Notornis , 2001, Vol. 48: 235-241
0029-4470 © The Ornithological Society of New Zealand, Inc. 2001

Nest materials of skuas (*Catharacta* spp.) and kelp gulls (*Larus dominicanus*) at Cierva Point, Antarctic Peninsula

RUBÉN D. QUINTANA
Laboratorio de Ecología Regional, Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Pab. II, Ciudad Universitaria, (1428) Buenos Aires, Argentina and Department of Organismic and Evolutionary Biology, Harvard University

VERONICA CIRELLI
OSCAR BENITEZ
Departamento de Ciencias Biologicas, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Pab. II, Ciudad Universitaria, (1428) Buenos Aires, Argentina

Abstract Use of nest materials for skuas (*Catharacta* spp.) and kelp gull (*Larus dominicanus*) was studied in the Antarctic Peninsula during the 1992-1993 breeding season. Material from 126 skua and 51 gull nests found in 10 habitat types (HTs) was analyzed. Plant censuses were conducted to evaluate the availability of species commonly used as nesting material. Skuas used mainly *Polytrichum alpestre,* while gulls used mainly *Deschampsia antarctica.* No correlation was found in the use of different nest material in skuas and gulls, indicating that they differ in their use. The narrow range of resources found in nest material suggests a selective pattern of use restricted to a few plant species. However, use of nesting material also appears linked to its availability, although skuas and gulls' preference for *P. alpestre* and *D. antarctica,* respectively was observed in HTs with a low and discontinuous covering of these plant species.

Quintana, R.D.; Cirelli, V.; Benitez, 0. 2001. Nest materials of skuas and Kelp Gulls at Cierva Point, Antarctic Peninsula. *Notornis 48(4)*: 235-241.

Keywords *Catharacta* spp.; *Larus dominicanus*; preference; vegetation use

INTRODUCTION

Skuas (Family Stercoraiidae) and gulls (Family Laridae) are close relatives (Furness 1987) and sometimes nest sympatrically. Skuas are mainly found in the Southern Oceans and the Antarctic continent while kelp gulls (*Larus dominicanus*) nest on all the main land masses of the Southern Hemisphere including Antarctica (Moynihan 1959; Fordham 1964; Watson 1975; Brooke & Cooper 1979). The South Polar skua (*Catharacta maccormicki*) and the brown skua (*C. lonnbergi*) are the most common Antarctic skua species (Furness 1987). The breeding areas of both skua species are usually disjunct, but they nest sympatrically in a few areas, mainly along the Antarctic Peninsula, between 61º and 65ºS (Pietz 1987). Kelp gulls breed on the Antarctic Peninsula as far south as Stonnington Island, Marguerite Bay (68º 11´S) and on virtually all the subantactic islands (Watson 1975).

This work analyses the use of nest materials by skuas and kelp gulls and the distribution of their nests to evaluate whether the use of nesting resources and nesting habitat are in any way related, in a site where these species breed in sympatry.

Received 11 November 2000; accepted 20 January 2001

STUDY AREA

This study was carried out during the 1992-1993 breeding season at Cierva Point, on the Danco Coast, Antarctic Peninsula (64º 09´ S, 60º 57´W), a heterogeneous mosaic of different habitat types in a relatively small area (*c.* 3 km^2; fig. 1 in Quintana & Travaini 2000). A high diversity of vegetation communities is present in this area, with a continuous cover of mosses, grasses, and associated lichens (Agraz *et al.* 1994). Mosses of the genus *Polytrichum* cover large areas, referred to as "moss-turf sociation" (*sensu* Smith 1972).

Weather at Cierva Point is moderate, considering the latitude and compared to more northerly locations on the Antarctic continent. During summer, the monthly mean temperature was 1.8-2.2ºC (range –1º – 6.3ºC). Relative humidity averaged 79%; it was cloudy and rainy almost every day, and snow was frequent. Mean wind speed was 7.9 km h^{-1} (range 0 – 40.6 km h^{-1}).

Table 1 Percentage composition (dry weight) of skua (*Catharacta* spp.) and kelp gull (*Larus dominicanus*) nest materials throughout the different habitat types, and number and percentage of nests in each habitat type.

