

*Experimental closure of purse-seine fishing in areas around African penguin breeding sites in the Western Cape*

**Foraging strategies and habitat utilisation of the African penguin, *Spheniscus demersus* around Robben and Dassen Islands**

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**FINAL report: ZA 1541.I Penguin dynamics on the West Coast**

to

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## 1. **Project summary** (please provide a one-paragraph summary of the scope and objectives of the project)

Based on the precarious conservation status of the African Penguin *Spheniscus demersus* after a decrease of 60% of the global population in 6 years (2001-2007), an island closure feasibility study was approved in 2008, by the former Department of Marine and Coastal Management (now Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Environmental Affairs (DEA)) in cooperation with the South African Pelagic Fisheries Association. The aim of this study was to evaluate the power of a long-term experiment to detect the effects of island closures around penguin colonies on penguin life-history parameters and foraging behaviour, and the potential benefits to the conservation status of African Penguins. The area (extending 20 km seaward from the low-water mark) around the largest breeding colony in the Western Cape, Dassen Island, was closed to purse-seine fishing over a period of 2 years (1 January 2008 - 31 December 2009) while nearby Robben Island, where fisheries continued, served as a reference point for the prevailing environmental conditions. A year later, in the Eastern Cape, St. Croix was closed to fishing (1 January 2009 – 31 December 2011) while nearby Bird Island was kept open. Although a two-year period was initially intended for that feasibility study, data demonstrated early on that this period was insufficient to allow experimental power to be estimated for all the traits monitored. This was mainly because of the short time series of data available for some of the penguin traits being monitored, specifically penguin foraging behaviour for which monitoring only started in 2008. For this reason it was decided to prolong the feasibility study until such time as the data allow sufficiently precise estimates of the effects of interest.

Following deliberations of the Pelagic Scientific Working Group, its subsidiary body the Island Closure Task Team and the International Stock Assessment Panel, at the end of 2010, agreement was reached that the study be extended until the end of 2014. It was further agreed on that alternation between open and closed islands be implemented to optimise the outcome of the study taking account of the sometimes conflicting objectives of (a) rapid alternation to maximise contrast for more precise estimation, (b) a slower alternation to take account of possible autocorrelation in the penguin indices being monitored, and (c) the desirability to integrate the feasibility study and experiment to lead to earlier answers.

Funding from the RFA was kindly granted to carry out the fieldwork in 2014, the last year of this feasibility study in the Western Cape, on Robben and Dassen islands, to ensure a successful continuation of this unique experiment.

## 2. **Conservation impacts achieved**

We have worked collaboratively for the conservation of the endangered African Penguin by obtaining fundamental data on the penguin's ecology, and strengthening local capacity to conduct scientific research, implement practical conservation measures, and support robust decision-making for a sustainable management of the ecosystem.

## 3. **Project objectives**

The objectives of this project were to:

**Objective 1** Add to the long-term and high quality data set that will be shedding light on the foraging strategies of breeding African penguins in the Western Cape.

**Objective 2** Write manuscripts for submission to peer reviewed journals.

**Objective 3** Provide a final report to the Island Closure Task Team on the data gained from 2008 to 2014 as a base for subsequent management decisions.

### 3a. **Significant changes to the objectives during the reporting period.**

**To Objective 1** The sample size for Dassen Island in 2014 is smaller than anticipated. However, breeding activity was very low, the annual census confirmed another decrease in penguin numbers by

about 20% compared to the previous year and adults in general seemed in poor condition. So as not to add more stress to the few breeding birds and increase the risk of nest abandonment and breeding failure and thus losing the device (and data; note this device stores the information and does not transmit the positions) it was decided to stop deployments on Dassen Island.

**To Objective 3** The last ICTT meeting was held in April 2014, prior to data collection in 2014, and will not be continued until further notice. However, the Pelagic Scientific Working Group will continue to consider this study.

#### 4. Progress towards the achievement of the objectives

##### Objective 1

- **Successful establishment of a globally unique experiment based on a joint effort of academic, governmental, non-governmental, non-profit institutions and organisations and cooperative industries.**

This study forms part of an international and interdisciplinary project in collaboration with the University of Cape Town, the Department of Environmental Affairs, the Department of Agriculture, Forestry and Fisheries, BirdLife South Africa and WWF South Africa, Cape Nature, South African Foundation for the Conservation of Coastal Birds (SANCCOB), the responsible Fisheries Alliance, the South African Pelagic Fishing Industry Association as well as the University of Bristol in the UK.

