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A report on the Red Funnel FerryBox 2004 - an overview of the data obtained, improvements and calibration procedures

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ABSTRACT

This report aims to provide a complete record of the work done as part of The ‘FerryBox’ activities on the Red Funnel Ltd. ‘Red Falcon’ ferry in Southampton Water and the Solent in 2004. The procedures, hardware and software used are described and listed in detail. The results are summarised. Details are provided of the content and location of all of the data files produced, both observational data and data collected to calibrate the instruments. The collection of high quality, long term data in as many environments as possible is required to investigate the interplay of different factors affecting phytoplankton bloom development. With this in mind the Southampton Water and Solent estuarine system has been intensively monitored over the last 6 years using the FerryBox system. The ferry travels the length of the estuary up to 16 times a day. The ‘FerryBox’ suite of sensors measures temperature, salinity, fluorescence and turbidity. These data are collected with at a frequency of 1Hz and are merged with position data, collected using a GPS system.

In 2004 the FerryBox methods were improved to reduce the affects of bio fouling on the sensors. The sensors were systematically cleaned and the sensors calibrated during weekly ferry crossings. Calibrations of the turbidity and fluorescence sensors were monitored using materials suspended in solid Perspex blocks. The sensors were found to be stable and a high quality dataset was produced. Variations were seen in the ratio of fluorescence to chlorophyll throughout the estuary and with the time of year. Using the ‘FerryBox’ dataset the occurrence of phytoplankton blooms has been related to environmental factors such as light and to the tides. Such continuous monitoring allows us to pinpoint the timings of phytoplankton bloom initiation and duration. In 2004 a series of regular peaks in fluorescence occurred throughout the summer months. The detailed data from the FerryBox allows the occurrence of these blooms to be correlated with changes in the tidal energy of the system, light and fresh water run off.

KEYWORDS

Eutrophication, FerryBox, Nutrients, Plankton Blooms, Southampton Water, Time Series

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Contents

1.0 Aims and Objectives

At present Southampton Water is not considered to be eutrophic (Nixon, 1995; OSPAR, 2001). However, nutrient concentrations are high enough to support a series of phytoplankton blooms throughout the summer but they are of short duration and not associated with harmful effects. This report provides an overview of phytoplankton bloom development during 2004, in relation to tidal energy, light and nutrient status. The data were collected using the FerryBox system.

The FerryBox consists of a suite of sensors which make high frequency (1Hz) measurements of conductivity, temperature, pressure (from which salinity can be derived), fluorescence (CTDF) and turbidity. It is fitted in the engine room of a ferry operating between Southampton and Cowes (Isle of Wight). The crossing is made up to 16 times daily. Water is diverted from the engine cooling water inlet and passes through flow cells containing the sensors and out to the engine cooling outlet. The pressure drop across the cooling system maintains a flow across the sensor heads. The sensors transmit data, which is collected by a logging system, and this is collected periodically.

A Ferry Box system has been installed onboard the Red Falcon ferry (Red Funnel Group) since 1999. Experience gained in previous years has highlighted that the regular cleaning of the system was essential. Further experience with the FerryBox system installed on the Pride of Bilbao (P&O Group) showed that increasing the number of calibration samples might be critical for detecting shifts in the fluorescence to chlorophyll ratio. This occurs in different parts of the estuary due to changes in plankton type and photo physiology. Hence the 2004 Red Falcon dataset benefits from rigorous sensor cleaning and frequent calibration crossings. Improved monitoring of the fluorescence sensor stability was achieved by using solid-state calibration blocks for the first time in 2004. In addition new methods of data presentation were developed. The fluorescence data for example has been corrected for baseline drift to remove the influence of bio fouling of the optics.

The instrumentation and measurement methodology of the Ferry Box system have evolved with time, as has the use of calibration samples to ground truth the returned data. This document sets out to describe the procedures that were applied during 2004 highlighting changes improvements made during 2004.

2.0 Listing of available data files

2.1 Location of key data files

Location	Path
A	S:\GDDPRIV\Ferrybox\RedFalcon\ (7_May04 - 27_Oct04)
B	S:\GDDPRIV\Ferrybox\RedFalcon\ascii_data
C	S:\GDDPRIV\Ferrybox\RedFalcon\Calibration data
D	S:\GDDPRIV\Ferrybox\RedFalcon\documentation\diaries
E	S:\GDDPRIV\Ferrybox\RedFalcon\documentation\2004 calibration sheets
F	S:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\bulk raw
G	S:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\weekly
H	S:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\binned
I	S:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated

Filename	Format	Location	Description	Section	Size(MB)
Mdddhhmm.prc	ASCII	A&B	MiniPack Processed	9.5	77-237
Gdddhhmm.txt	ASCII	A&B	GPS	9.5	0.05-0.1
Mdddhhmm.CAL	ASCII	B	Minipack calibration crossings	6.3	1.6
cal_chl_sal_turb	Excel	C	calibration sample results	6.3	0.06
Red Falcon Diary	Excel	D	crossing notes and timings	10.5	0.1
RFnutr	Excel	C	nutrient data	3.4	2.5
Turbidity cals	Excel	C	Turbidity measurements	4.3	0.16
Fluorimeter check	Excel	C	weekly fluor & Minitracka checks	4.3	0.06
cal_chl_sal_turb	ASCII	B	As above. a.k.a. caldata	6.3	0.01
ctgqa[01-17]	Excel	E	calibration forms	6.4	0.3
RF2004raw[1-16]	Matlab	F	core raw 1Hz variables	7.0(2)	10-40
RF04[14-44]	Matlab	G	weekly core raw 1Hz + salinity	7.1(3)	0.5
RF0419av	Matlab	H	weekly raw 60 latitude binned	7.1(4)	0.008
RF04min	Matlab	I	decimated raw	7.1(6-7)	18
RF04res	Matlab	I	residual fluorescence	7.1(10)	24

2.2 Data file formats

File	Variables
cal_chl_sal_turb	chlorophyll-a salinity optical-backscatter
RF2004raw??	COND FLUOR LAT LON MTRK PRESS TEMP jd
RF04??	COND FLUOR LAT LON MTRK PRESS TEMP jd YR HH MM SS
RF04??av	fluom fluosd latm latsd lonm lonsd salm salsd turbm turbsd jdm
RF04min	COND60 FLUOR60 LAT60 LON60 MTRK60 PRESS60 SAL60 TEMP60 YR60 jd60
RF04res	cond fluor fluorres jd lat lon mtrk press sal temp

3.0 Overview of the Data Obtained in 2004

3.1 Background

If we are to resolve the different mechanisms that control the onset, magnitude and duration of phytoplankton blooms and the degree to which they are influenced by eutrophication we need to study a variety of regions over a number of years. The Red Falcon FerryBox has been collecting data since 1999 through Southampton Water and the Solent between Southampton and Cowes. It has been particularly successful in mapping the way that the position of blooms shift in the estuary - the early spring bloom occurs throughout the estuary and the later summer blooms (which are a feature of this area) are more local to Southampton, where nutrient levels remain high throughout the year. Inter annual variation occurs in the timing of bloom events. The spring bloom for example generally occurs in May, on a spring tide as in 1999 (Holley & Hydes, 2002). However 2002 saw frequent cloud cover and increased river inputs in May which delayed the onset of the bloom and reduced its magnitude (Iriarte & Purdie, 2004).

Measurements of fluorescence are used to make in-situ estimates of phytoplankton biomass (Aitken, 1981). The measurements are subject to considerable uncertainties: changes in taxa, size and physiological state of the organisms, photo-quenching due ambient light field variation. However, once a link has been established between in-situ fluorescence measurements and water sample chlorophyll concentrations, fluorescence measurements have proved to be invaluable for the estimation of biomass variability (e.g. Howarth et al., 1992).

3.2 Salinity and water temperature

To put the fluorescence data in context the salinity and temperature data have been plotted in Figures 3.1 and 3.2. Figure 3.1 compares salinity data from the FerryBox (extracted at one position, in this case near Netley) with tidal data (Admiralty, 2004). The variation in salinity generally corresponds to variation in the spring and neap tidal cycle. However the effect of increased rainfall in August (with flash floods on 16th August, day 227 and the remnants of a tropical storm on the19th, day 230) can be seen in the salinity data, in Figure 3.1, where the salinity decreases at the Netley location despite the spring tide.

Figure 3.2 shows the FerryBox temperature data (extracted at a latitude near Netley for clarity) plotted alongside light data. The light data were obtained from Waniek (pers com.) and a 3 day running mean of the total radiation received at SOC has been calculated. The water temperature data can be used as a proxy for the weather (Wright et al, 1997) as plateaus in the increasing temperature data through spring will follow cloudy or stormy weather. During 2004 there is a plateau to the upward trend in solar energy (Figure 3.2) from day 121 (30th April) to day 137 (16th May) following a period of thunderstorms and flooding across the south at the end of April 2004. A second plateau in solar radiation occurs from day 171 (19th June) to day 202 (20th July) with a corresponding plateau in water temperature. A decrease in water temperature also follows the decrease in light at the end of the summer.

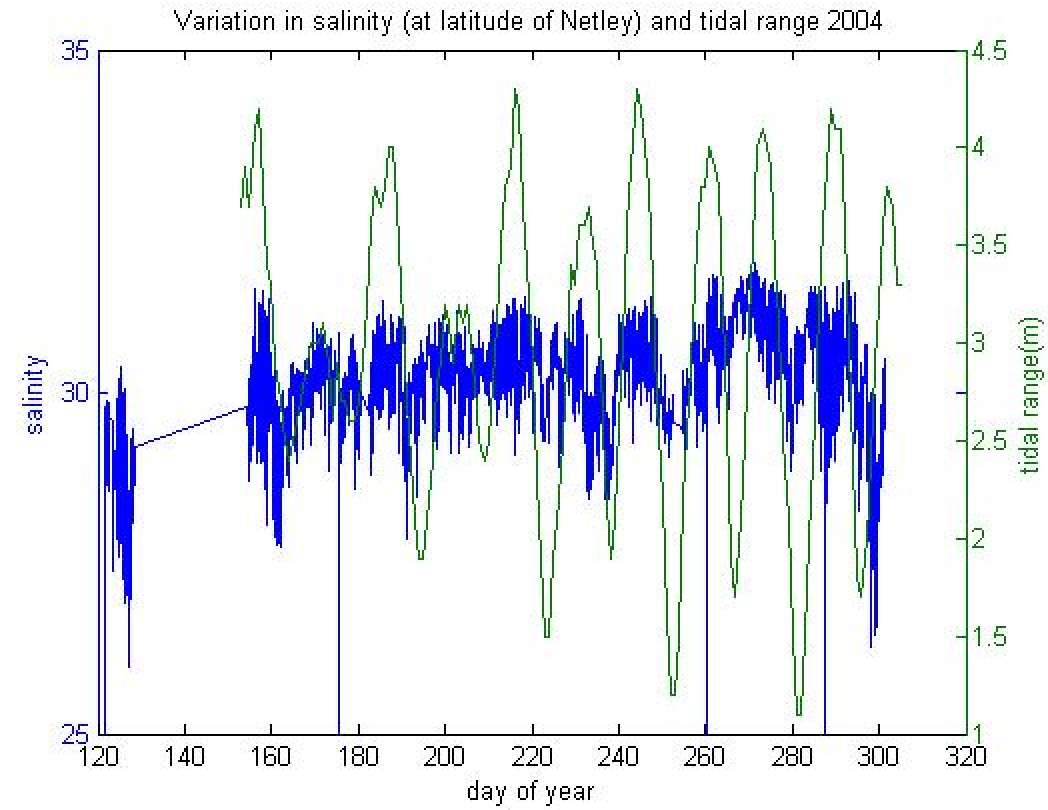


Figure 3.1 Salinity data (extracted at the latitude of Netley) alongside tidal range data (Admiralty, 2004)

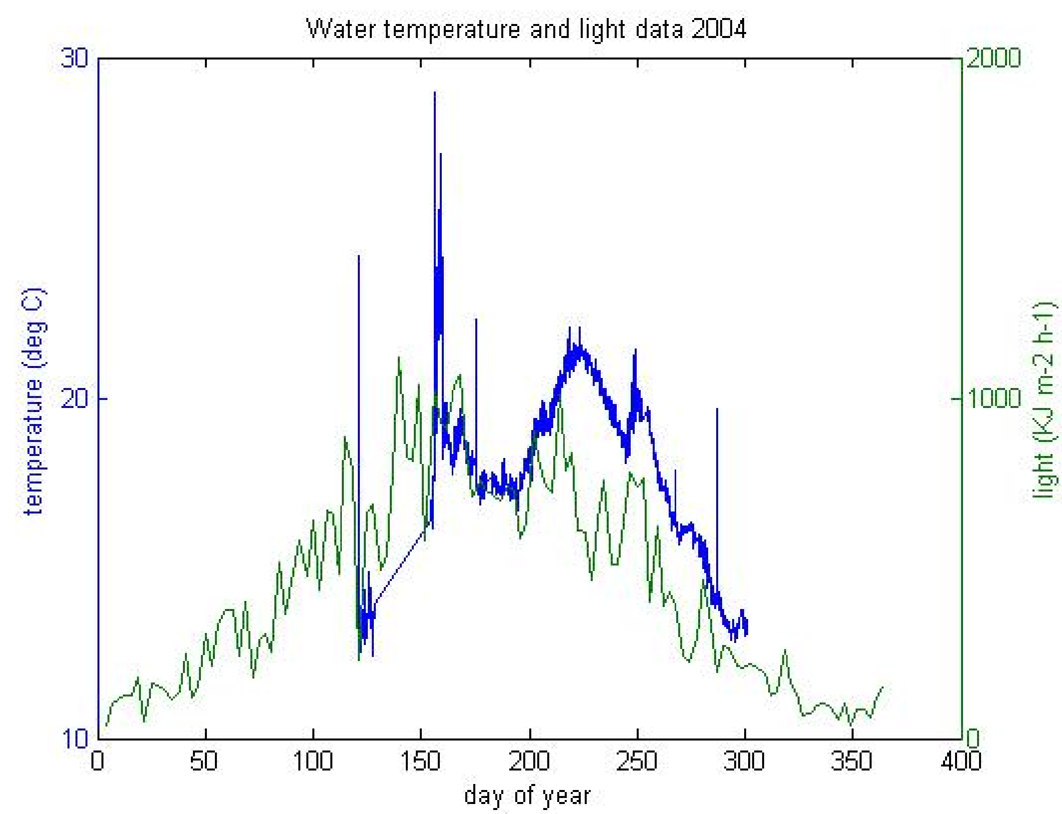


Figure 3.2 Temperature data (at Netley latitude) and total radiation at SOC (Waniek, pers com.)

3.3 Fluorescence data

Figure 3.3 shows the variation in the FerryBox fluorescence residual throughout 2004 plotted alongside a 3-day average of solar energy received at SOC (Waniek, pers com.). Fluorescence residual is the fluorescence reading after it has been corrected for baseline drift. A fluorescence residual of 50 approximates to a chlorophyll value of 10 ug/l and indicates a bloom. One of the main factors controlling the timing of the spring bloom is light availability to the phytoplankton cells (Townsend et al, 1994). This is determined by the interplay of water column transparency and incident light levels (Iriarte & Purdie, 2004). Riley (1967) suggested a threshold value of 465 W h m-2 d-1 for incident radiation. This value was confirmed in Southampton Water for the 2001 FerryBox dataset (Holley & Hydes, 2002) and was exceeded by April in 2004 prior to a period of storms at the end of the month. The spring diatom bloom tends to follow this increase in light, in early May. We do not have fluorescence data from the FerryBox until June 2004 to investigate the timing of the spring bloom. However we can identify a series of regular phytoplankton blooms throughout the summer, even once the light levels have decreased below the threshold value (Figure 3.3). This suggests that other factors are important in the timing of the blooms.

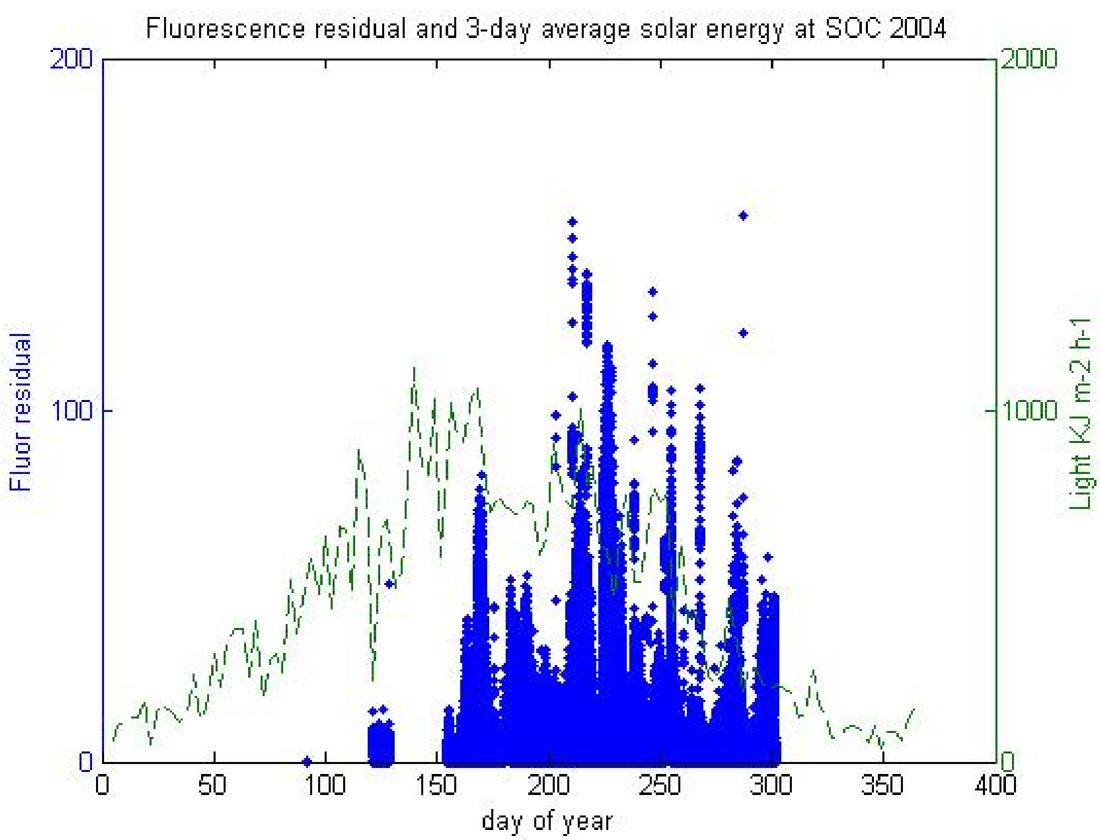


Figure 3.3 Corrected 2004 FerryBox fluorescence data (fluorescence residual) shown alongside 3-day average solar energy received at SOC (J.Waniek, pers com.)

Table 3.1 is a summary of the bloom events during 2004 as identified from Figure 3.3 showing the duration, frequency and peak fluorescence residual. These are shown alongside the tidal range, from Admiralty tables (2004) and light data (solar energy recieved at SOC, Waniek pers.com.) at the peak of the bloom. The nitrate concentration (in high salinity waters see Figure 5(c)) at the peak of the bloom is interpolated from discrete samples obtained on service visits.

Table 3.1 A summary of bloom events (A threshold residual fluorescence of 25 units has been chosen to define a bloom this, approximates to 5ug/l chlorophyll) alongside other related factors during 2004

Bloom event	Start day	End day	Duration (days)	Frequency (days)	Peak fluorescence residual	Light (Kj m-2h-1)	Tidal Range (m)	NO3 (uM)
1	161	173	11		84	837	3	6
2	180	193	13	19	54	543	2	1
3	195	198	3	15	35	348	1	2
4	208	218	10	13	155	1554	6	17
5	223	233	10	15	120	1196	5	17
6	235	240	5	13	93	935	4	10
7	245	250	5	10	135	1348	5	8
8	253	255	3		109	1087	4	9
9	258	260	3	13	43	435	2	9
10	265	268	3		109	1087	4	10
11	275	285	10	18	87	870	3	10
12	290	300	10	15	59	587	2	10

To create this table a bloom event was defined as a fluorescence residual of 25 (equivalent to 5ug/l chlorophyll). Had the threshold been lower then more blooms would be apparent. As can be seen in Figure 3.3, a threshold fluorescence residual of 75 units (7.5ug/l chlorophyll) for example would divide blooms 1 and 2 (in Table 1) into four separate blooms. Likewise a lower threshold, such as 12.5 fluorescence units (2.5ug/l chlorophyll) would combine the later summer blooms into blooms of a longer duration. Blooms 7 and 8 could be part of the same bloom event (likewise blooms 9 and 10) and the frequency of bloom events is calculated to reflect this. It is also important to consider the light environment, tides and nitrate concentrations prior to the bloom event itself.

The weather is likely to affect the initiation and duration of a bloom in a variety of ways. Cloudy days would reduce the incident light for example and flash floods may increase nutrient input to the estuary from the rivers. On the 23rd June (day 173) a deep depression crossed the UK, accompanied by heavy rainfall. The start of July was also a stormy period with increased rain and there was a record low July temperature and further storms on the 17th July (day 197). This period is followed by an increase in residual fluorescence (Figure 3.3), indicating a bloom around day 180 (28th June). Interestingly fluorescence residual values for this bloom are low when compared with the previous and following blooms that occur during 2004, although the bloom is of a similar duration.

In Figure 3.4 the fluorescence residual is plotted alongside tidal range (Admiralty, 2004). Southampton Water is a macro-tidal estuary so tidal range is an important factor influencing the timing of bloom development (Wright et al., 1997). The change from spring to neap tides will affect the mean water column irradiance and will also result in changes in turbidity. In previous years the spring diatom bloom has coincided with the peak tidal range of the spring tide in May. The spring diatom bloom timing cannot be established from this dataset as consistent measurement could not start until June 2004. However the FerryBox dataset shows a series of blooms occurred throughout the summer months. Figure 3.4 suggests that these tended to coincide with the spring tides in June whereas later in the year the blooms coincided with neap tides. Table 1 suggests that blooms were initiated every 2 weeks throughout the summer. The largest influence on the timing (although not the peak) of the blooms is therefore likely to be the tides.

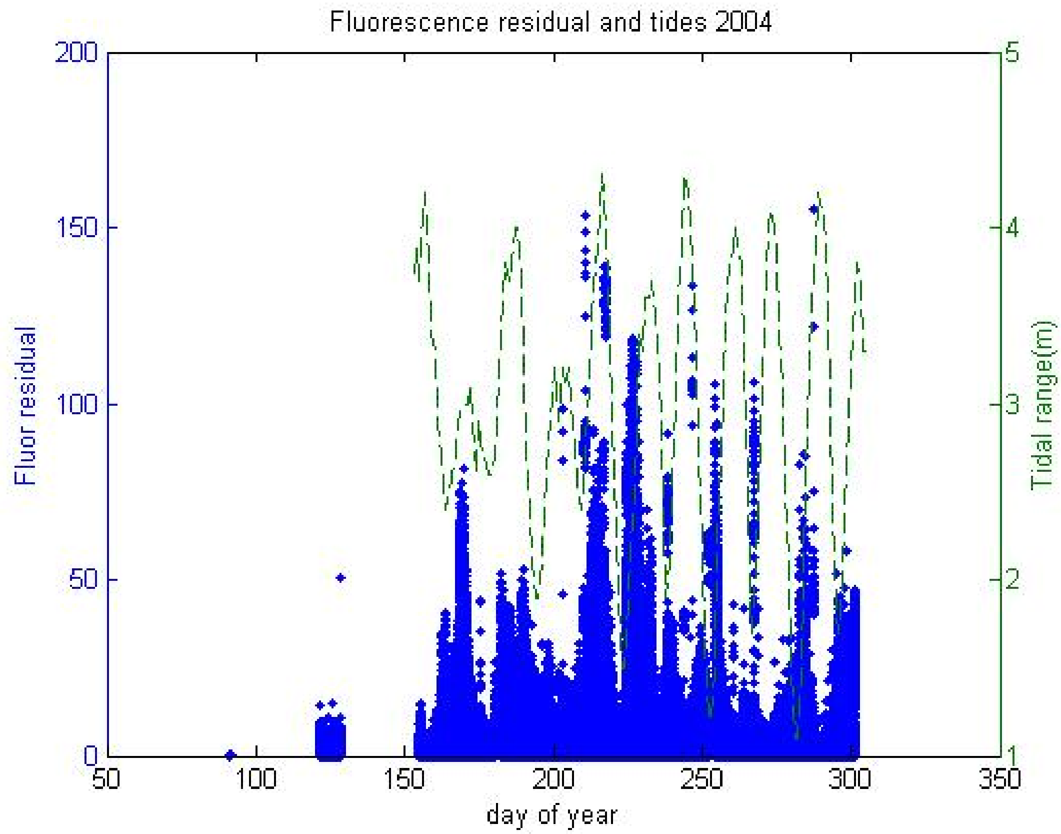


Figure 3.4 Corrected 2004 FerryBox fluorescence data (fluorescence residual) shown alongside tidal data (Admiralty,2004)

3.4 Nutrient data

Frequent calibration crossings were performed in 2004 and discrete samples were taken along the ferry route. Figure 3.5 shows examples of the nutrient and salinity data obtained. Depleted nitrate is one of the limiting factors in bloom development. Figure 3.5(a) suggests that nitrate is depleted in high salinity waters on days 162 (10th June) and 189 (7th July). Nitrate is also depleted in the high salinity waters on day 168 (16th June) when chlorophyll values were also high. Figure 3.5(b) suggests a conservative relationship between nitrate and salinity later in the year and that nitrate does not reach low concentrations that would be limiting to bloom development. The range of salinity values encountered shifts to higher values later in summer (Figure 3.5(b)).

Figure 3.6 shows residual fluorescence extracted at the latitude of Calshot off shore and Netley, which is closer to Southampton. Figure 3.7 maps the variation in fluorescence residual with location and time for the whole ferry route. This shows the distribution of the blooms that developed in 2004. Early blooms tend to develop offshore and later summer blooms develop in the lower salinity waters closer to Southampton, where nutrient levels remain high (Holley & Hydes, 2002). A series of blooms occur in August as seen by the high residual fluorescence values in Figures 3.6 and 3.7. August was an unsettled month with flash floods on the 16th (day 227) and a deep low from an ex tropical storm around the 19th August (day 230).

Flash floods increase river flow, which in turn increases nutrient input to the estuary. Nitrate data in Figure 3.5(a) show that concentrations on the day 203 (July 21st) crossing are noticeably higher than the other days. This may be due to an increase in nitrate concentrations following the period of storms and floods from day 171 to day 202. It was thought that such an injection of nutrients would have little influence offshore at Calshot, where tidal mixing dominates (Iriarte & Purdie, 2004). However nitrate concentrations are elevated even in the high salinity water on the day 203 crossing. Variations in chlorophyll and inorganic nutrients, in high salinity waters (33.75 to 34.25) through the year, is summarised in Figure 3.5(c). The depletion in nutrients by day 170 (when chlorophyll is high) and day 190 is clearly seen in Figure 3.5(c). Maximum nitrate concentrations were recorded from day 203 to day 217, remaining fairly high towards the end of the summer.

The largest peak in residual fluorescence was recorded following this particular period of storms when light levels again reached a peak (Figure 3.3). This high magnitude bloom occurred in the lower salinity waters nearer Southampton where the summer blooms tend to form (as seen in Figures 3.6 and 3.7). It also occurred just prior to a large spring tide (Figure 3.4). This illustrates the interplay of factors controlling phytoplankton blooms in the estuary.

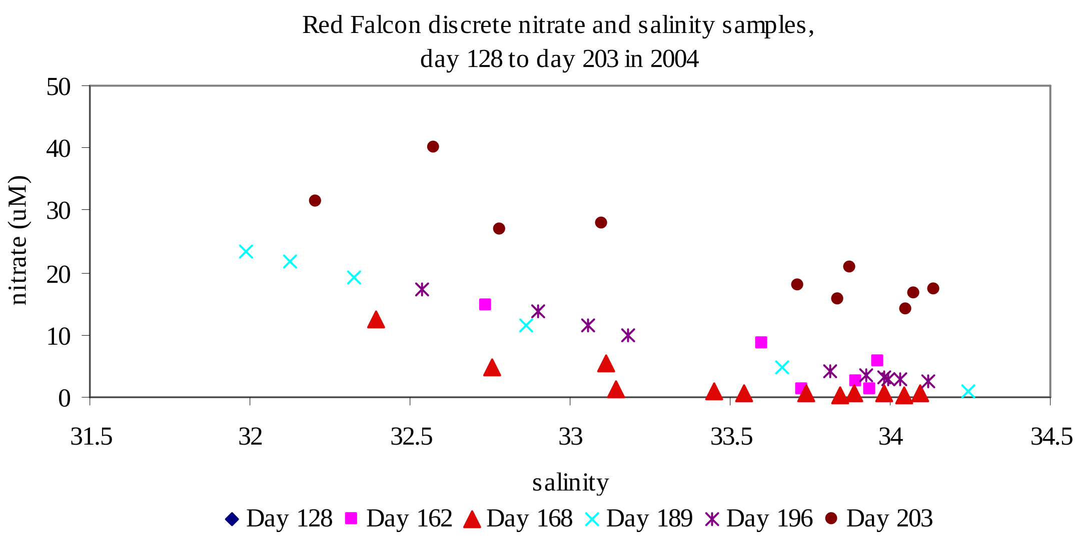


Figure 3.5 (a) Nitrate variation with salinity, calibration crossings day 128 to day 203

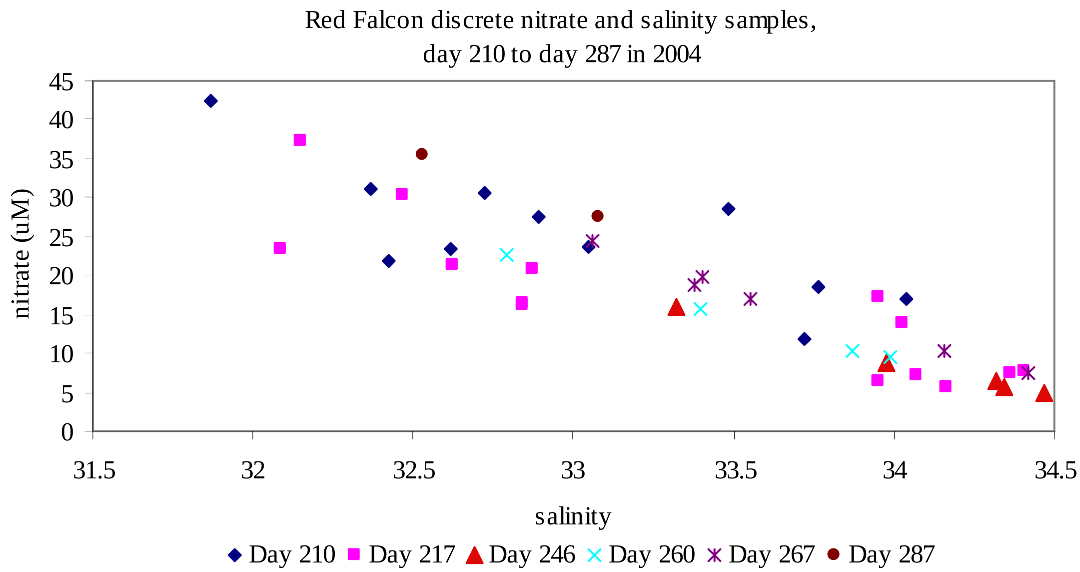


Figure 3.5 (b) Nitrate variation with salinity, calibration crossings day 210 to day 287

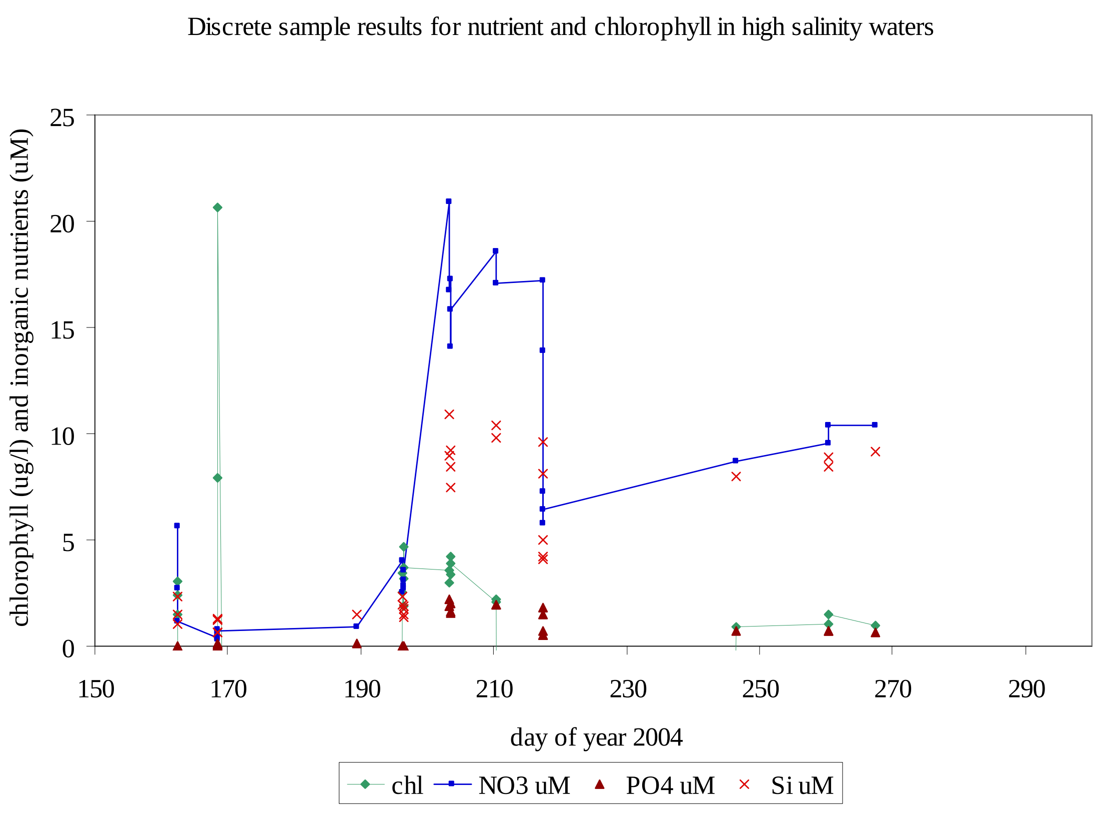


Figure 3.5 (c) Variation in chlorophyll and dissolved inorganic nutrients from discrete samples in high salinity (33.75 to 34.25) waters

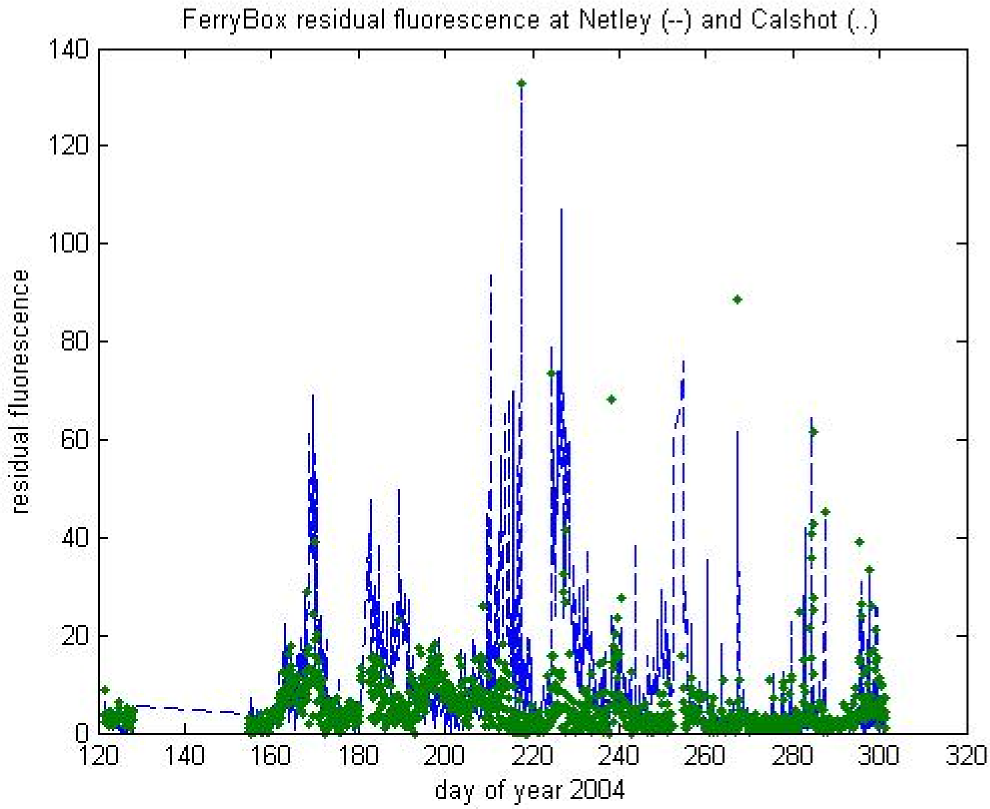


Figure 3.6 Residual fluorescence: in high salinity water offshore (green represents data extracted at a latitude close to Calshot 50.806-50.808°N) and in lower salinity water (blue represents data extracted at a latitude close to Netley 50.871-50.873°N).

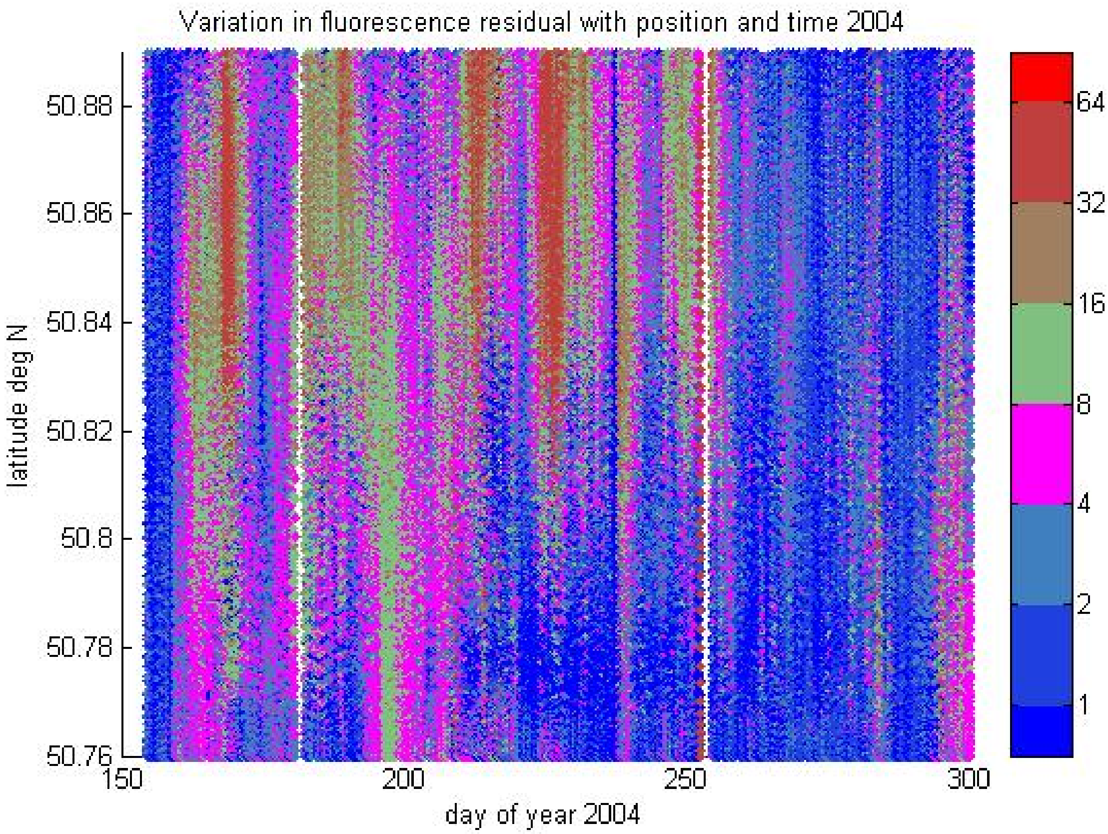


Figure 3.7 A map of fluorescence residual with location (latitude) and time with a colour bar that depicts a doubling of values (ranging from 0 to over 64 fluorescence units, each approximating to 5x the chlorophyll concentration in ug/l)

4.0 Calibration of the FerryBox System and Improvements Made During 2004

In early 2004 the Red Falcon underwent major structural alterations in order to increase its carrying capacity. During these alterations the communications cable between the engine room logger and the GPS logger on the bridge was severed. This prevented the environmental variables from the engine room being relayed to the bridge PC and so they could not be transmitted ashore in real time. It also prevented the direct merging of the positional data with the CTDF. Consequently in 2004 the position data were merged with those from the engine room on the timestamp of the two systems on return to Southampton Oceanography Centre. In previous years data logging has been accomplished with a PC running a Linux operating system, data summaries were transmitted via the Vodaphone paknet system where they were retrieved and displayed at SOC. The full set of measurements was obtained by visiting the ferry, plugging in a laptop PC and downloading over a terminal session. In contrast, this year a PC running software on a DOS based system has been used and data download is now accomplished simply by exchanging memory flash cards. The addition of a flat panel display screen that shows the current values of the logged variables as well as the logger's time has enabled the accurate timing of the calibration samples with the logged data and has given confidence in calibration results obtained through data extraction methods.

Calibration of the fluorimeter has been achieved as in previous years by comparison of the instruments recorded values with quantities of chlorophyll extracted from water samples. However, an important addition this year has been the use of solid state transparent blocks containing chlorophyll samples. These have been used during calibration visits to track any possible drift in the measurements and hence in the stability of the instrument. Similarly a formazine standard has also been employed on two of the later crossings to check the response of the turbidity sensor.

4.1 Calibration Crossings Procedure

Calibration samples were collected from the ferry on a weekly basis where possible, usually on a Wednesday morning. On the day prior to the crossing the Red Falcon was contacted by email to inform them of who would be travelling and on which crossing. Each visit to the ship was ascribed an integer and each sample a decimal fraction, so for instance the sixth sample on the twelfth visit was given the number 12.06, known as the event number. The complete return crossing takes 3 hours; 1 hour travel time in each direction with half an hour turnaround at each port. After arriving on the ferry the work required during the calibration crossing can be divided into three parts: the first part consists of cleaning the instruments, with some sensor tests; the second consists of collecting and processing samples; the third entails collecting the logged data.

4.2 Fluorimeter Calibration

4.2.1 Fluorimeter checks using plastic blocks

Figure 4.1.Performing fluorimeter checks using plastic calibration blocks

4.2.2 Method

After arriving in the engine room the fluorimeter sensor was checked with 2 optical blocks. These are plastic blocks containing fluorescent chlorophyll particles, one has a high concentration, marked H, the other a low concentration, marked L. When using the blocks they are carefully oriented so that the blocks largest face is against the fluorimeter‘s sensing window with the second largest face abutting the emitter. The scribed L or H is topmost (connectors at bottom). The blocks are wrapped in black fleece towelling to protect them from damage. This fleece is used to cover the sensor head during the `in the dark` measurements. Once the Minipack is removed from its flow cell and placed on a support the following checks are made:

1. in air ie. no block in place
2. in air in the dark ie. covered with black towelling.
3. with block L in place
4. with block L in place covered
5. with block H in place
6. with block H in place covered

These checks were performed prior to cleaning the optical sensor and then again afterwards. The displayed value was taken from the screen together with the time of the reading, (Appendices\Red Falcon diary.xls shows an example of the tabulated results). Knowledge of the timestamp allows the data for the duration of the measurement to be extracted from the retreived files. An arithmetic mean can then be calculated (Section 4\Fluorescence checks processing) to give a more precise result.

4.2.3 Results

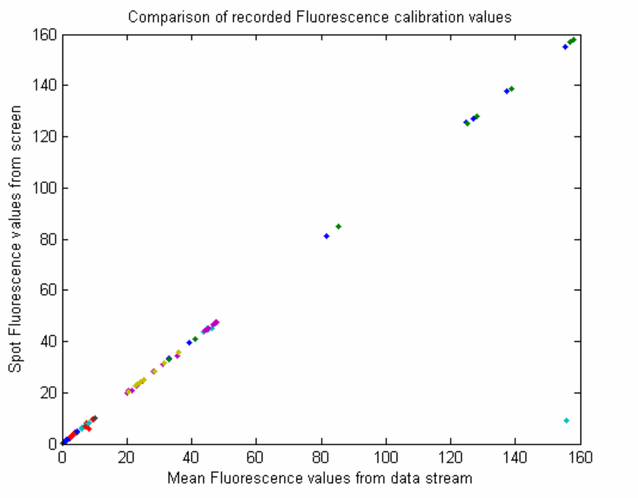


Figure 4.2 Comparison of mean and spot values of fluorescence

The mean fluorescence values that were calculated from the logged data are compared with the spot values recorded at the time of measurement (See Data Processing flowchart Figure 6.1). The averaged values were plotted against the spot values yielding a good straight line fit, Figure 4.2. The mean and spot values were then compared by plotting the difference between the two sets of values against the mean fluorescence values, Figure 4.3.

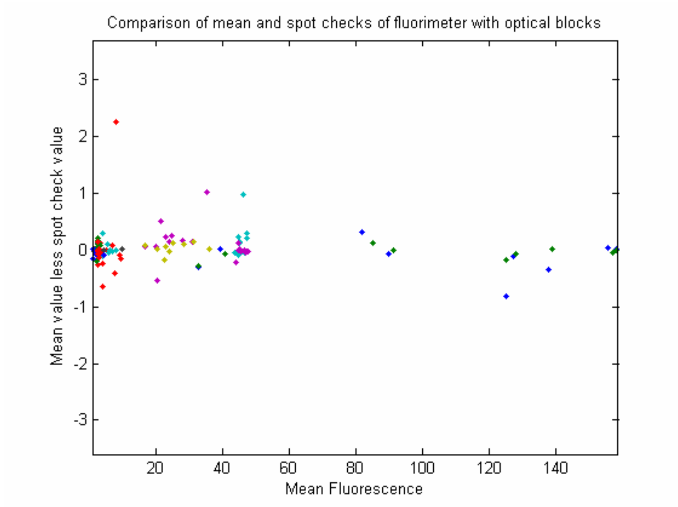


Figure 4.3 fluorescence mean-spot difference

It is apparent from these plots that provided that the block is held steadily in place for a few seconds the readings generated are quite stable. In effect the difference between the two methods (`logged averaged` and spot value) is small enough in comparison with other uncertainties in the measurements that the spot checks could be used for assessing any drift in the calibration of the fluorimeter.

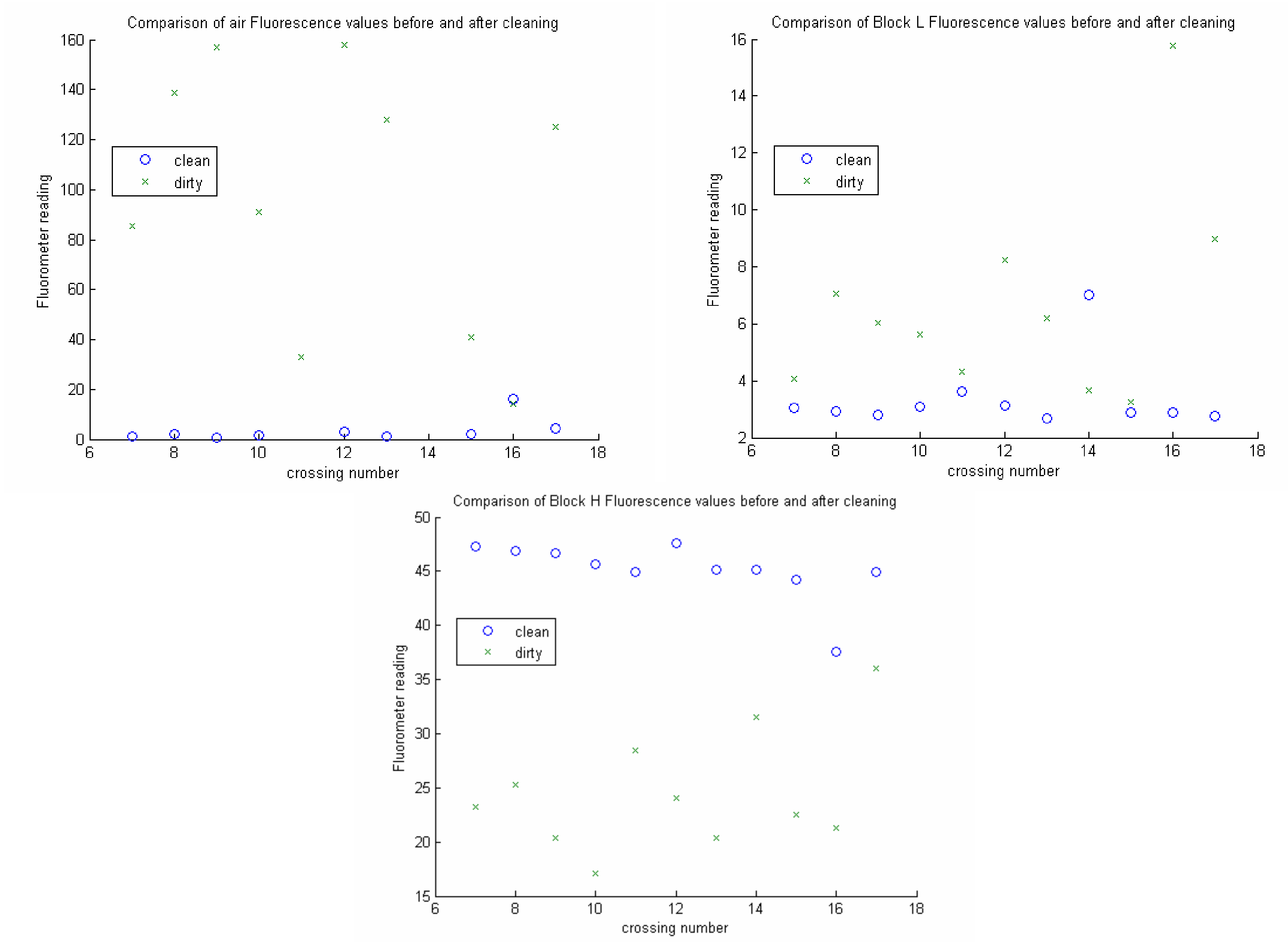


Figure 4.4 Changes in Block fluorescence values with crossing number

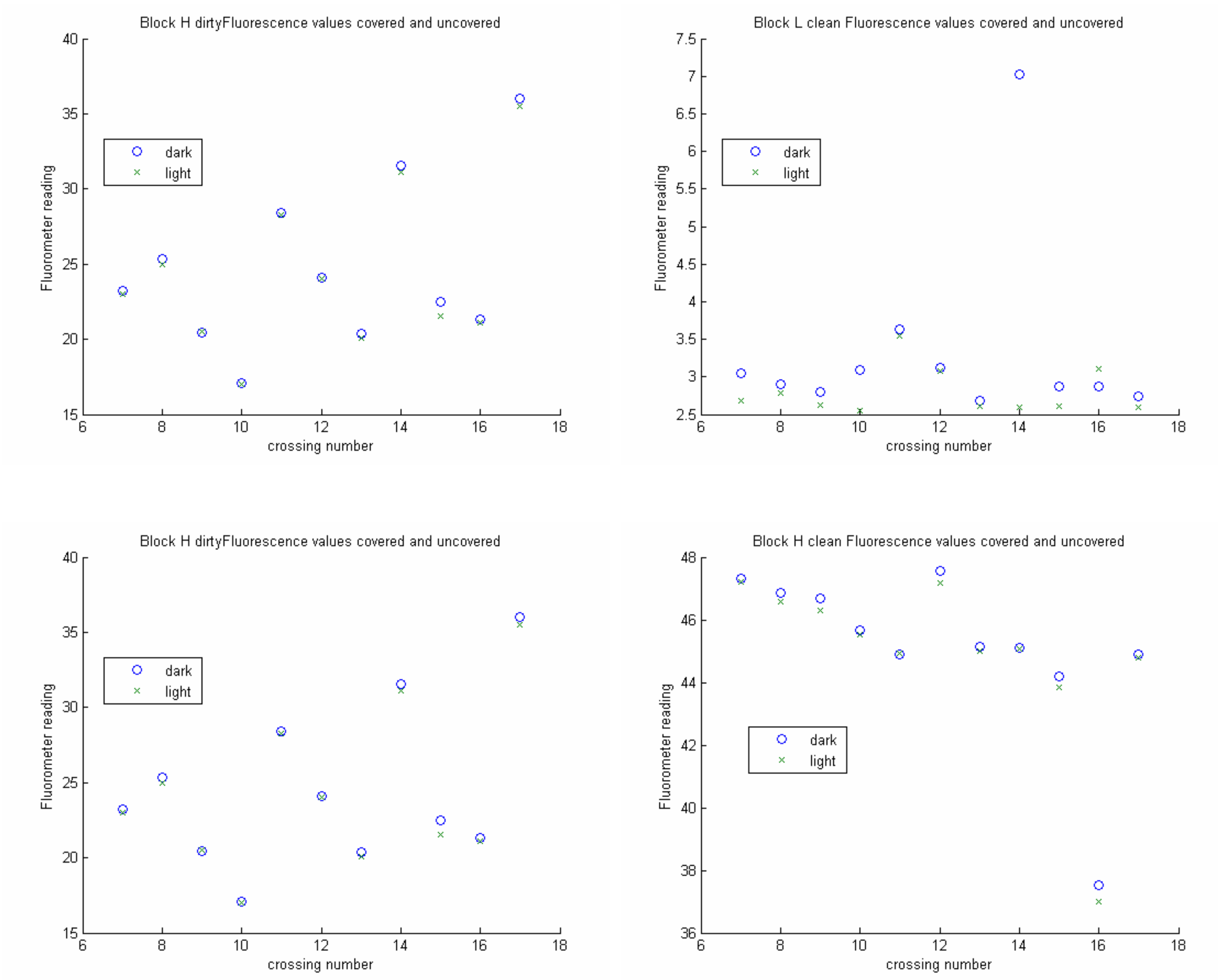


Figure 4.5 Changes in Block fluorescence values with crossing number

Figures 4.5 shows comparisons between the clean and the dirty readings that have been obtained from the logged data from the sensors whilst covered. They indicate that the cleaning of the fluorimeter sensor windows is critical to obtaining sensible values from the instrument.

In both cases there was a greater spread of 'dirty' values than of 'clean'. The mean difference between the dirty and the clean values for block H was 20.5 compared with 3.3 for the L block. The striking thing was that in the case of block H, the dirty values were invariably lower than the corresponding clean values, whereas block L shows the reverse effect. In the case where no block was present the situation was similar to that of the block L, the main difference being in the magnitude of the mean difference at 100.6. In the absence of fluorescing particles the clean fluorimeter could be expected ideally to produce a consistent zero reading. In actuality (neglecting run 16) the mean reading was 2 fluorescence units.

Figure 4.6 shows the changes in fluorescence of the calibration blocks with crossing number. The readings that were obtained from the blocks whilst covered tended to be slightly higher than their counterpart uncovered readings, although in general there is good comparison, except that is for block L when dirty; the covered values could be higher or lower than the uncovered

4.2.4 Long term fluorimeter stability

Run 16 was removed as an outlier. The results obtained from the The fluorimeter sensor checks using block H were linearly regressed. There appears to be a reduction in the fluorescence yield from the block with time; a slope of -0.55 was evident with an intercept of 51.6.When the same procedure was applied to the cleaned sensor the air and Block L values we obtained were;

Clean Block L run 14 removed.		Clean Air (no block) run 16 removed	
Intercept	2.7285	Intercept	-0.6054
Slope	0.0574	Slope	0.2405

4.2.5 Fluorescence Chlorophyll ratio

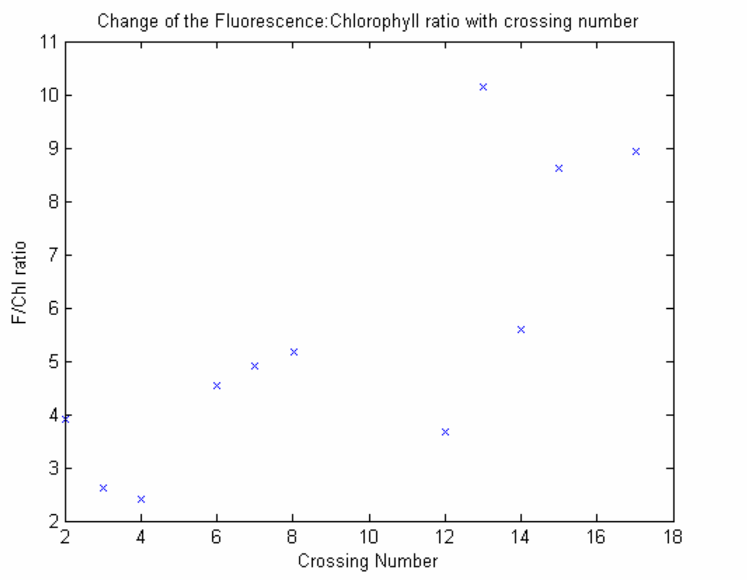


Figure 4.6 Change in fluorescence Chlorophyll ratio

Analysis of the fluorescence to chlorophyll ratio shows that it seems to increase with ascending crossing number. The slope of the ratio value with crossing number was 0.552 with 95% confidence intervals of 0.43 and 0.67. This analysis takes no heed of the change in instrument just prior to crossing 5. Linear regression of the 10 second mean fluorescence gives:

fluor = 2.9694xchlorophyll + 5.9422 and r2 = 0.85.

where the chlorophyll ratio was calculated from events 5 through 17 inclusive. The non zero intercept indicates that there may be an offset in the way that the fluorescence is currently measured.

4.2.6 Comments

Ideally the cleaned instrument would produce the same value for each block irrespective of the time that the measurement was made. The fluctuation that occurs could suggest that there is a trend for the bio-fouling to absorb the exciting radiation before it has a chance to be taken up and fluoresced by the material within the block itself.

4.3 Minitracka

4.3.1 Checks using plastic blocks

This check used blocks of similar construction to those that were used for the fluorimeter calibration checks. A known concentration of particles suspended throughout the blocks scatter light, mimicking the effect of particulates suspended in the water flowing past the sensor. The same proceedure as was used to perform the turbidity checks as was used for the fluorimeter checks, here though the blocks were labelled A and N. The reults were written to the file `Fluorimeter check.xls`

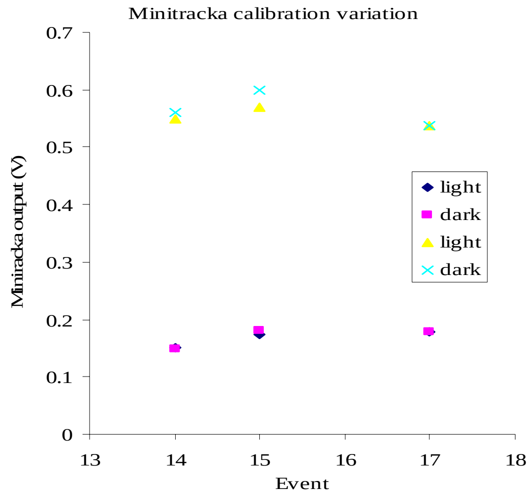


Figure 4.7 Minitracka check results using plastic blocks

4.3.2 Checks using optical stops

With the Minitracka resting on its support a plane white sheet of card was placed in a geometrically repeatable position against the head of the sensor. The light reflected from the card was incrementally reduced in intensity on its path to the receiver by using optical stops. Stops of value 1, 2 and 3 were arranged singly and in conjunction to provide stop values of 1 to 12. Each increase in stop value by 1 decreases the light intensity by a factor of 2. The turbidity values and times that they were recorded were written to the excel file ‘Fluorimeter check' and graphed as below. Relative light intensity is defined as having a value of 1 for a stop of 12 and doubles each stop reduction to 4096 for no stops.

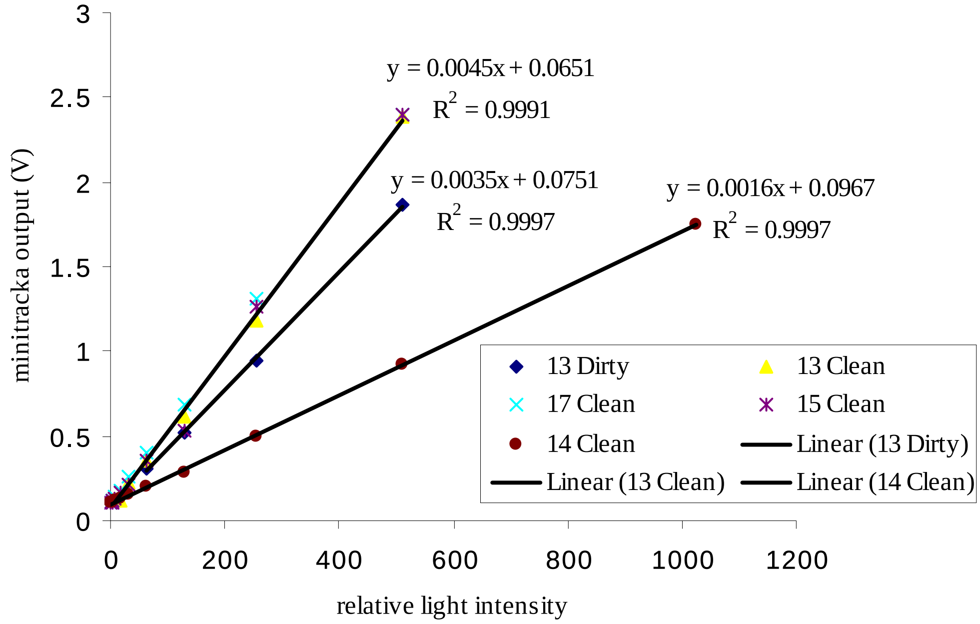


Figure 4.8 Minitracka check results using optical stops

4.3.3 Minitracka calibration using Formazine

The Second calibration method involved comparing averages of the logged data against several known dilutions of a Formazine standard. Once the volume had been estimated from the internal dimensions of the Minitracka flow cell (pers. comm J. Elliot CTG), it was found that the bottles used for the SPM samples were large enough to hold sufficient formazine solution to fill the flow cell cavity. These were then used to hold the prepared formazine dilutions. Ideally the prepared dilutions should be used immediately, they were actually prepared the afternoon before the calibration crossing due to time constraints.

4.3.4 Method

The Formazine solutions were prepared as follows.

2.5 ml of 1014 FTU stock solution was placed into a 100 ml measuring cylinder. De-ionised water was added to the 100 ml level. This was transferred to the SPM sample bottle. A further 150 ml of DI was added to this diluted stock, producing a dilution of 2.5/250 or 0.01*stock. More concentrated solutions were made in the same way to dilutions of 0.02, 0.04, 0.08, 0.16 and 0.32 times stock. 2 of the bottles were filled with de-ionised water alone.

Calibration took place in situ, that is with the Minitracka in its flow cell.

1. Firstly the Minitracka and internal flow cell walls had were cleaned .
2. The top pipe was removed from the Minitracka flow cell
3. The system was then flushed through with tap water from the engine room fresh water supply.
4. The Minitracka was removed from its flow cell allowing the tap water to remain in the flow cell`s lower pipe up to the level of the bottom of the flow cell.

5. The Minitracka was inserted into the flow cell and held in place by hand with enough force to stem the flow past the sealing ‘O’ ring.
6. De-ionised water was poured into the flow cell through the top feed pipe hole.
7. The Minitracka was removed from the flow cell to allow the DI water to escape.
8. The Minitracka was replaced and the flow cell again filled with DI water.
9. The Minitracka reading was taken from logger screen and the time of the reading noted.
10. The Minitracka was removed and replaced.
11. The flow cell was refilled with most dilute Formazine solution (0.01*stock)
12. Steps 9 & 10 were repeated

The procedure was repeated for the (0.02*stock) solution, (0.04*stock) solution etc.

4.3.5 Results

The minitracka’s full scale reading occurs at 2.39692 volts. The prepared solutions of concentrations greater than 0.04*stock (10/250) were beyond the resolution of the instrument. The 3 solutions that fell within the instruments range have been plotted below along with the value for DI water. The readings given are spot readings, as mentioned, from the logger screen. The averaged logged data has not been extracted as yet although the ‘spot readings’ generated were quite stable.

The regression line for event 15 shown below includes all 3 Formazine solutions and the DI water , a much better fit is obtained from the 3 solutions on their own. There was obviously a requirement for more data points to lie within the range of the instrument, particularly at lower dilutions where the measurement errors become more appreciable. It is also likely that there is some residual effect caused by scattering from the chamber walls even though they are black. This could also be resolved by taking more sample points. The exercise was repeated taking the aforementioned into consideration these results from Event 17 are also displayed below.

20 ml samples of the diluted stock solutions were provided to Kai Sorrenson (NIVA) for comparison with standards; these were stored at ambient lab temperature approx 18 degc. Future storage should be made at lower temperatures to minimise any sample degradation, however the sample analyses showed good overall agreement between the theoretical FTU values and the actual FTU. The Measured concentrations corrected for blanks,

Measured _corr = 0,969*theoretical concentration + 0,2713, R^2 = 0,9981.

Formazine	**DI**	**concentration (FTU)**			**Minitracka output (V)**	
Qty	**Vol**	**Theoretic**	**actual(15)**	**actual(17)**	**Event 15**	**Event 17**
		0	0	0		0.399
1.25	500	2.535		3.5		0.517
2.5	500	5.07		5.4		0.612
2.5	250	10.14	8.83		0.92	0.845
5	250	20.28	17.4	18.7	1.42	1.244
7.5	250	30.42		29.9		1.698
10	250	40.56	35.4	40	2.3	2.142

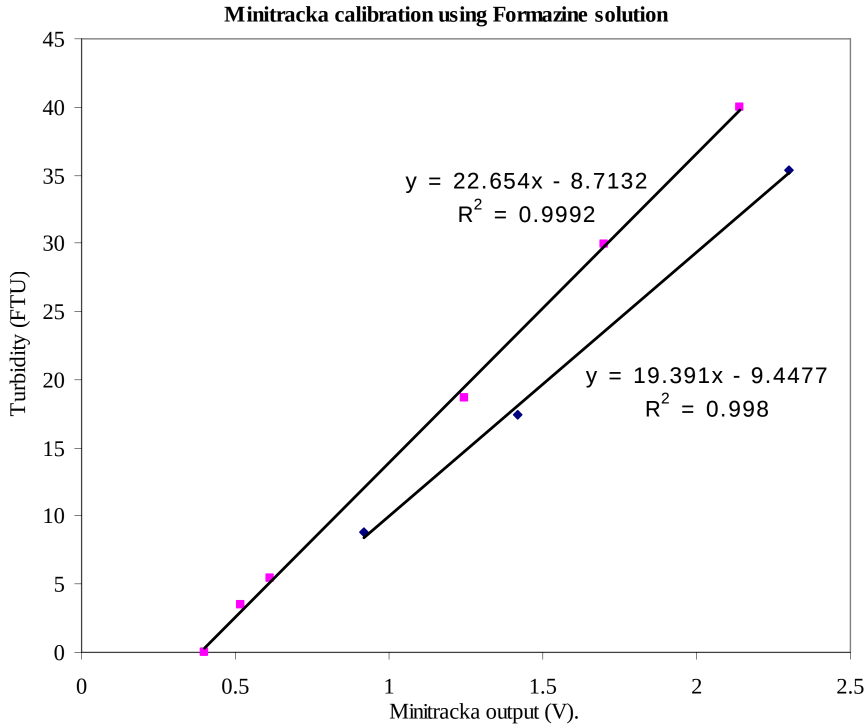


Figure 4.9 Minitracka calibration graph using Formazine solution as standard

4.3.6 Suspended Particulate Matter

Each calibration event saw the collection of two 250ml samples of water. These were analysed using a gravimetric technique at SOC in order to ascertain of the amount of solid material suspended in the water column. The samples were filtered through 47mm GFF Filters using the following procedure:

The glass filters were initially rinsed by filtering 150ml of Deionised water through them, they were then dried in an oven overnight at a temperature between 60 and 75°C. The filters were then weighed on scales with a resolution of 0.1mg and placed into numbered Petri dishes. The results were tabulated in file `Turbidity cals.xls`.

