Environment and Climate Change Canada | Environnement et Changement climatique Canada

# QA Summary of Surveillance Cruise 2013149-010-006

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# 1. Scope

This internal document describes the details on the QA assessment of shipboard seabird profiles, manual lab measurements, and bridge data collected in **Lake Winnipeg** on the **2013149-010-006 Research Consortium Cruise**. A total of **61** stations were visited that commenced on **2013-05-29** and ended on **2013-06-14.** The QA officer assessed the quality of the shipboard data and prepared it for the principle investigator on **2020-11-06**.

# 2. Terms and Definitions

| | |
|---|---|
| Cast | The act of collecting one depth-profile with a sonde onboard a research ship. |
| Cruise | A trip travelled through a body of water by ship where depth-profiles are collected at pre-arranged stations. Cruise Numbers have become more descriptive, based on the year and the first Julian Day of the cruise, the lake identifier, and the vessel identifier. For example, 2016130-010-006 indicates that on May 9, 2016, a Lake Winnipeg (lake 010) cruise was conducted onboard the Namao (vessel 006). |
| CSN | Consecutive Station Number |
| Depth-profile | A quantitative analysis of a section of a body of water representing distinctive water quality characteristics with respect to depth. |
| DO | Dissolved oxygen |
| Erroneous (data) | Data points that measure outside the expected instrumental range, or values considered globally impossible, which are typically observed as single spikes in the data |
| Headerline | Information in a data file located in the lines preceding the data columns. File, station, and instrument information (including calibration coefficients) are found here. |
| OIC | Officer In Charge |
| PSN | Permanent Station Number |
| QA | Quality Assurance |
| QAS | Quality Assurance Annual Summary |
| QAO | Quality Assurance Officer |
| Q'd file | Data file that has been assessed by a quality assurance officer. |

| | |
|---|---|
| RFUB | Relative Fluorescence Units blank subtracted. Units for chlorophyll are in these units in the processed data files, unless quantified concentrations are made available, in which they will be corrected. |
| SB (or SBE or WQP) | SeaBird Water Quality Profiler; four-channel profiling sonde. Raw output include .hex, .xmlcon, and .hdr for each profile. Processed "raw" file has a .cnv file extension. Fully processed and QC'd files that include the calibration coefficients for the optical sensors as well as the DO corrections have the extension .xls (4 Hz) and _DepthAvg.xls (depth-averaged in 0.5 m increments). Sensors include: depth (m), temperature (°C), specific conductance (µS/cm), dissolved oxygen (mg/l and %saturation), turbidity (NTU), chlorophyll (RFUB), and descent rate (m/s). The raw .cnv data files have the optical sensors (turbidity and chlorophyll) output in voltage, although the raw output file may state otherwise. The coefficients for the two optical sensors are input into the .xmlcon file for each SeaBird. The raw output .cnv files contain the calculated RFU values rather than the voltages. These calculated values are calibrated to best-approximated concentration units, if in-situ measurements are available. Surface PAR and underwater PAR data now available (uEm^-2s^-1). Underwater PAR data is not corrected to surface PAR. |
| Shipboard | Pertaining to activities performed and equipment used on board a research vessel. |
| Station | A pre-set location within a body of water classified with a unique number and identified by its GPS location. |
| Suspicious (data) | Data points that do not follow the expected trend (based on historical and statistical reasoning). However, this does not necessarily imply that the data is false. |
| WQA | Water Quality Assurance |
| WQAS | Water Quality QA Summary |