	Skuas										Gulls		
Habitat type	1	2	3	4	5	6	7	8	9	$\bar{x}$	9	10	$\bar{x}$
Mosses													
Calliergidium sarmentosum	0.0	0.8	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	13.2	7.1
Grimmia grisea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	3.4	3.1
Pohlia nutans	4.3	4.6	2.2	3.1	0.0	8.8	2.8	2.3	2.4	3.4	1.1	2.9	2.0
Polytrichum alpestre	50.8	60.3	42.3	84.6	0.0	68.8	59.1	81.1	24.7	52.4	4.4	0.0	2.2
Polytrichum alpinum	0.0	0.9	7.5	0.5	0.0	1.9	0.2	0.0	4.7	1.7	2.3	8.2	5.2
Polytrichum piliferum	6.7	1.9	0.1	4.6	0.0	0.0	7.0	0.0	0.1	2.3	0.0	0.0	0.0
Sanionia uncinata	6.2	4.0	2.1	0.0	0.0	3.2	8.1	0.1	17.0	4.5	3.0	1.2	2.1
Other mosses	1.1	2.4	5.4	1.2	0.0	3.9	0.3	0.0	7.7	2.4	1.0	0.2	0.6
Lichens													
Crustose muscicola lichens	16.8	10.4	3.9	1.0	0.0	12.0	4.3	0.0	40.1	9.8	3.3	2.3	2.8
Grass													
Deschampsia antarctica	7.3	8.4	17.3	3.3	0.0	0.0	4.2	13.3	2.6	6.3	67.7	53.5	60.6
Others													
Antarctic limpet valves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.6	4.4
Pebbles	5.9	5.8	16.0	1.3	100.0	0.1	12.1	0.0	0.4	15.7	3.1	13.3	8.2
Bones	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.1
Others (feathers, algae)	0.0	0.2	1.3	0.0	0.0	0.2	0.5	0.0	0.0	0.2	0.5	0.0	0.3
Number of nests	10	53	3	25	1	7	21	2	4		45	6	
(%)	7.9	42.1	2.4	19.8	0.8	5.6	16.6	1.6	3.2		88.2	11.8	

Human activity is infrequent and limited to summer (late November to mid-March). Because of the area's animal and plant species diversity, the Antarctic Treaty has declared it a "Site of Special Scientific Interest" so tourism is prohibited (Quintana *et al.* 1995, 2000).

METHODS

The study area was classified into 10 habitat types following Agraz *et al.* (1994). The arrangement and more detailed description of the habitat types are given in Quintana & Travaini (2000). Plant censuses were carried out in each of the 10 habitat types, to determine the availability of plant species used as nesting material. Fifty 10 x 10 cm quadrats were sampled in each of 41 5-m transects for the whole area (Smith 1972).

Samples were collected from 177 nests scattered throughout all 10 habitat types (126 from skua nests and 51 from kelp gull nests) during the nesting season and separated into components (mosses, lichens, vascular plants, and other items such as pebbles and feathers), using 10x magnification. As it was often difficult to determine which of the two skua species built a particular nest, the skua nest samples were pooled for comparison with those of the gulls. Plant identification was made to species level when possible. The components were dried in a stove at 65-70ºC and then weighed to determine their percentage of the total nest composition by dry weight.

The percentage frequency of each nesting resource was calculated for both bird groups in each habitat type. The correlation between the nesting materials used in each bird group was calculated using the 2-tailed Spearman's Rank Correlation Coefficient (Zar 1996). Nesting materials from each habitat type were compared both for skuas and gulls separately, and also in bulk (averaging the amount of each building item among all habitat types) to assess whether the composition of nest material differed between skuas and kelp gulls in the study area as a whole. The breadth of resource use was calculated with the Corrected Levins Index (Krebs 1989). The breadth indices were treated statistically using the "bootstrap" analysis (Jaksic & Medel 1987), followed by a Mann-Whitney Normal Approximation Test (Zar 1996). The values thus found were in turn globally compared between both skuas and gulls, taking the study area to be a unit. Finally, preference of nesting resources was estimated using the Preference Index and subsequent application of confidence limits (Hobbs 1982).

