CRUISE REPORT
Body Condition Project 2014 - *Hyperoodon* Jan Mayen Trial

Bottlenose whales near the island of Jan Mayen. (Photo by S. Isojunno)

Jan Mayen, Norway, June 02 – 30, 2014

T/S *Prolific*

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EXECUTIVE SUMMARY

A 28-day research trial was successfully accomplished using 29m sailing vessel Prolific. Whales were effectively sighted from the sailboat platform, with large numbers of northern bottlenose whales sighted near Jan Mayen and in waters north of Iceland. Weather conditions were calm during the trial, with only five days having been lost due to unworkable weather conditions. Tags could not be deployed using traditional hand-poles methods, but six Dtags were attached to northern bottlenose whales using the ARTS launching system, with five high quality data sets recorded. Biopsy samples were collected using a custom biopsy system attached to the ARTS carrier during 3/6 tag deployments. Rotation of the carrier during tag deployment was the primary factor causing failure to collect a biopsy sample during tag deployments. An additional nine biopsy samples were collected using the ARTS system, but none of these were from tagged animals which were not easy to track and re-approach. Difficulty with tracking made it impossible to carry out a playback experiment with northern bottlenose whales, though one playback experiment was successfully accomplished with long-finned pilot whales in the Vestfjorden basin.

Three SPLASH tags were successfully attached to northern bottlenose whales, demonstrating the potential utility of this method to study movement and behaviour of the species, but tag placement may have limited the duration and quality of the data obtained. Other species were sighted and a set of tag deployments and a playback experiment was successfully accomplished with long-finned pilot whales. An acoustic buoy was deployed near Jan Mayen, but was later found damaged upon recovery, indicating care is needed to prevent pressure damage in those poorly-charted waters. Towed hydrophones were somewhat effective at detecting northern bottlenose whales, but carried a risk of entanglement with the vessel.

The results of the trial demonstrate the effectiveness of using a sailboat to sight, tag, and collect biopsy samples from northern bottlenose whales in the Jan Mayen area. Future trials could seek to operate in the waters between Iceland and Jan Mayen, as well as near Jan Mayen itself. Successful collection of a biopsy sample during tag deployment seems critical to obtain biopsy samples for tagged whales. Northern bottlenose whales could not be easily tracked or re-approached after tagging, so VHF tracking systems should be optimized to enable effective tracking. If possible, archival tags should be outfitted with ARGOS satellite transmitters to aid tag recovery in the case of poor VHF tracking and large movements by the tagged whale.

PERSONNEL

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Joanna Kershaw	Sea Mammal Research Unit, University of St. Andrews, UK
Dr. Saana Isojunno	Sea Mammal Research Unit, University of St. Andrews, UK
Lars Kleivane	LKArts, Norway
Rune Hansen	University of Oslo, Norway
Captain Chris Rose + crew	T/S *Prolific*

ITINERARY

02-06/6/2014	Preparation in Akureyri
07/06/2014 12:00	Depart Akureyri
09/06/2014 19:30	Arrive near Jan Mayen
10/06/2014 03:21	Deployed acoustic buoy started research on northern bottlenose whales
15/06/2014	At anchor, poor weather
18/06/2014	At anchor, poor weather
26/06/2014 19:50	Depart Jan Mayen
28/06/2014	Arrive Vestfjorden, Norway, research on pilot whales
30/06/2014	Arrive Bodo, Norway End of Trial

RESEARCH OBJECTIVES AND CRUISE TASKS

The main goal of this research is to develop and ground-truth non-invasive methods to estimate body condition of free ranging cetaceans. Secondary goals were to study the biology of northern bottlenose whales and other cetacean species. Primary tasks had a higher priority than the secondary tasks. We tried to accomplish as many of the secondary tasks as possible, without interfering with our ability to accomplish the primary tasks.

Primary tasks:

1. Deploy Dtag loggers on Northern bottlenose whales (*Hyperoodon ampullatus*) using suction cups with remote launching device, taking a biopsy sample of the same whale during, or immediately after tag deployment. Photo-identify the tagged whale using photogrammetry.

2. Deploy 3MPD3GT loggers on Northern bottlenose whales using suction cups with a blow-expirate collection device on the tag pole, taking a biopsy sample of the same whale during, or immediately after tag deployment. Photo-identify the tagged whale using photogrammetry.

3. Collect biopsy samples of northern bottlenose whales, simultaneous with collection of blow-expirate from the same animal when feasible.

4. Collect CTD profiles using a Valeport Mini-CTD to measure water density in the study area. Attempts should be made to lower the system to 600m on a line close to areas where tags are deployed, and near the acoustic buoy.

5. Observe tagged whales for presence or absence of calf. Take photogrammetry images of tagged whales and associated calves.

Secondary tasks:

1. Deploy Little Leonardo camera logger on Northern bottlenose whales using suction cups with a blow-expirate collection device on the tag pole, taking a biopsy sample of the same whale during, or immediately after tag deployment. Photo-identify the tagged whale using photogrammetry.

2. Deploy up to 5 SPLASH tags on northern bottlenose whales.

3. Deploy an EARS bottom-mounted buoy.

4. Tag and conduct observations of 3S target species, including sperm, killer, long-finned pilot, humpback, and minke whales. Biopsy samples can be taken in association with tag deployment on this species. Photo-identify the tagged whale using photogrammetry.

5. Collect sightings, photographs, and acoustic recordings of target species and other cetaceans encountered.

6. Conduct playback of killer whale sounds to bottlenose or pilot whales.

OPERATION AREA

Waters approaching Jan Mayen from Iceland, near Jan Mayen, and within Vestfjorden basin, Norway.

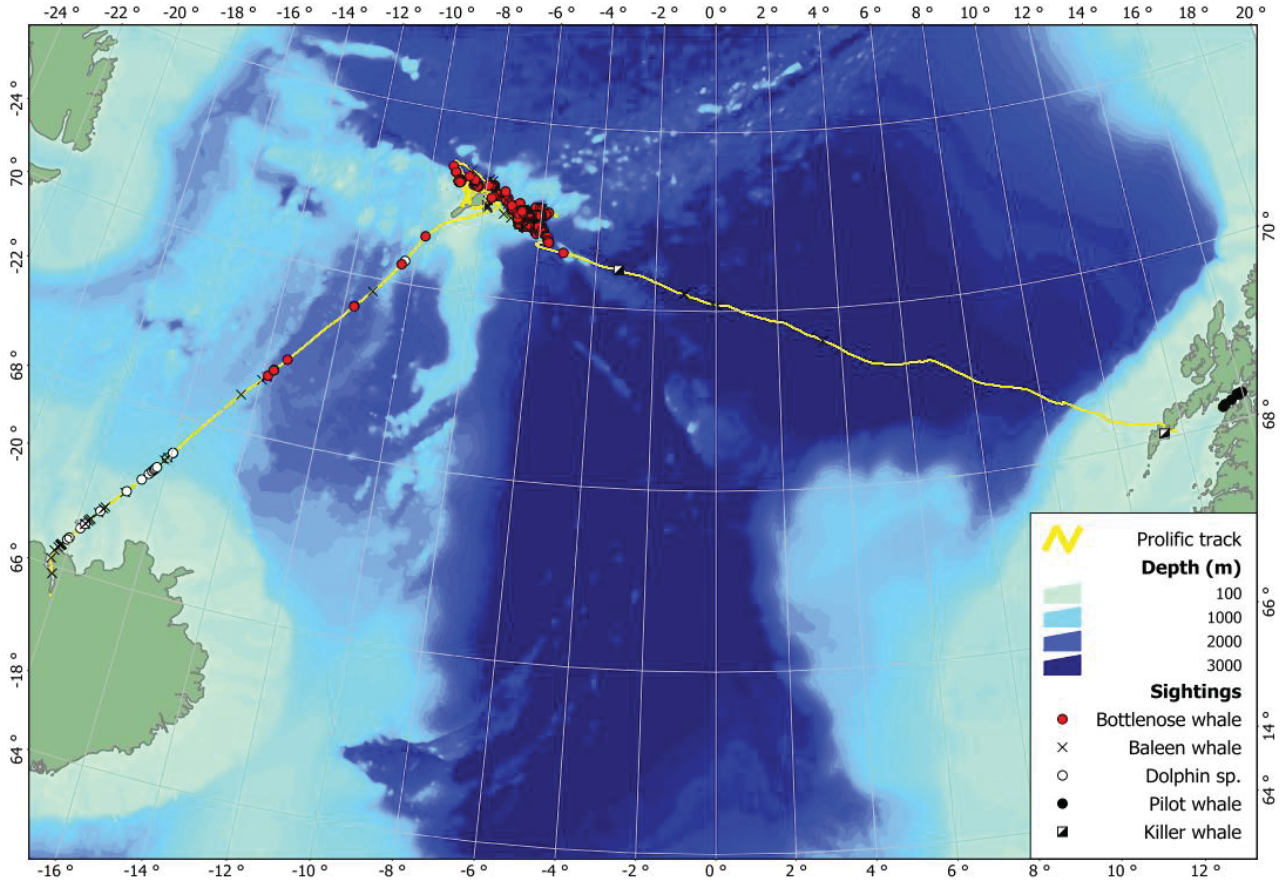


Figure 1. Map of study area with vessel track and species sightings overlaid.

