

Lessons from the Looming Extinction of the Tasmanian Devil

EXTINCTION in the wild is now regarded as likely for the Tasmanian Devil *Sarcophilus harrissi*. In 1996, a disease, Devil Facial Tumour Disease (DFTD), was seen in a Devil in the wild. By mid-2008, the population had declined by about 70%, and the disease was spreading rapidly from east to west across Tasmania. DFTD is an infectious cancer, passed from one Devil to another principally, or entirely, by biting. The bite implants the cancer cells; the low genetic diversity in the Tasmanian Devil population from previous population bottlenecks or selective sweeps means that those cancer cells are not recognized by the immune system and the cancer grows in the infected Devil. Estimates of the time to extinction in the wild range from about 20 to 35 years. If, however, there are resistant genotypes within the Devil population then extinction in the wild may be averted, with numbers augmented through captive breeding programmes and active management to spread these genotypes in the wild.

The tumour is thought to have arisen as a mutation in one Devil, developing a distinctive complex chromosomal rearrangement, after which it was passed onto other Devils. Thus, all tumours are clonally derived from this single animal, and are essentially identical, but are slightly genetically distinct from their host, although insufficiently so to trigger an immune response. There is some evidence of evolutionary change in the tumour itself, with at least eight chromosomal strains identified, but whether these changes are adaptive is unknown.

Once in a population, disease prevalence increases to at least 50% in adults within four years and it is maintained at that level despite massive population declines. The disease is disfiguring, with the majority of primary cancers being around the mouth. Almost all infected animals die within six months of clinical signs appearing. In a minority of cases, the tumours interfere with feeding or vision as the tumours grow into eye sockets and force teeth out of jaws. Infectious cancers of this type are extremely rare, with only one other example (a venereal tumour of dogs) known. For more detailed information, consult <http://www.dpiw.tas.gov.au/inter.nsf/WebPages/LBUN-5QF86G#WhatIsDevilFacialTum> (accessed 9 July 2008), (Hawkins *et al.* 2006, Pearce and Swift

2006, Jones *et al.* 2007, Lachish *et al.* 2007, McCallum *et al.* 2007, Pyecroft *et al.* 2007, Siddle *et al.* 2007, Woods *et al.* 2007, Jones *et al.* 2008, McCallum in press). A workshop in Hobart on 3-6 July 2008 was convened by the IUCN Conservation Breeding Specialist Group to make recommendations for an insurance plan for the species. Its report will be available later on their website in 2008.

The Tasmanian government has committed \$12 million and the Commonwealth government \$10 million to saving the Devil. Insurance populations, intended to permit reintroduction should extinction in the wild occur, will involve Devils being bred in zoos and wildlife parks, large enclosures and on Tasmanian islands, including fenced off peninsulas. Issues of quarantine, biosecurity, good governance of captive populations, a recovery plan and clear co-ordination of the programme are relevant. As ecologists interested in the conservation of populations of native fauna in the wild, we draw some more general conclusions for conservation biologists.

On the second day of the workshop, Ross Garnaut's climate change report was released. With targets dates of 2020 and 2050 identified for stages in emissions reduction, the matter has captured centre stage in the environmental debate. The plight of the Tasmanian Devil presents a new twist to assessing priorities for conservation action, particularly as the world leaders at the G8 summit struggle to arrive at emissions targets, agreeing only to "share" a vision of a 50% reduction in emissions by 2050 (*Sydney Morning Herald* 9 July 2008). By this date, the disease may have already caused the extinction of the Tasmanian Devil in the wild. However, if the insurance policy is successful, then Devils, re-introduced to the wild, will have resumed their functional ecological role. The point here is that wildlife conservation and insuring the survival of the Devil cannot wait for the "diabolical" policy problem of climate change issue to be met.

