CURRENT REPORT FOR BRIER ISLAND (2011)

Deployment ID: DG004

Prepared By	Date	Version	Contact
Danielle Dempsey	January 2026	V3	P: 1-902-442-4660
Anne McKee			E: info@cmar.ca
Kiersten Watson			W: www.cmar.ca
Rachel Woodside			

Table of Contents

1 Introduction

The Centre for Marine Applied Research (CMAR) measures essential ocean variables around the coast of Nova Scotia through the Coastal Monitoring Program. As a part of this Program, the Nova Scotia Department of Fisheries and Aquaculture (NSDFA) and CMAR have deployed Acoustic Doppler Current Profilers (ADCPs) to measure currents and sea state (waves). CMAR has also deployed tilt meters to measure currents in several locations.

This document presents deployment details and summary figures from current data collected by an ADCP deployed in Digby County (Figure 1), at the **Brier Island** Station (Figure 2) in 2011 (deployment ID DG004). Current reports from other stations can be found on the Reports page of the CMAR website.

The data are available for download from the Nova Scotia Open Data Portal. For more information on CMAR and the current datasets, visit the CMAR website.

This document should be considered as a guide only. The information may be revised pending ongoing data collection and analyses.

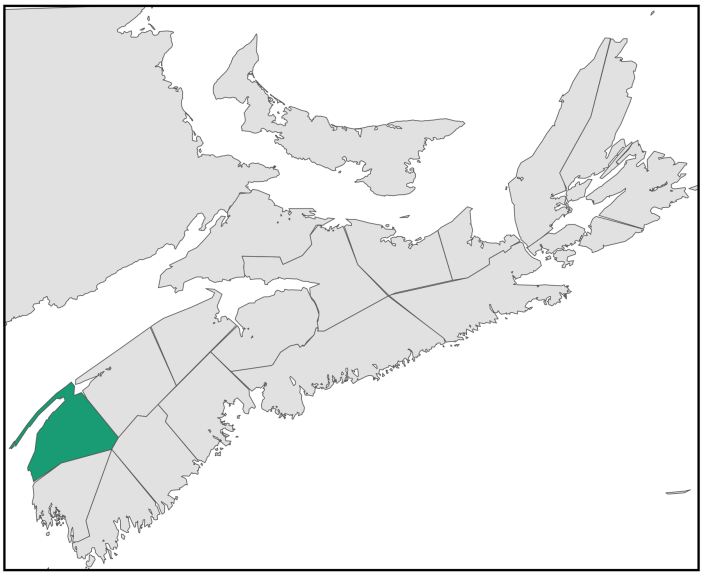

Figure 1: Digby County (green).

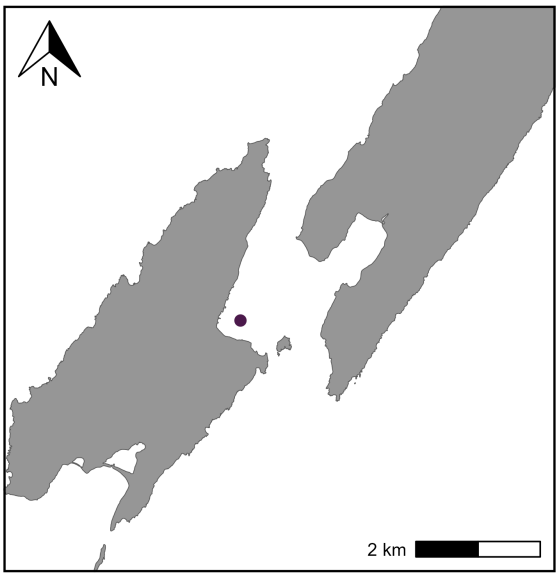

Figure 2: Location of ADCP deployed at the Brier Island station in Westport Harbour in 2011.

1.1 Data Collection

NSDFA collects current data using upward facing ADCPs that are mounted on the sea floor for 1 - 3 months (Figure 3). An ADCP uses sound to measure current speed and direction through the water column. The ADCP transmits "pings" of sound at a specific frequency, which can be reflected back from particles in the water column. Sound waves reflected from particles moving away from the ADCP have a slightly lower frequency than sound waves reflected from particles moving toward the instrument. The difference in frequencies is called a Doppler shift and is used to calculate the water speed and direction.

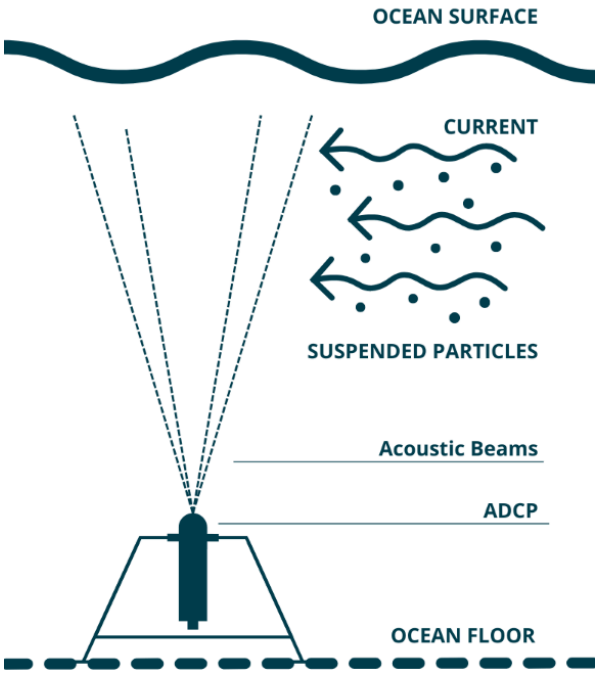

Figure 3: Schematic representation of an ADCP (not to scale).

ADCPs typically report current speed and direction at several depths through the water column, called bins. For this report, each bin is identified by its height above the sea floor (in metres). This distance remains constant over the deployment, in contrast to the depth below the surface, which changes with the tidal cycle. The number and size of bins depends on several factors including the water depth and ADCP settings.

There are a few limitations to where the ADCP can measure current. For upward-facing ADCPs, the current below the sensor cannot be measured. NSDFA ADCPs are typically mounted 0.5 to 1 m above the sea floor. There is also a "blanking distance" directly above the sensor where no measurements can be made. For NSDFA deployments, the blanking distance is typically around 1 m. Finally, measurements from bins near the surface can be contaminated by pings reflecting off the water surface. This is called side-lobe interference, and can be removed by the ADCP data processing software. The number of bins impacted depends on the beam angle of the ADCP and the water depth (Teledyne Rd Instruments, 2011).

NSDFA uses several ADCP instrument models, including the Sentinel V20, Sentinel V50, Sentinel V100, and Workhorse Sentinel 600kHz. NSDFA processes the data using Velocity Software (Teledyne RD Instruments, 2017), and sends the output to CMAR. CMAR compiles and formats the data for publication with the adcp R package (Dempsey, 2023).

Table 1 lists the deployment details and sensor configuration for the data presented in this report.

For an overview of ADCP principles including explanations of the Doppler Effect, measurements near the surface, ensemble and averaging intervals, and pings per ensemble (Table 1), refer to Teledyne Rd Instruments (2011).

1.2 Quality Control

1.2.1 Velocity Software

The Velocity software automatically performed Quality Control checks during data processing (Teledyne RD Instruments, 2017). In addition, CMAR applied two automated Quality Control tests. For consistency with the CMAR Water Quality data, each data point was assigned a flag of "Pass", "Fail", or "Suspect/Of Interest"[1] (IOOS, 2020).

1.2.2 Gross Range Test

The Gross Range test was applied to identify outlying and unexpected values. However, most observations were flagged as "Pass", very few were flagged as "Suspect/Of Interest" (typically < 1 % of observations in a bin), and none were flagged as "Fail". Most of the "Suspect/Of Interest" observations are considered "Of Interest" and included in the figures below. Few "bad" observations were identified with this test because the data has already been processed and reviewed by the Velocity Software (Teledyne RD Instruments, 2017). For example, each observation is actually an average of many pings, which reduces the velocity error (Teledyne Rd Instruments, 2011). The software also screens data based on several criteria (e.g., Intensity, Correlation, and Fish) (Teledyne RD Instruments, 2017).

1.2.3 Bin Height

The Bin Height test was applied to identify bins that do not contain a complete dataset of the entire deployment period. As the tide fluctuates, bins furthest from the ADCP will only record valid observations when the water level is at a sufficient height. As a result, these more distant bins collect fewer observations than those nearer the ADCP, and then only during high water levels (Figure 4). While observations in these bins are individually accurate, they describe only a specific circumstance and may not be representative of conditions over the whole deployment.

The test determines a maximum acceptable bin height based on the ADCP configuration (beam angle, height above the sea floor, bin height) and minimum recorded depth. The Bin Height test flagged data in bins above this maximum as "Suspect/Of Interest". Bins containing fewer than 25%

[1]The "Not Evaluated" flag level was not applicable.

of total possible observations were flagged as "Fail" and have been excluded from the figures below (Figure 4).

Anyone interested specifically in near-surface currents should refer to the full datasets, which include all observations. Datasets can be downloaded from the Nova Scotia Open Data Portal.

