Grand skink (*Oligosoma grande*) and Otago Skink (*Oligosoma otagense*) Captive Management Plan 2007-2014

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Adult female grand skink in rock crack Photo: James Reardon

INTRODUCTION

The Grand and Otago skink Captive Management Plan is a statement of policy and direction for the Captive Management of these two species for the period 2007-2012. It provides more detail of the objectives set out in the grand and Otago skink recovery plan and gives context for the grand and Otago skink husbandry manual.

Captive management of grand and Otago skinks is undertaken by a range of individuals and institutions. The purpose of this plan is to provide a frame work for these people and institutions of the direction for captive management.

The draft plan has been reviewed by captive holders, the grand and Otago skink recovery group. It is approved for implementation by the Department.

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1. Introduction

1.1 TAXONOMY

Grand skink	*Oligosoma grande*
Otago skink	*Oligosoma otagense*
FAMILY	Scincidae
ORDER	Sauria
CLASS	Reptilia

1.2 CONSERVATION STATUS

Under the Department of Conservation's threat ranking system, both grand and Otago skinks are listed as Nationally Critical, with the qualifiers Conservation Dependent (likely to move to a higher threat category if current management ceases) and Human Induced (present distribution is a result of direct or indirect human activity) (Hitchmough et al. 2005).

In the New Zealand Threat Classification System both species meet criteria number 3 for listing in the highest possible threat ranking: There is a predicted decline of > 80% in the total population in the next 10 years due to existing threats.

The Nationally Critical ranking equates with the IUCN 2000 Red List of Threatened Species category "Critically Endangered".

The distribution of Grand and Otago skinks is now restricted to 8% of their former range, with the population trend still in serious decline. The main causes for the decline are likely to be habitat destruction/degradation and introduced mammalian predators (refer to Grand and Otago skink recovery programme summary and Annual Report 2006 DOCDM-108134).

1.3 HISTORY IN CAPTIVITY

Grand and Otago skinks have probably been collected from the wild and kept in captivity ever since European occupation of Otago began.

Otago skinks: first known to be collected from the wild in the mid 1960's. Olive Smithells and her family of Dunedin made regular forays to known Otago skink sites in inland Otago during the 1960's (probably Sutton), and collected a number of pairs. They also sent a pair to Gerald Durrell at the Jersey Zoo, UK, which died soon after. All those the Smithells captured were released into the wild prior to the family moving on to the North Island sometime in the 1970's. At least eight private collectors captured Otago skinks between 1970 and 1982, prior to collection becoming illegal. They are known to have been collected from Macraes Flat, Emerald Creek, Middlemarch, Conical Hill, Sutton and Pukerangi. Six of these are listed on the Otago Skink database and all have died. One captured as an adult in 1970 survived until 2003.

From 1985 to 1986 David Towns collected five Otago skinks; four from Macraes Flat and one from Deighton Creek for the National Wildlife Centre (NWC) at Mount Bruce, Wairarapa. No breeding was recorded at NWC and in July 1992 the three surviving specimens were transferred to Mike Kean, and the male was subsequently transferred to

Dennis Keall. One of these animals is still alive and is the last to be taken into captivity from the wild. In March 2008, 12 Otago skinks were taken into captivity from Macraes Flat. As of December 2008 97 Otago skinks are in captivity, spread over 12 facilities, and all of them are from Otago's Middlemarch/Macraes Flat/Deighton Creek area (i.e. from the Eastern population).

Grand skinks: David Towns took eight grand skinks into captivity between 1983 and 1985, from Ross Road, Macraes Flat. Four of them went to NWC to found a captive colony; the other four went to Canterbury University, before being sent to NWC in 1985. Two juveniles (female half siblings) were produced in October and November 1986, and a single juvenile in November 1986. The unsexed juvenile was sent to Orana Park, Christchurch.

Marion Priest collected four grand skinks in February 1988. They first went to Rainbow Springs, Rotorua and were transferred to Orana Park in May 1989. In 1993, the only surviving skink was transferred to Mike Kean, but died a few days later. The five surviving skinks from NWC were handed to Mike Kean in 1992. The only male died two years later in 1993. One of the females born at NWC died suddenly in 1997, and another female died in 2004. A male grand skink was collected illegally by a tourist in 1991 and given to Martin Foster in Matamata. This animal was handed to Mike Kean in 1993.

