OC469 Cruise Report
Draft 10/23/10

Contents

1. Introduction

The diazotroph *Trichodesmium* spp. constitutes a major pathway of nitrogen flow into marine planktonic ecosystems, but estimates of its impact on global nitrogen budgets vary widely. Sampling is made difficult by the fragility of the organism with the consequence that *Trichodesmium* spp. are difficult to manipulate in both field and laboratory experiments. Optical methods that sample the organism nondestructively are thus appealing. A recent transatlantic survey using the Video Plankton Recorder (VPR) revealed unexpectedly high abundance of *Trichodesmium* spp. at depth, suggesting the vertical distribution of the organism within the euphotic zone may be more uniform than previously thought (Davis and McGillicuddy, 2006). Application of a simple bio-optical model of productivity to the observed profile of abundance suggests the depth-integrated nitrogen fixation rate could be three to five times higher than that based on the canonical profile of exponential decrease in abundance with depth.

The unexpected vertical distribution of *Trichodesmium* spp. reported in Davis and McGillicuddy (2006) came from an area in which its overall abundance is relatively low, near the northern periphery of its geographic range. If this same vertical distribution is also present in the high-abundance regions further to the south, and the deep populations of *Trichodesmium* spp. are actively fixing nitrogen, the implications for the nitrogen budget would be substantial. This leads us to the following key questions motivating this study:

(1) Is the vertical distribution of *Trichodesmium* spp. in the high abundance region of the tropical Atlantic similar to that reported in Davis and McGillicuddy (2006) for the northern Sargasso Sea?

(2) How does the distribution of *Trichodesmium* spp. vary over a continuum of scales spanning 1-1000km in the tropical and subtropical Atlantic?

(3) Is the reported association of local *Trichodesmium* spp. maxima with anticyclones robust? Does this association provide clues to the physical, chemical, and biological factors regulating abundance of the organism?

(4) Are the deep populations of *Trichodesmium* spp. actively fixing nitrogen?

(5) What is the impact of *Trichodesmium* spp. populations on net biogeochemical fluxes?

2. Cruise Synopsis

R/V *Oceanus* Voyage #469 was the first of two cruises designed to answer these questions. The survey track (Figure 1) began with a meridional section from Bermuda to Puerto Rico that transects the gradient in *Trichodesmium* spp. separating the relatively low-abundance region in the central Sargasso Sea from the high-abundance region in the southern limb of the subtropical gyre. This particular section has the added benefit of ancillary data from the BATS validation cruises that have occupied this section numerous times in the past, as well as an occupation that is nearly concurrent with this cruise (October 18-28, 2010). The second segment of the survey runs southeast through the high-abundance region that has been sampled in prior studies. The final segment from east to west provided another cut through the high-abundance region, with the ship making port in Barbados.

A variety of data streams facilitated adaptive sampling during the cruise. Near-real-time altimetric data (Leben et al., 2002) allowed us to target several eddy features along our survey track. Altimetric information was supplemented with shipboard VPR, ADCP, and XBT observations to determine the precise location of eddy features. Our adaptive sampling strategy was further augmented with a satellite ocean color proxy for the probability of *Trichodesmium* spp. blooms (Westberry and Siegel, 2006; Westberry et al., 2005), kindly provided by Toby Westberry (Figure 2).

Daily station work typically consisted of three standard casts: (1) pump profiles to collect organisms for nitrogen fixation incubations and gene expression assays, (2) Niskin bottle profiles of the upper 80m, with samples gravity filtered for microscopic cell counts and qPCR, and (3) hydrographic profiles of the upper 700m to measure nutrients, chlorophyll, and alkaline phosphotase activity. A color digital VPR and holocam were affixed to the CTD rosette to provide profiles of plankton images on each cast. A typical station schedule is provided in Appendix B. A table of station identifiers is included as Appendix C. See Appendix D for plots of all CTD casts.

