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DISTRIBUTION AND ABUNDANCE OF BREEDING STRIATED CARACARAS IN THE FALKLAND ISLANDS (MALVINAS)

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ABSTRACT.—We conducted surveys of breeding pairs of the endemic and globally “Near Threatened” Striated Caracara (*Phalacrocorax australis*) on 79 outer islands in the Falklands archipelago (Islas Malvinas) during the austral-summer breeding seasons of 2013–2014 and 2014–2015. A total of 354 breeding pairs (defined as pairs with evidence of egg-laying), or an archipelago-wide adult breeding population of at least 0.05 birds/km² was recorded. An additional 477 probable breeding pairs also were found. The distribution of breeding pairs remains similar to that found during surveys in the 1990s and 2000s. Grand Jason, Steeple Jason, New Island, Beauchêne Island, and Bird Island, the five islands with the highest numbers of breeding pairs, accounted for half of the total breeding population. “Vegetationally pristine” islands with dense areas of tussac grass (*Poa flabellata*) and high densities of small burrowing seabirds—namely Bird Island, Saddle Island, and Beauchêne Island—supported the highest densities of breeding pairs. Eighty percent of all pairs occurred on National Nature Reserves or on privately owned nature sanctuaries. Our surveys suggest that sustained protection of key breeding sites is critical for the long-term conservation of this species. We recommend that populations of Striated Caracaras at Tierra del Fuego also be surveyed and that the global population status of the species be reassessed.

KEY WORDS: *Striated Caracaras*; *Phalacrocorax australis*; *breeding*; *Falkland Islands*; *Islas Malvinas*; *population survey*.

DISTRIBUCIÓN Y ABUNDANCIA DE *PHALACROBORUS AUSTRALIS* EN LAS ISLAS MALVINAS

RESUMEN.—Censamos parejas reproductivas de la especie endémica y globalmente categorizada como casi amenazada, *Phalacrocorax australis*, en 79 islas periféricas en el archipiélago de las Islas Malvinas durante las temporadas reproductivas del verano austral de 2013–2014 y 2014–2015. Se registró un total de 354 parejas reproductivas (definidas como parejas con evidencia de puesta de huevos) o una población adulta reproductiva del archipiélago completo de al menos 0.05 aves/km². También se encontró un adicional de 477 parejas reproductivas probables. La distribución de las parejas reproductivas es similar a la encontrada durante los censos realizados en las décadas de 1990 y 2000. Las cinco islas con los mayores números de parejas reproductivas, Grand Jason, Steeple Jason, New Island, Beauchêne Island y Bird Island, representaron la mitad del total de la población reproductiva. Las islas con vegetación prístina con áreas densas de *Poa flabellata* y densidades elevadas de aves marinas de madriguera, principalmente Bird Island, Saddle Island y Beauchêne Island, albergaron las mayores densidades de parejas reproductivas. El 80% de todas las parejas fue registrado en Reservas Naturales Nacionales o en santuarios naturales privados. Nuestros censos sugieren que la protección sostenida en el tiempo de sitios de reproducción clave es crítica para la conservación a largo plazo de esta especie. Recomendamos que también se censén las poblaciones de *P. australis* en Tierra del Fuego para re-evaluar el estatus global de la población de esta especie.

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The most southerly distributed of all birds of prey, the relatively little-studied Striated Caracara (*Phalco boenus australis*) is a medium-sized raptor (approximately 1.5–2.0 kg) with a global, island-restricted breeding range of 30,000 to 46,000 km² on the Fuegian regions of Argentina and Chile and outer islands in the Falkland Islands (Islas Malvinas; Ferguson-Lees and Christie 2001, Marín et al. 2006, Birdlife International 2017). Striated Caracaras, which lay up to 4-egg clutches and feed largely on carrion, typically breed in association with seabird colonies (Strange 1996, Woods 2017). The Falkland Islands are believed to be the global population stronghold for the species (Woods and Woods 1997, Woods 2017), which is currently estimated at between 1500 and 4000 adult individuals (Birdlife International 2017).

Early accounts of this species on the Falklands described it as both common and abundant. During visits to the main island of East Falkland in 1833 and 1834, Charles Darwin noted that not only were caracaras “exceedingly numerous,” but that they “constantly haunted the neighborhood(s) of houses to pick up all kinds of offal” (Darwin 1845). In 1861, Charles Abbott (Abbott 1861) suggested that the species was “one of the commonest birds in East Falkland.”