EQUIPMENT AND PROCEDURES

Biologging research to study diving behaviour

Three different types of suction-cup attached tags were used for the cruise (Table 1), and one minimally-invasive barb satellite tag. For this cruise, some tag attempts were made from a tag boat (zodiac), but most of the tagging effort was from the side of the sailing vessel Prolific. We attempted tagging using a 6.5 m carbon-fibre pole with a straight Tag Attachment Device (i.e. in line with the pole), but most tagging was accomplished using an ARTS launching system. The ARTS tag carrier was outfitted with a custom system for collecting biopsy samples ('LKRBC'). An array of 4 Yagi antennas (frequency range of 148MHz) were mounted on the vessel's mast and connected to an Automated Direction Finder (ADF), which was used to track the animal with Dtag.

Table I. Details of the four types of tags used in the cruise. The 3M-tag was not deployed.

Tag Type	Animal-borne devices	SPOT5	VHF range	Recording parameters
3M-tag	W2000-3MPD3GT (Little Leonardo), Fastloc GPS logger (Sirtrack)	Yes	148 MHz	Swim speed, depth, temperature, 3-axis magnetism, 3-axis accelerations, GPS locations
D-tag	Dtag 2	No	148 MHz	Depth, temperature, 3-axis magnetism, 3-axis accelerations, vocalization
Camera tag	W2000-PD3GT, DSL2000DT-II with LED flashlight (Little Leonardo)	Yes	148 MHz	Swim speed, depth, temperature, 3-axis magnetism, 3-axis accelerations, still images
SPLASH10	Wildlife computers SPLASH10 with LIMPET attachment system	Argos position	n/a	Satellite (ARGOS) up-linked positions and diving data

Biopsy sampling system

Biopsy samples were collected using LKDarts deployed from the ARTS launching system.

Photo-ID and photogrammetry systems

Digital cameras were used to take photographs of study animals. One camera was equipped with laser-dot system to provide a reference indicator of the size animals. Photographs of dorsal fins were taken for identification, and photographs were taken during tagging and biopsy operations.

Figure 2 Tagging attempt of a Dtag2 on a Northern bottlenose whale using the ARTS launching system.

SMRU towed acoustic array

The array is composed of a 100m tow cable, with 2 HS150 hydrophones and Magrec HP-02 pre-amplifiers separated by ~96cm. The array plugs into a rugged, self-standing pelican case which contains a breakout box. The array was towed from the observation boat PROLIFIC.

Searching and line-transect surveys

Visual sightings of Northern bottlenose whales and other cetaceans were collected from the deck of T/S *Prolific* whenever weather conditions permitted. All sighting information was recorded using a geo-referenced Logger software.

CTD measurements

CTD profiles were planned to be taken using a Mini-CTD probe (Valeport). Unfortunately, the device was not functioning, so instead temperature-depth profiles were measured using a LL tag (W2000-D2GT, Little Leonardo), which recorded temperature and depth every 1 s.

CHRONOLOGICAL SUMMARY

02 June 2014

Science crew arrives in Akureyri, installed gear and tested all systems

07 June 2014

12:00 *Prolific* departed Akuyeyri

20:00 Passing Grimsey Island. Baleen whales and dolphins sighted

08 June 2014

08:30 Passing over 1000m contour

20:00 Encounters with bottlenose whales. Photographs taken.

09 June 2014

09:00 Collected a biopsy sample from one mid-sized adult bottlenose whale

15:00 Departed to move closer to Jan Mayen, more bottlenose sighted

10 June 2014

01:00 Start operation to deploy acoustic buoy

03:30 Buoy weight deployed at 71 º 09.946'N 007º 41.609'W

05:15 Temperature profile measured

18:30 Deployed towed hydrophone array, unsuccessful tagging attempts from zodiac

11 June 2014

08:00-20:00 Encountered whales, several attempts, no tag-on

12 June 2014

12:55 First Dtag deployed using ARTS system, 2 biopsy samples collected

pm Attempting to locate tag, VHF search

13 June 2014

01:17 Dtag still on the animal

pm Dtag recovered, no data recorded, Searching NE of Jan Mayen

18:03 Second Dtag deployed using ARTS

14 June 2014

07:25 Second Dtag recovered, with data

Practice shooting

15 June 2014

08:30 Third Dtag deployed

22:43 Dtag recovered, off-effort rough weather moving to anchor

16 June 2014

22:00 Poor weather, moved around Jan Mayen Island

17-19 June 2014

Poor weather, no whales seen, visited Jan Mayen station

20 June 2014

am	Substantial target practice with ARTS system
pm	Back to sea, searching for whales

21 June 2014

Found whales, no tagging attempts

22 June 2014

am	Some damage to topsail
pm	Whales found, close approaches, missed attempts with Dtag
20:00	First SPLASH tag deployed

23 June 2014

07:30	Fourth Dtag deployed
08:10	Second SPLASH tag deployed
09:18	Fifth Dtag deployed
18:40	Fourth Dtag recovered, searching for Fifth Dtag

24 June 2014

01:05	Fifth Dtag recovered.
01:30	Hydrophone array caught in propeller. Array damaged but boat OK.
am	CTD conducted
19:30	Sixth Dtag deployed, no biopsy collected, so we tracked to try to obtain biopsy
22:40	Five biopsy samples collected from one group of 5-7 adults
23:28	Third SPLASH tag deployed

25 June 2014

05:03	Sixth Dtag recovered.
am	Moving away from Jan Mayen, searching for whales, few sightings

26-27 June 2014

Transit toward Vestfjorden. Science crew de-briefing of bottlenose whale effort. GeoCeltic survey vessel passed on 27 June at 08:00 operating at 68º 57'N 08 º 32'E

28 June 2014

04:17	Killer whales sighted in Vestfjorden
13:15	Heike Vester reports sighting of long-finned pilot whales
18:20	First sighting of long-finned pilot whales
22:13	Camera tag deployed on long-finned pilot whales

29 June 2014

am	Camera tag deployed and re-attached on long-finned pilot whales
10:00-11:00	Two Dtags attached to long-finned pilot whales
pm	Tagged whale tracked successfully, conducted playback of killer whale sounds and a control signal.
pm	All tags recovered, transit to Bodø

30 June 2014

am	Arrived Bodø, packed equipment for shipping, data backup

01 July 2014

am	Departed the vessel

DATA COLLECTED

Animal-attached tag data for northern bottlenose whales

We deployed 2 types of tags to different Northern bottlenose whales. Archival-recording Dtag version 2 were attached to six individual animals, but one tag deployed did not record any data (Table II). All of the tag deployments were accomplished using the ARTS system, tagging whales directly from the deck of the sailboat *Prolific*. The tag carrier (Fig. 2) contained a custom biopsy sample collection system, but samples were only collected from 3 of the five tag deployments. We made every effort to obtain a biopsy sample using LKDarts from the tagged whales for which biopsy samples were not collected by the tagging system. However, we were not able to collect a biopsy sample for any of the tagged whales after tag attachment.