- **Successful data collection without interruption between 2008 and 2014.**

Since the launch of the Island Closure feasibility study in 2008, penguin monitoring at the penguin's main breeding sites has been intensified with parameters monitored including number of breeding pairs, numbers of moulters, adult survival, breeding success, chick condition, foraging effort of adults, and diets of adults feeding chicks. Data have been successfully collected without any year-gaps.

##### Objective 2

- **Following manuscripts are in preparation as first or co-author in collaboration with colleagues of the ADU, CapeNature, the Fisheries Research Dept. of Agriculture, Fisheries and Forestry, as well as the Department of Environmental Affairs, Oceans and Coasts as well as international colleagues:**

**Steinfurth A**, Richard B. Sherley, Lorie Pichegru, Res Altwegg, Christina Hagen, Astrid Jarre, Azwianewi B. Makhado, Alistair McInnes, Lize van der Merwe, Herman Oosthuizen, Kate J. Robinson, Peter G. Ryan, Leslie G. Underhill, Lauren J. Waller, Ross Wanless, Henning Winker, Robert J. M. Crawford in prep. Evidence for a benefit of fishing closures around breeding colonies of African Penguins. **(presented in this report)**

**Steinfurth A**, Navarro R, Underhill LG, Coetzee J, Van der Lingen C, Wanless R, Crawford R in prep. Energetic requirements of the African Penguin, *Spheniscus demersus*: an approach to fisheries and ecosystem management.

**Steinfurth A**, Crawford R, Upfold L, Visagie J, Coetzee J, Van der Lingen C, Underhill LG in prep. Seasonal variability in foraging behaviour and habitat use of African penguins, *Spheniscus demersus*, breeding on Dassen Island, Western Cape: Do some like it hot?

**Steinfurth A**, Robinson K, Sherley R, Upfold L, Visagie J, Crawford R, Underhill LG in prep. Near and far: Foraging behaviour of African penguins breeding on Robben vs Dassen islands. Implications for the specie's conservation.

**Steinfurth A**, Crawford R, Upfold L, Merkel D, Coetzee J, Underhill L in prep. From dusk till dawn: Diving patterns and performance of African penguins in relation to the lunar cycle.

**Steinfurth A**, Boersma PD, Wilson RP, Vargas H, Crawford R, Underhill L, Simeone A, Luna-Jorquera M in prep. Comparison between the foraging strategies of the four *Spheniscus* species.

Robinson K, **Steinfurth A**, Sherley R, Barham P, Barham B, Underhill, Crawford R LG in prep. Foraging behaviour of Endangered African penguins breeding at Robben Island and the influence of local prey availability.

- **Data were presented at the 15<sup>th</sup> Southern African Marine Science Symposium held in Stellenbosch, South Africa**

- **An abstract was submitted to the 2<sup>nd</sup> World Seabird Conference held 26 – 30 October in Cape Town, South Africa. Status pending.**

### **Objective 3**

Data from 2008 to 2013 were analysed in a combined effort by the respective data owners at the BirdLife SA workshop, held 13 - 17 October 2014 at the Department of Environmental Affairs, Foretrust, Cape Town, South Africa. Due to the still ongoing data collection in October and/or just recently finished field season, data for 2014 could not be considered for the BirdLife SA workshop.

Results obtained at this workshop were presented to the Panel of the International Stock Assessment hosted by MARAM, at the University of Cape Town 1 – 5 December 2014. The outcome of the workshop can be viewed on the MARAM webpage.

<http://www.mth.uct.ac.za/maram/publications.php?year=2014&class=ws>.

### **Further milestones achieved:**

- **Working towards the aims established in the Biodiversity Management Plan for the African Penguin (BMP-AP), in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004)**

A workshop held at Arniston, Western Cape, in October 2010 initiated the development of a Biodiversity Management Plan for the African Penguin (BMP-AP), in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), a vision and desired state for African Penguin conservation was debated and agreed upon by the workshop participants. The Island Closure study is one of the actions in the BMP-AP, which it is thought will increase the population size of the penguins.

- **Strengthening local capacity by training students, governmental and non-governmental interns, volunteers and personnel**

Within this project two PhD and several Master students as well as interns, volunteers and personnel from the Department of Environmental Affairs, Cape Nature, and the Tristan Conservation Department have been successfully trained on scientific research on African penguins.

## **5. Constraints affecting progress**

- **Dispute within the ICTT**

An unfortunate dispute started within the ICTT at the beginning of 2014 has sadly and greatly hindered a productive and constructive working relationship between the group members. The dispute revolved around how to analyse the data and what conclusions had been drawn. Based on this dispute all ICTT meetings were suspended and the task team itself disbanded which put a stop in any kind of collaborative work.

