Using the literature to assess if double-crested cormorants in Ontario are a conservation issue with respect to common loon populations

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Ontario is home to a wide variety of waterbirds. Two species in particular focus the attention of the public for very different reasons: double-crested cormorants (*Phalacrocorax auritus*) and common loons (*Gavia immer*) (Fig 1). With the recovery of cormorant populations in the U.S. interior and Canada (ON, MB, SK and AB; Weseloh et al. 2002) the public has expressed concern that cormorants are contributing to a decline in the number of loons where the two species overlap. Here, I provide a brief summary of the relevant literature and assessment of this concern.

Ontario has one third of the global population of common loons and Ontario and Quebec combined have over half of the total North American population, where the majority of common loons reside (Evers et al. 2010). While the Great Lakes region population of common loons has declined (Evers et al. 2010), winter surveys suggest that the total common loon population in Canada is increasing (Evers 2007; Evers et al. 2010). The Committee on the Status of Endangered Wildlife in Canada has categorized common loon populations as "not at risk" (COSEWIC 1997).

Cormorants have five subpopulations across North America, all of which have recovered or are recovering (see Wires and Cuthbert 2006) from the negative impacts of pesticides and pollutants banned in the 1970s (DDT/PCBs; Environment Canada 1995; Weseloh et al. 2002; Wires and Cuthbert 2006). Although they were virtually absent in the Great Lakes for several decades (Wires and Cuthbert 2006), they are a native bird to Ontario (see Weseloh et al. 1995; Wires and Cuthbert 2006).

As fish eating birds, both loons and cormorants are positioned high in the food web, accumulate pesticides and are used to track the bioaccumulation of these pollutants (mercury, PCBs DDT, flame retardants etc.; Evers et al. 2010, Dorr et al. 2014). Because of the link to acidification of lakes (i.e., lakes with lower pH increase conversion of elemental mercury to methylmercury which is transferred through food webs (Steffen et al. 2016)), researchers track mercury in common loons populations in particular (e.g., Evers et al. 2008; Evers et al. 2011; Depew et al. 2013).

Migratory cormorants and loons use both freshwater and marine systems throughout their life cycle. Below I evaluate the likelihood that loons and cormorants are competing in the Great

Lakes region for nesting space during the breeding season and for prey during migration (the only period where they may compete for food, see below).

Nesting habitat. Cormorants nest in colonies (either on the ground or in trees), usually on islands (remote islands 0.5 to 10 ha in size in the Great Lakes; Wires and Cuthbert 2010). The majority of the Great Lakes Region nesting population is located on the largest bodies of water (e.g., Great Lakes; Wires et al. 2001; Wires and Cuthbert 2006; see also Weseloh et al. 2002). Wires and Cuthbert (2010) estimate cormorants nest on 3% of the islands available on the Great Lakes.

Loons are a solitary nesting species which prefer nesting on clear lakes larger than 24 ha with islands and irregular shorelines (Evers et al. 2010; Radomski et al. 2014). Very little nesting occurs on the Great Lakes proper (Evers et al. 2010). Loons need shorelines with vegetation to camouflage their ground nests and nests are preferentially placed adjacent to water on islands when available.

During the breeding season loons are very territorial (Evers et al. 2010) and thus there is a small number of individuals in any one area. Cormorants do not defend sections of a lake and often forage in groups, thus observations of many cormorants together are common. Given the different nesting habitat needs, nesting strategies and little geographic overlap during the breeding season, it is extremely unlikely that these two species compete for nesting space. This conclusion implies they do not compete for prey during the breeding season. During their life cycles the two species may co-occur on the Great Lakes during migration.

Feeding habits. Both species are visual pursuit divers of fish (Evers et al. 2010; Dorr et al. 2014). Due to the perceived conflicts with recreational fisheries, the literature on cormorant diet and foraging behaviour is extensive (see Dorr et al. 2014). Wires et al. (2003) provide an excellent summary of the data that are required to conclude that cormorants have impacts on fish populations.

On Lake Ontario, cormorants primarily feed upon two invasive, non-native forage fish, alewife and round gobies (Dorr et al. 2014, Fraser unpublished data). Cormorants typically forage within sight of land (< 2.5km from shore) and at a depth of 10 m or less (Dorr et al. 2014).

Evers et al. (2010) summarize loon diet during the breeding season (in order of importance): yellow perch, pumpkinseed, blue gill, salmonids and suckers. Loons also consume invasive alewife and round gobies while migrating through the Great Lakes (see Evers et al. 2010). Both fish species are vectors for avian botulism which has caused large die offs (thousands) of adult common loons (and cormorants) on the Great Lakes (Evers et al. 2010; Dorr et al. 2014). Strong and Bissonette (1989) report that breeding loons in Minnesota prefer to forage in waters < 5m and near shore (within 150 m); avoiding deeper sections.

During migration while they are on the Great Lakes, cormorants and loons consume similar prey fish, but there is likely little spatial overlap because of the differences in preferred distance from

shore and water depth; therefore competition for prey is minimal and not contributing to declines in loon populations on the Great Lakes.

In a review of all peer-reviewed literature on common loons (Evers et al. 2010), cormorants were not identified as a potential conservation concern to loon populations. Loons have a delayed reproduction (average 6 years) and low reproductive rates (Evers et al. 2010) and thus the populations are very sensitive to adult mortality. The three main sources of adult loon mortality are: avian botulism, predation (mostly by bald eagles) and ingestion of fishing line/sinkers leading to lead ingestion (Evers et al. 2010). Factors which contribute to decreased breeding success include: 1) loss of vegetation along shorelines, often through increased cottage development (Newbry et al. 2005); 2) predation of nests (raccoons, whose numbers increase with increased human densities); 3) predation of chicks (by snapping turtles, large fish, gulls and bald eagles); 4) mortality due to boats and jet skis; and 5) lake acidity (primarily due to coal burning, which is declining in North America) (Evers et al. 2010). Loon populations can be sustained by maintaining undeveloped sections of lakes which support healthy fish populations and reducing human disturbance during the breeding season (Environment Canada 1994).

The nesting habitat and habits, and the foraging strategies of loons and cormorants are very different. While there may be occasional individual interactions, there is no evidence that indicates that the recovered cormorant population in Ontario has had or will have a negative impact on the common loon population.

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Figure 1. Double-crested cormorant (left) and common loon (right). Photo credits G.S. Fraser (cormorant) and D. Hilgendorf (loon).