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First description of nesting ecology of the endemic Grey-flanked *Cinclodes* *Cinclodes oustaleti baeckstroemii* from the Juan Fernández Islands, Chile

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Abstract. The habitat and nest sites of an island-endemic, the Másafuera Grey-flanked *Cinclodes*, are described for the first time. The species breeds only in natural cavities in steep rock-walls and rocky slopes or ridges. The nest entrance diameter ranges from 5.5 to 20 cm, the nest chamber being placed within the rock so as to be invisible from the outside. The nest sites found — solely on Alejandro Selkirk Island — were located from a little above the sea-level to the summit region, the preferred habitats being barren canyon bottoms with small streams, and humid alpine plateaus. Nesting extends from early December to late January, indicating a core breeding season from November to January. Fledgling numbers per clutch average about two.

Key words: Grey-flanked *Cinclodes*, *Cinclodes oustaleti baeckstroemii*, breeding ecology, Alejandro Selkirk Island, Furnariidae, island birds, nest sites, ovenbirds

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The Másafuera Grey-flanked *Cinclodes* (Passeriformes: Furnariidae) is endemic to Alejandro Selkirk Island of the Juan Fernández group. It was described by Lönnberg (1921) on the basis of specimens collected by Bäckström in 1917. The validity of this subspecies was confirmed by Hellmayr (1925; see also Johnson 1967) as it shows a more rufous-chestnut coloration of the flanks and under tail-coverts than its "grey-flanked" continental conspecific as well as several biometric differences. It is worth emphasising that the Furnariidae family is almost exclusively restricted to the South American continent and some islands very close to the coast. The Másafuera *Cinclodes* is of biogeographical interest, since, together with the sympatric Másafuera Rayadito *Aphrastura masafuerae*, it has departed most distantly from the Neotropis and the continental family range. These weak fliers have managed to reach the remote oceanic island in the first place (being absent from Robinson Crusoe Island) and

founded a furnariid outpost (Schlatter 1987). Distributional range and population size are bounded by the relatively small size of the island. Although a systematic census was lacking in 1993, the Másafuera *Cinclodes* was categorized as endangered (Glade 1993). This classification was justified by recent surveys that showed a total of 1500 individuals only (Hahn et al. 2005).

Suggestions on the *Cinclodes o. baeckstroemii* nest sites only come from analogous observations of the mainland subspecies *Cinclodes o. oustaleti* that it nests in "holes in banks and escarpments" (Johnson 1967, P. Vergara, pers. comm.) as well as in crevices of rocks (Remsen 2003). Observations by W. R. Millie, published by Johnson (1967), are inconsistent with those of other researchers. His cited descriptions of the island topography, distribution of bird species, and failure to record several resident birds raise doubt about the value of this specific source. In January 1986 Brooke (1987) saw a family party of four in the Quebrada Casas

on Alejandro Selkirk Island, up to that date the only reliable reproduction-related observation of *baeckstroemii*. No further information of the breeding ecology existed and no nest of this bird had been found (Lönnerberg 1921, Johnson 1967, Vaurie 1980, Brooke 1987). Thus the Másafuera Cinclodes not only represents an endangered endemic species restricted to a single relatively small island, but also is the least-known bird of the archipelago and is one of the last Chilean birds whose reproduction has not been described. Here we present first data concerning a small breeding population. This basic information may also serve for future conservation management demands.

Alejandro Selkirk (formerly Másafuera) is the westernmost island of the Juan Fernández archipelago (33°45' S, 80°45' W). It is located in the south-east Pacific 167 km west of the other major island Robinson Crusoe (formerly Másatierra), and 769 km off the coast of Chile. The isolated island (44.64 km², 1320 m high) is of recent volcanic origin, shaped like a big rock dome, and is one of the steepest islands worldwide. The entire island is a part of the Juan Fernández national park founded in 1935, and UNESCO Biosphere Reserve since 1977. More detailed geographical descriptions may be found in Castilla (1987) and Skottsberg (1920–1956). Field work was carried out on the island during the austral summers from 25 Nov. 1992 to 1 Feb. 1993, 15 Dec. 1994 to 9 Feb. 1995, and 23 Jan. to 8 Feb. 2002. Visual field identification of birds was based on Lönnerberg (1921) and Araya et al. (1998).

Másafuera Cinclodeses were observed at all elevations during the nesting period, from little above sea-level up to the summit region of the island. They occupy an area of about 2200 ha covering five types of habitat on Alejandro Selkirk Island (own unpubl. data, see also Hahn et al. 2005). Our observations show that its occurrence is related to the presence of specific landscape structures: small streams and v-shaped canyons (quebradas) carrying water all year round are being preferred. This is especially the case in the Quebradas Tongo, Varadero, Inocentes, Vacas, Casas, Sanchez, and Guaton. The rocky beaches are not occupied, except for the few places where freshwater flows to the sea through a waterfall from a cliff, like at the end of the Quebrada Inocentes. However, the Másafuera Cinclodes is also found in upland regions where no permanent water bodies exist, like in open areas of the

alpine fern stands, along rocky ridges and on stone walls. These high-elevation regions are moist and often covered with clouds. Thus, the two most important habitats are small streams surrounded by barren quebrada bottoms, and alpine areas with scarce/low vegetation.

