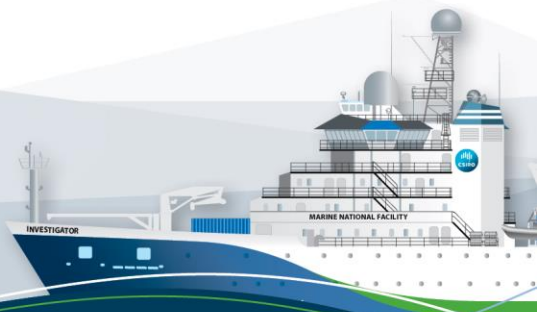
# RV *INVESTIGATOR*

# HYDROCHEMISTRY DATA PROCESSING REPORT

| | |
|---|---|
| **Voyage:** | in2019_t03 |
| **Chief Scientist** | Dr Alain Protat |
| **Voyage title:** | ORCA: Using the Investigator radar as a moving reference for the Australian operational radar network. |
| **Report compiled by:** | Peter Hughes |



# Contents

# 1 Executive Summary

This voyage was a transit from Darwin to Fremantle. There were three projects carried out along the way. Titles and custodians of these projects are listed here.

1. ORCA: Using the Investigator radar as a moving reference for the Australian operational radar network. (Primary). Dr. Alain Protat.
2. Microplastic in the food chain: impact on the microbial and planktonic organisms. Dr Sophie Leterme.
3. Spatial and temporal variability in the distribution and abundance of seabirds. Dr Eric Woehler.

There were no Hydrochemistry staff on this voyage. The TSG salinity samples were collected by the DAP staff and stowed in the underway lab. These samples were measured by Peter Hughes (hydrochemistry) during the port period at the end of this voyage.

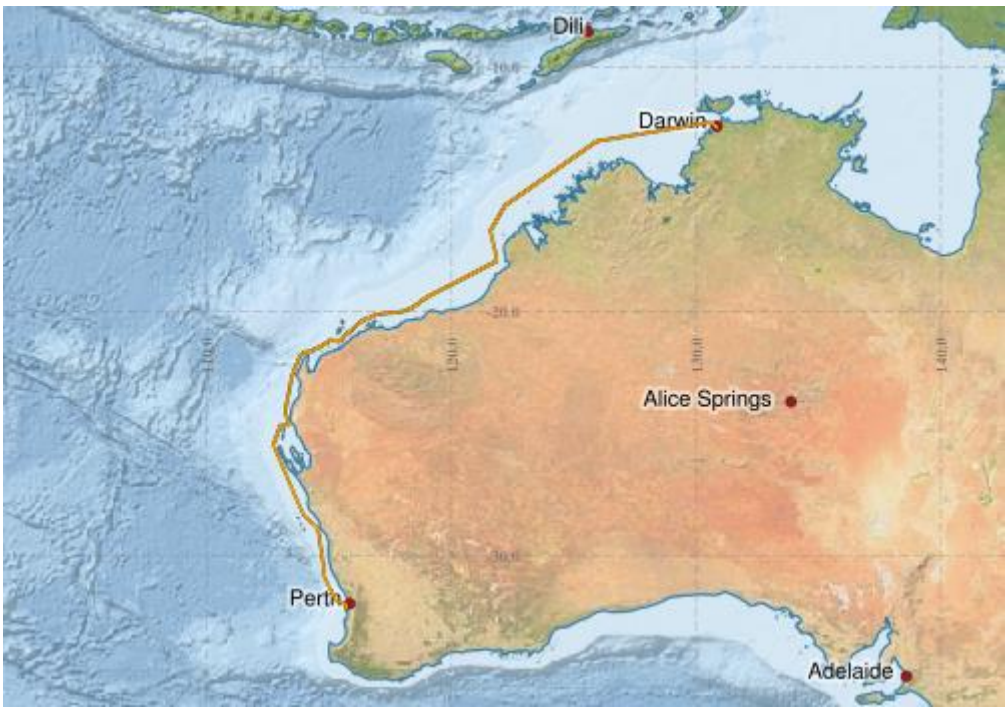
Final hydrology data, analytical methods, and related log sheets and processing notes can be obtained from the CSIRO data centre.

