LONG-TAILED SKUAS *Stercorarius longicaudus* IN NEW ZEALAND

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ABSTRACT

A wreck of Long-tailed Skuas on North Island beaches in early 1983 is reported. Characters used to identify Long-tailed and Arctic Skuas in the hand are reviewed with reference to New Zealand material. It is suggested that there may have been several New Zealand records of Long-tailed Skuas before the first accepted specimen record in 1964. The importance of retaining all small skuas found on New Zealand beaches for critical examination is emphasised. The 1983 wreck may be related to the 1982/83 El Niño, which apparently caused a reduction of food for at least some seabird species.

INTRODUCTION

Three species of holarctic-breeding skuas have been recorded from New Zealand. The first claimed specimen of the Arctic Skua (*Stercorarius parasiticus*) was collected by Buller in 1864 (Hutton 1871) and currently this species is "easily the most numerous skua off the coasts of the North and South Islands south to Foveaux Strait" (Falla *et al.* 1979). The Pomarine Skua (*S. pomarinus*), which was first collected in 1933 by Deeming (Falla 1936), is a "scarce but probably regular [austral] summer visitor to New Zealand south to Cook Strait" (Falla *et al.* 1979). The first record of the Long-tailed Skua (*S. longicaudus*) was of an immature found at Muriwai, Auckland, on 10 January 1964 (Sibson 1967). A second bird was found at this locality on 3 January 1982 and another immature was collected at East Beach (near Houhora Harbour), Northland, in 1981. Powlesland (1983) reported that the latter bird was found on 3 October 1981. However R. N. Thomas (pers. comm.) has advised that it was found alive on 23 September and died within 20 minutes of being picked up. There are also sight records of two immature Long-tailed Skuas near Picton in December 1981 (P. Hayman, *in litt.*) and of one immature observed and photographed by M. Morse at Lake Taupo in October 1981 (Sibson, in press). A wreck of Long-tailed Skuas which occurred on North Island beaches in January and February 1983, when at least 16 specimens were collected, was thus unprecedented. This paper details the 1983 wreck, reviews the criteria currently used to identify small *Stercorarius* skuas in the hand, and reconsiders earlier records of Arctic Skuas.

THE 1983 WRECK

A small skua collected at Whangaparaoa beach, Bay of Plenty, on 19 January (G. Taylor, *in litt.*) was almost certainly a Long-tailed Skua but the specimen was not kept. The first confirmed Long-tailed Skua was collected

by W. J. Campbell during a beach patrol on 22 January near Dargaville. A further 13 skuas found during this patrol, which covered 57 km of beach from Maunganui Bluff south to Tikinui Stream, were disposed of, having been identified as Arctic Skuas. However, these birds were similar in appearance to the specimen kept (W. J. Campbell, pers. comm.) On the same date seven live skuas (one noticeably larger than the others) were seen between Maunganui Bluff and Omamari (W. J. Campbell), and about 12 were seen between Mahuta Gap and Glinks Gully (P. Cozens). The identity of these birds remains uncertain but W. J. Campbell (*in litt.*) suggested that they were probably Long-tailed, the larger bird being an Arctic. He reported that several of the skuas appeared to be "feeding along the tide-line, rising up into the air and then dropping with head down and picking up unidentified material".

On 17 January W. J. Campbell saw a skua flying steadily northwards, about 16 km from Dargaville on the Dargaville-Whangarei State Highway 14. This bird looked similar to those seen alive on the coast on 22 January.

S. Cotter collected a dead Long-tailed Skua at South Makara Beach, Wellington, on 28 January. Initially this bird was thought to be an Arctic Skua.

A further ten Long-tailed Skuas were collected by OSNZ members from Ninety Mile Beach, Northland, on 29/30 January (one of these specimens was mislaid after identification by the author). A further four skuas found on Ninety Mile Beach and one from Twilight were described as being similar to the specimens kept, but they were not critically examined and so their identity is uncertain.

Single Long-tailed Skuas were collected at Muriwai, Auckland, on 4 February by C. Exley, at Pekapeka and Te Horo Beaches, West Wellington, on 12 February by A. Tennyson, and at Hokio Beach, Levin, on 17 February by R. N. Thomas.

The Dargaville skuas were quite freshly dead, but the Northland specimens appeared to have been dead for a week or more. The Muriwai bird had been dead for some time and had few feathers remaining (B. J. Gill, *in litt.*)

There were several claimed sightings of Long-tailed Skuas off Sydney, Australia, at the same time as the New Zealand wreck: at least 11 on 22 January, three adults on 26 and 27 February, and a single adult on 26 March (D. Eades, *in litt.*) Also in March a dead Long-tailed Skua was found near Darwin, Northern Territory, and a live one was seen off Queensland (J. L. McKean, *in litt.*).

IDENTIFICATION

Identification of adult Long-tailed Skuas in breeding plumage should present no problems, but adults in non-breeding plumage, juveniles and immatures may be confused with pale morph Arctic Skuas, especially in the hand when differences of flight behaviour cannot be observed. While I was trying to confirm the identity of the 1983 skuas it became apparent that much of the literature on skua identification is oversimplified, confusing and at times

TABLE 1 — Body measurements (mm) of Long-tailed Skuas collected in New Zealand

Ref.	Wing*	Total head +bill	Exposed culmen	Bill at base		Tarsus	MTC	Centre rectrix
				Width	Depth			
AM1220.1**	(c.315)	-	26.5 (25)	11.5 (11)	11	42 (44)	41.5 (40)	144
AM1220.2	272	-	26	8.5	10	37.5	34.5	141
NM22692	295	74	31	12	10	44	38.5	143
NM22781***	300	-	27.8	-	-	41.4	35.8	161
NM22770	-	68.5	26.5	10	10.5	42	36.5	160
NM22771	-	72	29	10.5	10	43	41.5	144
NM22772	296	69	25	10.5	10	42	38.0	153.5
NM22773	292	70	28	12	11	40	37.5	148
NM22774	296	74	29.5	12	10.5	42	38.0	146
NM22775	294	72.5	29	10.5	10	42	38.5	135
NM22776	302	76.5	30	-	11.5	45	38.0	174
NM22777	308	72.5	27	10	10.5	43	39.5	190
NM22778	-	-	-	-	-	44.5	39.5	145
NM22780***	303	-	30	-	-	45.3	35.3	141
NM22779***	288	-	27.1	-	-	41.2	38.6	-
n	11	9	14	10	11	15	15	14
Mean	295.1	72.1	28	10.75	10.45	42.3	38.1	151.8
SD ±	9.5	2.6	1.8	1.14	0.52	2.0	2.0	15.0

* Primaries worn in all specimens
** Figures in parentheses from Sibson (1967)
*** Measurements by National Museum. All other measurements are by author.

contradictory owing, at least in part, to a shortage of specimens and a failure by some authors to considered that characters may change with the age of the bird.

Walter (1962) gave a useful review of identification characters for Long-tailed and Arctic Skuas and highlighted some of the pitfalls. A recent review by Roselaar (1983) was based on a sizeable collection of specimens but, as with Walter's, was concerned with birds in the western Palearctic and suffered from the relatively small number of specimens taken in winter*. For example, note that the collection of the British Museum (Natural History) has no winter specimens of Long-tailed Skua.

In the following discussion of identification criteria for small skuas in the hand, New Zealand material is mentioned or described where appropriate. The amount of information available for the New Zealand specimens varies because I became aware of certain identification characters only as the study progressed and I could not always re-examine material.

