

Mullach Mor, Isle of Rum

Hydrographic Data Report: Deployment ID446

14th February – 27th April 2025

November 2025

Mowi Scotland Limited

› Registered in Scotland No. 138843 Registered Office, 1st Floor, Admiralty Park Admiralty Road Rosyth FIFE KY11 2YW	OFFICE	PHONE	FAX
	Farms Office, Glen Nevis Business Park PH33 6RX Fort William		-
	POSTAL	MAIL	
	Farms Office, Glen Nevis Business Park PH33 6RX Fort William	environment@mowi.com	
		WEB	
		http://mowi.com	

CONTENTS

1.	INTRODUCTION	5
2.	MATERIALS & METHODS.....	5
	<i>2.1 Bathymetry.....</i>	<i>5</i>
	<i>2.2 Current Data</i>	<i>5</i>
	<i>2.3 Magnetic Variation</i>	<i>6</i>
	<i>2.4 Data Processing.....</i>	<i>6</i>
	<i>2.5 Meteorological Data</i>	<i>8</i>
3.	RESULTS AND DISCUSSION	8
4.	HYDROGRAPHIC DATA SUMMARY SHEETS	9
5.	CONCLUSION.....	16
	ANNEX 1. SURVEY EQUIPMENT DEPLOYMENT LOG.....	17

LIST OF FIGURES

Figure 1. The proposed Mullach Mor, the existing Rum site and current meter deployment (▲) location.	5
Figure 2. Mean beam intensity of the ADCP signal for the ID446 dataset from 14 th February to 27 th April 2025 plotted by cell number and depth.	8
Figure 3. Current Data Summary Sheet for the near-surface, cell 25, 3.62 m below min sea level, 14 th February – 27 th April 2025 inclusive (ID446).	9
Figure 4. Current Data Summary Sheet for the cage bottom, cell 14, 14.62 m below min sea level, 14 th February – 27 th April 2025 inclusive (ID446).	10
Figure 5. Current Data Summary Sheet for the near sea bed, cell 1, 14 th February – 27 th April 2025 inclusive (ID446).	11
Figure 6. Speed and direction components of the near surface cell	12
Figure 7. Speed and direction components of the cage bottom cell.	13
Figure 8. Speed and direction components of the near sea bed cell.	14
Figure 9. Cumulative vector plots of all velocity data from near-surface cell 25, cage bottom cell 14 and near sea bed cell 1 for ID446.	15
Figure 10. Summary of heading data throughout deployment ID446.	16
Figure 11. Summary of pitch and roll data throughout deployment ID446.	16
Figure 12. Pressure data throughout deployment ID446.	16

LIST OF TABLES

Table 1. Nortek Signature 1000 ADCP Specifications.	7
---	---

QUALITY ASSURANCE

Mowi Scotland maintains a Quality Manual which defines the Quality and Environmental Policy of Mowi Scotland Farming Limited and includes an overview of its processes and acts as a signpost to key elements of its Quality Management System according to the requirements of BS EN ISO 9001, BS EN ISO 14001, GLOBALG.A.P. and British Retail Consortium Global Standard Food. Note the BRC standard is relevant to Blar Mhor processing plant only.

1. Introduction

Mowi Scotland Ltd. is preparing an application to the Scottish Environmental Protection Agency (SEPA) for a new salmon farm site Mullach Mor, north-east off the Isle of Rum. Eight 160 m circumference pens, in a 2 x 4 formation, will be sought.

Mowi Scotland Ltd have carried out a hydrographic survey at the site in 2025 between 14th February and 27th April (ID446). This report describes the data from this deployment at Mullach Mor and assesses the suitability of the collected hydrographic data for calibration of a hydrodynamic model around the Small Isles region.

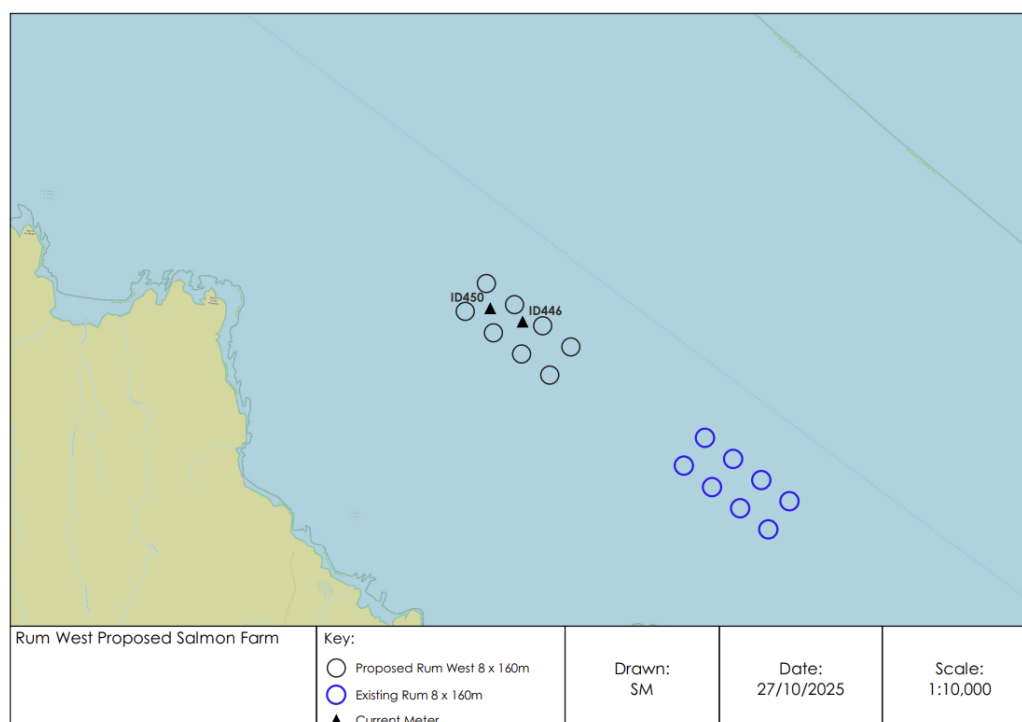


Figure 1. The proposed Mullach Mor, the existing Rum site and current meter deployment (▲) location.

