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SHORT NOTE

High altitude New Zealand record for a long-tailed skua (*Stercorarius longicaudus*)

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At 1146 h (NZST) on 5 Nov 2010, an in-bound passenger aircraft to Auckland Airport collided with a bird at an altitude of 4084 m. The aircraft's position at the time of impact was recorded as 40 NM northeast of Auckland Airport, placing the location above the northern Coromandel Peninsula (Fig. 1; pilot incident report received, but commercial sensitivity prevents publication of precise flight details). Sufficient tissue of the bird was retrieved after the aircraft landed to allow for identification.

Although fragmentary, the remains allowed specific identification that was subsequently confirmed by DNA analysis (Fig. 2). The remains, consisting of some tissue, feathers and one foot, are from a bird about the size of a red-billed gull (*Larus novaehollandiae scopulinus*). The short, bi-coloured, webbed foot, combined with the grey-brown dorsal plumage, and white ventral plumage with some buff and grey barring, indicate that it came from a small skua (Stercorariidae). The length of the tarsometatarsus was a few mm longer than 38.5 mm (based on the damaged remains); the middle toe and claw length was 38.5 mm. The tarsometatarsus was mainly mottled grey but black where it joined the tibiotarsus; the foot and toes were black.

The remains were not from a pomarine skua (*Coprotheres pomarinus*) because that species has a longer tarsometatarsus (>48.0 mm) and middle toe and claw (>42.0 mm; Higgins & Davies 1996). The feet of the arctic skua (*Stercorarius parasiticus*) and long-tailed skua (*S. longicaudus*) are of similar size to the remains, but arctic skua usually have longer feet (Higgins & Davies 1996). In these 3 species of skua, leg and foot colour gets darker

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with age (Higgins & Davies 1996). While pomarine skua may have the leg and foot colour of the Coromandel bird in their second or third year, arctic skua have this colour as juveniles only as their tarsometatarsus is always 30-90% black by their second year. Long-tailed skua, however, can retain this leg colour after their juvenile plumage (Higgins & Davies 1996).

The white ventral plumage indicates that the Coromandel bird was a light or intermediate morph plumage phase. Juvenile arctic skua are dark ventrally, therefore the combination of plumage and leg/foot colour indicates that the remains cannot be from this species. The remains match the characteristics of a long-tailed skua (*S. longicaudus*) older than its first year. The record was accepted as this species by the Ornithological Society of New Zealand's Record Appraisal Committee (UBR 2012/48, C. Miskelly, *pers. comm.*), and the specimen is preserved in the Museum of New Zealand Te Papa Tongarewa (registration number OR.29718).

For genetic identification a small piece of tissue was removed from the Coromandel bird with a sterile razor blade and DNA isolated using a DNeasy blood and tissue kit (Qiagen). A fragment of the mitochondrial cytochrome oxidase subunit 1 (COI) gene was PCR amplified and sequenced with the primers AWCF1 and AWCR6, following Patel *et al*. (2010). Closely related sequences were identified by a BLAST search of the GenBank nucleotide database (http://www.ncbi.nlm.nih.gov/blast/Blast.cgi) and aligned manually to the 785bp sequence from the Coromandel bird. Phylogenies were constructed from the aligned sequences with maximum parsimony (MP) in PAUP* 4.0b10 (Swofford 2002) and Bayesian analysis (BA) using MrBayes 3.1.2 (Ronquist & Huelsenbeck 2003). For the MP analysis a heuristic search algorithm with 100 random addition replicates and tree-bisection-reconnection branch-swapping was used. Nodal support was tested with 1000 bootstrap replicates. BA was performed with nst = 6, rates = invgamma, and the default priors. Two concurrent analyses were run, each with 4 Markov chains of 10 000 000 generations. The chains were sampled every 1000 generations, and the first 50% of these samples were discarded as 'burn-in'. Convergence was confirmed with Tracer 1.4.1 (Rambaut & Drummond, 2007) by confirming that effective sample size values were >200.

The Coromandel bird sequence (GenBank Accession KC832466) clustered with long-tailed skua sequences with high support (1.00 Bayesian posterior probability, 100 MP bootstrap) and was identical to some sequences from this species (Fig. 2). Within long-tailed skua there was little CO1 sequence diversity and structuring across the species' range, precluding identification of the breeding population of origin of the Coromandel bird. DNA sexing of one of the bird's feathers at Massey University's Equine Parentage and Animal Genetic Service Centre showed it to be female.

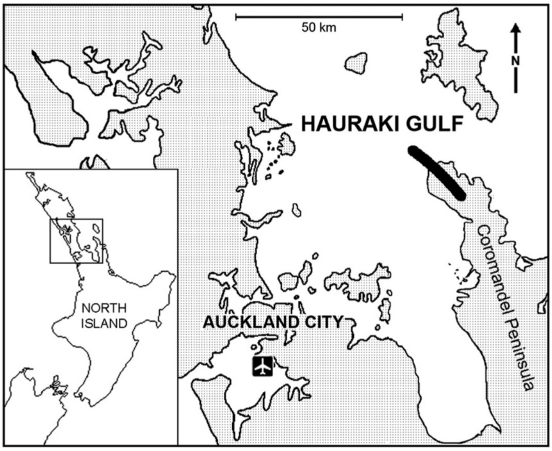

Fig. 1. Hauraki Gulf, New Zealand, with an arc indicating a location 40NM northeast of Auckland Airport over the northern Coromandel Peninsula.

