A strategic plan for kea conservation

Strategic objective 1

Kea Research and Monitoring Plan

A collaboration between the Department of Conservation (DOC) and the Kea Conservation Trust (KCT)

Authors: Orr-Walker, T *[1], Kemp, J[2], Adams, NJ[1, 3], Roberts, LG[1, 3].

*Corresponding author: info@keaconservation.co.nz

1. Kea Conservation Trust, PO Box 2619, Wakatipu, Queenstown 9349.

2. Department of Conservation, Private Bag 5, Nelson, New Zealand

3. Department of Natural Sciences, Unitec Institute of Technology, Private Bag 92025, Auckland, New Zealand.

Draft – V3 April 2017

Contents

1 Vision and Mission

The overall Vision and Mission of the Strategic Plan for Kea Conservation is;

Vision: A healthy and secure future for kea.

Mission: To secure a thriving kea population in the wilds of New Zealand's South Island – Te Wai Pounamu – and a well-managed global captive population that may be appreciated by and inspire all who encounter them.

2 Purpose and scope of this document

The Kea Research and Monitoring Plan has been developed to enable delivery of Objective 1 of the Strategic Plan for Kea Conservation, which states that kea population size, trends, dynamics and genetic structures are measured. This will a) provide conservation managers and kea stakeholders with a better understanding of individual population drivers across the species range, in order to better manage the remaining kea population; and b) provide a list of projects to coordinate research and monitoring across stakeholders.

This document therefore outlines the background, justification, methods and projects needed to achieve this objective under the following Outcomes sections;

1) Estimate kea numbers and measure change in numbers over time
2) Understand how kea populations work (i.e. the relative importance of different vital rates e.g. productivity versus survival)
3) Understand the drivers of genetic structure (present and historical)

3 Background

The structure and dynamics of the remaining kea population is poorly known. Monitoring of kea populations continues to be a challenging task due to the extensive range (an estimated 3.5 million hectares across the length of the South Islands Southern Alps), difficult terrain and breeding habits (annually during winter). Population numbers across the species range of 1000-5000 are a guesstimate only based on information extrapolated from presence/absence data (Atlas data) and existing survey/sightings information. Understanding the population dynamics and structure of kea is vital for ensuring appropriate conservation management. Kea are long lived and have a low reproductive rate. The population dynamics of species with these life history characteristics are particularly sensitive to changes in adult survival rates. Additionally, it is important to understand the impact of predators and threat mitigation methods (including differing pest control methods) on kea survivorship and productivity (refer Aim 2 – National Kea Management Plan for details).

Gaining a better picture of the remnant populations in key areas across the species range, is key to ensuring their appropriate management and survival in the future.

4 Outcomes

4.1 Estimate kea numbers and measure change in numbers over time

An adequate kea counting method is the holy grail of kea population biology. This section describes four potential monitoring methods that might be considered for measuring population change over the long term.

4.1.1 Census

Census data can also be used to estimate total population size, by extrapolation of local density to comparable areas across the species range. Within a defined area it is possible, with great effort, to locate and map a high proportion of the resident adult females.

The approach to estimating total population size is to conduct localised census at carefully selected study areas, under different predator control regimes, calibrate the census results with an index of relative abundance, and then measure relative abundance at a large number of localities across the species range.

Our strategic approach to measuring long term trends is to repeat census the localised census areas at 10 year intervals, and to conduct relative abundance indexing annually.

Project: Census key populations within differing pest control management areas and landscape types. Utilise the results of these to estimate population numbers and establish population structure (e.g. gender biases and age structure), across the kea range.

Project: Review the current 'census' and 'encounter rate' approaches. Explore automatic recording devices. Confirm preferred long term monitoring methodology and establish monitoring programme. Actions: Develop a monitoring strategy.

Project: Follow up radio-tagged adults (particularly females) to determine residency and breeding status and map territory.

4.1.2 Cavity Occupancy

Kea nest cavities are long lasting entities. Breeding pairs generally utilize 1-3 favoured cavities within their home territory over time. 'Favourite' cavities are often taken up by new keas if the old ones die. Long term changes in cavity occupancy rates, expressed as the proportion of cavities occupied per year may, therefore, indicate overall population change. Much of the primary breeding habitat of kea includes upland beech forest and lowland podocarp forest and is where a substantial portion of the research has occurred. Keas nest on the ground in naturally formed cavities such as a small cave/crevice in a rocky outcrop or under the roots of a large tree. Kea breeding occurs in most years, but only about half of all adult females breed in any given years. Egg-laying occurs August-November in upland beech forests and July-August in lowland rimu forests. The female cares for the eggs and nestlings in the cavity, while the male forages for the whole family. It takes a pair of keas four months to hatch the eggs and raise the nestlings into free-flying fledglings

Currently, the collection of cavity occupancy data relies on repeated visits to all known nest cavities during each breeding season. Trail cameras can be used to reduce the number of observer visits required. In addition, cavity occupancy data might be collected remotely, using long life electronic devices placed at the cavity (cavitometers). The device would count visits by keas, and then transmit the data to a fixed wing aircraft or a ground based observer. With the move to egg-timer transmitters, SkyRanger technology will be routinely used in future (refer to appendix for details of this technology). Monitoring of Cavitometers, therefore, can occur during routine skyranger flights at little or no extra cost.

