**REVISION NOTICE TABLE**

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| **DATE** | **DESCRIPTION OF REVISION** |
| 12-Feb-2025 | Corrected channel name for chlorophyll flag in CHE files. CHE files renamed as BOT since sampling done from hydro wire. G.G. |
| 07-Oct-2017 | Change channel name from Flag:Phaeophytin to Flag:Phaeo-Pigment:Extracted to be consistent with every other cruise. R.H. |
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**PROCESSING NOTES**

Cruise: 9736

Agency: IOS

Project: Red Tide

Chief Scientist: Rod Forbes

Platform: Revisor

Date: 13 August 1997 – 19 August 1997

Processed by: Germaine Gatien

Date of Processing : 12 January 2004 – 22 January 2004

Number of original CTD casts: 65

Number of casts processed: 65

**INSTRUMENT SUMMARY**

A SeaBird Model SBE 19 SEACAT CTD (S/N#197957 - 1294) was used with transmissometer (S/N 136) attached.

**SUMMARY OF QUALITY AND CONCERNS**

The data is of good quality and required only slight editing.

The bottle data was confused. Typical of “old” data there were several versions of the bottle analyses available. For chlorophyll and phaeophytin the values differed from one source to another. Depth was wrongly identified as pressure in some files. Some files were numbered sequentially rather than by event number as recorded on the log sheets. The depth of sampling was based on estimates during the cruise and was occasionally significantly different from the evidence of the CTD data. Most of these contradictions were resolved, but some uncertainty remains about depths of samples.

SeaCat salinity is prone to error due to mismatch of conductivity and temperature response times. These errors are likely to be larger than the calibration errors. The descent rate was generally lower than that recommended by SeaBird. Salinity should be considered +/-0.05psu in areas of high gradient and +/-0.01psu elsewhere.

There are comments in the SeaBird header section for many of the casts indicating very specific locations relative to local features such as fish pens. Separate casts were used for many of the bottles in the top 50m and one of the deep bottles. Steve Romaine has records which contain details on sampling. Linda White has details on nutrient, chlorophyll and salinity sampling.

**PROCESSING SUMMARY**

**1**. **Seasave** - This step was completed at sea; the raw data files are \*.hex.

**2. Preliminary Steps**

CTD/Rosette sampler log sheets were obtained. There is no list of equipment or personnel.

Nutrient files were available.

The times in the log are in PDT.

Salinity data was obtained from Linda White.

The cruise summary sheet was completed.

1. **Conversion of Raw Data**

The raw data was converted using conversion file 9736.con. Two voltage channels were converted to see if they contained anything useful. One looks exactly like the transmissivity channel and the other contains no useful signal.

The calibrations for temperature, conductivity and pressure in con file 9743.con are believed to be from a calibration done on 12 February 1993. The details from that calibration were not available, so no checks could be made. There was a post-cruise calibration done April 29, 1998 which was used to prepare file 1294-apr98.con. The report from 1998 shows that C and T increased by ~0.0025s/m and ~0.002Cº between the 2 calibrations, for T and C values in the range expected for this data set. Tests were done converting files using 9736.con and 1294-apr98.con and comparing the output. The differences are dependent on temperature and conductivity. For the values found during this cruise there was a drift in temperature of from ~0.0005Cº near the surface to ~0.0017Cº from 100m downwards. The salinity increased by from 0.01psu to 0.022psu. If we select drift values of +0.0014Cº for temperature and +0.002psu for salinity we can expect errors to be ±0.0003Cº and ±0.003psu below 10m. Given the precision of the SeaCat these are acceptable errors. (See 9736-cal-study-cast24.xls and 9736-cal-study-cast38.xls.)

If the drift was steady between calibrations we would expect that using the calibrations of 1993 would result in temperature too low by ~0.0012Cº and ~0.016psu in August 1997. Alternately, using the 1998 calibrations we would expect temperature to be too high by ~0.0002Cº and salinity too high by ~0.003psu. Using the later calibrations should lead to smaller errors than using the 93 data.

The data was reconverted using the 1998 calibrations. If we based our correction on the calibration information we would subtract 0.0002Cº and 0.003psu from T and S respectively. However, this accounts for errors in the CTD at rest only. SeaCat data has errors due to the poor time-response with salinities overshooting when the temperature gradient is large; while these errors occur in both directions, there is likely a net effect. Since the temperatures are going down with depth, the salinity is probably, on average, a little high. Editing will remove some of this error. There is salinity bottle data that will be studied that can help determine how serious this effect is.