RESULTS

Most (75.4%) of all skua nests were found in habitat types (HT) characterized by abundant cover of the "moss-turf sociation" (HTs 1, 2, 4, 6; Table 1). In addition, 16.7% of all skua nests were located within HT in spite of the low cover and discrete distribution of *Polytrichum* patches (Table 1). The greatest number of gull nests (91%) was found in one (HT 9) of the 2 habitat types in which they nested (Table 1).

Table 2 Comparison of nesting material collected in different habitat types (HT) for skuas (*Catharacta* spp.) and gulls (*Larus dominicanus*), and between both bird groups (for skuas, only comparisons of habitat types with similar composition of nesting materials are shown). r_s = Spearman's r; n, number of compared nest material items; P, probability level; [a], similar material; [b], different material.

Taxon	Comparison	n	r_s	P
Skuas	HT1 v HT2	17	0.87	<0.0001[a]
	HT1 v HT4	15	0.63	0.012[a]
	HT1 v HT7	15	0.82	<0.0001[a]
	HT2 v HT3	17	0.68	0.003[a]
	HT2 v HT4	18	0.69	0.001[a]
	HT2 v HT6	17	0.56	0.02[a]
	HT2 v HT7	17	0.82	<0.0001[a]
	HT2 v HT9	18	0.62	0.006[a]
	HT4 v HT7	17	0.56	0.02[a]
	HT6 v HT9	15	0.56	0.03[a]
Gulls	HT9 v HT10	20	0.62	0.003[a]
	Skuas v gulls	22	0.35	0.129[b]

Three main plant groups were identified as important constituents of nest material: grasses, mosses and lichens (Table 1). Only 2 species, *P. alpestre* and *D. antarctica*, were the main components of the nest material of skuas and gulls, respectively (Table 1). *P. alpestre* constituted 52.4% of the total skua nest material and *D. antarctica* comprised 60.6% of the total gull nest material (Table 1). In skua nests, 5 identified items (*P. alpestre, D. antarctica, Sanionia uncinata,* lichens, pebbles) provided 80% of the nest material in 8 of the 9 habitat types used. *P. alpestre* alone provided between 42.3% (HT 3) and 84.6% (HT 4) of nest material, except in HT 9 (where gulls also nested) where it was less important (24.7%). This moss species was also found in gull nests, but was less common (4.4%). Only 1 skua nest was found in HT 5. Unlike all others, it was built entirely of small pebbles (Table 1) possibly because there was almost no vegetation in that habitat type.

There was a correlation in the frequency of use of different nesting materials by gulls between HT's 9 and 10 (Spearman's Rank Correlation; $r_s = 0.62$; $P < 0.05$), and, in skuas, between several habitat types (Table 2). No correlation was found in overall nest composition between skuas and gulls (Spearman's Rank Correlation; $r_s = 0.35$; $P > 0.05$), indicating that they differ in their use of nesting material.

Skuas used a narrower range of nesting resources than did gulls (Corrected Levins Index; BA = 0.21

Table 3 Preference index (PI) and 95% confidence limits (LCL, lower; UCL, upper) for each item in the nesting material of skuas (*Catharacta* spp.) and kelp gulls (*Larus dominicanus*). Habitat, habitat type; Field, mean percentage of each taxon from field; Nest, mean percentage of each taxon from nests.

