CHAPTER 5 DISEASE

5.1. Rationale to the approach to disease investigation

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Abstract

The Woylie Disease Reference Council (WDRC) was established to provide a rapid response to the need to identify the possible role(s) of disease in recent woylie declines. The WDRC was designed to efficiently and effectively co-ordinate the complexity of a multidisciplinary and highly collaborative disease investigation including haematology, bacteriology, parisitology virology, toxicology, pathology, nutrition and clinical investigations, epidemiology, and genetics. The broad objectives of the disease investigations associated with the Woylie Conservation Research Project (WCRP) are outlined. The rationale for the WCRP approach, its charter and membership are provided. The general strategies for the disease investigations are listed. In addition to successfully addressing the needs of the WCRP, this approach provides a valuable model for future investigations on disease-related wildlife issues in Western Australia.

5.1.1. Introduction

Australia has the worst modern mammal extinction rate in the world and currently 20% of the remaining mammal species are threatened with extinction. Disease is known to be a primary threat associated with at least 11% of declining vertebrate species (e.g. Yiming and Wilcove, 2005). The Tasmanian devil facial tumour disease, chytridimycosis in many frog species, *Chlamydia* in koalas, *Papilloma* virus in western barred bandicoots, and *Treponema* (human syphilis) in Gilbert's potoroo are just some Australian examples of these cases (Warren *et al.*, 2005). Wildlife diseases as a source of zoonosis are also significant human health issues, including avian influenza, SARS, lyssavirus in some bats, *Rickettsia*, Leptospirosis, hydatid disease, *Salmonella*, Psittacosis, Arboviruses (e.g. Ross River, Murray Valley encephalitis), toxoplasmosis, and mycobacteriosis.

Little is known about the present disease status of Western Australia's native fauna. What information is available is sparse, fragmentary and incomplete, and has largely been opportunistically derived from carcasses. The extent to which infectious diseases represent a threat to wildlife populations in WA will depend upon a complex interplay between characteristics of both the host and the infectious agent which include viruses, bacteria, protozoa and macroparasites, such as helminths and arthropods. The most important host characteristics are population size, density and migration rate.

Infectious diseases may, at least partially, be responsible for the most recent declines in Western Australian small mammal fauna. There is some evidence to support this view: the declines are widespread, but species-selective; they have occurred in the face of continuing fox control through the *Western Shield* program; there are no obvious correlations between the declines and abiotic factors; and preliminary surveys have identified high prevalences of parasitic infection in some populations of some species.

The disease agents potentially responsible for marsupial population declines (either in isolation or in concert with other factors) are extensive and can be grouped as;

1. viral
2. bacterial
3. haemoparasites
4. endoparasitic
5. ectoparasitic
6. toxic
7. nutritional

Other disease-related disciplines include;

8. haematology
9. pathology
10. clinical medicine
11. genetics
12. epidemiology

5.1.2. WCRP objectives for disease investigation

1. Identify parasites and other micro-organisms and evaluate their potential role in woylie declines.
2. Use expertise to prioritise which known and unknown diseases may be associated with woylie declines.
3. Examine indirect evidence (e.g. demographic changes) that may help to determine whether a disease in general or a specific disease may be responsible for recent woylie declines.
4. Assess the prevalence and potential for specific high-risk disease agents to be a causal factor in the decline of woylies.

5.1.3. The Woylie Disease Reference Council (WDRC)

The woylie decline represented a unique opportunity to address a wildlife decline at the outset, using the full breadth of multidisciplinary expertise available in Western Australia. Thus clinicians, ecologists, geneticists, epidemiologists, infectious disease specialists, nutritionists and pathologists were brought together to work on the problem collectively and cooperatively, in terms of planning, execution and interpretation. The Woylie Disease Reference Council (WDRC) has been established with expertise from Murdoch University and Perth Zoo in association with representation from DEC. Such a group response is quite different to bringing in individual expertise only when required for specific data collection, sample analysis, etc.

The rationale for a disease reference council model over other options includes;

- Considerations of the size and complexity of the issues and the short timeframe in which to respond and assess the possible roles of disease while declines were occurring.
- A strength of the council model is the direct involvement of the specialist expertise within each of the disease subdisciplines, which collectively provide an indepth and comprehensive treatment of the major components within wildlife health and disease.

The charter for the WDRC is;

1. Be the principle forum for addressing woylie disease issues.
2. Assist in the collation of existing information on woylie/wildlife diseases in Western Australia
3. Provide expert advice and direction on research priorities into putative disease agents of woylie/wildlife declines
4. Facilitate and develop collaborative endeavours into woylie/wildlife disease research between DEC WCRP staff and disease experts and students.

