2017

DOKE Field Work Report
Aerial Survey

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Grant Munro

Austral biodiversity

Background

South Atlantic Environmental Research Institute (SAERI) is leading a multi-partner project entitled 'Dolphins of the Kelp: Data priorities for Falkland's inshore cetaceans' (hereinafter DOKE), which is funded by the UK Government's Darwin Plus Funding scheme and the Falkland Islands Government (FIG). The project partners are Falklands Conservation (FC), Shallow Marine Surveys Group (SMSG), Austral Biodiversity, Oregon State University, and University of St Andrews. The aim of DOKE is to establish baseline data on the abundance, distribution, natural history and genetic diversity of the Falklands inshore cetacean populations to provide a scientific basis for conservation and ecosystem-based marine management initiatives. The target species are the Commerson's (*Cephalorhynchus commersonii*) and Peale's dolphins (*Lagenorhynchus australis*) although all cetaceans encountered are recorded.

The project is delivered through three complimentary work programmes: 1. island-wide transect survey, using line transect methods to estimate abundance of both species; 2. focal studies, carried out in three areas (A. Port Stanley – Port Williams – Berkeley Sound; B. Choiseul Sound; C. Port Howard – Many Branch) and using photo-identification and passive acoustic monitoring methods; 3. tissue sampling to determine genetic diversity, local population structure, and relationship to SW Atlantic contiguous continental stocks.

The purpose of this report is to describe the field work related to aerial survey, fulfilling the first of the three complimentary work packages of the project.

Summary

Line transect methodologies are standard techniques used to estimate the abundance of wild animal populations over large areas using vessels or aircraft as observation platforms. For this project a vessel was initially considered as suitable platform to carry out the island-wide survey within 10 km from the coast.

However, observations from a short vessel-based pilot survey, indicated that dolphins were strongly attracted to the research vessel, which violates one of the key method assumptions i.e. that animals do not respond to the survey platform before they are detected by the observers. If this assumption is not met density estimates will be positively biased, resulting in numbers up to six times higher than when the response movement is not taken into account (Cañadas et al., 2004).

To minimise dolphin attraction, the use of an aeroplane instead of a vessel was adopted in 2017. This observation platform also offers the flexibility to select only good weather days to carry out the survey, which minimises the number of days lost as a result of poor weather conditions and also improves the financial efficiency of the project.

Furthermore, aerial-based surveys are considered more efficient than vessel surveys for wider areas, and have been successfully carried out with several cetaceans including species similar to the target species of this project (MacKenzie & Clement 2014; Palka et al., 2016).

Small aeroplanes with bubble windows, double engines and experienced pilots were available in the Falklands where the Falkland Islands Government Aerial Service – FIGAS (www.fig.gov.fk/figas) is an essential part of the island transport infrastructure and way of life.

Survey design

The study area covered 19,314 km^2 which included areas within 10km of main two islands (East Falkland and West Falkland) as well as the 778 smaller satellite islands with the exception of Beauchêne Island lying about 54 km south of the main Islands (**Figure 1**).

The software Distance 6.2 (Thomas et al., 2010) was used to generate different survey designs for the study area (**Figure 1**). Distance 6.2 allows for the comparison of several designs and therefore the selection of the most suitable for the characteristics of the area and the target species. Distance 6.2 is specifically designed for this kind of research activity and is widely used to obtain robust estimates of the abundance and density of several species in the marine and terrestrial environments. The software uses an automated survey design engine to examine the coverage properties of candidate survey designs prior to their implementation. For each given design, the software generates a map showing coverage probabilities estimated by simulation (**Table 1**) and allows researchers to determine whether a particular survey design is appropriate. Based on these considerations, the survey designed for the planned monitoring activities ensures a uniform coverage of the study area (i.e. each point within the study area has the same probability to be surveyed) and gives the maximum efficiency per unit effort, for instance, by minimising off effort i.e. time such as the time requested to travel to and from the airports and fly between successive transect lines.

The study area was divided in 12 strata accounting for possible differences in physical characteristics with respect to the prevailing winds and currents and the general physiography of the sea bottom.

A total of 217 transects spaced between 5 and 6 km and generally oriented perpendicular to the coast north-south were generated by the software Distance 6.2. Overall, the total length of the designed transects was 4,317 km (**Table 1**). Accordingly, the estimated time to survey the planned transects, considering transfer time (to and from airports and from transect to another) is 52 hours.

