CENTRE FOR MARINE APPLIED RESEARCH

YARMOUTH COUNTY WATER QUALITY REPORT

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1 Introduction

The Centre for Marine Applied Research (CMAR) measures essential ocean variables around the coast of Nova Scotia through the Coastal Monitoring Program. The Nova Scotia Department of Fisheries and Aquaculture started this program in 2015 to inform aquaculture site selection and management. CMAR assumed responsibility for the program in 2019 and has since expanded its scope and mandate. For more information on CMAR and the Coastal Monitoring Program, visit the CMAR website.

This document presents deployment details and summary figures of Water Quality data collected in **Yarmouth County** (Figure 1 and Figure 2). The data are available for download from the Nova Scotia Open Data Portal and from the ERDDAP server through the Canadian Integrated Ocean Observing System.

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

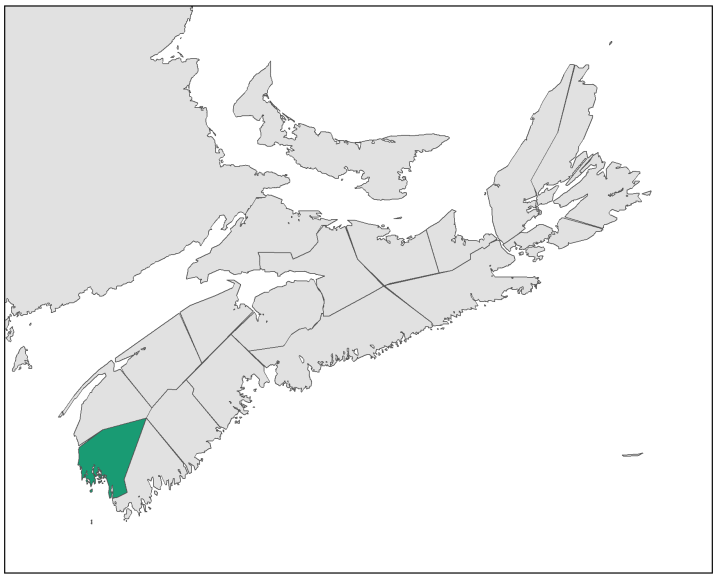

Figure 1: Yarmouth County (green).

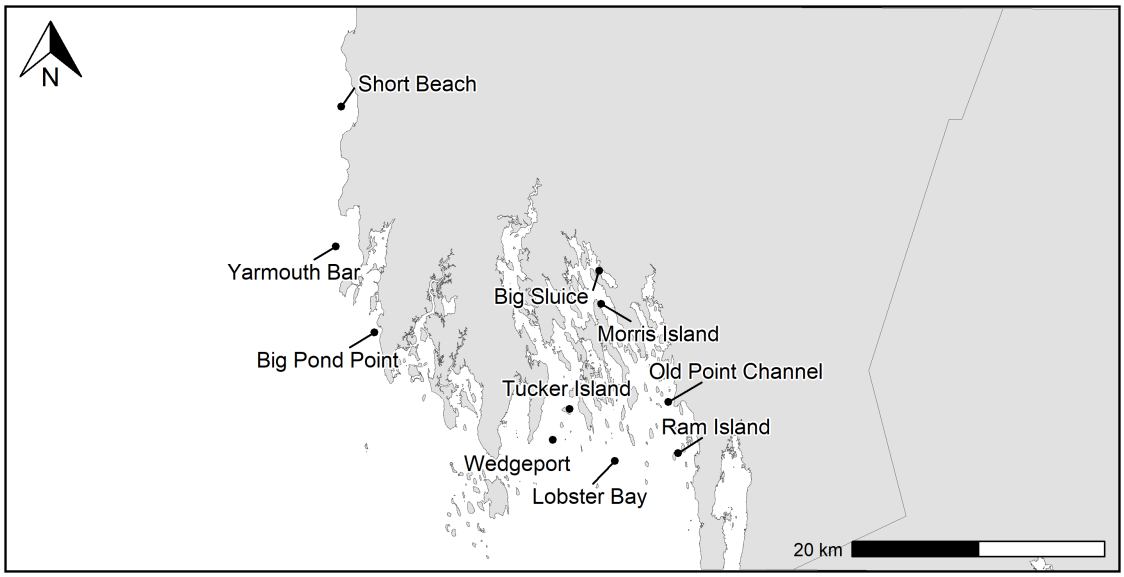

Figure 2: Sampling stations in Yarmouth County.

1.1 Data Collection

CMAR collects temperature, dissolved oxygen, and salinity data using moorings referred to as "sensor strings". A typical sensor string configuration consists of a rope attached to the seafloor by an anchor and suspended by a sub-surface buoy, with sensors attached at various depths (Figure 3). Alternatively, sensors may be attached to floating docks, surface buoys, equipment, or fixed structures (Table 1).

