

ACOUSTIC DOPPLER CURRENT PROFILER DATA ANALYSIS FOR OKEHAMPTON BAY, TASMANIA



Report to

Tassal

July 2019



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¹ Cover image, Approximate ADCP location in Okehampton Bay, Tasmania

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3 EXECUTIVE SUMMARY

An Acoustic Doppler Current Profiler (ADCP) was deployed by Tassal for 12 months, between May 2018 and April 2019, to record current flow characteristics at the Okehampton Bay lease on the east coast of Tasmania. Marine Solutions were contracted by Tassal to analyse the data from this deployment period.

Currents direction were relatively consistent across depths with no strong direction bias. Minor seasonal variation was observed with north-west currents marginally more dominant in summer. Current velocities are generally quite low ($< 10 \text{ cm s}^{-1}$), although slightly faster currents are observed in surface waters compared to the rest of the water column with maximum velocities reaching just over 76 cm s^{-1} at depths $< 6.5 \text{ m}$.

4 INTRODUCTION

Marine Solutions were contracted by Tassal to analyse hydrodynamics data (current direction and current velocity) within their lease in Okehampton bay east Tasmania. Measurements were collected by Tassal between May 2018 to April 2019 for a 12-month period via a Xylem510 Acoustic Doppler Current Profiler (ADCP). Current dynamics including direction and velocity are presented for each depth bin throughout the water column, for each month from May to April.

5 METHODS

Hydrodynamics data including current direction and current velocity were collected via a Xylem510 Acoustic Doppler Current Profiler (ADCP). This unit was deployed by Tassal and remained in place for 12 months from the 01/05/2018 to 30/04/2019. The instrument was deployed in Marine Farming Lease No. 236, Okehampton Bay, on the east coast of Tasmania (Figure 1).

The raw data files were supplied to Marine Solutions for analysis and interpretation. The valid data period is from the 01/05/2018 to the 30/04/2019. Measurement parameters for the unit include:

- Blanking distance of 0.5 m (assumed),
- Sampling range of approximately 25 m (assumed),
- Cell width of 1.0 m,
- Reporting bin width of 2.0 m; and
- Cell count of 26.



Figure 1 Approximate location of ADCP deployment between May 2018-April 2019 in Okehampton Bay on east coast Tasmania

6 RESULTS

6.1 CURRENT DYNAMICS

6.1.1 Current Flow

The data collected ranges from a depth of 2.5 m (surface; group 12) below the surface to a depth of 24.5 m (bottom; group 1). Table 1 below shows the reporting groups used for analysis with the corresponding depth bins.

Table 1 Reporting group and corresponding depth for ADCP data

| Reporting Group | Depth (m) |
|-----------------|-----------|
| Group 12 | 2.5 m |
| Group 11 | 4.5 m |
| Group 10 | 6.5 m |
| Group 9 | 8.5 m |
| Group 8 | 10.5 m |
| Group 7 | 12.5 m |
| Group 6 | 14.5 m |
| Group 5 | 16.5 m |
| Group 4 | 18.5 m |
| Group 3 | 20.5 m |
| Group 2 | 22.5 m |
| Group 1 | 24.5 m |

The currents throughout the water column at the ADCP site do not show a strong bias to a direction across depths or time. Currents in bottom water show a marginal bias to the south-west (Figure 2 and Figure 3), which is generally consistent throughout the water column (Figure 3), although shallower waters also show marginal bias of flow to the north-west (Figure 2, Figure 3). Currents show a slight seasonal variation with flows slightly more to the northwest during summer, and the southwest during winter and spring (Figure 4).

