FEATURE ARTICLES

Bald Eagle Predation and Other Disturbance Factors at Double-crested Cormorant and Great Blue Heron Nesting Colonies in the Creston Valley, British Columbia

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Abstract

Instances of Bald Eagle (*Haliaeetus leucocephalus*) predation were observed at nesting colonies of Great Blue Herons (*Ardea herodias*) and Double-crested Cormorants (*Phalacrocorax auritus*) at Leach Lake in the Creston valley, in southeastern British Columbia. During 1,055 volunteer hours of field observations made between 2003 and 2007 four events of Bald Eagle predation on adults and nestlings were observed, two on cormorants and two on herons. The calculated rate of predation for the observation period was once every 264 hours, suggesting that at these colonies Bald Eagle predation is currently a rare event, with minor impact to colony size, stability, and reproductive success.

Responses by nesting cormorants and herons to an additional nine species of potential avian predators and human disturbances occurring at or near the colonies are also documented.

Introduction

There are many factors that affect the reproductive success of fresh-water colonial nesting birds. Some of these include weather, availability of food, longevity of nest sites, habitat alteration**,** chemical contamination, direct disturbance by humans, and events like predation (Kushlan 1992, Schreiber and Burger 2002). In British Columbia, Bald Eagle (*Haliaeetus leucocephalus*) disturbance and predation at coastal Great Blue Heron (*Ardea herodias*) and Double-crested Cormorant (*Phalacrocorax auritus*) nesting sites have recently been identified as a major threat to breeding success and in some cases has resulted in colony abandonment (Norman et al. 1989, Butler 1997, Chatwin et al. 2001, Moul and Gebauer 2002, Vennesland and Butler 2004). In the interior of the province, Bald Eagle incursions and predation have been observed at Great Blue Heron colonies in the Columbia Basin (Machmer and Steeger 2003, 2004, Machmer 2006, 2007). Elsewhere in North America, the Bald Eagle is considered a key predator especially on large chicks; it also causes panic among breeding adults which can lead to nest abandonment and reproductive failure (Todd et al. 1982, Hobson et al. 1989, Hatch and Weseloh 1999). Predation by eagles on adult cormorants at breeding colonies has been reported from Manitoba (Hunt et al.1992).

In addition to predation by eagles both direct and indirect disturbances from other potential avian predators may impact nesting colonies (Forbes et al. 1985). In the interior of British Columbia little is known about the long term effects of predation and disturbance on colonial nesting waterbirds. This paper describes observations of Bald Eagle predation at Great Blue Heron and Double-crested Cormorant breeding colonies and summarizes observations of other predatory birds interacting with the colonies. The study was conducted during the breeding periods of 2003 through 2007. For the purpose of this discussion herons and cormorants are addressed as separate colonies even though they inhabit the same general area for a period of time each season. The colonies are located in the Leach Lake Unit of the Creston Valley Wildlife Management Area in southeastern British Columbia.

Colony Description

Great Blue Heron and Double-crested Cormorant colonies are situated on the west bank of the Kootenay River along the eastern boundary of Leach Lake Unit at an elevation of 543 m (Figure 1). Nests are located in riparian habitat that is dominated by mature black cottonwood (*Populus balsamifera*) trees that range from an estimated 28 to 36 m tall. The understory is comprised primarily of dense red-osier dogwood (*Cornus stolonifera*) that measures up to 4 m tall. From 2003 through 2007 the nesting territory of both species increased in size and presently occupies an

Figure 1. An aerial view of Great Blue Heron and Double-crested Cormorant nesting colonies (whitewash area to the left) in a dense stand of riparian mature black cottonwood. Leach Lake, BC. 20 July 2007 (Cyril Colonel). BC Photo 3591**.**

area approximately 322 m along the rivershore with a westward expansion of 300 m at the north sector (Figure 2). The number of nesting Great Blue Herons and Double-crested Cormorants increased between 2003 and 2006; however, prior active heron colonies at Kootenay Landing, Duck Lake, and Goat River were abandoned which may account for the increase at Leach Lake.

Although both species build "stick" nests, the characteristics of the nests differ between species. Herons build a large flat platform of bare twigs (Figure 3) which when used in successive years can become quite bulky. Cormorants initially build a shallow nest comprised of twigs, leafed branches, long rootlets, and strands of bark, all of which becomes coated with excrement during the breeding period. Cormorants frequently add nesting materials throughout the season and so the nest often becomes quite large (Figure 4). Both species build their nests in the lower to upper canopy of the cottonwood trees although cormorants tended to build their nests higher than nearby herons. Nest heights for both species ranged from approximately 20 to 35 m with most between 25 and 30 m.

Feeding areas for both species are to the west within the Leach Lake ponds, to the south at Corn Creek marsh, and north to north-west at Duck Lake and Six Mile Slough. Later in the season, when water levels from the Kootenay River subside after spring-run off, both species forage along the river and cormorants also forage at the south end of Kootenay Lake. Extensive agricultural fields and a shrubby, grassy dyke lie to the east of the colony where herons are frequently observed hunting for small mammals.

Currently, a pair of Osprey (*Pandion haliaetus*) nest on a black cottonwood snag in the north sector of the heron and cormorant nesting colonies. The nearest active Bald Eagle nests are 4.5 and 5 km to the north-west.

Figure 2. View of the Great Blue Heron and Double-crested Cormorant colonies in black cottonwood trees along the Kootenay River at Leach Lake, BC. Observations of the colony were taken from 250 m away on the opposite shore of the river. 26 March 2006. (Cyril Colonel). BC Photo 3592**.**

Figure 3. When Great Blue Herons arrive in the spring, nests from previous years are quickly occupied and new shallow stick nests are under construction. Leach Lake, BC. 4 April 2005 (Cyril Colonel). BC Photo 3593.

Figure 4. Double-crested Cormorant nests can become quite bulky and heavy, as nesting materials are added throughout the breeding season; even when large nestlings are present. Leach Lake, BC. 18 July 2005. (Cyril Colonel). BC Photo 3594.