Population declines in the species in the late 1800s and early 1900s may have been related to increased human activity across the archipelago, with sealers (Bryan 2011) and sheep farmers (Cawkell and Hamilton 1961) playing major roles. Sealers decimated important food resources for the caracaras during the seal and penguin “oil rushes” of the nineteenth century (Bryan 2011). Sheep farming reduced native tussock grass (*Poa flabellata*) caracara breeding habitat via grazing and reduced populations via persecution because the caracaras were feeding on dead and dying sheep (Cobb 1910, Cawkell and Hamilton 1961, Bryan 2011).

Human threats appear to have been greatest and most consequential between the late-nineteenth century and the mid-twentieth century, at a time when caracaras were considered vermin by many local inhabitants (Cobb 1910, Cawkell and Hamilton 1961). The peak of Striated Caracara vulnerability from extensive human persecution likely occurred from 1908 to 1930 when the Falkland Islands Government placed a bounty on the species (Cawkell and Hamilton 1961). Persecution persisted after the bounty was lifted, and legal protection was granted in 1964. Most breeding pairs are now on

privately held islands, and since 1999, a government license to cull individuals can be obtained for the purpose of “preventing serious damage to primary rural livelihoods” (Falkland Islands Government 1999).

Several population surveys of Striated Caracaras on the Falkland Islands were undertaken during the second half of the twentieth century, with the first counts derived from a series of visits to offshore islands during the breeding seasons of 1963–1965 and 1983–1986 (Strange 1996). These counts estimated 450 and 337 breeding pairs on 40 and 58 islands visited, respectively (Strange 1996). In October and November of 1997 and 1998, the Falkland Islands Government sponsored more thorough multi-island surveys in anticipation of the establishment of the Conservation of Wildlife and Nature Ordinance 1999 (Falklands Islands Government 1999). These surveys, which encompassed 54 islands, resulted in an estimated Falklands population of 500 pairs (Woods and Smith 1999). An additional 18 islands surveyed in November 2006 (Woods 2007) suggested that breeding numbers were stable overall, although there were small, local increases on several islands visited in both 1997–1998 and 2006–2007 (Woods 2007). The surveys suggested that breeding Striated Caracaras are locally numerous on several outer islands in the Falklands, principally the northern and western parts of the archipelago, north and west of the main island of West Falkland, and on outer islands off the southern coast of the main island of East Falkland (Strange 1996, Woods and Woods 1997; Fig. 1) with much smaller numbers nesting on West Falkland itself (Fig. 1). Currently there are no records of Striated Caracaras breeding on the main island of East Falkland (Woods 2007).

The Striated Caracara is an aggressive and opportunistic scavenger that feeds principally on vulnerable young seabirds, as well as on dead and dying adult seabirds during the austral breeding season (Strange 1996), and on livestock and marine mammal carcasses and feces and marine and terrestrial invertebrates (M. Reeves unpubl. data) year-round (Strange 1996, Woods and Woods 1997, Woods 2017). The caracara’s breeding range on the Falklands strongly reflects the distribution of seabird and seal colonies and their associated habitats, with virtually all of the breeding population restricted to offshore islands that have colonies of seabirds and that are largely uninhabited or unfarmed (Strange 1996, Woods and Woods 1997, Woods 2007).

