JNCC Report
No: 616

MRV Scotia 1111S Cruise report: Survey of Scottish Marine Protected Areas Search Features north of Rona and within the 'windsock' closure area

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October 2019

ISSN 0963-8091

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This report should be cited as:

Golding, N. & Robertson, M. 2019. MRV Scotia 1111S Cruise report: Survey of Scottish Marine Protected Areas Search Features north of Rona and within the 'windsock' closure area. *JNCC Report No. 616*, JNCC, Peterborough, ISSN 0963-8091.

This report is compliant with the JNCC Evidence Quality Assurance Policy http://jncc.Defra.gov.uk/default.aspx?page=6675.

Please note that the data used in this report is from a survey conducted in September and October 2011, therefore some information may now be out-of-date at time of publication.

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1 Introduction

1.1. Survey details

Mobilisation: 14th September 2011, Aberdeen

Sailing: 17th September 2011, Aberdeen

Demobilisation: 2nd October 2011, Aberdeen

Vessel: *MRV Scotia* (Marine Scotland Science)

Scientific personnel: Scientist in Charge (MSS)
Client Rep (JNCC)
Science staff x 3 (MSS)
Science staff x 3 (JNCC)

Equipment on board: TV Drop frame and VMUX controller
TV sledge
600m multicore and netsonde cable
Konsberg OE14-366 colour zoom (TV) camera (x2)
Konsberg Simrad OE14-208 digital stills camera (x2)
oe1234 download box
miniDV recorder
HDD/DVD recorder
Day grab
Hamon grab
Reson SeaBat 7125 swath bathymetry system with PDS2000 acquisition software

Size of survey area: ~798km^2

Depth range: 93-136m

Objectives:

1. To verify the presence and potential extent of Scottish Marine Protected Area (MPA) search feature biotopes, in particular:
   - Offshore deep-sea muds
   - Offshore subtidal sands and gravels
   - Burrowed mud

2. To identify any priority marine features within the survey area.

2 Background to the survey area north of Rona and the 'windsock' closure

The area north of Rona and within the 'windsock' closure was selected due to the occurrence of sandy gravels identified from UKSeaMap2010[1], a biotope for which the Scottish MPA project has very little information on within Scottish waters. The area identified is also the only area within Scotland's seas where there are any benthic samples, which after taxonomic analsyis, have resulted in records of sublittoral sand biotopes.

The survey area is also of interest due to the 'windsock' closure area; an area closed to bottom trawl fisheries since 2001. Surveying here could add to our understanding of the 'contribution of other areas' of management to an ecologically coherent network of marine protected areas.

2.1. Survey plan

Areas were selected based on the distribution of seabed sediments described in UKSeaMap2010.

The survey gathered high quality acoustic data (bathymetry and backscatter) from two areas (Figure 1/Table 1) using the Reson 7125 swathe system along with a RoxAnn Acoustic Ground Discrimination System (AGDS) installed on the *MRV Scotia*.

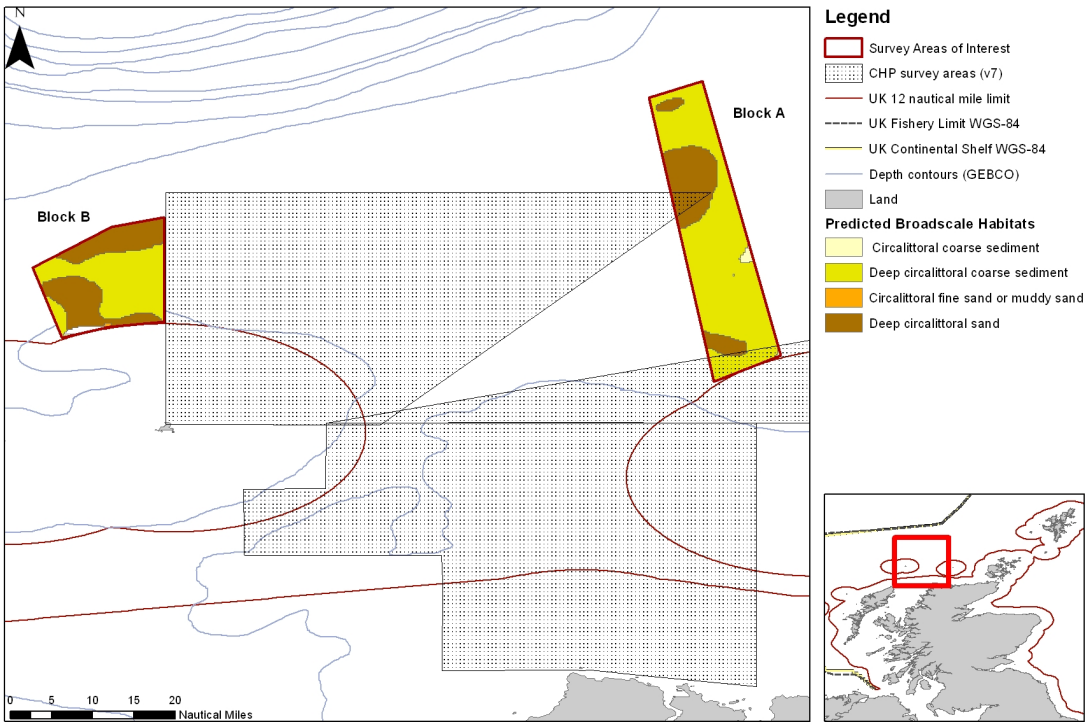

Figure 1: Overview of survey area, showing underlying seabed sediment types as described by UKSeaMap.

