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QA Summary of Surveillance Cruise 2012254-010-006

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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 **2012254 -010-006 Research Consortium Cruise**. A total of **61** stations were visited that commenced on **2012-07-10** and ended on **2012-10-10.** The QA officer assessed the quality of the shipboard data and prepared it for the principle investigator on **2020-12-21**.

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
2012254-010-006_2_060_01.mat	2
2012254-010-006_3B_059_01.mat	3B
2012254-010-006_3C_058_01.mat	3C
2012254-010-006_5_052_01.mat	5
2012254-010-006_6_051_01.mat	6
2012254-010-006_7_050_01.mat	7
2012254-10-006_9_048_01.mat	9
2012254-010-006_10S_047_01.mat	10S
2012254-010-006_11_005_01.mat	11
2012254-010-006_12B_008_01.mat	12B
2012254-010-006_13B_011_01.mat	13B
2012254-010-006_19_023_01.mat	19
2012254-010-006_20_025_01.mat	20
2012254-010-006_21_026_01.mat	21
2012254-010-006_22_033_01.mat	22
2012254-010-006_23B_032_01.mat	23B
2012254-010-006_23ES_030_01.mat	23ES
2012254-010-006_23S_054_01.mat	23S
2012254-010-006_26S_036_01.mat	26S
2012254-010-006_28_028_01.mat	28
2012254-010-006_31_035_01.mat	31
2012254-010-006_33_037_01.mat	33
2012254-010-006_34S_034_01.mat	34S
2012254-010-006_36S_057_01.mat	36S
2012254-010-006_37S_054_01.mat	37S
2012254-010-006_39_038_01.mat	39
2012254-010-006_41_040_01.mat	41
2012254-010-006_43S_041_01.mat	43S
2012254-010-006_44S_010_01.mat	44S
2012254-010-006_45_042_01.mat	45
2012254-010-006_46S_007_01.mat	46S
2012254-010-006_49S_009_01.mat	49S
2012254-010-006_53_018_01.mat	53

2012254-010-006_54_016_01.mat	**54**
2012254-010-006_55_015_01.mat	**55**
2012254-010-006_56_013_01.mat	**56**
2012254-010-006_57B_055_01.mat	**57B**
2012254-010-006_58S_056_01.mat	**58S**
2012254-010-006_59_004_01.mat	**59**
2012254-010-006_60_003_01.mat	**60**
2012254-010-006_60B_001_01.mat	**60B**
2012254-010-006_60C_053_01.mat	**60C**
2012254-010-006_62_061_01.mat	**62**
2012254-010-006_64_043_01.mat	**64**
2012254-010-006_65_044_01.mat	**65**
2012254-010-006_68_045_01.mat	**68**
2012254-010-006_69_017_01.mat	**69**
2012254-010-006_W1_031_01.mat	**W1**
2012254-010-006_W2_027_01.mat	**W2**
2012254-010-006_W3 20S_024_01.mat	**W3/20S**
2012254-010-006_W4 42S_039_01.mat	**W4/42S**
2012254-010-006_W5 18_022_01.mat	**W5**
2012254-010-006_W6 48_021_01.mat	**W6**
2012254-010-006_W7 50S_020_01.mat	**W7/50S**
2012254-010-006_W8 15_014_01.mat	**W8/15**
2012254-010-006_W9 10A_006_01.mat	**W9/10A**
2012254-010-006_W10 57_046_01.mat	**W10/57**
2012254-010-006_W11 8_049_01.mat	**W11/8**
2012254-010-006_W12_002_01.mat	**W12**
2012254-010-006_W13 14_012_01.mat	**W13/14**
2012254-010-006_W14 16S_019_01.mat	**W14/16S**

3.2 Changes/Corrections/Comments

Seabird Profile information/flags:

- Seabird 5116 was used for all profiles. The Seabird DO Sensor was changed from S/N: 430782 to S/N:431643 on September 22, 2012 at 11:20. The default SOC for SBE 5116 (0. 4768) was used for S/N 0782 before the change date. The default SOC for SBE 5116 (0. 3981) was used for S/N 1643 after the change date. 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 2012 Namao Field Log.
- PSN W12 latitude was corrected using the field log.
- Additional profiles were processed and added to folder titled ‘Greg-North shore 2’.
- Underwater PAR data is not corrected to surface PAR.
- PSNs containing non-alphanumeric characters were renamed for processing as follows:
    - *PSN W3/20S was renamed to PSN W3 20S.*
    - *PSN W4/42S was renamed to PSN W4 42S.*
    - *PSN W5/18 was renamed to PSN W5 18.*
    - *PSN W6/48 was renamed to PSN W6 48.*
    - *PSN W7/50S was renamed to PSN W7 50S.*
    - *PSN W8/15 was renamed to PSN W8 15.*
    - *PSN W9/10A was renamed to W9 10A.*
    - *PSN W10/57 was renamed to W10 57.*
    - *PSN W11/8 was renamed to W11 8.*
    - *PSN W13/14 was renamed to W13 14.*
    - *PSN W14 & 16S was renamed to W14 16S.*

