcedinidae)					
Belted Kingfisher	<i>Ceryle alcyon</i>	Yellow	N/A	No	Resident
Woodpeckers (Picidae)					
Northern Flicker	<i>Colpates auratus</i>	Yellow	N/A	No	Resident
Flycatchers (Tyranidae)					
Dusky Fly Catcher	<i>Empidonax oberholseri</i>	Yellow	N/A	No	Breeding Migrant
Pacific Slope Flycatcher	<i>Empidonax difficilis</i>	Yellow	N/A	No	Breeding Migrant
Vireos (Vireonidae)					
Red Eyed Vireo	<i>Vireo olivaceus</i>	Yellow	N/A	No	Breeding Migrant
Warbling Vireo	<i>Vireo gilvus</i>	Yellow	N/A	No	Breeding Migrant
Jays, Crows and Ravens (Corvidae)					
Clark's Nutcracker	<i>Nucifraga columbiana</i>	Yellow	N/A	No	Resident
Black-billed Magpie	<i>Pica hudsonia</i>	Yellow	N/A	No	Resident
American Crow	<i>Corvus brachyrhynchos</i>	Yellow	N/A	No	Resident
Common Raven	<i>Corvus corax</i>	Yellow	N/A	No	Resident
Swallows (Hirundinidae)					
Tree Swallow	<i>Tachycineta bicolor</i>	Yellow	N/A	No	Breeding Migrant
Violet Green Swallow	<i>Tachycineta thalassina</i>	Yellow	N/A	No	Breeding Migrant
Northern Rough- Winged Swallow	<i>Stelgidopteryx serripensis</i>	Yellow	N/A	No	Breeding Migrant
Chickadees (Paridae)					
Black-Capped Chickadee	<i>Poecile atricapilla</i>	Yellow	N/A	No	Resident
Mountain Chickadee	<i>Poecile gambeli</i>	Yellow	N/A	No	Resident
Nuthatches (Sittidae)					
Red Breasted Nuthatch	<i>Sitta canadensis</i>	Yellow	N/A	No	Resident
Wrens (Troglodytidae)		Yellow	N/A	No	
Winter Wren	<i>Troglodytes troglodytes</i>	Yellow	N/A	No	Resident
Dippers (Cinclidae)					
American Dipper	<i>Cinclus mexicanus</i>	Yellow	N/A	No	Resident
Bluebirds, Solitaires and Thrushes (Turdidae)					
Townsend's Solitaire	<i>Myadestes townsendi</i>	Yellow	N/A	No	Breeding Migrant
Swainson's Thrush	<i>Catharus ustulatus</i>	Yellow	N/A	No	Breeding Migrant



Common Name	Latin Name	Provincia l List	COSEWIC 1	Identified Wildlife	Bridge R. Status
American Robin	<i>Turdus migratorius</i>	Yellow	N/A	No	Breeding Migrant
Wagtails and Pipits (Motacillidae)					
American Pipit	<i>Anthus rubescens</i>	Yellow	N/A	No	Migrant
Waxwings (Bombycillidae)					
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Yellow	N/A	No	Breeding Migrant
Wood-Warblers (Parulidae)					
Nashville Warbler	<i>Vermivora ruficapilla</i>	Yellow	N/A	No	Breeding Migrant
Yellow Warbler	<i>Dendroica petechia</i>	Yellow	N/A	No	Breeding Migrant
Yellow-Rumped Warbler	<i>Dendroica coronata</i>	Yellow	N/A	No	Breeding Migrant
Townsend's Warbler	<i>Dendroica townsendi</i>	Yellow	N/A	No	Breeding Migrant
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	Yellow	N/A	No	Breeding Migrant
Wilson's Warbler	<i>Wilsonia pusilla</i>	Yellow	N/A	No	Breeding Migrant
Tanagers (Thraupidae)					
Western Tanager	<i>Piranga ludoviciana</i>	Yellow	N/A	No	Common Breeding Migrant
Tohees, Sparrows and Buntings (Emberizidae)					
Song Sparrow	<i>Melospiza melodia</i>	Yellow	N/A	No	Common Breeding Migrant
Dark-Eyed Junco (Oregon Race)	<i>Junco hyemalis</i>	Yellow	N/A	No	Common Breeding Migrant

