

# Seasonal Timing of Bald Eagle Attendance and Influence on Activity Budgets of Glaucous-winged Gulls in Barkley Sound, British Columbia

AJIA F. WHITE<sup>1</sup>, JOEL P. HEATH<sup>2</sup> AND BRIAN GISBORNE<sup>3</sup>

<sup>1</sup>101-25 E. 12th Ave. Vancouver, BC V5T 2G6

Internet: [ajawhite@gmail.com](mailto:ajawhite@gmail.com)

<sup>2</sup>Centre for Wildlife Ecology, Dept. Biological Sciences, Simon Fraser University  
8888 University Drive, Burnaby, BC, Canada. V5A 1S6

<sup>3</sup>427-118 Menzies Street, Victoria, BC, Canada. V8V 2G5

**Abstract.**—As raptor populations recover following the banning of organochlorine pesticide use, there may be consequences for prey populations. While Bald Eagles (*Haliaeetus leucorhynchus*) actively prey on Glaucous-winged Gulls and their offspring (*Larus glaucescens*), their presence at colonies and roost sites may also influence reproductive success of gulls by impacting activity budgets. Here we investigate changes in Bald Eagle abundance in relation to gull breeding phenology over 6 years at Seabird Rocks (Vancouver Island, Canada) and compare activity budgets of gulls in relation to Bald Eagle abundance. Bald Eagle abundance varied seasonally, peaking during late incubation and hatching of gull eggs. As Bald Eagle presence increased, gulls showed a strong increase in time allocated to vigilance (54%) and frequency of flushing (up to 6 times/hr). These results indicate that Bald Eagle attendance patterns at gull colonies coincide with hatching of gull chicks and can influence time-activity budgets of gulls. Predator-induced changes in gull behavior during the breeding season may influence reproductive success by impacting time and energy budgets and facilitating egg and chick predation. These findings could be important for understanding failure at gull colonies in Barkley Sound and evaluating impacts of increasing Bald Eagle populations in the region. *Received 21 December 2005, accepted 23 August 2006.*

**Key words.**—Bald Eagle, disturbance, Glaucous-Winged Gull, reproductive success, time-activity budget, vigilance.

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Bald Eagle (*Haliaeetus leucorhynchus*) populations in British Columbia have dramatically increased in the last two decades following a reduction in organochlorine pesticides (Kirk and Hyslop 1998). As these populations recover, prey species are affected in both their ability to reproduce as well as their survival rate as adults. Bald Eagle disturbance leading to nest failure has been documented in a number of bird communities, including Great Blue Heron (*Ardea herodias*) and Common Murre (*Uria lomvia*) in the Pacific Northwest (Parrish *et al.* 2001; Vennesland and Butler 2004). Bald Eagles often flush birds from colonies, raising stress levels and lowering reproductive success, as well as preying directly on both chicks and adults (Gillett *et al.* 1975; Vermeer and Devito 1989; Brown and Morris 1995; Parrish *et al.* 2001). Flushing of adults also facilitates predation on eggs by crows and other gulls (Verbeek 1982; Ellis and Good 2004). Increasing numbers of Bald Eagles in British Columbia could therefore impact both sur-

vival and reproduction of Glaucous-winged Gulls (*Larus glaucescens*) in colonies.

While predation of adults by Bald Eagles certainly impacts gull populations (Vermeer and Morgan 1989), a number of direct and indirect influences are likely important in explaining extensive breeding failure observed at some colonies (up to 81%; Sullivan *et al.* 2002). In addition to direct mortality, predation risk from Bald Eagles could influence time and energy budgets by increasing nest guarding and vigilance and decreasing time available to forage. This could be particularly important during chick rearing when gulls must spend time provisioning chicks as well as self-feeding. Impacts on time-activity budgets could potentially influence parents' ability to care for offspring (Drent and Daan 1980; Lima and Dill 1990).

The objectives of this study were to determine 1) how the timing of Bald Eagle abundance at Seabird Rocks, Vancouver Island coincides with breeding phenology of Glaucous-winged Gulls, and 2) if Bald Eagle pres-

ence on and near the colony influences  
time-activity budgets of gulls by increasing

results were observed for Bald Eagles directly on the colony;  $\chi^2_1 = 9.03$ ,  $P \leq 0.01$ ). Additionally, the frequency of Bald Eagle disturbance (flushes) increased with eagle presence in the immediate area near the colony, with significant increases in flush frequency when Bald Eagle presence increased from 1 to 4 (Table 1;  $\chi^2_4 = 12.78$ ,  $P \leq 0.01$ ).

Focal sampling also indicated that the amount of time spent vigilant in a 5-minute interval increased in relation to number of Bald Eagles present on the colony (Table 1;  $\chi^2_2 = 13.93$ ,  $P$

