Rehabilitation as a management tool to enhance population size of yellow-eyed penguins

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The most dramatic outcome of rehabiliation: creation of a new colony through translocation of rehabiliated penguins
Janice Jones hand-fed two penguins, Sweet Pea and Diesel Dick, on site at Katiki Point as part of their soft-release in 1991. They remained to breed here in 1991, initiating a new colony and fledging 28 chicks over 15 seasons. Sweet Pea has been the most productive female at Moeraki. A total of 17 of her female descendants have returned to breed, resulting in a further 133 chicks fledged by 2018. Sweet Pea suffered an eye injury in 2005 and was rehabilitated off-site for 3 months. Meanwhile Diesel Dick was seduced by Jezebel. When Sweet Pea finally returned she was attacked by Jezebel, went to sea and was never seen again: a cautionary tale against keeping birds too long in rehabiliation.

Introduction

The population of the endangered yellow-eyed penguins *Megadyptes antipodes* is declining rapidly along the south-eastern coast of South Island, New Zealand. Nest numbers have fluctuated; rising from 453 in 1982 to a peak of 642 in 1996 and subsequently declining to 227 in 2018, at an overall arithmetic average annual decline of 1.9% through 37 seasons. Rehabilitation has been shown to be an effective management technique for this species, increasing the average annual survival of female breeders by 9% at a colony on Otago Peninsula [1].

At Moeraki, North Otago, intensive management by Penguin Rescue began in 1982 with six nests (1.5% of the South Island total), peaked with 58 nests in 2013 and 2014 and finished at 41 nests in 2018 (18% of the South Island total), at an average annual increase of 5.5%.
Rehabilitation of compromised penguins began at Moeraki in 1984. Here we assess the impact of rehabilitation on the Moeraki population and present the most common reasons for rehabilitating penguins over the last 35 years.

Criteria
We restricted our assessment to penguins rehabilitated to either juveniles (recognisable as fledged birds up to midway through their first moult) or adults (older birds); and assumed that they would have died if not rehabilitated. Analyses excluded chicks because we could not assume that all would have died without rehabilitation. The sample size was for the number of individuals (not number of admissions), with individuals scored on their first admission to our rehabilitation facility.

Accounting for anomalies
In an idealised marked population, all breeders and their descendants are identified. Consequently all unmarked breeders encountered are either immigrants from an unmarked population or individuals that have lost their identification mark. As with all marked populations of yellow-eyed penguins, the Moeraki population contains unmarked individuals. In order to resolve this anomaly, we present outcomes as ranges, not as definite values.

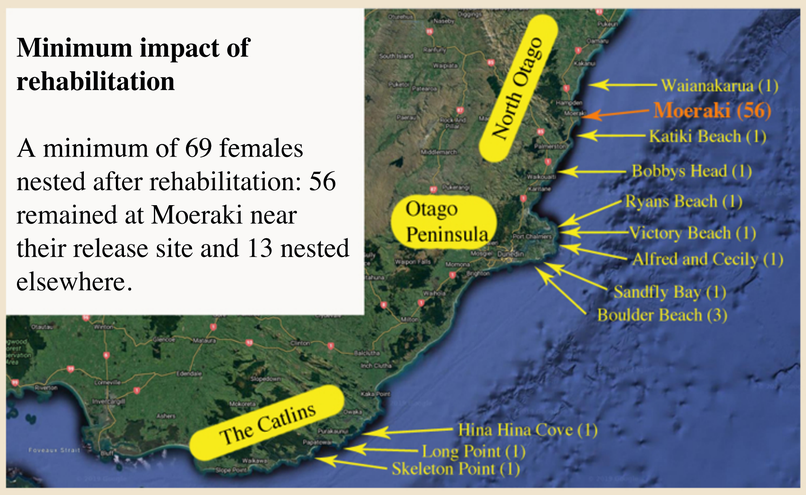
Numbers rehabilitated
A total of 610 individuals were successfully rehabilitated through the duration. Of these 22 had anomalous marks (either misread or not in any data base) leaving a valid total of 588 of which 499 were marked and 89 unmarked.