Reptiles (St John 2002 and Gregory and Campbell 1984)

Common Name	Latin Name	Provincial List	COSEWIC 1	Identified Wildlife	Bridge R. Status
Northern Alligator Lizard (Northwestern)	<i>Elgaria coerulea principis</i>	Yellow	NAR	No	Common Resident
Common Garter Snake (Valley Garter Snake)	<i>Thamnophis sirtalis fitchi</i>	Yellow	N/A	No	Common Resident
Western Terrestrial Garter Snake (Wandering Garter snake)	<i>Thamnophis elegans vagrans</i>	Yellow	N/A	No	Common Resident



Sources for Provincial and Federal rankings:

- <http://srmwww.gov.bc.ca/atrisk/> provincial endangered species tracking database;
- http://www.cosewic.gc.ca/eng/sct5/index_e.cfm Committee on the Status of Endangered Wildlife In Canada (COSEWIC); and
- Province of BC. 1999. Identified Wildlife Management Strategy: Species at Risk and the Forest Practices Code. Ministry of Forests and Ministry of Water, Land and Air Protection. 180pp. Also see: <http://wlapwww.gov.bc.ca/wld/identified/>



Appendix 3 Harlequin Duck densities from other river systems. Text in italics indicate data used in this report.

Location	Survey Year(s)	Total Km Surveyed	# Adult Birds/km (Pair Period)	# Birds/km (Brood Period)	Source
BRITISH COLUMBIA					
<i>Lower Bridge River</i>	<i>2006</i>	<i>15.9</i>	<i>0.06</i>	<i>0.50</i>	<i>Present study</i>
<i>Lower Bridge River</i>	<i>2005</i>	<i>15.9</i>	<i>0.19</i>	<i>0.51</i>	<i>Walton and Heinrich (2005)</i>
<i>Lower Bridge River</i>	<i>2004</i>	<i>6.0</i>	<i>0.33</i>	<i>1.33</i>	<i>Walton and Heinrich (2004)</i>
Lower Bridge River	2004	5.0	0.40	---	Esler <i>et al</i> (2005)
Lower Bridge River	2003	5.0	0	0.20	Esler <i>et al</i> (2004 and 2005)
<i>Lower Bridge River</i>	<i>2000</i>	<i>11.8</i>	<i>0</i>	<i>0.51</i>	<i>Wright and Walton (2001b)¹</i>
<i>Lower Bridge River</i>	<i>1999</i>	<i>11.8</i>	<i>0.51</i>	<i>0.25</i>	<i>Wright and Walton (2001a)¹</i>
Yalakom River	2003	5.28	0.95	0.00	Esler <i>et al</i> (2005)
Yalakom River	2000	17.5	0.74	0.00	Wright and Walton (2001b)
Yalakom River	1999	17.5	0.74	0.29	Wright and Walton (2001a)
Seton Area, Lillooet, BC	2000	10.5	1.24	0.95	Wright and Walton (2001b)
Seton River	2004	4.22	3.33	---	Esler <i>et al</i> (2005)
Seton River	2003	4.22	1.90	0.00	Esler <i>et al</i> (2005)
Cayoosh Creek	2004	5.0	0	---	Esler <i>et al</i> (2005)
Cayoosh Creek	2003	5.24	1.15	0.19	Esler <i>et al</i> 2004 and (2005)
Ryan River	2004	5.1	0.39	---	Esler <i>et al</i> (2005)
Ryan River	2003	5.07	2.85	0.00	Esler <i>et al</i> (2004 and 2005)
Cheakamus River	2004	5.0	2.80	---	Esler <i>et al</i> (2005)
Cheakamus River (lower)	2003	5.27	1.90	0.76	Esler <i>et al</i> (2004 and 2005)
Salmo River & tributaries	2000	69.0	0.65	0.72	Machmer (2001)
Scottsimpson Creek	2005	2.2	1.8	---	Rescan (2006)
Rutherford Creek	2004	6.1	0.49	---	Esler <i>et al</i> (2005)
Birkenhead River	2003	5.25	0.38	0.00	Esler <i>et al</i> (2004 and 2005)
Vancouver Island (Coastal)	1980/81	50.0	1.5	---	Canadian Wildlife Service ²
ALBERTA					
Elbow River, AB	2000	10.0	0.60	0.39	Smith (2001)
Kananaskis River, AB	2000	12.0	0.42	1.33	Smith (2001)
Sheep River, AB	2000	5.7	---	1.40	Smith (2001)
Oldman River, AB	2000	17.4	1.55	1.32	Paton (2000)
Livingstone River, AB	2000	15.4	0.45	0.17	Paton (2000)
Racehorse Creek, AB	2000	2.0	1.00	0	Paton (2000)
Castle River, AB	2000	5.2	0.19	0	Paton (2000)
MONTANA					
Marten Creek	1989	9.3	0	1.51	Fairman <i>et al</i> (1989)
Swamp Creek	1989	6.0	---	2.0	Fairman <i>et al</i> (1989)
Vermilion River	1989	17.8	---	0.62	Fairman <i>et al</i> (1989)
Trout Creek	1989	18.8	---	0.56	Fairman <i>et al</i> (1989)
Graves Creek	1989	9.7	0.62	---	Fairman <i>et al</i> (1989)
Wounded Buck Creek	1989	4.5	---	0.89	Fairman <i>et al</i> (1989)