Standard measurements

The Long-tailed Skua is generally regarded as the smallest skua (e.g. Tuck & Heinzel 1980). However, there is some overlap of standard body measurements of this species and the Arctic Skua (e.g. Murphy 1936, Witherby *et al.* 1941, Godfrey 1966, Dement'ev & Gladkov 1969).

Measurements of the New Zealand Long-tailed Skuas (Table 1) are in general agreement with those given by Roselaar (1983) for the western Palearctic (Table 3), the shorter wing lengths of New Zealand birds being due to abrasion. Two races of the Long-tailed Skua are currently recognised (e.g. Manning 1964), based on plumage characters, there being only slight size differences. The measurements available for New Zealand and Australian Arctic Skuas (Table 2) overlap those of the Long-tailed Skuas, although the latter are generally smaller. Roselaar (1983) noted that, in Arctic Skuas breeding on the Kuriles and Bering Island, the wing length averages only 309 mm, whereas in those from southern Alaska it is 325 mm, in those from northern Alaska and northern Canada 328 mm, and in those from northern Siberia east of the Pechora River 335 mm (sample sizes not given). He also noted that these differences in wing length are also reflected in body weights and possibly in other measurements. The six adult specimens from the Kuriles/ Bering Island in the British Museum (Natural History) have a considerable range in measurements, dark morph birds having shorter wings than light morph birds (Table 4). However, it is uncertain whether these birds were breeding on the islands — three were collected in late July-early August and three are undated. If small Kuriles/Bering Island Arctic Skuas occur in the western Pacific during the non-breeding season, as the relatively small wing lengths of New Zealand birds suggest, then it is likely that standard body measurements will be of little use in New Zealand for differentiating any but the smallest Long-tailed from the largest Arctic Skuas.

*In this paper "summer" and "winter" refer to the Northern Hemisphere. Thus, skuas breed during the summer.

TABLE 2 — Body measurements (mm) of Arctic Skuas collected in New Zealand and Australia

Sex	Age	Morph*	Wing	Exposed culmen	Bill at base Width	Bill at base Depth	Tarsus	MTC	Centre rectrix
				NEW ZEALAND					
♀	Juv		304	30	11.5	13	45	43	152
?	Juv		314	32.5	12	11	44.5	42.5	-
?	Juv		298	31	10.5	10.5	44	41	145.5
♂	Ad	D	319**	29	10	10.5	44.5	41	204
♀	Ad	L	317	31.5	13	12	46	44	200
♀	Ad***		303	31	-	-	43.5	43	165
♂	Ad***	L	325	33	-	-	48	45.2	142
	Mean		311.4	31.1	11.4	11.4	45.1	42.8	168.1
	SD±		9.9	1.4	1.2	1.1	1.5	1.5	27.4
				VICTORIA, AUSTRALIA					
?	Juv		324**	32.5	12.5	11.5	44.5	-	178
?	Juv		321	-	11	11	46	42.5	150
?	Imm		319	-	12	9.5	46	44	181
?	Imm		-	-	13.5	9.5	44.5	45	-
?	Imm	L	-	32	11.5	10.5	46.5	42	-
?	Imm	D	322	29.5	12	11	47	44	164
♂	Ad	L	316	29	11	11	41.5	42.5	-
?	Ad	D	-	-	13	10.5	43	43	-
?	Ad	L	-	29	12	10.5	45.5	43.5	193
	Mean		320.4	30.4	12.1	10.6	44.9	43.3	173.2
	SD±		3.0	1.7	0.8	0.7	1.8	1.0	16.6

* L = Light; D = Dark
** Fresh primaries, all other wings abraded
*** Records from National Museum of New Zealand

Australia (after Serventy *et al.* 1970)*

Sex	Wing	Exposed culmen	Tarsus	MTC	Centre rectrix
♂**	312 (299-335)	28.1 (25.8-31.6)	42 (39-45)	41 (38-46)	180 (158-205)
♀**	320 (304-340)	28.6 (27.2-31.5)	45 (43-46)	44 (41-46)	174 (156-199)

* Average and range
** n = 11

The bill of the Long-tailed Skua generally appears more stubby than that of the Arctic, and both Witherby *et al.* (1941) and Godfrey (1966) noted that it is narrower at the base than in the Arctic. However, Walter (1962) found a considerable overlap in bill length/bill width measurements in juvenile Long-tailed and Arctic Skuas, but not in adults.

Various authors (e.g. Brooks 1939, Godfrey 1966) have noted that the length of the 'false cere' (supranasal saddle) is longer than the cord of the 'nail' (maxillary unguis) in the Arctic Skua and equal to or less than the nail in the Long-tailed Skua. Measurements are available for eight New Zealand Long-tailed Skuas (the nail being measured from the anterior tip of the false cere on top of the bill). In seven specimens the false cere is shorter or equal to the nail, and in the eighth specimen the false cere is longer (14.5 : 14 mm). However, this character is not as promising as it first appears because, in

TABLE 3 — Body measurements (mm) of Long-tailed Arctic Skuas (after Roselaar 1983)

	Wing		Exposed culmen		Tarsus		MTC		Centre rectrix	
Adult Long-tailed Skua*										
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Mean	306	309	28.5	28.4	42.6	42.5	35.1	36.0	c.290	c.285
Range	292-318	294-323	26-31	26-31	39-46	39-45	32-38	33-38	c.251-367	c.239-337
SD±	6.51	8.12	1.34	1.32	1.82	1.60	1.90	1.79		
n	36	38	75	53	75	54	75	54		
Adult Arctic Skua										
	♂**	♀**	♂	♀	♂	♀	♂	♀	♂	♀
Mean	330	341	31.1	31.8	44.3	44.4	39.4	40.3	c.198.2	c.194.5
Range	327-333	328-347	29-34	30-34	41-47	42-47	38-41	38-43	c.174-227	c.173-215
SD±	2.58	6.60	1.18	1.42	1.66	2.01	1.61	1.69		
n	4	9	34	46	34	46	33	46		

Juvenile Long-tailed Skua***

	♂	♀
Mean	293	298
Range	280-306	285-308
SD±	6.24	8.10
n	21	15

Juvenile Arctic Skua****

	♂	♀
Mean	308	314
Range	293-320	302-323
SD±	8.79	7.21
n	19	14

* Adult *S. l. pallescens*, NE Greenland, June August
** Wing lengths of adults from northern Siberia, other measurements pooled for western Palearctic
*** Race unknown, Netherlands, September-early October
**** Netherlands, autumn

five New Zealand Arctic Skuas, one has the false cere and nail of equal length and four have the false cere shorter, and in seven Australian specimens (from Victoria) the false cere is longer than the nail in one and shorter in six. Walter (1962) also found the false cere: nail ratio to be an unreliable character, and Willet & Howard (1934) noted that most authors do not state whether measurements of the false cere are taken from the top or the side of the bill, the two methods giving very different results.

When examining skins I noted that in many specimens the false cere is flaky. Roselaar (1983) noted that in both Long-tailed and Arctic Skuas the ratio of exposed culmen to nail decreases with age, i.e. the nail becomes proportionately longer, presumably as a result of flaking at the anterior edge of the false cere. He gave ratios of exposed culmen to nail for Long-tailed Skuas as 2.04 in juveniles, 1.98 in immatures, and 1.89 in adults. Only about 10% of Arctic Skuas (in the western Palearctic) have bill ratios as low as Long-tailed Skuas of the same age (Roselaar 1983), but it is obviously a prerequisite to know the age of the specimen (which is not easy — see below) before determining its identity by this method. Bill ratios of nine New Zealand Long-tailed Skuas range from 1.61 to 2.07, mean 1.87 ± 0.13. In two New Zealand Arctic Skuas bill ratios are 1.76 (adult) and 1.94 (juvenile), and in five birds from Victoria, Australia, 1.76 to 1.94, mean 1.82 ± 0.08. The small ratios of the Arctic Skuas could result from damage to the false cere, or possibly Pacific birds have smaller ratios than those from the western Palearctic.