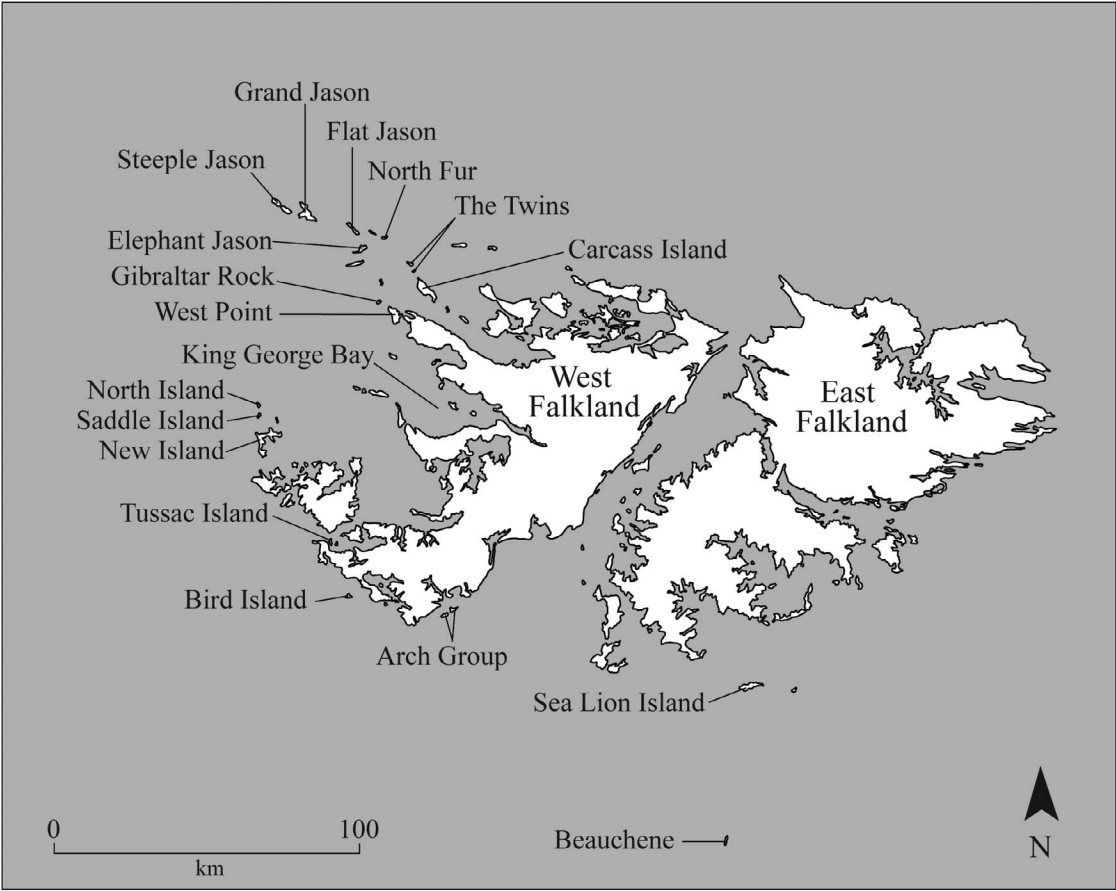


Figure 1. Map of the Falkland Islands indicating the locations of all place names mentioned in the text and Table 1.

Overall, the species favors breeding areas on or near coastlines adjacent to large seabird colonies, and typically nests in dense stands of tussac grass and in rock and cliff crevices (Strange 1996, Woods and Woods 1997, Woods 2007).

To evaluate the current breeding population and range of this species, we conducted geographically extensive surveys during two austral summers at known and probable locations across the species' known breeding range on the Falkland Islands. Such surveys provide important baseline data to inform conservation efforts and assessments.

METHODS

Survey Coverage. We identified 145 islands for potential surveys based on breeding activity recorded during previous surveys and on anecdotal observations supporting evidence of breeding pairs

(Strange 1996, Woods and Smith 1999, Woods 2007). In all cases, we obtained landowner permission before landing on islands. We did not survey islands when information obtained from landowners, who lived on or frequently visited their islands, indicated an absence of this conspicuous species or if permission to enter the island was not obtained from the landowner. In sum, we visited 79 islands, or approximately 55% of those identified as potential breeding sites based on previous surveys (Woods and Woods 1997, Woods 2007), during our surveys.

Survey Timing. We made surveys of potential breeding islands in November, December, and January, during the austral summers of 2013–2014 and 2014–2015, which coincides with the known peak breeding period (i.e., incubation and small-nestling stage). We visited all islands only once to avoid duplicate sampling. During this time of year,

adults remain close to their nests and display aggressive behavior that includes raucous screeching and aerial diving at intruders approaching their nests. After nestlings hatched in December and January, their begging calls also helped us locate nests, including those in dense stands of tussac grass.

Survey Methods. Survey efforts were conducted during six field campaigns, two of which were undertaken by boat and included brief landings on islands or brief nearshore (<20 m) circumnavigations of the islands, and four of which consisted of multi-day visits to individual islands via a small fishing vessel. Multi-day, land-based visits were made to accessible islands with known large breeding populations, including Steeple Jason (Jan 2013); Sea Lion Island (Jan 2013); Carcass Island (Jan 2013) and Grand Jason (Dec 2014; Fig. 1). The campaign on 4–22 December 2013 focused on islands to the north and northwest of West Falkland, and included islands in the Jasons Group, as well as islands to the west of West Falkland including the New Island Group (Fig. 1). A second campaign on 14–30 November 2014 surveyed islands in the southwest to the south of the main islands and included New Island, Bird Island and Beauchêne Island (See Reeves and Crofts 2015 for additional details). On small islands, where boat landings were not possible, we surveyed birds with binoculars from a boat within 20 m of the shoreline.