2. Materials & Methods

2.1 Bathymetry

Bathymetry for the study area was taken from the European Marine Observation and Data Network (EMODnet) bathymetry data ([Bathymetry | European Marine Observation and Data Network \(EMODnet\)](#)).

2.2 Current Data

Mowi staff carried out a hydrographic survey at the site in 2025. The purpose of this hydrographic report is to assess the suitability of the collected hydrographic data for use with the hydrodynamic model. The data contained in this report were recorded at the site from 14th February – 27th April 2025.

The instrument used was a Teledyne RDI Sentinel V100 Acoustic Doppler Current Profiler (ADCP) and was moored on the seabed about 34 m below mean sea level. The deployment location was positioned at 57.04838, -6.27928 (140569 E, 803399 N), which was approximately 830 m from the nearest shoreline and 24 m from the centre of the pen group (Figure 1).

The cell size was set at 1.0 m and the number of cells to 44. The data were averaged at 300 s intervals (20 minutes). The blanking distance above the transducers was 1.6 m, as recommended by the manufacturer to maintain good data quality, giving a first cell height of 3.02 m above the transducer heads.

Data was automatically written and stored to the internal memory within the Sentinel V100 ADCP main body and then downloaded to computer after completion of the deployment period via WiFi or a USB cable.

2.3 Magnetic Variation

No magnetic variation correction was made to the Signature 1000 ADCP during deployment, this was undertaken to the data after the instrument was recovered and data downloaded. The magnetic variation used was -1.13° ; this was determined using the British Geological Survey Grid Magnetic Angle Calculator. Further details can be found at https://geomag.bgs.ac.uk/cgi-bin/gma_calc.

2.4 Data Processing

Upon retrieval of the Sentinel V100 ADCP current meter, all data was downloaded to a computer for analysis. The raw data file was opened in Teledyne's "Velocity" software and exported to Matlab. Deployment diagnostic data (beam intensity, correlation, pitch and roll) were analysed to confirm that the deployment was successful with the instrument orientated upright. The heading data were also examined to identify any movement of the Sentinel V100 ADCP mooring frame during the deployment.

The diagnostic data suggested that velocities from the first 25 bins were valid (Figure 2). Calculations were undertaken to identify the cells to be used for surface and middle currents. Surface data was taken at an average depth (derived from the pressure sensor) of 6.29 m (cell 25), and cage-bottom data at 15.77 m (cell 20). Surface and middle cell heights above were 16.71 m and 27.71 m from the seabed respectively. The bottom cell (cell 1) was at a mean depth of 30.29 m and 3.71 m above the seabed.

Table 1. Sentinel V100 ADCP Specifications.

Depth Cell Size ¹	V20 (1000kHz)			V50 (500kHz)		V100 (300kHz)	
	Depth Cell Size ¹	Range (m) ^{2,3}	Std Dev (cm/s) ^{3,4}	Range (m) ^{2,3}	Std Dev (cm/s) ^{3,4}	Range (m) ^{2,3}	Std Dev (cm/s) ^{3,4}
		Wide/Narrow	Wide/Narrow	Wide/Narrow	Wide/Narrow	Wide/Narrow	Wide/Narrow
	0.25m	18.0/22.6	19.2/36.5				
	0.3m	19.3/24.0	11.1/20.8				
	0.5m	20.2/24.9	7.1/13.4	44.1/57.6	19.2/36.5		
	1.0m	22.1/26.9	3.6/6.7	50.5/64.6	7.1/13.5	94.5/120.6	10.9/20.6
	2.0m	24.5/29.4	1.7/3.2	56.0/70.6	3.6/6.7	103.5/130.4	5.5/10.3
	4.0m	26.9/32.0	0.8/1.6	63.1/78.2	1.7/3.2	114.6/142.3	2.7/5.2
	6.0m			67.4/82.8	1.1/2.1	121.7/151.5	1.8/3.3
Communications and Recording	Wireless			802.11b/g/n			
	Internal memory			One 16GB Micro SD Card included			
Profile Parameters	Velocity accuracy	V20/V50: 0.3% of the water velocity relative to the ADCP ±0.3cm/s					
	Velocity resolution	V100: 0.5% of the water velocity relative to the ADCP ±0.5cm/s					
	Velocity range	0.1cm/s					
	Ping rate	±5m/s (default); ±20m/s (maximum)					
		Up to 4Hz					
Echo Intensity Profile	Vertical resolution	Depth cell size					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	25°					
	Configuration	4-beam, convex; 5th beam vertical					
	Depth rating	200m					
	Materials	Transducer, housing, and end cap: plastic					
		Connector: metal shell					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, precision ±0.4°C, resolution 0.1°					
	Compass (magneto-inductive sensor)	Accuracy 2° RMS, resolution 0.1°, max. dip angle 85°					
	Tilt (MEMS accelerometers)	Pitch range ±90°, roll range ±180°, accuracy 2° RMS, precision 0.05° RMS, resolution 0.1°					
	Pressure sensor (mounted on transducer)	Range 300m, accuracy 0.1%FS					
Power	External DC input	12–20VDC					
	Internal battery voltage	18VDC new					
	Battery capacity; over-the-counter @0°C	100 watt hours (typical)					
	Battery pack @5°C	510 watt hours					
Software	Teledyne RDI's new software included	ReadyW—Pre-deployment (testing, planning, and data recovery) ⁵					
		Velocity—Post-processing (data handling, display, and export) ⁶					
Environmental	Standard depth rating	200m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	7.5kg – 16.0kg					
	Weight in water	1.6kg – 6.0kg					
Available Options	External battery case						
	• AC/DC power converter • 5th beam (at time of order only) • Waves processing • Straight or right-angle metal shell connector						
Dimensions	Special configuration drawing available upon request						

¹ User's choice of depth cell, not limited to the typical values specified.

² Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.

³ User selects the bandwidth mode; wide ~ 25% or narrow ~ 6%.

⁴ Standard deviations (Std Dev) are typical values for single ping data.

⁵ Resident in ADCP accessed via a web browser.

⁶ Windows™ based software program.

1. User's choice of depth cell not limited to the typical values specified.

2. Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.

3. User selects the bandwidth mode; wide = 25% or narrow = 6%.

4. Standard deviations (Std Dev) are typical values for single ping data.

5. Resident in ADCP accessed via a web browser.

6. Windows® based software program.

Specifications subject to change without notice.

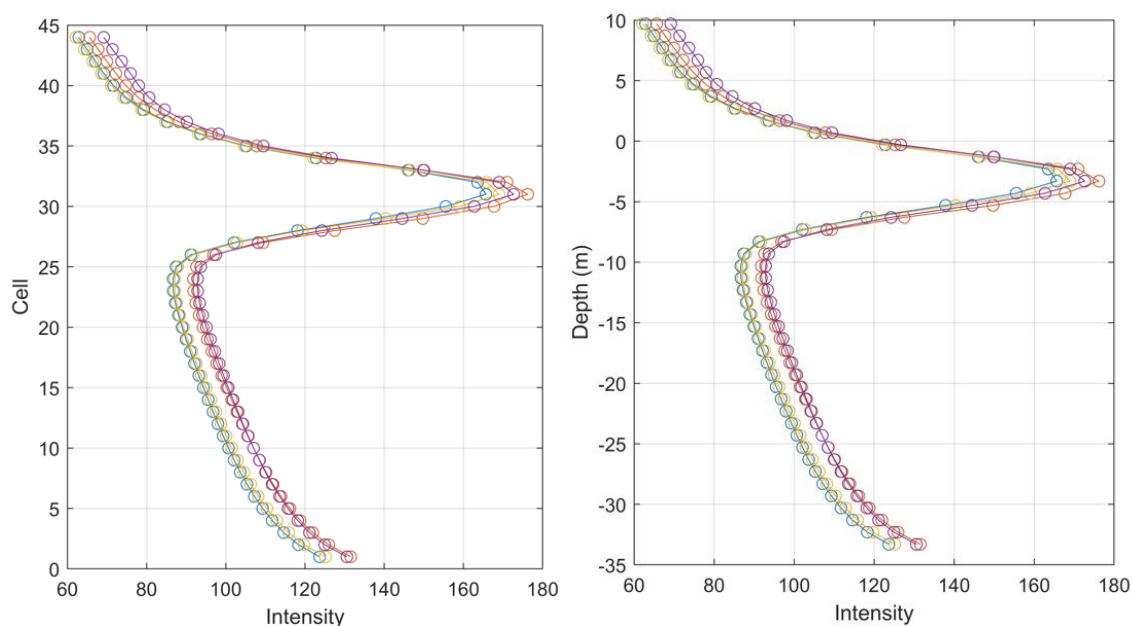


Figure 2. Mean beam intensity of the ADCP signal for the ID446 dataset from 14th February to 27th April 2025 plotted by cell number and depth.

2.5 Meteorological Data

The collection of meteorological data is no longer required to support the assessment process and consequently has not been undertaken. The current data used is collected using multiple deployments and over a longer period and thus provides a more realistic representation of site conditions than short deployments, thus allowing an assessment of the influence of meteorological conditions.

3. Results and Discussion

A summary of the current data is shown in Figure 3 to Figure 12. Over the period analysed for this report, the currents at the sea bed, cage bottom and sub surface had speed averages of 9.26 cm/s, 9.4 cm/s and 10.04 cm/s respectively. This gave an overall average of 9.57 cm/s. The orientation of the tidal velocities was north-west – south-east.

The residual currents at the three depths were all toward the north-west (293°G, 296°G, 321°G) Figure 6 - Figure 8. The magnitude of the residual currents for the three analysed depths were moderate, with mean values of 0.026 m/s, 0.018 m/s and 0.022 m/s respectively.

Time series of the instrument heading, pitch and roll, and measured pressure are shown in Figure 10 – Figure 12 respectively and demonstrate that the deployment during the selected period of 72 days was stable and the data reliable.

4. Hydrographic Data Summary Sheets

Site Name	Mullach Mor
CAR Licence Number (if applicable)	N/A
Easting	140569
Northing	803399
Latitude (decimal deg)	57.04838N
Longitude (decimal deg)	-6.27928W
Type of Data (single/stitched)	Single
Bin (surface/middle/bottom)	Surface
Bin Number	25
Bin Height (above seabed) (m)	27.71
Site Water Depth (m)	34
ADCP Model	ADCP
ADCP Serial Number	24559
ADCP Deployment (seabed/mid-dep)	Seabed

Deployment Details	
Number of Records	5197
Start Time (GMT)	14/02/2025 15:00:00
End Time (GMT)	27/04/2025 19:00:00
Number of Days	72.17
Interval (mins)	20

Depth Analysis (m)	
Max	8.83
Mean	6.29
Min	3.62

Velocity Analysis			
	Scalar Speed (m/s)	Parallel Component (m/s)	Normal Component (m/s)
Max	0.412	0.332	0.165
Mean	0.100	0.022	0.002
Min	0.002	-0.411	-0.142

