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FORTISBC

EXECUTIVE SUMMARY

From April 2006 to February of 2007, Pandion Ecological Research Ltd. completed year five of a Great Blue Heron and Bald Eagle inventory and stewardship project in the Columbia Basin. This project was intended to provide resource management agencies and the public with updated information on heron breeding distribution, population trends and habitat use in the Columbia Basin, and to promote habitat stewardship and conservation efforts directed at this blue-listed species. In response to increasing rates of heron nest failure and abandonment attributed to eagle disturbance, a 2006 eagle nest survey was conducted in key breeding areas. This data will provide a benchmark for eagle populations and permit a preliminary evaluation of eagle population trends and distributions in relation to critical heron habitats. Funding for these initiatives was provided by the Fish & Wildlife Compensation Program and Fortis BC.

In 2006, project objectives were to: (1) monitor breeding locations and productivity of heron colonies within the Columbia Basin; (2) conduct stewardship follow-up activities at selected heron breeding sites; (3) document productivity of eagle nests identified in the Creston Valley and Columbia Wetlands surveys in spring 2006; (4) provide a summary report of activities and two databases capturing heron nest data from 2002-2006 and eagle nest data for 2006; and (5) co-ordinate a bald eagle nest sighting program targeting the spring 2007 nesting season.

Biologists spent 187 hours (23.4 person-days) conducting heron and bald eagle field surveys in the Columbia Basin during 2006. Thirteen active heron breeding sites (ten in the East Kootenay and three in the West Kootenay) were confirmed, including three new sites and ten known from previous years. A total of 332 active heron nests (131 in the West Kootenay and 201 in the East Kootenay) were counted, and active sites had from 1–30 nest trees (mean $\pm$ SE = 11.3 $\pm$ 2.4) and 1–104 active nests (mean $\pm$ SE = 25.5 $\pm$ 7.9).

During five years (2002-2006) of monitoring, the total number of active nests has been increasing, whereas the number of active sites has been decreasing. This is particularly the case in the West Kootenay, where only three active sites are known, relative to eight in 2002. This decrease in sites is to some extent balanced by the increased number of active nests per site. 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 at Creston. As in previous years, five large colonies with >20 active nests each accounted for 78% of all active heron nests in the basin.

In 2006, reproductive success averaged 1.42 $\pm$ 0.16 chicks per active nest (n = 271) and 2.79 $\pm$ 0.18 chicks per successful nest (n = 155), based on a sub-sample of visible nests. These rates are comparable to those in 2005, but lower than those obtained in previous years. Nest failure rates were very high in 2006, with 43% (116 of 271) of all active visible nests failing to produce young. This trend was most evident in the East Kootenay where 62% (102 of 165) of active visible nests failed. High nest failure rates are identical to those reported in 2005, and are attributed to occupancy and subsequent abandonment of several large colonies in the East Kootenay (Parson, Gold Creek, Wilmer and Wasa). These colonies also failed or had extremely low reproductive success in 2005. Nest failure rates have increased steadily since monitoring was initiated in 2002, and based on anecdotal observations, eagle harassment and predation appears to be a factor in most cases. Colony failure rates in 2006 averaged 38% overall in the basin, with 33% in the West Kootenay and 40% in the East Kootenay, respectively. These rates are comparable to the highest rates of colony failure recorded in coastal heron colonies, which were also attributed primarily to bald eagle predation.

Active and historical breeding sites were located mainly in drier biogeoclimatic variants from 0 – 1,300 m (mean ± SE of 157.6 ± 45.2 m) away from water bodies. Closest water bodies included wetland complexes (31.4%), rivers (22.9%), small lakes (17.1%), large creeks (14.3%), reservoirs (11.4%) and large lakes (2.9%). Breeding sites were in mature (74.3%), young (17.1%), and old forest (8.6%) structural stages and tended to have high levels of crown closure (61.8 ± 4%). Nest stands were characterized as either pure coniferous (51.4%), cottonwood deciduous (42.9%), or mixed (5.7%), and mainly live trees of large diameter (mean ± SE = 61.8 ± 1.9 cm dbh) and height (29.0 ± 0.5 m) were used for nesting. Black cottonwood comprised 42% of sample nest trees, and at least eight different conifer species were used.

Approximately two thirds of active heron breeding sites in the basin are located on private land, with the remainder in provincial wildlife management areas (23%), and on crown land (7%). 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 2006/2007 included: (1) written follow-up with selected landowners and land managers to provide them with background information, brochures, to identify specific issues of concern, and investigate interest in potential conservation agreements or land purchases; (2) contacting NGO organizations and assembling information packages to enlist their support and provide context for landowner dialogue; (3) liaising with regional, provincial and federal land management agencies and providing information, as necessary, to promote heron habitat conservation; (4) initiating Wildlife Habitat Area establishment for two crown land breeding sites; and (5) presenting project findings to promote greater awareness of herons and their habitat. Site-specific stewardship activities completed or underway in 2006/2007 are itemized in Appendix 3 with a summary of management concerns, recommendations and priority rankings for further actions.

A total of 43 bald eagle nests including 37 active nests (12 and 25 in the West and East Kootenay, respectively) were documented during 2006 fixed wing and opportunistic vehicle surveys. Black cottonwood comprised 41 of 43 (95%) eagle nest trees and the remaining two nests were in live Douglas-fir. Seven eagle nests (all active and successful) were found in the Creston Wildlife Management Area and 25 (22 active and 20 successful) were counted in the Columbia Wetlands Wildlife Management Area. Based on published sources and other available data for these areas from the 1980's and 1990's, numbers of eagle nests appear to be increasing in both areas.

Of 37 active eagle nests, 33 (89.2%) were successful, 3 (8.1%) failed, and the outcome was unknown for 2 (5.4%) nests, due to long viewing distances and poor visibility. Productivity was estimated at 1.62 ± 0.11 young per active visible nest (n = 29) and 1.74 ± 0.9 young per visible successful nest (n= 27). These rates suggest healthy growing populations, based on previous data available for southeastern BC and adjacent jurisdictions.

General and specific recommendations for inventory, management and stewardship are provided, within the context of various stressors that appear to be impacting herons and their habitat within the Columbia Basin.

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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 more difficult to interpret because until recently, 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, 2006) and numbers of active breeding colonies have declined steadily during the first four years of the 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; Chatwin et al. 2006).

This interim report summarizes the results of systematic monitoring of heron breeding sites and progress on stewardship follow-up activities conducted from April 2006 to February 2007. It also presents the findings from bald eagle nest surveys and opportunistic productivity monitoring in selected areas of the Columbia Basin. Additional compilation of Bald Eagle nest location data will be completed by April 15th, 2007. The latter will be based on a sighting program launched in mid-February 2007 that encourages members of the public in the Columbia Basin to report known eagle nest locations.

