AUSTRALIAN FIELD ORNITHOLOGY 2009, **26**, 19–24

Forum—

Why are White-throated Needletails and Fork-tailed Swifts Often Last Observed in Southern Australia when Migrating Northwards?

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Summary. It is now known that swifts (Apodidae) are morphologically and physiologically designed to fly at high altitudes, and that they do so when flying towards their nests. Consequently, it is here proposed that both White-throated Needletails *Hirundapus caudacutus* and Fork-tailed Swifts *Apus pacificus* leave Australia at high altitudes and so are not sighted very often in northern Australia when departing. This contrasts with their arrival in Australia, where they are most often first seen flying at low altitude into Australian waters.

Higgins (1999) stated that for White-throated Needletails *Hirundapus caudacutus* there is 'much variation between years in locality of last sighting', but then gave data that clearly show, for this species and the Fork-tailed Swift *Apus pacificus*, that the last sightings are more often made in the southern rather than the tropical or northern sector of Australia. No reasons are given for these observations.

It is clear from the data in Table 1 that both the Fork-tailed Swift and the White-throated Needletail, on their south-bound migration to Australia, are just as likely to be first recorded south of the South Australian–Northern Territory and Queensland–New South Wales borders as they are north of these borders. However, it is also clear from the data in Table 2 that north-bound swifts are much more likely to be last recorded south of these borders rather than north of them.

It might be argued that, because a disproportionate percentage of observers recording swift sightings live south of the Queensland border, the data are skewed in favour of sightings south of the border (and of course south of a line drawn across Western Australia at the same level). However, this suggestion would not explain the similar number of sightings of immigrating birds each side of this boundary. The disproportionate nature of the location of sightings of emigrating swifts is real, and so the spread of human population density is probably only a small factor in these observations.

I believe that the major factor in this differential results from swifts utilising flight behaviour when they are emigrating that is different from that used when immigrating. Many Australian swift-watchers have recorded flocks of swifts which were so high that only the lower birds could be observed with the unaided eye. I have also discovered flocks of swifts in the background (when looking at something else) that were so high that none of them could be seen without binoculars or a spotting scope.

In Nepal, Inskipp & Inskipp (1991) recorded White-throated Needletails at altitudes of up to 3100 m and Fork-tailed Swifts at altitudes of between 3600 and 3800 m.

Table 1

Location and dates for first observations of swifts for each year listed = ARRIVALS (FTS = Fork-tailed Swift; WTNT = White-throated Needletail; T = tropical Australia, i.e. north of NT/SA and Qld/NSW borders; S = southern Australia, i.e. south of those borders). Source: author's database of all published (printed and electronic), privately sent (by other observers) and personal records of swift sightings. Ck = Creek, Env. Pk = Environmental Park, Is. = Island, Ra. = Ranges, Res. = Reserve, and Stn = Station.

Season	*No. birds*	*FTS location*	*T/S*	*No. birds*	*WTNT location*	*T/S*
1987/88	350	Mt Lofty Ra., SA	S	1	Woorail, Vic.	S
1988/89	5	Kimberley, n WA	T	6	Bribie Is., s Qld	T
1989/90	3	Blanchetown, SA	S	4	Bribie Is., s Qld	T
1990/91	50	Pomona, s Qld	T	8	Bribie Is., s Qld	T
1991/92	2	Lakes Entrance, NSW	S	4	Kuranda, n Qld	T
1992/93	4	Terrigal/Ludlow, NSW	S	35	Coffs Harbour, NSW	S
1993/94	?	Lower Bobo, NSW	S	10	Sheep Stn Ck Env. Pk, s Qld	T
1994/95	11	Jells Park, Vic.	S	2	Warkworth, NSW	S
1995/96	3	Christmas Is.	T	12	Anangrove, NSW	S
1996/97	2	Bilgola, NSW	S	2	Pilliga, NSW	S
1997/98	20	Dorrigo, NSW	S	4	Hat Head, NSW	S
1998/99	1000	Broome, n WA	T	1	Mossman, n Qld	T
1999/00	3	Adelaide, SA	S	2	Sunshine Coast, s Qld	T
2000/01	12	Broome, n WA	T	5	Bribie Is., s Qld	T
2001/02	1	Kununurra, n WA	T	1	Samsonvale, s Qld	T
2002/03	20	Noosa, s Qld	T	6	Five Day Ck, NSW	S
2003/04	1	Broome, n WA	T	1	Samsonvale, s Qld	T
2004/05	5	Mossman, n Qld	T	2	Crescent Head, NSW	S
2005/06	4	Kununurra, n WA	T	16	Byron Bay, NSW	S
2006/07	10	Anstead Bush Res., s Qld	T	2	Rollingstone, s Qld	T
2007/08	10	Jabiru, NT	T	1+	Innisfail, n Qld	T
2008/09	30	Buffalo Creek, NT	T	1	Morisset, NSW	S
Totals:			S = 9			S = 10
			T = 13			T = 12