4. Map of Stations

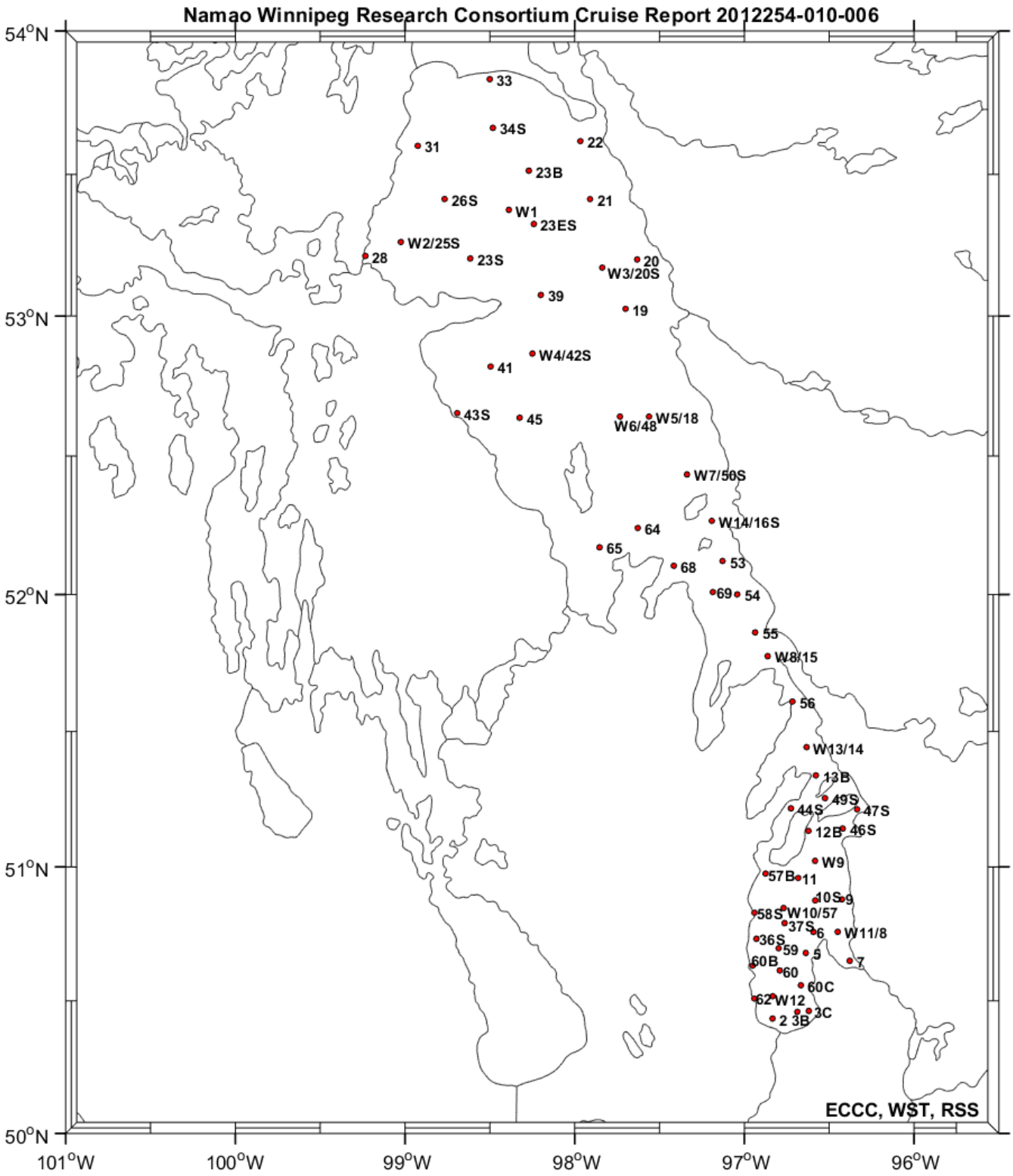

Figure 4-1. Plot of SeaBird profile stations visited during the Namao Research Consortium Cruise 2012254-010-006.

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.