Taxon and Habitat	Plant taxon	$\bar{x}$ Field	$\bar{x}$ Nest	PI	CL LCL	CL UCL
Skuas						
1	*Barbilophozia hatcherii*	0.0	0.1	9.1	0.0	30.9
	Pohlia nutans	1.9	4.3	2.2	0.1	4.4
	Polytrichum alpestre	42.4	50.8	1.2	0.8	1.6
	Prasciola crispa (alga)	0.0	0.0	0.4	0.0	1.3
	Sanionia uncinata	5.4	6.2	1.2	0.0	2.8
	Lichens	23.0	16.8	0.7	0.3	1.2
	Deschampsia antarctica	0.6	7.3	11.9	0.0	36.1
2	*Barbilophozia hatcherii*	0.1	0.4	4.6	0.0	12.8
	Calliergidium sarmentosum	0.9	0.8	0.9	0.0	2.0
	Pohlia nutans	4.8	4.6	1.0	0.7	1.2
	Polytrichum alpestre	37.0	60.3	1.6	0.0	3.3
	Polytrichum alpinum	0.9	0.9	0.9	0.8	1.1
	Prasciola crispa (alga)	0.1	0.2	1.6	0.8	2.4
	Sanionia uncinata	10.1	4.0	0.4	0.0	0.8
	Lichens	9.6	10.4	1.1	0.7	1.5
	Deschampsia antarctica	9.0	8.4	0.9	0.5	1.4
3	*Pohlia nutans*	4.0	2.2	0.5	0.0	2.
	Polytrichum alpestre	10.9	42.3	3.9	1.2	11.0
	Polytrichum piliferum	13.3	0.1	0.0	0.0	0.0
	Sanionia uncinata	5.2	2.1	0.4	0.0	2.1
	Lichens	0.4	3.9	9.9	0.0	26.4
	Deschampsia antarctica	1.1	17.3	15.8	0.0	77.1.
4	*Barbilophozia hatcherii*	1.2	0.3	0.2	0.0	0.5
	Pohlia nutans	8.3	3.1	0.4	0.1	0.6
	Polytrichum alpestre	80.2	84.6	1.1	0.9	1.2
	Polytrichum piliferum	16.9	4.6	0.3	0.0	0.6
	Lichens	0.3	1.0	3.7	0.2	7.2
	Deschampsia antarctica	0.0	3.3	97.5	0.0	274.1
6	*Calliergidium aciphyllum*	0.7	3.4	4.9	0.0	14.0
	Pohlia nutans	5.9	8.8	1.5	0.2	2.8
	Polytrichum alpestre	63.5	68.8	1.1	0.9	1.3
	Polytrichum alpinum	0.4	1.9	5.1	0.0	14.0
	Sanionia uncinata	8.1	3.2	0.4	0.0	1.0
	Lichens	21.8	12.0	0.5	0.3	0.8
7	*Calliergidium aciphyllum*	0.0	0.3	20.7	0.0	63.9
	Calliergidium sarmentosum	3.1	0.1	0.0	0.0	0.1
	Pohlia nutans	8.1	2.8	0.3	0.0	0.7
	Polytrichum alpestre	11.6	59.1	5.1	3.2	7.0
	Polytrichum alpinum	0.9	0.2	0.2	0.0	0.5
	Polytrichum piliferum	14.6	7.0	0.5	0.0	1.0
	Sanionia uncinata	7.4	8.1	1.1	0.0	2.3
	Lichens	5.9	4.3	0.7	0.1	1.4
	Deschampsia antarctica	10.2	4.2	0.4	0.0	0.8
8	*Pohlia nutans*	6.8	2.3	0.3	0.2	0.5
	Polytrichum alpestre	4.2	81.7	19.2	9.9	28.4
	Sanionia uncinata	1.7	0.1	0.1	0.0	0.4
	Deschampsia antarctica	3.0	13.3	4.8	0.0	29.9
9	*Pohlia nutans*	0.7	2.4	3.3	0.0	10.2
	Polytrichum alpestre	8.0	24.7	3.1	0.0	8.4
	Polytrichum alpinum	0.3	4.7	17.6	0.0	58.3
	Sanionia uncinata	2.8	17.0	6.0	0.0	19.5
	Lichens	24.6	11.9	0.5	0.0	2.4
	Deschampsia antarctica	17.2	2.6	0.2	0.0	0.4

