

Environmental and Social Management Plan for SeyCCAT financed project BGF2/L/N6:

“First use of satellite telemetry on small pelagic and abundant seabirds (juvenile Sooty Terns) to define potential Marine Protected Areas through identification of foraging areas used during the gaining of independence from their parents”

Section	Content
Project Description	<p>Sooty Terns <i>Onychoprion fuscatus</i> are Seychelles’ most abundant seabirds and are culturally and economically important. As one of the most far-ranging avian top predators, they are potential indicators of high marine productivity and sentinels of change in oceanic productivity resulting from anthropic changes such as climate change, overfishing and pollution by organic and inorganic contaminants. Their foraging distribution at sea can thus provide pointers to locations that should be integrated into Marine Protected Areas.</p> <p>When not breeding Sooty Terns from the c.500,000 pairs nesting colony on Bird Island disperse widely over the Indian Ocean north of c. 25°S, but favour the Bay of Bengal and areas straddling the undersea mounts of the Laccadive-Chagos and Ninety-East ridges (Jaeger et al. 2017: <i>Frontiers in Marine Science</i>, doi:10.3389/fmars.2017.00394).</p> <p>When breeding (June-September), frequent return to the nest site to relieve incubating mates or to feed chicks leads adults to feed within c.150 km of the colony, but during food shortage longer trips are required (Neumann et al. 2018: <i>Marine Ornithology</i> 46:11-18; Feare & Larose unpublished data).</p> <p>Prior to egg-laying, breeding adults undertake a pre-breeding exodus to the south-east of Seychelles, around the Saya de Malha Bank (Jaeger et al. 2017), c.1500 km from Bird Island. This exodus enables exploitation of an area of high productivity (Shoals of Capricorn Expedition report, 2011), allowing birds to accumulate nutrient reserves for egg production.</p> <p>However, we do not currently know where Sooty terns go when they fledge from the Bird Island (or any other) colony.</p> <p>The critical phase when young Sooty Terns become independent and must learn the skills of locating food sources and procuring prey, while avoiding predation from predatory fish, is likely to involve high mortality. We hypothesise that Sooty Terns should have evolved behaviour to buffer against this predictable mortality risk by utilising highly profitable “nursery” areas for feeding, where young Sooty Terns develop their own foraging skills, and where post-breeding adults commence their annual moult and replace their feathers. Such predictable food locations likely benefit other marine life and represent biodiversity ‘hotspots’.</p> <p>We propose to identify these areas using satellite telemetry to track juvenile Sooty Terns. Ringing individuals cannot identify where juveniles feed in their first months of life and other tracking approaches (geolocators and GPS loggers) are inappropriate for tracking juveniles due to the need to recapture devices to download data (juvenile Sooty Terns do not return to land/colonies until they reach breeding age at 4-5 years old). Satellite telemetry, using trackers with solar charged batteries that transmit data continuously for many years, represents the only currently-available technique that will provide relevant information.</p> <p>This project will deploy Microwave Telemetry Platform Transmitter Terminals (PTTs) on 10 juvenile Sooty Terns in the Bird Island colony in August-</p>

