

# Colony and nest site fidelity of the rock shag (*Phalacrocorax magellanicus*)

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**Abstract** The rock shag (*Phalacrocorax magellanicus*) is an endemic species from southern Argentina and Chile. In Argentina, the population is distributed along the Patagonian coast in 143 small colonies (5–377 pairs). We studied colony and nest site fidelity of rock shags at Punta Loma, Patagonia, Argentina. We banded 37 adults from December 2001 to June 2003, during two breeding and two non-breeding seasons. Nest site fidelity was extremely high during consecutive breeding and also non-breeding seasons. The high percentage of banded birds residing in the colony in consecutive seasons suggests that rock shags are highly faithful to breeding sites and supports the idea of low post-breeding dispersion.

**Keywords** Site fidelity · Patagonia · *Phalacrocorax magellanicus* · Rock shag

## Introduction

Rock shags (*Phalacrocorax magellanicus*) are foot-propelled pursuit-divers, endemic to coastal Patagonia. The

total population on the Atlantic coast is only 7,000 pairs (Yorio et al. 1998; Frere et al. 2005). In the Patagonian region, rock shags show a distinctive abundance and distribution pattern compared to other species of Patagonian cormorants, with in total about 143 colonies of small size (5–377 pairs) (Yorio et al. 1998; Frere et al. 2005).

Previous studies on this shag indicate that it remains at the colony through the year and suggest that post-breeding migration of adults is rare (Siegel-Causey 1986; Punta and Saravia 1993; Libenson 1997; Punta et al. 2003 and Sapoznikow and Quintana 2005). However, no studies have evaluated colony or nest site fidelity of the rock shag. As part of a broader study of the foraging ecology of this species, we analyzed colony and nest site fidelity of rock shags at Punta Loma, Chubut, Argentina (42°49'S, 64°53'W), one of the largest colonies along the Patagonian coast (Yorio et al. 1998; Frere et al. 2005).

## Methods

We banded 37 adults from December 2001 to June 2003 at Punta Loma colony (colony size = 280 pairs) during two breeding (October–February) and two non-breeding seasons (March–September) (Table 1). The extension of the breeding seasons includes the egg-laying and the chick-rearing periods. Birds were captured and banded at their nests during breeding seasons and in places where nests were previously built during non-breeding seasons. We marked each bird with a metal band (National Band and Tag, Inc., USA), with a unique combination of numbers and letters on the right tarsus, and a colored plastic band with a code of three letters (Pro-Touch Engraving, Inc., Canada), on the left tarsus. All nests were identified and numbered on large photographs, allowing an accurate nest survey within

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**Table 1** Rock shag's colony fidelity at Punta Loma, Patagonia, Argentina

	Banded birds ( <i>n</i> )	Fidelity to the colony (%)			
		NB 2002	B 2002	NB 2003	B 2003
B 2001	15	100	100	100	100
NB 2002	5		40	40	100
B 2002	12			100	100
NB 2003	5				60

Number of banded birds and percentage of resighted birds during four seasons

*NB* non breeding season, *B* breeding season

and between seasons. Once a week, each nest was checked once per day. We had direct access to most nests, and we checked others from the top of a cliff from where we could see the entire colony. Plastic bands were easy to read from the distance with binoculars 12 × 50 and a telescope 25×.

## Results

Colony fidelity of rock shags was high: 87% of banded birds were found at the colony during the breeding and non-breeding seasons following banding, 8% of the birds were found in some of those seasons, while 5% were never resighted. All the birds banded during breeding seasons ( $n = 27$ ) were seen during the following breeding and non-breeding seasons. In contrast, only 40–60% of the birds banded during non-breeding seasons ( $n = 10$ ) were seen in the following periods (Table 1). However, three of the five adults banded during the winter 2002, that were not seen in the following breeding season, were finally observed nesting during the 2003 breeding season, in the same site where they were captured and banded. Given the characteristics of the colony and the methodology used to record the birds, it is highly probable that these birds indeed did not attend the colony when we failed to record them.

Nest fidelity was also extremely high: 82% of banded birds bred at the same nest during consecutive seasons while only 5% occupied a different nest, adjacent to the previous site. We could not estimate nest site fidelity for 13% of the birds, as we did not register them as breeding in consecutive seasons. The 93 and 96% of banded birds that reproduced during 2001 and 2002, respectively, re-occupied the same nest in the following breeding season (Table 2). Nest site fidelity was also high during the non-breeding season: all banded birds breeding during 2001 and 2002 seasons continued to attend their nests during the following non-breeding seasons (Table 2).