Table 3 *continued*

Taxon and Habitat	Plant taxon	$\bar{x}$ Field	$\bar{x}$ Nest	PI	CL LCL	CL UCL
Kelp gull						
9	*Andraea* sp.	0.7	0.4	0.5	0.0	1.3
	Pohlia nutans	0.7	1.1	1.5	0.0	3.2
	Polytrichum alpestre	8.0	4.4	0.5	0.2	0.9
	Polytrichum alpinum	0.3	2.3	8.6	0.0	18.4
	Sanionia uncinata	2.8	3.0	1.1	0.4	1.7
	Lichens	24.6	3.3	0.1	0.0	0.2
	Deschampsia antarctica	17.2	67.7	3.9	3.0	4.8
10	*Pohlia nutans*	14.7	1.1	0.1	0.0	0.4
	Polytrichum alpinum	0.0	2.3	93.2	0.0	452.6
	Sanionia uncinata	0.8	3.0	3.6	0.0	10.8
	Lichens	6.0	3.3	0.6	0.0	2.1
	Deschampsia antarctica	1.4	67.7	49.8	15.4	84.1

and BA = 0.16, respectively). These values are significantly different (Mann-Whitney Normal Approximation Test; $Z = 26.52$; $P < 0.05$).

The use of *P. alpestre* by skuas was proportional to its availability in most habitat types, while a preference for it was observed in HTs 3, 7, and 8 (Table 3). Conversely, in all habitat types except HT 1, some poorly represented nest items were avoided. Gulls showed a marked preference for *D. antarctica* in HT 9, and particularly in HT 10 (Table 3). Poorly represented items were avoided in both habitat types.

DISCUSSION

Composition of nest material in both groups of birds was related to the general features of the nesting site, showing similar nest composition among similar habitat types. There were, however, significant differences in nest composition between skuas and gulls. Skuas used mainly *P. alpestre*, the most common moss species in those habitat types dominated by the "moss-turf sociation", although new items were incorporated in nests built in other habitat types. Even in those instances where species identification of the breeding pair (brown or South Polar skua) was possible, *P. alpestre* was still the most common element of the nesting material. In contrast, Peter *et al.* (1990) found that South Polar and brown skuas on King George/25 de Mayo Island displayed a different nest-building pattern: 1 species used lichen and the other moss exclusively. Peter *et al.* did not, however, report the availability of these items in the breeding areas.

Skuas used mostly the Politricaceae in spite of the varied availability of mosses of that family in the different habitat types and the main nest aggregations could be observed in those habitat types with a high cover of *Polytrichum* "moss-turf sociation". However, the greater the heterogeneity within a habitat type, the greater the use of different nest materials. On the other hand, gull nests were composed mainly of *D. antarctica,* which is related to the abundance of this grass in the breeding sites. In contrast, Burger & Gochfeld (1981) found that in South Africa, kelp gulls did not prefer any particular plant species as nesting material. Valves of the Atlantic limpet *(Nacella concinna)* were another important part of the nest material for gulls (see Table 1), and the species is also 1 of their more important food items (Fraser 1989), so much so that the southernmost nesting limit for kelp gulls coincides with southern limit of the distribution of this mollusc (Watson 1975; Branch 1985; Fraser 1989). This may reflect the importance of the spatial configuration of the breeding and foraging areas of this species. Fraser (1989) pointed out that kelp gulls breeding on the Antarctic Peninsula preferred nesting sites allowing exclusive access to large intertidal feeding territories. In Cierva Point, this species nested on small and discontinuous rocky terraces covered by *D. antarctica* located in both coastal habitat types (HTs 9 and 10); it did not use inland patches of this grass despite its abundance in some areas. Better access to feeding areas and avoidance of skua nesting territories could be factors underlying this choice (Quintana & Travaini 2000).

The narrow range of resources used in nest construction by both bird groups suggests a selective pattern of use restricted to a few plant species. However, use of nesting material also appears linked to its availability, although preferences were exhibited in some habitat types by both skuas and gulls. The skuas' and gull's preferences for *P. alpestre* and *D. antarctica,* respectively, were observed only in those habitat types with a low and discontinuous covering of these plant species. Although the gulls exhibited the same preferences in both of their nesting habitats, it was more marked in HT10, possibly as a result of its lower grass cover.

