

Red-tailed Tropicbird *Phaethon rubricauda*: five nesting seasons, 2020-2025, on Rottnest Island, Western Australia

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Received: 21 October 2024

Accepted: 10 April 2025

Abstract. The Red-tailed Tropicbird *Phaethon rubricauda* has nested on Rottnest Island, off Fremantle, Western Australia, on five consecutive nesting seasons since 2020. It is unusual to have this tropical seabird nesting at this latitude of 32° S. An earlier southern breeding colony on Sugarloaf Rock failed in 2001, as did the nesting attempt on Rottnest Island in 1959. During recent nesting on Rottnest, one pair successfully fledged a chick in the first three and the fifth seasons. Nesting and re-nesting failed in the fourth and fifth season. Successful breeding occurred again in 2024-25. The successful breeding pair used the same nest site each year. From eight nesting attempts at two nests, four birds fledged and four attempts failed, with an average of 45 days incubation and 78.5 fledging days. Intermittent observations during the first three seasons provided the basis for deployment of a remote camera and more intensive monitoring in 2023-2024 and 2024-2025. The results provide information on the timing of nesting, incubation, fledging, adult nest visits and predation at this southern latitude breeding site.

Keywords: Red-tailed Tropicbird, breeding, Rottnest Island.

INTRODUCTION

The eastern Indian Ocean population of the Red-tailed Tropicbird *Phaethon rubricauda westralis* was considered by Willacy *et al.* (2023) as a separate subspecies from the Pacific and western Indian Ocean populations and listed as Vulnerable under the IUCN criteria. This species is predominantly distributed in tropical and subtropical waters where sea surface temperatures (SST) exceed 22° C (Brooke 2002, Egerton *et al.* 2022). Most of the Indian Ocean population breeding occurs on Christmas Island at 10.28° S (Egerton *et al.* 2022). Since 1894, however, there have been periodic reports of the presence and breeding attempts in south-western Australia, including on the Houtman Abrolhos Islands, Rottnest Island and Sugarloaf Rock (Mather and Greenwell 2021, Serventy and Whittell 1967, Surman and Nicholson 2009, Tarburton 1977). Until the recent breeding on Rottnest in 2020, first observed by Steve Bell (2021), there had been no successful known breeding in the south-west since 2008 (Boyle and Hassell 2008).

Breeding records for Rottnest Island are important for three reasons and the nesting details are an integral part of this. It is unusual to have a tropical seabird breeding successfully at temperate latitudes. The protection of seabirds and shorebirds on the island is paramount to the Rottnest Management Plan 2023–2028, in which the coastal habitat and wetlands are established as key focal conservation targets (RMA 2023). Rottnest Island is a major tourist venue and hosts over 800,000 visitors annually. Consequently with the number of visitors on a small island, there is always the potential for habitat destruction and loss of avian species.

Dunlop (2009) and Dunlop and Greenwell (2020) showed that eight tropical seabird species have expanded south, benefitting from an increased sea surface temperature (SST), probably associated with a southward expansion of tropical

prey. The unique west continental coast phenomenon of a warm south flowing current, the Leeuwin Current, brings with it a range of marine food for pelagic seabirds. Added to this is the variation in the strength of the El Niño-Southern Oscillation (ENSO). Surman and Nicholson (2008) indicated, in a study of four tropical pelagic seabirds, that ENSO events resulted in reduced seabird productivity, coinciding with reduced volumes of key prey species in regurgitates. The first three successful breeding seasons for Red-tailed Tropicbirds (2020-21 to 2022-23) occurred during La Niña events, when sea surface temperatures are influenced by warmer water flowing into and strengthening the Leeuwin Current. Conversely, in 2023-24 and 2024-25, there was an El Niño event (BOM 2024).

The work presented here is an attempt to record, with limited resources, the observations from Red-tailed Tropicbird nesting events on Rottnest Island over five breeding seasons between 2020-21 and 2024-25, thereby developing a better understanding of the nesting, incubating and fledging pattern with breeding at this latitude. These records are also important for the protection of a possible development of a Red-tailed Tropicbird colony on Rottnest Island.