1. **FILTER**

The conductivity was low-pass filtered with a time constant of 0.5 seconds to force it to have the same response as the temperature. The pressure was filtered with a time constant of 2 seconds to increase the pressure resolution.

**5. ALIGNCTD**

This step will be done after conversion to IOS SHELL format.

**6. DERIVE**

Program DERIVE was run to calculate salinity.

There were no hemispheres indicated in the latitude and longitude. These were added.

**7. Conversion to IOS Headers**

The IOSSHELL routine for Sea Bird ASCII files (911+) was used to convert the SEA-Bird data to IOS Headers.

**8. Checking Headers**

A header check was run and suggests the speeds look too high around cast #24.

A header summary was produced and a few errors found. There was a disagreement between the log notes and the header as to times and positions for a few casts. The log notes were used to edit the headers, but time differences of 10 minutes or less were not changed. In one case UTC time was entered, but for all other casts PDT was used. The one UTC time was changed to PDT and the whole set will be changed to UTC later. To check that the times really are in PDT work hours were studied and all operations occur between 6am and 8pm as would be expected with near shore work on a small ship in summer.

The header check was rerun and looked ok.

A rough check was made of surface pressure by examining a few casts. The pressures look roughly correct, within 0.5db. No adjustment is necessary.

The cruise track was plotted and looks reasonable.

**9. Test plots**

File #18 contains two full casts. The first is better than the second so no special editing is required.

The transmissivity had sections of data with 0 values. These generally occurred at the bottom or near the top. The other data has occasional spikes but otherwise look ok.

**10. SHIFT**

The alignment of T and C was studied by applying shifts of 0.8, 1.0, 1.2 and 1.4 records to the temperature channel relative to pressure. The results were examined in T-S space to see which produced the least instabilities without oversmoothing. In general, +1.4 records (0.7s) proved the best choice, so this was applied to all casts.

**11. FIX TIME**

The ADD TIME CHANNEL routine was used to advance the time by +7 hours to change from PDT to UTC.

**12. DELETE**

The following DELETE parameters were used:

 Surface Record Removal: Last Press Min and Low Salt

 Maximum Surface Pressure (relative): 10.00

 Surface Swell Pressure Tolerance: .50

 Remove surface records with salinity less than 2

 Pressure filtered over width: 5

 Swells deleted. Warning message if pressure difference of 2.00

 The low drop rate feature was not applied since the descent rate was steady but low.

 Sample interval = .5 seconds.

The only warnings pertain to the repeat section in cast #18

**13. CTDEDIT**

Page plots were produced and were examined for spikes and instabilities to guide the use of CTDEDIT.

CTDEDIT was used to remove records corrupted by shed wakes and to clean salinity. All casts required some editing, except #42.

Note was made of the editing details in the relevant files.

**14. BOTTLE DATA and COMPARE**

A spreadsheet with salinity bottle data provided by Linda White was converted to SAL files. There is some uncertainty about the depths from which the samples were gathered. For some casts the deck sheets and salinity analysis sheets indicate a depth greater than any sampled by the CTD. Descent rates were examined to determine where the CTD was stopped. This information was compared with notes in the logs and a “best guess” was made for sample depth. See 9736\_bottle\_depth analysis.xls for the details. The salinity analysis file was edited to reflect these choices and the data converted to SAL files. The edited downcast CTD files were put through DERIVED QUANTITIES to calculate depth and were then bin-averaged in 1m bins. COMPARE was run using SAL and the averaged files with depth as the reference channel. When differences >0.3 were excluded a fairly flat trend line was found and the average of the points in the fit indicated that the CTD salinity was high by 0.009psu. Outliers were investigated, but none were obviously due to an error in choosing the depth for the bottles.

There is nutrient, chlorophyll and phaeophytin data available, but there were some problems with the data

* The NUC files were numbered consecutively, but nutrients were not taken at all casts. So the first job was to determine which Log Sheet event number corresponded to each NUC file. The information in the logs and maximum sampling in the CTD and NUC files were compiled in a chart to determine the correspondence. A check on this was provided by a list of chlorophyll sampling using the event numbers from the log sheets (9736-chl-sal-LindaWhite.xls); it is consistent with the match determined.
* There was chlorophyll and phaeophytin data in 3 separate files and the numbers differ for the same sample. Linda White investigated this and found that the values in file (9736-chl-sal-LindaWhite.xls) had an error. The values in the NUC files are ok. They agree with the values in file 9736chl-MEL.xls.