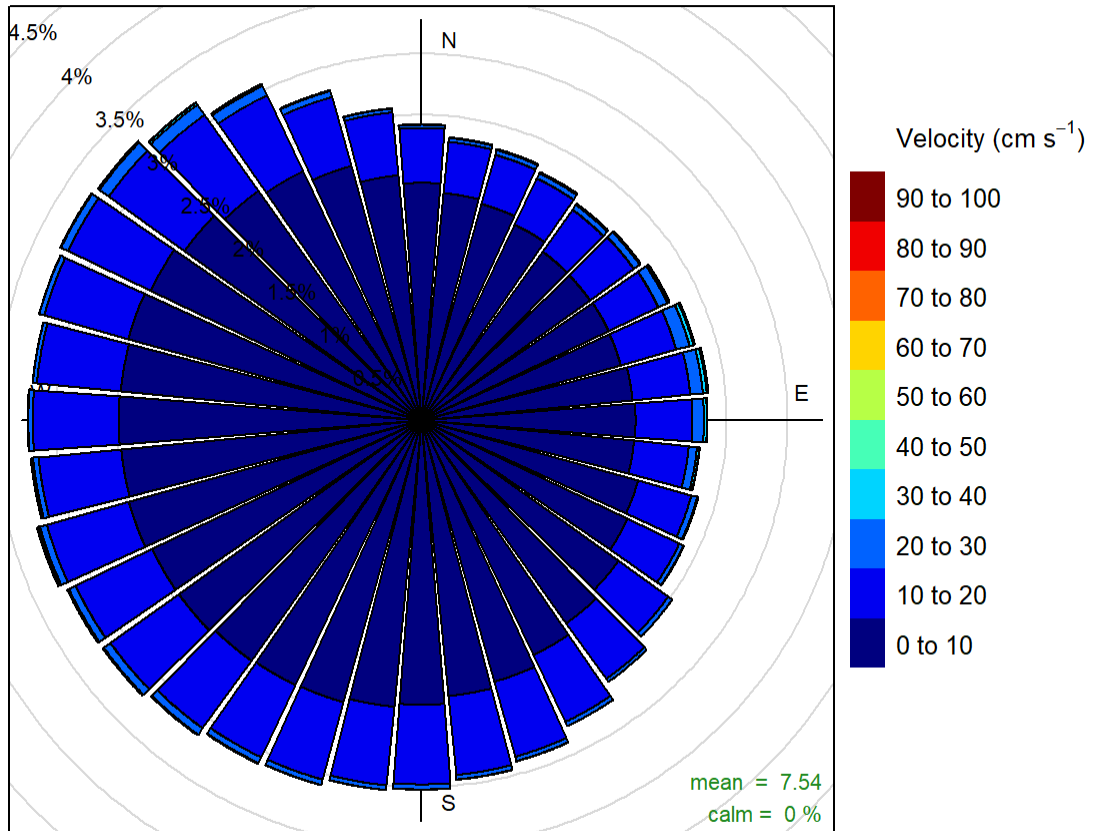


Figure 2 Current rose plot for all depths combined