3. Sampling overview

A total of 16 hydrographic stations were occupied, each consisting of one or more CTD casts (Figure 1). The initial station took place in transit between WHOI and BATS, northwest of Bermuda. Our roughly-meridional transect began with station #2 at BATS, which at the time was subject to northeastward flow on the southern flank of a cyclonic eddy (Figure 2). We then proceeded south with a VPR/XBT section through anticyclonic eddy AC1 to the periphery of cyclonic eddy C1. Although the survey track appears displaced from the center of AC1, this is due to westward propagation of the feature from the time of our survey to the central time of the altimetric analysis presented in Figure 2. A zoomed view of AC2 with an altimetric analysis for that particular time (Figure 3) reveals near-zero velocities were observed in the transect, indicating close approach to eddy center. Depression of the main thermocline and a warm temperature anomaly in the upper ocean (Figure 4) confirm this feature as a regular anticyclone (rather than a mode-water eddy). VPR Survey 1 (Figure 5) reveals a relatively saline water mass in the interior of the eddy and a subsurface fluorescence maximum that is deep and weak.

Upon completion of VPR/XBT Survey 1, station 3 was occupied on the northeast flank of cyclone C1. Formation and intensification of hurricane Otto required evasive maneuvers to the northwest, putting us on the northern flank of C1, where stations 4 and 5 were occupied. When

conditions improved, we undertook VPR/XBT Survey 2 (Figure 6) through cyclone C1 to the northeast flank of AC2. ADCP velocity vectors reveal the cyclonic rotation of C1 (Figure 2), and XBT measurements show characteristic uplift of the main thermocline (Figure 4). VPR data indicate relatively fresh waters in the interior of the cyclone, with enhanced fluorescence on the periphery of the eddy. Following completion of VPR/XBT survey 2, station 6 was occupied on the northeast flank of anticyclone AC2. Station 7 was occupied on the eastern flank of cyclone C2, and station 8 in the interior of cyclone C3 (Figure 2).

VPR/XBT Survey 4 began in the center of cyclone C3, proceeded through AC3, and ended in AC4 (Figure 7-9). VPR data reveal elevated fluorescence at the periphery of C3. VPR-based *Trichodesmium* estimates suggest low concentration in AC3, coincident with a fresh salinity anomaly in the upper ocean (S=35 at eddy center). The fluorescence peak at the base of the euphotic zone seems to be driven by rod-shaped diatoms. Given the low abundance of *Trichodesmium* we decided to abandon station work in favor of continued surveying. *Trichodesmium* concentrations continued low for most of the VPR survey except for a small patch of salty water southeast of AC3. Surface salinities very low overall, down to 34. Station 9 occupied at the center of AC4 in very low *Trichodesmium* abundance, not enough to justify a pump station.

As we proceeded southeast along our survey track, salinity rose to near 35 and *Trichodesmium* abundance increased. Net tows and surface pumps at station 10 yielded the biggest biomass of the trip. This biomass enhancement may coincide with a bloom detected by satellite (Figure 10). Stations 11 and 12 along that same transect contained high biomass as well.

A VPR/XBT survey was undertaken between stations 12 and 13 and between 13 and 14 (Figures 11-14). VPR data indicate highest abundance just prior to entering a lens of lower salinity water between stations 12 and 13.

Station 15 took place in low salinity (<33) green water, with very little *Trichodesmium* and lots of diatoms. Surface pump did not yield enough to do incubations, so deep pump was abandoned. Decided to steam back toward salinity front observed between 0200 and 0400GMT Oct 20 (Figure 15, top panel). We stopped at 1630GMT for a net tow on the salty side of the inshore salinity front. *Trichodesmium* had come back, but not high biomass. Proceeded to the offshore front and did a series of 3 CTD casts/net tows (Figure 15, middle panel). CTD48 at the base of the front (S=34.3) was chock-full of *Hemiolus*. *Trichodesmium* was present in moderate amounts in saltier waters of CTD49 and CTD50.

Station 16 occupied on the salty side of the front, at the same position as CTD50. On the way back west, the salinity front was sampled at S=34.5 with a net tow and CTD55 (Figure 15, bottom panel).

