# DY 131 – Exports

# NMF CTD Cruise Report

# 1st May – 1st June 2021

# Chief Scientist: Craig Lee

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# Contents

## CTD Summary

112 CTD casts were undertaken with an NMF 24-way Stainless Steel CTD frame with 24 off 20l Niskin water samplers. An additional 7 casts were undertaken with an NMF 24-way Titanium CTD frame with 10l trace metal Niskin water samplers. All instrument serial numbers were checked and all channels of the 9plus underwater unit checked prior to completing the sensors information sheet for DY131. A SBE 43 dissolved oxygen sensor was used to supplement the primary temperature and conductivity sensors all of which were mounted to the 9 plus. The secondary temperature and conductivity sensors were mounted on the vein. Additionally there was a user supplied Sequoia LISST-DEEP mounted on the frame, this was powered from the 9plus and logged internally. There was also a user supplied Hydroptic UVP5 mounted to the centre of the frame, this was independently powered and internally logging.

The deepest cast was CTD022 at station A2-C which descended to 2500m. The shallowest cast was TEST01 as stations TEST01 which descended to 30m.

For trace metal work on the Titanium CTD, the science party fitted the Niskin water samplers to the Titanium CTD frame just prior to the deployment to limit chances of contamination. For sampling, the Niskins were removed from the frame and carried into the clean lab by the CTD technicians wearing clean gloves.