J. de Korte (*in litt.*) found that the gonys was generally longer in the Long-tailed than in the Arctic Skua (Table 5). As the culmen length is usually shorter in Long-tailed than in Arctic Skuas (see above), de Korte suggested that the ratio of gonys length (from bill tip to angle) to culmen length could be a valuable method for separating the two species. No gonys measurements are available for the New Zealand birds or for Pacific populations of the two species, but future workers could usefully explore this topic.

Walter (1962) thought the length of the mid-toe and claw (MTC) to be a useful character because he found only a slight overlap of Long-tailed

TABLE 4 — Body measurements of Arctic Skuas from Bering Island/Kuriles in the collection of the British Museum (Natural History)

Sex	Age	Morph*	Wing	Exposed culmen	Bill at base Width	Bill at base Depth	Tarsus	MTC	Forearm
♀	Imm	L	340	28	12	11	45	42	113
♀	Ad	L	325	29.5	12	10.5	44.5	43.5	119
♂	Ad	L	330	30	12	-	45.5	45.5	116
♀	Ad	D	307	28	9.5	10.5	39.5	41.5	104
?	Ad	D	296	29	11.5	10	41	42	107
♂	Ad	D	315	29	11.5	10	42	42.5	110
?	Ad	D	305	28	12	11	39	39.5	104.5
♀	Juv		306	29	13	10.5	44	44	108
	Mean		315.5	28.8	11.7	10.5	42.6	42.6	110.2
	SD±		14.9	0.8	1.0	0.4	2.5	1.8	5.4

* L = Light; D = Dark

and Arctic measurements. Roselaar's (1983) measurements (Table 3) suggest that birds with a MTC measurement of less than 38 mm are Long-tailed and those with more than 38 mm are Arctic. The separation is not clear-cut in New Zealand material (Tables 1 and 2), there being a slight overlap between 41 mm and 41.5 mm. Nonetheless MTC measurement should give a good indication of the identity of many specimens.

Walter (1962) measured the *unterarmlänge* (forearm) which, when plotted against wing length, provided a clear-cut separation of adult Long-tailed and Arctic Skuas, but in juveniles there was some overlap. He considered that a forearm shorter than 100 mm indicated Long-tailed and longer than 105 mm Arctic. Walter did not define the *unterarmlänge*, but it appears that he measured the length of the forearm (ulna/radius) from the carpal joint to the anterior outer end of the ulna at the humeral joint (see Baldwin *et al.* 1931:85).

Forearm measurements (as above) of three New Zealand Long-tailed Skua skins are 92.0, 102.5, and 102.5 mm. Lambert (1980) noted forearm lengths of six Long-tailed Skuas from southwest Africa, range 92 to 100 mm, mean 96.5 ± 2.9, and De Roo & Van Damme (1970) recorded a juvenile female with a forearm of 95 mm. An adult from the Commander Islands in the British Museum (Natural History) has a forearm of 102 mm, and an immature from the Kuriles in the same collection has a forearm of 101 mm.

Two New Zealand Arctic Skuas have forearms of 111.5 and 113.5 mm. For nine Victorian birds the range is 109 to 118.5, mean 113.8 ± 2.63. One of these latter birds, a juvenile, has unworn primaries with a wing length of 324 mm and a forearm of 118.5 — at the upper end of the range for Arctic Skuas shown by Walter (1962, Fig. 7). These data generally support Walter's findings and so, as far as we know, the *unterarmlänge* is probably the most reliable measurement for separating the two species in the hand.

Skeletal measurements

Willet & Howard (1934) examine the wing and leg bones of a small sample of Long-tailed and Arctic Skuas and found a total overlap in tarsus measurements (Long-tailed 43-46 mm, Arctic 42-47 mm) but that the measurements of the wing bones did not overlap and that the ratio of the tarsus to the wing bones gave a definite identification (Table 6). De Roo & Van Damme (1970) reported a very small juvenile female Long-tailed Skua

TABLE 5 — Gonys and culmen lengths (mm) of Long-tailed and Arctic Skuas*

	Gonys**	Culmen
Long-tailed Skua***	7.8-9.9	24.5-31.5
Arctic Skua****	6.4-7.8	30.1-34.8

* Information courtesy of J. de Korte, Instituut voor Taxonomische Zoölogie, Zoölogisch Museum, Amsterdam
** Measured from bill tip to angle of gonys
*** East Greenland, n = 70
**** Spitsbergen, n = 27

TABLE 6 — Key to identification of Long-tailed and Arctic Skuas (after Willet & Howard 1934)

		Length (mm)			Ratios		
		Humerus	Ulna	Radius	tarsus / humerus	tarsus / ulna	tarsus / radius
Long-tailed	max	87.6	96.7	93.7	0.541	0.502	0.527
N = c.6*	av	85.4	92.5	90.6	0.527	0.488	0.516
	min	83.0	90.9	88.3	0.507	0.474	0.506
Arctic	max	104.6	110.8	107.5	0.480	0.436	0.460
N = c.14*	av	100.4	107.2	103.5	0.454	0.425	0.440
	min	94.3	101.8	98.5	0.436	0.410	0.422

* Their paper does not make clear exactly how many specimens of each species were examined.

TABLE 7 — Skeletal measurements of Long-tailed Skuas collected in New Zealand

	Length (mm)*				Ratios		
Ref.	Humerus	Ulna	Radius	Tarsus	tarsus / humerus	tarsus / ulna	tarsus / radius
AM717	79.6	86.2	83.85	-	-	-	-
NM22781	87.95	97.35	94.55	44.2	0.503	0.454	0.467
NM22770	82.65	90.15	88.45	42.6	0.515	0.473	0.482
NM22771	87.7	94.5	91.7	45.95	0.524	0.486	0.501
NM22772	82.35	90.35	87.6	44.35	0.539	0.491	0.506
NM22773	81.15	88.4	85.7	42.0	0.518	0.475	0.490
NM22774	83.9	90.95	88.4	44.35	0.529	0.488	0.502
NM22775	86.0	91.65	89.3	43.8	0.509	0.478	0.490
NM22776	85.2	92.85	90.25	46.1	0.541	0.496	0.511
NM22777	85.8	92.9	90.0	44.4	0.517	0.478	0.493
NM22778	81.8	99.3	95.8	45.75	0.559	0.461	0.478
NM22780	83.0	89.6	87.6	42.1	0.507	0.470	0.481
NM22779	90.6	96.8	96.8	46.65	0.515	0.469	0.482
NM22782	86.05	94.95	92.85	47.25	0.549	0.498	0.509
AM2004**	78.65	86.5	83.8	42.4	0.539	0.490	0.506
Mean	84.16	92.16	89.78	44.42	0.526	0.479	0.493
SD±	3.29	3.88	3.99	1.73	0.017	0.013	0.013

* Bones from both left and right sides of body were measured when available. When measurements for left and right differ, the average is given.
** Measurements by B. J. Gill. All others are by the author.

with humerus 82.7 mm, radius 86.9, and ulna 89.5. However, Ten Kate (1953) reported a juvenile Long-tailed Skua with a long humerus (91 mm) and another unidentified bird with a humerus of 89 mm and a ratio of tarsus to humerus of 44.9% (0.449) — cf. Table 6.

