FIELD REPORT

Marketing title

South African Penguins

PI name

Prof Peter J Barham; Prof Leslie G Underhill

Research site/ region

Robben Island

Country

South Africa

Research site latitude/ longitude

33.8°S 18.4°E

Protected area status

World Heritage Site

Period covered by this report

1 Jan 2009 to 31 Dec 2009

Report completed by

Peter Barham

SECTION ONE

We had seven teams and 24 volunteers in the 2009 Earthwatch “South African Penguin” project on Robben Island. So, thank you Pam, Beverly, Amy, Bruce, Darlene, Taylor, Heather, Stephen, Cicelia, Robert, Avelina, Judith, George, Nancy, Douglas, Jodi, Sandra, Siew, Ardella, Jane, Meagan, Elisabeth, Jeanne and Ginny, 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 347 breeding attempts from 299 penguin nests in all. We recorded 264 penguin chicks fledge at these nests; a total of 0.76 chicks per breeding attempt.
We are very grateful to those of you spent long and patient hours trying to find penguins wearing flipper bands and the even more time trying to read the bands with telescopes. This year we recorded 871 retraps corresponding to 463 individual penguins. This data is of the utmost importance as it lets us make good estimates of the annual survival rates of the African penguin.

Unfortunately both the breeding success rates and the annual survival rates appear, from the data you help us gather, to continue to fall steadily giving us ever more concern for the long term prospects of the African penguin.

We measured the heads and flippers of 855 chicks to determine how well they were growing. There was at last some good news here: your measurements indicate that this year the chicks were, on average, well fed and in better condition than chicks in 2004 when the baseline data were collected; Team 3 in May, saw the best fed chicks – while Team 1 in the heat of March found the chicks in the poorest condition. Thanks to all who got pounded by flippers or covered in guano in the process of catching chicks to measure, as well as when checking nests and banding birds!

Many of you also helped catch oiled or injured birds that were sent to the Southern African Foundation for the Conservation of Coastal Bird (SANCCOB) from Robben Island this year. 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, retraps, moult counts, nest counts (area U within the study site), wader counts, game counts and BIRP (Birds in Reserves Project) 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 data has also been submitted to the Department Environmental Affairs and Tourism, Marine and Coastal Management Branch (MCM) to assist in the decision-making process when the fisheries closure around Dassen Island comes up for review.

Some teams braved “rough sea crossings” on the ferry water and electricity failures, days when rain stopped play, penguin diet sampling and even lost a PI to mumps! 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, Mario, Les, Rob and Rich 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 every success for the future. If you are off on an Earthwatch project in the coming year, we hope you enjoy it.

Top highlight from the past field season

In 2009, volunteers started helping us measure the growth and condition of chicks (See Figures 1 and 2). Importantly, the data we have gathered is proving to be very useful – preliminary analysis suggests there are close correlations with the condition of the chicks and the availability of prey. For the volunteers, who helped by holding chicks as their head length was measured or kept them still while their siblings were measured, some helped by keep hold of the adult as we briefly "borrowed" its chicks, this was a real highlight of their Earthwatch experience.

Figure 1. Volunteer helping Richard Sherley note down measurements of a chicks condition (copyright Peter Barham)

Figure 2. Measuring the head length of a chick (copyright Peter Barham)

Non-technical overview of results

2009 was a very productive field season, volunteers helped to gather a wealth of data which we are only beginning to analyse fully.

The regular nest monitoring has provided us with a very useful data set of the contents of about 200 nests throughout the whole breeding season. The detailed analysis of this data set together with data from previous years is ongoing (it will form a part of Richard Sherley's PhD thesis).

However, we can make some preliminary conclusions. For example, if we use a simple measure of breeding success, we can see there has been a steady decline in average breeding success on Robben Island over the past 3 years. In 2007 we had 1.42 fledges per nesting attempt; in 2008 this had fallen to 1.14 and this year (2009) we found that only 0.98 chicks were fledged per nesting attempt. As yet we do not understand why this is happening – hopefully Richard Sherley's detailed analysis and comparisons with global variables such as the availability of fish around the island and the climate during the breeding season will help provide an explanation.

