GREAT BLUE HERON AND BALD EAGLE INVENTORY AND STEWARDSHIP IN THE COLUMBIA BASIN (2005-2006)

PREPARED FOR:

COLUMBIA BASIN FISH & WILDLIFE COMPENSATION PROGRAM
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Executive Summary

From April 2005 to March of 2006, Pandion Ecological Research Ltd. completed year four of a Great Blue Heron breeding inventory, habitat assessment and stewardship project in the Columbia Basin. This project was intended to provide resource management agencies with updated information on heron status, population estimates and breeding distributions in the Columbia Basin, and to promote habitat stewardship and conservation efforts directed at this blue-listed species. Funding for this initiative was provided by the Columbia Basin Fish & Wildlife Compensation Program and Fortis BC.

In 2005, project objectives were to: (1) monitor breeding locations and assess breeding activity and productivity of heron colonies within the Columbia Basin; (2) conduct stewardship follow-up activities at selected breeding sites; and (3) provide a summary report of activities, and a single database capturing nest colony data from 2002-2005.

Biologists spent 18.25 person-days conducting field surveys in 2005 and confirmed twelve active breeding sites (nine in the east Kootenay and three in the West Kootenay). All sites were known from previous years and a total of 32 breeding sites (12 active and 20 historical) have been documented in the Columbia Basin from 2002-2005.

In 2005, 302 active heron nests (131 in the West Kootenay and 171 in the East Kootenay) were counted at 12 sites. Active sites had from 1–25 nest trees (mean ± SE = 11.5 ± 2.3) and 1–109 active nests (mean ± SE = 31.9 ± 10.2). In relation to previous years, the total number of active nests has remained relatively stable, although the number of breeding sites has declined steadily, particularly in the West Kootenay, where only three active sites are known, compared to eight in 2002. This decrease in active sites is to some extent balanced by the increased number of active nests per breeding site. Breeding colony size in the West Kootenay averaged more than double that in the East Kootenay, due mainly to one large colony at Leach Lake. As in previous years, five large colonies with >20 active nests accounted for more than 75% of all active heron nests in the basin.

Reproductive success averaged 1.25 ± 0.27 chicks per active nest and 2.25 ± 0.10 chicks per successful nest. Rates of reproductive success were particularly low in the East Kootenay (1.10 ± 0.31 chicks per active nest), where 64% of all active visible nests failed. These high failure rates were attributed to the re-occupancy and subsequent abandonment of the Parson, Gold Creek and Wilmer breeding sites, coupled with low nest success in the Wasa and Sparwood rookeries. Based on anecdotal observations, Bald Eagle harassment was a factor at two and potentially all three sites that failed. Overall reproductive success rates in 2005 are lower than in any other year of monitoring and nest failure rates (44% of all active nests in 2005) have been steadily increasing since 2002. Reproductive success and failure rates determined for the Columbia Basin in 2005 are comparable and higher, respectively, than those reported for coastal herons during recent years.

Active and historical breeding sites were located mainly in drier biogeoclimatic variants from 4–1,300 m (mean ± SE of 165 ± 49 m) away from water bodies. Closest water bodies included large to small rivers (25%), small lakes and wetland complexes (21% each), large creeks (16%), reservoirs (12%) and large lakes (3%). Breeding sites were in mature (69%), young (19%), and old forest (12%) structural stages and tended to have high levels of crown closure (65 ± 4%). Nest stands were characterized as either pure coniferous (47%), cottonwood deciduous (47%), or mixed (6%), and mainly live trees of large diameter (mean ± SE = 60.4 ± 2.0 cm dbh) and height (29.0 ± 0.5 m) were used for nesting. Black cottonwood comprised 47% of sample nest trees, and at least seven different conifer species were used.

Two thirds (67%) of active breeding sites in the basin during 2005 are located on private land, with the remainder in provincial wildlife management areas (25%), and on crown land (8%). These results emphasize the need to promote stewardship efforts and work cooperatively with private landowners to protect heron breeding habitat and minimize disturbance at active sites.

Stewardship activities conducted in 2005/2006 included: (1) written follow-up with selected landowners and land managers to provide them with background information and identify specific issues of concern, (2) contacting NGO organizations and assembling information packages to enlist their support with landowner contacts, (3) liaising with regional, provincial and federal land management agencies and providing information, as necessary, to promote heron habitat conservation, and (4) presenting project findings to promote greater awareness of herons and their habitat. Site-specific stewardship activities completed or underway in 2005/2006 are itemized in Appendix 4 with a summary of management concerns, recommendations and priority rankings for further actions.

General recommendations for further monitoring, management and stewardship of heron habitat and specific sites are proposed and include the following:

1. Continue monitoring rates of nest activity and reproductive success (per active and successful nest) at active heron breeding colonies in the Columbia Basin based on protocols established from 2002-2005. Opportunistically document heron injury/mortality during visits (and if possible, install video cameras at the Parson and Wilmer colonies) to record potential eagle-induced heron disturbance, mortality, and colony abandonment;

2. Provide data and reports produced to provincial (MOE, CDC) and federal (CWS) agencies that are mandated to protect this species and/or its habitat and promote liaison with the Pacific Heron Working Group to share information and findings;

3. Lobby provincial and federal agencies to have the interior great blue heron subspecies (a) re-instated as eligible for WHA designation, and (b) considered in any federal status evaluation, respectively.

4. Continue to undertake stewardship activities aimed at securing conservation agreements, covenants or land acquisitions for active heron breeding sites based on the priorities and responsibilities summarized in this report;

5. Continue with opportunistic nest surveys for Bald Eagles and conduct systematic eagle surveys (in the Columbia Wetlands and Creston Wildlife Management Area) to establish a benchmark for comparison and evaluate changes in population trends;

6. Conduct late fall/winter heron searches in the basin (based on existing data in the sightings database), identify key overwintering sites, and make recommendations for stewardship and habitat protection;

7. Undertake or encourage cottonwood protection projects at active and good potential heron breeding sites in the basin and develop a basin-wide cottonwood protection, management and recruitment strategy directed at crown and private land; and

8. Acknowledge the efforts of all volunteers involved in the heron study with an article summarizing the main findings of the project to date and thanking all of the contributors.

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1.0 Introduction and Background

Great Blue Herons (*Ardea herodias*) are large, distinctive wading birds found throughout North America (Butler 1997). Two subspecies occur in British Columbia and both are provincially blue-listed (Conservation Data Centre 2005) because of habitat loss and disturbance in prime breeding and wintering habitats. The coastal *A.h. fannini* subspecies appears stable to declining (Gebauer and Moul 2001; Vennesland 2003) and is listed of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003). Population trends for the interior *A.h. herodias* subspecies are difficult to interpret because data on colony size, breeding activity, nesting success and productivity have been collected only sporadically using non-standardized methods (Gebauer and Moul 2001).

Interior herons breed along the margins of lakes, slow-moving rivers, wetlands and sloughs in small to large colonies (Campbell et al. 1990; Forbes et al. 1985b; Butler 1992; Machmer and Steeger 2003; 2004), and occasionally as single pairs (Machmer 1996; Butler 1997). They nest and roost in mature black cottonwood (*Populus balsamifera*) or coniferous trees in isolated locations near shallow water foraging habitat (Forbes et al. 1985b; Butler 1992a; Machmer and Steeger 2003, 2004; Machmer 2005). Fish is their primary prey, however small mammals, amphibians, reptiles, invertebrates and birds are also taken (Forbes 1987a; Butler 1992a; Machmer 2002, 2003). Some interior herons migrate south during the winter months, while others remain around ice-free watercourses with an adequate food supply (Campbell et al. 1990; Machmer 2002, 2003).

Valley bottom riparian and wetland areas in the Columbia Basin represent important breeding and wintering habitats for herons. Systematic monitoring of heron breeding sites has been conducted since 2002 (Machmer and Steeger 2003, 2004; Machmer 2005) and numbers of active breeding colonies have declined steadily during the four year monitoring period (16, 15, 13 and 12 sites in 2002, 2003, 2004, and 2005, respectively). Numbers of active nests fluctuate considerably from year to year, but abandonment and/or failure of some of the largest and most successful colonies within the basin in recent years has raised concerns regarding this species.

Herons typically abandon breeding sites when disturbed, particularly during the early stages of nest building, pair formation and egg-laying (Quinney 1983; Butler 1992a; Vos et al. 1985; Vennesland and Butler 2004). The most significant sources of disturbance observed in heron colonies within and outside the Columbia Basin include Bald Eagle (*Haliaeetus leucocephalus*) attacks and human activity (Norman et al. 1989; Butler et al. 1995; Vennesland and Butler 2004; Machmer and Steeger 2003, 2004; Machmer 2005). Both of these factors are negatively correlated with heron nesting productivity and their combined effects are thought to be responsible for higher rates of breeding failure observed at colonies in south-coastal BC (Vennesland and Butler 2004).

This interim report summarizes the results of systematic monitoring of heron breeding sites and progress on stewardship follow-up activities conducted from April 2005 to March 2006. Additional monitoring of heron breeding sites and a Bald Eagle breeding inventory (focusing on the Columbia Wetlands and the Creston Wildlife Management Area) are planned for April and May of 2006. This project is funded by the Columbia Basin Fish & Wildlife Compensation Program (CBFWCP) with assistance from Fortis BC.