In Australia, in Victoria Needletails have been observed from the ground at an estimated height of >1200 m, as they were well above Mt St Leonard (1005 m) (Salter 1960). In south-eastern Australia, a pilot of a light aircraft (Coventry 1989) recorded Needletails on six occasions in groups of from three to >300 at between 305 and 915 m above ground. On the evening of 10 March 1969, Carter (1969) reported that two of three groups of Fork-tailed Swifts that he was watching rose to 'several thousand feet' after the sun had set over Frankston, Vic. Cooper (1975) also watched Needletails fly up to 1000 m above Mt Leonard in Victoria at sunset, though he thought they were doing so to feed. All of these observations are contrary to the assertion made by an Australian pilot, after discussing a range of birds, including swifts, that 'very few species ever attain a height of more than a few hundred feet, and then only for short periods', for he had never observed any birds above 330 m (Cameron 1952).

Table 2

Location and dates for last observations of swifts for each year listed = DEPARTURES (codes as for Table 1). Source: as for Table 1. NP = National Park, Obs. = Observatory, Prom. = Promontory, R. = River, and SF = State Forest.

Season	*No. birds*	*FTS location*	*T/S*	*No. birds*	*WTNT location*	*T/S*
1987/88	760	Eyre Bird Obs., WA	S	2	Kambah, ACT	S
1988/89	160	Ingham, n Qld	T	50	Weston, ACT	S
1989/90	100	Reevsby Is., SA	S	10	Aranda, ACT	S
1990/91	12	Tooperang, SA	S	6	Pt Nepean NP, Vic.	S
1991/92	5	Murray R. mouth, SA	S	35	Coffs Harbour, NSW	S
1992/93	19	Calpernum, SA	S	3	ACT	S
1993/94	1	Geelong, Vic.	S	1	Newtown, Vic.	S
1994/95	6	Garden Is., WA	S	1	Gungahlin, NSW	S
1995/96	120	Adelaide, SA	S	30	Newtown, Vic.	S
1996/97	50	Adelaide Plains, SA	S	1000	Braidwood, NSW	S
1997/98	30+	Vaucluse, NSW	S	1	Chaelundi SF, NSW	S
1998/99	5	Adelaide, SA	S	?	Maffra, Vic.	S
1999/00	12	Broome, WA	T	3	Mudgee, NSW	S
2000/01	150	Goolwa, SA	S	1	Faulconbridge, NSW	S
2001/02	4	Griffith, NSW	S	1	Samsonvale, s Qld	T
2002/03	50	Ravensthorpe, WA	S	20	Wilson's Prom., Vic.	S
2003/04	?	Bulgunnia Stn, SA	S	20+	Grampians, Vic.	S
2004/05	10	Newstead, Vic.	S	10	Central Coast, NSW	S
2005/06	10	Little Desert, Vic.	S	3	Strath Creek, Vic.	S
2006/07	20	Norah Head, NSW	S	20	Norah Head, NSW	S
2007/08	4	Eden, NSW	S	4	Katoomba, NSW	S
Totals:			S = 19 T = 2			S = 20 T = 1

So both species of Australian swifts do fly high at times, but is it normal behaviour? It would appear that swifts are adapted to fly at high altitudes. Palomeque *et al.* (1980) took haematocrit measurements, haemoglobin concentrations, erythrocyte counts and haematimetric indices for three swifts: Common Swift *Apus apus*, Alpine Swift *A. melba* and Pallid Swift *A. pallidus*. They found that their haematological values were uniformly high, with only hummingbirds (Apodiformes: Trochilidae) surpassing them. Their red-blood-cell values were similar to those of montane birds resident above 2500 m. The swifts' erythrocytes were larger than those of other birds and had a higher oxygen affinity than for all other birds in the study. All of these factors would enable the gathering of the maximum amount of oxygen from the 'thin' air at high altitudes. These authors suggested that the long, narrow wing-shape also favours gliding flight, which can save up to 72% of energy normally expended in flight. The sickle shape of the wings of swifts additionally reduces the energy required for flight, and together these factors help explain why swifts have low flight metabolism: 2–5 times the Sleeping Metabolic Rate, whereas most birds have an increase of around 12 times SMR (Lyuleeva 1970).

Adaptations of swifts for economic and powerful flight are still being discovered. Videler *et al.* (2004) have shown that the alula or 'hand-wing' of swifts is used to create leading-edge vortices that provide extra lift even at low angles of attack (when the bird is in level flight at slow speed, as when 'sleeping' or resting on the wing). Work on Common Swifts in the wind tunnel at Lund University in Sweden has shown that swifts are one of the few birds able to create lift on the upstroke as well as the downstroke. This ability means that scientists had to develop new models to explain the dynamics of the flight of swifts (Henningsson *et al.* 2008). These new models show that the calculated lift-to-drag ratio of the Common Swift is the highest of any bird measured to date.