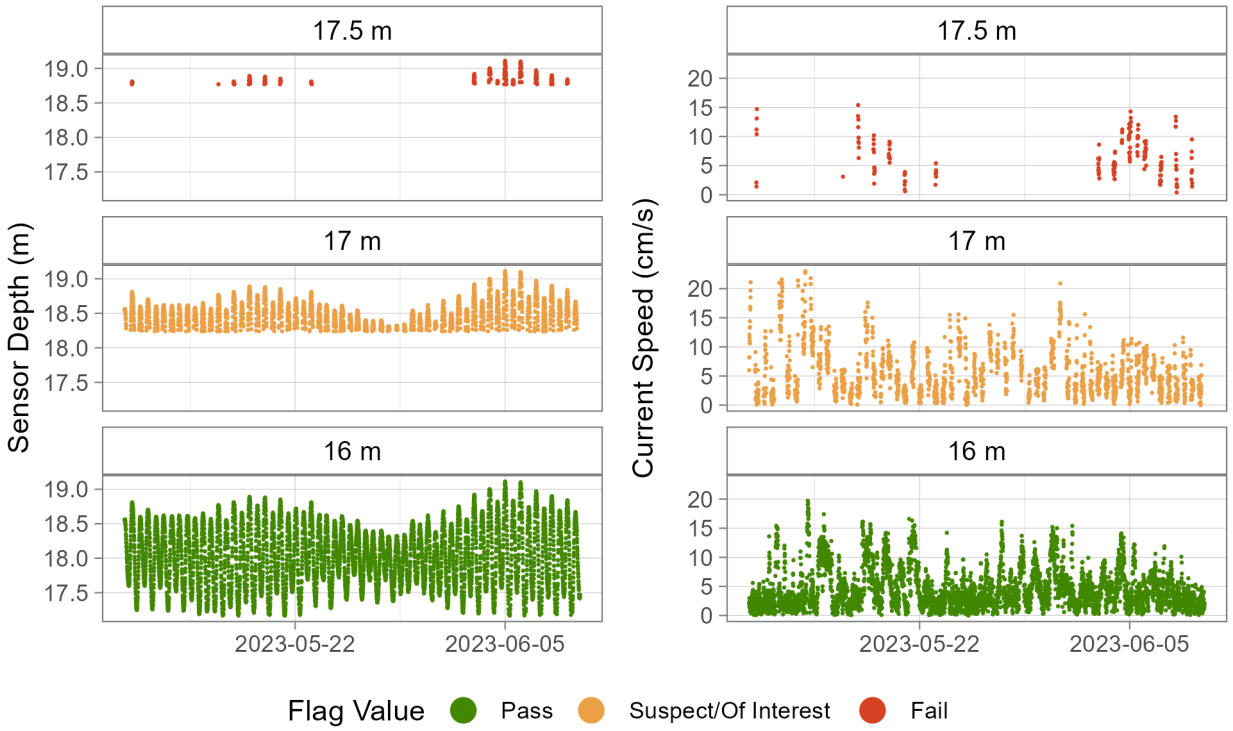

Figure 4: Example sensor depth and current speed data from three bins, and the associated flags from the Bin Height test. The top panels are from the shallowest bin, where observations are only made at very high tides. All data in this bin is flagged as "Fail" because it is not representative of the full tidal cycle and there are relatively few observations. The middle panels are from another shallow bin, where observations are made at medium and high tides. All data in this bin is flagged as "Suspect / Of Interest" because it is unclear how well these observations represent the full tidal cycle. The bottom panels are from a bin with data over the full tidal cycle. These observations are flagged as "Pass".

2 Brier Island Current Data

The current direction presented in this report is travelling away from the ADCP, and all compass headings are relative to True North. For example, a reading of 90 degrees indicates current travelling from west to east. The current roses indicate the percent of observations travelling in a given direction and speed interval (indicated by colour).

The speed observations have been divided into 12 equal intervals. To facilitate comparison between bins, the intervals are the same for each bin. The histograms indicate the percent of observations in a given speed interval.

Bin heights are the distance from the seafloor to the centre of the bin.

2.1 Deployment Details

Table 1: DG004 deployment details.

Station	Brier Island
Instrument Model	Workhorse Sentinel 600 kHz
Latitude	44.261
Longitude	−66.347
Deployment Date	2011-03-30
Recovery Date	2011-05-04
Duration (d)	35
Depth Sounding (m)	13
Ensemble Interval (s)	600
Averaging Interval (s)	600
Pings per Ensemble	100
Sensor Height above Sea Floor (m)	0.6
First Bin Range (m)	1.73
Bin Size (m)	0.75

2.2 Summary Figures

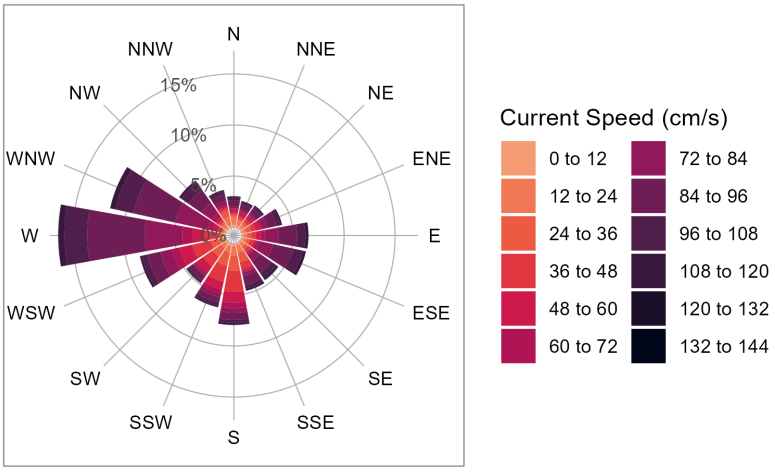

Figure 5: Current speed and direction from all bins.

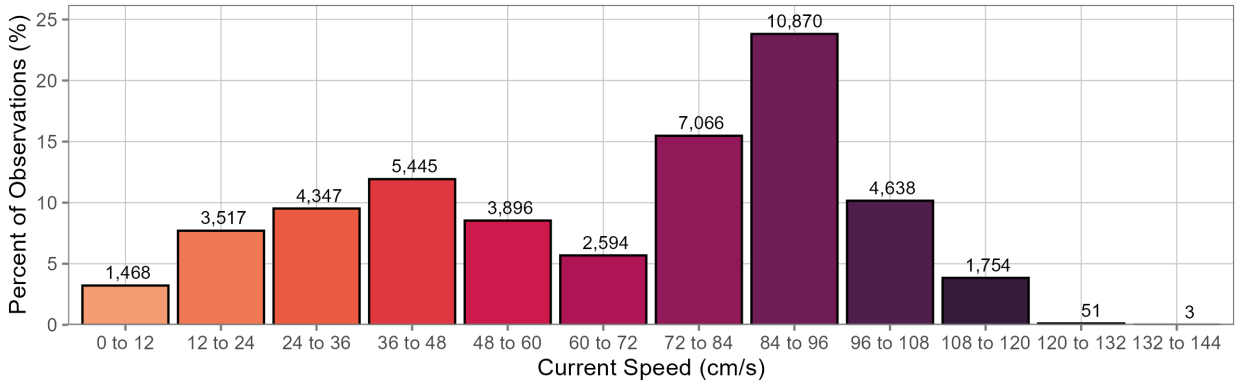

Figure 6: Current speed distribution from all bins. The number of observations in each interval is noted above the bar.

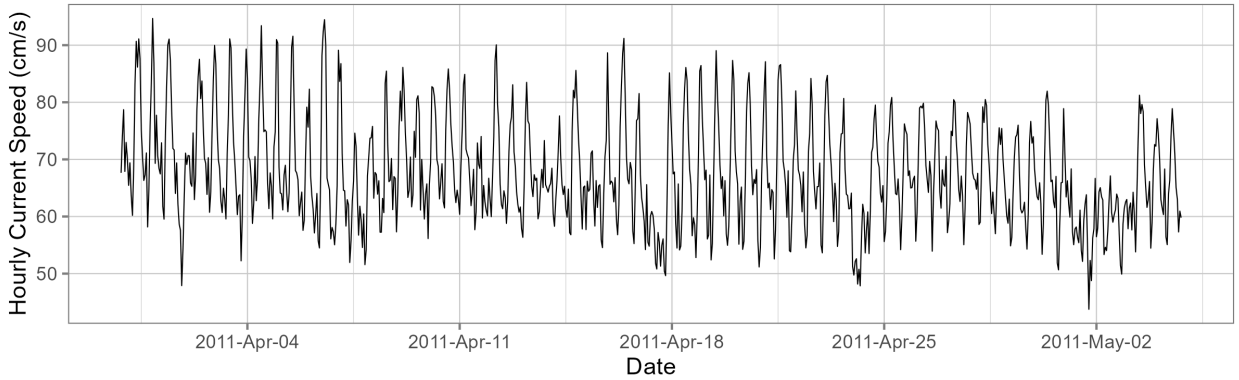

Figure 7: Average hourly current speed across all bins.