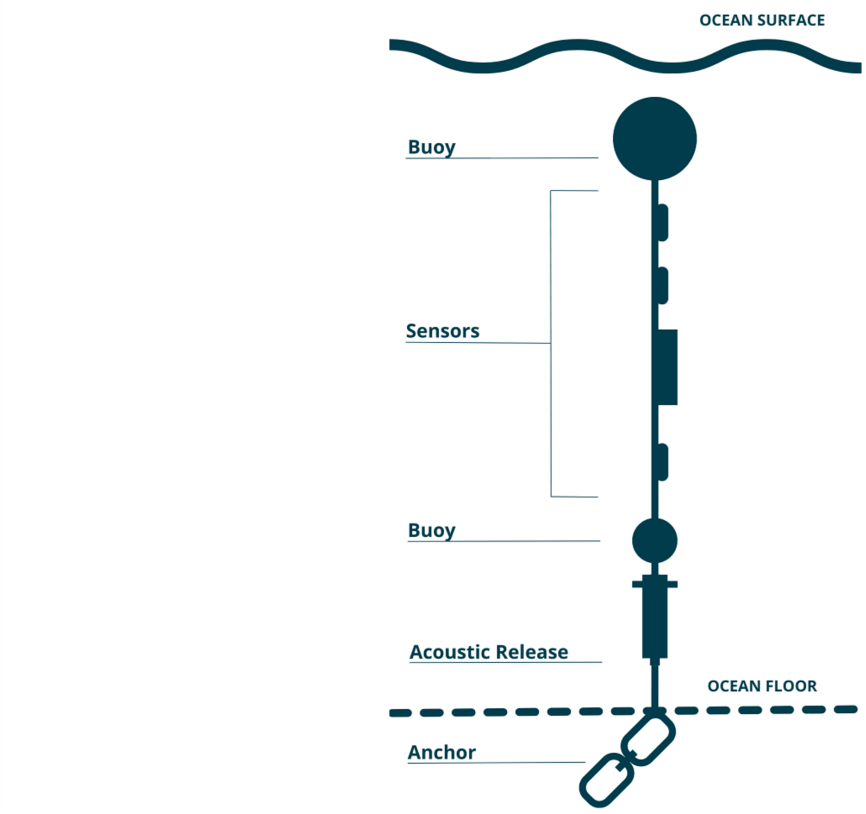

Figure 3: Example sensor string configuration (not to scale).

Sensor strings are typically deployed at a station for several months to a year, and data are logged every 1 minute to 1 hour. Sensors must be retrieved to offload the data. The retrieval method depends on the sensor configuration, and may include triggering an acoustic release, directly removing sensors from surface moorings, or employing divers or grappling methods (Table 1).

To build long term data series, key stations around the province have multiple consecutive deployments. At these stations, new sensors are deployed during the same field trip that the previous sensors are retrieved. Other stations may have fewer deployments due to reduced interest in the area or operational constraints. New stations are added based on interest-holder requests or to fill spatial gaps.

Table 1: Description of sensor string configurations.

Configuration	Description
Sub-surface buoy	Attached to sub-surface buoy. Typically has an acoustic release, but sometimes retrieved by diver or drag line. Does not float with the tide.
Surface buoy	Attached to a surface buoy. Floats with the tide.
Attached to gear	Typically attached to aquaculture gear[1], but may be attached to another structure. Floats with the tide.
Attached to fixed structure	Typically attached to a wharf, but may be attached to a bridge or pole. Does not float with the tide.
Floating dock	Attached to a floating dock. Floats with the tide.
Unknown	Configuration not indicated in historical deployment log.

Interest-holder needs and characteristics of the station dictate the string design, including anchor weight, number and type of sensors, and configuration (Table 1). Sensor strings are generally deployed 200 m to 1000 m from shore, in depths up to 75 m. Historically, strings were deployed with only temperature sensors, but more recently a dissolved oxygen sensor is often attached 5 m below the surface. At the request of industry, salinity sensors are also included at stations near proposed and existing shellfish aquaculture leases. Some of the sensors used to measure these variables also measure sensor depth. CMAR has processed and published this opportunistic depth data with the Water Quality datasets, and measured sensor depth is included in the figures below.

1.2 Quality Control

Automated Quality Control tests were applied to the data to identify outlying and unexpected observations. Inspired by Quality Assurance/Quality Control of Real-Time Oceanographic Data (QARTOD) guidance, each data point was assigned a flag of "Pass", "Fail", "Suspect/Of Interest", or "Not Evaluated" (IOOS, 2020). These automated flags were reviewed by human experts, and modified where necessary (e.g., upgrading "Suspect/Of Interest" flags to "Fail" if there were known issues with the deployment). Observations flagged as "Pass" passed all tests and were included in the figures below. Observations that failed any test were considered poor quality data and excluded from the figures.

Observations flagged as "Suspect/Of Interest" were reviewed by human experts. Most "Suspect/Of Interest" salinity observations were considered "Suspect" due to sensor drift and excluded from the figures. In contrast, most of the temperature and measured depth observations were considered "Of Interest" and are shown in the figures below.

[1]Some aquaculture gear may be sunk to the bottom during winter or extreme weather conditions like hurricanes, and so the sensor depth may change during the deployment. This change would likely be flagged by quality control processes, but it is recommended that users critically review data from these deployments.

"Suspect/Of Interest" dissolved oxygen observations were more difficult to parse. Dissolved oxygen observations flagged as "Suspect/Of Interest" by the rolling standard deviation test have relatively high variability over a 24-hour period. These flags may indicate issues such as biofouling or sensor malfunction, and so the observations were excluded from the figures. Alternatively, some of these flagged observations may indicate signals from the Spring phytoplankton bloom or activity from the benthos. Researchers interested in high variability dissolved oxygen signals are referred to the full data set, which can be downloaded from the Nova Scotia Open Data Portal.

Some tests cannot be applied to certain observations, which were flagged as "Not Evaluated". These data points were not included in the figures.

Removing flagged observations can result in patchy time series, especially for dissolved oxygen data. The full Yarmouth County Water Quality Data, including Quality Control flags, can be downloaded from the Nova Scotia Open Data Portal or the Canadian Integrated Ocean Observing System. Data gaps can also be caused by battery failure, delays between retrieval and re-deployment, and accidental or intentional interference with equipment.

Note that some sensors (dissolved oxygen and salinity) may drift over time. The existing Quality Control tests do not explicitly detect sensor drift, and users should review all data prior to use.