Colony Monitoring

The breeding activity of Great Blue Herons and Double-crested Cormorants at the Leach Lake Unit has been monitored annually since 2003. Great Blue Herons have occupied this site for nesting since at least 1991(Wilson and Stushnoff 1992). Double-crested Cormorant is a recent arrival and first nested among the herons in 2003 (Van Damme 2004). Field monitoring activities commence on 1 March each year. Great Blue Herons are the first of these colonial species to arrive in the spring and the first to depart in the summer. Monitoring may extend some years into late September depending on the stage of the nesting cycle for Double-crested Cormorants.

Data collection included documenting the arrival dates of adults, courtship behaviour, nest-building

activities, total number of birds at the colonies, reproductive failure and success (*i.e.,* number of successfully fledged young), successful and unsuccessful predation events (*e.g.,* Bald Eagle and Common Raven, (*Corvus corax*);Van Damme 2006), and departure dates. During the 200 (+/-) hours of observation each year, interspecific nesting activities were also documented. Each season specific aspects of the colony, including a general colony profile, records of individual nests to follow productivity, mortality, and disturbance, were thoroughly documented by photographs. These were collated into an annual report and deposited with the Biodiversity Centre for Wildlife Studies as supplementary information to the BC nest record cards. (Figure 5) (Campbell et al. 2004, 2005, 2006, 2007).

Figure 5. Cyril Colonel takes a keen interest in photographing all aspects of the nesting colonies of Great Blue Herons and Double-crested Cormorants for historical purposes. Leach Lake, BC. 25 August 2007. (Linda M. Van Damme). BC Photo 3595.

Bald Eagle Predation at Great Blue Heron and Double-crested Cormorant Nesting Colonies

Great Blue Heron

Two instances of direct interactions between nesting Great Blue Heron and hunting Bald Eagle were observed. Two other "probable" interactions are noteworthy.

On 8 July 2003, Linda was alerted to something unusual when she heard alarm calls from adult Great Blue Herons flying from the nesting colony, and also from six adult Ospreys calling and circling over the nesting area. With the aid of binoculars and a 45x power spotting scope, trees with active nests were quickly scanned from a viewing location on the opposite shore of the Kootenay River. An immature Bald Eagle was discovered in a heron nest securing a large heron chick with its talons. The eagle plucked body feathers, tugging and pulling with its bill until flesh was exposed. Mantling over its prey, the eagle briefly looked overhead, and then commenced feeding. After a few minutes, it stood upright, and plucked another section of the nestling's body. At other nearby and active nests, 43 large heron chicks stood erect and silent, with all individuals facing in the direction of the predation incident. An adult Great Blue Heron that landed on a branch high above the Bald Eagle, ducked each time a pair of Osprey dove at the eagle with feet lowered and talons extended. After approximately 20 minutes of feeding the eagle took flight. A pair of Osprey repeatedly dove at the Bald Eagle and in one quick maneuver the eagle flipped upside down and exposed its talons to the Ospreys, which continued to chase the eagle until it was out of the observers view. After the chase, the pair of Osprey flew to a nest located at the north boundary of the heron colony. Moments after the Bald Eagle departed, the posture of three young herons in the nest closest to the attack was relaxed, even playful, as they sparred with their bills until an adult arrived to feed them.

The second incident of predation occurred on 23 July 2005 at 1215 hrs when Linda observed a first-year Bald Eagle fly into the Great Blue Heron nesting area with feet extended and grab a large heron chick standing in a nest. The Bald Eagle flew to a cottonwood tree branch which could not support the weight of the eagle and its prey. As the eagle tried to balance itself, it released the heron which subsequently fell down through the tree foliage where it would be difficult to retrieve. The Bald Eagle made another flight pass, this time landing near a nest with an incubating Double-crested Cormorant. Neither the adult sitting in the nest, nor its mate that was perched nearby flushed with the eagle's presence. The Bald Eagle departed and flew southwest with no further attempt at predation.

During the 2007 breeding season, Cyril twice

witnessed a "probable" interaction between Bald Eagles and Great Blue Herons. On 30 April 2007, an immature Bald Eagle was observed flying over the colony at 0945 hrs heading in a north westerly direction where the majority of heron nests were built. From his viewing location, Cyril counted 15 adult Great Blue Herons leaving the colony. At 1010 hrs loud alarm calls, which lasted about 2-3 minutes, were heard coming from the north west area of the heron colony. A second immature Bald Eagle appeared briefly in flight (Figure 6). At 1102 hrs the first immature eagle was observed flying from the west side of the colony and it was assumed that predation or an attempt at predation had occurred

Figure 6. Bald Eagles, like this immature, made frequent incursions into the Great Blue Heron nesting area when nestlings were present creating a natural disturbance. Leach Lake, BC. 5 May 2007 (Linda M. Van Damme).

The second probable incident of predation occurred on 13 May 2007, when an immature Bald Eagle was first sighted at 1025 hrs as it flew east away from the nesting colony, then at 1050 hrs it was observed flying to the south. At 1130 hrs, a major lift off of over 70 adult Great Blue Herons occurred as the Bald Eagle flew to the north west region of the nesting colony. Unfortunately, because of the dense foliage of the cottonwood trees, viewing was obscured.

Double-crested Cormorant

Two instances of predatory interactions between Double-crested Cormorant and Bald Eagle were observed, as well as one "probable" incident. Linda observed the first predation incident on 9 June 2006 at 1030 hrs when 71 incubating adult Double-crested Cormorants suddenly took to the air, calling loudly while circling in flight (Figure 7). The nesting colony was quickly scanned with binoculars to determine the cause of disturbance. At one nest, an immature Bald Eagle was standing on a struggling adult cormorant that had failed to leave its nest when the eagle approached the colony (Figure 8). This nest had been occupied since 20 April and although young had not yet been observed; it was likely that small young were present, which might explain why the adult remained at the nest. The Double-crested Cormorant struggled for approximately five minutes before it was subdued. While being held the cormorant thrashed its neck and head when the eagle changed position. Despite attempts to jab the eagle with its bill, the cormorant soon lost the fight as evidenced by the cormorant's limp head and neck that hung over the rim of the nest. Viewed through a spotting scope the eagle could be seen tearing at the body of the cormorant, swallowing chunks of flesh. The eagle fed from 1035 to 1108 hrs. While the eagle was present, incubating adult cormorants gradually returned to their nests, although the pair nesting closest to the predation incident did not return and that nest ultimately failed. When the Bald Eagle departed the wing of the predated adult cormorant dangled from the nest rim and was visible on return visits until 11 June. By 15 June, another adult cormorant claimed the nest site and successfully reared young.