The samples, which had been collected in 250ml bottles were returned to the laboratory. All equipment used was cleaned and dried and then the measurements were made as follows.

Firstly, half of the first sample bottle was emptied into a measuring cylinder then the remainder swirled to resuspend all particulates. This was repeated for the other bottle. The total sample volume was noted and the sample was then filtered through one of the prepared filters, noting the filter Petri dish number. The paper was then stapled to a sheet of aluminium foil, its position on the foil noted down and numbered on the foil itself. When all of the filters had been collected in this way they were dried overnight at 60 °C. When dry they were reweighed to give the weight of filter plus sample weight. They were reattached to the foil and put in a muffle furnace overnight at a temperature of 550 °C. The filters were weighed again now that all the organic matter had been ashed. All these weights were tabulated in the file `Turbidity cals.xls` and the quantity `density of suspended particulate matter` was calculated in mg/litre, as was the ashed component.

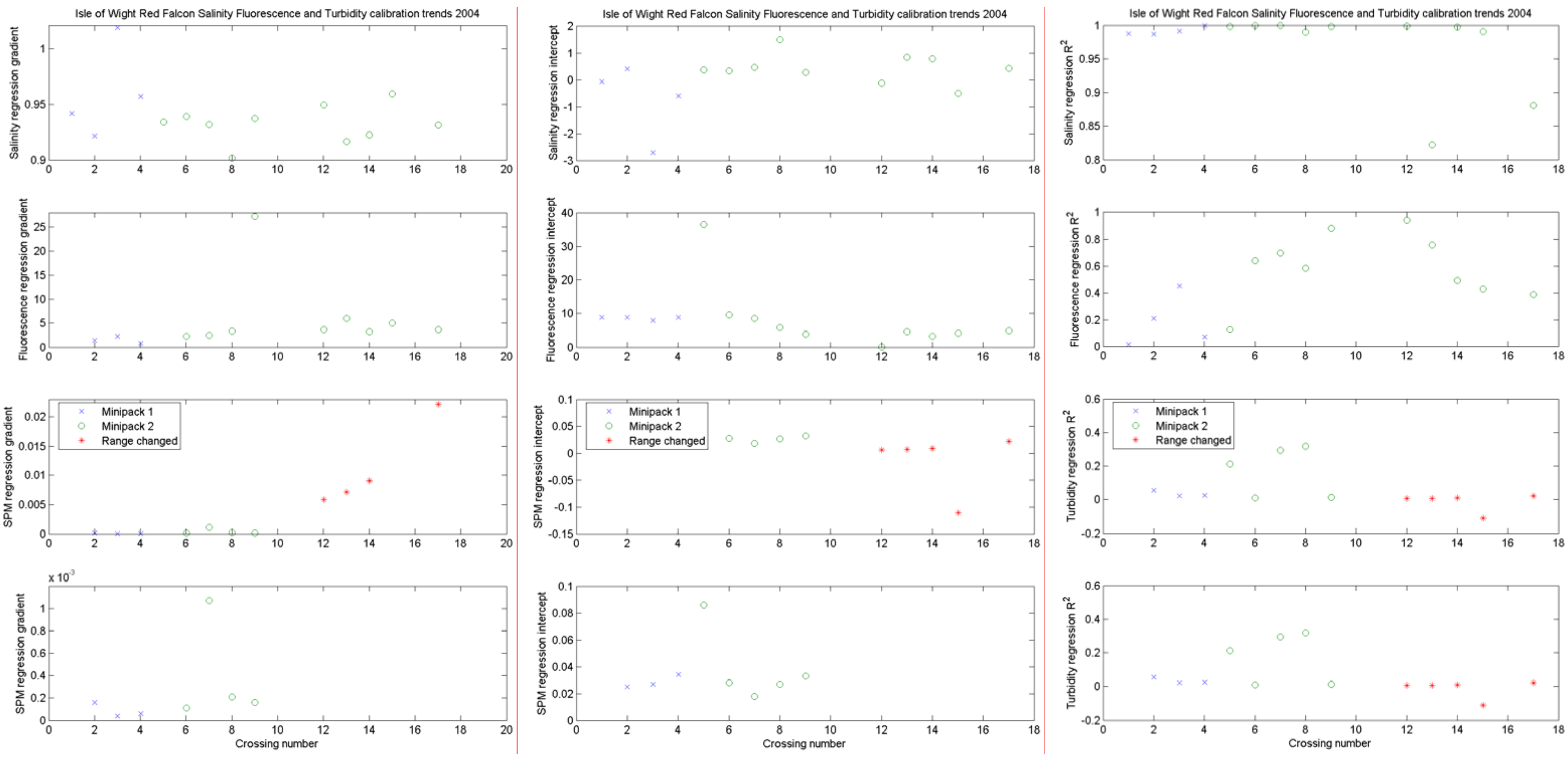


Figure 4.10 Change in regression gradient, intercept and R- squared values with increasing calibration crossing number

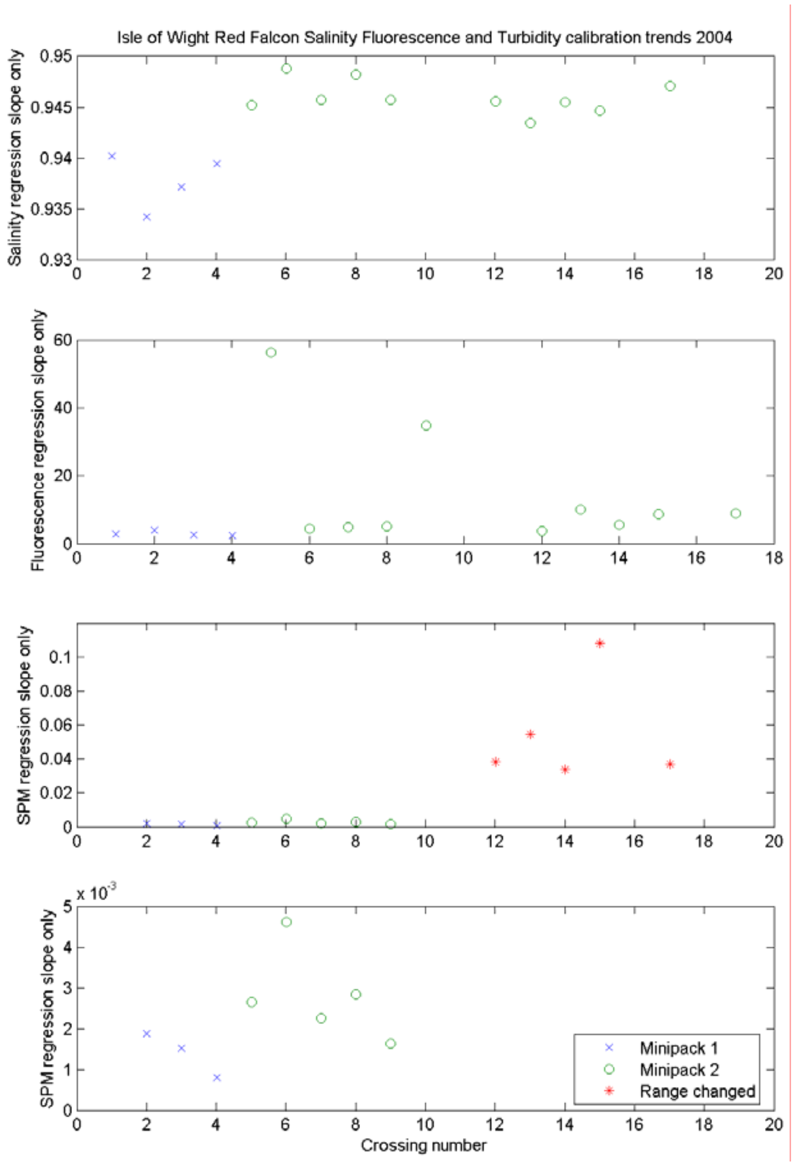


Figure 4.11 Change in regression slope with crossing, forced through origin

4.4 Calibration Data

For each calibration crossing made the collected samples were analysed at SOC. The results thus obtained were compared to the corresponding data that were logged and averaged via the FerryBox. Two linear regressions were derived; one having both slope and intercept, the other one being forced through the origin.

The gradients, intercepts and the R-squared values for salinity, suspended particulate matter vs optical backscatter and fluorescence vs chlorophyll a concentration were plotted against crossing number. This provides an indication of any long term change in the reliability of the data from the instrumentation. Figure 4.7 shows the unforced regression values and Figure 4.8 the regressions that were forced through the origin.

5.0 Data Download

5.1 May 2004 Overview

The system on Red Falcon comprises two PCs, one on the bridge and one in the engine room. These were to have been linked by a cable, allowing the engine room system to act as the primary logger and the bridge system as a backup. However, the cable was severed during the Falcon's "stretching" refit and may not be replaced due to the cost. This means that the bridge system only logs the GPS data and the engine room system only the MiniPack data.

5.2 Engine room logging

The "RedF_er.c" program running on the engine room PC records daily MiniPack files in binary format. These are stored on a CompactFlash card in the D:\MINIPACK directory. Because the cable to the bridge is absent, there are no GPS signals available to condition the PC's clock. Thus it is down to the operator to ensure that the PC's clock is correctly set each time the logger is started. A clock drift of 4 seconds per week has been observed. Data are logged at a rate of 1 Hz.

5.3 Bridge logging

The "RedF_br.c" program running on the engine room PC records daily GPS files in binary format. These are stored on a CompactFlash card in the D:\GPS directory. The PC's clock is conditioned by the GPS data, and therefore the time stamps should be within 1 second of UTC.

Short gaps in the GPS data are caused by the bridge logger momentarily diverting its attention to the Orbcomm Communicator. These gaps are normally between 3 and 30 seconds, and would not be present if the engine room logger was able to receive the GPS data. The RedProc3.c program interpolates latitude, longitude and speed values to fill in the missing values. A simple linear interpolation is used.

Around once a day (on average) the GPS receiver outputs a dubious position, which can be identified by a spike in the Speed Over Ground value. These values are trapped and replaced by interpolated values.

Data are logged at a rate of 1 Hz.

5.4 Power outages

Both logging systems are protected against short power glitches and failures by small UPS units. However, during the ferry's maintenance periods the power may be off for 6 or 7 hours and during these periods the loggers do not record.

6.0 Data Processing

6.1 Data Processing Procedures and Programs

On Jon Campbell's PC, take the CompactFlash card from the Bridge logger and copy the entire contents into a newly created directory such as C:\Projects\FBox\RedFalc\Bridge\16_Jun04

Take the CompactFlash card from the Engine Room logger and copy the entire contents into a newly created directory such as C:\Projects\FBox\RedFalc\Eng_room\16_Jun04

These directories act as archives for the raw binary data files and the logger's diagnostic files.

Start the Watcom IDE program and open the RedProc3.wpj project

Edit the first parameter in the redproc3.cfg configuration file to point to the “bridge” directory you have just created, C:\Projects\FBox\RedFalc\Bridge\16_Jun04

Run the RedProc3 program, which will take a few minutes to complete. It displays its progress and any errors in a DOS window. When prompted to do so, hit any key to close this window.

The RedProc3 program performs the following actions:-

1. Creates a new directory C:\Projects\FBox\RedFalc\Process\16_JUN04
2. Creates a log file for the GPS processing called C:\Projects\FBox\RedFalc\Process\16_JUN04\G1701407.log, where the file name is generated from the current Day number and time. This log file contains details of the files processed and any errors encountered.
3. Creates a new directory C:\Projects\FBox\RedFalc\Process\16_JUN04\GPS_PROC
4. Processes all the binary GPS files found in C:\Projects\FBox\RedFalc\Bridge\16_Jun04\GPS and for each one, creates two new files in the \GPS_PROC directory. One of these contains binary data with any missing values replaced by interpolated values, and the second is an ASCII text version of the same data.
5. The Speed Over Ground value in each GPS record is compared to a MAX_SPEED value (currently set to 20 knots) and any records that exceed this value are rejected. This seems to occur around once per day on average.
6. Details of missing records and “bad speed” records are recorded in the log file.
7. Once the GPS files have been processed, a second log file called C:\Projects\FBox\RedFalc\Process\16_JUN04\M1701407.log is created to store information about the processing of the MiniPack data.
8. All the binary MiniPack files in C:\Projects\FBox\RedFalc\Eng_room\16_Jun04\MINIPACK are then processed in to a single, large file called C:\Projects\FBox\RedFalc\Process\16_JUN04\M1541036.prc, where the filename is derived from the start time of the oldest MiniPack file.
9. Each parameter in each MiniPack record is checked to see that it lies between predefined maximum and minimum values. If any parameter fails this test, the record is rejected and an entry is made in the log file. The values currently in use are defined below.
10. Each valid MiniPack record is assigned a GPS position and speed from the processed GPS files. A “distance from a reference position” value is computed from the GPS position.
11. The 16 fields generated for each output record are explained below.

When RedProc3 has completed, open Matlab and edit the RedF_combined.m file to point to the .prc file you have just created. Run this program to produce a series of graphs, which will quickly show if all the data are sensible.

Finally, copy the .prc file to S:\GDDPRIV\Ferrybox\RedFalcon\16_Jun04

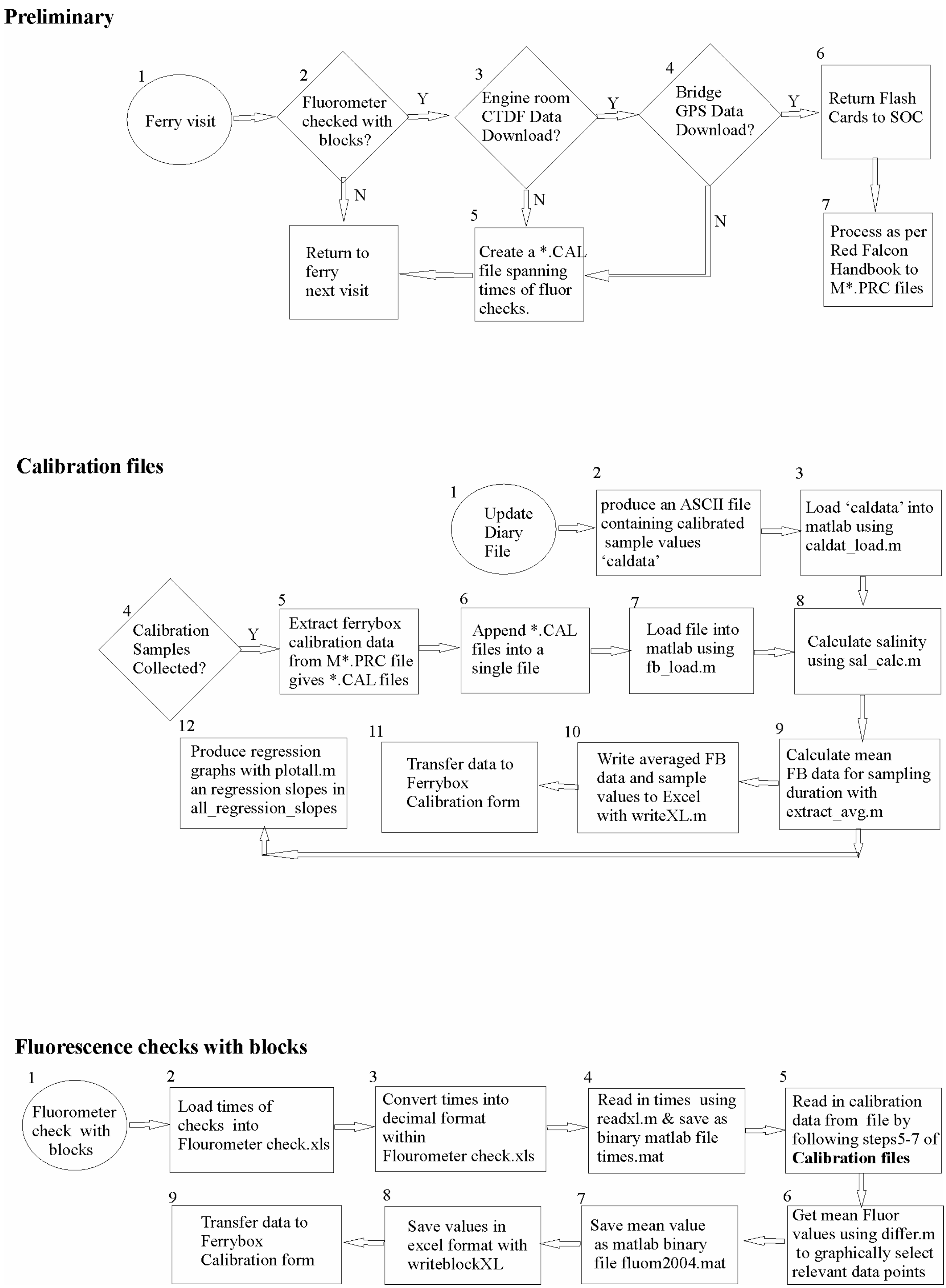


Figure 6.1 Red Falcon FerryBox data processing flowchart

6.2 Preliminary

1. Visit Ferry
2. Was the fluorimeter checked?
3. If the flashcard is running low on storage, or more usually at the end of a calibration run or cleaning visit; replace the flashcards in the engine room and in the bridge logging systems with fresh flashcards as per Red Falcon Handbook
4. as per 3
5. Generally, the data from the fluorescence block calibrations was extracted from the tail end of the data files downloaded at the end of a calibration crossing (5, Calibration files) sometimes the optical calibration block was used but no crossing made, in these cases new calibration files were created – data were extracted that spanned the times of the measurements and were written to files with the name chosen to numerically fall into sequence with the other *.CAL files.
6. Return flash card to SOC in order to read card onto computer system.
7. Process retrieved data as per Section 6.1 to ASCII M*.PRC files. The output of the program Redproc3 was saved onto the network as an ASCII text files of the form M1231030.PRC where 123 was the day number (1st January was day 1) and 1030 was the time of the first record.

6.3 Calibration files

1. Update Diary file. A diary file was created after each calibration visit, there were 3 worksheets to update; Calib Xings, diary and times. A copy was made of the latest worksheet labelled ddmmyy(event). This copy was then renamed to the calibration date and event, it was then updated with the values from the calibration crossing. See **Appendix\ Red Falcon diary.xls** for the location and an example of a diary file.
2. Once the salinity, chlorophyll and SPM measurements have been made the results were tabulated in the Microsoft excel file `cal_chl_sal_turb.xls`. This was then saved in Unicode format producing an ASCII file called **caldata** that contains calibrated sample values with the following columns; event number, jday, chlorophyll, salinity, Suspended sediment a portion of this file is shown in **Appendix**Structure of file caldata
3. Load the calibration results from the file **caldata** into matlab using **caldat_load.m**
4. Were there any calibration samples collected prior to retrieving the flash card?
5. In order to calibrate the data using the samples collected during a calibration crossing it was neccessary to reduce the size of the data files. The files were usually downloaded from the FerryBox at the end of a calibration run. Data were sampled at 1 Hz so the last 3.5 hours of the file were contained in the last 12600 lines of the **M*.PRC** file. The ASCII files were truncated by using the UNIX command **tail** to a file of the same name but with extension **.CAL** these smaller files were easier to manage. This was performed in the UNIX script **chopper** or **chopper2&3** where data was not downloaded that day.

N.B. the ASCII files generated by the FerryBox proceedure have names that correspond to the files starting date and time. When the end of the file was detached it still currently carries this name with the extension **.CAL**, although the data in the file may well be from a completely different day.

6. All the **.CAL** files were appended into a single calibration file.
7. The appended file was loaded into Matlab using the script **fb_load.m.** It was saved as a matlab binary file **caldat.ed**

8. Salinity was calculated from the logged FerryBox variables; Pressure, Temperature and conductivity using the script **sal_calc.m**
9. The data from the Ferry Box file was extracted for the duration of the calibration sample and averaged using **extract_avg.**

NB. The filling of the sampling container can take up to about 10 seconds, by the time that the PC clock time was recorded another 10 seconds can have passed. These timings were taken into consideration when averaging the logged data. An average value over 10 seconds was made along with standard deviations of all of the logged variables.

10. The averages obtained from the FerryBox data and the measurement values from the samples are written to Excel with the script writeXL.m
11. The data are then transferred to the current FerryBox calibration form.
12. plotall.m was used to create graphical representations of the calibrations at the same time creating and writing the values of regression slopes that were forced through the origin. These were listed in the file all_regression_slopes.

6.4 Fluorescence checks processing

1. If the solid state fluorescence bloocks have been used to check the fluorimeter then:
2. The times that the block was in situ are entered into the spreadsheet fluorimeter checks.xls.
3. The times entered into the spreadsheet fluorimeter checks.xls are converted into decimal day number within the file.
4. The decimal times are read into matlab using readXL.m. They are then saved as a binary matlab file times.mat. The tabulated fluorescence values obtained from the FerryBox screen were loaded and saved in the same manner.
5. The Matlab proceedure outlined below requires that there were certain variables loaded into the workspace. These were the the FerryBox variables contained in the cal file created using fb_load.m
6. The fluorescence values obtained whilst the calibration block is in place are selected by running the script differ.m which, this calls another m-file , box.m that lets the user graphically select the data points to be averaged from plots of Fuorescence against time. an average value is generated from the selected points.
7. These mean values are saved to the matlab binary file fluom2004.mat.
8. The script writeblockXL saves these values to a spreadsheet.
9. The Spreadsheet values are entered into the current calibration form.

7.0 Data Editing

1. Load all of the ASCII data files M*.PRC into a PC; directory
   C:\Documents and Settings\mch\Desktop\Red Falcon\Raw 1Hz
2. Run Fb_loadsingly to create matlab files for each .PRC file creating files
   FB2004raw1 through FB2004raw16 inclusive. These contain the variables
   jd,COND,TEMP,PRESS,FLUOR,MTRK,LAT,LON
3. remove surplus variables by typing
   clear str savefile s i array a YR V TDIFF SS SOG RECTDIFF R MM MA KM HH
4. load data file RF2004rawXX
5. plot (jd,PRESS)
6. select least and greatest reliable data values using data cursor

7. note the flagging limits to encompass these values

8. Clear all variables from workspace
9. Load in next file
10. repeat plot

file	acceptable limits	file	acceptable limits
raw1	13 to 18	raw9	5.0 to 10
raw2	12 to 19	raw10	8.5 to 16.5
raw3	10 to 16	raw11	6.5 to 13.5
raw4	7.0 to 13.5	raw12	12 to 18
raw5	7.0 to 13	raw13	5.5 to 10
raw6	7.0 to 13.0	raw14	8.0 to 10
raw7	7.0 to 10.5	raw15	6.5 to 10
raw8	5.0 to 10.6	raw16	5.0 to 10.5

7.1 Generating Quality Control plots

1. Starting with the M*.PRC files that are produced in accordance with the document 'Red Falcon Handbook'. The time information from the files are read into Matlab using the m-file
   E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\m_files\loaddata.m
2. loaddata.m creates a file RF04 that has the following structure:
   name week number start record stop record number of records
   where some week numbers are duplicated ie occur in two succesive files
3. E:\GDDPRIV\Ferrybox\RedFalcon\data\ascii_data\splitter.m
   then uses this control file to split the PRC data files into weekly files. (or otherwise if required)
4. E:\GDDPRIV\Ferrybox\RedFalcon\data\ascii_data\loadwk.m
   reads in the weekly files, calculates salinity, splits the data into latitude bins and then creates an average and standard deviation for all the variables for each bin. These are saved as files of the type;
   E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\binned\RF0419av.mat
5. E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\binned\plotit.m
   then generates postscript file showing graphs of the means +/- 1sd for salinity fluorescence OBS longitude and temperature. See the following for an example.
   E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\ps\RF0419tsf.ps
6. In order to visualise the residual fluorescence the data were reduced in frequency by using the matlab function 'decimate' in an m-file called minify
   E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\minify.m
7. data points were now occurring at 1 minute intervals enabling the full range of the fluorescence data to be viewed on a graph. An example of such a file is;
   E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\RF0419min.mat
8. E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\minappend.m
   joins all the 'min' files. into a single file
   E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\RF04min.mat
9. E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\minfluor.m
   checks the ferries direction of travel; if it changes the variable 'leg' is incremented.

10. E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\minfluor1.m
    Takes averaged data and finds the minimum value of the fluorescence for each leg, it then subtracts the minimum fluorescence from the current value. Output is saved to
    E:\GDDPRIV\Ferrybox\RedFalcon\data\matlab files\decimated\RF04res.mat

8.0 Data Presentation

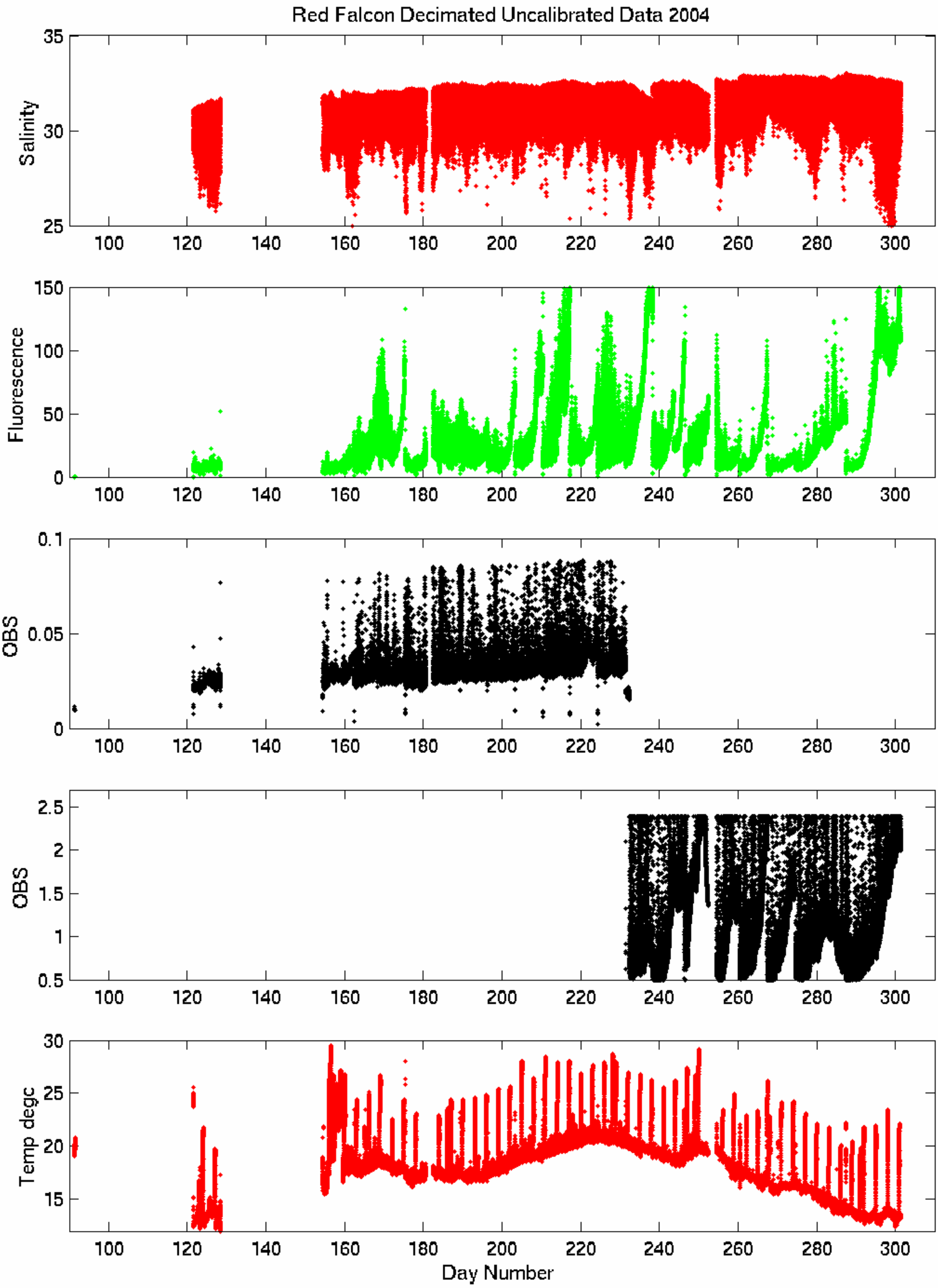
The data that has been acquired from the Ferrybox suite of sensors and portrayed within this document has had no editing applied, nor has it had any of the calibrations that have been derived from it applied to it. It is, or has been based on in the case of salinity the data as processed to the stage of the Mdddhhmm.prc files described in section 6.1.

8.1 Raw Weekly Data Plots and Mean Weekly Data Plots

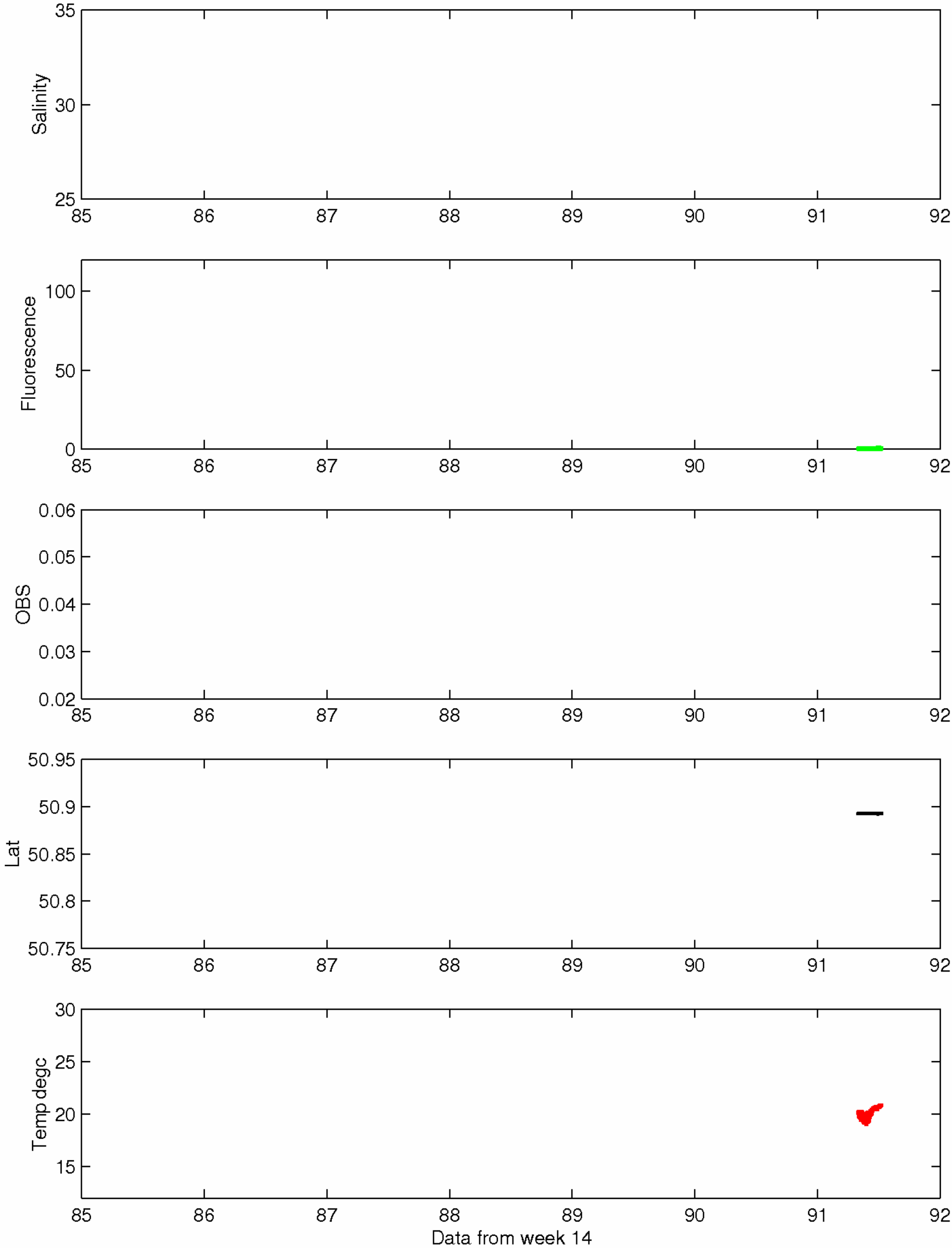
The following pages show the environmental data collected from the FerryBox system.. The first plot is an overview of the data that has been collected during 2004, It shows salinity, Fluoresence Optical Backscatter and temperature plotted against the day number. It is based on a subsampling of the 1 Hz data.

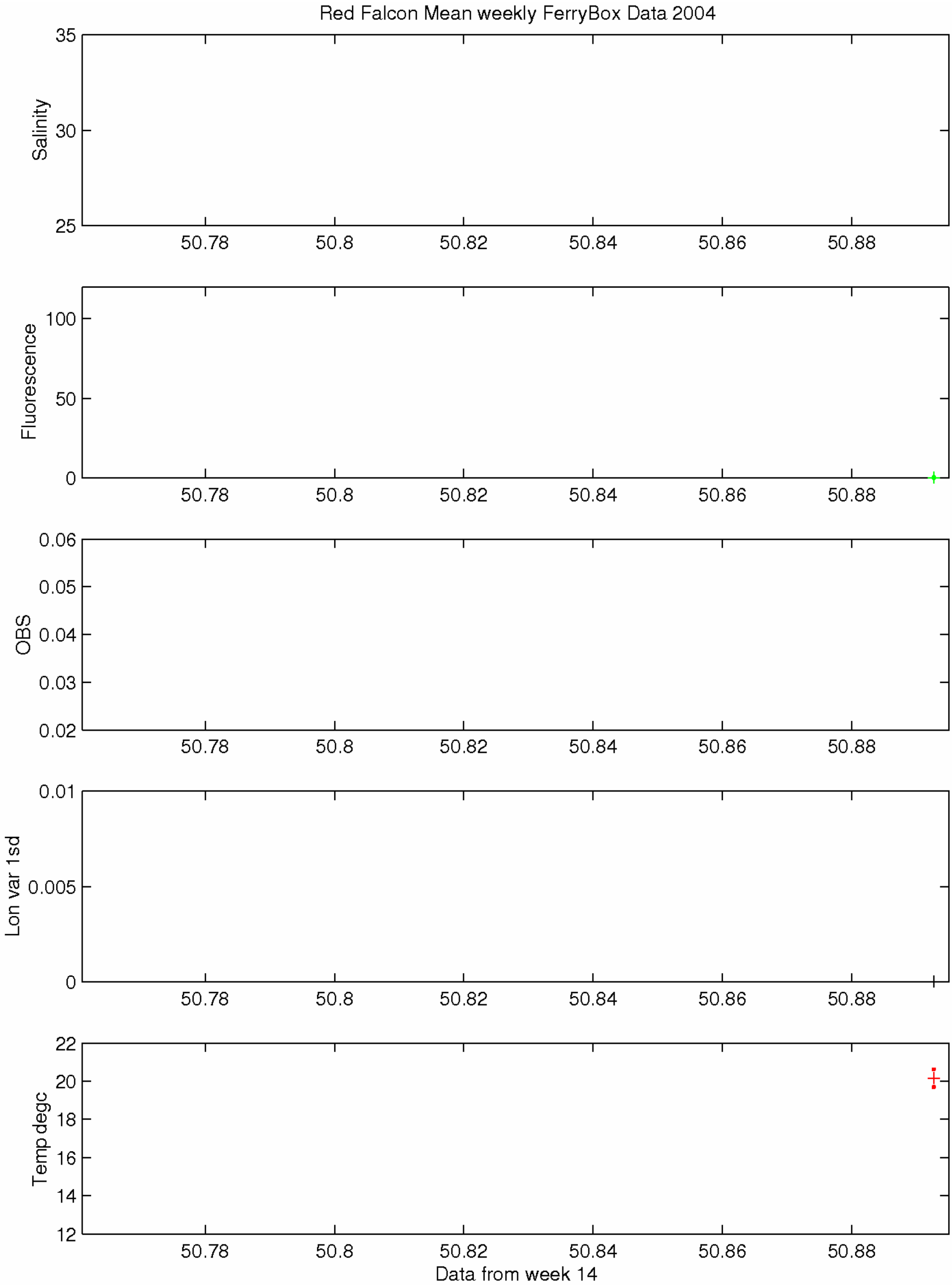
Subsequent pages are portrayed in pairs, both pages of the pair span the same duration of one week. The first page of a pair shows how the 1Hz salinity, fluorescence, optical backscatter, latitude and temperature data change through the week, this is indicated by the day number on the abcissae (day 1 corresponds to the 1st January).

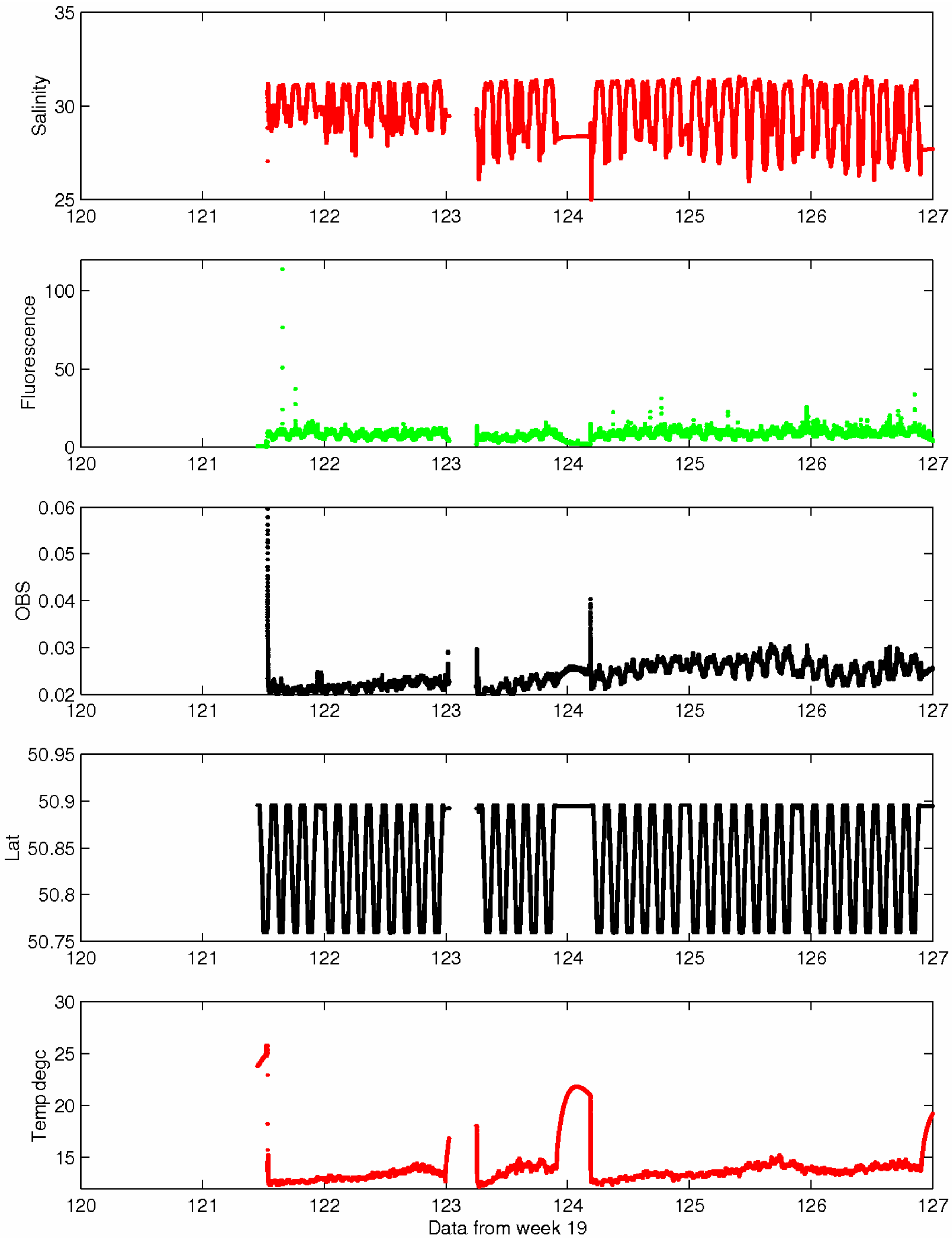
The corresponding page of the pair entitled Red Falcon Mean weekly FerryBox Data 2004 shows: the mean, mean plus 1 standard deviation and mean less 1 standard deviation of the same environmental parameters that have been calculated for 60 latitude bins along the crossing. This time plotted against the ships latitude; the left hand side corresponds to the latitude of East Cowes and the right hand side that of Town Quay, Southampton. Instead of Latitude the standard deviation of the longitude has been shown.

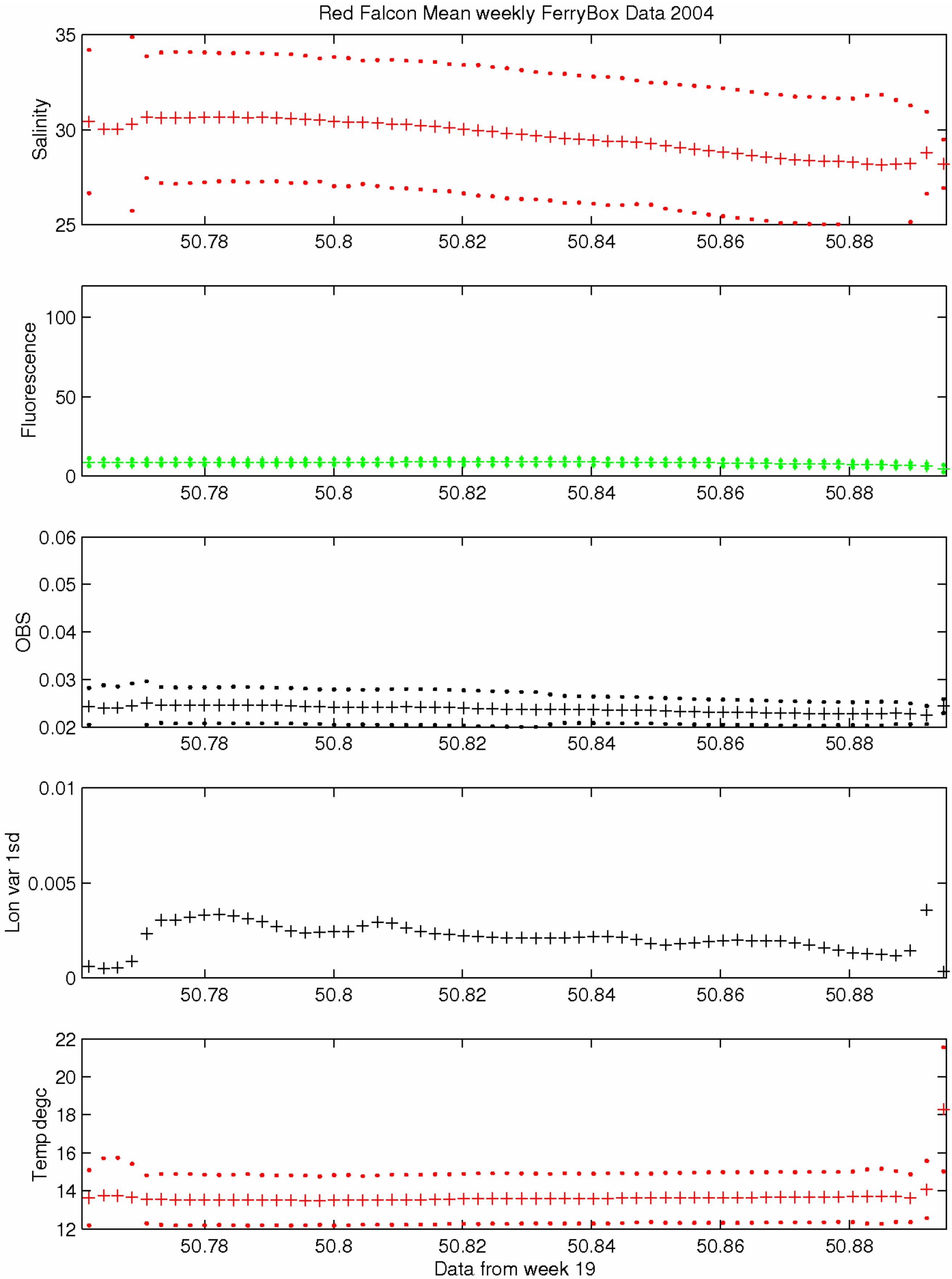


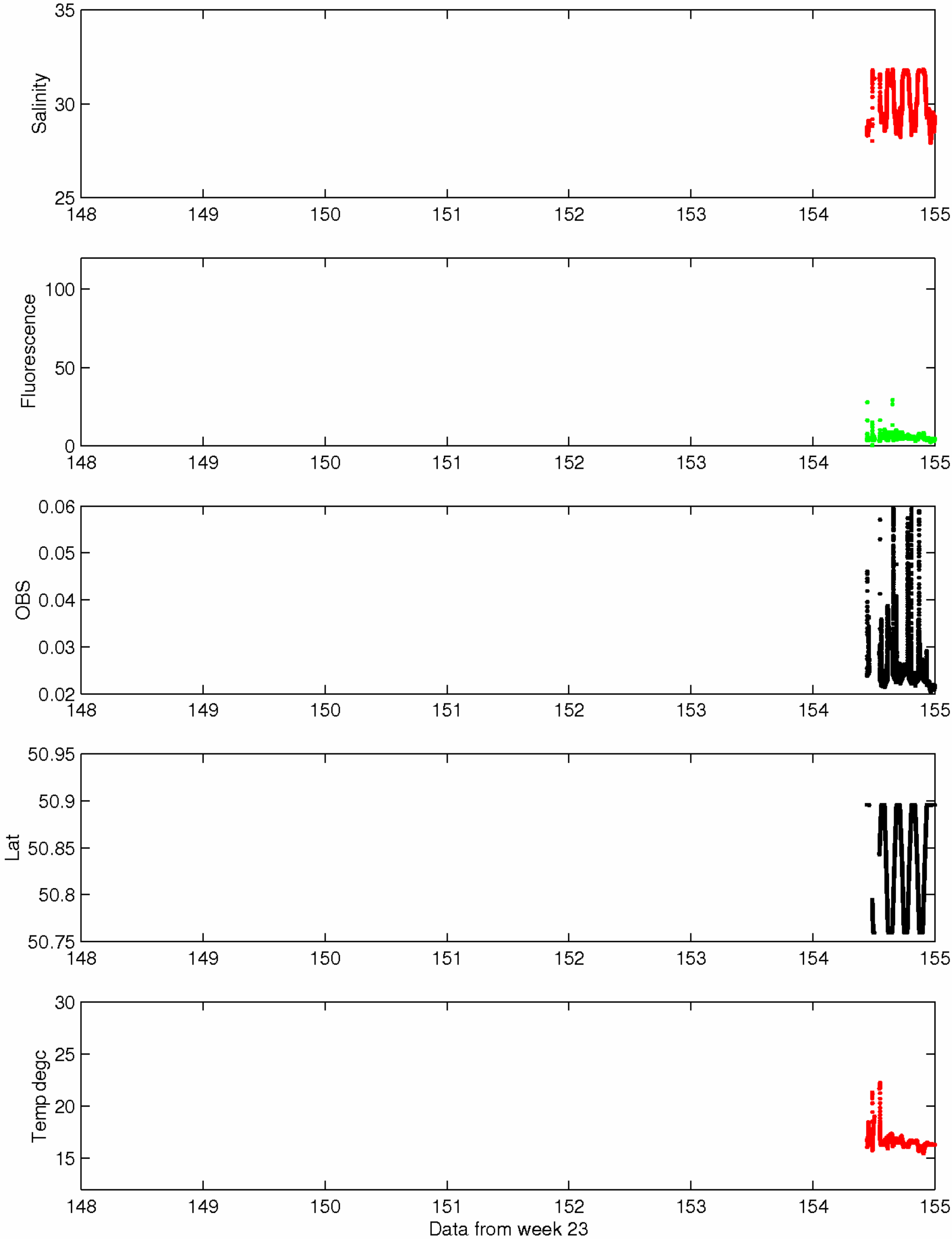
Red Falcon Decimated Uncalibrated Data 2004
Salinity
Fluorescence
OBS
OBS
Temp degc
Day Number


35
30
25
Salinity
85
86
87
88
89
90
91
92
100
50
0
Fluorescence
0.06
0.05
0.04
0.03
0.02
OBS
50.95
50.9
50.85
50.8
50.75
Lat
30
25
20
15
Temp degc
Data from week 14

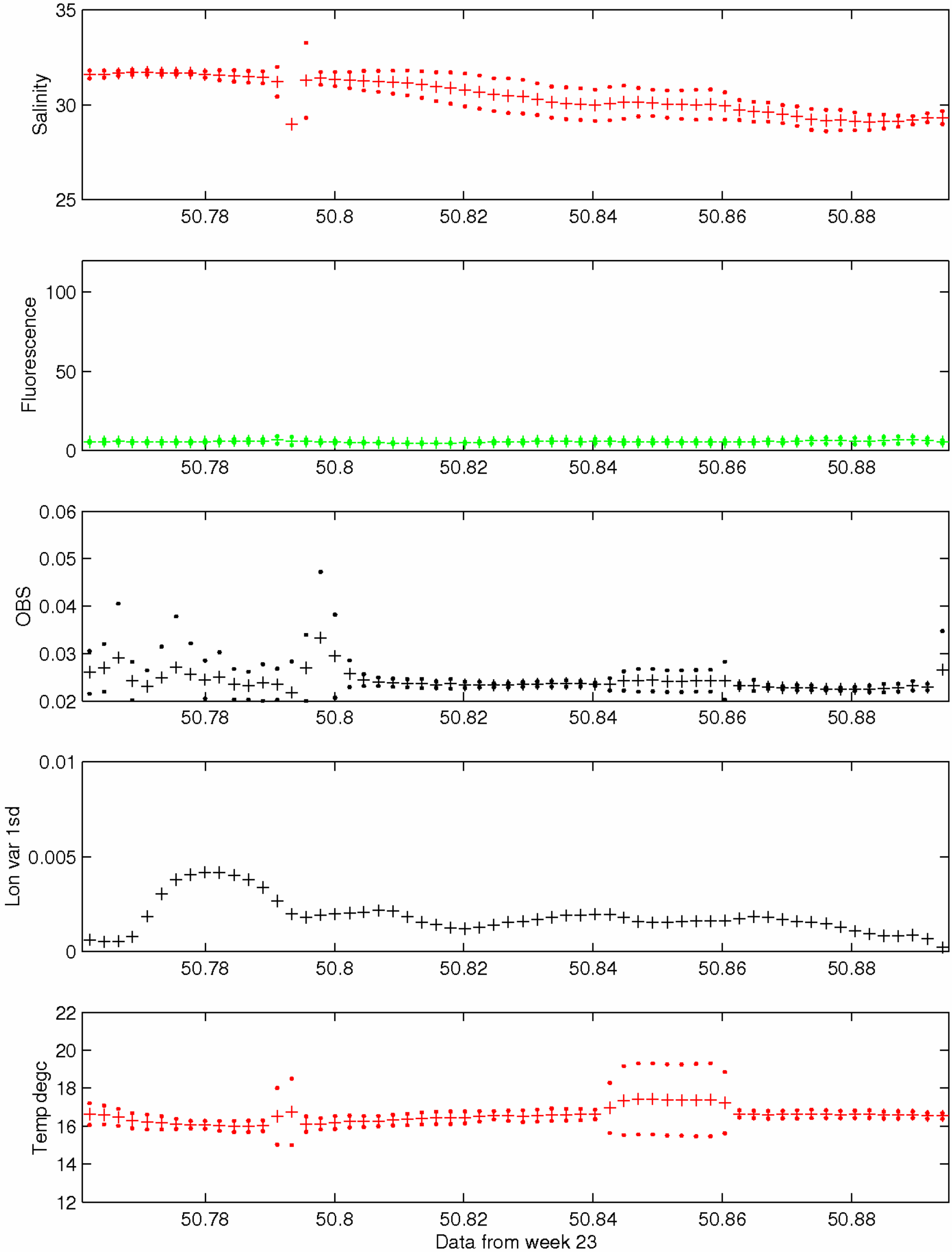

Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
50.78
50.8
50.82
50.84
50.86
50.88
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
Data from week 14

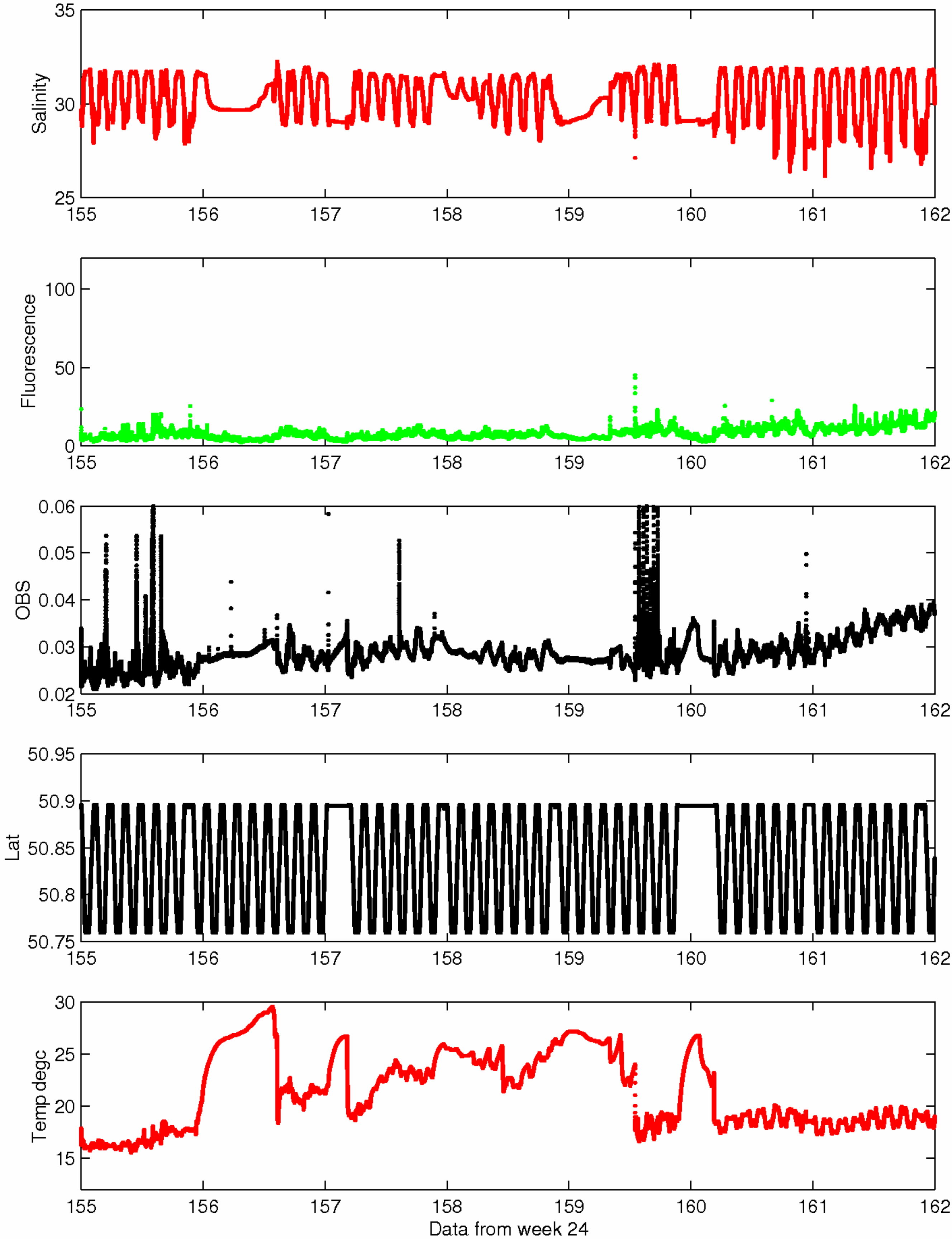

35
30
25
Salinity
120
121
122
123
124
125
126
127
100
50
0
Fluorescence
120
121
122
123
124
125
126
127
0.06
0.05
0.04
0.03
0.02
OBS
120
121
122
123
124
125
126
127
50.95
50.9
50.85
50.8
50.75
Lat
120
121
122
123
124
125
126
127
30
25
20
15
Temp degc
120
121
122
123
124
125
126
127
Data from week 19


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
50.78
50.8
50.82
50.84
50.86
50.88
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
Data from week 19

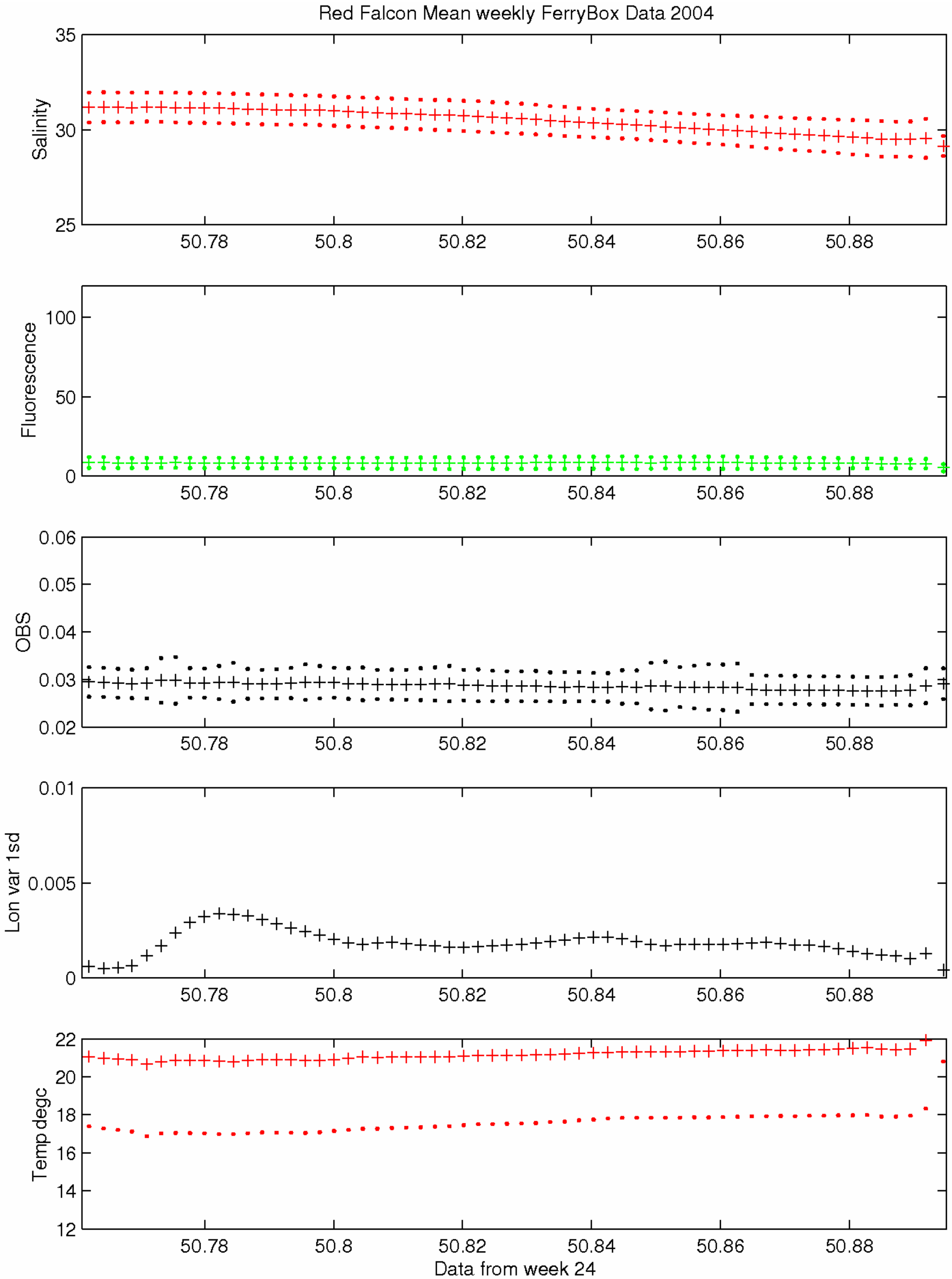

Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 23

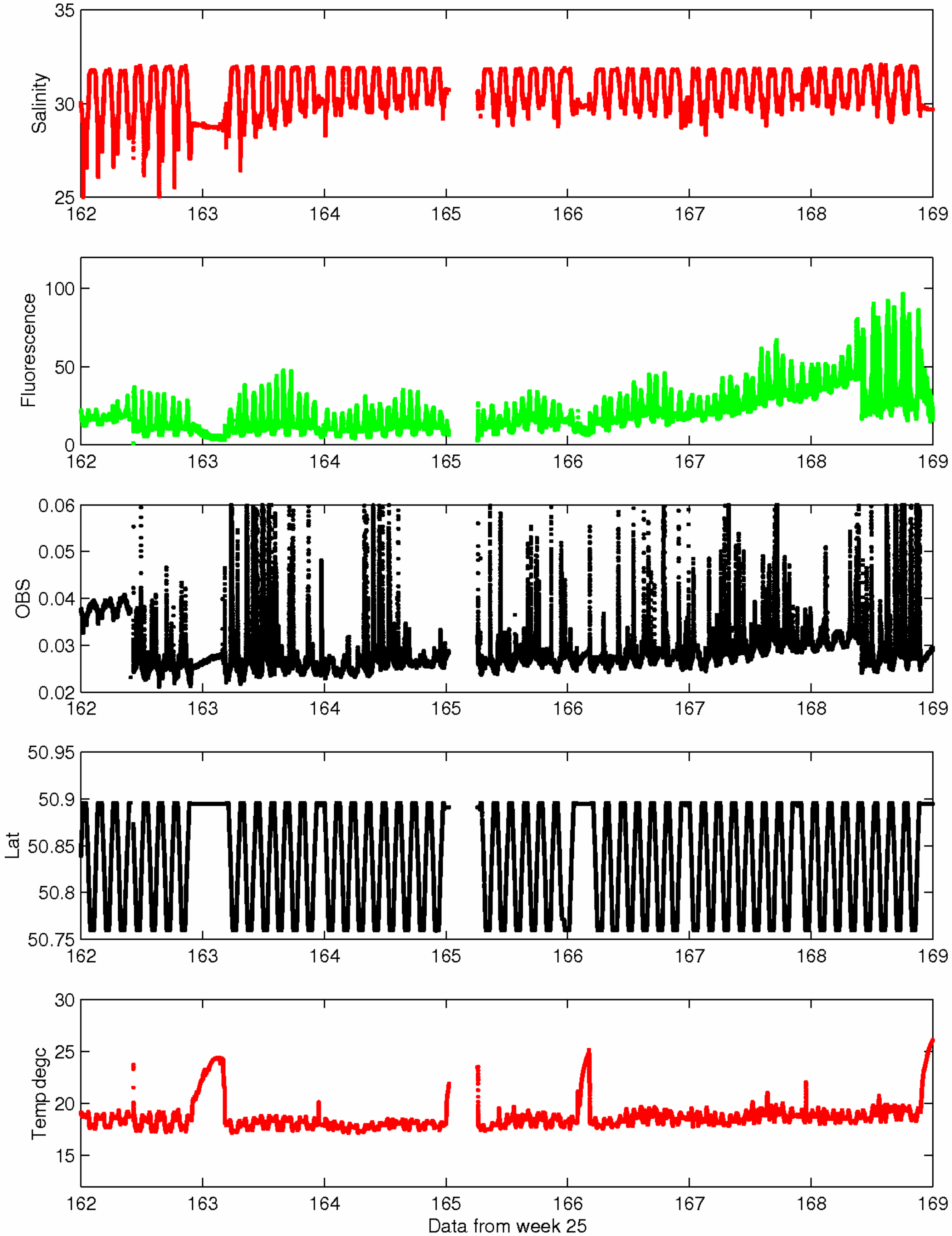
Red Falcon Mean weekly FerryBox Data 2004



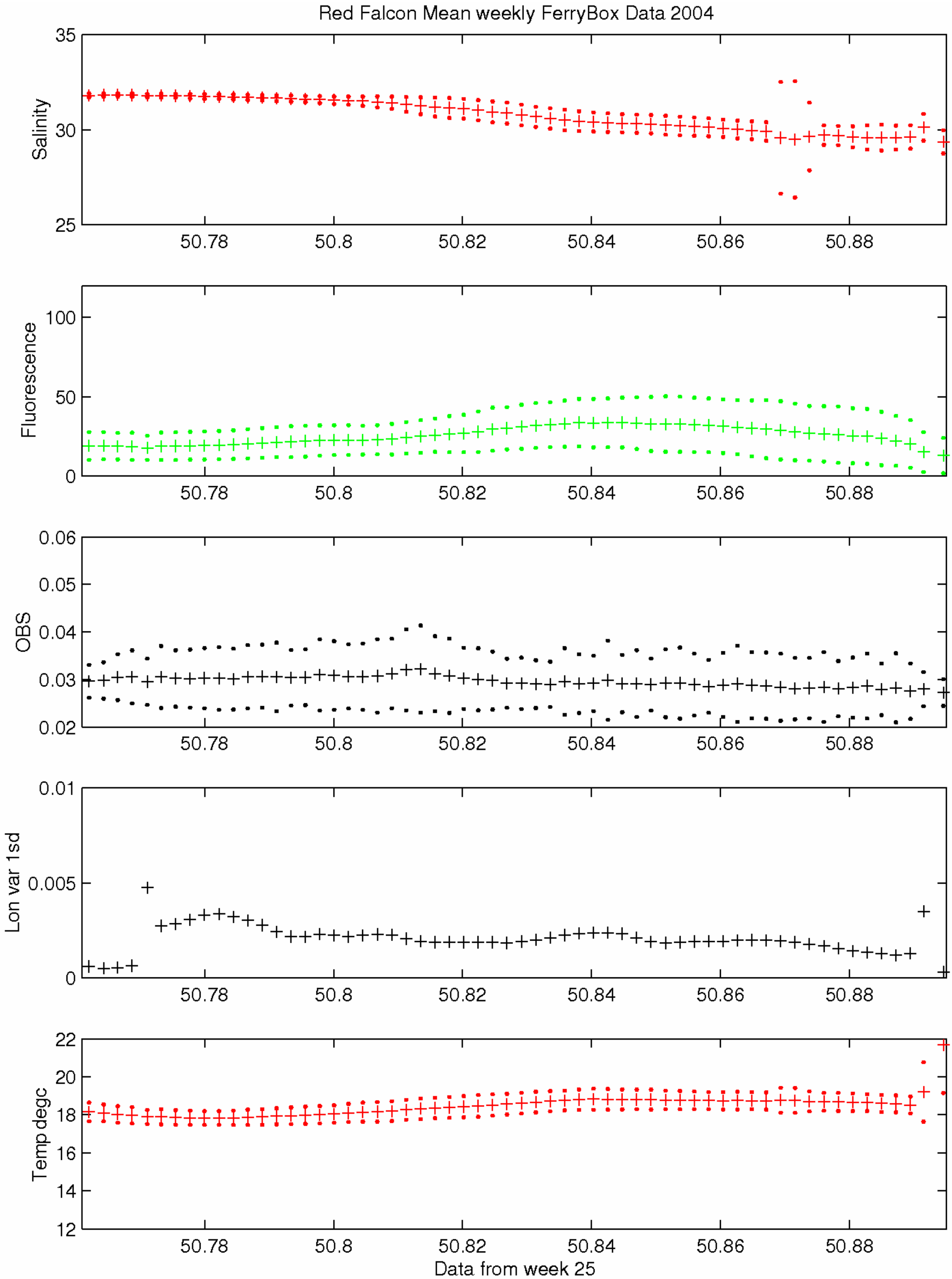


Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
155
156
157
158
159
160
161
162
Data from week 24