In summary, several factors determine the nest-site selection of both skuas and gulls in the study area (Quintana & Travaini 2000). However, these species built their nests, in most instances, on patches of particular plant species, regardless of availability. Thus, skuas built their nests on Politriciaceae patches and used mainly *P. alpestre* as nesting material. Kelp gulls, on the other hand, bred on patches of *D. antarctica* and used this grass as the main material in their nest construction. From this perspective, the 2 bird groups showed a clear division of nesting resources.

ACKNOWLEDGEMENTS

We want to express our gratitude to Alberto Ripalta Mengual for his cooperation in the fieldwork; to Claudio Aguirre and Marcelo Bertellotti for their invaluable bibliographic cooperation; to the logistic team of the Antarctic Summer Scientific Campaign 1993/94 for giving us their cooperation in all we needed. A special acknowledgement to María Aliberti and Laura Axcoaga for their invaluable help with the translation of this manuscript and Dr Otto Solbrig for his support at Harvard University. We thank Dr Pamela Pietz and the anonymous reviewers for discussion and constructive criticism. The fieldwork was supported by the Instituto Antártico Argentino (IAA) and the laboratory work by the IAA and the GESER, FCEyN, University of Buenos Aires. The first author enjoyed the Thalmann Fellowship from the University of Buenos Aires.

LITERATURE CITED

Agraz, J.L.; Quintana, R.D.; Acero, J.M. 1994. Ecología de los ambientes terrstres en Punta Cierva, Costa de Danco. *Contribución Instituto Antártico Argentino 439*: 1-32.

Branch, G.M. 1985. The impact of predation by kelp gull *Larus dominicanus* on the sub-Antarctic limpet *Nacella delesserti*. *Polar biology 4*: 171-177.

Brooke, R.K.; Cooper, J. 1979. The distinctiveness of the southern African *Larus dominicanus* (Aves: Laridae). *Durban Museum novitiates 12*: 27-37.

Burger, J.; Gochfield, M. 1981. Nest site selection by kelp gulls in southern Africa. *Condor 83*: 243-251.

Fordham, R.A. 1964. Breeding biology of the southern black-backed gull. 1: pre-egg and egg stage. *Notornis 11*: 3-34.

Fraser, W.R. 1989. Aspects of the ecology of kelp gull (*Larus dominicanus*) on Anvers Island, Antarctic Peninsula. Unpubl. PhD thesis, University of Minnesota, Minnesota.

Furness, R.W. 1987. *The skuas*. Calton, Staffordshore, T. & A.D. Poyser.

Hobbs, N. 1982. Confidence limits on food preference indices. *Journal of wildlife management 46*: 505-507.

Jaksic, F.; Medel, R. 1987. El acuchillamiento de datos como método de obtención de intervalos de confianza y de prueba de hipótesis para indices ecológicos. *Medio ambiente 8*: 95-103.

Krebs, C. 1989. *Ecological methodology*. New York, Harper & Row.

Moynihan, M. 1959. A revision of the family Laridae (Aves). *American Museum novitates 1928*: 1-42.

Peter, H.U.; Kaiser, M.; Gebauer, A. 1990. Ecological and morphological investigations on South Polar skuas (*Catharacta maccormicki*) and brown skuas (*Catharacta skua lonnbergi*) on Fildes Peninsula, King George Island, South Shetland Islands. *Zoologischer Jahrbuecher Abteilung Fuer Oekologie und Geographie der Tiere 117*: 201-218.

Pietz, P.J. 1987. Feeding and nesting ecology of sympatric South Polar and brown skuas. *Auk 104*: 617-627.

Quntana, R.D.; Travaini, A. 2000. Characteristics of nest sites of skuas and kelp gull in the Antarctic Peninsula. *Journal of field ornithology 71*: 236-249.

Quintana, R.D.; Agraz, J.L.; Borgo, L.C. 1995. Biodiversidad en ecosistemas terrestres antárcticos. *Ciencia Hoy 32*: 37-43.

Quintana, R.D.; Cirelli, V.; Orgeira, J.L. 2000. Abundance and spatial distribution of bird populations at Cierva Point, Antarctic Peninsula. *Marine ornithology 28*: 21-27.

