Breeding Population of Red-legged Cormorant (*Phalacrocorax gaimardi*) along the Araucania Region Coast, South-central Chile

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Abstract.—The Red-legged Cormorant (*Phalacrocorax gaimardi*) is a neotropical cormorant with a moderately small population and is currently categorized as "Near Threatened" by the International Union for Conservation of Nature. The Red-legged Cormorant is distributed only along the coasts of Peru, Argentina and Chile; however, the most important breeding population for this species occurs within a small area in Chile. Between 1998 and 2000, the entire breeding population size of the Red-legged Cormorant and its distribution in Chile were determined, but some areas were poorly surveyed. The breeding population sizes of the Red-legged Cormorant were surveyed along the Araucania coast, an area in south-central Chile not considered in previous studies. A total of 3,175 nests and 13,018 adults were distributed over 10 breeding colonies along the Araucania coast. Our results increased the known breeding population size of the Red-legged Cormorant in Chile by almost 62% (from 5,018-5,218 to 8,193-8,393 breeding pairs) and the rangewide population estimate by almost 43% (from 30,000 to 43,018 individuals). This area could be one of the most important breeding areas for this species throughout its range. Currently, the colonies of Piureo-Puaucho (1,506 nests), Nigue (1,009 nests) and Punta Ronca (Queule) (964 nests) represent almost 42% of the breeding population of this species in Chile, so these breeding sites should be a priority for conservation efforts. *Received 18 March 2014, accepted 17 April 2014.*

Key words.—breeding population, Chile, conservation, *Phalacrocorax gaimardi*, Red-legged Cormorant.

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The Red-legged Cormorant (*Phalacrocorax gaimardi*) is one of the smaller and most colorful cormorants of the world, with a moderately small population that is threatened by fishing activities and the occurrence of El Niño Southern Oscillation events (Zavalaga *et al.* 2002; Frere *et al.* 2004). Currently, this species is showing rapid population declines and is listed as "Near Threatened" (International Union for Conservation of Nature 2013). The Red-legged Cormorant is found along the coasts of three countries of South America: Peru, with 1,500 to 2,100 individuals (breeding population estimates not available) (Zavalaga *et al.* 2002); Argentina, with 900 to 1,100 breeding pairs (Gandini and Frere 1995; Frere *et al.* 2005); and Chile, with 5,018 to 5,218 breeding pairs, which represent more than 70% of the known breeding population of the Red-legged Cormorant. However, the most important breeding population for this species occurs within a small area in Chile (Frere *et al.* 2004). In Chile, the species is distributed from Arica (18° 30' S) to the Península de Taitao (46° 25' S) with almost 40 breeding areas containing at least 54 colonies (Frere *et al.* 2004). Although the breeding range of Red-legged Cormorants in Chile is well known, some areas inside its range are still poorly surveyed (Frere *et al.* 2004). In 2009, one large colony was discovered on the Araucanian coast (Barros and Díaz 2009), motivating the exploration of the Araucania region, an area apparently not covered by Frere *et al.* (2004). The objectives of this study were to: 1) record the breeding sites of Red-legged Cormorants in the Araucania region; and 2) determine their breeding population size.

METHODS

During the three springs and summers of 2010-2012, we conducted an intensive search of Red-legged Cormorant colonies. We surveyed 112.6 km of coastline in the Araucania region (between 38° 28' S and 39° 23' S), south-central Chile (Fig. 1). We used satellite images, maps from the Instituto Geográfico Militar (Chile), information from locals and the experience of the authors to look for suitable cliffs for colonies. For each colony, we recorded geographic location with a Global Positioning System (GPS), and the number of active nests and adults of Red-legged Cormorants. Depending on the topography and accessibility, the counts were conducted by transects from the beach at low tide (e.g., Piureo-Puaucho) or by fixed points in high spots that allowed observation of the entire colony (e.g., Nigue). A nest was considered active when it contained at least one adult, eggs or chicks (Frere *et al.* 2004). The nest counts were performed by two observers, using binoculars (10x42) and scopes (20-60x) to avoid counting error and to have a better coverage of each colony. A third observer recorded adult Red-legged Cormorants.