1.1 Project Objectives

Objectives of this project in 2005-2006 are to:

1. Monitor breeding locations and productivity of heron colonies within the Columbia Basin for 2005 and early season monitoring in spring 2006;

2. Conduct stewardship contact follow-up at selected nest colonies;
3. Co-ordinate and complete early season 2006 Bald Eagle nest distribution surveys in the Creston Valley and the Columbia Marshes.
4. Provide a summary report of activities, and a single database capturing nest colony data from 2002-2005.

Deliverables associated with 2006 fieldwork and stewardship activities will be submitted by May 30th, 2006.

1.2 Study Area

The survey area for this inventory encompassed most of the Columbia Basin, as defined by the program mandate of the CBFWCP. This area includes the East and West Kootenays and the Robson Valley (roughly bordered by the Fraser River at McBride in the north, Upper/Lower Arrow Lakes to the west, and the Elk River to the east), but excludes the Okanagan, Similkameen and Flathead drainages. The vast size of the study area and the available budget did not permit systematic surveys of all potential heron breeding habitat in the basin. Areas were therefore prioritized for field inventory based on (a) breeding activity and nature and frequency of reported heron sightings received from 2002-2004, (b) proximity to suitable riparian/wetland foraging habitat, and (c) accessibility within the constraints of the project budget.

2.0 Methods

2.1 Breeding Inventory and Nest Site Monitoring

In 2005, ground-based surveys were conducted at current, historical and good potential heron breeding sites in the Columbia Basin, based on the findings from previous years. Surveys were conducted during the incubation and nestling periods (late April to July) using standardized methods outlined by the Resources Inventory Standards Committee (1998) and Moul et al. (2001). Survey areas were generally accessed by vehicle or boat, and more intensive follow-up searches were conducted on foot.

2.1.1 Assessment of Nesting Activity

All potential breeding sites were visited a minimum of twice during the season to quantify abundance (based on the total number of nests visible and the number of active nests). Potential nesting areas were approached cautiously to minimize disturbance, particularly early in the nesting period (April to early June). As the observer entered the colony, he/she searched for signs of activity including presence of eggshells, whitewash, boluses, incubating adults, or chicks in nests. A nest was considered active during the breeding season when a heron was present in the nest and/or fresh eggshells were observed on the ground below the nest (Moul et al. 2001). During initial visits, an accurate nest count was undertaken and the configuration of each colony (i.e., locations/numbers of nest trees and numbers of nests per tree) was mapped out. Bald Eagle, human and/or other forms of disturbance at breeding sites were recorded opportunistically during monitoring visits.

2.1.2 Assessment of Nesting Success

Active breeding sites were re-visited in late June to determine nest success and to count the number of young in visible nests. Last visits were scheduled in an attempt to count chicks before they were "branching" away from their nests (i.e., preferably ≤6.5 weeks old) and a nest was considered successful if one or more chicks were observed in the nest at this time (Moul et al. 2001). Nest visibility was a

limiting factor, particularly in large colonies characterized by dense stands of black cottonwood, where visibility deteriorated through the course of the breeding season. Reproductive success was calculated for all visible nests based on (a) the number of chicks per active nest, and (b) the number of chicks per successful nest.

The mean and variation (standard error) in the numbers of nest trees, nests, active nests, and reproductive success were calculated for all breeding sites in 2005, and then compared with those determined for previous monitoring years (2002-2004).

2.1.3 Assessment of Breeding Habitat Characteristics

Assessments of breeding habitat and site characteristics were conducted during the last visit to new active breeding sites. The following site and habitat parameters were recorded during field visits: estimated distance (m) from water and closest water body; dominant forest type and structural stage (as defined by BC Ministry of Environment, Lands and Parks and BC Ministry of Forests 1998); slope and aspect; mean crown closure (defined as the average of four readings taken with a spherical densiometer in the middle of a colony); nest tree species; and estimated diameter [dbh in cm], height [m] and decay class (BC Wildlife Tree Committee 2001) of ≤5 randomly selected nest trees at a breeding site.

The locations of all active and historical breeding sites were determined using GPS and mapped by Amy Waterhouse (CBFWCP). The biogeoclimatic zone/variant and land designation and ownership status for each breeding site was subsequently determined from maps, also with the assistance of Amy Waterhouse. A photo record was assembled for active and historical breeding sites, as well as other features of interest encountered during our surveys.

2.2 Stewardship Activities

Ongoing liaison with relevant agencies (Canadian Wildlife Service, Ministry of Environment, Conservation Data Centre & BC Hydro & Power Authority) has included provision of annual reports, submission of data files with breeding locations, nest activity and success records, and updates on local inventory, monitoring and stewardship efforts. As in 2004, 2005 and 2006 nest records will be prepared and submitted by the West Kootenay Naturalists to the BC Nest Record Scheme.

Stewardship activities included talking directly with landowners at active and historical nest sites, enlisting the support of landowners and neighbors with ongoing monitoring efforts and corresponding with them, providing landowners/land managers with heron habitat stewardship brochures and maps of nest areas, preparing letters for selected landowners and land management agencies, contacting NGO representatives to enlist their assistance with landowner contacts, and providing NGOs with information packages to facilitate this process.

To promote awareness among the scientific community and the general public of heron status, habitat requirements, habitat use and potential population threats in the Columbia Basin, Marlene Machmer will attend and present a brief update of project findings at the annual meeting of the Pacific Northwest Heron Working Group in April 2006. She will also deliver a heron presentation at the Wings Over the Rockies Bird Festival On May 6th, 2005.

2.3 Opportunistic Bald Eagle Nest Survey

In conjunction with the breeding inventory for herons in 2005, the locations and status (not active, active, active with chicks, number of chicks) of any Bald Eagle nests encountered opportunistically were noted.

UTM coordinates were either determined with a GPS or estimated, where direct access to the nest site was not possible. Beginning in April 2006, more systematic Bald Eagle nest distribution surveys will be conducted in two focal areas: the Creston Valley Wildlife Management Area and the Columbia Wetlands Wildlife Management Area.

3.0 Results and Discussion

3.1 Breeding Inventory and Nest Site Monitoring

A survey log that lists areas surveyed by date, surveyor, and survey methods used is provided in Appendix 1. Biologists spent a total of 146 hours (18.25 person-days) conducting field surveys in 2005. In accordance with the project budget, the bulk of the effort was directed at monitoring of existing breeding sites. However, selected sites with high potential for breeding activity (based on sightings in previous years and/or new information) were searched in 2005. In the West Kootenay, these included the Slocan River area (Lemon Creek area and the Walter Clough Bird Sanctuary), the Slocan Lake/Bonanza Creek to Summit Lake corridor, and the Salmo, Proctor and Crawford Bay areas. In the East Kootenay, search effort was focused in the Fort Steele, Radium, Thompson's Landing, Edgewater, Brisco, Spillimacheen and Harrogate areas (Appendix 1).

In mid-September of 2005, a tip was received regarding five new stick nests with whitewash and nearby heron activity on the Lower Kootenay Reserve, close to the international border south of Creston (Aaron Reid and Thomas Hill, pers. comm.). Based on the lateness of the season, it was not possible to conclusively determine whether this site was successfully used for breeding in 2005, but this area will be thoroughly searched again in spring 2006.

3.1.1 Nesting Activity

Twelve heron breeding sites (nine in the East Kootenay and three in the West Kootenay; Table 1) supporting a total of 302 active nests (131 in the West Kootenay and 171 in the East Kootenay; Tables 1 and 2) were confirmed in 2005 (Figure 1 and Table 1). All were re-nests from previous years, and two of the breeding sites active in 2004 (Parson NW and Proctor) were not re-occupied in 2005. Data pertaining to breeding site locations, breeding activity, reproductive success, and habitat characteristics of active sites are summarized in Appendix 2. A total of 32 breeding sites (12 active and 20 historical) have been found during heron inventories conducted between 2002-2005 (Figure 1 and Table 1) and a separate database summarizing all inventory findings is provided in Appendix 3.

In relation to previous years, the total number of active nests has remained relatively stable, although the number of breeding sites has declined steadily since 2002, particularly in the West Kootenay, where only three active sites are known relative to eight in 2002 (Figure 2a and 2b, respectively). This decrease in sites is to some extent balanced by the increased number of active nests per breeding site, particularly in the West Kootenay (Figure 2c). Active colonies had from 1–25 nest trees (mean ± SE = 11.5 ± 2.3) and 1–109 active nests (mean ± SE = 31.9 ± 10.2). Colony size in the West Kootenay averaged more than double that in the East Kootenay, however this difference was due entirely to the one large colony (109 active nests) at Leach Lake (Tables 1 and 2). As in 2004, five large colonies with >20 active nests accounted for 77% of all active heron nests in the basin in 2005.