	<p>September 2019. The PTTs will be custom-built to our design, which will be based on the design of GPS loggers that we are currently successfully using to track adult Sooty Terns while foraging during the incubation and early chick-rearing stages of the breeding cycle. This involves attaching the loggers to the lower backs of the birds using a thigh harness, which has been trialled, fine-tuned and used by this project team over the past five breeding seasons and found to be reliable and safe for the birds. The PTTs have an integrated solar panel and can continue to transmit location data for many years. American company, Microwave Telemetry (www.microwavetelemetry.com), is now producing small tags weighing 5 g, which represents 2.8 % of the body mass of a 180 g Sooty Tern, less than the 3 % limit often now accepted as the safe limit for flying birds (see annex 1).</p> <p>Location and activity data will be recorded and processed by the Argos satellite system and relayed to us via the internet.</p> <p>The satellite transmitters (PTTs) will be attached to juvenile Sooty Terns in the breeding colony on Bird Island, which is the most accessible of Seychelles' large Sooty Tern colonies, where most research has been undertaken since 1973 and where the birds are very tolerant of researcher disturbance.</p>
<p>Potential Impacts during project Implementation and Operation</p>	<p>Potential Impacts during project implementation and operation to project staff and Sooty Terns are:</p> <ol style="list-style-type: none"> 1. Are 10 tags enough? (a) Loss of PTTs due to early mortality of young Sooty Terns. While the annual survival of adult Sooty Terns is high (91%), the survival of young Sooty Terns from fledging to return as breeding adults at 5-years-old has been estimated as only 27% (Feare & Doherty 2011: Marine Ornithology 39: 221-226). However, research has shown that heavier weight and earlier fledging juveniles have a significantly higher survival rate than lighter and later fledging chicks (Feare & Bristol 2013: Ringing & Migration 28: 1-5); (b) Satellite tagging studies to date always have small sample sizes due to the high costs of tags. Numerous satellite tagging studies have been published in reputable journals with sample sizes of less than 5 individuals. 2. El Niño events (and possible related Indian Ocean Dipole switches). These cyclic oceanic oscillations can severely impact seabird breeding success and survival. If a severe event is predicted, which could result in lower fledging weights, poorer breeding success, or worst-case scenario-complete breeding failure. 3. Harness material. For our GPS logger studies, the harness material used is a flexible slip elastic (www.prestonsinnovations.com), which biodegrades after c. 4-6 months, leading the device to fall off and thus not to remain on the bird for life. For the satellite telemetry study, we shall need a more permanent material. The material most frequently used for satellite telemetry studies of birds is Teflon tubing, a material that is more resistant to biodegradation and maintains logger attachment for years, and which has been found to be well tolerated and not to cause injury to birds in other satellite telemetry studies and in trials undertaken by this project team on adult Sooty terns on Bird Island in 2015. 4. Risk of injury to Sooty Terns during handling by researchers. This is a very low risk as the researchers are highly skilled, experienced and internationally qualified bird ringers and handlers (see annexes 2a and 2b) and all 3 have previous experience of ringing, handling and attaching harnesses and GPS loggers to Sooty Terns (of the same design as that to be used to attach the PTTs).

	<p>5. Health and Safety of researchers while conducting fieldwork on Bird Island. This work is not strenuous or dangerous fieldwork. The Sooty Tern colony on Bird Island is on flat, open ground with no dangers, situated c. 5-minute walk from the Hotel. Bird Island runs a tourist establishment (Bird Island Lodge), they have an established Health & Safety protocol (detailed in annex 3), several Bird Island staff are trained first aid providers, Bird Island charters regular flights to and from Mahé, and in cases of emergency they charter plane or helicopter to evacuate to Mahé at short notice.</p>
<p>Mitigation Plan</p>	<ol style="list-style-type: none"> 1. Are 10 tags enough? Loss of tags and juveniles. In short yes 10 tags are enough- Satellite telemetry studies have been published with much smaller sample sizes (<5 individuals) than this due the expense of satellite tags. We envisage some tag loss, however, we shall minimise/mitigate against the risk of loss of tagged birds by selecting chicks for tracking that are among the earliest and heaviest to fledge (>190g), since these birds have significantly higher survival to return to breed than lighter and later chicks (Feare & Bristol 2013: Ringing & Migration 28: 1-5). 2. El Niño events. If a poor Sooty Tern breeding season is predicted due to El Niño events, which will be known before we put tags on, we will delay the project by 1 year until better breeding conditions prevail to mitigate against loss of tagged juveniles. This project timeframe can accommodate deferral of attaching PTTs by 1 year. 3. Harness material. Recommended harness material (Teflon tubing) will be trialled with dummy PTTs to test for comfort and acceptability for the birds. The trials will be undertaken on Adult Sooty terns in the 2019 breeding season during incubation and early chick rearing so the birds can be recaptured and checked for chafing or discomfort to the birds. The tubing size (2mm, 3mm 4mm external diameter) will be trialled and best tubing size based on comfort to the birds will be selected for the long-term PTT attachment. 4. Risk of injury to Sooty Terns during handling, ringing and attaching PTTs will be mitigated against by using only qualified and highly experienced bird ringers and handlers to undertake his work. Two project staff are qualified ringers with International ringing and handling qualifications and all three project staff have a lot of experience in handling, ringing and attaching GPS loggers (of same harness design) to Sooty Terns. Handling time and associated stress will be kept to a minimum, following International Best Practice (see annex 4). 5. Health and Safety of researchers while conducting fieldwork on Bird Island. The health and safety of researchers will be maximised, and any potential dangers minimised by following Best Practice for fieldwork in Sooty Tern colonies established by Chris Feare from over 30 years' experience working extensively in Sooty Tern colonies. Workers will wear sun hats to prevent sunburn, drink lots of water to prevent dehydration, wear noise cancelling ear muffs/ear plugs to prevent ear damage due to the constant noise created by the Sooty Terns' vocalisations' and wear solid footwear to protect feet. Additionally, Bird Island is a tourist destination with many years' experience of accommodating guests and fieldworkers alike. The island has an established health and safety protocol (annex 3) and the project staff will be covered by this which includes qualified first aiders present on the island, regular flights and options for short notice charter of plane or helicopter in case of emergency. In the unlikely event of serious injury