Table II. Details of the Dtag deployments on northern bottlenose whales.

Data name	**Tag on time UTC**	**Tag on location**	***D*ur (h)**	**Biopsy**	**notes**
Ha14_163a	12 Jun, 12:55	70.197366N 06.669168W	0	Y	No data recorded
Ha14_165a	14 Jun, 18:03	71.20313N 08332885W	9.4	N	
Ha14_166a	15 Jun, 08:22	71.2253N 08.92817W	12.2	Y	
Ha14_174a	23 Jun, 07:30	70.82314N 06.06898W	5.8	Y	
Ha14_174b	23 Jun, 09:18	70.82445N 5.996147W	12.2	N	
Ha14_175a	24 Jun, 14:09	70.75144N 05.69599W	12.0	N	Skin sample

The Dtag data were successfully downloaded, and have been processed into whale-frame movement data. In addition, the sounds recorded on the tag have been audited (Fig. 3). Whales were found to have variable dive depths, with indications of feeding during some dives <500m deep.

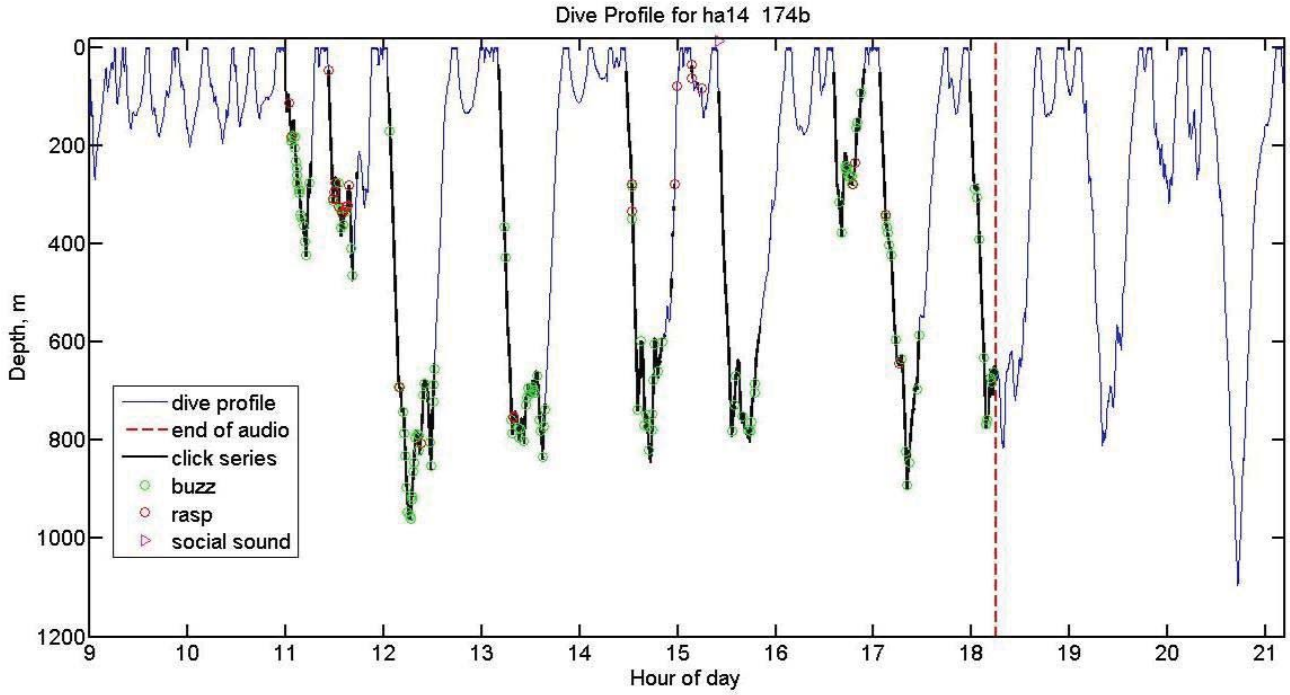


Figure 3. Dive record of a bottlenose whale tagged of Jan Mayen. Sounds marked on the dive profile were thought to be produced by the tagged whale.

SPLASH tags on northern bottlenose whales

An extensive testing procedure for tag deployment was carried out and involved the development of a new, operational carrier for the ARTS pneumatic tag launcher. Using this system, three bottlenose whales were tagged with location-dive tags (SPLASH10) in the Jan Mayen area. One tag was lost when a deployment attempt missed the animal and the tag detached from the launching carrier. Duration of transmissions ranged from 14 hours to 6 days (Table III). The behaviour Log was the prioritised tag function for collecting data on dive behaviour; transmitting start and end times, maximum depth and dive shape (U, V or square) for about five successive dives. Five Behaviour Log records were attained. The percentage of received messages (containing dive data) which was successfully decoded ranged from 7 to 14 %. Tags were attached into the blubber below the dorsal fin, which may have influenced the duration and quality of the transmissions.

Whale 134664 spent all 4 days wandering around the slopes and mounts within the canyon complex, displaying a movement pattern which can expected for bottlenose whales searching for prey (Fig. 4). Conversely, the track of 134663 show characteristics of migratory movement; the animal moved out

of the canyon about 12 hours after tag deployment and moved south-west in a nearly straight line along the Jan Mayen ridge for the remaining 5.5 days of transmission. The final Argos location received was over halfway to Iceland, indicating a total distance travelled of approximately 440 km (73 km per day).

The duration of the tag data was too short to determine whether this was a migration movement. An alternative explanation may be that the tracks of the two whales rather represent different roaming ranges, and, or prey search strategies. Nevertheless, the data for the two animals demonstrate diverse areal usage and movement behaviours over a "short-term" period, and represent new and important knowledge for understanding the behaviour of the bottlenose whales around Jan Mayen.

Table III. Deployments of SPLASH tags to northern bottlenose whales.

Date (UTC)	Time (UTC)	Latitude	Longitude	No of fixes	Transmission Duration	Serial nr.	Argos Ptt nr.
22.06.14	19:45	70.96742°N	06.08943°W	59	4d, 7hr, 3min	13A0910	134664
23.06.14	09:15	70.82495°N	5.996147°W	9	6d, 2hr, 11min	13A0912	134666
24.06.14	23:28	70.69778°N	05.68475°E	41	14hr, 12min	13A0145	134663