3.1.2 Nesting Success

Reproductive success in 2005 breeding colonies averaged 1.25 ± 0.27 chicks per active nest (n = 239) and 2.25 ± 0.10 chicks per successful nest (n = 138), based on a sub-sample of visible nests (Table 2). The

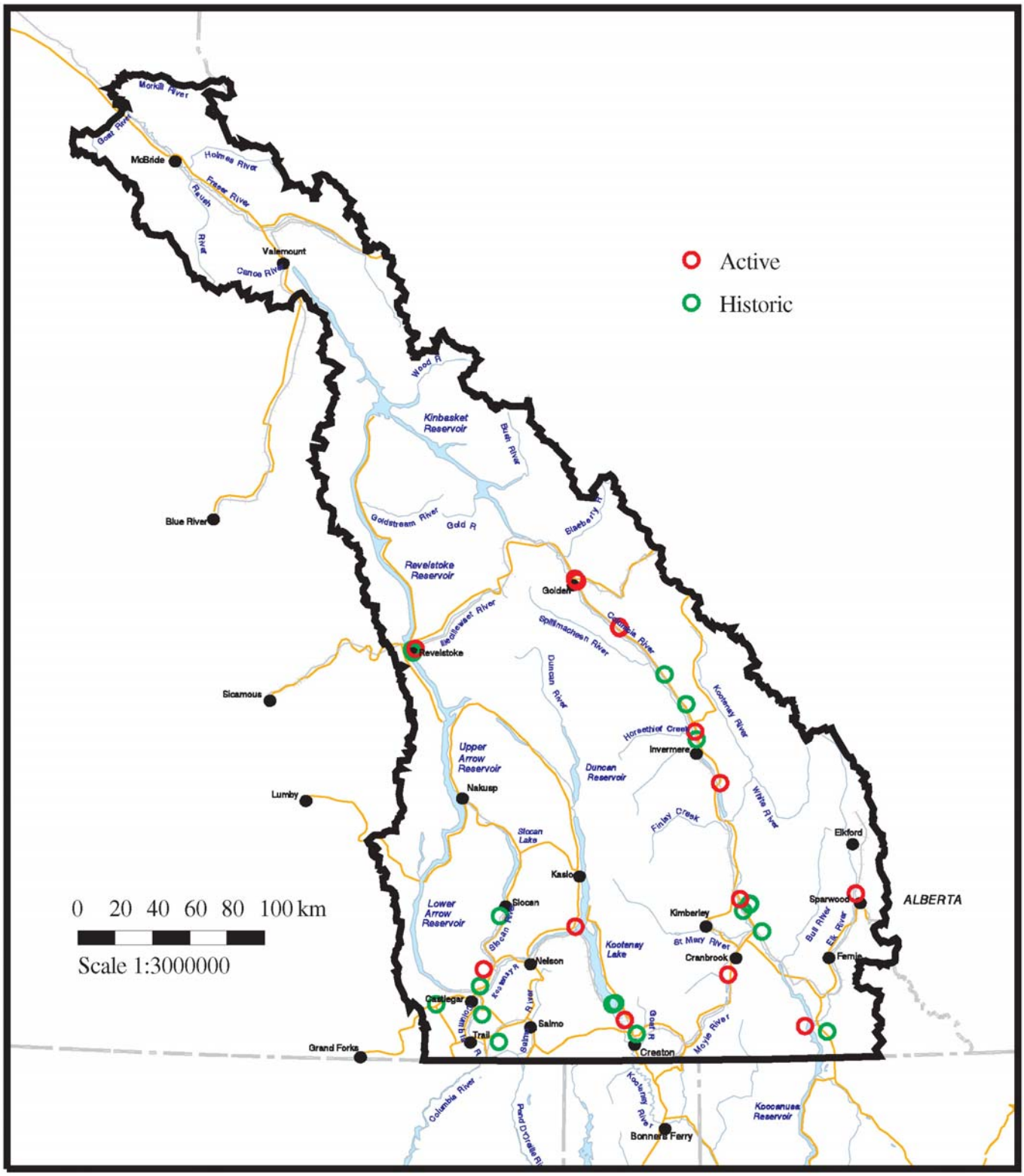


Figure 1. Locations of 12 active and 20 historical heron breeding sites in the Columbia Basin.

Table 1. Summary of data collected on breeding colony size, nest activity and reproductive success (RS) at 12 sites active in the Columbia Basin during 2005 surveys. Breeding site names and available data from the last year of known activity are also provided for 20 historical sites mapped in Figure 1.

Breeding Site Name	Last Active[1]	Successful (y/n)	# Nest Trees	# Total Nests	# Active Nests	# Visible Nests	# Visible & Succ. Nests	# Young in Visible Nests	RS/Active Nest	RS/Succ. Nest
Leach Lake	2005	y	24	121	109	67	64	150	2.24	2.34
Revelstoke	2005	y	25	25	22	22	20	35	1.59	1.75
Goose Creek	2005	ND[2]	ND	ND	ND	ND	ND	ND	ND	ND
Dutch Creek	2005	y	11	55	35	14	12	30	2.14	2.50
Nicholson	2005	y	10	25	23	23	17	44	1.91	2.59
Moyie Lake	2005	y	5	18	18	18	14	34	1.89	2.43
Sparwood	2005	y	5	6	4	4	2	4	1.00	2.00
Wasa Lake	2005	y	17	23	19	19	8	19	1.00	2.38
Golden	2005	y	1	1	1	1	1	2	2.00	2.00
Parson SE	2005	n	12	50	45	45	0	0	0.00	-
Wilmer	2005	n	9	19	18	18	0	0	0.00	-
Gold Creek	2005	n	7	8	8	8	0	0	0.00	-
Total	**12**	**9**	**126**	**351**	**302**	**239**	**138**	**318**	**1.25 ± 0.27**	**2.25 ± 0.11**
Proctor	2004	n	3	6	3	-	-	-	-	-
Parson NW	2004	n	14	36	34	-	-	-	-	-
Goat River	2003	n	5	26	26	-	-	-	-	-
Toby Creek	2003	n	2	2	2	-	-	-	-	-
Fort Steele	2003	n	2	4	4	-	-	-	-	-
Creston West	2002	n	3	5	4	-	-	-	-	-
Duck Lake	2002	n	3	5	5	-	-	-	-	-
Saughum Lake	2002	-	14	27	1	-	-	-	-	-
Champion Lake	2002	-	3	2	2	-	-	-	-	-
Waldie Island	2001	-	1	5	UN[3]	-	-	-	-	-
Brisco	1999	-	UN	UN	UN	-	-	-	-	-
Thompson's Landing	1998	-	UN	UN	UN	-	-	-	-	-
Perry Siding	1998	-	1	1	UN	-	-	-	-	-
Edwards Lake	1998	-	5	UN	UN	-	-	-	-	-
Norbury Lakes	1998	-	2	2	UN	-	-	-	-	-
Pend d'Oreille	1998	-	1	4	UN	-	-	-	-	-
Mud Lake	1996	-	1	1	UN	-	-	-	-	-
Begbie Falls	1992	-	1	UN	UN	-	-	-	-	-
Begbie 1 & 2	1992	-	2	UN	UN	-	-	-	-	-
Cherry Creek	UN	-	4	4	UN	-	-	-	-	-

[1] Year active is the last year of known breeding activity at each site.

[2] ND = Not determined (access not permitted, but it was assumed that this site fledged at least some young, based on observations of adults feeding at the adjacent wetland from the public road).

[3] UN = Unknown number (data was provided anecdotally by observers prior to the onset of this study).

Table 2. Summary of numbers of nest trees, nests, active nests, reproductive success (RS) per active and successful nest, and % of active nests and breeding sites failed at all active sites surveyed in the CBFWCP area from 2002 to 2005.[1]

