

Nature Foundation SA Grant Report

Project Title: Investigating correlates of *Toxoplasma gondii* infection to explain its higher seroprevalence on Kangaroo Island

Applicant: Patrick Taggart

Abstract:

Toxoplasma gondii is a coccidian parasite of cats that has significant impacts on wildlife. On Kangaroo Island, the seroprevalence of *T. gondii* is substantially higher than on mainland South Australia. This is of particular concern on KI as the island supports a number of threatened and endemic species. This project aimed to demonstrate the higher prevalence of *T. gondii* in wildlife on Kangaroo Island when compared to the adjacent mainland SA and better understand why this pattern exists. We have trapped and sampled a range of wildlife species on Kangaroo Island and the adjacent mainland, but are required to complete further trapping and animal sampling before this component of the project is finished. Other components of this project have identified a spatial cluster of a related cat-borne disease on Kangaroo Island and described an approximate tenfold difference in the relative abundance of cats per study site between Kangaroo Island and the adjacent mainland.

Introduction:

Toxoplasma gondii is a coccidian parasite of cats that has significant impacts on wildlife (Canfield, Hartley et al. 1990). Toxoplasmosis, the disease caused by *T. gondii*, can cause a range of symptoms in wildlife, including respiratory, neurological and gastrointestinal problems, as well as possible behavioural changes (Canfield, Hartley et al. 1990, Bettiol, Obendorf et al. 2000). Australian marsupials are particularly susceptible to infection, with fatalities observed in many species (Obendorf and Munday 1983, Canfield, Hartley et al. 1990).

On Kangaroo Island (KI), the seroprevalence of *T. gondii* in feral cats and sheep is substantially higher than on mainland South Australia (O'Donoghue, Riley et al. 1987, Fancourt and Jackson 2014), however reasons for the difference are not understood. Possible explanations include differences in the seroprevalence of *T. gondii* in intermediate hosts, cat and/or intermediate host densities, the availability and accessibility of infected macropod carcasses, and/or environmental conditions. Whilst the seroprevalence of *T. gondii* in KI wildlife is unknown, the high prevalence in cats and sheep suggests a high level of environmental contamination with *T. gondii*, thereby exposing wildlife to a high risk of infection. A higher level of environmental contamination may be in part the consequence of higher cat densities on KI, resulting in more infective oocysts passed into the environment. This is of particular concern on KI as the island supports a number of threatened and endemic species, including, the KI dunnart (*Sminthopsis aitkeni*), Southern brown bandicoot (*Isoodon obesulus*) and Australian sea lion (*Neophoca cinerea*). Accordingly, it is vital that we determine the prevalence of *T. gondii* in KI wildlife, and understand if and why it differs to the mainland.

Materials & Methods:

This project aimed to collect blood from small mammal assemblages at three sites on the Dudley Peninsula on KI and three sites on the adjacent Fleurieu Peninsula on mainland SA. Small mammals were trapped in native vegetation using Elliot and cage traps baited with peanut butter and rolled oats. Captured animals were anaesthetised using isoflurane in oxygen for the collection of blood and other samples. All animals were released at the site of capture following processing.

Results:

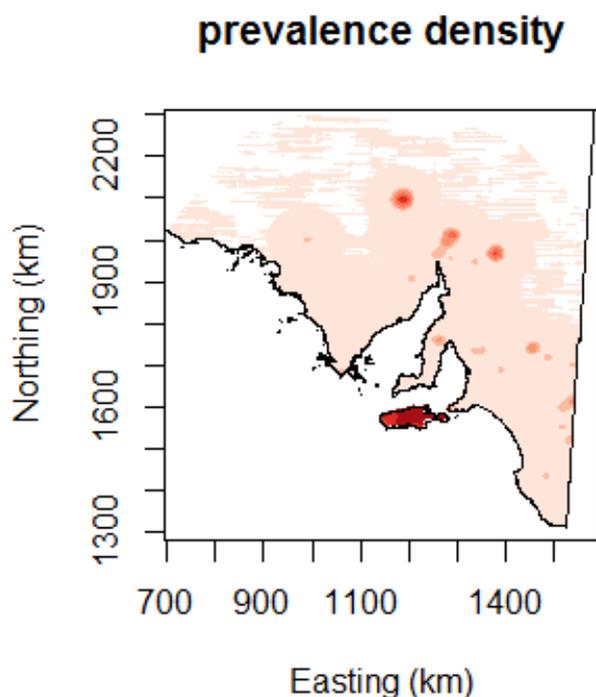
To date we have trapped 4 field sites, three on Kangaroo Island and one on mainland SA. In total we have sampled approximately 200 bush rats (*Rattus fuscipes*), 100 house mice (*Mus Musculus*), 30 brush tail possums (*Trichosurus Vulpecula*) and 10 southern brown bandicoots (*Isoodon obesulus*) (Photos included below). During trapping at Deep Creek Conservation Park on mainland SA we confirmed a healthy and breeding population of southern brown bandicoots (Photos included below). Through, the dissection of two bush rats that died accidentally during trapping, due to foxes shaking Elliot traps, we were able to confirm differences in that jugular anatomy of bush rats when compared to lab rats (*Rattus rattus*).

Other project results:

Using camera traps we have compared the relative abundance of cats between the Dudley Peninsula on Kangaroo Island and the adjacent Fleurieu Peninsula on mainland SA. We deployed 5 cameras at each of 11 sites on both the island and mainland. Camera trap images were then sorted and cats identified. Data on cats were then used in a Royle Nicholes abundance induced heterogeneity model to compare the relative abundance of cats per site between kangaroo Island and mainland SA. The results of this study suggest an approximate tenfold greater relative abundance of cat per sites on the Dudley peninsula on Kangaroo Island when compared to the adjacent Fleurieu Peninsula on mainland SA. Differences in the ability camera trap model to detect cats was also identified; different camera trap models were not equal in their performance.

A third component of this project has identified a spatial cluster of a second cat-borne parasite, *Sarcocystis*, in sheep on Kangaroo Island using Primary Industries and Regions SA abattoir surveillance data (See map below).

Figure: Spatial cluster of macroscopic *Sarcocysts* in Kangaroo Island sheep.



Discussion:

The dissection of bush rats has helped explain why we initially had trouble collecting blood from bush rats. These differences in rat jugular anatomy have not previously been published and we hope will help others wishing to collect blood from native rats for research purposes in future.

To complete the wildlife trapping and blood collection component of our research we must sample small mammal assemblages at two more location on mainland SA. Following animal sampling, blood samples collected will be used to test for and compare the level of exposure to *T. gondii* in small mammals between Kangaroo Island and the adjacent mainland SA.

The tenfold difference in the relative abundance of cats identified between Kangaroo Island and the adjacent mainland is potentially the main reason why cat-borne diseases and parasites cluster on Kangaroo Island, although other explanations remain to be properly tested. Further thought and discussion is needed to address why cats are more abundant on Kangaroo Island and how best to manage or mitigate their impact on native wildlife.

Sarcocystis is a very closely related parasite to *T. gondii* and helps to demonstrate the cluster of cat-borne parasites and disease on Kangaroo Island. By using data layers of environmental variables and overlaying these on our *Sarcocystis* prevalence density map (above), we can increase our understanding of why Kangaroo Island may support increased level of both *Sarcocystis* and *T. gondii*.

References:

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