[1] http://jncc.defra.gov.uk/page-2117 UKSeaMap 2010

Table 1: Lat and Long (WGS84) coordinates for the planned survey areas in Figure 1 above.

Box	Latitude	Longitude
B	59.30683	-6.03736
B	59.44783	-6.09724
B	59.53033	-5.93718
B	59.54963	-5.83151
B	59.33813	-5.82985
B	59.32846	-5.94170
A	59.27035	-4.58260
A	59.21761	-4.71774
A	59.79209	-4.84999
A	59.82544	-4.74058

Fourteen smaller blocks, nested within Block A and Block B, were selected (Nine in survey area A, five in survey area B). Within these smaller blocks, 100% swath coverage was planned (bathymetry and backscatter to be stored)

Once swathing of a block was complete, the RoxAnn AGDS data were used to discriminate the range of acoustic groundtypes present through examining E1 (Roughness) and E2 (Hardness) values. The locations of four camera tows were selected to reflect the range of acoustic groundtypes recorded. Some of these camera tows were also located across boundaries of potentially different seabed types. Following the camera work, grab samples were taken at either the start (start of line SOL) or end (end of line EOL) of each tow. A $0.1m^2$ day grab was used initially but as the seabed sediments became coarser, the day grab started to fail getting valid samples so a mini-hamon grab was employed instead. Four replicate grab samples were taken at the start of the survey. However, this was reduced to three samples due to the volume of sample being gathered through using the mini-hamon.

Redundant cameras (TV and video) were available in case of equipment failures with primary kit. The mini-hamon grab was borrowed from CEFAS.

The general survey plan was to carry out swath data acquisition overnight. Ground truthing was carried out during the day, usually between 6:00 and 18:00 UTC on completed blocks of swath bathymetry. Seabed imagery and grab samples were acquired. Each 500m camera tow took approximately 30 minutes (including deployment and recovery), with statistical still images captured at one-minute intervals along the tow line. Additional stills images were taken of features of interest. Video imagery was recorded onto miniDVs and DVDs while still images were downloaded at regular intervals from the stills camera and saved onto an external hard drive. For each grab sample, a PSA sample was collected prior to sieving the sample through a 1mm sieve. The residue was then preserved in a 5% formal-saline solution with borax buffer.

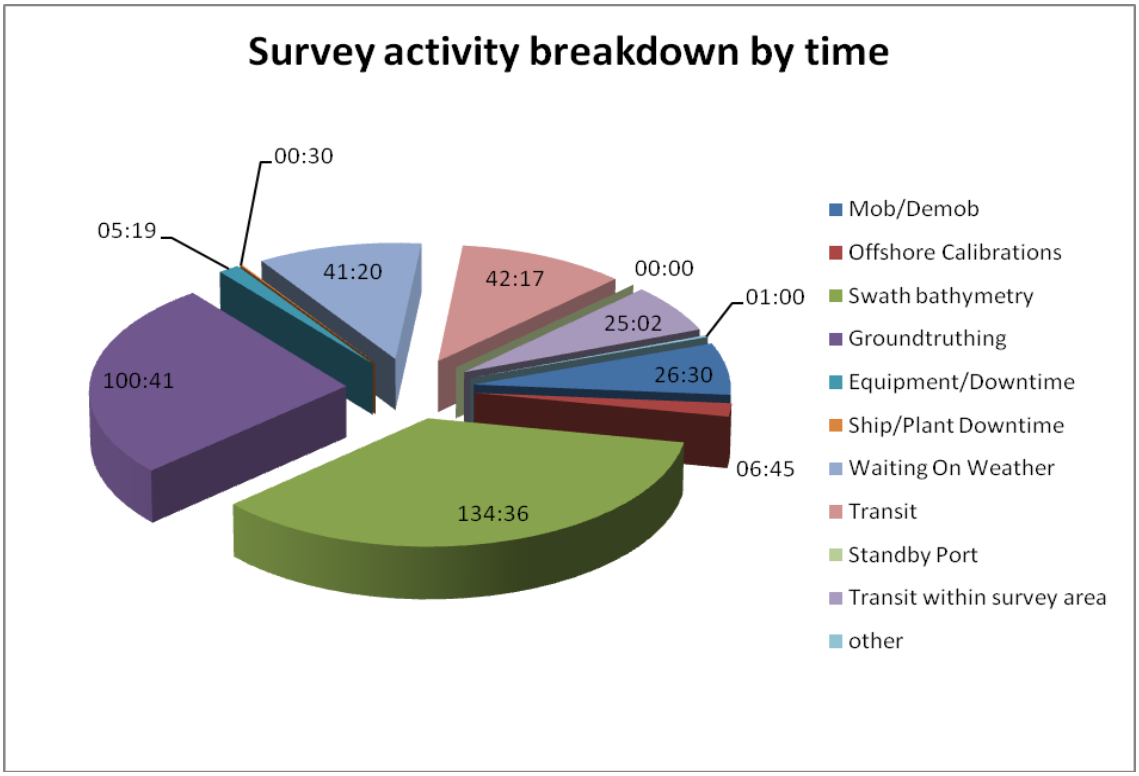

Figure 2: A breakdown of survey activities in hours (total time 384 hours: 16 days).

3 Cruise Diary

The full survey area of the Scotia 1111S survey can be seen in Figure 1 with a summary of the daily survey effort in Table 2 and a breakdown in Figure 2. Tables detailing the exact locations of each video and grab station are presented in Appendix A. A breakdown of survey activity by time is also presented in Figure 2.

Table 2: Summary of daily survey effort.