The second predation incident observed by both authors occurred on 22 August 2006, starting at 0640 hrs when an immature Bald Eagle approached from a south-westerly direction and landed on a black cottonwood snag at the south end of the Double-crested Cormorant colony. While perched, the eagle preened its feathers. In the meantime, although the adult cormorants were fully alert, none flushed from their nests or perches near the nests. At 0835 hrs, the eagle flew to the north end of the colony and landed in the bowl of an empty stick nest**.** All adult cormorants panicked and left the colony to circle briefly before

Figure 7. When a Bald Eagle enters the colony it causes panic among nesting adult Double-crested Cormorants and Great Blue Herons who quickly flush from nests and nest trees. Leach Lake, BC. 9 June 2006 (Linda M. Van Damme). BC Photo 3596.

Figure 8. Immature Bald Eagle preying on adult Double-crested Cormorant while two large Great Blue Heron nestlings look on only a few feet away. Leach Lake, BC. 9 June 2006 (Linda M. Van Damme) BC Photo 3598.

landing in the Kootenay River. The Bald Eagle returned to the south cottonwood snag and perched on a lower branch. At 0920 hrs the eagle flew once again to the north end of the cormorant colony making a flight pass over one nest where a single black downy cormorant chick with emerging wing feathers stood upright and vocalized. The eagle made a second flight pass, this time with outstretched feet which struck the young cormorant frontally, knocking it from the nest and causing it to fall backwards and into a tangle of tree branches below. Curiously, the young cormorant faced the eagle and did not cower in the nest as one might expect when a predator approaches. It may be possible that the cormorant chick did not recognize the eagle as a threat. As we observed the incident it appeared that the eagle made no attempt to grasp the young cormorant as prey. The Bald Eagle then flew along the eastern and western boundaries of the colony. Although other cormorant chicks stood upright in their nests, also vocalizing, no further eagle attacks were observed. The eagle returned again to a perch at the south boundary, close to a nest where an adult cormorant with its back to the eagle was busy feeding its three young. The Bald Eagle finally departed at 1010 hrs flying southeast over a swathed timothy seed field being harassed by an Osprey and two Northern Harriers (*Circus cyaneus*), which took turns diving at the eagle. The immature Bald Eagle

had been present at the Double-crested Cormorant nesting colony for 3 hours and 25 minutes.

After witnessing the above attack we suspect an eagle was responsible for cormorant chicks being driven from their nests on 21 August. On each visit, individual nests are checked for occupancy and developmental stage of the cormorant young. On this particular day Linda noted that 14 young, all incapable of flight, were absent from six nests. We carefully scanned the nesting area and found six dead cormorant young hanging from tree branches below the colony. Along the rivershore we discovered five live chicks in the same developmental stage as the one observed being attacked by an eagle (Figure 9). Four chicks were quite active, swimming along the shoreline and climbing about on fallen dead tree branches, but the fifth one was prostrate on the muddy shore and appeared weak in its movements. Adult cormorants were observed flying to and from the colony or landing in the river, but showed no interest in the displaced young. At two of the newly vacant nests adult cormorants were observed peering into the empty nest bowl and tugging at the nest lining as though distressed by the disappearance of their offspring. The last grounded cormorant chick survived to 25 August and its carcass was visible along an animal trail but disappeared a couple of days later. During the 2006 season, we had observed

Figure 9. Unable to fly or catch fish on their own, these five Double-crested Cormorant chicks perished along the river shore below the Leach Lake nesting colony. 21 August 2006 (Linda M. Van Damme). BC Photo 3599.

Black Bear (*Ursus americanus*), Coyote (*Canis latrans*), and Striped Skunk (*Mephitis mephitis*) frequenting the area below the nesting colony, likely scavenging for fallen nestlings.

On 24 August 2006, at 0810 hrs, an immature Bald Eagle arrived and perched in a cottonwood snag south of the colony and departed at 0850 hrs without flushing Double-crested Cormorant adults, or attacking young in nests. On 25 August an immature Bald Eagle approached the colony from the northeast at 0900 hrs and flushed 20 cormorants from their perches, with no attempt at predation. The 2006 nesting season ended with two confirmed Bald Eagle attacks.

Discussion of Bald Eagle Disturbance

Bald Eagle visits were recorded when an eagle was observed flying in proximity to or soaring over the nesting colonies or landing in the nesting trees. The Bald Eagle, a known predator of Great Blue Heron adults and young, was recorded in the vicinity of the nesting colony at Leach Lake on 56 occasions (14 adults and 42 immatures) during the study (Table 1; Appendix 1). Two of these observations resulted in direct predation and two more were thought to be predatory attempts.

Great Blue Herons responded to the presence of Bald Eagles by abandoning their nests and/or nesting trees, squawking loudly and circling in flight before perching in trees away from the colony or landing on the shore of the Kootenay River. We observed this behaviour on 19 occasions (34%). Of the remaining visits by eagles there was no avoidance response by attending Great Blue Herons and adults either remained at the nest site or perched in nearby trees (see Appendix 1).

Bald Eagles (10 adults and 47 immatures) were observed in the vicinity of the Double-crested Cormorant colony on 57 occasions. On two occasions successful predation of an adult and nestling cormorant by an immature eagle was observed (Table 2; Appendix 1). We also documented one suspected attack.

Double-crested Cormorants responded to the presence of Bald Eagles by loudly vocalizing and abandoning nests and perch sites near nests. Initially, the cormorants would circle above the colony

Table 1. Total observations, age classes, and successful predatory attacks by Bald Eagle at the Leach Lake Great Blue Heron colony, 2003-2007.

Year	Observations	Adults	Immatures	Predation
2003	3	0	3	1
2004	7	1	6	0
2005	5	1	4	1
2006	11	5	6	0
2007	30	7	23	0
Total	**56**	**14**	**42**	**2**

Table 2. Total observations, age classes, and successful predatory attacks by Bald Eagle at the Leach Lake Double-crested Cormorant colony, 2003-2007.