On land-based surveys, survey participants were assigned an area of coastline that was traversed on foot, during which GPS units recorded the locations of suspected breeding Striated Caracaras. In addition to caracaras approaching and calling at surveyors, breeding adults typically perched near their nests (i.e., <25 m), often at high points along cliff ledges or on elevated vegetative tussac pedestals 2–4 m above the surrounding treeless coastal heath landscape. As a result, both breeding adults and, in many cases, their nests were readily observable with binoculars from up to several hundred meters away, both from land and sea. The ability to survey using binoculars from a boat was especially important when surveying otherwise inaccessible islands where steep cliffs dominated the shoreline, prohibiting landings. During both land-based and boat-based surveys, evidence of breeding and probable breeding was based on six criteria used in previous surveys (Woods and Smith 1999, Woods 2007). These included (1) evidence of egg-laying, including an adult sitting tightly on a nest, or nestlings or eggs in a nest (also termed an “active nest”), (2) one or two

adults displaying or acting aggressively toward us, (3) one or two adults seen in a potential nesting area, (4) empty but recently built nest with one or two adults in the area. We considered criterion 1 indicative of breeding and criteria 2–4 indicative of probable breeding.

Limitations of Surveys. During the boat-based surveys, we could not always land on islands due to adverse high winds, rain, and rough seas; thus, some surveys were conducted near-shore from the boat. In these instances, GPS waypoints taken from the boat were later interpolated using Google Earth to mark waypoints on land. In some cases, islands could not be fully circumnavigated on foot due to steep cliffs or impenetrable stands of tussac grass, e.g., sections of coastline at Beauchêne Island, South Jason and Sea Lion Island. In these instances the sections amounted to <2.5% of the total coastlines involved, and all were surveyed from a boat when it was safe to do so. In light of these constraints, our results are best viewed as estimates of minimal numbers of breeding pairs and probably-breeding pairs.

RESULTS AND DISCUSSION

Of 145 islands identified as potential sites for breeding pairs, we surveyed only 79, due to logistic and safety constraints. Of the 79 islands, 68 held breeding pairs of Striated Caracaras. As in previous surveys (cf. Woods 2007), time, funding, and logistical limitations prohibited a complete survey of the islands.

We found 343 breeding pairs for which we observed either eggs or young, and an additional 11 sites at which an adult appeared to be incubating, which we also considered indicative of breeding pairs with active nests (criterion 1). We considered that evidence at an additional 477 sites suggested probable breeders there. Included in these were 176 sites at which birds displayed aggressive behavior when approached (criterion 2), 243 sites with at least one adult in a potential territory but no aggressive behavior (criterion 3), and 58 sites with empty but recently built nests and an adult nearby (criterion 4). We also saw six empty nests with no adult birds in the area.

Our estimate of 354 breeding pairs should be viewed as the lowest minimum for the islands we visited, and 831 breeding pairs (see above) a more realistic estimate for the islands we surveyed.

Overall, surveys conducted between 1963 and 2015 indicated that a total of 120 islands have had a presence of potentially breeding Striated Caracaras

Table 1. Breeding pairs (active nests) and probable breeding pairs on only key islands that were surveyed at least twice between 1983–1986 and 2013–2014, together with percent differences in subsequent surveys in parentheses as applicable. The symbol — indicates an island not surveyed. The percent differences represent the differences between the most previous survey versus the one in the column in which they appear.

