Australian Field Ornithology 2025, **42**, 176–179
http://dx.doi.org/10.20938/afo42176179

Evidence of Rakali predation on a Little Penguin chick

T. Scott[1]* and V.F Sperring[1, 2]

[1]Earthcare St Kilda, 34A Blessington Street, St Kilda VIC 3184, Australia
[2] School of Biological Sciences, Monash University, Clayton VIC 3800, Australia
*Corresponding author. Email: tiaescott00@gmail.com

Abstract. The Australian Water-rat or Rakali *Hydromys chrysogaster* is an opportunistic predator known to feed on a variety of aquatic species, as well as birds' eggs and carrion. Although Rakali often share habitat with Little Penguins *Eudyptula minor*, documented predation events are rare. Trail cameras were installed in eight Penguin nests along the breakwater in St Kilda, Victoria, over one Penguin breeding season. Cameras recorded one instance of a Rakali killing a Penguin chick that was being guarded by an adult, and another of a Rakali scavenging a dead chick. This represents the first video evidence of Rakali preying on and consuming Little Penguins, and the first recorded instance of an attack on a chick under adult supervision. These observations suggest that Rakali predation on Little Penguins may be more common than previously thought.

Introduction

The Australian Water-rat or Rakali *Hydromys chrysogaster* is a semiaquatic rodent native to Australia and New Guinea. The commonly used name Rakali was originally given to this species by the Ngarrindjeri people, the traditional inhabitants of the lower Murray River and Coorong region of South Australia. This species is commonly found near permanent water sources including freshwater and marine environments (Atkinson *et al*. 2008). It is a highly opportunistic predator and scavenger, consuming a wide variety of prey and occasionally vegetation (Woollard *et al.* 1978). Its weight ranges from 620 to 1200 g, with an average of 700 g (Menkhorst & Knight 2011). As a coastal inhabitant, the Rakali's home range overlaps with many seabird species, and it is known to consume shearwaters, ducks, and several waterfowl species (Woollard *et al*. 1978). The Rakali has also been identified as a probable predator of the Little Penguin *Eudyptula minor*, but evidence is limited, and direct reports are extremely rare (see Warham 1958; Preston 2008).

The Little Penguin is the smallest penguin species, standing at just 20–30 cm tall and weighing on average ~1 kg (Davies *et al.* 2022). This seabird is nocturnally active on land and nests in burrows or crevices close to shore, making it particularly susceptible to mammalian predators (Waas 1991; Colombelli-Negrel & Tomo 2017; Davies *et al.* 2022). Rakali are present in Little Penguin colonies across Victoria and South Australia (Bool *et al*. 2007; Preston 2008; Colombelli-Negrel & Tomo 2017). Although suspected to be predators of Little Penguins on Granite Island, South Australia (Bool *et al*. 2007), more recent research has found very low rates of nest visitation and no evidence of predation (Colombelli-Negrel & Tomo 2017). There are no published reports of Rakali predating penguins on Phillip Island, Victoria. The only reported occurrence of Little Penguin predation by a Rakali in Victoria was on an unattended, post-guard chick in the St Kilda colony (Preston 2008); the cause of death was determined based on injuries and distinctive Rakali teeth marks found on the deceased chick.

The St Kilda Little Penguin colony is located on the breakwater at the end of the St Kilda pier, Melbourne (–37.8646, 144.9647). It has ~1400 Penguins, and Rakali can be seen regularly on and around the breakwater (Williams & Serena 2018; GBIF Secretariat 2023; Z. Hogg unpubl. data). Despite limited direct evidence, the 450-m pier with 24-hour lighting that separates the colony from the nearest landmass (Preston 2010) is likely a key factor in reducing access for introduced predators, such as Black Rats *Rattus rattus*, Red Foxes *Vulpes vulpes*, feral cats *Felis catus* and dogs *Canis familiaris.* Long-nosed Fur Seals *Arctocephalus forsteri* are the primary marine predators of the Little Penguin within Port Phillip Bay (Page *et al*. 2005; Kowalczyk *et al.* 2015). Little Ravens *Corvus mellori* are present on the St Kilda breakwater and are known to take Penguin eggs on Phillip Island (Ekanayake *et al*. 2015; Tan *et al*. 2022) but there are no reports of Little Raven predation in the St Kilda colony. Here we report on observations of predation on Little Penguins at this colony.

Observations

Motion-sensing trail cameras (WIFI ProCam 4K Trail Security Camera, ProsChoice®) were installed in eight active Little Penguin nests (designated A–H) in October–December 2021 (Table 1). Nests were chosen opportunistically based on breeding stage and accessibility. Each camera was placed outside the nest and programmed to take 10–20-second videos upon activation of a motion sensor during both the day and night. For nocturnal videos, the cameras were equipped with infrared technology to capture clear images in low-light conditions. Rakali activity was detected at three out of eight nests (38%) and predation at two of the eight nests.

