



## Little Galloo Island, Lake Ontario: Two decades of studies on the diet, fish consumption, and management of double-crested cormorants



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### ABSTRACT

The double-crested cormorant (*Phalacrocorax auritus*) colony at Little Galloo Island, Lake Ontario has been a Great Lakes focal point of controversy regarding cormorant–fish interactions for over two decades. We examined cormorant diet and fish consumption at the colony from 1992 to 2013. During this time period, two events, management actions and round goby (*Neogobius melanostomus*) invasion, occurred that affected the number of fish consumed by cormorants and their diet composition. The purpose of this study was to evaluate the effects of round goby on the feeding ecology of cormorants and evaluate the efficacy of management actions on meeting cormorant population targets at the colony. Round goby first appeared in the diet in 2004 (0.8%) and within one year were the primary prey (29.3%). The presence of round goby in the diet of cormorants: (1) eliminated seasonal variability in diet composition, (2) reversed seasonal trends in the number of fish consumed daily, (3) increased daily fish consumption, and (4) significantly reduced the consumption of other species including yellow perch and smallmouth bass. Management actions, such as egg oiling and culling, were also effective in reducing nesting activity and the number of cormorant feeding days at the Little Galloo Island colony. There is evidence that the combination of management actions and round goby may have allowed some population recovery of yellow perch and smallmouth bass in eastern Lake Ontario.

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### Introduction

Although several factors have contributed to the recovery of double-crested cormorants (*Phalacrocorax auritus*) (hereafter called cormorants) perhaps the most important were their protection under the Migratory Bird Treaty Act as amended in 1972 and the banning of DDT that occurred the same year (Wires and Cuthbert, 2006). It is well documented that cormorant population recovery has led to conflicts with fishing interests. Specifically, cormorants have been implicated in the decline of several important sport fish species (Belyea et al., 1999; Collis et al., 2002; Rudstam et al., 2004; Fielder, 2008) and even impacts on local economies (Shwiff et al., 2009). Conversely, several studies have shown limited sport fish consumption in the vicinity of cormorant colonies with diets mainly comprised of forage and rough fish species (Craven and Lev, 1987; Neuman et al., 1997; Seefelt and Gillingham, 2008). The ability to detect impacts on fish populations from cormorant predation may partially be due to inadequate information on the fish populations near the colonies. Stang et al. (2004) emphasized the importance of long term data sets on fish populations in helping elucidate potential impacts from cormorant predation.

In the early 1990s increasing populations of cormorants in the eastern basin of Lake Ontario drew the attention of sport fishermen who were concerned about predation on game fish species. In 1992, diet studies were initiated at several Great Lakes cormorant colonies, including several in eastern Lake Ontario. The initial diet studies indicated that two important game species, yellow perch (*Perca flavescens*) and smallmouth bass (*Micropterus dolomieu*), comprised a surprising portion of the diet at Little Galloo Island (LGI) (Johnson et al., 2002). Those annual diet studies coupled with increased cormorant nesting at LGI suggested that population levels could be sufficient to cause localized depletion of fish populations surrounding the island. This effect, known as the halo effect, had previously been observed at other piscivorous waterbird colonies (Birt et al., 1987). Consequently, in 1999 the New York State Department of Environmental Conservation (NYSDEC) initiated a management program to control cormorant nesting success at LGI and to reduce the number of feeding days by the colony (McCullough and Mazzocchi, 2012).

The eastern basin of Lake Ontario (Neuman et al., 1997; Johnson et al., 2002) along with the Les Cheneaux Islands region of Lake Huron (Belyea et al., 1999; Diana et al., 2006) have been at the forefront in the Great Lakes in terms of studying cormorant impacts on fish populations. The Lake Huron cormorant issue is especially intriguing since it has resulted in conflicting findings (no effect, Diana et al., 2006, depressant effect, Fielder, 2008) specific to the effects on yellow perch

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populations. Studies carried out in Lake Ontario on yellow perch (Burnett et al., 2002) and smallmouth bass (Lantry et al., 2002) in the vicinity of large colonies, have documented a depressant effect on these important game fish species. Management programs to reduce cormorant nesting were initiated at both Little Galloo Island in Lake Ontario in 1999 (Farquhar et al., 2012) and in the Les Cheneaux Islands in 2004 (Fielder, 2008). Management actions carried out at cormorant colonies in the Les Cheneaux Islands were effective in increasing yellow perch abundance (Fielder, 2010).

In this paper we review a 22 year history of diet and fish consumption studies conducted at the LGI cormorant colony. We also consider the effects of round goby (*Neogobius melanostomus*) on the feeding ecology of cormorants at LGI. Furthermore, we evaluate the efficacy of management actions to meet targets in terms of nesting pairs and feeding

days. Finally, we examine the effects of management actions and the inclusion of round goby in the diet, on the consumption of yellow perch and smallmouth bass.