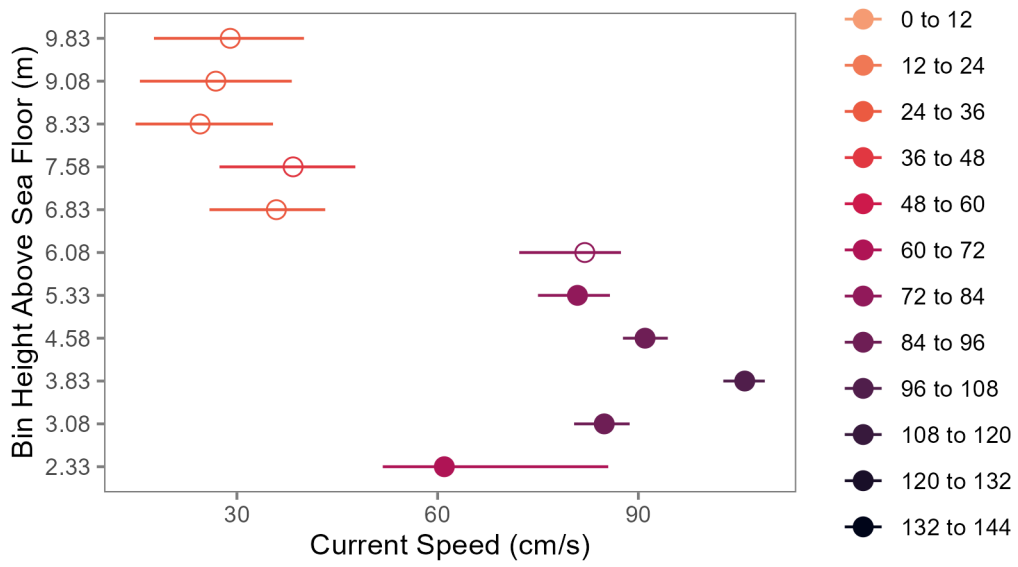

Figure 8: Median current speed at each bin (circle). The line starts at the 25th quartile and ends at the 75th quartile. Empty circles indicate bins where observations were only recorded at high water levels. Full circles indicate bins with observations over the full tidal cycle.

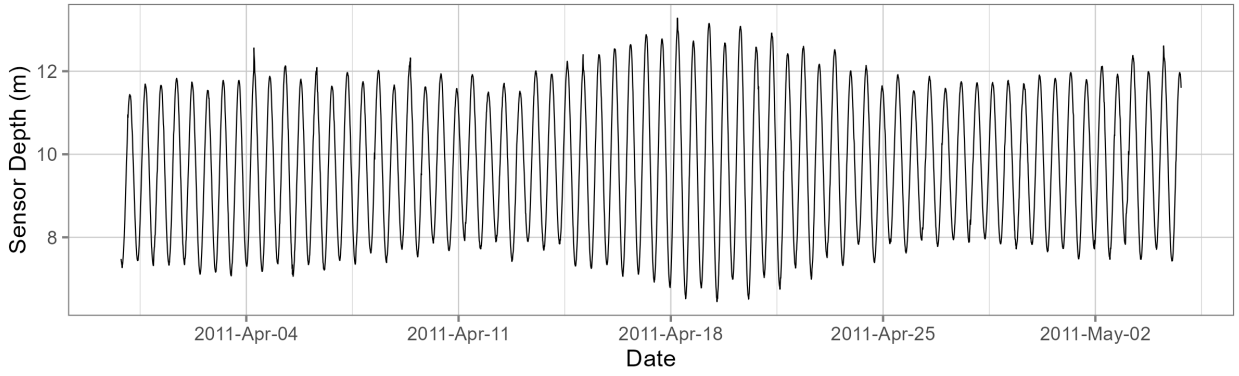

Figure 9: ADCP sensor depth below the surface over time.

2.3 Current Speed & Direction by Bin

Figures begin on the following page. Figures are presented from shallowest bin to deepest bin. Note the differences in y-axis scale between figures.

2.3.1 Bin Height: 9.83 m

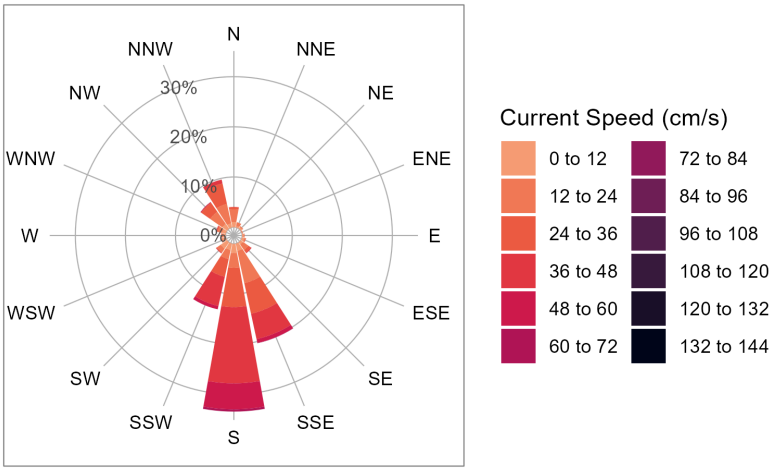

Figure 10: Current speed and direction 9.83 m above the seafloor.

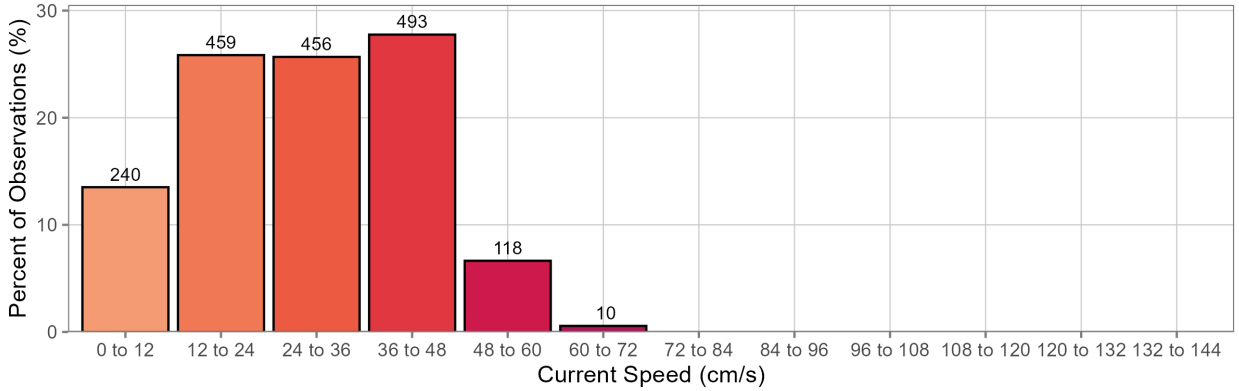

Figure 11: Current speed distribution 9.83 m above the seafloor. The number of observations in each interval is noted above the bar.

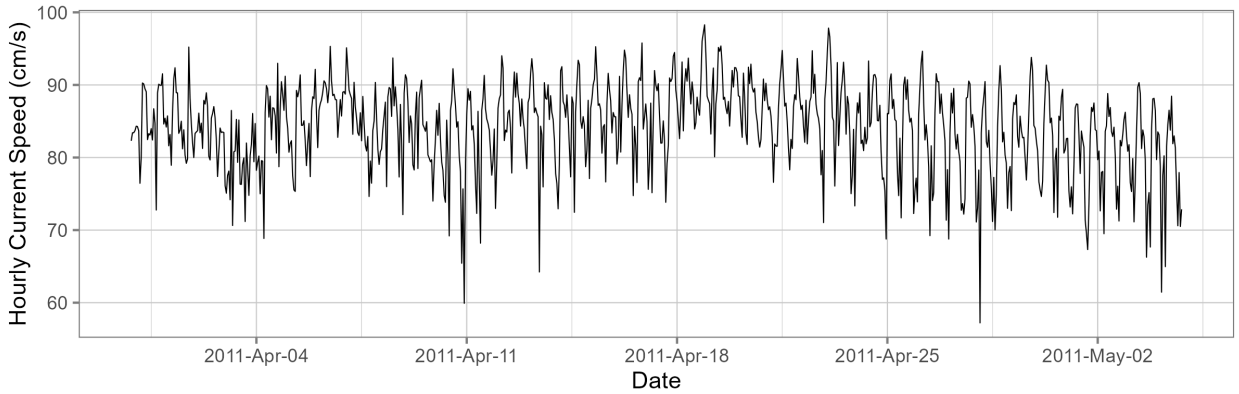

Figure 12: Average hourly current speed over time 9.83 m above the seafloor.

2.3.2 Bin Height: 9.08 m

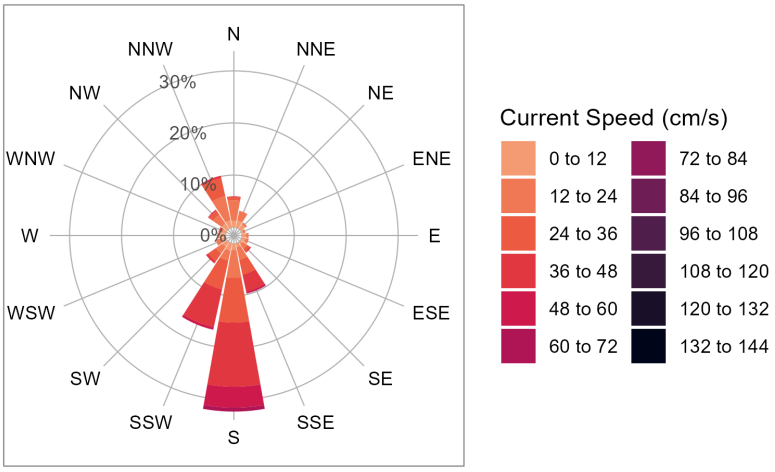

Figure 13: Current speed and direction 9.08 m above the seafloor.

