

# Tuberculosis in Australian seals

## Fact sheet

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### Introductory statement

Tuberculosis is a sporadic cause of morbidity and mortality among fur seals and sea lions in Australia. In addition to its potential impact on the health of seal populations, tuberculosis originating in seals may have the potential to infect other mammalian species including humans and domestic livestock. It is important, therefore, to define the likelihood of transmission and disease-causing potential of seal tuberculosis to humans and livestock. This will enable public health agencies to define 'at risk' groups in the community and formulate risk management strategies aimed at preventing pathogen transfer. In addition, knowledge of the epidemiology of seal tuberculosis will be of interest to livestock industries, particularly those involved in export of beef products.

### Aetiology

Seal tuberculosis is caused by the bacterium *Mycobacterium pinnipedii* (Cousins et al. 2003). Phenotypic and genetic characteristics of this organism place it within the *Mycobacterium tuberculosis* complex. Members of the *M. tuberculosis* complex include *M. tuberculosis* and *M. bovis*, important pathogens of humans and cattle respectively.

### Natural hosts

The natural hosts of *M. pinnipedii* are seal (pinniped) species although the organism has been demonstrated to be capable of infecting a number of other mammalian species including humans and cattle (Forshaw and Phelps 1991; Hunter et al. 1998). Of the pinnipeds, *M. pinnipedii* has, as yet, only been isolated from otariid species (fur seals and sea lions). There are no reports of infection in wild or captive phocid (true) seals.<sup>1</sup>

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<sup>1</sup> *M. pinnipedii* is also known to affect dolphins, and there are a number of other species known to be susceptible including pudu, llama, gorilla and some others. This is important in relation to risk in valuable zoological collections (Cousins pers. comm.).

## World distribution

*M. pinnipedii* has been isolated from seals in Europe, South America and Australasia. However, tuberculosis of wild seals has only been reported from the southern hemisphere. In addition to isolates made from seals from Australian waters, *M. pinnipedii* has been found in wild New Zealand fur seals (*Arctocephalus forsteri*) in New Zealand and in wild Southern sea lions (*Otaria flavescens*), South American fur seals (*A. australis*) and subantarctic fur seals (*A. tropicalis*) in Argentina (Bernardelli et al. 1996; Hunter et al. 1998; Bastida et al. 1999).

## Occurrences in Australia

In Australia, *M. pinnipedii* has been identified as the cause of tubercular lesions in wild individuals from all seal species resident in Australian mainland and Tasmanian waters, these being Australian fur seals (*A. pusillus doriferus*), New Zealand fur seals (*A. forsteri*) and Australian sea lions (*Neophoca cinerea*) (Cousins et al. 1993; Woods et al. 1995). In addition, the bacterium was isolated from New Zealand fur seals and Australian sea lions resident in a captive facility in Western Australia (Forshaw and Phelps 1991). Notably, a strain of *M. pinnipedii* was recovered from a seal trainer from this facility who was suffering from pulmonary tuberculosis. The genotypic characteristics of the strains recovered from the seals and trainer were identical (Thompson et al. 1993).

## Epidemiology

The prevalence of *M. pinnipedii* infection and resulting morbidity and mortality rates in Australian seal populations is unknown. However, opportunistic post mortem surveillance conducted by pathologists in government agencies, universities and zoos suggests a low prevalence of tuberculosis in Australian seals. In addition, no antibodies to *M. tuberculosis* complex bacteria were found in 104 apparently healthy, adult female Australian fur seals sampled in Victoria in 2007 and 2008 (M. Lynch, unpublished data). The means by which infected is transmitted are unknown but it should be presumed that the respiratory route is important as the lung appears to be consistently involved in pathology (Cousins et al. 1993; Woods et al. 1995; Bernardelli et al. 1996). Tuberculosis has been reported from both adult and sub-adult age classes but not from young juveniles or pups. There appears to be a predominance of males in cases of tuberculosis reported from wild seals although the total number of individuals in these reports is small.

## Clinical signs

Wild seals with severe pathology due to tuberculosis typically are in poor body condition, lethargic and spend longer than normal periods of time ashore. They may also display clinical signs associated with impairment of their pulmonary capacity such as increased respiratory effort (Cousins et al. 1993). Increased frequency of coughing has not been reported as typical clinical sign in animals known to be diseased (Forshaw and Phelps 1991). Animals in earlier stages of disease often are usually relatively asymptomatic.

## Diagnosis

Ante mortem diagnosis of tuberculosis in seals can be challenging. The sensitivity and specificity of intradermal tuberculin tests in pinnipeds is unknown and false positive results have been reported (Forshaw and Phelps 1991). A competitive ELISA, developed using sera from confirmed *M. pinnipedii* infected seals was found to be a useful diagnostic aid for animals in the more advanced stages of disease (Cousins 1987). A

recently developed rapid serological test (STAT-PAK, Chembio Diagnostics, Medford, New York) is showing some promise as an aid to tuberculosis diagnosis in pinnipeds (Moser et al. 2008). Seal-specific gamma interferon tests that are used extensively for tuberculosis diagnostics in other mammal species have not yet been developed. The definitive ante mortem diagnosis of tuberculosis in pinnipeds relies on identification of the organism from lung washes either by culture or molecular techniques.