Date	General location	Line km swath	Number of video tows	Number of grab sample stations
17/09/11	Transit to Block A	0	0	0
18/09/11	Block A	97	3	3
19/09/11	Block A	63	4	4
20/09/11	Block A	65	0	7
21/09/11	Block A	21	0	0
22/09/11	Block A	73	0	5
23/09/11	Block A	115	11	0
24/09/11	Block A	11	4	8
25/09/11	Block A & B	55	10	0
26/09/11	Block B	79	4	4
27/09/11	Block B	64	4	7
28/09/11	Block B	58	4	0
29/09/11	Block B	29	6	7
30/09/11	Block A	94	0	8
01/10/11	Block A	50		
	TOTAL	874	50	53

14th – 16th September 2011

Mobilisation: Loading and testing of equipment for the survey began on the 14th including the hired Kongsberg camera equipment, and the Hamon grab that was on loan from CEFAS. Most of the survey crew stayed onboard the night prior to vessel departure, which was scheduled for early on the 17th Sept.

17th September 2011

The Scotia departed Aberdeen harbour at 06:30 UTC and steamed to pick up a damaged MSS hydrographic mooring off Garron Point, Stonehaven. A safety briefing, and for the new bodies on board (mostly JNCC) a tour of the vessel, took place immediately after the ship left the harbour. Following successful recovery of the mooring, MSS performed a calibration of the 400kHz and 200kHz frequencies of the swath system (Reson SeaBat 7125). The remainder of the day was spent transiting to Block A of the survey area and finalising the survey plan and shift arrangements with the MSS and JNCC team. This was communicated to the vessel master by the Scientist in Charge and the JNCC survey lead.

18th September 2011

Multibeam data acquisition started upon arrival at survey area 'A' Block A1 at around 07:00 UTC. Following completion of Block A1, Block A2 was started. Once a block had been complete, data from the RoxAnn AGDS system was reviewed to discriminate between the hard and softer seabed types, and sampling stations were identified for groundtruthing. Once camera tows for Block A1 were identified acoustic data acquisition was halted and groundtruthing began.

Three camera tows were completed in Block A1, which consisted of muddy sand with rippled features and some cobbles. Notable epifauna included hermit crab (Pagurus spp.), flatfish, anemones and brittlestars (one tow was considered too hard for the sledge to be used safely). When transitioning to more cobbly areas there was an increase in the numbers of sponges and bryozoans encountered. Day grabbing commenced in the afternoon, with replicate grabs (predominantly muddy sand) taken at one end of each camera tow.

Grabbing continued until 23:00, after which the vessel returned to Block A2 to continue multibeam acquisition.

19th September 2011

Block A2 multibeam was completed and Block A3 was started. There were some technical issues with the POS MV (Multibeam MRU: Motion Reference Unit) whilst completing Block 3. At 06:30 UTC camera tow lines were identified using the RoxAnn data and four camera tows were taken. Camera work was abandoned at one station (A2_CS03) as it was too rocky, and a substitute station identified (A2_CS05). The bottom type varied from shelly sand with some cobbles to cobbly gravel with some boulders. Sponges (*Axinella spp*., *Polymastia spp*. and other encrusting), stagshorn bryozoans, anemones, cushion starfish (*Porania*) and the occasional scallop were seen on the coarser sediments.

Grabs were taken from the EOL for each camera tow for Block 2. It was decided after sampling at the first station (A2_GB02) that the sediment was too coarse for effectively sampling with the Day grab and for the remainder of the survey the Hamon Grab was used

for benthic sampling. All of the grabs at this station were sands, with varying amounts of gravel. One sample contained lumps of clay-like sediment.

Once groundtruthing in Block A2 was completed we transited up to Block A3 where, after SVP calibration for the multibeam echosounder (MBES), multibeam acquisition re-commenced. Problems continued with the Multibeam POS MV system. Some data were collected for Block A3 but it was later recommended by Reson technical support that these data would need to be re-acquired.

Multibeaming at Block A4 was then started at 22:35 UTC.

20th September 2011

Sea state was quite rough and the forecast was for rougher weather so expectations for this days sampling were quite low. Multibeam data acquisition was completed on Block A4, including repetition of one line due to missing data. Swathing was carried out on Block A5 until 08:00 UTC.

The rough weather precluded camera work and instead grab samples were collected at the end of the proposed camera tow lines in Blocks A3 (four stations) and A4 (two stations). Epifaunal samples were taken for identification purposes from a boulder brought up during a grab attempt at A3_GB02.

Towards the end of the afternoon, the inclement weather and deteriorating sea stated resulted in repeated grab failures; groundtruthing was abandoned in Block A4 and operations switched to swathing. Swath lines could only be run in one direction due to the weather, with only two lines could be achieved before the survey went into weather downtime at 18:14 UTC.

It was anticipated the weather would be poor for at least 24 hours, with gale force 8 winds forecast. Due to unprecedented size of samples being taken by Hamon grab, resulting in higher use of formaldehyde, we agreed to use weather downtime opportunity to collect additional formaldehyde that could be dispatched to Scrabster from the Marine Scotland Science marine lab, to be collected around midday on the 21st. The vessel headed for shelter along the north coast near Dounreay.

21st September 2011

Rough weather and high winds continued and the Scotia remained sheltered near Dounreay until 13:00. The Scotia work boat was put in the water to collect the additional formaldehyde from Scrabster. Following this the vessel steamed back to Block A5 and multibeam data acquisition recommenced from 20:40 UTC as weather and sea state improved.