In the years up to 2005, there was a clear difference between the breeding success of birds that were oiled in the *Treasure* spill and those that were not. Previously oiled birds had a significantly reduced breeding success. However, in the past 3 years this trend has more or less disappeared so that now there are no clear differences in breeding success between birds that were or were not oiled in the *Treasure* spill.

We are not as yet sure whether this is due to less successful breeders who were oiled in the *Treasure* spill ceasing to breed; to an improvement in the overall health of birds that were oiled in the *Treasure* spill; to the least healthy birds that were oiled in the *Treasure* spill having a reduced survival rate; or even to the fact that the overall breeding success of all birds has dropped.

This year, volunteers read 871 l bands which corresponded to 463 different birds; 227 had been oiled in the *Treasure* spill. Ten were hand reared orphaned chicks from the *Treasure* spill, and 36 were birds that had been translocated to Port Elizabeth during the *Treasure* spill. We use this to help estimate the annual survival rates of the penguins. Although we have seen a small drop in the proportion of birds oiled in the *Treasure* spill amongst these retraps in the past few years (60% in 2006, 53% in 2007 and 2008, compared to 49% in 2009) with the currently available analysis tools, 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. However, this is not as yet a firm conclusion and we will need several years more data before we can be sure.

As we noted above, measurements of chick growth and condition seem to show great promise as a method of assessing the overall health of the African penguin (*Spheniscus demersus)* population.

We are actively using a lot of the other data collected by volunteers – for example, the regular moult counts of area U are being used to analyse how accurately the overall population can be estimated from the nest counts carried out in just one week - by seeing how the number of nests being used in this one area varies through the year we can begin to correct the annual census data to allow for the fact that birds that breed very late (or early) in the season may be missed.

Acknowledgements

The Animal Demography Unit (ADU) provided logistical support; Robben Island Museum provided transport to and from the island as well as accommodation on the island; the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB) took in and treated many oiled, injured and malnourished penguins that we sent to the mainland.

SECTION TWO - TECHNICAL RESULTS

REPORTING ON RESEARCH OBJECTIVES

Objective 1: To determine the duration and the location of foraging trips and the diet of African Penguins through the whole breeding season

During the peak of the breeding season penguins at selected nests were fitted with GPS data-loggers and dive depth recorders to record details of their foraging trips. This work was carried out by MCM and the ADU with assistance (in some cases) from Earthwatch volunteers – who helped keep watch for returning penguins carrying data-loggers so the loggers could be recovered at the nest. These data are still being analysed and compared with data from penguins at other colonies.

MCM staff took diet samples from a sample of penguins at regular intervals – many Earthwatch volunteers assisted in the process catching and holding penguins for the MCM staff. The data from these diet samples is also still being analysed at MCM.

The main reason for recording foraging trip durations and diets is to be able to determine availability of prey over the entire breeding season. This data forms an important part of the fisheries closure project. However, we need data covering several years and from several different islands before any firm conclusions can be drawn.

Objective 2: To compare breeding success of penguins using different types of nest site and provide nest boxes to replace lost habitat

The regular nest monitoring has provides us with a very useful data set of the contents of about 200 nests throughout the whole breeding season. We have recently developed an improved (modified Mayfield) method to analyse this data (and that from all the previous seasons) so that we can make reliable comparisons between breeding success for different groups of birds, or nest sites, etc. This re-analysis is ongoing – we will have the results before the start of the next field season.

In the past we have used simpler measures of breeding success (e.g. chicks fledged per egg hatched). These measures are really only useful when the differences between groups of nests are large – so that as yet we have not shown any significant differences between nest types. As soon as we have any significant findings we will make sure the data are used to inform programmes to provide nest boxes and artificial burrows (see Figure 3).

