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Engaging the community: A little penguin citizen science project

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Background

Penguin Island supports Western Australia's largest and most northern colony of little penguins and may contain up to 500 breeding pairs. Egg incubation and chick rearing duties are shared between parents during the breeding season, with shifts typically lasting three to four days across approximately 60 days. While one parent remains on the nest the other forages at sea, returning to the island at dusk and usually returning to the nest using the same route. This predictable behaviour allows us to estimate the relative numbers of little penguins that may breed each year and makes them ideal candidates for citizen scientists to collect long-term data. Monitoring little penguins is important as populations in SA, Victoria, NSW and Tasmania have declined in size over recent years. The more drastic of these declines has occurred at Granite Island, SA, where the colony has shrunk from ~1600 to 20 breeding little penguins in only ten years. The cause of these declines is not completely understood, but human activities, diminished food availability and predation by introduced animals are most likely to be contributory factors. The major threats to the little penguin population at Penguin Island are likely to be changes to prey availability caused by changing climate patterns, and disturbance or mortality caused by boat use. It is thought that unusually high sea temperature in the Penguin Island area in recent years has led to less prey being available in the feeding grounds most frequently used by these breeding penguins. Monitoring population-based metrics provides an annual estimate of the relative number of breeding little penguins and provides citizen scientists with the opportunity to make a significant contribution to conservation science and management.

Methods

Several monitoring methods are used to estimate penguin abundance, including *in situ* nightly counts of little penguins as they return to the colony after foraging at sea. The logistics and cost of using trained observers to collect these data on Penguin Island each night would be prohibitively expensive, so infra-red video cameras were permanently installed at two major landfall beaches. The cameras record video footage of individuals or groups of penguins arriving (Figure 1). These sites were identified as being representative of all beach landings on the island and captured about 75% of all arrivals. Citizen scientist video observers then record the time of arrival and the total number of penguins returning to the island by viewing the videos at the citizen science web portal www.penguins.dpaw.wa.gov.au. Since 2012, citizen scientists have made 8343 observations spanning a period of eight years from 2010 to 2017 and these data provide a robust indication of intra and inter-annual trends in the abundance of breeding adults at the colony.

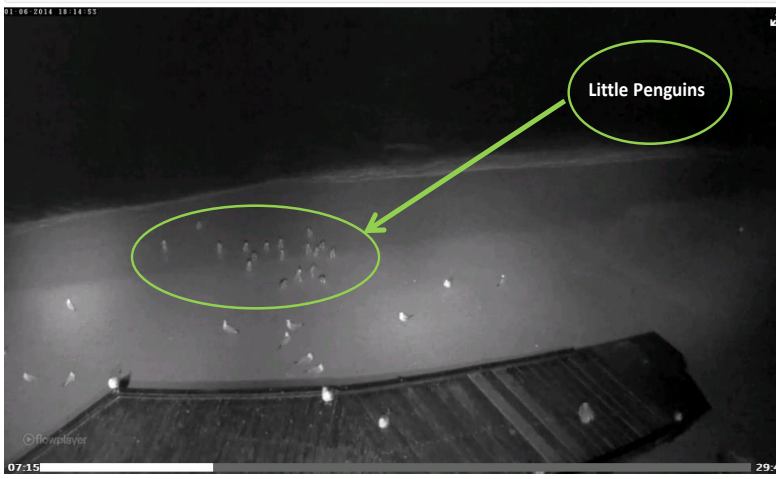

Figure 1. Infrared video footage of a group of little penguins (*Eudyptula minor*) returning via their usual route on the north-eastern beach at Penguin Island, Perth Western Australia. The image is a screen capture taken from a video on the citizen science webportal www.penguins.dpaw.wa.gov.au

Findings

The data indicate that the abundance of penguins returning at the two key landing beaches declined significantly (ANOVA p<0.01) between 2012 and 2015. The decline has been incremental since 2012 with the largest initial decline occurring between 2012 and 2014. From 2015 onwards, the number of beach returns has stabilised. On average, 20 individuals per night were counted in 2015, which is approximately 25% of those recorded by the cameras in 2012. The largest single group of penguins observed coming ashore in 2012 comprised 68 birds, while the largest group counted in 2016 was only 16 individuals.