Location	Survey Year(s)	Total Km Surveyed	# Adult Birds/km (Pair Period)	# Birds/km (Brood Period)	Source
Glacier National Park, Flathead, Kootenai and Lolo National Forests (10 streams)	1997	73.5	0.79	---	Hendricks and Reichel (1998)
Glacier National Park, Flathead, Kootenai and Lolo National Forests (14 streams)	1997	114	---	0.44	Hendricks and Reichel (1998)
IDAHO					
Granite Creek	1989	12	---	0.5	Cassirer and Groves (1989)
Hughes Fork	1989	13	---	0.3	Cassirer and Groves (1989)
Northern Idaho (Selway River to Canada Border- 12 streams)	1990	---	0.30	---	Cassirer and Groves (1990)
Lochsa River	1990	80	0.13	---	Cassirer and Groves (1991)
St. Joe River	1990	56	0.14	---	Cassirer and Groves (1991)
North Fork Granite Creek	1989	12	0.5	---	Cassirer and Groves (1991)
East Fork Lightning Creek	1990	5	0.40	---	Cassirer and Groves (1991)
Upper Priest River	1990	19	0.42	---	Cassirer and Groves (1991)
Gold Creek	1990	7	0.57	---	Cassirer and Groves (1991)
Hughes Fork	1990	13	0.66	---	Cassirer and Groves (1991)

¹ Only data from the Yalakom River confluence to Terzaghi Dam are included.

² Canadian Wildlife Service (unpublished data) cited in Campbell *et al* 1990.



Appendix 4 American Dipper densities from other river systems. Text in italics indicate data used in this report.

Location	Survey Year(s)	Total Km Surveyed	# Adult Birds/km (Pair Period)	# Birds/km (Brood Period)	Source
BRITISH COLUMBIA					
<i>Lower Bridge River</i>	<i>2006</i>	<i>15.9</i>	<i>0.31</i>	<i>0.57</i>	<i>Present study</i>
<i>Lower Bridge River</i>	<i>2005</i>	<i>15.9</i>	<i>0.69</i>	<i>0.62</i>	<i>Walton and Heinrich (2005)</i>
<i>Lower Bridge River</i>	<i>2004</i>	<i>6</i>	<i>0.67</i>	<i>0.83</i>	<i>Walton and Heinrich (2004)</i>
<i>Lower Bridge River</i>	<i>2000</i>	<i>11.8</i>	<i>1.44</i>	<i>0.76</i>	<i>Wright and Walton (2001b)¹</i>
<i>Lower Bridge River</i>	<i>1999</i>	<i>11.8</i>	<i>1.95</i>	<i>0.93</i>	<i>Wright and Walton (2001a)¹</i>
Yalakom River	2000	17.5	0.34	0.23	Wright and Walton (2001b)
Yalakom River	1999	17.5	0.80	0.23	Wright and Walton (2001a)
Seton Area, Lillooet, BC	2002	10.5	0.48	0	K. Wright (unpubl. data)
Seton Area, Lillooet, BC	2001	10.5	0.19	0.1	K. Wright (unpubl. data)
Seton Area, Lillooet, BC	2000	10.5	0.19	0	Wright and Walton (2001b)
Skagit River, BC	1971	30	---	0.1	King <i>et al</i> (1973)
Chilliwack River	1999-2002	16	3.0	2.1	Morrissey <i>et al</i> 2004
WYOMING					
Gardiner River, WY	1922	10	---	1.0	Skinner (1922)
MONTANA					
Rattlesnake Creek, MO	1956	21.7	---	1.2	Bakus (1959)