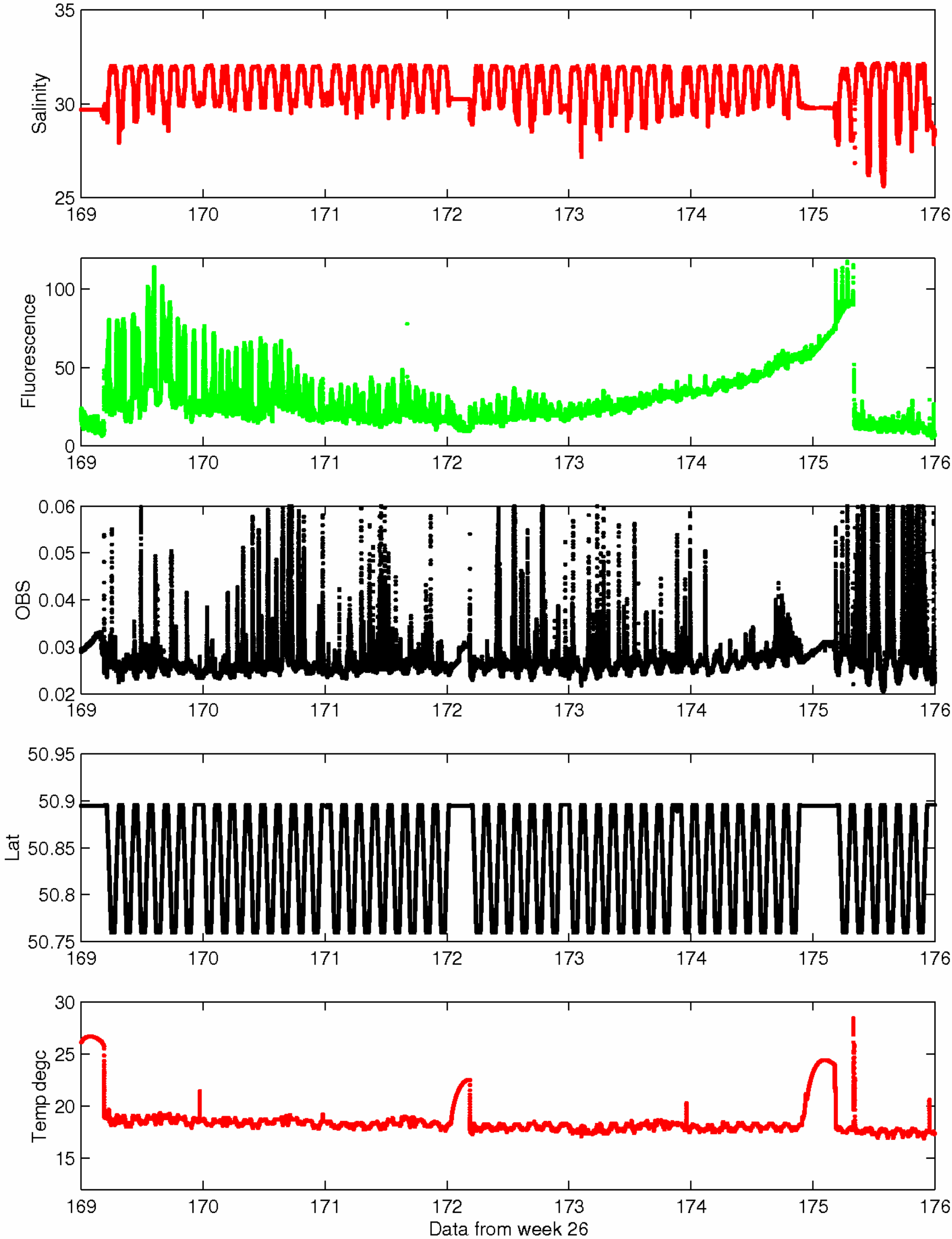

Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 24
35
30
25
100
50
0
0.06
0.05
0.04
0.03
0.02
0.01
0.005
0
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88

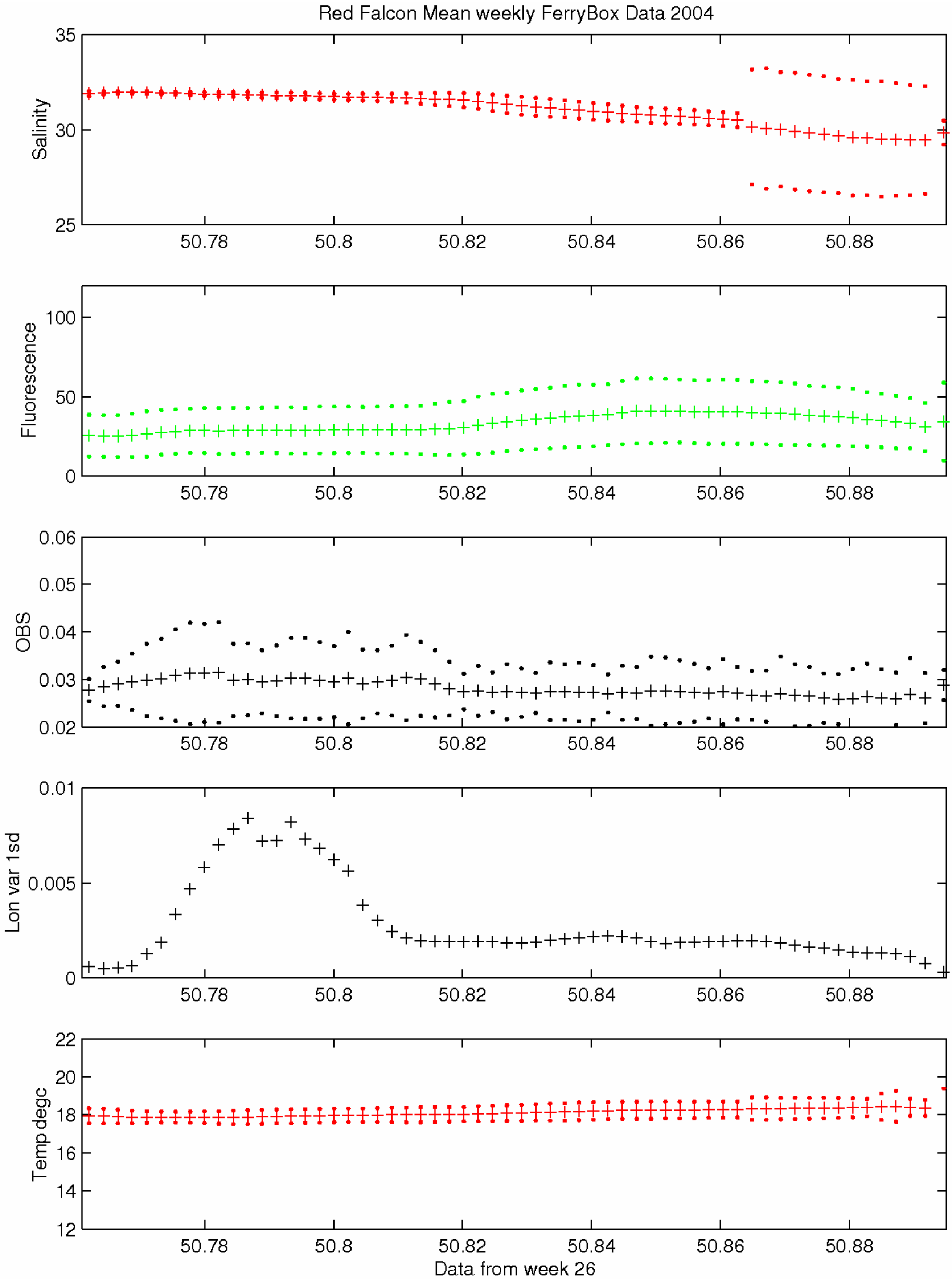


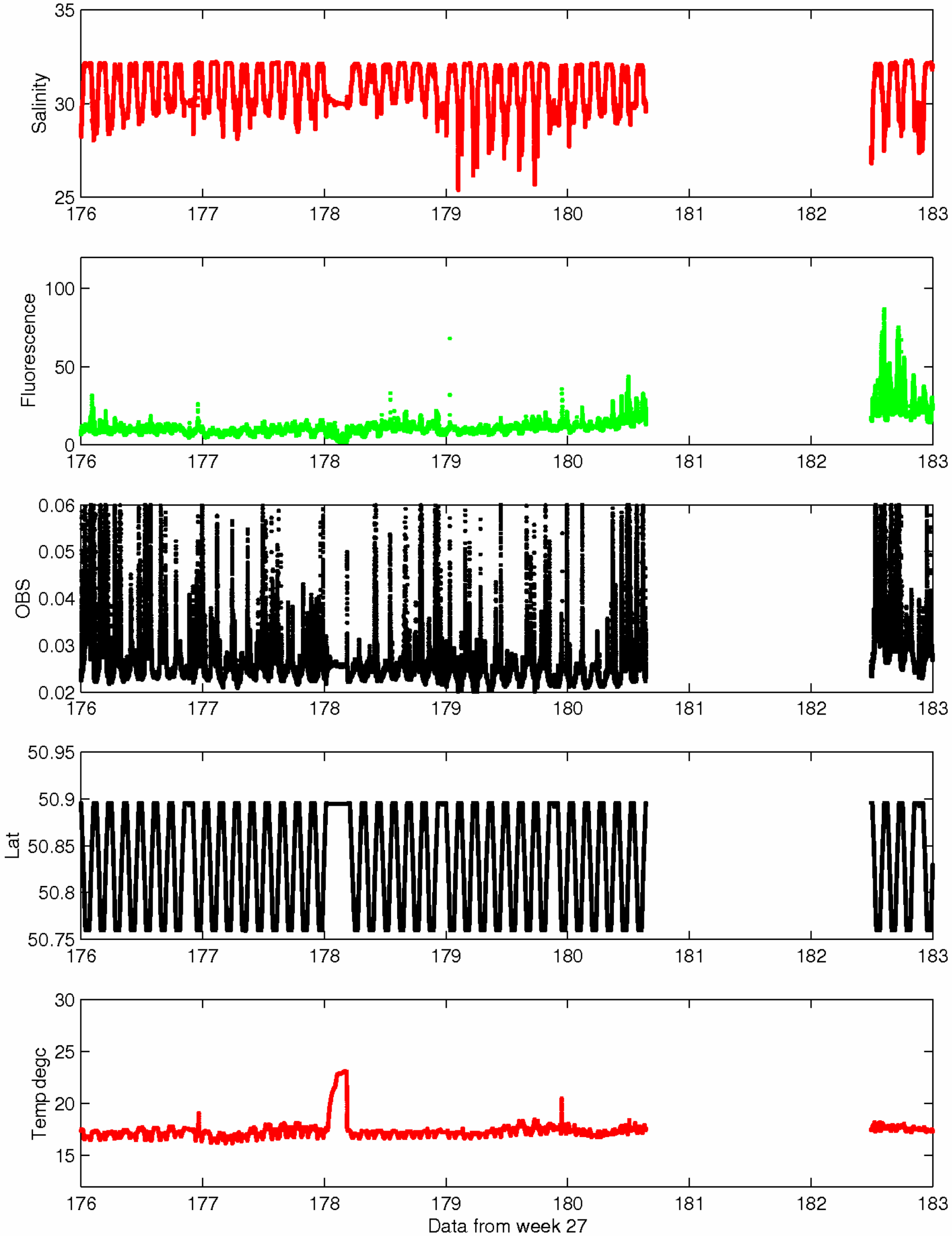
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
162
163
164
165
166
167
168
169
Data from week 25



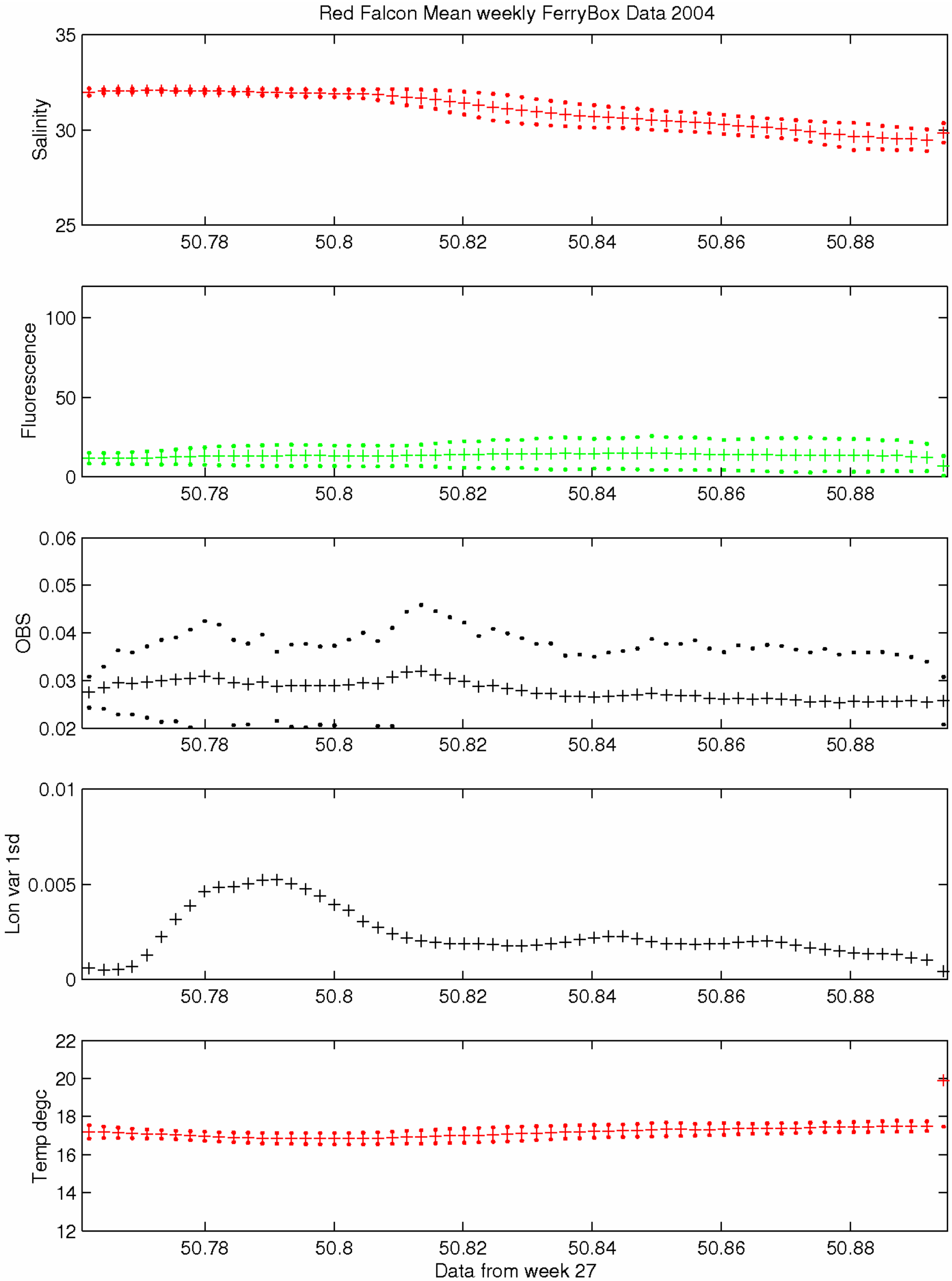
Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 25


Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
169
170
171
172
173
174
175
176
Data from week 26

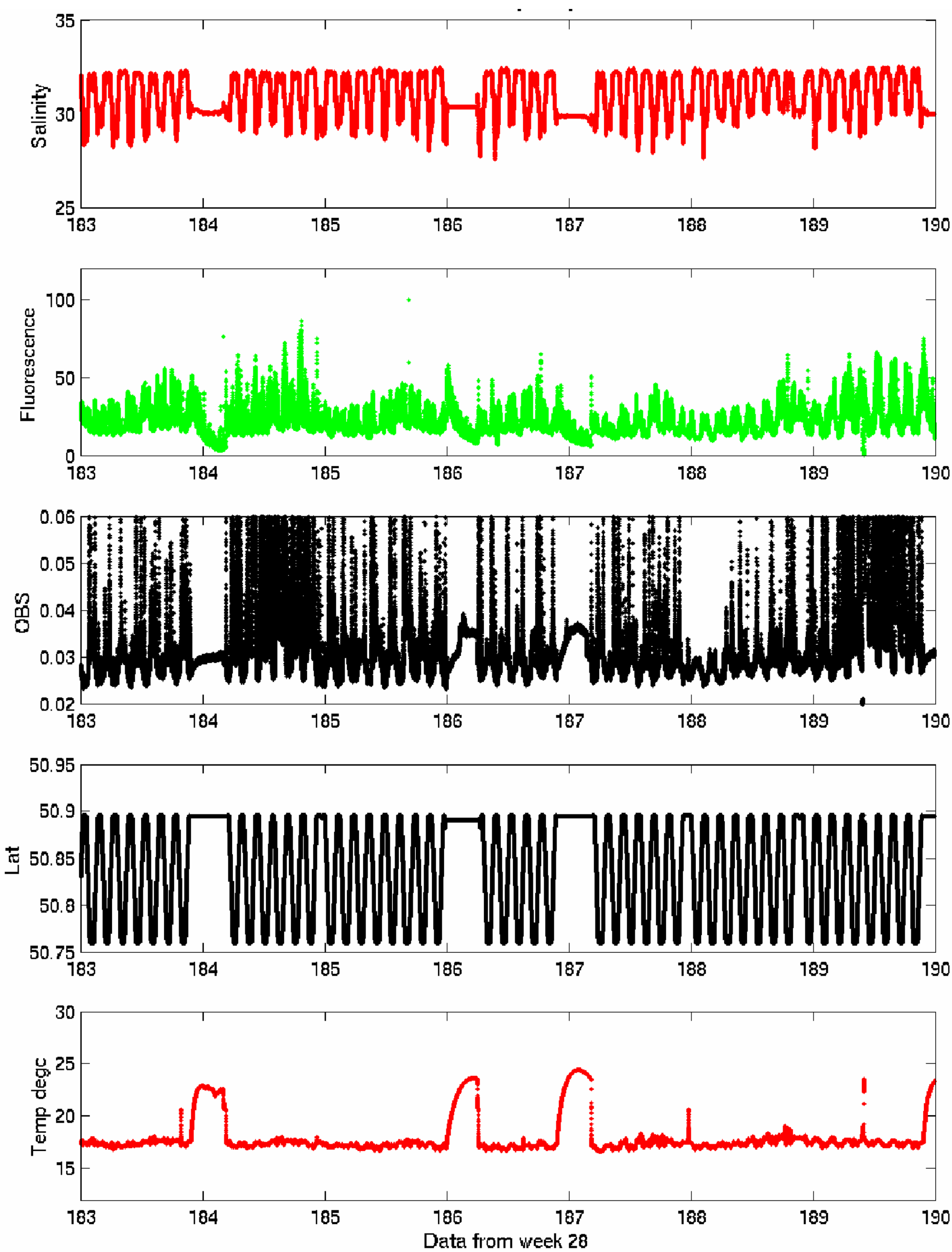

Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 26
50.78
50.8
50.82
50.84
50.86
50.88

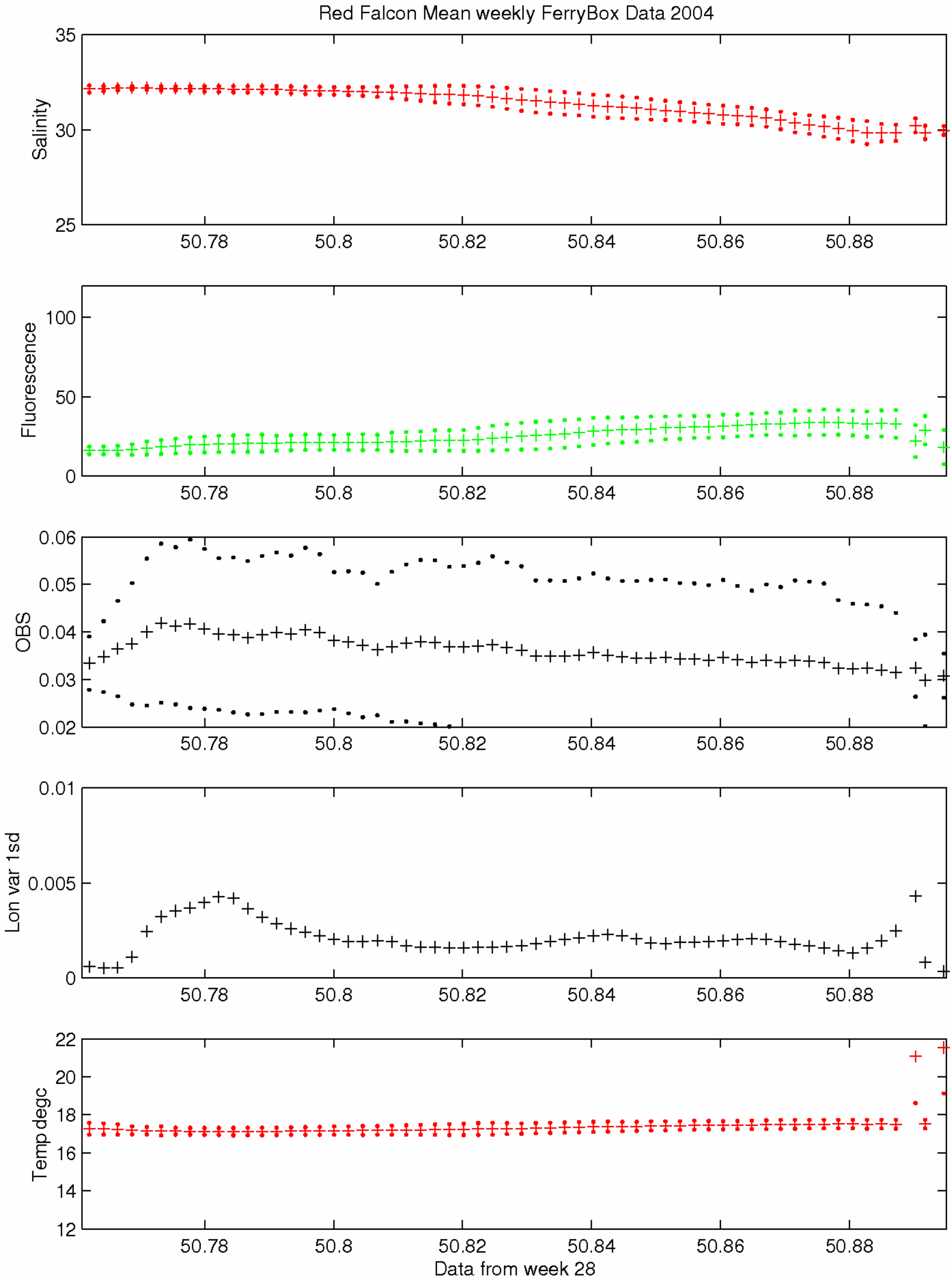


35
30
25
Salinity
100
50
0
Fluorescence
0.06
0.05
0.04
0.03
0.02
OBS
50.95
50.9
50.85
50.8
50.75
Lat
30
25
20
15
Temp degc
176
177
178
179
180
181
182
183
Data from week 27

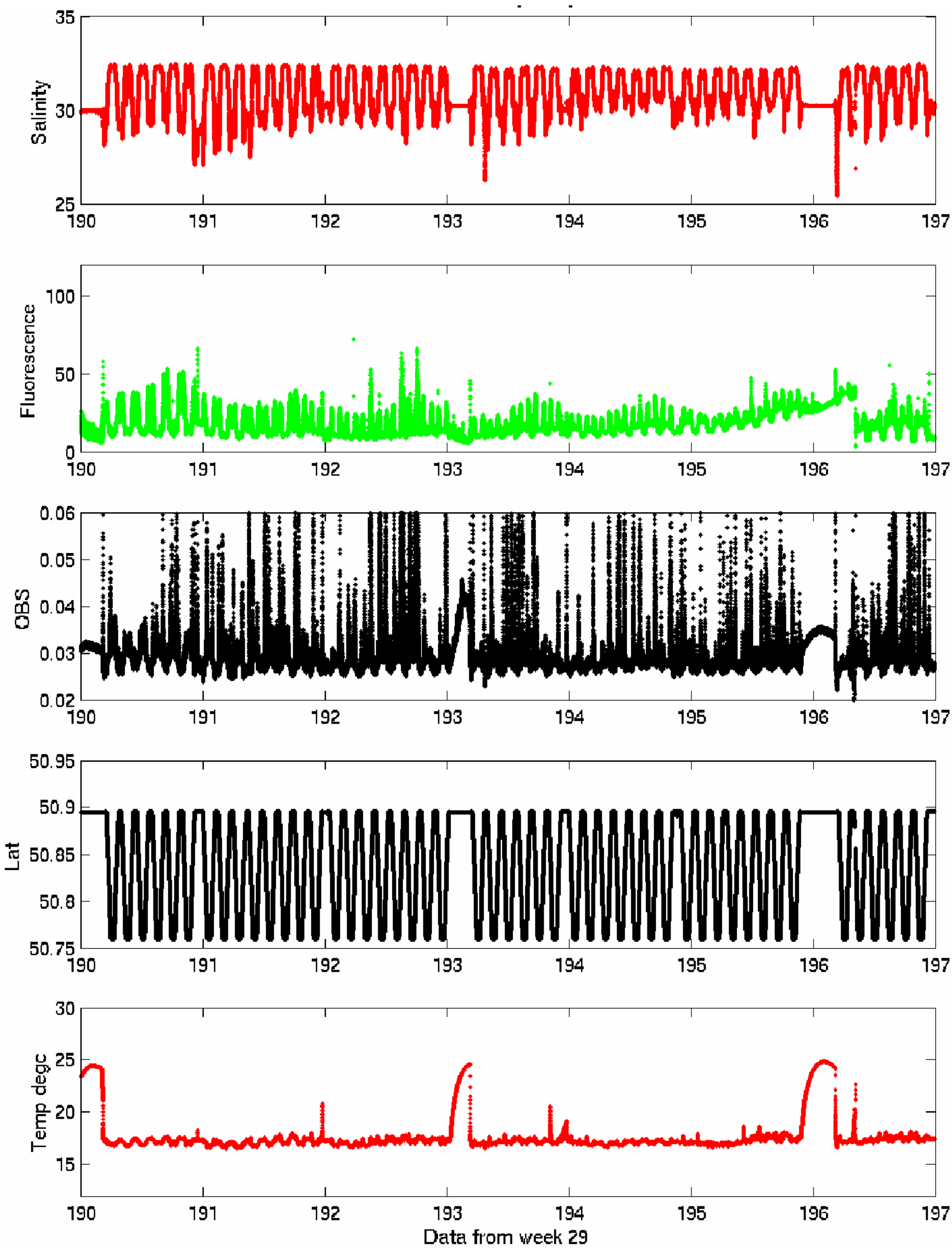


Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 27

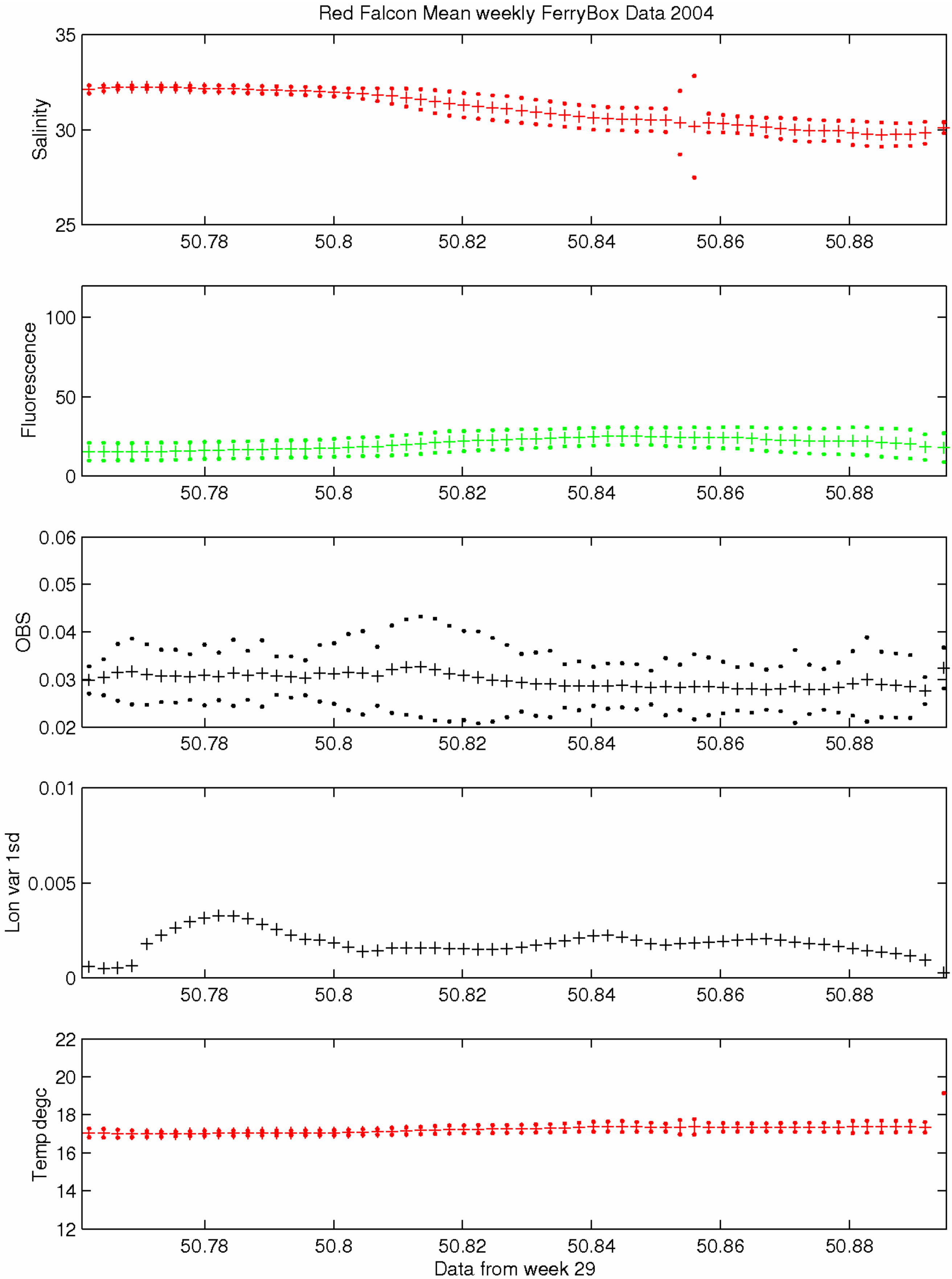

Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 28

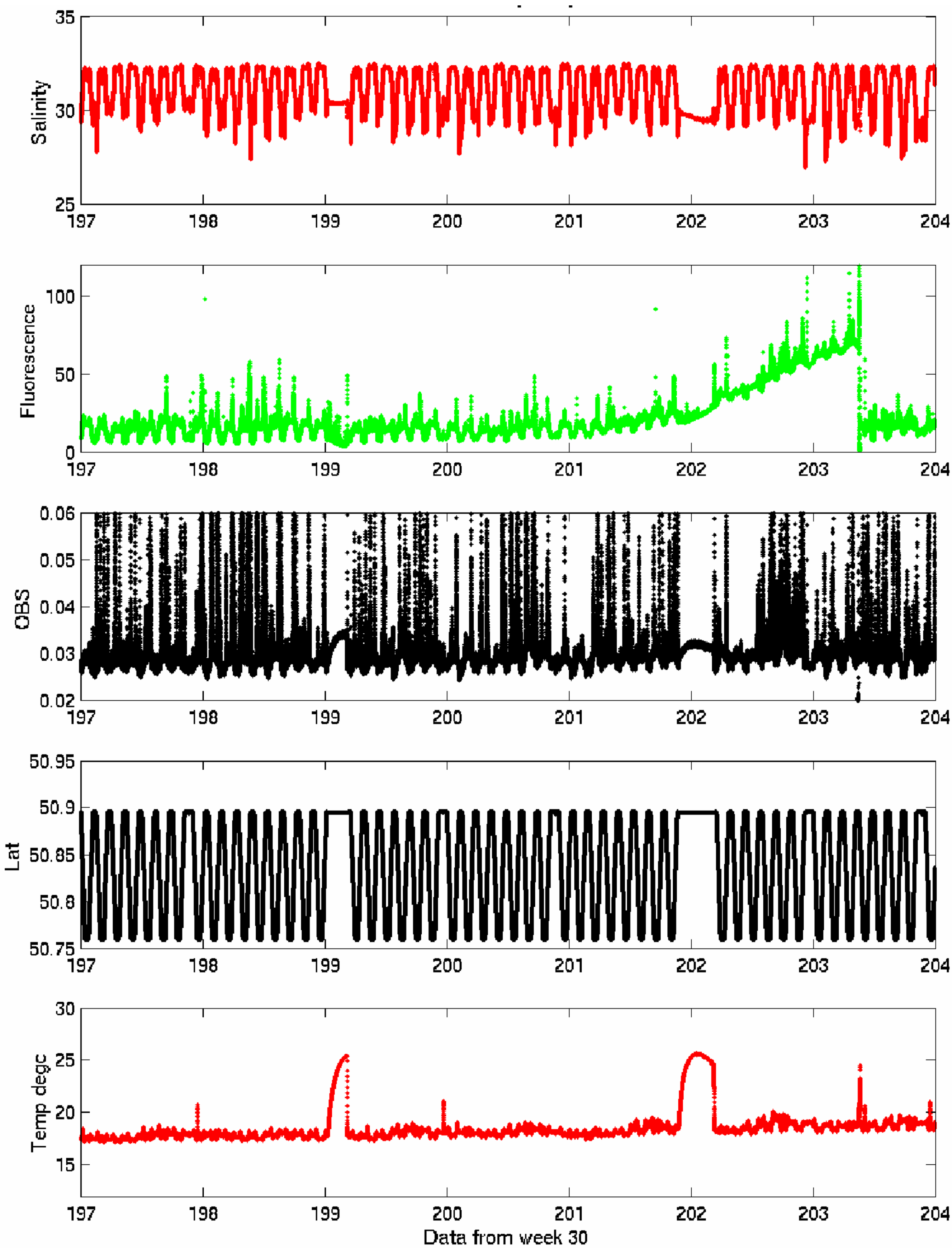


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 28

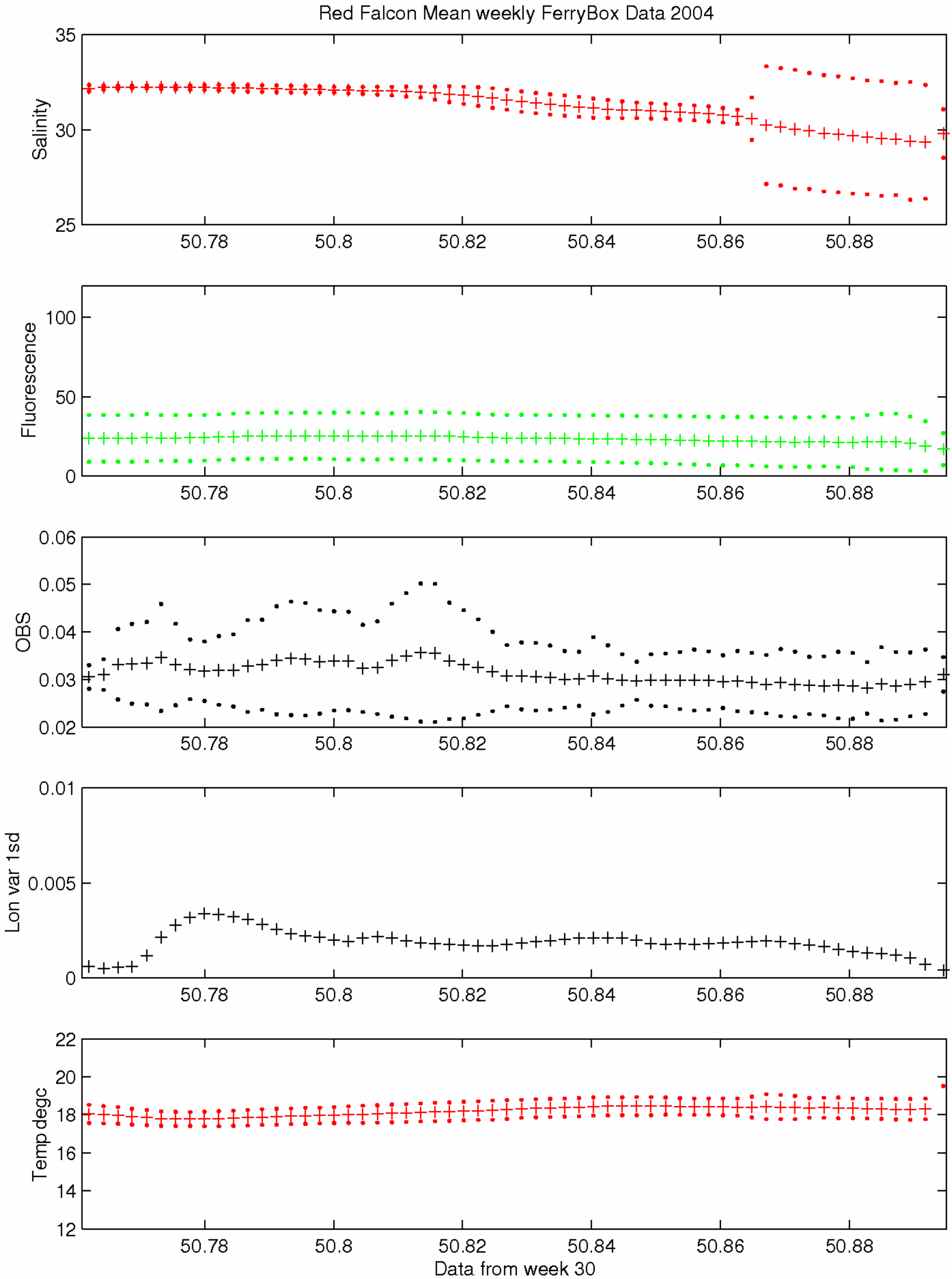


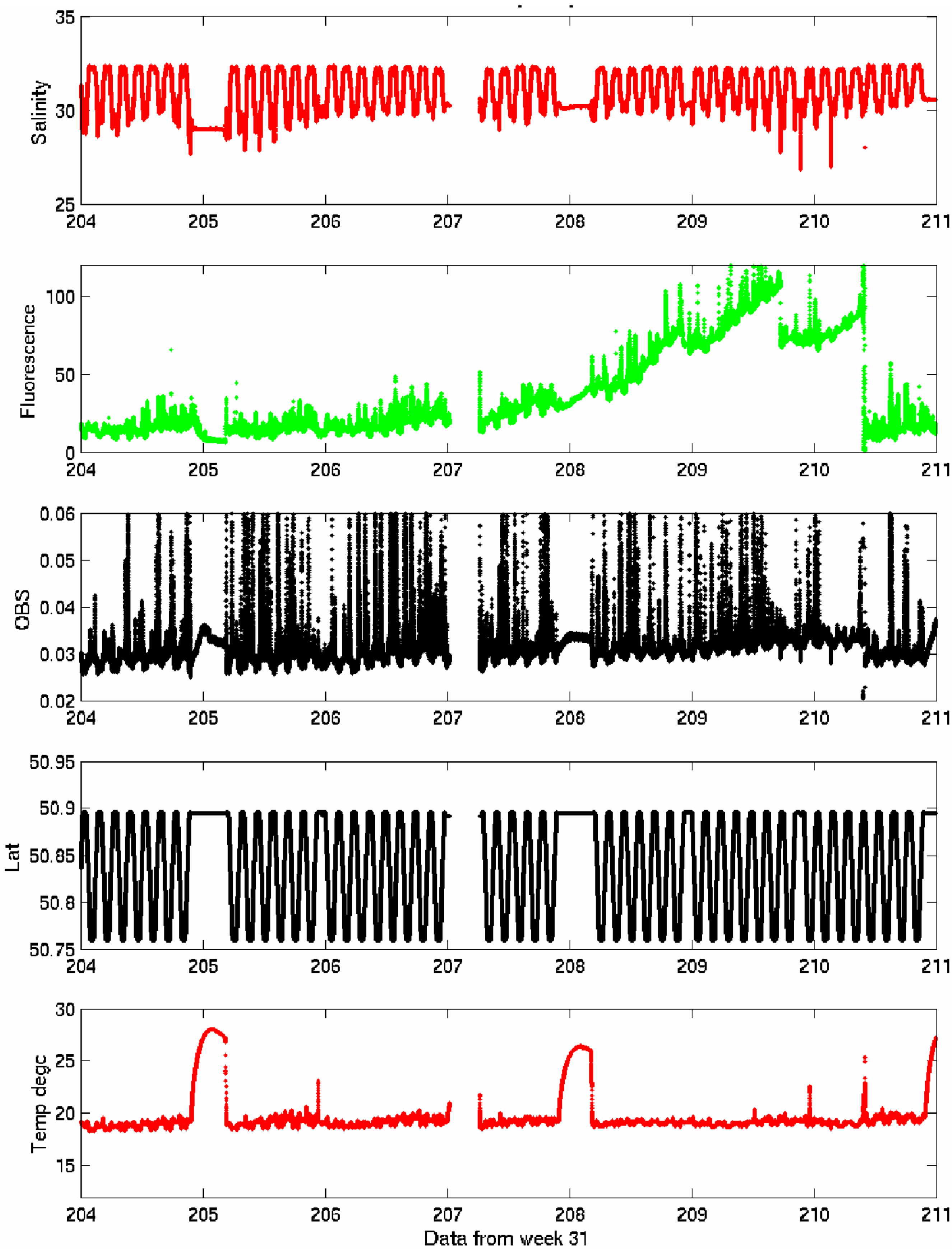
Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 29


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
50.78
50.8
50.82
50.84
50.86
50.88
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
Data from week 29

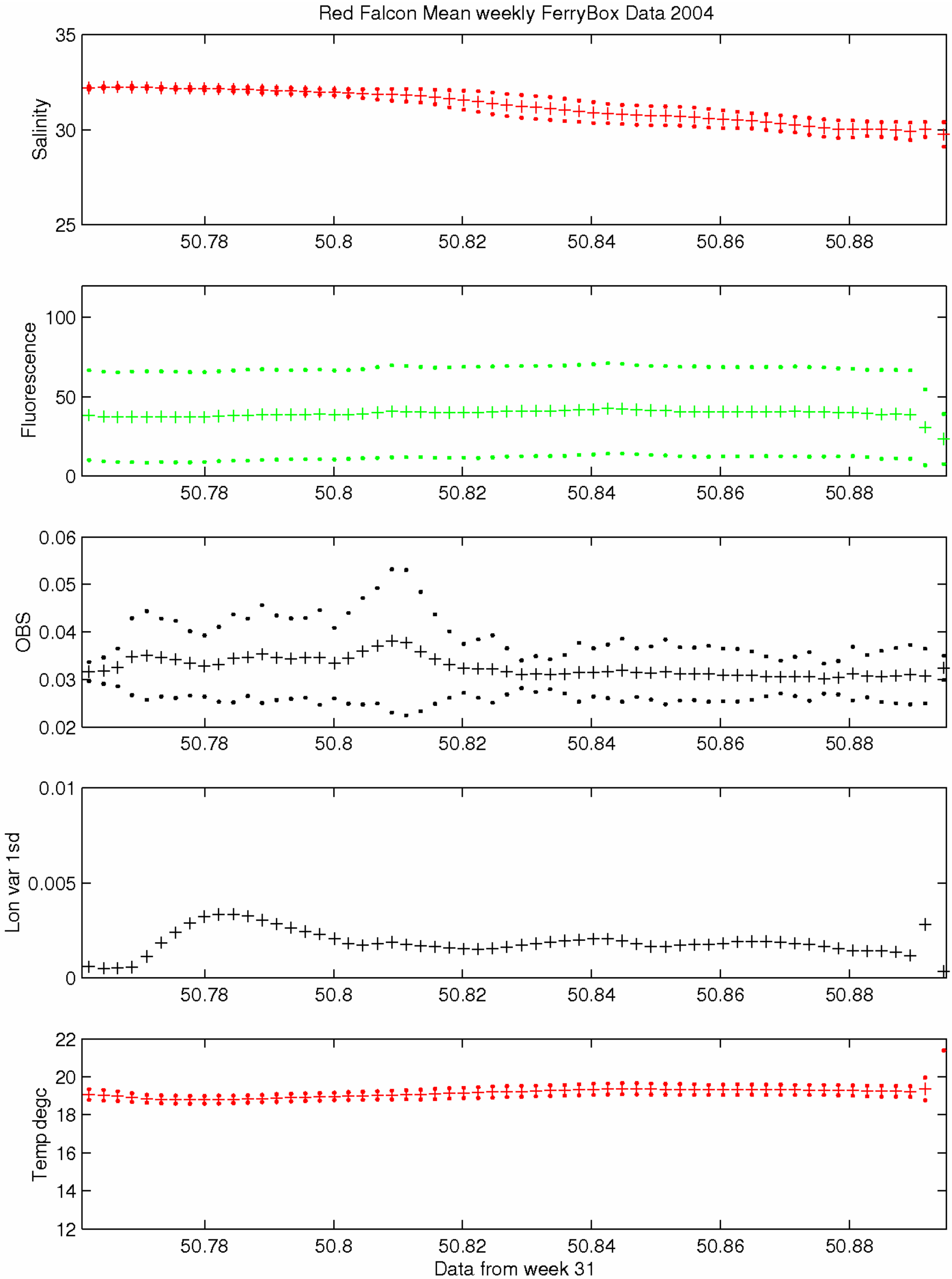


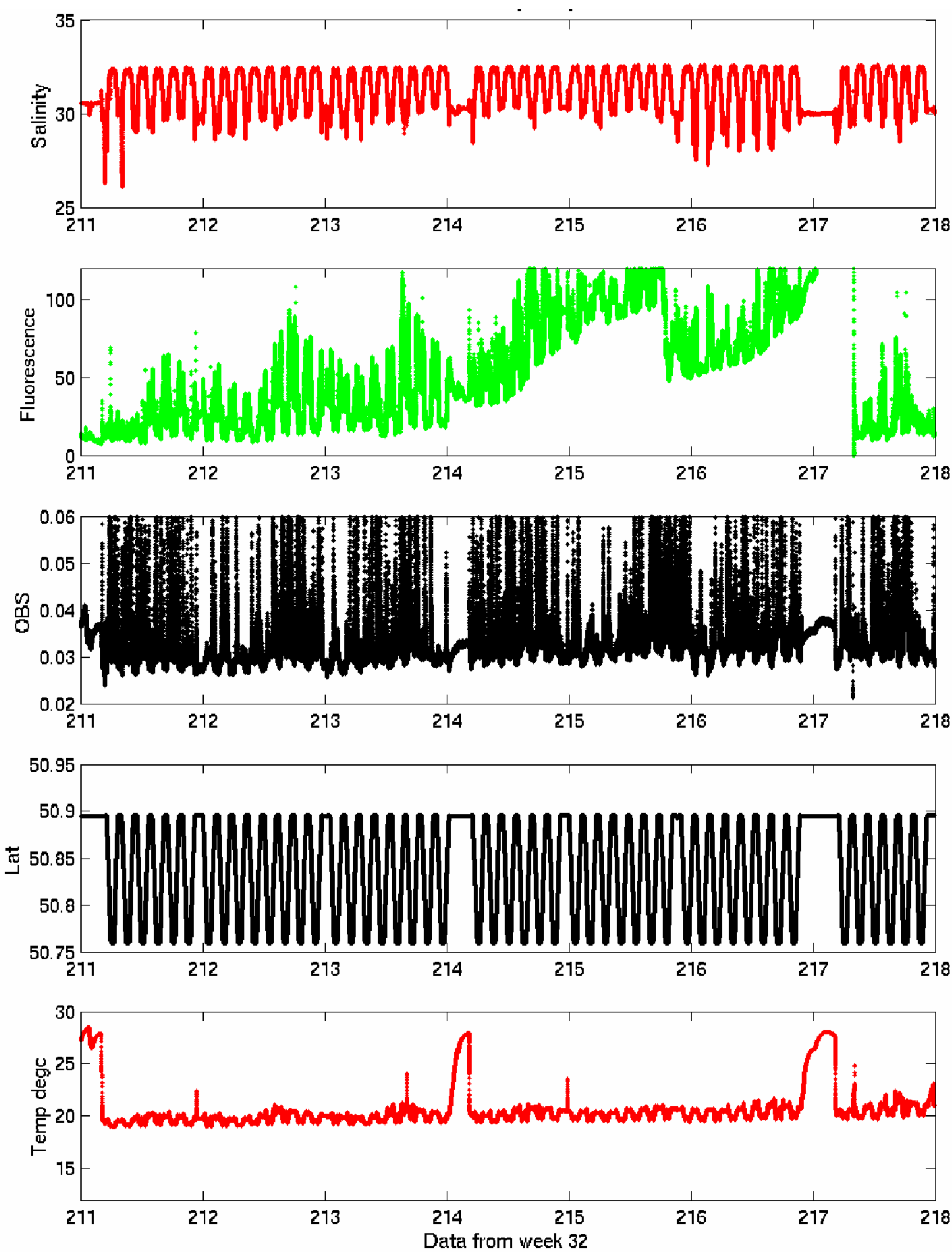
Salinity
Fluorescence
OBS
Lat
Temp degc
197
198
199
200
201
202
203
204
Data from week 30


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 30

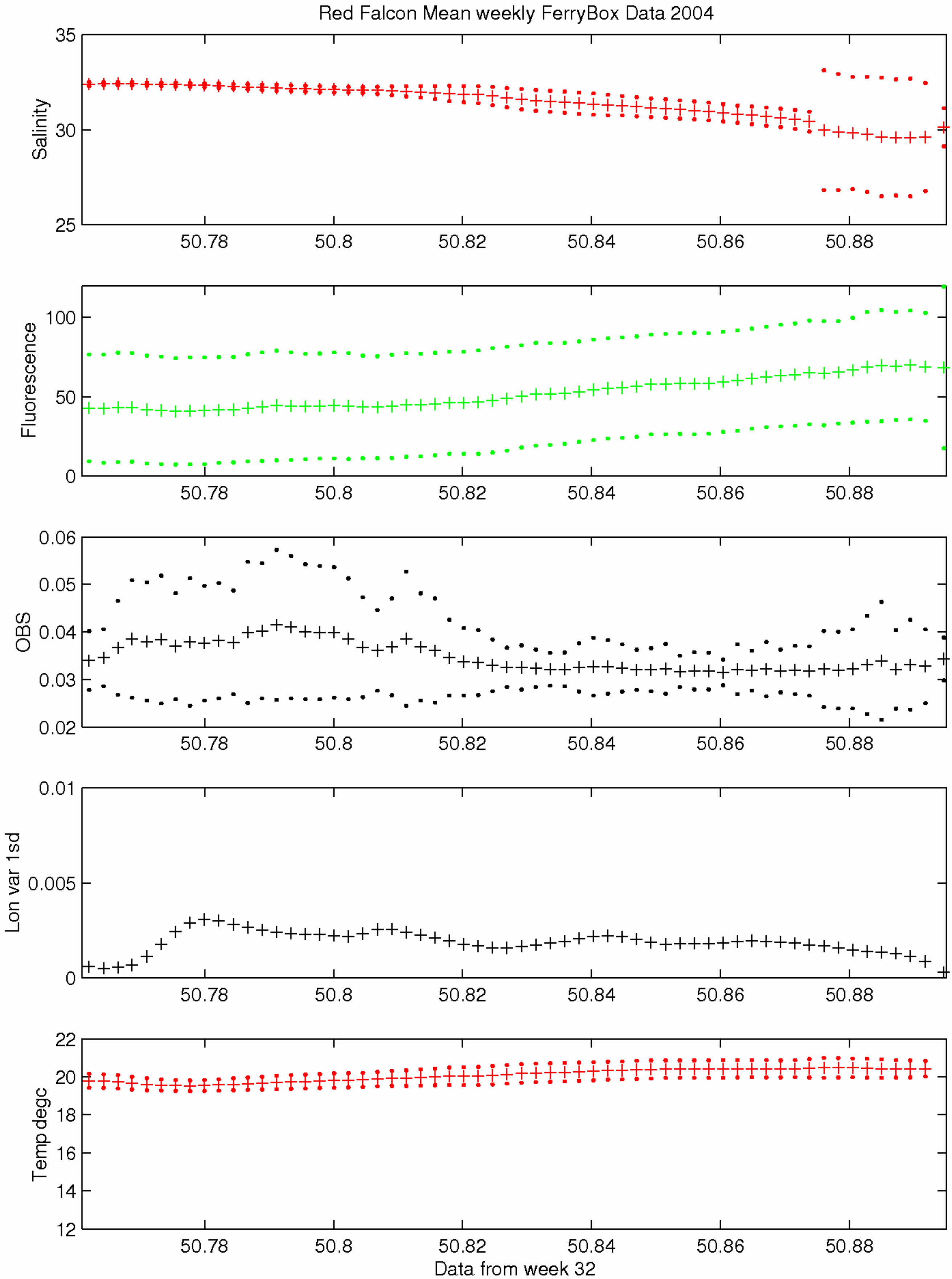


Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 31

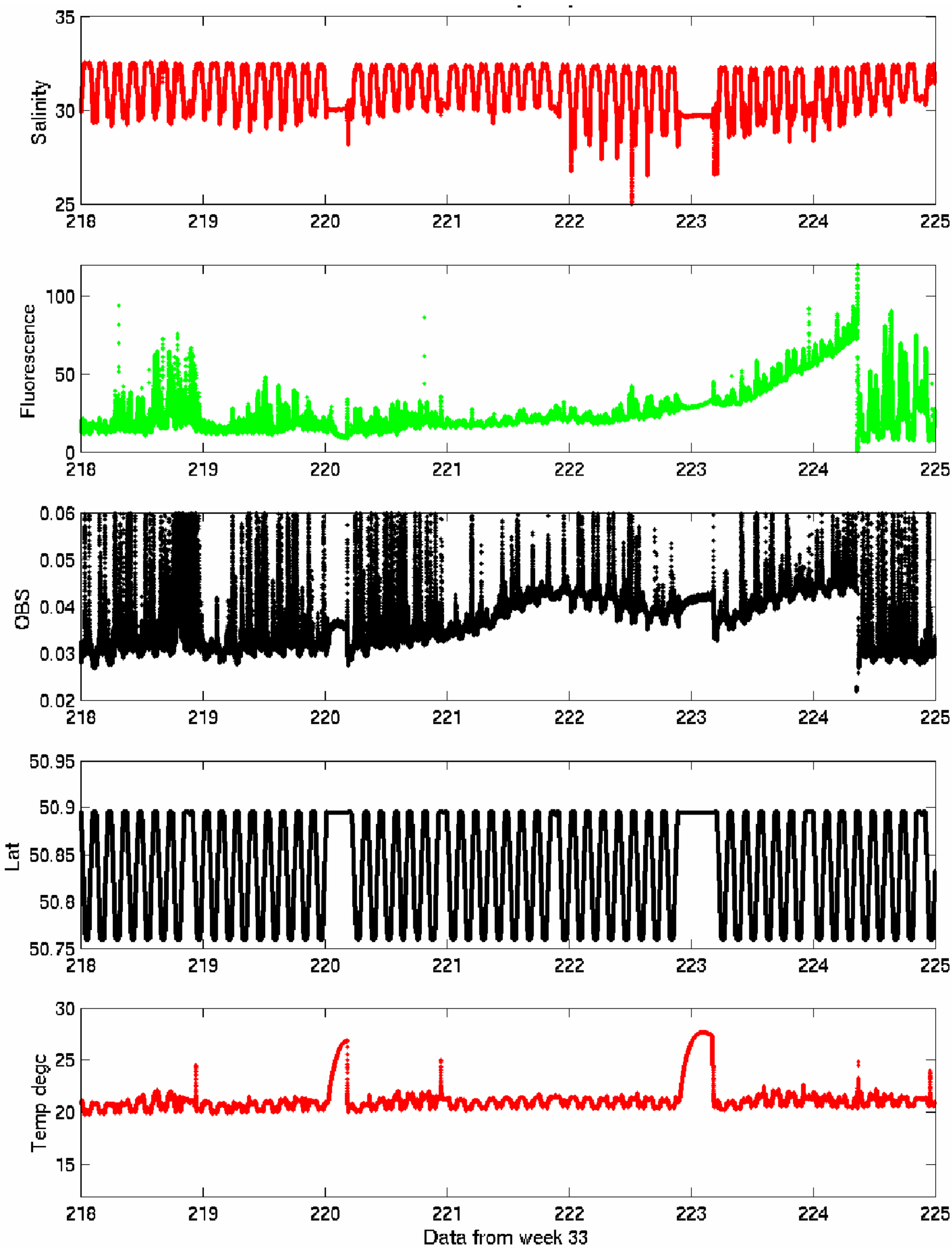

Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 31



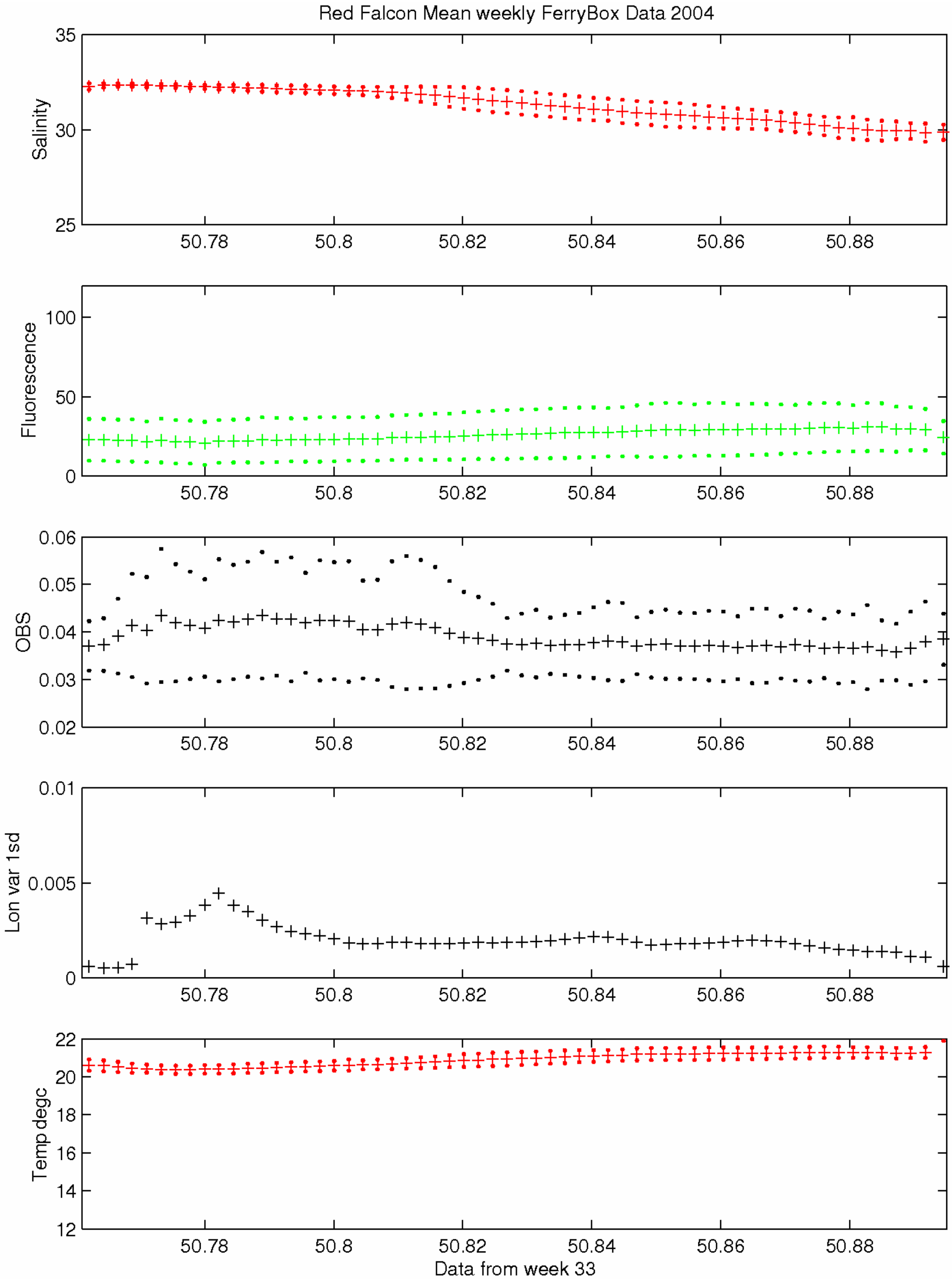
Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 32

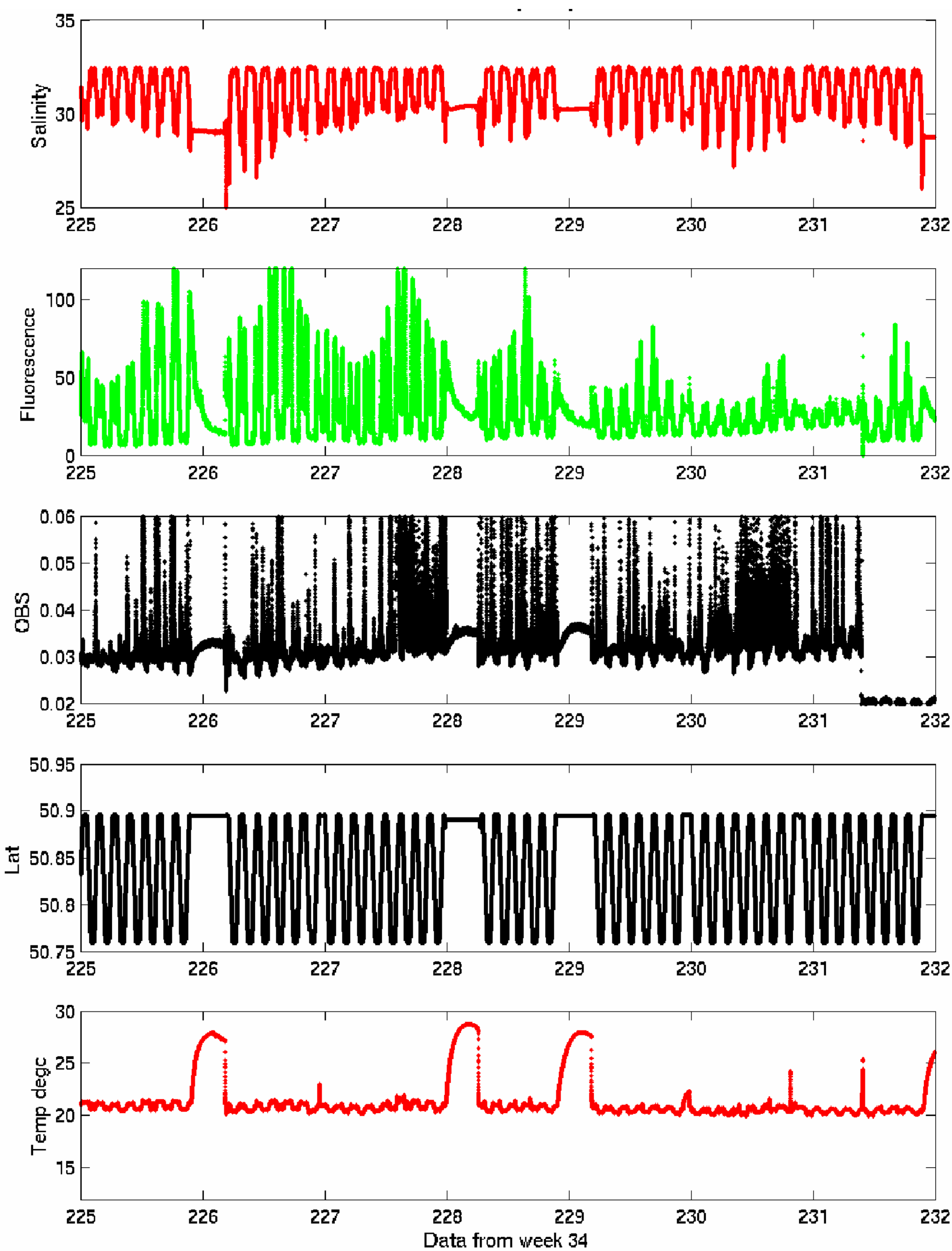


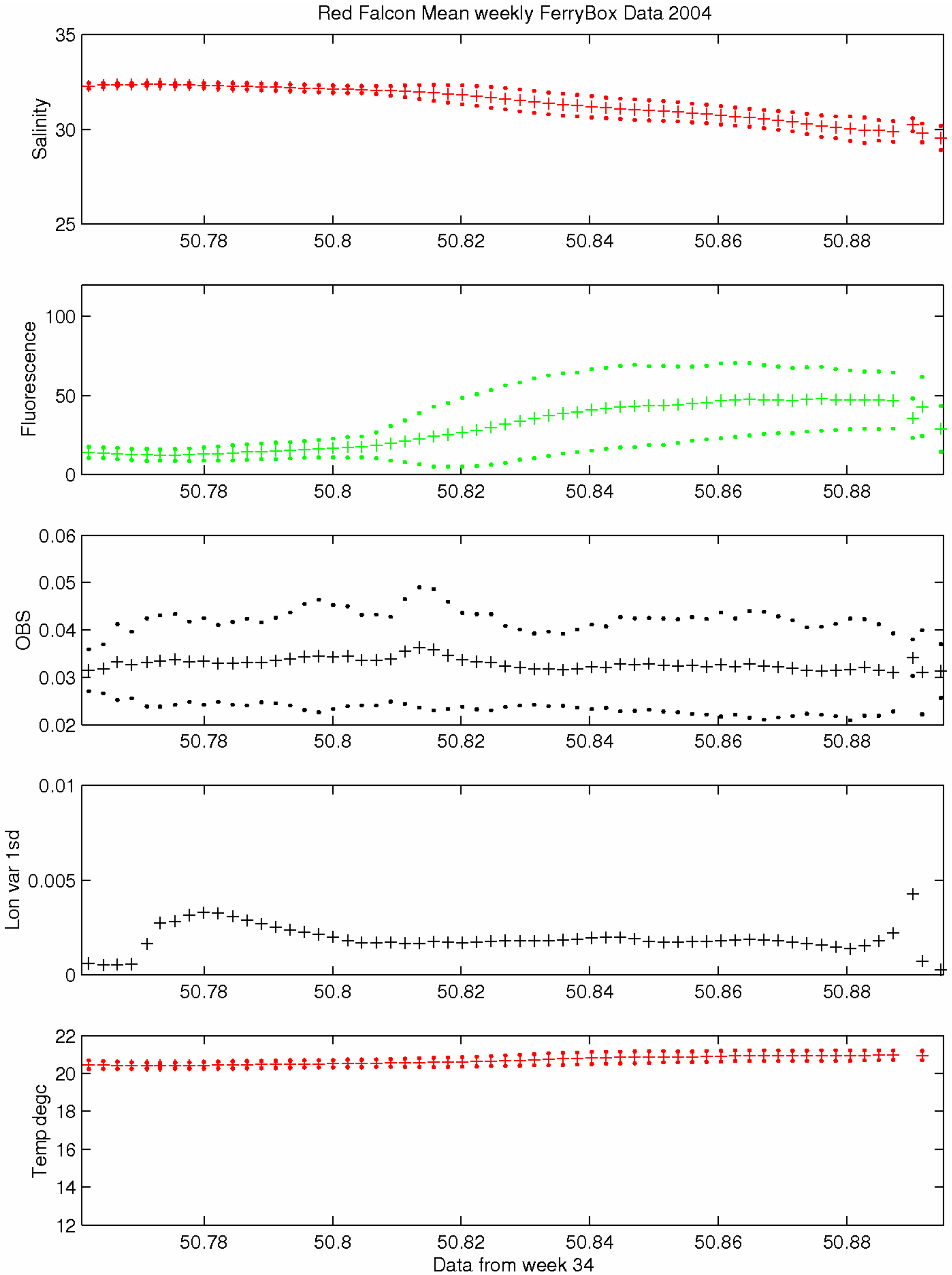
Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 32