Contact: DataLibrariansOAMNF@csiro.au

# 2 Itinerary

Darwin to Henderson, December 21st (2019) – January 2nd

Voyage Track:



# 3 Key personnel list

| Name | Role | Organisation |
|---|---|---|
| **Alain Protat** | Chief Scientist | BOM |
| **Matt Boyd** | Voyage Manager | CSIRO |
| **Peter Hughes** | Hydrochemist | CSIRO |

# 4 Summary

## 4.1 Sample Type and Number Assayed

| Analysis (instrument) | Number of Samples |
|---|---|
| Salinity (Guildline Salinometer) | 9 TSG |
| Dissolved Oxygen (SIO automated titration) | Not Collected |
| Nutrients (Seal AA3HR segmented flow) | Not Collected |

### 4.1.1 TSG (Thermosalinograph)

- Clean Scientific Seawater supply downstream from Thermosalinograph (TSG) Instrument in underway lab sampled by DAP staff. Sample salinity data used for the calibration of the TSG instrument.
- For TSG sample meta-data, refer to the TSG eLog from the voyage.

## 4.2 Data Processing Overview

The sample meta-data, measured bottle salinity results, dissolved oxygen assay results and the nutrient assay raw data are processed by the CSIRO program HyPro. The final output is the hydrology data set. An overview of this process is illustrated in figure 1.

