

Wildlife Ecology and Management

THE IMPACT OF THE TASMANIAN DEVIL'S FACIAL TUMOR
DISEASE ON THE POPULATION AND MANAGEMENT
PROGRAMS.

Introduction:

The Tasmanian Devil (*Sarcophilus harrisii*) is, today, the largest carnivorous marsupial in the world, comparable in size to that of a small dog, but stocky and muscular. Usually, males are larger than females, having an average body length of 65 cm, and an average weight of 8 kg. Its very characteristic fur has a blackish brown shade to it, with the exception of white spots usually found on his neck or other parts of the body.



The Tasmanian Devil used to live all over Australia before European settlers hunted it to extinction on the Australian mainland because of the threat it posed to livestock. Nowadays, we can find them only on the coastal scrub and sclerophyll forest of the Australian island state of Tasmania. These animals spend most of their days in their den or in the shrubbery and hunt at night.

Although they are solitary animals who hunt alone, eating is surprisingly a social event for the Tasmanian Devil. A feast can gather up to 12 individuals (often closely related). When feeding, devils can assume several physical postures, including their characteristic vicious yawn, and quite a few different vocal sounds that they use to communicate as they feed. They usually establish dominance by sound and physical posturing, although aggressive fighting does occur.

The Devil's estimated population size ranges between 20 000 to 50 000 mature individuals. Their sexual maturity is at approximately two years of age, breeding once a year from February to June with up to four young carried in the mother's pouch each year. Mating contains typically biting.

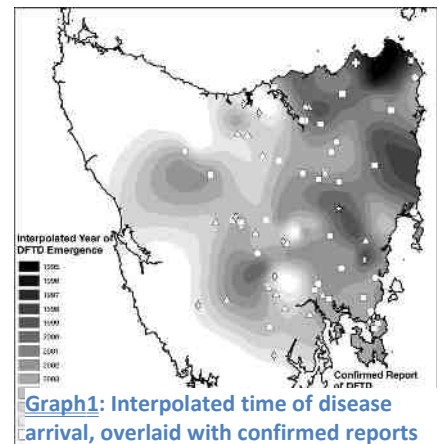
The devils life span is of six years in the wild.

The Tasmanian Devil is listed as a protected and vulnerable animal according to the conservation and protection acts. Until recently, *S. harrisii* were relatively common throughout their natural range and its main threats were road kills and the recent accidental introduction of the red fox. However, in June 2002, fears for the survival of the species were raised when a disease named devil facial tumor disease (DFTD) was associated with an unprecedented decline in their population. By 2005, the tumors were occurring on more than half of the range of the species, and associated with up to 80% population decline. DFTD is now recognized as occurring in the north, central, east, and south areas of Tasmania.

The Devil Facial Tumor Disease (DFTD):

DFTD appears to be a new disease discovered in 1996 that is restricted to Devils, and doesn't infect even closely related species such as the Quoll (*Dasyurus viverrinus*). The obvious spatial and temporal progression of the disease clearly demonstrates that it is infectious and that it is spreading.

The cancer begins as small lesions or lumps in and around the mouth (lips and oral mucosa) and quickly develops into large tumors on the face, neck and shoulders. The infected Tasmanian Devils die either from starvation or breakdown of body functions within 3 to 8 months of the lesion's first appearance. Mortality rate is at a 100% and no immunity or resistance in any individual has been detected or proved.



After its appearance in 1996, additional knowledge and description was vital to understanding the long term impact that the disease could have on population. A detailed description was needed prior to implementing any strategies to combat the disease.

In a first step, in R. LOH, D. HAYES, A.MAHJOOR and al⁴'s article, the neoplasm's histogenesis and biological behavior of the disease were studied by cytology, histological, and microscopical work. "Microscopic analysis confirmed DFTD tumors to be an aggressive, poorly differentiated malignant round cell neoplasm primarily affecting the facial regions of the body with frequent metastatic spread to regional lymph nodes and visceral organs". But unfortunately fails to characterize further the disease. Perhaps the best conclusion and discovery this article comes up with is the fact that there seems to be no viral particles identified in tissues from any cases of DFTD.

The same researchers were able to identify as well as classify the DFTD in another study ³. Using specific neuroendocrine stains along with evidence of weak differentiation, morphologic and ultrastructural characteristics, prove that being of neuroectodermal origin.

The information from these results leads scientists to believe that the cancer may be spread by "allograft theory", when cancerous cells are directly transmitted between individuals, probably when biting each other. As transmission appears to occur by biting, much of which happens during sexual encounters, the dynamics of the disease may be typical to that of sexually transmitted diseases. The DFTD is thus a parasitic cancer or transmissible cancer, in which cells or cluster of cancer cells can be transmitted from animal to animal. There is one similar case known: Canine transmissible venereal

tumor (CTVT) is sexually transmitted cancer between dogs. These cancers have a relatively stable genome as they are able to be transmitted without any vector (viral or other).