22nd September 2011

Multibeam data acquisition was completed in Block A5 at 02:00. It was still too rough to carry out camera work so, following the transit to Block A4, at 06:00 UTC grab sampling

continued from where it was abandoned due to poor weather on the 20th. The DPS thrusters struggled a little with the high swell, and we experienced a short period of ship downtime as a result. Grabs were taken from the remaining two stations in A4, although A4_GB03 required two attempts, moving slightly down the camera tow line for the second attempt. Both stations consisted of shelly sand.

Three stations were sampled in Block A5, all three were sandy although two stations were sandy with gravels. Three attempts made at the fourth station, but all were 'no samples'. We moved 15m along the line and made another attempt but only obtained one valid (cobbly) sample out of three. From this we concluded that this was cobbly/hard ground.

We started multibeam data acquisition on Block A6 at 13:00.

23rd September 2011

Multibeam data acquisition on Block A7 was completed followed by Block A8. Groundtruthing then commenced. As the weather was finer than previous days we focussed on camera work and carried out 11 camera tows across Blocks A5, A4, A3, and A6. Three tows were carried out in Block A5, the fourth was abandoned because of the presence of creels. Two of the tows were shortened due to a risk of damage to the cameras from boulders. The ground was generally hard, with cobbles, pebbles and gravels, although one tow was rippled sand with some gravel (and large boulders), dogfish, many worm burrows/casts on the seabed, and *Crossaster* were notable fauna on the tow.

Seven tows were completed in Blocks A4 and A3, one tow in A4 had to be abandoned, and one pulled up mid tow, due to creels. Most tows in A4 exhibited a bottom type of a mixture of shell/tusk shell, mega ripple bedforms and rippled sand with some gravels. Notable epifauna included anemones, the sponge *Polymastia spp*., starfish, scallops, and seapens. Fish species included a red gurnard. The bottom type in A3 was harder, with a mixture of gravels and boulders and little silt. The fourth tow on A3 was abandoned due to many boulders that could potentially damage the cameras on the sledge.

While in transit to Block 6 we changed from the camera sledge to the drop frame camera due to the large number of boulders being encountered and concerns regarding damage to the cameras. However, there was a lot of interference on the video display and the stills flash didn't appear to be working. Upon recovery, only 11 stills had been logged – all were black/dark apart from two.

The use of the drop frame was abandoned and for the remainder of the survey we used the camera sledge.

24th September 2011

Multibeam data acquisition (all of Block A8 and part of A9) stopped at 05:45 UTC to allow camera work to start. There were a few problems with the camera flash which hampered progress.

Four tows were completed in A6, including a repeat of the previous days drop frame camera tow. The bottom was initially sandy then transitioned into gravels for all four tows. Ripples becoming more pronounced at the end of the tows, with coarser sediment in the troughs. Burrows were evident as mounds of lighter sediment. Epifauna became increasingly abundant on the coarser sediment with Henricia spp., common sunstar (Crossaster.), Urticina spp., branching bryozoans and cup sponges (*Axinella infundibuloformis*), scallops.

Mobile species included dogfish and an octopus.

The swell increased to the point of preventing further camera work and we switched to grab sampling.

Eight grabs were taken from Block 6 and 7. Due to the sandy gravel bottom type it wasn't always possible to take three replicates at each station, even with moving further along the line to retry sampling.

Multibeam data collection continued to complete A9.

25th September 2011

Prior to starting groundtruthing parts of the multibeam in Block A3 was repeated to replace the data collected on the 19th.

It was decided we should complete the camera work in Block A and steam to Block B to enable commencement of multibeam at 8pm. This would provide the background data to plan the sampling on the morning of the 26th. The plan was to return to Block A8 and A9 to complete grab sampling once the work on Block B is completed if time allows in the survey schedule. All of A9 and part of A8 were outside of the windsock area.

Ten camera tows were completed in Blocks A7, A8 and A9. A7 and A8 were both coarse sediment, a mix of sands and gravels with occasional cobbles. Epifauna encountered included starfish (*Porania*, *Luidia,* and *Asterias)*, anemone, sponges (*Hymedesmia*, *Axinella infundibuliformis*), erect bryozoans, worm burrows/casts, squat lobster (*Munida rugosa*), hermit crabs and seapens (*Virgularia*). Rockfish, ling, cod, dogfish and dragonet were also seen. Possible evidence of trawl marks was seen mid and three quarters through the last tow on A8.

The four tows in A9 were predominantly sandy sediment with varying amounts of silt, shell fragments and cobbles. Seapens were present throughout one of the tows. Obvious epifauna in all tows include a variety of starfish (*Luidia*, *Porania*, *Anseropoda* (Goosefoot starfish), tubeworms and hydroids. One tow was particularly flat and featureless, whereas the other three tows were rippled sand. Multibeam in Block B2 commenced at 20:30.

26th September 2011

Completed multibeam data acquisition in B2, data collection in B3 continued until 05:30 UTC.

After an initial two tows in Block B2 we went into equipment downtime due to problems with the video camera focussing and the stills camera flash. Once these issues were rectified two further tows were completed. The first two tows were both coarse sand with cobbles and occasional boulders, with some rippled sandy sediment. Fauna observed included octopus and large anemones (possibly *Bolocera spp.*).

One of the remaining two tows was rippled sandy sediment with gravel with a variety of starfish including *Porania pulvillus* (cushion star), *Luidia* spp. (7-armed starfish), *Henricia spp.* and *Asterias rubens* (common starfish). The second tow was sandy, very flat and had

few notable fauna (very few polychaete burrows/casts, a few *Asterias*, brittlestars and seapens).