Active Breeding Site Location (# sites; # active nests)	Year	# Nest Trees mean ± SE (range)	# Nests mean ± SE (range)	# Active Nests mean ± SE (range)	RS/Active Nest[2] mean ± SE (range)	RS/Success. Nest mean ± SE (range)	Total Active Nests[2] Failed %	Total Active Sites Failed %
West Kootenay	2005	24.5 ± 0.5	73.0 ± 48.0	65.5 ± 43.5	1.91 ± 0.32	2.05 ± 0.30	6%	0%
(3 sites; 131 active nests)		(24 – 25)	(25 – 121)	(22 – 109)	(1.59 – 2.24)	(1.75 – 2.34)	(5 of 89)	(0 of 3)
East Kootenay	2005	8.6 ± 1.6	22.8 ± 6.2	19 ± 4.7	1.10 ± 0.31	2.28 ± 0.10	64%	33%
(9 sites; 171 active nests)		(1 – 17)	(1 – 55)	(1 – 35)	(0.00 – 2.14)	(2.00– 2.59)	(96 of 150)	(3 of 9)
Overall	2005	11.5 ± 2.3	31.9 ± 10.2	27.5 ± 9.0	1.25 ± 0.27	2.25 ± 0.11	44%	25%
(12 sites; 302 active nests)		(1 – 25)	(1 – 121)	(1 – 109)	(0.00 – 2.24)	(1.75 – 2.59)	(101 of 239)	(3 of 12)
West Kootenay	2004	16.0 ± 6.6	42.0 ± 28.4	38.3 ± 26.8	1.61 ± 0.91	2.63 ± 0.54	21%	25%
(4 sites; 115 active nests)		(3 – 24)	(6 – 98)	(3 – 91)	(0.00 – 3.17)	(2.09 – 3.17)	(17 of 80)	(1 of 4)
East Kootenay	2004	7.9 ± 1.4	19.1 ± 5.4	14.8 ± 4.0	1.84 ± 0.41	2.46 ± 0.13	44%	11%
(9 sites; 133 active nests)		(1 – 14)	(1 – 54)	(1 – 35)	(0.00 – 3.88)	(1.78 – 3.88)	(50 of 114)	(1 of 9)
Overall	2004	9.9 ± 2.0	24.8 ± 7.8	20.7 ± 7.1	1.78 ± 0.35	2.56 ± 0.22	35%	15%
(13 sites; 248 active nests)		(1 – 24)	(1 – 98)	(1 – 91)	(0.00 – 3.88)	(1.78 – 3.88)	(67 of 194)	(2 of 13)
West Kootenay	2003	11.4 ± 4.3	30.2 ± 15.8	27.2 ± 15.2	2.03 ± 0.49	2.36 ± 0.10	20%	0%
(5 sites; 136 active nests)		(4 – 27)	(7 – 92)	(3 – 86)	(0.70 – 3.00)	(1.75 – 3.00)	(9 of 45)	(0 of 5)
East Kootenay	2003	8.2 ± 1.8	20.0 ± 6.3	15.1 ± 4.8	2.00 ± 0.34	2.46 ± 0.13	20%	10%
(10 sites; 151 active nests)		(2 – 19)	(2 – 61)	(2 – 42)	(0.00 – 3.00)	(2.00 – 3.00)	(20 of 100)	(1 of 10)
Overall	2003	9.3 ± 1.8	23.4 ± 6.5	19.1 ± 5.9	2.03 ± 0.27	2.43 ± 0.12	20%	7%
(15 sites; 286 active nests)		(2 – 27)	(2 – 92)	(2 – 86)	(0.00 – 3.00)	(1.75 – 3.00)	(29 of 145)	(1 of 15)
West Kootenay	2002	6.4 ± 2.5	14.6 ± 7.8	11.5 ± 6.3	0.92 ± 0.44	2.14 ± 0.19	18%	38%
(8 sites; 92 active nests)		(1 – 21)	(2 – 67)	(1 – 53)	(0.00 – 2.52)	(1.90 – 2.52)	(11 of 61)	(3 of 8)
East Kootenay	2002	7.6 ± 1.2	25.8 ± 8.9	20.6 ± 8.0	1.73 ± 0.46	2.42 ± 0.19	28%	25%
(8 sites; 165 active nests)		(2 – 12)	(2 – 61)	(1 – 66)	(0.00 – 3.00)	(1.88 – 3.00)	(12 of 43)	(2 of 8)
Overall	2002	7.0 ± 1.3	20.2 ± 5.9	16.1 ± 5.1	1.32 ± 0.33	2.31 ± 0.10	22%	31%
(16 sites; 257 active nests)		(1 – 21)	(2 – 77)	(1 – 66)	(0.00 – 3.00)	(1.88 – 3.00)	(23 of 104)	(5 of 16)

[1] Data from 2002-2003 were re-analyzed to exclude the "Valemount" nest site reported by volunteers in 2002 and 2003 (this site lies outside the CBFWCP study area). Nest site sample sizes and means and standard errors differ slightly from those reported in Machmer and Steeger (2003, 2004) to reflect these updates.
[2] Only a subset of active nests that were visible during late season nest visits were included in these tabulations (see number of active visible nests visible in Table 1).

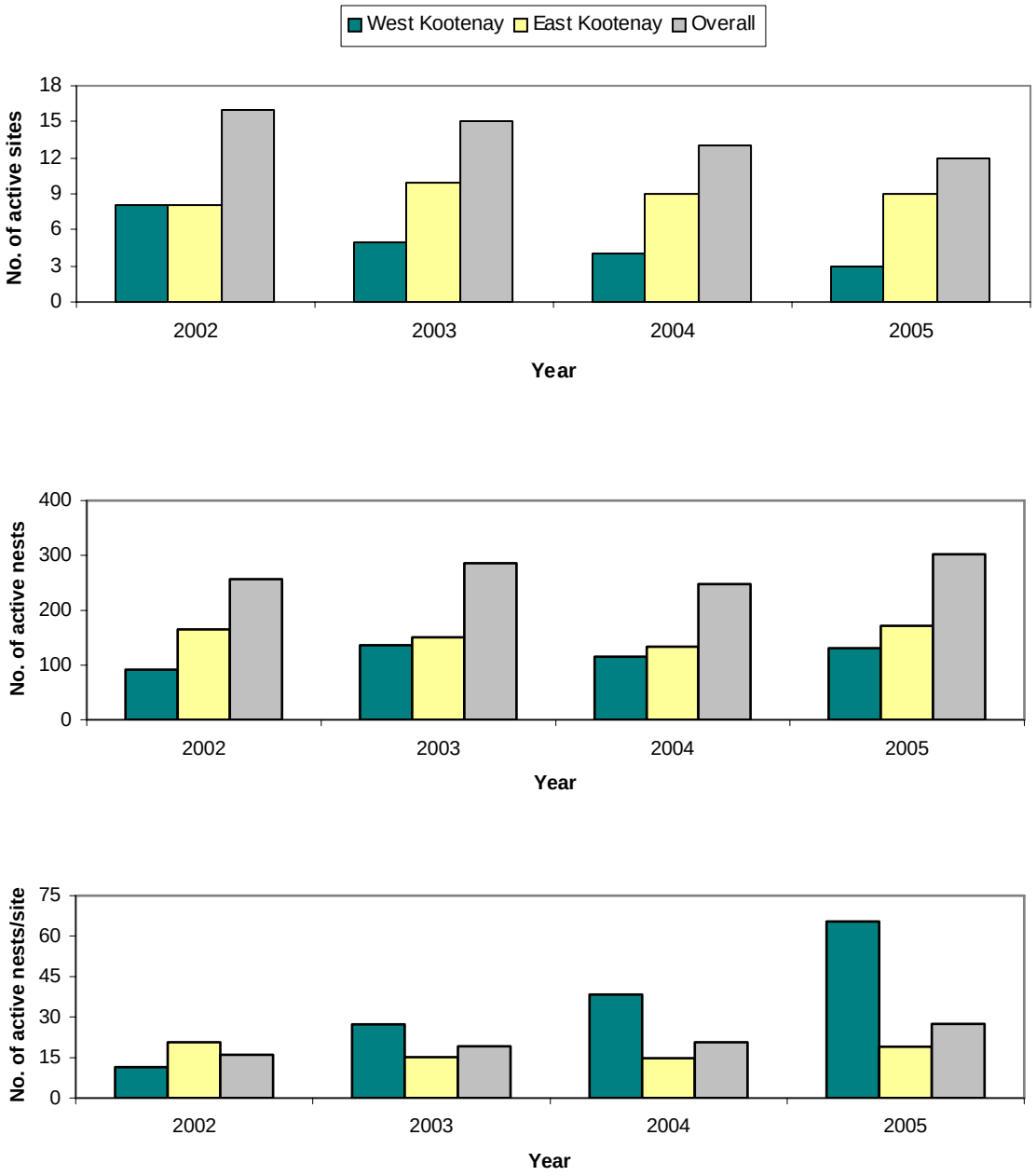


Figure 2. The (a) total number of breeding sites, (b) total number of active nests and (c) average number of active nests per breeding site in the West Kootenay, East Kootenay and overall in the Columbia Basin.

reproductive success at nine sites in the East Kootenay was extremely low (1.10 ± 0.31 chicks per active nest; Table 2). Overall reproductive success rates in 2005 are lower than those obtained from the basin in 2002-2004 (Table 2 and Figure 3a), and lower than rates found in southwestern BC from 1977–1981 (overall mean of 2.5 and a range of 2.2 – 2.8 young per successful nest; Forbes et al. 1985b). Rates measured in 2005 are comparable to those reported for colonies within the Strait of Georgia Strait (2.25 and 1.30 young per active nest in 2003 and 2004, respectively; McClaren 2003 and 2004), where very high rates of heron nest abandonment were attributed mainly to Bald Eagle predation.