4. Initial Findings

Our preliminary conclusions are:

(1) deep *Trichodesmium* populations are actively fixing nitrogen
(2) *Trichodesmium* populations covary with salinity on multiple scales

(3) *Trichodesmium* is more abundant in cyclones (cf. Davis and McGillicuddy, 2006)

(4) *Trichodesmium* co-occurs with dense blooms of Hemiolus at the edge of the Orinoco river plume (cf. Subramaniam et al.)

5. Daily Narrative

Oct 1 – storm delays departure by one day

Oct 2 – early AM in the Gulf Stream; too rough to pump; no cast taken

Oct 3 – too rough to pump; CTD/VPR/Holocam cast to 700m; CTD fluorometer very noisy, suspect interference from VPR strobe. Turned off VPR and did a 100m cast to verify (CTD2).

Oct 4 – Station 1 - pump station (CTD3). Developed large belly in pump hose due to high seas/currents, had to recover with tugger. Very low tricho, did not merit a 700m cast. Repositioning of fluorometer eliminated VPR interference. Incubations with the few tricho caught showed low but measurable N2-fixation rates.

Oct 5 – Station 2 - BATS: 20m pump station yielded low biomass (ca. 2 colonies), called off deep pump. Filled carboys with water from 20m (CTD4). Surface net tow yielded ca. 20 colonies and much more biomass. This is consistent with the fact that the net samples approximately an order of magnitude more volume than the pum: 40 cm net, undulated between the surface and 20m six times, or ca. 28.8 m^3. 700m cast carried out (CTD 5). Proceeding to AC1 at 30N 64W. A-frame hydraulic problem delays VPR deployment, but the VPR went in the water early afternoon. Surveying toward AC1.

Oct 6 – Station 3 - VPR survey completed through AC1 to the edge of C1. Shipboard ADCP reveals anticyclonic rotation of AC1 (Figures 2,3). XBT section (Figure 4) shows sharp depression of the main thermocline as the transect crossed very near the center of the eddy (near-zero velocity in Figure 3). Started hauling back VPR at 0800, CTD/pump (CTD6) in the water by 0900. Surface net tows yielded lots of Tricho, very little in the pump from 20m. Raised pump to 10m, made adjustments to barrel venting, and got enough biomass. Lowered pump to 60m, very little biomass. Recovered CTD/pump and did an 80m cast to collect water for gravity filtration (CTD7). A 700m cast followed (CTD8). Weather conditions dictate a run to the NW, holding at 29N, 66W.

Oct 7 – Station 4 - CTD/VPR/Holocam cast (CTD9) at 0600 to investigate vertical distribution. VPR cast suggest highest concentrations above 20m, lower concentrations below; a relatively few number of images prevents depiction of the details of the profile. Pump station (CTD10) followed by 80m cast for gravity filtration (CTD11) and 700m profile (CTD12). Abby reports N2 fixation rates higher overall than the day before, but this may be related to colony size. The rates will be normalized to carbon back in the lab. N2 fixation rates are similar between surface pump and surface net collections. Rates for the deep pump were only 4% of the surface pump, considerably lower than the day before. Tropical Storm Otto to our south forces us to remain in our holding pattern at 29N, 66W.

Oct 8 – Station 5 – Pump station (CTD13) with new cod end, seems to collect better. 80m cast for gravity filtration (CTD14), followed by 700m cast (CTD15). Still hove to in our holding spot, Otto closest point of approach expected ca. 1400.

Oct 9 – weather conditions improved enough for work to begin. Surface net tows prior to departure; VPR deployed at 0830, surveying through C1 and AC2.

Oct 10 – VPR recovered at 0845 on northern periphery of AC2, pump cast (CTD16) begun at 0900. 80m cast for gravity filtration (CTD17), followed by 700m cast (CTD18). VPR redeployed, flight control failed shortly thereafter. Steaming toward small cyclone C2 for morning operations.

