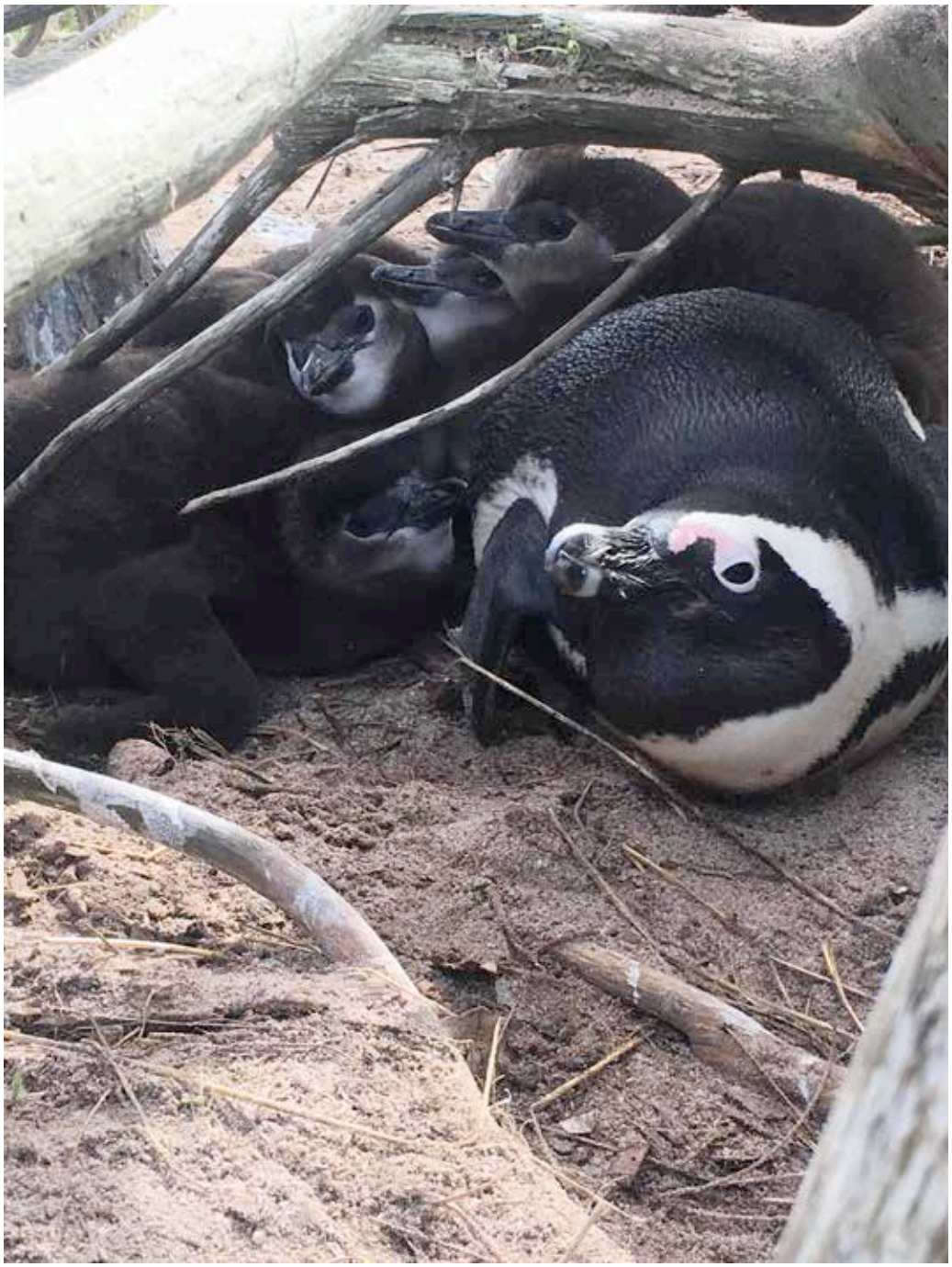

South Africa's penguins: 2019 Field Report

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Period covered by this report: 2019