There is considerable variation in skeletal measurements of Long-tailed Skuas collected in New Zealand (Table 7). Mean measurements are similar to those recorded by Willet & Howard (1934), but the ratios of tarsus:wing bones are somewhat lower than recorded by these authors. The variation in measurements of specimens labelled as "Arctic" Skuas is very pronounced (Table 8), and the mean measurements and tarsus:wing bone ratios approach those of Long-tailed Skuas. We should remember that "small" Kurile and Bering Island Arctic Skuas may occur in New Zealand waters (see above) and may account for the very small "Arctic" Skuas in Table 8. Alternatively, some of the specimens may be Long-tailed Skuas which have been misidentified, but of all New Zealand skins of Arctic, Long-tailed and Pomarine Skuas I have examined, none has been misidentified. However, many skeletons are likely to have come from decayed beach-washed material, where identification would be more difficult. Unfortunately, I could not examine skeletal material of the Kurile/Bering Island Arctic Skuas for comparison, there being none in the Paleontological Institute of the USSR Academy of Sciences, Moscow (E. Kurochkin, *in litt.*).

There appears to be a case for considering the possibility of misidentification for specimens NM15015, NM15284, NM17178, AM456, and AM95.9, all of which have bone lengths and tarsus:wing bone ratios well within the range of Long-tailed Skua. "Fresh" measurements are available for NM15284 (National Museum records): wing 285 mm (very worn), bill 27.3, cere 14.6, tarsus 39.8, toe 36.9, tail centre feather 181 (new). These are well

TABLE 8 — Skeletal measurements of "Arctic Skuas" collected in New Zealand

	Length (mm)*				Ratios		
Ref.	Humerus	Ulna	Radius	Tarsus	tarsus / humerus	tarsus / ulna	tarsus / radius
NM14979	103.15	109.55	106.8	48.7	0.472	0.445	0.456
NM15015	83.9	92.25	89.1	-	-	-	-
NM15284	86.8	94.75	91.95	43.65	0.503	0.461	0.475
NM17178	86.6	93.6	90.1	45.1	0.521	0.482	0.501
NM17179	105.9	108.0	106.0	45.0	0.425	0.417	0.425
NM18899	91.5	98.15	94.75	43.9	0.480	0.447	0.463
NM20992	102.65	110.7	107.5	47.3	0.461	0.427	0.440
NM22784	99.65	106.75	103.55	45.3	0.455	0.424	0.437
AM456	83.8	92.1	90.0	44.0	0.525	0.478	0.489
AM95.9	84.6	88.5	86.0	42.0	0.496	0.475	0.488
Mean	92.86	99.44	96.57	45.00	0.482	0.451	0.464
SD‡	8.98	8.42	8.43	2.00	0.033	0.025	0.026

* Bones from both left and right sides of body were measured when available. When measurements for left and right differ, the average is given.

within the range of measurements of New Zealand Long-tailed Skuas (Table 1). There is also an OSNZ specimen record card for AM456, completed by S. M. Reed, details of which are wing 315 mm, bill length 31, bill width at base 12, bill depth at base 11.5, tarsus 43, MTC 40, tail 150. These measurements are at the upper end of the range for New Zealand Long-tailed Skuas. The bird, which was noted as having been dead for over a week, was of the pale morph and was moulting on the chin, sides of the breast, and the flanks.

Two skeletons from Victoria are in the National Museum of Victoria, Melbourne. One, identified as "*Stercorarius parasiticus?*", measures ulna 102.0 mm, radius 105.5, tarsus 46.5. The other, originally identified as "*Stercorarius parasiticus*", measures ulna 111.5 mm, radius 108.5, tarsus 48.5. A handwritten note with the latter specimen by G. F. van Tets records it as *S. pomarinus*, "TMT is too long for other 2 species". The tarsus (TMT) is at the upper end of the range for New Zealand Arctics (Table 8) but is smaller than measurements of two New Zealand and one Victorian Pomarine Skuas: humerus 103.6 mm, 113.1, —; ulna 110.75, 117.0, 119.0; radius 107.1, 113.6, 115.0; tarsus 54.85, 54.2, 53.5.

Bare parts

Post mortem changes in the colours of bill, tarsus and feet make these characters of little value except with fresh material. Bill colouration is similar in adults of both Long-tailed and Arctic Skuas, the nail being black and the false cere dark but often tinged with shades of brown, olive or grey. In juveniles and immatures of the two species the bill is blue grey and the nail is black. Tarsus colouration is very variable in both species. Most popular works note that the Long-tailed Skua has a blue or blue-grey tarsus (e.g. Peterson *et al.* 1974, Falla *et al.* 1979, Tuck & Heinzel 1980). However, this feature is found only in about 50% of breeding adults, the others having black over a greater or lesser part of the tarsus (Roselaar 1983). In adult Arctic Skuas the tarsus is black. In juveniles of both species the amount of dark colouration on the toes and webs spreads across the feet and up the tarsus, and in the Arctic Skua it also spreads down the tarsus, with increasing age. Thus, in immature Arctic Skuas in their second calendar year 10-70% of the surface of the tarsus is blue grey, this being reduced to 0-10% in birds in their fifth calendar year (Roselaar 1983).

Moult

An outline of the chronology of moults in the Long-tailed Skua is given in Figure 1. However, the timing of moult may be quite variable as Stresemann & Stresemann (1966) recorded five "adults" from Valparaiso, Chile, which had not started primary moult in late November/early December. Two other "adults" collected at the same time had primary scores (see Ginn & Melville 1983) of about 4 and 21. Twelve immature Long-tailed Skuas off southwest Africa in mid-late December had primary scores ranging from 10 to 26 (Lambert 1980).

The adult post-breeding moult is complete. Only a few small body feathers are shed near the breeding grounds, most of the moult occurring in the wintering area. Primaries moult descendantly, and the secondaries

probably moult in two series, ascendant and descendant, meeting in the middle of the tract. Body feathers moult in the sequence crown, neck, mantle, chest, flanks, tail-coverts, rest of head, belly and vent, scapulars, back, and rump, but often nearly all parts moult at the same time (Roselaar 1983). The centre rectrices (R1) moult first, then often R6 or R5, R6; thereafter tail moult may be centrifugal or irregular. The upper and under wing-coverts, most scapulars and some lower back and rump feathers may moult only once a year at the same time as the wing. There is a partial prebreeding moult of the head, body (except as noted above) and centre rectrices, the latter taking 30-40 days to become full grown (Roselaar 1983).

The post-juvenile moult is complete and occurs in winter quarters. The first prebreeding moult in spring of the second calendar year (i.e. when about 7 months old) is partial (parts of head, neck and mantle). Thereafter moults are similar to those of adults, but variable amounts of plumage from previous feather generations may be retained, at least up to the third prebreeding moult (Roselaar 1983). Thus, immature birds moulting in winter may have feathers of three generations.