Citizen scientists as well as independent research show that the counts obtained from the cameras are consistent with *in situ* observations. This indicates that the routes utilised by little penguins to return to Penguin Island, which have the two infrared cameras, have remained consistent through time. Therefore, the declining trend observed in the data collected by the citizen scientist program is considered indicative of the overall trend for the breeding population. Several years of unusually high seawater temperature, most notably in 2011, correlate strongly with the observed declines in breeding colony attendance. This monitoring will now focus on identifying the possible recovery of breeding on Penguin Island, although this is likely to depend on there now being a sustained time without periods of unusually high seawater temperature.

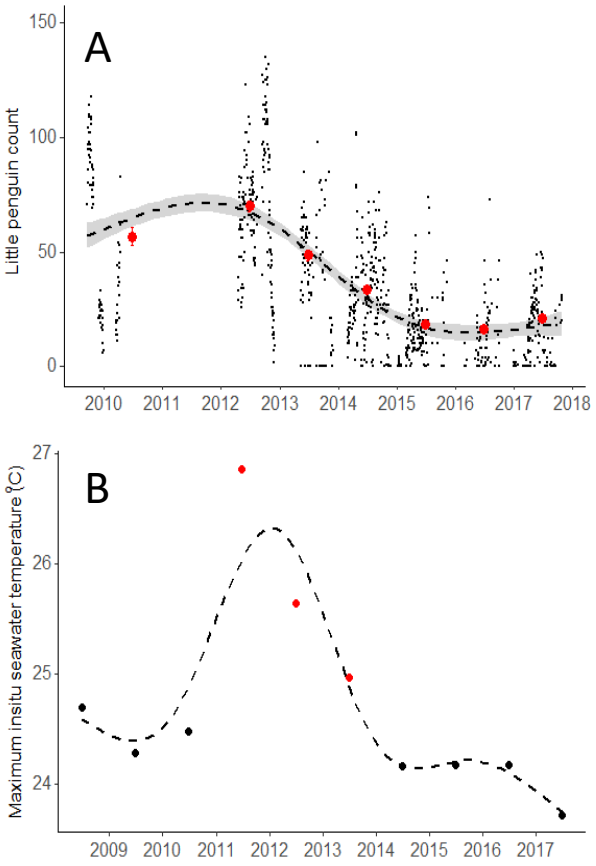

Figure 2 A: The relative abundance of breeding penguins returning to Penguin Island from 2010 to 2017. Black points indicate the total daily count from two infrared beach camera sites. Red points indicate the mean daily count ± SE., B; Maximum seawater temperature near Penguin Island over the same period, red points indicate seawater temperature that is significantly higher than average. Black dashed lines indicate fitted generalised additive models of daily counts A; adjusted r-squared (0.64) (p <0.01), and maximum seawater temperature B; adjusted r-squared (0.52) (p <0.01) over time.

Management Implications

This citizen science project has obtained important monitoring information on the relative abundance of little penguins that are breeding on Penguin Island. The combination of remotely-operated cameras and web-based contributions from citizen scientists has enabled the effective collection of important management data that would otherwise be very difficult to obtain.

This monitoring data clearly demonstrates that periods of unusually high seawater temperature correlates with lower breeding success by little penguins. It is most likely that this period of high seawater temperature has adversely affected the availability of fish prey for penguins in proximity to the breeding colony, forcing penguins to forage further away from the island during breeding. Breeding imposes high energetic demands on little penguins and a reliable and close-by source of prey is essential for successfully raising young. Travelling further from the island to forage means that parent birds have less food to share with their young and are exposed to higher risks of mortality.

This project demonstrates the importance of monitoring the anthropogenic as well as natural pressures that impact populations of this kind. The little penguins of Penguin Island are the northern-most population of this species in Western Australia and may be living close to their upper thermal tolerance that may be exceeded with warm seawater. Seawater temperature will therefore be an appropriate metric to monitor over the long-term in relation to the little penguin population of Penguin Island. It is also important to carefully manage other anthropogenic pressures on Penguin Island's little penguins over the short-term in order to improve the chances for population recovery.

Further reading

Bertram AE (2013). Patterns of arrival by little penguins (*Eudyptula minor*) at Penguin Island, Western Australia: Implications for population monitoring (Thesis). Crawley: The University of Western Australia.