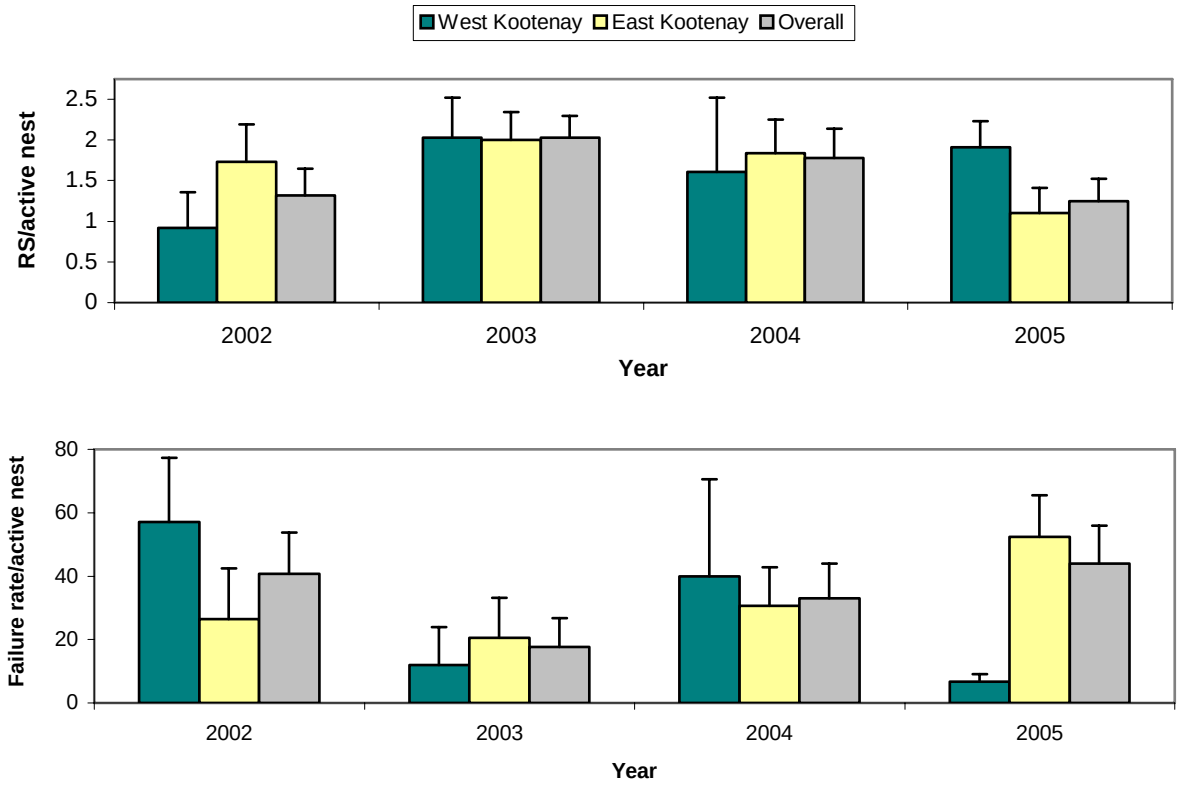


Figure 3. Average (a) reproductive success (i.e., number of young close to fledging age) and (b) nest failure rates per active nest at breeding sites in the West Kootenay, East Kootenay and overall in the Columbia Basin.

Active nest failure rates were very high in 2005 with 44% (101 of 239) of all active visible nests failing to produce young (Table 2). This trend is most evident in the East Kootenay where 64% of all active visible nests failed. These high failure rates were attributed to the re-occupancy and subsequent abandonment of the Parson, Gold Creek and Wilmer breeding sites coupled with low nest success in the Wasa and Sparwood rookeries. In the East Kootenay, total and average rates of active nest failure have been increasing since monitoring was initiated in 2002 (Table 2 and Figure 3b, respectively). Conversely, based on monitoring data from 2 of the 3 breeding colonies left in the West Kootenay (8 sites were present when monitoring was initiated in 2002), total and average failure rates appear to be declining (Table 2 and Figure 3b, respectively). An average active nest failure rate of 44% in the Columbia Basin during 2005 is considerably higher than rates documented in coastal colonies during 2004 (i.e., 21.8% on Vancouver Island/Gulf Islands and 28.7% on the Lower Mainland/Sunshine Coast). Breeding site failure rates averaged 25% overall and 33% in the East Kootenay (Table 2). These rates are comparable to the average 33% failure rates reported in coastal heron colonies (13 of 39 colonies; McClaren 2003) attributed mainly to eagle predation.

As previously mentioned, the Parson, Wilmer and Gold Creek colonies failed in 2005 and reproductive success was low at the Wasa and Sparwood breeding sites. The Parson breeding site was abandoned by the second week of May and eagle harassment was a factor here (R. van Vugt, pers. comm.) although not quantified. The Wilmer colony was abandoned sometime before May 20th (pers. obs.); an eagle nest was

active within the colony, and two additional eagle nests were occupied at Wilmer. Two eagle incursions (involving eagle harassment at heron nests) were noted. Some eagle activity was noted at the Wasa breeding site (Y. Stukator, pers. comm.), where the main nesting area occupied early on (in a dense spruce stand) was abandoned, and birds shifted to an adjacent area (dominated by ponderosa pine). Similarly, at Gold Creek, most of the birds abandoned their early season nest trees and re-nested 150 m away, and then subsequently abandoned. This site is quite remote and evidence of eagle activity was witnessed opportunistically on the first visit (an eagle was observed perched in a tree along the highway approximately 200 m from the colony). Eagles are active on the reservoir at the mouth of Gold Creek (pers. obs.).

Bald Eagle depredation on heron nestlings, juveniles and adults has frequently been reported in BC (Simpson and Kelsall 1978; Forbes et al. 1985a; Forbes 1987b; Simpson et al. 1987; Norman et al. 1989; Butler et al. 1995; Butler 1997; Vennesland 2000; Vennesland and Butler 2004). Such depredation is responsible for reduced breeding productivity and increased abandonment of colonies (Norman et al. 1989; Vennesland and Butler 2004). High levels of human activity near heron colonies have also been linked to increased disturbance from eagles and these two factors can act synergistically (Vennesland 2000). Eagle populations have been steadily increasing in coastal BC (Blood and Anweiler 1994) and their impact on *A.h fannini* populations is thought to be increasing (Vennesland 2000, Vennesland and Butler 2004). Eagle populations in the interior are likely also increasing, although no systematic surveys have been undertaken.

Human disturbance may still have been a factor at the Sparwood breeding site (in conjunction with an environmental monitoring program being conducted at Goddard Marsh), however concerns were communicated to Elk Valley Coal and efforts were made to reduce disturbance in 2005 (J. Frennette, pers. comm.).

As in previous years, black bear activity was evident at the Leach Lake and Dutch Creek sites and it appeared that some smaller fallen trees with nests (noted during early season visits) may have been the result of bear activity. In late June of 2005, a black bear was active in the stand and several juveniles unable to fly (likely ejected from their nests) were noted crouching under logs as the bear moved through the stand.

3.1.3 Breeding Site Habitat Characteristics

No new breeding sites were found in 2005 and the characteristics of active and historical sites have been described in previous reports (Machmer and Steeger 2003, 2004, Machmer 2005), therefore they are only briefly summarized here. Breeding sites were found in the following biogeoclimatic variants (see Appendix 2): IDFdm2 (n = 8 or 25%); PPdh2 (n = 6 or 18.8%); ICHxw (n = 5 or 15.6% of sites); ICHdw (n = 5 or 15.6%); IDFun (n = 3 or 9.4%); ICHmw3 (n = 3 or 9.4%); ICHmw2 (n = 1 or 3.1%); and MSdk (n = 1 or 3.1%). Over 80% were located on flat ground, and the remaining sites had shallow slopes (overall mean ± SE = 3.3 ± 1.3%). Breeding sites were located an average of 164.8 ± 48.9 m (range of 4–1,300 m) from a water body, but >70% of sites were found within 200 m of water. Closest water bodies ranged from rivers (n = 8 or 25% of sites) to small lakes and wetland complexes (n = 7 or 21% each), to large creeks (n = 5 or 16%), reservoirs (n = 4 or 12%) and large lakes (n = 1 or 3%). Often, multiple water bodies were associated with the same breeding site and field verification would be required to confirm where individuals were feeding.

Active and historical nesting stands were characterized either as deciduous cottonwood-dominated (n = 15 or 47%), coniferous (either Douglas-fir, hybrid white spruce or ponderosa pine-dominated; n = 15 or 47%), or mixed stands (n = 2 or 6%; see Appendix 2). In terms of structural stage, 69% of sites were classified as mature (i.e., age class ≥6), with the remaining 19% and 12% in young forest and old-growth

forest stages, respectively. Crown closure in these stands tended to be high (overall mean ± SE = 65 ± 4%), but a broad range (25–93%) was observed.

Values for the diameter, height, and decay class of sample nest trees (≤5 per nest stand) assessed in active and historical stands have changed only slightly in 2005 (since the same breeding sites were used as in previous years), but some new nest trees were occupied. Sample nest trees averaged 60.4 ± 2.0 cm in diameter at breast height (n = 75), 29.0 ± 0.5 m in height (n = 75), and their median decay class was 1 (range = 1-4). Herons appeared to be selecting trees of large diameter and height, relative to what was available in the surrounding stands, although characteristics of random available trees were not quantified directly. Of the sample heron nest trees, black cottonwood (*Populus balsamifera*) accounted for 47%, with conifer species (Douglas-fir [*Pseudostuga menziesii*], western white pine [*Pinus monticola*], hybrid white spruce [*Picea glauca x engelmannii*], ponderosa pine [*Pinus ponderosa*], western red cedar [*Thuja plicata*], western hemlock [*Tsuga heterophylla*], and western larch [*Larix occidentalis*]) comprising the remainder.

3.1.4 Other Observations

In 2005, minor beaver activity was noted only at the Parson site and in the vicinity of the Nicholson site. Most trees in these colonies have already been protected with wire mesh, but additional wrapping of cottonwood nest trees at the periphery of both colonies may be warranted. Nearby dominant cottonwoods that could function as recruitment nest trees in the event of nest tree failure are quite limited at the Parson, Nicholson and Wilmer sites. Physically protecting the bases of existing nest trees from beavers is the easiest and most cost-effective method to ensure suitable breeding habitat in the short term. The supply of older cottonwood stands appears to be declining in portions of the Columbia wetlands (Jamieson and Hennan 1998), and an active cottonwood recruitment strategy will be needed to ensure that adequate densities and distributions of veteran cottonwoods are maintained through time.

At the Leach Lake heron colony, blue-listed Double Crested Cormorants (*Phalacrocorax auritus*) have been noted nesting since monitoring began in 2002. Numbers of active cormorant nests have been increasing steadily during the four years of monitoring (M. Machmer, unpublished data). There is considerable ecological overlap between these two species and interactions between them should continue to be monitored at this site.