Oct 11- Morning CTD operations at C2– casts CTD19, 20, 21. Proceeded to P1 22° 18'N, 66° 30'W, where Toby Westberry's satellite imagery shows a cluster of hits Oct 3-8, pre-hurricane Otto (Figure 3). A surface net tow yielded approximately the same biomass as prior stations, so we proceeded to C3.

Oct 12 – Morning CTD operations at C3 (Station 8, casts CTD22, 23, 24). Tricho colonies visible at the surface. VPR repaired overnight, deployed at the center of C3 and towed toward AC3. Relatively high Tricho abundance in C3, with a diatom-driven fluorescence max at the periphery.

Oct 13 – AC3 has very low Tricho abundance, and a fresh salinity anomaly in the upper ocean (S=35 at eddy center). Strong fluorescence peak at the base of the euphotic zone, seems to be driven by rod-shaped diatoms. Given the low Tricho abundance we decided to abandon station work for today in order to keep surveying for a Tricho patch. Proceeding to SSE to AC4.

Oct 14 – Tricho mostly absent from VPR survey except for a small patch of salty water SE of AC3. Surface salinities very low overall, down to 34. Lost comms with VPR flight control at 0400, recovered the fish. Arrived on station at 0730, did a quick net tow and Tricho abundance was very low. Decided to forego the pump station, but did a 700m cast (CTD25) and an 80m cast (CTD26) for gravity filtration. Began steaming for 10N, 45W in an attempt to get out of the fresh water. VPR redeployed at 1400, flight control can loses comms while paying out cable.

Oct 15 – Salinity rose to near 35 and the Tricho are back! Net tows and surface pumps yield the biggest biomass of the trip thus far. Biomass was low at 60m. Station 10, CTD casts 27,28,29.

Oct 16 – Strong biomass at the surface and 50m. Station 11, CTD casts 30 (100m to orient pump), 31 (pump), 32 (gravity filtration + 10 150m VPR yoyos), 33 (700m).

Oct 17 – Station 12, CTD casts 34 (100m to orient pump), 35 (pump), 36 (gravity filtration), 37 (700m; note bottle 19 misfire). VPR deployed, heading for patch at 11 30 N, 51 30 W identified in Westberry satellite imagery.

Oct 18 – VPR tow shows highest abundance just prior to entering a lens of lower salinity water. Not enough time to turn back to the higher abundance area, so sampled at the end of the VPR

tow. Station 13, CTD casts 38 (pump), 39 (gravity filtration, 40 (700m). VPR deployed, pressure sensor failed. Pressure sensor repaired, VPR redeployed. Flight control communication lost, VPR recovered.

Oct 19 – Station 14, CTD casts 41 (100m to orient pump), 42 (pump), 43 (gravity filtration), 44 (700m).

Oct 20 - Station 15 took place in low salinity (<33) green water, with very little *Trichodesmium* and lots of diatoms. Surface pump did not yield enough to do incubations, so deep pump was abandoned. Decided to steam back toward salinity front observed between 0200 and 0400GMT. Stopped at 1630GMT for a net tow on the salty side of the inshore salinity front. Tricho had come back, but not high biomass. Proceeded to the offshore front and did a series of 3 CTD casts/net tows. CTD48 at the base of the front (S=34.3) was chock-full of Hemiolus. Tricho was present in moderate amounts in saltier waters of CTD49 and CTD50.

Oct 21 – Station 16 (CTDs 51-54) occupied on the salty side of the front, same position as CTD50. On the way back west, the salinity front was sampled at S=34.5 with a net tow and CTD55.

Oct 22 – Arrival in Barbados.