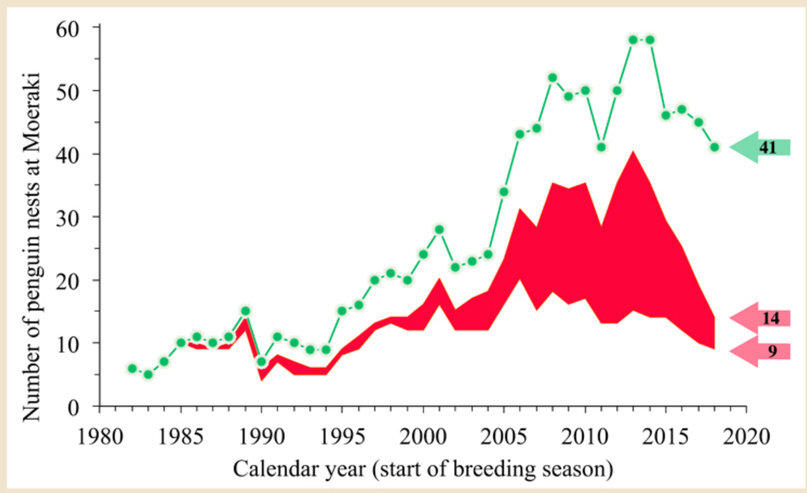
Analyses

Analyses were restricted to females that bred after rehabilitation because males vastly outnumber females in the population[2] a pattern repeated at Moeraki.
To resolve the anomaly of unmarked birds we split female breeders into two categories. (1) Minimum impact of rehabilitation—number of rehabilitated females marked as pre-breeders (typically as chicks or juveniles) and their female descendants.
(2) Maximum impact of rehabilitation—number of unmarked female recruits, and adult females marked in rehabilitation, and their female descendants. Some females in this category were later rehabilitated and the outcome of subsequent breeding was transferred to category (1).
This occurred eight times.

Minimum impact of rehabilitation

A minimum of 69 females nested after rehabilitation: 56 remained at Moeraki near their release site and 13 nested elsewhere.





Green line: annual nest numbers at Moeraki beginning with six in 1982 and finishing with 41 in 2018.
Red area: range in impact of rehabilitation on actual nest numbers, where the upper annual limit shows the minimum impact of rehabilitation and the lower annual limit shows the maximum impact of rehabilitation.
We attribute the steep drop since 2012 to the combination of relative high female mortality and low recruitment.

The impact of rehabilitation on actual nest numbers has increased dramatically through recent years. We attribute this to a larger than usual influx of compromised females that otherwise would have died without rehabilitation.

Conclusions

We have shown that rehabilitation of yellow-eyed penguins has dramatically increased the number of nests at Moeraki. Without rehabilitation of compromised yellow-eyed penguins nest numbers would have only about doubled from six to 9–14 nests instead of increasing 7-fold from 6 to 41 nests. This justifies the use of rehabilitation as an effective management tool to increase numbers of this endangered species. The most dramatic outcome has been the initiation of a new colony at Katiki Point created by translocated penguins. This colony has subsequently become the largest on South Island, with 23 nests in 2018. The other colony at Moeraki, Okahau Point, has become the second largest on South Island, with 18 nests. This long-term growth has occurred despite the widespread collapse of the species elsewhere on South Island.

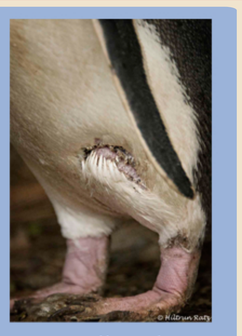
Two main reasons for rehabilitation

We have accurately documented causes for admissions to our rehabilitation facility since the start of 1986. These data have been analysed for the 31 years up to the end of 2016 for the total of 648 admissions of juveniles or adults. The initial split is into two categories: 359 (55%) emaciated uninjured individuals and 289 (45%) injured individuals (including many emaciated but with old injuries).

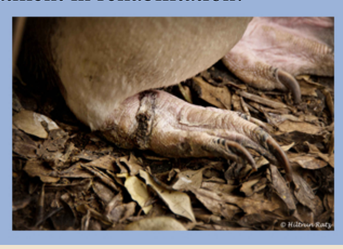
An example of emaciation
The annual moult lasts four weeks and in some years some penguins were unable to gain enough weight to complete the moult successfully. Here, the protruding breast bone of the thin bird (right) indicates severe weight loss: this bird will not survive without rehabilitation. Its mate (left) has already completed the moult and is a healthy weight.

Bleeding adult—some injuries look worse than they are
Here a blood-splattered male guarding his chick had a deep cut under his left flipper. He was admitted to the rehabilitation facility for a few days; the cut healed quickly and he was returned to his parental duties at the nest after a 5-day treatment of antibiotics. Fortunately the chick was post-guard and old enough to not need continuous brooding. No further intervention was required here because the chick received sufficient food from the female parent during the male's absence.