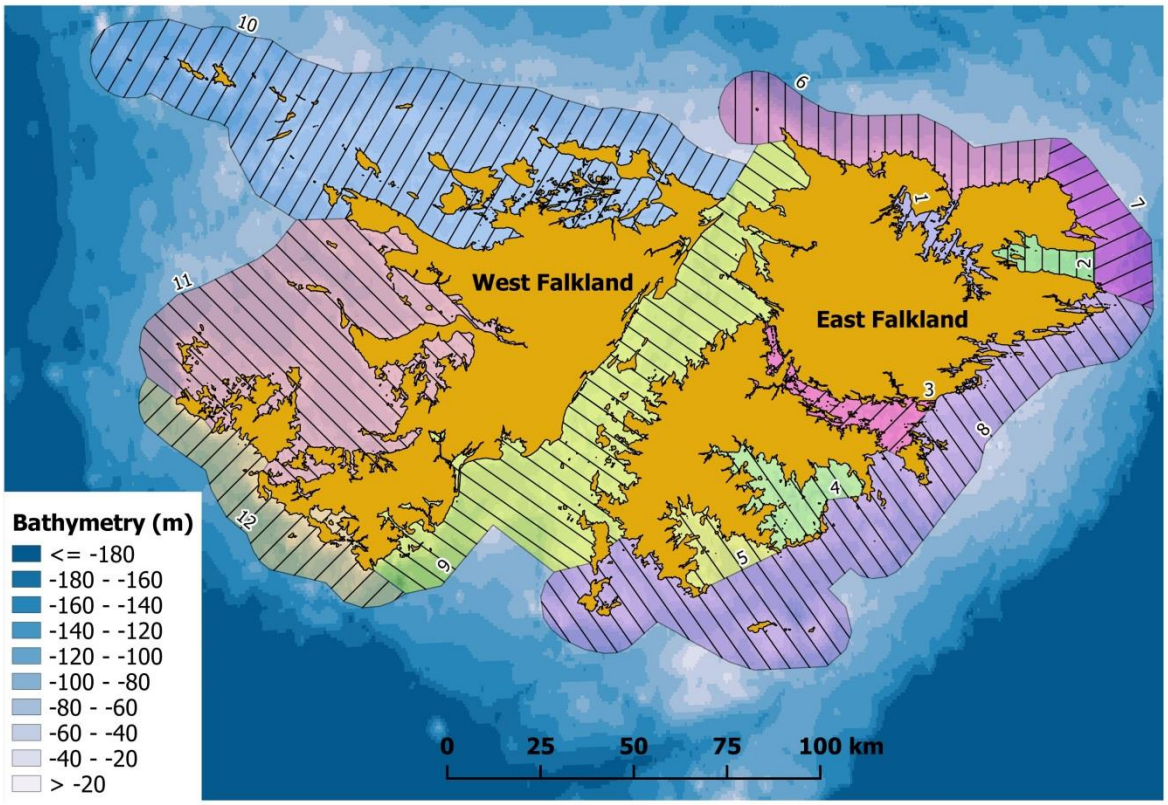

Figure 1 – Map of the Falkland Islands showing the study area within 10 km from the coastline (divided in 12 strata) and transects (parallel black lines) obtained with the software Distance 6.2.

Table 1 - Summary information on the planned aerial survey.

Stratum		Area (km^2)	Coverage probability (%)	Effort (km)	No. transect
Id	**Name**				
1	Port Salvador	174.5	0.57	46.4	8
2	Berkeley Sound	175.8	0.79	43.0	6
3	Choiseul Sound	349.9	0.68	76.3	11
4	Adventure Sound	447.1	0.69	88.0	7
5	Bay of Harbour	290.2	0.65	52.1	4
6	North East Falk.	,1162.6	0.86	254.4	20
7	East point East Falk.	590.1	0.80	126.6	11
8	West East Falk.	3,640.7	0.85	823.2	41
9	Falkland Sound	3,143.3	0.82	740.3	35
10	Northwest West Falk.	4,890.4	0.84	1,082.4	38
11	Middle West Falk.	3,335.4	0.81	751.1	17
12	South West Falk.	1,114.3	0.79	233.2	19
Total		**19,314.3**	**0.82**	**4,317.0**	**217**

Aircraft

The survey platform is the BRAVO-OSCAR Britten-Norman BN-2B Islander with high-wing, double engine and two bubble windows on the rear allowing observation below the plane itself (**Figure 2**). The aircraft flies at **150 m** of altitude at the target speed of 90 knots (~**167 km/hour**). The maximum permitted cruise time is approximately six hours allowing for about 1,000 km to be flown per day.