Year	Observations	Adults	Immatures	Predation
2003	3	0	3	0
2004	7	1	6	0
2005	3	0	3	0
2006	16	5	11	2
2007	28	4	24	0
Total	**57**	**10**	**47**	**2**

for 2 to 5 minutes before landing in the Kootenay River (Figure 10). This behaviour was noted on 18 occasions (32%; see Appendix 1). On one occasion the cormorants remained in the river and were absent from their nests for 2 hours 45 minutes which subsequently resulted in the stealing of several eggs by Common Ravens.

Figure 10. During prolonged Bald Eagle presence adult Double-crested Cormorants retreat to the nearby Kootenay River for safety. 9 April 2007 (Cyril Colonel). BC Photo 3601.

For the period 1998 to 2007 there has been a 50% increase in the number of active Bald Eagle nesting sites in the Creston valley (L. Van Damme unpublished data). Incidents of adults at or near the Great Blue Heron colony account for 25% of observations and 17.5% of observations at the Double-crested Cormorant colony. The number of immature Bald Eagle observations was substantially greater in 2007 compared to the previous four-year average, with a 385 % increase at the heron colony and a 317 % increase at the cormorant colony. On any given day, no more than three immature eagles were observed and so the increase may simply be individual birds returning to the colonies on subsequent days**.**

From 10 March through 30 April 2007 Bald Eagles were observed on 14 occasions in or near nesting trees at a time when Great Blue Herons had returned for the breeding season and were attempting to build new nests or occupy old nests. The presence of eagles may have delayed the onset of nesting activities (Figure 11).

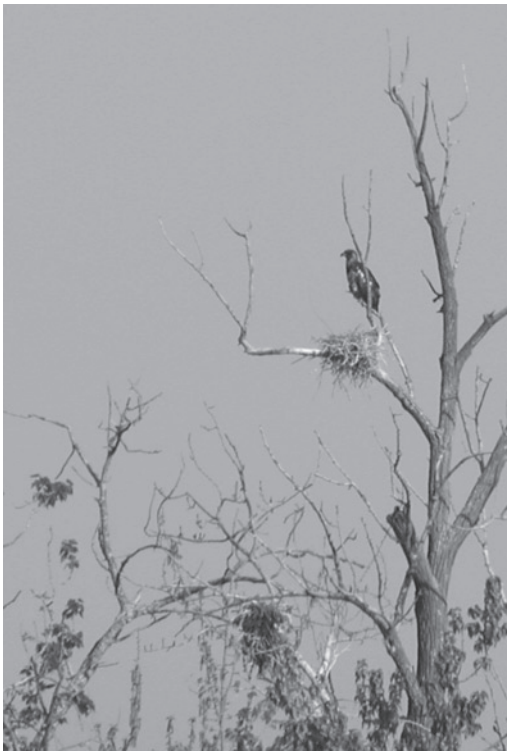

Figure 11. This immature Bald Eagle perched in the colony amidst active Great Blue Heron nests caused incubating adults to temporarily abandon their nests. Leach Lake, BC. 10 May 2007 (Cyril Colonel). BC Photo 3602.

Predation by Bald Eagles at Great Blue Heron colonies has frequently been reported in southern British Columbia (*e.g.,* Norman et al. 1989, Butler 1997, Machmer and Steeger 2003, 2004, Vennesland and Butler 2004) but we cannot speculate about the general impact at all nest sites. Predation may be local and seasonal, may not be annual, may result in a minor disturbance or major disruption, or may be a combination of physical and ecological processes, including food availability for both predator and prey. Weather, especially storms and high winds occurring early in the nesting season is frequently a cause for desertion (R.W. Campbell pers. comm.).

Responses and Disturbances by Other Potential Avian Predators

The behavioural responses and disturbances to nesting Great Blue Herons and Double-crested Cormorants from other potential predatory species that flew near, or landed in the colony, were also documented. These included Turkey Vulture (*Cathartes aura*), Osprey, Cooper's Hawk (*Accipiter cooperii*), Red-tailed Hawk (*Buteo jamaicensis*), Rough-legged Hawk (*Buteo lagopus)*, Merlin (*Falco columbarius*), Peregrine Falcon (*Falco peregrinus*), and Common Raven (see Appendix 1). Northern Harriers were observed on numerous occasions but their behaviour had no observed effect and thus are not included in the discussion that follows.

Turkey Vulture

Turkey Vulture (Figure 12), a common species in the Creston valley (Van Damme 2002), was recorded in the vicinity of the nesting colonies on 36 occasions between 6 April and 2 September (see Appendix 1). Their presence while soaring caused little reaction from herons or cormorants but when a vulture flew low over the colony, or directly through it, their visit incited a reaction. Rarely, however, did nesting birds leave the colony. Turkey Vultures are known to kill and eat young herons in the nest and could potentially have an impact on the success or abandonment of nests (Temple 1967).

Osprey

Osprey is a common nesting species in the Creston valley. There were 12 recorded incidents of adult Ospreys harassing juvenile Great Blue Herons. Some of these may have been the result of activity by a territorial pair which nested at the north sector of the heron colony. On occasion, an Osprey would expose its talons when diving at a heron but no direct body contact was ever observed (Figure 13). However, a juvenile heron was found dead on the east rivershore on 16 August 2006 with injuries to the right upper body so the possibility of an assault by an Osprey cannot be dismissed (Figure 14). In a couple of instances "pseudo" attacks occurred, and twice an Osprey forced juvenile herons into the Kootenay River and they had to swim to shore. The positive effects of having a nesting pair of Osprey in

Figure 12. As the nesting season progresses a strong stench develops from regurgitated prey remains, dead nestlings, and guano which attracts Turkey Vultures. On some days up to 11 were observed soaring above the colony. 19 August 2006. Leach Lake, BC. (Linda M. Van Damme).

Figure 13. This juvenile Great Blue Heron was perched in a tree on the opposite shore of the Kootenay River at least 300 m south of an active Osprey nest, yet it was continually harassed by an adult Osprey. Leach Lake, BC. 8 August 2007. (Marcia Long).

Figure 14. Mortality in the first year of a Great Blue Heron's life is as high as 69%. Kootenay River shore opposite Leach Lake nesting colony. 16 August 2006. (Linda M. Van Damme).

the heron colony may outweigh the cost of pseudo-attacks on herons. On 10 occasions one or two Ospreys were seen chasing a Bald Eagle from the vicinity of the colony.

