Developing biosecurity strategies for an invasive reptile,

the plague skink *(Lampropholis delicata)* on Great Barrier Island

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"May your trails be crooked, winding, lonesome, dangerous,

leading to the most amazing view.

May your mountains rise into and above the clouds"

Edward Abbey

Abstract

Human exploration has a long history of removing geographical barriers and facilitating species dispersal. In the last 100 years alone, human activities and international trade have further circumvented these biogeographic boundaries, allowing species to access, establish and impact novel locations at an unprecedented rate.

The biological invasion process is composed of three distinct phases: arrival, establishment and spread. Once established, pest species across plant, invertebrate and vertebrate taxa can cause substantial harm to ecosystems and have severe socioeconomic impacts. Management of pest invasion has historically been reactionary, however, as the consequences have become increasingly apparent, conservation managers and invasion biologists have redirected their focus towards arrival prevention where possible. While efforts have been largely focussed on terrestrial vertebrates, there has been a distinct lack of progression in the development of effective control and eradication techniques for invasive herpetofauna.

The Australian plague skink *(Lampropholis delicata)* arrived in New Zealand in the late 1960s and has rapidly dispersed throughout much of the North Island. Additionally, it has established thriving populations on several off-shore islands in Auckland's Hauraki Gulf. It is now considered as New Zealand's only established pest reptile species since it's classification as an Unwanted Organism under the Biosecurity Act (1993) in 2010. The discovery of *L. delicata* on Great Barrier Island (Aotea) in April 2013 and subsequent biosecurity incursion response have provided the opportunity to test and develop effective control and eradication techniques in the absence of any existing management strategy for this species.

To test and evaluate techniques of detection for low density populations of *L. delicata*, we designed a surveillance system to locate the dispersal pathways and range limits of the plague skink population at Tryphena Wharf, Great Barrier Island. Approximately 750 traps were installed and serviced according to a mixture of standard and removal sampling designs. No skinks were found beyond the estimated boundary line which was supported statistically with 95% confidence.

To test and evaluate eradication techniques we designed a trapping grid system to parameterize the requirements of reducing the plague skink population to extinction using a highly adaptive and experimental operational framework. Two grids were set up using three standard herpetological monitoring trap types at varying spatial intensities according to the practicalities of the heterogeneous and often inaccessible landscape. Intensive trapping was implemented for several months before the effort and tools were statistically evaluated for their efficiency. Logistic ANCOVA indicates the effort was not sufficient, suggesting that greater intensity, greater efficiency or alternative methodologies are required.

To support a multi-facetted management approach a controlled laboratory trial was implemented to test the oral toxicity of acetaminophen to plague skinks. An 'Up-down procedure' was used to calculate the lethal dose required to kill 50% of the population (LD50). Acetaminophen was found to be lethal at a 550 mg/kg dosage, indicating its potential as a commercially viable toxicant.

An urgent focus on the development of effective techniques is required to manage invasive herpetofauna, which are becoming globally problematic at an increasing rate. Our operational field effort and research will make a practical and meaningful contribution towards the development of this field of invasion biology.

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