For more technical details about the Quality Control tests, visit the CMAR Data Governance website.

2 Yarmouth County Water Quality Data

Water Quality data is arranged by waterbody and station. For each waterbody, there is a table of deployment details followed by figures showing the data collected at each station. Note the differences in scales between figures (x-axis, y-axis, and colour).

2.1 Careys Cove

Table 2: Deployment details for Careys Cove.

Station	Deployment Date	Retrieval Date	Latitude	Longitude	Configuration	Variables Measured
Yarmouth Bar	2023-08-03	2024-08-07	43.8315	−66.1732	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Yarmouth Bar	2024-08-07	2025-07-31	43.8315	−66.1731	sub-surface buoy	depth dissolved oxygen (% sat) temperature

2.1.1 Yarmouth Bar

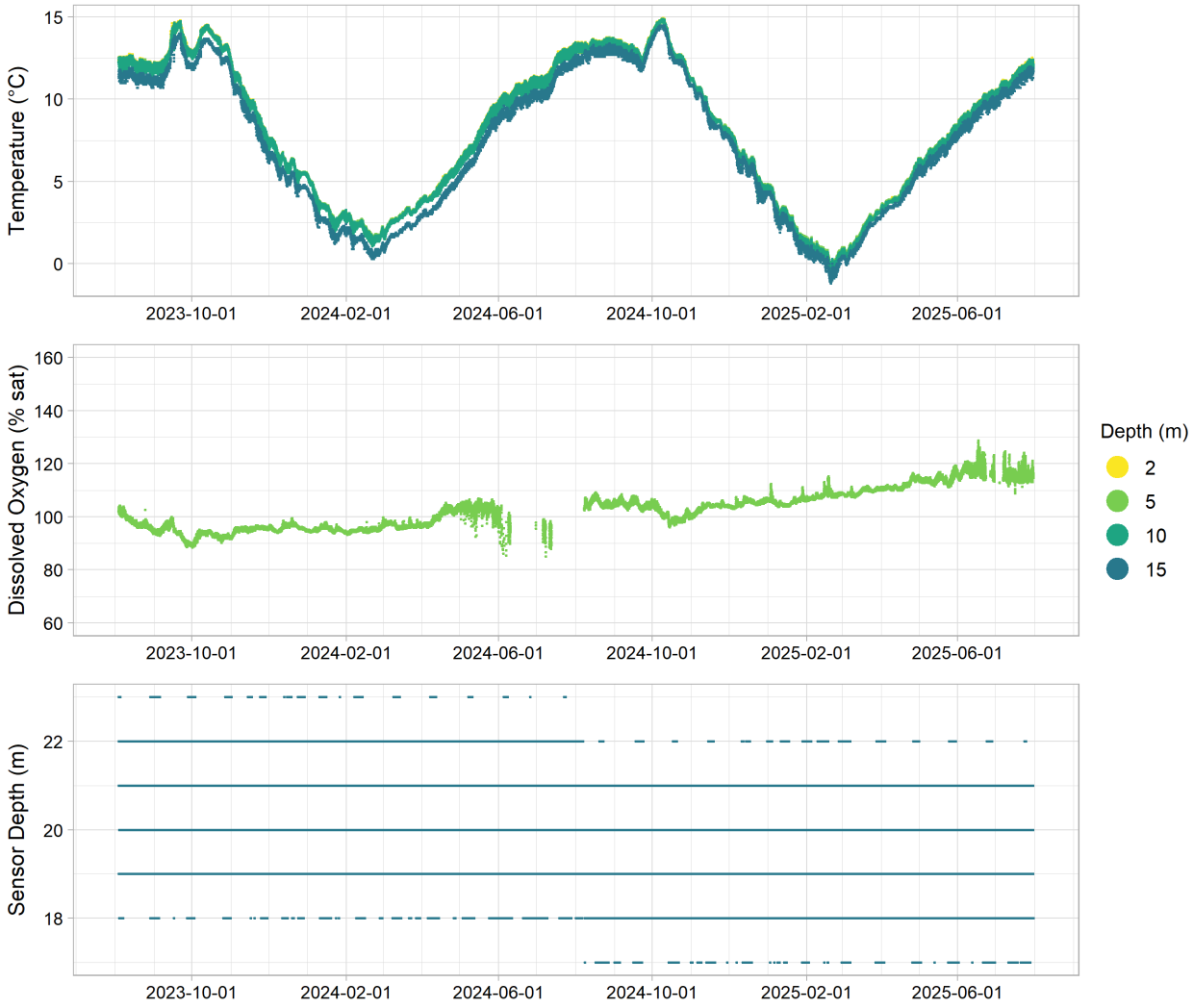

Figure 4: Yarmouth Bar water quality data.

2.2 Chebogue Harbour

Table 3: Deployment details for Chebogue Harbour.