In 2005, 8 grand skinks were taken into captivity from Macraes Flat, of which 4 remain. In March 2008, 12 grand skinks were taken into captivity from Macraes Flat. As of December 2008, there are 19 grand skinks in captivity, 18 of which originated from the Macraes Flat area, and the other was born in captivity in January 2008. Mike Kean holds 8 (3 females, 5 males), Dennis Keall holds 5 (2 males, 2 females, 1 juvenile) and Wellington Zoo hold 6 (3 males, 3 females).

Record keeping: A SPARKS database was first set up in 1985 to maintain grand and Otago skinks records. Only skinks alive in captivity at the time were included into the database; for many of them, collection dates and locality information wasn't available. In 1993, Rob Lawrence of Orana Park was appointed captive management coordinator and took responsibility for the SPARKS database until he left Orana Park in 1996, when additions to ceased. At the same time, Mike Kean set up a second database and became captive management coordinator. This database was entered into SPARKS by the CMR in 2008; the same was also completed for grand skinks.

Success in captive husbandry and breeding

Otago skinks: Over the years many improvements have been made to Otago skink captive husbandry, resulting in repeated successful breeding events. In particular, the establishment of ecto-parasite free enclosures resulted in immediate breeding success for Otago skinks (Dennis Keall pers. comm.). Of note, reproductive output in captivity apparently exceeds that observed in the wild (Mike Kean pers. obs., Cree, 1994).

In the wild, female Otago skinks reproduce annually and reach maturity at 101-106 mm snout-vent-length (SVL). Their annual reproductive output has been estimated at 2.34 offspring/female/year (Cree 1994). Captive females have been known to produce a clutch at 48mm SVL (2 years of age; Dennis Keall pers. comm.). Litters of 5 and 6 have been produced on occasion in captivity, a phenomenon never observed in the wild. The generation time (birth to reproducing) for Otago skinks is 3-4 years, based on information both from the wild and from captive animals. They have a life span of 40+ years, based on skinks that were caught in the wild in the 1970's. Second and third generation Otago skinks have been produced in captivity.

Grand skinks: There has been recent breeding success with grand skinks. In the wild, female grand skinks reach reproductive maturity at a snout-vent-length of 78-81mm.

Most females produce a young each year, with an estimated annual reproductive output of 2.17 offspring/female/year (Cree 1994). Based on information from the wild, the generation time for grand skinks is also 3-4 years. Grand skinks live 12+ years in the wild and can reach 26+ years in captivity; a female captured as an adult in 1983 is still alive).

Origins of existing stock

Otago skinks
Of the 97 Otago skinks now held in captivity, all but 16 were born in captivity. All Otago skinks originate from Otago's Middlemarch/Macraes Flat/Deighton Creek area.

Grand skinks
Of the 18 wild caught skinks, all but one of the existing was collected from the Macraes Flat vicinity. A tourist took one male grand skink from an unknown location.

Current captive holdings

Table 1. Otago skinks alive in captivity as at 30 December 2008.

	Male	Female	Unsexed	Total
Richard Brosnan	2	1		**3**
Paul Mainwaring	2	2		**4**
Mike Kean	8	10	1	**19**
Ivan Borich	2	2	2	**6**
Gary Molloy	2	3	9	**14**
John Greenwood	3	3	2	**8**
Otorohanga Kiwi House	1	1		**2**
Willowbank	1	3		**4**
Malcolm Bazeley				**0**
Dennis Keall	5	9	1	**15**
Wellington Zoo	4	5	3	**12**
COET	4	3	3	**10**
Total	**34**	**42**	**21**	**97**

Table 2. Grand skinks alive in captivity as at 30 December 2008.

	Male	Female	Unsexed	Total
Mike Kean	3	5		**8**
Dennis Keall	2	2	1	**5**
Total	**8**	**11**	**1**	**19**

1.4 CAPTIVE MANAGEMENT POLICY

Grand and Otago skinks are included in category 1 of the department's policy on Captive Management of Wildlife and absolutely protected under the Wildlife Act 1953 (OLDDM-781413). This incorporates species where captive management forms an important part of recovery in the wild. One of the principles stated in the Captive Management Policy is:

…animals of threatened species should not be held in captivity except where recommended and approved as an action in a species recovery plan and where a captive management plan has been approved to support the in situ conservation of the species.

In cases where captive (ex situ) management has been identified as a component of a threatened protected species recovery strategy, there should be:

…close integration between ex situ and in situ programmes, with captive management designed to support programmes aimed at conserving the species in the wild (DOC 2003).