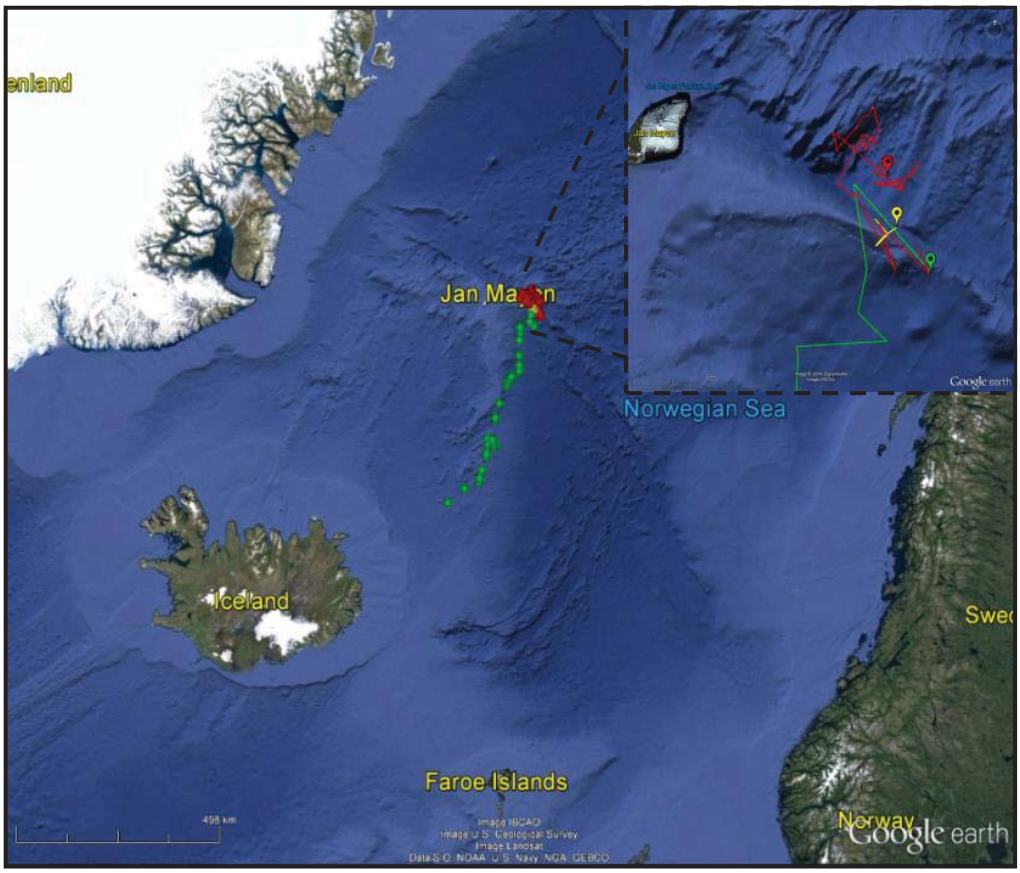


Figure 4. Map of the Norwegian sea with Argos locations received from tags 134663 (green), 134664 (red) and 135666 (yellow). The tracks and tag deployment locations (circular symbols) within the deep-sea canyon east of Jan Mayen are indicated in the dashed inset box.

Animal-attached tag data for long-finned pilot whales

Tags were deployed on 6 different long-finned pilot whales (Table IV). Four deployments used the camera logger (Fig. 5), and two with Dtag. Tags were attached to pilot whales using a hand-pole from a 4m boat. A total of 19.8 hrs of data were recorded using the camera tag, and 21.1 hrs of data was recorded using the Dtag. We deployed two Dtag2 and one camera tag (ID N14PWcameraD) in a same group. Paired tagged animals (ID gm14_180b, N14PWCameraD) made synchronous dives (Fig. 6).

Table IV. Details of tag attachments to long-finned pilot whales.

Data name	Tag type	Tag on time (UTC)	Tag on location	Duration (hrs)	notes
28June2014_N14PWcameraA	camera	28 June, 16:53	68°13.83'N, 15°27.356'E	6.3 516 photos	
29June2014_N14PWcameraB	camera	29 June, 00:45	68.15348N, 15.18049E	5.5 1548 photos	
29June2014_N14PWcameraC	camera	29 June, 10:00	68.286N, 15.975E	0.1 97 photos	
29June2014_N14PWcameraD	camera	29 June, 10:17	68.286N, 15.975E	8.0 5028 photos	KW playback
gm14_180a	Dtag2	29 June, 10:28	68.276N, 15.978E		KW playback
gm14_180b	Dtag2	29 June, 11:02	68.278N, 15.959E		KW playback

Figure 5. Camera tag on a long-finned pilot whale.

Figure 6. Dive profiles from tag deployments on long-finned pilot whales. The tag id is noted within the figure (see table II). Note that no deep foraging dives were recorded during any deployments.

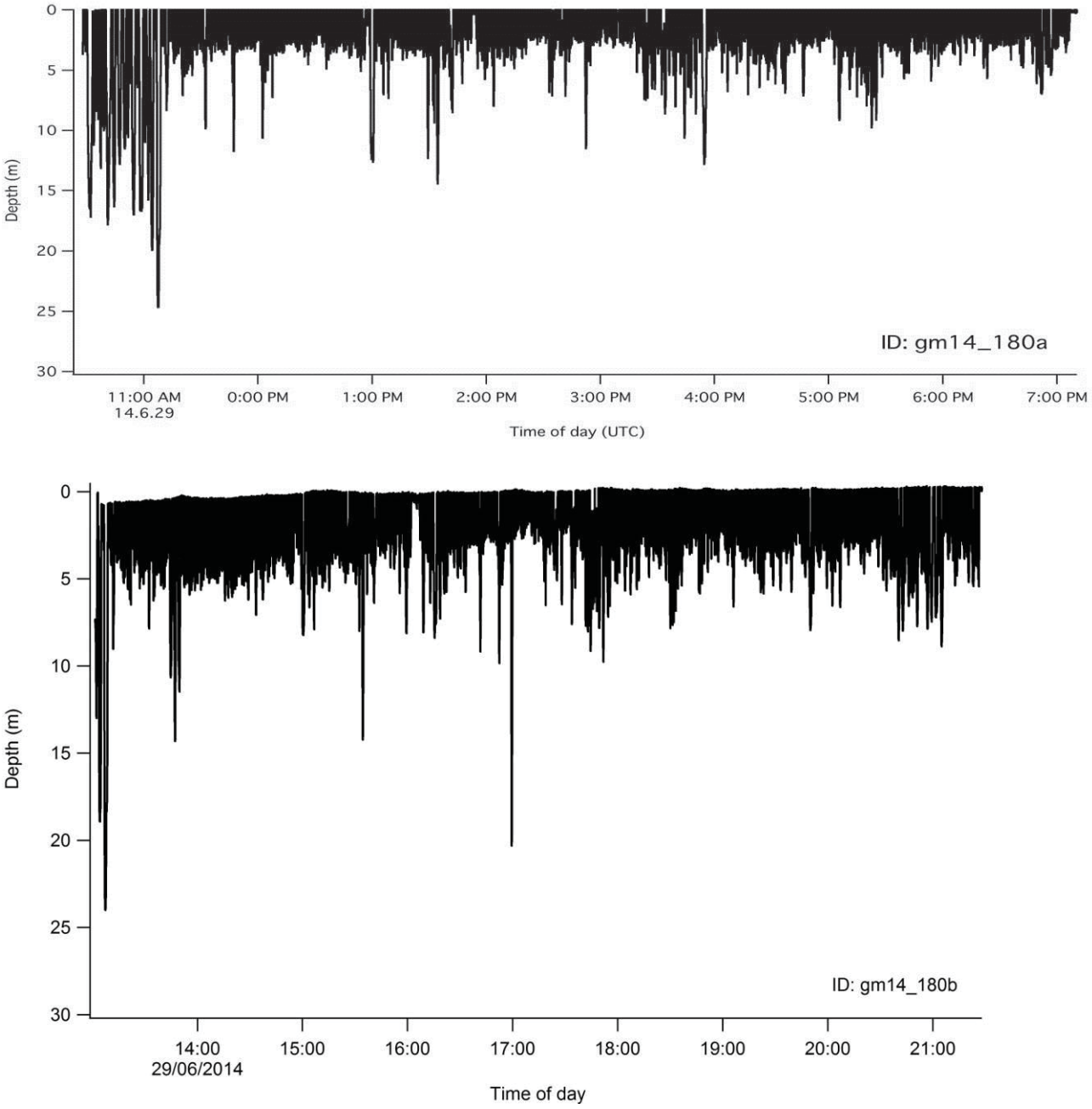
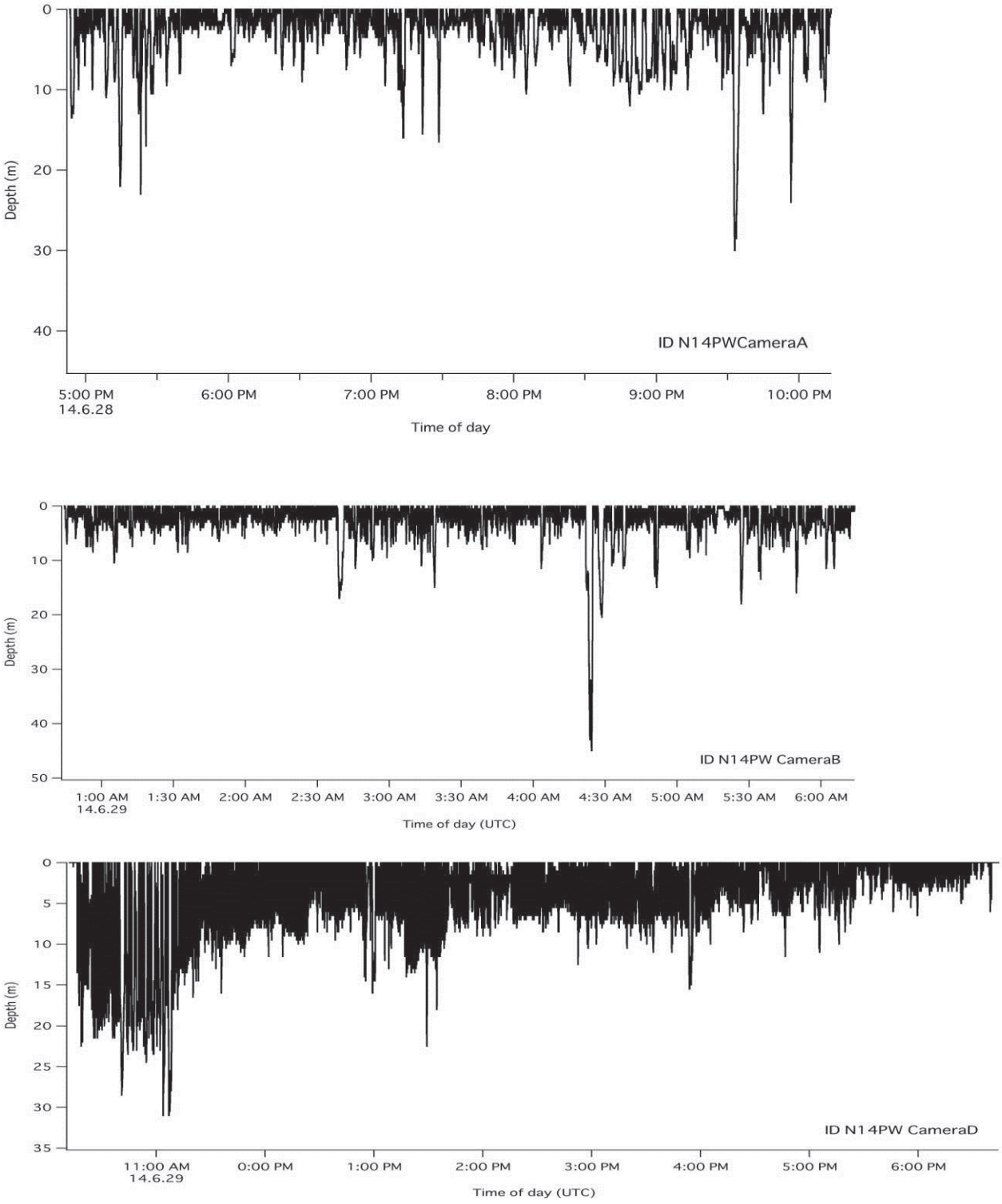