Station	Deployment Date	Retrieval Date	Latitude	Longitude	Configuration	Variables Measured
Big Pond Point	2021-07-08	2021-11-09	43.7704	−66.1352	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Big Pond Point	2021-11-09	2022-06-21	43.7704	−66.1351	sub-surface buoy	depth temperature
Big Pond Point	2022-06-21	2023-08-03	43.7703	−66.1352	sub-surface buoy	depth temperature
Big Pond Point	2023-08-03	2024-08-07	43.7704	−66.1352	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Big Pond Point	2024-08-07	2025-07-31	43.7706	−66.135	sub-surface buoy	depth dissolved oxygen (% sat) temperature

2.2.1 Big Pond Point

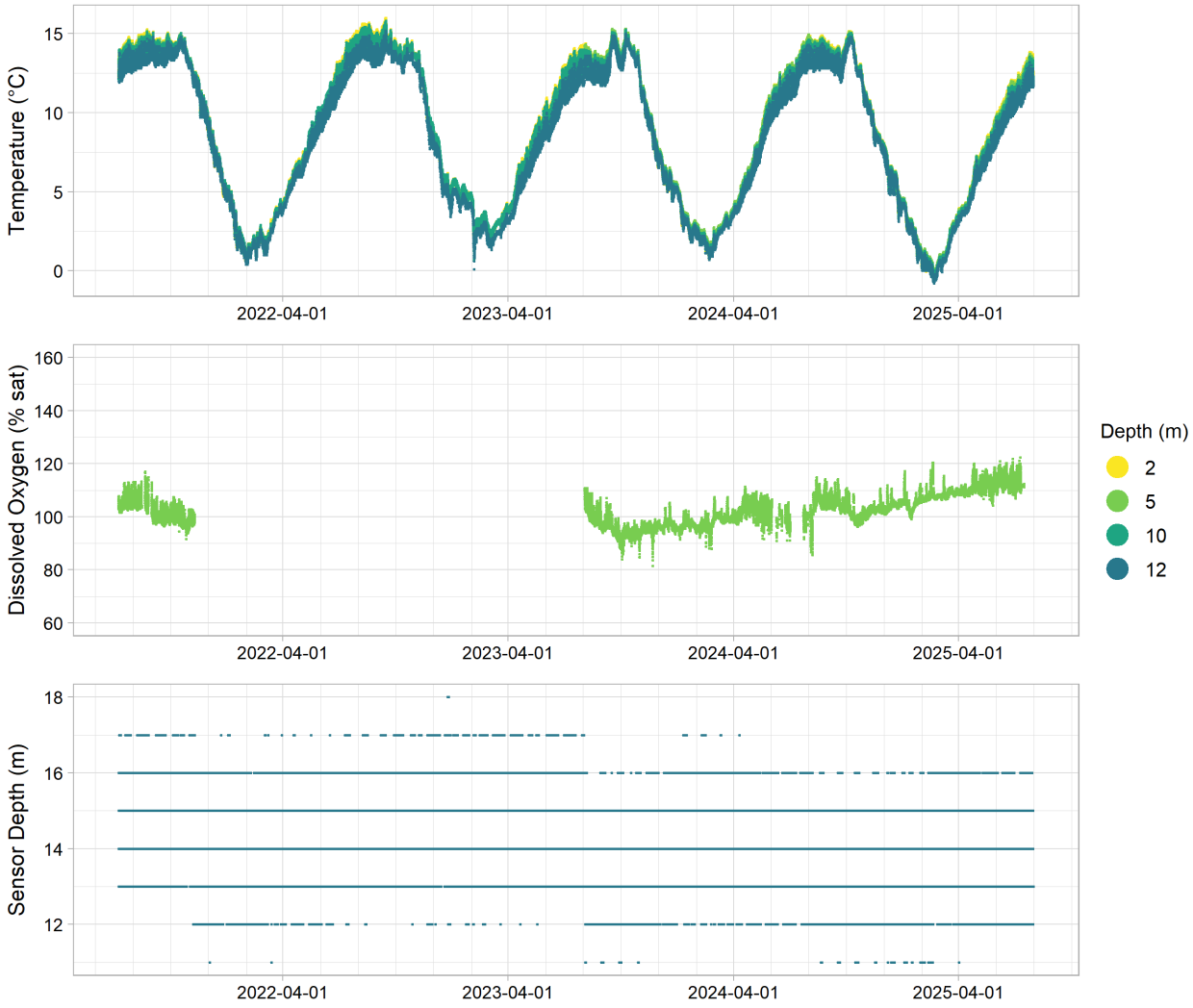

Figure 5: Big Pond Point water quality data.

2.3 Lamonts Cove

Table 4: Deployment details for Lamonts Cove.

Station	Deployment Date	Retrieval Date	Latitude	Longitude	Configuration	Variables Measured
Short Beach	2023-08-03	2024-08-07	43.9309	−66.168	sub-surface buoy	depth dissolved oxygen (% sat) temperature