There were only three direct incidents involving cormorants. Two of these were fly overs resulting in no response and another observation of an Osprey diving eight times on a family at its nest without flushing (see Appendix 1).

Cooper's Hawk

Four incidents involving immature Cooper's Hawks and Double-crested Cormorants occurred between 19 August and 12 September. At this time only cormorants were still feeding young in nests. The hawk dove at cormorants on two occasions (one flush and one no response), another flew over without a response and on the fourth occasion displaced two fledged cormorants, chasing one until it landed in the river.

Red-tailed Hawk

Red-tailed Hawks (Figure 15), common year-round in the Creston valley, were present sporadically throughout the entire heron and cormorant breeding period from 2 March to 24 September. Most of the 34 incidents recorded had no flushing response from herons or cormorants but they did remain alert and often appeared agitated. One hawk was observed diving at adult and fledged cormorants perched

in black cottonwood trees and at large nestlings standing in their nests. This behaviour appeared to be "harassment" as no attempt was made to strike the cormorants.

Figure 15. Although Red-tailed Hawks were commonly seen soaring over the colonies, it was the immatures which infrequently harassed perched nesting Double-crested Cormorants by diving and sometimes succeeding in flushing them. Leach Lake, BC. 6 June 2006 (Linda M. Van Damme).

Rough-legged Hawk

On 16 April 2007 a late migrant Rough-legged Hawk made a low flight pass over the colony, causing three adult herons and 40 adult cormorants to flush. Double-crested Cormorants were especially wary and nervous after recent Bald Eagle activity, and often would flush at the appearance of almost any large bird of prey flying near the colony.

Merlin

On 28 August 2006, a Merlin was observed diving at adult cormorants perched in black cottonwood trees and large nestlings standing in their nest and then it chased a cormorant in flight for a short distance, as if in intentional harassment, before returning to a perch.

Peregrine Falcon

Single migrants (one an immature) perched in the cormorant colony on 17 August 2005 and another (age unknown) in flight over cormorant colony on 13 September 2006 without response from late nesting cormorants.

Common Raven

Common Ravens (Figure 16) are a common resident in the Creston valley and were observed near the colonies throughout the heron and cormorant nesting seasons therefore only pertinent visits are summarized in Appendix 1. Since 2003, a pair of Common Raven have nested within 700 m of the Leach Lake colonial nesting area. The ravens were frequently observed flying to and from their nest to the colonies where they removed sticks from unoccupied nests, stole eggs, and examined empty nests for food items. This species may have the greatest impact on the nesting colonies because of their egg stealing/caching and nestling predating habits (Van Damme 2006).

During our study, Common Ravens opportunistically stole eggs of nesting Double-crested Cormorants. The pilfering usually happened during incidents of Bald Eagle disturbance at which time incubating cormorants departed their nests leaving the contents exposed and vulnerable. Cooperative foraging among two Common Ravens

Figure 16. It is not uncommon for Common Ravens, when flying to and from the Leach Lake nesting colonies, to antagonize other birds, such as this Eastern Kingbird (*Tyrannus tyrannus),* who may deter predatory intentions. Leach Lake, BC. 1 August 2006 (Linda M. Van Damme).

was also observed. While one bird flushed a nesting adult the other would steal an egg. These disturbances are likely a factor in nest abandonment and may contribute to the protracted nesting time and age disparity in chicks observed in some cormorant nests.

Responses and Disturbances from Human Sources

Other non-avian disturbances were also noted for nesting herons and cormorants. Observations of small, fixed-winged aircraft in the vicinity of the colonies caused adult Great Blue Herons and Double-crested Cormorants to assume an alert posture, but no flushing was observed. Helicopter over flights can be a major source of disturbance to both nesting species. For example, on 2 September 2003, a helicopter flew directly over the colony (Figure 17) when Double-crested Cormorants had young still in the nests. All adults and fledged young flushed from the cottonwood trees. Helicopter activity in the general area of the nesting colonies increased during the 2007 season.

Motorized boats along the Kootenay River (Figure 18) prompted an alert posture in both herons and cormorants and on rare occasions cormorants flushed from the trees; non-motorized watercraft appeared to have no effect.

Summary

Over the five year period of this study, from 2003 to 2007, and during 1,055 hours of field observations, Bald Eagle presence was observed on 56 occasions in the vicinity of the Great Blue Heron colony that resulted in two kills, both on large nestlings. Eagles were also noted near the Double-crested Cormorant colony on 57 occasions with two kills, one an adult and the other a large nestling. All predatory attacks involved immature Bald Eagles.

At the present time Bald Eagle predation is a rare, but normal event in the dynamic life of Great Blue Herons and Double-crested Cormorants nesting at Leach Lake. Recently, however, Bald Eagle activity has increased substantially, which may potentially lead to an increase in predation.

Figure 17. Helicopter activity in or near the Leach Lake nesting site causes a major disturbance to both Great Blue Herons and Double-crested Cormorants and was especially disruptive in 2007 when activity increased. 10 August 2006 (Linda M. Van Damme).

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Figure 18. US biologists conducting sturgeon studies stop to inspect a dead cormorant chick along Kootenay River shore. 22 August 2006. Leach Lake, Creston BC. (Linda M.Van Damme).

About the Authors

Linda has had an interest in the rich and diverse bird life of the Creston valley since moving to the West Kootenay in 1979. While living in Nelson, she initiated one of her several monitoring projects, winter raptor surveys, which often required a stay-over and a three-hour round trip once a month. Fifteen years later, as a result of these six-month surveys, from October to March, she has collected over 7300 records of birds of prey and documented the Creston valley as a major wintering area in the interior of British Columbia. After a 30-year career as a Registered Nurse, Linda retired in 2003 and moved to Creston where she happily devotes her free time to natural history research.

Cyril was employed at an early age and has had a varied work life, starting out as an express messenger with the Canadian Pacific railway, working in a tungsten mine, road and airport construction in the Yukon, dam and bridge construction in southern BC, commercial diving, and in 1960 started his own trucking company. From 1974 to 1995 he farmed the fertile lands of the Creston valley. He has been an elected officer in the Creston Chamber of Commerce, Reclamation Dyking District, Kootenay Valley Dyking District, Creston Valley Beef Growers, Creston Valley Grain Growers, and the Creston Valley Agricultural Society. Cyril is past president and honourary life member of the Creston Museum and Archives and strongly believes in preserving historical information. In recent years he has re-cultivated his boyhood interests of bird study and photography. Over the past 10 years he has been photo-documenting breeding birds and changes to their habitats in the Creston valley and submitting this valuable information to the British Columbia Nest Record Scheme.