Grabs were taken from four stations in B2. All were sandy gravels. By this stage sea state was getting quite rough and we aborted sampling and switched to multibeam acquisition in Block 1.

27th September 2011

Multibeam data acquisition on Block B1 was completed ahead of schedule so camera work began in this block at 06:05 UTC. Once the camera work was completed in B1 the captain recommended we undertake the grabbing in this area (rather than continue camera work in next block) to avoid having to return (5nm transit to next block). The downside however was that the weather picked up, precluding camera work to be continued in next block.

Four tows were completed in B1, all were rippled sandy sediment with gravel in troughs. A number of fish seen throughout the tows (flatfish, small gobies, cuckoo ray). Other epifauna included starfish, hermit crabs, anemone (*Bolocera* spp.) and either a stalked anemone or a tall sponge.

Grabs were taken from four stations in B1 and three stations in B3. The seabed was composed of coarse sand with gravels and cobbles. A number of failed grabs were attributed to the stop plate on the Hamon grab being loose. This was tightened and sampling continued. Sampling eventually had to be aborted due to the thrusters tripping in the high swell. We transited to Block 5 and commenced multibeam data acquisition.

28th September 2011

Multibeam on Block 5 was completed at 05:30 UTC, so we transited to Block B3 for camera work. Four tows in Block B3, all coarse sandy sediment. One of the tows was particularly devoid of interesting features, a few starfish and cobbles on very flat sand. Other tows were rippled sand with gravels in troughs, although one became flatter towards the end of the tow. Visible epifauna included *Luidia spp, Asterias spp* and *Bolcera spp*. Whale bones, fish and a sponge that may have been Polymastia spp or *Desmacidon spp* were notable features in one of the tows.

The weather became too rough for camera work so we set up for grabbing, but the deteriorating sea state meant that all ground truthing was abandoned. Attempted MBES in the late afternoon but this too was abandoned after only a couple of lines were completed due to inclement weather.

Multibeam data acquisition was completed in Block B4.

29th September 2011

Camera work began at 05:00 UTC. Six tows were taken in Blocks B4 and B5, completing the camera work planned. Both tows in B4 consisted of coarse sand without apparent bed forms. Notable epifauna were hermit crabs, anemones and a few fish.

The four tows in B5 consisted of coarse sand with variable ripples and shell in troughs. Notable fauna included flat fish, octopus, starfish (*Porania pulvillus, Asterias rubens*), stalked anemone, bryozoans, hermit crabs, *Sabella spp*. Small fish suspected to be sand eels were seen in all four tows, and low-profile burrows/casts were seen in one of the tows.

A total of eight stations were sampled from Blocks B5, B3 and B4. All four stations in B5 were shelly sand. The grabs taken from the two stations in B3 (one station repeated from the 28th due to the poor weather conditions at the time) and the two in B4 were all coarse sandy sediment.

30th September 2011
Finished multibeam data acquisition in Block B and transited to Block A9 to begin grab sampling at 04:00 UTC. Grabs taken from four stations in Block A9 ranged from cobbly sand to muddy sand. All four stations sampled in Block A8 were muddy sand.

Remaining survey time was spent gathering additional multibeam data, extending the existing blocks of multibeam from north to south. This was continued from 11:30 into the next day.

The nicest weather day we'd had all survey.

1st October 2011
A flat calm day, with sightings of dolphins during the steam back to Aberdeen. We left the survey area at 08:00 UTC and reached the Pentland Firth at 15:00 and continued steaming to Aberdeen through the night.

2nd October 2011
Arrived in Aberdeen harbour and demobilised in morning.

3.1. Survey Summary

A total of 874 line kilometres of multibeam data were acquired (see Figure 3 below). A total of 50 video transects were completed in 14 days (see Table 2 and Table A2) along with 53 grab stations totally 149 samples (Table A1). Total video footage collected equalled 17:01:24 (h:m:s).

