### Salinity

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#### Sampling

Salinity samples were collected from selected Niskins on rosette casts. Water samples were collected from Niskin bottles immediately following a rosette cast, after the gases and other sensitive samples have been collected. Salinity bottles used a two cap system, an insert cap followed by a screw on cap. Salinity bottles and insert caps were rinsed 3 times with sample water before filling. Samples were transferred to the temperature controlled room for storage until they were analyzed onboard. Salinity samples were also occasionally collected from the underway loop system for system calibration.

#### Analysis

All analysis was performed on shore at IOS. No analysis done at sea.

Samples were analyzed onboard, within 1 week of collection, on the Guildline Autosalinometer Model 8400B (S/N: 69086) by Hugh Maclean(DFO-IOS) and Mike dempsey (DFO-IOS). Procedure followed methods as outlined in the standard IOS protocol. Room and sample temperature was maintained consistently between 21°C and 24°C as much as was possible. Fluctuations in temperature caused minor problems in maintaining a stable standby number. An order placement system was established within the room whereby salinity cases were cycled in order to establish a constant sample temperature. This system ensured two things: 1) the analyst knew which case to begin analysis and location of each subsequent case, and 2) each case was held at a stable temperature for an extended period of time before analysis. Bottles were inverted and mixed prior to analysis.

IAPSO Standard Seawater (OSIL, batch P156, expiry 23 July,2016, salinity 34.993 PSU) was measured typically before the beginning of a significant run (3 or more cases) to calibrate the AutoSal and identify instrument drift or if the standby number changed by more than 2 units, however on this cruise the stability of the standby number changed by up to 2 units due to temperature fluctuations in the lab If the standard value obtained was within ±0.0001 of the standard K15 value on the bottle, the value was accepted. If the value was greater, the cell was flushed and another reading was taken. If it was still unable to get within the range then the standardize knob was used to bring it within range. A “Deepwater standard” (see below) was run at the end of each sample case (24 samples). Data are reported in practical salinity units (PSU; Lewis & Perkin 1978). See Table 1 for salinity precision values.

A reference “Deepwater standard” composed of deep seawater was run periodically during salinity sample analyzing. These were collected on the LSSL 2017-11 cruise.

Ten litres were collected each time into a collapsible plastic carboy and mixed thoroughly. The sea water was then decanted into regular sampling bottles. Two cases from each of these stations were put aside to run the Deep Water standards after each case of samples were run. See Table 2 for Deep Water Reference values.

#### Issues with Salinometer

There were no issues with the Water Properties Autosalinometer #68572 during analyzing.

#### Precision and Accuracy

Table 1 Water Sample Precision

The L.o.D. represent the Limit of Detection, the *sp* represent the pooled standard deviation of duplicates for precision. The accuracy is calculated by comparing the mean of our Arctic Ocean DWR samples to the constant, expected value for these samples (see Table 2).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Chemistry Sample** | **Units** | **Minimum Range** | **Maximum Range** | **L.O.D** | **Precision (*s*p)** | **Number of Replicates (*n*)** | **Outliers removed** | **Accuracy (% Recovery)** |
| Salinity (all samples, all depths) | psu | |  | | --- | | 22.8362 | |  | | 34.8830 | N/A | 0.0012 | 24 | 1 |  |
| Salinity (all, > 500db) | n/a | n/a | n/a | n/a | n/a |

**Table 2. Salinity Deepwater reference values for precision**

The %RSD represent the percent relative Standard Deviation (SD) to the mean, and indicates the day to day variability (precision).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | **Mean (psu)** | **% RSD** | **Expected Arctic Ocean Deep Water salinity (± SD)** | **n** |
|  |  |  |  |  |
|  |  |  |  |

The precision of our analyses was determined as the pooled standard deviation (*sp*) of duplicate samples as well as the percent relative standard deviation (%RSD) of deep water reference samples collected (Table 1 and 2, respectively). Both precision value are excellent and within the expected variability of the instrument which is accuracy of < +/- 0.0001 conductivity ratio and resolution <0.00001 conductivity ratio.

The accuracy was determined by comparing the mean measured values for our Arctic Ocean Deep Water reference samples to the constant expected values (% accuracy). Arctic Ocean Deep Water is known to be constant over the years (need references), and thus we calculated the mean value of the DWR collected from JOIS XXXX to XXXX and used it as a surrogate for a certified reference material (CRM) to calculate accuracy.

#### Issues with Salinometer

Report of issues/problems/observations HERE, including sampling, equipment, analysis issues

1. DUS08 and DUS07 have overlapping sample numbers from 416 through to 426. Requires further investigation.
2. Samples 1 to 452 were collected in 200 mL type II glass bottles with a NEW disposable plastic insert and screw cap.
3. A different 120ml bottle and cap/cone type inserts were used for samples from 453 to 588.
4. The samples had no salt on rims indicating no leaking after collection and 4 month storage -this is a good thing!!
5. Flushed samples 4 times when transitioning from a shallow to deep. Last bottle of station to first bottle of next station.
6. All DWR samples were flushed 4 times prior to taking a reading.
7. Calculated Standard pool of the mean (Sp): 0.0012 using 24 replicates
8. all Autosal Analysis Logsheets were scanned to PDF and Archived on the Arctic Drive: *N:\SHARE\DATA\2017\2017-20\_Frosti\Data\Salinity Data*
9. all Autosal Analysis Logsheets papers are archived in 2017 archive filing cabinet room 1246
10. The Autosal Standby value remained very stable.

Autosal accuracy for electronics is < 0.002 PSU equivalents

The electronics of the Autosal 8400B drifted within the manufactures spec's during analysing

A calibration was done before analysing started on each day

correction values were within manufactures spec's

because no adjustments were needed the Rs value 6.42 and the Standby value read 24+6094 remained the same after each calibration

#### References