

Quality Issue #001: RINKO-AROD-FT optodes

Table 1: Change log

| Issue number: 1 | | | |
|--|------------|---|----------------------------------|
| Contact details: chiara.monforte@voiceoftheocean.org; callum.rollo@voiceoftheocean.org | | | |
| Version | Date | Comments | Authors |
| 1 | 2023-07-07 | Creation of document | Chiara Monforte and Callum Rollo |
| 2 | 2023-07-10 | Added info on new missions: SEA044_M83 and SEA063_M62 | Chiara Monforte |
| 3 | 2023-07-27 | Added info on new missions: SEA067_M46; SEA069_M15; SEA077_M24 and SEA078_M14 | Chiara Monforte |
| 4 | 2023-08-04 | Added info on new mission: SEA044_M84 | Chiara Monforte |
| 5 | 2023-08-14 | Added info on new mission: SEA063_M63 | Chiara Monforte |
| 6 | 2023-09-21 | Added info on new mission: SEA056_M64; SEA079_M14; SEA044_M85; SEA044_M86 and SEA076_M19 | Chiara Monforte |
| 7 | 2023-09-27 | Added info on new mission: SEA063_M65 | Chiara Monforte |
| 8 | 2023-10-06 | Added info on new mission: SEA077_M25 and SEA078_M15 | Chiara Monforte |
| 9 | 2023-10-10 | Added info on new mission: SEA069_M17 | Chiara Monforte |
| 10 | 2023-10-18 | Added info on new mission: SEA056_M66 | Chiara Monforte |
| 11 | 2023-10-23 | Added info on new mission: SEA069_M19 | Chiara Monforte |
| 12 | 2023-11-13 | Added info on new mission: SEA063_M67 and SEA079_M16 | Chiara Monforte |
| 13 | 2023-11-20 | Added info on new mission: SEA069_M21; SEA066_M52 and SEA076_M21 | Chiara Monforte |
| 14 | 2023-11-29 | Added info on new mission: SEA067_M51 | Chiara Monforte |
| 15 | 2023-12-02 | Added info on new mission: SEA069_M22 | Chiara Monforte |
| 16 | 2023-12-07 | Added info on new mission: SEA077_M28 and SEA078_M19 | Chiara Monforte |

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Table 1: Change log (Continued)

| | | | |
|-----------|------------|--|-----------------|
| 17 | 2023-12-15 | Added info on new mission: SEA056_M68 and SEA063_M69 | Chiara Monforte |
| 18 | 2023-12-27 | Added info on new mission: SEA069_M23 | Chiara Monforte |
| 19 | 2024-01-08 | Added info on new mission: SEA076_M22 and SEA079_M18 | Chiara Monforte |
| 20 | 2024-01-10 | Added info on new mission: SEA077_M29 and SEA067_M53 | Chiara Monforte |
| 21 | 2024-01-18 | Added info on new mission: SEA044_M88 | Chiara Monforte |
| 22 | 2024-01-30 | Added info on new mission: SEA068_M30 | Chiara Monforte |
| 23 | 2024-02-08 | Added info on new mission: SEA078_M22; SEA056_M71; SEA076_M24 and SEA069_M25 | Chiara Monforte |
| 24 | 2024-02-20 | Added info on new mission: SEA063_M71 | Chiara Monforte |

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1 Introduction

A fault has affected dissolved oxygen concentration values on all gliders with the AROD RINKO dissolved oxygen sensor deployed from 2022-12-01. In the affected datasets, oxygen concentration is around 100 $\mu\text{mol m}^{-3}$ less than expected. This offset decreased during the mission at a non linear rate. All affected datasets have been flagged with the variable `oxygen_concentration_qc`. We are working to fix the affected sensors.

The table below (Table 2) shows an updated list of all the missions deployed after 2022-12-01 with an AROD RINKO sensor, color-coded by severity. Flag column corresponds to data quality: suspect (3), fail (4), and good (1).