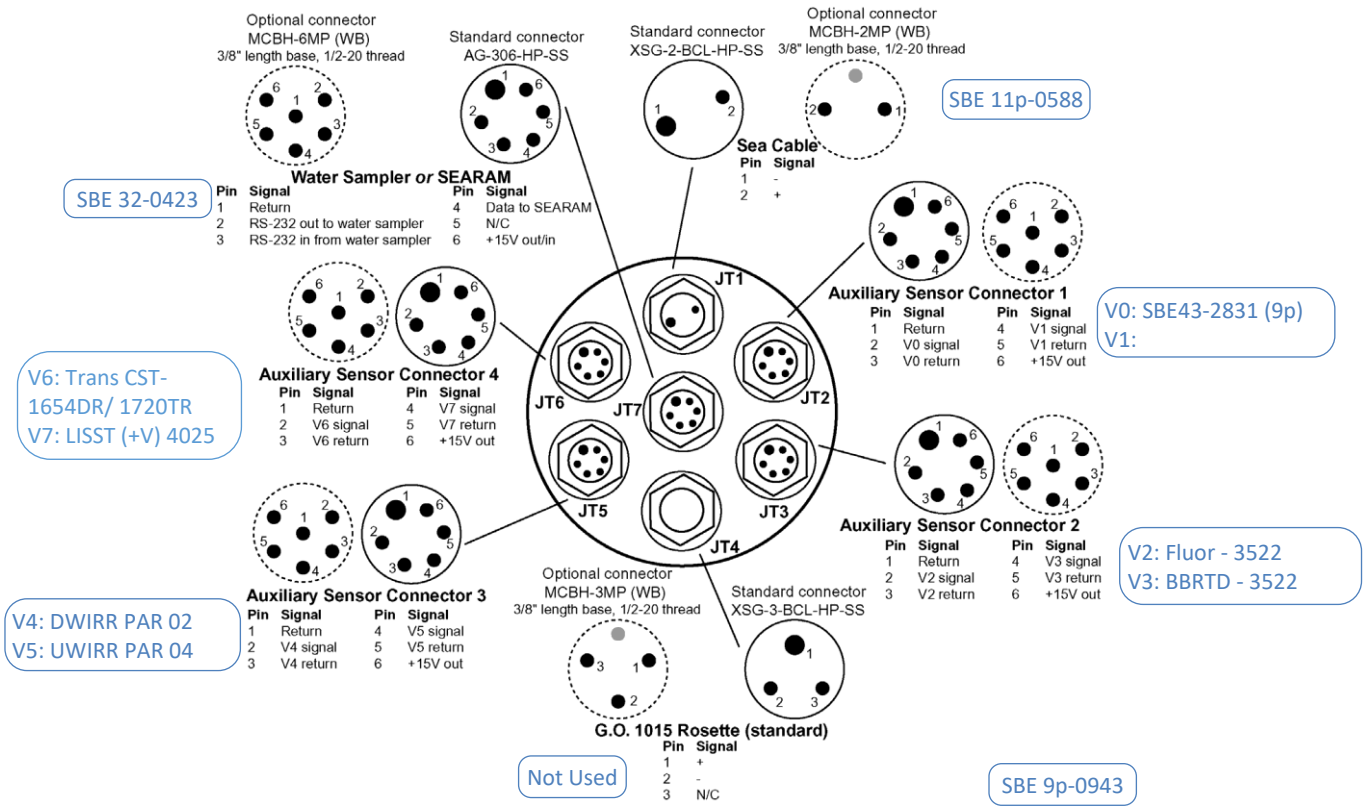
# CTD Configuration

## Stainless Steel CTD Instrument Package

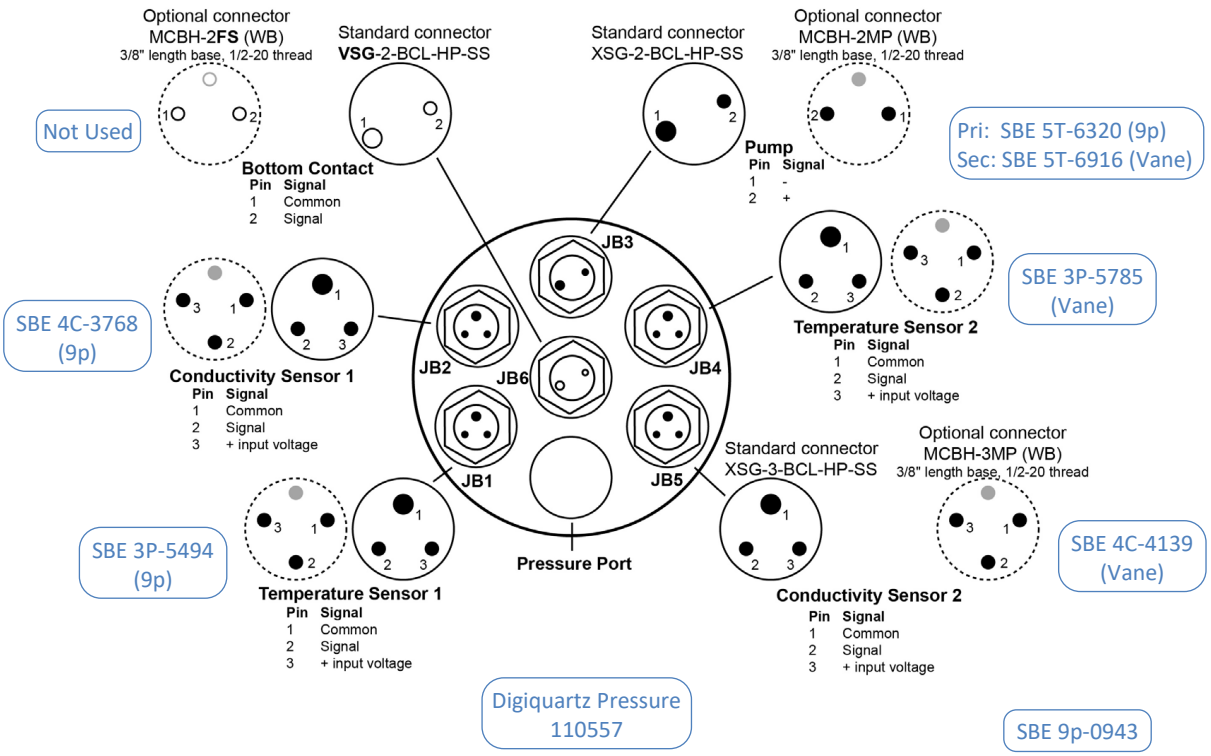
The following sensors were fitted to the Stainless Steel CTD frame:

| Instrument / Sensor | Manufacturer/ Model | Serial Number | Channel | Casts Used |
|---|---|---|---|---|
| Primary CTD deck unit | SBE 11plus | 11P-24680-0588 | n/a | All casts |
| CTD Underwater Unit | SBE 9plus | 09P-54047-0943 | n/a | Casts 1 - 112 |
| Stainless steel 24-way frame | NOCS | CTD 6 | n/a | Casts 1 - 112 |
| MDS Titanium CTD Swivel | MDS | 1246-2 | | All Casts |
| Primary Temperature Sensor | SBE 3P | 03P-5494 | F0 | Casts 1 - 112 |
| Primary Conductivity Sensor | SBE 4C | 04C-3768 | F1 | Casts 1 - 112 |
| Digiquartz Pressure sensor | Paroscientific | 110557 | F2 | Casts 1 - 112 |
| Secondary Temperature Sensor | SBE 3P | 03P-5785 | F3 | Casts 1 - 112 |
| Secondary Conductivity Sensor | SBE 4C | 04C-4139 | F4 | Casts 1 - 112 |
| Primary Pump | SBE 5T | 05T-6320 | n/a | Casts 1 - 112 |
| Secondary Pump | SBE 5T | 05T-6916 | n/a | Casts 1 - 112 |
| 24-way Carousel | SBE 32 | 32-31240-0423 | n/a | Casts 1 - 112 |
| SBE 35 DOST | SBE35 | 35-34173-0037 | n/a | Casts 1 - 112 |
| Dissolved Oxygen Sensor | SBE 43 | 43-2831 | V0 | Casts 1 - 112 |
| | | | V1 | |
| Fluorometer | WETLabs FLBBRTD | 3522 | V2 | Casts 1 - 112 |
| Light Scattering Sensor | WETLabs FLBBRTD | 3522 | V3 | Casts 1 - 112 |
| PAR Up-looking DWIRR | CTG | PAR 02 | V4 | Casts 1 – 17, 20 – 27, 29 – 30, 35 – 85, 87 – 101, 103 - 112 |
| PAR Down-looking UWIRR | CTG | PAR 04 | V5 | Casts 1 – 17, 20 – 27, 29 – 30, 35 – 85, 87 – 101, 103 - 112 |
| Transmissometer | CTG Alphatracka MKII | CST-1654DR | V6 | Casts 1 - 18 |
| Transmissometer | CTG Alphatracka MKII | CST-1720TR | V6 | Casts 19 - 112 |
| LISST-DEEP | SEQUOIA | 4025 | V7 | Casts 1 – 112 |
| UVP5 | Hydroptic | 001 | n/a | Casts 1 – 112 |
| 20L Water Samplers | OTE | | n/a | All stainless casts |