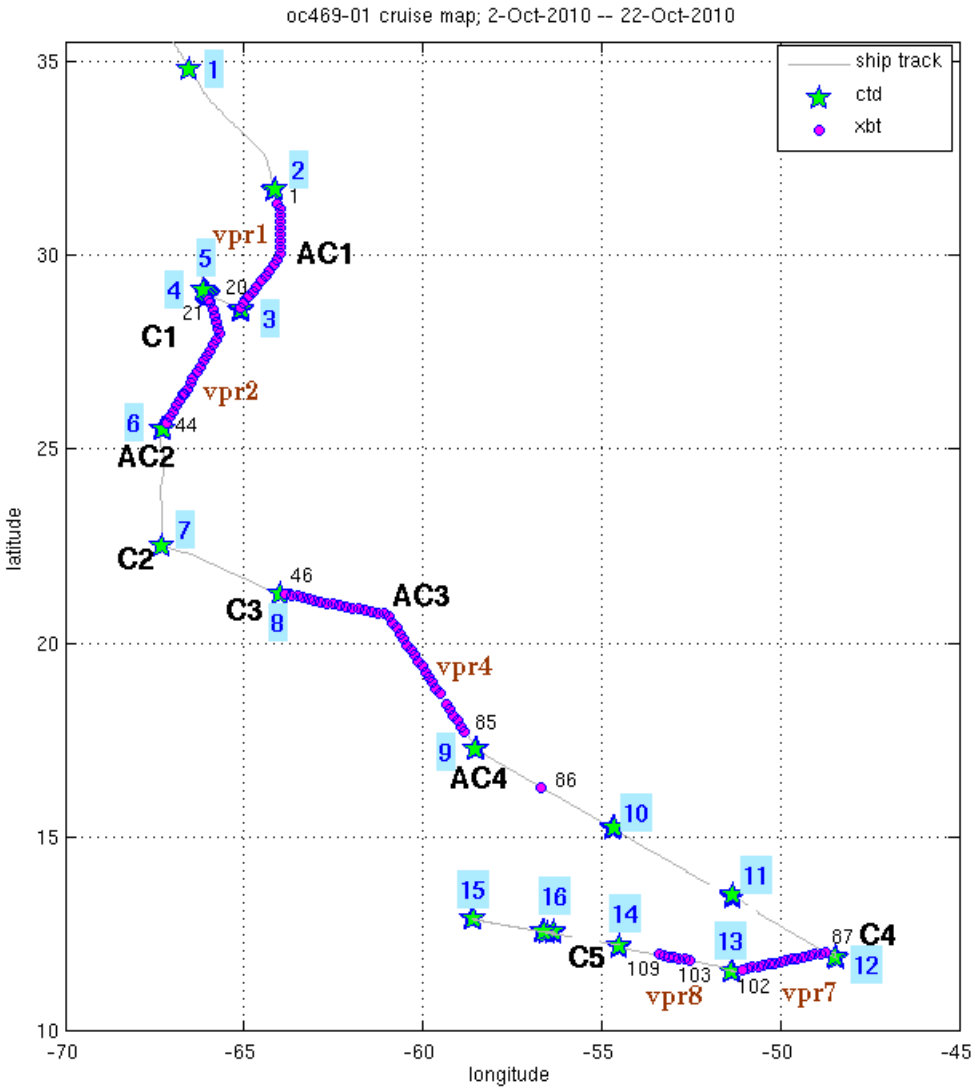


Figure 1: OC469 sampling. Hydrographic stations indicated by stars, each consisting of one or more CTD casts. XBTs along VPR transects are shown as magenta dots with sequential drop numbers indicated.