Figure 2 – The aircraft BRAVO-OSCAR used for the survey was a Britten-Norman BN-2B Islander from FIGAS.

Data Collection

The research crew consisted of a recorder and two observers. Date, time, position, heading and speed of the plane were automatically recorded every second on a laptop running the software Logger with an MS Access customised database (Logger 2000, International Fund for Animal Welfare) interfaced via a GPS Garmin GPS 72H. Observers searched for cetaceans looking downward from the trackline to 90 degrees port or starboard. Sighting data were communicated to the recorder using the airplane communicating system. Data collection details are available at SAERI website www.south-atlantic-research.org/media/files/Aerial_Survey_Protocol_Data_Collection_2017.pdf.

Survey Summary

The aerial survey was carried over nine days from the 18th of March to the 8th of May 2017 (**Figure 3**). Bad weather conditions and logistic issues with the aircraft extended the survey period to over two months. A total of 4,576.5 km were flown following the survey design corresponding to almost 100% of the coverage of the planned transects. More than 50% of the flight time was however used to reach the starting point of the daily survey and moving between transect lines (**Table 2**).

Table 2 - Aerial survey days, pilot in control, flight time, kilometer covered during the flight per day and km covered following the transect lines.

Date (2017)	Pilot	Time	Total km	Km on transect
18 March	Paul Robertson	06:20:11	1087.3	616.4
19 March	Andrew Alazia	06:10:08	1171.3	524.0
25 March	Troyd Bowles	05:49:31	1078.7	519.6
02 April	Drew Robertson	04:29:08	786.3	363.9
06 April	Drew Robertson	05:46:22	1069.7	535.1
09 April	Andrew Alazia	06:39:21	1153.1	588.6
17 April	Troyd Bowles	04:52:06	954.7	417.1
23 April	Troyd Bowles	05:02:07	951.9	359.3
08 May	Troyd Bowles	06:28:15	1202.1	652.5
9 days	**4 pilots**	**51:37:09**	**9455.2**	**4576.5**

