THE IMPERIAL SHAG (*PHALACROCORAX ATRICEPS*) IN THE NAHUEL HUAPI LAKE (NORTHWESTERN PATAGONIA, ARGENTINA): DISTRIBUTION, ABUNDANCE, AND POTENTIAL THREATS FROM SCAVENGING BIRDS

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ABSTRACT.— We describe the distribution and breeding abundance of the Imperial Shag (*Phalacrocorax atriceps*) in the northern portion of the Nahuel Huapi Lake (northwestern Patagonia, Argentina) during the 2006-2007 and 2007-2008 reproductive seasons. We recorded low population numbers and null breeding success in both seasons. Attacks from several scavenging birds were recorded, and breeding activities were interrupted abruptly. Future studies should consider the potential threats from scavenging birds, subsidized by urban garbage dumps, over this freshwater shag.

KEY WORDS: *breeding disruption*, Coragyps atratus, *garbage*, Larus dominicanus, *Nahuel Huapi*, Phalacrocorax atriceps.

RESUMEN. EL CORMORÁN IMPERIAL (*PHALACROCORAX ATRICEPS*) EN EL LAGO NAHUEL HUAPI: DISTRIBUCIÓN, ABUNDANCIA Y AMENAZAS POTENCIALES DE AVES CARROÑERAS.— Se describen la distribución y la abundancia del Cormorán Imperial (*Phalacrocorax atriceps*) en el norte del lago Nahuel Huapi (noroeste de la Patagonia, Argentina) durante las temporadas reproductivas 2006-2007 y 2007-2008. Se registraron abundancias bajas y un éxito reproductivo nulo en ambas temporadas. Se registraron ataques de aves carroñeras y la actividad reproductiva se vio bruscamente interrumpida. Futuros estudios deberían considerar la potencial amenaza de las aves carroñeras, subsidiadas por los basurales a cielo abierto, sobre este cormorán.

PALABRAS CLAVE: *basura*, Coragyps atratus, *interrupción de la nidificación*, Larus dominicanus, *Nahuel Huapi*, Phalacrocorax atriceps.

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The Imperial Shag (*Phalacrocorax atriceps*) is a seabird that can be well adapted to live in freshwater environments of southern South America (Nelson 2005). The information on mainland populations of this species is scarce. The Nahuel Huapi National Park (northwestern Patagonia, Argentina; Fig. 1) holds one of these rare and small mainland freshwater populations (Navas 1970). Two other mainland breeding areas are located in Vintter Lake, Chubut Province (Rasmussen et al. 1992), and in Yehuin Lake, Tierra del Fuego Province (Reynolds 1934).

Around 11% of Phalacrocoracidae species are at some conservation risk (Duffy 1995, Nelson 2005). Several threats affect colonial nesting waterbirds, including human disturbance and predation (Butler et al. 1985, Yorio and Quintana 1996, 1997). Opportunist scavenging birds may negatively affect cormorants and shags (Spear 1993, Williams and Ward 2006), and the predatory behaviour of Kelp Gull (*Larus dominicanus*) (Yorio and Quintana 1997, Quintana and Yorio 1998), Black Vulture (*Coragyps atratus*) and other species over chicks and eggs of waterbirds is well known (Butler et al. 1985, Branco 2003, Dantas and Morgante 2010).

The objective of this study was to describe the distribution and breeding abundance of the Imperial Shag in two colonies located in the northern portion of the Nahuel Huapi Lake (Nahuel Huapi National Park), and to provide some evidence of negative effects from bird predators which could affect the breeding performance of shags.

Table 1. Number of adult birds and nests of the Imperial Shag (*Phalacrocorax atriceps*) in two colonies located in the northern portion of the Nahuel Huapi Lake (Nahuel Huapi National Park, northwestern Patagonia, Argentina) during the 2006-2007 and 2007-2008 reproductive seasons.

	Fray Menéndez Island		Puerto Mercedes	
	2006-2007	2007-2008	2006-2007	2007-2008
Adults	21	26	14	8
Nests	12	11	4	2 [a]

[a] These nests were empty; no adults could be associated.