¹ Only data from the Yalakom River confluence to Terzaghi Dam are included.

Appendix 5 Common Merganser densities from other river systems. Text in italics indicate data used in this report.

Location	Survey Year(s)	Total Km Surveyed	# Adult Birds/km (Pair Period)	# Birds/km (Brood Period)	Source
BRITISH COLUMBIA					
<i>Lower Bridge River</i>	<i>2006</i>	<i>15.9</i>	<i>1.32</i>	<i>1.32</i>	<i>Present study</i>
<i>Lower Bridge River</i>	<i>2005</i>	<i>15.9</i>	<i>1.01</i>	<i>1.13</i>	<i>Walton and Heinrich (2005)</i>
<i>Lower Bridge River</i>	<i>2004</i>	<i>6</i>	<i>1.0</i>	<i>6.83</i>	<i>Walton and Heinrich (2004)</i>
<i>Lower Bridge River</i>	<i>2000</i>	<i>11.8</i>	<i>0.85</i>	<i>1.44</i>	<i>Wright and Walton (2001b)¹</i>
<i>Lower Bridge River</i>	<i>1999</i>	<i>11.8</i>	<i>1.36</i>	<i>0.42</i>	<i>Wright and Walton (2001a)¹</i>
Yalakom River	2000	17.5	0.29	0	Wright and Walton (2001b)
Yalakom River	1999	17.5	0.69	0.11	Wright and Walton (2001a)
Seton Area, Lillooet, BC	2000	10.5	1.62	1.05	Wright and Walton (2001b)
Peace River	1999	150	---	0.26	Robertson 1999

¹ Only data from the Yalakom River confluence to Terzaghi Dam are included.



Appendix 6 Belted Kingfisher densities from other river systems. Text in italics indicate data used in this report.

Location	Survey Year(s)	Total Km Surveyed	# Adult Birds/km (Pair Period)	# Birds/km (Brood Period)	Source
BRITISH COLUMBIA					
<i>Lower Bridge River</i>	<i>2006</i>	<i>15.9</i>	<i>0.13</i>	<i>0.25</i>	<i>Present Study</i>
<i>Lower Bridge River</i>	<i>2005</i>	<i>15.9</i>	<i>0.51</i>	<i>0.34</i>	<i>Walton and Heinrich (2005)</i>
<i>Lower Bridge River</i>	<i>2004</i>	<i>6</i>	<i>0.5</i>	<i>1.5</i>	<i>Walton and Heinrich (2004)</i>
<i>Lower Bridge River</i>	<i>2000</i>	<i>11.8</i>	<i>0.25</i>	<i>0.85</i>	<i>Wright and Walton (2001b)¹</i>
<i>Lower Bridge River</i>	<i>1999</i>	<i>11.8</i>	<i>0.33</i>	<i>0.59</i>	<i>Wright and Walton (2001a)¹</i>
Yalakom River	2000	17.5	0.17	0.06	Wright and Walton (2001b)
Yalakom River	1999	17.5	0.06	0	Wright and Walton (2001a)
Seton River Area	2000	10.5	0.96	0	Wright and Walton (2001b)
Peace River	1999	150	---	0.03	Robertson 1999

¹ Only data from the Yalakom River confluence to Terzaghi Dam are included.

Appendix 7 Spotted Sandpiper densities from other river systems. Text in italics indicate data used in this report.

