SORP RESEARCH REPORT

Title of project The South African Blue Whale Project

Details of named investigators (Principal Investigator first)

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Background to the proposal

This project aims to initiate a long-term programme of monitoring the distribution, abundance and movements of blue whales in the Antarctic sector south of South Africa (0˚-20˚E, an area of probably the highest polar abundance of the species), coupled with investigations of the seasonal pattern of abundance at lower latitudes, including local waters.

Overall objectives

1. To investigate the distribution and abundance of Antarctic blue whales off Queen Maud Land between 0˚ and 20˚ E from December to February, using autonomous acoustic monitoring and line transect surveys that incorporate photo-identification and biopsy sampling

2. To study the seasonal occurrence of Antarctic blue whales in lower latitudes from March to November using acoustic monitoring at a series of autonomous recording stations

Requirement for resources sought in this application

The Greenland Climate Research Centre and the Applied Physics Laboratory of Washington University planned to deploy five Autonomous Acoustic Recorders (AARs) west of Disko Bay on the western coast of Greenland, in August / September of 2012, to investigate whale migration patterns in relation to the extent of sea ice. These deployments were to be carried out under the guidance of Malene Simon of the Greenland Climate Research Centre and Craig Lee of the Applied Physics Laboratory. The deployment of these five instruments in a relatively short period of time (a week was proposed) was considered an outstanding opportunity for one of us, Meredith Thornton, to gain experience in the technical aspects of AAR deployment at sea. The need for this experience lay in our proposed deployment of three similar instruments both in the Southern Ocean and off the west coast of Southern Africa.

The deployment cruise in Disko Bay was to be carried out from Nuuk, so funds were sought to enable Thornton to travel between Cape Town, South Africa and Nuuk, Greenland and for subsistence for two days each side of the cruise.

Project report

Meredith Thornton flew to Greenland in September 2012 to participate in the 3-week oceanographic cruise that was co-run by Dr Malene Simon from the Greenland Institute of Natural Resources' (GINR) Greenland Climate Research Centre and Prof. Craig Lee from the University of Washington's (UW) Applied Physics Laboratory. The two projects undertaken on the cruise on the GINR research vessel *Sanna* were:

1. Climate change and the role of baleen whales as apex predators in West Greenland – one of the aims of which is to monitor the seasonality and distribution of whales using passive acoustic monitoring (via acoustic mooring arrays), and to correlate these to sea ice conditions,

2. Observational oceanographic network in the North Atlantic – with the aims of quantifying variability associated with strong, narrow coastal flows and estimating volume and freshwater fluxes.

The cruise was divided into two parts, the first being the UW component and the second the GINR component.

Meredith embarked at Sisimiut, Greenland, on 3 September, sailed across to Cape Davis, Canada, and then back to northern and western Greenland, finally disembarking in Uummannaq on 21 September. The work involved the setting up, construction, deployment and retrieval of numerous trawl and iceberg resistant, near bottom, subsurface oceanographic (ADCP & CTD) and acoustic moorings (AURALs and EARs) across the Baffin and Greenland shelves. Meredith participated fully in, and observed how to organise deck operations, learning which floatation and materials to use (and not to use) for deep sea moorings and various techniques for deployment and retrieving lost moorings. She also participated in trouble-shooting while setting up AURALs, and assisted in mooring retrieval and observed Seaglider deployment and retrieval.

Generally AURALs were deployed in deep water at 200m depths (they have a 300m depth limitation). Briefly these moorings comprised an anchor system (railway carriage wheels), coupled by a short (approximately 20m) riser length (of chain and Technora / Dyneema rope) to an acoustic transponder release system comprising the transponder release, a long main riser line (Technora / Dyneema rope) linking the transponder to the AURAL passive acoustic recorder, and a floatation line attaching mooring buoyancy above the recorder.

The following list gives specific technical details of what was learned, including the pros and cons of various choices.

Mooring Cable.
Dyneema melts under friction, but can handle wear.
Fibre-coated kevlar line cannot handle wear as well as Dyneema, but it doesn't melt.
Cable ends need to be back and forward spliced under pressure – i.e. line needs to be stretched and kept tight. The outer layer should be melted and the inner core divided into 4. The splicing should be fixed at each end and in the middle. Heat shrink should be used to seal it all off.
Cable eyes are custom machined for the specific line, or commercial ones can be used. Nylon is a good material for this.
Coiling of line is done in a figure of eight, for shorter lengths, or for deep moorings cable should be spooled on the winch cable to avoid tangling.
Cable bite has not occurred in the Arctic waters, but has been observed in sub-tropical waters – suspected to be from predatory fish going after prey that is sheltering around the mooring.

Buoyancy.
Do not compromise on quality as everything depends on the mooring rising to the surface again.
Glass buoys are the best buoyancy option, but the most expensive.
Glass buoys are secured by means of plastic covers ("hats") that are supplied by the manufacturer of the buoys. Some are spherical and some are square.
Large steel buoys are used in conjunction with the glass buoys, they are depth rated and very heavy, but highly visible.