1.1 Project Objectives

Objectives of this project in 2006-2007 are to:

1. Monitor breeding locations and productivity of heron colonies within the Columbia Basin for 2006;
2. Opportunistically document productivity of bald eagle nests identified in Creston and East Kootenay surveys in spring 2006;
3. Conduct stewardship contact follow-up at selected nest colonies;
4. Co-ordinate bald eagle nest sighting program intended for roll out in February 2007; and
5. Provide a summary report of activities, and two databases capturing heron nest colony data from 2002 to 2006, and eagle nesting data for 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 2002-2005, (b) proximity to suitable riparian/wetland foraging habitat, and (c) accessibility within the constraints of the project budget.

2.0 Methods

2.1 Heron Breeding Survey and Monitoring of Productivity

Ground-based surveys were conducted at current, historical and selected 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 Committee (1998), Moul et al. (2001) and Vennesland and Norman (2006). Survey areas were generally accessed by vehicle or boat, and more intensive follow-up searches were conducted on foot. Searches for heron breeding sites and activity were also conducted during a fixed wing aircraft survey of the Creston Valley and the Columbia Wetlands (Fairmont to Golden) on April 17th and 21st, respectively.

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). The observer 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, active sites, and reproductive success and failure rates per active nest and site were calculated for all breeding sites in 2006, and then compared with those determined for previous monitoring years (2002-2005).

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 Heron Stewardship Activities

Ongoing liaison with relevant agencies (Canadian Wildlife Service, Ministry of Environment, Heron Working Group, Conservation Data Centre, Creston Valley Wildlife Management Area, BC Hydro & Power Authority & Washington Department of Fish and Wildlife) has included provision of annual reports and data, submission of data files with breeding locations, nest activity and success records, and updates on local inventory, monitoring and stewardship efforts. In April 2006, MM gave a presentation to the heron working group regarding Columbia Basin monitoring efforts and interim results. Information regarding our Columbia Basin Sightings Network was supplied to Gerald Hayes (Washington State Department of Wildlife), to assist with a similar public awareness effort on the US side of the border. Our landowner brochure was also supplied to the Heron Working Group, to assist them with their development of a landowner brochure.

Wildlife Habitat Area (WHA) application forms were submitted for two candidate heron breeding sites (Gold Creek, Jaffray). Other 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 with heron habitat stewardship brochures and maps of nest areas, preparing letters for selected landowners and land management agencies, contacting and meeting with NGO representatives to enlist their assistance with landowner contacts, and providing NGOs with information packages and additional background to facilitate this process.

To promote awareness among the general public of heron status, habitat requirements, habitat use and potential population threats in the basin, MM delivered heron presentations at:

- The Canada/US Heron Working Group Meeting in Delta, BC (April 19, 2006);
- The Wings Over The Rockies Bird Festival in Invermere (May 6, 2006);
- The Columbia Basin – A Cultural Environment & An Environmental Culture Conference (Species at Risk Technical session) in Castlegar (October 19-21, 2007);
- The Revelstoke Community Centre (February 26, 2007); and
- The Golden Senior Centre (February 27, 2007).

MM was also interviewed on Nelson Cooperative Radio (November 7, 2006) about the heron project findings to date and the expansion of the project to address bald eagle distribution.

2.3 Bald Eagle Nest Survey and Monitoring of Productivity

Fixed wing aircraft surveys were conducted in the Creston Valley Wildlife Management Area (CVWMA) and in the Columbia Wetlands Wildlife Management Area (CWWMA) extending from Fairmont to Golden on April 17th and 21st, respectively. On both surveys, Marlene Machmer (MM) was assisted by an experienced biologist familiar with each area (Marc-Andre Beaucher and Davy Lewis, respectively) and the locations of all eagle nests were determined using a GPS (Garmin GPS Map 76CX). The status of each nest was recorded as either active (if one or more adults present at the nest and/or incubating) or not active (if no adults visible at nest or perched nearby). In cases where the species that had constructed an empty nest was questionable, this uncertainty was noted and the nest was excluded from the tally of eagle nests. To monitor eagle productivity, an effort was made to re-visit as many of the nests surveyed from the air in April 2006 as possible. Where access was not possible from the ground, nests were accessed with the use of a boat (CVWMA) or with assistance of a spotting scope from a vantage (CWWMA).

In conjunction with ground-based monitoring for herons in 2006, the locations and status (not active, active, active with chicks and number of chicks) of all bald eagle nests encountered opportunistically along the route was also noted. Locations were either determined directly with a GPS, or later based on an estimated bearing and distance from a vantage point.

2.4 Bald Eagle Nest Sighting Program

The Bald Eagle nest sighting program was initiated in late February of 2007 and involved preparation of the following materials:

- An eagle awareness poster soliciting sighting information from the public was developed (see Appendix 1) and 200 color copies were posted on various community information boards, libraries, schools, etc.;

- An information package (consisting of a poster and background information letter was mailed to various naturalist, wildlife, outdoor & conservation organizations throughout the Columbia Basin;
- A link and web-page was developed on the FWCP website to permit the public to submit their eagle observation data (Appendix 2);
- An information article and digital poster were circulated throughout the basin to local newspapers as a media release;
- An article and poster were posted on the Columbia Mountains Institute website;
- MM was interviewed on Castlegar FM Radio, CBC Radio, Nelson Coop Radio and KBS radio regarding this project; and
- An article was prepared for the FWCP Update Magazine summarizing the status and interim results of the project and soliciting eagle nest sighting information.

A team of Nelson Naturalists conducting osprey surveys in the Balfour to Trail area beginning in 1996 were contacted in March 2006 to promote information exchange regarding potential eagle/osprey nest location information gathered during the 2006 season (R. Wege, pers. comm.).

3.0 Results and Discussion

3.1 Heron Breeding Survey and Monitoring of Productivity

A survey log that lists areas surveyed by date, surveyor, and survey methods used is provided in Appendix 3 and photos of selected sites surveyed are provided in Appendix 4. Biologists spent a total of 187 hours (23.4 person-days) conducting heron and bald eagle field surveys in 2006. In accordance with the project budget, the bulk of the effort was directed at monitoring of existing breeding sites of herons, and documenting activity and productivity at eagle nests (Appendix 3). The distribution of active and historical sites heron is shown in Figure 1 (see Figure 2 in section 3.3 for the distribution of eagle nests).

During the five years of monitoring, the total number of active nests has been increasing, whereas the number of active breeding sites has been declining. This is particularly the case in the West Kootenay, where only three active sites are known, relative to eight in 2002 (Figure 3a and 3b, 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 3c). Active colonies in 2006 had from 1–30 nest trees (mean $\pm$ SE = 11.3 $\pm$ 2.4) and 1–104 active nests (mean $\pm$ SE = 25.5 $\pm$ 7.9). 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 (104 active nests) at Leach Lake (Tables 1 and 2). As in previous years, five large colonies with >20 active nests each accounted for 78% of all active heron nests in the basin.