A Rakali preyed on a *c*. 3-week-old chick from Nest A on 17 November 2021 (Figure 1). Rakali were observed investigating the nest five times over 2 days before the attack. In each of these instances, the adult Penguin was facing towards the entrance used by the Rakali, resulting in the Rakali quickly retreating. During the attack, however, the adult Penguin was facing away from the Rakali. The Rakali entered the nest and removed the chick while it was next to the adult Penguin, which let out a single alarm call but remained in the nest.

Table 1. List of Little Penguin nests monitored at St Kilda, Victoria. Breeding stages (incubation, guard and post-guard) recorded are denoted by X. Where known, the outcome of each nest is given in parentheses.

Nest	*Incubation*	*Guard*	*Post-guard*
A	X	X (Rakali predation)	
B	X	X (cause of death unknown)	
C			X (fledged)
D	X (failed to hatch)		
E	X (failed to hatch)		
F	X	X (cause of death unknown)	
G		X (cause of death unknown; later scavenged by Rakali)	
H			X (fledged)

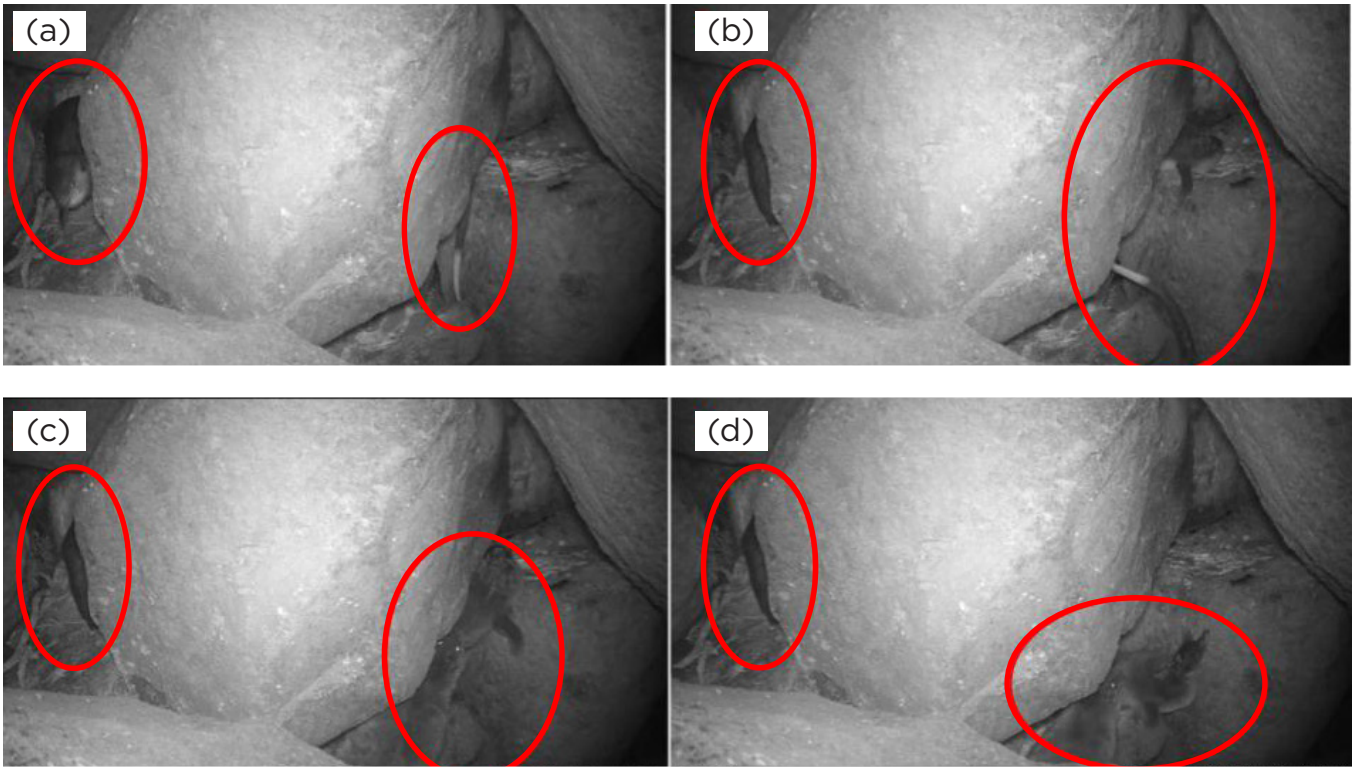

Figure 1. Sequential screenshots of a Rakali stealing a 3-week-old Little Penguin chick from inside a guarded nest. (a) An adult Penguin faces the front of its nest (left) while a Rakali (right) approaches the back of the nest, (b) the adult Penguin faces the back of the nest and a chick (right) has been moved outside the nest by the Rakali (bottom right), (c) the chick is subsequently dragged down the rocks (right) while the adult Penguin remains in the nest (left), (d) the chick is taken underneath the nest by the Rakali and disappears from view. Red outlines indicate where the Penguins and Rakali are in each image.