Table 2: Info summary for all the missions deployed after 2022-12-01 with an AROD RINKO sensor. The different basins mentioned in the ‘Location’ column, follow the division made by HELCOM which is shown in A.1

| Glider | Mission | Location | Mission Start date | Sensor Serial | Issue description | Flag |
|---------------|---------|---------------------|--------------------|---------------|-------------------|------|
| SEA044 | 72 | Skagerrak, Kattegat | 2023-02-06 | 70 | B | 4 |
| | 75 | Skagerrak, Kattegat | 2023-03-18 | 70 | C | 3 |
| | 77 | Skagerrak, Kattegat | 2023-04-14 | 70 | D | 4 |
| | 78 | Skagerrak, Kattegat | 2023-05-04 | 70 | D | 4 |
| | 79 | Skagerrak, Kattegat | 2023-05-31 | 70 | D | 4 |
| | 81 | Skagerrak, Kattegat | 2023-06-16 | 70 | D | 4 |
| | 83 | Skagerrak, Kattegat | 2023-07-10 | 68 | E | 4 |
| | 84 | Skagerrak, Kattegat | 2023-08-04 | 68 | E | 4 |
| | 85 | Skagerrak, Kattegat | 2023-08-23 | 68 | E | 4 |
| | 86 | Skagerrak, Kattegat | 2023-09-14 | 68 | E | 4 |
| SEA045 | 88 | Skagerrak, Kattegat | 2024-01-18 | 58 | A | 1 |
| | 73 | Bornholm Basin | 2022-12-16 | 39 | C | 3 |
| | 74 | Bornholm Basin | 2023-02-02 | 39 | B | 4 |
| | 75 | Bornholm Basin | 2023-03-16 | 39 | B | 4 |
| | 79 | Bornholm Basin | 2023-05-30 | 58 | E | 4 |
| SEA055 | 52 | Skagerrak, Kattegat | 2022-12-01 | 58 | C | 3 |
| | 53 | Skagerrak, Kattegat | 2022-12-21 | 58 | C | 3 |
| | 54 | Skagerrak, Kattegat | 2023-01-20 | 58 | C | 3 |
| | 56 | Skagerrak, Kattegat | 2023-02-27 | 58 | B | 4 |
| SEA056 | 56 | Bornholm Basin | 2022-12-09 | 50 | C | 3 |
| | 57 | Bornholm Basin | 2022-12-17 | 50 | C | 3 |
| | 62 | Bornholm Basin | 2023-05-09 | 69 | D | 4 |

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Table 2: Info summary for all the missions deployed after 2022-12-01 with an AROD RINKO sensor. The different basins mentioned in the ‘Location’ column, follow the division made by HELCOM which is shown in A.1 (Continued)

| | | | | | | |
|---------------|----|---|------------|----|---|---|
| | 64 | Bornholm Basin | 2023-09-06 | 39 | E | 4 |
| | 66 | Bornholm Basin | 2023-10-18 | 39 | E | 4 |
| | 68 | Åland Sea | 2023-12-14 | 67 | A | 1 |
| | 71 | Western Gotland Basin | 2024-02-06 | 39 | E | 4 |
| SEA063 | 55 | Bornholm Basin | 2023-03-01 | 71 | C | 3 |
| | 60 | Bornholm Basin | 2023-04-22 | 39 | D | 4 |
| | 62 | Bornholm Basin | 2023-07-08 | 50 | E | 4 |
| | 63 | Bornholm Basin | 2023-08-11 | 50 | E | 4 |
| | 65 | Bornholm Basin | 2023-09-27 | 50 | E | 4 |
| | 67 | Bornholm Basin | 2023-11-13 | 50 | E | 4 |
| | 69 | Bornholm Basin | 2023-12-15 | 69 | E | 4 |
| | 71 | Bornholm Basin | 2024-02-20 | 40 | A | 1 |
| SEA066 | 52 | Western Gotland Basin | 2023-11-18 | 67 | A | 1 |
| SEA067 | 41 | Bornholm Basin | 2023-04-04 | 39 | D | 4 |
| | 42 | Bornholm Basin | 2023-05-09 | 67 | D | 4 |
| | 44 | Bornholm Basin | 2023-06-18 | 58 | D | 4 |
| | 46 | Bornholm Basin | 2023-07-26 | 39 | E | 4 |
| | 51 | Bornholm Basin | 2023-11-29 | 39 | E | 4 |
| | 53 | Bornholm Basin | 2024-01-09 | 39 | E | 4 |
| SEA068 | 30 | Bornholm Basin | 2023-01-30 | 67 | A | 1 |
| SEA069 | 15 | Bornholm Basin | 2023-07-26 | 50 | E | 4 |
| | 17 | Skagerrak, Kattegat | 2023-10-10 | 68 | E | 4 |
| | 19 | Skagerrak, Kattegat | 2023-10-23 | 68 | E | 4 |
| | 21 | Skagerrak, Kattegat | 2023-11-17 | 66 | E | 4 |
| | 22 | Skagerrak, Kattegat | 2023-12-02 | 66 | E | 4 |
| | 23 | Skagerrak, Kattegat | 2023-12-27 | 66 | E | 4 |
| | 25 | Skagerrak, Kattegat | 2024-02-08 | 66 | E | 4 |
| SEA076 | 13 | Northern Baltic Proper, Eastern Gotland Basin | 2023-01-13 | 41 | C | 3 |
| | 16 | Eastern Gotland Basin, Northern Baltic Proper | 2023-04-11 | 66 | D | 4 |
| | 17 | Western Gotland Basin | 2023-06-20 | 66 | E | 4 |
| | 19 | Western Gotland Basin | 2023-09-06 | 41 | E | 4 |