2.3.1 Short Beach

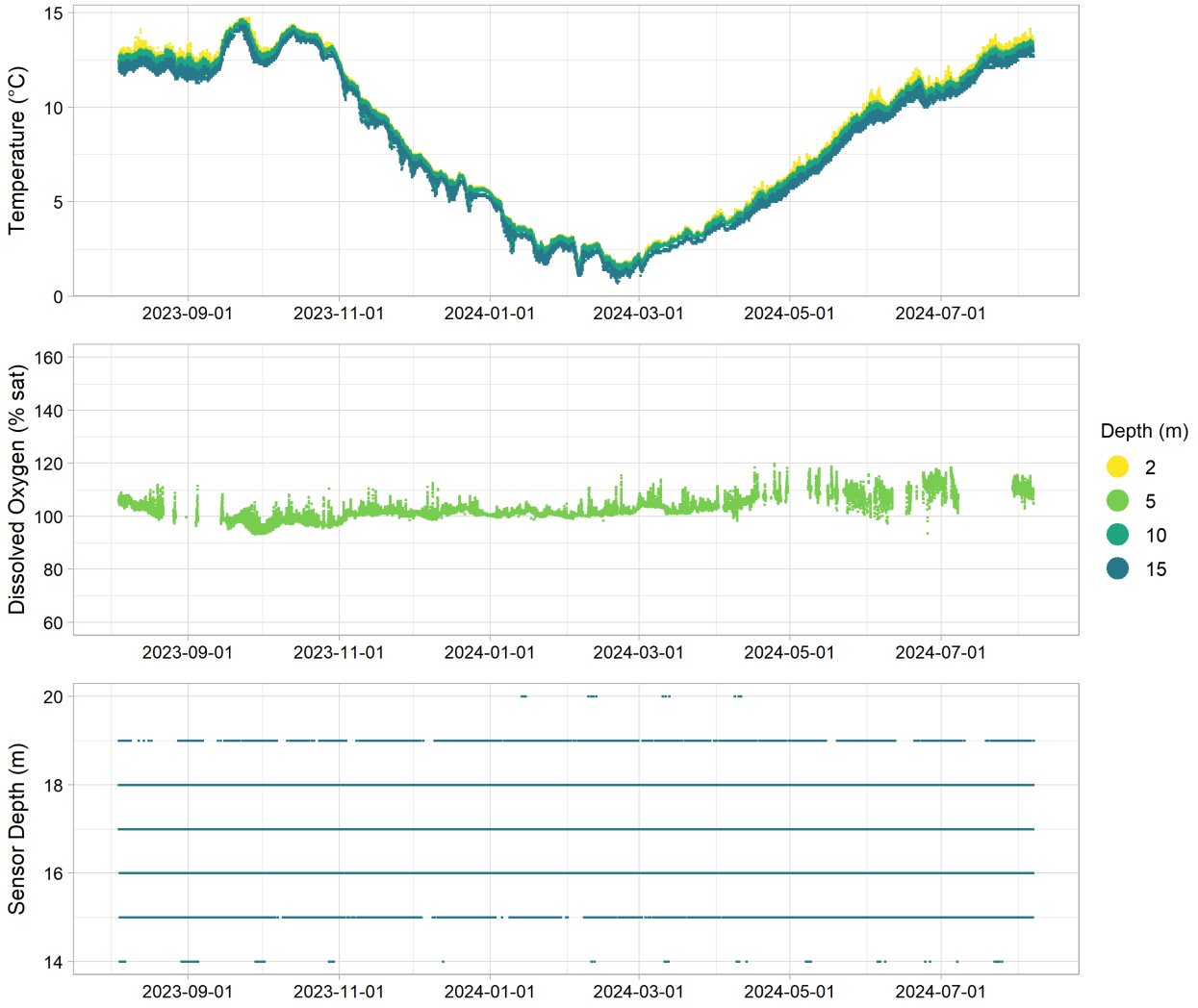

Figure 6: Short Beach water quality data.

2.4 Lobster Bay

Table 5: Deployment details for Lobster Bay.

Station	Deployment Date	Retrieval Date	Latitude	Longitude	Configuration	Variables Measured
Lobster Bay	2020-06-22	2020-09-16	43.679	−65.8982	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Lobster Bay	2020-09-16	2025-06-13	43.679	−65.898	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Lobster Bay	2022-06-21	2023-08-02	43.679	−65.8973	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Lobster Bay	2023-08-02	2024-08-07	43.679	−65.898	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Lobster Bay	2024-08-07	2025-07-31	43.6791	−65.8979	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Morris Island	2020-06-16	2020-09-15	43.7908	−65.9116	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Morris Island	2020-09-15	2021-07-08	43.791	−65.911	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Morris Island	2021-07-08	2021-07-19	43.7908	−65.9116	sub-surface buoy	depth dissolved oxygen (% sat) temperature
Old Point Channel	2016-02-19	2016-11-25	43.721	−65.8457	surface buoy	temperature
Old Point Channel	2016-11-25	2018-03-20	43.721	−65.8457	surface buoy	temperature
Old Point Channel	2018-03-20	2019-06-15	43.721	−65.8457	surface buoy	temperature
Ram Island	2016-11-26	2018-03-20	43.6845	−65.836	unknown	temperature
Ram Island	2020-06-22	2021-07-08	43.6822	−65.8362	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature

Station	Deployment Date	Retrieval Date	Latitude	Longitude	Configuration	Variables Measured
Ram Island	2021-07-08	2022-06-21	43.6829	−65.8345	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Ram Island	2022-06-21	2023-08-02	43.6823	−65.8362	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Ram Island	2023-08-02	2024-08-07	43.6822	−65.8362	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Ram Island	2024-08-07	2025-07-31	43.6823	−65.8361	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Tucker Island	2016-02-19	2016-11-28	43.7161	−65.9427	surface buoy	temperature
Wedgeport	2020-06-16	2020-09-16	43.694	−65.9594	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Wedgeport	2020-09-16	2021-07-08	43.694	−65.9594	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Wedgeport	2021-07-08	2022-06-21	43.6941	−65.9594	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Wedgeport	2022-06-21	2023-08-02	43.694	−65.9594	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature
Wedgeport	2023-08-02	2024-10-28	43.694	−65.9594	sub-surface buoy	depth dissolved oxygen (% sat) salinity temperature

