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Shelter me, feed me! Quokkas using plants for shelter and food

Quokkas have been isolated on Rottnest Island over the last 7,000 years, since sea levels rose and cut off connectivity with the mainland. The island has a high density of animals. In autumn, after a hot and dry summer, if animals do not have sufficient body reserves, they can be particularly challenged to survive.

You would therefore think that quokkas don't have a lot of choice in their diet and shouldn't be picky about what they eat. But in fact they are.

In this study, we reveal the complex diet of the Rottnest Island quokka from sampling scats. We also recorded where animals were resting during the day, to determine what plant species they had been using as cover to sleep under. This information can be valuable in revealing parts of the islands that provide the best shelter and diet resources for these animals.

Methods and results

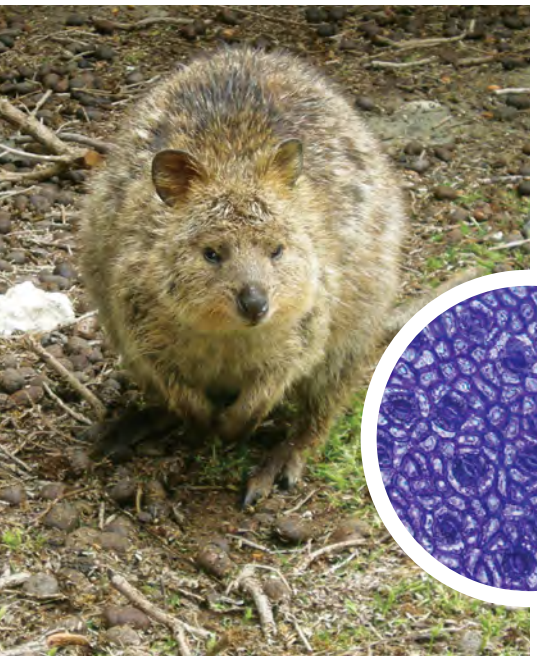
We sampled scats from across the island, to see what individual animals had been eating after the summer of 2010, the hottest and driest summer on record (up till that date!). Analysing 67 of these scats under the microscope allowed us to then determine plant species that had been eaten by these animals. Plant cell walls are composed of cellulose ('fibre') that can make them hard to digest. The epithelium that coats plant leaves has designs that are unique to each plant species, and indigestible parts of the leaves can be found in the scats and therefore identified to species. It takes a lot of careful work, but can be very rewarding.

As part of our scats collection across the island, we inadvertently 'flushed' animals from their rest sites. We opportunistically recorded the plant species (n = 73) they had been sleeping under before they were disturbed.

Once we knew what plant species had been used as food or shelter by quokkas, we could then compare this with how common those species were on the island. For 210 plots across the island, we had recorded the presence and abundance of plants. We could then determine which plant species quokkas had been avoiding, and which ones were preferred (eaten or used as shelter in greater quantities than we would predict from the abundance of these plants).

For the eight preferred food and shelter plant species, we mapped where these plant species were distributed using hyperspectral imagery. This method uses the unique spectral signature of plant species — the light that they reflect — to identify their presence. We identified the particular spectral signature of our key plant species, and then determined where else that particular signature could be found — effectively mapping where all the best food and shelter plants could be found.

*ABOVE: Clumps of tea tree (*Melaleuca lanceolata*) and wattle (*Acacia rostellifera*) are important shelter for quokkas on Rottnest Island. Quokkas also eat the smaller plants, potentially challenging re-vegetation attempts.*



*ABOVE: Rottnest Island supports the largest population of quokkas (*Setonix brachyurus*). These macropods are recognised as 'vulnerable' and are consequently protected under the national* Environmental Protection Biodiversity Conservation Act 1999.

INSET: Microscopic image of an *Acacia rostellifera* leaf epithelium. The anatomy of this epithelium is unique to each plant species and can therefore be used to identify what plants an animal has eaten.