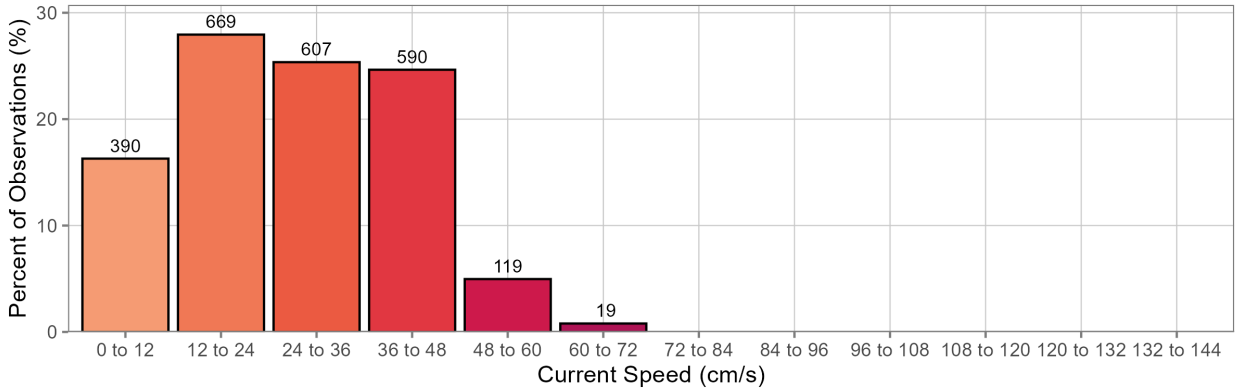

Figure 14: Current speed distribution 9.08 m above the seafloor. The number of observations in each interval is noted above the bar.

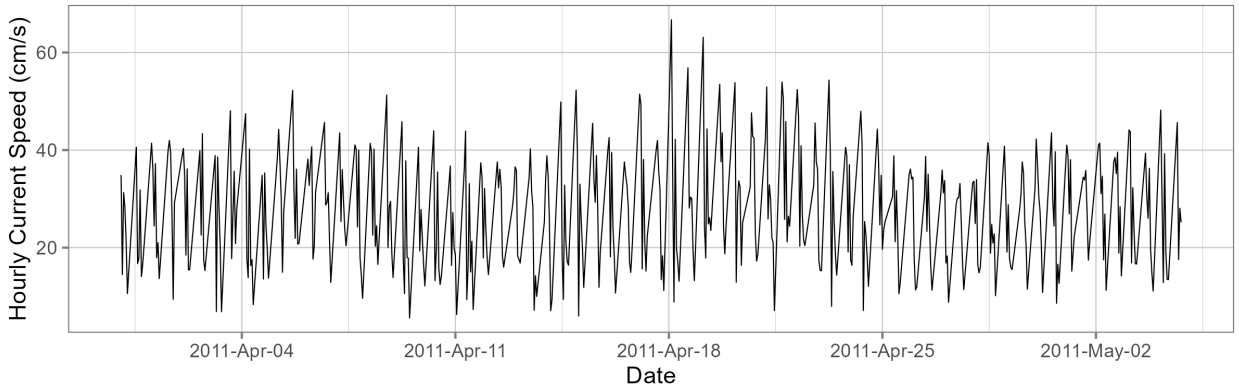

Figure 15: Average hourly current speed over time 9.08 m above the seafloor.

2.3.3 Bin Height: 8.33 m

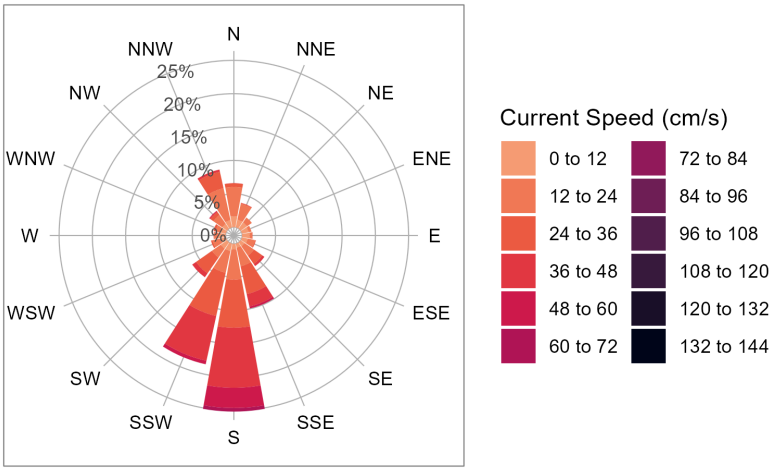

Figure 16: Current speed and direction 8.33 m above the seafloor.

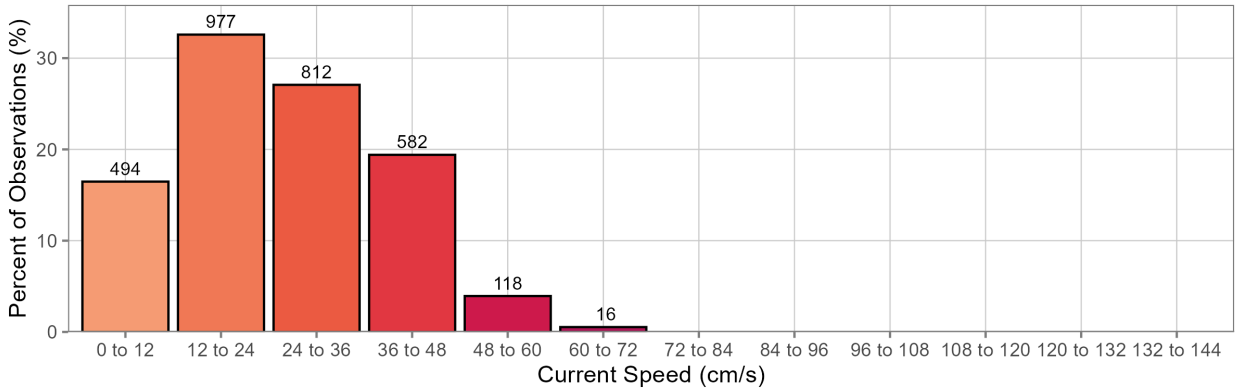

Figure 17: Current speed distribution 8.33 m above the seafloor. The number of observations in each interval is noted above the bar.

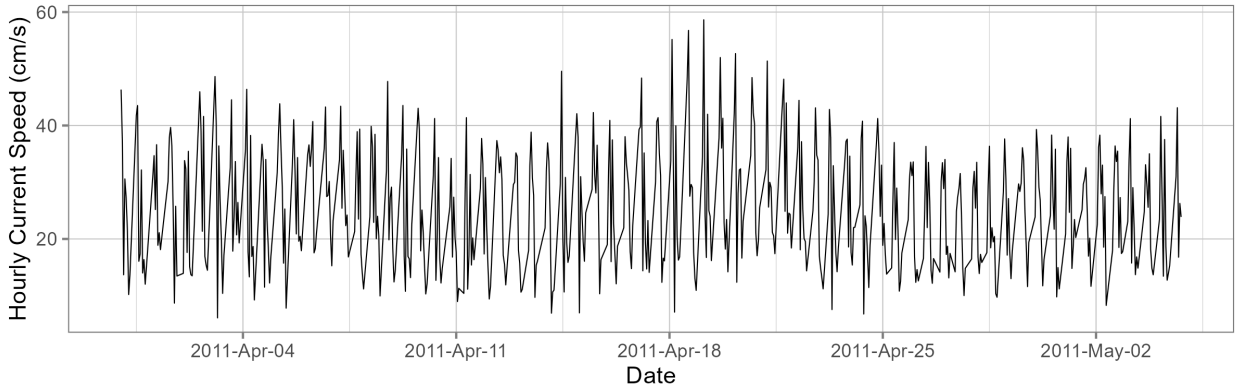

Figure 18: Average hourly current speed over time 8.33 m above the seafloor.

2.3.4 Bin Height: 7.58 m

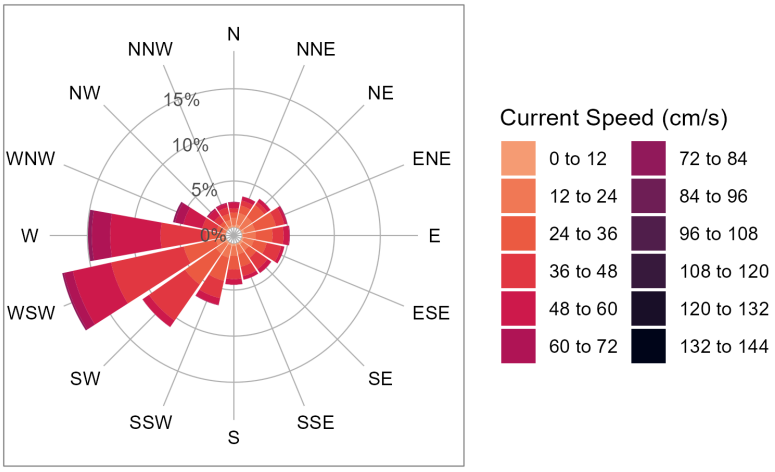

Figure 19: Current speed and direction 7.58 m above the seafloor.