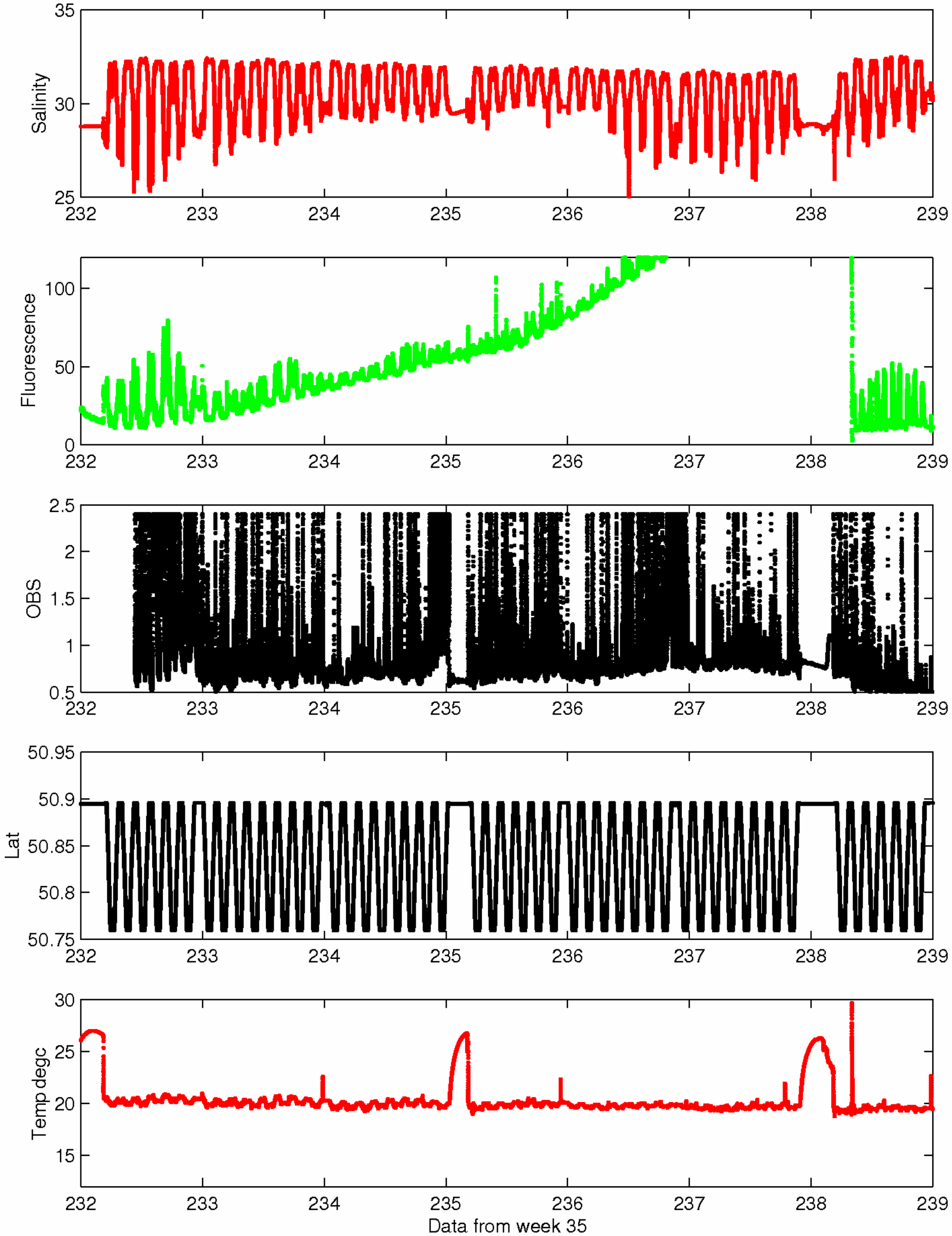
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
218
219
220
221
222
223
224
225
Data from week 33


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 33

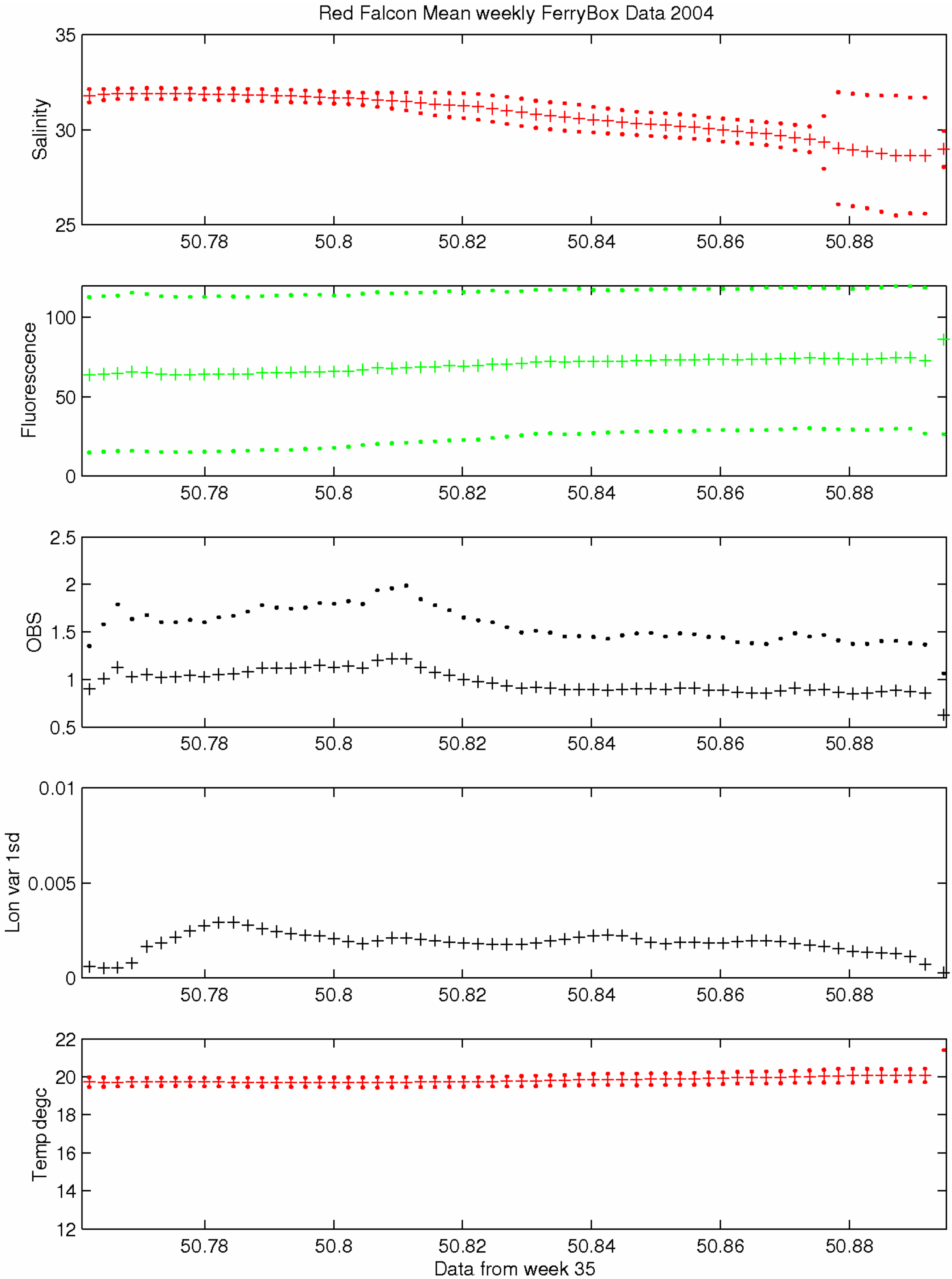

Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 34

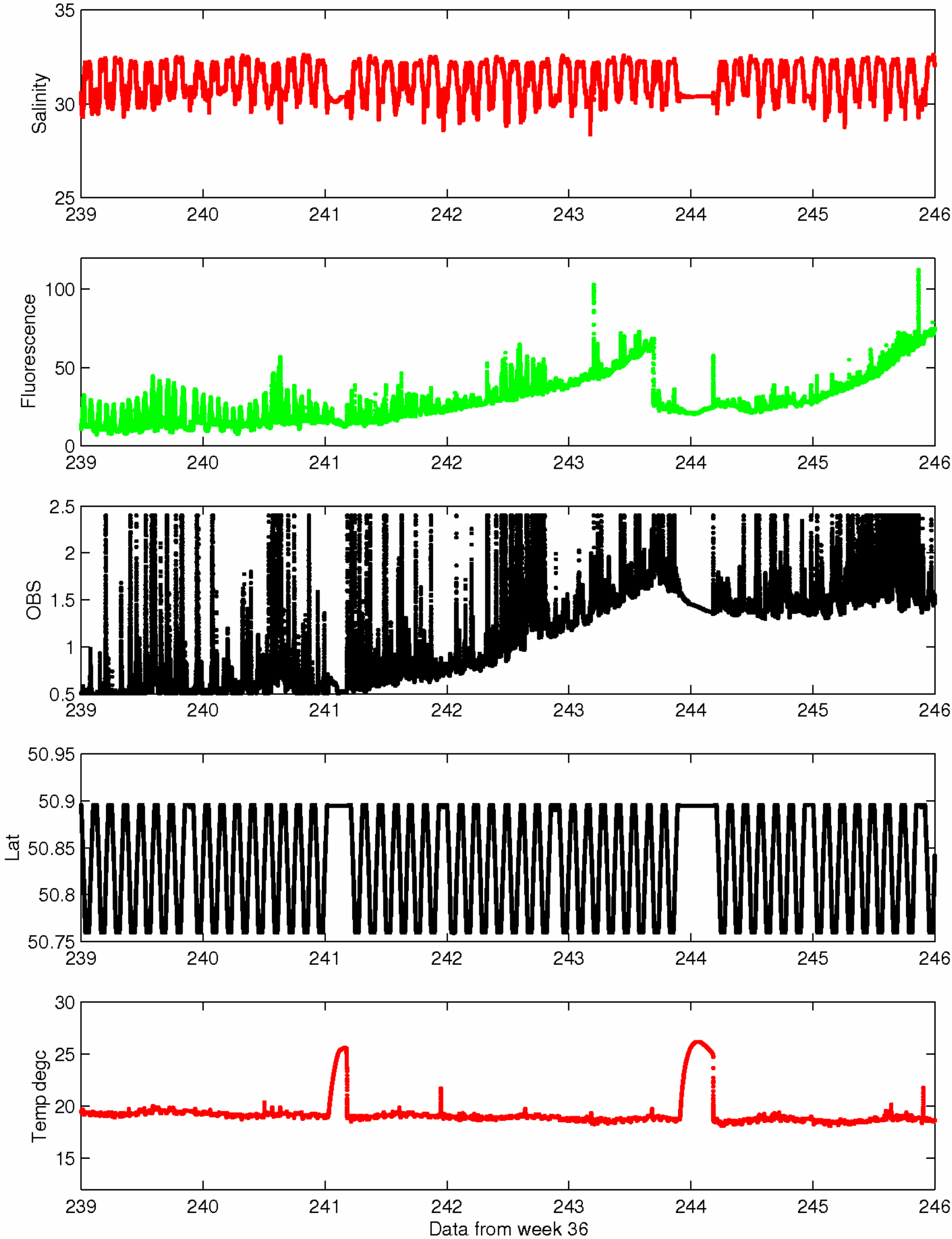


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
0.06
0.05
0.04
0.03
0.02
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 34

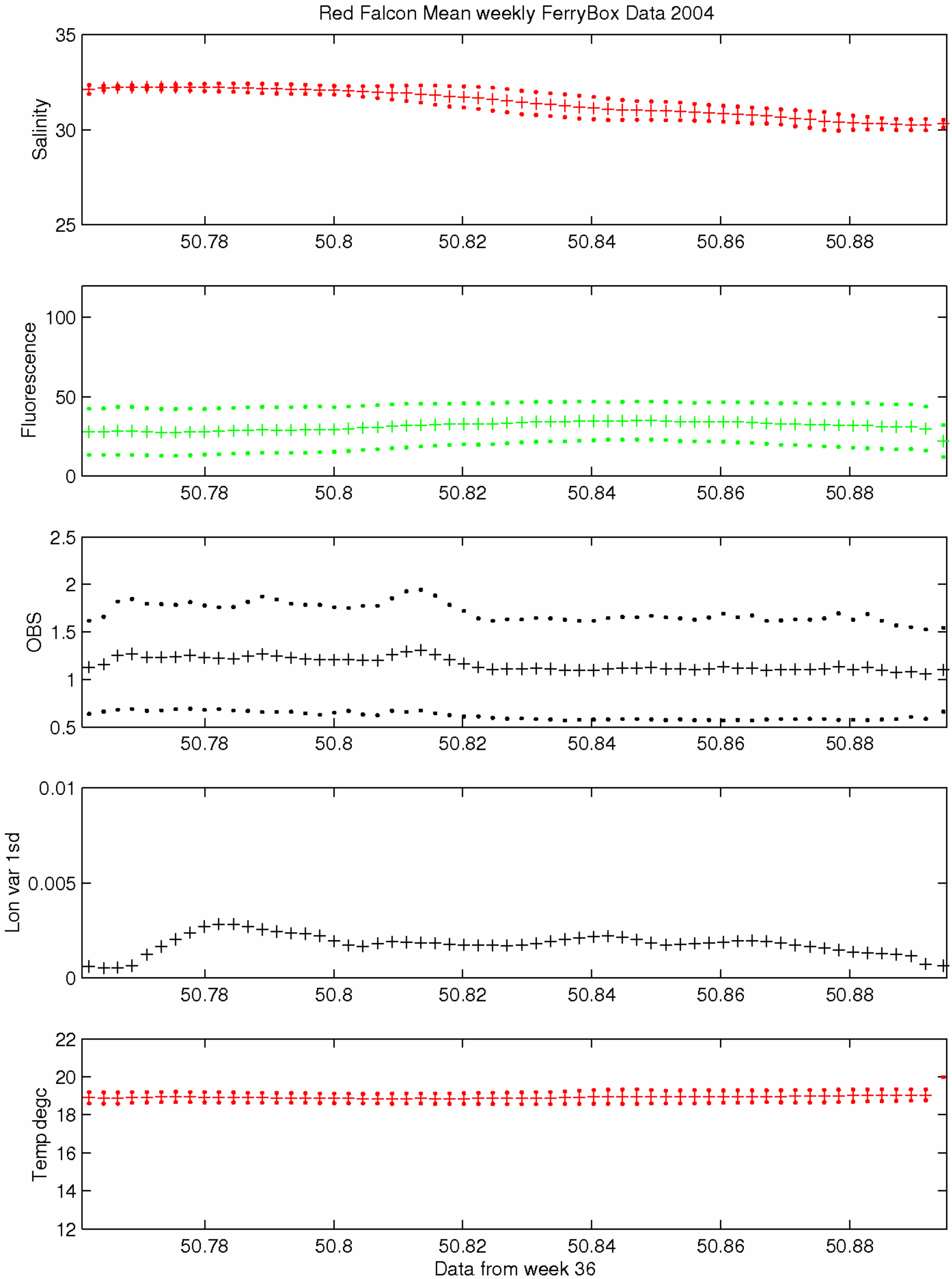


Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
232
233
234
235
236
237
238
239
Data from week 35

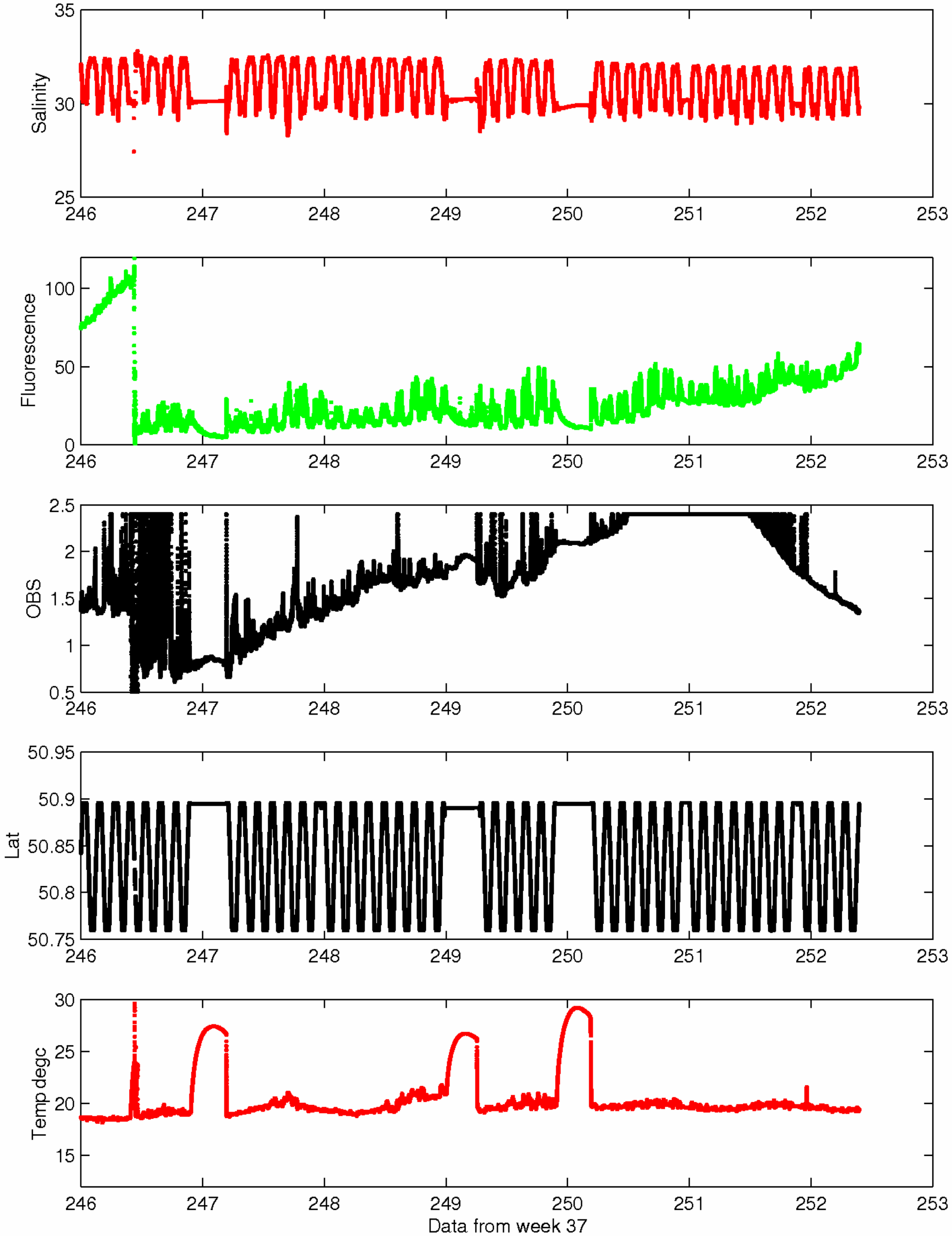

Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 35

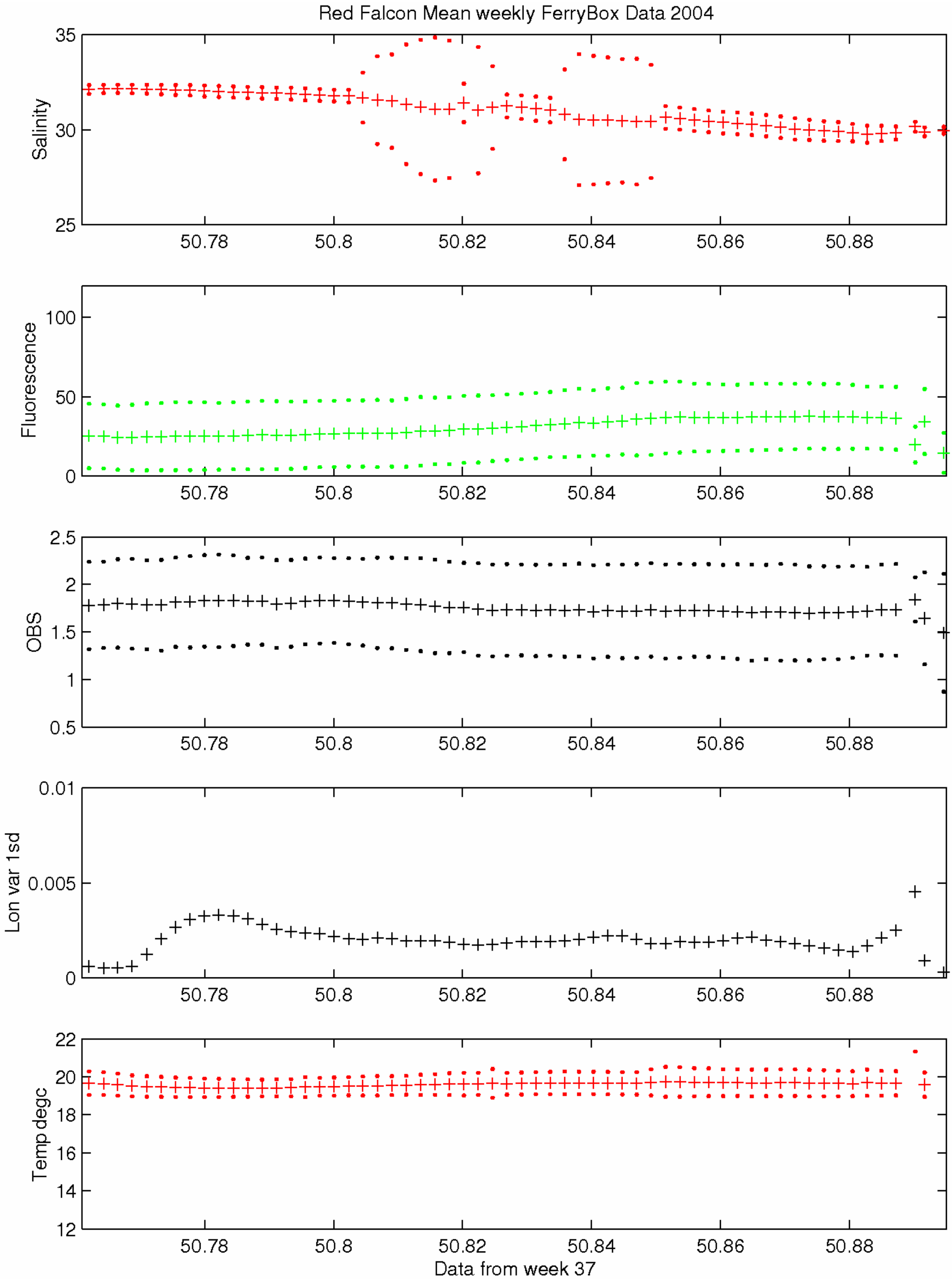


Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 36

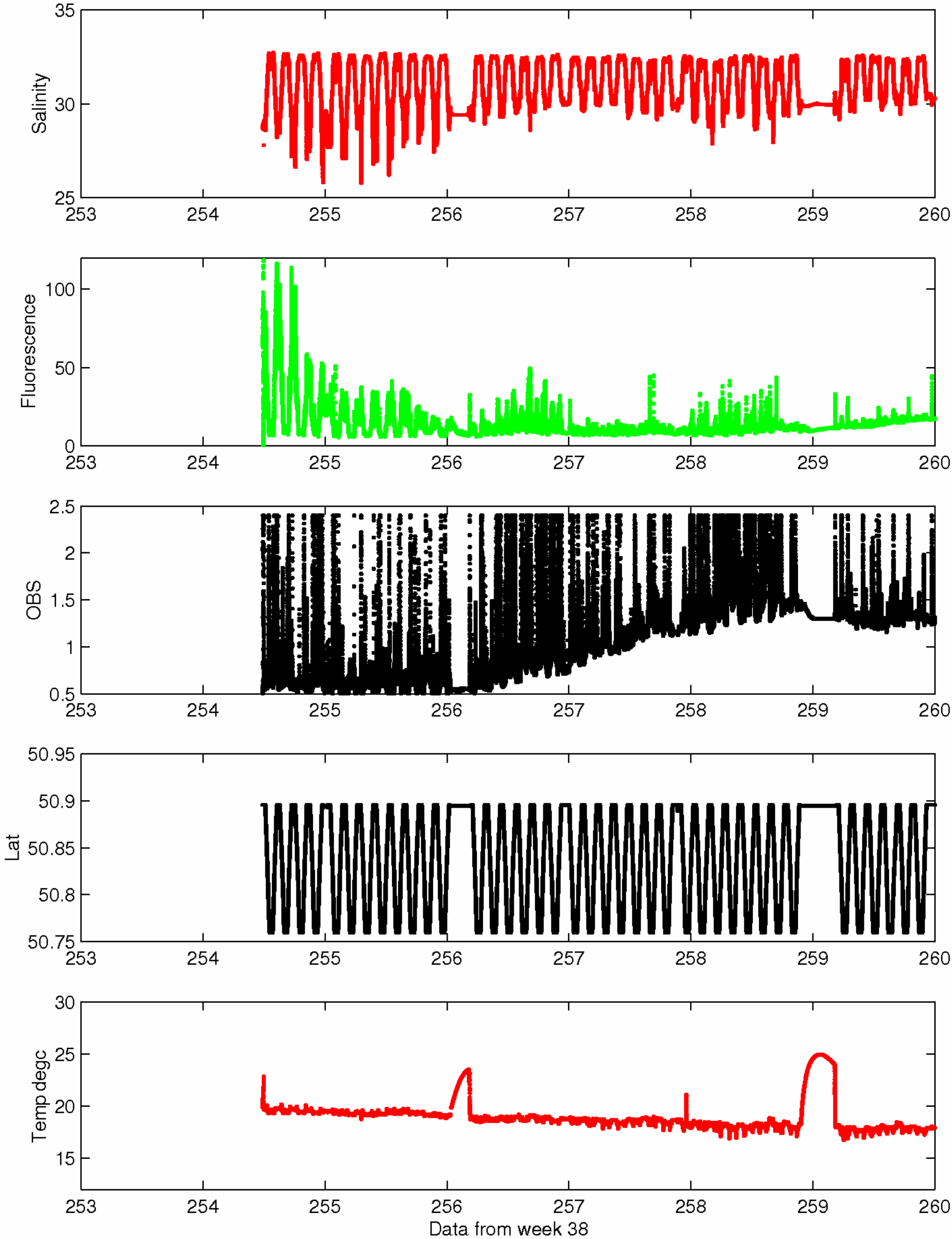


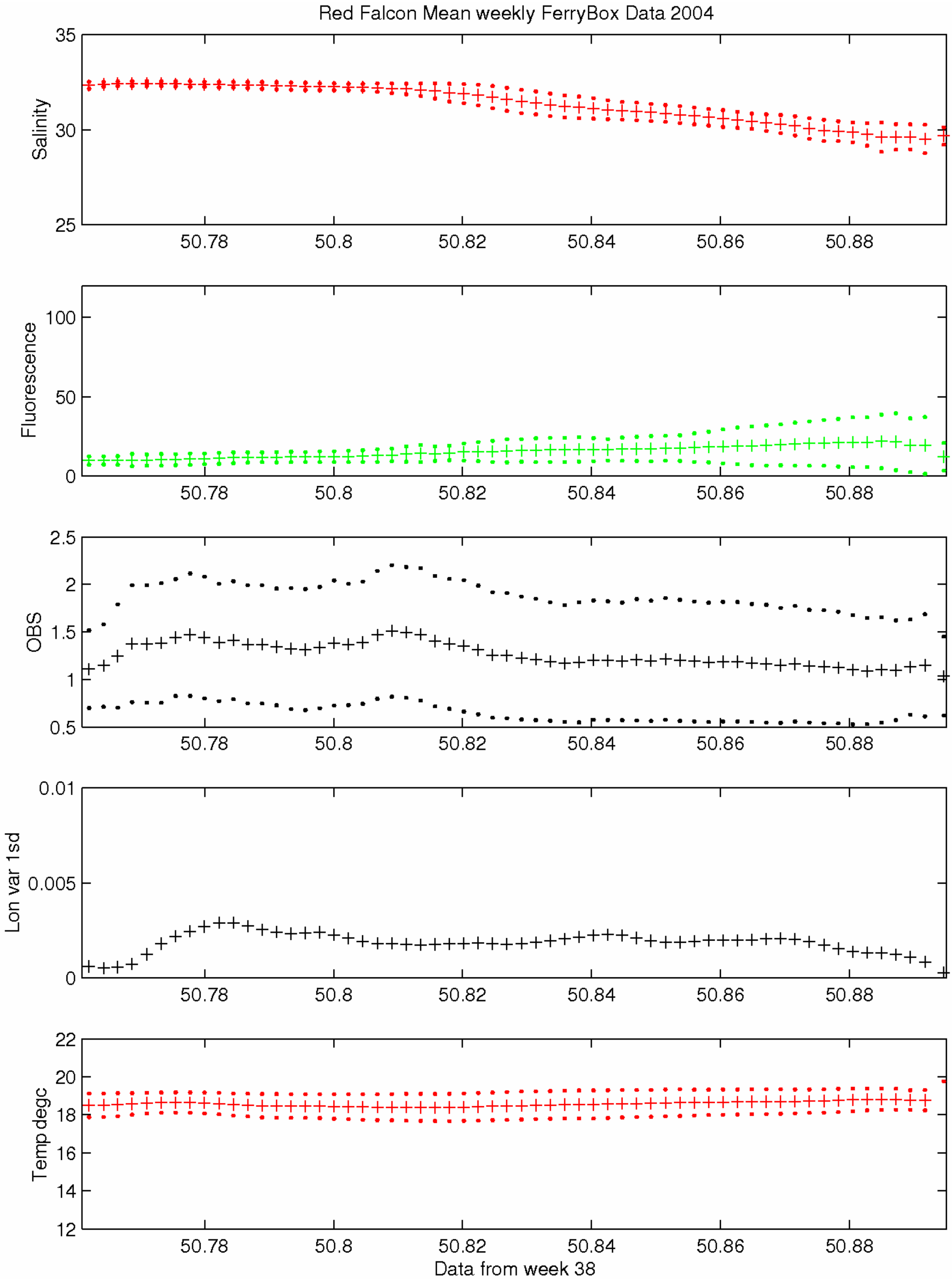
Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 36

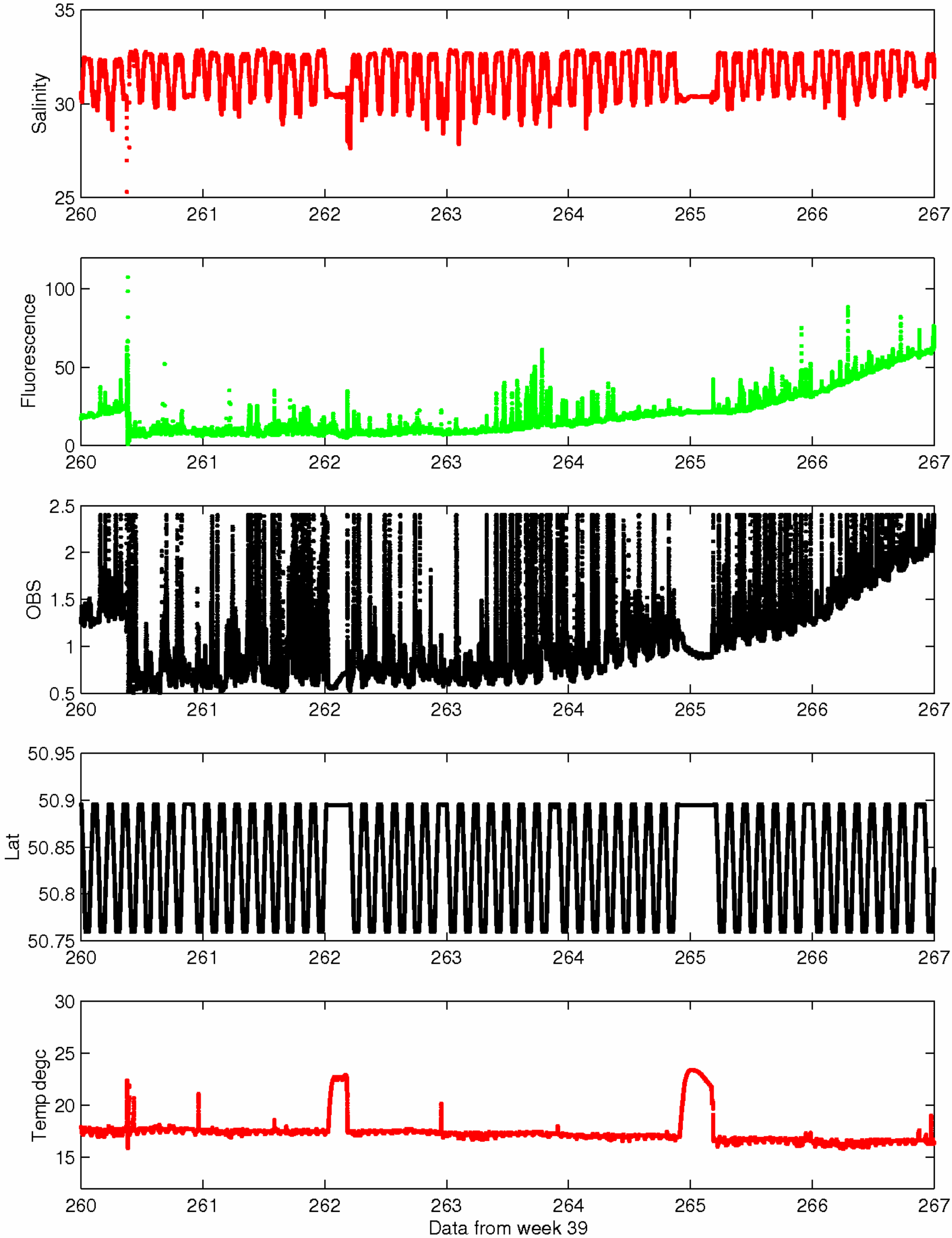

Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 37



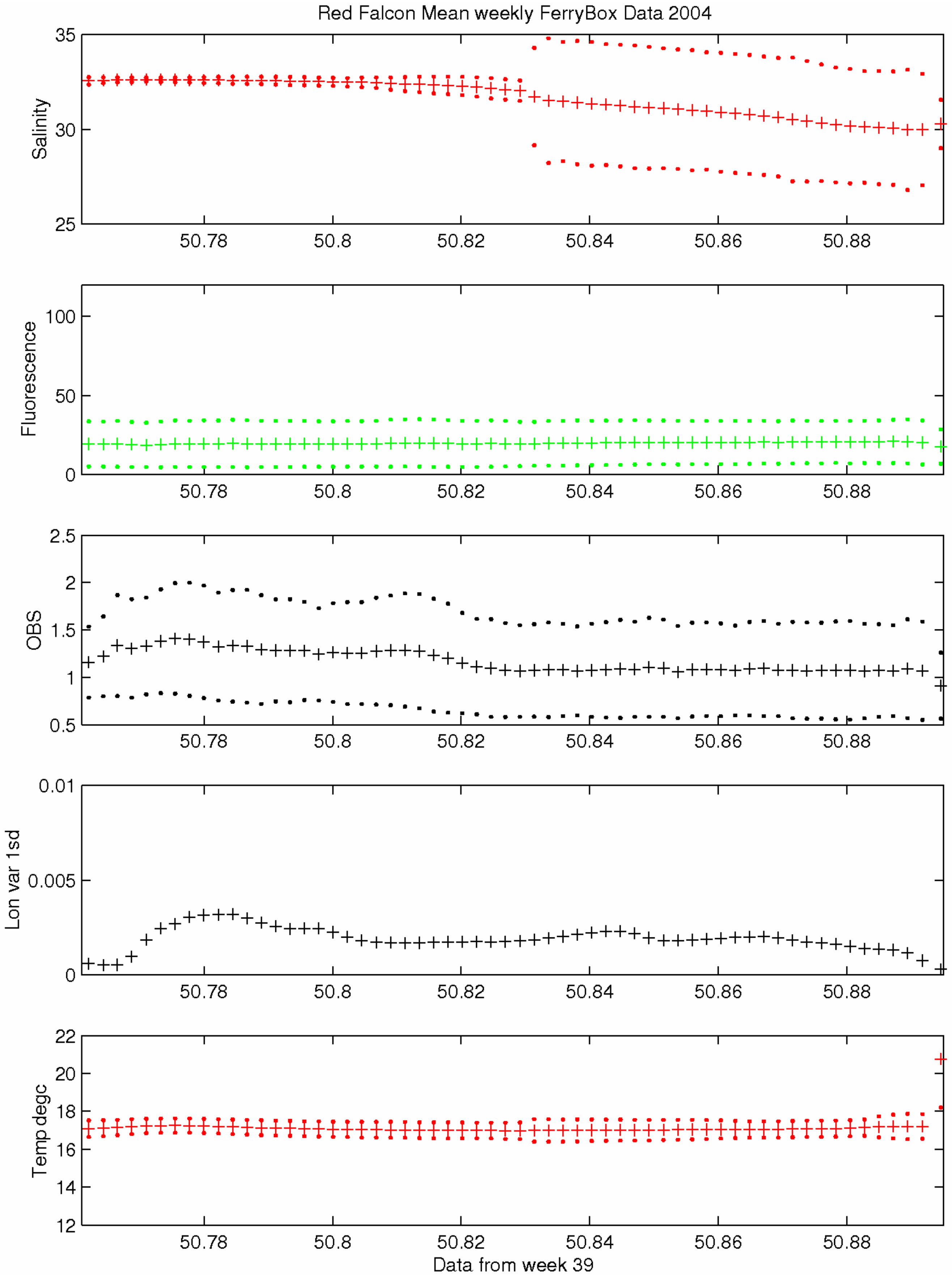
Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 37

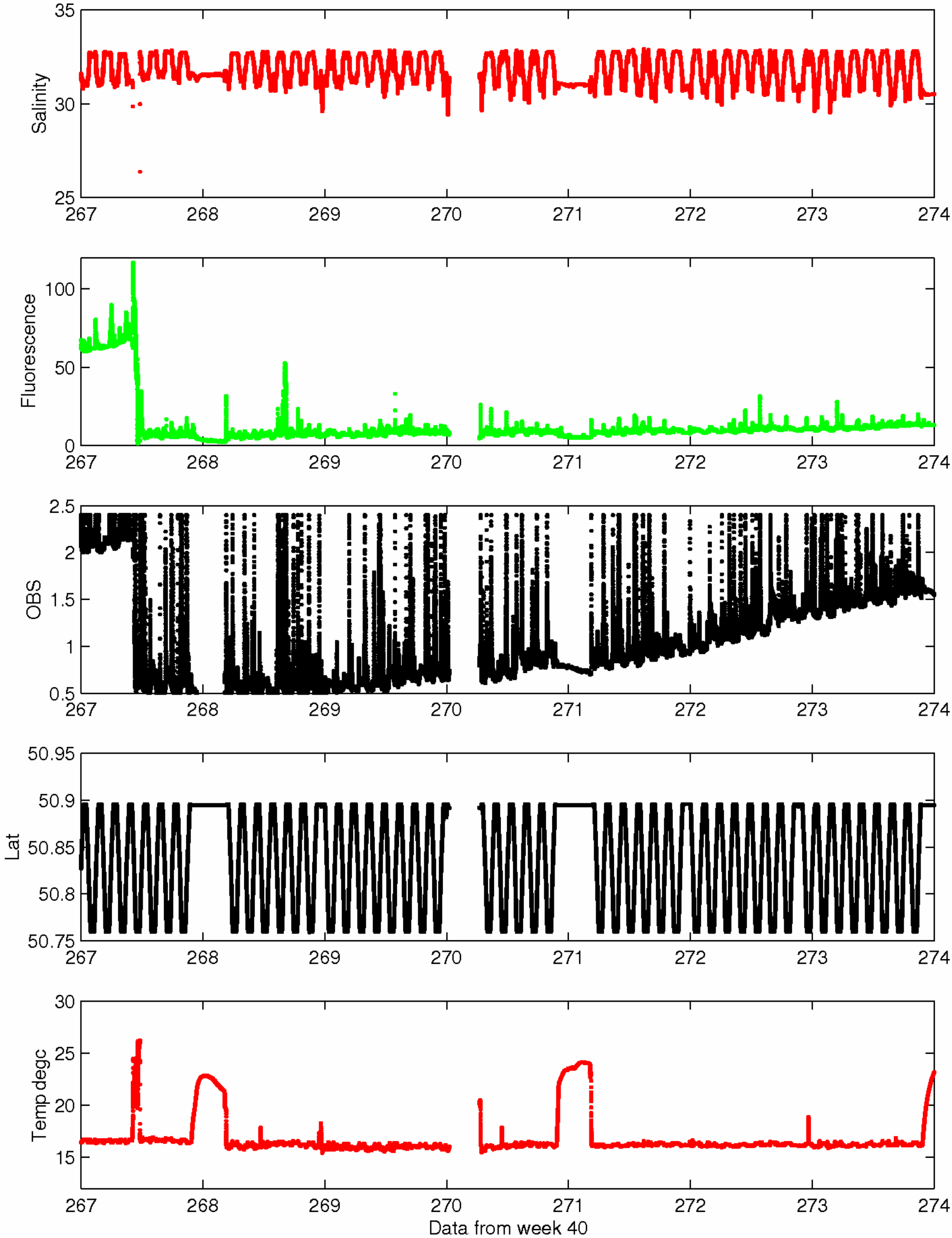

Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 38

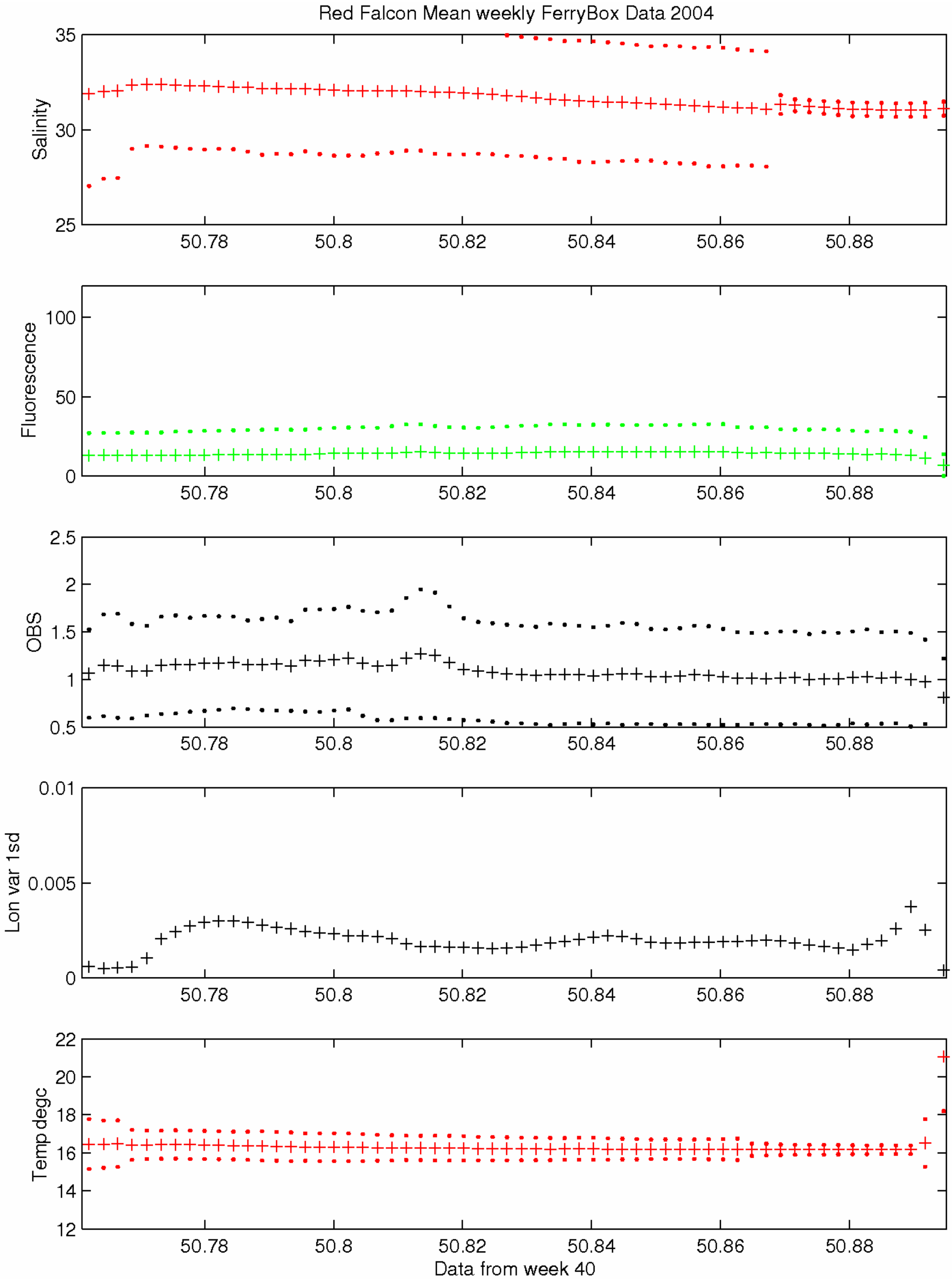

Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 38



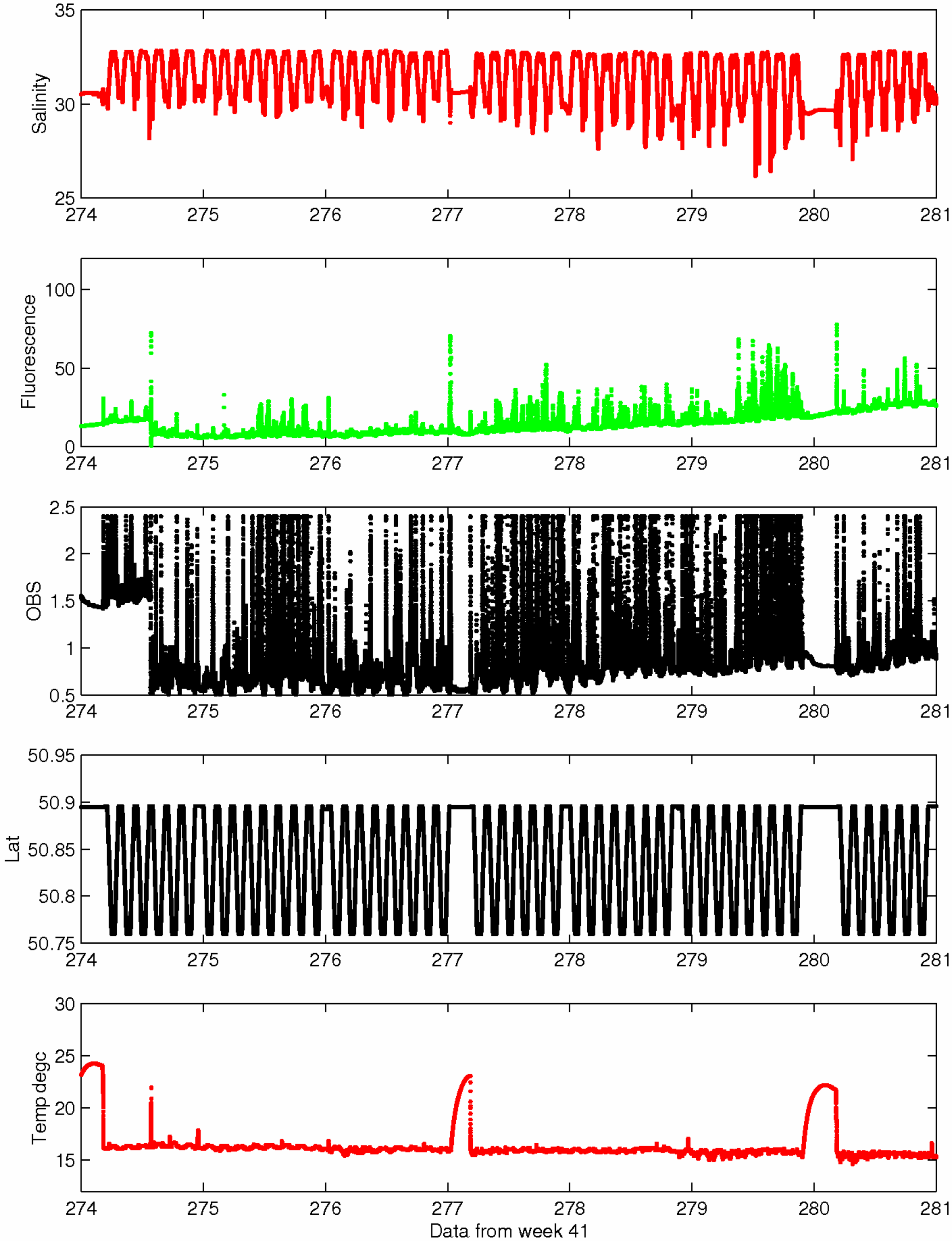
Salinity
Fluorescence
OBS
Lat
Temp degc
Data from week 39


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88
Data from week 39


Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
267
268
269
270
271
272
273
274
Data from week 40

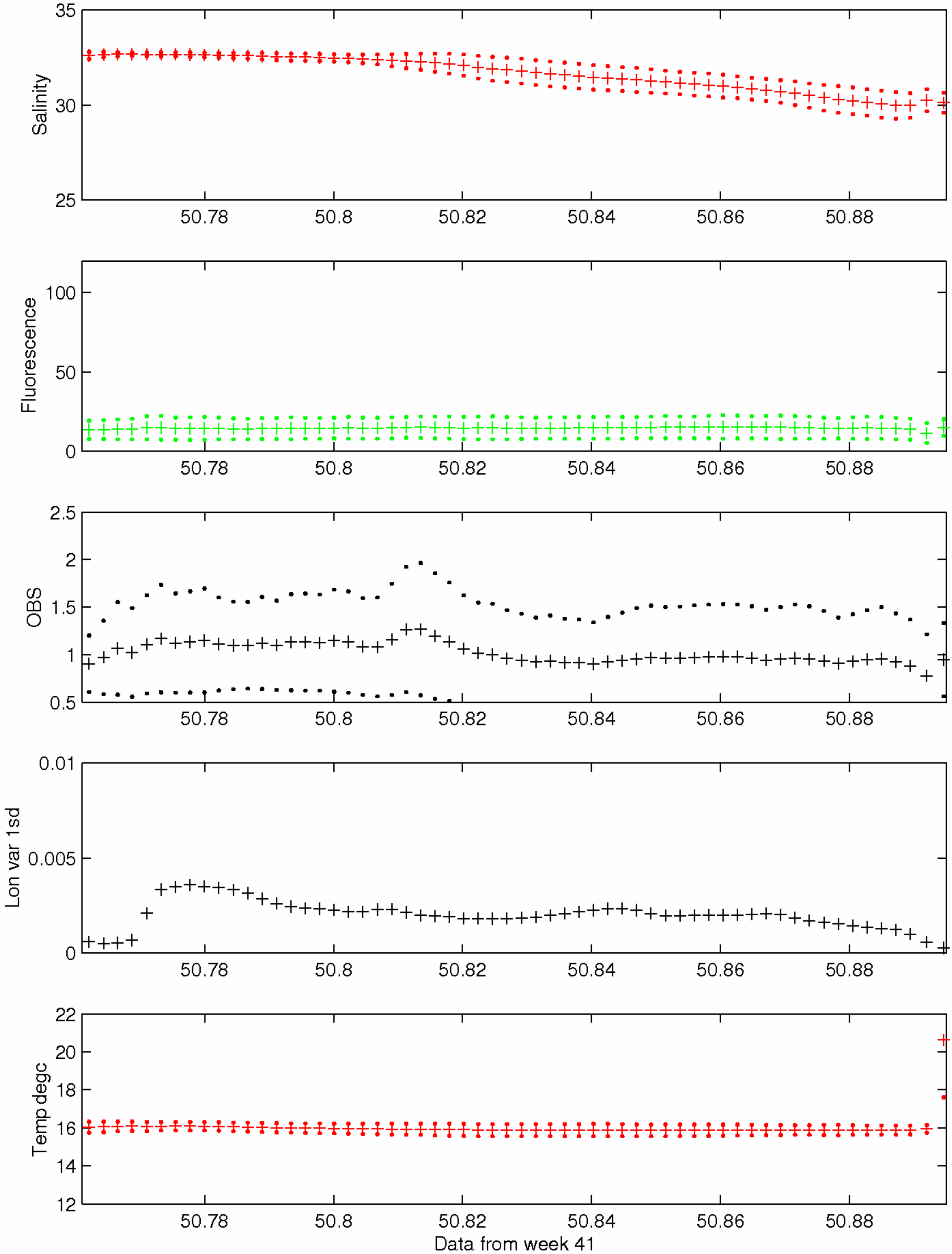


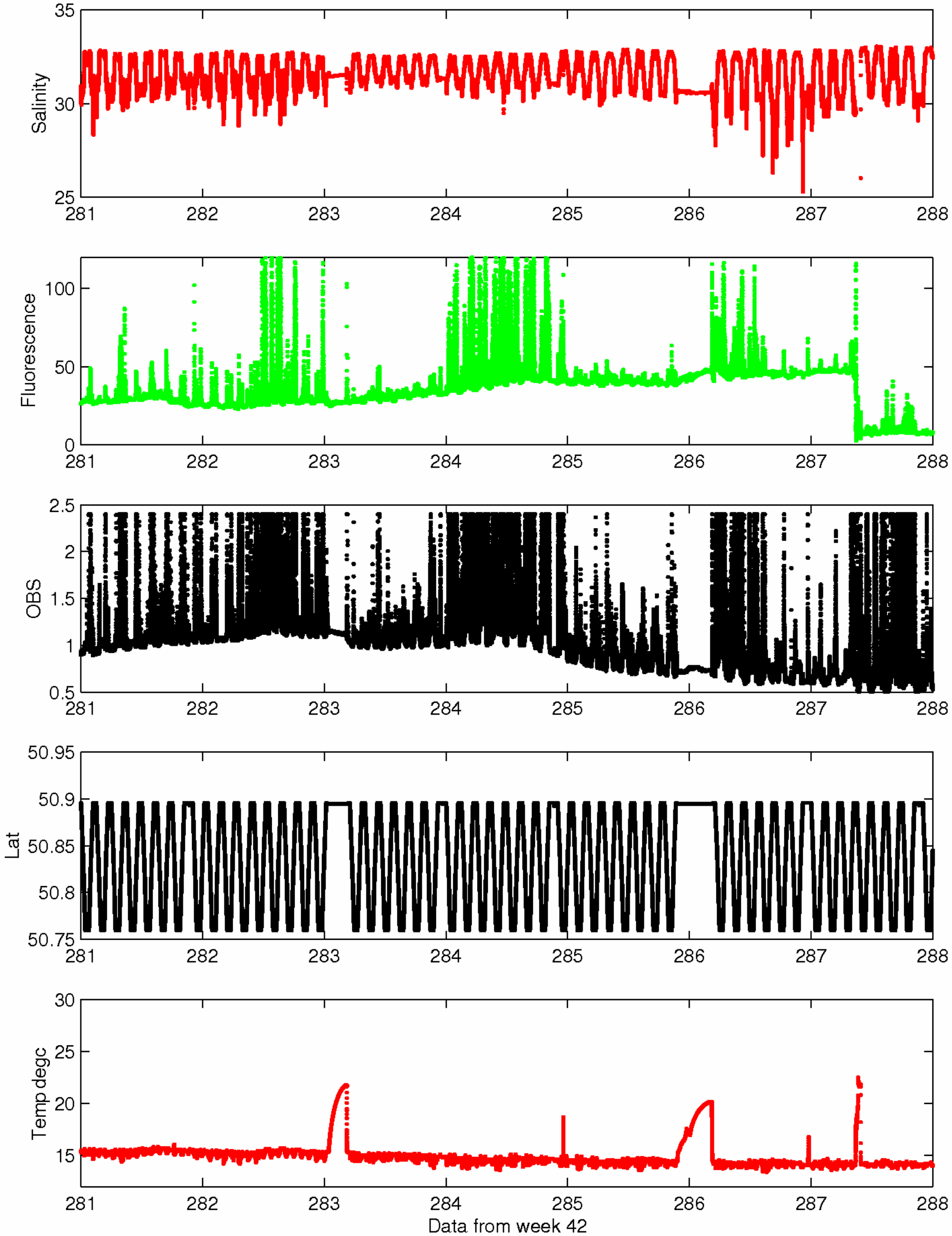
Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
50.78
50.8
50.82
50.84
50.86
50.88
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
Data from week 40



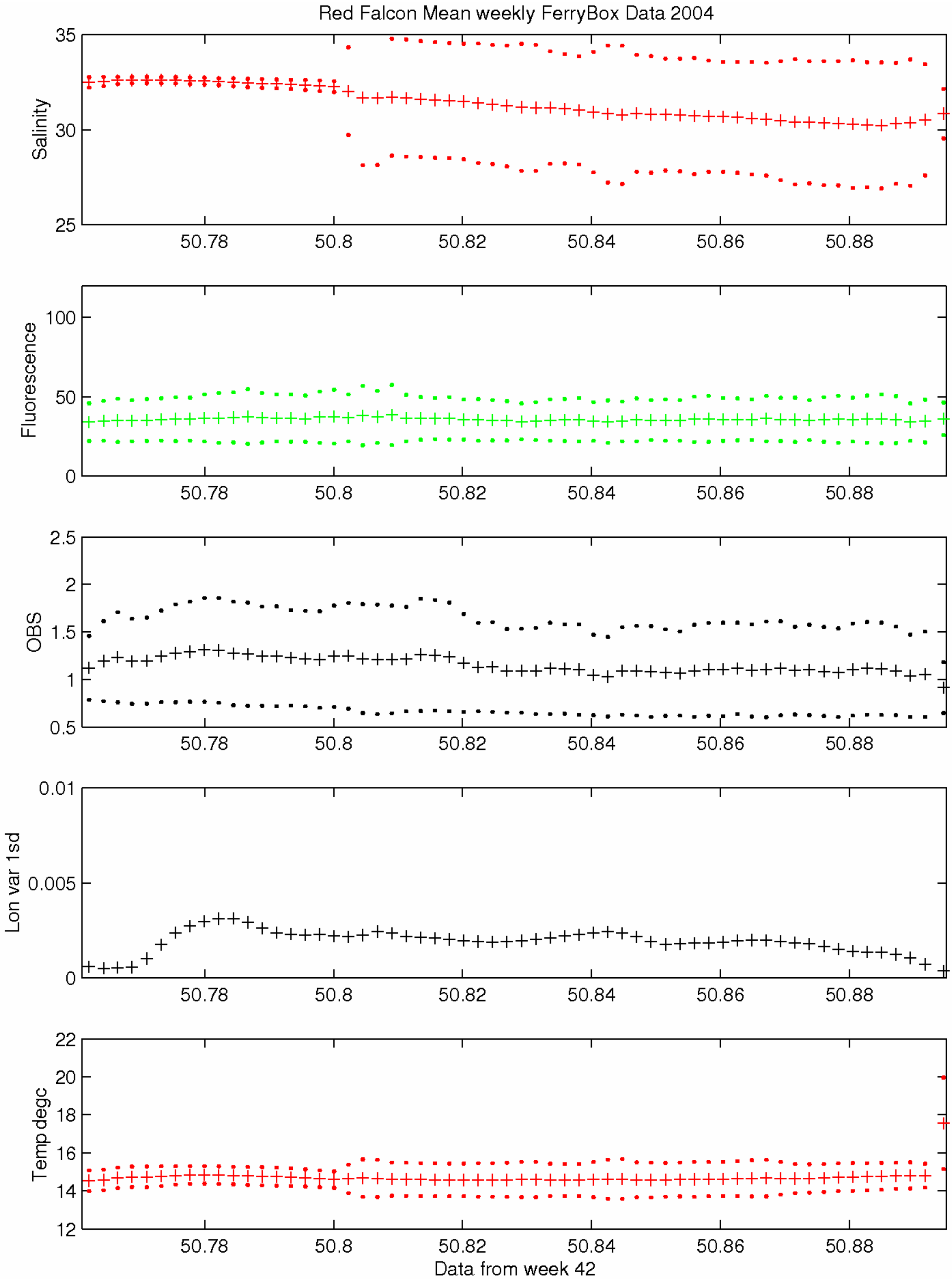
Salinity
35
30
25
274
275
276
277
278
279
280
281
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
Data from week 41

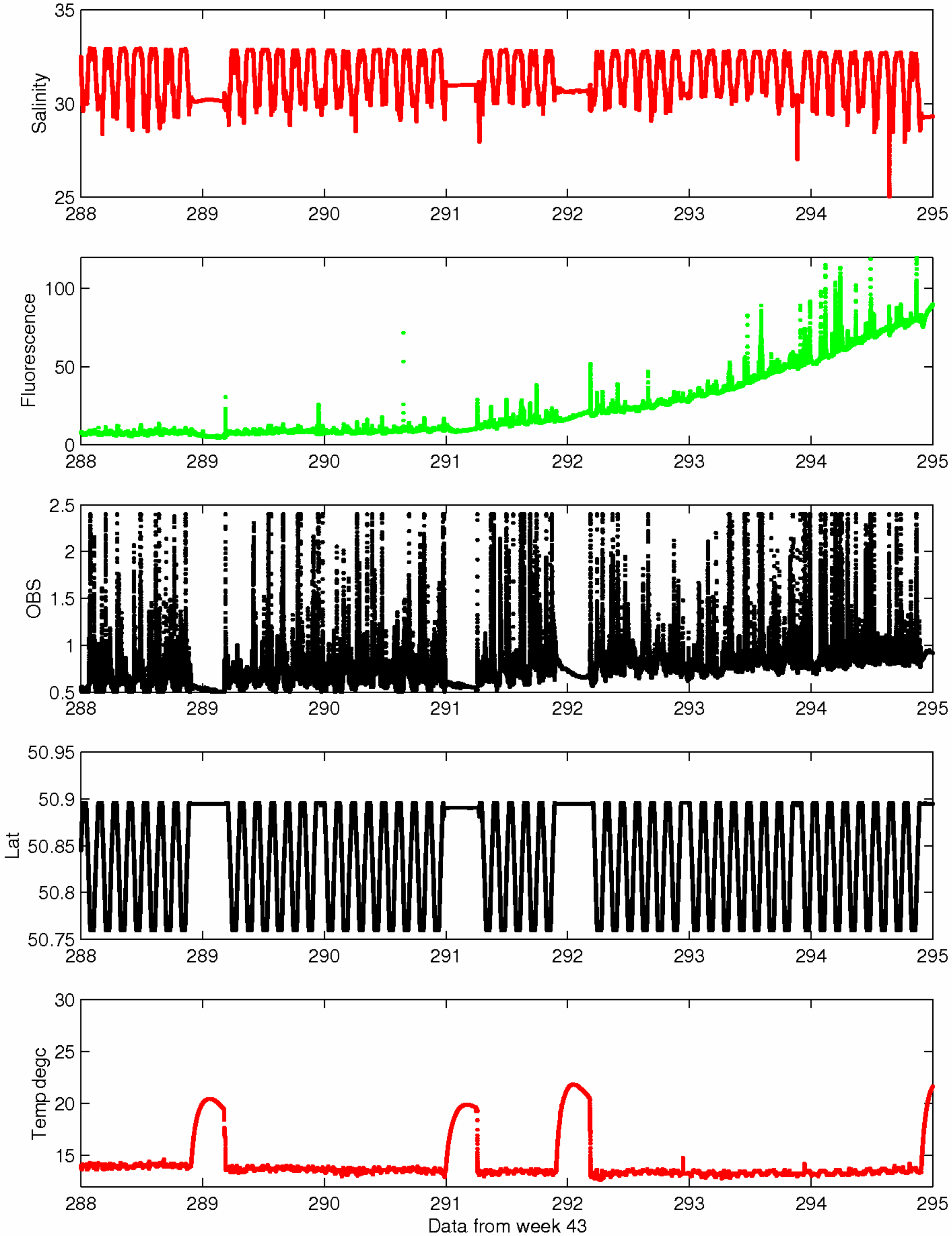
Red Falcon Mean weekly FerryBox Data 2004



