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Avian reactions towards human approaches in different urban greenery structures in Nanaimo

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ABSTRACT

Urban green spaces are vital for human quality of life and urban avian ecology. In consequence, these areas attract cutting edge research on human/animal relations and the human roles in avian foraging grounds. However, few studies of bird reactions to human presence have included bird adaptation and attraction to human behaviour. More commonly, studies focus on structured, human approaches to subject birds, and consequent avian reactive distances (alert and flight distances and alert periods). This study of green spaces in Nanaimo, Canada, examines the less studied factors for bird reactive behaviour, including the more complex human behaviours such as hand waving, bird anticipation of feeding, passerine and non-passerine bird behaviour and non-feeding human presence. It also tests the hypothesis that bird species size, greater vegetation height, more open vegetation and road and path distance increase avian reactive distances. Consistent with established theory, longer alert and flight distances resulted from larger species size and proximate tree stands, but inconsistent with published hypotheses, taller vegetation, and less dense shrubbery were not sufficient predictors of avian reactive distances. Inconsistent with other findings, larger species were also more attracted to humans than smaller species, and anticipatory perching for human provided food balanced with the alert periods between the alert and flight distances. Most species had shorter reactive distances in human presence and were either significantly more likely to forage in human presence or showed no correlation with human presence or absence. The results of this study contribute to current knowledge of bird reactions to human presence and behavior in variable urban green spaces.

1. Introduction

Urban green spaces, including parks, gardens, treed avenues, cemeteries, sports fields and undeveloped lots, are well researched as vital for human quality of life and avian ecology (Konijnendijk, 2003; Traut and Hostetler, 2004; Gill and Brumm, 2014). Studies of avian urban presence are bolstered by increased urbanization, green space development, variable and increased urban avian presence and conservation politics (Lim and Sodhi, 2004; White et al., 2005; Lepczyk and Warren, 2012). Bird species size, vegetation configuration, human behaviour and cultural features such as roads may contribute to avian presence or absence (Hostetler and Knowles-Yanez, 2003; Erickson, 2004; Campbell, 2008, 2009). Bird behaviour and reactions to these variables may also be conditioned by predator avoidance and feeding adaptation (Marzluff et al. 2001; Campbell, 2010; Diaz et al., 2013).

Avian reactive distances in human presence may be measured by three parameters: (1) the alert distance, or the distance between the subject bird and the approaching human at the first noticeable attention from the bird; (2) the flight distance, or the distance between the subject bird and the approaching human when the bird takes flight, always equal to or less than the alert distance; and (3) the alert period, or the time between first alert and flight, as the bird observes the intruding person and ceases foraging activity. Alternatively, during the alert period the bird may resume foraging, especially if human-offered food is available (Campbell, 2007, 2010; Clucas and Marzluff, 2012; Gill and Brumm, 2014).

Larger bird size, more open and lower vegetation, increased human movements, lack of human feeding behaviour and increased distance of roads and footpaths are identified as factors for longer alert distances (Skagen et al., 1991; Holmes et al., 1993; Campbell, 2006). Larger birds have a larger awareness radius, hence their earlier awareness of human presence influences longer reactive

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distances (Lima and Zollner, 1996; Gutzwiller et al., 1998; Kiltie, 2000). Birds in open fields may be more sensitive to predation risk, due to the lack of cover, hence they have longer alert and flight distances and shorter alert periods (Ydenberg and Dill, 1986; Kramer and Bonenfant, 1997; Diaz et al., 2013).

Taller vegetation may influence longer alert distances, as birds may fly earlier due to the longer journey to the higher branches of trees (Fernández-Juricic et al., 2001; Campbell, 2010). The lack of the refuge of dense shrubbery and undergrowth, may also encourage earlier flight (Martín and López, 1995; Kramer and Bonenfant, 1997). When in same-species or multiple-species flocks, some studies indicate that the most sensitive individual may initiate the flight response, the so-called sentinent hypothesis (Metcalfe, 1984; Paton et al., 2000; Weston et al., 2012). However, this situation would be difficult to observe with solitary feeding birds, as many species only rarely feed both individually and in flocks, and distances among the different individuals would have to be controlled in a study (Campbell, 2010).

Birds near roads and footpaths may have shorter alert and flight distances, due to increased habituation to human presence or human feeding behaviour (Campbell, 2007). Human behaviour is probably the most important factor for alert and flight distances (Campbell, 2008; Clucas et al., 2011; Clucas and Marzluff, 2012). Human disturbances are measurable in degrees of impact, hence while some studies measure avian reactions to uniform human behaviour, others assess the impacts of different human behaviors on the subject bird (Fernández-Juricic et al., 2001; Campbell, 2010).

This article examines the alert and flight distances and alert periods of seven passerine and non-passerine species in the green spaces of Nanaimo, Canada (Fig. 1, Table 1). These species were selected for their common status, combined size range, and presence in a wide range of vegetation structures and types. Bird size, standardized methods of observer approach, dominant vegetation cover (trees, shrubs, undergrowth and/or grass), vegetation height, and road, pavement and footpath proximity are examined as predictors of alert and flight distances and alert periods. The aim of the study was to determine bird species tolerance to variable styles of human approaches.