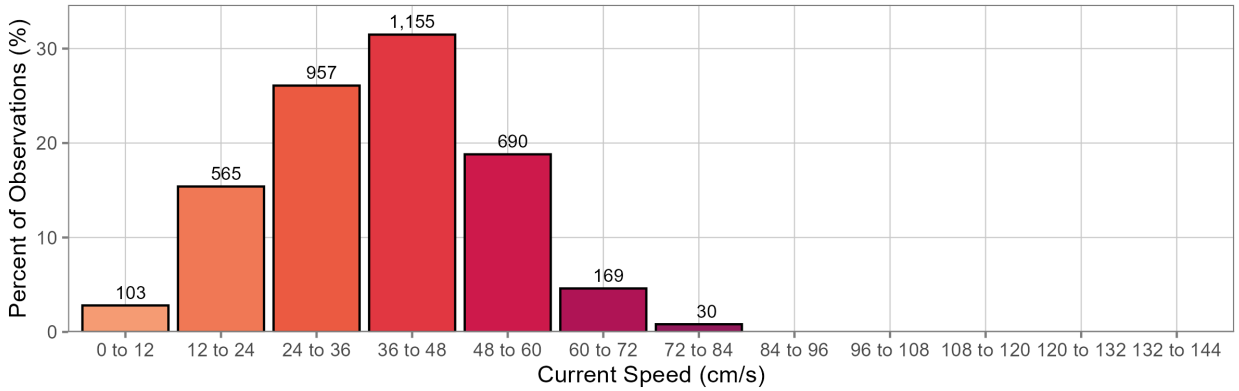

Figure 20: Current speed distribution 7.58 m above the seafloor. The number of observations in each interval is noted above the bar.

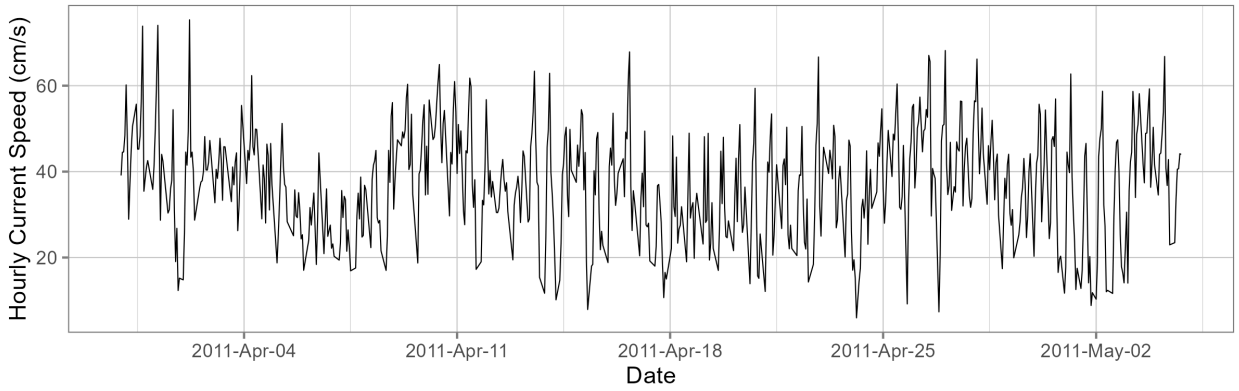

Figure 21: Average hourly current speed over time 7.58 m above the seafloor.

2.3.5 Bin Height: 6.83 m

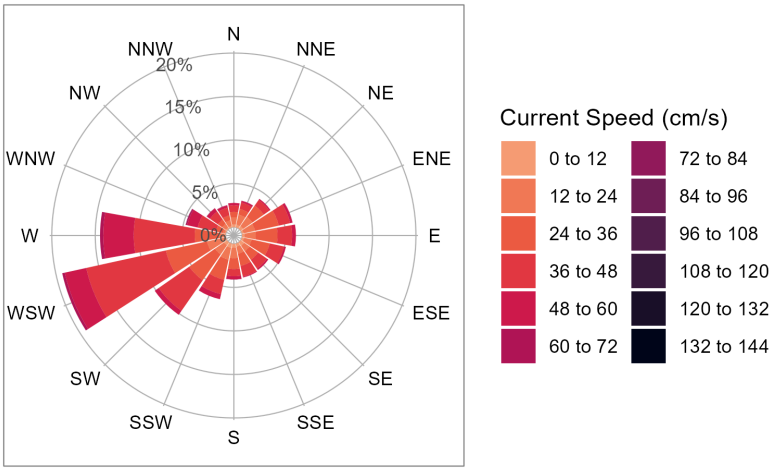

Figure 22: Current speed and direction 6.83 m above the seafloor.

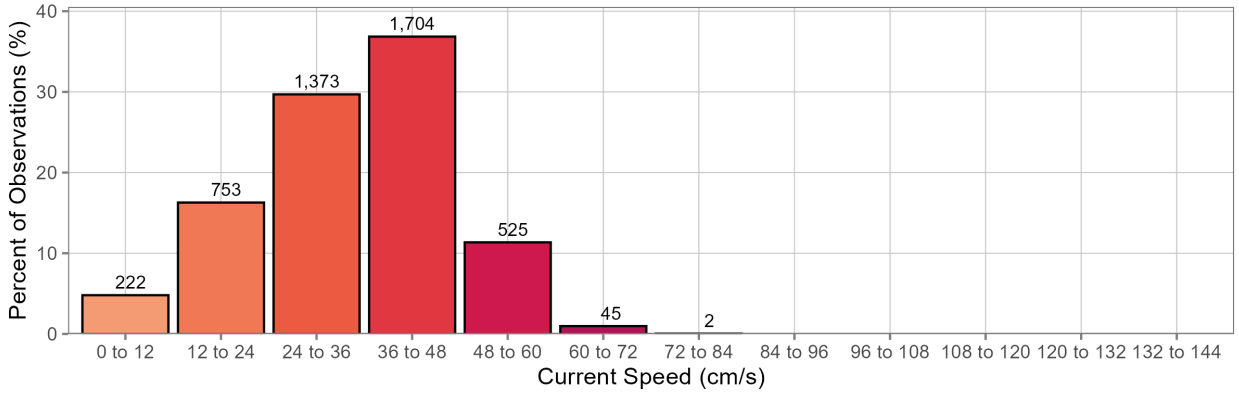

Figure 23: Current speed distribution 6.83 m above the seafloor. The number of observations in each interval is noted above the bar.

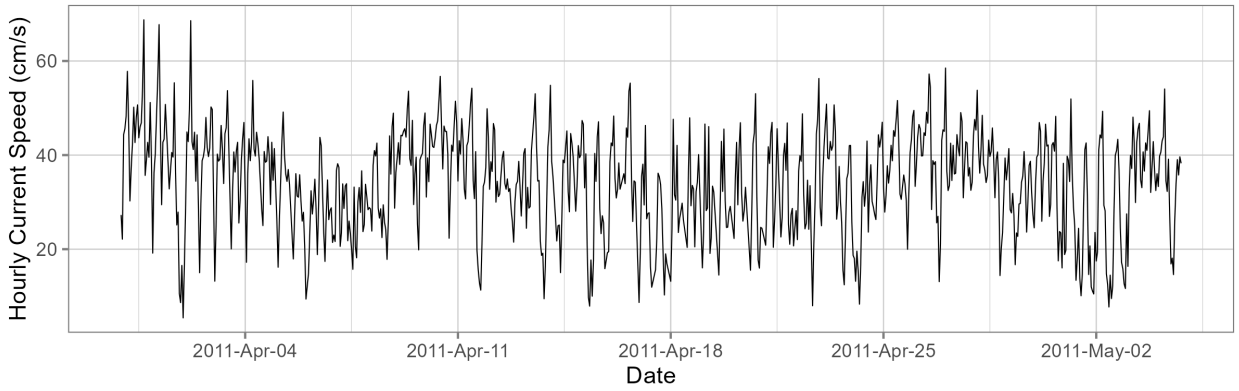

Figure 24: Average hourly current speed over time 6.83 m above the seafloor.

2.3.6 Bin Height: 6.08 m

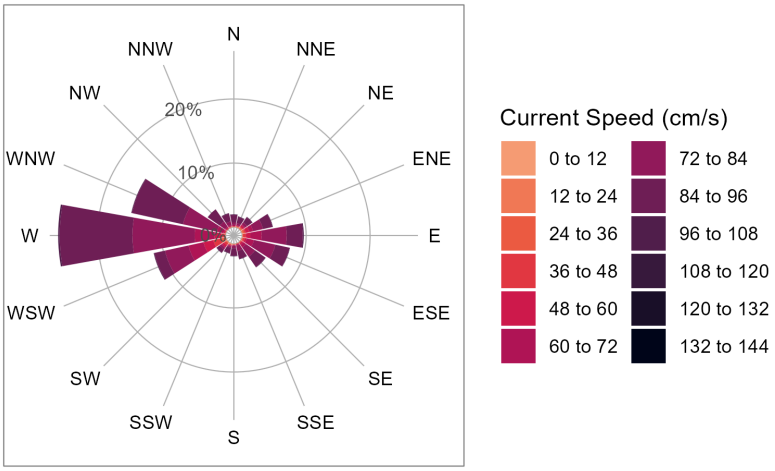

Figure 25: Current speed and direction 6.08 m above the seafloor.