Direction Analysis	
Major Axis (+ve) (Deg)	315
Minor Axis (+ve) (Deg)	045

Bath Model Input Data	
Mean Speed (m/s)	0.100
Residual Speed (m/s)	Parallel Component
	Normal Component
Tidal Amplitude	Parallel Component
	Normal Component

Fishfarm Database Input Data							
Number of Days	Mean Speed (m/s)	% <= 0.095 m/s	Major Axis (deg)	Major Amp/Minor Amp	Residual Speed (m/s)	Residual Direction (deg)	% <= 0.030 m/s
72.17	0.100	53%	315	2.988	0.022	321	9%

Residual Analysis	
Residual Speed (m/s)	0.022
Residual Direction (deg)	321

Figure 3. Current Data Summary Sheet for the near-surface, cell 25, 3.62 m below min sea level, 14th February – 27th April 2025 inclusive (ID446).

Site Name	Mullach Mor
CAR Licence Number (if applicable)	N/A
Easting	140569
Northing	803399
Latitude (decimal deg)	57.04838N
Longitude (decimal deg)	-6.27928W
Type of Data (single/stitched)	Single
Bin (surface/middle/bottom)	Middle
Bin Number	14
Bin Height (above seabed) (m)	16.71
Site Water Depth (m)	34
ADCP Model	ADCP
ADCP Serial Number	24559
ADCP Deployment (seabed/mid-dep)	Seabed

Deployment Details	
Number of Records	5197
Start Time (GMT)	14/02/2025 15:00:00
End Time (GMT)	27/04/2025 19:00:00
Number of Days	72.17
Interval (mins)	20

Depth Analysis (m)	
Max	19.83
Mean	17.29
Min	14.62

Velocity Analysis			
	Scalar Speed (m/s)	Parallel Component (m/s)	Normal Component (m/s)
Max	0.341	0.341	0.078
Mean	0.094	0.017	-0.006
Min	0.001	-0.327	-0.103

Residual Analysis	
Residual Speed (m/s)	0.018
Residual Direction (deg)	296

Direction Analysis				
Major Axis (+ve) (Deg)	315	Parallel Amplitude	0.149	Amplitude Anisotropy
Minor Axis (+ve) (Deg)	045	Normal Amplitude	0.033	4.505

Bath Model Input Data		
Mean Speed (m/s)		0.094
Residual Speed (m/s)	Parallel Component	0.017
	Normal Component	-0.006
Tidal Amplitude	Parallel Component	0.149
	Normal Component	0.033

Fishfarm Database Input Data							
Number of Days	Mean Speed (m/s)	% <= 0.095 m/s	Major Axis (deg)	Major Amp/Minor Amp	Residual Speed (m/s)	Residual Direction (deg)	% <= 0.030 m/s
72.17	0.094	55%	315	4.505	0.018	296	11%

Figure 4. Current Data Summary Sheet for the cage bottom, cell 14, 14.62 m below min sea level, 14th February – 27th April 2025 inclusive (ID446).

Site Name	Mullach Mor
CAR Licence Number (if applicable)	N/A
Easting	140569
Northing	803399
Latitude (decimal deg)	57.04838N
Longitude (decimal deg)	-6.27928W
Type of Data (single/stitched)	Single
Bin (surface/middle/bottom)	Bottom
Bin Number	1
Bin Height (above seabed) (m)	3.71
Site Water Depth (m)	34
ADCP Model	ADCP
ADCP Serial Number	24559
ADCP Deployment (seabed/mid-dep)	Seabed

Deployment Details	
Number of Records	5197
Start Time (GMT)	14/02/2025 15:00:00
End Time (GMT)	27/04/2025 19:00:00
Number of Days	72.17
Interval (mins)	20

Depth Analysis (m)	
Max	32.83
Mean	30.29
Min	27.62

Velocity Analysis			
	Scalar Speed (m/s)	Parallel Component (m/s)	Normal Component (m/s)
Max	0.300	0.300	0.139
Mean	0.093	0.025	-0.008
Min	0.000	-0.232	-0.123

Residual Analysis	
Residual Speed (m/s)	0.026
Residual Direction (deg)	293

Direction Analysis			
Major Axis (+ve) (Deg)	310	Parallel Amplitude	0.133
Minor Axis (+ve) (Deg)	040	Normal Amplitude	0.052
		Amplitude Anisotropy	2.570

Bath Model Input Data		
Mean Speed (m/s)		0.093
Residual Speed (m/s)	Parallel Component	0.025
	Normal Component	-0.008
Tidal Amplitude	Parallel Component	0.133
	Normal Component	0.052

Fishfarm Database Input Data							
Number of Days	Mean Speed (m/s)	% <= 0.095 m/s	Major Axis (deg)	Major Amp/Minor Amp	Residual Speed (m/s)	Residual Direction (deg)	% <= 0.030 m/s
72.17	0.093	56%	310	2.570	0.026	293	7%

Figure 5. Current Data Summary Sheet for the near sea bed, cell 1, 14th February – 27th April 2025 inclusive (ID446).