Bite injury—some injuries are worse than they look
A severe bite on the lower abdomen sustained by this female required surgery and a lengthy convalescence. After the injury healed the bird was released but she was found emaciated a month later and had to be re-admitted. She was released again and recruited to breed the following season. Post-release starvation is typical among penguins that have recovered from severe injuries. Consequently regular checks of these birds ashore is crucial.



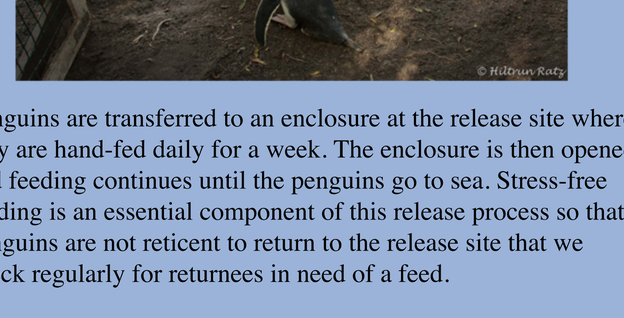
Slashed feet
The most common injury (36% of injured penguins) was foot damage attributed to bites by barracouta *Thysites atun*, a pelagic predatory fish typically up to 80 cm long. These bites are rarely lethal (shown by the fresh slashes in the left photo) but they often become infected (shown by the swelling in the right photo). If swelling occurs individuals typically remain ashore resulting in emaciation. However, the infection can be cleared with antibiotic treatment in rehabilitation.



Three major breakthroughs in techniques

1. Hand-feeding in hospital

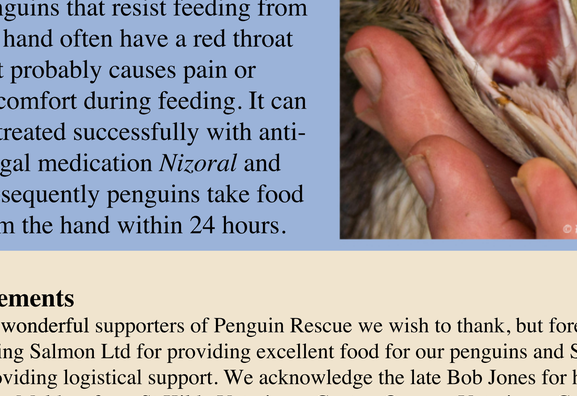
1988 – Janice Jones discovers that penguins can be taught to eat from the hand, removing the need to handle them while in rehabilitation.



Penguin stress is greatly reduced when they are fed without being handled. It typically takes 2–4 days of training to teach a penguin how to take the fish from the hand after which they become cooperative and appear unstressed.

2. Soft-release pens

1990 – Chris Lalas implements soft-release technique in an attempt to increase the likelihood of penguins returning.

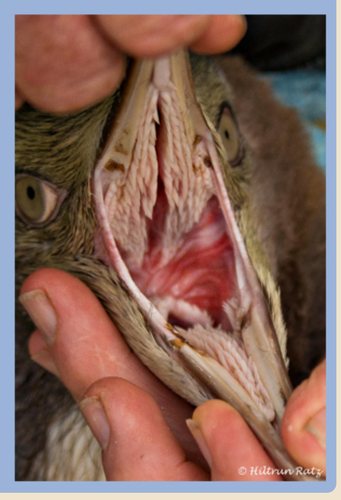


Penguins are transferred to an enclosure at the release site where they are hand-fed daily for a week. The enclosure is then opened and feeding continues until the penguins go to sea. Stress-free feeding is an essential component of this release process so that penguins are not reticent to return to the release site that we check regularly for returnees in need of a feed.

3. Diagnosis and treatment of throat infections

2002 – Rosalie Goldsworthy diagnoses and implements treatments for throat infections.

Penguins that resist feeding from the hand often have a red throat that probably causes pain or discomfort during feeding. It can be treated successfully with anti-fungal medication *Nizoral* and subsequently penguins take food from the hand within 24 hours.



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References
[1] Ratz, H. and Lalas, C. 2010. An assessment of rehabilitation as a tool to increase population size of an endangered seabird, the yellow-eyed penguin *Megadyptes antipodes*. J Wildlife Rehab 30:13-20.
[2] Richdale, L. 1957. A population study of penguins. Oxford at the Clarendon Press.