

SHORT NOTE

New Zealand fairy tern (*Sternula nereis davisae*) foraging behaviour at Te Arai Stream

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The New Zealand fairy tern (*Sternula nereis davisae*; hereafter referred to as NZFT) is one of New Zealand's rarest endemic breeding birds (Robertson *et al.* 2013), with a current population of *c.*43 individuals. Since 2004, regular breeding has been restricted to 4 locations: Papakanui, Mangawhai and Waipu sandspits, and Pakiri River mouth. All breeding sites are in the northern North Island between Auckland to the south and Whangarei to the north. Of the 4 regular NZFT breeding sites, Mangawhai Sandspit currently has the greatest number of NZFT breeding pairs, with a maximum

of 7 pairs in the 2014/2015 breeding season. The sandspit is 3.5 km long, and is managed as the 245 ha Mangawhai Wildlife Refuge (hereafter MWR). It separates the Mangawhai estuary from the Pacific Ocean and is recognised for its ecological and landscape values as a Priority Place for Protection (PPP 1, Mangawhai-Pakiri, in Mitchell *et al.* 1992).

The Te Arai Stream mouth lies ~ 3.5 km south of MWR, and in 2012 was the site of a single unsuccessful nesting attempt by a pair of NZFT, the first documented nest for this species at this location. Northern New Zealand dotterel (*Charadrius obscurus aquilonius*), variable oystercatcher (*Haemotopus unicolor*), and pied stilt (*Himantopus himantopus*) also breed in this location each summer. Within

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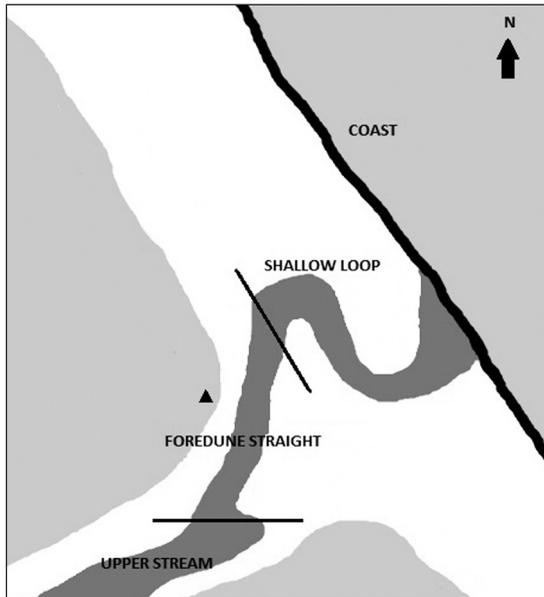


Fig. 1. Diagrammatic scheme of the stream mouth configuration at the time of the foraging study (2013/14), showing stream sections and location of the observation point (black triangle).

the Mangawhai – Te Arai area, NZFT foraging activity has been observed in the Mangawhai estuary, the eastern coast adjacent to PPP1, the Te Arai Stream mouth and a short distance inland at Slipper, Spectacle and The Sanctuary lakes. The lagoons within Mangawhai sandspit were once also a favoured foraging area for NZFT during the time they were regularly inundated by salt water (1996–2009). An understanding of how often locations within the Mangawhai–Te Arai area are used by NZFT for foraging, and at which stage of breeding, could assist with future management of the species.

This short note summarises the findings of a 6 week observational study of NZFT foraging activity at the Te Arai Stream mouth during the 2013/14 chick-rearing period. Although the stream mouth exit to the ocean was configured slightly differently in the 2012/2013 season when a NZFT nest was discovered there, it was decided in the following season to investigate the use of Te Arai Stream mouth as a foraging habitat for NZFT given the potential for a nest there in the future.

A single observation point was established on the northern bank of the Te Arai Stream to enable good views of the stream mouth as well as the adjacent coastal zone (Fig. 1). Access was from the west so as not to disturb any breeding shorebirds. Thirty days of observations were undertaken between 21 December 2013 and 9 February 2014.