## Methods

Little Galloo Island (43°89'N, 76°40'W) in eastern Lake Ontario is a 17.5 hectare limestone shelf owned by the NYSDEC (Fig. 1). Cormorants were first observed nesting on LGI in 1974 when 22 nests were recorded (Price and Weseloh, 1986). By 1996 cormorant nesting activity exceeded 8400 nests (Farquhar et al., 2002). The NYSDEC has established management targets of a 1500 breeding pair population and 780,000 total feeding days for the LGI cormorant colony (McCullough and Mazzocchi, 2012). Specific annual goals were to

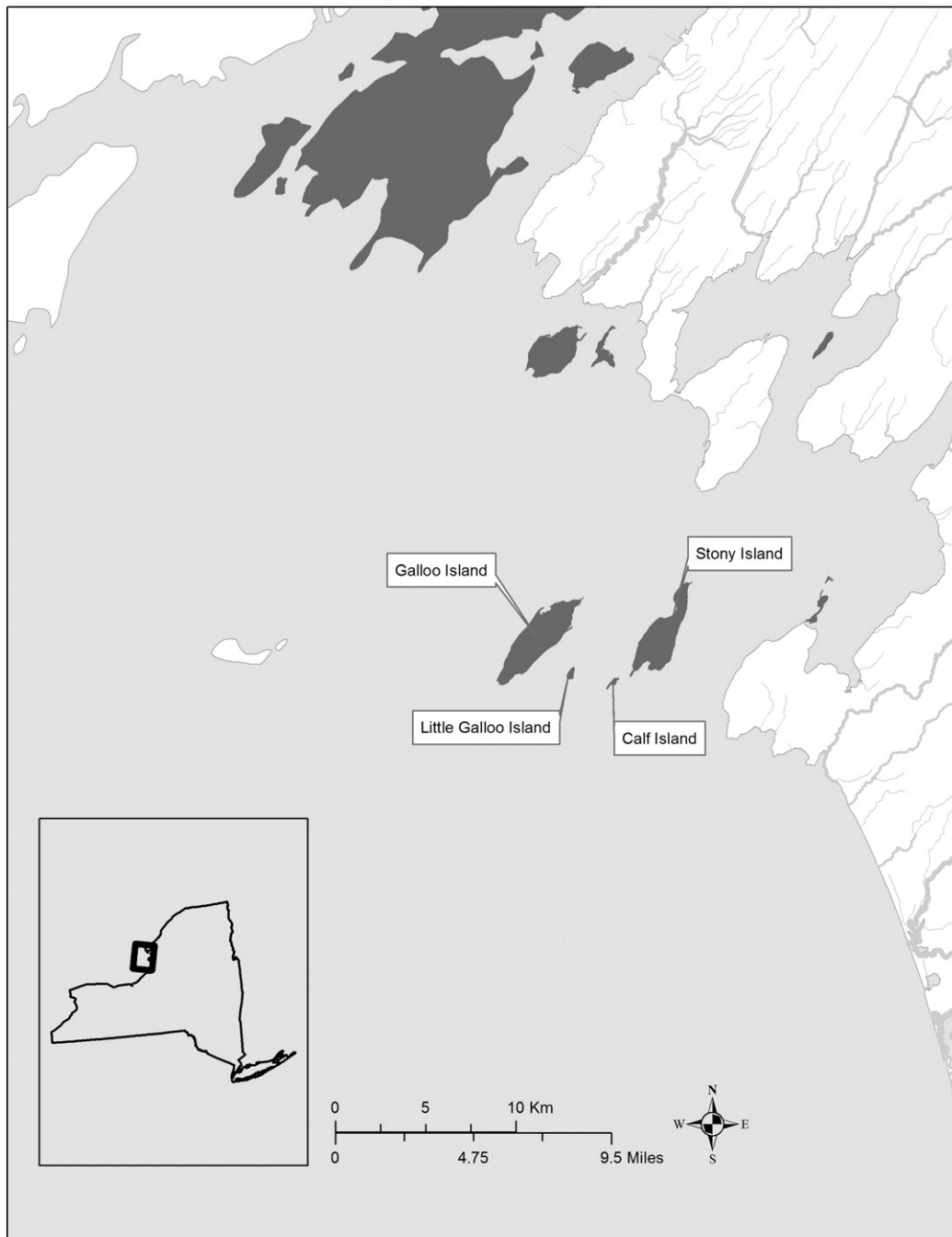


Fig. 1. Location of Little Galloo Island in eastern Lake Ontario.

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