Figure 6, continued.



Biopsy samples

A total of 12 biopsy samples were collected from Northern bottlenose whales (Table V). Three of these were from tagged whales, but data was not recorded for one of those three tag records.

Table V Summary of biopsy samples collected during the Jan Mayen trial.

Sample Number	Date	Skin Thickness (mm)	Blubber Thickness (mm)	Tag	Age Class	Reaction Category
LK-Ha-01	09/06/2014	1.5	47		adult	1
PM-Ha-02*	12/06/2014	5	17	D-Tag 243	adult	1
PM-Ha-03	12/06/2014	1.5	12		sub-adult	1
PM-Ha-04	12/06/2014	2	4		sub-adult	1
RH-Ha-05	15/06/2014	2	21	D-Tag 245	adult	1
LK-Ha-06	23/06/2014	2	10	D-Tag 245	sub-adult	1
PM-Ha-07	23/06/2014	2	5		sub-adult	1
LH-Ha-08	24/06/2014	2	29		adult	1
LH-Ha-09	24/06/2014	2.5	51		adult	1
LK-Ha-10	24/06/2014	2.5	59		adult	2
LK-Ha-11	24/06/2014	2	29		adult	1
LH-Ha-12	24/06/2014	2.5	5		adult	1

In all cases but one, we observed a low-level reaction to tagging, only a short-term mild change. Though we attempted to collect biopsy samples from a consistent location on the body of the whale, samples were obtained from diverse locations on the body (Fig. 7).

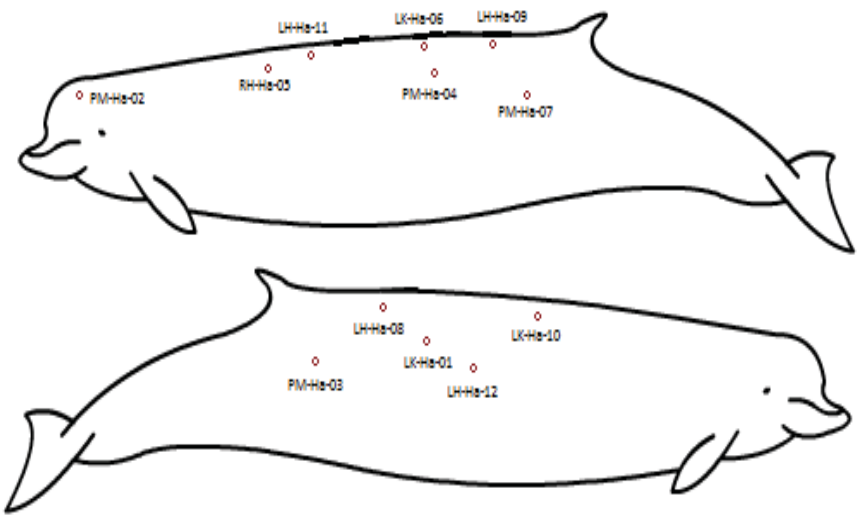


Figure 7. Twelve northern bottlenose whale biopsy sampling sites with associated biopsy numbers from June 2014. All samples were taken from the anterior part of the body, in front of, or level with the dorsal fin.

Photo Identification and phogrammetry images

A total of 11704 photo-ID images were taken (Table VI), roughly half using the photogrammetry camera outfitted with green laser dots spaced 10 cm apart.

Table VI Number of photos taken by date

Date	Time	No of photos	Notes
07–08 June	20:00 – 08:00	0	Transit toward Jan Mayen
08 June	08:00 – 20:00	292	Transit toward Jan Mayen
08-09 June	20:00 – 08:00	67	Transit toward Jan Mayen
09 June	08:00 – 20:00	0	Transit toward Jan Mayen
09-10 June	20:00 – 08:00	0	
10 June	08:00 – 20:00	1271	
10-11 June	20:00 – 08:00	215	
11 June	08:00 – 20:00	723	
11-12 June	20:00 – 08:00	0	
12 June	08:00 – 20:00	706	
12-13 June	20:00 – 08:00	0	
13 June	08:00 – 20:00	0	
13-14 June	20:00 – 08:00	108	
14 June	08:00 – 20:00	797	
14-15 June	20:00 – 08:00	7	
15 June	08:00 – 20:00	473	
15-16 June	20:00 – 22:00	0	Anchored at Jan Mayen on 16 June
17 June		73	Photos of a blue whale
17-20 June		0	Anchored at Jan Mayen
20-21 June	20:00 -08:00	0	
21 June	08:00 – 20:00	154	
21-22 June	20:00 – 08:00	0	
22 June	08:00 – 20:00	250	
22-23 June	20:00 – 08:00	166	
23 June	08:00 – 20:00	664	
23-24 June	20:00 – 08:00	47	
24 June	08:00 – 20:00	443	
24-25 June	20:00 – 08:00	764	
27-28 June	20:00 – 08:00	211	Photos of killer whales sighted in Vestfjorden
28 June	08:00 – 20:00	1014	Photos of pilot whales at Vestfjorden
28-29 June	20:00 – 06:00	877	Photos of pilot whales at Vestfjorden
29 June	08:00 – 20:00	2382	Photos of pilot whales at Vestfjorden

CTD measurements

A total of four casts were made with a Little Leonardo tag in place of a Valeport CTD (Table VII). This provided temperature profiles, but no direct information on water salinity. Also the Little Leonardo tag had a slow temperature response, so there were some differences in the values obtained during downcasts versus those during upcasts (Figure 6).

Table VII. Temperature casts made during the trial.