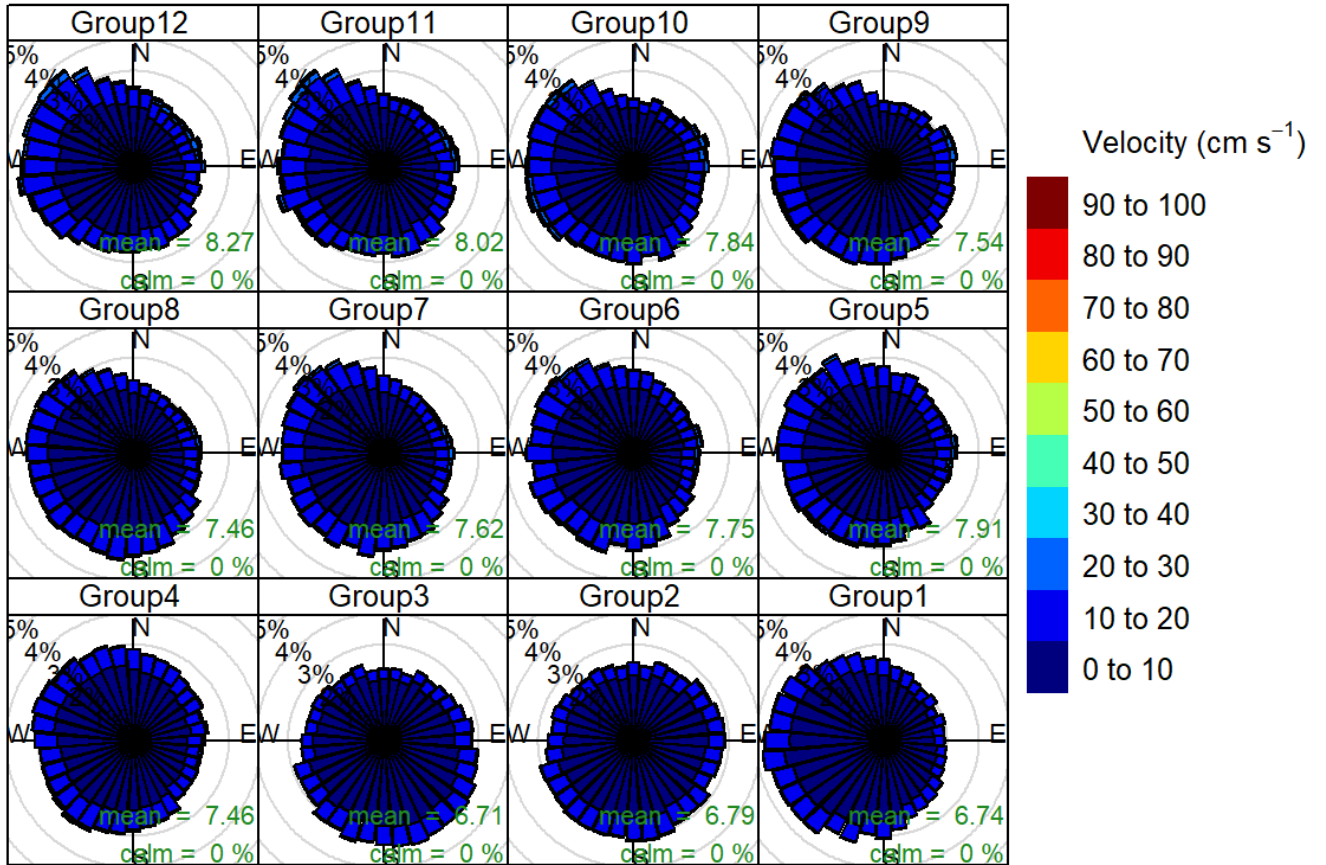


Figure 3 Current rose plots by depth (shallow to deep; Group 12 to Group 1)