Table 1. Recorded behaviours of each NZFT sighting.

Behaviour	No. of observations	% of total observations
Foraging over water:		
Coastal waters	5	1
Te Arai stream	25	6
Stream & coast	5	1
Resting / preening	341	82
Traversing	17	4
Consuming food when on land	25	6
Total	418	100

On each day, observations were conducted over a 5-hour period from ~1400–1900 hours. This time was intended to coincide with end-of-day NZFT chick feeding activity, as well as to cover all stages of the tidal cycle over the study period. The stream was divided into 3 sections for the purposes of recording foraging attempts. These sections, listed in order of increasing water depth at the time of the study, were the shallow loop, foredune straight, and upper stream (Fig. 1). Binoculars and a telescope were used to observe the terns. At the commencement of each observation period, the date, time, weather conditions and tidal stage (high and low tide times) were noted. For each NZFT sighting, we recorded the time, number of birds, direction of movement, location of foraging attempts (either coastal or one of the 3 stream sections), description of behaviour (*i.e.*, resting, preening, traversing through without stopping, foraging over water, or consuming food while on land), the number of dives made, and whether the bird obtained any prey. Each sighting was a distinct episode of an individual tern being continuously present within the study location (*e.g.*, 4 terns arriving simultaneously would equal 4 sightings, and an individual tern arriving, then leaving, then returning some time later would equal 2 sightings).

A total of 150 hours of observations were conducted during the study period. The daily breakdown of recorded activities over this 6 week period is shown in Fig. 2. During that time, 418 sightings of NZFT were recorded. Leg-band combinations noted while terns were resting in the area indicated at least 17 separate individuals (including 5 juveniles) were recorded at some point during the study, of which at least 6 (including 4 juveniles) were seen foraging over water. There was only one day (23 December 2013) during which no NZFT were recorded (Fig. 2). The number of NZFT sightings during each observational period

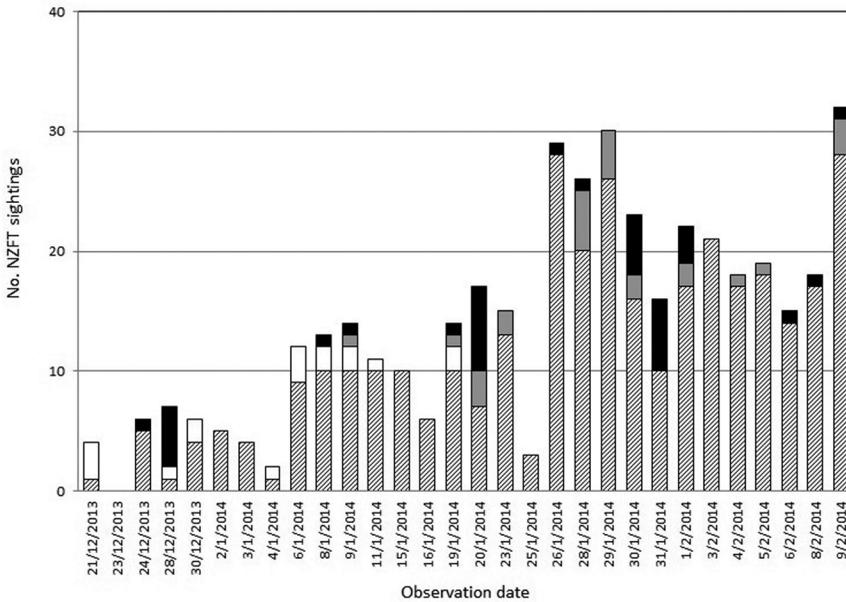


Fig. 2. NZFT behavioural activities recorded during observational periods over 6 weeks. Black bars, foraging over water; white bars, traversing; hatched bars, resting / preening; solid grey bars, consuming food when on land.