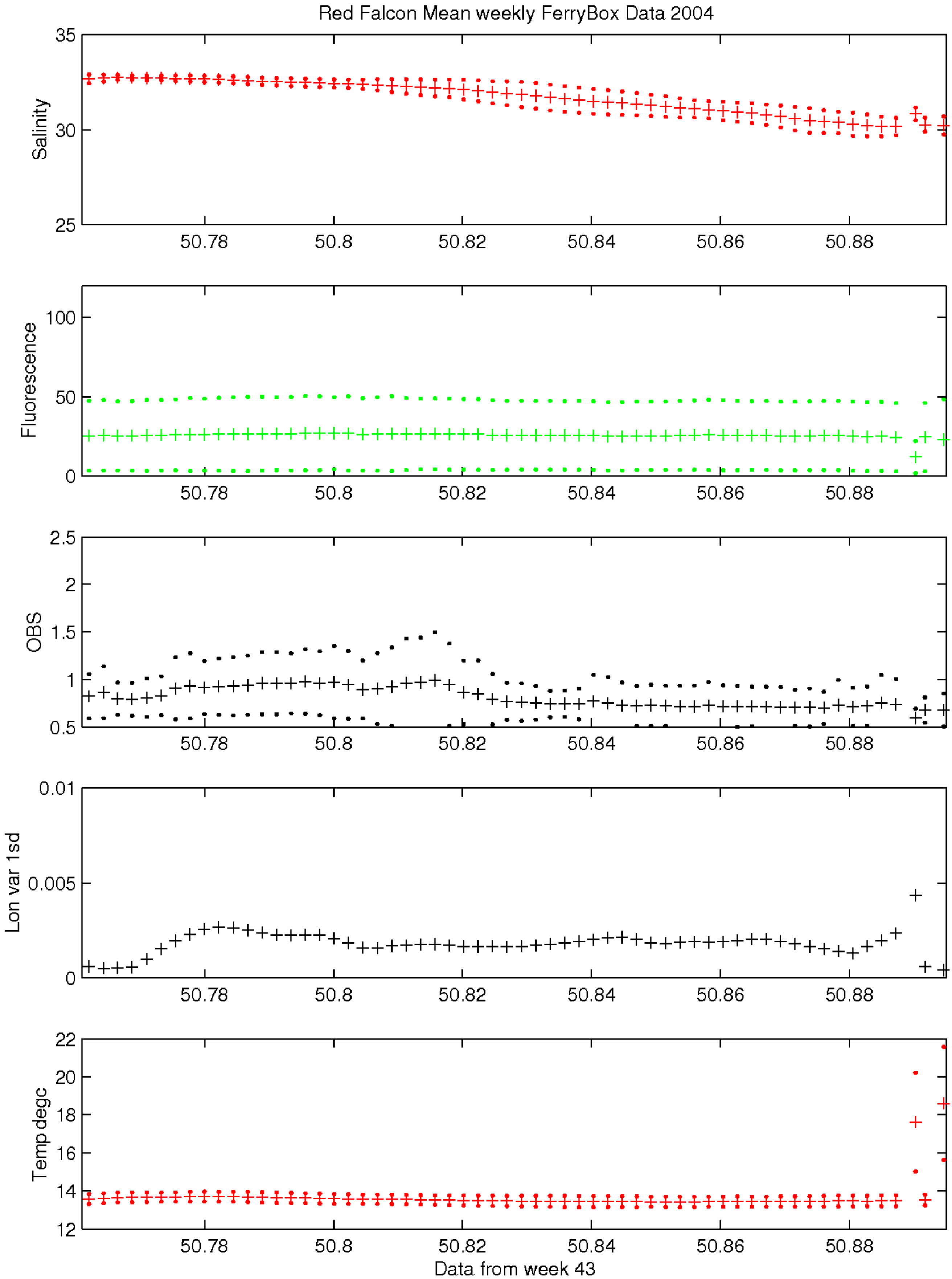


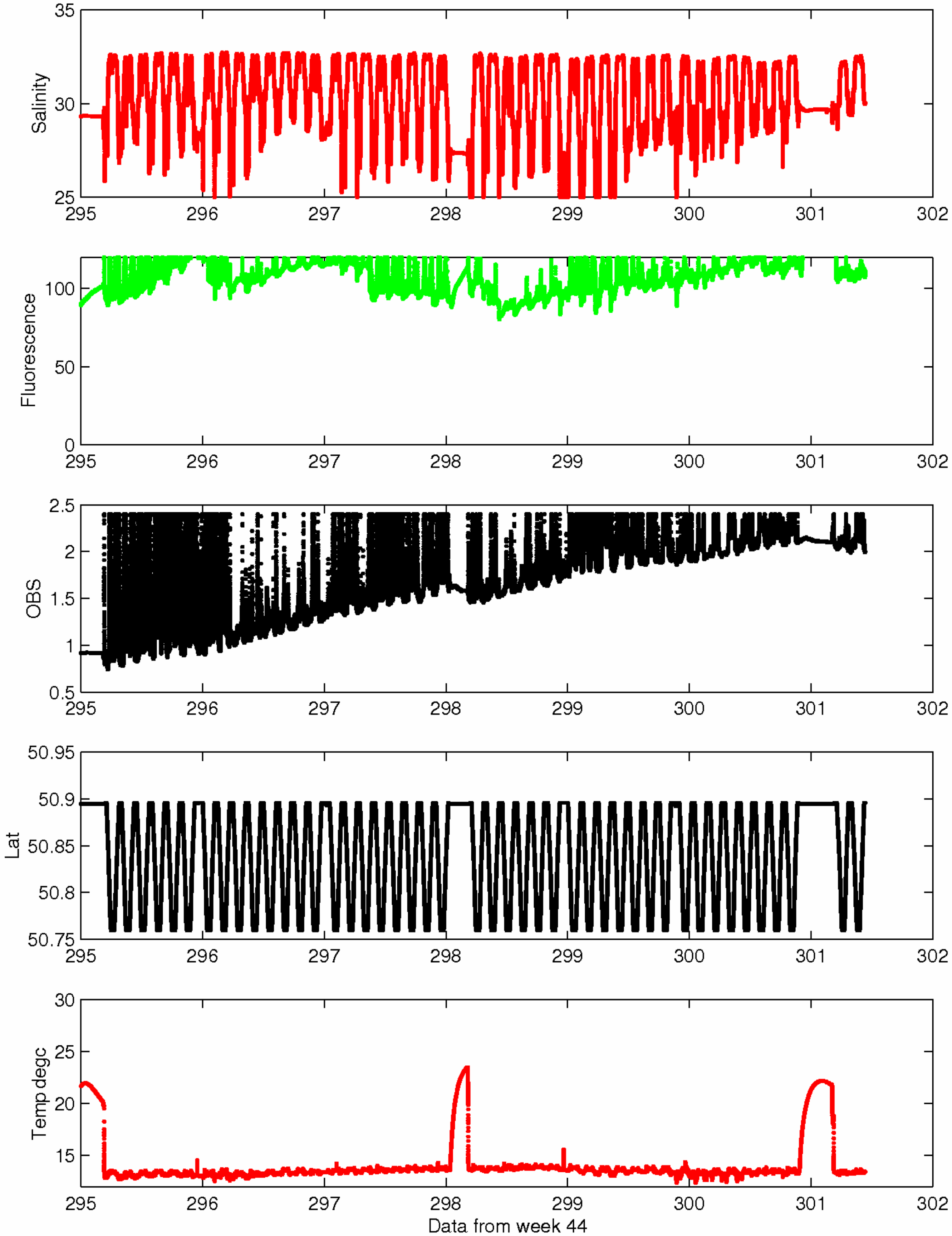
Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
281 282 283 284 285 286 287 288
Data from week 42


Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
50.78
50.8
50.82
50.84
50.86
50.88
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
Data from week 42

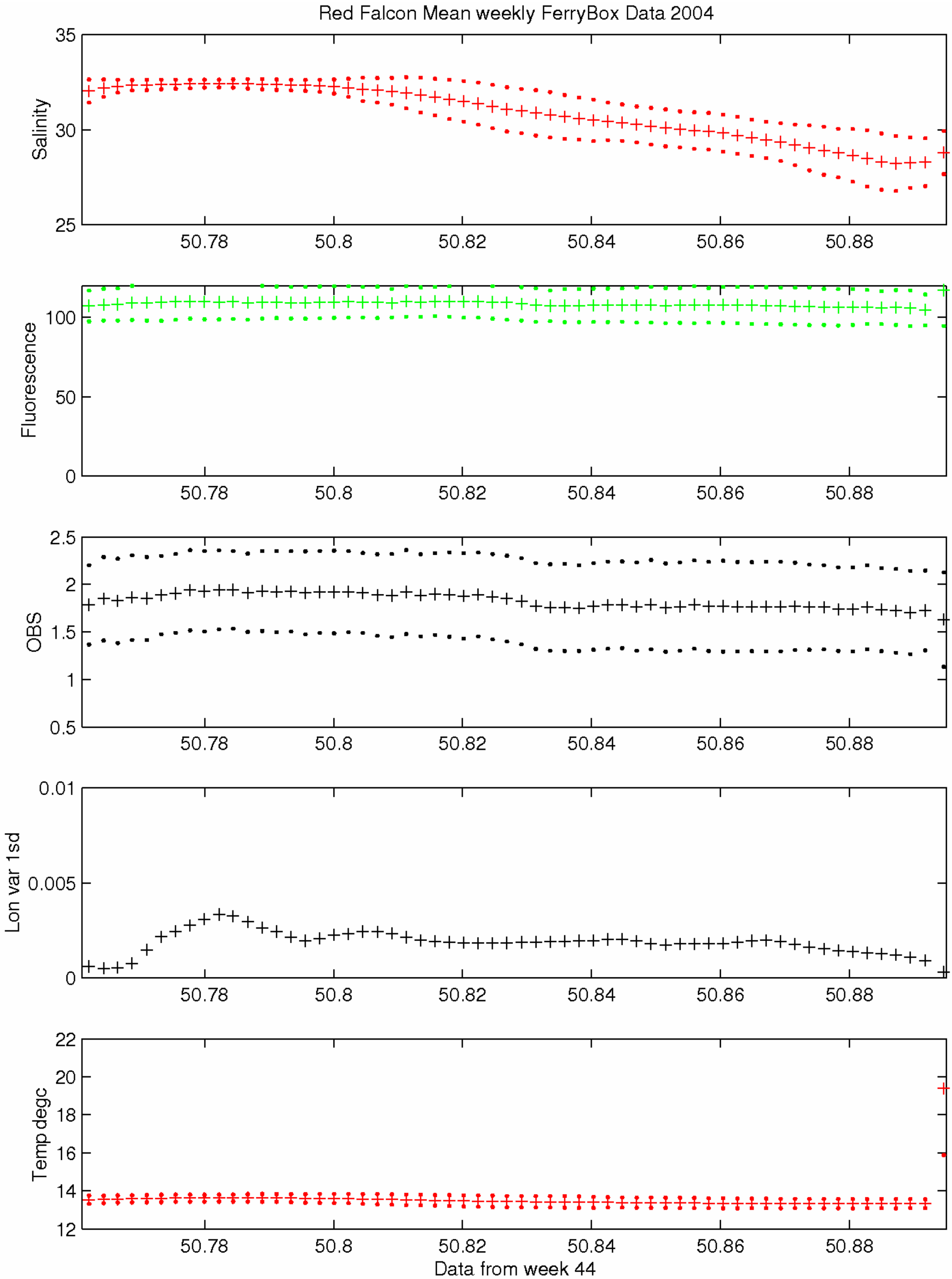


Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
288
289
290
291
292
293
294
295
Data from week 43


Red Falcon Mean weekly FerryBox Data 2004
Salinity
Fluorescence
OBS
Lon var 1sd
Temp degc
Data from week 43
35
30
25
100
50
0
2.5
2
1.5
1
0.5
0.01
0.005
0
22
20
18
16
14
12
50.78
50.8
50.82
50.84
50.86
50.88



Salinity
35
30
25
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lat
50.95
50.9
50.85
50.8
50.75
Temp degc
30
25
20
15
295 296 297 298 299 300 301 302
Data from week 44



Red Falcon Mean weekly FerryBox Data 2004
Salinity
35
30
25
50.78
50.8
50.82
50.84
50.86
50.88
Fluorescence
100
50
0
OBS
2.5
2
1.5
1
0.5
Lon var 1sd
0.01
0.005
0
Temp degc
22
20
18
16
14
12
Data from week 44

9.0 Appendix A

9.1 Red Falcon Ferry Box System Engine room data download instructions

1.0 Check display to make sure everything is normal and that PC clock is correct.
2.0 Stop the program by pressing the Esc key then Y to confirm.
3.0 If PC clock was incorrect, reset the time (GMT) using the DOS TIME command
4.0 Switch off the PC using the switch indicated below. Note that you need to pull this switch slightly before you can change its position.
5.0 Carefully remove the Compact Flash card.
6.0 DO NOT REMOVE OR INSERT FLASH CARD WITH POWER ON!!
7.0 Carefully replace with empty Flash card. See second image for orientation of card.
8.0 Switch on PC.
9.0 Check that all values are normal after a few minutes
10.0 Return full CompactFlash card to Jon Campbell for processing

CompactFlash card

Power switch

Coloured label this side　　　　　　Eject button

9.2 Engine Room Notes

9.2.1 Time stamping

The engine room logger is designed to use GPS time to condition the PC’s clock and hence provide accurate time stamping of the MiniPack data. Without the link to the bridge, the accuracy of the time stamping is dependent on the user checking the PC’s clock, and if necessary, resetting it. To do this exit from the program and then type “time” and enter the correct GMT time as prompted.

9.2.2 Data Rates

Both the GPS and the MiniPack generate around 3MB of data per day. Without the engine room to bridge cable, the engine room logger cannot record GPS data.

9.2.3 Flash Card preparation

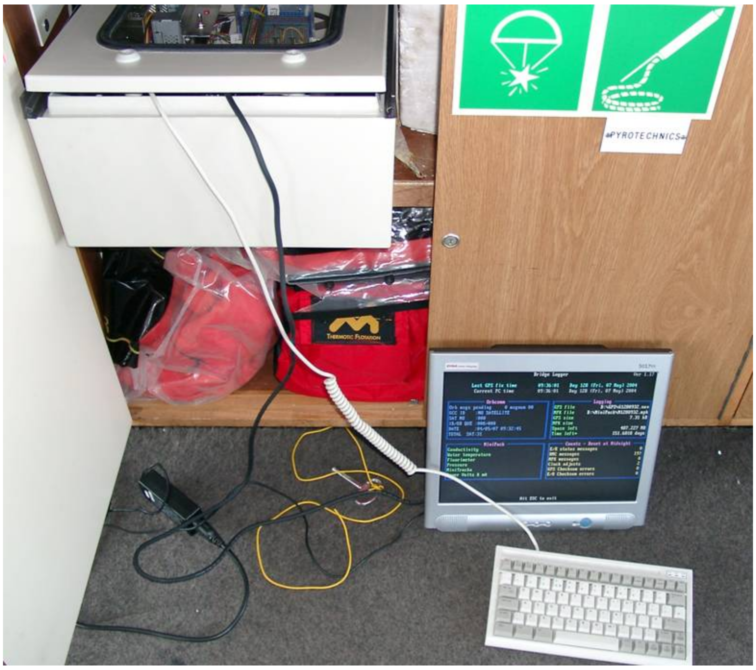
The CompactFlash card MUST have 2 directories present otherwise the redf_er.exe program will not run. These directories are \GPS and \MINIPACK. There are currently two, 256MB flash cards available for use in the Red Falcon engine room logger. Without the GPS data, each of these cards should hold around 80 days of MiniPack data.

9.2.4 Overheating

If the box seems unpleasantly hot inside, you can turn off the LCD display when you are not using it.

9.3 Bridge data download instructions

The picture below shows the location of the Bridge Logger and the mains distribution board that provides its power.



To download data from the Bridge Logger you will need:

1. An empty CompactFlash card with the correct directory structure
2. An LCD display
3. A keyboard
4. A cabinet key to open the logger box

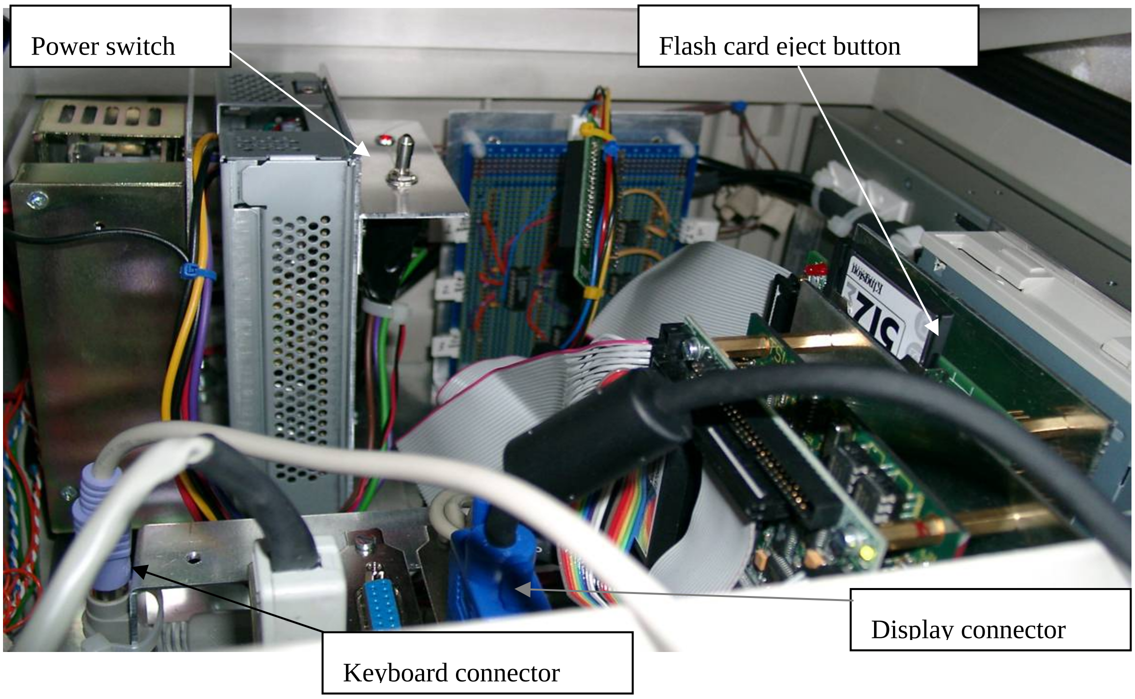
Once on the bridge:

1. Plug the LCD into the mains distribution board
2. Pull the logger box slightly out of the cupboard and open its lid with the cabinet key
3. Connect the LCD display and the keyboard

4. Check display to make sure everything is normal and that PC clock is correct.
5. Stop the program by pressing the Esc key then Y to confirm.
6. Switch off the PC using the switch indicated below. Note that you need to pull this switch slightly before you can change its position.
7. Carefully remove the Compact Flash card.

1. DO NOT REMOVE OR INSERT FLASH CARD WITH POWER ON!!

2. Carefully replace with empty Flash card. See photo below for orientation of card.
3. Switch on PC.
4. Check that all values are normal after a few minutes
5. Disconnect the display and the keyboard and close the logger box
6. Return full CompactFlash card to Jon Campbell for processing



9.4 Bridge Logger Notes

9.4.1 Time stamping

The bridge logger uses GPS time to condition the PC's clock and hence it should always be within one second of UTC.

9.4.2 Data Rates

Both the GPS and the MiniPack generate around 3MB of data per day. Without the engine room to bridge cable, the bridge logger cannot record MiniPack data.

9.4.3 Flash Card preparation

The CompactFlash card MUST have 3 directories present otherwise the redf_br.exe program will not run. These directories are \GPS, \ORBCOMM and \MINIPACK.

9.4.4 Overheating

The logger box gets quite hot inside, but not dangerously so.

9.4.5 Missing GPS data

The "RedF_br.c" logging program currently fails to record all 1 second GPS fixes when it is talking to the Orbcomm communicator. This produces occasional short gaps of up to 30 seconds in the GPS data, which can be filled by interpolation in the off-line processing.

9.5 Data Formats

9.5.1 MiniPack Processed files (Mdddhhmm.prc)

These are given the same name as the first MiniPack file to be processed, but with an extension ".prc".
The files contains 16, space-delimited fields. Working from left to right these are:-

1. The year as 2 digits
2. The Julian Day to 8 decimal places
3. The corresponding time expressed as hh:mm:ss.ss (This is superfluous, but can be useful)
4. The MiniPack conductivity reading in mmhos/cm
5. The MiniPack temperature reading in degrees centigrade
6. The MiniPack pressure reading in dbar
7. The MiniPack fluorimeter reading
8. The MiniTraka reading in Volts
9. The MiniPack power supply voltage in Volts
10. The MiniPack power supply current in mA
11. The GPS latitude
12. The GPS longitude
13. The distance in km from a "reference" position, in this case the Town Quay
14. The GPS Speed Over Ground in knots

15. The time difference in seconds between the GPS time stamp and the MiniPack time stamp
16. The elapsed time in seconds since the last MiniPack record. Useful for spotting gaps in the data

Here is an example of a data record:-

04 154.49162766 11:47:56.63 40.841 17.0736   0.23   4.94 0.01660 11.779 64.36 50.769555 -1.301370 15.859 10.70 0.61 0.99

9.5.2 GPS ASCII files (Gdddhhmm.txt)

These have the same names as the binary files but with a different extension.

The files contains 8, space-delimited fields. Working from left to right these are:-

1. The year as 2 digits
2. The Julian Day to 8 decimal places
3. The corresponding time expressed as hh:mm:ss.ss (This is superfluous, but can be useful)
4. The GPS latitude
5. The GPS longitude
6. The GPS Speed Over Ground in knots
7. The GPS "Dilution of Precision" in metres. The smaller the value, the more accurate the fix.
8. A flag that is set to 0 for interpolated values, or 1 for genuine values

Here is an example of a data record:-

04 146.00750023 00:10:48.02 50.881883 -1.397435 13.30   1.0 1

9.5.3 Parameter limits for good data are set at:-

Year	2004	2024
Day	1.0	367.0
Conductivity	-1.00	80
Temperature	0.0	40.0
Pressure	-1.0	100.0
Fluorescence	-0.5	900.0
Minitracka	-0.1	5.0
Voltage	0.0	25.0
Current	0.0	500.0
GPS Speed over Ground	0.0	20.0

9.5.4 Notes

1) As long as valid data is available, 1 Hz values are placed in the output files. NO averaging is performed.
2) The Town Quay reference position is 50.895668 ºN, 1.406478 ºW.
3) Currently no account is taken of possible clock drift in the engine room PC.

9.5.5 Engine room components

40 MHz 386 PC/104 card with 1xRS-232 port and 1xRS-485 port.

COM1 is bi-directional RS-232 to MiniPack

COM2 is RS-485 TX ONLY. Sends MiniPack and status NMEA messages to bridge.

DSP Design TS400 quad serial board configured with Channels A and B RS-232, Channels C and D RS-485.

GPS messages from Garmin receiver on bridge top are received on Channel C.

Runs MS-DOS 6.22 which is stored in 16 MB Disk-on-Chip along with all programs and configuration files. This is drive C:

Data is logged to 512MB Compact Flash card which is drive D:

A PC power supply provides +5V for PC, +12V for Compact Flash IDE card and MiniPack.

A MiniTraka is connected to input channel 9 on the MiniPack.

9.5.6 Bridge components

Same as for Engine Room system but with 20 GB HDD, no keyboard or display permanently attached.

The HDD is intended to allow the system to run for over a year without running out of space. It should only be necessary to touch this system if there is a problem of some kind.

To download data you need to use a parallel port Zip drive or a Compact Flash card, and a keyboard and display.

COM1 is bi-directional RS-485 link to Panasonic Orbcomm communicator on bridge top.

COM2 is RS-485. RX receives MiniPack and housekeeping messages from engine room.

TS400 Channel A is bi-directional RS-485 link to Garmin GPS 17N on bridge top.

PC power supply provides +5V and +/-12V for RS-485 to RS-232 interface circuits.

+24V supply provides power to the Orbcomm, GPS and RS-485 interface circuits on the bridge top.

9.5.7 COM Port assignments – Engine Room

COM 1 – RS-232 0x3f8, IRQ4 MiniPack

COM 2 – RS-485 0x2f8, IRQ3 Tx ONLY link to Bridge

TS400 A – RS-232 0x280, IRQ5 (shared), Hull temp?

TS400 B – RS-232 0x288, IRQ5 (shared), SUV6?

TS400 C – RS-485 0x290, IRQ5 (shared), GPS Rx ONLY

TS400 D – RS-485 0x298, IRQ5 (shared), Spare

9.5.8 COM Port assignments – Bridge

COM 1 – RS-232 0x3f8, IRQ4 Orbcomm via 232 to 485 interface

COM 2 – RS-485 0x2f8, IRQ3 Rx ONLY from Engine Room

TS400 A – RS-232 0x280, IRQ5 (shared), GPS (bi-directional) via 232 to 485 interface

TS400 B – RS-232 0x288, IRQ5 (shared), Spare

TS400 C – RS-485 0x290, IRQ5 (shared), Spare

TS400 D – RS-485 0x298, IRQ5 (shared), Spare

9.5.9 Red Falcon Orbcomm messages

The Red Falcon is fitted with a Panasonic Orbcomm communicator, S/N 9CBDE 212642, designated “fbox1”.

Two types of Orbcomm messages are sent - hourly status messages and more frequent data messages.

9.5.10 Hourly Status Message

This message reports various parameters from the Engine Room (E/R) PC and the Bridge PC.

Here is an example of a status message:-

FIXED_MSG:S3A,346.000000,3600,3600,238.211,11.725,64.358,346.000117,3552,3541,1896.938,29,00

The comma separated fields are:-

1. FIXED_MSG:SXX, where XX are 2 hexadecimal digits representing the Orbcomm message count. This number will increment up to FF and then wrap round to 00 and continue incrementing.
2. The Julian day time stamp for the Engine Room status (%10.6lf)
3. The number of MiniPack messages received by the E/R Box in the past hour (should be 3600).
4. The number of GPS fixes received by the E/R Box in the past hour (should be 3600).
5. The amount of disk space in MB remaining on the E/R PC (%8.3lf).
6. The average voltage measured by the MiniPack during the past hour.
7. The average current (in mA) measured by the MiniPack during the past hour.
8. The Julian day time stamp for the Bridge PC status (%10.6lf)
9. The number of MiniPack messages received by the Bridge Box in the past hour (should be 3600).
10. The number of GPS fixes received by the Bridge Box in the past hour (should be 3600).
11. The amount of disk space in MB remaining on the Bridge PC (%8.3lf).
12. The number of Orbcomm messages queued in the communicator, waiting to be sent.
13. The number of Orbcomm messages received by the communicator waiting to be processed.

Finally the Orbcomm adds a time stamp of its own with the format

,HHMMSS,DD,MM

Note that if no status message has been received from the engine room within the past hour, fields 2) to 7) are set to zeros.

9.5.11 Data Messages

Each data message contains two data records. The interval between records is initially set by a parameter in the RedF_Br.cfg configuration file, typically 10 minutes. However this interval is doubled if the Orbcomm message buffer reaches 15 (i.e. approximately half full), and will revert to its original value once the message queue reduces to 10.

Here is an example of a data message:-

FIXED_MSG:D39,346.001389,50.89265,-1.39571,0.00,346.001396,-0.122,18.5063,-0.06,

0.27,1.03583,346.005567, 50.89265, -1.39570, 0.00,346.005562, -0.122,18.5117, -0.05, 0.25,1.03561

The comma separated fields are:-

1. FIXED_MSG:DXX, where XX are 2 hexadecimal digits representing the Orbcomm message count, regardless of whether they are data or status messages. This number will increment up to FF and then wrap round to 00 and continue incrementing.
2. The Julian day time stamp for this GPS fix (%10.6lf)
3. The latitude for this fix (%9.5lf)
4. The longitude for this fix (%9.5lf)
5. The ship's speed over the ground in knots from the GPS receiver (%5.2f)
6. The Julian day time stamp for this MiniPack data (%10.6lf)
7. MiniPack conductivity reading (mmhos/cm) (%7.3f)
8. MiniPack temperature reading in degrees centigrade (%7.4f)

9. MiniPack pressure reading (dbar) (%6.2f)
10. MiniPack fluorimeter reading (%6.2f)
11. AquaTraka reading in Volts (%7.5f)

Parameters 2) to 11) are then repeated for the next data record.

Finally the Orbcomm adds a time stamp of its own with the format
,HHMMSS,DD,MM

9.5.12 Control of power down

Unfortunately there is no way for the Persistor to force the Orbcomm into power down mode. So the only alternative seems to be to use the KXA or KXB commands.
The KXB02 command has been used so far. This is a tracking function and hence forces the SC to check its GPS position as soon as it powers up.
For example, KXB02 = 0, 0, 10, 30, 60, 1, 1, 1
0, 0, sets the time zone to UTC (GMT).
10, 30, means turn on at 10:30
60, means repeat the operation every 60 minutes
1, 1, 1 means Track the position from a specified point and check if the distance specified by KXS56 has been exceeded. If so, send a position message to speed-dial address 1.
The reference position used in this computation is initially the current position when the KXB command is given, but will be updated whenever a “distance exceeded” event occurs. In practice the Persistor uses its own reference position defined in the configuration Orbcomm Settings
All our Orbcomm communicators have Rev E hardware and version 4.2 firmware.
SC stands for Subscriber Communicator, i.e. the Panasonic Orbcomm transceiver.
Inbound messages are messages sent from the SC to the Gateway.
Outbound messages are the reverse.

9.5.13 Useful commands (all case sensitive)

To enter command mode – CTRL + KXORB
To get status - KXST
To see all settings – KXS00
To see KXA /KXB command settings – KXA00 / KXB00
System diagnosis check – KXCHK
Control LED – KXLED = 0 always OFF, = 1 ON when satellite in view
To get latest position KXS23
To get current time KXUTC
Define fixed message KXM01=
Send fixed message immediately to speed dial 1 KXA06=1,3
To exit command mode CTRL+Q, then Y when asked to confirm.

9.5.14 Basic settings that need to be changed from the default values

KXS01 = 120 Sets the Network Control Centre (NCC) to Italy. The default setting is 1 for the USA.

KXS03 Message priority. Defaults to 0 which is the lowest (non-urgent) priority. Have not tried varying this.

KXS14 Sets the procedure used by the Communicator (SC) to search for Gateways. Probably best left to the default value of 0.

KXS23 = Set the current position. (For SOC KXS23=50.8913, -1.3938)

KXS37 Sets the power down mode. = 0 for continuous ON. Needs to be set to 1 for power saving operation.

KXS38 Sets the minimum number of minutes that the SC remains powered down. Default is 0.

KXS39 Sets the Inactive interval. Defaults to 0.

KXS43 = 5,2,1,8 Sets RS-232 parameters to 9600 baud, no parity, 1 stop bit and 8 data bits. The default baud rate is 4800.

KXS45 = 1 If the buffer is full, old messages are overwritten with new ones. Default value is 0.

KXS46 = 1 Same thing for outbound messages .

KXS48 Sets the Inbound/outbound queue sizes. A value of 7 sets the IB buffer to 7kB and the outbound to 1kB.

KXS56 Sets the distance to be used with tracking commands. E.g. 10,2 sets the distance to 10 nautical miles.

KXS75 Change message type to Globalgram when normal messaging not available (if set to 0, defaults to 1).

KXS79 Event timer for use with KXB commands. Default value is 10 minutes.

On Ferry boxes Orbcomm is always ON and tracking its position.

Use the KXB02 command to control this as follows:-

KXB02=0,0,HH,MM,0,1,1,1

Then set

KXS37 = 0 to disable power saving. file, to track distance and bearing.

9.5.15 20-way BT cable from Orbcomm box to bridge box

Pin	Colour	**Signal**	**Destination**
1	Red	+24V	
2	Red	+24V	
3	Red	+24V	
4	Red	+24V	
5	Red	+24V	
6	White	GND	
7	White	GND	
8	White	GND	
9	White	GND	
10	White	GND	
11	Orange	Spare	
12	Orange	Spare	
13	Brown	Orbcomm TX+	
14	Brown	Orbcomm TX-	
15	Grey	Orbcomm RX+	
16	Grey	Orbcomm RX-	
17	Blue	GPS TX+	
18	Blue	GPS TX-	
19	Green	GPS RX+	
20	Green	GPS RX-	

9.5.16 MiniPack cable to Engine room box; 8-way Impulse to 6 way Bulgin

Pin	Tail Colour	**Signal**	Colour	**Bulgin Pin**	**Destination**
1	Black	N/C			
2	White	232 RX	Blue	5	COM1/3
3	Red	+18 to +72V			
4	Green	N/C	Green		
5	Orange	232 TX	Yellow	4	COM1/2
6	Blue	0V	Black	2	GND
7	White/black	+9 to +16V	Red	1	+12V
8	Red/black	232 Common	White	3	COM1/5

9.5.17 Bridge to Engine Room Cable; 9-way Bulgins on Bridge Box and Engine Room Box

Bridge Box	Bulgin Pin	**Signal**	Colour	**Bulgin Pin**	**Destination in E/R Box**
25-way pin 17 Tx+	1	GPS Tx + to e/r	Blue	1	TS400 RXC+ pin 21
25-way pin 18 Tx-	2	GPS Tx- to e/r	White/blue	2	TS400 RXC- pin 22
COM2 Rx+ pin 3	3	E/R Rx + from e/r	Orange	3	COM2 Tx+ pin 2
COM2 Rx- pin 4	4	E/R Rx – from e/r	White/orange	4	COM2 Tx- pin 1
	5		Green	5	
	6		White/green	6	
	7		Brown	7	
	8		White/brown	8	
	9		N/C	9	

9.5.18 Bridge Box – TS400 connections

TS400 signal	50-way Pin	**Signal**	Colour	**25-way Bulgin Pin**	
RXC+	21	GPS Tx +	Blue	17	
RXC-	22	GPS Tx-	Blue	18	
TXC+, TTXC+	15, 14	GPS Rx+	Green	19	
TXC-, TTXC-	16, 17	GPS Rx-	Green	20	
RXD+, TRXD+	9, 8	Orbcomm Tx+	Brown	13	
RXD-, TRXD-	10, 11	Orbcomm Tx-	Brown	14	
TXD+, TTXD+	3, 2	Orbcomm Rx+	Grey	15	
TXD-, TTXD-	4, 5	Orbcomm Rx-	Grey	16	

9.5.19 Minitracka cable to Engine room box AND MiniPack; 4-way Impulse to 6-way Bulgin AND 16-way Impulse

Pin	Tail Colour	Signal	Colour	**Connector/pin**	Destination
1	Black	PWR GND	Black	6-way Bulgin, pin 2	GND
2	White	SIG +	Red	16-way, pin 3	Chan9 Hi
3	Red	+7 to +40V	Red	6-way Bulgin, pin 1	+12V
4	Green	SIG-	Green	16-way, pin 4	Chan9 Lo

10.0 Appendix B

10.1 Calibration crossing procedures

10.1.1 Pre calibration

1. Travel to Ferryport (aim to arrive before ferry does)
2. Take Equipment to engine room. See `Equipment preparation‘, Appendix B 10.7
3. Clear the operation with the engineers

10.1.2 Calibration (cleaning)

1. Check that the logger time is accurate, if out by more than a few seconds then correct the time, this is displayed on the screen.
2. Switch off the inlet and the outlet stop cocks.
3. Remove the sensors from their flow cells, catching any residual water in a container.
4. Perform dirty fluorimeter check with plastic blocks.
5. Clean the minipack, refer to `Instrument cleaning‘, Appendix B 9.7
6. Perform clean fluorimeter check with plastic blocks.
7. Replace the Minipack in its flow cell.
8. Perform dirty Minitracka check.
9. Clean the Minitracka.
10. Perform clean Minitracka check.
11. Replace the Minitracka in its flow cell.
12. Turn on water supply at both stop cocks.

10.1.3 Calibration (sampling)

1. Fill sampling jar with 1 litre of water from sampling tap. Collect spillage in pail.
2. Note the time displayed on the monitor together with the event number.
3. Note the values displayed on the monitor for the conductivity, temperature, pressure, fluor and turbidity.
4. Sample from the sample jar for nutrients and chlorophyll.
5. Sample for bottle salinity.
6. If the fluorescence value is high collect a water sample and preserve with Lugol’s iodine solution, one or two per crossing.
7. Agitate remainder of sample and fill suspended sediments sample bottles.

N.B. each sample should be marked with the event number

10.1.4 Calibration (data download)

1. Replace flashcard from engine room logger, following instructions in Appendix A
2. Replace flashcard from bridge logger, following instructions in RF handbook Appendix A

10.1.5 Post calibration

1. Returned collected samples to the lab for analysis.

2. Freeze Nutrient and chlorophyll samples if not to be analysed immediately.
3. Collect Salinity samples until there are sufficient for a batch to be processed.
4. Notify individuals concerned of samples whereabouts.
5. Create a new Diary File including details of the calibration crossing, see Data Processing (Section 6.0).

10.2 Instrument cleaning

Surfaces	**Cleaning tools**
sensor head and flow cell plastic surfaces	tap water and paper towelling
pressure sensor	tap water and paper towelling decon 90 and cotton buds
Conductivity Cell	tap water and paper towelling decon 90 and cotton buds
Fluorimeter lenses	decon 90 and cotton buds
Minitracka lenses	decon 90 and cotton buds

Water and paper towelling were used where possible to remove all surface deposition throughout, excepting optics. Decon 90 was used in conjunction with cotton buds for stubborn areas, for the interior of the conductivity cell and for the lenses of the optical sensors. The lenses were cleaned until there was no apparent discolouration of the cotton buds.

10.3 Sampling Procedures

Calibration samples were collected continuously throughout the outbound (Southampton to Cowes, IOW) and the return legs, 2 operators being ideal. Each sample is allocated an event number and this is noted along with the time that the sample was collected. The crossing duration is 1 hour and sampling takes about 10 minutes, this yields nominally 12 events per calibration run.

10.1.1 Nutrient and Chlorophyll

Fill the syringe with 60 ml of sample water. Place a 25mm filter holder with filter on the end of the syringe. Rinse a nutrient sample pot three times with the first 30 ml and then fill with the last 30ml. Remove filter holder. Refill the syringe. Replace filter holder. Expell the full 60ml through the filter. Ensure that the final part of the sample was filtered by passing some air from the syringe through the filter. Fold the filter with tweezers and submerge in 5ml 90% acetone.

10.1.2 Salinity sample

Part fill the salinity bottle, rinse bottle and plastic stopper. Repeat. Repeat. Fill the bottle to the shoulder. Insert the plastic stopper. Dry the bottle neck and lid thoroughly. Lightly screw down the lid.

10.1.3 Lugol

If a Lugol sample was to be taken,usually if the fluorescence value was high, fill the bottle to the shoulder and note the sample number and date on the label. Note also in the notebook that.

10.1.4 Suspended sediment

Agitate the remainder of the sample to resuspend any deposits. Fill two 250ml sample bottles. Replace the lids firmly

10.4 Oven Location

SONUS Lab		Filtration, oven
Instrument room	456/01	scales, oven
2nd and 3rd years practicals lab	456/07	muffle furnace

10.5 Red Falcon diary.xls – crossing log

Example of diary spreadsheet containing entries from calibration crossing 15

File; POLARIS.SHARED1/GDDPRIV/Ferrybox/RedFalcon/040923 Red Falcon diary.xls

Sample No.	Event	Jday 2004	Date	Time GMT	Salt No.	Cond	Temp	Fluor	Turbidity	Chl a
1	15.01	267.48383	23/9/04	11:36:43	43	42.10	16.70	6.3	0.6400	
2	15.02	267.48851	23/9/04	11:43:27	44	41.7	16.60	7.6	1.64	
3	15.03	267.49544	23/9/04	11:53:26	45	41.10	16.60	8.5	2.0300	
4	15.04	267.49946	23/9/04	11:59:13	46	40.60	16.60	9.5	1.5000	
5	15.05	267.50321	23/9/04	12:04:37	47	40.60	16.60	9.9	1.6000	
6	15.06	267.50862	23/9/04	12:12:25	48	40.60	16.60	8.6	0.7000	
7	15.07	267.51291	23/9/04	12:18:35	71	40.40	16.70	7.3	0.5800	
Initial Readings	15.00	267.42083	23/9/04	10:06:00		40.31	16.86	66.2	2.1400	
Water off										
Fresh flush				10:15:40		0.02	21.10	109.0	2.3900	

Minitracka		Fluorescence calibrations				
	Dirty	Condition	Medium	illumination	Reading	Time
in air		Dirty	air	Light	39.40	11:04:20
in dark		Dirty	air	Dark	41.00	11:05:05
white sheet		Dirty	Low	Light	2.90	11:05:30
sensor covered		Dirty	Low	Dark	3.20	11:05:50
	clean	Dirty	High	Light	21.00	11:06:25
in air		Dirty	High	Dark	22.70	11:06:50
white sheet		Clean	air	Light	1.80	11:12:55
in housing dry		Clean	air	Dark	2.33	11:13:25
		Clean	Low	Light	2.40	11:13:50
		Clean	Low	Dark	2.90	11:14:15
		Clean	High	Light	43.90	11:14:35
		Clean	High	Dark	44.40	11:14:57

10.6 Structure of file caldata

Event	**day**	**Chl**	**salinity**	**SPM**
13.01	246.48403	1.146	34.320	NaN
13.02	246.48800	0.917	34.347	22.049
13.03	246.49294	0.671	34.471	29.908
13.04	246.49705	0.575	34.147	19.171
13.05	246.50186	0.921	33.978	26.481
13.06	246.50672	1.625	33.324	47.103

10.7 Equipment Preparation

The sample containers were marked with the sample numbers prior to the calibration run.

Containers	**Description**	**Quantity**
Sample bottle	1 litre cuboid plastic bottle with screw lid	1
Nutrients	30ml dilu-vials coulter pots containers with plastic snap over liids	15
Chlorophyll	15 ml plastic vials, plastic stoppers with 5ml 90% acetone, 10% DI water.	15
Salinity	soft glass bottles with plastic stoppers and screwtop lids	15
Lugol	brown glass bottles with screwtop lids containig preservative.	3
Turbidity	250 ml plastic screwtop bottles	12
Syringe	60 ml plastic 2	(1 + spare)
Filters	GF/F 25mm glass filters	1 box
Filter holder	plastic	2

Equipment required for the measurement of suspended Particulate matter (SPM):

1000ml measuring cylinder   Vacuum pump   Vacuum tubing

Filtration setup for 47 mm glass filters.

DI water with squeegy bottle   Samples   Aluminium foil   Stapler and Indelible marker   Tweezers

10.8 Red Falcon Diary

date	entry by	
02/04/2004	djh	Red Falcon Back in service
	djh	
24/05/2004	djh	Cal Xing
07/05/2004	djh	Cal Xing nutrients taken
	djh	
02/06/2004	djh	09:00 Xing Unit in engine room had stopped logging about 16:00 on 1/6/04. Got flash card from SOC fitted on 12:00 system then ran OK. NO samples taken. All time went in refitting system. System left flowing at 4LPM.
02/06/2004	djh	12:00 Xing fit flow meter and adjust flow. Problem was alignment of minitracka. Flow left at 4LPM. Higher rate flow meter ordered.
		e-mail from Malcolm to say flow turned off and he would turn it on again
10/06/2004	djh	calibration Xing with Mark Hartman
16/06/2004	djh	cal Xing djh & mch
23/06/2004	djh	Day of storms and rain. Cal Xing djh & mch. 13 Nut & chl samples. System cleaned fouling looked like last week but data shows very high positive fouling particularly of fluorimeter. Fluorimeter and minitracka readings remained high in air before windows were cleaned. Very windy (35-40 kts?) from South high turbidity measurements as ferry took a detour over shallower waters.
30/06/2004	mch	No calibrations possible as Logging had stopped day 181 04:19:59 and would not restart. Fault traced to occur when cable plugged into Minipack. Replacement unit brought out to ferry upon return, fitted in place. Logging commenced as per usual. Fault deemed to lie in Minipack. Flow meter reading 20 lpm even when no flow problem caused by vegetation buildup within flow meter, unit removed.

07/0704	mch	Wind strong 5 ish from the East so some swell in Solent. First crossing with replacement Minipack. 1100 am sailing. Delayed Cowes (link span failure). Updated logging software installed whilst at Cowes, should now show unexpected signals from Minipack. 15 calibration samples made 5.01 to 5.15. Chl 5.05 and 5.06 filters very evenly covered brown rather than green. Nut 5.11 only had 1 cursory rinse.
14/07/2004	mch	Cal Xing mch & saw With djh onboard at outset. Wind Southerly steady breeze, second crossing with replacement minipack. 0900 sailing (0800 GMT). Little apparent fouling. No high variations in any recorded values. Data downloaded from Bridge and engine room loggers
21/07/2004	mch	Cal Xing mch, saw. Third crossing with replacement minipack. Little apparent overall variation. Temperatures from alcohol, IR and logger compared.
28/07/2004	mch	Cal Xing mch, saw. Fourth crossing with replacement minipack. Slimy transparent coating over lenses. One lugol sample taken.
04/08/2004	mch	Cal Xing mch, saw. Fifth crossing with replacement minipack. Slimy transparent coating over lenses slight increase in greenness of filters this week over the last few. One lugol sample taken 9.12. More filters required. Weather warm, some breeze from SW.
11/08/2004	mch	mch Fluorimeter check, cleaned sensors. Heavyish build up of muddy sediment over sensor head. Downloaded engine room data.
18/08/2004	mch	mch, djh cleaned sensors, downloaded all data. Chopped minitracka cable spliced as per PoB, refitted 19/8/04.
25/08/2004	mch	Cal Xing mch, djh. First crossing with new minitracka cable. Heavy deposits of grey/green substance. Wind from North.
02/09/2004	mch	Cal Xing mch. First leg attempt to assess minitracka output. 2nd leg calibration samples
16/09/2004	mch	cal Xing djh & mch. Clean sensors. Fluor check. Minitracka check using new blocks, no data download. Little fouling of optics.
23/09/2004	mch	cal Xing mch & mqurban. Formazine standard used with turbidity sensor in flow cell, acrylic blocks and photo stops. Cal check of fluorimeter, samples taken on Cowes - Soton leg, strong wind from W, high turbidity generally.
30/09/2004	mch	suh + djh. Clean Sensors. Fluor + minitracka check.
13/10/2004	mch	cal Xing djh & mch Sensors cleaned. Formazine standard used with turbidity sensor in flow cell, acrylic blocks and photo stops. Cal check of fluorimeter, Wind from South some white horses.
27/10/2004	mch	djh & mch data download. Removed sensors to SOC. Last data 10:40

11.0 Appendix C

11.1 Matlab and UNIX Scripts

box.m	draw a rubberband box on the plot to select data points that need to be averaged
caldat_load.m	loads calibration data from ascii text file (caldata1 or caldata2)
chopper	unix script for extracting the calibration crossing data
chopper2	unix script for extracting the calibration crossing data
chopper3	unix script for extracting the calibration crossing data
differ.m	Select portions of Ferrybox calibration file using a rubber band box, generates a mean of the selected values, saves the means to a matrix
extract_avg.m	selects the sample times, produces averages and standard deviations
fb_load.m	loads appended ASCII .CAL files into matlab workspace
fb_loadsingly.m	loads individual .PRC files into matlab workspace
loaddata.m	reads the time information from the .PRC files
loadwk.m	reads in the wereads in the weekly files, calculates salinity, splits the data into latitude bins and then creates an average and standard deviation for all the variables for each bins FB logged data from time of calibration crossing
minify.m	\`decimates\` the data to 1/60Hz and saes to .min file
minappend.m	joins all the 'min' files. into a single file
minfluor.m	checks the ferries direction of travel; if it changes the variable 'leg' is incremented
minfluor1.m	Takes averaged data and finds the minimum value of the fluorescence for each leg, it then subtracts the minimum fluorescence from the current value
plot_all.m	performs a regression on the averaged variables against sample values and plots these for salinity, chlorophyll and turbidity; all 3 on the same page
plotit.m	generates postscript file showing graphs of the means +/- 1sd for salinity Fluorescence OBS longitude and temperature
readXL.m	decimal times of fluorimeter block checks are read into matlab
sal_calc.m	produce salinity from the minipack data
splitter.m	splits .PRC files into weekly files
writeblockXL.m	saves mean fluorescence values to a spreadsheet
writeXL.m	writes averaged FB data to a spreadsheet

11.1.6 box

```
% draw a rubberband box on the plot to select data
% points that need to be averaged.  mch 12/2004
k = waitforbuttonpress;
point1 = get(gca,'CurrentPoint');    % button down detected
finalRect = rbbox;                   % return figure units
point2 = get(gca,'CurrentPoint');    % button up detected
point1 = point1(1,1:2);              % extract x and y
x1 = point1(1,1);
point2 = point2(1,1:2);
x2 = point2(1,1);
p1 = min(point1,point2);             % calculate locations
offset = abs(point1-point2);         % and dimensions
x = [p1(1) p1(1)+offset(1) p1(1)+offset(1) p1(1) p1(1)];
y = [p1(2) p1(2) p1(2)+offset(2) p1(2)+offset(2) p1(2)];
hold on
axis manual
plot(x,y)                            % redraw in dataspace units
```

11.1.7 caldat_load

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
% caldat_load
% loads calibration data obtained from lab analysis of samples
%
% mch August 2004
% echo on
% list files in current directory
!ls
R = input('Enter name of textfile containing calibration data: ','s');
fname = R;
% load calibration file
[calevent,caljd,calchl,calsal,calss]=textread(fname,'%f %f %f %f %f');
% determine and print range of events available to screen.
minevent = num2str(min(calevent));
maxevent = num2str(max(calevent));
strcat('first event : ', minevent,' last event : ', maxevent)
% ask for relevant ferry crossings
R = input('Do you wish to process more than one crossing (y/n): ','s');
if R == 'y'
  first = input('enter smallest event integer to be processed:   ');
  last = input('enter largest event integer to be processed:   ');
  last = last + 1;
else
  first = input('enter event integer:  ');
  last = first + 1;
end
  ev = find (first < calevent & calevent < last);
  % select relevant events from the following loaded variables
  calevent = calevent(ev);
  caljd = caljd(ev);
  calchl = calchl(ev);
  calsal = calsal(ev);
  calss = calss(ev);
% tidy up workspace
clear first last s ans R minevent maxevent fname;
% exit m-file
% error(' exit')
```

11.1.8 chopper

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
#/bin/csh -f
# this exec copies the last 14400 lines of the RED Falcon
# ascii files into a new file with the extension .CAL
# 12600 lines was equivalent to 3.5 hours ( 1 line/second)
foreach i(*.PRC)
set file = $i:r
/bin/rm -f $file.CAL
tail -12600 $i > $file.CAL
echo $file.CAL"  created"
echo""
end
exit
```

11.1.9 chopper2

```
#/bin/csh -f
grep '^04 217' M210*PRC > M2170000.PRC
grep '^04 260' M254*PRC > M2600000.PRC
chopper3
#/bin/csh -f
```

```
awk 'NR>=24552 && NR<=37152' M2170000.PRC > M2170000.CAL
awk 'NR>=28872 && NR<=41472' M2600000.PRC > M2600000.CAL
```

11.1.10chopper3

```
#/bin/csh -f
awk 'NR>=24552 && NR<=37152' M2170000.PRC > M2170000.CAL
awk 'NR>=28872 && NR<=41472' M2600000.PRC > M2600000.CAL
```

11.1.11differ

```
%
% Select portions of FerryBox calibration file using
% a rubber band box, generate a mean of the selected values
% save the  means to a matrix.  mch Dec 2004.
% requires matrix containing rows of events from one crossing in decimal
% day number form.
% Also requires Ferry box calibration data from all crossings.
%
close all
clear xmin xmax ymin ymax
xmin = (fluorjd(:,2:13));         %  cut out irrelevant data to create a matrix of start times only
xmax = xmin+0.001;              % create a matrix of times 0.001 days later
fluorchk = (fluorxl(:,2:13));
[a,b] = size(xmin);
fluomax = max(FLUOR)+ 10;
fluom = zeros(size(xmin));
% for i=1:a
%     for j=1:b
for i=12:12
   for j=4:4
      if isnan(xmin(i,j))==1  % check if start time is NaN
         disp (j)
      else
         figure
         xlval = int2str(fluorchk(i,j));
         plot(jd,FLUOR,'.')

         xlabel(['Estimated value ' xlval])
         axis([xmin(i,j) xmax(i,j) 0 fluomax])
         box
         xmax(i,j)= x2;
         k = find (x1 <= jd & x2 >= jd);
         fluom(i,j) = mean(FLUOR(k));
                  disp ([i, j, fluom(i,j)])
         r=input('any key- next, q- quit','s');
         if r=='q'
            error('user quits')
         else
            close
         end
         save fluom1
      end
   end
end
close all
% xdiff=(diff(fluorjd(:,2:13))');
% xmin=[123;456;678];
%
% ymin=zeros(size(xmin));
% ymax=100*(ones(size(xmin)));
%
% b=86400*(diff(fluorjd(:,2:13)'));
% plot (b)
```

11.1.12extract_avg

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
% "extract_avg.m"
% extract minipack data corresponding to the sample times
% from the red funnel ferry calibration crossings.
%
% mch Aug 2004
%
clear new* f1
% check that sample times lie within the minitracka data time span
if min(jd) > min(caljd); error('sample time preceeds minitracka data');end
if max(jd) < max(caljd); error('minitracka data preceeds sample time');end
% make the precision of the two day variables the same
% (i.e.to seven decimal places)
jd1=fix(jd*100000);
jd1= jd1/100000;
% find the index where the two days matchup
for i= 1: length (caljd)
```

```
   if caljd(i)< max(jd1) % if the sample time falls before the end of the minipack file
      f= find (jd1>= caljd(i)); % fill array f with the indexes of the minipack data
                              % times that were equal to or greater than the sample time
      caljd2(i) = caljd (i);    % caljd2 = caljd
      f1(i) =f(1);              % fill array f1 with the minipack index concurrent or
   end                          % immediatly after the sample time.
end
% now use the index f1 to get the minipack variable values at the sample time
newday= caljd2';
newlat= LAT(f1);
newlon= LON(f1);
newsal= SAL(f1);
newtemp= TEMP(f1);
newfluo= FLUOR(f1);
newturb= MTRK(f1);
newvars= [newday newlat newlon newsal newtemp newfluo newturb];
% change zero values to nan so that matlab can ignore them
newvars(newvars ==0) = nan;
% assign the day to the nearest integer
day =fix(newvars (1, 1));
% now get the 10 second averages (ò10 seconds)
secs= 10;
timefrac=secs/86400;    % equivalent fraction of a day
fid = fopen('means_and_sds.txt','w'); % open file to be written to
for i= 1:length (f1)
   % FIND THE JULIAN DAY corresponding to the sample time
   % set dnewp and dnewm to the actual start and stop times
   % of the calibration sample i.e. between 20 seconds and
   % 10 seconds before the PC time was noted.
   dnewp=jd(f1(i))- timefrac;
   dnewm=jd(f1(i))- (2*timefrac);
   % find the minitracka indices corresponding to this
   % 10 second interval
   k= find (jd >= dnewm & jd <=  dnewp);
   % AVERAGE ALL the RELEVANT DATA and get the standard deviation
   latm(i)= mean(LAT(k));
   lonm(i)= mean(LON(k));
   salm(i)= mean(SAL(k));
   tempm(i)= mean(TEMP(k));
   fluom(i)= mean(FLUOR(k));
   turbm(i)= mean(MTRK(k));
   latsd(i)= std(LAT(k));
   lonsd(i)= std(LON(k));
   tempsd(i)= std(TEMP(k));
   fluosd(i)= std(FLUOR(k));
   turbsd(i)= std(MTRK(k));
   % WRITE TO FILE
   % set the array crossmn to the variable list
   crossmn=[calevent(i) newvars(i,:) jd(f1(i)) latm lonm salm tempm fluom turbm latsd lonsd
tempsd fluosd turbsd];
   fprintf(fid,'%10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f
%10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f %10.5f
%10.5f\n',crossmn(1,1:20));
end
fclose( fid) % close file
```

11.1.13fb_load

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
% fb_load
% This m-file loads FerryBox data from files in the current directory
% with the extension .CAL
%
% mch Aug 2004
%
% echo on
close all
addpath /scratch/weekly1/mch/matlab/bin/seawater
% clear
% create a structure array of files ending in .CAL
array = dir ('FB*.CAL');
% display calibration filenames
for i = 1: length(array)
   disp (array(i).name);
end
R = input ('files will be appended in this order, OK? (y/n) : ','s');
if R ~= 'y'
   error('exit')
end
% initialise variables
YR = [];jd = [];HH = [];MM = [];SS = [];COND = [];TEMP = []; PRESS = [];
FLUOR = [];MTRK = [];V = [];MA = [];LAT = [];LON = [];KM = [];SOG = [];
TDIFF = [];RECTDIFF = [];
```

```
% load FerryBox calibration data
for i = 1: length(array)
[YR1,jd1,HH1,MM1,SS1,COND1,TEMP1,PRESS1,FLUOR1,MTRK1,V1,MA1,LAT1,LON1,KM1,SOG1,TDIFF1,RECTDIFF1]...
  =textread(array(i).name,'%d %f %2u:%2u:%f %f %f %f %f %f %f %f %f %f %f %f %f');
  % concatenate variables from subsequent files
  YR = [YR;YR1];jd = [jd;jd1];HH = [HH;HH1];MM = [MM;MM1];SS = [SS;SS1];COND = [COND;COND1];
  TEMP = [TEMP;TEMP1];PRESS = [PRESS;PRESS1];FLUOR = [FLUOR;FLUOR1];MTRK = [ MTRK;MTRK1];
  V = [V;V1];MA = [MA;MA1];LAT = [LAT;LAT1];LON = [LON;LON1];KM = [KM;KM1];SOG = [SOG;SOG1];
  TDIFF = [TDIFF;TDIFF1];RECTDIFF = [RECTDIFF;RECTDIFF1];
end
% tidy workspace
clear *1 r I
```

11.1.14fb_loadsingly

```
%
% This m-file loads FerryBox data from all the files in the current directory
% with the extension .CAL or .PRC and appends them.
%
% mch Aug 2004
%
% echo on
close all
% addpath /scratch/weekly1/mch/matlab/bin/seawater
% clear

% create a structure array of files ending in .PRC
% array = dir ('M*.CAL');
array = dir ('M*.PRC');

% display calibration filenames
for i = 1: length(array)
   disp (array(i).name);
end
R = input ('files will be converted in this order, OK? (y/n) : ','s');
if R ~= 'y'
   error('exit')
end

% initialise variables
YR = [];jd = [];HH = [];MM = [];SS = [];COND = [];TEMP = []; PRESS = [];
FLUOR = [];MTRK = [];V = [];MA = [];LAT = [];LON = [];KM = [];SOG = [];
TDIFF = [];RECTDIFF = [];

% load FerryBox calibration data
for i = 1: length(array)
%   [jd(i),COND(i),TEMP(i),PRESS(i),FLUOR(i),MTRK(i),LAT(i),LON(i)]...
  [jd,COND,TEMP,PRESS,FLUOR,MTRK,LAT,LON]...
  =textread(array(i).name,'%*d %f %*2u:%*2u:%*f %f %f %f %f %f %*f %*f %f %f %*f %*f %*f %*f');
%
[YR(i),jd(i),HH(i),MM(i),SS(i),COND(i),TEMP(i),PRESS(i),FLUOR(i),MTRK(i),V(i),MA(i),LAT(i),LON(i),KM(i),SOG(i),TDIFF(i),RECTDIFF(i)]...
%   =textread(array(i).name,'%d %f %2u:%2u:%f %f %f %f %f %f %f %f %f %f %f %f %f');
str=int2str(i);
savefile= ['FB2004raw' str];
s= ['save ', savefile];
eval (s)
disp savefile
clear jd(i) COND(i) TEMP(i) PRESS(i) FLUOR(i) MTRK(i) LAT(i) LON(i)
end
```

11.1.15 loaddata

```
%
% This m-file loads FerryBox data from files in the current directory
% with the extension .PRC
%
% mch Oct 2004
%
% echo on
close all % close all open graphics windows
% addpath /scratch/weekly1/mch/matlab/bin/seawater
array = dir ('M*.PRC');      % create a structure array of files ending in .PRC

% display FB filenames
for count = 1: length(array)                    % increment count from 1 to arraysize
   disp (array(count).name);                    % display filename
```

```
end
R = input ('files will be appended in this order, OK? (y/n) : ','s');
if R ~= 'y'
   error('exit')                    % Quit if order of files is incorrect
end

YR = []; jd = []; start=[];   % initialise variables
stop=[]; howbig=[]; week=[]; name=[];
ident='RF0';                            % set the beginning of filenames to be saved to 'RF0'

% load FerryBox calibration data
array = dir ('M*.PRC');                 % create a structure array of files ending in .PRC
for count = 1: length(array)            % increment count from 1 to arraysize
   filename = (array(count).name);
   disp(filename) %display filename to screen
   % Read in first 2 fields of file only
   [YR,jd]=textread(filename,'%d %f %*2u:%*2u:%*f %*f %*f %*f %*f %*f %*f %*f %*f
%*f %*f %*f %*f %*f');
   if count ==1    %         for the first file do the following
      save ([ident int2str(YR(1))],'name','week','start','stop','howbig') % create a file to append
to
   end
   wkstart = 0;     wk = 1;  % initialise week number
   for wkindex=1:7:366     % create a vector of week start indexes
      dp = find  ((jd >= wkstart) & (jd < wkindex));   % locate records lying within week
      mindp=min(dp);                    % set mindp to the first record of the week
      maxdp=max(dp);                    % set maxdp to the last record of the week
      start=[start;mindp];    % append weekly first records
      stop=[stop;maxdp];    % append weekly last records
      if dp ~= []                % if there are some records then;
         sizedp=size(dp,1);  % set sizedp to the number of records
         howbig=[howbig;sizedp];    % create vector of weekly number of records
         week=[week;wk];              % create vector of week numbers
         name=[name;filename];
      end
      wk = wk + 1;                       % increment week number
      wkstart = wkindex;    % ensure that next loop has wkindex = wkstart + 1
   end
%     a=(array(count).name);           % set a to the current filename
   save ([ident int2str(YR(1))],'name','week','start','stop','howbig','-append')
   % append variables to filename RF04
end
clear *1 r i           % tidy workspace
```

11.1.16 loadwk

```
%
% Reads through weekly files
%
% mch Oct 2004
clc
sotonlat = 50.895;  % and number of data bins.
coweslat = 50.761;  % these were determined by where the
bins = 60;          % ferry slowed to around 5 Kts
binsize = ((sotonlat-coweslat)/bins);

addpath /scratch/weekly1/mch/matlab/bin/seawater
array = dir ('RF*.mat');
dir
% enter name of list file
R = input ('Enter name of list file : ','s');

if exist(R)~=2
   error(' Sorry, file does not exist')
end
 % Read in first field of file only( there should only be one!
[RFfile]=textread(R,'%10c');

for i = length(RFfile)
   in = (RFfile(i,:));
   loadit = ['load ',in ];
   eval (loadit);


% calculate salinity
CONDD=COND/sw_c3515;            % conductivity ratio
j=1: length (CONDD);
    SAL(j)=sw_salt(CONDD(j),TEMP(j),PRESS(j));
SAL = SAL';% Salinity matrix needs to be transposed prior to being
% included in the newvars matrix later so

% average binned data
```

```
bin=1;                                    % initialise bin number
for binlat = coweslat:binsize:sotonlat-binsize   % go through the bins 1 by 1
   k = find  ((LAT > binlat) & (LAT < (binlat + binsize)));    % set k to the datacycles where
                                    % the Latitude falls within the current bin.
   % AVERAGE ALL the RELEVANT DATA and get the standard deviation
   jdm(bin)= mean(jd(k));
   latm(bin)= mean(LAT(k));       lonm(bin)= mean(LON(k));
   salm(bin)= mean(SAL(k));       tempm(bin)= mean(TEMP(k));
   fluom(bin)= mean(FLUOR(k));     turbm(bin)= mean(MTRK(k));
   latsd(bin)= std(LAT(k));       lonsd(bin)= std(LON(k));
   tempsd(bin)= std(TEMP(k));      fluosd(bin)= std(FLUOR(k));
   turbsd(bin)= std(MTRK(k));
   bin=bin+1;                  % increment bin number
end

m = ['save ',in(1:6) 'av',' *m',' *sd'];
eval(m)
end
```

11.1.17minify

```
%
% Reads through weekly files
%
% mch Oct 2004
clc
addpath /scratch/weekly1/mch/matlab/bin/seawater
dir
% enter name of list file
R = input ('Enter name of list file : ','s');

if exist(R)~=2
   error(' Sorry, file does not exist')
end
% Read in first field of file only( there should only be one!
[RFfile]=textread(R,'%10c');

for i = 1:length(RFfile)
   in = (RFfile(i,:));
   disp(in)
   loadit = ['load ',in ];
   eval (loadit);
   out = [(RFfile(i,1:6)) 'min'];

   YR60= decimate(YR,60,'fir');
   jd60= decimate(jd,60,'fir');
   COND60= decimate(COND,60,'fir');
   TEMP60= decimate(TEMP,60,'fir');
   PRESS60= decimate(PRESS,60,'fir');
   FLUOR60= decimate(FLUOR,60,'fir');
   MTRK60= decimate(MTRK,60,'fir');
   LAT60= decimate(LAT,60,'fir');
   LON60= decimate(LON,60,'fir');
   SAL60= decimate(SAL,60,'fir');

   m = ['save ',out,' SAL60',' YR60',' jd60',' COND60',' TEMP60',' PRESS60',' FLUOR60','
MTRK60',' LAT60',' LON60'];
   eval(m)
end
```

11.1.18minappend

```
%
% Appends weekly 60 second files
%
% mch Nov 2004
clc
addpath /scratch/weekly1/mch/matlab/bin/seawater
dir
% enter name of list file
R = input ('Enter name of list file : ','s');

if exist(R)~=2
   error(' Sorry, file does not exist')
end
% Read in first field of file only( there should only be one!
[RFfile]=textread(R,'%13c');
   yr=[];jd=[];cond=[];temp=[];press=[];fluor=[];mtrk=[];lat=[];lon=[];sal=[];
for i = 1:length(RFfile)
   in = (RFfile(i,:));
   disp(in)
   loadit = ['load ',in ];
   eval (loadit);
   out = [(RFfile(i,1:4)) 'min'];
```

```
    yr=[yr;YR60];           jd=[jd;jd60];
    cond=[cond;COND60];     temp=[temp;TEMP60];
    press=[press;PRESS60];  fluor=[fluor;FLUOR60];
    mtrk=[mtrk;MTRK60];     lat=[lat;LAT60];
    lon=[lon;LON60];        sal=[sal;SAL60];

    m = ['save ',out,' sal',' yr',' jd',' cond',' temp',' press',' fluor',' mtrk',' lat',' lon'];
    eval(m)
end
```

11.1.19minfluor

```
% checks the ferries direction of travel.
% If it changes the variable 'leg' is incremented.
% input file  - RF04min.mat
% output file - RF04leg.mat
% mch Nov 2004
%
format long
clear latd
leg = 1;
count = 0;
dir(1)=NaN;             % pad vectors creeated with diff function
latd(1)=NaN;
olddir = NaN;
len = length(jd);
latd = [latd;diff(lat)];     % initialise counters

for i = 2:len;
    if (latd(i) > -0.00005) & (latd(i) < 0.00005)
        latd(i) = NaN;  % set to absent data where the ferry has not moved much
    end
end

close all
plot(diff(lat),'g.')
axis ([0 1200 -0.004 0.004])
hold on
plot(latd,'r.')

for i = 2:len;
    if (latd(i) > 0.00005)

        dir(i) = 55;  % Going North
        if (olddir - dir(i)) ~= 0
            count = count + 1;
        end
    elseif (latd(i) < -0.00005)

        dir(i) = 45; % Going South
        if (olddir - dir(i)) ~= 0
            count = count + 1;
        end
    else
        dir(i) = 0; % Stationary
    end
    olddir = dir(i);
    leg=[leg;count];
end
dir=dir';
clear count i len olddir
```

11.1.20minfluor1

```
% mch 26 Nov 2004
% Take averaged data and find the minimum for each leg
% then subtract the minimum fluorescence from the current value
% input file  - RF04leg.mat
% output file - RF04res.mat

if exist('jd')~=1
    % load RF04leg
end
len = length(jd);
minl = min(leg);
maxl = max(leg);
for i = 1:maxl
    j=find(leg==i);
    jmin=min(j);
    jmax=max(j);
    fluoravg(i) = mean(fluor(j));
    fluormin(i) = min(fluor(j));
    fluormax(i) = max(fluor(j));
```

```
    for k=jmin:jmax
        fluorres(k)=fluor(k)-fluormin(i);
    end
disp(i)
end
fluorres=fluorres'
save RF04res




%
%
%
%
% % mch Nov 2004
% %
% format long
% clear latd
% leg = 1;
% count = 0;
% dir(1)=NaN;             % pad vectors creeated with diff function
% latd(1)=NaN;
% olddir = NaN;
%
% latd = [latd;diff(lat)];     % initialise counters
%
% for i = 2:len;
%     if (latd(i) > -0.00005) & (latd(i) < 0.00005)
%         latd(i) = NaN;  % set to absent data where the ferry has not moved much
%     end
% end
%
% close all
% plot(diff(lat),'g.')
% axis ([0 1200 -0.004 0.004])
% hold on
% plot(latd,'r.')
%
% for i = 2:len;
%     if (latd(i) > 0.00005)
%
%         dir(i) = 55;  % Going North
%         if (olddir - dir(i)) ~= 0
%             count = count + 1;
%         end
%     elseif (latd(i) < -0.00005)
%
%         dir(i) = 45; % Going South
%         if (olddir - dir(i)) ~= 0
%             count = count + 1;
%         end
%     else
%         dir(i) = 0; % Stationary
%     end
%     olddir = dir(i);
%     leg=[leg;count];
% end
% dir=dir';
% clear count i len olddir
```