3.1.5 Land Ownership and Protection of Breeding Sites

Considering both active and historical breeding sites, 37.5% (n = 12) are on private land, 25% each (n = 8) are on crown land and within designated Wildlife Management Areas (WMA), and 6.3% (n = 2) are managed by the Nature Trust of BC. One site (3.1%) is located within a provincial park and another historical site at Toby Creek is located on municipally owned land. Considering only active breeding sites, 8 sites (67%) are on private land, 4 (25%) are in WMAs, and one remaining site is on crown land.

One quarter of active heron breeding sites are currently protected under the WMA designation. The Great Blue Heron, its' nests and eggs are also legally protected year-round from direct persecution and harassment by the *British Columbia Wildlife Act* and the *Migratory Birds Convention Act*. Regional District zoning bylaws and best management practices may have some potential to protect breeding sites on private land (Ministry of Water, Land and Air Protection 2004a).

More than half of heron nest stands in the Columbia Basin are located in mature coniferous stands, and there is some potential for conflict between forestry operations and heron habitat protection. Under the *Results Based Code* and the *Forest Practices and Range Act*, some critical nesting and foraging habitats

could be addressed through the establishment of *Old Growth Management Areas* (OGMAs), *Riparian Management Areas* (RMAs), and *Wildlife Tree Patches* (WTPs). The interior *herodias* subspecies is currently not eligible for protection through *Wildlife Habitat Area* (WHA) designation, however this subspecies is expected to be reinstated to the list of eligible WHA species in the near future (S. Guy, pers. comm.). A new *Wildlife Habitat Features* designation will be available shortly which has the potential to protect the nest stand itself in a formal reserve (S. Guy, pers. comm.) and in the interim, licensees may voluntarily maintain a buffer to minimize disturbance and protect the integrity of nesting habitat. The *Results Based Code* offers no protection for the majority (≈67%) of active breeding colonies in the Columbia Basin located on private land. This emphasizes the need to promote heron awareness and voluntary stewardship amongst private landowners and the general public.

3.2 Stewardship Activities

Since 2002, heron stewardship efforts have targeted landowners and land managers at breeding sites. Landowners and managers were informally approached in 2002-2003 and informed of the presence and location of active heron nesting on their property. Information regarding heron status, habitat needs, breeding ecology, and sensitivity to disturbance was also provided. An attempt was made to identify and contact adjacent landowners to active breeding sites as well, in order to obtain additional background about breeding activity and to informally enlist their support with ongoing monitoring and protection efforts. The vast majority of landowners, managers and neighbours were receptive and expressed an interest in obtaining additional information on herons. In 2004, this information was provided in the form of a Heron Stewardship Brochure presented in person (or mailed, in the case of absentee landowners).

Stewardship activities completed and/or underway in 2005/2006 at specific breeding sites are itemized in Appendix 4, along with a summary of site-specific management concerns and recommendations. These sites are prioritized for follow-up stewardship or management action and the party responsible for such action is identified.

NGO organizations contacted directly for potential assistance with landowner contacts have included The Nature Trust, (Rob Neil), the Nature Conservancy (Dave Hillary), the Land Conservancy (Kathleen Shepherd and Paula Rodriguez de la Vega), and the East Kootenay Conservation Program (Darrell Smith). The EKCP agreed to take the lead on coordinating an approach to securing protection for selected heron breeding sites. An information package was sent to them (containing maps for each breeding site of interest, a summary of landowner contacts, management concerns, breeding site recommendations, stewardship actions to date, and priority for follow-up) and will be circulated to other partner organizations. A meeting of the EKCP securement and stewardship committees will be held sometime in late April of 2006 and either Marlene Machmer or John Krebs will attend to answer questions and/or address concerns for particular sites at that time.

To promote awareness of interior herons, their habitat use, requirements, and population threats in the Columbia Basin, Marlene Machmer will attend and present a brief update of project findings at the annual meeting of the Pacific Northwest Heron Working Group in April 2006. She will also deliver a heron presentation at the Wings Over the Rockies Bird Festival in May of 2005.

3.3 Opportunistic Bald Eagle Nest Survey

A total of 27 Bald Eagle nests (6 in the West Kootenay; 21 in the East Kootenay) were noted opportunistically in conjunction with the heron inventory. Appendix 5 provides a name, location, UTM coordinates, visit date and status (not active, active, active with chicks, number of chicks) for each nest.

UTM coordinates were determined with a GPS or estimated, where direct access to the nest site was not possible.

Of the 27 nests detected, 5 (18.5%) did not appear active, 6 (22.2%) were clearly active (i.e., eagle in attendance at nest) but no young were detected during follow-up visits, and the remaining 17 (63%) were active with young. Of the latter nests, 14 (82%) had 2 chicks and 3 (18%) had 1 chick visible during later visits. Based on these figures, eagle productivity was roughly estimated at 1.4 young per active nest. This compares with productivity estimate of 1.6 chicks per active nest (n = 18) in 2004. Ideally, all eagle nests should have been visited a minimum of twice during the season (early to verify whether nests were active and then again later to provide an accurate count of young near fledging age). Time and budget constraints did not permit this level of survey intensity at all nests and our active and total nest numbers are minimum estimates that are likely to increase substantially with systematic inventory.

4.0 Conclusions and Recommendations

During this inventory, an estimated 604 adult herons (in 302 active nests) and 318 pre-fledged young were counted. These are minimum estimates, because some active colonies were likely not detected, and herons frequently relocate or re-nest after nest failure or predation (Dodd and Murphy 1995). This makes it problematic to obtain accurate counts of large colonies and creates considerable age variation among chicks. During visits, some chicks were already branching while others were still relatively young, and time and budget constraints did not permit multiple follow-up visits to count all chicks during the most appropriate timing window. Acknowledging these limitations, numbers of active nests in 2005 were relatively high compared to those counted during 2002-2004 surveys. However, reproductive success per active nest was lower, and failure rates (determined for active nests and breeding sites as a whole) were higher than in any previous year of monitoring. Reproductive success and failure rates documented in 2005 within the Columbia Basin are comparable or higher (in the case of the East Kootenay) than those documented for the coastal *A.h. fannini* subspecies.

The following recommendations are proposed:

- In 2006, continue monitoring of nest activity and reproductive success (per active and successful nest) at known active heron breeding colonies in the Columbia Basin, according to protocols established in 2002-2005. Opportunistically document any incidences of adult or chick injury or mortality during visits, and if possible, install video cameras at the Parson and Wilmer colonies to record potential eagle-induced heron disturbance, mortality, and colony abandonment. This information will serve as background to interpret rates of site/nest abandonment, nest failure, and reproductive success. Data gathered and reports produced should be provided to provincial (MOE, CDC) and federal (CWS) agencies that are mandated to protect this species and/or its habitat.

- Lobby relevant provincial and federal agencies to have the interior subspecies (a) re-instated as eligible for WHA designation, and (b) considered in the latest COSEWIC status evaluation for Great Blue Heron, respectively.

- Continue with stewardship activities aimed at securing conservation agreements, covenants or land acquisitions for active heron breeding sites in the Columbia Basin, based on the priorities and responsibilities set out in Appendix 3.

- Continue with opportunistic nesting surveys for Bald Eagles and conduct systematic eagle surveys in the Columbia Wetlands and Creston Wildlife Management Area to establish a current population benchmark for the Columbia Basin. Compare nesting density estimates obtained with any previously

available data for these areas (Blood 1982; Forbes and Kaiser 1984; Machmer and Steeger, unpublished data; McMann 1996, 1997).

- Winter represents an energetic bottleneck for Great Blue Herons and severe winters are associated with high rates of juvenile and adult mortality in the Columbia Basin (Blus and Henny 1981; Butler 1992; Machmer 2002). Relatively little is known about the winter distribution of herons in the basin (R. Butler, pers. comm.), however identifying and protecting sites where herons aggregate in winter should be a key component of an overall conservation strategy for this species. Based on concentrations of fall/winter sightings provided in previous years (e.g., near Hills, Slocan, Nakusp, Edgewood, Renata, Castlegar, Argenta, Creston, Wardner and Wilmer), conduct late fall/winter (November – January) heron searches at selected sites in the basin. Based on findings, identify key overwintering sites used by herons, summarize their habitat characteristics, use, ownership/status, and make recommendations for habitat protection and enhancement.

- The CBFWCP should continue to place a strong emphasis on the inventory, management and conservation of riparian cottonwood habitat as part of its program mandate. The development of a basin-wide cottonwood management and recruitment strategy should be undertaken, to ensure that adequate densities and distributions of these habitat elements are maintained through time. This strategy must also address private land and provide an incentive program to promote protection of veteran cottonwood stands.

- Some active and historical rookeries in the Columbia wetlands have been impacted by beaver activity. Although most nest trees have already been protected with wire mesh, some additional protection for recruitment nest trees is warranted in the Nicholson, Wilmer, and Parson rookeries. This would involve wrapping the bases of any unprotected nest trees (as well as nearby veteran and dominant cottonwoods for nest tree recruitment) with wire mesh. The CBFWCP should also encourage and fund non-profit societies, outdoor groups, youth groups, etc. to undertake additional cottonwood protection projects in the wetlands under their direction.