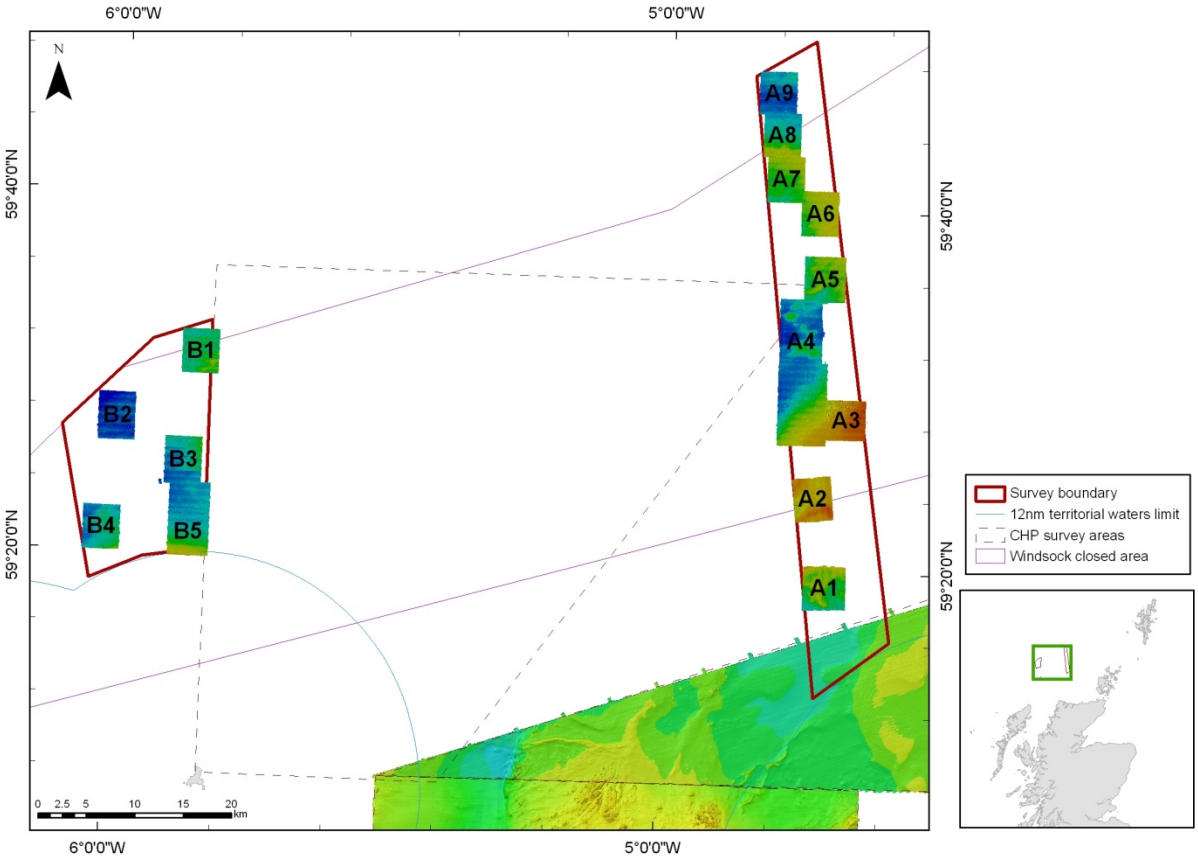

Figure 3: Summary of acoustic data gathered during the survey (note the extensive block of multibeam data to the south-east corner is MCA Civil Hydrography Programme data and was not acquired on this survey).

4 Challenges encountered

The key challenge to the survey was the weather. Downtime on the survey attributed to weather equated to over 40 hours, when we were unable to carry out groundtruthing or gather acoustic data on a number of occasions due to the sea state. Fortunately, the flexibility of the working shifts offered by Marine Scotland Science and the adaptability of the survey plan allowed for alternative data collection during most periods; for example, when camera work or grabbing wasn't possible, acoustic data was gathered.

The work programme was required to accommodate constraints with working shifts and maximum working hours. In particular for the camera work, this sometimes meant that there were times when it was necessary to curtail camera work and switch to other sampling methods to ensure that the one camera technician had the required rest periods.

There were occasional technical hitches with the equipment (cameras and multibeam) but these were resolved quickly by the MSS supporting scientists and with remote support from Reson and IVS 3D. In particular, there were some issues with the drop frame/vmux setup, that became apparent when it was necessary to switch from camera sledge to drop frame due to rockier the seabed in some areas. The issues (suspected with the netsonde cable termination at the frame end) resulted in poor quality video with interference and required us to return to using the camera sledge, with a small loss in time due to reconfiguring equipment. Overall though, the camera equipment performed well, partly due to the expertise and skill of the camera technician.

Another slightly unexpected challenge resulted from using the mini Hamon grab to collect benthic samples. The volume of the samples collected by this grab exceeded our expectations, and there was a moment when we thought it may also exceed the capacity of the sample containers and formaldehyde we had on board. We turned the weather downtime to our advantage and used the opportunity to collect additional supplies from Scrabster after being delivered by the MSS staff. The flexibility provided by Marine Scotland Science ensured that additional supplies could be delivered while having negligible impact on the survey operation. A further consequence of the large volume of samples collected was that the space reserved for sample storage was not going to be sufficient and an alternative option was required. Once again, Marine Scotland Science assisted, by providing temporary storage prior to the samples being sent for analysis.

5 Summary and recommendations

In summary, a vast amount of data were collected from across the two areas planned for survey; an excellent result for the first dedicated offshore Scottish MPA survey. The success of the survey can be attributed to the support from staff and crew, and the flexibility that was built into the survey plan.

In response to the few minor challenges we faced during the survey we've identified a limited number of suggestions that may be worthy of consideration for future surveys:

- Ensure sufficient flexibility is built into the into the work schedule to allow for weather downtime, particularly if surveying outside of the summer months;

- Overestimate the number of sampling containers required for samples. If using the Hamon grab the samples are likely to be much larger than those obtained using a Day grab, so larger sample containers will be needed (we used 5L buckets). However, there are issues with larger sample containers also – unwieldy, difficult to store and transport as well as more difficult to correctly preserve the contents.

- As per sample containers, budget for requiring more formaldehyde if using the Hamon grab;

- Digital stills camera settings – a number of different settings were trialled on the survey including standard settings used routinely by Marine Scotland Science. JNCC had previously used the following settings for the Kongsberg (Canon Powershot G5) OE14-208 DSC and would recommend these being used for future JNCC SMPA surveys; Aperture Priority mode (AP), f5.6, Fixed focus,

- Ideally staffing of the survey would allow for two shifts across the team of specialists and support crew throughout the survey duration (when running 24hr ops) to allow for continuous sampling should the conditions allow. JNCC appreciate that other MSS surveys were out at the same time as 1111S, which affected staff availability.

- Concerns over positioning of camera sledge on seabed. Kitting out the camera sledge with a positioning system would provide greater certainty of sledge location. Either through the use of the FRV Scotia HiPap system installed or the provision for buying in a solution from an external contractor – however this would be additional expense to Marine Scotland, although considered a worthwhile investment.