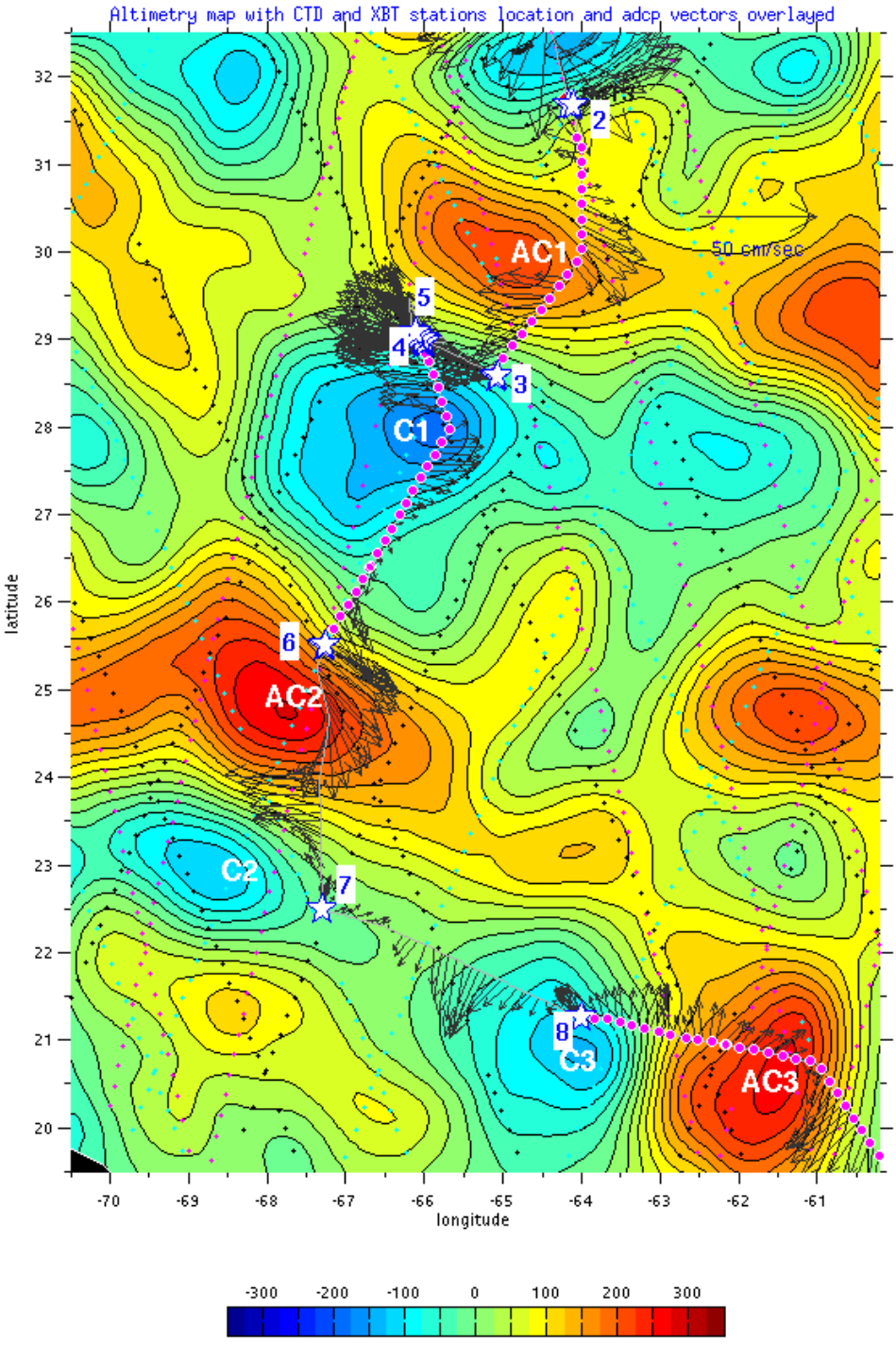


Figure 2: OC469 sampling for stations 2-8 overlayed on a satellite altimetric map for the central time for this subset of observations. Hydrographic stations indicated by stars, each consisting of one or more CTD casts. XBTs along VPR transects are shown as magenta dots. Velocity vectors derived from a vertical average (0-240m) of shipboard ADCP measurements.

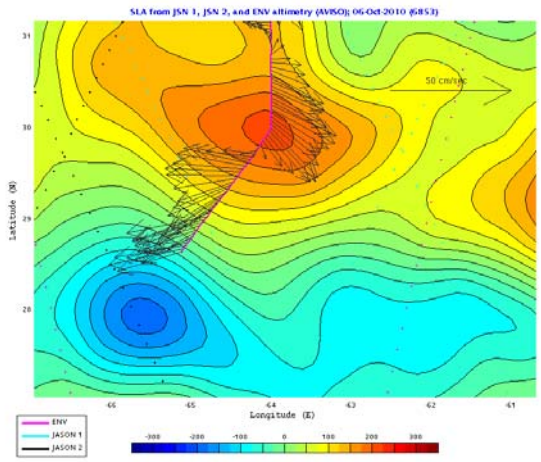


Figure 3: ADCP velocity vectors (averaged over the upper 240m) overlayed on sea level anomaly for October 6, 2010, showing a pass near the center of AC1 followed by approach to the northeast flank of cyclone C1.