	<p>to project staff they can be rapidly evacuated to Mahé via airplane or helicopter. We have 3 fully qualified and experienced researchers on this project and we only require 2 at any one time to undertake this work – we can therefore cover each other in case of illness or injury.</p>
Monitoring Plan	<ol style="list-style-type: none"> 1. Regular download and monitoring of satellite tracks: (i) minimum of 50% of tracked juveniles continue to provide tracking data post-independence till project end; (ii) tracks successfully recovered from Argos: daily while juveniles are still in the colony, then weekly until month 3, then monthly from month 4 to project end. 2. Marine conditions and predictions of El Nino will be monitored weekly from project start date onwards and decision to put tags on or not will be based on El Nino (absence/presence & severity) and chick weights on the point of fledging (which is when we would put on the PTTs) (September 2019/September 2020). 3. All birds used for trials of harness materials will be monitored during and post attachment for any signs of injury or discomfort. All trial harnesses will be removed either at the end of the trial period or immediately in the case of injury or discomfort. 4. All birds used for final PTT attachment will be monitored during and post attachment for any signs of stress or discomfort. Any birds showing stress will not be used for PTT attachment. 5. Health of project staff will be monitored via qualified medical practitioners. Any serious illness or injury to project staff will be reported to SeyCCAT immediately. Minor illness or injury will be reported to SeyCCAT at regular established reporting intervals (months 6,12,18,24).
Institutional capacity development and training	<p>No further training is required to implement this project safely and to international best practices and standards. All three staff have already undertaken training and/or have qualifications to ensure they undertake this work professionally, with minimal disturbance and discomfort to all birds involved while following a high level of personal health and safety standards. Rachel Bristol holds a bird ringing, catching and handling licence from the South African Bird Ringing Unit (SAFRING) (ringer licence number 1306 see annex 2a) Chris Feare holds a bird ringing, catching and handling license from British Trust for Ornithology (BTO) /A/1767-see annex 2b). Chris Feare and Christine Larose have been attaching geolocators and GPS loggers to Sooty Terns without causing injury or discomfort to the birds for 5 years. Chris Feare has ringed thousands of Sooty Terns and Rachel Bristol and Christine Larose have each ringed hundreds without injury to bird or ringer.</p>
Organization and Management	<p>All three project staff are self-employed. Rachel Bristol and Chris Feare have considerable experience managing donor funded projects including management of project finances in a transparent manner and project reporting to donors, stakeholders and general public. A new bank account has been opened specifically for this project to ensure transparent management of project finances. All project staff and Bird Island Management have existing good working relationships and communicate regularly via email, Skype, mobile and in person. All equipment required for this project has already been investigated and we are in communications with suppliers already to ensure equipment (satellite tags and Teflon tube) is available and/or will be manufactured to our requirements and on time. Accommodation and flights for fieldwork are all being provided by Bird Island.</p>

	The project staff already have all other equipment required for undertaking this project (laptops, GIS software, bird rings, ringing equipment, binoculars, other field equipment etc.)
Implementation schedule and cost estimates	All aspects of this ESMP have already been included in the project budget at the time of writing. There will be no additional costs incurred to implement this ESMP.

Annexes

Annex 1. Transmitter weight and placement accepted best practice

Widely accepted guide for weight of transmitters on flighted birds is <5% (traditionally) and more recently \leq 3% body weight. The “5% rule” is essentially arbitrary (Caccamise and Hedin 1985; Aldridge and Brigham 1988; Gessaman and Nagy 1988), while the “3% rule” appears to have been extrapolated from a review of albatross and petrel studies correlating device loads with foraging trip durations and nest desertions (Phillips et al. 2003)” (excerpt from Guidelines for instrumentation of birds, Wildlife Advisory Panel, UTAS Animal Ethics Board- see accompanying doc entitled Annex1a) as well as other meta-analysis of effects of transmitters on migration times, survival, behaviour and breeding success.