Briefly, if we use as fledges per nesting attempt as the measure of breeding success then we find showing a steady decline in average breeding success on Robben Island over the past 3 years. In 2007 we had 1.42 fledges per nesting attempt; in 2008 this had fallen to 1.14 and this year (2009) we found that only 0.98 chicks were fledged per nesting attempt.

Figure 3. Artificial burrows in use (copyright Peter Barham)

Objective 3: To 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

The sightings of previously banded birds (retraps) help to provide an impressive data set which is being used by Res Altwegg at the South African National Biodiversity Institute (SANBI) to model the annual survival rates using the MARK programme. Dr Altwegg is also collaborating with researchers in Europe to develop better statistical methods (in particular to use Bayesian statistics) to provide better estimates (in particular estimates with smaller error ranges) of survival rates.

The MARK programme tends to underestimate survival rates in recent years as some birds that the programme assumed to have died may in later years turn out to have survived – thus we only really have reliable estimates of survival rates up to 3 years ago.

This year volunteers read 871 bands which corresponded to 463 different birds 227 had been oiled in the *Treasure* spill. 10 were hand reared orphaned chicks from the *Treasure* spill, and 36 were birds that had to be translocated to Port Elizabeth during the *Treasure* spill.

There has been very little banding of African penguins since the *Treasure* spill in 2000; accordingly, these data show the expected continuing decrease in the number of bands read each year as the number of banded birds in the population steadily decreases. Although we have seen a small drop in the proportion of birds oiled in the *Treasure* spill amongst these retraps in the past few years (60% in 2006, 53% in 2007 and 2008, compared to 49% in 2009) with the currently available analysis tools, 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. However, this is not as yet a firm conclusion – we hope that the new, Bayesian, methodologies being developed at SANBI may in the future allow better analyses to be performed on the existing dataset.

As well as recording all sightings of bended birds, we also record banded birds at nests. We have noticed over the past three years that the proportion of birds oiled the *Treasure* spill at nests has fallen to a much greater extent than in the overall resightings which include birds on the beaches, etc. Although we still have to fully analyse these data they do suggest that some birds oiled in the *Treasure* spill may not be breeding as often as other birds.

Objective 4: To monitor the breeding success of birds that were oiled in the *Treasure* spill and compare it to other birds

In the years up to 2005, there was a clear difference between the breeding success of birds that were oiled in the *Treasure* spill and those that were not. Previously oiled birds had a significantly reduced breeding success. However, in the past 3 years this trend has more or less disappeared so that now there are no clear differences in breeding success between birds that were or were not oiled in the *Treasure* spill.

We are not as yet sure whether this is due to less successful breeders who were oiled in the *Treasure* spill ceasing to breed; to an improvement in the overall health of birds that were oiled in the *Treasure* spill; to the least healthy birds that were oiled in the *Treasure* spill having a reduced survival rate; or even to the fact that the overall breeding success of all birds has dropped.

Objective 5: To assist with the development of an automatic penguin recognition and identification system on Robben Island

The automated recognition system was further developed during this field season. Now that it is a semi-permanent installation, volunteers are no longer asked to help with setting up the system each day. However, volunteers continue to take photographs of penguin chest patterns so that they can be added to the ever growing database. This activity, collecting identification photographs of penguins will, in the long term as we slowly and steadily develop a database of penguins that can be recognised by their chest patterns and plot their movements, become increasingly important. Once we have a good database and can reliably collect data on the regular movements of large numbers of individual penguins, we should be able to use that data to obtain improved survival rate estimates.

Objective 6: To monitor the numbers and breeding success of other bird species on Robben Island

Each team carried out at least one complete count of all the wading birds visible around the coast of the island – these counts provide a baseline for the variation on numbers of waders (and other birds) present through the year.