LETTER TO VOLUNTEERS

We had seven teams with 14 volunteers in the 2019 Earthwatch “South African Penguin” project on Robben Island. So, thank you Sallie McCutcheon, Ruben Stenseng, Susan Wilmes, Victoria Kohler, Margo Ohrn, Gillian Atkinson, Douglas O’Neill, Darren Towers, Susan Ackerman, Sreeparna Gupta, Stephanie Ali, Yifang Zhu, Liz Murphy, Eri Yamamoto; both for the help you have provided the project and for being such fun to be with. We hope you enjoyed your brief stay with us as much as we enjoyed meeting you and that you learnt a little (or a lot?) about the feisty African Penguin. Together, we monitored 180 penguin nests in all. We recorded about 169 penguin chicks fledge at these nests; a total of approximately 0.94 chicks per breeding attempt. We are very grateful to those of you who spent long and patient hours trying to find penguins wearing flipper bands and even more time trying to read the transponders with the ‘wands’. This year we recorded 1,992 re-traps corresponding to 302 individual penguins; 299 of these were transpondered birds. These data are of the utmost importance as they let us make good estimates of the annual survival rates of the African penguin. The good news is that the proportion of chicks fledged per breeding attempt this year was at least comparable to previous years, something we hope will continue into the future. We measured the heads and weights of 247 chicks to determine their body condition. Thanks to all who got bitten, scratched, pounded by flippers or covered in guano in the process of catching chicks to measure, as well as when checking nests and re-sighting birds! Many of you also helped injured birds that were sent to SANCCOB from Robben Island this year along with several chicks we found that were seriously underweight. Most of them have now been treated and returned to their rightful environment. So, more thanks to you all for helping in this way to protect the penguins of Robben Island.

All the nest monitoring, re-traps, moult counts, nest counts (area U), wader counts, game counts and BIRP forms that you worked so hard to complete all contribute to ongoing data that will help with conservation and management decisions on Robben Island, as well as population studies of the African Penguin and several other species in the Western Cape. The big news of the year is that the designation of an area around Robben Island as a Marine Protected Area (MPA) came into force. One of the reasons for the protected area around Robben Island was to “to contribute to the conservation and protection of African penguin, bank and Cape cormorants and other threatened seabird and shorebird species”; this was included in the designation text in part thanks to work stemming from all the hard work put into our Earthwatch project over the years. In addition, the data we collected was also submitted to the Department of Environment, Forestry and Fisheries to assist in the decision-making process as the fisheries closures around Robben Island and Dassen Island were reviewed at the end of 2019 (the experiment will continue in 2020). Furthermore, all the data gathered by all the Earthwatch teams over the past 19 years has made a really important contribution to getting the official Biodiversity Management Plan for African penguins updated – this process was ongoing as we write, but hopefully the full implementation of the updated plan from 2020 will see a reversal in the decline of the penguins.

Some teams braved “rough sea crossings” on the ferry, water and electricity failures, days when rain stopped play and penguin diet sampling. These experiences are part of what make this project unique, but we hope it is more the delights of the close encounters with wildlife, South African wine, braais, prison tours, Robben's sunsets, shooting stars, the unique mix of wildlife and birds on the Island and the knowledge that you made a difference that you will never forget. On behalf of Sue, Les, Rich, Newi, Pete, Barb, Nola, Jenny, Andile and all the other project staff who shared time with you on Robben or help make this project what it is, thank you again. May we take this opportunity to wish you happy holidays and every success for the future. If you are off on an Earthwatch project in the New Year, we hope you enjoy it.

SUMMARY

Ten volunteers helped us to collect breeding success data from 180 nests, measure the body condition of 247 chicks and re-sight 302 marked individuals throughout the 2019 breeding season. The data collected by Earthwatch volunteers continues to be used by graduate students developing their research careers and to guide management decisions by Robben Island Museum and the government of South Africa. In 19 seasons, we have followed the fate of over 4,000 penguin breeding attempts; with human-induced pressures on the marine environment on the rise, the value of this long-term dataset to conservation decision making has never been greater.

GOALS, OBJECTIVES, AND RESULTS

Goal 1) Develop a dataset on penguins breeding success which can be used to: i) compare the productivity of different groups of penguins, such as those hand-reared as chicks, those affected by chronic oil spills and those in areas subject to different levels of research activity; ii) assess the efficacy in replacing lost nesting habitat of different designs of and modifications to artificial nests; iii) understand how breeding success responds to changes in environmental conditions and prey availability;

The regular nest monitoring has provided us with a very useful data set of the contents of 180 nests throughout the 2019 breeding season and over 4,000 breeding attempts over 19 breeding seasons. We have developed another improved method to analyze these data (Sherley et al. 2018) so that we can make reliable comparisons between breeding success for different groups of birds, or nest sites, etc. We are continuing to gather further data to tell whether one type of artificial nest is better than another - this is something we will continue to address in the coming season, particularly as new designs of artificial nest are now being trialed on the island. We also noted that over the past decade, breeding success has been related to the local availability of anchovy (the main prey during chick rearing) around the island (Sherley et al. 2013), that chick survival appears to be improved when fishing for sardine and anchovy is suspended around the island (Sherley et al. 2015, 2018) and we have noted relationships which suggest that prey availability over a larger spatial scale has important impacts on adult body condition (Weller et al. 2016).