## SBE 9plus CTD Top End Cap Configuration




## SBE 9plus CTD Bottom End Cap Configuration



## Titanium CTD Instrument Package

| Instrument / Sensor | Manufacturer/ Model | Serial Number | Channel | Casts Used |
|---|---|---|---|---|
| Primary CTD deck unit | SBE 11plus | 11P-24680-0588 | n/a | All casts |
| CTD Underwater Unit | SBE 9plus | 09P-77801-1182 | n/a | Ti Casts 1 – 7 |
| Titanium 24-way frame | NOCS | Tita 1 | n/a | Ti Casts 1 – 7 |
| Primary Temperature Sensor | SBE 3P | 03P-5495 | F0 | Ti Casts 1 – 7 |
| Primary Conductivity Sensor | SBE 4C | 04C-3529 | F1 | Ti Casts 1 – 7 |
| Digiquartz Pressure sensor | Paroscientific | 129735 | F2 | Ti Casts 1 – 7 |
| Secondary Temperature Sensor | SBE 3P | 03P-5835 | F3 | Ti Casts 1 – 7 |
| Secondary Conductivity Sensor | SBE 4C | 04C-4143 | F4 | Ti Casts 1 – 7 |
| Primary Pump | SBE 5T | 05T-3607 | n/a | Ti Casts 1 – 7 |
| Secondary Pump | SBE 5T | 05T-3609 | n/a | Ti Casts 1 – 7 |
| 24-way Carousel | SBE 32 | 32-60380 | n/a | Ti Casts 1 – 7 |
| Dissolved Oxygen Sensor | SBE 43 | 43-1940 | V0 | Ti Casts 1 – 7 |
| | | | V1 | |
| Fluorometer | CTG Aquatracka MKIII | 88-2050-095 | V2 | Ti Casts 1 – 7 |
| Light Scattering Sensor | WETLabs BBRTD | 1163 | V3 | Ti Casts 1 – 7 |
| PAR Up-looking DWIRR | CTG | 05 | V4 | Ti Casts 1 – 7 |
| PAR Down-looking UWIRR | CTG | 09 | V5 | Ti Casts 1 – 7 |
| Transmissometer | CTG Alphatracka MKII | CST-1837TR | V6 | Ti Casts 1 – 7 |
| | | | V7 | |
| 10L TMF Water Samplers | OTE | | n/a | Ti Casts 1 – 7 |

## Seasave Configurations & Instrument Calibrations

The Seasave Instrument Configuration files used for Stainless CTD casts 19 – 112 is shown below. Casts 1 – 18 used exactly the same except used Transmissometer CST – 1654DR.

*Date: 06/07/2021*

*Instrument configuration file: C:\Users\sandm\Documents\Cruises\DY131\SeaSave setup files\Stainless Steel\DY131_SS_0943_nmea_A_.xmlcon*

*Configuration report for SBE 911plus/917plus CTD*
---

*Frequency channels suppressed : 0*
*Voltage words suppressed : 0*

*Computer interface : RS-232C*
*Deck unit : SBE11plus Firmware Version >= 5.0*
*Scans to average : 1*
*NMEA position data added : Yes*
*NMEA depth data added : No*
*NMEA time added : Yes*
*NMEA device connected to : PC*
*Surface PAR voltage added : No*
*Scan time added : Yes*

*1) Frequency 0, Temperature*

*Serial number : 03P-5494*
*Calibrated on : 11 July 2018*
*G : 4.32421234e-003*
*H : 6.26025634e-004*
*I : 1.94626464e-005*
*J : 1.48486445e-006*
*F0 : 1000.000*
*Slope : 1.00000000*
*Offset : 0.0000*

*2) Frequency 1, Conductivity*

*Serial number : 04C-3768*
*Calibrated on : 25 July 2018*
*G : -1.02284081e+001*
*H : 1.49861592e+000*
*I : -1.33719830e-003*
*J : 1.94341809e-004*
*CTcor : 3.2500e-006*
*CPcor : -9.57000000e-008*
*Slope : 1.00000000*
*Offset : 0.00000*

*3) Frequency 2, Pressure, Digiquartz with TC*

*Serial number : 110557*
*Calibrated on : 21 September 2018*
*C1 : -6.010548e+004*
*C2 : -1.565601e+000*
*C3 : 1.823090e-002*
*D1 : 2.668300e-002*
*D2 : 0.000000e+000*
*T1 : 3.020528e+001*
*T2 : -6.718318e-004*
*T3 : 4.457980e-006*
*T4 : 1.203850e-009*
*T5 : 0.000000e+000*
*Slope : 1.00002000*
*Offset : 2.14950*

*AD590M : 1.280700e-002*
*AD590B : -9.299640e+000*

*4) Frequency 3, Temperature, 2*

*Serial number : 03P-5785*
*Calibrated on : 14 February 2019*
*G : 4.33667005e-003*
*H : 6.27899513e-004*
*I : 1.95462370e-005*
*J : 1.44258806e-006*
*F0 : 1000.000*
*Slope : 1.00000000*
*Offset : 0.0000*