5.1.3.1. Key WDRC Roles

Woylie Conservation Research Project Co-ordinator	Dr Adrian Wayne
Woylie Disease Reference Council Chair	Prof Andrew Thompson
WDRC Clinical Co-ordinator	Dr Paul Eden
WDRC Pathology Co-ordinator	Dr Graeme Knowles
WDRC Secretary	Dr Halina Burmej

5.1.3.2. WDRC Membership

Prof Andrew Thompson - Parasitology / Principal Murdoch liaison / WDRC chair
A/Prof Stan Fenwick – Microbiology and Public Health
*A/Prof Phil Clark – Clinical Pathology (Haematology)
Dr Phil Nicholls –Pathology
*Dr Graeme Knowles – Pathology / WDRC Pathology Co-ordinator
A/Prof Alan Lymbery – Parasitology and Ecology
Dr Andy Smith – Parasitology and Ecology (ectoparasites)
Dr Peter Adams – Parasitology and Microbiology
Dr Trevor Ellis – Virologist
A/Prof Ian Robertson – Epidemiologist
Cree Monaghan – Wildlife Clinician and Nutritionalist
Paul Eden – Wildlife Clinician / WDRC Clinical Co-ordinator
Carlo Pacioni – PhD Candidate (Molecular genetics)
Nevi Parameswaran – PhD Candidate (Toxoplasmosis in wildlife)
Unaiza Parkar – PhD Candidate (Endoparasites in wildlife)
Yazid Abdad – PhD Candidate (Ectoparasites and *Rickettsia* in wildlife)
*Lisa Hulme-Moir – PhD Candidate (Clinical pathology)
Halina Burmej – PhD Candidate (Ectoparasites in wildlife)
Keith Morris – Fauna Conservation Program Leader (DEC)
Dr Adrian Wayne –WCRP Co-ordinator and Chief Investigator (DEC)
Marnie Swinburn – Warren Region Fauna Conservation Officer (DEC)
Recent membership appointments;
Susana Averis – Trypanosome genetic characterisation
Andrea Reiss - Wildlife Clinician (Biochemistry)
Peter Irwin – Haemaparasites (Piroplasms)

* = recent retirements.

5.1.4. Strategies for addressing disease investigation

- Collation of existing information on woylie/wildlife diseases in WA to develop baseline information for clinically healthy animals in apparently stable populations.
- Development of a comprehensive list of wildlife diseases and an expertise-based risk assessment of their potential as a causal agent in the decline of woylies in southwestern Australia.
- Population screening to identify what diseases may be present and their prevalence in the Upper Warren, Karakamia, and other potentially valuable comparative sites.

- Disease/health profiles of individuals radio-collared and monitored as part of the survivorship and mortality research for direct comparison if/when the individuals are recovered dead.
- Disease/health monitoring and epidemiology as part of the associated trapping programs (i.e. Upper Warren Fauna Monitoring and PCS - density and demographics assessments; trapping programs at other woylie populations in WA and SA).
- Specific disease investigations as evidence become available.
- Diagnosis of sick, moribund and dead animals as they are encountered during other woylie conservation research activities and otherwise encountered opportunistically.
- Collect reference blood serum and other samples that will be stored indefinitely or until new information presents sufficient cause to undertake further analysis and/or specific tests.
- Post-mortem examination to identify factors contributing to the mortality of woylie study subjects and bodies that may opportunistically be recovered. Such post-mortem examinations provide immediate results from gross and light microscopy, but also build an archive of other tissues that can later be used for testing when a candidate agent is proposed.
- Collection and analysis of tissue samples to examine genetic attributes associated with declining and remnant woylie populations.

5.1.5. Discussion

The multidisciplinary and highly collaborative investigations into the potential role of disease in recent woylie declines are effectively and efficiently co-ordinated through the WDRC. Collectively these efforts also serve to substantially improve the knowledge base of diseases, parasites and other infectious agents associated with woylies and sympatric species within southwestern Australia and South Australia.

Identifying what parasites and diseases are present within woylie populations across space and time is the first step to understanding their potential association with woylie declines. Understanding their capacity to facilitate population declines is the second step. In addition to highly pathogenic agents, it is as important to consider infectious agents that may affect behaviour, condition and fecundity in a manner that can increase vulnerability to predation and/or other factors that result in increased mortality or reduced recruitment, given that these too are capable of driving declines such as those observed in woylies.

The very large amount of disease data and information generated within a very short time frame is direct evidence of the effectiveness of the WDRC model and approach used in the WCRP. Subsequent sections of this report describe much of the progress made to date in relation to the many parallel disease investigations underway.

The success of WDRC serves as a model for future investigations on wildlife issues in Western Australia, particularly when disease is believed to be a contributing factor. The WDRC has already played a significant role in the establishment and operations of the collaborative (Murdoch University and DEC) ARC research project “The nature, diversity and potential impact of infectious agents in Western Australian threatened mammals” – funded by an ARC Linkage grant. The activities of the WDRC have, and will continue, to also offer excellent experience and training in wildlife conservation for research students.

5.1.6. References

Yiming, L. and Wilcove, D.S., 2005. Threats to vertebrate species in China and the United States, *BioScience* **55(2)** 147-153.

Warren, K. *et al.* (2005) Ocular *Chlamydiales* infections of western barred bandicoots (*Perameles bougainville*) in Western Australia. *J. Zoo Wildl. Med*. **36**: 100-102.