- Acknowledge the efforts of all contributors and volunteers involved in the heron study with an article summarizing the main findings of the project to date and thanking all of the contributors.

5.0 Literature Cited

BC Ministry of Environment, Lands and Parks and BC Ministry of Forests 1998. Field manual for describing terrestrial ecosystems. Land Management Handbook No. 25.

BC Wildlife Tree Committee. 2001. Wildlife/Danger Tree Assessor's Course Workbook. BC Min. Forests, Min. of Environment, Lands and Parks, and Workers' Compensation Board, Victoria, BC.

Blood, D.A. 1982. Kootenay River Diversion Study, Environmental Impact Assessment. Final Report on Wildlife Inventory and Potential Impacts. Prepared for BC Hydro and Power Authority. 144pp.

Blood, D.A. and G.G. Anweiler. 1994. Status of the Bald Eagle in British Columbia. BC Min. of Environment, Lands and Parks, Wildlife Branch, Victoria, BC. Wildlife Working Report WR-62.

Blus. L. and C. Henny. 1981. Suspected Great Blue Heron population decline after severe winter in the Columbia Basin. Murrelet 62: 16-18.

Butler, R.W. 1992a. Great Blue Heron. In Birds of North America, No. 25 (A. Poole, P. Stettenheim, and F. Gills, Eds.). Philadelphia: The Academy of Natural Sciences, Washington, DC: The American Ornithologists' Union.

Butler, R.W. 1992b. A review of the biology and conservation of the Great Blue Heron (*Ardea herodias*) in British Columbia. Can. Wildlife Service Tech. Report No. 154, Delta, BC.

Butler, R.W. 1997. The Great Blue Heron. UBC Press, Vancouver, BC. 167pp.

Butler, R.W., P.E. Whitehead, A.M. Breault, and I.E. Moul. 1995. Colony effects on fledging success of Great Blue Herons (*Ardea herodias*) in British Columbia. Colonial Waterbirds 18: 159-165.

Campbell, R.W., N.K. Dawe, I. McTaggert-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia, Volume 1. Introduction, Loons through Waterfowl. Royal British Columbia Museum and Environment Canada, Canadian Wildlife Service.

Conservation Data Centre. 2005. Species Explorer, Ministry of Sustainable Resource Management, Victoria, BC. (http://srmwww.gov.bc.ca/atrisk/toolintro.html).

COSEWIC. 2003. Canadian species at risk- May 2003. Canadian Wildlife Service, Environment Canada, Ottawa, ON.

Dodd, M.G. and T.M. Murphy. 1995. Accuracy and precision of techniques for counting Great Blue Heron nests. Journal of Wildlife Management 59: 667-673.

Forbes, L.S. 1987a. Feeding behaviour of Great Blue Herons at Creston, British Columbia. Can. J. Zool. 65: 3062-3067.

Forbes, L.S. 1987b. Predation on adult Great Blue Herons: is it important? Colonial Waterbirds 10: 120 122.

Forbes, L.S. and G.W. Kaiser. 1984. Observations of breeding bald eagles in southeastern British Columbia. Murrelet 65:22-25.

Forbes, L.S., K. Simpson, J.P. Kelsall and D.R. Flook. 1985a. Great Blue Heron colonies in British Columbia. Unpubl. Rep., Can. Wildl. Serv., Pacific and Yukon Region, Delta, BC. 66pp.

Forbes L.S., K. Simpson, J.P. Kelsall and D.R. Flook. 1985b. Reproductive success of Great Blue Herons in British Columbia. Can. J. Zool. 63: 1110-1113.

Gebauer, M.B. and I.E. Moul. 2001. Status of the Great Blue Heron in British Columbia. Wildlife Working report No WR-102, BC Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, BC. 66pp.

Jamieson, B. and E. Hennan. 1998. The Columbia Wetlands Wildlife Management Area: Operational Plan: 1998-2002. BioQuest International Consulting Ltd. and Legacy Biological Consulting. 46pp + Appendices.

McClaren, E.L. 2003. Pacific Great Blue Heron Population Inventory and Monitoring Project 2003, Strait of Georgia, British Columbia. Ministry of Water, Land and Air Protection, Nanaimo, BC. 15pp.

McClaren, E.L. 2004. Pacific Great Blue Heron Population Inventory and Monitoring 2004, Strait of Georgia, British Columbia. Ministry of Environment, Nanaimo, BC. 15pp.

McMann, M. 1996. Raptor nesting survey for the Creston Wildlife Management Area. Unpublished report, South Slocan, BC.

McMann, M. 1997. Raptor nesting survey for the Creston Wildlife Management Area. Unpublished report, South Slocan, BC.

Machmer, M.M. 1996. Management prescription for a Great Blue Heron nesting site located near Mud Lake, Arrow Forest District. Report prepared by Pandion Ecological Research Ltd. for the Small Business Forest Enterprise Program, Arrow Forest District. 21pp.

Machmer, M.M. 2002. Evaluation of fall and winter use of Waldie Island by Great Blue Herons. Report prepared by Pandion Ecological Research Ltd. for BC Hydro and Power Authority, Burnaby, BC. 27pp.

Machmer, M.M. 2003. Evaluation of fall and winter use of Waldie Island by Great Blue Herons. Report prepared by Pandion Ecological Research Ltd. for BC Hydro and Power Authority, Burnaby, BC. 34pp.

Machmer, M.M. and C. Steeger. 2003. Great Blue Heron breeding inventory and habitat assessment in the Columbia Basin. Columbia Basin Fish & Wildlife Compensation Program, Nelson, BC. 56pp.

Machmer, M.M. 2005. Great Blue Heron breeding inventory and stewardship in the Columbia Basin. Columbia Basin Fish & Wildlife Compensation Program, Nelson, BC. 42pp.

Machmer, M.M. and C. Steeger. 2004. Great Blue Heron breeding inventory and habitat assessment in the Columbia Basin. Columbia Basin Fish & Wildlife Compensation Program, Nelson, BC. 41pp.

Ministry of Water, Land and Air Protection. 2004a. Environmental Best Management Practices for urban and Rural Land Development. Section 4: Environmental planning and development at the site level. Ecosystems Standards and Planning, Biodiversity Branch. Province of British Columbia, Victoria, BC.

Ministry of Water, Land and Air Protection. 2004b. Accounts and Measures for Standards for Managing Identified Wildlife. Version 2004. Ministry of Water, Land and Air Protection, Province of British Columbia, Victoria, BC.

Moul, I.E., R.G. Vennesland, M.L. Harris, and R.W. Butler. 2001. Standardizing and interpreting nesting records for Great Blue Herons in British Columbia, Canadian Wildlife Service Progress Notes No. 217, Environment Canada, June 2001.

Norman, D.M, A.M. Breault, and I.E. Moul. 1989. Bald eagle incursions and predation at Great Blue Heron colonies. Colonial Waterbirds 12(2) 1989: 215-217.

Quinney, T.E. 1983. Comparison of Great Blue Heron, *Ardea herodias*, reproduction at Boot Island and other Nova Scotia colonies. Can. Field Naturalist 97: 275-278.

Resources Inventory Committee. 1998. Inventory Methods for Colonial-Nesting Freshwater Birds: Eared Grebe, Red-necked Grebe, Western Grebe, American White Pelican, and Great Blue Heron. Standards for Components of British Columbia's Biodiversity No. 8. Version 2.0. Ministry of Environment, Lands and Parks Resources Inventory Branch, Victoria, B.C. 45pp.

Simpson, K. and J.P. Kelsall. 1978. Capture and banding of adult Great Blue Herons at Pender Harbour, British Columbia. Proc. Colonial Waterbird Group 71-78.

Simpson, K., J.N.M. Smith, and J.P. Kelsall. 1987. Correlates and consequences of coloniality in Great Blue Herons. Can. J. Zool. 65: 572-577.

Vos, D.K., R.A. Ryder, and W.D. Graul. 1985. Response of breeding Great Blue Herons to human disturbance in north central Colorado. Colonial Waterbirds 8: 13-22.

Vennesland, R.G. 2000. The effects of disturbance from humans and predators on the breeding decisions and productivity of the Great Blue Heron. M.Sc. Thesis, Simon Fraser Univ., Burnaby, BC.

Vennesland, R.G. 2003. Coastal great Blue Heron (*Ardea herodias fannini*) inventory and monitoring project: 2002 breeding season report and historical analysis. Unpublished report. BC Ministry of Water, Land and Air Protection, Nanaimo, BC.

Vennesland, R.G.and Butler, R.W. 2004. Factors influencing Great Blue Heron Nesting Productivity on the Pacific Coast of Canada from 1998 to 1999. Waterbirds 27: 289-296.

