

Project Update: October 2013

Feasibility Study of Ultrasonic Acoustic Telemetry of Penguins

Behavioural observations of African Penguins

Unfortunately this aspect of the study was delayed, as the penguins were housed in a temporary enclosure for 6 months while renovations to the Oceanarium were conducted. The new penguin enclosure (completed in September 2013) includes a large pool suitable for testing their reaction to underwater sounds. The response of African penguins to an active and inactive VEMCO 69 kHz transmitter underwater was recorded, after it was established that they do not react to an active transmitter in air.

GoPro footage was used to record the behaviour of all birds in the water while observers recorded the behaviour of specific birds in the water (focal animal sampling) as follows:

- Record duration of behaviour in time intervals of <5 seconds, 5-10 seconds, >10 seconds
- Bird preening
 - Bird puts head underwater
 - Bird submerges entire body
 - Note any abrupt changes in behaviour
- Direction of swimming
 - Pops up to surface after diving
 - Exits water



Penguins swimming in large pool of new enclosure, where their response to underwater sounds was recorded.

In contrast to the behaviour of the birds in response to an audible sound – when all the birds climbed out of the penguin pool – the birds did not change their behaviour in response to an active 69 kHz transmitter underwater. The next stage of the feasibility study will entail trialling tag attachment techniques after range-testing at sea.



Left: recording. Right: Divers reporting on moored station and substrate.

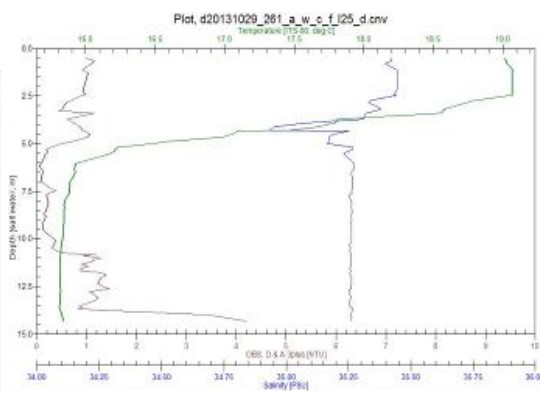
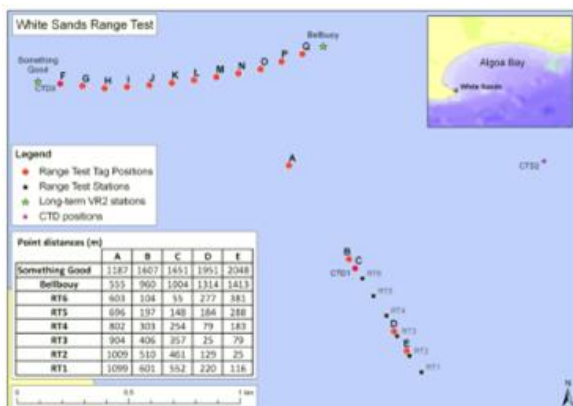
Ultrasonic tag range-testing at sea

The attachment and position of a transmitter (tag) on a penguin may have an impact on the detection distance of the transmitted signal at sea. In addition, various environmental factors may reduce or improve the distance at which a hydrophone (VEMCO VR2 listening station) can detect an acoustic tag. Range testing of these tags at sea is therefore an important aspect of the feasibility study. Unseasonal weather prevented sea trips during winter, but improved sea conditions in summer have enabled us to commence this aspect of the study.

We moored six listening stations 100 m apart in a straight line at White Sands, Algoa Bay.

- DNR Garmin was used to create waypoints in GIS
- Stations were surface-deployed on rails
- Divers inspected deployment and recorded the substrate at each station

It is anticipated that a total of nine boat trips under varying weather conditions will be conducted using the following range test procedure:



Left: Map indicating positions of moored stations and range test tag positions. Right: Data recorded by CTD, indicating presence of a thermocline.

- Switch off boat engines and echo-sounder.
- Do CTD (Conductivity, Temperature, Depth instrument) cast at three sites before range tests to determine presence of thermocline.
- Use VR100 (VEMCO ultrasonic telemetry and tracking receiver) to record each range test.
- For each range test, record the following:
 - Date
 - Weather & sea conditions
 - GPS position & accuracy
 - CTD cast number
 - Tag used
 - Exact time of tag in & out of water
 - Procedure followed

The VR100 allows us to record the transmitted signal from the boat, while the moored stations will record the range at which the signal is detected. We will therefore only be able to analyse the range test data once the moored stations have been retrieved. Apart from swell, wind chop, background noise and the positioning of the transmitter, the turbidity of the water (maroon line in adjacent graph), presence of a thermocline (green line), and salinity of the water (blue line) may have an impact on the detection range of a transmitter. In addition, different transmitter power outputs (dB re 1 μ Pa) are also being investigated.



Custom built penguin model with taxidermy skin and feathers for use in tag range testing. One of the tag attachment positions on the lower back is visible.

Various tag attachment positions are tested, using a custom-built model penguin and a taxidermy skin. The model floats in swimming posture, and has simulated airsacs and a stomach. This allows for an investigation into the influence that air sacs and the air trapped

in the feather layer have on the detection range of a tag placed at various external and internal positions.

Tag attachment trials

In order to minimise the extent of tag attachment trials on live birds, the results of the tag range tests will be used to establish which tag attachment positions are feasible for ultrasonic telemetry. Only those tag positions that provide an adequate detection range (~300 m) will be trialled on live birds. At the moment it seems as if internal placement of the tag results in very limited pulse transmission through the feather-layer, so it may not be necessary to subject live birds to internal tag attachment trials. However, external tag attachment trials will commence as soon as clearance has been granted by the Ethics Committee.