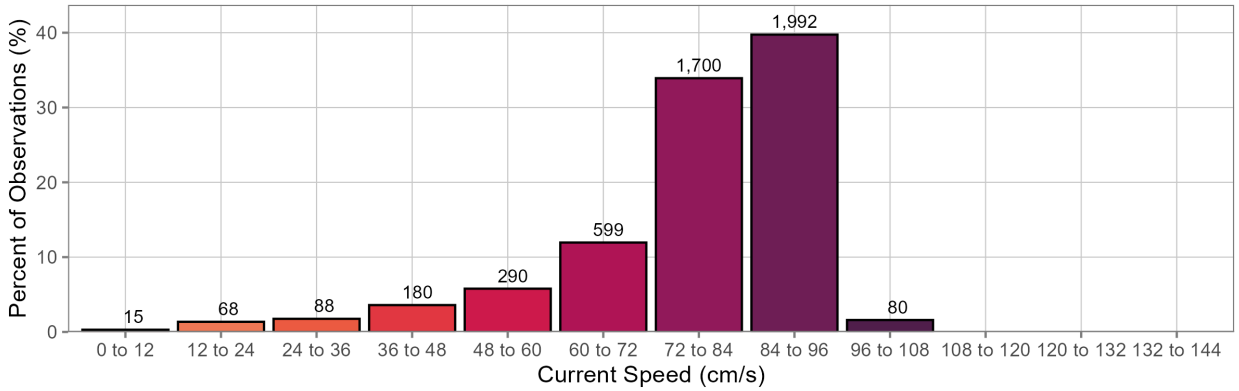

Figure 26: Current speed distribution 6.08 m above the seafloor. The number of observations in each interval is noted above the bar.

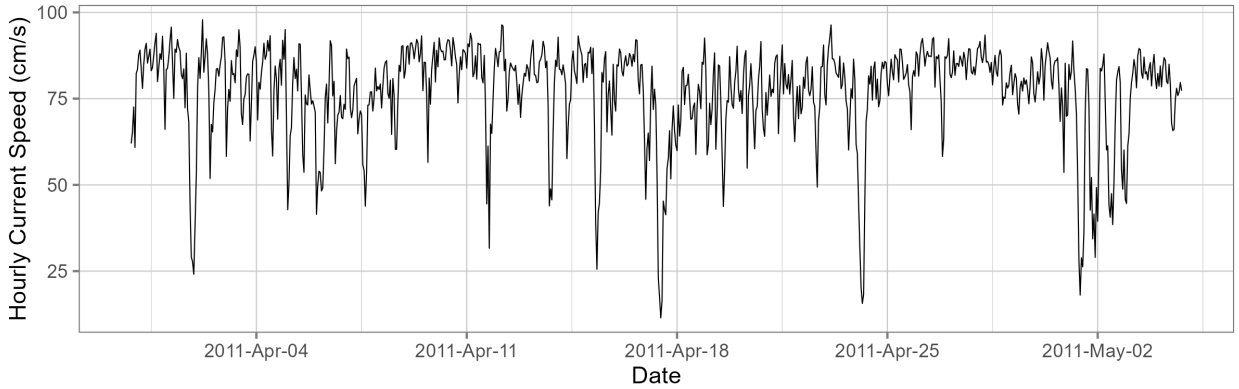

Figure 27: Average hourly current speed over time 6.08 m above the seafloor.

2.3.7 Bin Height: 5.33 m

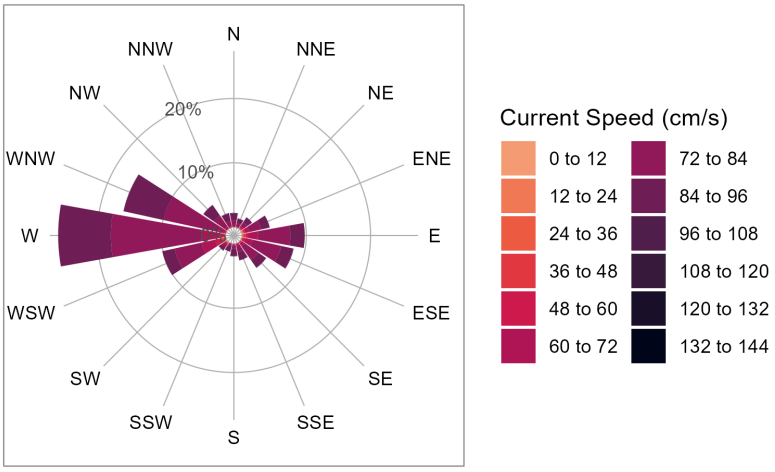

Figure 28: Current speed and direction 5.33 m above the seafloor.

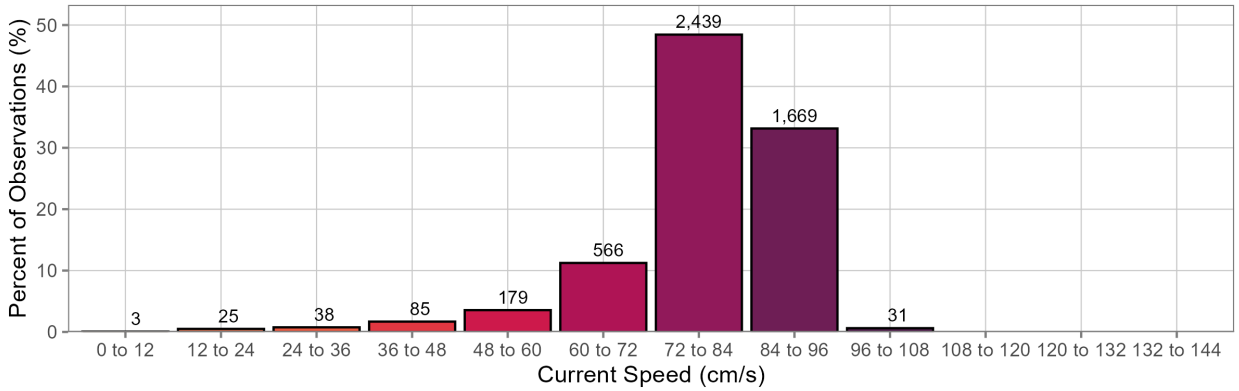

Figure 29: Current speed distribution 5.33 m above the seafloor. The number of observations in each interval is noted above the bar.

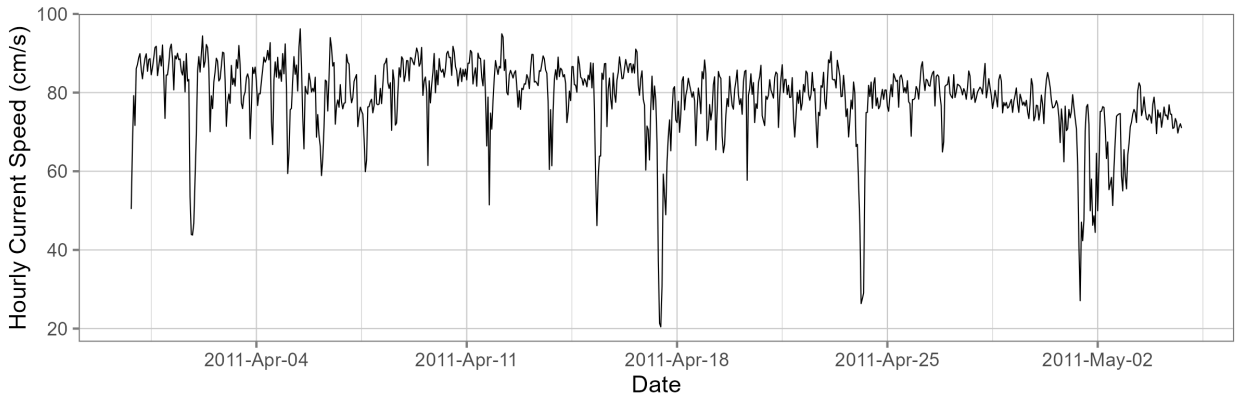

Figure 30: Average hourly current speed over time 5.33 m above the seafloor.

2.3.8 Bin Height: 4.58 m

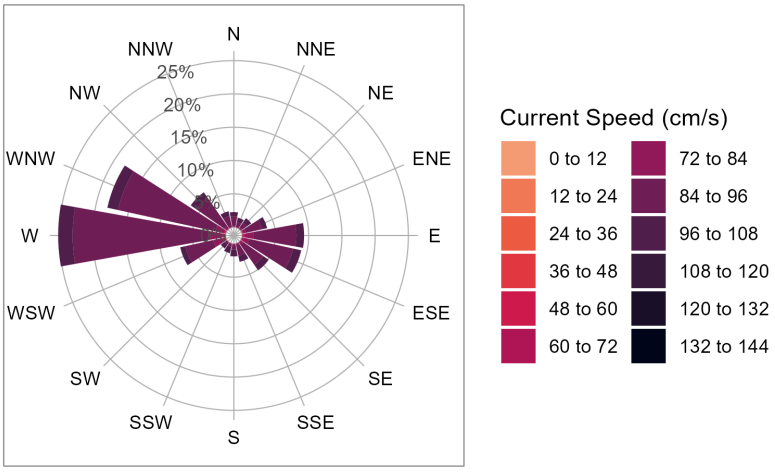

Figure 31: Current speed and direction 4.58 m above the seafloor.