To overcome this halt and to ensure that the voices of both groups were heard, it was agreed that the island closure study would be presented at the International Stock Assessment workshop in December 2014. Prior to this BirdLife South Africa initiated a data analysis workshop in October, providing the space and base for data owner and invited independent expert statisticians to get together for a week of data crunching.

The results of this workshop were presented to the Panel of the International Stock Assessment workshop (see above) and constitute the base of the manuscript attached to this report

In 2015, Emeritus Professor George Branch was asked to convene and facilitate meetings among the respective group to discuss interactions of scientists concerned with the penguin/fisheries issue, with the intent to seek a modus operandi that will allow constructive integrated gathering and use of data for Scientific Working Group purposes and decision-making.

Both groups have met with Prof. Branch. He will present the outcome of these meetings at the Pelagic Working Group meeting on 1<sup>st</sup> April 2015. I hope this will help to create a positive and constructive

way forward.

## **6. Financial report**

See attached

## **7. Equipment status**

Two external hard drives 1TB Titanium were purchased for data storage of our tracking data base (East and West Coast). Less than 1 year old. Excellent condition.

## **8. Describe any lessons learned, and provide any recommendations.**

- **Experimental design**

In 2008 a two-year period was initially intended for the duration of the feasibility study, but it was recognised early on that this period was likely too short to allow experimental power to be estimated for all the quantities proposed to be monitored. The 'study to assess the feasibility of a full-scale experiment' was extended to 2014. In short, the feasibility period ended, and the two groups, although agreeing on the successful completion of the feasibility study, have reached different conclusions about how the data should be interpreted. The international review panel, who reviewed the work in December 2014, indicated that a full-scale experiment was merited.

We found predominantly positive effects of closures; however, traits and islands differed in their responses. Clear benefits to chick condition or foraging behaviour were apparent at three of the four islands and fledging success improved at one colony. Hence, the results thus far suggest that by enhancing breeding conditions for penguins, closures will likely benefit juvenile and adult survival in the long run, leading to improved population trajectories.

The fact that foraging traits for Dassen Island showed the opposite effects of closure is likely due to a very low sample size in 2008 and 2009, when Dassen Island was closed to fisheries, brought about by logistical difficulties and financial constraints. The study period for 'Closure' has been too short to allow experimental power to be estimated for all the traits proposed and although we found statistical evidence for a benefit of fishing closure around penguin breeding sites, it might be too premature to draw final conclusions.

For this reason we recommend that the closure being continued as a full experiment until such time that clear-cut results with sufficient experimental powerful are obtained.

We agree with the Panel that "the exact number of years needed to achieve a given outcome, in terms of the effect of fishing on penguin demographics, will depend on a power analysis accepted by DAFF under a process specified by their Director Research". It is hoped that the power analysis can be completed in 2015. However, we do not think that an experiment will need to run for as long as the Panel presents in their report (an additional 16 years) to come to an answer about the utility of closures.

- **Funding and Publications**

As a rule of thumb one needs at least double as much time to analyse data than to collect them and even more time has to be added to publish them. Unfortunately funding agencies often don't take this into account and the funding period is limited to the time of being in the field. This project has involved an immense amount of time-consuming fieldwork since the start of the feasibility study. Our endeavour has provided us with an invaluable set of high quality data that represent a novelty in penguin research. However, although these data have been analysed for the most part and written up in various reports as well as having been presented at several scientific meetings (see above), the West Coast tracking data are still pending publication in peer journals. I have produced drafts of important papers, listed above and several are close to completion. Both from the perspective of the

conservation of the African Penguin as well as for personal reasons, I believe that it is critically important that I complete these papers and submit them to peer reviewed journals as soon as possible.

**9. Provide a statement of conclusion, which summarises the successful completion and conservation value of the project.**

In conclusion, the ICCT as well as the Panel agrees that the feasibility study has been successfully completed. Based on the predominantly positive effects of closures found in this study, fishing closures can potentially benefit African Penguins, thereby contributing to securing the objectives of the Biodiversity Management Plan for the African Penguin (BMP-AP). Combining fishing closures around islands with a suite of other management actions described in the BMP-AP currently implemented will achieve the objectives of halting penguin decline and subsequently increasing their numbers. We therefore recommend that a full experiment should commence in continuation of the feasibility study but that a power analysis should be conducted to give an estimate of how long the experiment will need to run before significant effects are detected.

**10. Acknowledgement of Donors –**

We would like to acknowledge the Responsible Fisheries Alliance for the provision of this grant through WWF-SA. Furthermore we would like to express our gratitude to Cape Nature for providing accommodation on Dassen Island and helping with the logistics getting me to the island and back home. I am thankful to the Department of Environmental Affairs for covering most part of the field equipment, their invaluable help in the field and providing me accommodation on Robben Island.