*5) Frequency 4, Conductivity, 2*

*Serial number : 04C-4139*
*Calibrated on : 14 February 2019*
*G : -9.89572830e+000*
*H : 1.45992719e+000*
*I : -4.60288486e-004*
*J : 1.24094742e-004*
*CTcor : 3.2500e-006*
*CPcor : -9.57000000e-008*
*Slope : 1.00000000*
*Offset : 0.00000*

*6) A/D voltage 0, Oxygen, SBE 43*

*Serial number : 43-2831*
*Calibrated on : 20 August 2019*
*Equation : Sea-Bird*
*Soc : 4.89100e-001*
*Offset : -4.82600e-001*
*A : -4.73590e-003*
*B : 2.06550e-004*
*C : -3.00620e-006*
*E : 3.60000e-002*
*Tau20 : 1.32000e+000*
*D1 : 1.92634e-004*
*D2 : -4.64803e-002*
*H1 : -3.30000e-002*
*H2 : 5.00000e+003*
*H3 : 1.45000e+003*

*7) A/D voltage 1, Free*

*8) A/D voltage 2, Fluorometer, WET Labs ECO-AFL/FL*

*Serial number : 3522*

*Calibrated on :*
*Dark output : 0.0860*
*Scale factor : 9.00000000e+000*

*9) A/D voltage 3, OBS, WET Labs, ECO-BB*

*Serial number : 3522*
*Calibrated on : 9 May 2018*
*ScaleFactor : 0.001400*
*Dark output : 0.078000*

*10) A/D voltage 4, PAR/Irradiance, Biospherical/Licor*

*Serial number : 02*
*Calibrated on : 27 June 2019*
*M : 0.45712800*
*B : 1.08610800*
*Calibration constant : 1000000000000.00000000*
*Conversion units : Watts/m^2*
*Multiplier : 0.99890000*
*Offset : 0.00000000*

*11) A/D voltage 5, PAR/Irradiance, Biospherical/Licor, 2*

*Serial number : 04*
*Calibrated on : 03 Sep 2020*
*M : 0.51512300*
*B : 1.00565600*
*Calibration constant : 1000000000000.00000000*
*Conversion units : Watts/m^2*
*Multiplier : 0.99830000*
*Offset : 0.00000000*

*12) A/D voltage 6, Transmissometer, WET Labs C-Star*

*Serial number : CST-1720TR*
*Calibrated on : 26 June 2018*
*M : 21.1810*
*B : -0.1800*
*Path length : 0.250*

*CASTS 1 – 18 TRANSMISSOMETER*

*Serial number : CST-1654DR*
*Calibrated on : 29 July 2020*
*M : 21.4777*
*B : -0.1568*
*Path Length : 0.250*

*13) A/D voltage 7, Free*

*Scan length : 45*
---
*Pump Control*
*This setting is only applicable to a custom build of the SBE 9plus.*
*Enable pump on / pump off commands: NO*
---
*Data Acquisition:*
*Archive data: YES*

*Delay archiving: NO*
*Data archive:*
*C:\Users\sandm\Documents\Cruises\DY131\Data\CTD_Raw_Data\DY131_CTD_064.hex*
*Timeout (seconds) at startup: 60*
*Timeout (seconds) between scans: 20*
*---*
*Instrument port configuration:*
*Port = COM4*
*Baud rate = 19200*
*Parity = N*
*Data bits = 8*
*Stop bits = 1*
*---*
*Water Sampler Data:*
*Water Sampler Type: SBE Carousel*
*Number of bottles: 36*
*Port: COM5*
*Enable remote firing: NO*
*Firing sequence: User input*
*Tone for bottle fire confirmation uses PC sound card.*
*---*
*Header information:*
*Header Choice = Prompt for Header Information*
*prompt 0 = Ship: RRS Discovery*
*prompt 1 = Cruise: DY131*
*prompt 2 = Cast:*
*prompt 3 = Station:*
*prompt 4 = Julian Day:*
*prompt 5 = Date:*
*prompt 6 = Time (GMT):*
*prompt 7 = Latitude:*
*prompt 8 = Longitude:*
*prompt 9 = Depth (uncorrected m):*
*prompt 10 = Principal Scientist: Dr Craig Lee*
*prompt 11 = Operator:*
*---*
*TCP/IP - port numbers:*
*Data acquisition:*
*Data port: 49163*
*Status port: 49165*
*Command port: 49164*
*Remote bottle firing:*
*Command port: 49167*
*Status port: 49168*
*Remote data publishing:*
*Converted data port: 49161*
*Raw data port: 49160*
*---*
*Miscellaneous data for calculations*
*Depth, Average Sound Velocity, and TEOS-10*
*Latitude when NMEA is not available: 48.000*