2.4.1 Lobster Bay

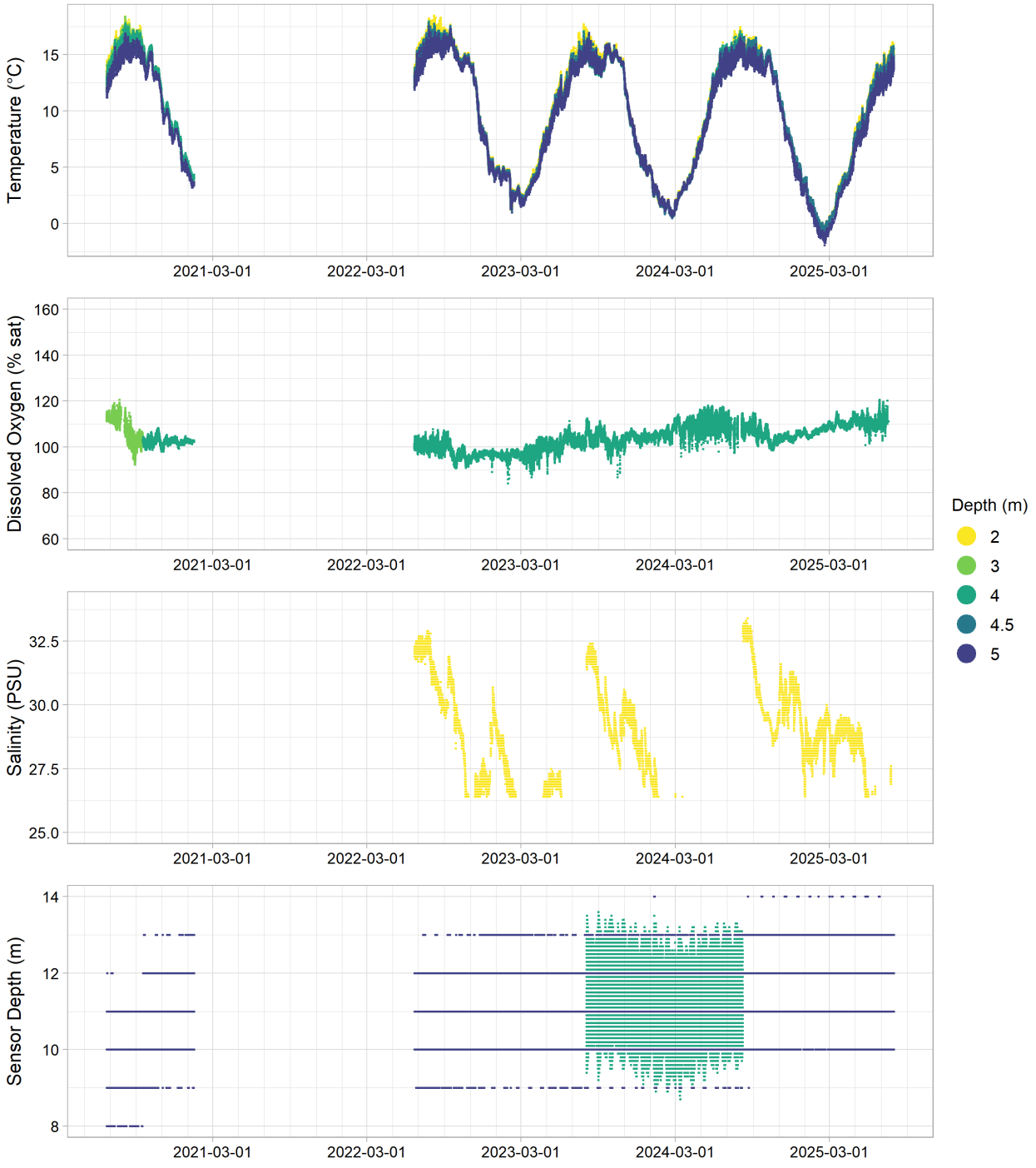

Figure 7: Lobster Bay water quality data.