So the physiology and the anatomy of the swifts are predisposed to high-altitude, low-energy-use flight, but when would they use it? We obtain some clues from work also done at Lund in Sweden. Gustafson *et al.* (1985) took ten breeding swifts 405 km away from their nests at night, and released them after attaching altimeters. Nine of those birds flew home high, at an average maximum altitude of 1870 m, while one flew home low with a maximum altitude of only 700 m. The experiment was repeated, with four birds flying home at an average maximum altitude of 2750 m and a single maximum altitude of 3600 m. The birds flew day and night, and it was clear that they tended to fly at higher altitudes during the night.

These facts fit my own observations when radio-tracking fledgling and non-breeding Common Swifts in Germany (Tarburton & Kaiser 2001). The pre-breeders and some of the fledglings left the colony in the daytime, but some of the fledglings departed from the nest about an hour after sunset when most normally make their maiden (and only) nest departure (Kaiser 1984). The radios that I had attached to the birds had a 9-km range, but by 0200 h some of the birds were giving very weak signals even when we were right below them. These birds were flying at very high altitudes, where the fledglings would hone their flying skills without the risk of predators or anything else interrupting their progress. The signals became stronger again towards dawn.

From these observations, can we determine anything about the Australian situation? Probably the earliest records of Fork-tailed Swifts migrating to Australia over the adjacent oceans are those of Dom Serventy (1951), where in the Timor Sea between 2 and 7 October 1949, groups of six, six, four, one, and one were observed flying low to the south-east. One of these birds hit the ship's rigging after dusk. It was exhausted and was apparently trying to roost, for it again landed on the boat. None of these observations was of large flocks so, comparing these observations with the data we have for the Common Swift, even when our two species are immigrating to Australia many of them (those that have adequate energy stores) may be flying too high to be seen, but those that are feeding while travelling are low enough to be observed.

We do not have any records of swifts flying northwards over the water north of the Australian mainland (Table 3). I can find no records of Fork-tailed Swifts flying north over New Guinea, only records during September to December as they fly south. There are only a few records of White-throated Needletails in New Guinea during the period January to April. Again, most of the records are of birds early in the season on their south-bound migration. It is probable that a few spend the season on the island of New Guinea and it could be these birds which have been observed moving northwards. Some others could be the minority that fly at low altitudes.

Table 3

Observations of migrating swifts just north of Australia (species codes and abbreviations as in Tables 1–2). NZ = New Zealand, PNG = Papua New Guinea.

No. birds	*Species*	*Location*	*Behaviour*	*Date*	*Source*
1	FTS	Adele Is. off Kimberley, n WA		20/11/2004	A. Boyle & G. Swann pers. comm.
50	FTS	N of Cambridge Gulf, Kimberley, n WA	Groups of 2–3 flying S 1 m above water	10/10/1998	Ian May pers. comm.
18+	FTS	West Is., Ashmore Reef	Flying to SE	16/10/2001	Rohan Clarke pers. comm.
17	FTS	Near Ashmore Reef	Flying low to SE	17/10/2000	Rohan Clarke pers. comm.
15	WTNT	Little Tuesday Is., Torres Strait	Passing over island on way south	7/10/2007	Hansbro & Baxter 2007
7	WTNT	Motupore Is., PNG	Over Motupore Is., then heading SE (to NZ?)	7/10/2007	M. Tarburton pers. obs.
4	WTNT	Saibai Is., Torres Strait	Travel-feeding	12/11/2008	M. Tarburton pers. obs.
150	WTNT	Saibai Is., Torres Strait	Spiralling up then drifting N, later 70 moving S	15/11/2008	M. Tarburton pers. obs.

Most birds of both species probably start their journey northwards, on their return to Asia to nest, at high altitudes. This hypothesis is consistent with the majority of Common Swifts being shown to make the return flight to their nests at high altitudes. It is clear that not all of our swifts stay at high altitudes, as Adrian Boyle (pers. comm. 2005) recorded small flocks (1–30 birds) of Fork-tailed Swifts flying northwards near Shanghai in China during March, April and May. White-throated Needletails have also been recorded flying north at low altitudes in Siberia (Lyuleeva 1991). So both species probably reduce their altitude toward the end of both their north-bound and south-bound journeys. If they commence their north-bound journey at high altitude, then this is the reason we have few records of north-bound birds just north of Australia. As birds feeding in northern Australia do not have as far to fly as those feeding in southern Australia, it is logical to assume that they would have stored enough energy for the return flight before those feeding in southern Australia, and so leave earlier than the latter do. Experienced Common Swifts appear to gain an advantage by arriving at their breeding grounds early, so they can use the same nest as last year and begin breeding before unestablished birds arrive to take up empty sites (Lack 1958). This phenomenon would explain why the last swifts to be seen in Australia are usually in the southern half of the continent. They have farther to fly and, as they do not feed again until they reach Asia, they have to continue feeding for longer than those feeding in northern Australia in order to store the extra energy needed. Then when they leave, most fly too high to be seen by day or night.

Thanks to the observers listed in Table 3 for their records of swifts, and to the many observers who have published their observations in Australian and PNG journals and newsletters or on the Internet, or have sent them directly to me, and have therefore contributed to the database for Tables 1 and 2.

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Received 19 January 2009 ■