	Percentiles	Current Speed (m/s)
Percentile Analysis	1%	0.009
	5%	0.021
	10%	0.031
	25%	0.053
	50%	0.090
	75%	0.140
	90%	0.182
	95%	0.209
	99%	0.265
	100%	0.412
Threshold Values	9%	0.030
	19%	0.045
	53%	0.095
Mean	56%	0.100

Major Axis (Deg)	315	0.154 m/s
Residual Current (m/s)	0.022	at 321 Deg

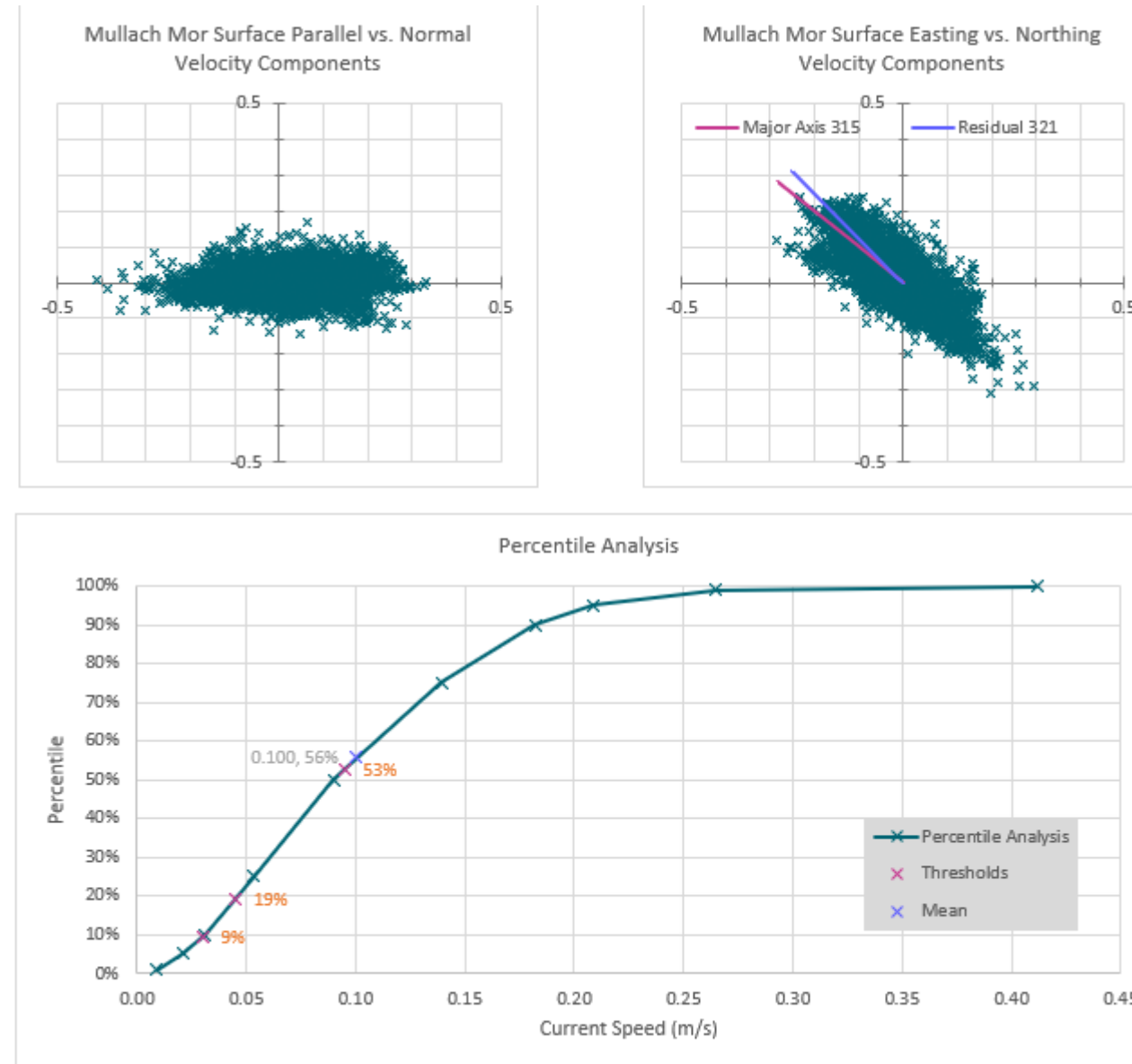


Figure 6. Speed and direction components of the near surface cell

	Percentiles	Current Speed (m/s)
Percentile Analysis	1%	0.010
	5%	0.020
	10%	0.028
	25%	0.049
	50%	0.086
	75%	0.132
	90%	0.171
	95%	0.194
Threshold Values	99%	0.243
	100%	0.341
	11%	0.030
Mean	22%	0.045
	55%	0.095
	55%	0.094