STUDY AREA

Red-tailed Tropicbirds breeding on Rottnest Island were studied for five breeding seasons from September to March in 2020 to 2025. The Island, managed under the Rottnest Island Authority (RIA), is 18 km west of the port of Fremantle and is the largest island in a chain of small limestone islands and reefs on the continental shelf that runs from Jurien Bay (220 km north) to Rockingham (40 km south). Separated from the mainland about 6500 years ago (Playford and Leech 1977), the island is 11 km long and 4.5 km at its widest point with 63 sheltered beaches and 20 bays. The land area is 1900 ha and

Table 1

The timing and results of five breeding seasons 2020-21 to 2024-25 at Rottneest Island. The number of images and site observations supporting the breeding results are indicated.

Date	2020-21 nest W	2021-22 nest W	2022-23 nest W	2023-24 nest W	2023-24 re-nest E	2024-25 nest W	2024-25 nest W	2024-25 nest E	Av.
In nest area- 1st obs.	7-Jan-21	20-Oct-21	3-Oct-22	16-Sep-23	1-Dec-23	25-Aug-24	26 Oct 24		
Egg laying	15-Nov-20	3-Nov-21	17-Oct-22	24-Aug-23		31-Aug-24	13-Nov-24	21-Nov-24	
Hatching	1-Jan-21	17-Dec-21	26-Nov-22	7-Nov-23			1-Jan-25	7-Jan-25	
Est. # incubation days	47	44	40	44			49	47	45
Fledging	20-Mar-21	4-Mar-22	14-Feb-23				21-Mar-25		
Est. # fledge days	78	77	80				79		78.5
Failed breeding				14-Nov-23	25-Jan-24	16-Oct-24		12-Jan-25	
Failed evidence				est. 7 day chick dead	broken egg	broken egg		est. 1 day chick-Raven predation	
Camera on site				2-Aug-23		16-Aug-24			
# Images	5	21	14	45	37	57		130	
# on site observations	7	37	32	12		14		27	

encompasses an inland lake system of 200 ha or about 10.5% of the land mass (Playford and Leech 1977).

The nests and nest site on Rottneest Island comprised shallow scrapes in the sand and gravel within clumps of Coast Saw-sedge *Gahnia trifida* on a disused dumped gravel site, close to a lake shoreline and reef-fringed bay. The characteristics of this breeding site are typical of other successful breeding sites: under shrubs with few stems; 0.5 square metres nest space; high peripheral sides; an open area for adult landing and shade (Clark *et al.* 1983, Egerton *et al.* 2022, Hamer *et al.* 2002, Mott *et al.* 2020). This differs from the other recent sites of rocky ledges on Sugarloaf Rock (Tarburton 1977).

METHODS

Observations of nesting behaviour were made by volunteers and RIA staff through all seasons (Table 1). Observers kept a distance of 3-4 m from the nests unless confirmation with a photograph was needed to try to establish, for example, if an egg had been laid. Adults were not individually identified. Chicks were not banded. Distance observations of the nest site were impractical because of the infrequency and unpredictability of adults coming to and leaving the nest and the limited availability of an observer.

Following three successive seasons, a Swift Endurance 4G camera, set to take still and video images, was installed on a one-metre post 3 m from the nest opening, which faced 270°. The still image was taken 1 second before the video clip. Refining this monitoring with experience resulted in limiting images to movement-triggered still and video clips both day and night. The video clips of five seconds in 2023-24 were extended to ten seconds for 2024-25 (Table 1). The images were viewed daily off-site. The occurrence of activity, time, dates and other taxa in the nest area were recorded. The images did not show activity within the nest, so photographs inside the nest were taken at site visits. The timing of egg laying, hatching and chick fledging were estimated from adult or chick behaviour and chick development.



Figure 1. Red-tailed Tropicbird with a downy chick alongside, 9 January 2021.

Photo: S. Bell

RESULTS

The incidental discovery on 7 January 2021 of breeding on the Island resulted in the first photographic record, which showed a grey, downy chick. Based on this image (Fig. 1), the estimated age of the chick was one week, indicating the egg was laid around mid-November 2020.

From eight breeding attempts between 2020 and 2025, four Red-tailed Tropicbird chicks fledged and four nests failed (Table 1). The average estimated numbers of incubation and fledging days for this breeding site are 45 and 78.5, respectively (Table 1). The results from the first three breeding seasons were from

Table 2

Comparison of estimated number of incubation and fledging days at Pacific and Indian Ocean Red-tailed Tropicbird breeding sites (Diamond 1975, Egerton *et al.* 2022, Fleet 1972, Hamer *et al.* 2002, Schreiber and Ashmole 1970, Sommerfeld *et al.* 2015, Tarburton 1977).