## Pathology

Tuberculosis in seals is characterised primarily by lung and pleural pathology but generalised lesions involving liver, spleen, lymph nodes and, peritoneum is also commonly observed (Cousins et al. 1993; Bernardelli et al. 1996). Typically, lesions are granulomatous in nature and grossly often appear as masses of varying sizes with necrotic, purulent centres. Compared to tubercular lesions seen in cattle and humans, lesions in seals are less caseating and mineralisation and giant cell formation are not prominent (Barnes et al. 2008). Peritoneal and pleural involvement can result in significant effusions into the thoracic and abdominal cavities. The peritoneum and pleura may be coated with villi-like growths consisting of fibrin, lymphoid cells and macrophages. The predominant histological lesions in lungs and abdominal viscera are pyogranulomatous in nature. Acid-fast bacteria can be detected in lesions by Ziehl-Neelsen staining.

## Differential diagnoses

The predominant clinical signs of tuberculosis in seals are non-specific in nature. Grossly, masses within organs and sheets of lymphogranulomatous cells on pleural and peritoneal surfaces may appear neoplastic in nature. However, the histological appearance of lesions and the demonstration acid-fast bacteria within these lesions is highly suggestive of mycobacterial infection.

## Laboratory diagnostic specimens & laboratory procedures

Seals suspected of tuberculosis should have the following samples collected:

**Serum (frozen):** Serological testing (Currently only STAT-PAK test available)

Tissue samples from granulomatous lesions: Mycobacterial-specific culture

**Effusions:** Culture and cytology

**Tissues in formalin:** Histological examination including Z-N stain

**Frozen tissues:** Molecular diagnostics (*M. tuberculosis* complex-specific PCR, 16S sequencing for species identification) and culture.

Tissues should include lung, mediastinal lymph node, liver, mesenteric lymph node, spleen and peritoneum.

## Treatment

Treatment of tuberculosis in seals is currently not indicated as ante mortem tests are not sufficiently sensitive to indicate if treatments have been curative. Therefore, affected wild animals are not suitable for rehabilitation and re-release. In addition, these animals pose an unacceptable zoonotic disease risk if maintained in captivity.

## Prevention and control

Prolonged exposure to infected animals poses a risk to humans, cattle and other pinnipeds. Prevention of human infection is by identification of at risk groups and adoption of appropriate personal protection measures (see below). Cattle have on occasion become infected with *M. pinnipedii*, presumably from association with infected seals; seven such cases have been reported in New Zealand. Seals held in captive facilities are at risk of infection being introduced from other pinnipeds of unknown tuberculosis status. A quarantine period that includes diagnostic investigation by a combination of intradermal tuberculin and serological tests and culture of lung washes is required to minimise risk of disease introduction.

## Surveillance and Management

Wildlife disease surveillance in Australia is coordinated by Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions. NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au).

A search of disease reports contained in eWHIS for all pinniped species found in Australian waters returned three cases of tuberculosis.

## Statistics

Tuberculosis in seals. Source eWHIS

2008: Australian fur seal, Tasmania

2008: Australian fur seal, Tasmania

2000: New Zealand fur seal, NSW

## Research

To more accurately quantify the importance of tuberculosis as a health issue in seal populations, the prevalence of infection needs to be established. This would require the development of a sensitive and specific ante mortem screening test such as a seal-specific gamma interferon assay. Accurate prevalence data would also enable better assessment of the disease risk posed by seal tuberculosis to human and domestic livestock populations.

## Human health implications

Groups at most risk of infection with *M. pinnipedii* from seals are those that have close contact and/or contact of a prolonged duration with infected animals. Such groups include staff working in facilities holding captive pinnipeds particularly those that accept wild seals for treatment and rehabilitation. Other groups potentially at risk are research scientists working with wild pinnipeds and wildlife officers who may handle infected animals. Staff working closely with seals in captive and rehabilitation facilities should be monitored at regular intervals for exposure to *M. tuberculosis* complex bacteria. Both intradermal skin testing and human-specific gamma interferon assays have been utilised for this purpose. Appropriate personal protection

(gloves, protective clothing and mask) should be employed when conducting post mortem examinations on pinnipeds.

## Conclusions

Tuberculosis is known to be present in Australian seal populations. It is caused by a novel member of the *M. tuberculosis* complex, *M. pinnipedii* for which seals are the natural hosts. The prevalence of tuberculosis in Australian seals is unknown but is likely to be low. *M. pinnipedii* is capable of infecting humans and other mammals so appropriate protective measures should be adopted by those at risk of infection to prevent and monitor transmission.

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## To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au).

Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au). We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

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