METHODS

During December 2006, January and December 2007 we visited the three previously known Imperial Shag colonies (Fray Menéndez Island, 40°46'S, 71°40'W; Puerto Mercedes, 40°52'S, 71°35'W; and Punta Sur, 41°01'S, 71°29'W; Navas 1970, Rasmussen et al. 1993; Fig. 1), as well as other potential breeding places along the Nahuel Huapi Lake, looking for reproductive activity. Other near water bodies such as Espejo Lake, Correntoso Lake and several lagoons were visited looking for the species. We also made use of complementary information provided by fishermen.

Censuses of birds and nests were carried out at two of the three colonies: Fray Menéndez Island and Puerto Mercedes. Colonies were visited every 3 days unless under bad weather conditions. Most of the censuses were done early in the morning and late at dusk to avoid missing nonbreeding shags, as suggested by Rasmussen et al. (1993). We stayed >30 min 50 m apart from the cliffs during each visit, counting individuals and nests with the help of binoculars.

We visited the Fray Menéndez Island colony in winter (28 July 2005), autumn (3 April 2007) and spring (just before the beginning of the breeding season; 20 October 2007) to check for the presence of roosting shags. We also visited the urban waste dump of Villa La Angostura in 2007 in order to record the presence of scavenging bird species. Finally, during 2008 we carried out 18 censuses (between 9:00–19:00; 10 min each one) in the urban waste tip of Villa La Angostura to evaluate foraging by Black Vulture in the area.

RESULTS

The three known colonies of Imperial Shag (Fray Menéndez Island, Puerto Mercedes, and Punta Sur) were active. We were not able to detect other nesting sites, including those previously reported at Península Quetrihué (see Rasmussen et al. 1993). We did not find or

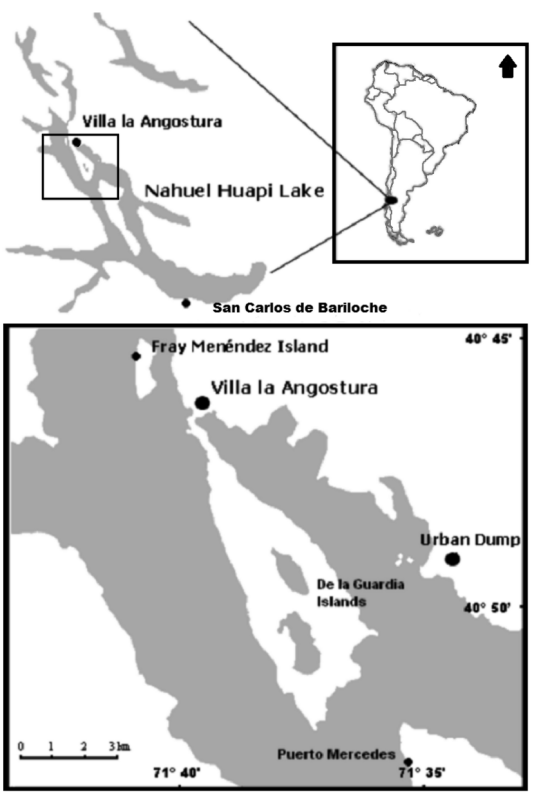

Figure 1. Map of the study area in the Nahuel Huapi National Park, northwestern Patagonia, Argentina.

were informed of any adult or subadult in nearby lakes and lagoons.

The number of adult birds and nests in Fray Menéndez Island and Puerto Mercedes colonies is shown in table 1. We found well built nests in the three colonies. Adults were incubating and permanently repairing the nests in Fray Menéndez Island in both reproductive seasons. We did not detect chicks or signs of them (e.g., nest-feeding behaviour) in Fray Menéndez Island and Puerto Mercedes during the time of the study, though we found three chicks in Punta Sur in 17 December 2007. Only one subadult was recorded in Fray Menéndez Island in December 2007. We estimated null breeding success in these colonies and observed an abrupt end of breeding activity in Fray Menéndez Island in both reproductive seasons.