2) Measure the overall body condition of chicks throughout the breeding season to build a time-series of chick condition data which can be compared to changes in environmental conditions and prey availability;

We randomly selected up to 50 chicks each week and measured their condition – we avoided picking the same chicks twice by using different areas of the colony in each week. We measured 247 'condition' chicks in 2019. Work undertaken in recent years has demonstrated a clear relationship between the condition of chicks and the prey available within 20 km of Robben Island (Campbell et al. 2019) while another recent analysis of these data suggest an impact of the fisheries closures on chick condition (Sherley et al. 2018).

3) Mark a sample of wild-reared juvenile birds prior to fledging with RFID tags to build a dataset from which we can determine the survival and movements of juvenile and immature birds and record condition and mass at fledgling for marked birds.

Between 2013 and 2019, we have marked almost 300 fledglings with RFID tags. We will continue with this monitoring protocol in 2020. It is too early to draw any inference on survival or movement rates from these data, but we will continue the dataset in subsequent years so that we will be able to do this in future. This is important as recent research has suggested that juvenile birds may be particularly vulnerable to human-induced changes in marine ecosystems. However, the difficulty of studying them, means these impacts are often difficult to detect (Sherley et al. 2017).

4) Continue to record sightings of previously banded penguins to establish the success of rehabilitation projects and provide other demographic data such as annual survival rates and age at breeding to relate to changing environmental conditions as well as monitoring a sample of breeding African penguins in different nest types using RFID (radio frequency identification) tags.

This year volunteers read 13 bands numbers from 3 individual birds. We have used these data to determine that the survival rates of rehabilitated birds (such as those oiled in the Treasure spill) are similar to those of birds that have never been handled. We have also modelled annual survival rates using multi-state statistical models. The results showed an alarming and continuing decline in annual survival rates for adult penguins up to the end of 2012 (Sherley et al. 2014). It appears that this trend is linked to a decreasing availability of adult sardine off the west coast of South Africa (Sherley et al. 2014). Data from transpondered birds over the last five seasons suggest this trend may have reversed (Barham 2017, Barham et al. in prep). The programme of transpondering penguins on Robben Island was started in 2013 and >600 birds have been transpondered to date. We now actively look for these birds at the nests using hand-held transponder readers and a portable ground-based reader. From a total of 1,979 transponder readings this year we found 136 of the birds mostly breeding at or close to the nests where they were transpondered. The portable ground-based reader provided readings of a further 90 birds, but we did not manage to establish whether or not they were breeding.

5) Determine whether breeding success, chick condition and penguin survival rates are modified by the introduction of spatial fisheries management. Small-scale closures (20 km radius) will be in place around Robben Island for 2011-2013 and 2017-2019. A spatial quota system for the sardine fishery, splitting the catch between the west coast and south coasts of South Africa, is expected to be introduced in 2018.

We have recently analyzed the data collected between 2001 and 2015 to compare chick survival and chick condition during years with and without small-scale fishery closures around Robben Island and Dassen Island (Sherley et al. 2018). We found that chick survival was increased during the years when the closure was in place and that this would be expected to have a small beneficial effect for the two island populations in the long run. Chick condition was also markedly improved by the closures at

Robben Island, but not at Dassen Island. This may translate into improvements in juvenile survival; if it does this would be expected to have a greater beneficial effect on the Robben Island population. However, unless adult survival rates recover (see above) any benefit from these closures would not be sufficient to reverse the population decline on their own (Sherley et al. 2014, 2015, 2018; Weller et al. 2016). We have also contributed data on the condition of chicks on Robben Island to ongoing assessments of these small-scale closures taking place at the Department of Agriculture Forestry and Fisheries (DAFF) and the Department of Environmental Affairs (DEA).