3.1.2 Nesting Success

Reproductive success in 2006 breeding colonies averaged 1.42 $\pm$ 0.16 chicks per active nest (n = 271) and 2.79 $\pm$ 0.18 chicks per successful nest (n = 155), based on a sub-sample of visible nests (Table 2). Overall reproductive success rates in 2006 are comparable to 2005, but lower than those obtained from the basin in 2003-2004 (Table 2 and Figure 4a). Success rates in the Columbia Basin are somewhat comparable to those reported for coastal *fannini* colonies on Vancouver Island in 2005 (i.e., 1.49 young per initiated [visible] nest; Chatwin et al. 2006).

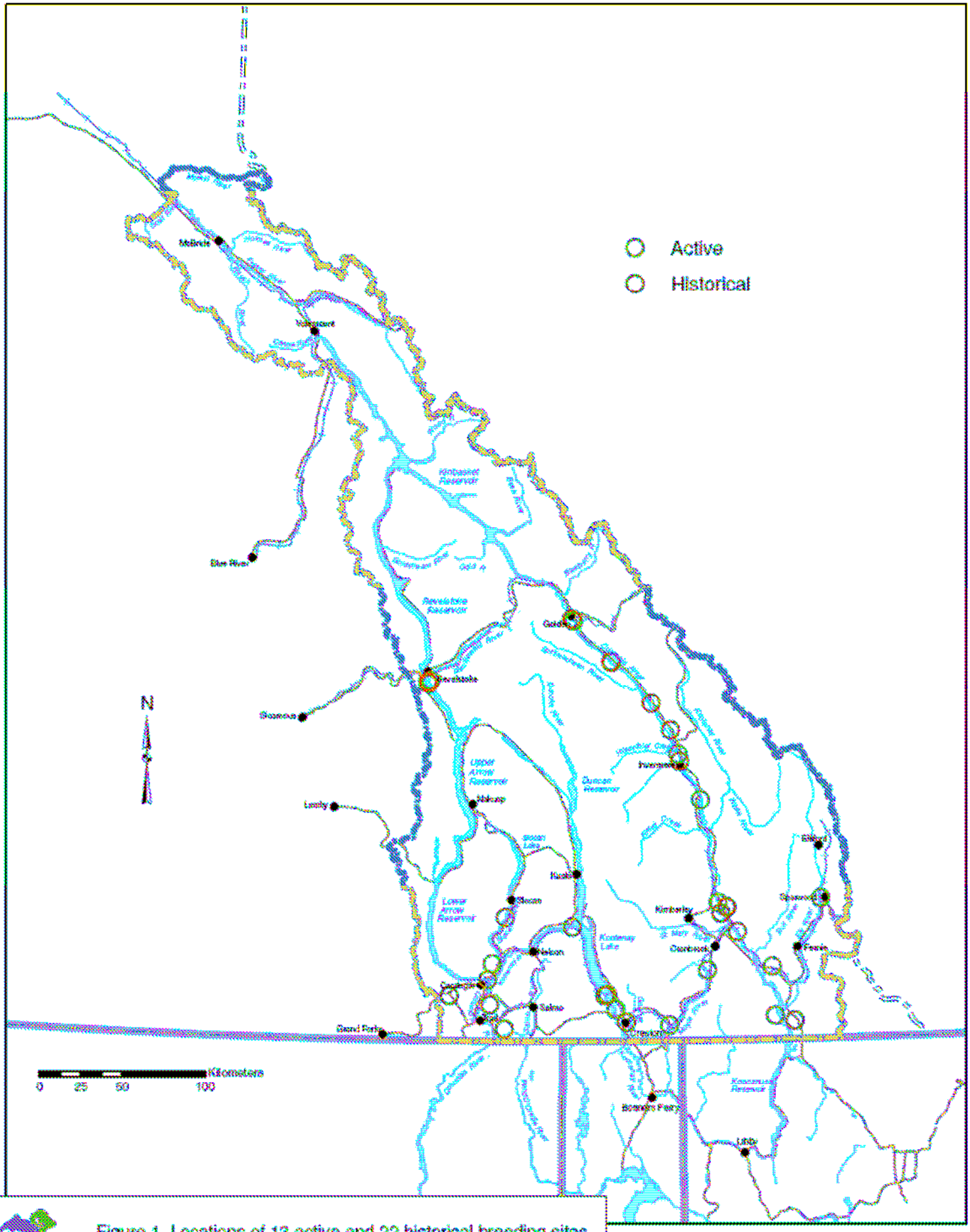

Figure 1. Locations of 13 active and 22 historical breeding sites found in the Columbia Basin study area during a 2006 breeding survey.

Table 1. Summary of data collected on breeding colony size, nest activity and reproductive success at 13 sites in the Columbia Basin during 2006 surveys. Breeding site names and available data from the last year of known activity are also provided for 22 historical sites mapped in Figure 1.

Breeding Site Name	Last Active[1]	Successful (y/n)	# Nest Trees	# Total Nests	# Active Nests	# Visible Nests	# Visible & Successful Nests	# Young in Visible Nests	RS/Active Nest (±SE)	RS/Succ. Nest (±SE)
Leach Lake	2006	y	30	111	104	83	77	180	2.17 (0.07)	2.34 (0.07)
Revelstoke	2006	y	25	25	24	22	15	36	1.64 (0.27)	2.40 (0.16)
Goose Creek (WE)	2006	n	1	1	1	1	0	0	0.00 (0.00)	-
Yahk	2006	y	1	1	1	1	1	4	4.00 (0.00)	4.00 (0.00)
Dutch Creek	2006	y	11	38	38	12	8	21	1.75 (0.41)	2.63 (0.26)
Nicholson	2006	y	12	40	40	30	20	55	1.83 (0.26)	2.75 (0.14)
Moyie Lake	2006	y	5	19	19	19	14	42	2.21 (0.34)	3.00 (0.18)
Sparwood	2006	y	6	6	5	6	5	15	3.00 (0.45)	3.00 (0.45)
Jaffray	2006	y	10	18	18	18	15	33	1.83 (0.26)	2.20 (0.20)
Wasa Lake	2006	n	12	20	15	15	0	0	0.00 (0.00)	-
Parson SE	2006	n	14	55	52	52	0	0	0.00 (0.00)	-
Wilmer	2006	n	9	25	10	10	0	0	0.00 (0.00)	-
Gold Creek	2006	n	9	10	3	3	0	0	0.00 (0.00)	-
Total Active	13	8	147	371	332	271	155	386	1.42 ± 0.16	2.79 ± 0.18
Goose Creek (UP)	2005	ND[2]	ND	ND	ND	ND	ND	ND	ND	ND
Golden	2005	n	1	1	0	-	-	-	-	-
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]	-	-	-	-	-

Breeding Site Name	Last Active[1]	Successful (y/n)	# Nest Trees	# Total Nests	# Active Nests	# Visible Nests	# Visible & Successful Nests	# Young in Visible Nests	RS/Active Nest (±SE)	RS/Succ. Nest (±SE)
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	-	-	-	-	-
Total Historical	22		>68	>131	>81					

[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 was not successful in 2006, since as many as 16 herons were observed flying around for a 2 week period in April and no evidence of recent breeding was noted in the stand by the Conservation Officer Service in late July 2006).
[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 and reproductive success per active and successful nest, and % active nests and breeding sites failed at sites surveyed in the FWCP area from 2002 to 2006.

