

- nesting success of cavity-nesting birds in high elevation forest drainages. *Auk* 108:405–418.
- LOMBARDO, M. P. 1988. Evidence of intraspecific brood parasitism in the Tree Swallow. *Wilson Bulletin* 100:126–128.
- MEEK, S. B., R. J. ROBERTSON, AND P. T. BOAG. 1994. Extrapair paternity and intraspecific brood parasitism in Eastern Bluebirds revealed by DNA fingerprinting. *Auk* 111:739–744.
- MOORE, W. S. 1995. Northern Flicker (*Colaptes auratus*). *The Birds of North America*, no. 166.
- MOORE, W. S. AND W. D. KOENIG. 1986. Comparative reproductive success of Yellow-shafted, Red-shafted, and hybrid flickers across a hybrid zone. *Auk* 103:42–51.
- PETRIE, M. AND A. P. MOLLER. 1991. Laying eggs in others' nests: intraspecific brood parasitism in birds. *Trends in Ecology & Evolution* 6:315–320.
- PICMAN, J. AND J.-C. BELLES-ISLES. 1988. Evidence for intraspecific brood parasitism in the House Wren. *Condor* 90:513–514.
- PINXTEN, R., O. HANOTTE, M. EENS, R. F. VERHEYEN, A. A. DHONDT, AND T. BURKE. 1993. Extra-pair paternity and intraspecific brood parasitism in the European Starling, *Sturnus vulgaris*: evidence from DNA fingerprinting. *Animal Behaviour* 45:795–809.
- PÖYSÄ, H. 1999. Conspecific nest parasitism is associated with inequality in nest predation risk in the Common Goldeneye (*Bucephala clangula*). *Behavioral Ecology* 10:533–540.
- RAPHAEL, M. G. AND M. WHITE. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. *Wildlife Monographs*, no. 86.
- ROMAGNANO, L., A. S. HOFFENBERG, AND H. W. POWER. 1990. Intraspecific brood parasitism in the European Starling. *Wilson Bulletin* 102:279–291.
- SANDELL, M. I. AND M. DIEMER. 1999. Intraspecific brood parasitism: a strategy for floating females in the European Starling. *Animal Behaviour* 57:197–202.
- SEMEL, B. AND P. W. SHERMAN. 2001. Intraspecific parasitism and nest-site competition in Wood Ducks. *Animal Behaviour* 61:787–803.
- SHERMAN, A. 1910. At the sign of the Northern Flicker. *Wilson Bulletin* 22:135–171.
- WIEBE, K. L. 2002. First reported case of classical polyandry in a North American woodpecker, the Northern Flicker. *Wilson Bulletin* 114:401–403.
- WIEBE, K. L. 2003. Delayed timing as a strategy to avoid nest-site competition: testing a model using data from starlings and flickers. *Oikos* 100:291–298.
- WINKLER, H., D. A. CHRISTIE, AND D. NURNEY. 1995. Woodpeckers: a guide to the woodpeckers of the world. Houghton Mifflin, Boston, Massachusetts.
- YOM-TOV, Y. 1980. Intraspecific nest parasitism in birds. *Biological Reviews of the Cambridge Philosophical Society* 55:93–108.
- ZINK, A. G. 2000. The evolution of intraspecific brood parasitism in birds and insects. *American Naturalist* 155:395–405.

Wilson Bulletin, 116(1), 2004, pp. 97–101

Common Loon Pairs Rear Four-Chick Broods

Steven T. A. Timmermans,^{1,2} G. Eoin Craigie,¹ and Kathy E. Jones¹

ABSTRACT.—Common Loons (*Gavia immer*) normally lay a single clutch of two eggs each breeding season. They occasionally lay one- or three-egg clutches, and rarely, four-egg clutches. Participants of the Canadian Lakes Loon Survey provided seven independent observations of loon pairs rearing four-chick broods. Photographic evidence confirmed two separate instances of adult loon pairs at Anglin Lake, Saskatchewan, and Kasshabog Lake, Ontario, exhibiting parental behavior toward a four-chick brood. Occurrence of four-chick broods may be the result of supernumerary clutches, nest parasitism, post-hatch brood amalgam-

ation, or a combination of these factors. *Received 8 July 2003, accepted 24 March 2004.*

Supernumerary broods, either as a result of nest parasitism by unrelated conspecifics, supernumerary clutches, or post-hatch brood amalgamation, are relatively common among grebes (Storer and Nuechterlein 1992, Cullen et al. 1999, Muller and Storer 1999, Stout and Nuechterlein 1999, Stedman 2000) and waterfowl (Afton and Paulus 1992:90, table 3–21; Sayler 1992). However, there are few documented instances of supernumerary broods in loons (Barr et al. 2000), including the most widely studied species, the Common Loon

¹ Bird Studies Canada, P.O. Box 160, Port Rowan, ON N0E 1M0, Canada.