# 3. QA Assessment

### *3.1. Stations Analyzed*

**Table 3-1. Seabird profile stations assessed by QA**

| FILENAME | STATION |
|---|---|
| 2013149-010-006_2_006_01.mat | 2 |
| 2013149-010-006_3B_007_01.mat | 3B |
| 2013149-010-006_3C_008_01.mat | 3C |
| 2013149-010-006_5_010_01.mat | 5 |
| 2013149-010-006_6_010_01.mat | 6 |
| 2013149-010-006_7_012_01.mat | 7 |
| 2013149-010-006_9_048_01.mat | 9 |
| 2013149-010-006_10S_048_01.mat | 10S |
| 2013149-010-006_11_048_01.mat | 11 |
| 2013149-010-006_12B_015_01.mat | 12B |
| 2013149-010-006_13B_017_01.mat | 13B |
| 2013149-010-006_19_026_01.mat | 19 |
| 2013149-010-006_20_027_01.mat | 20 |
| 2013149-010-006_21_029_01.mat | 21 |
| 2013149-010-006_22_030_01.mat | 22 |
| 2013149-010-006_23B_031_01.mat | 23B |
| 2013149-010-006_23ES_039_01.mat | 23ES |
| 2013149-010-006_23S_039_01.mat | 23S |
| 2013149-010-006_26S_036_01.mat | 26S |
| 2013149-010-006_28_038_01.mat | 28 |
| 2013149-010-006_31_035_01.mat | 31 |
| 2013149-010-006_33_034_01.mat | 33 |
| 2013149-010-006_34S_033_01.mat | 34S |
| 2013149-010-006_36S_003_01.mat | 36S |
| 2013149-010-006_37S_003_01.mat | 37S |
| 2013149-010-006_39_040_01.mat | 39 |
| 2013149-010-006_41_042_01.mat | 41 |
| 2013149-010-006_43S_043_01.mat | 43S |
| 2013149-010-006_44S_016_01.mat | 44S |
| 2013149-010-006_45_044_01.mat | 45 |
| 2013149-010-006_46S_014_01.mat | 46S |
| 2013149-010-006_49S_014_01.mat | 49S |
| 2013149-010-006_53_021_01.mat | 53 |

| | |
|---|---|
| **2013149-010-006_54_020_01.mat** | **54** |
| **2013149-010-006_55_020_01.mat** | **55** |
| **2013149-010-006_56_020_01.mat** | **56** |
| **2013149-010-006_57B_002_01.mat** | **57B** |
| **2013149-010-006_58S_002_01.mat** | **58S** |
| **2013149-010-006_59_049_01.mat** | **59** |
| **2013149-010-006_60_002_01.mat** | **60** |
| **2013149-010-006_60B_004_01.mat** | **60B** |
| **2013149-010-006_60C_009_01.mat** | **60C** |
| **2013149-010-006_62_002_01.mat** | **62** |
| **2013149-010-006_64_045_01.mat** | **64** |
| **2013149-010-006_65S_046_01.mat** | **65S** |
| **2013149-010-006_68_047_01.mat** | **68** |
| **2013149-010-006_69_002_01.mat** | **69** |
| **2013149-010-006_W1_032_01.mat** | **W1** |
| **2013149-010-006_W2_037_01.mat** | **W2** |
| **2013149-010-006_W3 20S_028_01.mat** | **W3/20S** |
| **2013149-010-006_W4_041_01.mat** | **W4** |
| **2013149-010-006_W5_025_01.mat** | **W5** |
| **2013149-010-006_W6_024_01.mat** | **W6** |
| **2013149-010-006_W7_023_01.mat** | **W7** |
| **2013149-010-006_W8_019_01.mat** | **W8** |
| **2013149-010-006_W9_013_01.mat** | **W9** |
| **2013149-010-006_W10_001_01.mat** | **W10** |
| **2013149-010-006_W11_011_01.mat** | **W11** |
| **2013149-010-006_W12_005_01.mat** | **W12** |
| **2013149-010-006_W13 14_018_01.mat** | **W13/14** |
| **2013149-010-006_W14 16S_022_01.mat** | **W14/16S** |

### *3.2 Changes/Corrections/Comments*

**Seabird Profile information/flags:**

- Seabird 5116 was used for all profiles.
- The default SOC for SBE 5116 (0. 4092) was used for every profile. This calculation should be taken into consideration for further DO analyses. Detailed information on the calculation of new SOC values can be made available upon request.
- No NMEA latitude, longitude, or time available. GPS coordinates used instead.
- No system UTC available. System upload time converted to UTC used instead.
- Default coefficients for chlorophyll were used to process data.
    - Updated Chlorophyll Coefficients
    - <SerialNumber>2100476</SerialNumber>
    - <A0>0.00000000</A0>
    - <A1>1.00000000</A1>
    - <A2>0.00000000</A2>
    - <A3>0.00000000</A3>
- Filenames, PSN, latitudes, and longitudes were added or corrected in the files where necessary using the 2013 Namao Field Log.
- The latitude and longitude coordinates for PSN 26S were left blank. Coordinates from the 2013 Field log were used.
- PSN W12B was separated as no underwater PAR was present. Placed in folder labelled 'W12B No Underwater PAR'.
- Underwater PAR data is not corrected to surface PAR.
- PSNs containing non-alphanumeric characters were renamed for processing as follows:
    - *PSN W13/14 was renamed to PSN W13 14.*
    - *PSN W14/16S was renamed to PSN W14 16S.*
    - *PSN W3/20S was renamed to PSN W3 20S.*