Reference	Site	Incubation	Fledging
Schreiber and Ashmole (1970)	Christmas Island, Pacific Ocean	42	82
Fleet (1972)	Kure Atoll, Hawaii, Pacific Ocean	42-46	88.7
Diamond (1975)	Aldabra Atoll, Indian Ocean	51	90
Tarburton (1977)	Sugarloaf Rock, WA	41-48	68-91
Hamer <i>et al.</i> (2002)	Johnston Atoll	42-44	80-90
Vanderwerf and Young (2014)	O'ahu, Hawaii, Pacific Ocean	44.2	82.3
Sommerfeld <i>et al.</i> (2015)	Christmas Island, Indian Ocean	42	90



Figure 2. Red-tailed Tropicbird adult and newly hatched downy chick, 8 January 2025.

Photo: S. Coleman

incidental on-site visits and handheld photographs (Table 1). Those from the following five nesting attempts were obtained from an in-situ camera, incidental on-site visits and handheld photographs. The birds were not individually identified, so it is unknown whether or not the second breeding attempts in 2023-24 and 2024-25 were re-nesters; however, the occupation of two nests in 2024-25 indicated that only one of the two pairs was re-nesting.

The death of an estimated seven-day chick was recorded in 2023-24. A new nest, 1 m to the east of the previously used one, failed with a broken egg found at the deserted nest.

The 2024-25 breeding resulted in a failed attempt in the original nest (west) followed by a failed re-nesting or a new pair nesting at the east nest. A chick from the west nest successfully fledged at an estimated 79 days.

DISCUSSION

The breeding results, timing and behaviour of the Red-tailed Tropicbirds on the island during the five seasons closely followed the pattern of breeding colonies elsewhere in the Indian and Pacific Oceans (Diamond 1975, Egerton *et al.* 2022, Fleet 1972, Hamer *et al.* Schreiber and Ashmole 1970, Sommerfeld *et al.* 2015, Tarburton 1977, Visser, 2002).

Nest site

Successful Red-tailed Tropicbird breeders have shown a 70% probability of selecting the same nest site in subsequent years (Mott *et al.* 2020, Schreiber and Schreiber 2020, Sommerfeld *et al.* 2015). The same nest site was used at Rottnest with the original nest used each year. A new nest was established in 2023-24, 1 m to the east of the original nest. These seabirds are known to lay again if an egg or chick is lost, either in the same or a nearby nest (Schreiber and Ashmole 1970, Sommerfeld *et al.* 2015).

Incubation

The estimated period from egg laying to hatching was 40-49 days with an average of 45 days for five of the eight breeding events. This is in accord with 41-51 days at other known breeding sites (Table 2). Figure 2 supports this hatching estimate with a presumed one-day chick (8 March 2025) with a full downy coat. Fleet (1972) showed chicks alongside and protected by the adult after three to four days, as is seen in Figure 1.

Images recorded Tropicbird adult arrivals and departures from the nesting area and gave some indication of the nest provisioning pattern (Fig. 3). This showed the greatest arrival and departure activity between 1100 and 1300 hours. Sommerfeld and Hennieke (2010), using GPS tracking of the Christmas Island colony, showed a bimodal foraging pattern of alternation between long and short foraging trips, as is suggested with the adult activity at Rottnest (Fig. 4).

Fledging

The estimated number of days from hatching to fledging at Rottnest varied from 77 to 80 days, within the variation at other sites of 68-91 days. Prys-Jones *et al.* (1980) showed large young birds that had lost their downy natal plumage always fledged

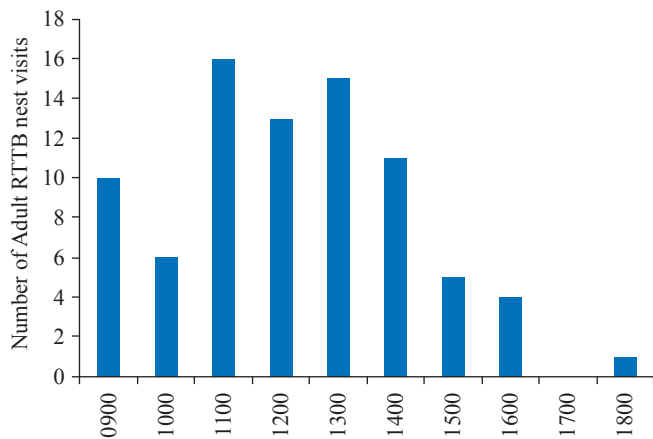


Figure 3. The time periods at which adult Red-tailed Tropicbirds arrived at and left the nesting site.