The department's Captive Management Standard Operating Procedure (SOP) (DOCDM-266180) provides the criteria for holding protected species in captivity under Category 1 – Species recovery or ecosystem restoration purposes. All holders of grand and Otago skinks are required to operate under the requirements of the Captive Management Plan and Husbandry Manual.

2. Goals, objectives and context of captive management plan

2.1 TIME FRAME OF PLAN

The recovery strategy for grand and Otago skinks is set out in the Grand and Otago skink Recovery Plan 2006 – 2016 (Norbury, Reardon & McKinlay 2006).
The Captive Management Plan (CMP) covers the next 5 years (2007 – 2012). The Captive Management Plan should be read in conjunction with the Grand and Otago skink Recovery Plan (2006-2016) and the Grand and Otago skink Husbandry Manual (2007).

2.2 LONG-TERM GOALS

The long-term recovery goal of the Grand and Otago skink Recovery Plan is:

To maintain and restore viable populations of grand and Otago skinks across their natural range, and to maintain their genetic diversity.

Within this long-term goal are four goals for the recovery plan period 2006 – 2016:
1. Identify the agents of decline
2. Secure both species in captivity
3. Secure both species in the wild
4. Raise community awareness and support for skink conservation

Captive management supports the preferred option for recovery identified in the Recovery Plan (Norbury et al 2006; Section 1.6), and will be used as a tool to secure the taxa and help maintain the genetic diversity of both species (Recovery Plan objectives 2.1 and 7.1). The other important roles of the captive populations are as part of research and translocation programmes, education and advocacy.

The long-term goal of the captive population is to secure in captivity a genetically representative population of grand and Otago skinks. This will safeguard against further loss of genetic variability, the risk of the species' extinction. and to directly support in-situ recovery initiatives by providing animals for future release into the wild.

2.3 OBJECTIVES OF CAPTIVE MANAGEMENT PLAN

Objective 1: Achieve security of genotypic variability for both species' eastern and western populations by captive breeding representative wild remnant populations.
Objective 2: Maintain a captive population large enough to maintain genetic variability and provide insurance against failure of in-situ management treatments.
Objective 3: Refine and document husbandry techniques for skinks and provide minimum health standards for screening and translocation.
Objective 4: Provide skinks for reintroduction into secure habitat, as and when it becomes available and for the development of translocation techniques.
Objective 5: Research and trial, applications that may be used for skink conservation.

Objective 6: Provide continuing support to the captive management community through advice and leadership

Objective 7: Raise community awareness and support for skink conservation.

Objectives 1 – 6 are the highest priority for captive management.

3. Captive management strategy and work plan

Objective 1: Achieve security of genotypic variability for both species' eastern and western populations by captive breeding of representative wild remnant populations.

Explanation
Grand and Otago skinks are now known from only two areas that together cover just 8% of their estimated former range. It is desirable to keep the genetic base of these severely diminished populations as variable as possible, to conserve the species' potential for adaptation, and to avoid the long-term effects of inbreeding depression. The captive programme aims to secure and breed from representatives of the eastern and western populations.

Using existing captive stock and from the founder populations to be collected from the eastern and western populations in 2007/8, it is essential that maximal out-breeding is achieved through the use of individual records and studbook maintenance, to minimise loss of variability from the groups whilst maintaining the eastern and western populations separately. This out-breeding programme should be pursued until the captive population is at the capacity of the holding facilities/individuals. The captive management programme is subject to review, following more accurate information on genetic variation and representation in the captive populations of alleles.

Currently, private individuals dominate the productive aspect of the captive management programme and hold the greatest skills. Institutions such as zoos and private conservation parks are also expressing interest in being involved. Such groups, with the appropriate facilities and experience, will be encouraged to participate.

Tasks
- Engage further captive facilities, to expand the programme's capacity, operating under the department's Captive Management SOP. Finalise which organisations and individuals will be included in the captive management programme.
- All skinks in the programme will undergo veterinary health screening as soon as possible, as a prerequisite to full inclusion in the captive programme. It is important that new skinks collected from the wild are not exposed to unscreened captive stock.