All Long-tailed Skuas collected in New Zealand that I have examined were in active wing moult. Table 9 shows considerable variation in the progress of moult in individual birds collected in January/February, but all appear to be keeping to an "adult" timetable. The specimen collected in September is most exceptional in that it is in active moult at a time when no birds of

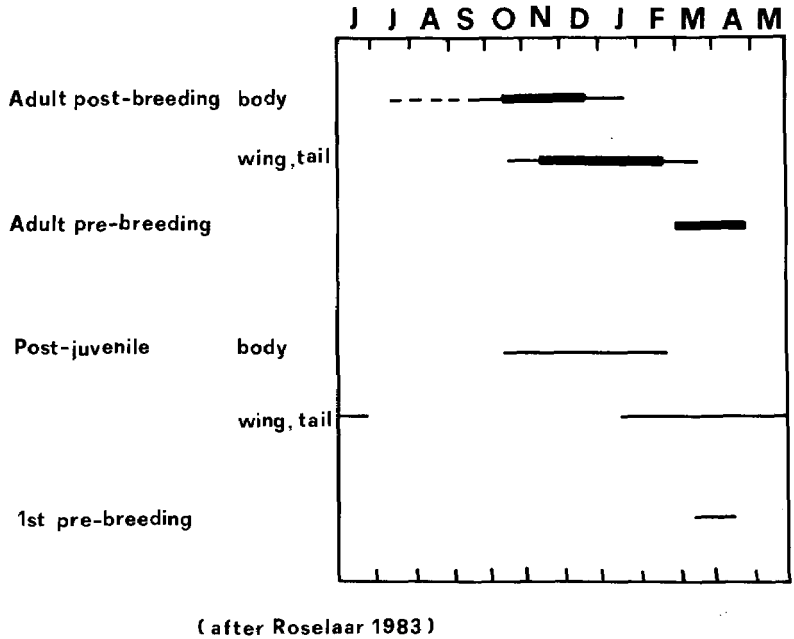

FIGURE 1 — Timing of moults in the Long-tailed Skua

TABLE 9 — Moult of primaries and rectrices of Long-tailed Skuas in New Zealand*

Date	Primaries In									Out**	Total Score	Rectrices Left						Right					
8.1.64	5	5	5	5	5	5	4	1	0	0	35	1	4	0	5	5	5	5	5	5	0	4	1
23.9.81	5	5	5	5	5	5	2	0	0	0	32	0	0	0	0	5	0	0	5	0	0	0	0
3.1.82						0	0	0	0	0***													
22.1.83	5	5	5	4	3	2	0	0	0	0	24	3	0	0	3	5	5	5	5	4	0	0	3
28.1.83	5	5	5	5	4	2	0	0	0	0	26	0	0	0	0	4	0	0	4	0	0	0	0
29/30.1.83	5	5	5	5	5	-	-	0	0	0		0	0	0	0	-	0	0	2	0	0	0	0
29/30.1.83	5	5	5	5	5	5	4	3	1	0	38	4	0	2	4	5	5	5	5	4	2	0	-
29/30.1.83	5	5	5	4	2	-	0	0	0	0		-	0	0	-	5	5	5	5	-	0	0	-
29/30.1.83	5	5	5	5	5	4	3	0	0	0	32	3	0	1	5	5	0	0	4	3	5	5	2
29/30.1.83	5	5	5	5	5	5	-	0	0	0		2	0	1	4	5	-	0	5	4	2	0	-
29/30.1.83	5	5	5	5	5	5	3	1	0	0	34	5	3	5	5	5	0	0	5	5	5	3	5
29/30.1.83	5	5	5	5	5	5	4	2	0	0	36	5	-	-	5	5	5	5	5	5	-	0	5
29/30.1.83	5	5	5	5	5	5	5	3	0	0	38	3	0	2	4	5	5	5	5	4	2	0	5
29/30.1.83	5	5	5	5	5	5	5	4	2	0	41	5	2	4	5	5	5	-	-	5	4	3	5
12.2.83									0	0***													
12.2.83								0	0	0***													

* Scoring system after Ginn & Melville (1983): 0 = old; 5 = fully grown new; 1 - 4 = intermediate stages; - = feather missing
** Outermost (11th) primary is much reduced and is excluded
*** Records from National Museum of New Zealand

any age group should be moulting. The outer primaries of this bird are old and worn, but they are proportionately less worn than those of the birds collected in January. It is possible that this bird had suspended primary moult after replacing the inner six primaries and had resumed moult shortly before it was collected, but I am unaware of any records of suspended moult in skuas, and the condition of the old primaries does not suggest that they had been retained exceptionally long.

Moult in Arctic Skuas is generally similar to that in the Long-tailed Skua, but Roselaar (1983) noted that the centre rectrices moult only once (early in the post-breeding moult). This is, however, not always the case because, in one New Zealand and four Australian specimens of adult Arctic Skuas, the centre rectrices are still growing in April (Table 10) and it is likely that at least some birds moult the centre rectrices twice, as do Long-tailed Skuas.

Plumage

For detailed descriptions of the plumage of Long-tailed and Arctic Skuas, see Roselaar (1983). The descriptions of immatures and winter adults are probably based on relatively small samples, and Roselaar (1983) noted that in the Arctic Skua "Well-fed immatures may be expected to fit much sooner into adult moult cycles than others, and perhaps even fully mature adults may at times return [to the breeding grounds] in partial non-breeding [plumage] after a particularly adverse winter". Presumably the same applies to Long-tailed Skuas.

TABLE 10 — Moult of primaries and rectrices of Arctic Skuas

Date	Primaries (In … Out)	Total Score	Rectrices Left	Rectrices Right
	NEW ZEALAND			
15.11.78	2 2 0 0 0 0 0 0 0 0	4		
14.12.59	0 0 0 0 0 0 0 0 0 0	0***		
30.12.77	3 3 3 2 0 0 0 0 0 0*	11		
-. 1.66	1 0 0 0 0 0 0 0 0 0**	1***		
7. 3.53	5 5 5 5 5 5 5 3 0 0	38		
8. 3.69	5 5 5 5 5 5 4 1 0 0*	35		
23. 3.29	5 5 5 3 1 0 0 0 0 0	19***	0 0 0 0 0 5	5 0 0 0 0 0
-. 4.29	5 5 5 5 5 5 3 0 0 0	33***	1 0 0 0 4 5	5 5 0 0 0 1
7. 4.29	5 5 5 5 5 5 5 5 5 5	50	5 5 5 5 5 4	4 5 5 5 5 5
16. 4.31	5 5 5 5 5 5 5 5 4 1	45		
16. 4.31	5 5 5 5 5 5 5 5 5 5	50		
8. 5.66	5 5 5 5 5 5 5 5 5 3	48		
	VICTORIA, AUSTRALIA			
13.11.48	1 1 1 0 0 0 0 0 0 0	3	0 0 0 0 0 1	1 0 0 0 0 0
23.12.81	0 0 0 0 0 0 0 0 0 0	0***	0 0 0 0 0 0	0 0 0 0 0 0
18. 4.84	5 5 5 5 5 5 5 5 5 4	49	5 5 5 5 5 2	3 5 5 5 5 5
18. 4.84	5 5 5 5 5 5 5 5 4 3	47	5 5 5 5 5 3	3 5 5 5 5 5
18. 4.84	5 5 5 5 5 5 5 5 5 3	48	- 4 - 5 5 2	2 5 5 5 4 5
----	5 5 5 5 5 5 2 0 0 0	32	1 5 0 2 5 5	5 5 2 0 5 1
----	5 5 5 5 5 4 1 0 0 0	30	5 1 0 4 5 5	- 4 2 2 5 -
----	5 5 5 5 5 5 5 5 5 4	49	5 5 5 5 5 4	4 5 5 5 5 5

* Records from National Museum of New Zealand
** Specimen New York 744614, after Stresemann & Stresemann (1966)
*** Juveniles

The plumage of the first New Zealand Long-tailed Skua was described by Sibson (1967). The back of this bird is about half in non-breeding plumage, the feathers being dark grey-brown with white spots, tips and bars. The rest of the back is "medium neutral gray"* the features apparently being fairly fresh. A few old, bleached feathers remain on the back and most of the lesser and median coverts are old and worn. The under wing-coverts are of the "adult" type, being uniform grey.