² Corresponding author; e-mail: stimmermans@bsc-eoc.org

(*Gavia immer*; McIntyre 1988:30, McNicholl 1993).

Common Loons are large, long-lived waterbirds that normally lay a single clutch of two eggs each breeding season, although occasionally they will lay one or, even less frequently, three-egg clutches (Peck and James 1983, Croskery 1991, McIntyre and Barr 1997). The frequency of three-egg clutches reported for Common Loons is low and ranges from 0.5% (Campbell et al. 1990) to 0.8% (Peck and James 1983, McIntyre 1988:table 2–5). Clutches containing four eggs are rare, but have been noted several times (Nelson 1983, Peck and James 1983, Zicus et al. 1983, McNicholl 1993). To our knowledge, there is no confirmed record of Common Loons rearing four-chick broods. In this paper we report seven instances of Common Loon adults accompanying and rearing four-chick broods, two of these confirmed by photographic records.

METHODS

Data were gathered by volunteer participants of the Canadian Lakes Loon Survey (CLLS), who monitored Common Loon breeding pairs on lakes, rivers, and bays throughout Canada. Participants selected their own water body or portion of a water body to survey breeding loons and recorded observations of breeding pairs at least once during each of three time periods: nesting (early June to mid-July), hatching and early brooding (early to late July), and pre-fledging (mid-August to mid-September). All surveys lasted a minimum of 2 hr and often were supplemented by incidental observations. During each survey, observers recorded the date, survey method (e.g., from a single point on shore, walking along shoreline, or from a boat or canoe), maximum number of adult loons observed (including paired loons), maximum number of mated loon pairs present, and maximum number and age class of young. The CLLS survey protocol instructed volunteers to classify chicks as downy young (<1/3 adult

length with dark gray down feathers), small young (1/3 to 2/3 adult length with light brown-gray or mottled-gray down feathers) or large young (2/3 adult length or longer with a full coat of light and dark gray feathers). Although not part of the survey protocol, CLLS participants often found loon nests during surveys and recorded clutch sizes. Periodically, participants also provided photographic records of observations during surveys. These records provided the basis for results reported here.

RESULTS AND DISCUSSION

Since the initiation of the CLLS in 1981, participants have reported 6 of 687 (0.87%) loon nests containing three-egg clutches and no four-egg clutches. CLLS participants reported 45 of 6021 (0.75%) Common Loon pairs with supernumerary broods (>2 chicks), which is similar to values that others have reported for this species (see above). In five separate instances, CLLS participants provided written evidence of four-chick Common Loon broods: two on Shepherd Lake, Ontario (44° 39' N, 81° 7' W) during 1983 and 1984; one on Oak Lake, Ontario (44° 36' N, 77° 55' W) during 1984; and two on the Mactaquac River, New Brunswick (46° 01' N, 66° 58' W) during 1988 and 1993. Participants also provided photographic evidence of two separate instances of Common Loon pairs accompanied by four-chick broods. The first photograph was taken on 14 July 1999 at Anglin Lake, Saskatchewan (53° 44' N, 105° 56' W; Fig. 1A). This group of birds was observed intermittently from 14 July to 17 August 1999. CLLS participants estimated these chicks to be 3 weeks of age on 14 July, and adults exhibited feeding behavior toward all four chicks.

Photographic evidence was also secured at Kasshabog Lake, Ontario (44° 38' N, 77° 57' W; Fig. 1B, C), where a Common Loon pair was observed attending four chicks from 21 July to 30 September 2001. CLLS participants estimated this four-chick brood to be 3 weeks

→
 FIG. 1. Photographs of two different pairs of adult Common Loons with four-chick broods: (A) Anglin Lake, Saskatchewan, Canada, 14 July 1999 (photograph by W. R. and E. V. Hoffman), and (B and C) Kasshabog Lake, Ontario, Canada, July 2001 and August 2001, respectively (photographs by P. Grisson).

A



B



C



of age on 21 July, and adults exhibited feeding behavior toward all four chicks. Observations later that summer showed that one of these chicks was smaller than the other three, and often it was observed farther away from the adults than the other chicks (Fig. 1C).