Location	Survey Year(s)	Total Km Surveyed	# Adult Birds/km (Pair Period)	# Birds/km (Brood Period)	Source
BRITISH COLUMBIA					
<i>Lower Bridge River</i>	<i>2006</i>	<i>15.9</i>	<i>1.45</i>	<i>1.32</i>	<i>Present Study</i>
<i>Lower Bridge River</i>	<i>2005</i>	<i>15.9</i>	<i>1.01</i>	<i>1.76</i>	<i>Walton and Heinrich (2005)</i>
<i>Lower Bridge River</i>	<i>2004</i>	<i>6</i>	<i>0.33</i>	<i>3.33</i>	<i>Walton and Heinrich (2004)</i>
<i>Lower Bridge River</i>	<i>2000</i>	<i>11.8</i>	<i>0.17</i>	<i>1.19</i>	<i>Wright and Walton (2001b)¹</i>
<i>Lower Bridge River</i>	<i>1999</i>	<i>11.8</i>	<i>0.17</i>	<i>1.44</i>	<i>Wright and Walton (2001a)¹</i>
Yalakom River	2000	17.5	0.29	0.29	Wright and Walton (2001b)
Yalakom River	1999	17.5	0.06	0	Wright and Walton (2001b)
Seton Area	2000	10.5	0.86	0.95	Wright and Walton (2001b)
Peace River	1999	150	---	1.01	Robertson 1999

¹ Only data from the Yalakom River confluence to Terzaghi Dam are included.



SCHEDULE A FINANCIAL REPORT

	Income	Expensed	
Income			
BCRP	\$ 11,987.00		
(List other income)	None		
Total Income			
Expenses		BCRP	(other)
Project Personnel			
Wage		\$ 10,125.00	
Consultant fees			
(List others as required)			
Equipment & Expenses			
Equipment rental			
Equipment purchase			
Materials purchased			
Travel expenses		\$1,425.00	
Permits			
(List others as required)			
Overhead		\$437.00	
Office supplies			
Photo copies & printing			
Postage (Courier)			
(list others as required)			
Subtotal		\$ 11,987.00	
Total Expensed		\$ 11,987.00	
Balance		*\$ 0.00	

*Unspent BCRP financial contribution to be returned to:

BC Hydro, BCRP
 6911 Southpoint Drive (E16)
 Burnaby, BC. V3N 4X8
 ATTENTION: ANDREW MACDONALD



SCHEDULE B PERFORMANCE MEASURES

Performance Measures – Target Outcomes

Project Type	Primary habitat benefit targeted of project (m ²)	Primary Target Species	Habitat (m ²)											
			Estuarine	In-stream Habitat – Mainstream	In-stream Habitat – Tributary	Riparian	Reservoir Shoreline Complexes	Riverine	Lowland Deciduous	Lowland Coniferous	Upland	Wetland		
Impact Mitigation														
Fish passage technologies	Area of habitat made available to target species													
Drawdown zone revegetation/stabilization	Area turned into productive habitat													
Wildlife migration improvement	Area of habitat made available to target species	Riverine Birds (Including Harlequin Ducks, American Dippers, Ospreys etc)		15 km		15 km		15 km						
Prevention of drowning of nests, nestlings	Area of wetland habitat created outside expected flood level (1:10 year)													
Habitat Conservation														
Habitat conserved – general	Functional habitat conserved/replaced through acquisition and management													
	Functional habitat conserved by other measures (e.g. riprapping)													
Designated rare/special habitat (subset)	Rare/special habitat protected													
Maintain or Restore Habitat forming process														
Artificial gravel recruitment	Area of stream habitat improved by gravel placement													
Artificial wood debris recruitment	Area of stream habitat improved by LWD placement													
Small-scale complexing in existing habitats	Area increase in functional habitat through complexing													
Prescribed burns or other upland habitat enhancement for wildlife	Functional area of habitat improved													
Habitat Development														
New habitat created	Functional area created													
New Habitat assessment	Functional area of habitat improved	Riverine Birds (Including Harlequin Ducks, American Dippers, Ospreys etc)		15 km		15 km		15 km						



SCHEDULE C CONFIRMATION OF BCRP RECOGNITION

Ralph Heinrich will be presenting the results of this project to the:

Lillooet Naturalist Society

By October 31, 2006

Lillooet, B.C.