# 4. Map of Stations

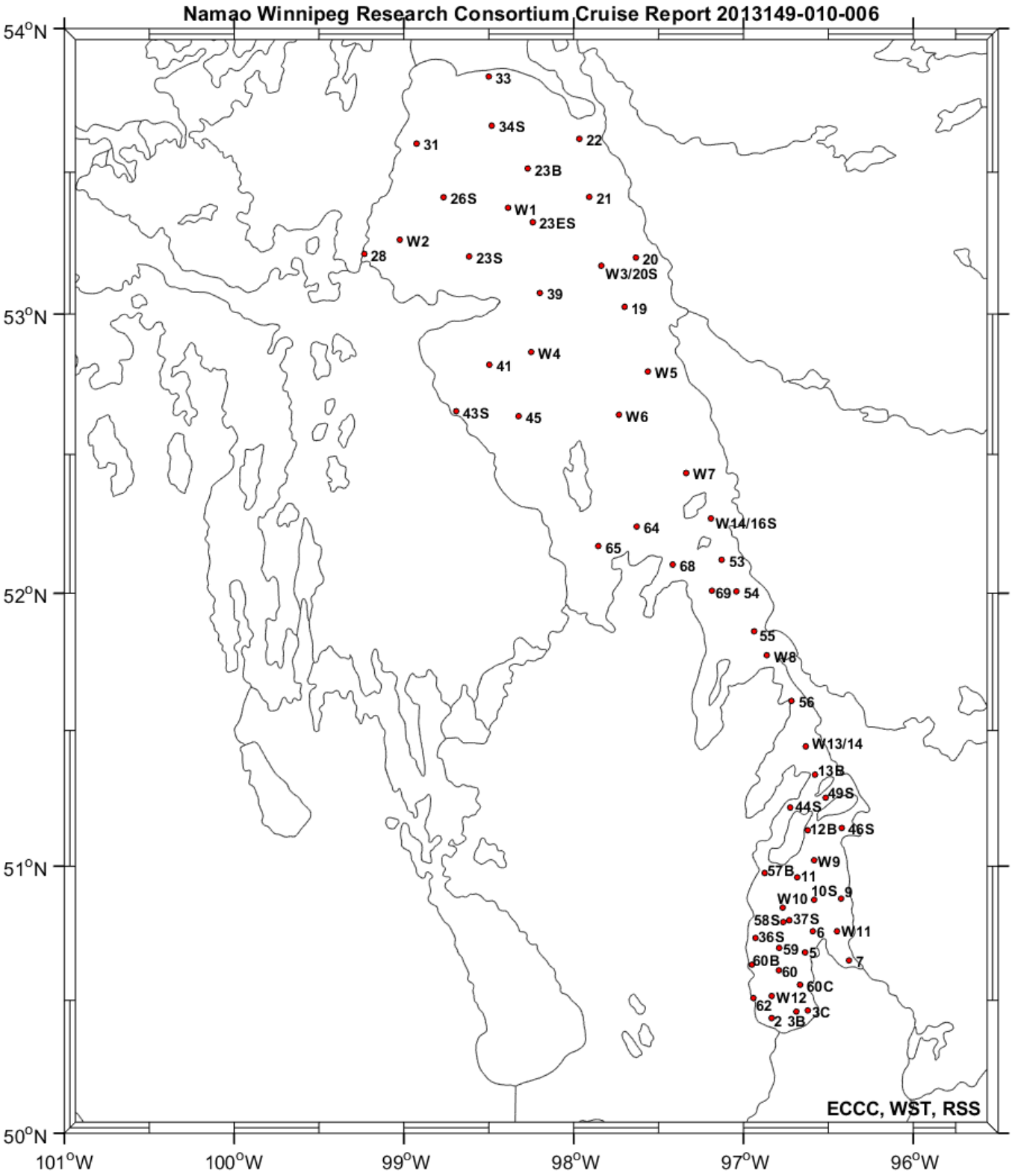


**Figure 4-1. Plot of SeaBird profile stations visited during the Namao Research Consortium Cruise 2013149-010-006.**

# 5. Corrective Action

The calibration coefficients for the four optical sensors (Turbidity and Chlorophyll) are in the SeaBird .xmlcon files, using the User Polynomial option.Table 5.1 below lists the voltages, and user polynomial identifiers for each parameter.

**Table 5-1. Informative list of the voltages associated with the optical parameters attached to the SeaBird 19+ SN. 5116.**

| Probe | A/D Voltage Channel in .xmlcon file | SeaSaveV2 Display | SBEDataProcessing – Win32 |
|---|---|---|---|
| Turbidity (T) | 3 | User Polynomial, 2 | Upoly 1, Turner Cyclops Turbidity (NTU) |
| Chlorophyll (C) | 1 | User Polynomial | Upoly 0, Turner Chlorophyll (RFU) |

Post-processing of the raw .hex files from the SeaBird are primarily done using the SBE Data Processing software (SeaBird Data Processing Version 7.23.2, SeaBird Electronics 2014). The following steps are taken:

1. Data Conversion – Parameters independent of temperature and those not requiring filtration and correction with rate of descent are collected here (Scan Count, Pressure (db), Temperature (°C), Conductivity (µS/cm), Oxygen raw (V), Turbidity (NTU), Chlorophyll (RFU), PAR/Irradiance.
2. Filter – Low pass filter A is set to 1 for pressure. Low pass filter B is set to 0.5 (for sampling at 2 Hz) for temperature and conductivity.
3. Align CTD – Advance values are set to 0.5 for Temperature, 0.1 for Conductivity and 4 for Oxygen, raw.
4. Loop Edit – Minimum speed is set to 0.01 m/s. Percent of Mean Speed is set to 10% with a window size of 300. Surface Soak is removed at a depth of 1m. Min/Max soak depths are 0.5 m and 2 m respectively.
5. Derive – Parameters dependent on temperature and influenced by the rate of decent are derived here (Depth (m), Specific Conductance (µS/cm), Oxygen (mg/l), Oxygen (%saturation).