Breeding Site Location (#active sites; nests)	Year	# Nest Trees mean ± SE (range)	# Total 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 Failed[2]	% Total Active Sites Failed
West Kootenay (3 sites; 131 nests)	2006	19.3 ± 9.2 (1– 30)	46.3.0 ± 33.2 (1 – 111)	43.7 ± 31.0 (1 – 104)	1.27 ± 0.11 (0.00 – 2.17)	2.37 ± 0.12 (2.34 – 2.40)	13% (14 of 106)	33% (1 of 3)
East Kootenay (10 sites; 201 nests)	2006	8.9 ± 1.2 (1 – 14)	23.2 ± 5.3 (1 – 55)	20.1 ± 5.5 (1 – 52)	1.46 ± 0.45 (0.00 – 4.00)	2.93 ± 0.21 (2.20– 4.00)	62% (102 of 165)	40% (4 of 10)
Overall (13 sites; 332 nests)	2006	11.3 ± 2.4 (1 – 30)	31.9 ± 10.2 (1 – 121)	25.5 ± 7.9 (1 – 104)	1.42 ± 0.16 (0.00 – 4.00)	2.79 ± 0.18 (2.20 – 4.00)	43% (116 of 271)	38% (5 of 13)
West Kootenay (3 sites; 131 nests)	2005	24.5 ± 0.5 (24 – 25)	73.0 ± 48.0 (25 – 121)	65.5 ± 43.5 (22 – 109)	1.91 ± 0.32 (1.59 – 2.24)	2.05 ± 0.30 (1.75 – 2.34)	6% (5 of 89)	0% (0 of 3)

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

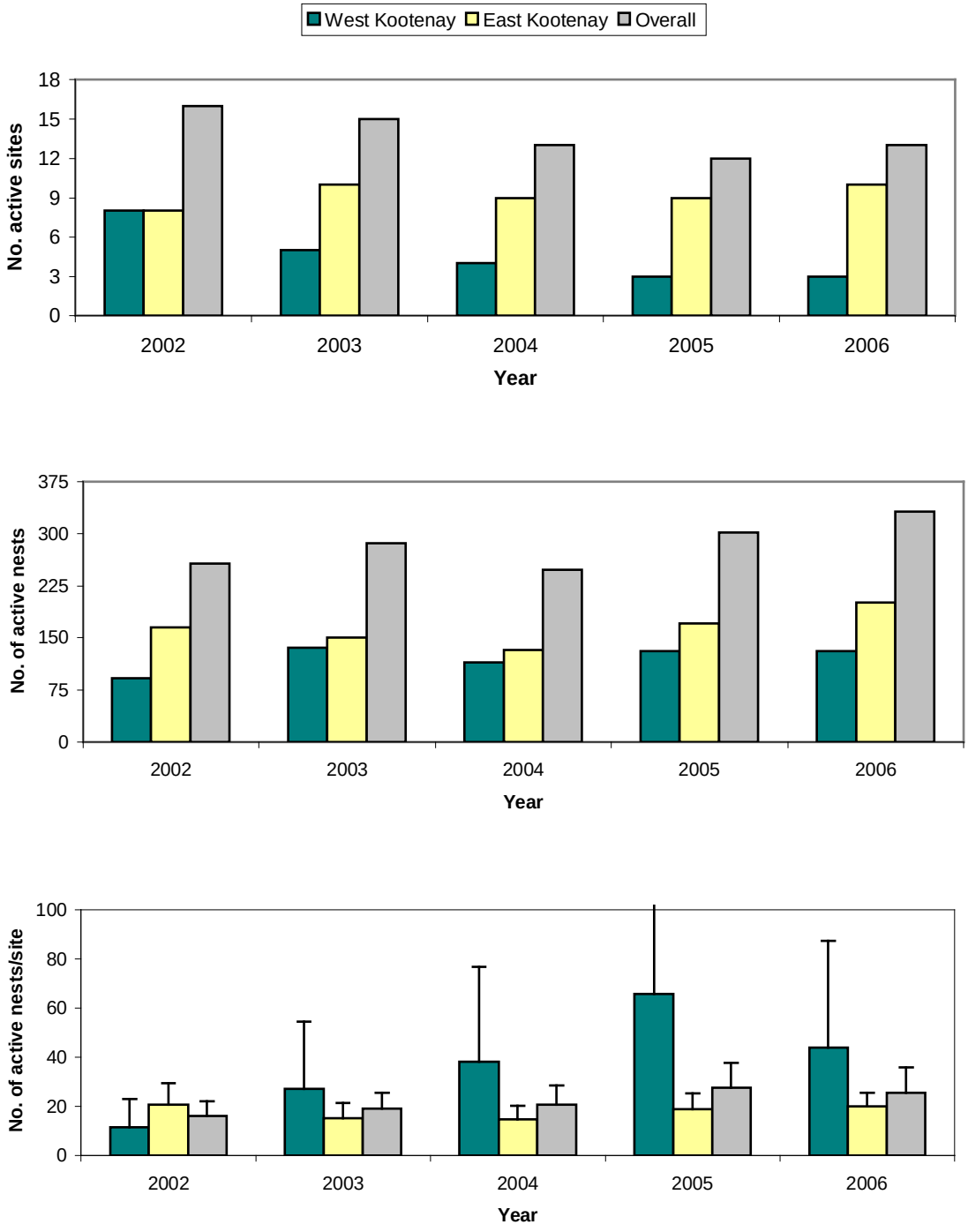

Figure 3. The (a) total number of breeding sites, (b) total number of active nests and (c) average number of active nests per breeding site in the West Kootenay, East Kootenay and overall in the Columbia Basin.