2.4.2 Morris Island

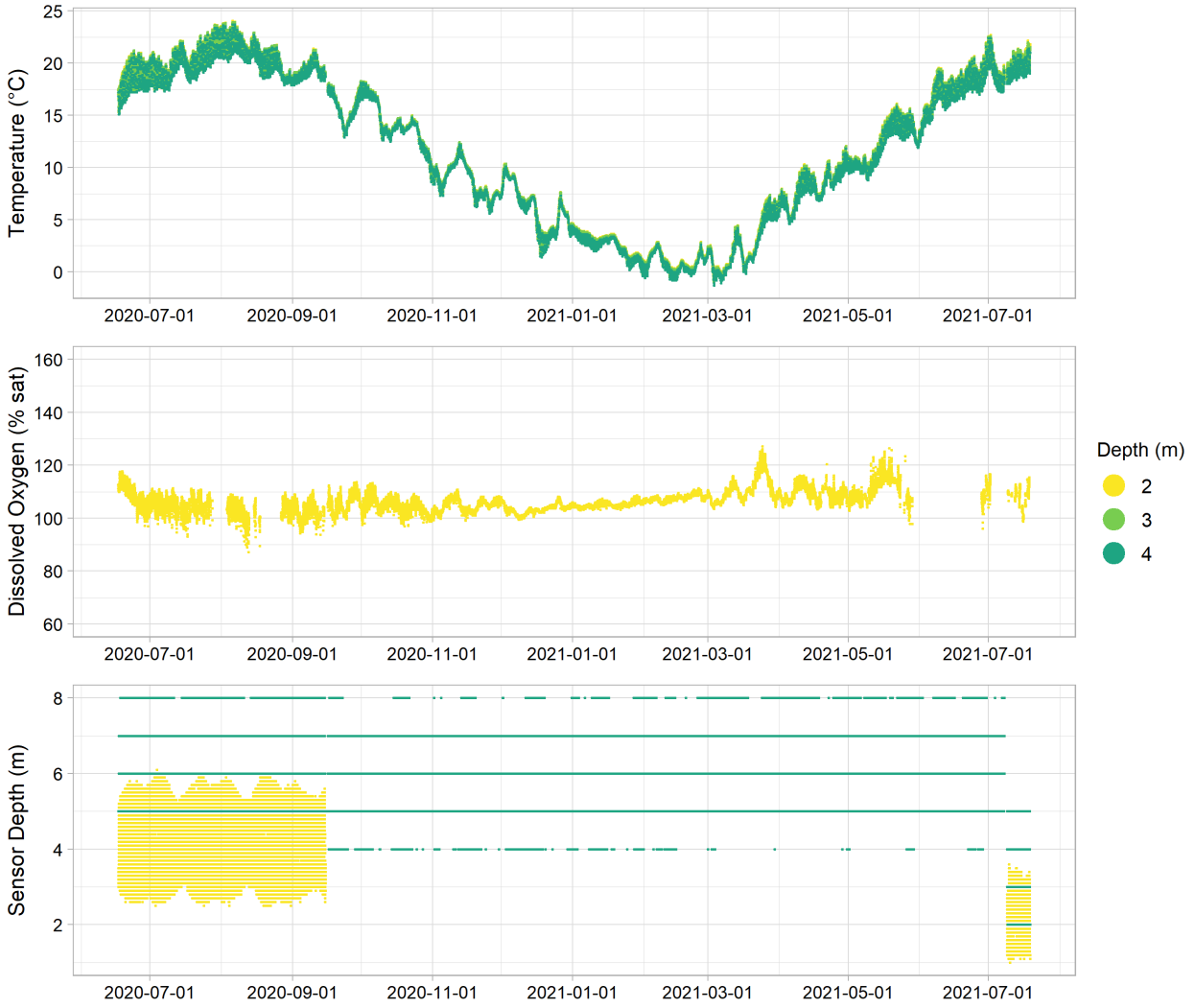

Figure 8: Morris Island water quality data.

2.4.3 Old Point Channel

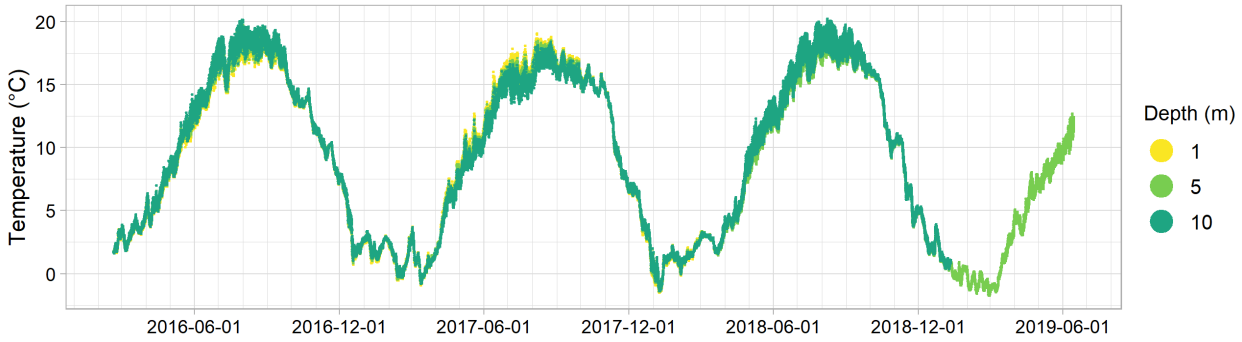

Figure 9: Old Point Channel water quality data.

2.4.4 Ram Island

Figure 10: Ram Island water quality data.

2.4.5 Tucker Island

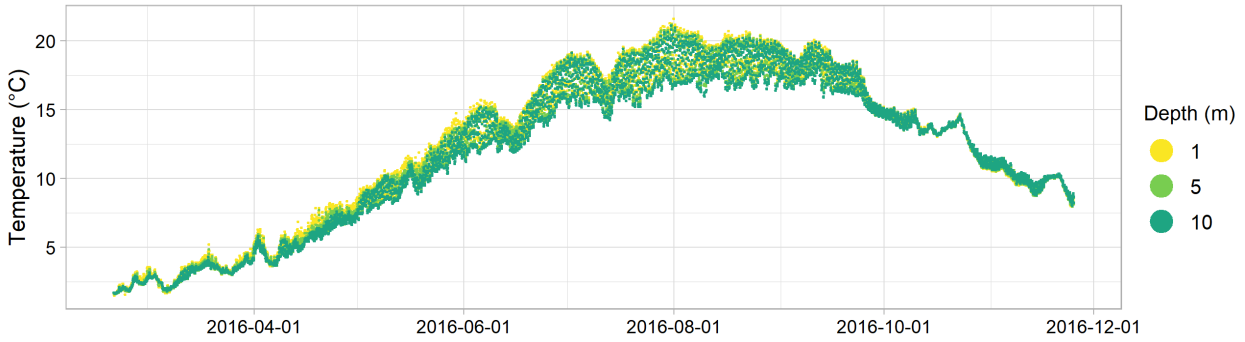

Figure 11: Tucker Island water quality data.