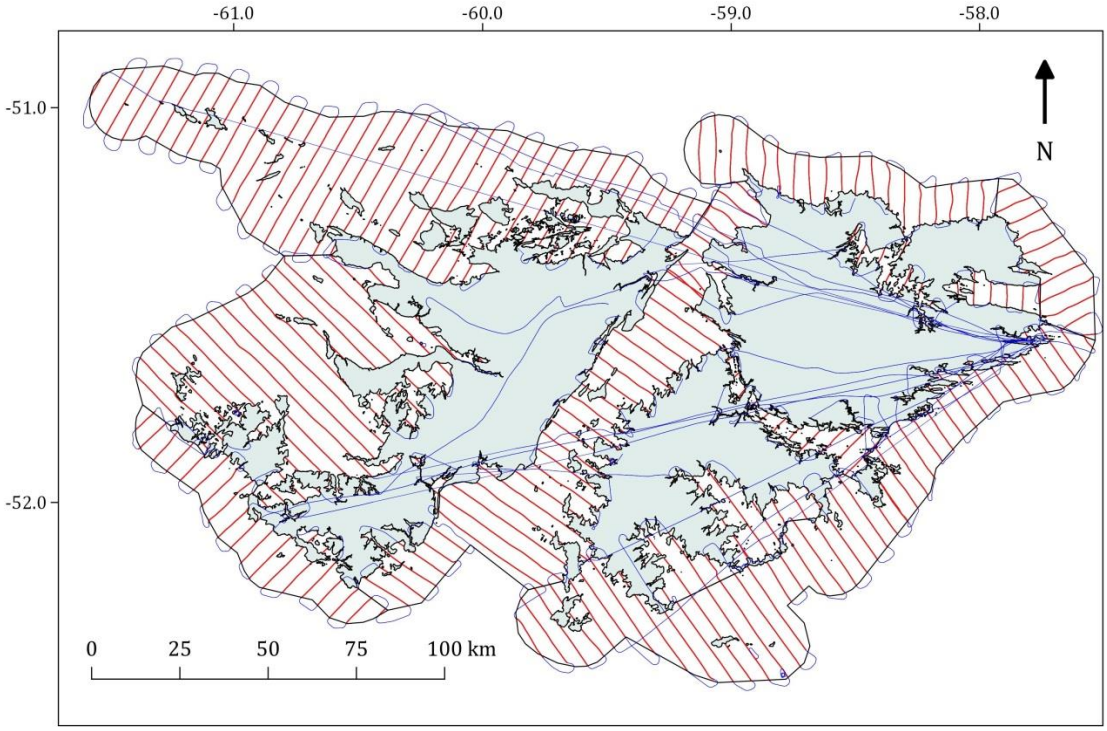

Figure 3 - Aircraft route on transect (red line) and between lines and to/from the airport in Stanley and the starting/end point.

A total of 454 cetacean sightings were made and seven species were identified including Commerson's dolphin (238 sightings), Peale's dolphin (60 sightings), sei whale (74 sightings), fin whale (12 sightings), blue whale (2 sightings), common minke whale (2 sightings), and southern right whale (1 sighting). The remaining 65 sightings were recorded as unidentified baleen whales (**Table 3**). The majority of the sightings (85%) were made on transect.

Table 3 - Sightings made in total and while flying following the transects divided by species plus the a category including unidentified baleen whales. The last column report the percentage of sightings made on transect respect to the total per species/category.

Species	Sightings total	Sightings on transect	% of sighting on transect
Commerson's dolphin	238	195	82
Peale's dolphin	60	55	92
Sei whale	74	68	92
Fin whale	12	8	67
Blue whale	2	1	50
Common minke whale	2	2	100
Southern right whale	1	0	0
Unidentified baleen whales	65	58	89
Tot	**454**	**387**	85

Sightings distribution map show that Commerson's' dolphins are distributed all along the coast of the Falkland Islands, mainly concentrated near shore in relatively shallow and sheltered areas, including harbours, bays and sounds (**Figure 4**).

Peale's dolphins are found in both offshore and near shore waters. Along shore, Peale's appear to prefer exposed coastlines. Peale's were not spotted in the central part of the Falkland Sound (**Figure 4**).

Baleen whales were spotted in all the waters around the Falkland Islands with the exception of the southern part (**Figure 5**).

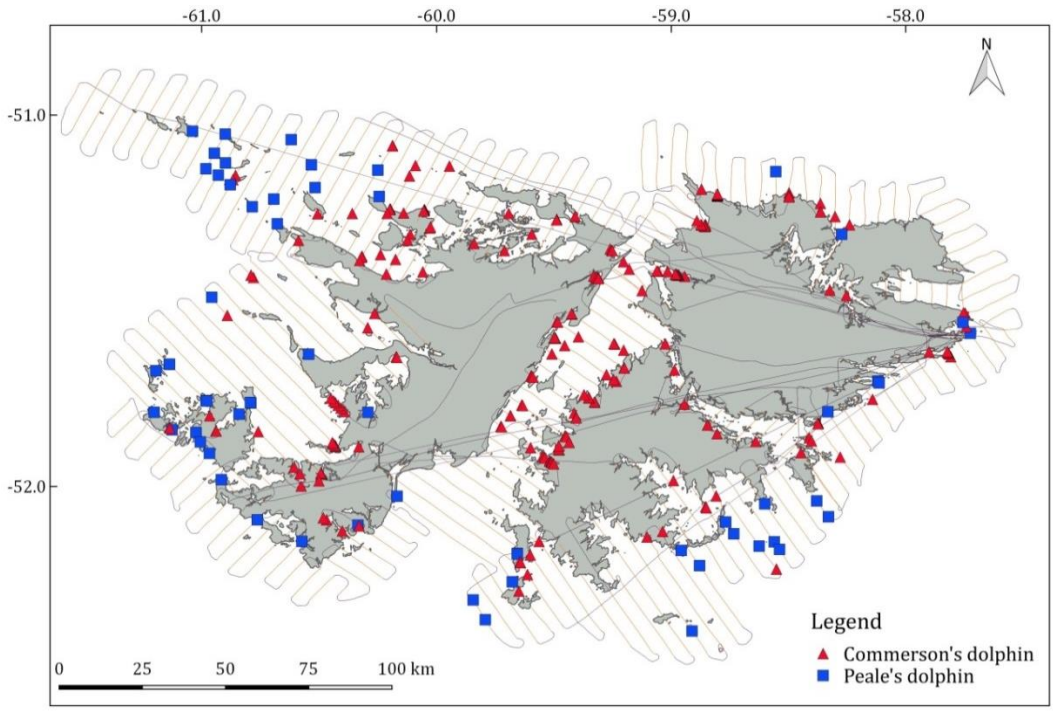

Figure 4 - Sighting distribution of Commerson's (red triangles) and Peale's dolphins (blue squares) observed during the aerial survey (including navigation of transect).