Appendices

1. Biologist Survey Log

2. 2005 Breeding Site Database (CDrom - confidential information)

3. Management Concerns, Recommendations and Stewardship Actions Conducted to Date (confidential)

4. Photo Record

5. 2005 Bald Eagle Nest Site Database

6. Project Summary Database for 2002-2005 (CDrom - confidential information)

APPENDIX 1: Biologist Survey Log

(Observers: MM = Marlene Machmer; Chris Steeger)

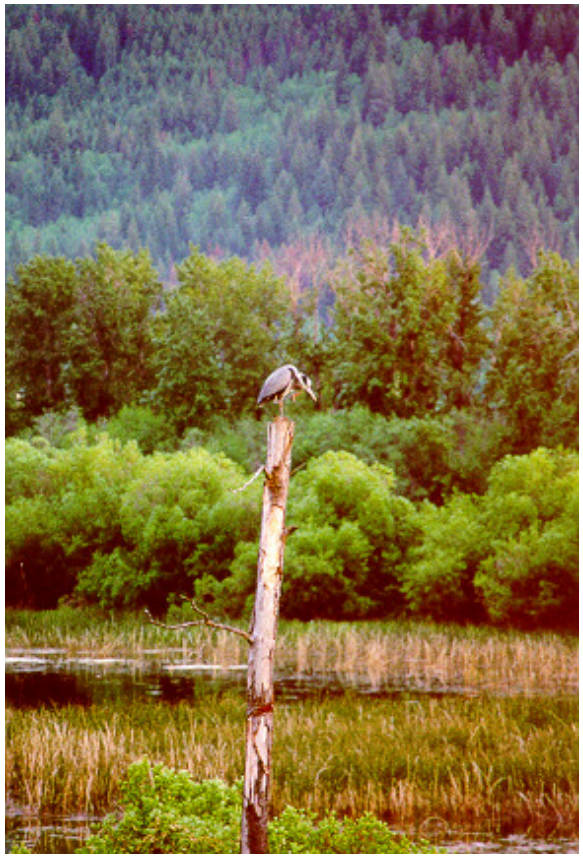
Date	Observer	Location	Hours	Type of Survey	Mileage
18-Apr	CS	North shore of Kootenay Lake, Proctor area	4	car, foot	128
21-Apr	MM	Salmo area, Moyie	6	car, foot	
24-Apr	MM	Fernie area, Gold Creek	5	car, foot	
25-Apr	MM	Sparwood, Fort Steele, Cherry Creek, Wasa, Fairmont	12	car, foot	
26-Apr	MM	Wilmer, Brisco, Spillimacheen, Harrogate, Parson, Nicholson, Golden	15	car, foot	
27-Apr	MM	Revelstoke, Slocan Valley, Goose Creek	8	car, foot	1,337
10-May	MM	Creston Valley	13	car, foot, kayak	225
20-May*	MM	Wilmer, Radium, Thompson's Landing, Edgewater	16*	kayak	880*
15-Jun	MM	West Arm Of Kootenay Lake, Proctor, Crawford Bay, Creston Valley	9	car, foot	250
25-Jun	MM	Creston Valley, Moyie, Wasa	13	car, foot	
26-Jun	MM	Golden, Nicholson, Parson, Spillimacheen, Harrogate, Wilmer	13	car, foot	
27-Jun	MM	Sparwood, Gold Creek, Fairmont	15	car, foot	1,520
29-Jun	CS	Revelstoke	4	car, foot	270
30-Jun	MM	Goose Creek	3	car, foot	100
12-Jul*	MM	Gold Creek	4*	car, foot	500*
30-Aug*	MM & CS	Slocan Lake, Bonanza Creek to Summit Lake	6*	kayak, foot, bike	250*
Totals			146		2,890

*Time and mileage on these days was voluntary (in kind).

APPENDIX 2: Breeding Database (CDrom - confidential)

APPENDIX 3: Management Concerns, Stewardship Recommendations and Actions (confidential).




APPENDIX 4: Photo Record

Active breeding sites (left to right):

Upper: fledglings at Wilmer; dead chick at Dutch Creek; listed herons and cormorants co-nesting at Leach Lake

Middle: adult heron from abandoned Parson site; Dutch Creek; Leach Lake

Lower: wetland feeding area near Revelstoke nesting site






Selected active nest stands (left to right):

Upper: Wilmer, Revelstoke; Gold Creek

Middle: Sparwood, Golden (hot tub in foreground)

Lower: Moyie; Nicolson

Selected active nest stands (left to right):

Upper: Wasa pine stand; osprey nest beside heron colony; eggshells & whitewash..

Lower: flightless heron chick hiding under log; eagle nest with young at Fairmont.








Selected areas searched with good heron breeding potential, some heron activity, but no nests confirmed (left to right):

Upper: Summit Lake; Edgewood wetland; Bonanza Creek wetland

Middle: Salmo wetlands; small private lake near Crawford Bay; Crawford Bay

Lower: Lake Windermere; Fort Steele area

APPENDIX 5: 2005 Bald Eagle Nest Database

Bald Eagle	Breeding Site Location				
Breeding Site Name	**Northing**	**Easting**	**Location Description**	**Visit Date**	**Active/No. Chicks**
Slocan Lake North Wetland	5549500	466000	in Act along margin of small wetland at north end of Slocan Lake	27-Apr; 30-Aug	active - 1 adult; no chicks visible; successful - 2 chicks
West Arm of Kootenay Lake	5493776	491631	in Act along shoreline opposite Kokanee Creek Provincial Park	18-Apr' 15-Jun	active - 2 adults; active - 2 chicks
Creston Valley North	5457000	523700	outer levee between Six Mile Slough and West branch of Kootenay in Act	10-May	active - 1 adult; not active
Goat River, Creston	5436500	532200	in Act along between the old Goat and Kootenay River Channels	10-May	active - 2 chicks
Moyie Provincial Park	5470015	584987	SW side of Highway 3, 120 m from highway in Moyie Provincial Park lowlands	21-Apr; Jun-25	not active; not active
Cameron Pond, Wasa	5513000	594500	Cameron Pond Access Road east of Highway 3	25-Apr	active - 1 adult; active - 2 chicks
Nicholson Heron Rookery	5680225	504755	0.5 km south of Nicolson heron rookery	26-Apr; 26-Jun	Canada Goose I; not active
Parson Crossing (2)	5657053	524801	400 m south of 2nd (middle) Parson crossing on levee	26-Apr	active - 1 adult I; active - 2 chicks
Well's Landing, Parson	5655753	527822	0.5 km south of Well's Landing B&B and 1 km north of Danby's B&B	26-Apr; Jun-26	active - 2 adults; active - 2 chicks
Hatch Creek, Harrogate	5645984	540673	on levee (107 km on rail line) – 1 km before Ben Hynes road and 2 km before Harrogate	26-Apr; Jun-26	active- 2 adults; 1 adult I active - 2 chicks
Spillimacheen Bridge North	5643461	542348	250 m off highway 1 km north of Spillimacheen	26-Apr; Jun-26	active- 1 adult I; active - 1 chick
Brisco North	5633170	550004	2 km N of Bugaboo turnoff on main channel; in slough furthest from highway	26-Apr; Jun 26	active - 2 adults; active - 1 chick
Wilmer Heron Rookery	5600560	567189	on levi between 2 islands in Wilmer Refuge accessed from east side	25-Apr; Jun 26	active - 2 adults; 1 adult I; active - 2 chicks
Peters Road, Crawford Bay	5525000	510500	accessed from Peters Road or through trail from main beach site	15-Jun	active - 2 chicks

Bald Eagle	Breeding Site Location				
Breeding Site Name	**Northing**	**Easting**	**Location Description**	**Visit Date**	**Active/No. Chicks**
Wilmer Slough	5598808	567243	on levee in slough by Wilmer canoe launch; dead class 3 Act	25-Apr; 26-Jun	active – 2 adults; 1 adult I; active – 2 chicks & 3 adults
Toby Creek	5597007	567548	in sewage lagoon area on east bank of Toby Creek in live forked Act	27-Jun	active – 2 big chicks
Slavin Road, Castledale	5652695	532984	north of Slavin Road and 1,000 m south of Quinn Creek campground	26-Apr	no BAEA – CAGO in nest
Quinn Creek	5652925	532765	200 m south of Quinn Creek before parson; in dead Act on levee	Jun-26	active – 2 adults; no visibility
Mitchell Road, Nicholson	5668896	511945	7 km south of Nicholson turnoff and 80 m from Mitchell Road; dead Act on levee	26-Apr; 26-Jun	active – adult I; active – 2 chicks
Riverside, Fairmont	5576488	581345	west of access road to Riverside, beside Creek	25-Apr; 27-Jun	active – 1 adult I; active – 2 chicks
Cherry Creek, Wasa South	5550000	595500	at mouth of Cherry Creek, near Bummer's Flats	25-Apr	active – 1 adult within 250 m
Yahk South	5441626	570148	5 km south of Yahk on west side of road - near jade place	21-Apr; Jun 25	active - 2 adults; 1 I; active - 1 chick
Radium-Thompson's	5609948	562939	1 km north of Radium on main river in live Act, west side	22-May	active – 1 adult
Thompson’s Landing	5611327	562590	2 adult eagles perched, but no nest visible	22-May	hunting
Edgewater South	5614832	561296	between Thompson's Landing & Edgewater off main river in levee on Sx - east side	22-May	not active
Edgewater to Moore’s Bridge	5615038	561300	in Fd of west bank	22-May	half built nest; adult perched
Moore’s Bridge	5615235	561104	in live Act 1 km before bridge, west bank	22-May	not active
Fernie West	5477849	640957	6 km west of Fernie in live Act on south side of Elk River	21-Apr; 27-Jun	active – 1 adult I; active – 2 chicks
Total: 27 nests					nests not active = 4; nests active but no chicks visible = 6; nests active with 1 or 2 chicks = 17; (14 with 2 chicks and 3 with 1 chick)

APPENDIX 6: 2002-2005 Database (CDrom format -confidential)