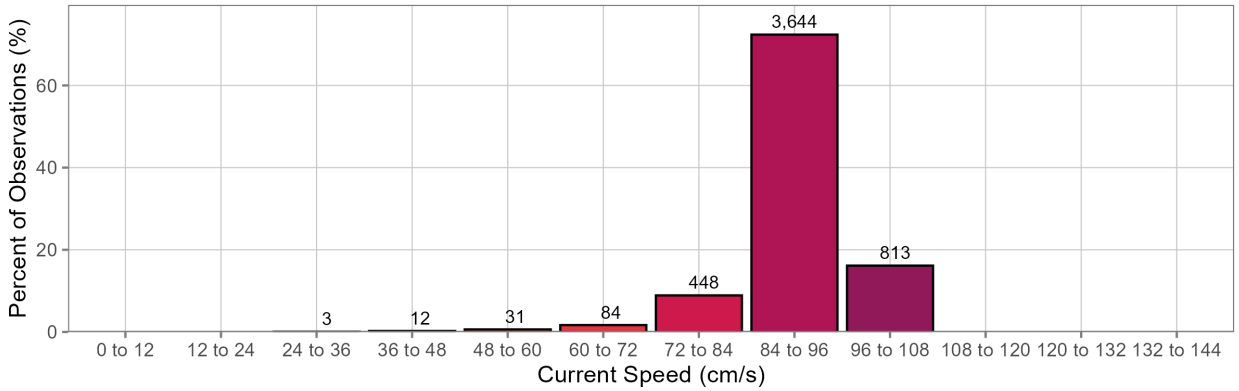

Figure 32: Current speed distribution 4.58 m above the seafloor. The number of observations in each interval is noted above the bar.

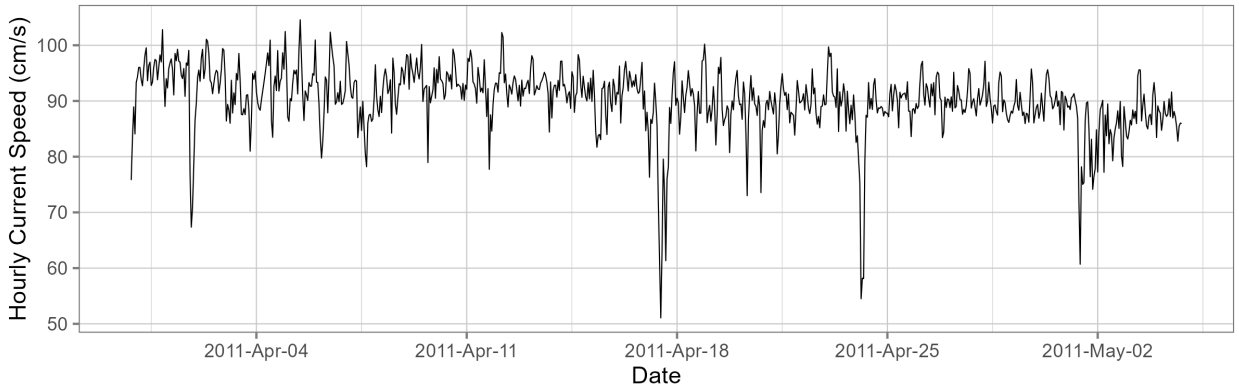

Figure 33: Average hourly current speed over time 4.58 m above the seafloor.

2.3.9 Bin Height: 3.83 m

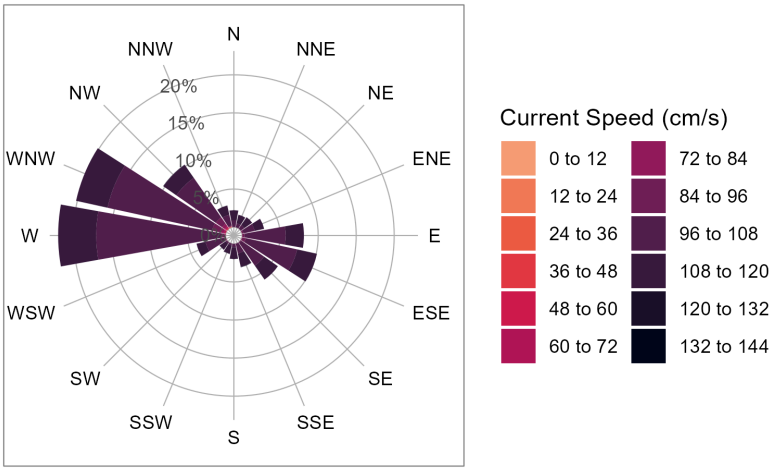

Figure 34: Current speed and direction 3.83 m above the seafloor.

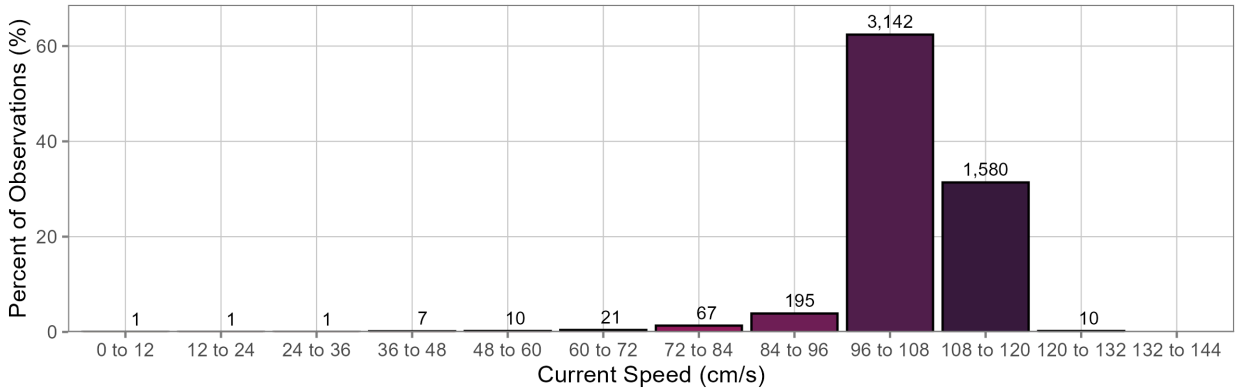

Figure 35: Current speed distribution 3.83 m above the seafloor. The number of observations in each interval is noted above the bar.

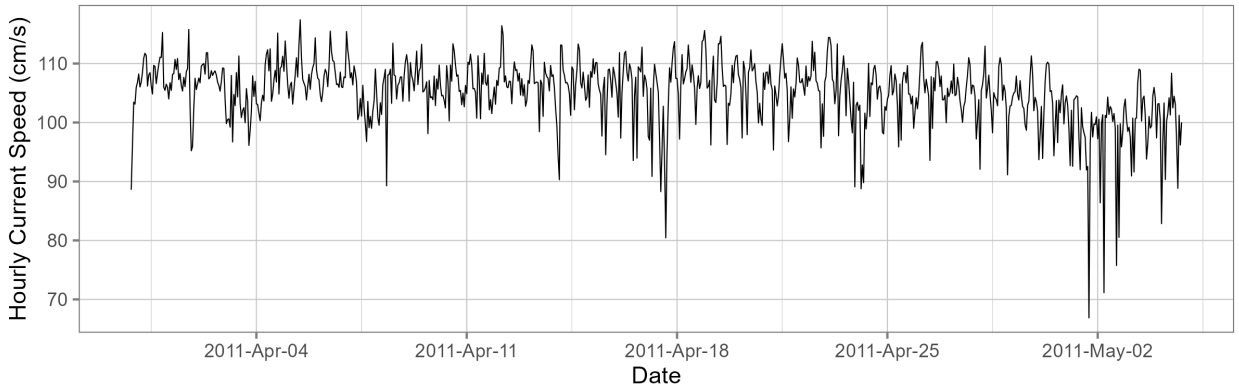

Figure 36: Average hourly current speed over time 3.83 m above the seafloor.

2.3.10 Bin Height: 3.08 m

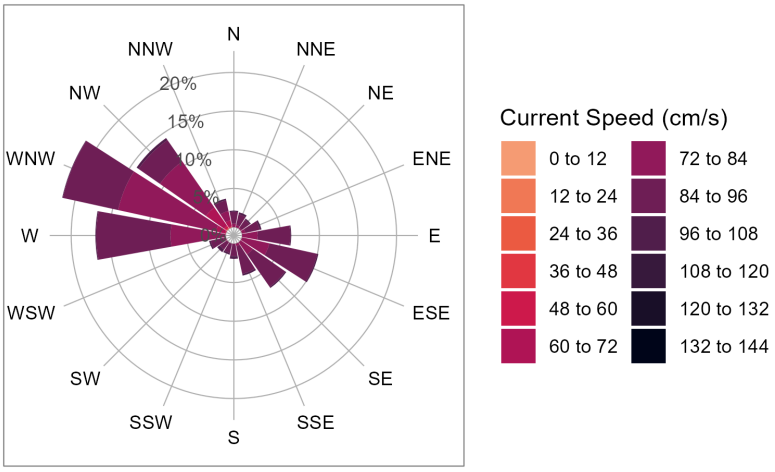

Figure 37: Current speed and direction 3.08 m above the seafloor.