The 1981 East Beach specimen is similar to the previous bird but with slightly more yellow on the neck and is somewhat less advanced in primary and body moult. The back is in almost complete winter plumage, still with a few old "summer" feathers. The lesser and greater coverts are mostly old, the rest of the upperparts being a mixture of old, bleached, worn feathers and new winter plumage. The head and neck are darker than those of the preceding bird. It has "adult" type under wing-coverts.

*Colours in "quotation" marks are after Smithe (1975).

The Ninety Mile Beach birds and that from Dargaville are generally similar to the two previous specimens but the back feathers are in a more advanced state of wear. The Dargaville bird has an almost completely uniform "medium neutral gray" back and upperparts, which appear to be the result of abrasion of the white tips of the winter plumage and a general lightening of the plumage, rather than the result of moult. A few old, bleached, abraded feathers remain on the upperparts, while the under wing-coverts are "adult".

Of the Ninety Mile Beach birds, the back was "medium neutral gray" in one and "dark neutral gray" in six and two lacked most of the back feathers. The under wing-coverts were not examined at the time when the birds were picked up, but on recollection several weeks later, I thought that all had 'adult' type feathers.

A photograph of the 1981 bird at Lake Taupo clearly shows a mixture of brown and white barred "juvenile" and uniform grey "adult" under wing-coverts. Unfortunately it is not possible to determine the state of wear and moult of the flight feathers from the photographs.

In all New Zealand specimens examined, the newly grown fresh primaries are "blackish neutral gray". In specimens of adult Long-tailed Skuas collected on the breeding grounds (Alaska, Spitsbergen) and held in the National Museum, Wellington, the back is browner than in the New Zealand birds, tending towards a pale "brownish olive". Whether this difference is due to a continuing change in the colour of the mantle from exposure to sunlight (possibly post mortem?), to the use of borax to preserve the specimens, or to the birds being of different ages is unknown.

The back of Arctic Skuas collected in New Zealand is more "olive brown" than that of the Long-tailed Skuas, and if birds of the same age are compared this difference should be noticeable. However, as the above descriptions indicate, we have to bear in mind that the back colours apparently change throughout the season.

TABLE 11 — Length of centre rectrices* (mm) of Long-tailed and Arctic Skuas (after Roselaar 1983)

Age**	Long-tailed***	Arctic
1st (Juv)	23 (18- 32)	17 (12- 22)
2nd	56 (36- 82)	40 (30- 46)
3rd	88 (60-134)	51 (35- 63)
4th-5th	130 (65-213)	61 (40- 80)
6th & over (Ad)	179 (135-256)	82 (60-105)

* Length given is difference between lengths of centre and outer rectrices, average and range. Length of outer rectrix c.112 mm in Long-tailed, and c.116 in Arctic.
** Age in calendar years. All birds taken in summer.
*** Some shorter measurements of immatures probably caused by retention of non-breeding plumage centre rectrices.

The shape of the tips of the primaries and rectrices are useful in distinguishing between juvenile Long-tailed and Arctic Skuas (Walter 1962). In juvenile Long-tailed the outer primaries and rectrices are rounded, whereas in Arctic they are pointed. However, these characters are not noticeable in juvenile Arctic Skuas collected in New Zealand, owing to abrasion, and are unlikely to be of value except for birds early in the autumn. The centre rectrices are longer in Long-tailed than in Arctic Skuas of the same age (Table 11), but this character is of limited value with broken or abraded feathers. However, when examining New Zealand material, I noticed that the rachis of the centre rectrices of Long-tailed Skuas was more flexible than that of Arctic Skuas and this character could be helpful even when the tips of feathers are missing. In addition, in at least some immature plumages of the Long-tailed Skua the centre rectrices taper into very fine, long projections (Figure 2).

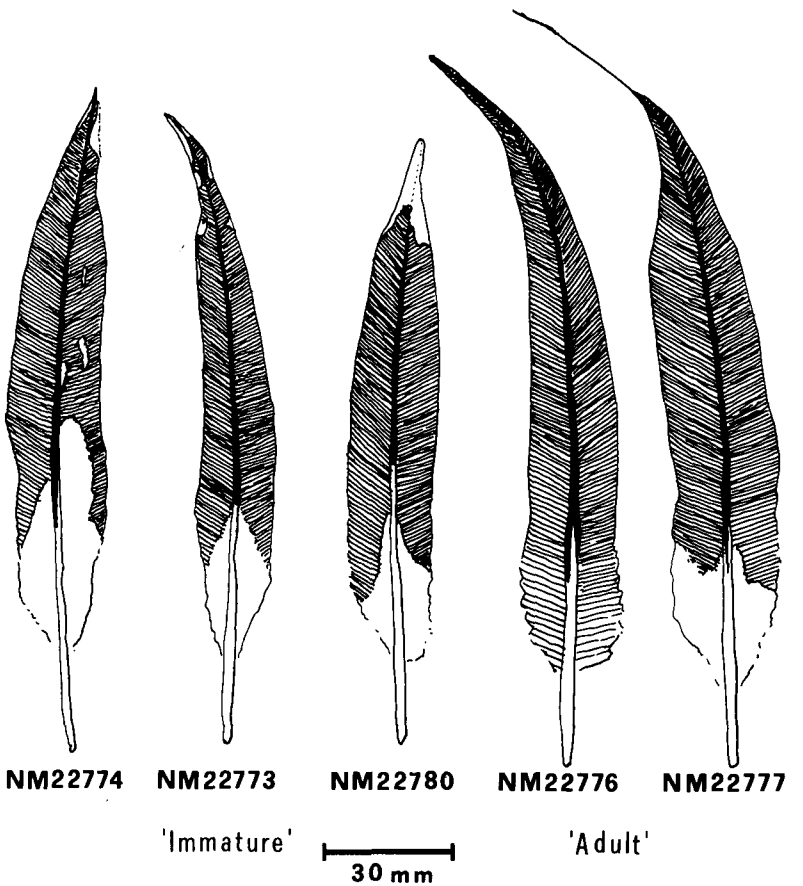

FIGURE 2 — Centre rectrices of Long-tailed Skuas from New Zealand

Long-tailed Skuas collected in New Zealand exhibit two types of centre rectrix colouration: dark brown with white bars/fringes, or very dark grey (Figure 2). Witherby *et al.* (1941) noted that the tail of juvenile Long-tailed Skuas is "as Arctic but usually less white at base and often (but not always) with small buffish-white tips" and that the tail of juvenile Arctics is "brown-black, concealed base white often tinged rufous, outer feathers with very narrow tips, or spots at tips, of buff". Roselaar (1983) also noted that juvenile Long-tailed Skuas have narrow white tips to the rectrices, whereas in juvenile Arctic Skuas the centre rectrices are "usually uniform black". Published information suggests that in immature birds the centre rectrices are similar to those of the adults, but I have been unable to find any reference to the colour of the centre rectrices of adult Long-tailed Skuas in non-breeding plumage. In New Zealand Long-tailed Skuas, seven have "adult" type centre rectrices and eight "juvenile" type. There was considerable variation in the amount of white on the vanes of the "juvenile" feathers, and in the colour of the rachis of both "juvenile" and "adult" feathers — some being all dark, others mostly white. As noted above, all specimens had "adult" under wing-coverts. If the "juvenile" centre rectrices are also found in adult winter plumage, one would expect such feathers in January/February to be fairly fresh, whereas all were fairly worn, as in six birds with "adult" rectrices. There is no obvious explanation for this discrepancy but it is possible that "juvenile" rectrices occur in some immature plumages. This question will remain unresolved until more material is available for examination.