Guichenotia ledifolia (family Malvaceae) was present in the diet of quokkas at a greater abundance (37% of all identified plant fragments) than would be predicted from its abundance on the island (where it is present over 28% of the island) (Figure 1a).

Dutch, French and English explorers described Rottnest as 'heavily wooded', with low forests of Rottnest Island pine (*Callitris preissii*), tea tree (*Melaleuca lanceolata*), and wattle (*Acacia rostellifera*) that covered 65% of island. Today, native forest is present over only 5% of the island, while another 6% of the island has been re-vegetated. The tea tree and wattle make up important parts of the quokka diet (Figure 1) and are also used as shelter by these animals.

Prickly *Acanthocarpus preissii* is present across much of the island. These shrubs are used as shelter in proportion to abundance of the plant (it is present over 30% of the island), but this species was never found in the quokka's diet (Figure 1).

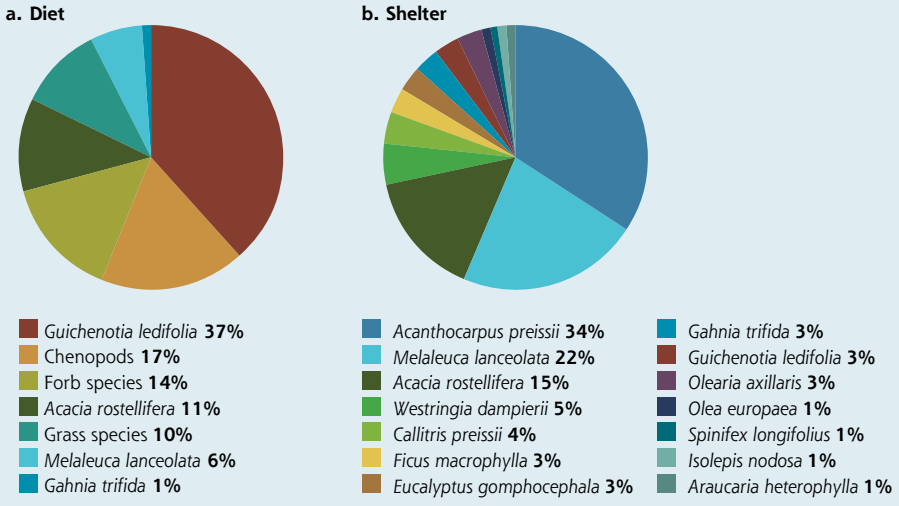


FIGURE 1 Pie charts showing plant species used for food (a) and shelter (b) by Rottnest Island quokkas.

Conclusions and recommendations

The last studies of the diet and shelter requirements of Rottnest Island quokkas were conducted over 50 years ago. There have been substantial changes to the vegetation on Rottnest Island since then due to fires, subsequent revegetation activities and intensive browsing pressure from quokkas.

Understanding resource limitation over the most physiologically-challenging time of the year provides important information for quokka conservation. Quokkas prefer plants from the family Malvaceae as food plants[1], and use dense, abundant shrubs for shelter.

Quokkas appear to have shifted their use of food plants since a previous study (50 years ago), likely reflecting modification of island vegetation due to anthropogenic influences, fire and herbivory over time.

In the face of changing climate, this information will serve as an important guide towards conservation management actions on the island. For example, the Rottnest Island Authority plant 50,000 trees a year which are fenced to keep out quokkas until they have sufficiently established. Information generated in this study can guide the types of plants put in and where we need to carry out revegetation. It also helps with planning for habitat protection and enhancement. ■

More information

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Acknowledgements

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References

1 Hayward, M.W. *Diet of the quokka (*Setonix brachyurus*) (*Macropodidae: Marsupialia*) in the northern jarrah forest of Western Australia*. Wildlife Research, 2005. **32:** p. 15–22.

This is an excerpt from: Poole, H.L., Mukaromah, L., Kobryn, H.T., and Fleming, P.A. *Spatial analysis of limiting resources on an island: diet and shelter use reveal sites of conservation importance for the Rottnest Island quokka*. Wildlife Research, 2014. **41(6):** p. 510–521.

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