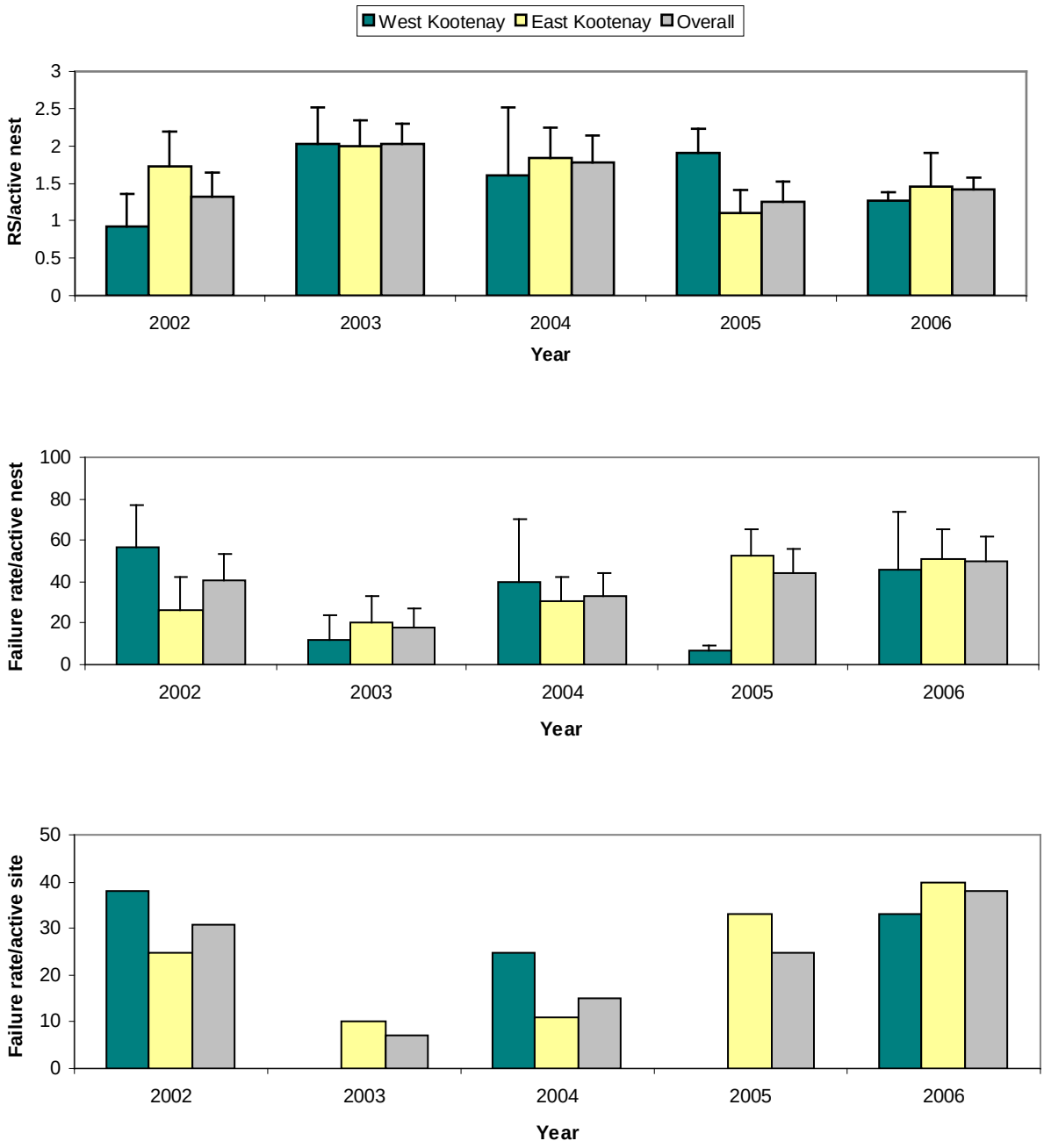

Figure 4. (a) Average reproductive success per active nest, (b) average nest failure rates per active nest, and (c) failure rates per active site at breeding sites in the West Kootenay, East Kootenay and overall in the Columbia Basin.

Nest failure rates were very high in 2006 with 43% (116 of 271) of all active visible nests failing to produce young (Table 2). This trend was even more evident in the East Kootenay where 62% (102 of 165) of active visible nests failed. These high failure rates are identical to those reported in 2005 (Machmer 2006), and they are attributed to occupancy and subsequent abandonment of several large colonies (i.e., Parson, Gold Creek, Wilmer and Wasa). The Parson,

Gold Creek and Wilmer breeding sites also failed in 2005, whereas the Wasa site had extremely low reproductive success that year. The rates of active nest and site failure in the East Kootenay have been increasing since monitoring was first initiated (Table 2; Figure 4b and 4c). Conversely, based on monitoring data from three breeding colonies left in the West Kootenay (eight sites were present when monitoring was initiated in 2002), nest and site failure rates appear to fluctuate from year to year (Table 2; Figure 4b and 4c).

Overall nest failure rates of 43% during 2006 (and 44% in 2005) are higher than those reported for coastal *fannini* colonies in 2004 (21.8% for Vancouver Island & Gulf Islands and 28.7% for Lower Mainland & Sunshine Coast; McClaren 2004), but lower than those documented in 2005 (52% on Vancouver Island; Chatwin et al 2006). Active site (colony) failure rates averaged 38% overall in the basin, with 33% in the West Kootenay and 40% in the East Kootenay, respectively (Table 2; Figure 4c). These rates are comparable to the highest rates of colony failure ever recorded annually in coastal colonies (38 and 42% in 1998 and 1999, respectively; Vennesland and Butler 2004). In coastal areas, colony failure was attributed mainly to bald eagle predation.

In the Columbia Basin, eagle harassment and predation appear linked to colony failure at three or more of the five sites where it occurred in 2006. The Parson breeding site was abandoned by late May and eagle harassment was likely a factor here, as juvenile and adult eagles were observed in the colony on both visits, and by a nearby landowner (R. van Vugt, pers. comm.). The Wilmer colony was abandoned sometime before May 30th, and multiple observations of eagles attacking herons, adult eagles carrying herons and feeding on adult herons were made this year (J. Thorsell; pers. comm.). The Gold Creek site is remote, and although no eagles were detected during site visits, they are known to be active on the reservoir at the mouth of Gold Creek (pers. obs.). At least two eagle incursions (involving eagle harassment at heron nests) were noted at the Wasa breeding site (Y. Stukator, pers. comm.). Based on the presence of eggshells, at least some young appeared to have hatched in all of the above colonies before they were abandoned. At Goose Creek, two mid-sized young were observed in the nest in early June when a large weasel-like mammal identified as a lynx raided the nest and killed the chicks (S. Jmayoff, pers. comm.).

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; Machmer 2005; Chatwin et al. 2006). 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, presumably due to recovery from past persecution and the detrimental effects of pesticides (Blood and Anweiler 1994; Buehler 2000; Elliott and Harris 2001). Their impact on *A.h fannini* populations is also thought to be increasing (Vennesland 2000; Vennesland and Butler 2004). In the interior, eagle populations may also be increasing and systematic surveys were initiated in 2006 to establish a benchmark for two key areas (CVWMA and CWWMA; section 3.3).

3.1.3 Breeding Site Habitat Characteristics

The characteristics of all active and historical sites in the Columbia Basin have been described in previous reports (Machmer and Steeger 2003, 2004; Machmer 2005, 2006), therefore they are only briefly summarized here. Breeding sites were found in the following biogeoclimatic variants (see Appendix 5): IDFdm2 (n = 9 or 25.7%); ICHdw (n = 7 or 20%); PPdh2 (n = 6 or 17.1%);

ICHxw (n = 5 or 14.3% of sites); IDFun (n = 3 or 8.6%); ICHmw3 (n = 3 or 8.6%); ICHmw2 (n = 1 or 2.9%); and MSdk (n = 1 or 2.9%). Over 80% of sites were located on flat ground, and the others were on shallow slopes (overall mean ± SE = 3.2 ± 1.2%). Breeding sites were located an average of 157.6 ± 45.2 m (range of 0 – 1,300 m) from a water body, and ≈75% of sites were found within 200 m of water. Closest water bodies ranged from wetland complexes (n = 11 or 31.4% of al sites), rivers (n = 8 or 22.9%) and small lakes (n = 6 or 17.1%) to large creeks (n = 5 or 14.3%), reservoirs (n = 4 or 11.4%) and large lakes (n = 1 or 2.9%). 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 conifer-dominated (either Douglas-fir, hybrid white spruce or ponderosa pine-dominated; n = 18 or 51.4%), pure deciduous cottonwood (n = 15 or 42.9%), or mixed stands (n = 2 or 5.7%; see Appendix 5). In terms of structural stage, 26 sites (74.3%) were classified as mature (i.e., age class ≥6), with the remaining 6 (17.1%) and 3 (8.6%) sites in young forest and old-growth forest stages, respectively. Crown closure in these stands tended to be high (overall mean ± SE = 61.8 ± 3.9%), but a broad range (25–93%) was observed.