Feather lice

Feather lice (Mallophaga) may be partly or wholly host-specific. When a louse is found only on one host species it can be used to determine the identity of that host. Pilgrim & Palma (1982) listed Mallophaga found on Arctic Skuas in New Zealand. The Long-tailed Skuas from Ninety Mile Beach and Dargaville were examined for Mallophaga, and single species of the genera *Quadraceps* and *Saemundssonia* were collected that were different from lice of the same genera collected from Arctic Skuas. They have yet to be identified as to species (R. L. Palma, pers. comm.). If Mallophaga can be found which are host-specific to the Long-tailed Skua, they could be used to identify otherwise unidentifiable skua material — provided that all skua specimens are stored separately so that they are not contaminated with lice from other species.

Summary

The identification of beach-washed skuas remains difficult as no characters of plumage (except the centre rectrices in breeding-plumage adults), bare parts, standard body measurements or skeletal measurements are known to be definitive. A combination of characters, especially forearm and MTC length, should allow the identification of some specimens, and Mallophaga may allow the identification of some specimens. Beach patrollers are strongly advised to collect all small skuas found on beaches, keep each one separate, and to send them to a museum for further examination and preservation. Eventually enough material may be available for criteria for readily identifying skuas to be worked out.

POSSIBLE ADDITIONAL RECORDS OF LONG-TAILED SKUAS FROM NEW ZEALAND

During the 1983 wreck it became apparent that beach patrollers were likely to misidentify Long-tailed Skuas as Arctic Skuas, the literature being generally unhelpful. This raised the question as to whether all previous records of Arctic Skuas were correct and whether some had been Long-tailed Skuas. I have reviewed all readily available New Zealand material of both species and most of the literature records.

All skins which I have examined in New Zealand collections had been correctly identified. Of ten skeletal specimens of "Arctic" Skuas, however, I had reason to suspect that five may be Long-tailed, but without any definite skeletal character for separating the two species they must remain as "possible" Long-tailed, except for NM15284, which seems a certain Long-tailed (see above). Details of the five birds are as follows:

Reference	Locality	Date	Collector
AM Skel 95.9	Muriwai	12 Apr 1942	Bull, Sibson, Turbott
NM15015	Himitangi Beach	8 Mar 1969	Edlin
NM15284	Himitangi	8 Mar 1969	Edlin
AM Skel 456	Muriwai	21 Nov 1971	Reed
NM17178	Dargaville	11 Dec 1971	Crockett

Early records of skuas from New Zealand are plagued by complications of taxonomy and nomenclatorial changes (see Saunders 1896). Mathews & Iredale (1913) were "inclined to believe that both Arctic and Long-tailed Skuas have occurred in New Zealand waters". The first published record of the Arctic Skua for New Zealand is of one *Lestris parasiticus* collected by Buller at "Wanganui", reported by Hutton (1871), who gave a very brief description. In 1873 Buller published a full description, apparently of the same bird (*Stercorarius parasiticus*), which he noted was shot by himself on 30 April 1864 at Horowhenua. Buller gave the same description in 1888 under the name *Stercorarius crepidatus*. Measurements of this specimen (originally given in inches) are as follows:

Hutton (1871): Total length 393.7 mm, wing 284.5, bill from gape 45.5, tarsus 41.9
Buller (1873): Total length 419 mm, wing 292, bill along edge of lower mandible 43, bill along ridge 30.5, tarsus 40.6, mid toe and claw 38, extent of wings 965, tail 140, bare tibia 12.7

Both authors noted the species as Arctic Skua but the plumage descriptions are inadequate for identification. Finsch (1873) considered the specimen to be *Lestris longicaudus*. Further discussion of this specimen (Buller 1875a, Saunders 1876) culminated in a paper by Buller (1878b) in which he reviewed the four specimens of *Lestris* (=*Stercorarius*) collected up to that time. Figure 2 of that paper depicted the tail feathers of the April 1864 bird, which Buller described as "only partially developed, being encased in a sheath at the base. They extend only about an inch beyond the rest, and are much abraded, having a peculiar filamentous appearance". This description and the generally small measurements all indicate that the bird was a Long-tailed Skua. This specimen was presumably in the collection which Buller sold to the Colonial Museum in 1873, but it was not present when the Museum collection was first catalogued in 1914 and cannot be traced. It is not in the collections of

the British Museum (Natural History), the Rothschild Museum, Tring or the American Museum of Natural History (I. C. J. Galbraith, *in litt.*, M. LeCroy, *in litt.*).

The other three early specimens noted by Buller (1875b, 1878a, 1878b) cannot be identified from the published descriptions. These and several other early specimens that were not described (Buller 1879, 1905) cannot be traced.

There is a skua humerus collected on 29 December 1972 by R. J. Scarlett from sand dunes at Te One, Chatham Island (Canterbury Museum Av 30,323). A note with this specimen states "Storrs Olson 18. 12. 1973 suggested that this may be *Stercorarius longicaudus*". The length of this bone (83.2 mm — slightly worn) strongly suggests that it is from a Long-tailed Skua.

Numerous field records of Arctic Skuas published in the *Annual Reports of the Ornithological Society of New Zealand* (1939-1941), *Bulletin of the Ornithological Society of New Zealand* (1942), *New Zealand Bird Notes* (1943-1948) and *Notornis* (1951-present) cannot be assessed as no descriptions were given.

DISTRIBUTION AND HABITS IN THE NON-BREEDING SEASON

The Long-tailed Skua breeds in the far north of Norway, Sweden, Finland, USSR, Alaska, Canada, and Greenland. Its distribution away from the breeding grounds is little known. Vaurie (1965) recorded that it winters in the Pacific "from about 10°S. Lat. to about 50°". Tuck & Heinzel (1980) and Harrison (1983) showed the main Pacific migration route as down the eastern side, but Johnson (1965) suggested that there are also main migration routes through the western and central Pacific. It has been recorded between Valparaiso and Juan Fernandez, Chile, in December and once off Ancon, Peru, in June (Murphy 1936). Tuck & Heinzel (1980) depicted the main Pacific wintering area as off the southwestern tip of South America, even though there do not appear to be any records of the species from that area! Brown *et al.* (1975), who recorded three Long-tailed Skuas in the Atlantic off Santa Cruz, Argentina, did not record any from inshore waters off the Chilean Pacific coast, and it was not recorded by Jehl (1973) in this area in June, although he did see several Arctic Skuas.