Responsibility: Recovery Group, Captive Management Ranger
Timeframe: By end of 2007

- Seek advice from molecular ecologists to finalise numbers of animals required to secure each genetically distinct population in captivity, and the best way to manage them (Recovery Plan Objective 2.1).
- Harvest founder stock from a diverse range of wild populations for captivity. These highly valuable individuals will go to herpetoculturalists with proven experience.
- Provide the Captive Management Ranger with SPARKS studbook (or similar) and associated programmes, appropriate training and on-going support.

Responsibility: Recovery Group
Timeframe: By end of 2007

- Maintain stable, self-sustaining populations of GAOS from both east and west as distinct units.
- Breed from captive stock with the focus on out-breeding, to achieve maximum conservation of genetic variability, using SPARKS or a similar studbook system.
- Ensure all individual animals are accompanied by individual records that are clearly accountable to a given specimen, and contain pertinent data on parentage, age, health records, weights/measurements, transfers, reproductive history and progeny etc.
- Maintain a stud book for all captive stock and animals that are moved between collections, in accordance with breeding requirements, and informed by inbreeding co-efficients calculated from the stud book management system.

Responsibility: Captive Management Co-ordinator and Captive Management Ranger
Timeframe: By end of 2008/09 season.

Objective 2: Maintain a captive population large enough to maintain genetic security and provide insurance against failure of in-situ management treatments.

Explanation
The captive management programme is critical as insurance against failure of the in-situ management treatments to restore skink populations (Norbury et al. 2006). The in-situ programmes are experimental management that aim to identify the key agents of decline. Therefore, not yet at the stage where the taxa can be secured in the wild.

Tasks
- Engage further captive facilities as necessary to expand the programme's capacity. Facilities may play different roles in supporting the programme, such as head starting/rearing juveniles to maturity or breeding genetically valuable individuals.
- Engage with holders to ensure this objective is achievable.
- The maximum number of animals to be held in captivity will be determined by the Recovery Group and reviewed annually.
- Follow documented husbandry techniques to maximise productivity.

Responsibility: Recovery Group, Captive Management Co-ordinator (CMC) and Captive Management Ranger (CMR)
Timeframe: Ongoing until captive population at holding capacity

Objective 3: Refine and document husbandry techniques for grand and Otago skinks.

Explanation
Grand and Otago skinks require the application of specialised husbandry techniques to ensure their survival and reproduction in captivity. There are a number of health requirements and record requirements that are prerequisites for captive animals retaining their value to conservation outcomes. The highest husbandry and documentation standards must, therefore, be maintained. A husbandry manual for grand

and Otago skinks has been developed and requires detailed record keeping by all captive holders to increase productivity and further improve current techniques.

Improvements and refinements to the husbandry of both skink species are expected. These must be documented to be included in updates of the husbandry manual. As such, the success and/or failure of various protocols adopted by all or some of the captive facilities must be reported. Regular communication between the CMC, CMR, captive skink holders and the Recovery Group is essential for information exchange and progress.

The CMC and CMR will collate significant findings and modifications to husbandry protocols and report these annually to the recovery group.

The husbandry manual has been released to the GAOS Captive holders as a Wiki. It can be found at http://wildlifemanagement.net.nz/wiki/doku.php?id=grand_and_otago_skinks All captive holders will be encouraged to post changes in practice here. Debate on changes to the Husbandry Manual will be overseen by the Captive Management Ranger and Captive Management Coordinator.

Annual reports are required from each holder by 30 April each year. This short document or email should detail the year's highlights (specifically breeding data and notes) and health issues. All reports from holders will be presented by the CMC or CMR on behalf of all the captive facilities at the annual recovery group meeting. All holders will receive a copy.

Tasks

- Complete a husbandry manual for Grand and Otago skinks
- Manage changes to the Husbandry Manual as required.

Responsibility: Programme Manager GAOS recovery programme, in consultation with Captive Management Coordinator.
Timeframe: Completion of initial manual by 30 June 2007

- The CMC and CMR will endeavour to be informed of any new husbandry developments and issues and will inform all holders and the Recovery Group as required.
- Obtain an annual report from each captive holder by 30 April each year. Collate and present to the annual recovery group meeting. Ensure all holders receive a copy.

Responsibility: Captive Management Co-ordinator and Captive Management Ranger
Timeframe: Annually and ongoing

Objective 4: Provide skinks for reintroduction into secure habitat as and when it becomes available.