- If the samples are not being delivered directly for sample processing when demobilising, ensure that adequate space has been identified for sample storage prior to survey mobilisation;

- Provision of multibeam data processing support (solution could be bought in externally). This would allow MBES data (bathy and backscatter) to be processed soon after acquisition and allow more effective and robust selection of groundtruthing stations. This would be an additional expense during the survey but would mean that processing post survey would not be required.

JNCC would like to thank the MSS scientists on the survey (Mike Robertson, Phil Copland, Charlie Hepple and Gareth Jones) and the Master (Iain Craig) and the MRV Scotia crew for their involvement and support during the survey.

Appendix A

Table A1: Grab station summary.

Area	Station	Date	Latitude	Longitude	Gear Type
A1	A1_GB01	18/09/2011	59.312208	-4.722850	Day grab
A1	A1_GB03	18/09/2011	59.329541	-4.686483	Day grab
A1	A1_GB04	18/09/2011	59.299179	-4.699654	Day grab
A2	A2_GB02	19/09/2011	59.40093	-4.747986	Day grab
A2	A2_GB01	19/09/2011	59.413691	-4.760441	Hamon grab
A2	A2_GB04	19/09/2011	59.41010	-4.720233	Hamon grab
A2	A2_GB05	19/09/2011	59.405762	-4.738367	Hamon grab
A3	A3_GB01	20/09/2011	59.490812	-4.697204	Hamon grab
A3	A3_GB02	20/09/2011	59.482946	-4.647708	Hamon grab
A3	A3_GB03	20/09/2011	59.474421	-4.653433	Hamon grab
A3	A3_GB04	20/09/2011	59.475204	-4.681929	Hamon grab
A4	A4_GB02	20/09/2011	59.553421	-4.755029	Hamon grab
A4	A4_GB04	20/09/2011	59.532946	-4.757620	Hamon grab
A4	A4_GB01	22/09/2011	59.553162	-4.785875	Hamon grab
A4	A4_GB03	22/09/2011	59.559761	-4.797294	Hamon grab
A5	A5_GB01	22/09/2011	59.591817	-4.729644	Hamon grab
A5	A5_GB02	22/09/2011	59.600239	-4.707322	Hamon grab
A5	A5_GB03	22/09/2011	59.607277	-4.685711	Hamon grab
A5	A5_GB04	22/09/2011	59.619350	-4.734150	Hamon grab
A6	A6_GB01	24/09/2011	59.681515	-4.703365	Hamon grab
A6	A6_GB02	24/09/2011	59.652625	-4.694345	Hamon grab
A6	A6_GB03	24/09/2011	59.658899	-4.750531	Hamon grab
A6	A6_GB04	24/09/2011	59.673379	-4.758102	Hamon grab
A7	A7_GB01	24/09/2011	59.678475	-4.795309	Hamon grab
A7	A7_GB02	24/09/2011	59.691505	-4.760127	Hamon grab
A7	A7_GB03	24/09/2011	59.698394	-4.777908	Hamon grab
A7	A7_GB04	24/09/2011	59.712523	-4.817676	Hamon grab
B2	B2_GB02	26/09/2011	59.468415	-5.987011	Hamon grab
B2	B2_GB03	26/09/2011	59.459027	-5.968499	Hamon grab
B2	B2_GB04	26/09/2011	59.448934	-5.980292	Hamon grab
B1	B1_GB01	27/09/2011	59.535306	-5.851051	Hamon grab
B1	B1_GB02	27/09/2011	59.520033	-5.853722	Hamon grab
B1	B1_GB03	27/09/2011	59.513509	-5.830250	Hamon grab
B1	B1_GB04	27/09/2011	59.505753	-5.878990	Hamon grab
B3	B3_GB01	27/09/2011	59.438262	-5.845151	Hamon grab
B3	B3_GB02	27/09/2011	59.424175	-5.856249	Hamon grab
B3	B3_GB03	27/09/2011	59.413304	-5.890399	Hamon grab
B3	B3_GB04	29/09/2011	59.399219	-5.894326	Hamon grab
B4	B4_GB01	29/09/2011	59.343801	-6.021904	Hamon grab
B4	B4_GB02	29/09/2011	59.349832	-6.042722	Hamon grab
B5	B5_GB01	29/09/2011	59.366793	-5.864333	Hamon grab

Area	Station	Date	Latitude	Longitude	Gear Type
B5	B5_GB02	29/09/2011	59.356841	-5.835832	Hamon grab
B5	B5_GB03	29/09/2011	59.350332	-5.880460	Hamon grab
B5	B5_GB04	29/09/2011	59.343658	-5.859755	Hamon grab
A8	A8_GB01	30/09/2011	59.731262	-4.793950	Hamon grab
A8	A8_GB02	30/09/2011	59.731121	-4.822101	Hamon grab
A8	A8_GB03	30/09/2011	59.740563	-4.804900	Hamon grab
A8	A8_GB04	30/09/2011	59.751875	-4.811399	Hamon grab
A9	A9_GB01	30/09/2011	59.768609	-4.783043	Hamon grab
A9	A9_GB02	30/09/2011	59.774893	-4.803800	Hamon grab
A9	A9_GB03	30/09/2011	59.784705	-4.788078	Hamon grab
A9	A9_GB04	30/09/2011	59.790065	-4.832546	Hamon grab

Table A2: Camera tow station summary.