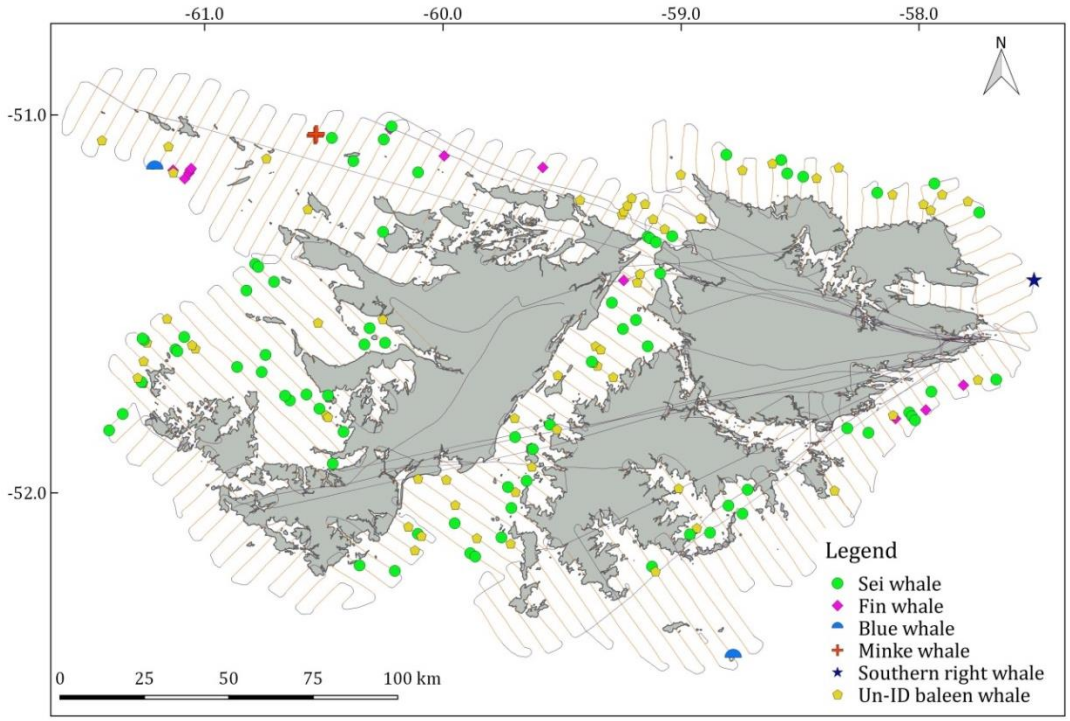

Figure 5 - Sighting distribution of baleen whales observed during the aerial survey (including navigation of transect).

Data management

Data management for the project operates in two ways, with the help of the IMS-GIS Data Centre Manager.

a) Storage: the data (navigation and sighting data) are saved on a secure server and backed up hourly and off-site.
b) Metadata: the data have been documented using the standard metadata form (19115). Metadata is made available online through the SAERI metadata catalogue (www.south-atlantic-research.org/metadata-catalogue).

In both cases the project is taking into account what is written in the current Falkland Islands data policy (www.south-atlantic-research.org/guide-for-researchers/planning-research-in-the-falkland-islands).

Conclusions and next steps statement

The aerial survey was conducted successfully. Commerson's' dolphins were relatively easy to spot because of their body coloration (black and white). Whale identification was quite challenging when whales were far away from the trackline but we reckon would have been the same from a vessel.

More than 50% of the effort was used to move between lines and from/to the airport and the starting/ending point of transects. Increasing the tank capacity or the minimum hours of flight might help to reduce costs.

The next steps include:

- detection probability estimate/category;
- group size estimate per species/category;
- availability bias estimate per dolphins using a drone and/or by land;
- abundance and density estimate/category;
- paper about Falklands Commerson's and Peale's abundance drafted for the end of December 2017.

Acknowledgements

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