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Table 2: Info summary for all the missions deployed after 2022-12-01 with an AROD RINKO sensor. The different basins mentioned in the ‘Location’ column, follow the division made by HELCOM which is shown in A.1 (Continued)

| | | | | | | |
|---------------|----|---|------------|----|---|---|
| | 21 | Åland Sea | 2023-11-17 | 70 | A | 1 |
| | 22 | Western Gotland Basin | 2024-01-07 | 70 | A | 1 |
| | 22 | Åland Sea | 2024-02-07 | 70 | A | 1 |
| SEA077 | 21 | Eastern Gotland Basin | 2023-03-16 | 66 | B | 4 |
| | 22 | Eastern Gotland Basin, Northern Baltic Proper | 2023-05-16 | 41 | D | 4 |
| | 24 | Eastern Gotland Basin, Northern Baltic Proper | 2023-07-28 | 69 | E | 4 |
| | 25 | Eastern Gotland Basin, Northern Baltic Proper | 2023-10-06 | 69 | E | 4 |
| | 28 | Eastern Gotland Basin, Northern Baltic Proper | 2023-12-06 | 40 | A | 1 |
| | 29 | Åland Sea | 2024-01-08 | 40 | A | 1 |
| SEA078 | 11 | Northern Baltic Proper, Eastern Gotland Basin | 2023-03-16 | 68 | B | 4 |
| | 12 | Eastern Gotland Basin | 2023-05-16 | 71 | D | 4 |
| | 14 | Western Gotland Basin | 2023-07-28 | 66 | E | 4 |
| | 15 | Western Gotland Basin | 2023-10-06 | 66 | E | 4 |
| | 19 | Western Gotland Basin | 2023-12-06 | 58 | A | 1 |
| | 22 | Northern Baltic Proper, Eastern Gotland Basin | 2024-02-06 | 69 | E | 4 |
| SEA079 | 9 | Northern Baltic Proper, Eastern Gotland Basin | 2023-02-14 | 69 | B | 4 |
| | 11 | Eastern Gotland Basin | 2023-04-11 | 68 | D | 4 |
| | 12 | Eastern Gotland Basin, Northern Baltic Proper | 2023-06-20 | 69 | E | 4 |
| | 14 | Eastern Gotland Basin, Northern Baltic Proper | 2023-09-06 | 71 | E | 4 |
| | 16 | Eastern Gotland Basin, Northern Baltic Proper | 2023-11-11 | 81 | A | 1 |
| | 18 | Eastern Gotland Basin, Northern Baltic Proper | 2024-01-07 | 81 | A | 1 |

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| Legend | | Flag |
|--------|--|------|
| A | Data is good | 1 |
| B | Deterioration of the foil has caused uncorrectable errors in the dissolved oxygen concentration. Values are observed to be substantially lower than the reference CTD cast at deployment. There is an apparent non-linear temporal increase in dissolved oxygen concentration throughout the mission. | 4 |
| C | Dissolved oxygen concentration values may be inaccurate. Deterioration of the foil has caused uncorrectable errors and non-linear temporal drift in other missions with this sensor during this timeframe. We have not observed issues in this particular mission, but we recommend caution when using this data. | 3 |
| D | The absolute values of the oxygen data can be unreliable. The relative variability is confirmed to be valid and no temporal drift exist has been observed. Absolute values may be inaccurate and lower than reference data. Re-calibration of the sensor is required. | 4 |
| E | Following issues with the oxygen sensor, a 2-point calibration has been performed (the exact date can be found in the mission metadata). This 2-point calibration has been applied to the data. The values at 0 and 100 % saturation are accurate. Absolute values between these two extremes may be inaccurate. The relative variability is confirmed to be valid and no temporal drift occurs. During tests, values outside the manufacturer acceptance range have been observed when compared to the output from a reference sensor. This issue is particularly evident around 100µmol/l. | 4 |