Area	Station	Date	Start of Line		End of Line		Gear Type
			Latitude	**Longitude**	**Latitude**	**Longitude**	
A1	A1_CS01	18/09/2011	59.30283	-4.72410	59.30731	-4.72479	camera sledge
A1	A1_CS03	18/09/2011	59.32117	-4.68707	59.32641	-4.68555	camera sledge
A1	A1_CS04	18/09/2011	59.29800	-4.69938	59.30332	-4.69957	camera sledge
A2	A2_CS01	19/09/2011	59.41928	-4.74951	59.41451	-4.75426	camera sledge
A2	A2_CS02	19/09/2011	59.40282	-4.74314	59.39953	-4.75144	camera sledge
A2	A2_CS04	19/09/2011	59.41651	-4.70973	59.41257	-4.71625	camera sledge
A2	A2_CS05	19/09/2011	59.41293	-4.72593	59.40890	-4.73298	camera sledge
A3	A3_CS01	23/09/2011	59.49435	-4.69387	59.48822	-4.70025	camera sledge
A3	A3_CS02	23/09/2011	59.48694	-4.64009	59.48455	-4.64553	camera sledge
A3	A3_CS03	23/09/2011	59.47587	-4.65296	59.47463	-4.65442	camera sledge
A3	A3_CS04	23/09/2011	59.47560	-4.68042	59.47423	-4.68247	camera sledge
A4	A4_CS01	23/09/2011	59.55642	-4.78136	59.55317	-4.78703	camera sledge
A4	A4_CS03	23/09/2011	59.56218	-4.71203	59.55816	-4.71758	camera sledge
A4	A4_CS04	23/09/2011	59.53273	-4.75432	59.53196	-4.75577	camera sledge
A5	A5_CS02	23/09/2011	59.60138	-4.70478	59.59990	-4.70914	camera sledge
A5	A5_CS03	23/09/2011	59.60841	-4.68263	59.60505	-4.68936	camera sledge
A5	A5_CS04	23/09/2011	59.62030	-4.72762	59.61985	-4.73024	camera sledge
A6	A6_DC02	23/09/2011	59.65608	-4.69140	59.65044	-4.69694	drop frame
A6	A6_CS01	24/09/2011	59.68219	-4.70158	59.67867	-4.70782	camera sledge
A6	A6_CS02	24/09/2011	59.65348	-4.69581	59.64951	-4.70093	camera sledge
A6	A6_CS03	24/09/2011	59.66011	-4.74859	59.65681	-4.75511	camera sledge
A6	A6_CS04	24/09/2011	59.67883	-4.74600	59.67522	-4.75416	camera sledge
A7	A7_CS01	25/09/2011	59.68483	-4.78887	59.67983	-4.79385	camera sledge
A7	A7_CS02	25/09/2011	59.69491	-4.75482	59.69081	-4.76295	camera sledge
A8	A8_CS01	25/09/2011	59.73543	-4.78355	59.73249	-4.79200	camera sledge
A8	A8_CS02	25/09/2011	59.73615	-4.81327	59.73245	-4.81955	camera sledge
A8	A8_CS03	25/09/2011	59.74298	-4.80109	59.73844	-4.80849	camera sledge
A8	A8_CS04	25/09/2011	59.75693	-4.79943	59.75345	-4.80762	camera sledge
A9	A9_CS01	25/09/2011	59.77084	-4.77958	59.76700	-4.78623	camera sledge
A9	A9_CS02	25/09/2011	59.77772	-4.79937	59.77410	-4.80636	camera sledge
A9	A9_CS03	25/09/2011	59.78748	-4.77975	59.78482	-4.78797	camera sledge
A9	A9_CS04	25/09/2011	59.79061	-4.82670	59.78806	-4.83522	camera sledge
B2	B2_CS01	26/09/2011	59.47479	-6.00920	59.47223	-6.01721	camera sledge

Area	Station	Date	Start of Line		End of Line		Gear Type
B2	B2_CS02	26/09/2011	59.46999	-5.97810	59.46971	-5.98754	camera sledge
B2	B2_CS03	26/09/2011	59.45755	-5.96437	59.45753	-5.97463	camera sledge
B2	B2_CS04	26/09/2011	59.44973	-5.97070	59.44934	-5.98268	camera sledge
B1	B1_CS01	27/09/2011	59.54058	-5.84332	59.53636	-5.84756	camera sledge
B1	B1_CS02	27/09/2011	59.52658	-5.84321	59.52226	-5.85033	camera sledge
B1	B1_CS03	27/09/2011	59.51615	-5.82522	59.51177	-5.83361	camera sledge
B1	B1_CS04	27/09/2011	59.51187	-5.86828	59.50844	-5.87404	camera sledge
B3	B3_CS01	28/09/2011	59.44157	-5.84066	59.43714	-5.84791	camera sledge
B3	B3_CS02	28/09/2011	59.42664	-5.85122	59.42288	-5.85725	camera sledge
B3	B3_CS03	28/09/2011	59.41660	-5.87932	59.41446	-5.88710	camera sledge
B3	B3_CS04	28/09/2011	59.40595	-5.88185	59.40205	-5.88798	camera sledge
B4	B4_CS01	29/09/2011	59.34527	-6.01989	59.34079	-6.02328	camera sledge
B4	B4_CS02	29/09/2011	59.35227	-6.03972	59.35142	-6.04073	camera sledge
B5	B5_CS01	29/09/2011	59.37529	-5.86018	59.37021	-5.86350	camera sledge
B5	B5_CS02	29/09/2011	59.36481	-5.82986	59.35960	-5.83384	camera sledge
B5	B5_CS03	29/09/2011	59.35293	-5.87930	59.34843	-5.88161	camera sledge
B5	B5_CS04	29/09/2011	59.34660	-5.85761	59.34150	-5.86140	camera sledge