Project: Deploy trail cams at known nest cavities in July. Download data throughout the nesting season and analyse. Retrieve all cameras in February.

Project: Develop 'Cavitometer'.

4.1.3 Visitation rates at sites of human activity

Counts of keas present at alpine car parks and villages may reveal population trends over time. However, these sites possibly present a biased picture if they are particularly attractive to keas. That is, if carparks are particularly attractive, then counts might be stable while the greater population declines. Furthermore, adult female keas seldom visit carparks, so there might be a time lag between a decline in adult females and a decline in carpark counts of young keas. The pros and cons of this method need to be properly addressed and a counting protocol devised if the method appears justifiable.

Project: Assess pros and cons of counts at sites of human activity, conduct power analysis, devise methodology, and implement counts.

4.1.4 Call count surveys

Annual treeline surveys conducted after the breeding season can shed light on population dynamics within study sites. They have been attempted already at 4 sites over 5 years, with calls per hour correlating encouragingly with census results. An advantage of this method is that all ages and genders may be encountered. Recent productivity can be gauged. Adult females may be encountered and captured for fitting with radio tags. This methodology could utilise voice recorders to record kea calls over longer periods and reduce the labour required.

Project: Formally report results of treeline surveys to date. Make recommendations for future use of this method.

Project: Explore utility of automatic call recorders as a monitoring tool, for indexing relative abundance, including analysis of the DOC bird recording data set, held by Graeme Elliott, from South Westland.

4.2 Understand kea population dynamics

The widely accepted method for understanding how animal populations work (i.e. what drives growth) is population simulation modelling. This is a computer based method, requiring estimates of population parameters such as sex ratio, age structure, age at first breeding, annual productivity rates, annual age-specific survival rates and annual immigration and emigration rates rates. Population models use this information to identify which factors are most important to the growth of a population over time. Thus, they help to target research and monitoring to the most critical factors.

Our strategic approach to understanding how kea populations work is to have a working kea population model developed and refined by an appropriate scientist. Field studies will be guided by the recommendations arising from analysis using the model. The KCT/DOC kea science advisors will be familiar with the model.

Project: Produce population model integrating all current information on sex ratios, survival rates and productivity rates. Incorporate DOC's Natural Heritage Management System (NHMS) programme, AHB possum control strategy, community pest control programmes (Which areas will be under predator control? What type of predator control?) and new data on kea movements and dispersal into spatially explicit population model being developed by DoC and University of Auckland.

Actions: Work with relevant organisations on dispersal data collection and model building. Write up implications and recommendations arising from it.

Project: Measure nest survivorship with respect to stoat plagues and predator control

Project: Measure kea dispersal distances

4.3 Understand kea population dynamics

The South Island kea population was previously assumed to be a single genetic unit. This assumption was based on the contiguousness of habitat within the species' range (Figure 1 in the Strategic Plan for Kea Conservation document) combined with the kea's strong powers of dispersal. However, some fragmentation of the species does exist, most notably in the east (Figure 1). A recent study undertaken at the University of Otago (Dussex et al, 2014) has confirmed this assumption. Tissue samples were collected from a large number of birds representing most known areas inhabited by kea throughout the South Island, results showing that the wild kea population appears to be a single genetic unit due to a single contiguousness habitat and large dispersal distances (Dussex et al, 2014).

Comparison of contemporary, historical and fossil kea samples shows a loss of mitochondrial diversity since the end of the last glaciation (Otiran Glacial) but no loss of overall genetic diversity associated with the cull. Microsatellite data indicated a recent bottleneck for only one population and a range-wide decline in effective population size (N_e)dating back some 300 – 6,000 years ago, a period predating European arrival in NZ. These results suggest that despite a recent human persecution, kea might have experienced a large population decline before stabilizing in numbers prior to human settlement of New Zealand in response to Holocene changes in habitat distribution. This therefore highlights the need to understand the respective effects of climate change and human activities on endangered species dynamics when proposing conservation guidelines (Dussex et al, 2015).

Project: Consider results and recommendations from Dussex et al, 2014 related to genetics to better understand the drivers of kea genetic diversity and any implications on kea management.

5 Assessment of management objectives – implementation, monitoring, reporting and review

Evaluation to be conducted at the end of each project or annually (whichever comes first) to ascertain programmes effectiveness. Evaluation summaries to be discussed to ensure appropriate incorporation into further programmes.

6 Appendices

6.1 List of projects, timeframes and outcomes