The breeding of the Bank's cormorants (*Phalacrocorax neglectus*) was monitored regularly by staff from the ADU assisted, from time to time by Earthwatch volunteers. Where such monitoring required close inspection of nests, it was carried out only by one or two trained researchers; where it could be done form a distance using telescopes volunteers were able to help on some occasions.

Further estimates of the numbers of African Black Oystercatchers, Hartlaub's gulls, Kelp Gulls and Swift terns breeding were carried out by staff from MCM and the ADU with some assistance from Earthwatch volunteers.

Objective 7: To determine movements of juvenile and immature birds

We have started to fit large chicks on Robben Island with the new rubber bands this year so that over the coming few years we will begin to be able to monitor movements of these birds as they come into the breeding population. Similar banding programmes are in place at other colonies so that we will be able to see movements of such birds between colonies in the coming years.

Amongst the resighting data we gathered there were just over 50 records relating to individual 23 birds that had been hand reared and fitted with bands. These resightings, together with a further 150 or so from previous years will be helpful in the analysis of movements of juvenile and immature birds we will carry out once we have a larger data set in two or three years time.

PARTNERSHIPS

Robben Island Museum (RIM), Marine and Coastal Management, Department Environmental Affairs and Tourism (MCM); the Animal Demography Unit, University of Cape Town (ADU) and The University of Bristol, UK (UoB) all provide staff, equipment and logistical support for the project.

Bristol Zoological Gardens (BZG) assisted with the testing of the rubber flipper bands and made those used this year.

The Southern African Foundation for the Conservation of Coastal Birds (SANCCOB) rehabilitates oiled, weak, injured and orphaned seabirds sent by the Earthwatch teams from Robben Island. SAFRING at the ADU, maintains the central database of recaptured birds.

All the data gathered is shared with all partner organisations and can be used for a number of purposes. At the moment, perhaps the most important use of the data is by MCM who are responsible for the experimental fisheries closures around selected colonies. The data generated from Robben Island provides an important input to that project.

PROJECT DEVELOPMENT

We have included a new activity; monitoring the growth and condition of chicks during the breeding season. This work forms a part of the monitoring required for the fisheries closures experiment. Similar measurements are being undertaken at the other colonies involved in the closure experiment. Measurements of chick growth rates together with snapshots of the condition of chicks provide insights into the availability of prey through the breeding season.

New objective 1: To monitor the condition of chicks during the breeding season

Methods

The condition of chicks is measured by comparing their size (measured by head length) with their body mass. An earlier study (in 2004) of the growth of a large number of chicks on Robben Island demonstrated that the mass of chicks increases approximately linearly with head length. A study by Lubbe (in 2008) showed that this baseline data can be used to define a “chick condition index”; chicks of mass greater than the average mass of chicks of similar size in the 2004 study have a positive index while those with a lower mass have a negative index.
Every two weeks 50 chicks are selected at random and measurements are made of the head length and mass these are then used to find the condition index and provide data on its variation through the year.

DISSEMINATION

Printed:

Barham, P. J.; Underhill, L. G.; Crawford, R. J. M.; Altwegg, R.; Leshoro, T. M.; Bolton, D. A.; Dyer, B. M.; Upfold, L (2008). Impact of flipper-banding on breeding success of African penguins (*Spheniscus demersus*) at Robben Island: comparisons among silicone rubber bands, stainless steel bands and no bands. *Bird Conservation International*, 18, 144-152.

Meetings and conferences:

Work from the Earthwatch project was widely reported at the International African Penguin Conference in Gaansbaai in April 2009. Presentations by Peter Barham, Les Underhill, Rob Crawford, Res Altwegg and Richard Sherley all included data gathered by Earthwatch volunteers.