2.4.6 Wedgeport

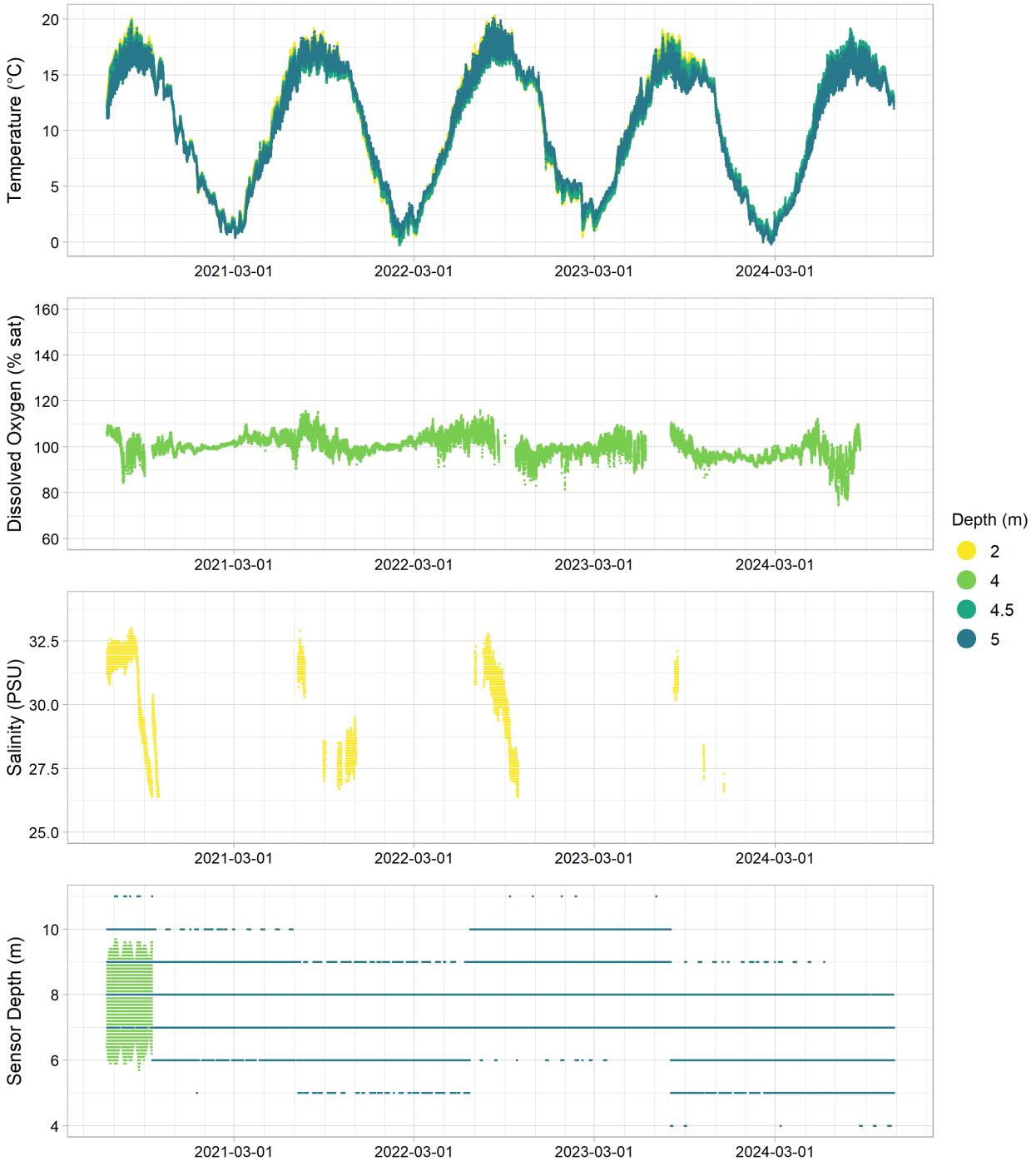

Figure 12: Wedgeport water quality data.

2.5 Salt Bay

Table 6: Deployment details for Salt Bay.

Station	Deployment Date	Retrieval Date	Latitude	Longitude	Configuration	Variables Measured
Big Sluice	2017-06-21	2017-11-17	43.8144	−65.9137	attached to gear	temperature
Big Sluice	2018-05-18	2018-10-01	43.8125	−65.9106	attached to gear	temperature

2.5.1 Big Sluice

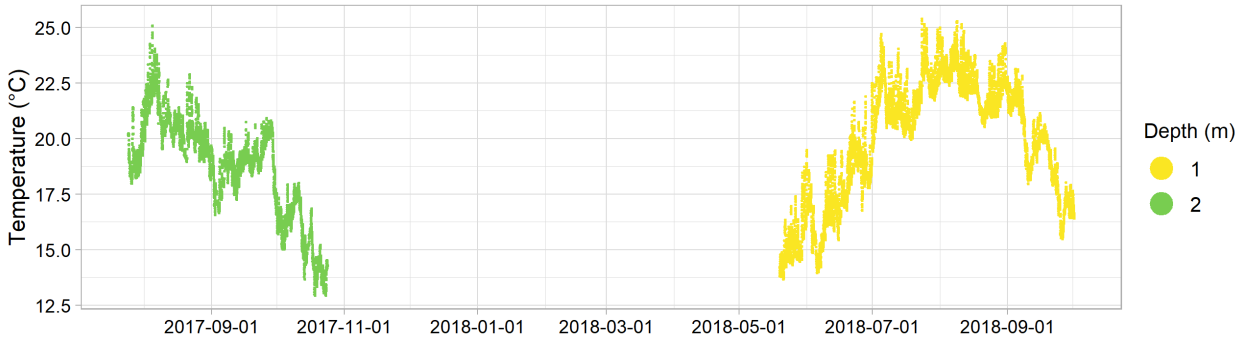

Figure 13: Big Sluice water quality data.

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 Water Quality 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

Table 7: Document history.

Version	Date	Amendments
V1	2021-01-26	New document.
V2	2022-01-06	New data release. Additional QAQC of previous release. Revised text in Section 1 for clarity.
V3	2023-01-05	New data release. Additional QAQC of previous release. Updated Figure 3.
V4	2024-04-12	New data release. Automated QC tests applied and reviewed by experts. Refreshed text, figures, and tables.
V5	2025-01-06	New data release. Refreshed text, links, and report template.
V6	2026-01-05	New data release. Refreshed text, links, and report template.

References

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