Explanation
A re-introduction programme has yet to be developed, as current recovery efforts for in-situ populations are still in the research phase (Recovery phase 1 – researching agents of decline). The timeframe for completing this phase is unknown and depends on the outcome of the experimental mammal control treatments. However, it is expected that

growth of the captive population will take some time and needs to be initiated as soon as possible in advance of sites becoming available for release into the wild.

If timing of these does not match, temporary maintenance of animals might be necessary in case numbers are ready for release before sites are available. Captive stock will be translocated for release when there are captive skinks surplus to the maintenance of the genome within the captive populations. And when proven secure habitat is identified and maintained, with skink abundances known to be below carrying capacity of the environment.

Techniques for the successful re-introduction of captive-bred grand and Otago skinks into the wild are also yet to be developed. Three small predator-proof enclosures based in-situ at Macraes flat will provide the opportunity to carry out the first translocation trials. These could be undertaken as soon as March 2007.

Tasks

- Breed grand and Otago skinks in captivity for reintroduction programmes and maintain them until secure habitat becomes available for reintroduction.
- Provide skinks for translocation trials.

Responsibility: Captive Management Co-ordinator and Captive Management Ranger
Timeframe: start mid-2007

Objective 5: Research and trial techniques that may be used for conservation of skinks

Explanation
Captive animals are accessible, readily observed and compared with wild animals. This makes them ideal subjects to trial proposed applications or techniques. The close monitoring available in the captive situation can help to prevent or respond to, any problems developing as a result of trials. Captive stock will be available for experimental management when there are captive skinks, within the captive populations, surplus to the maintenance of the genome.

Research is needed to investigate issues such as:

- optimum parasitology and disease treatments
- development of translocation and release techniques
- in-situ carrying capacity

The knowledge gained from these trials can greatly benefit the conservation of the overall population and improve current techniques.

Tasks

- Breed and maintain grand and Otago skinks in captivity, and identify appropriate skinks for experimental management or research, without detriment to objectives 1-4 of this plan.
- Research will only be undertaken on the approval of the recovery group.

Responsibility: Captive Management Co-ordinator, Captive Management Ranger, Recovery Group
Timeframe: As required by Recovery Group

Objective 6: Provide continuing support to the captive management community through advice and leadership

Explanation

The Captive Management Co-ordinator and the Captive Management Ranger will provide direction and advice, as required, to all members of the captive management community. The aim is to facilitate compliance with the precepts of the CMP, and the requirements of the husbandry manual, through advice, meetings, and supplying information and practical help as and when required.

An annual framework of communications and meetings with the captive breeding community will also operate under this objective.

Tasks

- Ensure captive holders with grand and Otago skinks have a strong and open relationship with the Captive Management Co-ordinator and Captive Management Ranger. This will be achieved through face-to-face meetings, clear communication of the scope of the whole GAOS Recovery Programme, and sincere engagement over any husbandry issues.
- Establish a regular format for two-way communication with the captive management community, through electronic updates and annual meetings.
- Lend support as deemed necessary to ensure all required data are collected in appropriate manner and communicated to the CMC and CMR within specified timeframes.
- Be available to offer practical help to any member of the captive breeding community facing technical, logistical or resource problems.
- Provide the required support to ensure that all members of the captive breeding community are able to participate in the programme.

Responsibility: Captive Management Co-ordinator, Captive Management Ranger.

Timeframe: Ongoing

Objective 7: Raise community awareness and support for skink conservation.

Explanation

Public awareness of the conservation status and threats faced by grand and Otago skinks is limited. Further community awareness should lead to improving public commitment to the conservation of the skinks in the long term (Norbury et al. 2006).

Captive holdings provide an ideal opportunity for the public to view grand and Otago skinks, and learn about the threats they face and the conservation management that is being undertaken. An advocacy plan (prepared by John Gordon, Otago CRO) for Grand and Otago skinks, approved by the recovery group (Recovery Plan Objective 10.3), is being developed by Otago Conservancy, under which captive holders displaying the skinks to the public are expected to participate.

This advocacy objective is secondary to, and must not negatively impact on, the other objectives of this plan.

Tasks

- Ensure captive holders with grand and Otago skinks on display operate under the Otago Conservancy's grand and Otago skink advocacy plan (strategy).

- Captive grand and Otago skinks on public display must always be accompanied by up to date advocacy material as outlined in the advocacy plan (strategy).
- Up to date information about wild populations will be provided to the holders via the CMR.

Responsibility: Captive Management Co-ordinator, Captive Management Ranger, Recovery Group
Timeframe: Ongoing

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