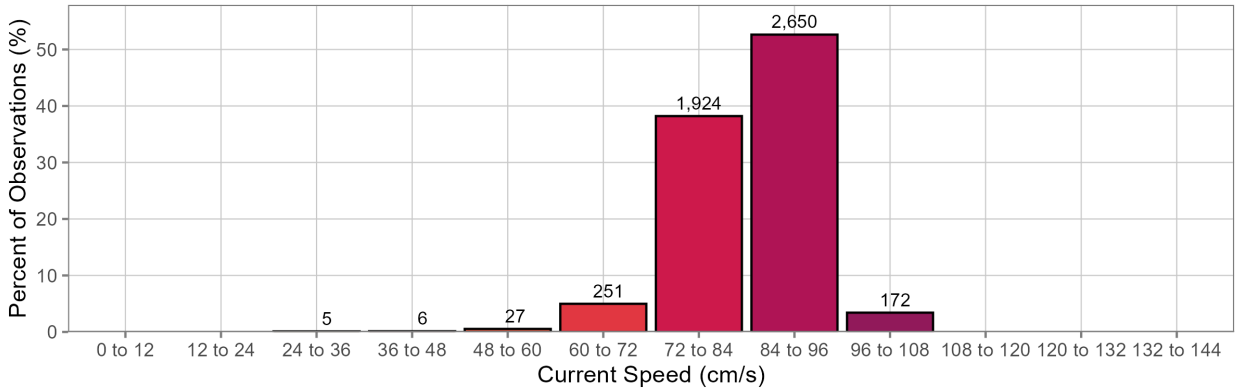

Figure 38: Current speed distribution 3.08 m above the seafloor. The number of observations in each interval is noted above the bar.

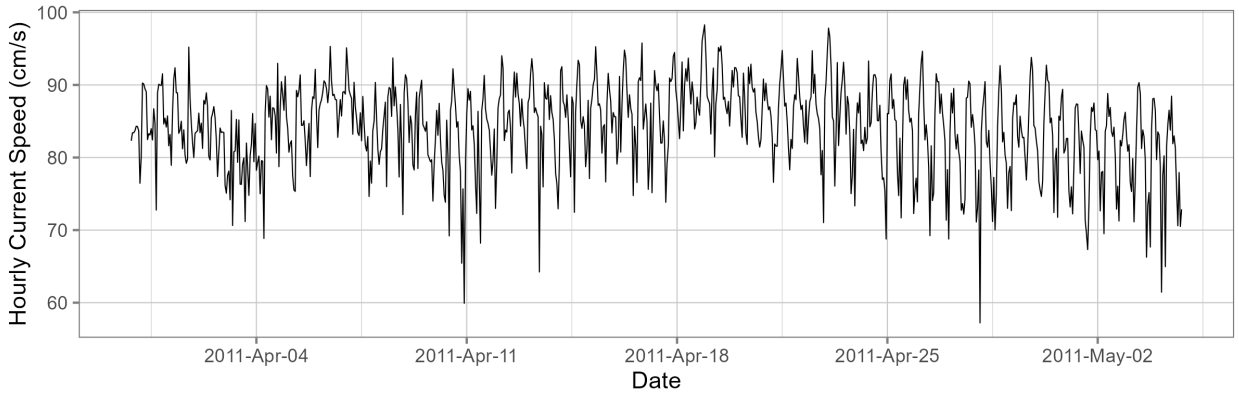

Figure 39: Average hourly current speed over time 3.08 m above the seafloor.

2.3.11 Bin Height: 2.33 m

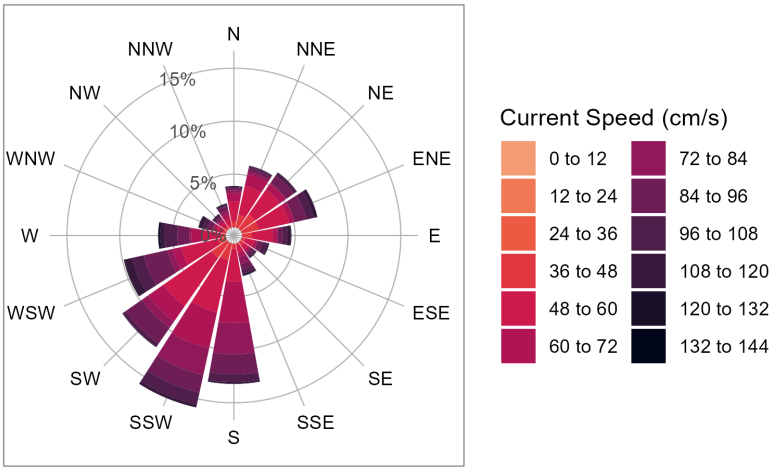

Figure 40: Current speed and direction 2.33 m above the seafloor.

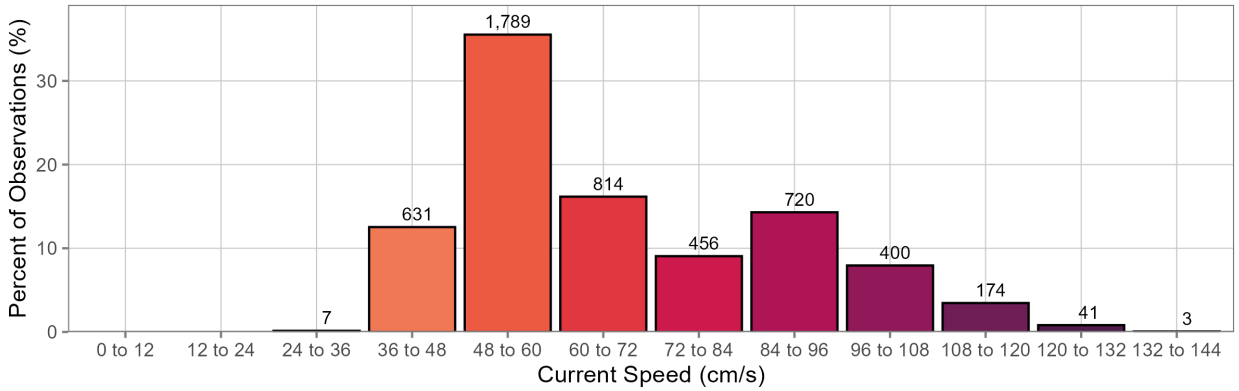

Figure 41: Current speed distribution 2.33 m above the seafloor. The number of observations in each interval is noted above the bar.

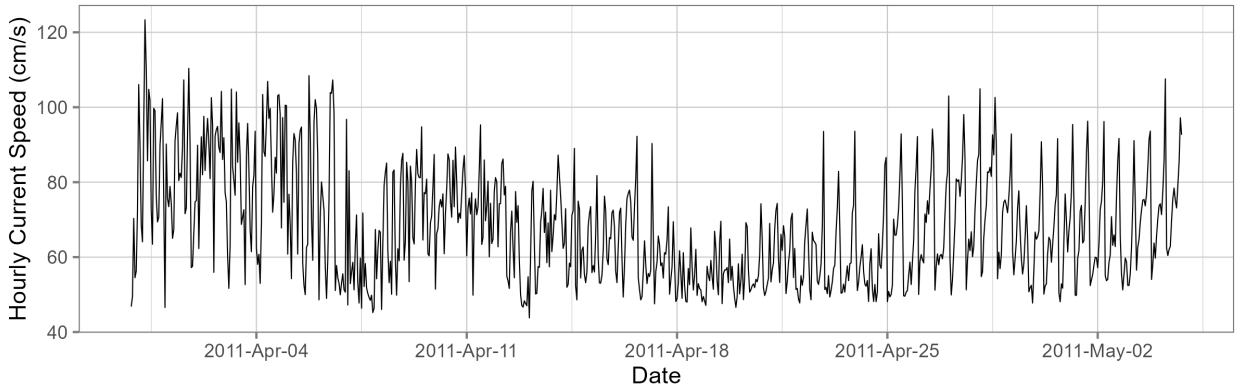

Figure 42: Average hourly current speed over time 2.33 m above the seafloor.

3 Data Acknowledgement

CMAR aims to prioritize data collection and processing efforts that best serve coastal interest holders. If you use this Coastal Monitoring Program data in a project or for decision making, please complete our anonymous questionnaire with your feedback. Please cite the report and/or datasets used.

4 Document History

Version	Date	Amendments
V1	2021	New document.
V2	2022	Trimmed data of sidelobe interference. Modified figures for clarity.
V3	2026	Applied additional quality control. Refreshed text, links, and report template.

References

Dempsey, D. (2023). Adcp: Format and visualize ADCP data. https://github.com/dempsey-CMAR/adcp

IOOS. (2020). QARTOD manual for real-time oceanographic data quality control flags (1.2). https://cdn.ioos.noaa.gov/media/2020/07/QARTOD-Data-Flags-Manual_version1.2final.pdf

Teledyne Rd Instruments. (2011). Acoustic doppler current profiler principles of operation a practical primer: Vols. P/N 951-6069-00 (January 2011).

Teledyne RD Instruments. (2017). Velocity software user's guide (P/N 95D-6000-00 (January 2017)).