The hypotheses, based on the above studies and those of others (Burger and Gochfield, 1991; Rodgers and Smith, 1995), were that alert and flight distances, and alert periods are increased by: (1) larger bird size; (2) taller vegetation; (3) denser shrubbery and undergrowth; (4) open grassy fields and open ground; (5) increased distance of roads, pavements and footpaths; and (6) increased motion of the proximate human, especially hand movements. Also (7), alert distances are reduced when human feeding is anticipated, especially for larger species.

2. Study area and methodology

The study locations were twelve green spaces in Nanaimo, in British Columbia, Canada. Nanaimo is a small city with a population of 83,810 and a population density of 918/km2, with coordinates of 49.1642o N, 123.9364o W, on the east coast of Vancouver Island, off the west coast of Canada (Statistics Canada, 2011) (Fig. 1). The city has an area of 91.30 km2, and 1,280.84 km2 in the metropolitan area (City of Nanaimo, 2016). Green spaces cover 880 ha (8.8 km2), including 13 City destination parks, 90 neighborhood parks and 12 dog off leash areas and 26 sports fields. The city has a narrow, rectangular north-south orientation, hence most of the green spaces are separated by less than 100 m of urban substrate (asphalt roads, rails, car parks, industrial and residential buildings).

The twelve green spaces were located in semi-managed parks in the suburban to semi-rural areas in and around the Nanaimo City area and also the larger metropolitan area. Here semi-managed

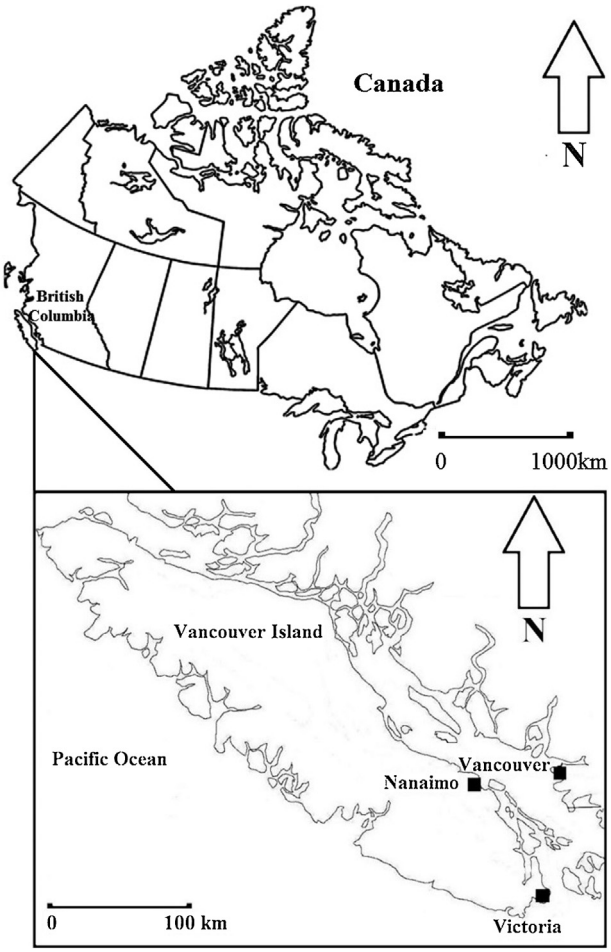

Fig. 1. Canada and Nanaimo, British Columbia study area.

refers to regular or occasional tending of grassed areas and trimming of tree branches. The green spaces were classified within the urban to rural gradient. Parks were *urban/suburban* (almost totally surrounded by urban substrate), *suburban* (nearer the city edge with connection to rural landcover) and *semi- rural* (located on the city edge, between urban and rural). Bowen Park was divided into two due to longitudinal extent. Those in the urban/suburban areas were: Maffeo Sutton Park (Lat. 49.1711, Long. −123.9380, 50 ha); Beban Park (Lat. 49.1994, Long. −123.9956, 50 ha) and Boundary Avenue Park (Lat. 49.1901, Long. −123.9711, 1 ha). Those parks located in the suburban areas were: Third Street Park 49.1647 −123.9670, <50 ha, Bowen Park (divided into two due to longitudinal extent, 49.1724, −123.9491, 49.1766, −123.9653, 36 ha), Buttertubs Marsh Park 49.1687, −123.9704, <50 ha, Beach Estates Park 49.1934, −123.9618, 5 ha); and Valley Oak Park 49.1694, −123.9781, < 50). Those parks located in semi rural areas were:Westwood Lake 49.1628, −123.9962, 100 + ha, Colliery Dam Park 49.1501, −123.9612, <50, and Neck Point Park 49.2351, −123.9660, <50 ha) (Global Landcover Facility 2014).

Common tree species were the Western hemlock (*Tsugo heterophylla*, (Raf.) Sarg.), Douglas fir (*Pseudotsuga menziesii*, (Mirb.) Franco), Big leaf maple (*Acer macrophyllum*, Pursh), Douglas maple (*Acer glabrum*, Torr.), Bitter cherry (*Prunus emarginata*, (Dougl. ex Hook.) Eaton 1836), Western white pine (*Pinus monticola*, Douglas ex D. Don) and cherries and plums (Genus *Prunus,* L.). Common shrubs were Scotch broom (*Cytisus scoparius,* L.) and the blackberry and raspberry (Genus *Rubus,* L.), which may also comprise the undergrowth in some areas. Four vegetation types were classified,