Sample nest trees (≤5 per nest stand) at 13 active and 22 historical sites averaged 61.8 ± 1.9 cm in diameter at breast height (n = 79), 29.0 ± 0.5 m in height (n = 84), with a 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 42%, 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*], western larch [*Larix occidentalis*] and lodgepole pine [*Pinus contorta*]) comprising the remainder. These results are in sharp contrast to the pure deciduous stands (i.e., 100% black cottonwood) reported during a survey of Kootenay Region heron colonies in the late 70's and early 80's (Forbes et al. 1985).

3.1.4 Other Observations

Double Crested Cormorants (*Phalacrocorax auritus*) have been observed co-nesting with the herons (often within the same trees) at the Leach Lake heron colony since monitoring began in 2002. There is considerable ecological overlap between these species in terms of nesting and feeding requirements, and hence, some potential for competitive effects.

Numbers of active cormorant nests have increased dramatically over the years, with ≤10 nests visible in 2002, ≥36 nests in 2005, and ≥92 nests in 2006 (M. Machmer, unpublished data). Such explosive increases in cormorant populations have also been noted at Stum Lake (A. Stewart, CDC pers. comm.), and in other areas of the Pacific Northwest (G. Hayes, Washington Department of Fish & Wildlife, pers. comm.). Cormorants are currently blue-listed in BC, due to declines documented in coastal breeding numbers. The CDC has been alerted to cormorant increases in the interior and it is not clear whether the latter populations should be classified as the same subspecies present on the coast, in which case the species may require de-listing (A. Stewart, pers. comm.). These factors are being evaluated and in the interim, interactions between herons and cormorants should continue to be monitored.

Minor beaver activity was noted at the Parson and Nicholson sites in 2006. 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. 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.

3.1.5 Land Ownership and Protection of Breeding Sites

Considering both active and historical breeding sites, 14 sites (40%) are on private land, 9 (25.7%) are on crown land, 8 (22.9%) and within designated Wildlife Management Areas (WMA), 2 (6.3%) are managed by the Nature Trust of BC, one site (2.9%) is located within a provincial park, and another is on municipal land. The Jaffray rookery comprises a combination of crown and private land. Considering only active breeding sites, 8 sites (61.5%) are on private land, 3 (23%) are in WMAs, one site (7.7%) is crown, and the Jaffray site is a combination of private and crown land.

Of active heron breeding sites, three are currently protected under the WMA designation and the Yahk site on private land has a conservation covenant registered by The Nature Conservancy (T. Ennis, The Nature Conservancy of Canada, pers. comm.). 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 (Section 34).* The *Migratory Birds Convention Act* prohibits the possession, buying or selling of herons and their eggs, and the *Canada Wildlife Act* prohibits the possession or harming of wildlife (including herons) except as permitted by regulations. Regional District zoning bylaws and provincial/regional best management practices and guidelines may have some potential to protect breeding sites on private land (Ministry of Environment 2006).

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 on crown land could be addressed through the establishment of Wildlife Habitat Areas (WHAs), Wildlife Habitat Features (WHFs), *Wildlife Tree Patches* (WTPs), *Riparian Management Areas* (RMAs) or *Old Growth Management Areas* (OGMAs). The *Results Based Code* offers no protection for the majority of active breeding colonies in the 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 surveys were initiated in 2002, heron stewardship efforts have targeted landowners and land managers at breeding sites. Landowners and managers were informally approached 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 verbally. 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. Since 2004, this information has been provided in the form of a

Heron Stewardship Brochure presented in person (or mailed, in the case of absentee landowners) to landowners and adjacent neighbours. This has been supplemented with heron breeding territory maps showing core nesting habitat and secondary (recruitment nesting and foraging) buffer areas. These maps were updated in fall 2006 by Amy Waterhouse, and additional maps were created for three new breeding sites.

Also in late fall of 2006, MM filled out WHA application forms for the Gold Creek & Jaffray rookery and provided Janna Foster-Wilfong (MOE, Penticton) with maps delineating core buffer and secondary areas. Additional queries have been responded to as they arise with respect to the establishment of these WHAs.

NGO organizations contacted directly for potential assistance with landowner contacts have included The Nature Trust, (Rob Neil), the Nature Conservancy (Dave Hillary, Tim Ennis), The Land Conservancy (Kathleen Shepherd, Paula Rodriguez de la Vega, Emily Nielson), and the East Kootenay Conservation Program (Darrell Smith). In 2005, the EKCP agreed to take the lead on coordinating an approach to securing protection for selected heron breeding sites. An information package was sent (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), which they then circulated to all other partner organizations. Kathleen Sheppard (KS) at The Land Conservancy expressed interest in working on securement of heron breeding sites. In August of 2006, an updated information package incorporating 2006 breeding results was prepared and forwarded to KS. This was supplemented in fall with the provision of updated and new breeding territory maps for all private land sites. MM met with KS in Cranbrook on December 13th, 2006 to discuss strategies to approach specific landowners. To date, private landowners have not been approached directly by NGO's, despite considerable effort, encouragement and support from the project biologist. Based on interactions with local NGO groups, there appears to be a lack of capacity to prioritize these relatively small conservation projects within the Kootenay Region at this time. Capacity-building within the NGO community through provision of resources, personnel, and training may be necessary to meet the current and increasing demand for such initiatives in the region.

To promote awareness of interior herons, their habitat use, requirements, and population threats in the Columbia Basin, MM has given the following presentations this year:

- The Canada/US Heron Working Group Meeting in Delta, BC (April 19th, 2006);
- The Wings Over The Rockies Bird Festival in Invermere (May 6, 2006);
- The Columbia Basin – A Cultural Environment & An Environmental Culture Conference (Species at Risk Technical session) in Castlegar (October 19-21, 2007);
- The Revelstoke Community Centre (February 26, 2007); and
- The Golden Senior Centre (February 27, 2007).

MM was interviewed on Nelson Cooperative Radio (November 7th, 2006) about the heron project findings to date and the expansion of the project to address bald eagle distribution. She also provided information and reviewed the web page text for a feature article on herons at Waldie Island, prepared by Walter Volovsek for a Columbia Basin Trails in Time website (www.trailsintime.org).