The low number of pairs banded ( $n = 6$ ) did not allow us to estimate mate fidelity. However, we registered two

**Table 2** Rock shag's nest site fidelity at Punta Loma, Patagonia, Argentina

	Banded birds ( <i>n</i> )	Nest site fidelity (%)			
		NB 2002	B 2002	NB 2003	B 2003
B 2001	15	100	93		
B 2002	29			100	96

Number of banded birds breeding in each season and percentage of birds resighted at the same nest in consecutive seasons

*B* breeding season, *NB* non breeding season

divorces. In both cases, pairs remained together after breeding, and the divorce occurred at the beginning of the following breeding season with one member of the pair remaining at the previous nest and the partner moving to a new one.

## Discussion

The high percentage of banded birds remaining at the colony in consecutive seasons indicates that rock shags are highly faithful to the colony. The presence of a very high proportion of banded birds throughout the year supports the idea of a low post-breeding dispersion (see also Sapoznikow and Quintana 2005). However, some non-breeding adults could be present, prospecting the colony exclusively during the non-breeding seasons. In fact, five individuals banded during the non-breeding seasons were not seen in subsequent breeding periods, although three of them were breeding a season later. Prospecting is of particular value for non-breeders during the breeding season (Danchin et al. 2004). Prospecting is seen as a process of choosing a future nesting site of highest possible quality (Schjørring et al. 1999; Dittman et al. 2007). Prospecting for longer periods is particularly important in long-lived species, breeding in places of predictable quality, but where good quality sites are rare (Boulinier and Danchin 1997). Such preconditions seem to be fulfilled in the case of cormorants breeding on cliffs (Forbes and Kaiser 1994) as does the rock shag at Punta Loma.

Nest site fidelity was extremely high during consecutive breeding seasons (93 and 96%) as it was during non-breeding seasons (100%). These results suggest that most of the adult birds that remain at the colony occupy the same nest even during the winter periods between breeding seasons. Nest site fidelity of rock shags at Punta Loma was higher than reported for other species of cormorants and shags. Studies of European shags (*P. aristotelis*) at Cíes Islands indicated high colony fidelity, but only 60% of nest site fidelity (Velando and Freire 2002). The species shows a similar behavior on the Isle of May (Aebischer et al. 1995). Nest site fidelity is usually related to a series of factors such as nest quality, breeding success in the

previous year, the ability of the female to recognize the male, and the timing of partner's return to the colony (Aebischer et al. 1995). Given that rock shags remain at the colony for the whole year (Sapoznikow and Quintana 2005), the last two variables are not likely to play a key role in determining nest site fidelity for this species. European shags breed in areas of low slope (Velando and Freire 2002), while rock shags build their nests on cliffs (Frere et al. 2005), where the number and quality of suitable breeding sites is extremely variable (Forbes and Kaiser 1994). Due to specific requirements concerning the quality of the nesting site and high competition, an existing nesting territory is probably a precious resource that needs to be defended continuously (Forbes and Kaiser 1994).

Brand's cormorants (*P. penicillatus*) in California and flightless cormorants (*P. harrisi*) in the Galapagos Islands, show low colony fidelity, variable nest site fidelity and a very low mate fidelity (Harris 1979; Boekelheide and Ainley 1989). These traits have been related to an extremely variable marine environment caused by characteristics of the California current and El Niño events, respectively. In contrast, the high values of colony fidelity, and the presence of the birds throughout the year at Punta Loma could be an indirect evidence for a relatively high tempo-spatial stability of food sources exploited by this species (Switzer 1993), as suggested by recent studies of seasonal variation of diet and diving behavior (Sapoznikow 2006).

Finally, the high percentage of resighted birds suggest a high colony and nest site fidelity. However, our findings should be considered as preliminary, as the total number of banded birds in this study was low. We therefore encourage long-term studies in this and other colonies, banding adults and chicks, to achieve a better understanding of the population dynamics of this species.

## Zusammenfassung

Kolonie- und Neststandortstreuung der Felsenscharbe (*Phalacrocorax magellanicus*)

Die Felsenscharbe lebt als endemische Art im südlichen Argentinien und Chile. Entlang der argentinischen Küste Patagoniens ist die Population auf 143 kleine Kolonien mit 5–377 Paaren verteilt. Wir untersuchten die Kolonie- und Neststandortstreuung der Felsenscharbe bei Punta Loma, Argentinien. 37 Altvögel wurden von September 2001 bis Juni 2003 in und nach zwei Brutzeiten markiert. Die Neststandortstreuung zwischen aufeinander folgenden Brut- und auch Nachbrutzeiten war sehr hoch. Der hohe Prozentsatz markierter Vögel in der gleichen Kolonie in aufeinander folgenden Saisons weist auf hohe Standortstreuung der

Felsenscharbe zum Brutplatz sowie auf geringe Dispersion außerhalb der Brutzeit hin.

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