appeared to increase after 25 January 14 (Fig. 2). This date coincides with juvenile NZFT being capable of moving from their natal sites at MWR and the Pakiri River mouth. Of the 418 NZFT sightings, 35 (8%) recorded birds foraging over water (Table 1). These 35 records occurred on 14/29 days (48%) that NZFT were sighted (Fig. 2), with 7 days including foraging over only the stream, 4 days with foraging over both stream and coast, while 3 days had foraging over the coast only. Of these 35 records, 25 were of birds foraging only in the Te Arai Stream, 5 over the coast only, and 5 over both the stream and coast, therefore 30/418 NZFT sightings (7%) involved birds foraging in the Te Arai Stream (Table 1). These 30 observations represented 99 minutes of foraging activity, comprising ~1% of the total observation period. There was an additional 23.5 minutes of foraging recorded over the coast, so a total of 122.5 minutes of foraging activity was recorded, during which 193 dives were observed (Table 2). Most dives (67%) were recorded in the shallow loop section of the Te Arai stream (Table 2). In terms of the success of the diving attempts, on no occasion was there positive confirmation of prey being caught. However, due to the distance from the observer and the small size of the terns and their prey, successful catches could have been missed if swallowed immediately. The sightings of prey items being consumed by birds on land were not the result of observed dives in the stream. Adult birds were seen to arrive from locations outside the viewing area carrying a fish, which was then usually fed to a juvenile bird or consumed by the adult itself.

Table 2. Location and number of NZFT dives observed during the 35 sightings that included foraging activity.

Location	No. times location was used for foraging	No. dives (% of total)
Coast	10	27 (14)
Shallow loop (stream)	19	129 (67)
Foredune straight (stream)	17	27 (14)
Upper stream	13	10 (5)
Total	35*	193

* Note total includes sightings in which more than one location was used.

The majority (92%) of observations collected were of birds resting on the beach, consuming food on land, or traversing. The high incidence of traversing between 21 December 2013 and 20 January 2014, combined with their flight path (largely south-southwest over the forest and dunes), suggests birds in transit between their foraging areas (*i.e.*, Slipper and Spectacle lakes). It is possible sightings of birds traversing ceased at a time coinciding with chicks fledging and being capable of accompanying their parents, with the adults needing fewer long trips between their food source and chicks.

Only a small proportion of the total observation time (~1%) was of NZFT foraging over the stream or coast. However, as the majority of NZFT dives were recorded over shallower water, it is possible that the 2012 configuration of the stream mouth influenced the occurrence of a NZFT nest at this location. In

2012, a shallow channel tracked northwards in a short straight section after emerging from the forest, before turning east and emptying to the ocean. This configuration provided a greater area of shallows over which NZFT could forage that year, in comparison to the season of this study (Fig. 1). Interestingly, on every day that light rain or drizzle was recorded, there were sightings of NZFT foraging and diving over the stream. Also, all foraging and dives recorded in the final 7 observational periods of the study were by juvenile birds, indicating that the stream mouth is a valuable site for them during their post-fledging period.

This study represents the first observations undertaken to investigate the foraging activity of NZFT at the Te Arai stream. The objective of the study was to obtain an understanding of the importance of the stream (particularly the stream mouth) as a foraging resource for these birds. From the data collected, it is apparent that while NZFT occasionally forage at the Te Arai Stream, they obtain a greater amount of their food from other areas. That the Te Arai Stream mouth is a favoured post-breeding flocking site for east coast breeding NZFT and their young, is confirmed by the NZFT Sightings Database (Department of Conservation) and it has long been known as such since Ornithological Society of New Zealand record keeping commenced (*e.g.*, MacDonald 1953). Even if Te Arai Stream is not critical breeding or foraging

habitat for NZFT, given the shifting and changeable environments they inhabit, seemingly marginal areas such as this site may prove vital in some years and thus worthy of protection to ensure this species has the ability to cope over the long term.

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