Figure 4. Adult Red-tailed Tropicbird entering the nest, 8 November 2023, 1242 hours. On-site camera.

successfully (Fig. 5). The 2024-24 successful fledging showed intermittent night time images of the chick wing flexing over a four week period (Fig. 6). Red-tailed Tropicbirds typically leave the nest site almost immediately on fledging, so without an on-site observer or an in-situ camera, accuracy of fledging days was an estimate. Schreiber and Schreiber (2020) stated that the fledged birds fly out to sea without adults. The assumption that they learn to forage on their own is supported by Shealer (2002). Ainley *et al.* (1986), however, documented observations of adult and juvenile Red-tailed Tropicbirds foraging together in the Pacific Ocean.

Nest failure

Sommerfeld *et al.* (2015) and Vanderwerf and Young (2014) assigned nest failure to nine categories, two of which apply to Rottnest Island breeding: broken eggs and predation. Sommerfeld *et al.* (2015) established that mate-fidelity outweighs the cost of pair-bond disruption, so it is assumed that the second breeding attempts in 2024-25 were one pair re-nesting and the other a new pair. Diamond (1975) showed that re-nesting occurs within 40-56 days, but this re-nesting or new nest breeding in 2024-25 was 28 days in the west nest and



Figure 5. Chick out of the nest having lost downy plumage, 13 February 2023. Fledged within 24 hours.

Photo: S. Bell



Figure 6. Chick out of nest at night flexing wings, 11 March 2025. On-site camera.

36 days in the east nest, suggesting that the successful fledging from the west nest was by a new pair.

Using the movement-triggered camera in the last two seasons gave the advantage of establishing what other taxa were in the nest area. There had been a reluctance to approach the nesting area too closely, due mainly to the presence of Australian Ravens *Corvus coronoides*, which are known to predate the eggs and chicks of nesting sea birds. This had occurred in the Sugarloaf Rock colony, where rocky ledge sites were modified to protect against Raven predation (Burbidge 2021). The Rottnest site in tussocks and gravel would not be suitable for this modification. Predation of a nearby Greater Crested Tern *Thalasseus bergii* colony had been observed on the island in these breeding seasons (C. Greenwell, pers. comm). Rees *et al.* (2015) also recorded Raven predation on Red-capped Plovers *Charadrius ruficapillus*. During the first nesting attempt in 2024-25, Ravens patrolled around the nest site from the 30 August 2024. Predation was confirmed for the first breeding attempt with Ravens observed in the nest at 0644 on 17 October 2024, followed by a broken egg found at a routine nest inspection at 1252 the same day. The 2024-25

breeding season recorded images of Ravens at the nest site on nine days, typically around 0700 hours.

Management and Implications

It became apparent that the presence and abundance of, and predation by, Ravens was a problem. Indications are that the camera attracts these birds. On-site observations were kept to a minimum (Table 1) until it was established that the chick was well developed and able to defend itself, so the presence of observers was not seen as a threat.

Data from the observations over the five nesting periods have formed the basis for more detailed nest monitoring, anticipating future nesting at this site. It would be valuable to establish better monitoring methods so that the details of breeding on this southern latitude island can be established. This work continues to confirm the conservation values of Rottneest Island.

ACKNOWLEDGEMENTS

While Rottneest Island is not far off shore from Fremantle, resources such as transport and accommodation are limited, resulting in detailed nest monitoring being expensive and difficult for volunteers and Rottneest Island staff. Consequently this work has had invaluable volunteer assistance from Dr Claire Greenwell and Steve Bell, who contributed much time in discussion and monitoring at the beginning; however, this work would not have been possible without the contribution of staff, time and equipment from the RIA, particularly the past and present Rangers. I also acknowledge Nic Dunlop's assistance in the discussions I have had with him based on his experience with seabirds in the Indian Ocean.

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