11.1.21plot_all

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
%
% determine the linear regression of the variables SAL and FLUOR
% mch Aug 2004
% remove any NaN's from data
calsal2 = calsal(~isnan(calsal));
% remove corresponding indeces from salm
salm2 = salm(~isnan(calsal));
salm2= salm2';
close all
clear newx newy;
% plot calibrated against uncalibrated salinity.
[p,s]= polyfit(salm2,calsal2,1); % fit a polynomial of order 1 ie linear
% create a cartesian mirrored data set ie. reverse sign of all coordinates
negsalm2= -salm2;
negcalsal2= -calsal2;
% concatenate original data onto mirrored data
newx= [negsalm2;salm2];
newy= [negcalsal2;calsal2];
% fit a polynomial of order 1 ie linear to the weighted data so that intercept = 0
```

```
[newp,news]= polyfit(newx,newy,1);
salslope= newp(1);
% evaluate model at regularly spaced points
first = 26;
last = 33;
interval = (last-first)/((size(salm2,1))-1);
modelx = (first:interval:last)';
% multiply model values by regression slope
calvalue=newp(1)*modelx;
clf reset
figure (1)
set(gcf,'Position',[600 300 400 500]);
h = subplot(3,1,1);
plot(modelx,calvalue,'-',newx,newy,'o')
grid off
% annotate graph
xlabel('10 second mean FerryBox Salinity')
ylabel('Bottle Salinity')
title ('Isle of Wight Red Falcon Salinity Fluorescence and Turbidity 2004')
str1 = num2str(min(caljd));
str2 = num2str(max(caljd));
str3 = num2str(salslope);
str4 = num2str(calevent(1));
str5 = num2str(max(calevent));
out1= ['Calibration Data from ' str4 ' to ' str5];
out2= ['Regression slope = ' str3];
text(29.1,34.5,out1);
text(29.1,34,out2);
axis ([29 34 31 35])
%---------------------------------------------------------------------------
% determine the linear regression of FLUOR
% mch Aug 2004
% remove any NaN's from data
calchl2 = calchl(~isnan(calchl));
% remove corresponding indeces from fluom
fluom2 = fluom(~isnan(calchl));
fluom2= fluom2';
clear newx newy;
% plot calibrated against uncalibrated chlinity.
[p,s]= polyfit(fluom2,calchl2,1); % fit a polynomial of order 1 ie linear
% create a cartesian mirrored data set ie. reverse sign of all coordinates
negfluom2= -fluom2;
negcalchl2= -calchl2;
% concatenate original data onto mirrored data
newx= [negfluom2;fluom2];
newy= [negcalchl2;calchl2];
% fit a polynomial of order 1 ie linear to the weighted data so that intercept = 0
[newp,news]= polyfit(newx,newy,1);
chlslope= newp(1);
% evaluate model at regularly spaced points
first = 0;
last = 100;
interval = (last-first)/((size(fluom2,1))-1);
modelx = (first:interval:last)';
% multiply model values by regression slope
calvalue=newp(1)*modelx;
% overlay the original data in a plot
subplot(3,1,2)
plot(modelx,calvalue,'-',newx,newy,'o')
grid off
% annotate graph
xlabel('10 second mean FerryBox Chlorophyll Fluorescence')
yunit= (texlabel ('mu'));
yunit1= (texlabel ('l^(-1)','literal'));
ylabel(['Chlorophyll a (' yunit 'g ' yunit1 ')'])
str1 = num2str(min(caljd));
str2 = num2str(max(caljd));
str3 = num2str(chlslope);
str4 = num2str(calevent(1));
str5 = num2str(max(calevent));
out1= ['Calibration Data from ' str4 ' to ' str5];
out2= ['Regression slope = ' str3];
text(0.7,27,out1);
text(0.7,23,out2);
axis ([0 100 0 30]);
% axis ([0 35 0 8]);

%---------------------------------------------------------------------------
% determine the linear regression of the variables SPM
% mch Aug 2004

% remove any NaN's from data
```

```
calss2 = calss(~isnan(calss));

% remove corresponding indeces from turbm
turbm2 = turbm(~isnan(calss));
turbm2= turbm2';

clear newx newy;

% plot calibrated against uncalibrated salinity.
[p,s]= polyfit(turbm2,calss2,1); % fit a polynomial of order 1 ie linear

% create a cartesian mirrored data set ie. reverse sign of all coordinates
negturbm2= -turbm2;
negcalss2= -calss2;

% concatenate original data onto mirrored data
newx= [negturbm2;turbm2];
newy= [negcalss2;calss2];

% fit a polynomial of order 1 ie linear to the weighted data so that intercept = 0
[newp,news]= polyfit(newx,newy,1);
spmslope= newp(1);

% evaluate model at regularly spaced points
first = 0;
last = 0.1;
interval = (last-first)/((size(turbm2,1))-1);
modelx = (first:interval:last)';

% multiply model values by regression slope
calvalue=newp(1)*modelx;

% overlay the original data in a plot
% plot(modelx,calvalue,'-',turbm2,calss2,'o'); grid on
subplot(3,1,3)
h3 = plot(modelx,calvalue,'-',newx,newy,'o');
grid off

% annotate graph
xlabel('10 second mean FerryBox Turbidity (Volts)')
yunit1= (texlabel ('(mg l^(-1))','literal'));
ylabel(['SPM ' yunit1])
str1 = num2str(min(caljd));
str2 = num2str(max(caljd));
str3 = num2str(spmslope);
str4 = num2str(calevent(1));
str5 = num2str(max(calevent));
out1= ['Calibration Data from ' str4 ' to ' str5];
out2= ['Regression slope = ' str3];
text(0.002,90,out1);
text(0.002,80,out2);
axis ([0 0.1 0 100]);
%--------------------------------------------------------------------------
% create output file
out3= ['allreg_' str4 '_' str5];
fid = fopen(out3,'w');      % open file to be written to
crossmn=[calevent(1) salslope chlslope spmslope];
fprintf(fid,'%10.5f %10.5f %10.5f %10.5f \n',crossmn);
fclose( fid);   % close file

% save image
out4= ['allps_reg_' str4 '_' str5];
orient landscape;
print( gcf, '-depsc2', out4 );
out5= ['allreg_' str4 '_' str5 '.fig'];
saveas(gcf, out5, 'fig');
%--------------------------------------------------------------------------
```

11.1.22plotit

```
% plotit.m
% plot the average and standard deviation of the binned variables
% mch Aug 2004
clc
dir
R = input ('Enter name of list file : ','s');

if exist(R)~=2
   error(' Sorry, file does not exist')
end
% Read in first field of file only( there should only be one!
[RFfile]=textread(R,'%12c');
```

```
for i = 1:length(RFfile)
    in = (RFfile(i,:));
    disp(in)
    wk = (RFfile(i,5:6));
%   disp(wk)
    loadit = ['load ',in ];
    eval (loadit);
    %--------------------------------------------------------------------------
    clf reset
    figure (1)
    set(gcf,'Position',[600 300 400 500]);
    h = subplot(5,1,1);
    plot(latm,salm,'r+',latm,salm+salsd,'r.',latm,salm-salsd,'r.')
    grid off
    % annotate graph
    % xlabel('Mean Weekly FerryBox Salinity')
    ylabel('Salinity')
    title ('Red Falcon Mean weekly FerryBox Data 2004')
    str4 = num2str(wk);
    out1= ['Data from week ' str4];
    % text(50.765,34,out1);
    axis ([50.761 50.895 25 35])
    %--------------------------------------------------------------------------
    % overlay the original data in a plot
    subplot(5,1,2)
    plot(latm,fluom,'g+',latm,fluom+fluosd,'g.',latm,fluom-fluosd,'g.')
    grid off
    % annotate graph
    % xlabel('Chlorophyll Fluorescence')
    yunit= (texlabel ('mu'));
    yunit1= (texlabel ('l^(-1)','literal'));
    ylabel(['Fluorescence'])
    axis ([50.761 50.895 0 120]);
    %--------------------------------------------------------------------------
    subplot(5,1,3)
    h3 = plot(latm,turbm,'k+',latm,turbm,'k.',latm,turbm,'k.');
    grid off
    % annotate graph
    % xlabel('Turbidity(OBS) (Volts)')
    yunit1= (texlabel ('(mg l^(-1))','literal'));
    ylabel(['OBS'])
    % axis ([50.761 50.895 0.02 0.06]);  % range for weeks < 35
    axis ([50.761 50.895 0.5 2.5]);       % range for weeks > 34
    %--------------------------------------------------------------------------
    subplot(5,1,4)
    plot(latm,lonsd,'k+') %,latm,lonm+lonsd,'r+',latm,lonm-lonsd,'r+')
    grid off
    % xlabel('Longitude variation')
    ylabel('Lon var 1sd')
    axis ([50.761 50.895 0 0.01])
    % overlay the original data in a plot
    %--------------------------------------------------------------------------
    subplot(5,1,5)
    plot(latm,tempm,'r+',latm,tempm+tempsd,'r.',latm,tempm-tempsd,'r.')
    grid off
    % annotate graph
    weeknum = ['Data from week ' wk]
    xlabel( weeknum )
    yunit= (texlabel ('degc','literal'));
    yunit1= (texlabel ('l^(-1)','literal'));
    ylabel(['Temp ' yunit])
    axis ([50.761 50.895 12 22]);
%     axis ([50.761 50.895 0.5 3]);
    %--------------------------------------------------------------------------
    input('')
    out4= ['RF04' wk 'tsf'];
    orient tall
    print( gcf, '-dpsc2', out4 );
    % saveas(gcf, out4, 'fig');
end
% %--------------------------------------------------------------------------
```

11.1.23readXL

```
%
%
fluorxl = xlsread('Fluorchk.xls','Fluorvals' ,'a5:n16');
% fluorxl = xlsread('R:\RedFalcon\Calibration data\Fluorimeter Check.xls','Fluorvals' ,'a5:n16');
```

11.1.24sal_calc

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
% "sal_calc.m"
% calculate the salinity from the red funnel ferry data
%
% required input were the variables COND, TEMP, PRESS
%
% mch Aug 2004
%
addpath /scratch/weekly1/mch/matlab/bin/seawater
% calculate salinity
CONDD=COND/sw_c3515;        % conductivity ratio
j=1: length (CONDD);
    SAL(j)=sw_salt(CONDD(j),TEMP(j),PRESS(j));
% Salinity matrix needs to be transposed prior to being
% included in the newvars matrix later so
SAL = SAL';
```

11.1.25splitter

```
%
% This m-file splits FerryBox data from files in the current directory
% with the extension .PRC into weekly(or otherwise) files as determined
% by the control file created by loaddata.m
%
% mch Oct 2004
%
% echo on
close all % close all open graphics windows
array = dir ('M*.PRC');     % create a structure array of files ending in .PRC

% display FB filenames
for count = 1: length(array)              % increment count from 1 to arraysize
   disp (array(count).name);              % display filename
end
R = input ('files will be processed in this order, OK? (y/n) : ','s');
if R ~= 'y'
   error('exit')                 % Quit if order of files is incorrect
end

ident='RF0';                              % set the beginning of filenames to be saved to 'RF0'
%
load RF04              % Load control file
%
diff=diff(week);          % returns zero if 1 week split between 2 successive files
array = dir ('M*.PRC');              % create a structure array of files ending in .PRC

for count = 1: length(array)          % loop to step through ascii files
   filename=(array(count).name);
   disp (filename);              %display filename to screen
   % Read in all the data fom the ascii data file

[YR1,jd1,HH1,MM1,SS1,COND1,TEMP1,PRESS1,FLUOR1,MTRK1,LAT1,LON1]=textre
ad(filename,'%d %f %2u:%2u:%f %f %f %f %f %f %*f %*f %f %f %*f %*f %*f %*f');

   for i = 1:length(name)                   % increment i from 1 to end of control file
      if strncmp(filename,name(i,:),8)==1     % if the first 8 charaters of the ascii filename
         % match the name in the control file
         range = (start(i):stop(i));        % extract relevant datacycles
         if diff(i)==0  % test for weeks that are split between current and successive files
            % save variables so that data from thenext file can be
            % added
            YRa=YR1(range);       jda=jd1(range);       HHa=HH1(range);
            MMa=MM1(range);       SSa=SS1(range);       CONDa=COND1(range);
            TEMPa=TEMP1(range);                                     PRESSa=PRESS1(range);
FLUORa=FLUOR1(range);
            MTRKa=MTRK1(range);    LATa=LAT1(range);     LONa=LON1(range);
         else
            if exist('YRa') == 1 % !!!
               % for each of the variables concatenate current files
               % onto previous files data
               YR=    [YRa;YR1(range)];      jd=    [jda;jd1(range)];
               HH=    [HHa;HH1(range)];      MM=    [MMa;MM1(range)];
               SS=    [SSa;SS1(range)];      COND=   [CONDa;COND1(range)];
               TEMP=   [TEMPa;TEMP1(range)];   PRESS=  [PRESSa;PRESS1(range)];
               FLUOR=  [FLUORa;FLUOR1(range)]; MTRK=   [MTRKa;MTRK1(range)];
               LAT=    [LATa;LAT1(range)];     LON=    [LONa;LON1(range)];

               clear *a % remove variables stored as part week variables
            else
               % just create a weekly file
               YR=YR1(range);     jd=jd1(range);     HH=HH1(range);
```

```
            MM=MM1(range);      SS=SS1(range);      COND=COND1(range);
            TEMP=TEMP1(range);  PRESS=PRESS1(range);FLUOR=FLUOR1(range);
            MTRK=MTRK1(range);  LAT=LAT1(range);    LON=LON1(range);
          end
          % save weekly file in matlab format
          m = ['save ',ident num2str(YR1(1)) num2str(week(i)),' YR',' jd',' HH',' MM',' SS','
COND',' TEMP',' PRESS',' FLUOR',' MTRK',' LAT',' LON'];
          eval(m)
        end
      end
    end
end
    % 3456789012345678901234567890123456789 0
   % YR jd HH MM SS COND TEMP PRESS FLUOR MTRK LAT LON
```

11.1.26writeblockXL

```
%
%
status = xlswrite('CTGQA_data', event,'block','a1');
status = xlswrite('CTGQA_data', cleandarkair,'block','b1');
status = xlswrite('CTGQA_data', cleandarklow,'block','c1');
status = xlswrite('CTGQA_data', cleandarkhigh,'block','d1');
%
status = xlswrite('CTGQA_data', dirtydarkair,'block','f1');
status = xlswrite('CTGQA_data', dirtydarklow,'block','g1');
status = xlswrite('CTGQA_data', dirtydarkhigh,'block','h1');
```

11.1.27writeXL

```
%
%
salm1=salm';
status = xlswrite('CTGQA_data', calsal,'block','a1');
status = xlswrite('CTGQA_data', salm1,'block','b1');
%
fluom1=fluom';
status = xlswrite('CTGQA_data', calchl,'block','d1');
status = xlswrite('CTGQA_data', fluom1,'block','e1');
%
turbm1=turbm';
status = xlswrite('CTGQA_data', calss,'block','g1');
status = xlswrite('CTGQA_data', turbm1,'block','h1');
```

12.0 Appendix D

12.1 Calibration Sheets

For the EU FerryBox project John Elliott of CTG developed a set of forms on which the regularly collected calibration data are to be recorded. These forms are then to be returned to CTG so that John Elliott can establish an overview of the success of the calibration procedures applied in the project and identify any problem that might be arising.

The original form suggested by John was developed into the format seen here through discussions with Mark Hartman as to what it was practical to record give the practical constraints of FerryBox operation.

On the following (102) pages we reproduce the complete set of forms completed by Mark Hartman following each calibration trip on the Red Falcon in 2004. In all 17 calibration trips were done.

Trip Number	Date	XLS file
1	7/5/04	ctgqa1
2	10/6/04	ctgqa2
3	16/6/04	ctgqa3
4	23/6/04	ctgqa4
5	7/7/04	ctgqa5
6	14/7/04	ctgqa6
7	21/7/04	ctgqa7
8	28/7/04	ctgqa8
9	4/8/04	ctgqa9
10	11/8/04	ctgqa10
11	18/8/04	ctgqa11
12	25/8/04	ctgqa12
13	2/9/04	ctgqa13
14	16/9/04	ctgqa14
15	23/9/04	ctgqa15
16	30/9/04	ctgqa16
17	13/10/04	ctgqa17

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	7/5/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

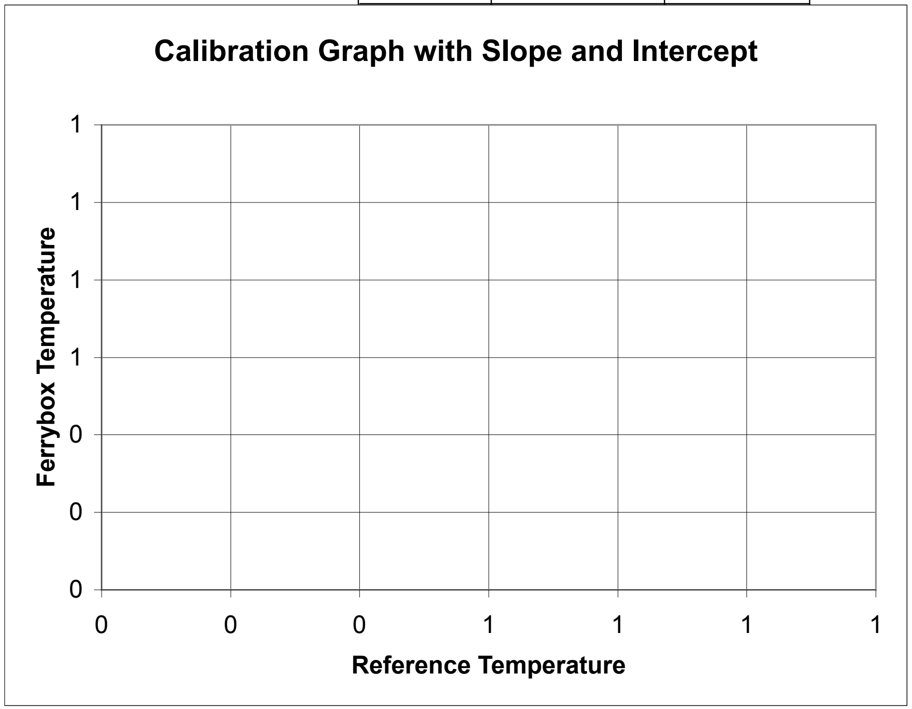
ctgqa01.xls 7May04

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	7/5/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



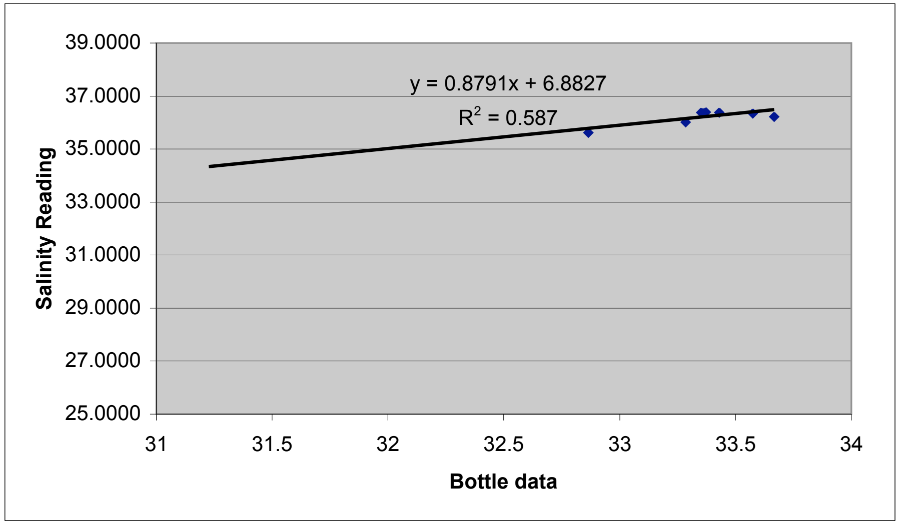
Route 6 NERC-SOC Southampton - Cowes Page 4
Salinity Calibration using bottle samples

Date form completed	7/5/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration

	Bottle Readings	Salinometer Readings	
1	31.30174892		
2	31.22661622		
3	31.93399052		
4	32.86445846	35.6200	these are spot not averaged valu
5	33.28537721	36.0090	
6	33.35226169	36.3800	
7	33.3590878	36.36	
8	33.37196046	36.4	
9	33.42950667	36.38	
10	33.57392678	36.34	
11	33.66726521	36.212	
12	33.30545989		
	32.86698815	35.68	



ctgqa01.xls 7May04

Route 6 NERC-SOC Southampton - Cowes Page 5
Salinity Calibration with cleaning

Date form completed	7/5/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes Page 6

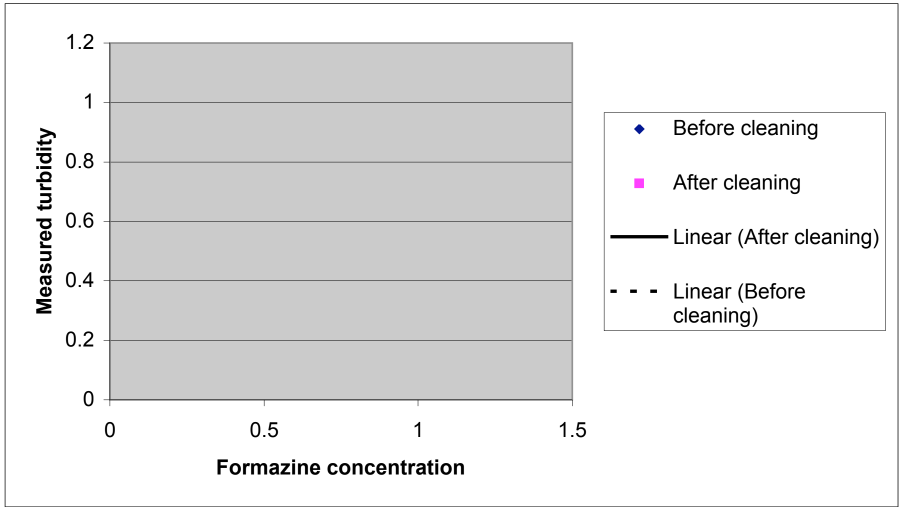
Turbidity Calibration by Formazine

Date form completed	7/5/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch

Description of calibration Standard	
Description of calibration Blank	

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning	**Before cleaning**	After cleaning
This is dummy data Please insert your own	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes Page 7

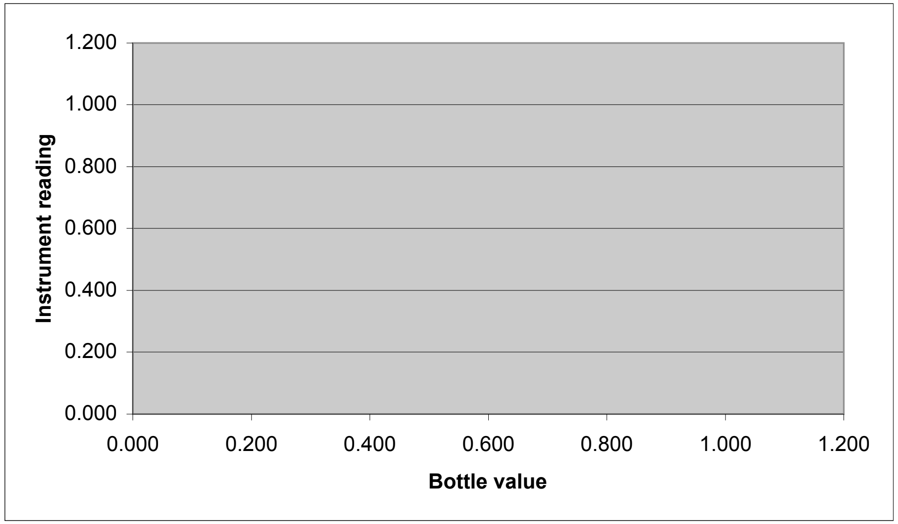
Turbidity Calibration using bottle samples

Date form completed	7/5/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user		
Checked today by (Name)	mch	

Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	7/5/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Date last calibrated by user	
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0	0
Slope mV/ unit			

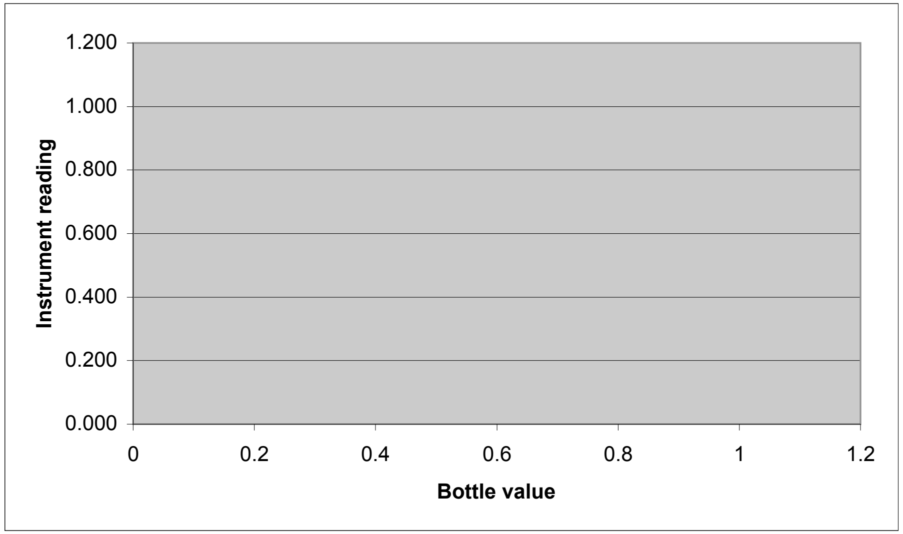
ctgqa01.xls 7May04

Route 6 NERC-SOC Southampton - Cowes

Fluorimeter Calibration using bottle samples

Date form completed	7/5/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	7/5/04

Temperature Sensor	
Type	Minipack
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	
Standard used for calibration check	

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	
Standard used for calibration check	

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	30/6/04
Date calibration last checked	

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	
Calibration life remaining	
Date calibration last checked	
Standard used for calibration check	
Date windows last cleaned	

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	10/6/04
Name of Member Organisation	National Environment Research Council
	Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre
	Waterfront Campus
	Empress Docks
	SO14 3ZH
	Southampton Oceanography Centre
	Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form Page 2

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Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
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The blank and standard readings should be taken at 10 second intervals to check drift and stability.
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Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
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Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

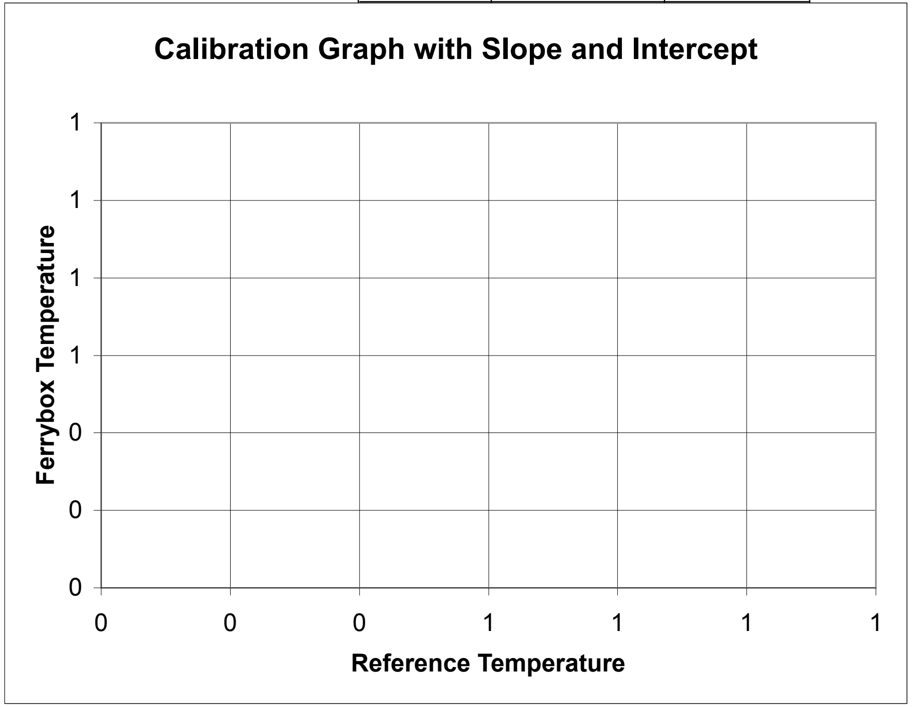
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

ctgqa02.xls 10June04

Route 6 NERC-SOC Southampton - Cowes Page 3
Temperature Calibration

Date form completed	10/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	
Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes

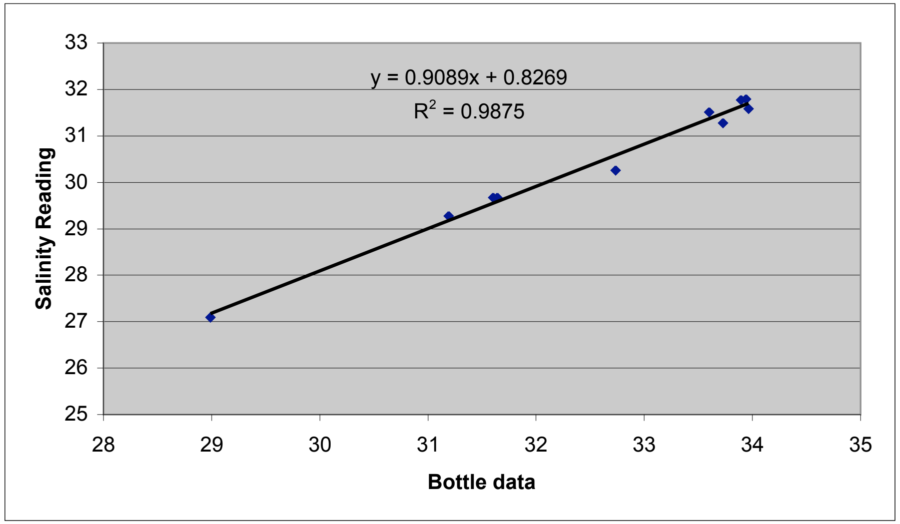
Salinity Calibration using bottle samples

Date form completed	10/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration

	Bottle Readings	Salinometer Readings
1	32.73626	30.25408321
2	33.60165	31.51574742
3	33.96512	31.58682138
4	33.89531	31.77173284
5	33.9395	31.79414301
6	33.72606	31.27298117
7	31.63969	29.67600369
8	31.60216	29.67016919
9	31.19321	29.27806016
10	28.98944	27.09478736
11		
12		



ctgqa02.xls 10June04

Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration with cleaning

Date form completed	10/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	Before cleaning	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	After cleaning	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning n/a

Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

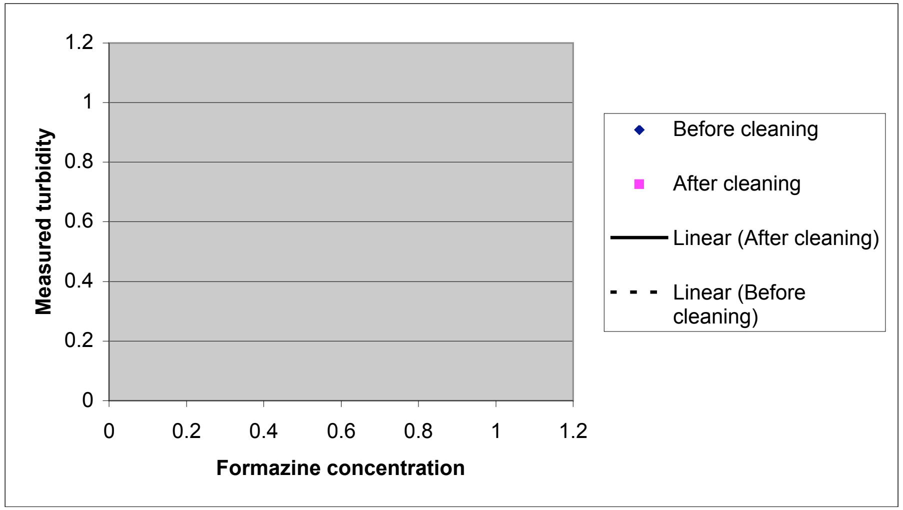
Turbidity Calibration by Formazine

Date form completed	10/6/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch

Description of calibration Standard	
Description of calibration Blank	

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning	**Before cleaning**	After cleaning
This is dummy data Please insert your own	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes

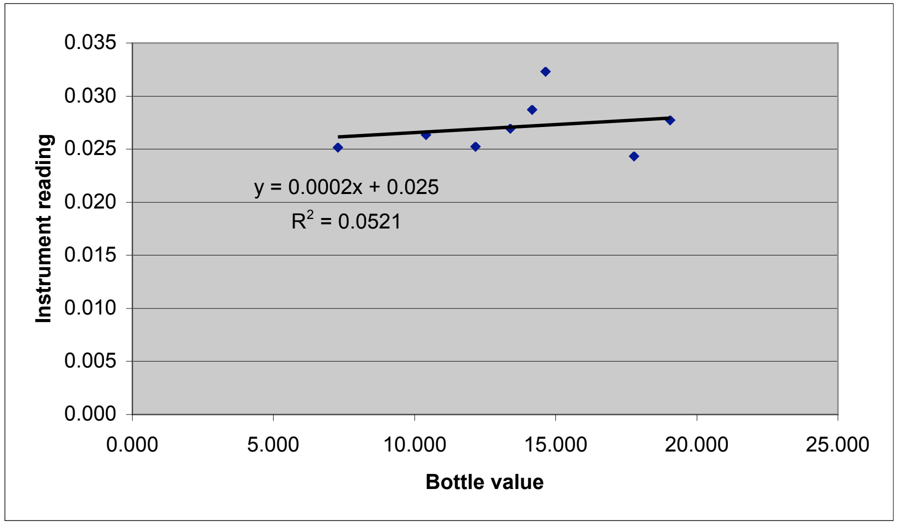
Turbidity Calibration using bottle samples

Date form completed	10/6/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user		
Checked today by (Name)	mch	

Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Bottle Readings	Minipack Readings
1	7.280	0.025
2	13.396	0.027
3	10.397	0.026
4	19.048	0.028
5	14.159	0.029
6	14.634	0.032
7	12.157	0.025
8	17.778	0.024
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	10/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Date last calibrated by user	
Frequency of user calibration check	
Checked today by (Name)	mch
Units of measurement	
Specification accuracy	
Concentration of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

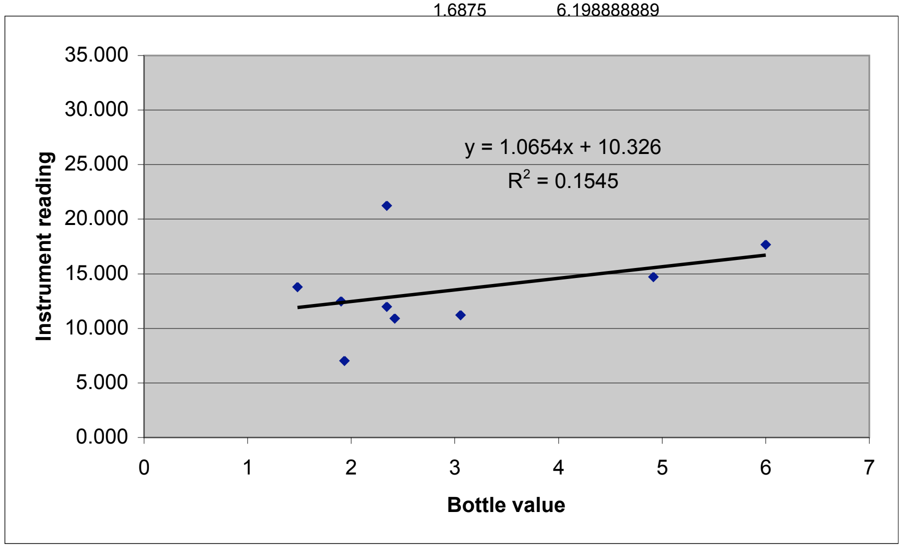
	Before cleaning	Before cleaning	Before cleaning
	Blank Readings	Low Standard Readings	High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning	After cleaning	After cleaning
	Blank Readings	Low Standard Readings	High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	10/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Bottle Readings	Minipack Readings
1	2.34167	21.232
2	1.9	12.473
3	1.47917	13.784
4	3.05417	11.206
5	2.42083	10.917
6	2.34167	12.006
7		31.678
8	6	17.679
9	4.91667	14.719
10	1.93333	7.029
	1.6875	6.198888889



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	10/6/04

Temperature Sensor	
Type	Minipack
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	
Standard used for calibration check	

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	
Standard used for calibration check	

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	30/6/04
Date calibration last checked	

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	
Calibration life remaining	
Date calibration last checked	
Standard used for calibration check	
Date windows last cleaned	

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa03.xls 16June04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	16/6/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form Page 2

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jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

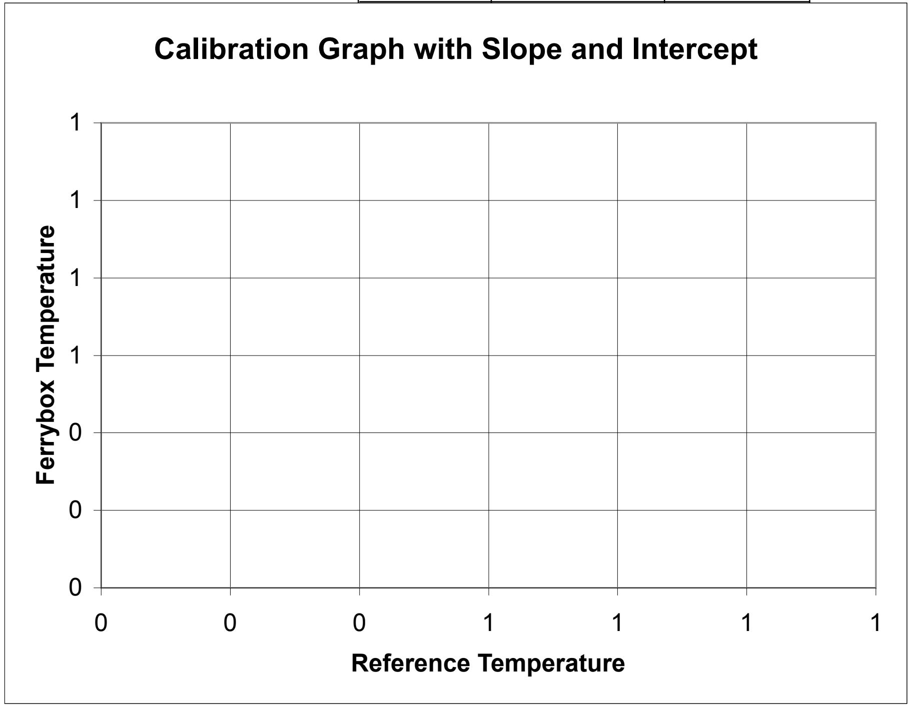
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes Page 3
Temperature Calibration

Date form completed	16/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			

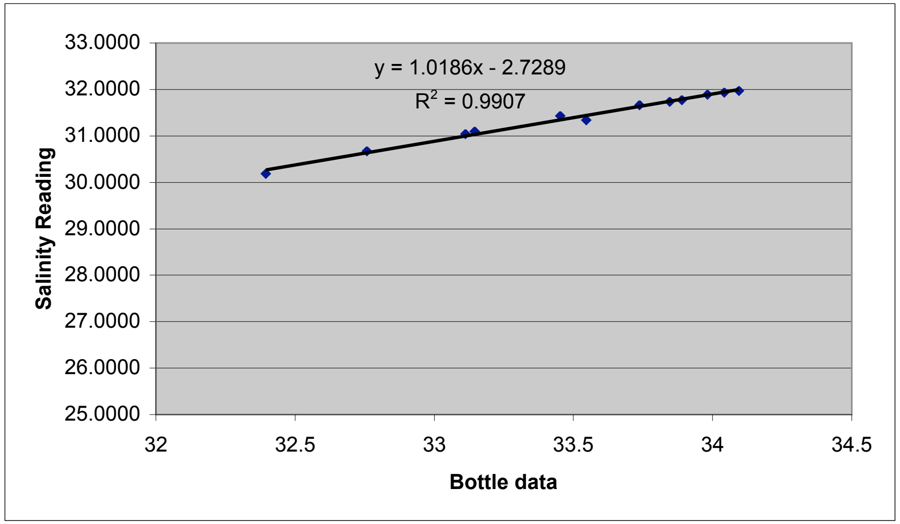


Route 6 NERC-SOC Southampton - Cowes Page 4
Salinity Calibration using bottle samples

Date form completed	16/6/04	
Manufacturer	CTG	
Model	Minipack	
Serial number		
Date last calibrated by manufacturer		
Calibration life remaining (months)		
Frequency of user calibration check	weekly	
Units of measurement	PSU	
Date last calibrated by user(if applicable)	10/6/04	
Checked today by	mch	
Calibrated against	Guildline Salinometer	
Type of standard	OSI 33 psu	

Slope mV/ unit from previous calibration 0.9089

	Bottle Readings	Salinometer Readings
1	32.39542	30.1897
2	32.75863	30.6702
3	33.14524	31.0955
4	33.45194	31.4262
5	33.84605	31.7351
6	33.89023	31.7750
7	34.09483	31.97567561
8	34.0418	31.93923838
9	33.98194	31.89512403
10	33.737	31.66405735
11	33.5466	31.33962562
12	33.11212	31.04146173



ctgqa03.xls 16June04

Route 6 NERC-SOC Southampton - Cowes Page 5
Salinity Calibration with cleaning

Date form completed	16/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	Before cleaning	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

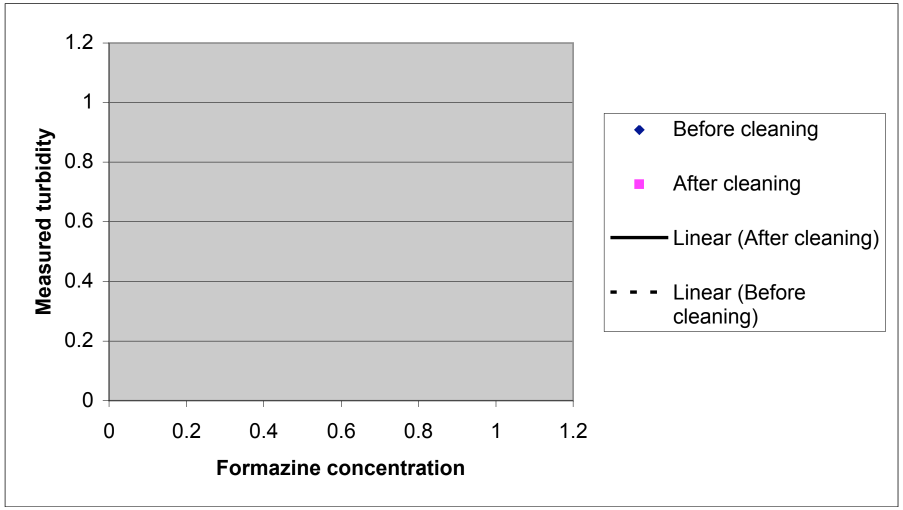
After cleaning	Blank Readings	After cleaning	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes Page 6
Turbidity Calibration by Formazine

Date form completed	16/6/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

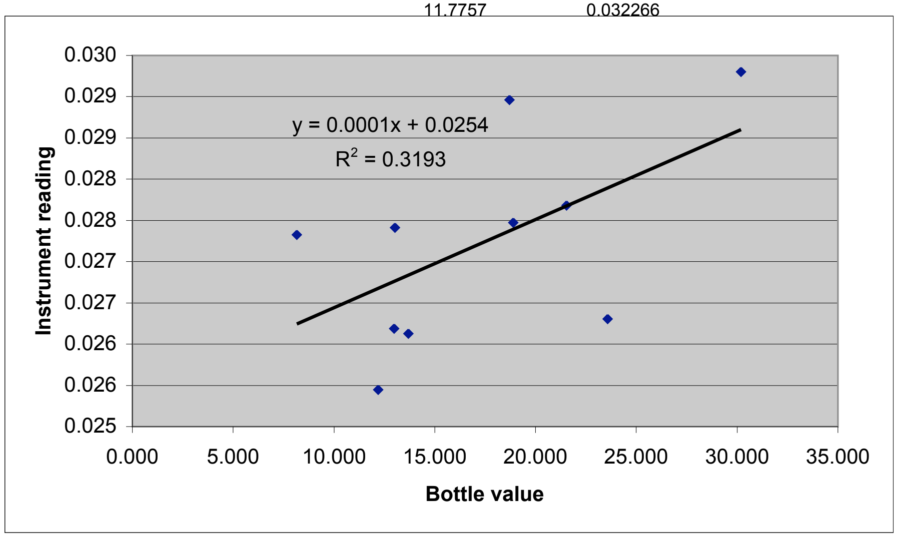
	Before cleaning	**Before cleaning**	After cleaning
This is dummy data Please insert your own	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes Page 7
Turbidity Calibration using bottle samples

Date form completed	16/6/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	10/6/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration		
Slope mV/ unit from previous calibration	0.0002	

	Bottle Readings	Minipack Readings
1	12.195	0.025
2	18.899	0.027
3	13.696	0.026
4	30.189	0.029
5	23.585	0.026
6	21.544	0.028
7	18.704	0.029
8	12.980	0.026
9	8.148	0.027
10	13.019	0.027
	11.7757	0.032266



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Page 8

Date form completed	16/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Date last calibrated by user	
Frequency of user calibration check	
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	
Concentration of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

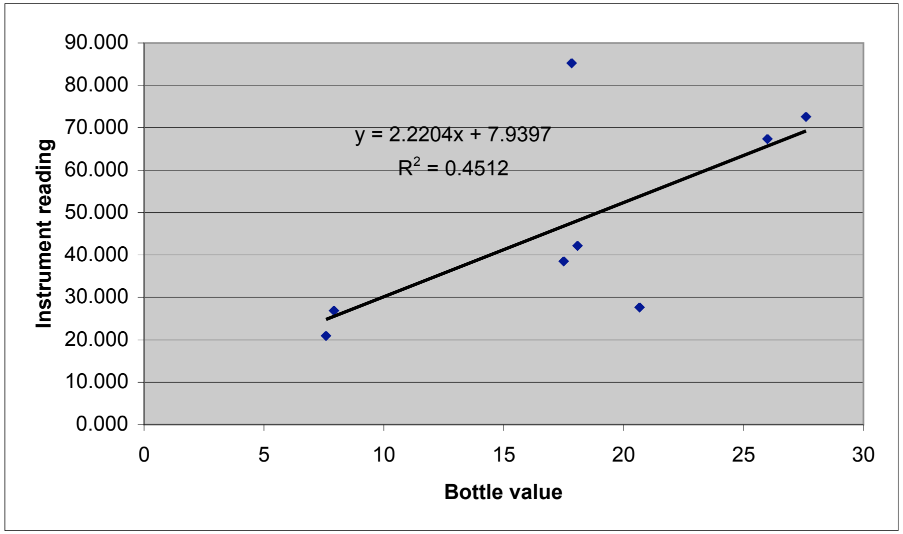
	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Page 9

Date form completed	16/6/04	
Manufacturer	CTG	
Model	Minipack	
Serial number		
Date last calibrated by manufacturer		
Calibration life remaining (months)		
Frequency of user calibration check	weekly	
Units of measurement	_g Chlorophyll-a /litre	
Date last calibrated by user	10/6/04	
Checked today by (Name)	mch	
Description of calibration Standard	Chl-a in acetone	
Description of calibration Blank		
Mean from previous calibration		
Std Dev from previous calibration	0.1545	R-squared
Slope mV/ unit from previous calibration	1.0654	

	Bottle Readings	Minipack Readings
1	7.91667	26.865
2	20.66667	27.625
3	18.08333	42.225
4	17.5	38.504
5	26	67.382
6	17.83333	85.232
7	27.60417	72.643
8	7.58333	20.974
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	16/6/04

Temperature Sensor	
Type	Minipack
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	10/6/04
Standard used for calibration check	salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	10/6/04
Standard used for calibration check	salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	10/6/04
Date calibration last checked	10/6/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	
Calibration life remaining	
Date calibration last checked	10/6/04
Standard used for calibration check	Chl-a in acetone
Date windows last cleaned	10/6/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa04.xls 23June04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	23/6/04
Name of Member Organisation	National Environment Research Council
	Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre
	Waterfront Campus
	Empress Docks
	SO14 3ZH
	Southampton Oceanography Centre
	Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

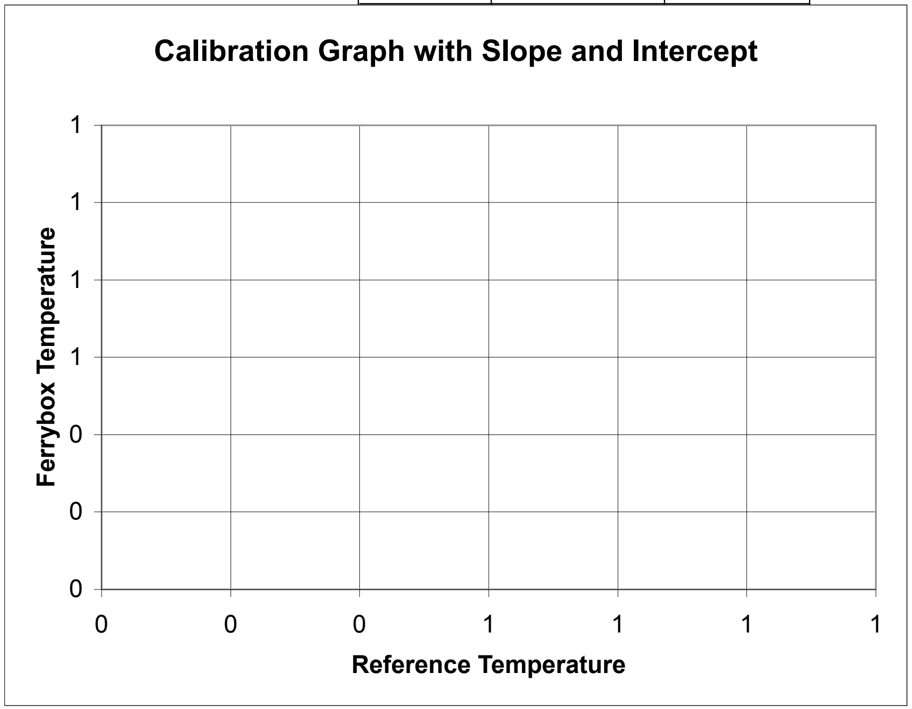
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	23/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes Page 4

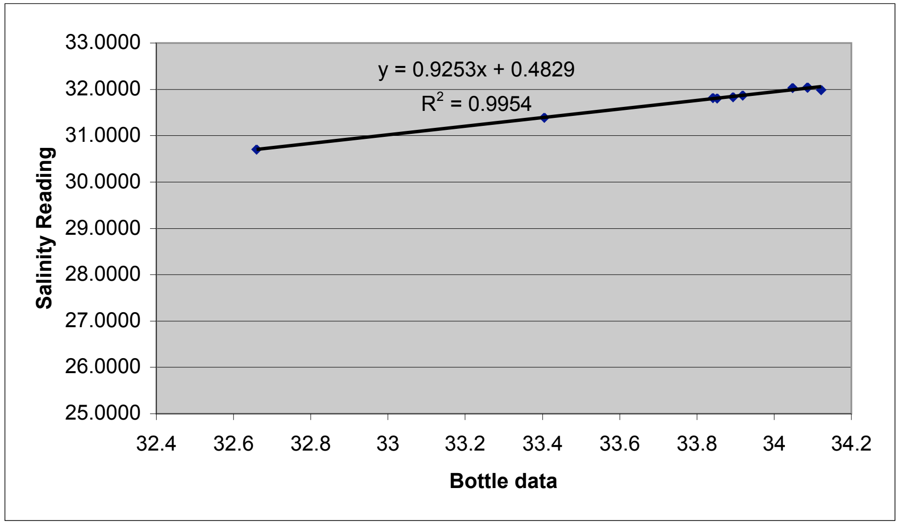
Salinity Calibration using bottle samples

Date form completed	23/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	16/6/04
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 1.0186

	Bottle Readings	Salinometer Readings
1	32.66004	30.7050
2	33.40512	31.3871
3	33.84116	31.8142
4	33.89375	31.8308
5	34.12164	31.9911
6	34.04747	32.0287
7	34.08602	32.04090879
8	34.08719	32.04373566
9	33.85211	31.80506456
10	33.91819	31.86642612
11		31.90148727
12		31.22015452
	32.93258	30.97917469



ctgqa04.xls 23June04

Route 6 NERC-SOC Southampton - Cowes Page 5

Salinity Calibration with cleaning

Date form completed	23/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	Before cleaning	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	After cleaning	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

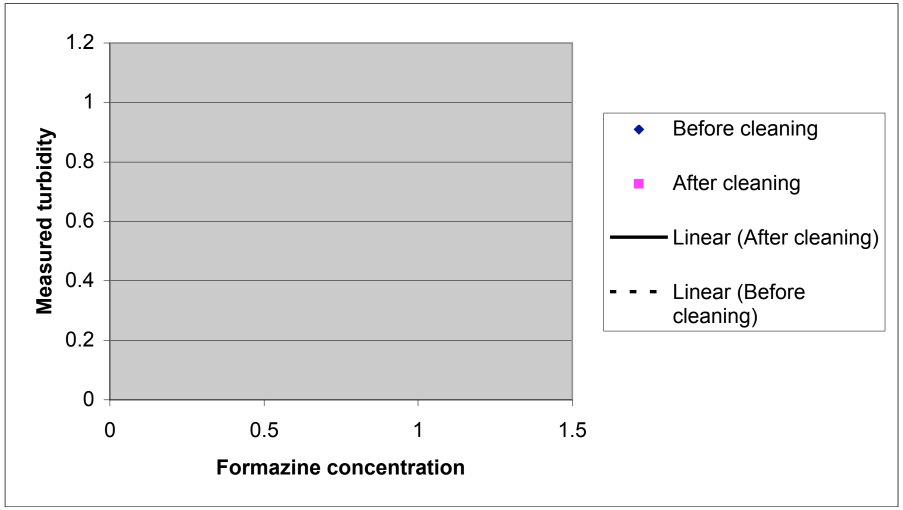
Turbidity Calibration by Formazine

Date form completed	23/6/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch

Description of calibration Standard	
Description of calibration Blank	

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning	**Before cleaning**	After cleaning
This is dummy data Please insert your own	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes

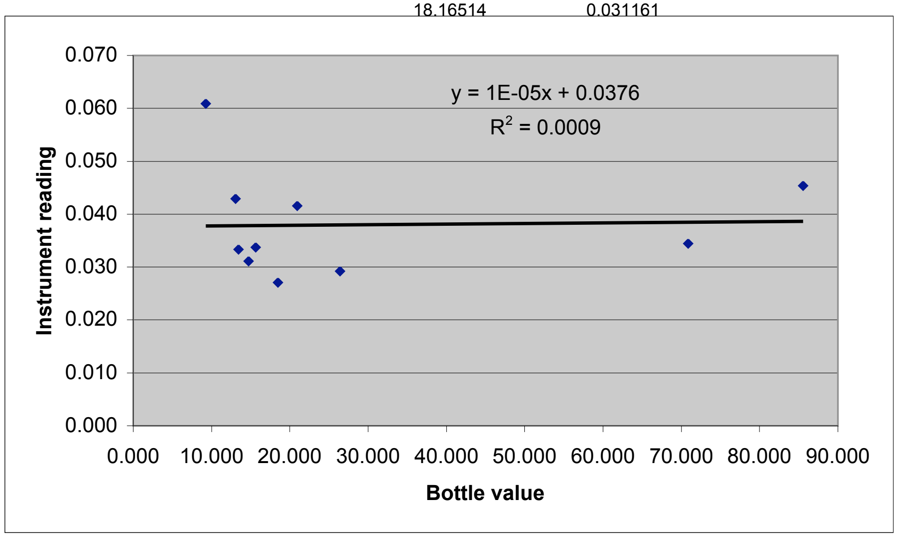
Turbidity Calibration using bottle samples

Date form completed	23/6/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user		
Checked today by (Name)	mch	

Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids

Mean from previous calibration		
Std Dev from previous calibration	0.3193	R-squared
Slope mV/ unit from previous calibration	0.0001	

	Bottle Readings	Minipack Readings
1	70.877	0.034
2	26.408	0.029
3	15.636	0.034
4	13.076	0.043
5	9.259	0.061
6	13.455	0.033
7	18.459	0.027
8	14.717	0.031
9	85.532	0.045
10	20.968	0.042
	18.16514	0.031161



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	23/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Date last calibrated by user	
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

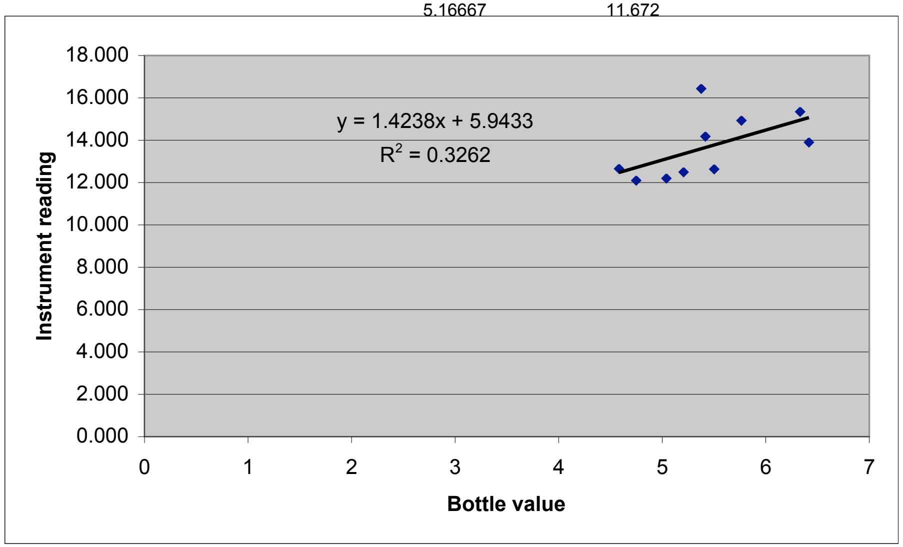
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	23/6/04
Manufacturer	CTG
Model	Minipack
Serial number	
Date last calibrated by manufacturer	
Calibration life remaining (months)	
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	16/6/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.4512 R-squared
Slope mV/ unit from previous calibration	2.2204

	Bottle Readings	Minipack Readings
1	5.76531	14.934
2	5.04167	12.206
3	5.5	12.642
4	5.41667	14.169
5	5.375	16.438
6	4.58333	12.650
7	4.75	12.104
8	6.41667	13.895
9	6.33333	15.342
10	5.20833	12.492
	5.16667	11.672



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	23/6/04

Temperature Sensor	
Type	Minipack
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	16/6/04
Standard used for calibration check	salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	
Date of last calibration	
Calibration life remaining	
Date calibration last checked	16/6/04
Standard used for calibration check	salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	16/6/04
Date calibration last checked	16/6/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	
Calibration life remaining	
Date calibration last checked	16/6/04
Standard used for calibration check	Chl-a in acetone
Date windows last cleaned	16/6/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM

Route 6 NERC-SOC Southampton - Cowes

DATE	7/7/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

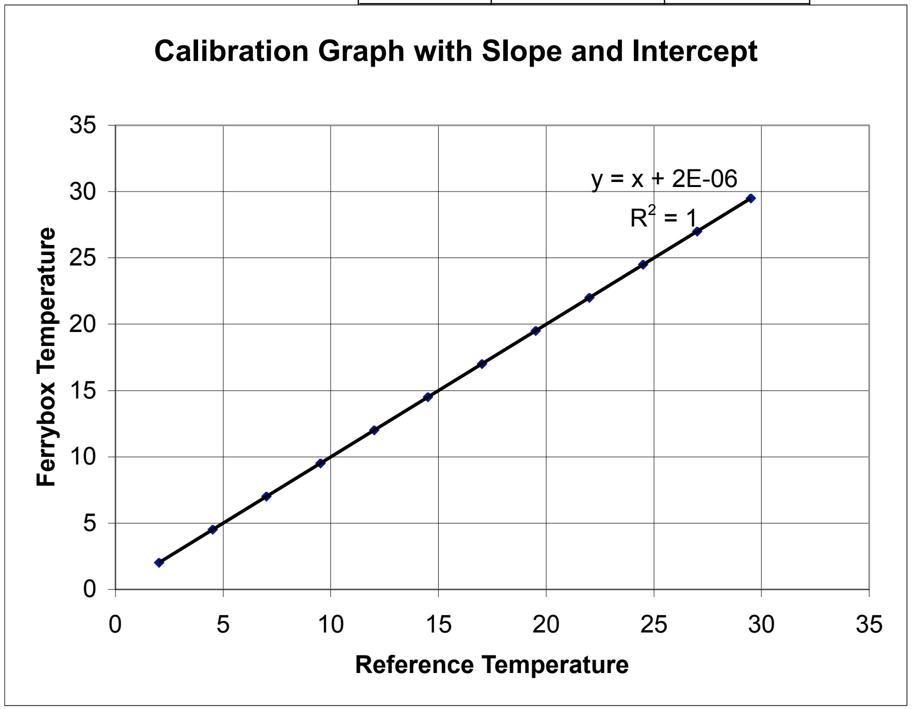
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	7/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

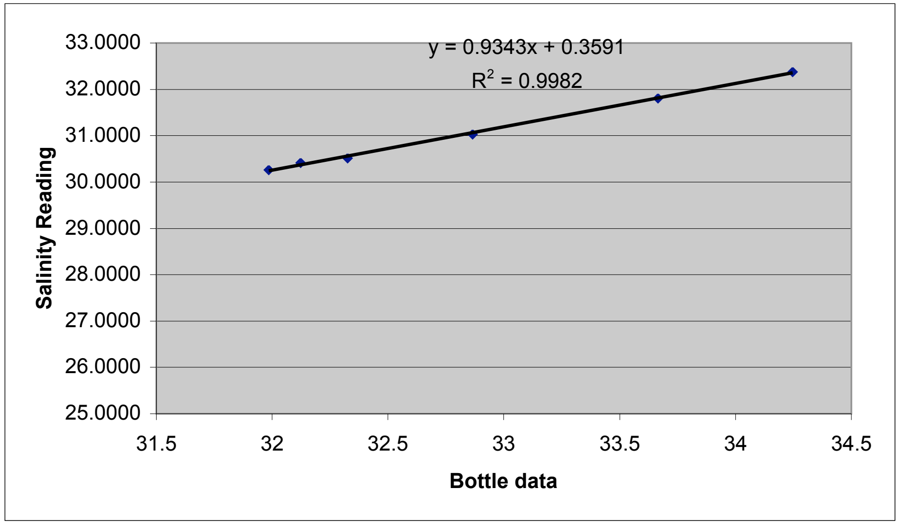
	Reference temperature	Ferrybox temperature	Difference
1	2.0214	2.0210	-0.0004
2	4.5203	4.5209	0.0006
3	7.0200	7.0201	0.0001
4	9.5180	9.5184	0.0004
5	12.0168	12.0163	-0.0005



Route 6 NERC-SOC Southampton - Cowes Page 4
Salinity Calibration using bottle samples

Date form completed	7/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu
Slope mV/ unit from previous calibration	

	Bottle Readings	Salinometer Readings
1	31.986	30.2630
2	32.865	31.0305
3	33.665	31.8077
4	34.246	32.3748
5	32.325	30.5109
6	32.123	30.4165
7		
8		
9		
10		
11		
12		



ctgqa05.xls 7July04

Route 6 NERC-SOC Southampton - Cowes Page 5
Salinity Calibration with cleaning

Date form completed	7/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

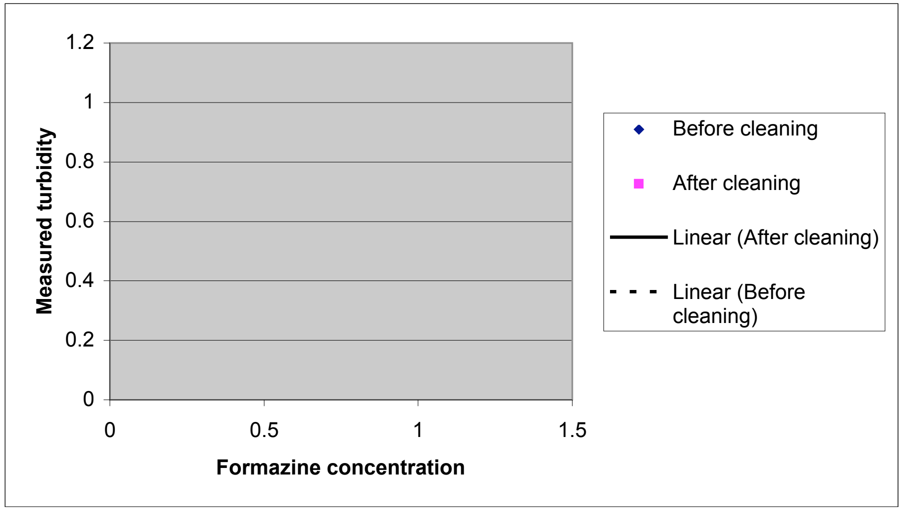
Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration by Formazine

Date form completed	7/7/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning	**Before cleaning**	After cleaning
This is dummy data Please insert your own	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



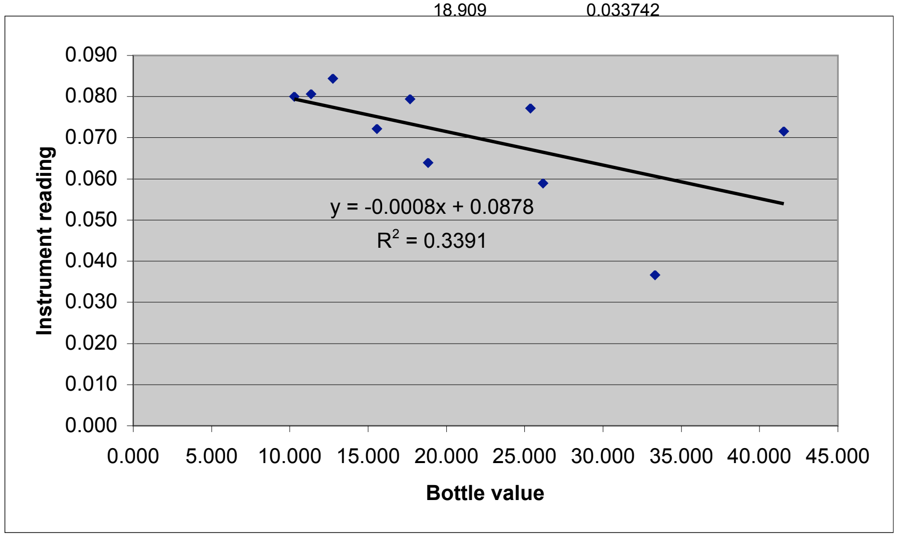
ctgqa05.xls 7July04

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration using bottle samples

Date form completed	7/7/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	mgl^{-1}
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	Gravimetric
Description of calibration Blank	Suspended Solids
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Bottle Readings	Minipack Readings
1	12.743	0.084
2	10.280	0.080
3	15.556	0.072
4	11.359	0.081
5	17.691	0.079
6	18.819	0.064
7	26.160	0.059
8	33.333	0.037
9	25.357	0.077
10	41.549	0.072
	18.909	0.033742