Other flotation options should not be considered as there is no guarantee beyond the rated soak time, and plastic buoys will crush and become ineffective.

Anchors.
Train wheels are used as anchors.
Metal plate and tubing are used to connect the wheels in a stack for multiple deployment.

Stowing of equipment.
Tyres are used for securing the metal buoys.
Wire cages are used for stowing the cable, shackles and glass buoys.
Train wheels are secured directly to the deck, with tie-down ratchet straps to secure the wheels, tyres, cages and buoys.
Large eyes are screwed to the deck hatch covers and D-shackles are used to secure everything to the deck.
Wood is used for on top of lab benches to fix tool boxes, fastener containers etc. to, using tie down straps and metal eyes.

Data recording.
One person is designated to sign off on the deployment.
A diagram of the mooring is used during the procedure and they need to (1) record the serial numbers of instruments, (2) check that the sequence of cables, buoys and instruments is correct, (3) ensure that cotter pins for each D-shackle are present, (4) record time of each instrument touching the water, (5) record final time and position of the anchor drop.
Nothing goes overboard until this person gives the go ahead.
This person is also in charge of safety and security during the deck operations because they stand back and have an overall view of what is happening.

Safety and security.
All deck personnel require hard hats, working life jackets, gumboots, gloves
Man overboard button / procedure needs to be gone through with the team.
Line on deck to be coiled carefully at all times.
Tag lines required on either side of anchor for stabilisation as instrument is streaming aft while waiting for final drop.

Deployment.
The mooring is constructed while the vessel is underway, steaming towards the deployment locality.
The mooring is streamed out top down (i.e. anchor last) aft of the vessel.
A releasable hook is needed for the winch.
Tag lines are necessary for stabilisation.
Trial and error will determine the co-ordination between mooring construction and streaming and the timing for the drop locality, plus accounting for the swing and settling effect. It is better to be ready early for the drop than have to do a turn and go back onto it.

Locality recording.
After deployment, several positions around the deployment locality should be recorded, along with the bearing to the instrument, according to the acoustic release signal received by the deck unit. This is to determine an even more accurate position for retrieval.

Acoustic releases.
No consensus was reached on which acoustic release is better to use.
Edgetech make releases that are cheaper than Benthos that are good for coastal deployments.
The bigger Edgetech unit for the deep water is heavier and more expensive.
Not all deck units work with all instruments, or if they do work they can sometimes be a bit fiddly.
Suggest always going to sea with two deck units i.e. buy one your own and borrowing one as a back up - if money was no object they would buy some deepwater and some coastal Edgetechs.
Usually when a signal is sent to an Edgetech instrument it works first time but with Benthos, not always - it can be finicky and you sometimes have to go over and over the area a few times. However, in practice in Greenland, this didn't happen.

On the other hand when queried more specifically about Benthos they said that they had had no problems in their most recent work with them.
Good option is to use 2 releases per deployment, so if one fails then the other is a backup.

Other.
Line and shackles are never re-used, new line is always bought for each deployment.
Galvanised iron is better than stainless steel because it is stronger. Stainless steel can rot due to acidification wherever there is abrasion. If using stainless steel then coat it with paint.
It is strongly suggested to have a satellite-tracking device on each mooring in the event that it goes missing or breaks free, e.g. if it is dragged or trawled as a result of ice formation, fishing, seismic surveying, or if it breaks loose.
If a mooring cannot be found then it needs to be dragged for, which is a time consuming process. This is the very last resort. It is suggested to send the release signal regardless of hearing back from the interrogation signal and see if it releases anyway.

List of tools and consumables needed.
Side cutters
Spanners
Screwdriver set with hex heads and long extension arm
Philips and flat head screwdriver
Cotter pins – various sizes
Sacrificial zinc anodes – specially manufactured
Nuts and bolts – nylocks
Kim (similar) tissue paper for o-rings
Silicone grease for o-rings and bolts
Vinegar for cleaning bolts
Batteries for instruments
Multimeter for testing voltage
D-shackles
Non-slip rubber for underneath instruments when setting up and downloading data
Oil filter-type opener for Aurals

Expenditure

Item	Expenditure (ZAR)* Subtotals		Budget**
Air fares, CT – Copenhagen return	11,623.00		
Copenhagen - Sisimiut	5,230.40		
Uummaanak - Ilulissat	2,695.00		(£2000.00)
Nuuk - Copenhagen	7,667.78	27,216.18	26,620.00
Accommodation, Copenhagen	693.00		
Sisimiut	3,759.00		(£500.00)
Uummaanaq	2,240.00	6,692.00	6,655.00
TOTAL		33,908.18	33,275.00

*@ 1DKK = ZAR1.4 **@1£ = ZAR 13.31

Peter B. Best 24 May 2013