Appendix 1. Responses of nesting Great Blue Herons* (Figure 19) *and Double-crested Cormorants* (Figure 20) *to nine potential avian predators flying near or perching in the colony including additional visits by Bald Eagles.

Acronyms for species are: **BAEA** - Bald Eagle, **CORA** - Common Raven, **COHA** - Cooper's Hawk, **DCCO** - Double-crested Cormorant, **GBHE** - Great Blue Heron, **MERL** - Merlin, **OSPR** - Osprey, **PEFA** - Peregrine Falcon, **RLHA** - Rough-legged Hawk, **RTHA** - Red-tailed Hawk, and **TUVU** - Turkey Vulture.

Turkey Vulture

2003: 6 June – adult TUVU and RTHA soaring over colonies, no response from DCCO or GBHE; 26 August – eight soaring over colony, no response from DCCO or GBHE still with two young in a nest; and 2 September – adult soaring over colony, no response from DCCO with young still at nests or GBHE still with two young in a nest. **2004:** 20

Figure 19. After fledging, this juvenile Great Blue Heron was found foraging along the shallow waters of the Kootenay River several kilometres north of the Leach Lake nesting colony. 22 August 2007. (Linda M. Van Damme).

June – two soaring over colonies, no response from DCCO or GBHE; 25 June – adult flew low over colonies, DCCO in alert posture and GBHE in alert posture and became silent (none flushed); 5 July – two flew low over the colony, 18 DCCO flushed and two TUVU and one OSPR flew low over the colony, three GBHE flushed; 13 July – one soaring over the colonies, no response from DCCO or GBHE still with 30 young in nests; 22 July – two soaring over the colony, no response from DCCO or GBHE; 31 July – one flew low over colony, four adult DCCO flushed; and 26 August – three soaring high over colony, no response from DCCO. **2005:** 6 April – 3 soaring high with an immature RTHA, no response from GBHE; 12 April – two soaring over colonies with two adults and one immature RTHA, no response from GBHE or DCCO; 29 June – one soaring high over colonies, no response from DCCO or GBHE; 17 July - one soaring high over colonies, no response from DCCO or GBHE; and 12 August - one soaring high over colonies, no response from DCCO or GBHE. **2006:** 14 May – adult soaring above colonies with immature RTHA, no response from DCCO or GBHE; 18 June – five soaring over colonies, no response from DCCO or GBHE; 23 June - one soaring over colonies, no response from DCCO or GBHE; 26 June – two adults soaring over colonies, no response from DCCO or GBHE; 5 July - two adults soaring over colonies, no response from DCCO or GBHE; 15 July – one soaring over colonies with one RTHA, no response from DCCO or GBHE; 27 July – two adults soaring low over south end of colony, no response from DCCO; 7 August – five soaring over colony with one RTHA, no response from DCCO; 16 August – five adults soaring over colony, no response from DCCO; and 3 September – five adults soaring over colony, no response from DCCO. **2007:** 30 April – adult approached from west, DCCO in alert posture but did not flush; 3 May – adult soaring over south end of colony, no response from DCCO; 6 May – adult flew low over the colonies, no response from DCCO or GBHE; 7 May – three adults soaring high, no response from DCCO or GBHE; 14 May – one soaring high over colonies with one RTHA, no response from DCCO or GBHE; 20 May – one soaring low over colonies, no response from DCCO or GBHE; 29 May – adult low over colony for 10 minutes, no response from DCCO; 11 June - adult soaring high, no response from DCCO; 17 June – adult low over colony, one adult DCCO flew to lower perch, others alert and vocalizing but no lift-offs; and 28 July – adult soaring low over colony, DCCO vocalizing loudly but no lift-offs.

Osprey

2003: 24 August – one dove eight times at DCCO adult and young in two nests, DCCO agitated and calling. **2004:** 5 July – one OSPR and two TUVU flew low over the colony, three GBHE flushed, later

Figure 20. Soon after fledging, some Double-crested Cormorants gather on fallen trees in the Kootenay River, just north of the Leach Lake nesting site. 23 August 2007. (Linda M. Van Damme) BC Photo 3581.

one OSPR harassed juvenile GBHE and forced it into the river; heron swam to shore. OSPR then dove at another juvenile GBHE nine times forcing it from a tree branch, again into the river. The heron swam to shore; 5 July – one flew low over colony, eight DCCO flushed; and 19 July – two adults harassing juvenile GBHE perched in tree, flew to different perch. **2005:** 8 July – adult, with talons exposed, dove at a fledged GBHE which flew into trees. **2006:** 1 July – adult diving at a fledged GBHE; 5 July – four adults soaring over colony, one diving and chasing juvenile GBHE; 5 August – adult harassing fledged GBHE, repeatedly diving at it; and 3 September – one flew in from east, swooped at two DCCO which ducked but did not flush. **2007:** 16 April – adult chasing adult GBHE, no contact; 10 May – adult diving at GBHE perched in tree, GBHE flushed at north end of colony; 11 May – adult chased adult GBHE into the river, no contact; and 14 July – adult continually diving at fledged GBHE on perch above river, no contact.