CTD No.	Date	Start time	Start location	End time	End location
1	09 Jun	03:52	71.15908N, 07.68533W	05:14	71.14862N, 07.67227W
2	13 Jun	14:43	71.16706N, 07.26293W	15:36	71.17698N, 07.286148W
3	15 Jun	15:06	71.25162N, 08.90451W	16:04	71.23498N, 08.87847W
4	24 Jun	05:23	70.78597N, 06.00788W	06:03	70.79091N, 06.05554W

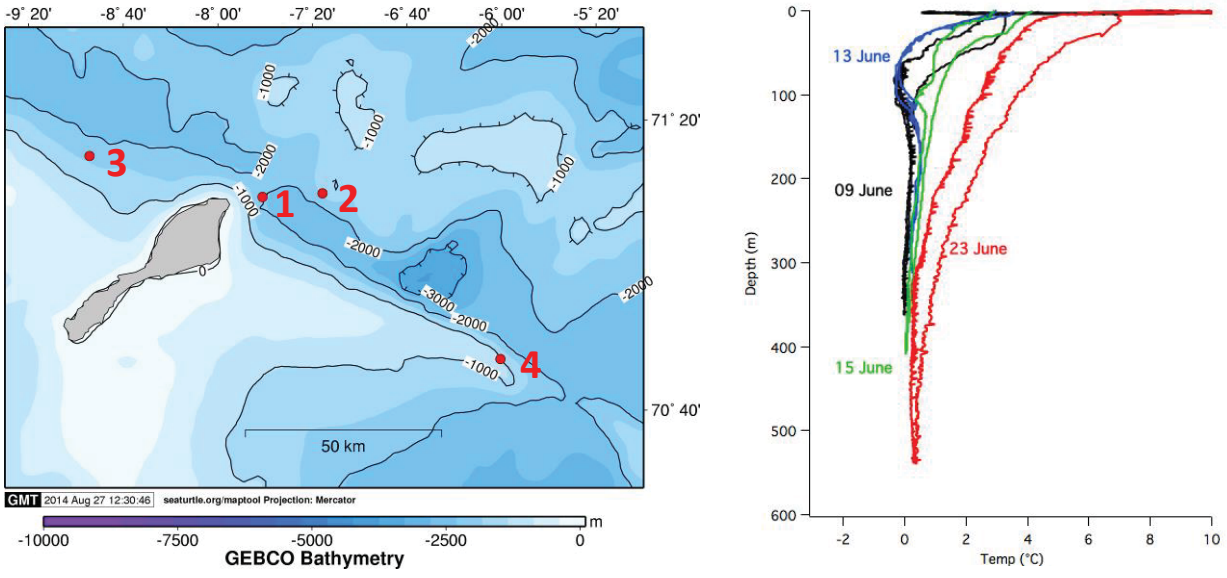


Figure 6. Location of temperature casts (left) and temperature profiles on downcast and upcast (right).

Blow samples

No blow samples were collected.

Towed Hydrophone array data

The towed acoustic array was used to monitor beaked whale presence in real time, and make continuous stereo recordings at 44.1 kHz sample rate. The passive acoustic monitoring (PAM) system consisted of the towed hydrophone (2 HS150 hydrophones and Magrec HP-02 pre-amplifiers separated by ~96 cm, at the end of 100 m tow cable) connected to a soundcard (TASCAM US-366) and a laptop with a gps and cetacean monitoring software Pamguard. Pamguard was used to monitor both raw and high-pass filtered sound, to display beaked whale acoustic detections on a map, and to record raw sound data. A total of 146 hours of sound recordings were made over 13 days (Table VIII).

Table VIII. Daily summary of acoustic recordings. *shows initial recordings at 192 kHz sample rate, later lowered to 44.1 kHz. Bottlenose whale acoustic detections give indicative UTC times from Pamguard field notes (MS access database 'JanMayen14_PAM.accdb').

Day dd/mm	**# Files**	**File duration (min)**		**Label of first wav-file**	**Bottlenose whale acoustic detections**
		total	average		
05/06	1	0.5	0.5	PAM_20140605_163240*	
10/06	6	125.2	20.9	PAM_20140610_214825*	
11/06	40	843.4	24.1	PAM_20140611_083600*	12:00, 15:00, 19:40
12/06	24	1440.0	60.0	PAM_20140612_004517	09:45-18:40; buzzing events 12:30, 15:10, and 15:20
13/06	22	1203.3	54.7	PAM_20140613_004520	19:20
14/06	26	1437.1	55.3	PAM_20140614_001651	10:45-20:00
15/06	13	600.0	54.5	PAM_20140615_001717	buzzing events 09:15, 12:25
17/06	9	487.2	54.1	PAM_20140617_090112	
18/06	8	261.7	43.6	PAM_20140618_084333	09:00
20/06	6	240.0	60.0	PAM_20140620_192140	
21/06	20	928.0	46.4	PAM_20140621_001021	10:15-13:00, 17:40-18:20
22/06	19	831.6	46.2	PAM_20140622_083031	08:40-09:00, 13:10-15:00, 17:20-22:30; buzzing events 14:45-15:00, 17:45
23/06	9	386.5	48.3	PAM_20140623_080459	08:00-10:00

Recording duration was occasionally limited due to power outages, as the powering of the laptop required use of the ship's mains power. The value of the real-time acoustic monitoring was increased search effort in areas of acoustic detections when sighting conditions were poor.

Real-time spatial tracking of bottlenose whale clicks appeared limited. On a few occasions, we could determine bearings to groups of animals based upon acoustics alone, but we suspect these occasions were a rare convergence of suitable conditions including bathymetry and whale orientation. On the 24th, the tow cable was severed in an accident and the system could no longer be used.

Acoustic Buoy deployment

The acoustic buoy was deployed on 10 June at the target location. However, when it was recovered in August by the HNLMS Zeeland, it was found to have been damaged, and no data was recovered. The cause of the damage was likely to have been excessive pressure on the device, and it is considered likely that the actual depth at the deployment location was substantially deeper than that indicated on the charts. In future, a deeper-rated buoy is recommended for deployment in these poorly charted waters.

Summary of accomplishments related to Cruise Tasks

Primary tasks:

1. *Deploy Dtag loggers on Northern bottlenose whales (Hyperoodon ampullatus) using suction cups with remote launching device, taking a biopsy sample of the same whale during, or immediately after tag deployment. Photo-identify the tagged whale using photogrammetry.*

- Tagging was successful using the ARTS launching system, with 5 useful Dtag records collected. This represents a substantial on our performance in previous trials, indicating that the sailboat platform is effective for tagging this species with the ARTS tagging system. Biopsy samples were only collected for 50% of the tag attachments, so the reliability of the biopsy-collection system should be improved to assure biopsy collection with the tag deployments.

2. *Deploy 3MPD3GT loggers on Northern bottlenose whales using suction cups with a blow-expirate collection device on the tag pole, taking a biopsy sample of the same whale during, or immediately after tag deployment. Photo-identify the tagged whale using photogrammetry.*

- No tags could be deployed using poles from the sailboat. We only made limited efforts to attach tags from the small zodiac skiff, so it remains possible that tags can be attached using poles form a small skiff launched from the sailboat.

3. *Collect biopsy samples of northern bottlenose whales, simultaneous with collection of blow-expirate from the same animal when feasible.*

- Biopsy samples could be collected during tagging (3 of 6 tag attachments), and independently using the ARTS system (9 biopsy samples). However, 6 of the 12 biopsy samples collected had blubber thickness of <20mm. Thus, it is recommended to consider alterations to the standard Finn-Larsen tip that was used in this study in order to more consistently obtain full depth samples.

4. *Collect CTD profiles using a Valeport Mini-CTD to measure water density in the study area. Attempts should be made to lower the system to 600m on a line close to areas where tags are deployed, and near the acoustic buoy.*

- The Valeport Mini-CTD failed to operate, but temperature profiles were obtained using the Little Leonardo data logger. However, the temperature time constant of the logger was undesirably slow leading to differences in the downcast and upcast profiles. For future trials, consider to bring a back CTD.

5. *Observe tagged whales for presence or absence of calf. Take photogrammetry images of tagged whales and associated calves.*

- Calf presence was reliably observed, though none of the tagged whales were associated with calves. Photogrammetry images were obtained for several whales, but the photogrammetry method remains challenging due to need for the whale to be oriented perpendicular to the angle of the photograph.