Major Axis (Deg)	315	0.149 m/s
Residual Current (m/s)	0.018	at 296 Deg

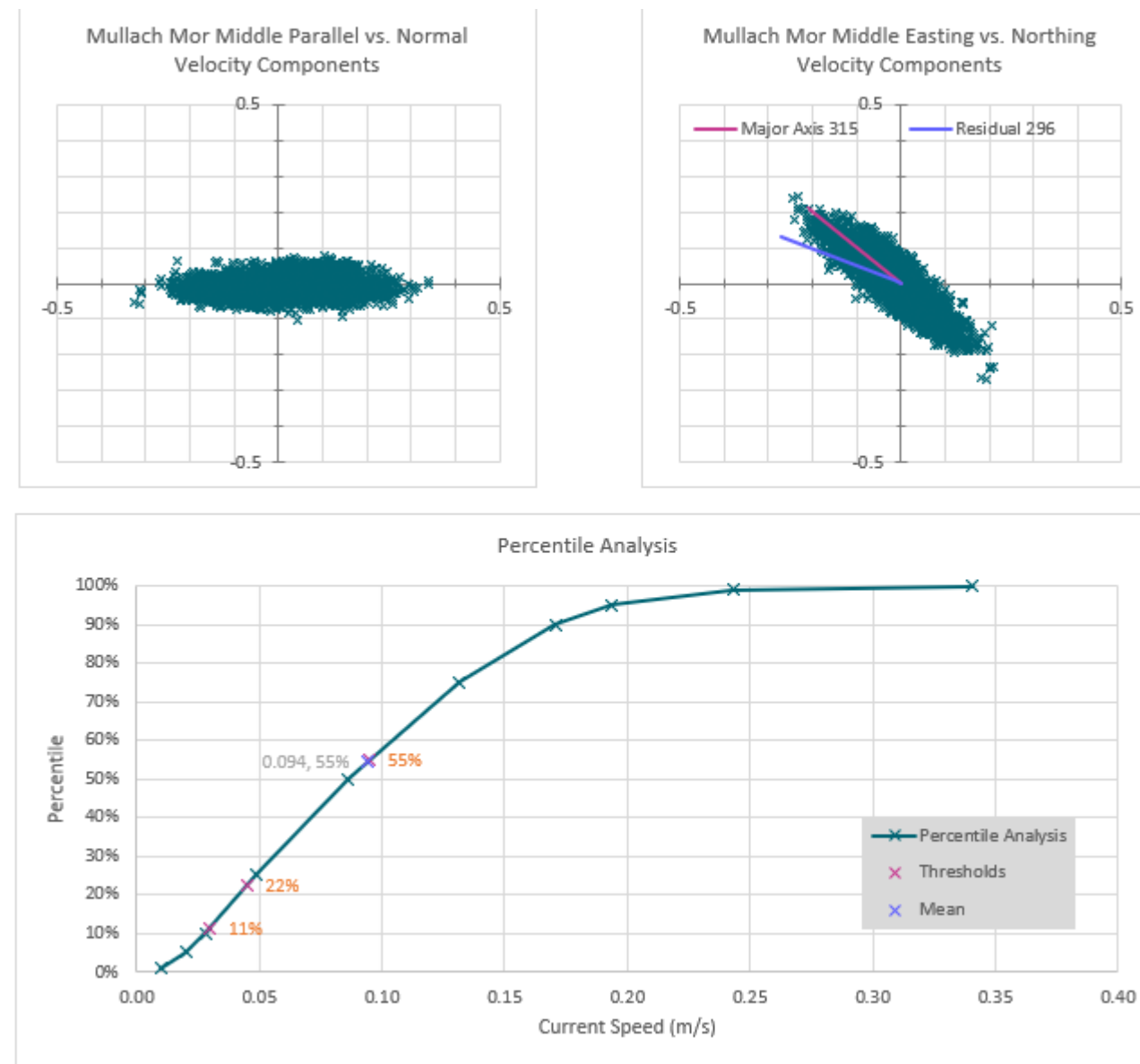


Figure 7. Speed and direction components of the cage bottom cell.

	Percentiles	Current Speed (m/s)
Percentile Analysis	1%	0.012
	5%	0.026
	10%	0.036
	25%	0.056
	50%	0.087
	75%	0.123
	90%	0.157
	95%	0.179
Threshold Values	99%	0.223
	100%	0.300
	7%	0.030
Mean	16%	0.045
	56%	0.095
	54%	0.093