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	7/7/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Date last calibrated by user	
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

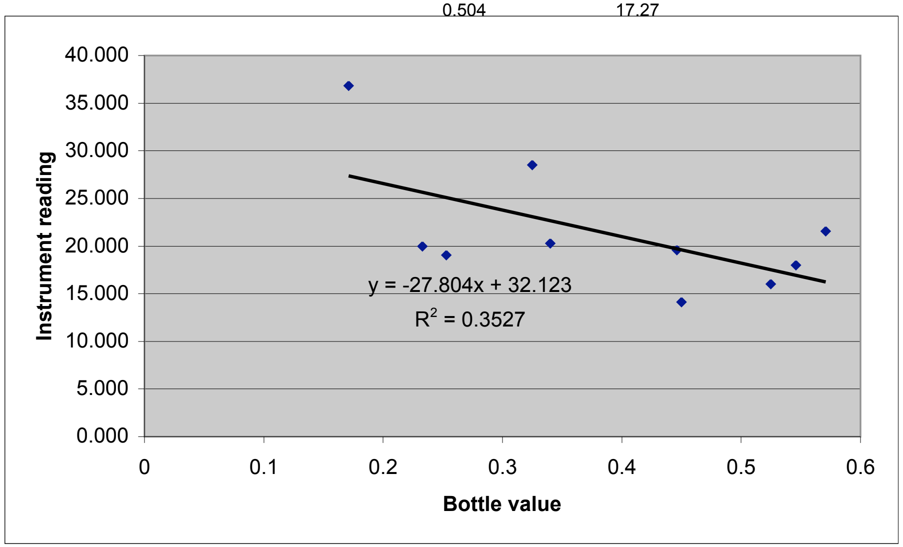
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	7/7/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Bottle Readings	Minipack Readings
1	0.171	36.845
2	0.325	28.498
3	0.34	20.267
4	0.253	19.044
5	0.571	21.558
6	0.546	18.000
7	0.45	14.122
8	0.525	16.031
9	0.446	19.577
10	0.233	19.964
	0.504	17.27



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	7/7/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	
Standard used for calibration check	

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	
Standard used for calibration check	

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	30/6/04
Date calibration last checked	

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	
Standard used for calibration check	
Date windows last cleaned	

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	14/7/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

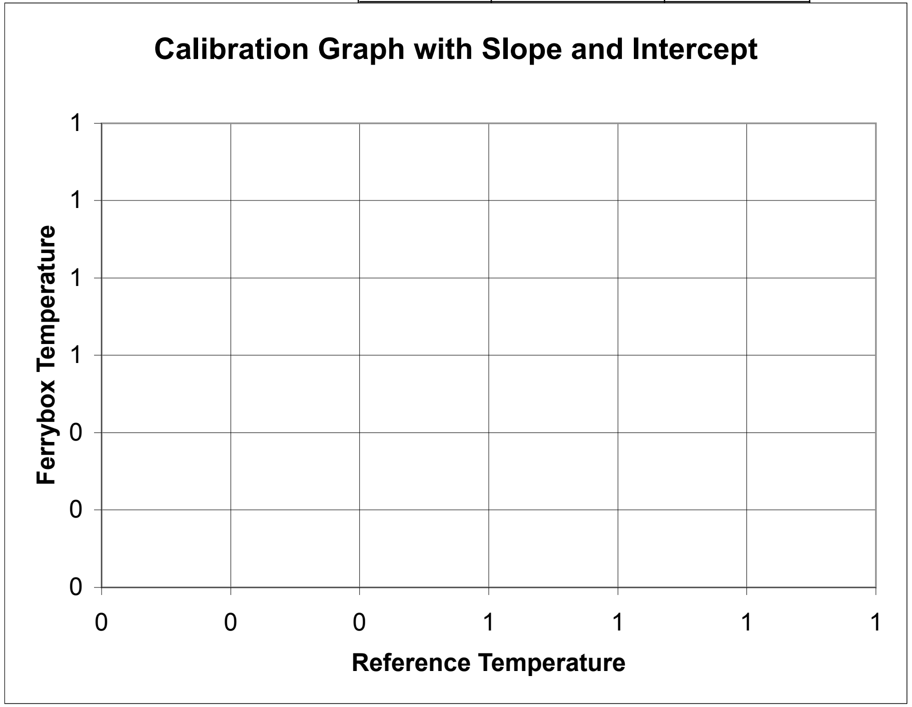
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	14/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes Page 4

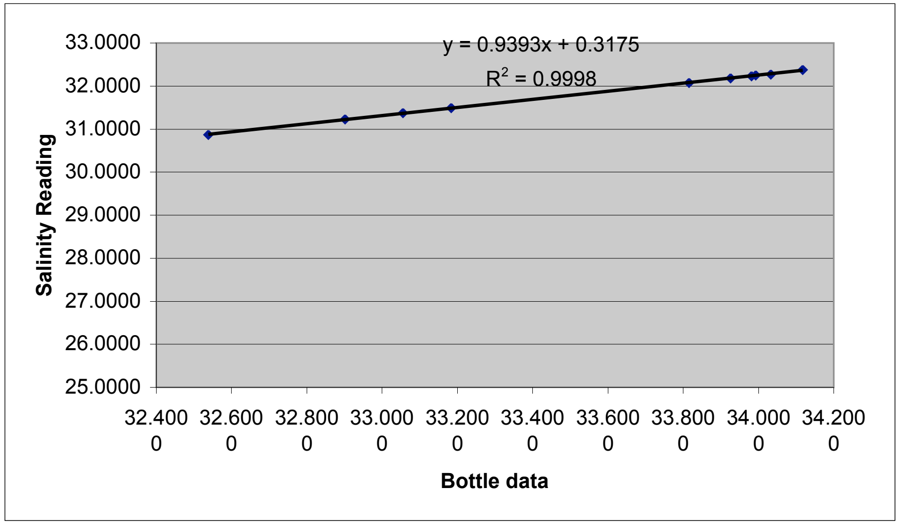
Salinity Calibration using bottle samples

Date form completed	14/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration	0.9343

	Bottle Readings	Salinometer Readings
1	32.9020	31.2310
2	33.8150	32.0758
3	34.1180	32.3814
4	33.9930	32.2489
5	33.9820	32.2349
6	34.0330	32.2743
7	33.9260	32.1858
8	33.1840	31.4873
9	33.0550	31.3768
10	32.5380	30.8733
11		
12		



ctgqa06.xls 14July04

Route 6 NERC-SOC Southampton - Cowes Page 5

Salinity Calibration with cleaning

Date form completed	14/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

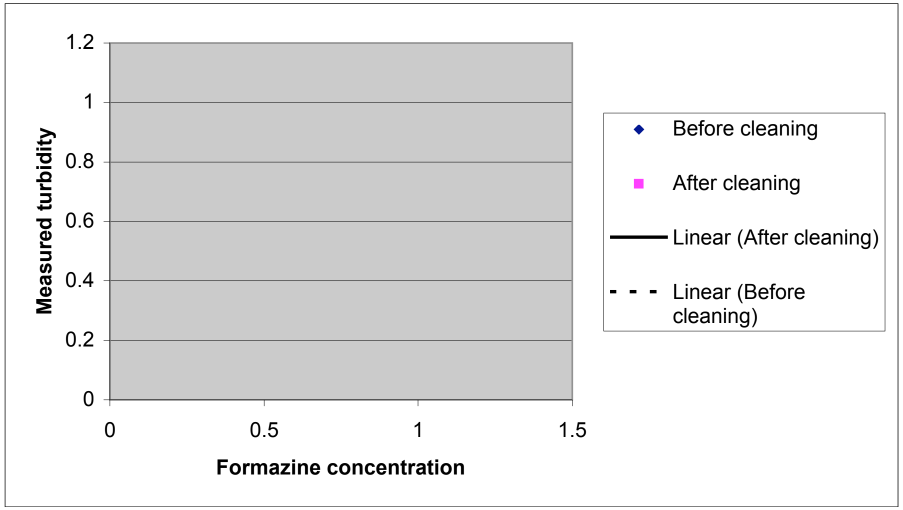
Turbidity Calibration by Formazine

Date form completed	14/7/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch

Description of calibration Standard	
Description of calibration Blank	

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes

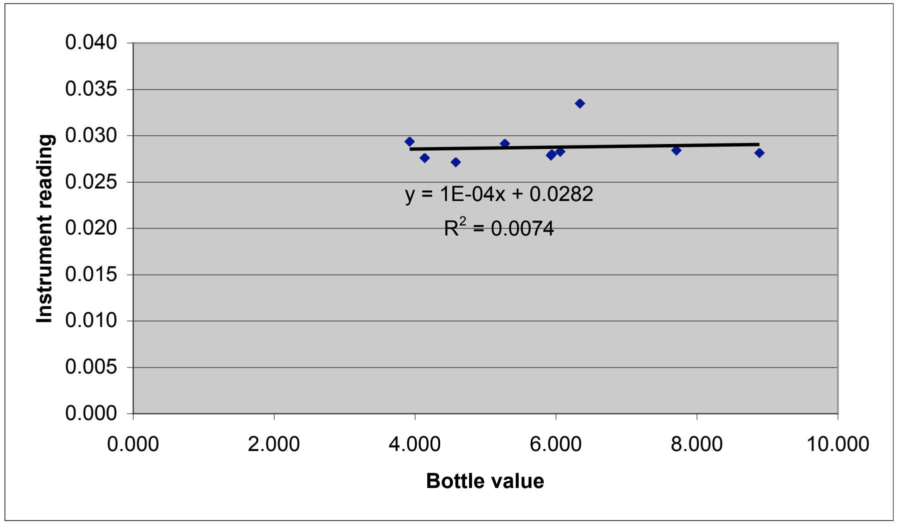
Turbidity Calibration using bottle samples

Date form completed	14/7/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	7/7/04	
Checked today by (Name)	mch	

Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids

Mean from previous calibration		
Std Dev from previous calibration	0.3391	R-squared
Slope mV/ unit from previous calibration	-0.0008	

	Bottle Readings	Minipack Readings
1	8.889	0.028
2	5.926	0.028
3	5.273	0.029
4	6.061	0.028
5	7.706	0.028
6	6.338	0.033
7	3.922	0.029
8	4.138	0.028
9	5.940	0.028
10	4.577	0.027



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	14/7/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Date last calibrated by user	23/9/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

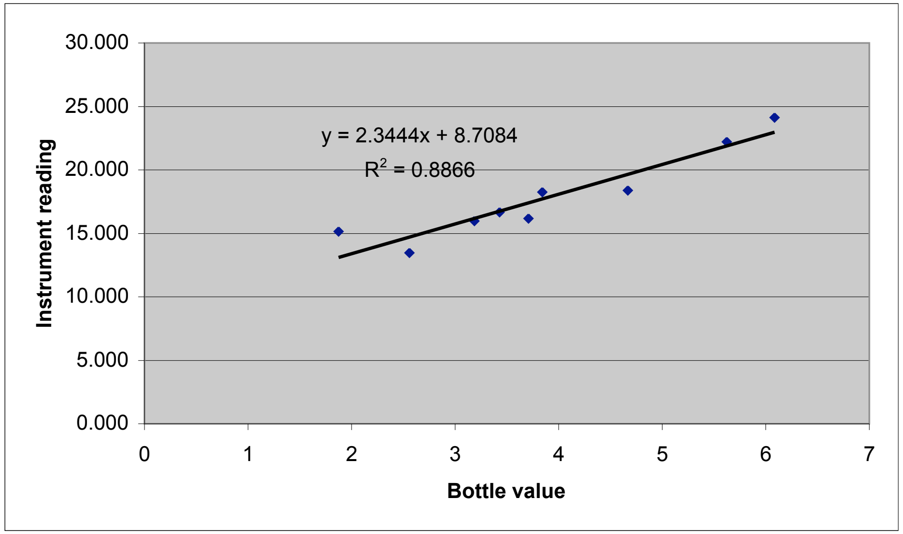
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	0	0
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	14/7/04	
Manufacturer	CTG	
Model	Minipack	
Serial number	210011	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	_g Chlorophyll-a /litre	
Date last calibrated by user		
Checked today by (Name)	mch	
Description of calibration Standard	Chl-a in acetone	
Description of calibration Blank		
Mean from previous calibration		
Std Dev from previous calibration	0.35	R-squared
Slope mV/ unit from previous calibration	-27.8	

	Bottle Readings	Minipack Readings
1	6.083	24.114
2	3.429	16.676
3	2.558	13.457
4	1.875	15.134
5	3.188	15.985
6	4.667	18.377
7	3.708	16.173
8		
9	5.625	22.205
10	3.842	18.250



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	14/7/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	7/7/04
Standard used for calibration check	Bottle Salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	7/7/04
Standard used for calibration check	Bottle Salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	7/7/04
Date calibration last checked	7/7/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	7/7/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	7/7/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa07.xls 21July04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	21/7/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

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4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

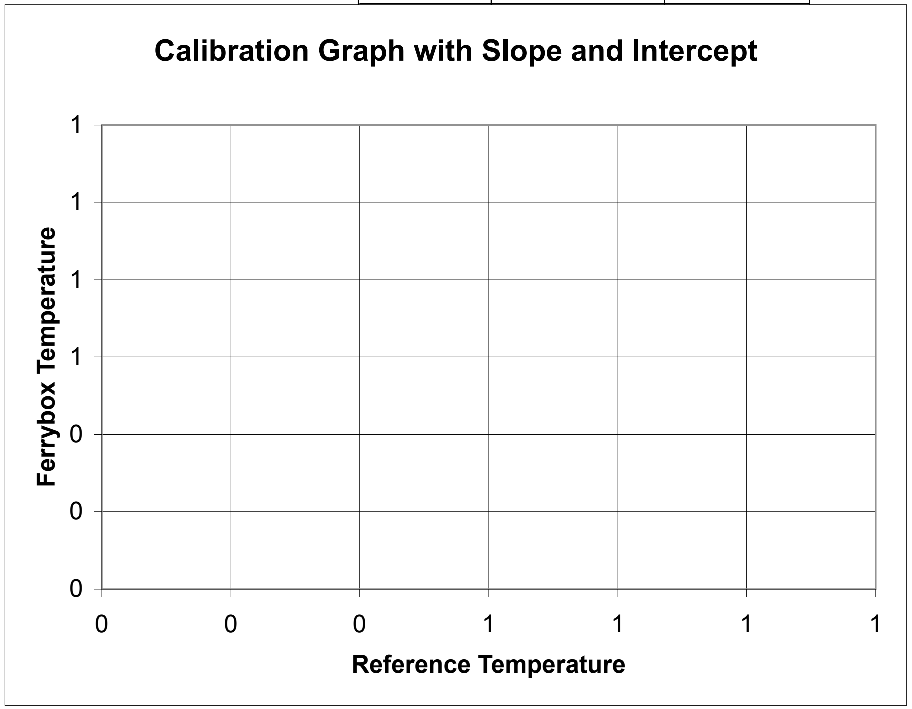
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	21/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

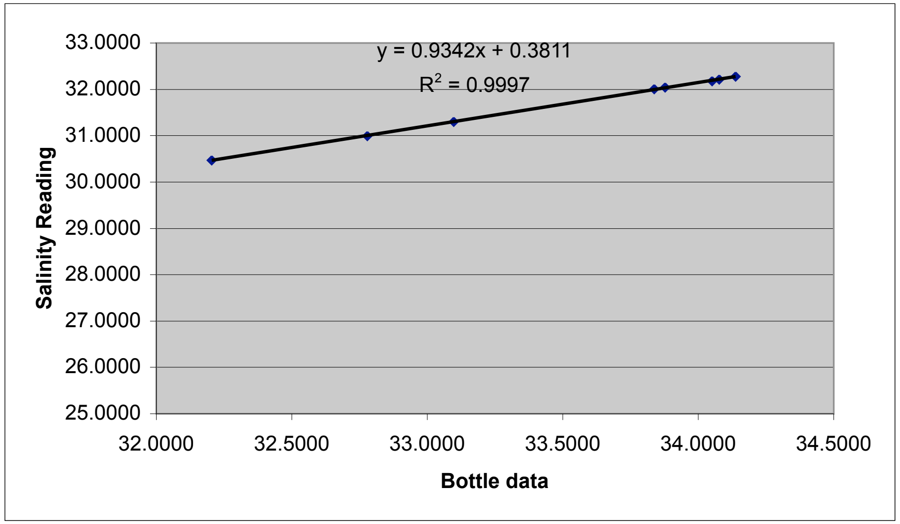
	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes
Salinity Calibration using bottle samples

Date form completed	21/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	14/7/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu
Slope mV/ unit from previous calibration	0.9393

	Bottle Readings	Salinometer Readings
1	33.8770	32.0458
2	34.0780	32.2098
3	34.1370	32.2769
4	34.0510	32.1732
5	33.8380	32.0051
6	33.0980	31.2998
7	32.7790	30.9951
8	32.2040	30.4707
9		
10		
11		
12		



ctgqa07.xls 21July04

Route 6 NERC-SOC Southampton - Cowes
Salinity Calibration with cleaning

Date form completed	21/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

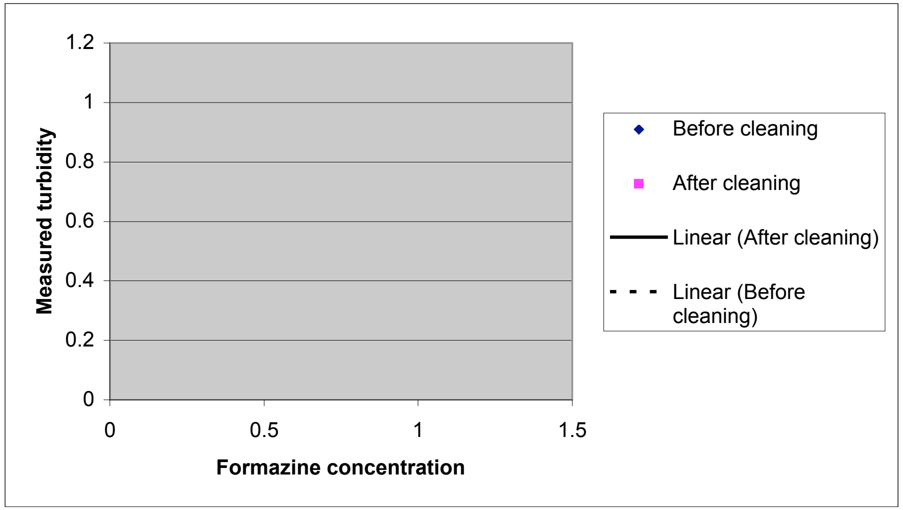
Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration by Formazine

Date form completed	21/7/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



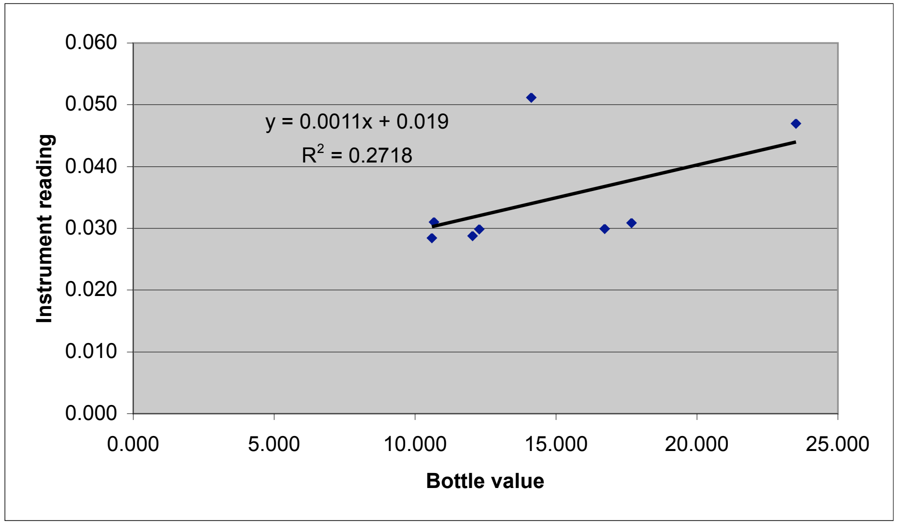
ctgqa07.xls 21July04

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration using bottle samples

Date form completed	21/7/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	14/7/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.0074	R-squared
Slope mV/ unit from previous calibration	1.00E-04	

	Bottle Readings	Minipack Readings
1	17.679	0.031
2	23.519	0.047
3	16.727	0.030
4	14.128	0.051
5	12.278	0.030
6	10.664	0.031
7	12.037	0.029
8	10.592	0.028
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	21/7/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Date last calibrated by user	
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

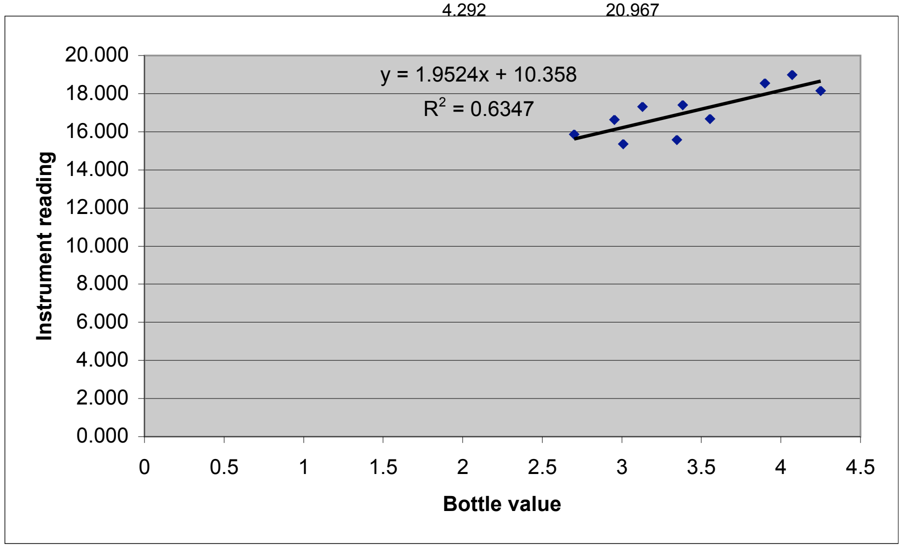
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	85.2	4.0	23.2
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	8.524066667	0.404694915	2.320470588
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	1.4	3.0	47.3
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	1.398095238	3.042142857	47.32466667
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	7.125971429	-2.637447942	46.91997175
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	21/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	14/7/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.8866 R-squared
Slope mV/ unit from previous calibration	2.3444

	Bottle Readings	Minipack Readings
1	4.071	18.979
2	2.7	15.874
3	3.383	17.394
4	3.554	16.678
5	3.008	15.352
6	3.346	15.576
7	4.25	18.160
8	3.9	18.556
9	2.954	16.644
10	3.129	17.324
	4.292	20.967



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	21/7/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	14/7/04
Standard used for calibration check	Bottle Salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	14/7/04
Standard used for calibration check	Bottle Salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	14/7/04
Date calibration last checked	14/7/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	14/7/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	14/7/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes
DATE 28/7/04

Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form Page 2

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

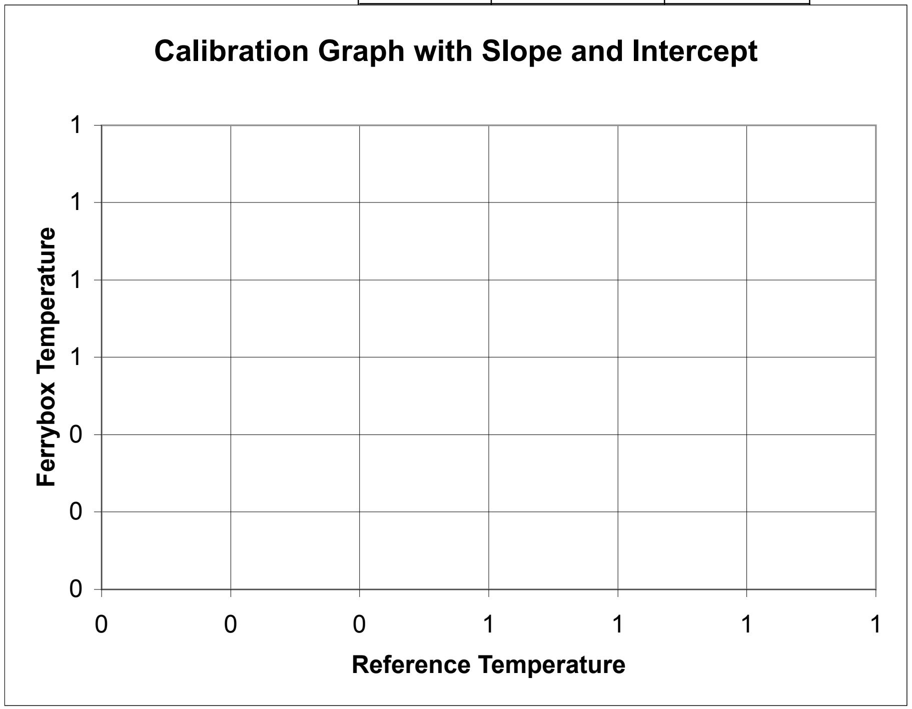
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes Page 3
Temperature Calibration

Date form completed	28/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes Page 4

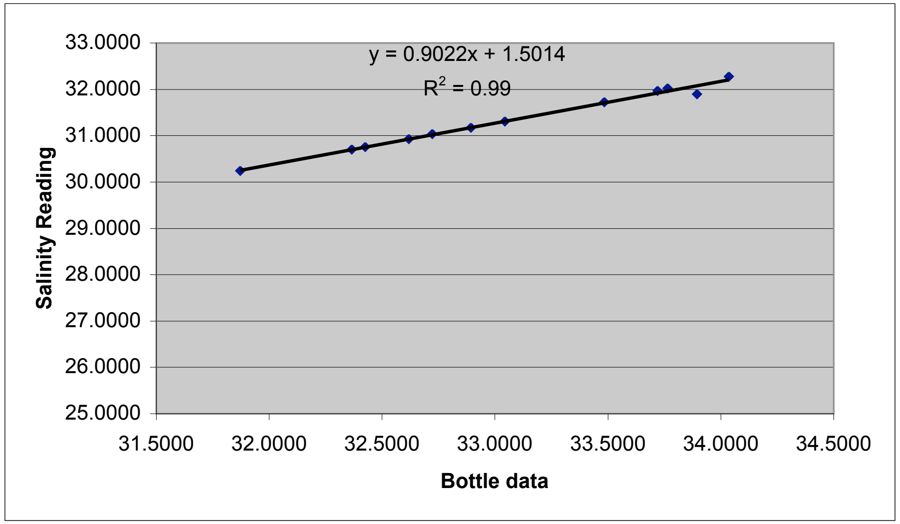
Salinity Calibration using bottle samples

Date form completed	28/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	21/7/04
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration	0.9342

	Bottle Readings	Salinometer Readings
1	31.8710	30.2423
2	32.3660	30.7027
3	32.7220	31.0426
4	32.8930	31.1736
5	33.0440	31.3113
6	33.7650	32.0204
7	34.0360	32.2758
8	33.7190	31.9713
9	33.8940	31.8971
10	33.4840	31.7236
11	32.6190	30.9311
12	32.4260	30.7540



ctgqa08.xls 28July04

Route 6 NERC-SOC Southampton - Cowes Page 5

Salinity Calibration with cleaning

Date form completed	28/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

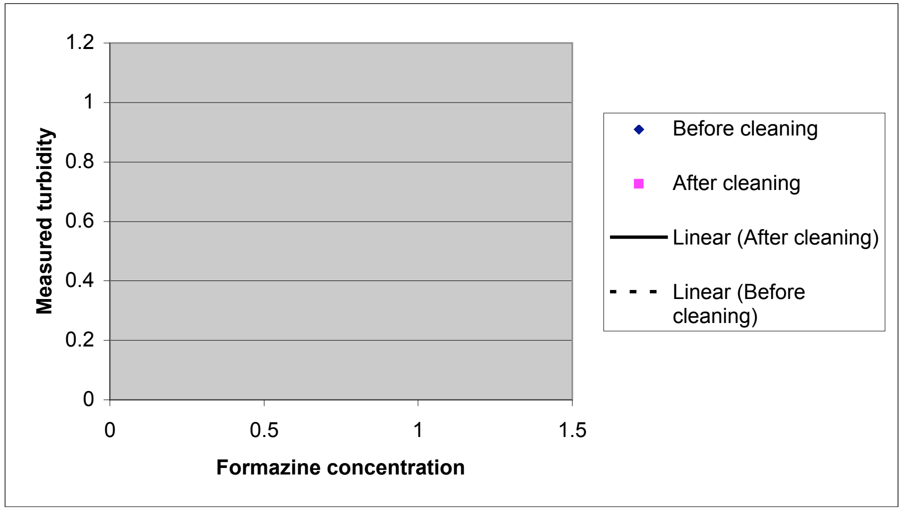
After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes Page 6
Turbidity Calibration by Formazine

Date form completed	28/7/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

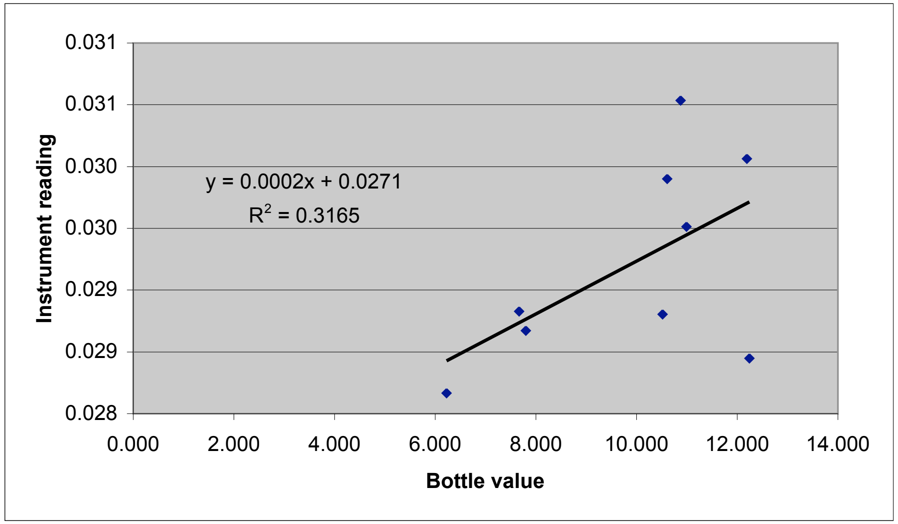
		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes Page 7
Turbidity Calibration using bottle samples

Date form completed	28/7/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	18	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	21/7/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.2718	R-squared
Slope mV/ unit from previous calibration	1.10E-03	

	Bottle Readings	Minipack Readings
1	6.228	0.028
2	12.238	0.028
3	10.517	0.029
4	7.665	0.029
5	7.799	0.029
6	10.877	0.031
7	12.191	0.030
8	10.609	0.030
9	10.989	0.030
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	28/7/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	18
Date last calibrated by user	21/7/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch

Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known

Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks

Mean from previous calibration	3.04	Low
Std Dev from previous calibration		
Slope mV/ unit from previous calibration		

	Before cleaning	Before cleaning	Before cleaning
	Blank Readings	Low Standard Readings	High Standard Readings
1	138.7	7.1	25.3
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	138.7065	7.056428571	25.31166667
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning	After cleaning	After cleaning
	Blank Readings	Low Standard Readings	High Standard Readings
1	2.0	2.9	46.8
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	2.009166667	2.903076923	46.84571429
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	136.6973333	4.153351648	39.78928571
Slope mV/ unit			

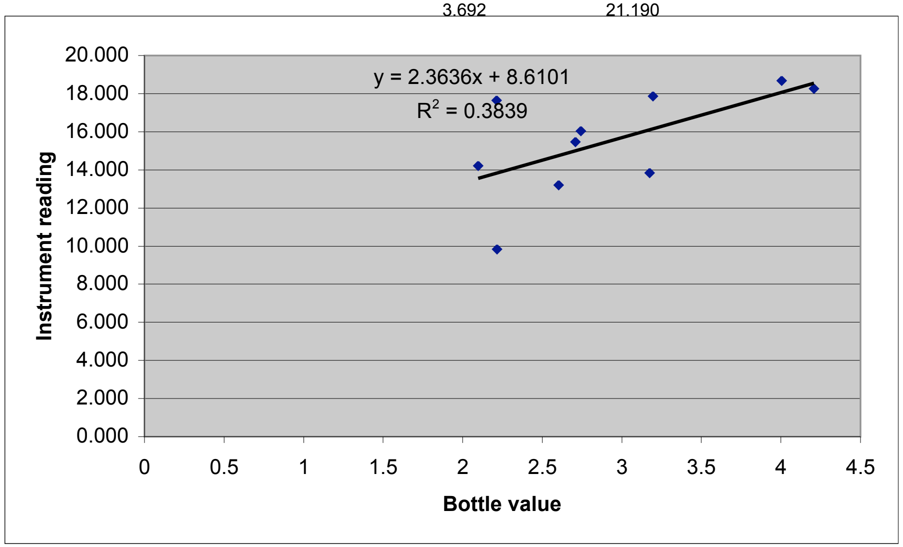
Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	28/7/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	18
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	21/7/04
Checked today by (Name)	mch

Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	

Mean from previous calibration		
Std Dev from previous calibration	0.6347	R-squared
Slope mV/ unit from previous calibration	1.9524	

	Bottle Readings	Minipack Readings
1	2.604	13.199
2	4.004	18.684
3	2.213	17.646
4	4.208	18.251
5	3.196	17.876
6	2.096	14.204
7	2.217	9.824
8	3.175	13.834
9	2.742	16.044
10	2.708	15.469
	3.692	21.190



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	28/7/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	21/7/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	21/7/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	18
Date windows last cleaned	21/7/04
Date calibration last checked	21/7/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	18
Date calibration last checked	21/7/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	21/7/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa09.xls 4August04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	4/8/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

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3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

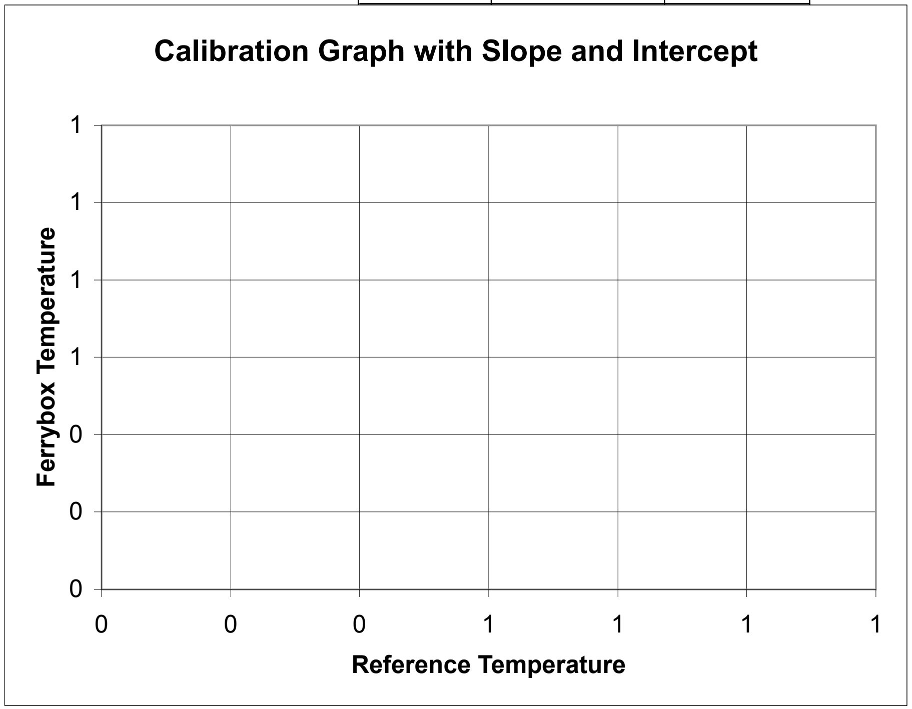
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

Route 6 NERC-SOC Southampton - Cowes

Temperature Calibration

Date form completed	4/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	
Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes

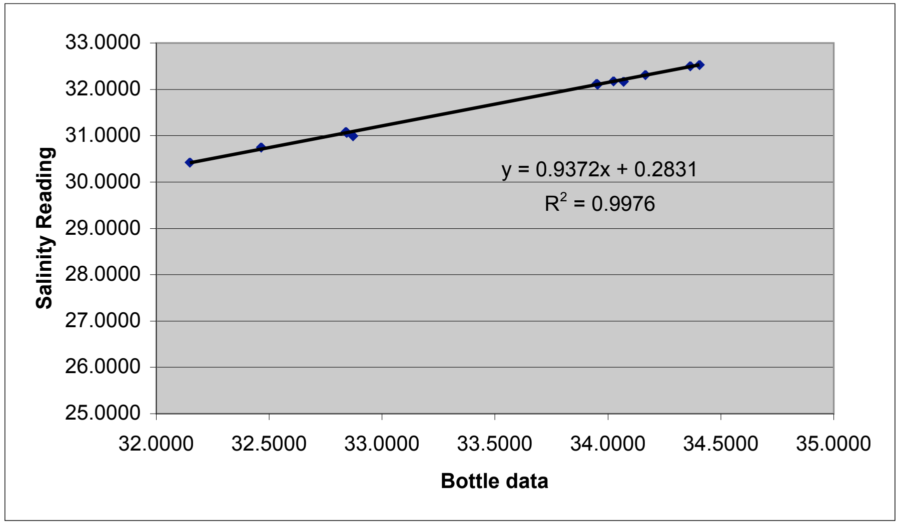
Salinity Calibration using bottle samples

Date form completed	4/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	21/7/04
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 0.9022

	Bottle Readings	Salinometer Readings
1	32.1480	30.4235
2	32.4640	30.7504
3	32.8720	30.9919
4	33.9510	32.1268
5	34.0240	32.1766
6	34.3650	32.5070
7	34.4050	32.5343
8	34.1660	32.3117
9	34.0690	32.1689
10	33.9540	32.1065
11	32.8390	31.0853
12	32.8440	31.0690
	32.62	30.85522889



Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration with cleaning

Date form completed	4/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	Before cleaning	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	After cleaning	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

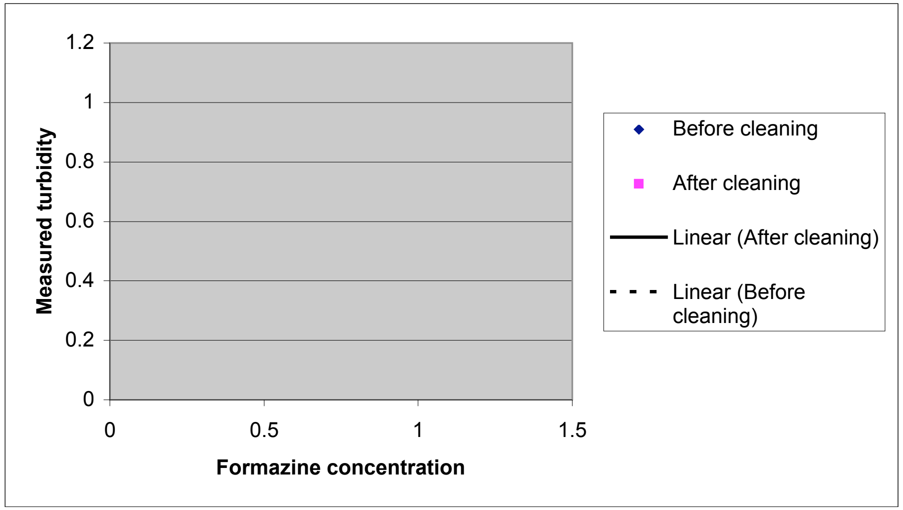
Difference before & after cleaning n/a

Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Turbidity Calibration by Formazine

Date form completed	4/8/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	17
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

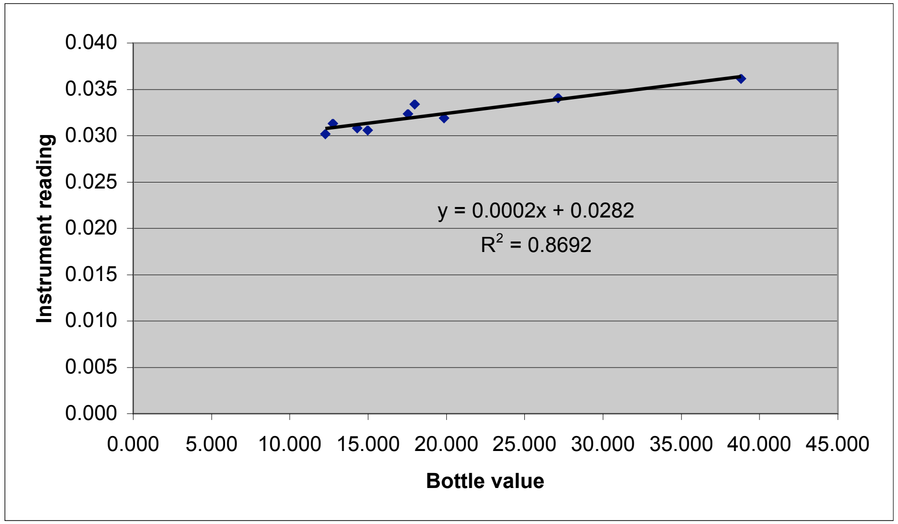
		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes
Turbidity Calibration using bottle samples

Date form completed	4/8/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	17	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	28/7/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.3165	R-squared
Slope mV/ unit from previous calibration	2.00E-04	

	Bottle Readings	Minipack Readings
1	14.310	0.031
2	12.759	0.031
3	14.973	0.031
4	17.544	0.032
5	38.801	0.036
6	19.859	0.032
7	12.263	0.030
8	27.145	0.034
9	17.962	0.033
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	4/8/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Date last calibrated by user	28/7/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch

Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known

Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks

Mean from previous calibration	2.9	Low
Std Dev from previous calibration		
Slope mV/ unit from previous calibration		

	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	157.0	6.0	20.4
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	157.0018182	6.018666667	20.419375
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	0.8	2.8	46.7
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0.784285714	2.806666667	46.69166667
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	156.2175325	3.212	40.673
Slope mV/ unit			

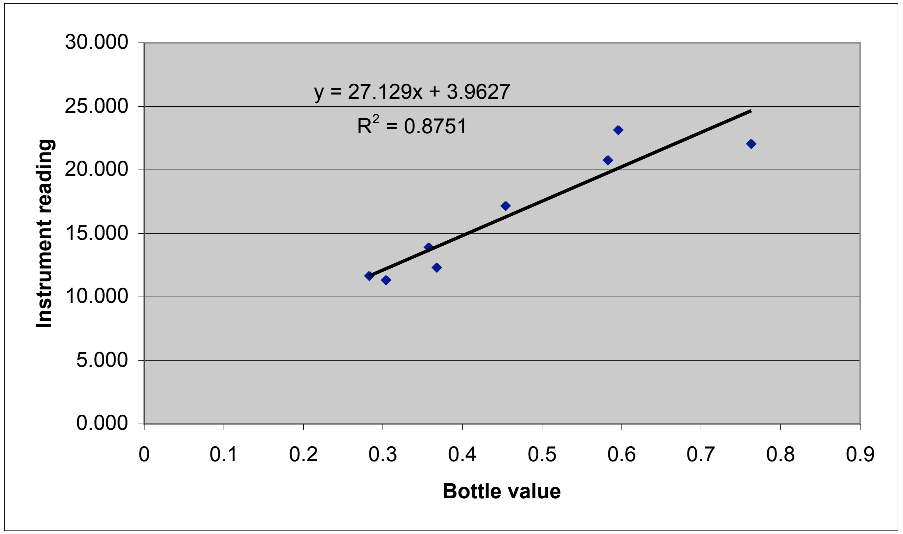
Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	4/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	28/7/04
Checked today by (Name)	mch

Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	

Mean from previous calibration		
Std Dev from previous calibration	0.3839	R-squared
Slope mV/ unit from previous calibration	2.3636	

	Bottle Readings	Minipack Readings
1	0.763	22.061
2	0.596	23.128
3	0.454	17.173
4	0.304	11.327
5	0.358	13.895
6	0.283	11.646
7	0.368	12.320
8	0.583	20.771
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	4/8/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	28/7/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	28/7/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	17
Date windows last cleaned	28/7/04
Date calibration last checked	28/7/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	28/7/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	28/7/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa10.xls 11August04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	11/8/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form Page 2

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

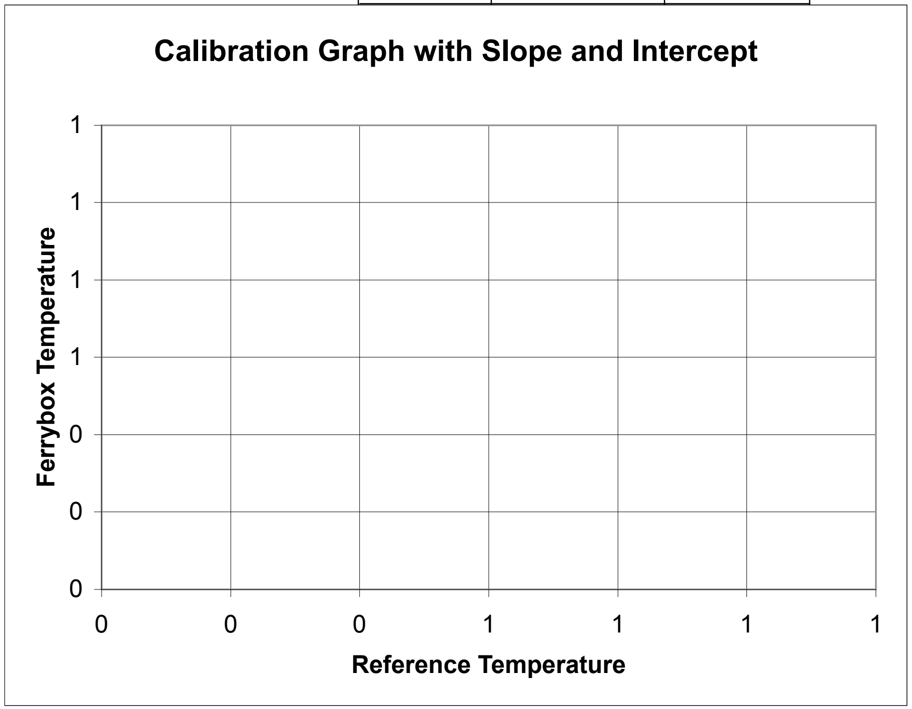
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

ctgqa10.xls 11August04

Route 6 NERC-SOC Southampton - Cowes Page 3
Temperature Calibration

Date form completed	11/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	
Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes Page 4

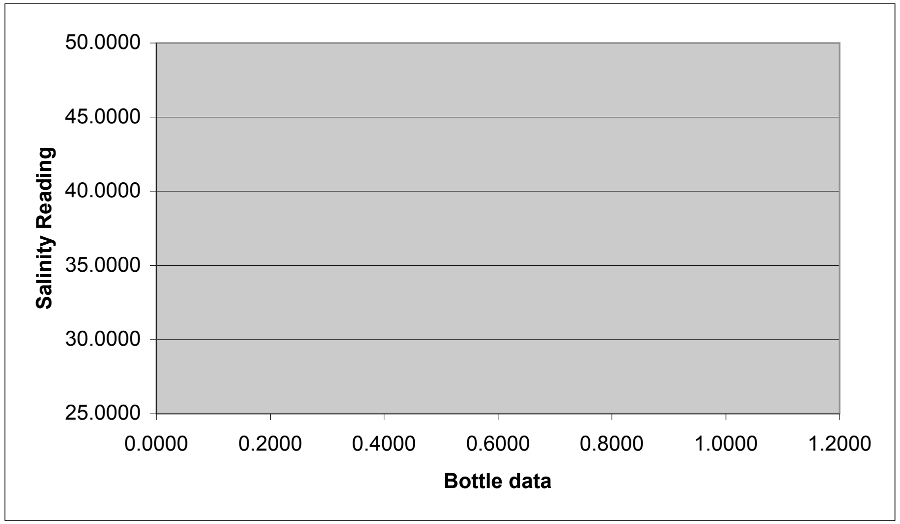
Salinity Calibration using bottle samples

Date form completed	11/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	4/8/04
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration	0.9022

	Bottle Readings	Salinometer Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		



Route 6 NERC-SOC Southampton - Cowes Page 5

Salinity Calibration with cleaning

Date form completed	11/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes Page 6

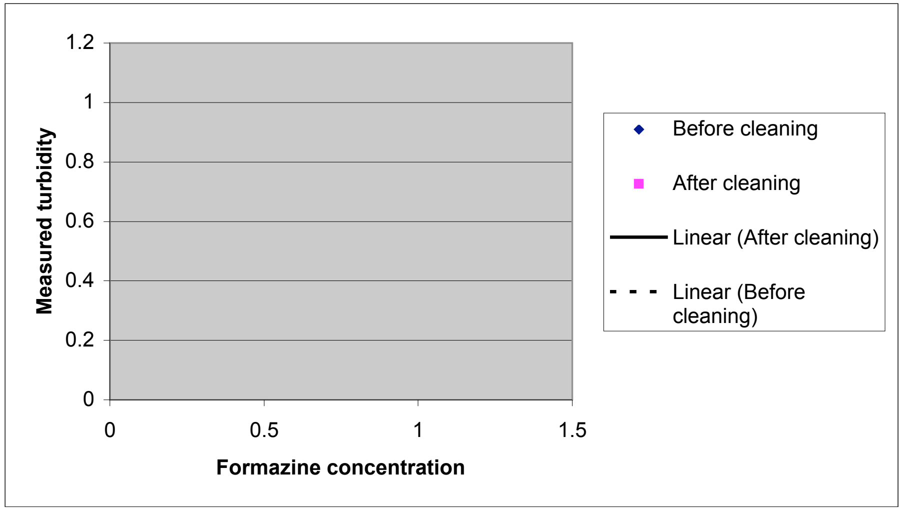
Turbidity Calibration by Formazine

Date form completed	11/8/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	17
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch

Description of calibration Standard	
Description of calibration Blank	

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes Page 7

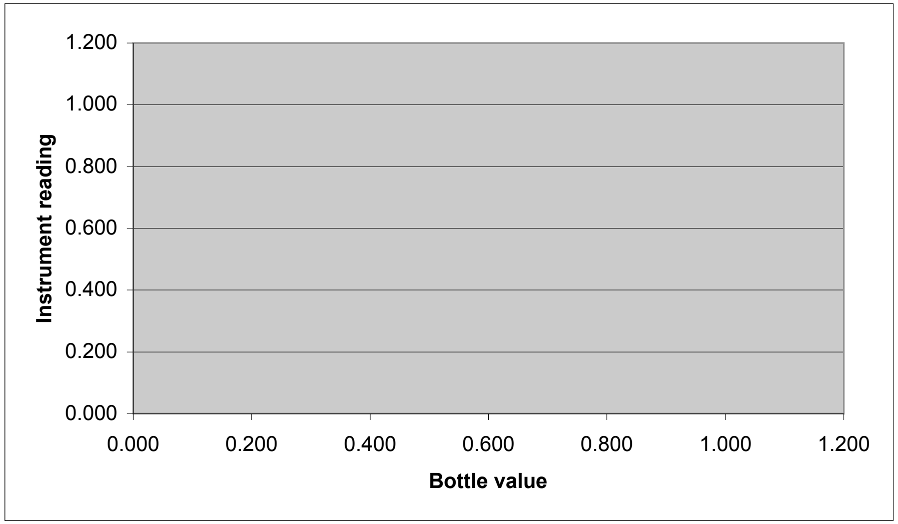
Turbidity Calibration using bottle samples

Date form completed	11/8/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	17	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	4/8/04	
Checked today by (Name)	mch	

Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids

Mean from previous calibration		
Std Dev from previous calibration	0.3165	R-squared
Slope mV/ unit from previous calibration	2.00E-04	

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	11/8/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Date last calibrated by user	4/8/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	2.81 Low
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

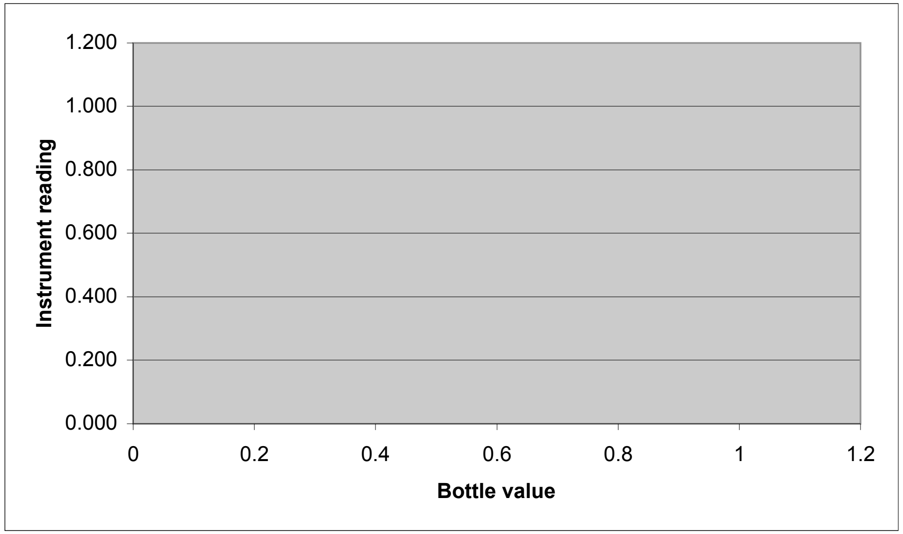
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	91.1	5.6	17.1
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	91.08357143	5.605555556	17.05625
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	1.8	3.1	45.7
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	1.83125	3.087142857	45.683
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	89.25232143	2.518412698	40.07744444
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	11/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	4/8/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.3839 R-squared
Slope mV/ unit from previous calibration	2.3636

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	11/8/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	4/8/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	4/8/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	4/8/04
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	17
Date windows last cleaned	4/8/04
Date calibration last checked	4/8/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	4/8/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	4/8/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM

Route 6 NERC-SOC Southampton - Cowes

DATE	18/8/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

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2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

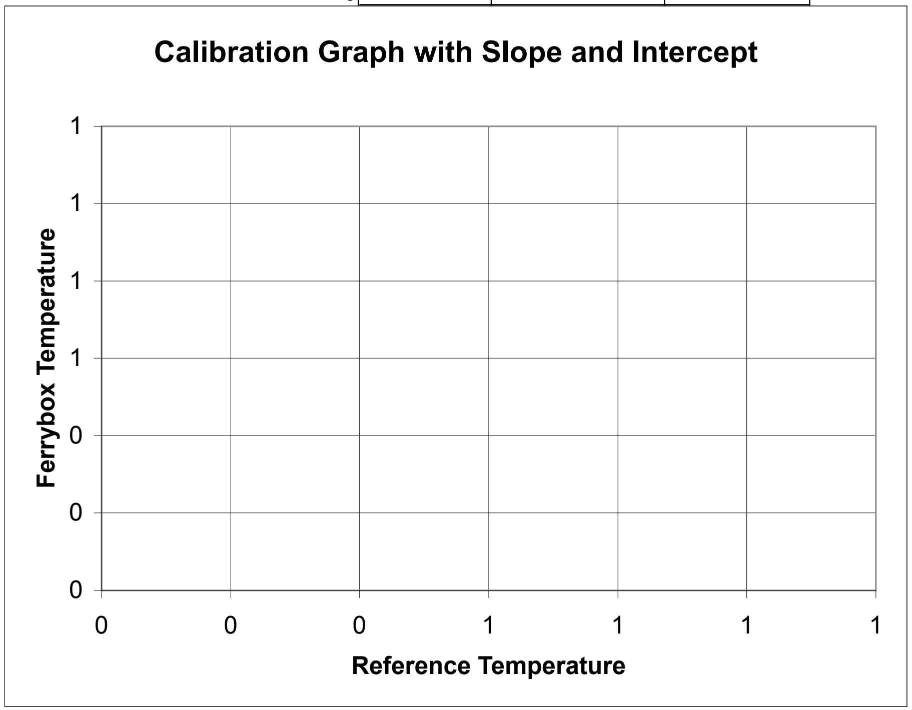
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

ctgqa11.xls 18August04

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	18/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	
Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



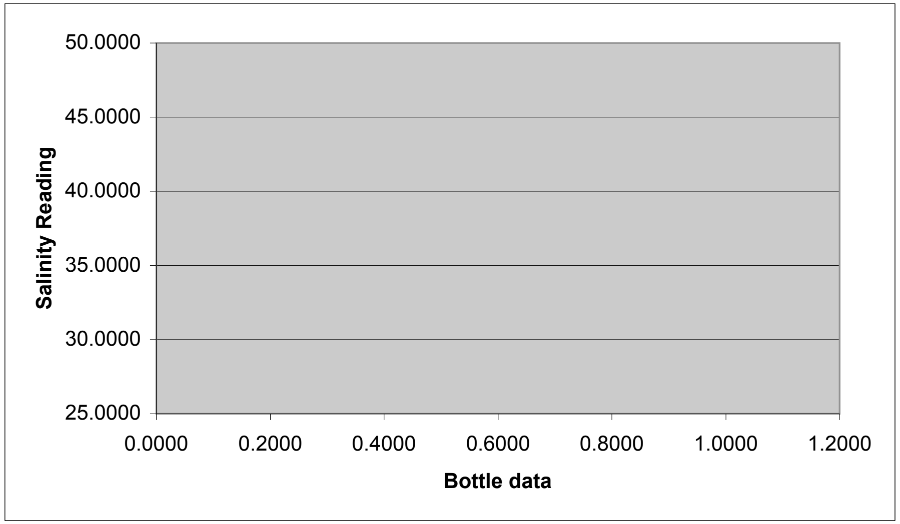
Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration using bottle samples

Date form completed	18/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	4/8/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 0.9022

	Bottle Readings	Salinometer Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		



ctgqa11.xls 18August04

Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration with cleaning

Date form completed	18/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

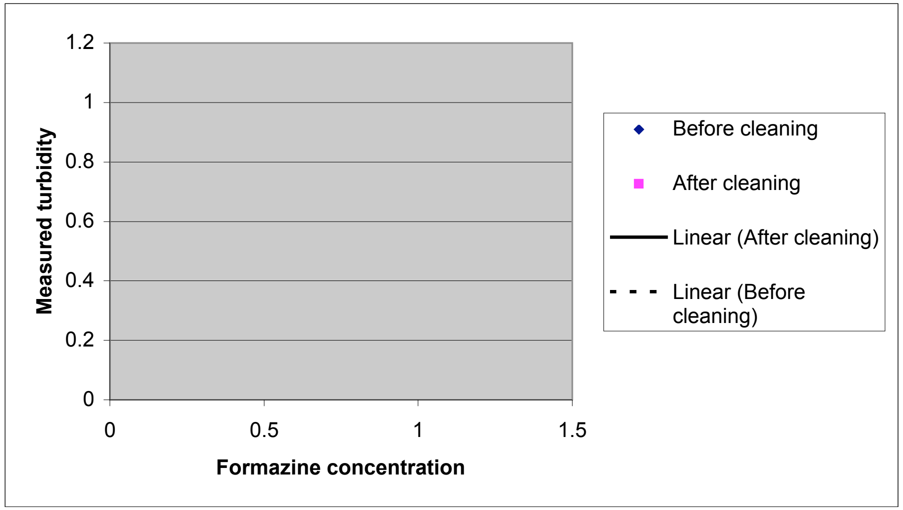
Turbidity Calibration by Formazine

Date form completed	18/8/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	17
Frequency of user calibration check	
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch

Description of calibration Standard	
Description of calibration Blank	

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Route 6 NERC-SOC Southampton - Cowes

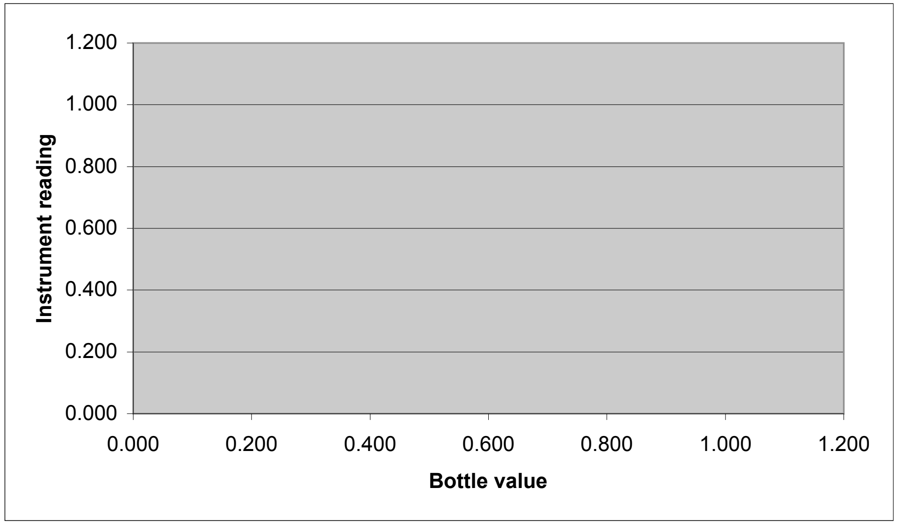
Turbidity Calibration using bottle samples

Date form completed	18/8/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	17	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	4/8/04	
Checked today by (Name)	mch	

Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids

Mean from previous calibration		
Std Dev from previous calibration	0.3165	R-squared
Slope mV/ unit from previous calibration	2.00E-04	

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	18/8/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	17
Date last calibrated by user	11/8/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	3.1 Low
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

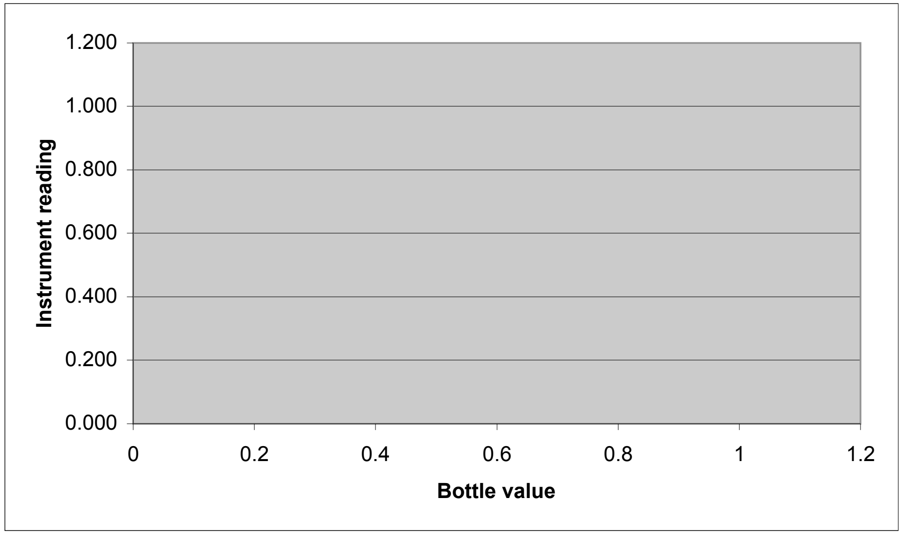
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	32.8	4.3	28.4
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	32.84944444	4.294285714	28.44571429
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1		3.6	44.9
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	3.634	44.90090909
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	32.84944444	0.660285714	40.60662338
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	18/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	17
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	4/8/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.3839 R-squared
Slope mV/ unit from previous calibration	2.3636

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	18/8/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	4/8/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	4/8/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	4/8/04
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	17
Date windows last cleaned	11/8/04
Date calibration last checked	4/8/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	17
Date calibration last checked	11/8/04
Standard used for calibration check	Blocks
Date windows last cleaned	11/8/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	25/8/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

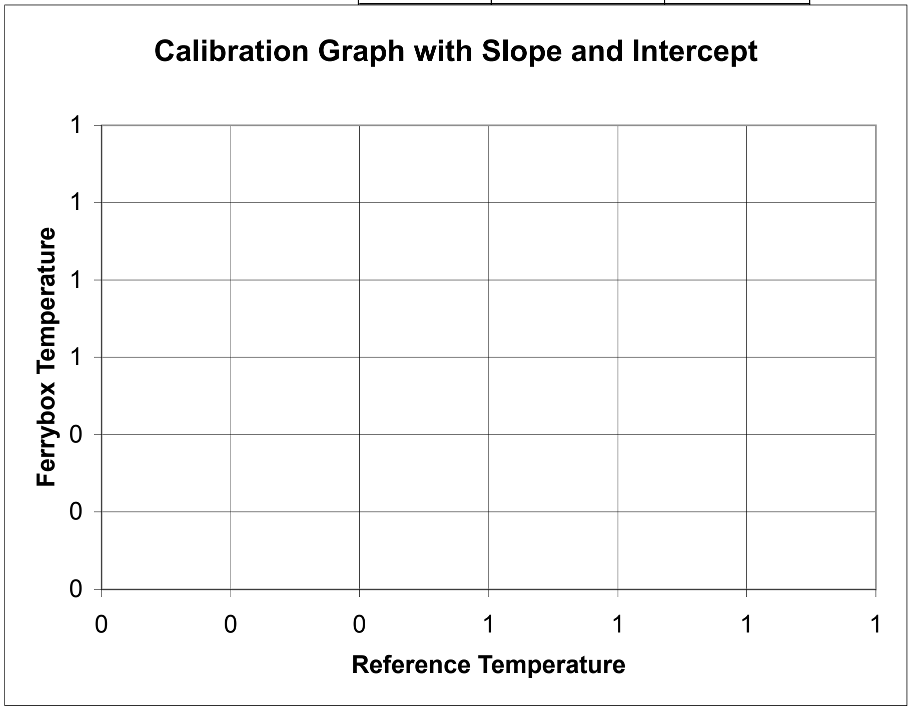
Route 6 NERC-SOC Southampton - Cowes

Temperature Calibration

Date form completed	25/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



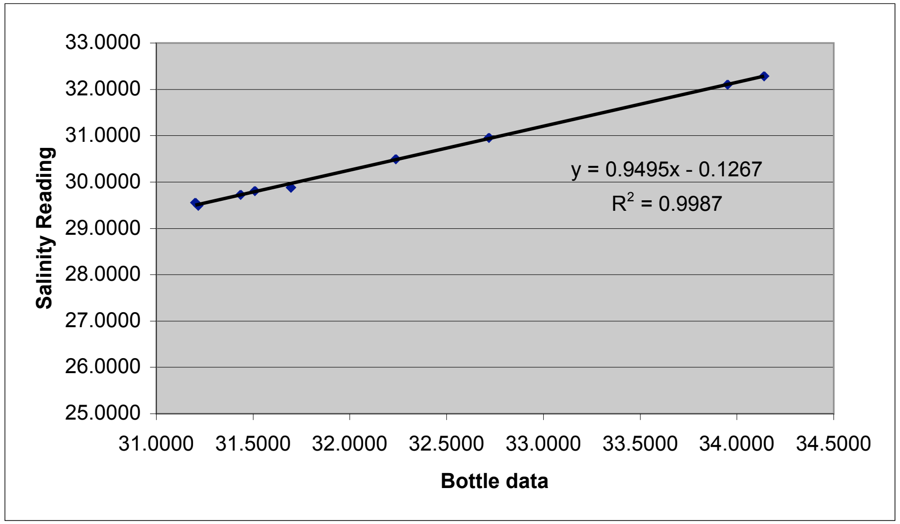
Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration using bottle samples