Stewardship activities completed and/or underway in 2006/2007 at specific breeding sites are itemized in Appendix 6, 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.

3.3 Bald Eagle Nest Survey

A total of 43 bald eagle nests (13 in the West Kootenay; 40 in the East Kootenay), including 37 active nests (12 and 25 in the West and East Kootenay, respectively) were documented during 2006 fixed wing and vehicle surveys. Active nests are mapped in Figure 2, and as expected based on the survey locations and intensity, the greatest concentrations of eagle nests were in the CVWMA and the CWWMA. Appendix 6 provides information on visit dates, nest status (A = active, NA = not active; UN = unknown; S = successful; F = failure), reproductive success (number of young close to fledging at visible nests) and nest locations and descriptions. UTM coordinates were either determined with a GPS, or they are based on an estimated distance and bearing from a vantage point that was GPS-located.

In the CVWMA, seven eagle nests (all active and successful) were found in 2006. This compares with five eagle nests found within the same area in 1996 and 1997 (McMann 1996, 1997), and four eagle nests documented in 1982 (Forbes and Kaiser 1984). Based on these data, there does appear to be an increasing trend in the size of the Creston Valley eagle population.

In the CWWMA, 25 eagle nests (22 active and 20 successful) were counted in 2006. Blood and Anweihler (1994) reported a density of 15 eagle nests for a similar area (162 km of shoreline from Athalmer to Donald) also surveyed by fixed-wing aircraft in the early 1980's. These data also suggest an increase in the population of eagles breeding in the Columbia Wetlands.

Of 37 active eagle nests counted in 2006 within the basin, 33 (89.2%) were successful, 3 (8.1%) failed, and the outcome was unknown for 2 (5.4%) nests, due to long viewing distances and poor visibility. Productivity was estimated at 1.62 ± 0.11 young per active visible nest (n = 29) and 1.74 ± 0.9 young per successful visible nest (n= 27). These estimates appear to indicate relatively high productivity levels, compared with reported productivity for eagle populations in BC and nearby jurisdictions (Idaho, Montana and Washington States), which range from 0.9 - 1.5 young per active nest and 1.4 – 1.9 young per successful nest (Blood and Anweiler 1994).

In terms of nest tree species, 41 of 43 (95%) nest trees were in black cottonwood trees (34 live and 7 dead) and the remaining two nests were in live Douglas-fir trees. These data are almost identical to those reported by Forbes and Kaiser (1984) which indicate a predominance (96) of black cottonwood, with few Douglas-fir (4%) nest trees.

4.0 Summary and Recommendations

During this inventory, an estimated 664 adult herons (based on 332 active nests) and 386 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. With the exception of the Creston colony, 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 2006 were higher than those counted in previous years. However, failure rates determined for active nests (43% overall and 62% in the East Kootenay) and active sites (38% overall and 40% in the East Kootenay) were as high as in 2005 (Machmer 2006) and higher than in all previous year of monitoring. Reproductive success and failure rates documented in 2005 and 2006 within the

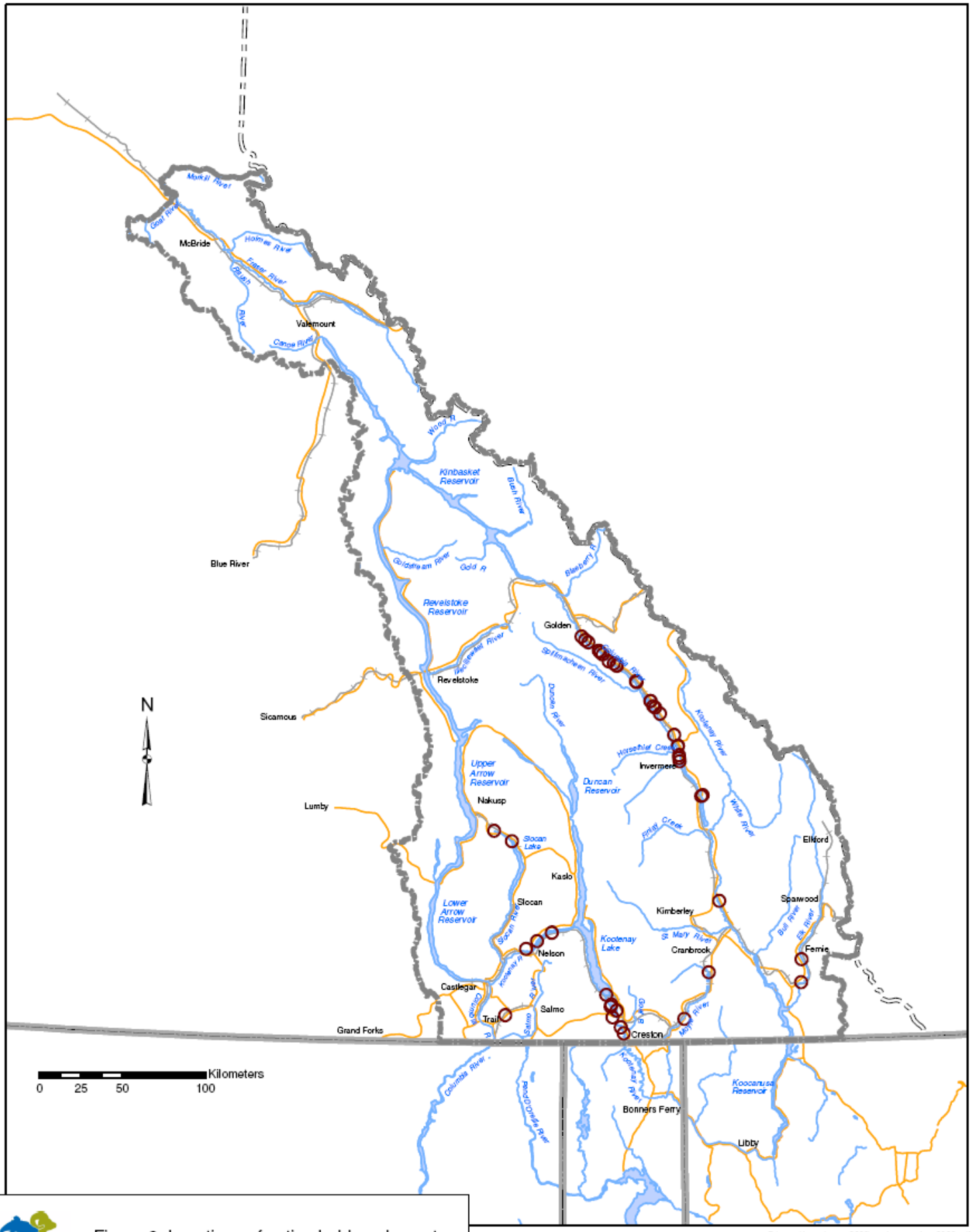

Figure 2. Locations of active bald eagle nests found in the Columbia Basin during 2006

B:\maps\heron\maps2006\eagle_map_loc_2006.pdf
W:\srm\net\Workarea\cbfwcp\heron\2006\eagle_map_loc_2006.pdf

It is assumed that the majority of large heron colony failures observed in the East Kootenay are attributable to bald eagle harassment and predation. This may be related to a higher density of eagles co-nesting in proximity to heron breeding colonies and may also be influenced by a diminishing supply of suitable habitat free of human disturbance in valley bottoms of the basin. It is not currently known whether the trend toward increasing use of conifer-dominated and mixed stands for nesting by herons is (1) an adaptive response to increase nest site concealment and hence reduced harassment and predation by eagles, or (2) a shift toward less preferred nesting habitat due to a diminishing supply of highly suitable habitat and/or competitive displacement by an increasing number of bald eagles.