Smith, R.I.L. 1972. Vegetation of the South Orkney Islands with particular reference to Signy Island. *British Antarctic Survey scientific report 68*.

Watson, G.E. 1975. *Birds of the Antarctic and Subantarctic*. Washington, D.C., American Geophysical Union.

Zar, J. 1996. *Biostatistical analysis, 3rd ed.* Englewood Cliffs, New Jersey, Prentice Hall.

Notornis, 2001, Vol. 48: 241-244
0029-4470 © The Ornithological Society of New Zealand, Inc. 2001

SHORT NOTE

Survival and reproductive success of stitchbird (hihi, *Notiomystis cincta*) suffering from a bill abnormality (oral fistula)

ISABEL CASTRO
Department of Ecology, Massey University, New Zealand.
Present address: P.O. Box 21, Tuai, Hawke's Bay
hikihiwi@clear.net.nz

JASON TAYLOR
Department of Conservation, Auckland Conservancy, Auckland.
Present address: 21 Buchanan Street, Devonport, Auckland
jas.shaarina@hyper.net.nz

Although the scientific literature contains many papers dealing with human handicaps, little has been written about disabled animals and their survival in the natural environment. In New Zealand, we found only 2 references on wild birds surviving with handicaps. Barlow (1978) reported the survival of spur-winged plovers, *Vanellus miles novaehollandiae,* and pied stilts *Himantopus leucocephalus* surviving on New Zealand farms after losing 1 or both feet. Sutton (1973) found an Australasian harrier *Circus approximans* lacking "its feet and about one third of the tarsus". This bird was at least in average condition. The completely healed stumps suggested it had survived for a while without feet. In addition, R.M. Colbourne (pers. comm.) found that 30% of 15 brown kiwis *Apteryx mantelli* captured at Okarito, New Zealand, were blind in 1 eye and 1 bird was blind in both eyes. All the kiwi were in good condition which suggested that they can survive in the wild with this handicap.

We report here the survival and reproductive success of 5 wild stitchbird or hihi *Notiomystis cincta* with handicaps to the bill. The stitchbird is an endangered honeyeater, endemic to New Zealand with now a single self-sustaining population on Little Barrier Island. Birds were transferred to Kapiti (1991, 1992), Mokoia (1994), and Tiritiri Matangi (1995, 1996) islands from Little Barrier Island with the hope of establishing secondary self-sustaining populations (Rasch *et al* 1996; Castro *et al.* 1994a). Stitchbirds feed on nectar, fruits, and insects (Gravatt 1970; Craig *et al.* 1981; Angehr 1984; Castro *et al.* 1994b) in various proportions depending on their availability. All honeyeaters have specialised tongues that facilitate the consumption of nectar (Paton & Collins 1989; McCann 1963). Nectar is collected by capillary action and swallowed after the tongue has been withdrawn back into the beak.

Castro (1995), Castro *et al.* (1994b, 1996), and Armstrong *et al.* (1999) studied the behavioural ecology of stitchbirds on Kapiti Island from 1991 to 1994 and on Mokoia island from 1994 to 1998. Taylor (1999, 2000) observed the species on Tiritiri Matangi Island from 1998. On the 3 islands, stitchbirds were observed daily throughout the breeding months of October to March and less often during the remainder of the year. Birds were observed at nest sites, feeding stations, and wherever they were heard or seen. During the incubation and brooding periods the time spent inside and outside of the nest by individual females was also recorded (Castro *et al.* unpubl. data).

During observations on Kapiti Island in August 1992, female GY-A was observed in her traditional wintering area with her tongue hanging outside her bill. She was mist-netted and it was found that she had lost the skin and muscle of her mandible and her tongue had fallen out through this opening or oral fistula (Fig. 1). She could still feed on fruits and insects but some food was lost through the opening in her jaw. She had to turn her head to seize fruits or insects with the edge of her beak and then throw her head back to swallow them. In October 1992 she started visiting the feeder at the ranger's house (P. Daniel, pers. comm.) where she fed on sugar water served in a broad-mouthed jar. She seemed able to get some liquid in her tongue and

Received 21 July 2000; accepted 9 December 2000