A key connection between managing the threats of Devil disease and climate change is the need to consider introducing threatened species to locations in which they are not known to have recently existed. For the Devils, the only medium term way to ensure healthy, free-

ranging populations is by introducing them to offshore islands (or even the mainland of Australia). To address climate change, assisted migration for some species may also be the only way of saving them (Hoegh-Guldberg *et al.* 2008). Some conservationists are opposed to any introduction of a species, including the Devil, beyond its current range. We believe it is time to re-evaluate blanket objection to *ex-situ* introductions to the wild. The situation in Tasmania is complicated by the unfortunate coincidence of the malicious introduction of the European Red Fox *Vulpes vulpes* and the decline of the top mammalian predator, the Devil, which may have held fox populations down. Offshore islands may also need to be considered for the conservation of a raft of medium-sized marsupials that have declined or become extinct on the mainland, and for whom Tasmania was a large fox-free refuge, but which are now threatened in Tasmania by the introduction of the fox. There are no such species, however, that do not coexist and have not coexisted with Devils for many thousands of years on Tasmania or formerly on the Australian mainland; these species should not have difficulty dealing with the same predator on islands, providing there is sufficient suitable habitat. Indeed, most of these species, including the Devil, once occurred on the offshore islands, following rising sea levels on the Bassian Plain to create Bass Strait. Sub-fossil records of Devils on the largest of the offshore islands, Flinders Island, are thought to date to the early period of European / human settlement. At the outset of the workshop, the concern by the Aboriginal community about the use of offshore islands as locations for establishing Devil populations was made clear. The issue relates to an assumption that these islands might be used without consultation with the Aboriginal people, with their present position being that the islands are off limits for Devil translocations. This matter will require skilled negotiation.

The irreversible element of climate change will be the loss of biodiversity. In our view, it should capture more of the policy debate than has been noticeable so far. Instead, price increases dominate the headlines. That comparatively short-term economic issues once again seize centre stage to the detriment of the long-term environmental consequences presents an ethical challenge to all those with responsibility for environmental policy. We are not the first to lament the bias to economic progress over wildlife conservation, but we now have an example in the Devil of a timetable to a loss of an internationally iconic species to press the point for increasing our collective effort to sustain our wildlife, while the big issue of climate change is sorted out. This will involve strategies, such as assisted migration and the

translocation of species, that have not been considered necessary or desirable in the past.

Even in the heart of the Tasmanian wilderness, Devils will bite one another and the disease will relentlessly spread. This means that the major effort to resolve such land use debates as logging vs wilderness will not save the Devil. Fauna conservation is not just a subset of the land use debate, it is a discipline that has its own focus. We recognise that habitat loss, exacerbated by fragmentation and degradation of what remains, is the single biggest issue for conserving biodiversity, but it is not the only issue. Threats from predators, disease and competitors need to be actively managed to prevent further additions to Australia's atrocious record of extinctions of native mammals (the worst record in any continent over the last 200 years).

From a planning perspective, there are features of the decline of the Devil that need to be emphasized. The need for a recovery team arose as a top priority in the workshop, which can be conceptually expanded to say that wildlife generally should be subject to long-term planning, long before crises arise. The value of all the research done to date on Devils is now of immense importance because there is now no time to conduct such research. Without baseline studies of our wildlife, any rescue efforts will be greatly hampered in their effectiveness, and any monitoring programmes would be less likely to detect a problem in its early stages. Threats from entirely novel diseases are particularly insidious. In the case of the Devil, there was about an eight-year gap between the threat arising and its identification as an infectious disease. In the case of the chytrid fungus currently threatening much of Australia's frog biodiversity, declines probably commenced in the early 1980s, but disease was not suggested as a cause until 1996 and the causative agent was not identified until 1998. Only ongoing monitoring, with sharing of patterns of potential declines between workers in different places, offers any prospect of identifying disease threats early.

One only had to step outside the venue of the workshop and look at the number plates of the passing cars. They feature the Thylacine *Thylacinus cynocephalus*; the tragedy of its extinction still haunts all Australians who are keen to see our fauna persist beyond our lifetime. Will a new generation of number plates, perhaps those reserved for fuel-efficient vehicles, feature the Tasmanian Devil to remind us of what was lost, but could have been saved? Not only is decisive action required to save the Devil, but we now need to ensure the action taken allows for climate change. The demise of

the Devil is forcing the pace for us to challenge old dogmas and learn new lessons.

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