King (1967) noted that the Long-tailed Skua "passes rapidly through the Tropical Pacific en route to wintering areas in the South Pacific in September and October, and returns to its breeding grounds in April and May. Recorded regularly but in low numbers at sea in the Central Pacific". Subsequently, King (1970) noted it as a "Rare spring and fall migrant" and recorded only four probable sightings in the period March 1964-June 1965 in an area southeast of Hawaii. Fisher & Lockley (1954) noted that "We can find no record whatsoever of this species from . . . Australia, or the West Pacific south of Japan", but Saunders (1896) recorded a specimen of *Lestris hardyi* (= *S. longicaudus*) from "between Philippines and Sandwich Is.", and there was a probable sight record of one in Sydney Harbour in c. 1930 (Iredale 1940, Hindwood & McGill 1958). Subsequently, there have been several sightings of the species from eastern and southern Australia (Carter 1966, Barton 1978, 1982, Pizzey 1980), in addition to those noted above. There are single records of adults from Micronesia in September (Engbring & Owen 1981) and from Hong Kong in May (Melville 1977), and Greensmith (1975) observed an immature off the Solomon Islands in February. In Japan it is an "offshore

passage migrant, in spring mostly in May. Regular but few in number" (Anon 1974). Apparently the species is uncommon in the central and southern Pacific as numerous sea-watch logs do not record it e.g. Jespersen (1933), Fleming (1950), Macdonald & Lawford (1954), Ferdinand (1956), King & Pyle (1957), Morzer-Bruyns (1965), Shuntov (1972), Rogers (1980), but it is noteworthy that it is less ready to approach ships than Arctic and Pomarine Skuas (Rankin & Duffey 1948, Austin & Kuroda 1953), although Harrison (1983) noted that it "attends trawlers". The summer distribution of immature birds is not known, but Cramp & Simmons (1983) noted "certainly some present in North Atlantic", and Kuroda (1955) recorded two "young of the previous year" off Hokkaido in July. Roselaar (1983: 684) inferred that some visit the breeding grounds in their second calendar year, Kampp (1982) recorded a "club" of non-breeding immatures in widely varying plumages at Disko, western Greenland in July, and Andersson (1976) noted the presence of immatures on breeding grounds in northern Sweden.

Most authors consider that, outside the breeding season, the Long-tailed Skua is more pelagic in habits than the Arctic and Pomarine Skuas (e.g. Wynne-Edwards 1935, Cramp & Simmons 1983) and is generally solitary, although groups may be seen on migration (Lambert 1983) and large groups winter around the Benguela Current (Lambert 1980). There are three records of large northward spring movements in the central North Atlantic (Cramp & Simmons 1983), and one of a southerly movement along the coast of Argentina in November after "a tremendous gale" (Wetmore 1926). No large movements have been recorded in the Pacific.

Little is known of the feeding habits of the species in the non-breeding season. Dement'ev & Gladkov (1951) recorded their feeding on berries before autumn departure, Witherby *et al.* (1941) recorded their feeding on marine fish (*Cyclopterus, Liparis*), offal and carrion (see also Kuyken 1970, Harrison 1983), and Sage (1968) recorded one chasing a Wilson's Warbler (*Wilsonia pusilla*) in the Atlantic. During a large movement of Long-tailed Skuas near Buenos Aires, Wetmore (1926) recorded that "At intervals one dropped lightly to the beach near the watermark to pick up a few beetles that had drifted ashore after the storms, and then remained to rest for a few minutes" — cf. W. J. Campbell's observations near Dargaville. Bent (1921) recorded that the species gets much of its food by piracy, and Witherby *et al.* (1941) stated "At sea pursues terns and gulls, but perhaps less frequently than other skuas". Off southwest Africa Lambert (1980) recorded them parasitising Arctic and Common Terns (*Sterna paradisaea* and *S. hirundo*) and Sabine's Gulls (*Xema[Larus]sabini*). Larger species including albatrosses (*Diomedea* spp.), Cape Gannets (*Sula capensis*), and other Long-tailed Skuas were also pursued, quite successfully, when food could be seen protruding from the victim's bill. In the possibly atypical conditions of the Benguela Current fishing grounds, where fish offal was plentiful, Lambert noted Long-tailed Skuas indulging in food piracy more often than Arctic Skuas. Away from the fishing grounds Lambert considered it likely that Long-tailed Skuas usually took free-living organisms from the water surface.

DISCUSSION

The Long-tailed Skua is the least common of the three holarctic-breeding skuas visiting New Zealand, even allowing for the possibility that some earlier specimens of Long-tailed were misidentified as Arctic Skuas. The 1983 wreck was exceptional in that 16 known Long-tailed Skuas and a further 19 probable Long-tailed Skuas were collected. The only other northern skua collected in

early 1983 was a juvenile Pomarine from Dargaville on 22 January (W. J. Campbell, NM22783). Very few northern skuas have been collected since the inception of the beached bird patrols in 1935, the maximum being three Arctic Skuas collected in both 1977 and 1978 (C. R. Veitch, *in litt.*, R. G. Powlesland, *in litt.*).

With so little known of the distribution and habits of Long-tailed Skuas in the non-breeding season it is difficult to speculate on the cause of the 1983 wreck. One event does merit consideration. During the summer of 1982 oceanographic and climatological conditions in the central Pacific were unusual and heralded the start of a severe and unusual El Niño, which persisted well into 1983. There was an unusually abrupt swing of the Southern Oscillation, winds along the equator to the west of 180° became westerly in June, and sea-surface temperatures rose. There followed an extended period of very heavy rainfall in the equatorial central Pacific. The movement of warm water towards the west coast of South America resulted in dramatic increases in sea-surface temperatures along the South American coast and a depression of the thermocline (the 20 °C isotherm) throughout the eastern half of the Pacific, which meant that water upwelling along the equator was warmer than before (Cane 1983, Rasmusson & Wallace 1983). In the eastern Pacific, Barber & Chavez (1983) noted a 5- to 20- fold reduction in primary productivity which was associated with "an absolute decrease in growth and reproductive success [of higher trophic levels] caused by disruption of the normal food web".

Schreiber & Schreiber (1983) reported a near-total breeding failure of seabirds on Christmas Island (2°N, 157°W) in November 1982, apparently due to a disappearance of food, mainly flying fish (Exocoetidae) and squid (Ommastrephidae). If food supplies in the central Pacific did change, birds which normally frequent the area may have moved elsewhere, and so Long-tailed Skuas may have wandered further south than usual in search of food. The Dargaville specimen was emaciated and weighed 180 g (on 2 February after refrigerated storage), which is similar to weights of exhausted juveniles in the Netherlands and slightly over 100 g lighter than non-breeding adults, and immatures over two years old, weighed in June/July (Roselaar 1983). Although no other unusual birds were associated with the Long-tailed Skuas in New Zealand, the appearance of Long-tailed Skuas in eastern Australia was associated with other warm-water species, e.g. White Tern (*Gygis alba*) and the first and second Australian records of White-necked Petrel (*Pterodroma externa cervicalis*) (D. Eades, *in litt.*).

The Pomarine Skua also winters in the central Pacific, where King (1967) recorded it as being "common from December through April", although Cramp & Simmons (1983) show it wintering only along the western and eastern seaboards, as well as off the northern coast of New Guinea (e.g. Morzer-Bruyns 1965) and in Australasian waters, whereas the Arctic Skua is unrecorded from the central Pacific (King 1967). The fact that these species were not found wrecked in association with the Long-tailed Skuas suggests that they may have different food preferences in winter or that they were not in the area from where the Long-tailed Skuas came. Arctic Skuas are commonly seen harrying terns in New Zealand (e.g. Oliver 1955, Fleming 1958, Edgar 1961), as well as scavenging (Hindwood 1955), whereas Pomarine Skuas feed mainly on fish during the non-breeding season (Cramp & Simmons 1983).

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