Occurrence of four-chick broods in Common Loons may be the result of supernumerary clutches, nest parasitism, post-hatch brood amalgamation, or a combination of these factors (Nelson 1983, Zicus et al. 1983, Belant and Olson 1991, McNicholl 1993). Both Nelson (1983) and Zicus et al. (1983) discounted the occurrence of four-egg clutches as a result of nest parasitism, suggesting that nest parasitism was unlikely due to aggressive territory defense exhibited by breeding loons. Four-egg clutches have been documented twice for Red-throated Loons (*Gavia stellata*); in both instances two different females were observed laying eggs in the same nest (Barr et al. 2000). Supernumerary clutches have been documented several times for Common Loons (see McNicholl 1993). However, there are only two confirmed reports of supernumerary clutches hatching successfully in Common Loons; McIntyre (1988) found two three-egg clutch nests on two different lakes, and later observed a brood of three young on each of these same lakes.

Adult loons may adopt chicks if the young become separated from their natal parents due to inclement weather (Strong and Bissonette 1989), human disturbance (Robertson and Flood 1980, Clay and Clay 1997), or parental abandonment (Gingras and Paszkowski 1999). Persistent wind and wave action can separate loon chicks from their natal parents (Sjolander and Agren 1976). On Anglin Lake in 1999, poor weather conditions occurred from 30 June through 6 July, and a severe hailstorm occurred on 12 July (W. R. Hoffman and E. V. Hoffman pers. comm.). Thus, weather conditions existed that could have resulted in chicks becoming separated from their natal parents and then being adopted by one of several other breeding pairs on Anglin Lake.

Post-hatch brood amalgamation can also occur when brood densities in breeding areas are high (Afton and Paulus 1992). Anglin Lake (1,500 ha) consistently had the highest annual number of breeding loon pairs recorded (mean of 38 pairs/year from 1996 to 2002)

on a lake by the CLLS. Concentrations of loon pairs on Anglin Lake were high on 14 July 1999, when 36 separate Common Loon pairs were observed. Size and behavioral differences in the brood photographed at Kasshabog Lake also suggested brood amalgamation. Intensive monitoring and/or genetic evidence are required to determine definitively whether supernumerary broods in Common Loons result from supernumerary clutches, nest parasitism, or post-hatch brood amalgamation.

ACKNOWLEDGMENTS

We thank J. F. Barr, C. A. Paszkowski, and an anonymous reviewer for their helpful and critical reviews, and we also thank S. S. Badzinski and J. D. McCracken who provided comments on an earlier draft of this manuscript. We gratefully acknowledge Canadian Lakes Loon Survey participants, whose survey efforts and support made this publication possible.

LITERATURE CITED

- AFTON, A. D. AND S. L. PAULUS. 1992. Incubation and brood care. Pages 62–108 in *The ecology and management of breeding waterfowl* (B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankney, D. H. Johnson, J. A. Kadlec, and G. L. Krapu, Eds.). University of Minnesota Press, Minneapolis.
- BARR, J. F., C. EBERL, AND J. W. MCINTYRE. 2000. Red-throated Loon (*Gavia stellata*). *The Birds of North America*, no. 513.
- BELANT, J. L. AND J. F. OLSON. 1991. Chick fostering by Common Loons, *Gavia immer*. *Canadian Field-Naturalist* 105:406–407.
- CAMPBELL, R. W., N. K. DAWE, I. MCTAGGART-COWAN, J. M. COOPER, G. W. KAISER, AND M. C. E. MCNALL. 1990. *The birds of British Columbia*, vol. 1. Royal British Columbia Museum, Victoria, British Columbia, Canada and Environment Canada, Canadian Wildlife Service, Ottawa, Ontario, Canada.
- CLAY, D. AND H. CLAY. 1997. Reproductive success of the Common Loon, *Gavia immer*, on a small oligotrophic lake in eastern Canada. *Canadian Field-Naturalist* 111:586–590.
- CROSKERY, P. R. 1991. Common Loon, *Gavia immer*, nesting success and young survival in northwestern Ontario. *Canadian Field-Naturalist* 105:45–48.
- CULLEN, S. A., J. R. JEHL, JR., AND G. L. NUECHTERLEIN. 1999. Eared Grebe (*Podiceps nigricollis*). *The Birds of North America*, no. 433.
- GINGRAS, B. A. AND C. A. PASZKOWSKI. 1999. Breeding patterns of Common Loons on lakes with three different fish assemblages in north-central Alberta. *Canadian Journal of Zoology* 77:600–609.
- MCINTYRE, J. W. 1988. *The Common Loon: spirit of northern lakes*. University of Minnesota Press, Minneapolis.