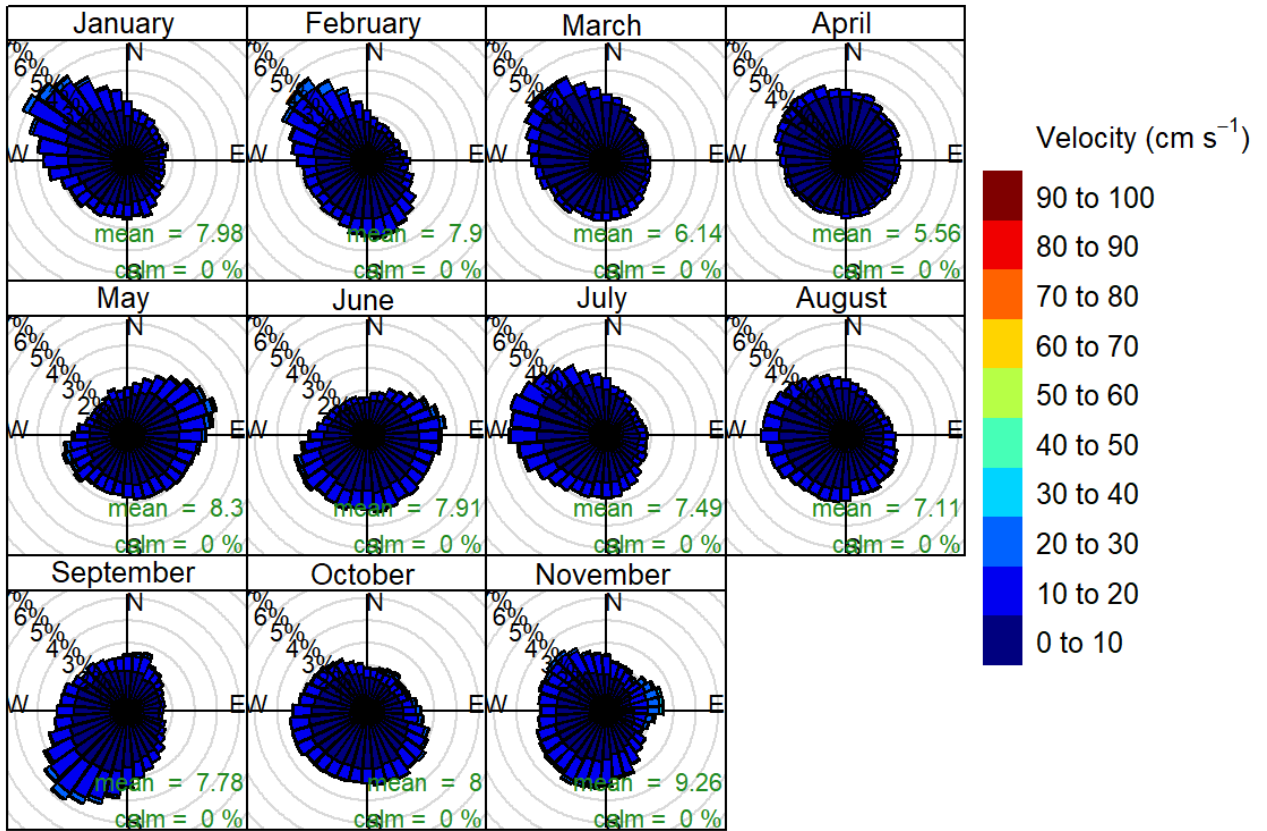


Figure 4 Current rose plot by month from May 2018 to April 2019

6.1.2 Current Velocity

Current velocities were generally low throughout the water column over the entire time period from May 2018 to April 2019, with a maximum flow of 78.7 cm s⁻¹ recorded at 6.5 m (Table 2). The highest proportion of velocity readings were between 0-10 cm s⁻¹ across all depths, with up to 25 cm s⁻¹ recorded at each depth (Figure 6 and Figure 7).

Current velocities were slightly faster in surface waters, ranging from 0 cm s⁻¹ to 76.6 cm s⁻¹ with an average of 8.27 cm s⁻¹ (group 12; Table 2; Figure 5). This is compared to values ranging from 51.3 cm s⁻¹ (Group 1; Table 2) to 59.3 cm s⁻¹ (Group2; Table 2) in the deepest two Groups.

Table 2 Summary statistics for current velocities for each depth group

| Group | n | Mean | sd | Min | Max |
|---------|-------|------|------|-----|------|
| Group12 | 60736 | 8.27 | 5.72 | 0.0 | 76.6 |
| Group11 | 60739 | 8.02 | 5.65 | 0.0 | 76.0 |
| Group10 | 60731 | 7.84 | 5.63 | 0.0 | 78.7 |
| Group9 | 60740 | 7.54 | 4.94 | 0.0 | 66.0 |
| Group8 | 60740 | 7.46 | 4.77 | 0.0 | 62.1 |
| Group7 | 60739 | 7.62 | 4.85 | 0.0 | 54.4 |
| Group6 | 60740 | 7.75 | 4.94 | 0.1 | 44.4 |
| Group5 | 60740 | 7.91 | 4.98 | 0.0 | 56.0 |
| Group4 | 60740 | 7.46 | 4.65 | 0.0 | 60.0 |
| Group3 | 60740 | 6.71 | 4.15 | 0.0 | 53.0 |
| Group2 | 60740 | 6.79 | 4.44 | 0.1 | 59.3 |
| Group1 | 30369 | 6.74 | 4.02 | 0.0 | 51.3 |