6. Bin Average – Depth, interpolated is selected with a bin size of 0.5. The data flagged in the Loop Edit step are not used in the interpolation.

To correct the voltage readings from the Turner probes, MilliQ is used as a reference, in the dark, to “zero” the sensors and formazin at 126 NTU is used as the second standard for turbidity. These values are collected once at the start of the field season and are used to correct each optical sensor to RFUB units (and NTU for turbidity). At the end of the field season, a check will be done again to verify minimal drift in each sensor. Any necessary corrections will be made at that time, assuming linear drift.

The profiling protocol is to submerge the Seabird at 3m (to ensure the top of the plumbing is submerged) and hold for 400 scan counts. The Seabird is then brought up to approximately 1m or to the minimum depth where the Y-tubing is not exposed at the water surface. It is to be held there for 100 scan counts, and then profiled at 10% speed through the water column. Once the Seabird has completed its profile, it

is to be raised from the bottom for 20 scan counts. Recording can now be stopped and the Seabird brought back up to the surface. Dissolved oxygen check protocols and Seabird cleaning protocols have been made available onboard the Namao.

To avoid inadvertently repeating cruise numbers, or going out in the field without a pre-defined cruise number, an updated nomenclature will ensure duplicates are impossible and the number can be easily determined anytime of the year. See Research Support Cruise Numbers 2016 document for a list of lake and ship reference numbers.

YYYYJDN-LLL-SSS

YYYYJDN – Seven digit cruise start date

LLL – Three digit lake number

SSS – Three digit ship/small boat number

# 6. References

DePalma, S., 2010. Quality assurance procedures for shipboard depth-dependent profiled data. Document RS-10-002, Environment Canada, Canada Centre for Inland Waters, Burlington, ON.