- MCINTYRE, J. W. AND J. F. BARR. 1997. Common Loon (*Gavia immer*). The Birds of North America, no. 313.
- MCNICHOLL, M. K. 1993. Supernumerary clutches of Common Loons, *Gavia immer*, in Ontario. Canadian Field-Naturalist 107:356–358.
- MULLER, M. J. AND R. W. STORER. 1999. Pied-billed Grebe (*Podilymbus podiceps*). The Birds of North America, no. 410.
- NELSON, D. H. 1983. A Common Loon nest from New Hampshire containing four eggs. Wilson Bulletin 95:672–673.
- PECK, G. K. AND R. D. JAMES. 1983. Breeding birds of Ontario: nidiology and distribution, vol. 1: non-passerines. Royal Ontario Museum Life Sciences Miscellaneous Publication, Toronto, Canada.
- ROBERTSON, R. J. AND N. J. FLOOD. 1980. Effects of recreational use of shorelines on breeding bird populations. Canadian Field-Naturalist 94:131–138.
- SAYLER, R. D. 1992. Ecology and evolution of brood parasitism in waterfowl. Pages 290–322 in The ecology and management of breeding waterfowl (B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankney, D. H. Johnson, J. A. Kadlec, and G. L. Krapu, Eds.). University of Minnesota Press, Minneapolis.
- SJOLANDER, S. AND G. AGREN. 1976. Reproductive behavior of the Yellow-billed Loon, *Gavia adamsii*. Condor 78:454–463.
- STEDMAN, S. J. 2000. Horned Grebe (*Podiceps auritus*). The Birds of North America, no. 505.
- STORER, R. W. AND G. L. NUECHTERLEIN. 1992. Western Grebe (*Aechmophorus occidentalis*) and Clark's Grebe (*Aechmophorus clarkii*). The Birds of North America, no. 26.
- STOUT, B. E. AND G. L. NUECHTERLEIN. 1999. Red-necked Grebe (*Podiceps grisenga*). The Birds of North America, no. 465.
- STRONG, P. I. V. AND J. A. BISSONETTE. 1989. Feeding and chick-rearing areas of Common Loons. Journal of Wildlife Management 53:72–76.
- ZICUS, M. C., R. H. HIER, AND S. J. MAXSON. 1983. A Common Loon nest from Minnesota containing four eggs. Wilson Bulletin 95:671–672.

Wilson Bulletin, 116(1), 2004, pp. 101–103

A Possible Foraging Association between White Hawks and White-nosed Coatis

Susan D. Booth-Binczik,^{1,3,4} Gerald A. Binczik,² and Ronald F. Labisky¹

ABSTRACT.—Some species of birds commonly forage by following other animals and capturing prey flushed by the movements of the latter. Here we describe a possible foraging association between White Hawks (*Leucopternis albigollis*) and white-nosed coatis (*Nasua narica*) in Tikal National Park, Guatemala. The frequency of association varied seasonally, perhaps due to differences in availability of reptiles, the hawks' main prey. Received 28 January 2003, accepted 26 March 2004.

Many species of birds habitually forage by capturing prey flushed by other animals. For instance, Barred Forest-Falcons (*Micrastur ruficollis*) frequently follow army ants (Willis

et al. 1983, Thiollay and Jullien 1998), and Double-toothed Kites (*Harpagus bidentatus*) associate with several species of primates (e.g., Fontaine 1980, Egler 1991). There are occasional reports of other Eastern and Western hemisphere raptors that appear to forage in association with a variety of mammalian carnivores, although prey capture has been observed only rarely (e.g., Sliwa 1994, Silveira et al. 1997).

Here, we describe a possible association between White Hawks (*Leucopternis albigollis*) and an omnivorous mammal, the white-nosed coati (*Nasua narica*), in the lowland tropical forest of Tikal National Park, Guatemala. White Hawks, which prey primarily on snakes and lizards (Draheim et al. in press), have been documented following monkeys in Costa Rica (Boinski and Scott 1988) and French Guiana (Thiollay and Jullien 1998, Zhang and Wang 2000). White-nosed coatis are diurnal procyonids; their diet consists primarily of

¹ Dept. of Wildlife Ecology and Conservation, Univ. of Florida, Gainesville, FL 32611, USA.

² Dept. of Zoology, Univ. of Florida, Gainesville, FL 32611, USA.

³ Current address: 450 Paradise Ln., Bronson, FL 32621, USA.

⁴ Corresponding author; e-mail: suebb@gru.net