CONTRIBUTIONS TO LOCAL, NATIONAL AND REGIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

In 2007, the Ecosystem Approach to Fisheries and Pelagic Scientific Working Groups of Marine and Coastal Management, Department of Environmental Affairs and Tourism (South Africa) recommended:

a) that a two-year feasibility study of the design of an experiment which would have the potential to achieve adequate power within a realistic time period to confirm the effects of closure on African Penguins be undertaken;
b) that marine areas around the largest penguins breeding colonies in the Western Cape (Dassen Island) and in the Eastern Cape (St Croix Island) be closed to purse-seine fishing for a period of two years from 1 January 2008–31 December 2009, with appropriate compliance measures put in place to ensure that such closure is effected in practice;
c) that the extents of the closed areas be 20 km to seaward from the low-water mark of Dassen Island and 30 km to seaward from the low-water mark of St Croix Island;
d) that intensive monitoring of African Penguins be undertaken at these islands and at nearby islands (Robben Island in the Western Cape; Bird Island in the Eastern Cape) that may serve as controls, as well as at the important southern colony of Dyer Island, with the aim better to inform the design of a possible subsequent experiment to detect the efficacy of using such closed areas to improve the reproductive success and survival rates of African Penguins at the associated colonies, and the methods which should be employed to monitor such closures;
e) that the design of such monitoring focus in particular on informing estimation of process and observation error for different data sets, and how the latter depends on the intensity of monitoring, to inform on the estimation of experimental power, and on which of the methods are the most cost effective in terms of increasing such power;
f) that immediate steps be taken to eliminate feral predators at Robben Island, whose continued presence could both impact the African Penguin population negatively and confound interpretation of results from the feasibility study;
g) that (as also recommended by the July 2007 international stock assessment workshop) existing mark-recapture data be made available (on a colony specific basis), in particular to allow an analysis of the power of continued collection of such data to detect the effects on survival rates of African Penguins of closure of regions around islands to fishing;
h) that the managing authorities of the islands (CapeNature, Robben Island Museum and SANParks) be requested to assist with the design of the monitoring programmes and their execution;

i) that the purse-seine fishing industry be requested to assist in every possible way to ensure compliance with the area closures; and
j) that results from this feasibility study be reported no later than 31 October 2009 to inform a decision then on whether to proceed with a full experiment to attempt to detect the effects of closure.

Subsequently, an area of radius 10.8 nautical miles centred on the lighthouse at Dassen Island was closed to purse-seine fishing for a period of two years commencing 15 January 2008. A similar area around St Croix Island and an area of radius 5 km around the Riy Bank were closed to purse-seine fishing for a period of two years commencing 1 January 2009.

The Earthwatch project has taken the lead in collecting and providing the data required from Robben Island for this very important conservation project, which will form the basis for any long term closures of fisheries around penguin colonies in South Africa. A measure that we believe can provide a major boost to the conservation of the African penguin.

Specifically, the Earthwatch project provides information of the influence of food on abstinence from breeding and breeding success of African Penguins to the Ecosystem Approach to Fisheries Working Group and the Pelagic Scientific Working Group of South Africa's Department of Environmental Affairs and Tourism, which advise on total allowable catches of pelagic fish off South Africa and are currently conducting experimental closures to Purse-Seine fishing of areas around African Penguin breeding colonies. The Earthwatch principal investigators are members of the working group.

LONG TERM IMPACT OF PROJECT

Taxa of conservation significance enhanced, restored or maintained

Bank cormorant (*Phalacrocorax neglectus)* listed by IUCN as Endangered. Robben Island now hosts one the main breeding groups of Bank cormorants. Research into the stability of the population both by measuring breeding success and the movements of birds between colonies contributes to the planning of the conservation management of this species.

ANYTHING ELSE?

We would like to thank Earthwatch for their continued support - it is only through the Earthwatch project that we have been able to maintain a long term study of the penguins on Robben Island. The long term data set we are still gathering is proving invaluable in helping try to understand the underlying causes of the alarming decline in the population of the African penguins. We are not aware of any other source of funding that is able to provide this necessary long term support.