RESULTS

We recorded a total of 10 breeding colonies of Red-legged Cormorants along the 112.6 km of coastline in the Araucania region (Table 1; Fig. 1), with 3,175 active nests and 13,018 adults. Punta Casa de Piedra was the only locality where we observed the presence of non-breeding Red-legged Cormorants.

Sizes of the breeding colonies varied between 20 and 1,506 nests (Table 1). Two colonies, Piureo-Puaucho and Nigue, were the most important, both in the number of nests and in the abundance of Red-legged Cormorants, with both sites combined containing 79.2% (n = 2,515) of the nests and 73.7% of the adults (n = 9,620) found in the Araucania region. From the total of adults recorded, only 6,350 (48.7%) were breeding. Half of the colonies (n = 5) were on crushed stone platforms, the rest were on metamorphic rock substrate (n = 3) and rocky islands (n = 2).

DISCUSSION

In this study, we found 10 colonies that were not reported by Frere *et al.* (2004),

Table 1. Location and size (number of active nests and number of adults) of Red-legged Cormorant colonies in the Araucania region, south-central Chile.

Site Number	Colony	Geographical Coordinates	Number of Adults	Number of Active Nests	Dates
1	Punta Manuel	38° 30' S, 73° 31' W	380	67	9 February 2012
2	Hueñalihuén	38° 31' S, 73° 30' W	300	53	2 November 2010
3	Lilicura	38° 33' S, 73° 30' W	551	131	10 February 2012
4	Los Arrayanes	38° 35' S, 73° 29' W	150	20	2 November 2010
5	Coicoi	38° 36' S, 73° 29' W	227	97	10 December 2010
6	Lobería de Coicoi	38° 38' S, 73° 28' W	1,257	246	10 February 2012
7	Playa Maule-Boca Budi	38° 48' S, 73° 24' W; 38° 49' S, 73° 23' W	383	26	20 January 2011
8	Piedra Alta	38° 55' S, 73° 21' W	150	20	21 January 2011
9	Piureo-Puaucho	38° 53' S, 73° 21' W; 38° 56' S, 73° 20' W	6,890	1,506	21 January 2011
10	Nigue	39° 17' S, 73° 13' W; 39° 18' S, 73° 13' W	2,730	1,009	8 December 2010
TOTAL			13,018	3,175	