ISLAND	NUMBER OF BREEDING PAIRS			
	1983–1986 ^a	1997–1998 ^b	2006–2007 ^c	2013–2014 ^d
Gibraltar Rock	8	6 (–25)	—	12
The Twins	3	6 (100)	—	14
West Point	5	—	7	15 (114)
Carcass Island	9	15 (67)	11 (–27)	27 (145)
North Fur	2	16 (700)	16 (0)	28 (75)
Flat Jason	20	34 (70)	26 (–24)	30 (15)
North Island	6	—	—	31
Elephant Jason	20	35 (75)	30 (–14)	41 (37)
Bird	10	32 (220)	36 (13)	66 (83)
Beauchêne	62	—	—	70
New Island	7	—	—	86
Steeple Jason	40	72 (80)	64 (–11)	89 (39)
Grand Jason	14	71 (407)	44 (–38)	96 (118)
Total	206	305 (48)	248 (–19)	605 (144)

^a Strange 1997.
^b Woods and Smith 1999.
^c Woods 2007.
^d This study.

at some time or another (i.e., adults in breeding plumage and the presence of nests, eggs, or young). We estimate that islands surveyed previously (Strange 1996, Woods and Smith 1999, Woods 2007), but not during this survey, currently may include up to 100 breeding pairs based on existing habitat and seabird colonies there, leading us to suggest that the current breeding population in the Falkland Islands may be as high as 930 breeding pairs.

Previous Surveys of the Falklands Islands. The population estimate for 1963–1965 (approximately 40 islands), was 450 pairs, and for subsequent surveys in the 1980s was 337 pairs (approximately 58 islands; Strange 1996). In 1997–1998 and 2006, population estimates were 500 and 520 pairs (approximately 54 and 18 islands), respectively (Woods and Smith 1999, Woods 2007). In addition, an estimated 85 breeding pairs inhabited New Island during the austral summer of 2006–2007 (Catry et al. 2008). Although this number was not included in the Woods (2007) island estimate, we have added it to the Woods (2007) estimate in Table 1.

Distributions and Densities of Caracaras. Considering all breeding pairs and probable breeding pairs together ($n=831$), we found that the Jason group of islands in the far northwest of the Falklands

supported 39% of all such pairs. The New Island group held 17%. Beauchêne Island at the extreme south of the archipelago and isolated from the main islands by some 60 km held 9.5%. Islands to the south of West Falkland, including Tussac Island and Bird Island to the Arch Island group supported 11%. Islands surveyed around the southern coast of East Falkland, the Falkland Sound and the Sea Lion group supported 5%, as did islands in King George Bay, including the Passage Island group.

The five most important islands in terms of numbers of nesting pairs and probable nesting pairs in 2013–2014 were Grand Jason with 96, Steeple Jason with 89, New Island with 86, Beauchêne Island with 70, and Bird Island with 66. These five islands hold about half (49%) of the nesting and probable nesting pairs of Striated Caracaras (Table 1).

Islands with highest known breeding densities (i.e., pairs/km²) were Bird Island with 55 pairs/km², Saddle Island with 54 pairs/km² (Woods 2007; Fig. 1), and Beauchêne Island with 41 pairs/km². Vegetationally pristine islands with dense areas of tussac grass and high densities of small burrowing seabirds—namely Bird Island, Saddle Island, and Beauchêne Island—supported the highest densities of breeding pairs. Approximately 80% of all pairs occurred on National Nature Reserves or on

privately owned nature sanctuaries. We suggest that sustained protection of key breeding sites with dense tussock grass and high densities of small burrowing seabirds is critical for the long-term conservation of this species.

Conservation Implications. Historical counts mentioned above suggest that the species declined in conjunction with sheep farming in the late 1880s to mid-1950s, and that when monitoring began in earnest in the mid-1960s the population estimate may have stood at about several hundred pairs. It is not possible to derive an accurate population estimate for the species before Europeans arrived on the islands, but early nineteenth century accounts suggest the caracara population was higher than it is now, and that the breeding range encompassed additional islands, for example both East and West Falkland. We believe that it is unlikely that the species will ever breed in numbers approaching pre-European settlement. The population could be described as having recovered from the lows of the late 1800s and early to mid-1900s; this recovery possibly driven in large part by changing human attitudes and wildlife protection legislation. Maintaining the long-term persistence of current populations of the species almost certainly requires maintaining the species' strongholds mentioned above and in Table 1, fostering increased breeding activity at sites such as New Island, where studies indicate substantial increases in breeding activity since heavy persecution ended there in the 1960s (Cattri et al. 2008). We recommend additional research on both inter- and intra-island movements of the species, along with its year-round feeding requirements (cf. Rexer-Huber and Bildstein 2013). Ideally the species' global population on both the Falklands Islands and Tierra del Fuego should be assessed and routinely monitored, and the extent of movement between these two populations, if any, should be determined.

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