6) To provide general assistance with a range of projects on the island including monitoring the numbers and breeding success of other bird species on Robben Island and monitoring the population of other animals on the island (including, rabbits, deer, etc.).

Volunteers provided a wealth of assistance with other projects. We carried out 1 count of wading birds around the island and completed lists of bird species seen in 5 of the weeks a team was on the island – these feed directly into several atlasing projects run at the ADU and provide valuable data on the movements of birds around Southern Africa. Most teams helped by counting the mammals on the island at least once during each team (11 counts in total) – this data is very useful for the conservation management on the island as it provides a consistent baseline data set to help estimate the actual populations of Steenbok, Springbok and Fallow deer.

Project Impacts

1. Increasing Scientific Knowledge

a) Total citizen science research hours

8 hours per day, 8 days per team, 7 teams per year, **2.00** volunteers per team = **896** volunteer hours.

b) Peer-reviewed publications

Campbell KJ, Steinfurth A, **Underhill LG**, Coetzee JC, Dyer BM, Ludynia K, **Makhado AB**, Merkle D, Rademan J, Upfold L and **Sherley RB**. 2019. Local forage fish abundance influences foraging effort and offspring condition in an Endangered marine predator. Journal of Applied Ecology 56: 1751–1760. *Published. Earthwatch was acknowledged.*

c) Non-peer reviewed publications:

Sherley RB, **Barham BJ**, **Barham PJ**, Campbell KJ, Crawford RJM, de Blocq A, Grigg J, Le Guen C, Hagen C, Ludynia K, **Makhado AB**, McInnes A, Meyer A, Morris T, Pichegru L, Steinfurth A, Upfold L, van Onselen M, Visagie J, Weller F, Winker H. A Bayesian approach to understand the overall effect of purse-seine fishing closures around African penguin colonies. Department of Environment, Forestry and Fisheries Report: FISHERIES/2019/NOV/SWG-PEL/32.

d) Books and book chapters

e) Presentations:

Ludynia K, **Grigg J**, **Barham B**, McInnes A, **Parsons N**, van der Spuy S, Urban R, **Sherley R**. Insights into the "lost years" of young African penguins: using transponders in SANCCOB's hand-reared penguins to understand movements and their role in bolstering the wild population. 10th International Penguin Conference, Dunedin, New Zealand. *Conference presentation.*

Grigg J, Votier S, Cotton A, Waller L, Ludynia K, Hagen C, **Makhado AB** and Sherley R. Shining light on the lost years to inform conservation planning: investigating the movement ecology of immature African penguins (*Spheniscus demersus*). 10th International Penguin Conference, Dunedin, New Zealand. *Conference presentation.*

Sherley RB. Managing forage fish and marine predators: fisheries impacts through the age-classes of endangered penguins. Pew Fellows in Marine Conservation Annual Meeting, Hilo Hawai'i, *Conference presentation.*

2. Mentoring

a) Graduate students

Student Name	Graduate Degree	Project Title	Anticipated Year of Completion
Camille Le Guen	PhD	Fine-scale interactions between penguins and their prey	2020
Jennifer Grigg	PhD	Causes and consequences of dispersal and recruitment in African penguins (*Spheniscus demersus*)	2021

b) Community outreach

Name of school, organization, or group	Education level	Participants local or non-local	Details on contributions/ activities

3. Partnerships

Partner	Support Type(s)[1]	Years of Association (e.g. 2006-present)
University of Exeter	Technical Support; Academic Support	2015-present
University of Bristol	Technical Support; Academic Support	2001-present
University of St Andrews	Academic Support; Collaboration	2016-present
Animal Demography Unit, University of Cape Town	Logistics; Data; Technical Support; Academic Support	2001-present
Robben Island Museum	Logistics; Collaboration	2001-present
Oceans and Coasts Branch, Department of Environment, Forestry and Fisheries	Logistics; Collaboration; Permits; Funding; Data	2001-present
Bristol Zoological Society	Funding; Collaboration	2001-present
Southern African Foundation for the Conservation of Coastal Birds (SANCCOB)	Logistics; Collaboration	2001-present
Department of Agriculture, Forestry and Fisheries (DAFF)	Data; Collaboration	2008-present
BirdLife South Africa	Collaboration	2016-present
Pew Charitable Trusts	Funding	2016-present
Zoological Society of San Diego	Funding	2016-present
The Association of Zoos and Aquaria.	Funding	2017-present