To merge the NUC files with the SAL files required a number of steps:

* The NUC files were copied to NUT files and then renamed with the proper event numbers.
* The pressures of the bottom bottles were changed for those casts with salinity sampling, so that they match the values determined in doing the salinity analysis. This was not done for other sampling, since in many cases the shallow bottles came from a separate cast run immediately after the CTD cast, so the information is not available to judge the depth of sampling. And the depth is not as critical for the other sampling, given there is no possibility of matching them against the CTD.
* ADD CHANNEL was run to add flag channels for all the nutrients and chl and phaeop. At the same time the pressure channel in the NUT files was changed to DEPTH since these really are depths, not pressure.
* The NUT and SAL files were then merged on DEPTH (Output:MRG). There were two SAL files for which there was no corresponding NUT file, so they were copied to MRG.
* A set of CTD files was prepared. First depth was calculated using DERIVED QUANTITIES (CTDDQT), then the files were cleaned to remove SeaBird headers and thinned on depth to the same levels as in the MRG files. The output was CTDTHN.
* Finally those CTDTHN files were merged with the MRG files to add headers and T and S.
* Flags were set as follows based on comments by Linda White which are in the headers:

 Flag:Nitrate\_plus\_nitrite –all set to “d”

Flag:Silicate – set to “c” for deep bottles of cast 13,16 and “d” for all bottles of casts #29, #30, #43, #56, #58, #60

Flag:Phosphate – set to “c” for deep bottles of cast 13, 16

**15. Other Intercomparisons**

Repeat casts – There were a number of casts that were very close together. Casts 51 and 52 were the closest pair. The differences in salinity are <0.01psu along γ-lines around 40db but is up to 0.03 at 100db. The temperature varies by up to 0.1Cº. This is probably as much as can be expected from the SeaCat.

Historic ranges – There was no appropriate historic data available.

**16. Recalibration**

The comparison with bottles shows that the CTD salinity is high by about 0.009. The calibration history suggests it should be high by about 0.003psu. The difference between these two may reflect a systematic error due to poor matching of conductivity and temperature.

All casts were recalibrated (using file 9736-recal.ccf) by subtracting 0.009psu from the salinity channel.

COMPARE was rerun using the recalibrated data and the results show the corrections reduced the average differences between bottles and CTD to +0.0001psu.

**17. BIN AVERAGE**

The following Bin Average values were used:

Bin channel = pressure

Averaging interval = 1.000 Minimum bin value = .000

Average value will be used

Interpolated values are NOT used for empty bins

**17. Final Plots**

Page plots were prepared using the edited data.

**18. REMOVE and HEAD EDIT**

The following channels were removed from all CTD casts: Scan\_Number, Conductivity, Descent Rate and Flag.

HEAD EDIT was run on the CTD files to fix formats and channel names and to add the comment in file 9736header.txt. The final files were named CTD.

HEAD EDIT was also run on the bottle files to fix formats and channel names and to add the comment in file 9736header-bot.txt. The final files were named CHE.

Standards Check was run and no problems found.

**19. Producing final files**

a.) The final files were renamed \*.ctd.

b.) A cross-reference listing was produced.

c.) The sensor history file was updated.

**Particulars**

1. Salinity bottle taken during separate cast from CTD

**March 2025 – CHE files renamed as BOT since samples were collected on a wire.**

**Institute of Ocean Sciences**

**CRUISE SUMMARY**

Cruise ID#: 9736

Dates: Start: 13 August 1997 End: 19 August 1997

Location: B.C. Mainland Inlets

Vessel: REVISOR

Chief Scientist: Rod Forbes

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| --- | --- | --- | --- | --- | --- |
| **CTD#** | **Make** | **Model** | **Serial#** | **Used with Rosette?** | **CTD Calibration Sheet Competed?** |
| 1 | SEABIRD | SBE19 SEACAT | 1294 | No | Yes |

**Institute of Ocean Sciences**

**CTD Calibration Information**

**Make/Model/Serial#: SEABIRD/19 SEACAT / 1294**

**Cruise ID#: 9736**

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| --- |
| **Calibration Information** |
| **Sensor** | **Pre-Cruise** | **Post Cruise** |
| **Name** | **S/N** | **Date** | **Location** | **Date** | **Location** |
| **Temperature** | **1294** | **12 Feb 1993** | **Factory** | **29 Apr 1998** | **factory** |
| **Conductivity** | **1294** | **12 Feb 1993** | **Factory** | **29 Apr 1998** | **factory** |
| **Pressure Sensor** | **163223** | **12 Feb 1993** | **12 Feb 1993** | **7 May 1998** | **factory** |

**Sensor Calibration Notes:**

The configuration file used is attached; this includes the sensor calibrations.