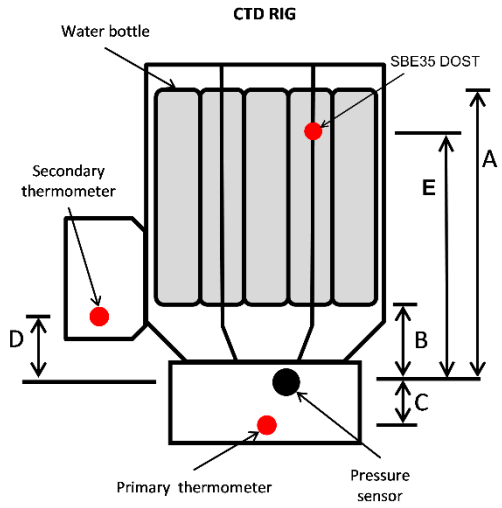
*Longitude when NMEA is not available: 0.000*
*Average Sound Velocity*
*Minimum pressure [db]: 20.000*
*Minimum salinity [psu]: 20.000*
*Pressure window size [db]: 20.000*
*Time window size [s]: 60.000*
*Descent and Acceleration*
*Window size [s]: 2.000*
*Plume Anomaly*
*Theta-B: 0.000*
*Salinity-B 0.000*
*Theta-Z / Salinity-Z 0.000*
*Reference pressure [db] 0.000*
*Oxygen*
*Window size [s]: 2.000*
*Apply hysteresis correction: 0*
*Apply Tau correction: 1*
*Potential Temperature Anomaly*
*A0: 0.000*
*A1: 0.000*
*A1 Multiplier: Salinity*
---
*Serial Data Output:*
*Output data to serial port: NO*
---
*Mark Variables:*
*No variables are selected.*
---
*Shared File Output:*
*Output data to shared file: NO*
---
*TCP/IP Output:*
*Raw data:*
*Output raw data to socket: NO*
*XML wrapper and settings: NO*
*Seconds between raw data updates: 0.000*
*Converted data:*
*Output converted data to socket: NO*
*XML format: NO*
---
*SBE 11plus Deck Unit Alarms*
*Enable minimum pressure alarm: NO*
*Enable maximum pressure alarm: NO*
*Enable altimeter alarm: NO*
---
*SBE 14 Remote Display*
*Enable SBE 14 Remote Display: NO*
---
*PC Alarms*
*Enable minimum pressure alarm: NO*
*Enable maximum pressure alarm: NO*

*Enable altimeter alarm: NO*
*Enable bottom contact alarm: NO*
*Alarm uses PC sound card.*

---

*Options:*
*Prompt to save program setup changes: YES*
*Automatically save program setup changes on exit: NO*
*Confirm instrument configuration change: YES*
*Confirm display setup changes: YES*
*Confirm output file overwrite: YES*
*Check scan length: YES*
*Compare serial numbers: YES*
*Maximized plot may cover Seasave: NO*

## Stainless Steel CTD Frame Geometry




| ID | Vertical distance from pressure sensor (m positive-up) |
|---|---|
| A | 1.2 (Top of water samplers) |
| B | 0.34 (Bottom of water samplers) |
| C | -0.075 (Primary T mounted on 9p) |
| D | 0.085 (Secondary T mounted on Vane) |
| E | 1.025 (SBE35 DOST probe sheath tip) |

## Sea-Bird SBE35 DOST Configuration

The SBE35 was connected to the SBE9plus underwater unit and the SBD32 carousel using its 'y' – cable. It was configured to take 8 temperature samples each time that a bottle was fired.