Secondary tasks:

1. *Deploy Little Leonardo camera logger on Northern bottlenose whales using suction cups with a blow-expirate collection device on the tag pole, taking a biopsy sample of the same whale during, or immediately after tag deployment. Photo-identify the tagged whale using photogrammetry.*

- The camera logger was not deployed on northern bottlenose whales due to the difficult in using poles to attach tags to the species. We were able to use the pole system to attach this tag to long-finned pilot whales.

2. *Deploy up to 5 SPLASH tags on northern bottlenose whales.*

- Three of the four SPLASH tags taken on the trial were deployed by Rune Hansen, of U Oslo. Though data records were short, this limited pilot data indicates that they could be a valuable tool to record the movement and diving behavior of the species over longer termporal and larger spatial scales than are possible using suction cup tags. No tags were deployed into the dorsal fin, which may have impacted tag duration and data transmission quality.

3. *Deploy an EARS bottom-mounted buoy.*

- The buoy was deployed in the correct location, but was damaged upon recovery likely due to excessive depth. Deeper rated buoys should be used in this area, and a system to ascertain water depth before deploying the buoy would decrease risk of excessive depth in future deployment attempts.

4. *Tag and conduct observations of 3S target species, including sperm, killer, long-finned pilot, humpback, and minke whales. Biopsy samples can be taken in association with tag deployment on this species. Photo-identify the tagged whale using photogrammetry.*

- Only long-finned pilot whales were tagged, and useful information was collected for this species.

5. *Collect sightings, photographs, and acoustic recordings of target species and other cetaceans encountered.*

- A large number of sightings, photographs, and acoustic recordings were obtained from species encountered. The sailboat platform was highly effective for these research methods.

6. *Conduct playback of killer whale sounds to bottlenose or pilot whales.*

- A playback experiment was successfully conducted with long-finned pilot whales, but was not possible for northern bottlenose whales. The challenge with northern bottlenose whales is the difficulty tracking the tagged whale using the VHF signal from the tag, due to short surfacing times and long-distances travelled by the animals between surfacings. Antenna placement high on the sailboat mast, and robust cabling is recommended for future trials to improving effectiveness of tracking.

Appendix: Sightings of cetaceans during the 2014 Jan Mayen Trial. Missing sighting numbers are due to data entry processing, and do not represent missing sightings. Species codes are: BA: *Balaenoptera acutorostrata* minke whale; BM: *Balaenoptera musculus* blue whale; BP: *Balaenoptera physalus* fin whale; CC: *Cystophora cristata* hooded seal; GM: *Globicephala melas* long-finned pilot whale; HA: *Hyperoodon ampullatus* northern bottlenose whale; LA1: *Lagenorhyncus albirostris* white-beaked dolphin; MN: *Megaptera novaeangliae* humpback whale; OO: *Orcinus orca* killer whale; B? unidentified large cetacean; S?: unidentified small cetacean; SL?: unidentified small seal; W?: unidentified whale; OT: other (not cetacean).

Sighting Number	Vessel Latitude	Vessel Longitude	Species	Estimated Number	Calves
23	65.91817	-18.21283	MN	1	0
24	66.07641	-18.36958	MN	1	0
25	66.16812	-18.34878	MN	1	0
26	66.21387	-18.27908	MN	1	0
27	66.2371	-18.24336	MN	1	0
28	66.24105	-18.23737	MN	1	0
29	66.24949	-18.2234	MN	1	0
30	66.25503	-18.2149	MN	1	0
31	66.2582	-18.2098	MN	1	0
32	66.25924	-18.20822	MN	1	0
33	66.32313	-18.10665	S?	2	0
34	66.3503	-18.06663	OT	1	0
35	66.4866	-17.85842	LAl	0	0
36	66.5425	-17.7777	MN	1	0
37	66.5479	-17.76974	LAl	5	0
38	66.55218	-17.76378	MN	1	0
39	66.58828	-17.71154	MN	1	0
40	66.60478	-17.68457	MN	1	0
41	66.62038	-17.65935	MN	1	0
42	66.71146	-17.5096	MN	1	0
43	66.73303	-17.47354	LAl	3	0
44	66.76952	-17.40883	B?	1	0
45	66.79237	-17.36971	MN	2	0

46	67.01174	-16.96552	MN	1	0
47	67.02935	-16.92951	LAl	5	0
48	67.20175	-16.61848	LAl	4	0
49	67.28467	-16.46713	LAl	4	0
50	67.32114	-16.39947	LAl	25	0
52	67.36045	-16.33069	LAl	5	0
53	67.38008	-16.29587	LAl	7	0
54	67.4782	-16.14079	B?	1	0
55	67.50713	-16.09044	CC	1	0
56	67.51598	-16.07595	MN	3	0
57	67.5807	-15.9683	LAl	12	0
58	67.58102	-15.96782	LAl	4	0
59	68.40397	-14.47726	W?	1	0
60	68.61926	-13.96997	MN	1	0
61	68.66221	-13.86761	BM	2	0
62	68.67265	-13.84288	W?	1	0
63	68.67991	-13.8261	HA	5	0
64	68.75867	-13.6864	HA	7	1
65	68.75343	-13.68812	HA	3	0
66	68.90572	-13.35731	HA	4	0
67	69.64468	-11.67845	HA	7	1
69	69.8512	-11.18155	MN	1	0
70	70.20864	-10.42059	HA	4	0
71	70.25124	-10.32793	S?	2	0
72	70.56289	-9.801883	HA	1	0
73	71.12627	-7.652634	HA	0	0
75	71.13382	-7.478616	HA	3	0
76	71.12778	-7.42425	HA	3	0
77	71.07579	-7.232031	HA	3	0
78	71.05049	-7.09464	MN	1	0
79	71.03915	-7.033725	W?	1	0
80	71.00126	-7.01389	HA	4	0
81	71.00462	-7.047536	HA	3	0
82	70.9937	-7.02849	HA	3	0

83	71.00833	-6.973407	HA	4	0
84	71.05022	-6.850694	W?	1	0
85	71.08098	-6.775885	HA	2	0
86	71.01746	-6.61599	W?	2	0
87	71.01106	-6.593113	HA	3	0
88	71.00075	-6.56451	HA	4	0
89	71.00459	-6.568178	HA	0	0
90	71.00307	-6.519969	HA	0	0
91	70.97861	-6.464429	HA	2	0
92	70.96987	-6.443717	HA	5	0
93	70.96162	-6.432336	BA	1	0
94	70.95071	-6.416406	HA	3	0
95	70.95071	-6.416406	HA	0	0
96	70.96104	-6.414502	HA	3	0
97	70.96603	-6.411768	HA	4	0
98	70.96696	-6.415913	BA	1	0
99	70.95182	-6.367872	BA	2	0
100	70.94994	-6.36129	BA	1	0
101	70.94903	-6.358145	HA	2	0
102	70.94617	-6.353525	BA	1	0
103	70.94424	-6.354015	LAl	7	0
104	70.93831	-6.357355	HA	3	0
105	70.92966	-6.365115	BA	1	0
106	70.92685	-6.367305	HA	2	0
107	70.92554	-6.368348	BA	1	0
109	70.9225	-6.36422	HA	2	0
110	70.91708	-6.319201	BA	1	0
111	70.91916	-6.313093	HA	5	0
112	70.92852	-6.300627	BA	1	0
113	70.94315	-6.307197	BA	1	0
114	70.92934	-6.324869	BA	1	0
115	70.92005	-6.332253	HA	3	0
117	70.92369	-6.359534	HA	5	0
118	70.92451	-6.362756	BA	2	0