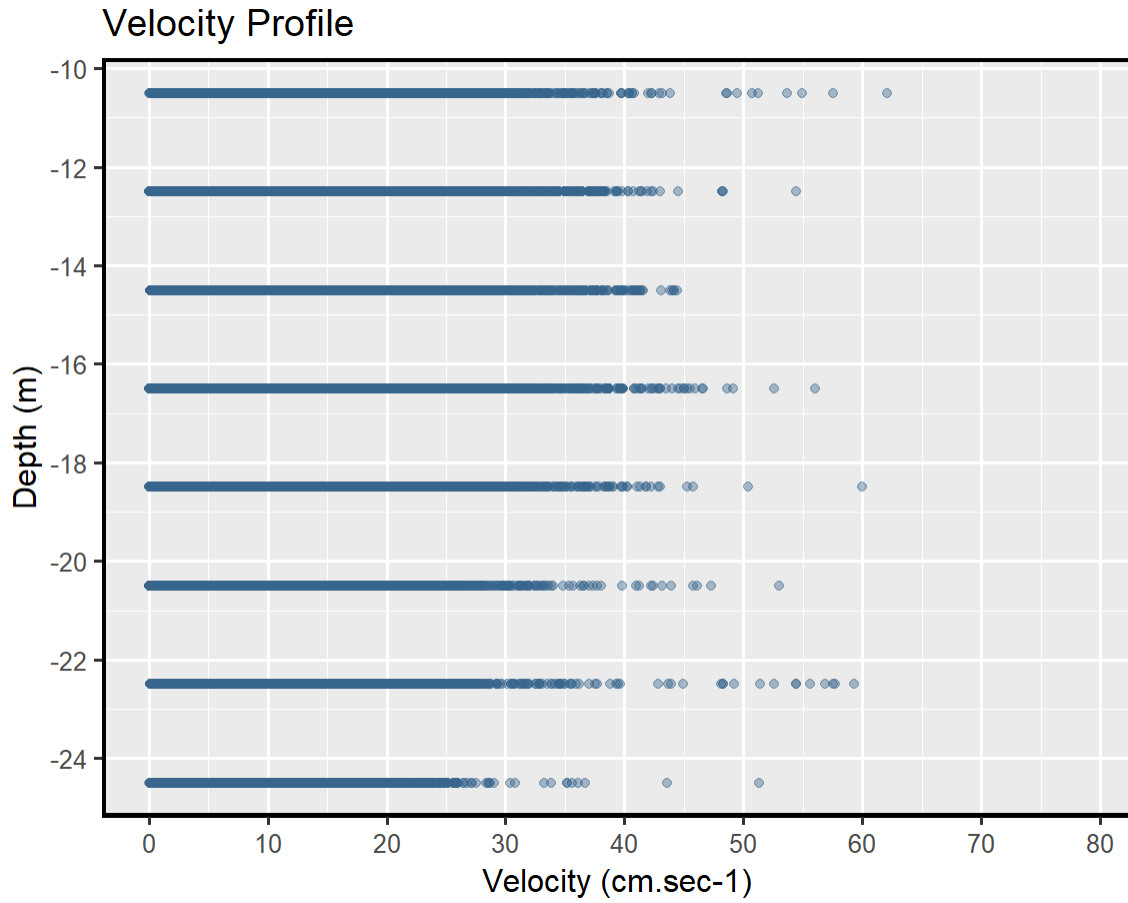


Figure 5 Current velocity profile

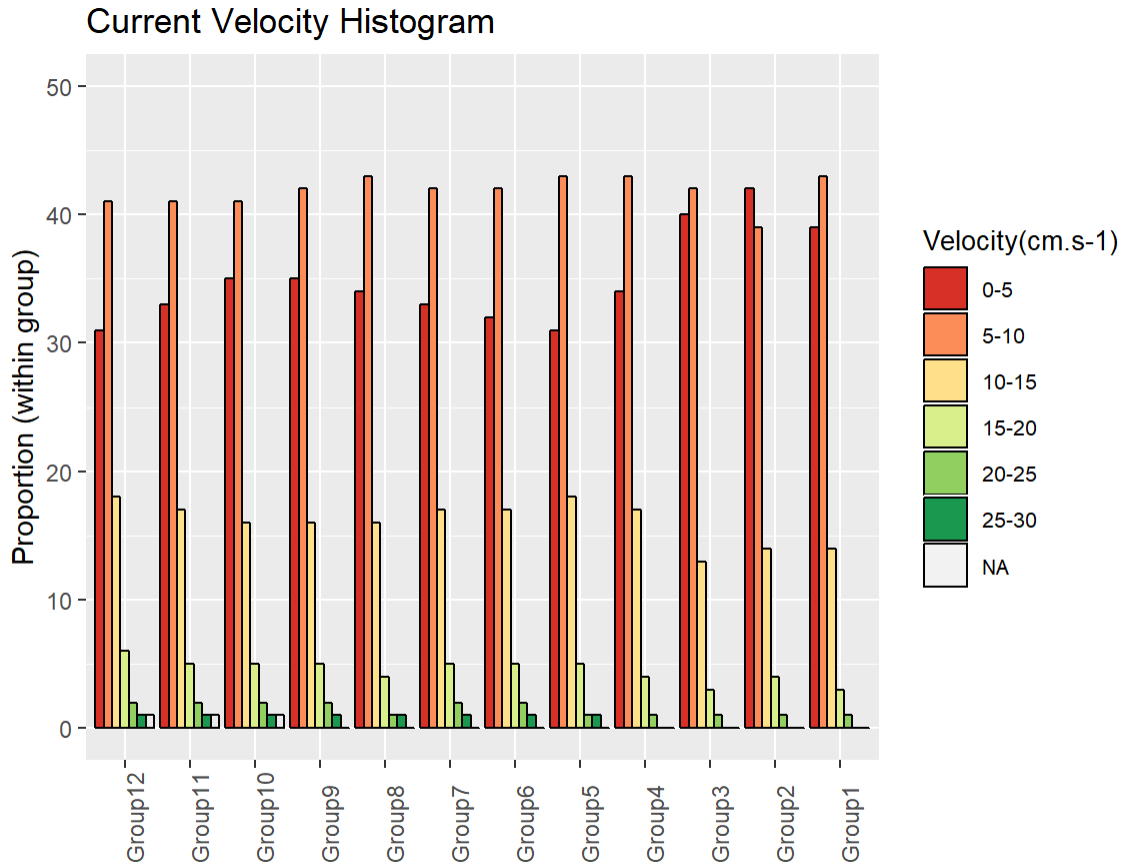


Figure 6 Current velocities by depth bin (shallow to deep; Group 12 = 2.5 m; Group 11 = 4.5 m; Group 10 = 6.5 m; Group 9 = 8.5 m; Group 8 = 10.5 m; Group 7 = 12.5 m; Group 6 = 14.5 m; Group 5 = 