** SBE35 V 2.0a SERIAL NO. 0037 05 May 2021 22:27:16*
** number of measurement cycles to average = 8*
** number of data points stored in memory = 0*
** bottle confirm interface = SBE 911plus*

** SBE35 V 2.0a SERIAL NO. 0037*
** 09-sep-19*
** A0 = 3.390297800e-03*
** A1 = -8.903628320e-04*
** A2 = 1.481338040e-04*
** A3 = -8.466477550e-06*
** A4 = 1.858195630e-07*
** SLOPE = 0.999998*
** OFFSET = 0.000050*

# Technical Report

## Stainless Steel CTD Wire CTD1

All stainless steel casts were carried out using wire CTD1, which was terminated using the potting method during the mobilisation for DY131. The CTD wire was electrically tested after terminating and had a Megger value of > 999 MOhms. The CTD wire resistance through the CTD wire only was 63.9 Ohms. The mechanical termination was load tested as per the standard CTD load test of 5 minutes at 0.5T, 1.0T, 1.5T and 2.0T. The mechanical termination did not slip under load.

During cast CTD018 the data from Transmissometer CST-1654DR appeared suspect. Deck testing provided evidence that the issue was with the sensor itself and not the cabling, while blanked the voltage would jump between 0v – 4v and the bulkhead connector showed signs of corrosion. This was replaced with CST-1720TR which was used for casts CTD019 – CTD112. No other sensor issues were encountered.

The Active Heave Compensation system was engaged on cast CTD006 – CTD112.

## AUTOSAL

A Guildline 8400B, s/n 68426 was installed in the Salinometer Room as the main instrument for salinity analysis. The bath temperature was set to 21°C with the lab ambient temperature ranging between 19°C – 21°C. The salinometer was standardised during the mobilisation, the zero value drifted in the following days so the salinometer was re-standardised prior to running the first samples. During the analysis of crate 29 on 27/05/2021 it was noticed that one of the lamps was no longer running. This was replaced which then required the salinometer to be re-standardised before carrying out anymore anaylsis.

In total 5 crates were run.

# Sea-Bird Data Processing

The table below lists the Sea-Bird processing routines run by NMF staff (if any). Note this is only the modules that were run by NMF, not by scientific staff.

| Module | Run? | Comments |
|---|---|---|
| Configure | N | |
| Data Conversion | Y | **As per BODC guidelines Version1.0 October 2010 (Oxygen Concentration umol/l and umol/kg, Latitude and Longitude (degrees), Scan Count, Time and Pressure Temperature)** |
| Bottle Summary | Y | **As per BODC guidelines Version1.0 October 2010, with above variables added (except not averaging Scan Count and Time)** |
| Mark Scan | N | |
| Align CTD | Y | As per BODC guidelines Version1.0 October 2010 **(dissolved oxygen advanced 6 seconds)** (appended file name) |
| Buoyancy | N | |
| Cell Thermal Mass | Y | As per BODC guidelines Version1.0 October 2010 (appended file name) |
| Derive | Y | As per BODC guidelines Version1.0 October 2010 (appended file name) |
| Bin Average | Y | As per BODC guidelines Version1.0 October 2010 **(1 metre depth bins)** (appended file name) |
| Filter | N | As per BODC guidelines Version1.0 October 2010 (appended file name) |
| Loop Edit | N | As per BODC guidelines Version1.0 October 2010 (appended file name) |
| Wild Edit | N | **Not applicable.** |
| Window Filter | N | |
| ASCII In | N | |
| ASCII Out | N | |
| Section | N | |
| Split | N | |
| Strip | Y | As per BODC guidelines Version1.0 October 2010 (appended file name) |
| Translate | N | |

| | | |
|---|---|---|
| Sea Plot | N | |
| SeaCalc II | N | |