The following specific recommendations are proposed:

- Continue monitoring of nest activity and reproductive success (per active and successful nest) at known and newly discovered active heron breeding colonies in the Columbia Basin, according to protocols established in 2002-2006. Opportunistically document any incidences of adult or chick injury or mortality during visits.

- If possible, either install video cameras or formally engage public/student volunteers to assist with gathering observations at the Parson and Wilmer colonies during the period from late April through May. This would permit collection of data on eagle-induced heron disturbance, mortality, and colony abandonment and would serve as background to interpret rates of site/nest abandonment, nest failure, and reproductive success.

- Continue to track cormorant nest numbers and heron/cormorant interactions at breeding sites where these species co-occur.

- All data gathered and reports produced should continue to be provided to federal (CWS, Heron Working Group) and provincial (MOE, CDC) agencies that are mandated to protect this species and/or its habitat.

- 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.

- Gather eagle nest location information in conjunction with the spring 2007 nest sighting program and then field-truth reported sites in mid to late June to verify locations, describe nest sites and determine productivity. Use this data to establish a benchmark for eagle nest numbers and breeding distribution across the basin. By repeating this survey periodically (i.e., every 5 years), using the same approach and methodology, one could obtain a rough estimate of eagle nest densities in the basin, and track population estimates over time.

- 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.

It is also recommended that the FWCP strive to promote, lobby for resources and/or actively develop capacity to undertake conservation projects that involve land acquisitions, and establishment of conservations covenants or land stewardship agreements on private lands. Increased local capacity in this sector is urgently needed to better integrate the findings from inventory, research and habitat management projects with the implementation of stewardship recommendations in a timely manner. This will require provision of resources, personnel, and training to meet the increasing demand for private land conservation initiatives in the region.

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6.0 Appendices

1. Eagle Awareness Poster

2. Eagle Observation Web Page

3. Biologist Survey Log

4. Photo Record

5. Heron Breeding Database (CDrom; confidential information)

6. Management Concerns, Recommendations and Stewardship Actions Conducted (CDrom; confidential information)

7. Bald Eagle Breeding Database (CDrom; confidential information)

8. Project Summary Database for 2002-2006 (CDrom; confidential information)

APPENDIX 1: Eagle Awareness Poster

APPENDIX 2: Eagle Nest Sighting Web Page

Columbia Basin Bald Eagle Nest Sighting Form

Thank you for your participation in this survey. Providing this information will help us establish a benchmark for eagle populations in the Columbia Basin.

Please fill out the form below if you have a nest sighting to report.

Observer Details

Name of observer

Contact information:
(telephone and/or email address)

Location Details

Brief description of specific eagle nest location:

(Name, distance and direction of closest town, creek, or other landmark to nest)

Observation Details

Date and Time of Observation:

(24hr time, day/month/year, or period (months/year) over which observations made)

Type(s) of observations at this location (check box):

- ☐ Occupied bald eagle nest(s)
- ☐ Unoccupied bald eagle nest(s)

Comments (e.g. other species observed, human activities in the area, additional details, etc...):

Submit

APPENDIX 3: Biologist Survey Log

(Observers: MM = Marlene Machmer; CS = Chris Steeger; MAB = Marc-Andre Beaucher; DL = Davy Lewis)

Date	Observer	Location	Hours	Type of Survey	Mileage
17-Apr	MM, MAB*	Creston Valley	5.5 + 3*	fixed wing	60
21-Apr	MM	Salmo, Kootenay River to Wasa	4.5	car, foot	
22-Apr	MM, DL*	Columbia Wetlands (Fairmont to Golden)	11 + 4*	fixed wing, foot	730
24-Apr	MM	Nelson to Proctor	4	car, foot	70
27-Apr	MM	Salmo, Creston Valley	7	car, foot	200
2-May	MM	Salmo, Moyie, Fort Steele, Jaffray, Elk River to Fernie	8	car, foot	
3-May	MM	Elk River from Fernie to Sparwood, Gold Creek, Wasa	13	car, foot	
4-May	MM	Wilmer, Brisco, Spillimacheen, Parson, Nicholson, Golden	13	car, foot	
5-May	MM	Revelstoke, Summit Lake, Bonanza Creek, Slocan Valley	12.5	car, foot	1,610
8-May*	MM	Proctor, Crawford Bay	2.5 + 3.5*	car, foot, kayak	81*
17-June	MM	Salmo & Creston Valleys	6	car, foot	228
23-Jun	MM	Creston Valley, Yahk, Moyie, Wasa, Fairmont, Wilmer	16	car, foot	
24-Jun	MM	Invermere, Radium, Brisco, Spilliamcheen, Parson, Nicholson, Golden	15.5	car, foot	
25-Jun	MM	Revelstoke, Summit Lake, Slocan Lake, Goose Creek	10.5	car, foot	1,240
27-Jun	MM	Jaffray, Gold Creek, Sparwood	11.5	car, foot	826
1-Jul	MM	Creston Valley	6	car, foot	216
3-Jul	MM	Creston Valley, Salmo Valley	7.5	car, foot	283
6-Jul*	MM, MAB*	Creston Valley	8.5 + 5*	boat, car	227
20-Jul*	MM* & CS*	Slocan Lake	6*	kayak	
21-Jul*	MM* & CS*	Slocan Lake	8*	kayak	250*
Totals			192		6,021

*Time spent and/or mileage incurred on these days was voluntary contribution (in kind) on behalf of one or more individuals indicated.







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: Parson

Selected active nest stands (left to right):

Upper: Wilmer, Revelstoke; wetland feeding area near Revelstoke nesting site

Middle: Sparwood, Yahk

Lower: Moyie; Nicholson

Selected active nest stands (left to right):

Upper: Wasa pine stand;Jaffray nest stand;Jaffray young

Lower:Goose Creek wetland with nest stand behind; Salmo wetland with nest-building attempt

Eagle surveys (left to right):

Upper: Grohman Island nest; Dutch Creek heron nest stand

Lower: Leach Lake breeding colony; Wilmer eagle nest with rookery adjacent

APPENDIX 5: Heron Breeding Database (CDrom; confidential information)

APPENDIX 6: Management Concerns, Stewardship Recommendations and Actions (confidential).

APPENDIX 7: Bald Eagle Breeding Database (CDrom; confidential information)

APPENDIX 8: Project Summary Database for 2002-2006 (CDrom; confidential information)