In total, six nest sites were found (Table 1). All nest sites were located by observing adults carrying food. Másafuera Cinclodeses breed in natural holes of steep rock walls and rocky slopes/ridges. The basaltic rocks are of volcanic origin; the holes may originate from lava bubbles or physical decay. Only nest site 4 was accessible from the ground; except for this nest which was placed under a stone block on a steep ridge, the holes were located well above the ground (1.5 to 5 m high). The orientation of nest entrances varied (Table 1).

The nest is located within the rock and can not be inspected through the small opening. All entrances were larger than necessary for Másafuera Cinclodeses to enter, ranging from 5.5 to 20 cm in diameter (Table 1). At nest 6 the minimum distance from the opening to the actual nest was found to be deeper than 25 cm within the rock. The opening was completely determined by the natural structure of the rock. As in the case of other cinclodeses, it was not modified by the bird. But we still do not know how the interior part of the nest hole is arranged or if it is modified, as in some other ovenbird species.

Feeding of nestlings was observed from early December to early February, which gives a minimum timeframe estimation. However, based on these data collected, we conclude that breeding takes place at least from mid-November to mid-January. Thus, the nesting season is likely to extend at least from November to February. In one case fledglings were observed in the hole entrance and in other cases the juveniles had already left the nest; never more than two were seen together. Foraging family groups usually consisted of two adults and two juveniles, which is typical of many South American passerines (J. Fjeldså, pers. com.). However, families of three were also seen, either with two adults and one juvenile or one adult and two juveniles. On 25 January 1995, during two hours of observation, only one adult was feeding two fledglings waiting at the hole entrance (nest 4). Such feeding by only one adult was exceptional and may have been related to the death of the partner. At the nests 1 and 5 both adults fed nestlings, which suggests that the species is

Table 1. Nest site data of the Másafuera Grey-flanked Cinclodes from Alejandro Selkirk Island, Chile.

Nest parameters	First observation	Location	Latitude (South)	Longitude (West)	Elevation (a.s.l)	Height above	Distance to top of rock ground	Total height	Structure of rock of rock	Exposition	Hole diameter x height	Incline (broad)
Nest 1	03 Dec. 1992	Q. Casas	33°45'52.5"	80°45'53.9"	61 m	4.8 m	7 m	12 m	rock wall	284° W	11x6	100°
Nest 2	08 Dec. 1992	El Castillo	33°47'11.0"	80°47'58.3"	1162 m	4.0 m	ca. 3 m	ca. 7 m	rock wall	E		ca. 80°
Nest 3	29 Dec. 1992	El Hombre	33°45'59.4"	80°48'41.3"	1227 m	5.0 m	ca. 7 m	ca. 12 m	rock wall	W		ca. 90°
Nest 4	05 Jan. 1995	P. Inocentes	33°47'01.0"	80°48'20.0"	1259 m	0 m	1.0 m	1.0 m	rock ridge	120° ESE	20x10	48°
Nest 5	24 Jan. 2002	Q. Casas	33°45'52.5"	80°45'53.9"	61 m	4.8 m	7 m	12 m	rock wall	284° W	11x6	100°
Nest 6	26 Jan. 2002	El Hombre	33°45'59.6"	80°48'40.6"	1234 m	1.4 m	2.1 m	3.5 m	rock slope	345° N	5.5x6.5	45°

socially monogamous (Remsen 2003). Visual monitoring showed that both the sexes shared feeding in similar proportions.

The elevation itself does not explain the absence of *Cinclodes o. baekstroemii* from Robinson Crusoe Island where alpine habitats are lacking, because breeding of this species was recorded also at lower elevations. Other environmental factors seem to be involved; Robinson Crusoe shows fewer small streams and, in addition, these are not embedded in v-shaped canyons with low vegetation at their bottom, but lead through u-shaped valleys often covered entirely by shrubs. As cinclodeses rarely enter dense vegetation, such areas are unsuitable. Some of its general habitat preferences on Alejandro Selkirk Island mentioned by Lönnberg (1921) were confirmed and described more precisely. However, this cinclodes was not so frequent at the sea-shore as suggested by Johnson (1967). No more than eight pairs may occupy summer home ranges bordering the sea-shore around the whole island. However, this may also be linked to the population decrease during the past century (for an overview of seashore and elevation shifts in *Cinclodes* — see Chesser 2004). Suitable feeding sources (Lepidoptera larvae, limnocolous Trichoptera) and open moist habitats seem to be generally important requirements for its persistence.

