11

Metapopulation management of an extreme disease scenario

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Summary

The Tasmanian devil is threatened by a transmissible cancer, devil facial tumour disease (DFTD), which has induced a decline of greater than 80% in the wild population. An insurance population has been established with the goals of maintaining an effective population of > 500 devils for 50 years that is DFTD-free, is genetically representative, is able to sustain a harvest for wild release, maintains a suite of associated flora and fauna (commensal, symbiotic and parasitic), and maintains wild behaviours. The insurance metapopulation now includes more than 550 individuals, from 128 founders, secured at 28 institutions in a combination of intensive captive-breeding enclosures, managed environmental enclosures, free-ranging enclosures, and a population introduced to an island outside the species' known historic range (i.e. a conservation introduction). In the next few years, the insurance metapopulation will incorporate wild-living, DFTD-free Tasmanian devil populations secured within their current range. Translocation of individuals occurs between multiple facilities, locations, Australian states and nations, and is influenced by a disease risk categorisation. The metapopulation is managed by generating recommendations for founder animals, breeding, translocation and harvesting, based on pedigree and genetic data using SPARKS and PMx software, supported by population modelling using VORTEX software. To achieve an effective population size (N_e) of 500, the minimum metapopulation size will need to build to between 1500 and 5000 individuals in order to maintain gene diversity at ≥ 95% for 50 years, while also replacing lost diversity. However, through biosecurity, risk categorisation and quarantine procedures, it is feasible to harvest from, and incorporate, diseased wild populations should they persist, permitting a lower metapopulation size.

Introduction

Wild Tasmanian devil (*Sarcophilus harrisii*) populations have declined by over 80% due to a lethal, transmissible cancer called devil facial tumour disease (DFTD) (Fig. 11.1), which is believed to have originated in the north-east of Tasmania in the mid-1990s (Hawkins *et al*. 2006). DFTD is an allograft, with the cancer cells being transmitted directly from