16.5 m; Group 4 = 18.5 m; Group 3 = 20.5 m; Group 2 = 22.5 m and Group 1 = 24.5 m)

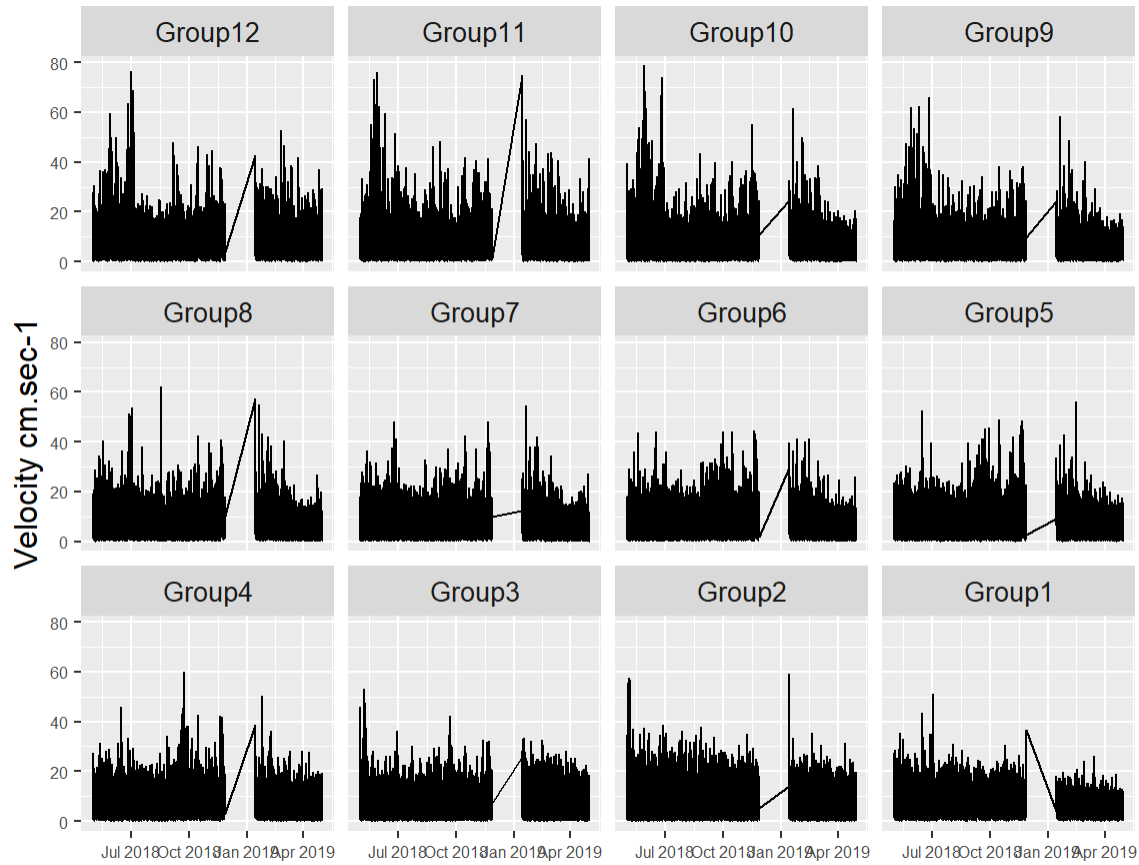


Figure 7 Current velocity time series for each depth group from shallow to deep water

Across different depths there was little difference between cumulative current velocities (Figure 8).