Major Axis (Deg)	310	0.133 m/s
Residual Current (m/s)	0.026	at 293 Deg

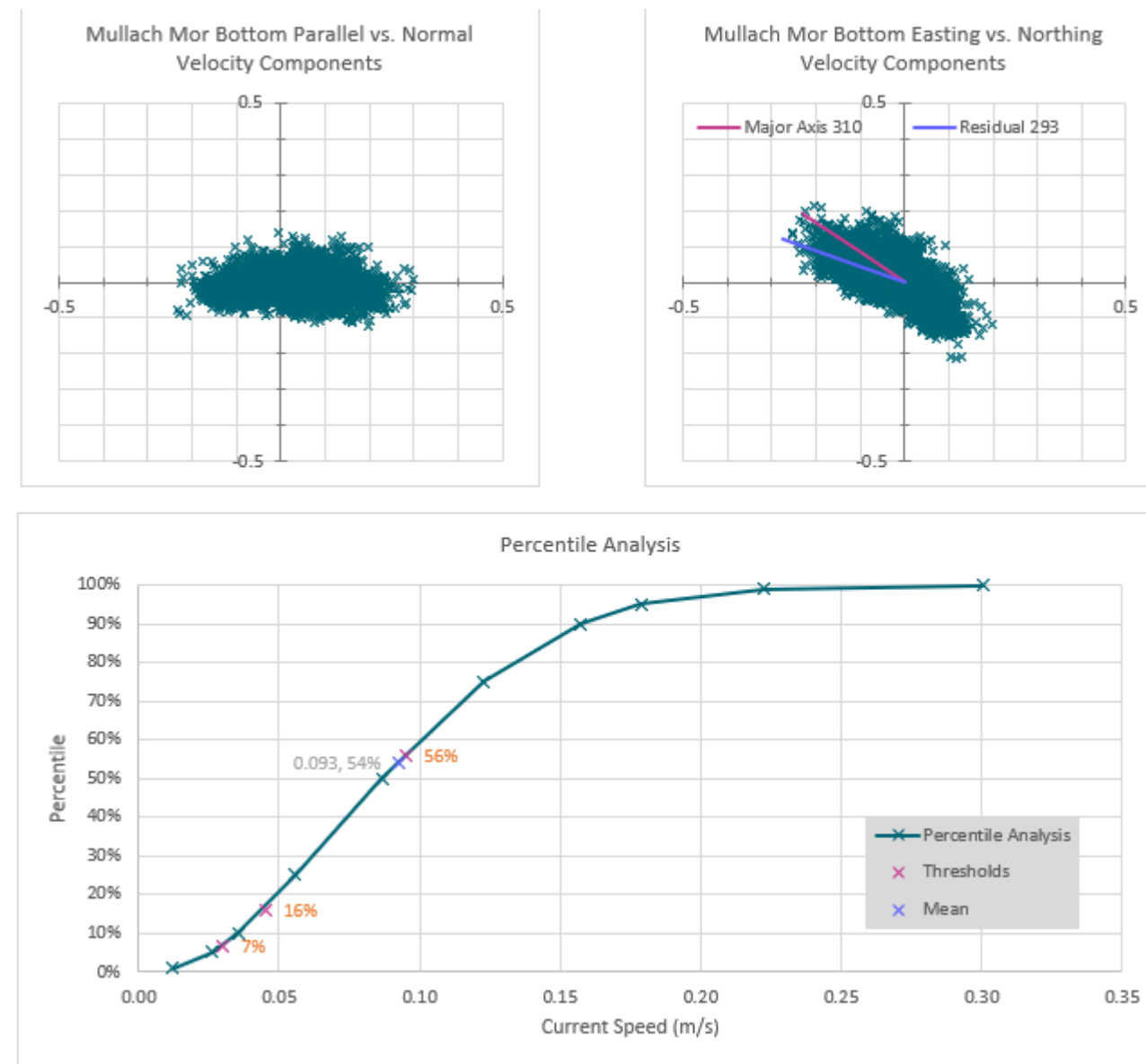


Figure 8. Speed and direction components of the near sea bed cell.

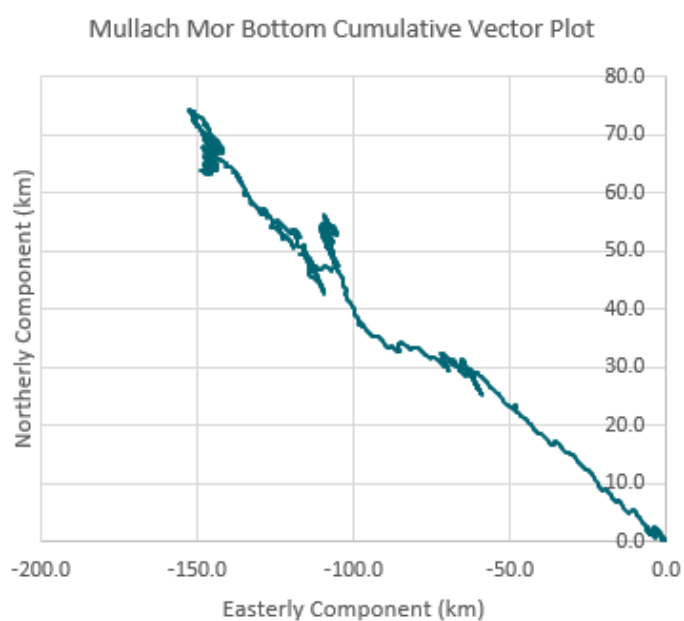
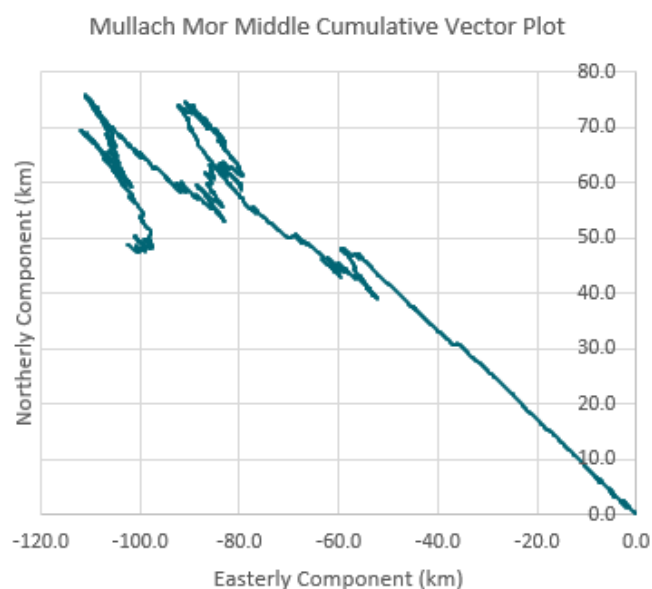
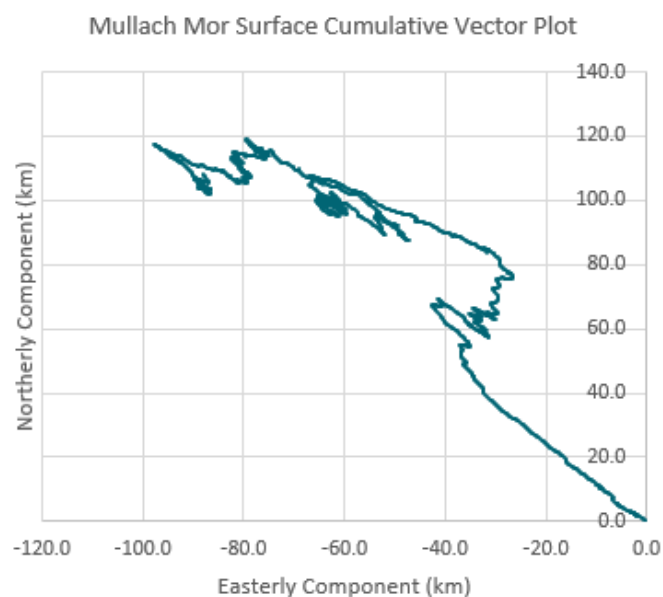


Figure 9. Cumulative vector plots of all velocity data from near-surface cell 25, cage bottom cell 14 and near sea bed cell 1 for ID446.