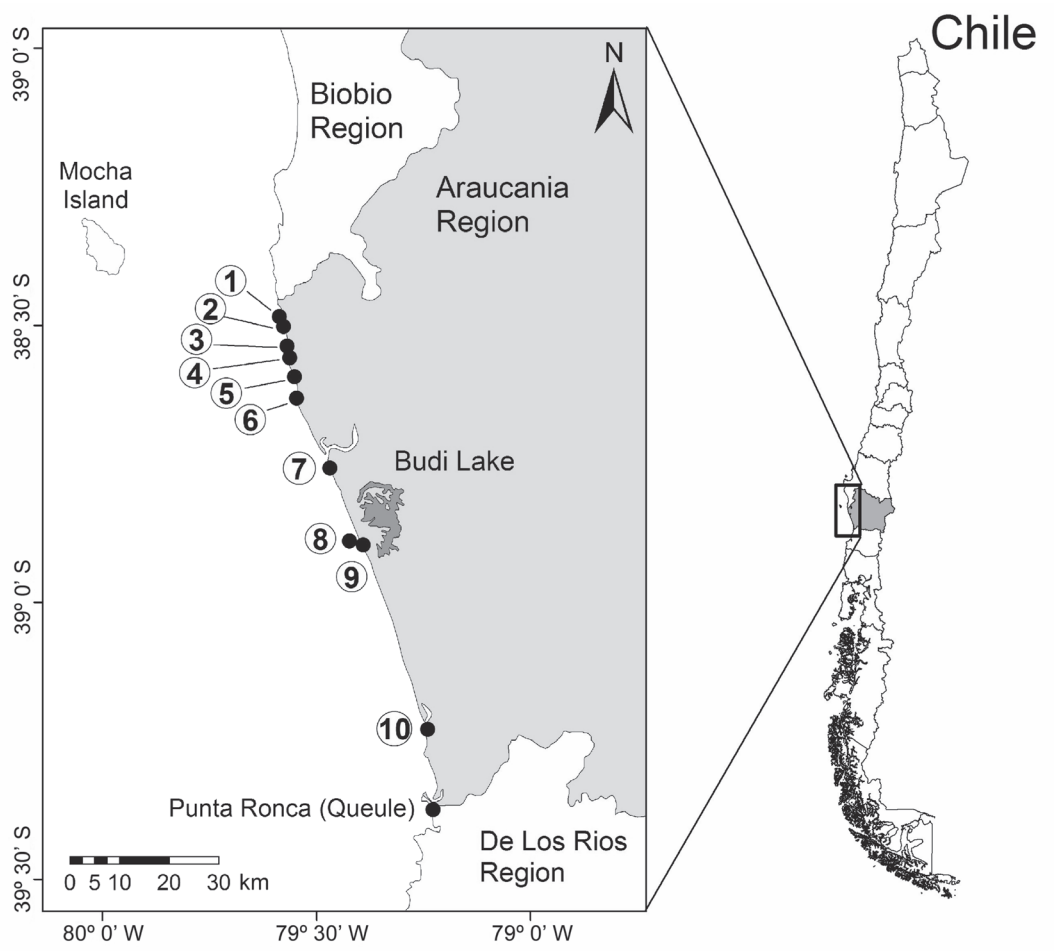

Figure 1. Breeding colonies of Red-legged Cormorant in the Araucania region, south-central Chile. Numbered circles indicate the name of each colony corresponding to Table 1. Also shown is the location of Punta Ronca (Queule) described by Frere *et al.* (2004), the third largest breeding colony of the species.

increasing the known breeding population of Red-legged Cormorants in Chile by 61-63%. This increases the known population from 5,018-5,218 (Frere *et al.* 2004) to 8,193-8,393 breeding pairs. This also increases the rangewide estimate of the Red-legged Cormorant breeding population by 43.4%, from 30,000 individuals (International Union for Conservation of Nature 2013) to 43,018 individuals. The largest colonies of this species (with more than 40% of the entire breeding population of Chile) are located between Piureo-Puaucho and Punta Ronca (Queule) (Frere *et al.* 2004). Thus, the area between latitudes 38° 48' S and 39° 23' S is the most important known nesting area for Red-legged Cormorants. Our results also support the idea of Frere *et al.* (2004) that this region might be a refuge for the species against the effects of El Niño Southern Oscillation events in northern areas and the lack of breeding sites available.

Recently, the coastal area of Budi Lake (38° 42' S to 39° 01' S) has been recognized and proposed as an Important Bird Area in Chile (Ortiz *et al.* 2009). Since 1992, this area corresponds with a "hunting-free zone," which provides some protection to several colonies of Red-legged Cormorants, including the locality of Piureo-Puaucho, the largest known breeding colony for this species (Frere *et al.* 2004, 2005). A different situation

occurs in Nigue and Punta Ronca (Queule), the second and third most important breeding colonies for the species, respectively, as both are unprotected.

The presence of rope access to the nests in the Piureo-Puaucho colony was the only human disturbance observed on breeding colonies. Additionally, we observed the remains of fishing nets and plastic bags used in the construction of the nests of Red-legged Cormorants. With the exception of Nigue, in all localities of the Araucania region where we detected breeding of Red-legged Cormorants, we also detected artisanal fishing. Although mortality of Red-legged Cormorants from artisanal fishing has not been documented in Araucania region, deaths of other seabirds (Magellanic Penguin, *Spheniscus magellanicus*) by these fisheries have been reported in this area (Schlatter *et al.* 2009). Furthermore, interactions between Red-legged Cormorants and fishing vessels is known from other regions of Chile (Frere and Millones 2012). In central Chile, accidental deaths of Red-legged Cormorants have been documented by various fisheries (Simeone *et al.* 1999; Frere *et al.* 2004; Frere and Millones 2012) and also by fishermen and seaweed and shellfish harvesters (Frere and Millones 2012). The landslides caused by the moment magnitude (Mw) 8.8 earthquake of 2010 produced the loss of some nests, but the effect on the size of the breeding population in the colonies affected is unknown. We suggest the development of a program to study the threats and population trends of this little known cormorant.

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