Date form completed	25/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	4/8/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 0.9372

	Bottle Readings	Salinometer Readings
1	31.5090	29.8100
2	32.2370	30.4974
3	32.7180	30.9612
4	33.9510	32.1059
5	34.1410	32.2902
6	31.2160	29.4916
7	31.2010	29.5520
8	31.6950	29.8799
9	31.4360	29.7270
10		
11		
12		



Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration with cleaning

Date form completed	25/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning n/a

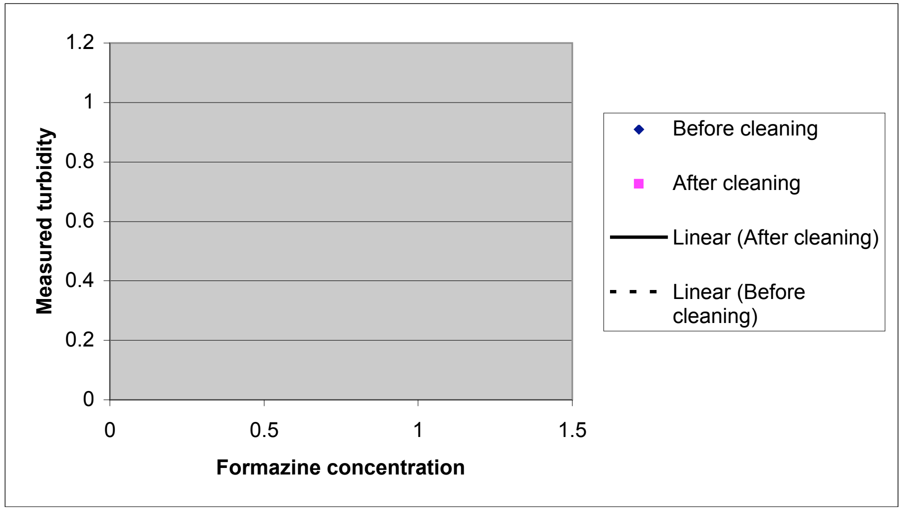
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration by Formazine

Date form completed	25/8/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	16
Frequency of user calibration check	Quarterly
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	In situ Formazine
Description of calibration Blank	Formazine 1014 FTU dilutions
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

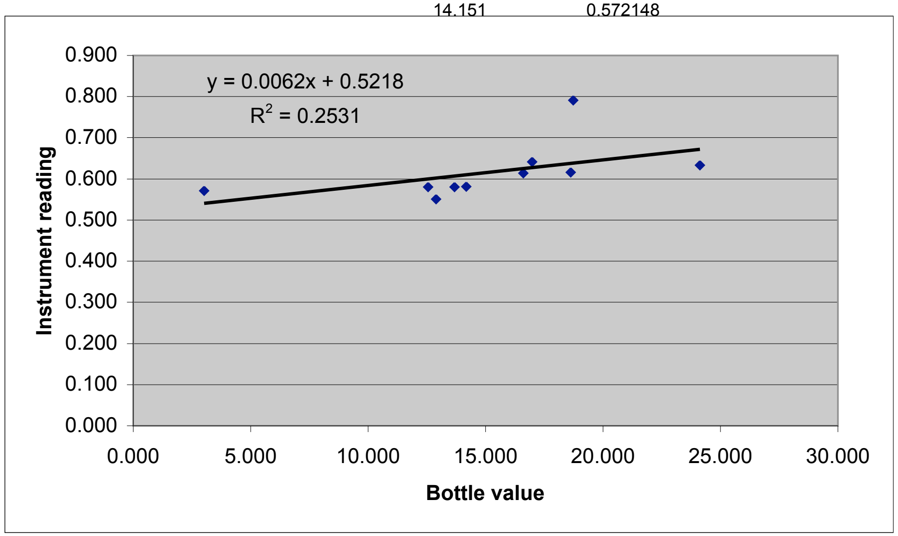


Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration using bottle samples

Date form completed	25/8/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	16	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	4/8/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.8692	R-squared
Slope mV/ unit from previous calibration	2.00E-04	

	Bottle Readings	Minipack Readings
1	18.631	0.616
2	3.019	0.571
3	12.897	0.550
4	24.131	0.633
5	16.981	0.641
6	16.604	0.614
7	18.727	0.791
8	14.182	0.581
9	12.546	0.581
10	13.670	0.580
	14.151	0.572148



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	25/8/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Date last calibrated by user	18/8/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	3.6 Low Standard
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	158.0	8.2	24.1
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	158.01	8.240909091	24.06916667
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

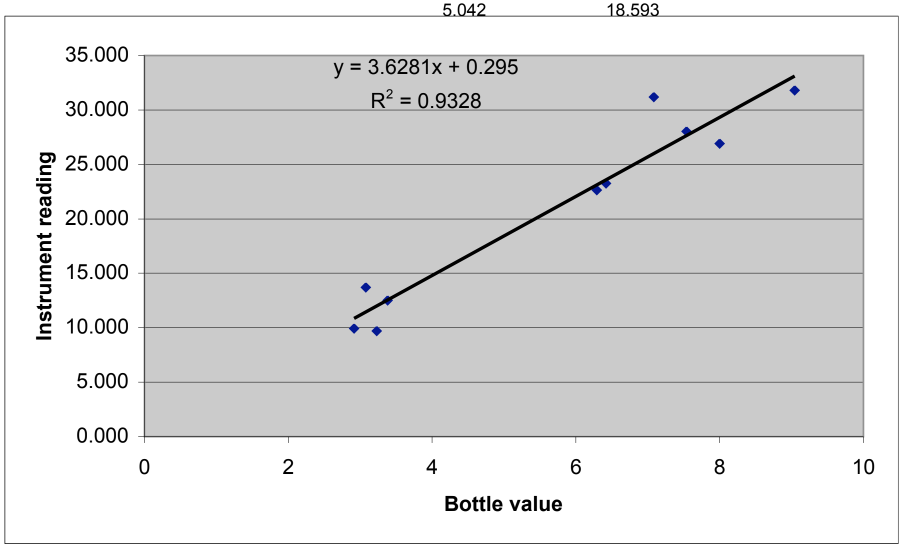
	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	2.9	3.1	47.6
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	2.860526316	3.119285714	47.56833333
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	155.1494737	5.121623377	39.32742424
Slope mV/ unit			

ctgqa12.xls 25August04

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	25/8/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	4/8/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.8751 R-squared
Slope mV/ unit from previous calibration	27.129 suspect chla analysis

	Bottle Readings	Minipack Readings
1	6.292	22.624
2	7.542	28.031
3	7.083	31.206
4	3.079	13.693
5	3.229	9.714
6	2.913	9.947
7	3.383	12.513
8	9.042	31.803
9	8	26.909
10	6.417	23.241
	5.042	18.593



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	25/8/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	4/8/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	4/8/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	16
Date windows last cleaned	18/8/04
Date calibration last checked	4/8/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	18/8/04
Standard used for calibration check	Blocks
Date windows last cleaned	18/8/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa13.xls 2September04

CALIBRATION REPORT FORM Page 1

Route 6 NERC-SOC Southampton - Cowes

DATE	2/9/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

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3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

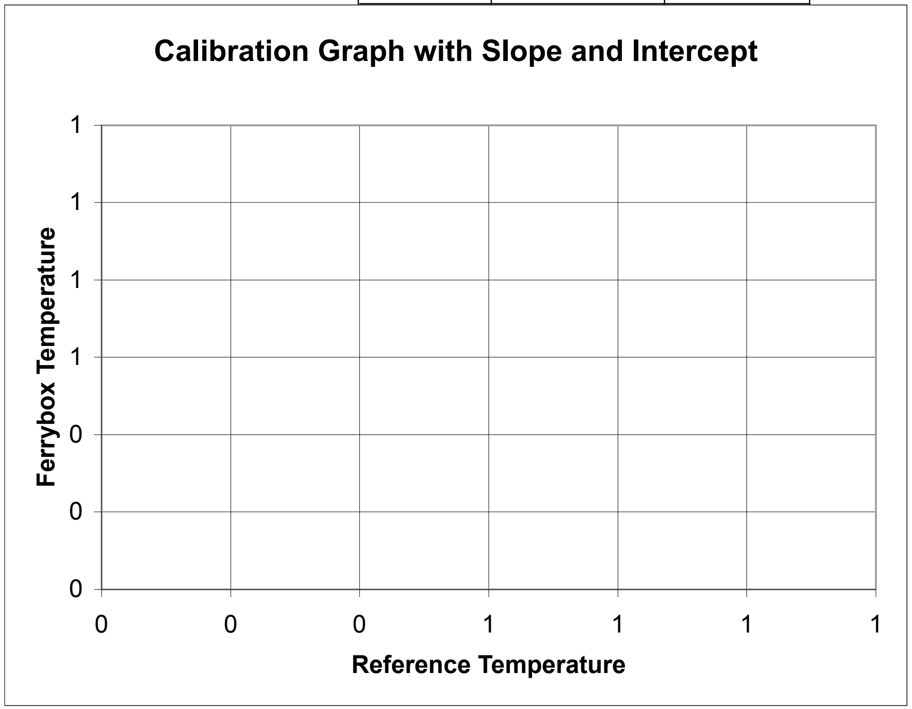
Route 6 NERC-SOC Southampton - Cowes

Temperature Calibration

Date form completed	2/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			

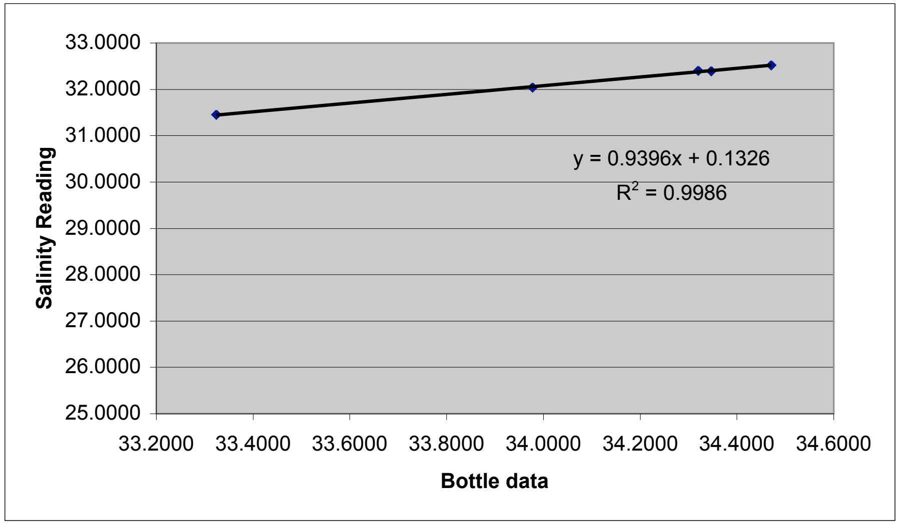


Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration using bottle samples

Date form completed	2/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	25/8/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu
Slope mV/ unit from previous calibration	0.9495

	Bottle Readings	Salinometer Readings
1	34.3200	32.4020
2	34.3470	32.3927
3	34.4710	32.5230
4	33.9780	32.0381
5	33.3240	31.4501
6		
7		
8		
9		
10		
11		
12		



Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration with cleaning

Date form completed	2/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	Before cleaning	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	After cleaning	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

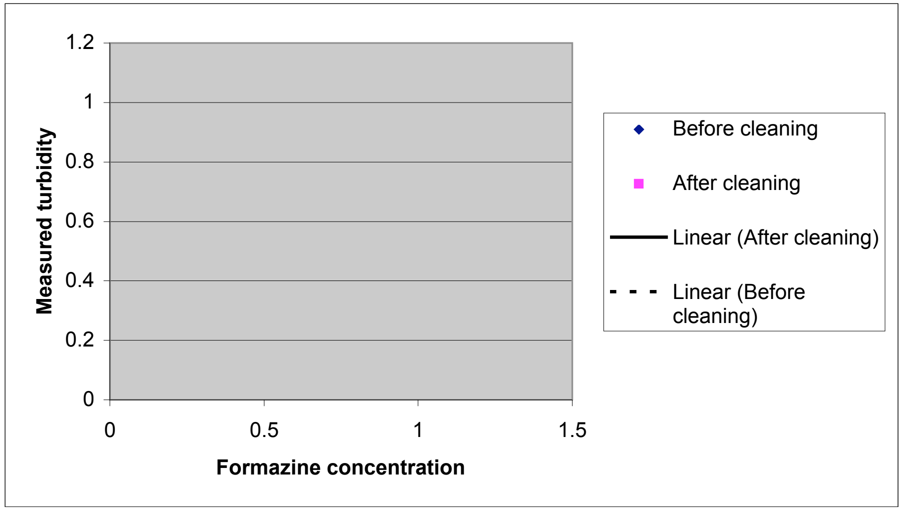
Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration by Formazine

Date form completed	2/9/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	16
Frequency of user calibration check	Quarterly
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	In situ Formazine
Description of calibration Blank	Formazine 1014 FTU dilutions
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

		Before cleaning	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

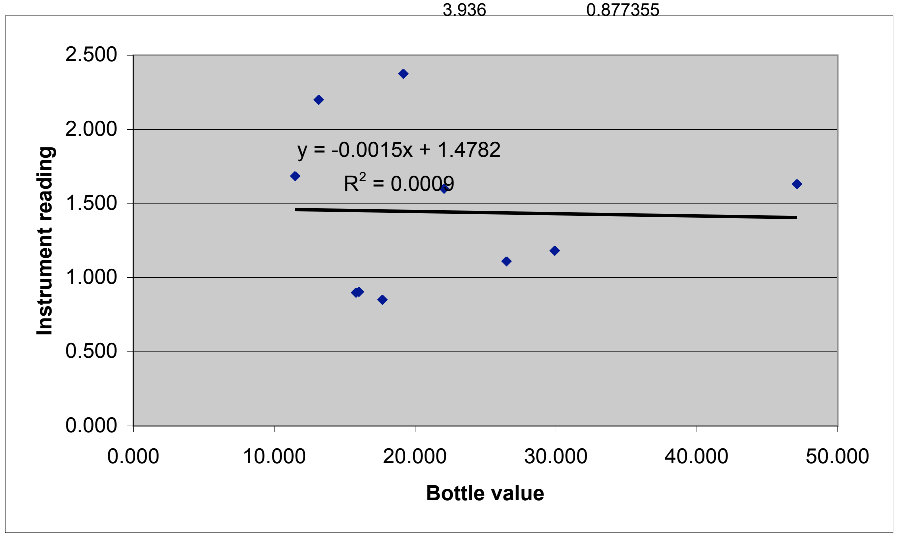


Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration using bottle samples

Date form completed	2/9/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	16	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	25/8/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.2531	R-squared
Slope mV/ unit from previous calibration	6.20E-03	

	Bottle Readings	Minipack Readings
1	22.049	1.602
2	29.908	1.182
3	19.171	2.374
4	26.481	1.113
5	47.103	1.632
6	16.014	0.906
7	17.678	0.850
8	15.817	0.898
9	11.498	1.687
10	13.167	2.201
	3.936	0.877355



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	2/9/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Date last calibrated by user	25/8/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	3.12 Low
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	127.9	6.2	20.4
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	127.93	6.188	20.38933333
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

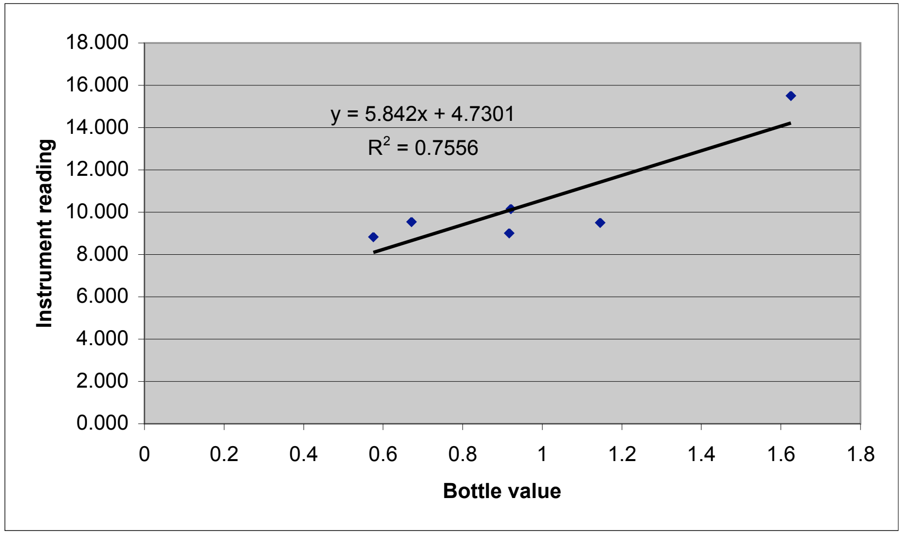
	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	1.3	2.7	45.1
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	1.325833333	2.69	45.1256
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	126.6041667	3.498	38.9376
Slope mV/ unit			

ctgqa13.xls 2September04

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	2/9/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	25/8/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.9328 R-squared
Slope mV/ unit from previous calibration	3.6281

	Bottle Readings	Minipack Readings
1	1.146	9.514
2	0.917	9.010
3	0.671	9.554
4	0.575	8.830
5	0.921	10.164
6	1.625	15.513
7		
8		
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	2/9/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	25/8/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	25/8/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	16
Date windows last cleaned	25/8/04
Date calibration last checked	25/8/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	25/8/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	25/8/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa14.xls 16September04

CALIBRATION REPORT FORM

Route 6 NERC-SOC Southampton - Cowes

DATE	16/9/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

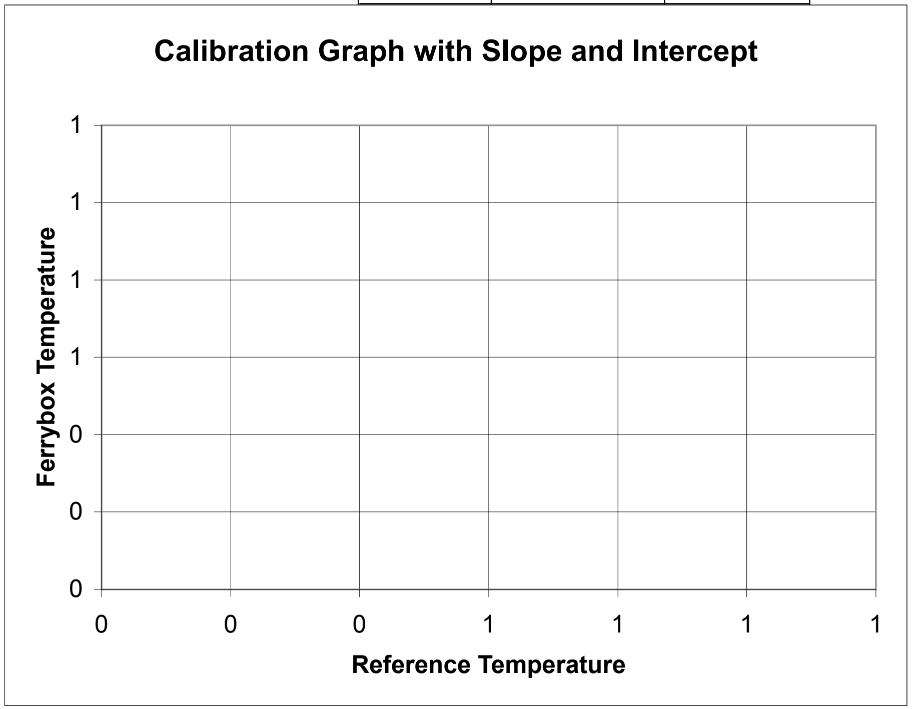
Route 6 NERC-SOC Southampton - Cowes

Temperature Calibration

Date form completed	16/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



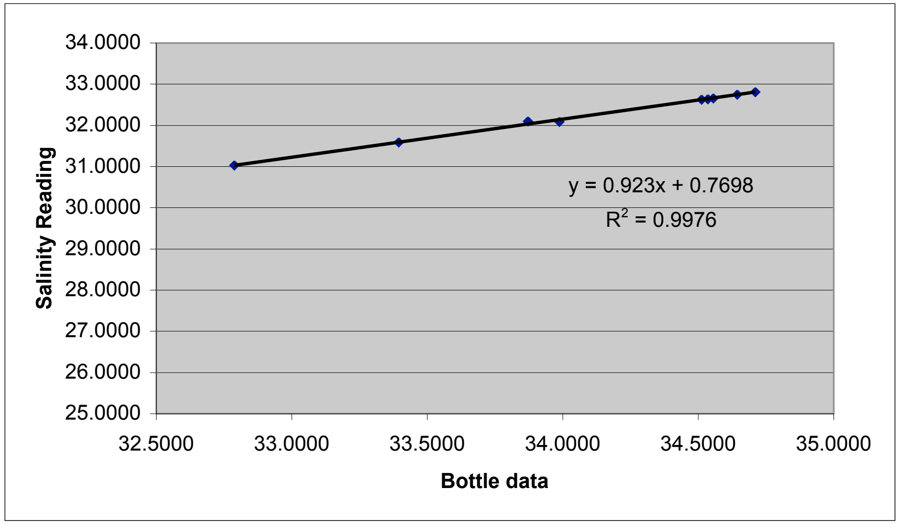
Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration using bottle samples

Date form completed	16/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	2/9/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 0.9396

	Bottle Readings	Salinometer Readings
1	33.9870	32.0848
2	34.5560	32.6623
3	34.6440	32.7508
4	34.5130	32.6252
5	34.7100	32.8101
6	34.5360	32.6348
7	33.8710	32.0954
8	33.3950	31.5905
9	32.7880	31.0271
10		
11		
12		



Route 6 NERC-SOC Southampton - Cowes

Salinity Calibration with cleaning

Date form completed	16/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning n/a

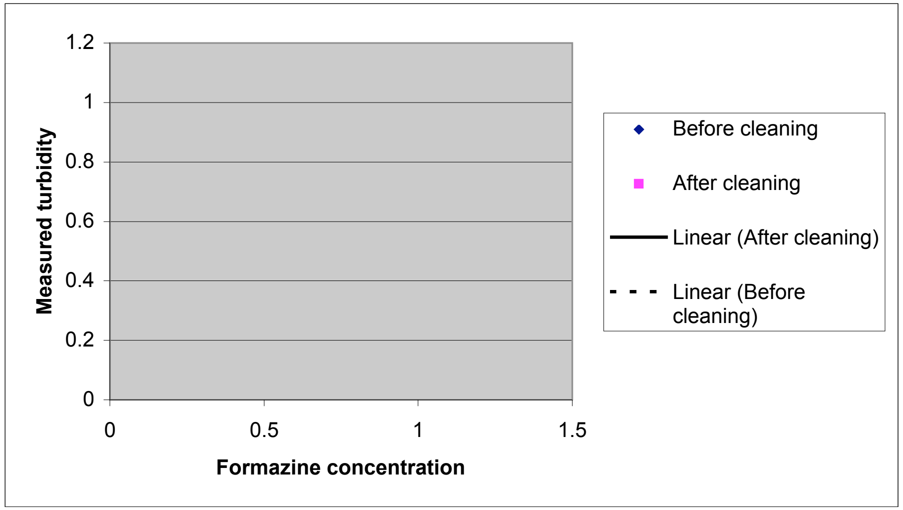
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration by Formazine

Date form completed	16/9/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	16
Frequency of user calibration check	Quarterly
Units of measurement	FTU
Date last calibrated by user	
Checked today by (Name)	mch
Description of calibration Standard	In situ Formazine
Description of calibration Blank	Formazine 1014 FTU dilutions
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning	**Before cleaning**	After cleaning
	Formazine concentration	Measured turbidity	Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

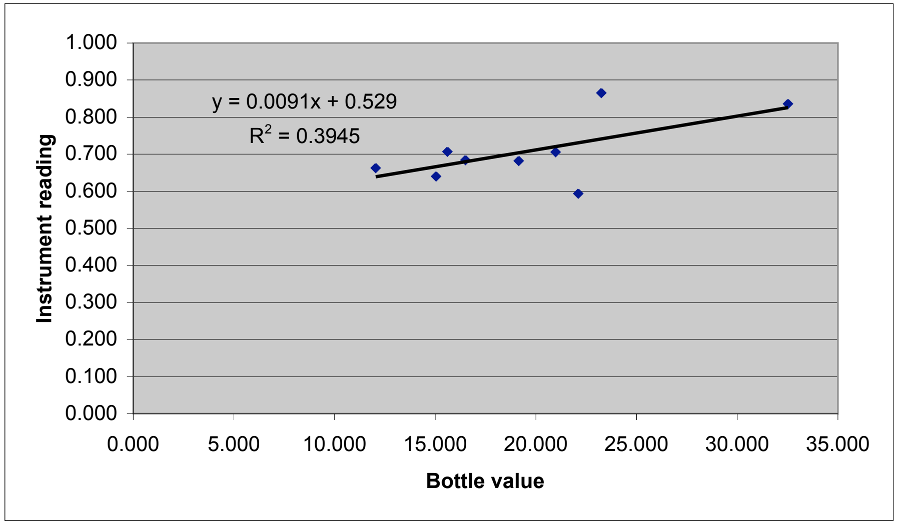


Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration using bottle samples

Date form completed	16/9/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	16	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	2/9/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.0009	R-squared
Slope mV/ unit from previous calibration	-1.50E-03	

	Bottle Readings	Minipack Readings
1	22.105	0.594
2	19.149	0.682
3	20.979	0.706
4	32.526	0.836
5	23.247	0.865
6	16.491	0.684
7	12.035	0.663
8	15.614	0.707
9	15.036	0.641
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	16/9/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	16
Date last calibrated by user	2/9/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	2.69 Low
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

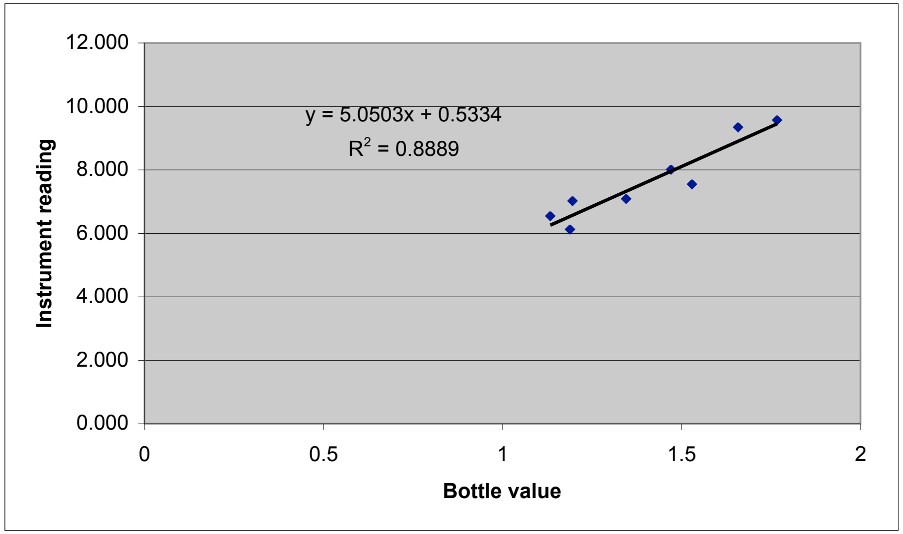
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1		3.7	31.5
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	3.663846154	31.54909091
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1		2.9	45.1
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	0	2.9	45.1
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	0	0.763846154	41.43615385
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	16/9/04	
Manufacturer	CTG	
Model	Minipack	
Serial number	21011	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	16	
Frequency of user calibration check	weekly	
Units of measurement	_g Chlorophyll-a /litre	
Date last calibrated by user	2/9/04	
Checked today by (Name)	mch	
Description of calibration Standard	Chl-a in acetone	
Description of calibration Blank		
Mean from previous calibration		
Std Dev from previous calibration	0.7556	R-squared
Slope mV/ unit from previous calibration	5.842	

	Bottle Readings	Minipack Readings
1		
2	1.346	7.092
3	1.188	6.124
4	1.529	7.552
5	1.133	6.546
6	1.196	7.024
7	1.471	8.013
8	1.767	9.573
9	1.658	9.351
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	16/9/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	2/9/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	2/9/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	16
Date windows last cleaned	2/9/04
Date calibration last checked	2/9/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	16
Date calibration last checked	2/9/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	2/9/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

ctgqa15.xls 23September04

CALIBRATION REPORT FORM

Route 6 NERC-SOC Southampton - Cowes

DATE	23/9/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form Page 2

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

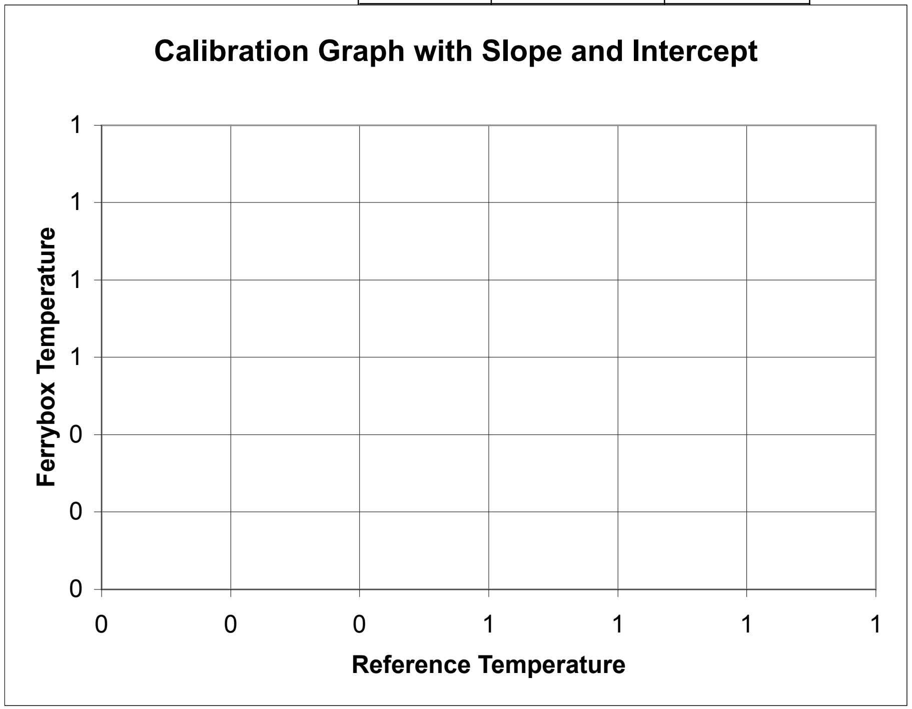
7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

ctgqa15.xls 23September04

Route 6 NERC-SOC Southampton - Cowes Page 3
Temperature Calibration

Date form completed	23/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	
Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			

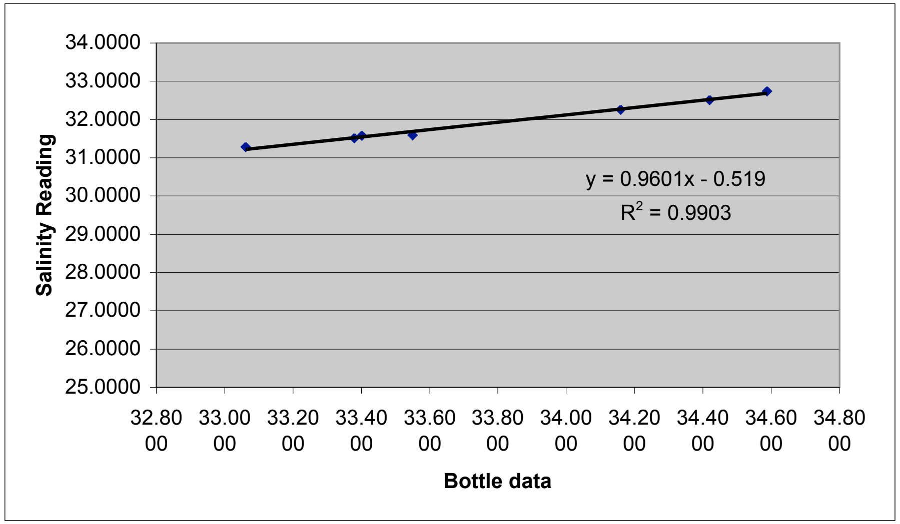


Route 6 NERC-SOC Southampton - Cowes Page 4
Salinity Calibration using bottle samples

Date form completed	23/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	16/9/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 0.923

	Bottle Readings	Salinometer Readings
1	34.5880	32.7386
2	34.4190	32.5126
3	34.1590	32.2612
4	33.5500	31.5866
5	33.3800	31.5181
6	33.4020	31.5807
7	33.0620	31.2830
8		
9		
10		
11		
12		



ctgqa15.xls 23September04

Route 6 NERC-SOC Southampton - Cowes Page 5
Salinity Calibration with cleaning

Date form completed	23/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	Before cleaning	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	After cleaning	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

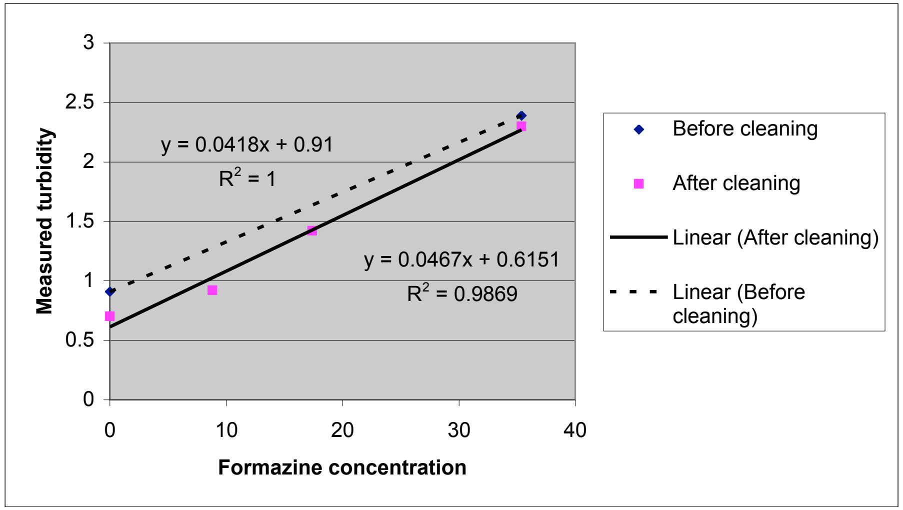
Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration by Formazine

Date form completed	23/9/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	Quarterly
Units of measurement	FTU
Date last calibrated by user	first cal
Checked today by (Name)	mch
Description of calibration Standard	In situ Formazine
Description of calibration Blank	Formazine 1014 FTU dilutions
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning Formazine concentration	**Before cleaning** Measured turbidity	After cleaning Measured turbidity
1	0	0.91	0.700
2	8.83		0.920
3	17.4		1.420
4	35.4	2.39	2.300
5			
6			
7			
8			
9			
10			

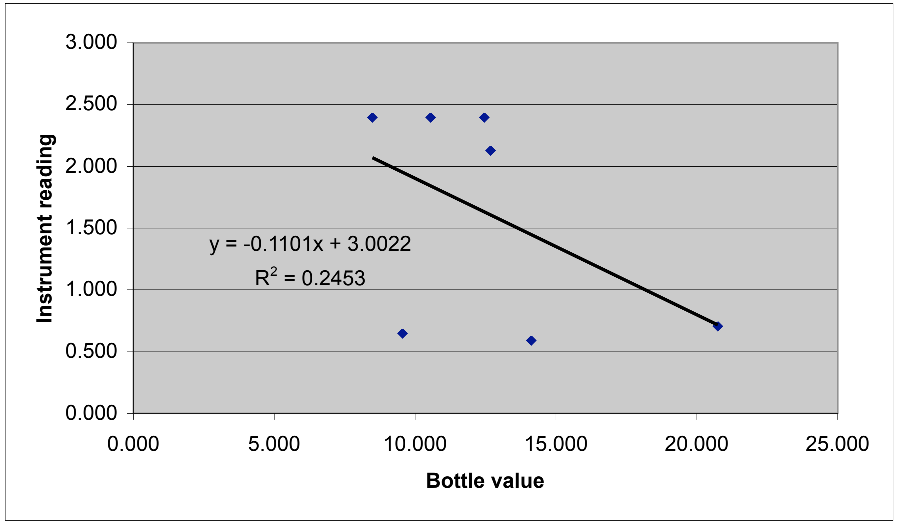


Route 6 NERC-SOC Southampton - Cowes

Turbidity Calibration using bottle samples

Date form completed	23/9/04	
Manufacturer	CTG	
Model	Minitracka	
Serial number	175250	
Date last calibrated by manufacturer	13/5/03	
Calibration life remaining (months)	15	
Frequency of user calibration check	weekly	
Units of measurement	mgl^{-1}	
Date last calibrated by user	16/9/04	
Checked today by (Name)	mch	
Description of calibration Standard	Gravimetric	
Description of calibration Blank	Suspended	Solids
Mean from previous calibration		
Std Dev from previous calibration	0.3945	R-squared
Slope mV/ unit from previous calibration	9.10E-03	

	Bottle Readings	Minipack Readings
1	20.751	0.705
2	12.453	2.395
3	10.556	2.395
4	8.478	2.397
5	12.681	2.129
6	9.558	0.649
7	14.115	0.592
8		
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	23/9/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Date last calibrated by user	
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	2.9 Low Standard
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

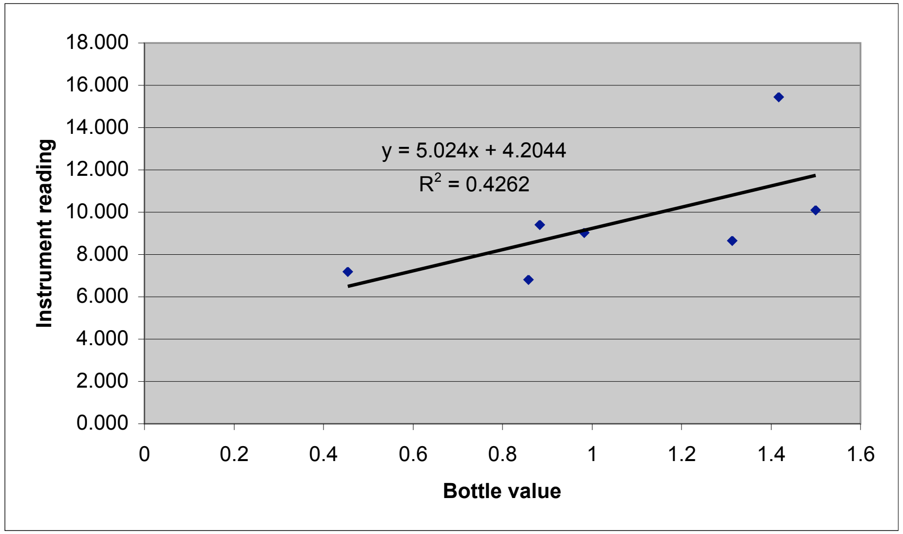
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	40.9	3.3	22.5
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	40.93733333	3.256	22.52666667
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	2.2	2.9	44.2
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	2.231538462	2.867857143	44.19142857
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	38.70579487	0.388142857	40.93542857
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	23/9/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	16/9/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.8889 R-squared
Slope mV/ unit from previous calibration	5.0503

	Bottle Readings	Minipack Readings
1	0.858	6.818
2	0.883	9.406
3	0.983	9.029
4	1.417	15.444
5	1.5	10.106
6	1.313	8.658
7	0.454	7.188
8		
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	23/9/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	16/9/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	16/9/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	15
Date windows last cleaned	16/9/04
Date calibration last checked	16/9/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	16/9/04
Standard used for calibration check	Chla in acetone
Date windows last cleaned	16/9/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM

Route 6 NERC-SOC Southampton - Cowes

DATE	30/9/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

1) The completed forms must be sent to CTG at the end of each month. Sections relating to instruments calibrated less frequently are to be left blank as appropriate.

2) Check the details on page 1. These should generally stay the same and can be copied into future forms.

3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

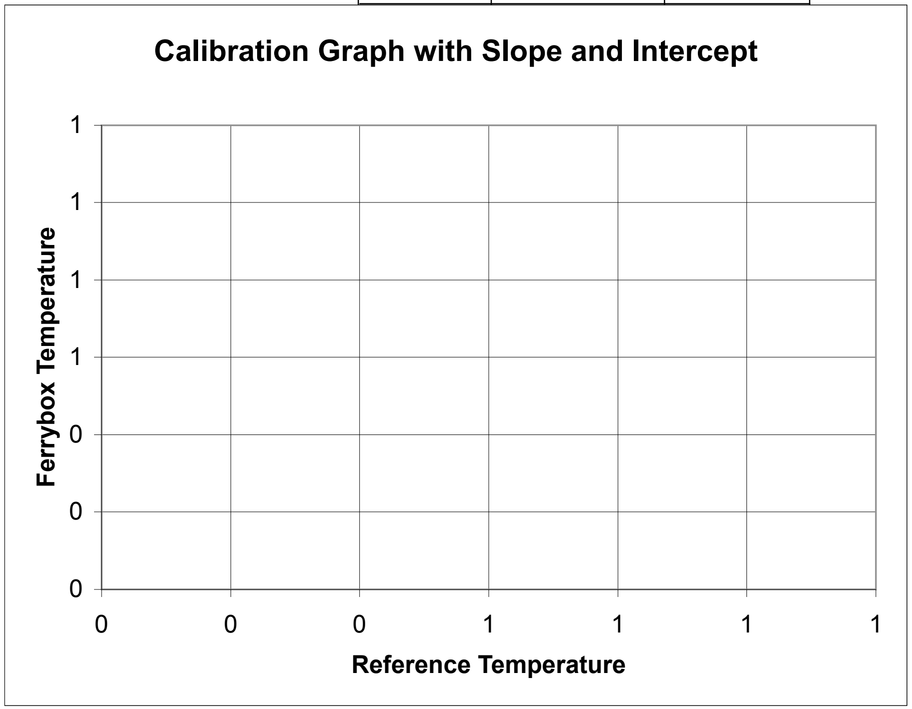
ctgqa16.xls 30September04

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	30/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes Page 4

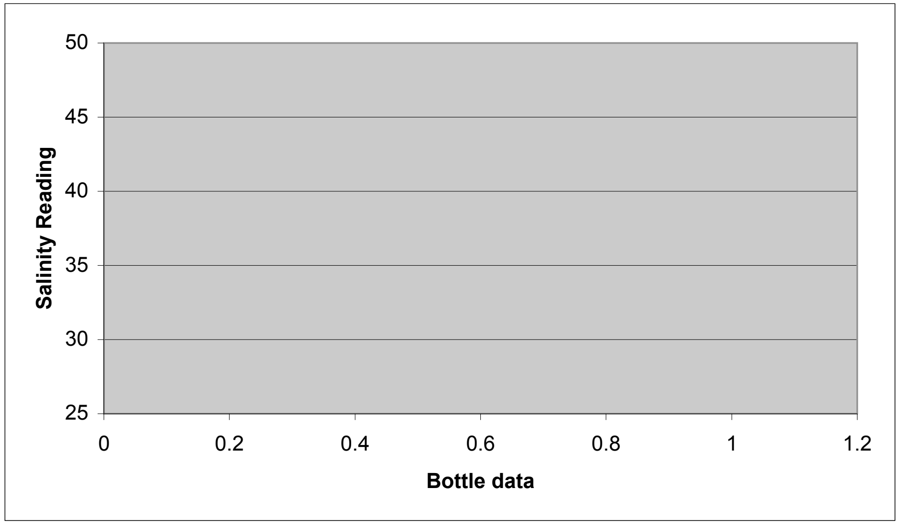
Salinity Calibration using bottle samples

Date form completed	30/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	23/9/04
Checked today by	mch

Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu

Slope mV/ unit from previous calibration 0.9601

	Bottle Readings	Salinometer Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		



ctgqa16.xls 30September04

Route 6 NERC-SOC Southampton - Cowes Page 5

Salinity Calibration with cleaning

Date form completed	30/9/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch

Description of calibration Standard	See page 4
Description of calibration Blank	See page 4

Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

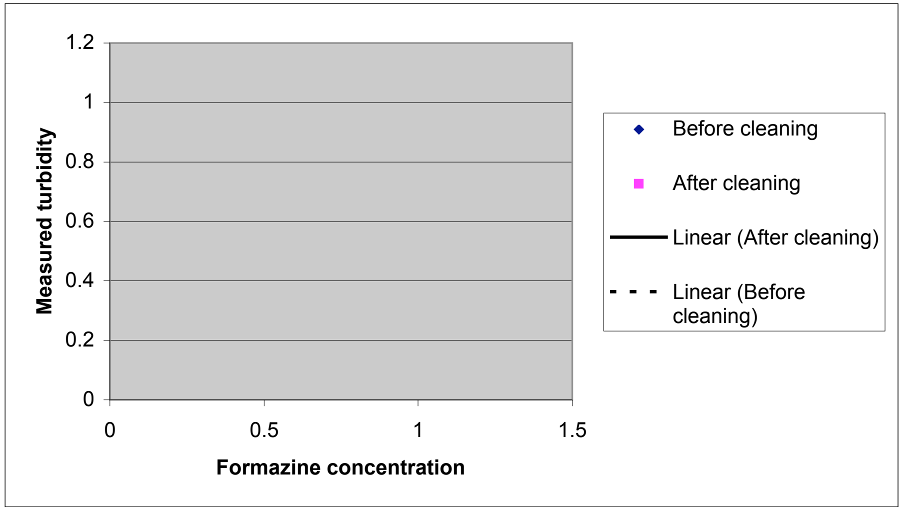
After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes Page 6
Turbidity Calibration by Formazine

Date form completed	30/9/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	Quarterly
Units of measurement	FTU
Date last calibrated by user	23/9/04
Checked today by (Name)	mch
Description of calibration Standard	In situ Formazine
Description of calibration Blank	Formazine 1014 FTU dilutions
Mean from previous calibration	
Std Dev from previous calibration	0.9869 R-squared
Slope mV/ unit from previous calibration	0.0467

	Before cleaning Formazine concentration	**Before cleaning** Measured turbidity	After cleaning Measured turbidity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

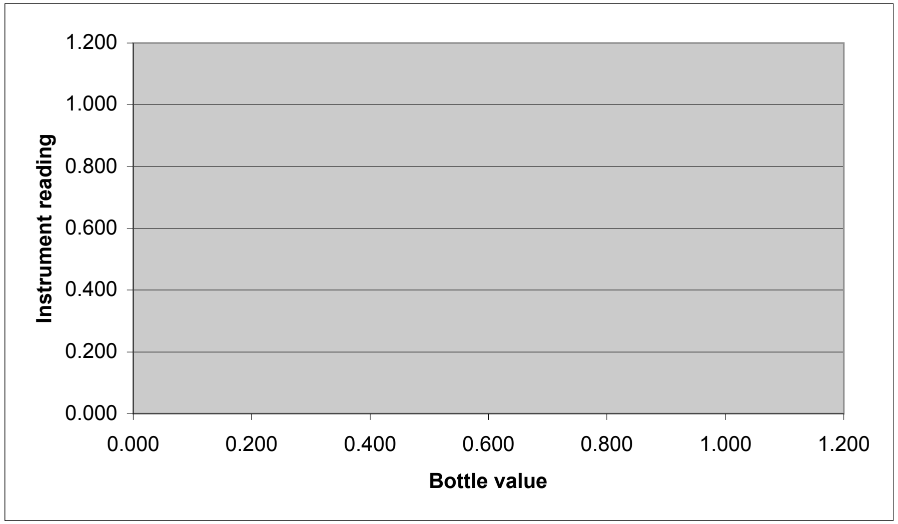


ctgqa16.xls 30September04

Route 6 NERC-SOC Southampton - Cowes Page 7
Turbidity Calibration using bottle samples

Date form completed	30/9/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	mgl^{-1}
Date last calibrated by user	23/9/04
Checked today by (Name)	mch
Description of calibration Standard	Gravimetric
Description of calibration Blank	Suspended Solids
Mean from previous calibration	
Std Dev from previous calibration	0.2453
Slope mV/ unit from previous calibration	-0.1101

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	30/9/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Date last calibrated by user	23/9/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	2.868 Low Standard
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	14.4	15.8	21.3
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	14.409	15.78666667	21.295
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

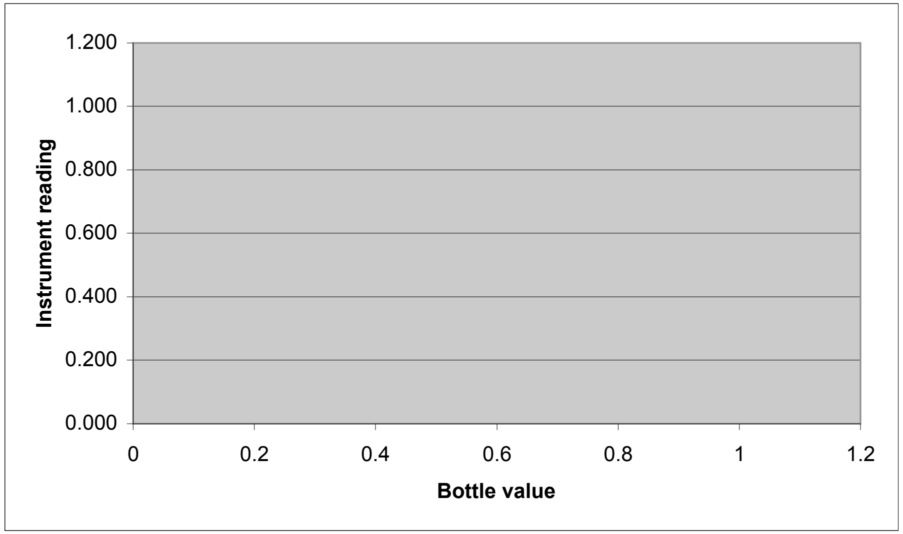
	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	15.9	2.9	37.5
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	15.9325	2.88	37.5275
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	-1.5235	12.90666667	21.74083333
Slope mV/ unit			

ctgqa16.xls 30September04

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	30/9/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	27/10/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.4262 R-squared
Slope mV/ unit from previous calibration	5.024

	Bottle Readings	Minipack Readings
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	30/9/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	23/9/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	23/9/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	15
Date windows last cleaned	23/9/04
Date calibration last checked	23/9/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	23/9/04
Standard used for calibration check	Chl-a in acetone
Date windows last cleaned	23/9/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	

FERRYBOX

CALIBRATION FORMS
FOR CORE SENSORS

2005-006-PQ

Issue B

Approved:		John Attridge
Checked:		Bill Neal
Originated:		Elliott
Issue	**ECO**	**Date**
A	Original Issue	6/8/04

CALIBRATION REPORT FORM

Route 6 NERC-SOC Southampton - Cowes

DATE	13/10/04
Name of Member Organisation	National Environment Research Council Southampton Oceanography Centre
Contact name	Dr David Hydes
Email address	djh@soc.soton.ac.uk
Telephone number	+44 2380 596 547
Address	Southampton Oceanography Centre Waterfront Campus Empress Docks SO14 3ZH Southampton Oceanography Centre Great Britain
Name of Ferry ship deployed	Red Falcon
Ferry operator	Red Funnel Lines
Travel time	
Frequency of sailings	8 per day
Depth of water intake	5 metres

Contents Page

Instructions for using the Calibration Form

At the end of each month complete this Excel form and email to;
jelliott@chelsea.co.uk

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3) Add the date for this months submission on page 1

4) Turbidity and Chlorophyll Sensors
Enter date of testing at the top of each page completed
Use page 6 for turbidity calibration with formazine
Use page 7 for turbidity calibration using bottle samples
Use page 8 for fluorimeter calibration using plastic block
Use page 9 for fluorimeter calibration with bottle samples
The standard and blank are measured before and after cleaning the sensor in manually cleaned systems
If there is a significant difference, it means that the previous data was degraded by the fouling and may not be valid.
If the system is automatically cleaned, only provide the after-cleaning data
The blank and standard readings should be taken at 10 second intervals to check drift and stability.
The mean and standard deviation are calculated automatically by the spreadsheet after values are entered
Until values are entered, #DIV/0! shows.

5) Temperature Sensor
Enter date of testing at top of page
For the annual temperature probe calibration, the probe reading should be compared with a calibrated standard temperature probe at several different temperatures. This can be achieved with a temperature controlled water bath.

6) Salinity measurements
Enter date of testing at top of page
Salinity is derived from conductivity, temperature and depth, so errors will be in combination.
Note Values may be different inside Ferrybox container than on bench due to metal proximity and plastic walls.
Use page 4 for bottle sample data
Use page 5 for data with cleaning
Calibration should be conducted inside flow cell to check for these effects.
10 consecutive readings are made at 10 second intervals to check for drift and stability.

7) Manufacturer/ laboratory calibration log
Use page 10 to keep track of manufacturer/laboratory instrument calibrations and when they are due.

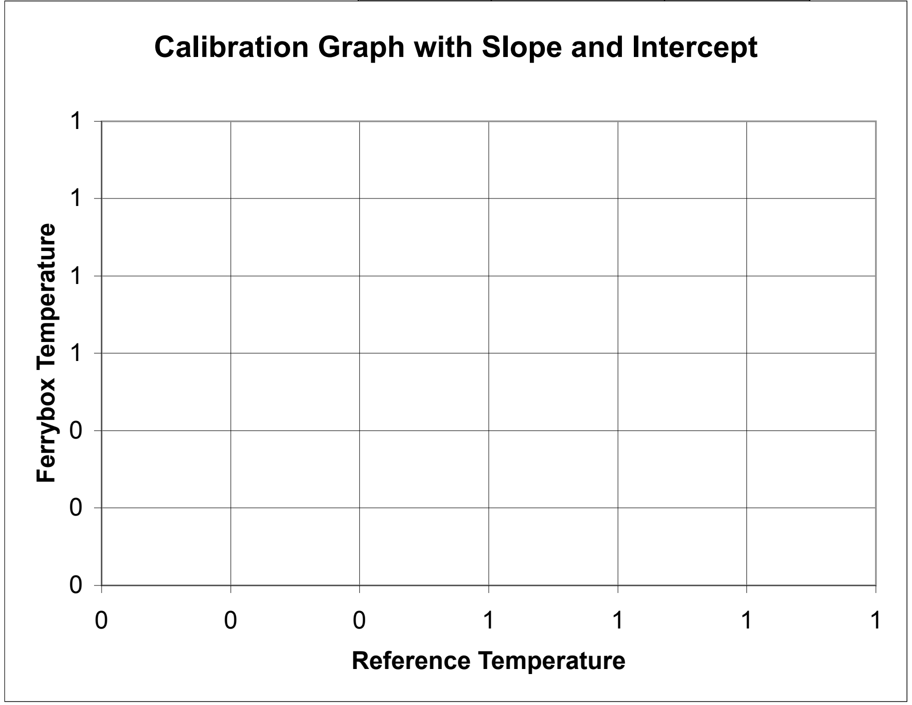
ctgqa17.xls 13October04

Route 6 NERC-SOC Southampton - Cowes
Temperature Calibration

Date form completed	13/10/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	
Units of measurement	Centigrade
Date last calibrated by user(if applicable)	

Checked today by	
Model of reference thermometer	standard PRT
Date of last manufacturer calibration of reference thermometer	ref CTG

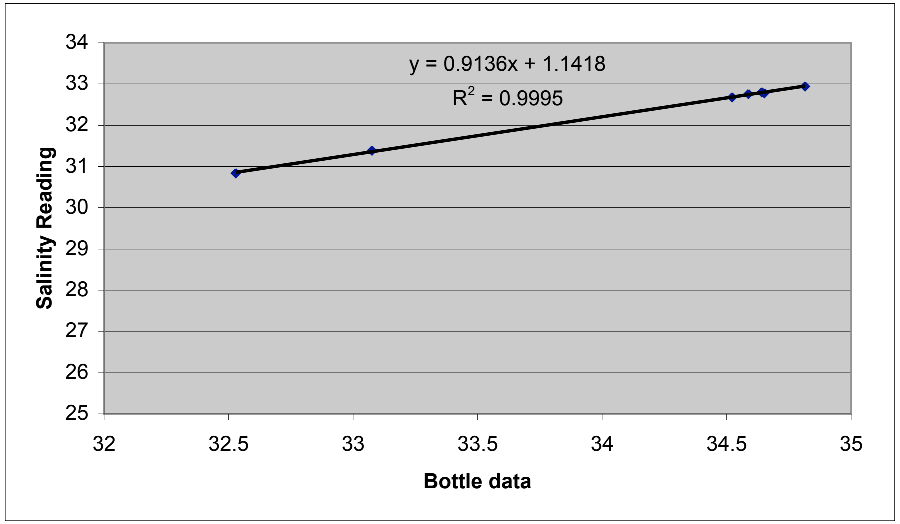
	Reference temperature	Ferrybox temperature	Difference
1			
2			
3			
4			
5			



Route 6 NERC-SOC Southampton - Cowes
Salinity Calibration using bottle samples

Date form completed	13/10/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	23/9/04
Checked today by	mch
Calibrated against	Guildline Salinometer
Type of standard	OSI 33 psu
Slope mV/ unit from previous calibration	0.9601

	Bottle Readings	Salinometer Readings
1	34.587	32.75833825
2	34.642	32.79636802
3	34.814	32.93990778
4	34.651	32.78027885
5	34.522	32.6817622
6	34.005	
7	33.075	31.38711119
8	32.528	30.83851203
9		
10		
11		
12		



Route 6 NERC-SOC Southampton - Cowes
Salinity Calibration with cleaning

Date form completed	13/10/04
Manufacturer	CTG
Model	Minipack
Serial number	210011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	PSU
Date last calibrated by user(if applicable)	
Checked today by	mch
Description of calibration Standard	See page 4
Description of calibration Blank	See page 4
Mean from previous calibration	
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

Before cleaning	Blank (fresh) Readings	**Before cleaning**	Standard (sea water) Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std Dev	#DIV/0!	Std Dev	#DIV/0!

After cleaning	Blank Readings	**After cleaning**	Standard Readings
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Mean	0	Mean	0
Std dev	#DIV/0!	Std dev	#DIV/0!

Difference before & after cleaning	n/a		
Mean Blank	0	Mean standard	0
Slope mV/ unit			

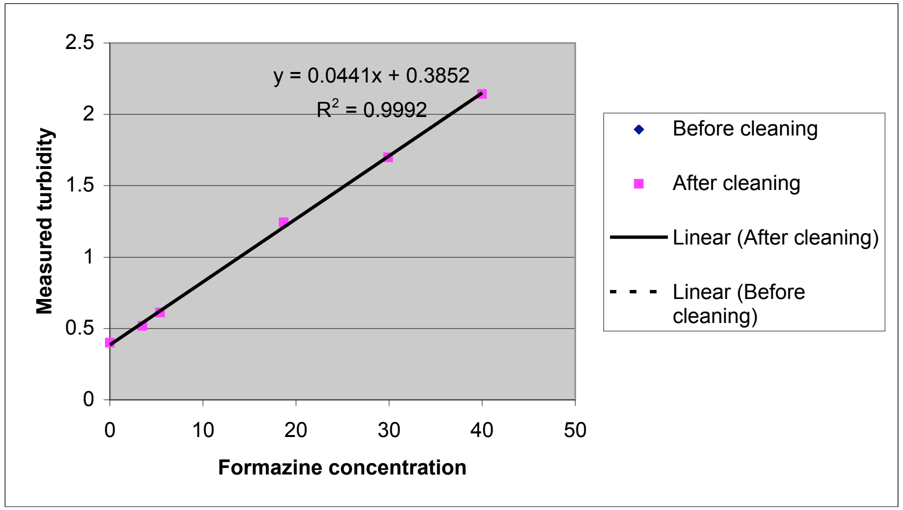
Route 6 NERC-SOC Southampton - Cowes
Turbidity Calibration by Formazine

Date form completed	13/10/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	Quarterly
Units of measurement	FTU
Date last calibrated by user	23/9/04
Checked today by (Name)	mch

Description of calibration Standard	In situ Formazine
Description of calibration Blank	Formazine 1014 FTU dilutions

Mean from previous calibration		
Std Dev from previous calibration	0.9869	R-Squared
Slope mV/ unit from previous calibration	0.0467	

	Before cleaning	**Before cleaning**	After cleaning
This is dummy data Please insert your own	Formazine concentration	Measured turbidity	Measured turbidity
1	0		0.399
2	3.5		0.517
3	5.4		0.612
4	18.7		1.244
5	29.9		1.698
6	40		2.142
7			
8			
9			
10			



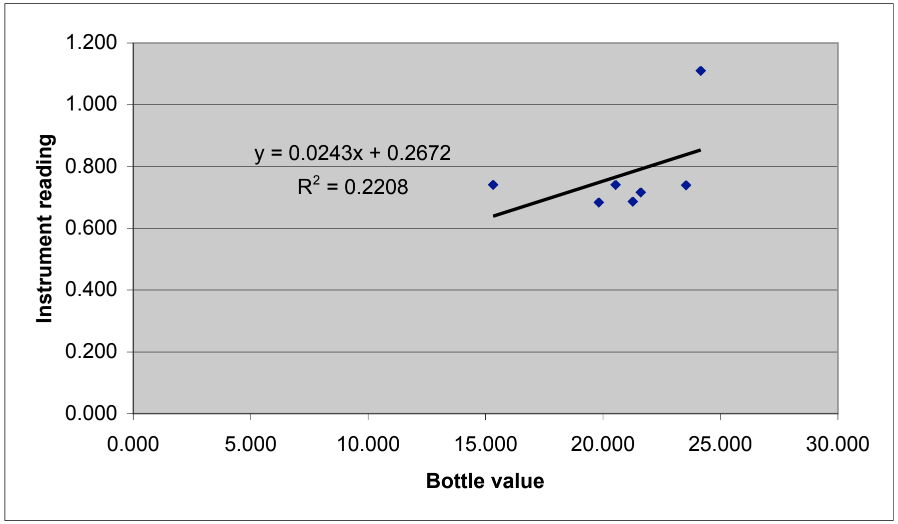
Route 6 NERC-SOC Southampton - Cowes
Turbidity Calibration using bottle samples

Date form completed	13/10/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	mgl^{-1}
Date last calibrated by user	23/9/04
Checked today by (Name)	mch

Description of calibration Standard	Gravimetric
Description of calibration Blank	Suspended Solids

Mean from previous calibration		
Std Dev from previous calibration	0.2453	R-squared
Slope mV/ unit from previous calibration	-0.1101	

	Bottle Readings	Minipack Readings
1	24.156	1.110
2	21.603	0.717
3	21.261	0.687
4	19.813	0.684
5	23.529	0.740
6	15.317	0.741
7	20.536	0.741
8		
9		
10		



Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using plastic blocks

Date form completed	13/10/04
Manufacturer	CTG
Model	Minipack
Serial number	21011
Date last calibrated by manufacturer	31/10/03
Calibration life remaining (months)	15
Date last calibrated by user	23/9/04
Frequency of user calibration check	weekly
Checked today by (Name)	mch
Units of measurement	_g Chlorophyll-a /litre
Specification accuracy	not known
Concentration of calibration Standard	0, Low & High
Description of calibration Blank	solid state chlorophyll blocks
Mean from previous calibration	2.88 Low Standard
Std Dev from previous calibration	
Slope mV/ unit from previous calibration	

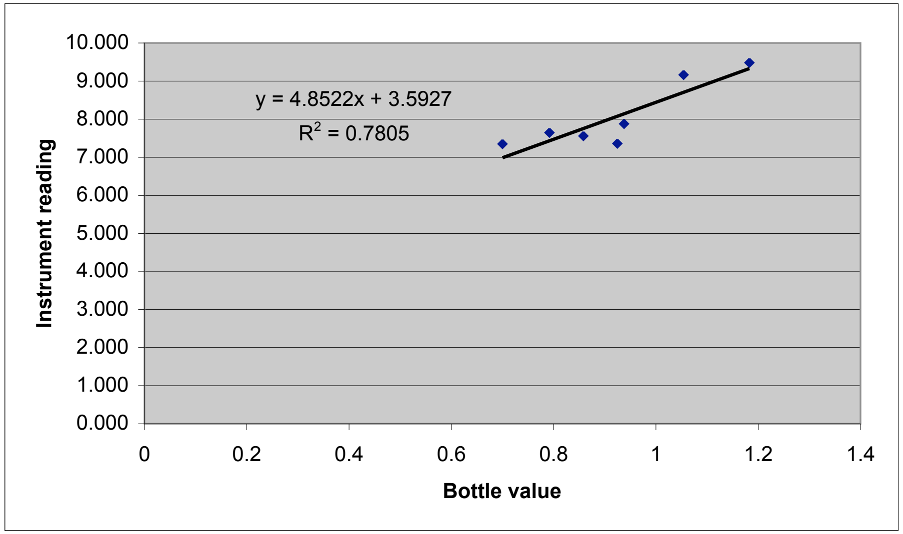
	Before cleaning Blank Readings	Before cleaning Low Standard Readings	Before cleaning High Standard Readings
1	125.0	9.0	36.0
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	125.01375	9	36.028
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!

	After cleaning Blank Readings	After cleaning Low Standard Readings	After cleaning High Standard Readings
1	4.6	2.7	44.9
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	4.605	2.741	44.89166667
Std Dev	#DIV/0!	#DIV/0!	#DIV/0!
Difference before & after cleaning	Mean Blank	Mean low standard	Mean high standard
	120.40875	6.259	35.89166667
Slope mV/ unit			

Route 6 NERC-SOC Southampton - Cowes
Fluorimeter Calibration using bottle samples

Date form completed	13/10/04
Manufacturer	CTG
Model	Minitracka
Serial number	175250
Date last calibrated by manufacturer	13/5/03
Calibration life remaining (months)	15
Frequency of user calibration check	weekly
Units of measurement	_g Chlorophyll-a /litre
Date last calibrated by user	30/9/04
Checked today by (Name)	mch
Description of calibration Standard	Chl-a in acetone
Description of calibration Blank	
Mean from previous calibration	
Std Dev from previous calibration	0.4262 R-squared
Slope mV/ unit from previous calibration	5.024

	Bottle Readings	Minipack Readings
1	0.938	7.877
2	0.925	7.362
3	0.858	7.561
4	0.792	7.648
5	0.7	7.345
6		
7	1.054	9.168
8	1.183	9.485
9		
10		



CALIBRATION REPORT FOR FERRYBOX ROUTE 6

DATE FORM COMPLETED:	13/10/04

Temperature Sensor	
Type	Minipack
Serial Number	210011
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	23/9/04
Standard used for calibration check	bottle salinity

Conductivity (Salinity) Sensor	
Type	Minipack 2994
Serial Number	210011/ 6386
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	23/9/04
Standard used for calibration check	bottle salinity

Turbidity Sensor	
Type	Minitracka
Serial Number	175250
Date of last calibration	13/5/03
Emission Wavelength	470nm
Excitation Wavelength	470nm
Calibration life remaining	15
Date windows last cleaned	30/9/04
Date calibration last checked	23/9/04

Chlorophyll *a* Sensor	
Type	Minipack
Serial Number	210011
Emission Wavelength	685nm
Excitation Wavelength	430nm
Date of last calibration	31/10/03
Calibration life remaining	15
Date calibration last checked	30/9/04
Standard used for calibration check	Blocks
Date windows last cleaned	30/9/04

Flow Through System	
Frequency of flushing	
Date last flushed	

Inspected by	

Signed	