Some relevant references referring to the 3% rule are:

Kenward RE (2001) A manual for wildlife radio tagging. London, UK: Academic Press. ISBN 9780124042421

Phillips, R.A., Xavier, J.C. & Croxall, J.P. (2003). Effects of satellite transmitters on albatrosses and petrels. *Auk* 120:1082–1090.

Heggøy O, Christensen-Dalsgaard S, Ranke PS, Chastel O, Bech C (2015) GPS-loggers influence behaviour and physiology in the black-legged kittiwake *Rissa tridactyla*. *Mar Ecol Prog Ser* 521:237-248. <https://doi.org/10.3354/meps11140>

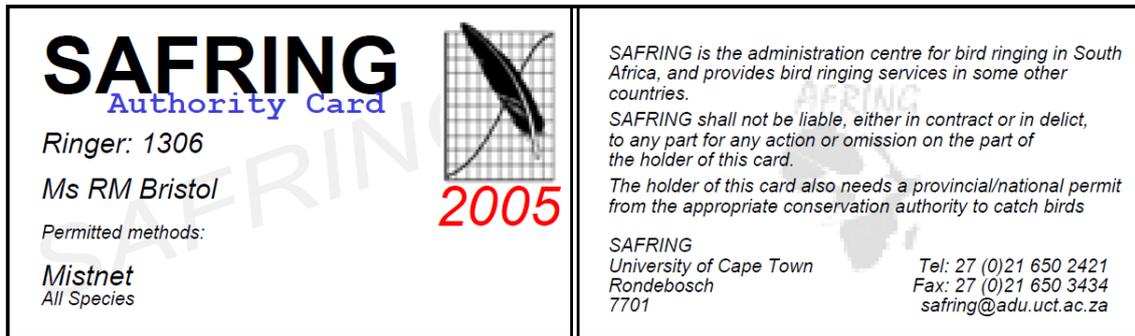
Transmitter attachment method used depends on species but should provide least discomfort to the birds while ensuring the transmitter is aerodynamic, positioned close to the bird’s centre of gravity and stays in place for the duration of the study.

Relevant references are:

Rappole JH, Tipton AR (1991). New Harness Design for Attachment of Radio Transmitters to Small Passerines. *Journal of Field Ornithology* 62(3): 335-337.

Mallory ML, GILBERT CD (2008). Leg-loop harness design for attaching external transmitters to seabirds. *Marine Ornithology* 36:183–188.

Annex 2a. Rachel Bristol SAFRING ringing permit



Annex 2b. Chris Feare BTO ringing permit – see accompanying document entitled Annex2b

Annex 3. Bird Island Lodge Health and Safety Protocol

Bird Island has an established Health and Safety Protocol that covers all persons on the island (guests, staff, visiting researchers etc alike). The protocol is widely known amongst all staff on the island. There is not an official written document for these protocols, however.

The protocol is as follows (identical procedures described to me separately by two different Bird Island Staff – (from both Front Fesk and Island Management).

In case of injury or illness to anyone on Bird Island the following procedures are implemented:

1. Assessment of injury or illness by qualified first aid staff on the island*
2. If the injury or illness is not serious, they deal with it themselves.
3. Check if there are any doctors present on the island amongst the guests. If Doctor is present get him/her to assess patient and provide professional assessment and treatment advice
4. Call a doctor and/or pharmacist on Mahé and seek advice.
5. Get ill or injured person off the island and back to hospital on Mahé – depending on how serious – either on the next scheduled plane (which may be later that day or the following day (flights are normally daily)
6. Or if the injury/illness is more serious charter a plane or helicopter to airlift the patient back to Mahé ASAP. This can be organised very quickly in a matter of hours.

*At all times on Bird Island several staff are present with first aid certificates. Bird Island management ensures that several staff are trained/attend refresher courses annually to ensure up-to-date valid certificates. The island has a well-stocked first aid kit.

Annex 4. Guides to best practice for bird capture, handling and ringing

The guidelines we follow are the ones provided by the ringing schemes we are qualified under.

Redfern, CPF, Clark, JA (2001). Ringers' Manual (4th Edition). British Trust for Ornithology, Thetford, UK.

De Beer SJ, Lockwood GM, Raijmakers JHFA, Raijmakers JMR, Scott WA, Oschadleus HD, Underhill LG (2001). SAFRING Bird Ringing Manual. Avian Demography Unit, University of Cape Town, SA. See accompanying document entitled Annex 4.