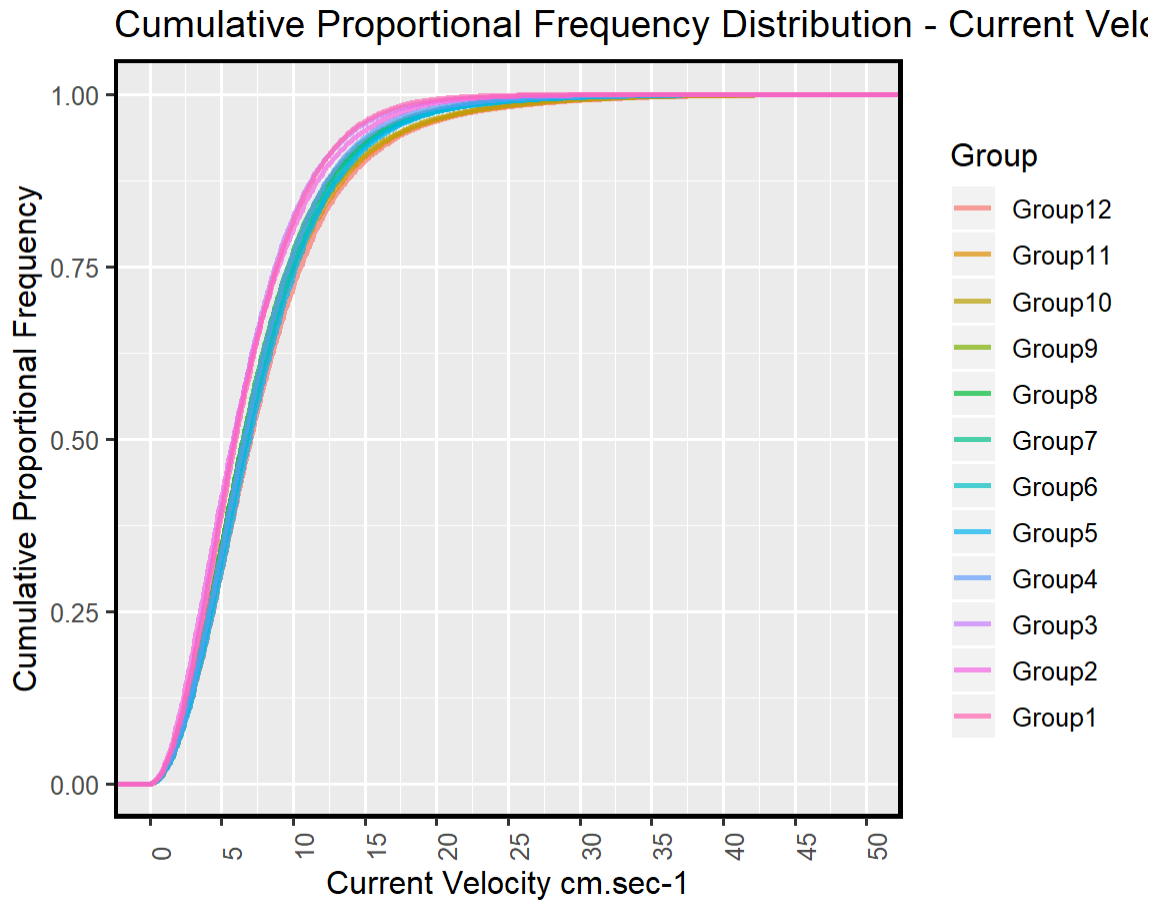


Figure 8 Cumulative proportional frequency distribution for current velocity for each depth group

7 CONCLUSION AND RECOMMENDATIONS

Overall, the hydrodynamics data collected from the ADCP unit deployed by Tassal indicates currents of low velocities with no strong direction bias. This is similar to results obtained from the same ADCP from October 2017 and May 2018 (Marine Solutions 2018).

9 REFERENCES

Marine Solutions (2018). Acoustic Doppler Current Profiler data analysis for Okehampton Bay, Tasmania. Report to Tassal, June 2018.

Appendix 1. Deployment Details

| Date | Personnel | Latitude | Location (Approximate) | Longitude |
|---------------------|-----------|------------|------------------------|------------|
| 01/05/18 – 30/04/19 | Tassal | -42.530658 | | 147.977013 |

Appendix 2. ADCP unit Direction Histogram