We saw Kelp Gull individuals next to the roosts in all visits in the three colonies while the Imperial Shag was breeding. A pair of gulls appeared to have breeding activity near the shags roosts in Fray Menéndez Island in both reproductive seasons, although we could not see the nest or chicks (probably hidden in the high unapproachable cliff). Breeding activity was suddenly finished in the colony a few days after we saw a gull unsuccessfully attacking shags in Fray Menéndez Island on 2 January 2007. Black Vultures usually flew over the shag colonies. We could see mixed groups of Black Vulture and Southern Crested-Caracara (*Polyborus plancus*) flying over the Fray Menéndez Island colony. An attack on a Flying Steamer-Duck (*Tachyeres patachonicus*) pair hidden below the cliffs was also recorded. Sporadically, we detected Chimango Caracara (*Milvago chimango*), and in 14 December 2007 we saw a male Condor (*Vultur gryphus*) in Fray Menéndez Island. In 15 December 2007 we recorded a final unsuccessful predation attempt by three vultures, and in 18 December 2007 we did not see the shags in the roosts. We believe that reproductive activities have been disrupted by scavengers' disturbance in this colony. The following days we did not see neither shags or scavengers in the roosts.

In the urban waste dump of Villa La Angostura the mean number (± SD) of Kelp Gull individuals was 21.4 ± 21.4 (range: 0–88). Black Vultures were even more abudant: 85.8 ± 43.5 (mean ± SD; range: 1–186). In 2007 and 2008 we also recorded Chimango Caracara and Southern Crested-Caracara.

DISCUSSION

The Imperial Shag in the Nahuel Huapi Lake builds colonies on cliffs with a western orientation. Many east-facing cliffs in Victoria Island, Península Quetrihué and Brazo Última Esperanza, with similar geological characteristics, are not occupied by the species. Breeding roosts in Puerto Mercedes and Punta Sur colonies look more vulnerable to predators, because they are located no more than 3 m high; Fray Menéndez Island roosts are higher and less accessible.

There is a paucity of historical information about Imperial Shag abundance and breeding. The Fray Menéndez Island colony was not visited as frequently as the Victoria Island colonies (Puerto Mercedes and Punta Sur) in the past. Breeding censuses conducted during the 1950's and 1980's showed an abundant population in these two colonies (Navas 1970, Chehébar and Ramilo 1989), whereas post-breeding censuses in 1990 showed signs of a numerous population in the three colonies (Rassmusen et al. 1993). Victoria Island colonies suffered from a local tsunami that devastated coastal areas along the lake on 22 May 1960 (G Munar, pers. com., Navas 1970, Villarosa et al. 2009), showing that a single catastrophic event could affect Imperial Shag roosts. The low numbers of breeding individuals and the null breeding success recorded during this study in the colonies located in the northern portion of the Nahuel Huapi Lake should be worrying.

The diet of Kelp Gull in De la Guardia Islands colony (40°49'S, 71°35'W; Fig. 1) includes bird eggs and chicks and shows a high frequency of organic garbage associated to the open waste dump of Villa La Angostura (Frixione 2009). Bird populations subsidized by garbage sources could increase predation harassment as well as kleptoparasitic behaviour over other bird species (Yorio and Quintana 1997, Quintana and Yorio 1998, Bertellotti and Yorio 1999, Sanz Aguilar et al. 2008, Weiser and Powell 2010). Urban expansion increases garbage offer to scavengers and leads to avian population changes (Auman et al. 2008, Weiser and Powell 2010), as reported for the Kelp Gull expansion in Patagonia (Yorio et al. 1994). Consequently, harassment by scavengers over breeding waterbirds could be increased by human disturbance (Hocking et al. 1992,

Duberstein et al. 2005). Even though we did not recorded successful predation attempts over the shag roosts, we believe that the sudden breeding disruption in both reproductive seasons was caused by scavengers disturbance. Frequent harassment can trigger nest abandonment, or force an increase of antipredatory vigilance, in consequence reducing foraging time (Frid and Dill 2002). A poor diet of breeding shags, associated with a poor body condition of the chicks, was observed in the Nahuel Huapi Lake (see Casaux et al. 2010).

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Thorough population studies are necessary to evaluate the situation of this freshwater shag, and the response of breeding birds to interactions and disturbance pressures should be studied in depth. Scavenger populations subsidized by urban dumps could be a new threat in the area, increasing predation and kleptoparasitism harassment.

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