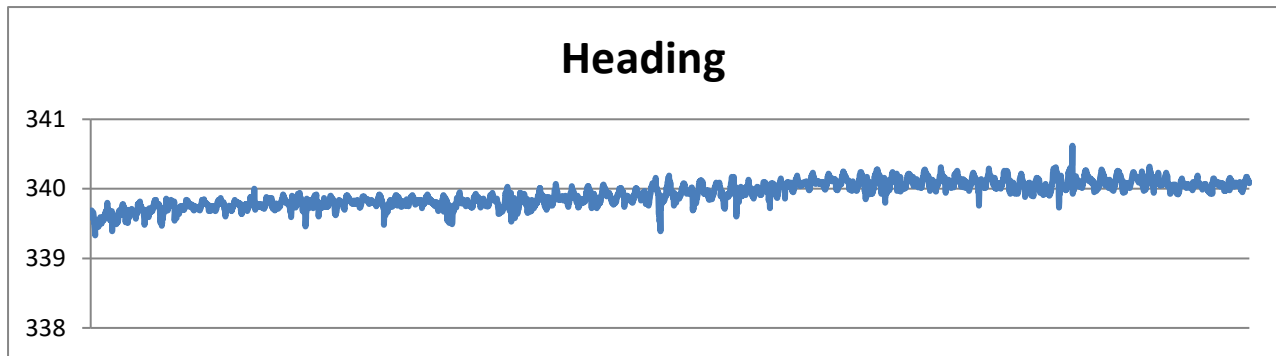


Figure 10. Summary of heading data throughout deployment ID446.

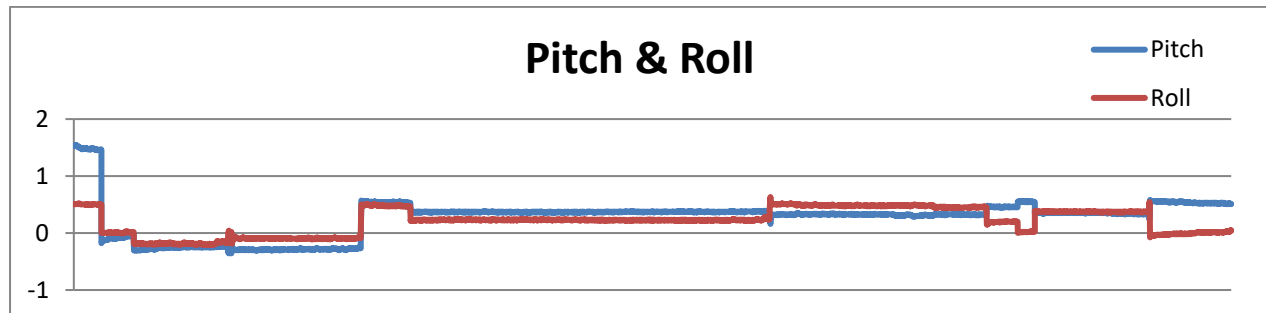


Figure 11. Summary of pitch and roll data throughout deployment ID446.

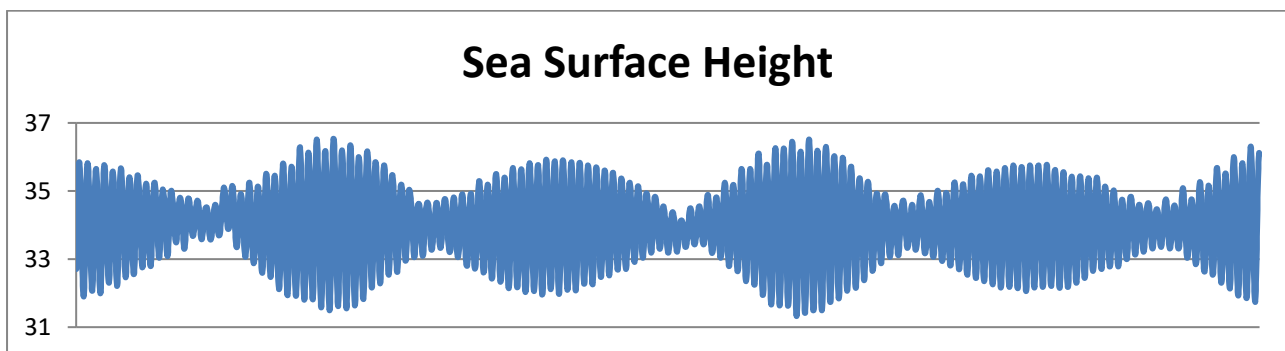


Figure 12. Pressure data throughout deployment ID446.

5. Conclusion

Mowi Scotland Ltd. has collected and analysed current and bathymetric data for the proposed salmon farm at Mullach Mor. The analysed current data for the 72 days and 5 hours period are believed to be reliable and representative of the proposed location. The bathymetric data from the EMODnet, provided a coherent bathymetric dataset for the site.

Annex 1. Survey Equipment Deployment Log

Location: Mullach Mor
 Nearest tidal port: Mallaig
 Time zone: UTC (raw data in BST)
 Meter switched on: 15:00:00 14/02/2025
 Meter switched off: 19:00:00 27/04/2025
 Period used for this report: 15:00:00 14/02/2025 – 19:00:00 27/04/2025
 ADCP serial number: 24559
 Meter position: 57.04838N, -6.27928W
 140569E, 803399N
 Minimum water depth: 31.33
 Mean water depth: 34
 Depth of meter from surface: 33.3 m (below mean sea level)
 Height of meter from seabed: 0.7 m

Table A1. ADCP meter settings.

Reference:	Transducer
Bin Size (m):	1
Dist. to 1st Bin (m):	3.01
Number of Bins:	44
Frequency (kHz):	307
Recording Interval (mins):	20
No. of Pings per Ensemble:	300
Magnetic Correction:	0
Ensemble (s):	300
Velocity Precision (cm/s):	0.63
Time/Ping (s):	2