119	70.929	-6.379472	BA	1	0
120	70.93303	-6.39377	HA	4	0
121	70.93286	-6.3937	SL?	1	0
122	70.93104	-6.39588	HA	4	0
123	70.92117	-6.387625	MN	1	0
124	70.89454	-6.387972	BA	1	0
125	70.87256	-6.38662	BA	1	0
126	70.86142	-6.38798	BA	2	0
127	70.85931	-6.388578	BA	1	0
128	70.85682	-6.389927	HA	2	0
129	70.84439	-6.39046	HA	3	0
130	70.84386	-6.393617	HA	3	0
131	70.81416	-6.46408	BA	1	0
132	70.8148	-6.469295	BA	1	0
133	70.82307	-6.53594	BA	1	0
134	70.82838	-6.577525	HA	4	0
135	70.83438	-6.573035	HA	4	0
136	70.82602	-6.577768	BA	1	0
137	70.8323	-6.597562	HA	3	0
138	70.83389	-6.617437	HA	4	0
139	70.84339	-6.691055	HA	3	0
140	70.84124	-6.718995	BA	1	0
141	70.83053	-6.469005	HA	2	0
142	70.82626	-6.533404	BP	1	0
143	70.8319	-6.536212	BA	1	0
144	70.84562	-6.65486	BA	1	0
145	70.85323	-6.732801	BA	1	0
146	70.85709	-6.756292	HA	3	0
147	70.86755	-6.768027	BA	1	0
148	70.87926	-6.781188	BA	2	0
149	70.88052	-6.782735	BA	1	0
150	70.89706	-6.80329	HA	3	0
151	70.91463	-6.786722	BA	1	0
152	70.91147	-6.787544	HA	1	0

153	70.90579	-7.028634	BA	1	0
154	70.9407	-7.289512	B?	1	0
155	71.00688	-6.631796	HA	0	0
156	71.00426	-6.604802	HA	3	0
157	70.98874	-6.618614	HA	0	0
158	70.97473	-6.624799	HA	5	0
159	70.97452	-6.627316	HA	4	0
160	70.97277	-6.880623	HA	3	0
161	70.96566	-6.796188	HA	2	0
162	71.01392	-7.023836	HA	2	0
163	71.04558	-7.050676	HA	3	0
164	70.9926	-6.67836	HA	1	0
165	71.19241	-7.32213	HA	4	0
166	71.22642	-7.725122	HA	4	0
167	71.24364	-7.724337	HA	3	0
168	71.23696	-7.782399	HA	2	0
169	71.23504	-7.800913	HA	1	0
170	71.23242	-7.853049	HA	5	0
171	71.23067	-7.934359	HA	0	0
172	71.25829	-8.945643	HA	2	0
173	71.2205	-8.437262	HA	2	0
174	71.21667	-8.442079	HA	3	0
175	71.22542	-8.293006	HA	0	0
176	71.20629	-8.272619	HA	3	0
177	71.20934	-8.308829	HA	2	0
179	71.23972	-8.426167	HA	4	0
180	71.25938	-8.445758	HA	3	0
181	71.26711	-8.429036	HA	4	0
182	71.27531	-8.425068	HA	5	0
183	71.30518	-8.642404	HA	2	0
184	71.24216	-8.898365	HA	3	0
185	71.23049	-8.919828	HA	7	0
187	71.2206	-8.962111	HA	4	0
188	71.23399	-9.002397	HA	1	0

189	71.22562	-8.93609	HA	4	0
190	71.10119	-7.771475	HA	4	0
191	70.99434	-7.865812	W?	1	0
192	70.98116	-7.884733	B?	1	0
193	71.01148	-7.891116	W?	0	0
194	71.01467	-7.909701	BM	1	0
195	71.06557	-7.886132	BM	1	0
196	71.05302	-7.18757	BP	1	0
197	71.12202	-7.204218	HA	3	0
198	71.29048	-7.797838	W?	1	0
199	71.30197	-7.911017	MN	1	0
200	71.2755	-7.993925	W?	1	0
201	71.25546	-8.443301	W?	2	0
202	71.32688	-9.122925	HA	3	0
203	71.33086	-9.125652	HA	0	0
204	71.39055	-9.239106	HA	3	0
205	71.37564	-8.57338	BM	1	0
206	71.15651	-7.657534	MN	2	0
207	71.15019	-7.627459	MN	2	0
208	71.14693	-7.606987	W?	2	0
209	71.14488	-7.590025	HA	2	0
210	71.13888	-7.526149	MN	1	0
211	71.09635	-7.261662	HA	3	0
212	71.0946	-7.255616	BA	1	0
213	71.04327	-6.927595	HA	4	0
214	71.03748	-6.907445	HA	4	0
215	70.98494	-6.755088	HA	3	0
217	70.97124	-6.69234	HA	3	0
218	70.9441	-6.607704	HA	0	1
219	70.9951	-6.481503	HA	1	0
220	71.05312	-6.21649	HA	2	0
221	71.05553	-6.06969	HA	0	0
223	71.04933	-5.991766	B?	2	0
224	71.00937	-5.75291	HA	4	0

225	70.9761	-5.852147	HA	0	0
226	70.98251	-5.863555	HA	0	0
227	70.98337	-5.85538	HA	3	0
228	70.98612	-5.852282	HA	1	0
229	70.99061	-5.845666	HA	5	0
230	70.96548	-6.024026	HA	4	0
231	70.96644	-6.02172	HA	2	0
232	70.97433	-5.980135	HA	4	0
233	70.96729	-6.027404	HA	3	0
234	70.96617	-6.043982	HA	2	0
235	70.97013	-6.054966	HA	3	0
236	70.9641	-6.11873	HA	3	0
237	70.97356	-6.101558	HA	2	0
238	70.96594	-6.115576	HA	1	0
239	70.96993	-6.159383	HA	0	0
240	70.96428	-6.165359	HA	0	0
241	70.92156	-6.47343	B?	1	0
242	70.87991	-6.544126	HA	2	0
243	70.86771	-6.504671	HA	0	0
244	70.82848	-6.09649	HA	1	0
247	70.82749	-5.989928	HA	1	0
248	70.82479	-5.996533	HA	0	0
249	70.82142	-6.026164	HA	3	0
250	70.8387	-6.006201	HA	1	0
251	70.84319	-5.969638	HA	0	0
252	70.84514	-5.941867	HA	0	0
253	70.8416	-5.939079	HA	3	0
254	70.81936	-5.944053	HA	1	0
255	70.83039	-5.938842	HA	4	0
256	70.83243	-5.938019	HA	3	0
257	70.81049	-5.867737	HA	3	0
258	70.80129	-5.936923	HA	1	0
259	70.80135	-5.949283	HA	3	0
260	70.82327	-6.085428	OT	1	0

261	70.81902	-6.092852	HA	5	0
262	70.81976	-6.07247	HA	5	0
263	70.77637	-6.152564	HA	3	0
264	70.76	-6.09878	HA	3	0
265	70.76257	-6.100856	HA	0	0
266	70.79739	-6.051165	HA	3	0
267	70.78996	-6.021152	HA	3	0
268	70.78308	-5.993545	HA	2	0
269	70.82325	-6.08096	HA	2	0
270	70.84075	-6.061442	HA	0	0
271	70.8046	-5.942199	HA	1	0
272	70.78089	-5.893507	HA	3	0
273	70.783	-5.877608	HA	3	0
274	70.75668	-5.780057	HA	3	0
275	70.7485	-5.75138	HA	3	0
276	70.73971	-5.716241	HA	3	0
277	70.67685	-5.637293	HA	2	0
278	70.6948	-5.677118	HA	0	0
280	70.69679	-5.699136	HA	3	0
281	70.69991	-5.688954	HA	5	0
282	70.67899	-5.654423	HA	3	0
283	70.5798	-5.13379	HA	0	0
284	70.43676	-3.238303	W?	3	0
285	70.43076	-3.245477	OO	8	0
286	70.19271	-1.055748	BA	3	0
287	70.19051	-1.03718	BA	1	0
288	70.07903	-0.100805	B?	1	0
289	70.06778	4.89E-02	BA	1	0
290	69.63889	3.426908	MN	0	0
291	68.05294	13.43804	OO	0	0
292	68.17968	15.31903	GM	20	0
294	68.19714	15.38589	GM	0	0
297	68.23095	15.61739	GM	30	0
298	68.27794	15.81593	GM	5	1

300	68.28034	15.90935	GM	0	0
301	68.28525	15.97152	GM	6	0
302	68.28126	15.97305	GM	15	1
304	68.27773	15.9638	GM	15	1