The long-tailed skua is a northern hemisphere breeder that migrates to areas including the SW Pacific in the austral summer. It is recorded as a regular visitor to SE Australia (Higgins & Davies 1996), though is considered a rare visitor to New Zealand (Melville 1985; Heather & Robertson 1996; Gill *et al.* 2010). Little is known of the migratory patterns of the species in the Pacific (Higgins & Davies 1996; Malling Olsen & Larsson 1997) because most records tend to be of dead specimens retrieved from beaches (Melville 1985). Known wintering areas for this species are in the southern Atlantic (Higgins & Davies 1996), but some authors suspect that there are also wintering areas close to Australia and New Zealand (Sittler *et al.* 2011).

Migration flight altitude during migration is poorly known for seabirds. Although radar studies in the northern hemisphere provide some data on the flight altitude of transoceanic migrants, this parameter is acknowledged as 'incomplete' (Hedenström *et al.* 2009). High altitude transoceanic flight, however, is considered to be more likely associated with arctic-breeding migrants, particularly waders, terns and skuas (Alerstam & Gudmundsson 1999; Gudmundsson *et al.* 2002; Hedenström *et al.* 2009; Dokter *et al.* 2013).

In a study of the 557 radar records of migrating seabirds (Hedenström *et al.* 2009), only 3.8% were at an altitude of 3-4 km, and only one record is known to be that of a long-tailed skua (altitude not stated). Specific migration details for the long-tailed skua are poorly known (Campbell *et al.* 1990; de

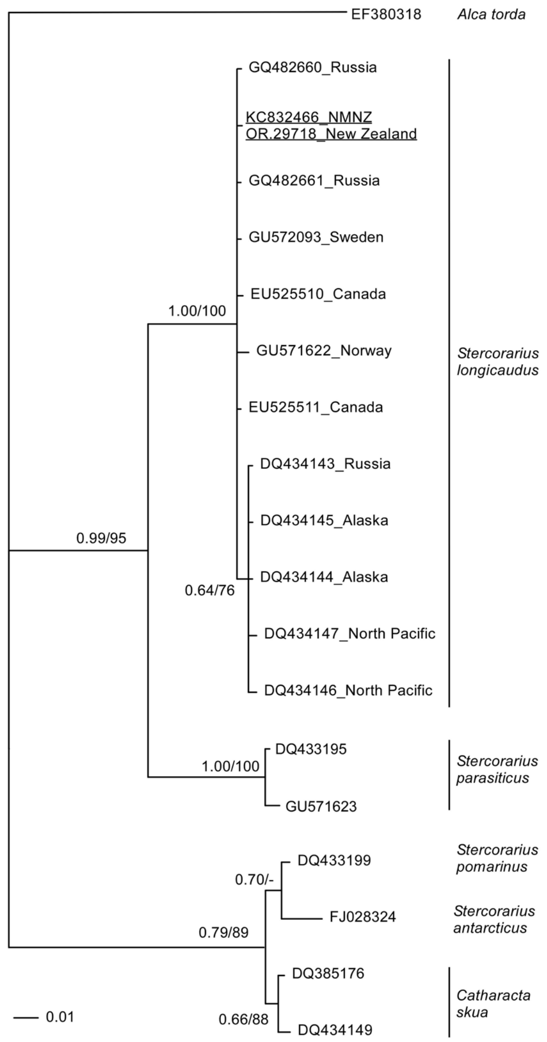

Fig. 2. Bayesian phylogeny of skua cytochrome oxidase subunit 1 (COI) sequences, showing the phylogenetic position of the sequence recovered from the Coromandel bird (underlined). The phylogeny is rooted with sequence from the razorbill (*Alca torda*). Numbers above the branches represent posterior probabilities and MP bootstrap values, respectively.

Hoyo *et al*. 1996; Higgins & Davies 1996; Sittler *et al.* 2011), however skua species are known to be high altitude migrants (Alerstam & Gudmundsson 1999). Alerstam and Gudmundsson (1999) identified a flock of 4 unidentified skuas at an altitude of 3019 m over the Northeast Passage.

Our record is therefore consistent with the current understanding of high altitude migration by skuas. High altitude migration is associated with long-distance flights, in which birds utilise favourable weather patterns, selecting tailwinds generated more frequently in high pressure weather systems (Gudmundsson *et al.* 2002; Hedenström *et al.* 2009; Dokter *et al.* 2011; Dokter *et al.* 2013).

The timing of the record, however, is outside of the recognised migration periods (south in Aug-Oct and north in Apr-May). Moreover, the species is a pelagic feeder, considered to be a rare inshore/inland vagrant (de Hoyo *et al.* 1996; Higgins & Davies 1996). The record location is on the eastern margin of the non-breeding distribution centered on SE Australia (Higgins & Davies 1996), and at a latitude (*c.* 36°S) consistent with that of the known non-breeding concentrations in the Atlantic at 35°S (Malling Olsen & Larsson 1997). The skua may have been moving laterally within this western Pacific non-breeding 'cell', using the high altitude conditions to assist the movement. Lateral movement of this nature has been recorded for the arctic tern (*Sterna paradisaea*) within the species' distribution in the southern ocean during the austral summer (Egevang *et al.* 2010). Weather in the Auckland region at the time of the record was anti-cyclonic (mean sea level pressure 1017.4 hPa; Sanctuary Weather Station 2013), indicating that the surface winds would have been light and rain minimal (Briggs & Smithson 1985).

This record is of significance as, not only does it provide further evidence of the long-tailed skua as a high-altitude flyer, but also provides additional data for the non-breeding distribution for the species and a further record of a species rarely reported in New Zealand.

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