The sample size of described *baekstroemii* nest sites is low, and only scarce precise data are available on the nest sites of the mainland subspecies *oustaleti* and *hornensis* (Johnson 1967, Narosky et al. 1983). Therefore, the results of this preliminary survey may only represent a first indication for some differentiation within this species. Nevertheless, the *baekstroemii* range of breeding elevations is broad, as the species was found to nest from the sea-level up to the alpine summit region. *Cinclodes o. oustaleti* leaves the sea-shore and lower elevations in spring to exclusively breed in the higher Andes; contrarily, southern *C. o. hornensis* seems to breed exclusively near the sea-shore (Fjeldså & Krabbe 1990, Remsen 2003). Thus *baekstroemii* is the only subspecies that occurs in alpine habitats as well as in sea-shore habitats for breeding. Reasons may be related to the more compressed climatic zones in isolated mountains/islands, while, at the same time, competition with other cinclodes species is absent. The nominate *oustaleti* subspecies shows similar preferences for alpine habitats and barren valleys with streams; these habitat similarities as well as the broad elevation range of nest sites suggests that

baeckstroemii may originate from an *oustaleti*-like ancestor rather than from a *hornensis*-like one.

Furnariidae, as the world's most diverse bird family, also shows a great differentiation of nest types between its genera and species (Zyskowski & Prum 1999, Irestedt et al. in press). Little is known about intra-specific differentiation. *Cinclodes o. baeckstroemii* is different from its continental nominate form *oustaleti* by breeding exclusively in already present natural rock holes, not excavating itself or making use of "holes in banks and escarpments" like the latter has been described to occupy (Johnson 1967). *Cinclodes o. oustaleti* also prefers such natural holes, or in the high Andes takes over *Upucerthia* and *Colaptes* nest holes (J. Fjelds , pers. com.) that are species making their own holes where no holes exist and where the substrate allows digging. Adequate banks and escarpments are absent on Alejandro Selkirk. Besides, nest holes in soft substrate like earth, sand or wood, would not be sufficiently protected against hawk predation. The M safuera Hawk *Buteo polyosoma exsul* was observed to actively search for nest holes of *Aphrastura masafuerae* and then to try to throw out the host offspring (Hahn et al. 2004). Thus the few data provide evidence that *baeckstroemii* uses a rather narrow substrate spectrum of nest sites. However, this may be a simple response to what is available and, probably also to a highly abundant, opportunistic island predator (see Fuentes et al. 1993 for its prey items).

Conservation management of the Juan Fern ndez archipelago has to include the M safuera *Cinclodes*, as the species is one out of only eight endemic terrestrial vertebrate taxa. Its present conservation status should increase to at least "vulnerable category", as distributional range and population size are doubtlessly much smaller than before the human impact began. Fires and goat grazing caused habitat destruction and led to the extensive drying of the area; in addition, cats, rats, and mice were introduced and represent highly severe predators. We recorded both Ship Rats and Norway Rats on the island. Norway Rats were observed climbing up walls to prey on passerine birds (R mer 1995) and on Robinson Crusoe they were seen even 7 m high in trees (own observ.). A comparable well documented case may be Lord Howe Island, where five endemic terrestrial bird species became extinct through the impact of introduced rodents (Atkinson 1985). A principal

conservation goal must be the total eradication of all introduced mammals. Conservation details are discussed by Bourne et al. (1992), Cuevas & van Leersum (2001), and Hahn & R mer (2002). These authors explain eradication campaigns. However, conservational efforts should also include the investigation of predator impacts as well as the monitoring of *baeckstroemii* habitat, range and population development. If population numbers will further decrease, natural nest sites ought to be protected and predator-safe nest boxes should be installed. Detailed studies on the breeding ecology, especially on reproductive success, are needed.

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STRESZCZENIE

[Pierwszy opis miejsc gniazdowych endemicznego podgatunku trzęsiogona szarobocznego]

W pracy opisano środowisko życia i miejsca gniazdowe podgatunku *backstroemi* zamieszkującego wyspę Alejandro Selkirk w archipelagu Juan Fernandez na Oceanie Spokojnym. Ptaki te gnieździły się w ubogich w roślinność dolinach małych potoków oraz wilgotnych płaskowyżach na dużych wysokościach. Sezon lęgowy trwa od listopada do stycznia (lutego). Dla 6 znalezionych gniazd opisano położenie geograficzne, wysokość n.p.m., wysokość nad ziemią, odległość od wierzchołka skały, ekspozycję i nachylenie. Dla 4 gniazd zmierzono także wielkość otworu wejściowego (Tab. 1).