[1] Support type options: funding, data, logistics, permits, technical support, collaboration, academic support, cultural support, other (define)

4. Contributions to management plans or policies

List the management plans/policies to which your project contributed this year

Plan/Policy Name	Type[2]	Level of Impact[3]	New or Existing?	Primary goal of plan/policy[4]	Stage of plan/policy[5]	Description of Contribution
Robben Island	Management Plan	National	Existing	Natural Resource	Adopted	MPA was

MPA				Conservation	(approved by Cabinet of South Africa)	approved in 2018 and implemented in 2019; PI Richard Sherley served on working groups that considered evidence for the inclusion of protection for seabirds in the MPA in previous years. Results in the published peer-reviewed literature and reports submitted to the South African government, based on data collected by this Earthwatch project in previous years, were used to support decision making.

[2.] Type options: agenda, convention, development plan, management plan, policy, or other (define)

[3.] Level of impact options: local, regional, national, international

[4.] Primary goal options: cultural conservation, land conservation, species conservation, natural resource conservation, other

[5.] Stage of plan/policy options: proposed, in progress, adopted, other (define)

5. Conserving natural and sociocultural capital

a) Conservation of taxa

i. List any focal study species that you did not list in your most recent proposal

Species	Common name	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source

ii. In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.

Species	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source	Description of contribution	Resulting effect[6]
African Penguin - *Spheniscus demersus*	Endangered	Endangered	IUCN	Our work provides a long-term dataset of breeding success and survival at one of the remaining major colonies. The project	Improved habitat, increased breeding success

				contributes significantly to a range of conservation work. Specific projects include a major fisheries closure experiment, the collection of oiled and injured birds (sent for rehabilitation at SANCCOB) and participation in a chick bolstering project led by Bristol Zoo.	

[6.] Resulting effect options: decreased competition, improved habitat for species, range increased, population increase, improved population structure, increased breeding success, maintained/enhanced genetic diversity, other

b) Conservation of ecosystems

In the past year, has your project helped conserve or restore habitats? If so, please describe below.

Habitat type	Habitat significance[7]	Description of contribution	Resulting effect[8]

[7.] Habitat significance options: nursery, breeding ground, feeding site, corridor, migration path, refuge, winter range, summer range, spring range, fall range or other (define)

[8.] Resulting effect options: extent maintained, condition achieved, restored, expanded, improved connectivity or resilience

c) Ecosystem services

☐Food and water

☐Flood and disease control

☐Spiritual, recreational, and cultural benefits

☐Nutrient cycling

Details:

d) Conservation of cultural heritage

Cultural heritage component[9]	Description of contribution	Resulting effect

[9.] Cultural heritage component options: traditional agriculture, artifacts, building(s), hunting ground or kill site, traditional ecological knowledge and practices, monument(s), oral traditions and history, spiritual site, traditional subsistence living

RESEARCH PLAN UPDATES

Report any changes in your research since your last proposal/annual report. For any 'yes' answers, provide details on the change in the 'Details' box. This section will not be published online.

1) Have you added a new research site or has your research site location changed? ☐ **Yes** ☒ **No**
2) Has the protected area status of your research site changed? ☐ **Yes** ☒ **No**
3) Has the conservation status of a species you study changed? ☐ **Yes** ☒ **No**
4) Have there been any changes in project scientists or field crew? ☒ **Yes** ☐ **No**

Details – provide more information for any 'yes' answers

ACKNOWLEDGEMENTS

We would like to thank all our collaborators for their ongoing support (especially Robben Island Museum who continue to provide logistical support, without which the project could not operate). We also thank all the team leaders and field assistants who have helped run the teams this year. Andy Brierley at the University of St Andrews and BirdLife South Africa provided key collaborations in 2019, and the Zoological Society of San Diego and the Association of Zoos and Aquaria provided funding to purchase GPS loggers, animal-borne cameras and accelerometers, which were used between 2017 and 2019 and will be used for several seasons to come.

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ANYTHING ELSE

As always, we would like to thank Earthwatch for the ongoing support and to re-emphasize the importance of the long-term data set that we continue to gather. The information we have gathered over the past 19 years provides a unique and valuable dataset which we continually refer back to and use when looking at trends across the region. We are now starting to get strong results indicating the benefit of the fisheries closures being in place around Robben and Dassen Island and are starting to see these Earthwatch collected data making significant contributions to policy in the region.