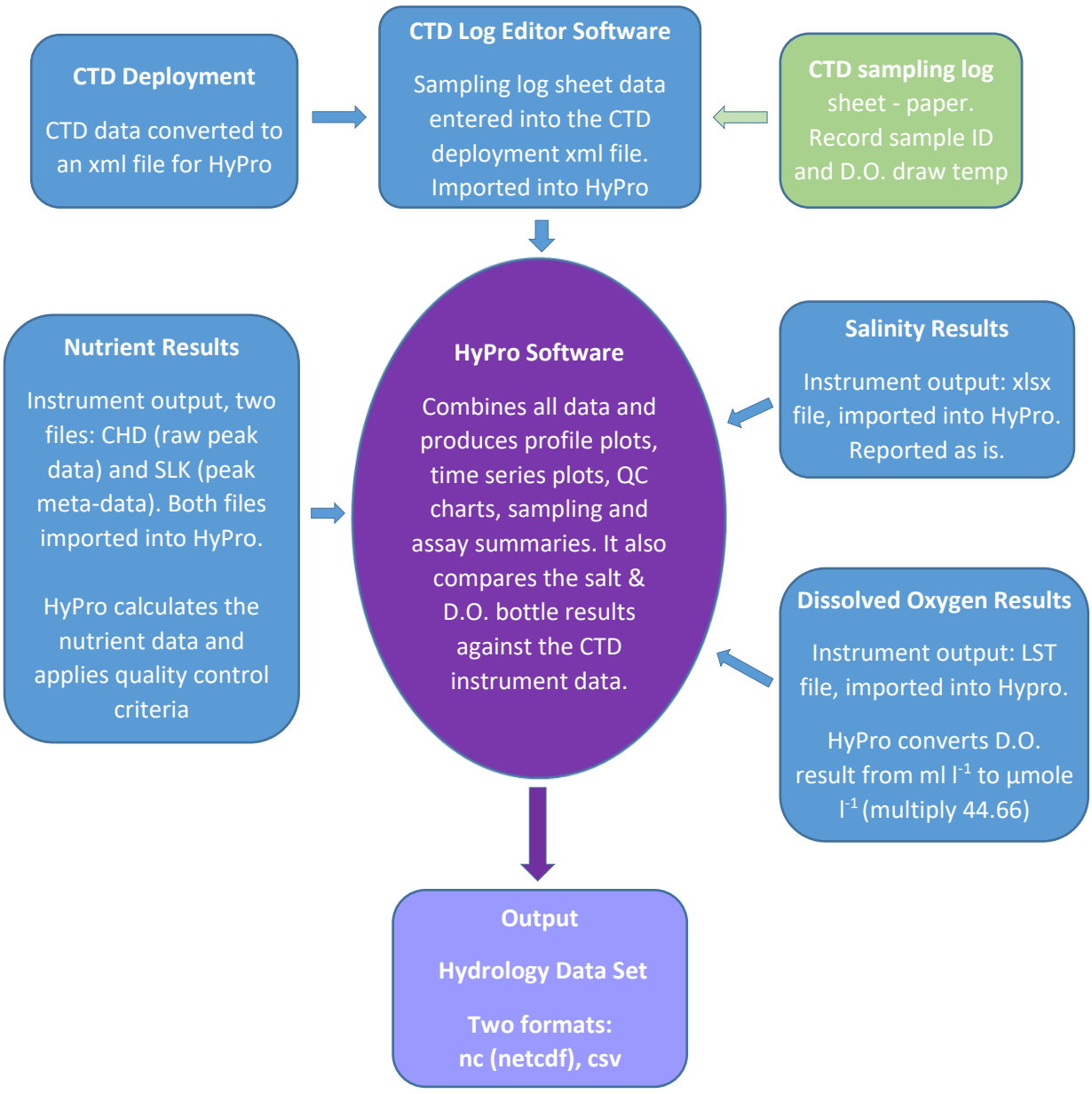



**Figure 1: Hydrology Data Processing Flow Diagram.**

# 5 Salinity Data Processing

## 5.1 Salinity Parameter Summary

| Details | |
|---|---|
| **HyPro Version** | 5.7 |
| **Instrument** | Guildline Autosal Laboratory Salinometer 8400(B) – SN 72151 |
| **Software** | Ocean Scientific International Ltd (OSIL) Data Logger ver 1.2 |
| **CSIRO Hydrochem Method.** | Sampling: WI_Sal_004<br>Measurement: SOP006 |
| **Accuracy** | ± 0.001 practical salinity units |
| **Analysts** | Peter Hughes |
| **Lab Temperature (±0.5°C)** | 21°C during analysis. |
| **Bath Temperature** | 24.01°C |
| **Reference Material** | OSIL IAPSO[1] - Batch P162, use by 16/04/2021, $K_{15}$ = 0.99983 |
| **Sampling Container type** | 200 ml volume OSIL standard seawater bottles made of type II glass (clear) with crimp seal. |
| **Sample Storage** | Samples stored in underway lab during voyage. Transferred to Salt lab for a minimum of 4 hrs before measurement. |
| **Comments** | Samples collected by DAP staff. |

## 5.2 Salinity Method

Salinity samples are measured on a Guildline Autosal 8400B salinometer.

Practical salinity (S), is defined in terms of the ratio ($K_{15}$) of the electrical conductivity measured at 15°C 1atm of seawater to that of a potassium chloride (KCl) solution of mass fraction 32.4356 x $10^{-3}$.

Before each batch of sample measurements, the Autosal is calibrated with standard seawater (OSIL, IAPSO[1] ) of known $K_{15}$ ratio. A new bottle of OSIL solution is used for each calibration. The frequency of calibration is one per set of 36 or fewer samples.

Method synopsis: Triplicate salinity samples are collected into 200ml OSIL standard seawater bottles, filled from the bottom, via a polytetrafluoroethylene (PTFE) straw, till overflowing. Note, the bottles are rinsed with the sample prior to filling. The bottle is removed from the straw and the sample is decanted to allow a headspace of approximately 25$cm^3$. A designated rubber insert is fitted then crimped to seal the bottle. The crimped bottled is stored upright in an opaque box until measured. To measure, the Autosal cell is flushed three times with the sample and then measured after the fourth and fifth flush. The OSIL data logger software captures the conductivity ratio and calculates the practical salinity.

The output from the data logger software is imported into HyPro. The measured data is exported without change from the original measurement.

[1] International Association for the Physical Sciences of the Oceans

### 5.5 Missing or Suspect Salinity Data

Data is flagged based on notes from CTD sampling log sheet, and observations during analysis.

No missing or suspect data for this voyage.

# 6 Appendix

## 6.1 Salinity: Reference Material Used

| OSIL IAPSO Standard Seawater | |
|---|---|
| **Batch** | P162 |
| **Use by date** | 16/04/2021 |
| **$K_{15}$** | 0.99983 |
| **PSU** | 35.993 |

## 6.2 Flag Key for Hydrology Data Set

| Flag | Description |
|---|---|
| **0** | Data is GOOD. |
| **133** | Data is bad. Flagged by operator. |
| **141** | No data. Only used in the netcdf result file (*.nc). |
| **192** | Raw Data. Not processed. |

## 6.3 GO-SHIP Specifications

### 6.3.1 Salinity

Accuracy of 0.001 is possible with Autosal™ salinometers and concomitant attention to methodology. Accuracy with respect to one particular batch of Standard Sea Water can be achieved at better than 0.001 PSS-78. Autosal precision is better than 0.001 PSS-78. A precision of approximately 0.0002 PSS-78 is possible following the methods of Kawano with great care and experience. Air temperature stability of ± 1°C is very important and should be recorded[1].

### 6.3.2 Notes

[1] Keeping constant temperature in the room where salinities are determined greatly increases their quality. Also, room temperature during the salinity measurement should be noted for later interpretation, if queries occur. Additionally, monitoring and recording the bath temperature is also recommended. The frequent use of IAPSO Standard Seawater is endorsed. To avoid the changes that occur in Standard Seawater, the use of the most recent batch is recommended. The bottles should also be used in an interleaving fashion as a consistency check within a batch and between batches.

# 7 References

Armishaw, P. (2003) "*Estimating measurement uncertainty in an afternoon. A case study in the practical application of measurement uncertainty*." Accred Qual Assur, 8: pp. 218-224