Bald Eagle

2003: 24 May – immature flew over colonies, no response from DCCO or GBHE; 8 July – immature standing in GBHE nest eating nestling, no response from DCCO on nests; and 11 August – immature soaring over colonies, no response from DCCO or GBHE still with young at nests. **2004:** 3 April – two immatures perched at south end of colony, 57 GBHE sitting in nests and 47 standing in nests. One BAEA flew over colony twice, herons remained silent. One BAEA flew northwest and 10 GBHE flushed and circled back to trees; 16 May – an immature flew over the colonies, no response from DCCO or GBHE; 22 May – an adult and immature perched on a log a few metres down river, no response from DCCO or GBHE; 8 July – two immatures soaring over river, no response from DCCO or GBHE; 26 August – one immature soaring high over colony, no response from DCCO; and 4 September – an immature flew over north end of colony, DCCO adult and fledged young on alert, three young laid flat in nest. **2005:** 23 March – an adult and immature flew through colony, GBHE flushed; 6 April – an immature soaring over the colonies, no response from DCCO or GBHE; 21 April – an immature flew into colony and perched on dead branch, all DCCO adults flushed and GBHE squawking while some took flight and others remained standing in nests. OSPR chased BAEA from colony; and 23 July – an immature entered colony at 1215 hrs. All adult DCCO flushed from nests. While BAEA preyed on GBHE chick some DCCO returned to nests. BAEA landed near incubating DCCO with its mate on nest rim, but neither flushed. BAEA departed and dropped GBHE prey. **2006:** 30 March – an adult and immature soaring near colonies, no response from DCCO or GBHE; 7 April – two adults flew over general area, no response from GBHE or DCCO; 10 April – adult flying with American Coot (*Fulica americana*) in talons landed north of colonies (Figure 21). Two immature BAEA chasing and screaming, no response from GBHE or DCCO; 9 June – an immature lands in DCCO nest, kills and feeds on incubating adult. All adult DCCO (and GBHE) flush but return to nests while eagle still present; 7 July – an adult and immature chasing each other and flew along the river by the colonies but no DCCO or GBHE flushed. Adult BAEA returned flying south and eight DCCO flushed. The immature flew by again. OSPR chased and dove at BAEA, no further DCCO flushed; 18 July – an immature flew south of colony. Adult DCCO standing alert, did not flush; 14 August – an immature flew over

Figure 21. The presence of a Bald Eagle causes panic among American Coots, one of their preferred prey items in the Creston valley. Duck Lake, BC. 19 June 2000. (Linda M. Van Damme).

the colony, six DCCO flushed; 21 August – an immature in DCCO colony, adult flushed. BAEA strikes nestling DCCO knocking it out of the nest; 24 August – an immature perched at colony, no attacks and no DCCO flushed; and 25 August – an immature flew through colony, 20 DCCO flushed but no attacks. **2007:** 10 March – an immature arrives at colony and stays 10 minutes, three GBHE return after eagle departs; 11 March – an immature perched in south tree, GBHE absent from colony; 20 March – an immature flying from nesting colony and one GBHE flying east from colony. Twelve American Crows (*Corvus brachyrhynchos*) harassing eagle then two adult BAEA landed in nesting trees, then flew from south of colony. One GBHE in north tree; 31 March – an immature circled high above colonies, no response from DCCO or GBHE; 1 April – an immature flew west over colonies, no response from DCCO or GBHE; 4 April – an immature at north end of colonies, no response from DCCO or GBHE; 5 April – an adult soaring southeast and an immature landed in an empty nest. A CORA harassing BAEA which flew southeast then two American Crows attacking it in flight. A second BAEA immature soaring over colonies flushing DCCO (to river) and GBHE, no attacks witnessed. An adult BAEA then perched in tree with 25 GBHE, then left to soar over colonies with no response and some DCCO and GBHE returned to their nests. A third immature flew high over the colony with no response; 8 April – adult flew from colonies at 1010 hrs, no DCCO flushed but 11 GBHE left site. BAEA returned to colonies at 1030 hrs and flushed 15 GBHE. Two immature BAEA soaring over colonies, 12 GBHE flushed but landed back in trees. DCCO flushed at 1155 hrs, cause unknown; 11 April – an immature arrived at 1055 hrs flying high, circled several times then departed no response from DCCO or GBHE; 15 April – immature lands in top of tree at 0930 hrs and six GBHE flush, then flies causing more GBHE to leave. All DCCO flush. BAEA relocated at 0943 hrs and 5 more GBHE flush. BAEA leaves perch, out of sight. At 1002 hrs, BAEA returns, lands in top of GBHE nest tree, herons do not flush. Immature perched until 1042 hrs in colony. At 1025 hrs an adult BAEA flies by, but did not enter colony. 19 April – an immature perched for 15 minutes on south tree at 1045 hrs, major lift off of DCCO and five GBHE flushed. At 1120 hrs flew to new perch, flushed eight DCCO which circled and returned to trees. At 1148 hrs a second immature BAEA flew through colony with an OSPR pursuing it (Figure 22). The first BAEA left and flew over the colony with no flushing; 20 April – an immature approached from the west and soared with three adult OSPR, then departed. A second BAEA approached from the southwest then flew east. No response in both incidents from DCCO or GBHE; 30 April – on arrival at 0945 hrs all DCCO off nests and 15 GBHE in air squawking loudly. An immature BAEA flew over colonies heading west toward nesting GBHE. At 1010 hrs loud volumes of noise at north end of colony lasting two to three minutes. A second immature (4-year old) arrived. At 1102 hrs an immature BAEA flew from west, where majority of GBHE are nesting and likely preyed on herons. At 1142 hrs an immature BAEA soaring high over colonies, DCCO loudly vocalized but none flushed. At 1152 hrs an adult BAEA soaring high over colonies from west to southeast, no DCCO or GBHE flushed; 4 May – an immature over colonies,

Figure 22. Territorial Ospreys nesting close to the Great Blue Heron and Double-crested Cormorant colonies frequently chase Bald Eagles away from the site each season. 29 July 2006. Leach Lake, BC. (Linda M. Van Damme).

major lift-off of DCCO and 20 GBHE flushed. Two adult OSPR also harassing BAEA; 6 May – on arrival at 1146 hrs an immature (4-year old) present, all DCCO flushed as well as 14 GBHE. American Crow harassing eagle that flew east with crows in pursuit; 9 May – at 0845 hrs all DCCO and 20 GBHE flushed, could not locate source. At 0920 hrs an immature BAEA near colony and caught a fish in Kootenay River. OSPR attacked BAEA who dropped fish and was chased west; 10 May – on arrival at 0715 hrs immature perched in centre of cormorant colony. All DCCO off nests and GBHE flushed from north end. BAEA flew away and DCCO returned to nests at 1000 hrs; 13 May – immature flew east at 1025 hrs and again south at 1050 hrs, no response from DCCO but 70 GBHE lift-off; 20 May – immature (4-year old) soaring northeast moving towards colonies and dropping in elevation. OSPR circled near it, no DCCO or GBHE flushed; 7 July – adult soaring over colony, two adult OSPR escorted eagle away to southeast; 3 August – immature flew over colony, chased away by adult OSPR. No lift-offs; 9 August – immature perched south end of colony, a few DCCO flushed (Figure 23). Young DCCO in nest close to eagle perch, no predation observed but on 11 August three nests near this perch missing all flightless young; and 25 August – immature flying from southeast chased by OSPR over agricultural fields and joined by 2 Northern Harriers.