On 17 November 2021, a Rakali was recorded feeding on the carcass of a dead chick in Nest G (Figure 2), 6 days after the chick had died at *c*. 2 weeks of age. A Rakali was also observed within Nest H, 6 days after a chick had fledged. No predatory behaviour was observed from any other species during the monitoring period.

Discussion

Our observations provide direct visual evidence of a 3-week-old Little Penguin chick being attacked and killed by a Rakali while under the guard of an adult Penguin, as well as evidence of a Rakali scavenging a dead chick. Chicks guarded by an adult are considered less vulnerable to predation (Bool *et al.* 2007; Preston 2008; Colombelli-Négrel 2015). However, in this case, the Rakali appeared to time its attack when the adult Penguin was facing away from the burrow entrance used by the predator, which highlights the vulnerability of penguin chicks, even when an adult is present. In most Little Penguin colonies, nests typically have a single entrance (Stahel & Gales 1987; Ekanayake *et al*. 2015; Colombelli-Négrel 2019), which may provide adults with a better opportunity to defend against predators (e.g. Colombelli-Négrel & Tomo 2017). In contrast, many nests among the rocks of the St Kilda breakwater are exposed and have multiple entrances (VFS pers. obs.), which would likely make them more difficult to defend from predators.

When the chick was attacked by the Rakali, the attending adult Penguin made little effort to protect it. This might have

Figure 2. Rakali feeding on the carcass of a Little Penguin chick that had died at *c*. 2 weeks of age.

been an act of self-preservation, which is beneficial for long-lived species as it allows individuals to maintain their own fitness for future reproductive attempts (Stearns 1992; Numata *et al.* 2000). Defending the chick might have posed too great a cost, particularly as the adult was acting alone (Waas 1991). Like most seabirds, Little Penguins exhibit an energy trade-off, prioritising their own survival over that of their offspring under poor food conditions (Saraux *et al.* 2011). Self-preservation is commonly observed during seasons of low prey availability, when adult penguins delay returning to their offspring in order to continue foraging, thereby preserving their future reproductive potential (Numata *et al.* 2000). However, this behaviour is not well understood in the context of predator avoidance in Little Penguins.

Although the St Kilda colony is free from invasive terrestrial predators such as cats, rats and foxes that are known to impact other Little Penguin colonies (Bool *et al.* 2007; Simeone & Luna-Jorquera 2012; Kirkwood *et al.* 2014), our observations suggest that predation by a native rodent species, the Rakali, may occur more frequently than previously expected (Preston 2008; Colombelli-Négrel & Tomo 2017). The primary prey of the Rakali in St Kilda is believed to be marine invertebrates and crustaceans, with Penguin eggs and chicks considered an infrequent and opportunistic addition to their diet (Preston 2008). We recommend that future research investigate the frequency of Rakali predation in Little Penguin colonies under varying environmental conditions.

The St Kilda Little Penguin colony is uniquely situated, as the only penguin colony persisting within 5 km of a major metropolitan city. The consequence of such proximity includes exposure to plastic and light pollution which may impact breeding success, and recreational fishing which may impact foraging success (Rodriguez *et al.* 2016; Kowalczyk *et al*. 2017). The colony is also indirectly affected by climate change, with drought and flood influencing both foraging efficiency and breeding success (Preston 2010; Kowalczyk *et al.* 2017). Additionally, human presence on the St Kilda breakwater has the potential to negatively impact breeding, as penguins have been shown to preferentially nest in areas inaccessible to the public (Giling *et al.* 2008). Despite exposure to this range of threats, research into the breeding success and key pressures facing the St Kilda colony remains limited.

Here, we provide evidence of Rakali predation and scavenging within an urban colony of Little Penguins. Given that this population is exposed to numerous anthropogenic threats – and contributes significantly to tourism and community engagement – further investigation into the key threats facing the St Kilda Little Penguins, including their role in the diet of the Rakali, is warranted.

Acknowledgements

We would like to thank Earthcare St Kilda for their support throughout the project and their continued commitment to the St Kilda colony. This observation was recorded as a part of an education program supported by funding from the Blackbird Foundation's Protostars program. Site access and permission for camera deployment were provided by Parks Victoria.

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Received 22 January 2025, accepted 8 July2025, published online 1 October 2025