Furthermore, evidences that most severe biting injuries occur among adult males and females in the mating season and that the disease persists even at very low population densities suggests that the pathogen may be strongly frequency-dependent (frequency of infected hosts in the population determines the transmission), rather than their density. At least two of the articles come to the same conclusion: there's therefore no threshold population size, the disease will probably not burn out at low host density and it will most likely cause extinction.

Although most of the research done is dated from 2006, the few articles from 2008 show a poor prognosis, worst than first expected in the year 2006.

Several of the articles seem to agree upon the distressing prognosis of the species. Indeed, mark-recapture analysis during the past 12 years and several epidemiological models (from studied articles), combined with estimated rates of ongoing spread, all seem to project local extinction of the Tasmanian Devil over a timeframe of 15 to 20 years from disease's emergence.

An explanation given by *Hannah V. Siddle, Alexandre Kreiss and al* for why there seems to be no immunological reaction or resistance against the DFTD is the low MHC diversity in the devil because of the many population fluctuations over the past centuries. This leads to a failure in recognizing the tumor as "foreign" by the immune system. This is uncommon because tumor cells especially infectious tumor cells (such as the CTVT) escape the immune system by controlling the expression of the MHC. Furthermore, the article gives a strong argument for the allograft theory previously mentioned and hypothesized by the other articles.

Conservation and Management:

An important point which should not be forgotten when wanting to protect the Tasmanian Devil is to continue to learn more about its main threats (DFTD, road kills...).

There are many strategies implemented by local governments while more information was still gathered about the Devil's main menace. Officials started a research program known as the "Save the Tasmanian Devil program" which focuses on important areas such as:

- 1) Population monitoring, helping in having a better view of the disease's infection area and the real impact it has on the population. It was so far believed that the western subpopulation having a small genetic difference would have a better resistance. This turned out to be false according to recent results.

Field monitoring involves trapping devils within a defined area to check for the presence of the disease and determine the number of affected animals. The same area is visited repeatedly to characterize the spread of the disease over time.

- 2) Trapping and removing diseased animals in the hope that the removal of diseased devils from wild populations should decrease disease prevalence and allow more devils to survive beyond their juvenile years and breed.
- 3) Wild management, by creating disease free zones (such as the Tasman Peninsula) where diseased devils are prevented from entering. The peninsula is being considered as a possible "clean area" with the single narrow access point controlled by physical barriers. Trials are still under way to determine the suitable barriers that need to be created. Cattle grid-like structures are being tested for the best shape and spacing for grids as to deter devils from passing. Or bright lights and barking dogs triggered by movement sensitive equipment is also considered.
- 4) An Insurance population was created in response to the impact of DFTD on the species; hundreds of Devils have been shipped to mainland Australian wildlife parks in order to preserve the genetic diversity of the species. These animals could eventually play an important role in helping with the reintroduction of healthy wild populations in Tasmania. These mainly zoo-based populations are probably sufficient to indefinitely maintain the species, but the "Save the Tasmanian Devil Program" is also looking at different management options that preserve the devils' natural behavior.

Unfortunately there's no consensus among scientists in the different articles.

Both articles from *R. LOH, D. HAYES and al* ^{and} concentrate solely on searching for and describing the causative agent and come short when it comes to suggesting conservation strategies.

Hamish McCallum and Menna Jones, seems to lean towards culling the infected animals in the Tasmanian territory. They also suggest trying to reduce the rates of contact between infected and healthy individuals with quarantine and movement control. They also mention the unlikely event of vaccination or similar prophylactic treatment: treating uninfected or/and infected individuals as well as decontamination of the environment. The same researches also show an interesting point: the capacity of the Tasmanian devils to respond to this disease with precocious sexual maturity. This mechanism facilitates early breeding, more rapid growth because of the reduced population density and probably reduced food competition. This gives a small hope in the persistence of the population if enough individuals adopt this new biological feature.

Unfortunately, the tasmanian devil faces another major threat, the European Red Fox (*Vulpus Vulpus*). So far devils have probably been playing a role of competitor (as a 'buffer' species) that prevented establishment of any foxes in Tasmania. However, the recent downfall of Tasmanian devil

partly removes this barrier. If foxes fill these recent emptied niches, it could prevent the Tasmanian devil from re-establishing should the disease be eliminated either through human intervention or natural dispersion in the population.

It is in my opinion that despite the lack of information and the uncertainties associated with this emerging disease, it is better to aim for a robust decision, utilizing all of the management strategies in cooperation, creating a pathway that aims to improve the chances of the survival of the species whilst maintaining the possibility to correct actions as more data becomes available. It is also vital to act quickly before permanent damage is done by the disease, the foxes, or our lack of action.

Unfortunately, the Tasmanian Devils Facial Tumor Disease presents an alarming example of the potential consequences of loss of genetic diversity which is fundamental for disease's resistance. Many other species, including the cheetah, and several species of whales could go down in the same gloomy path as the Tasmanian Devil.

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