Figure 23. On this date, the majority of Double-crested Cormorants remained at their nests while an immature Bald Eagle (left) perches nearby. Leach Lake, BC. 9 August 2007. (Cyril Colonel). BC Photo File 3620.

Cooper's Hawk

2005: 27 August – an immature dove at perched DCCO which did not flush. **2006:** 19 August – an immature diving at DCCO flushing them from perches; 21 August – an immature flew over colony with agitated calls from DCCO but none flushed; and 12 September – immature dove at and displaced two juvenile DCCO. COHA then chased one DCCO as it dropped down to the river, did not strike it.

Red-tailed Hawk

2003: 6 June – adult RTHA and TUVU soaring over colonies, no response from DCCO or GBHE; 27 July – adult soaring, all DCCO not sitting in nests flushed from trees and 14 young GBHE standing in nests showed no response; 28 August – an immature soaring over colonies, no response from DCCO or GBHE; and 11 September – two immatures soaring over colony, no response from one young GBHE still at nest. **2004**: 20 May – an adult soaring over colonies, no response from DCCO or GBHE; 18 June – an adult soaring over colonies, no response from DCCO or GBHE; 25 June – one calling in flight over colonies, DCCO and GBHE on alert. DCCO with some pumping of wings as if to fly but no flushing and GBHE in alert posture and became silent but none flushed; 2 July – an adult soaring over colonies, no response from DCCO or GBHE; 8 July - an adult soaring over colonies, no response from DCCO or GBHE; 16 July – one flew low over colony, seven DCCO flushed and three GBHE flushed; 31 July – an immature flew over colonies twice, eight DCCO flushed; and 6 September - an adult soaring over colony, no response from DCCO. **2005:** 6 April – an immature soaring high with three TUVU, no response from GBHE; 12 April – two adults and one immature soaring over the colony with two TUVU, no response from GBHE; 29 May – adult soaring high over colonies, no response from DCCO or GBHE; 13 July - adult soaring high over colonies, no response from DCCO or GBHE; 4 August – an immature flew low over colony, flushed DCCO from

trees. No adult GBHE on site but 19 young still in nests; 20 August – an immature flew low over colony, no response from DCCO or young GBHE in nests; and 23 August – an adult and immature soaring over colony, no response from DCCO. **2006:** 28 April – an adult soared over colonies, no response from DCCO or GBHE; 14 May – an immature soaring above colonies with adult TUVU, no response from DCCO or GBHE; 15 July – one soaring over colonies with one TUVU, no response from DCCO or GBHE; 7 August – one soaring over colony with five TUVU, no response from DCCO; and 30 August – an adult and immature flew from west side of colony flushing 30 DCCO. Immature flew back flushing more DCCO from perches. **2007:** 30 April – an adult soaring over north end of colony, no response from DCCO; 13 May – one flying close to colony, minor lift-off of adult DCCO; 14 May – one soaring high over colonies with one TUVU, no response from GBHE or DCCO; 21 July – an immature flew through colony with talons exposed, five DCCO flushed while other adults vocalized. OSPR gave chase to RTHA; 28 July – an immature flew through colony and flushed six adult DCCO; 3 August – an immature flew low over colony, two DCCO flushed while others were alert and vocal; 8 August – an immature flew low over the colony, DCCO alert and vocalizing but no lift-offs; 16 August – an immature flew low over the south end of colony, 12 adult DCCO flushed and returned quickly; 25 August – an immature flying through colony diving at nests in trees, 60 DCCO flushed; and 29 August – an immature chased a DCCO in flight into the trees, 11 others flushed.

Rough-legged Hawk

2007: 16 April – one flew low over the colonies, 40 adult DCCO and three adult GBHE flushed (Figure 24).

Merlin

2006: 28 August – adult flying through colony, diving at perched DCCO which were vocal and ducking but did not flush. MERL chased DCCO already in flight then MERL return to perch in a black cottonwood tree.

Figure 24. A Rough-legged Hawk flew low over the colony with no attempt at predation yet its presence caused panic among nesting Double-crested Cormorants. Leach Lake, BC. 27 January 2006. (Linda M. Van Damme).

Peregrine Falcon

2005: 17 August – an immature perched in tree with eight DCCO, no response. **2006:** 13 September – one flew over the colony, no response from late nesting DCCO (Figure 25).

Common Raven

2003: 24 August – one checking empty GBHE nests, perched below DCCO nest with adult and young. Adult DCCO agitated, calling and striking air with bill. **2004:** 17 August – two scavenging on remains of GBHE in nest. **2005:** 21 April – one seen twice flying with DCCO egg and caching; and 8 July – one checking empty GBHE nests close to two DCCO nests. Young DCCO stood upright vocalizing at CORA, female Western Tanager (*Piranga ludoviciana*) dove at CORA. **2006**: 11 July – two adults flew into DCCO nesting area, swooped at group of nests. Three incubating DCCO flushed, CORA took an egg from one nest; 15 July – one checking empty nests, no response from DCCO or GBHE; 24 July - one

checking empty nests, no response from DCCO or GBHE; 1 August – two adults checking empty nests, no response from DCCO; 7 August - one checking empty nests, no response from DCCO; and 19 August – one flew over colony, adult DCCO very vocal and agitated. **2007:** 12 March – one adult taking sticks from old GBHE nests, no herons at colony; 6 April – one flew through colonies, no response from DCCO or GBHE; 11 April – one diving near colony, several DCCO flushed; 15 April – three flew through the colony, DCCO flushed; 19 April - one flew through the colony, DCCO flushed; 7 May – two flew through colony, DCCO alert, vocalizing but did not flush; and 28 July – two adults checking empty nests, DCCO vocalizing only when CORA near a nest.

Figure 25. Some avian predators, like the infrequent visit of a Peregrine Falcon, do not elicit a response from nesting Double-crested Cormorants or Great Blue Herons. Creston, BC. 29 April 2006. (Linda M. Van Damme). BC Photo 3603.