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2 Examples

Few example missions from the Gotland Basin are shown below (Figure 1). Oxygen saturation over depth is presented and data is colored by time (in days since deployment). Some missions exhibit an evident temporal drift (SEA079_M9; SEA077_M21; SEA078_M11) with saturation values increasing from around 50% to just below 100% in about 25 days.

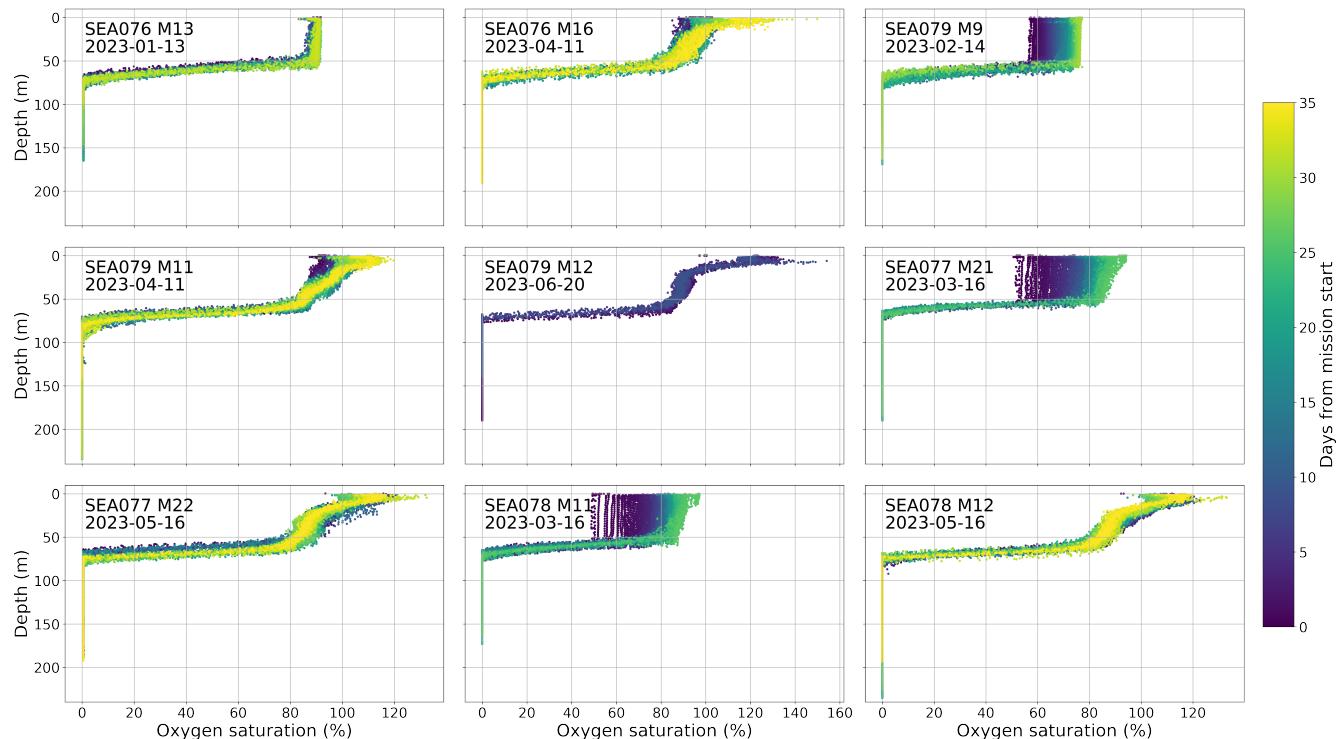


Figure 1: Oxygen saturation plotted over depth and colored by time (in days since deployment) for 9 missions in the Gotland Basin. Glider serial and mission number as well as the deployment date are noted on the top left of each subplot.

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A Appendix



Figure A.1: Map of the Baltic Sea showing the 17 sub-basins (Map taken from <http://stateofthebalticsea.helcom.fi/in-brief/our-baltic-sea/>)