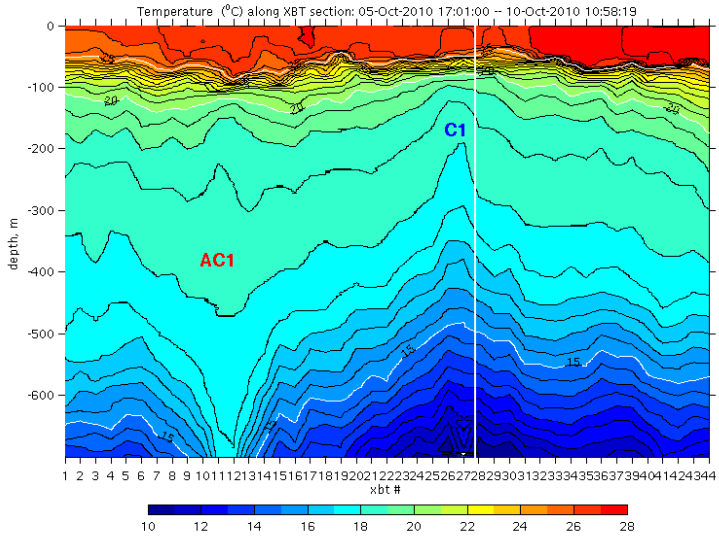
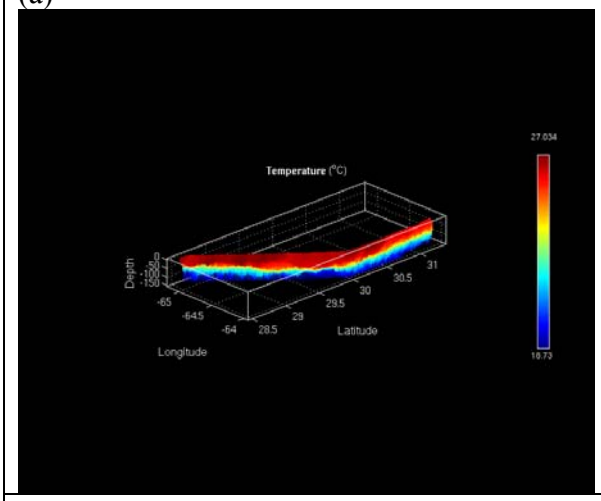


Figure 4. XBT section combining VPR/XBT surveys 1 and 2. Note the gap between XBTs 20 and 21 (Figure 1). The white vertical line indicates the turning point of the transect through C1.

(a)



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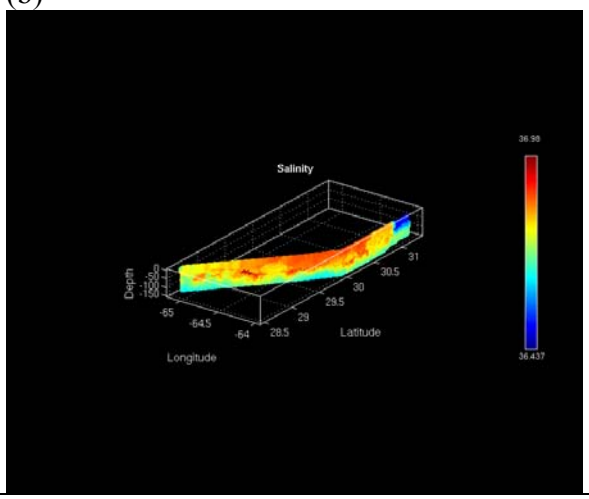
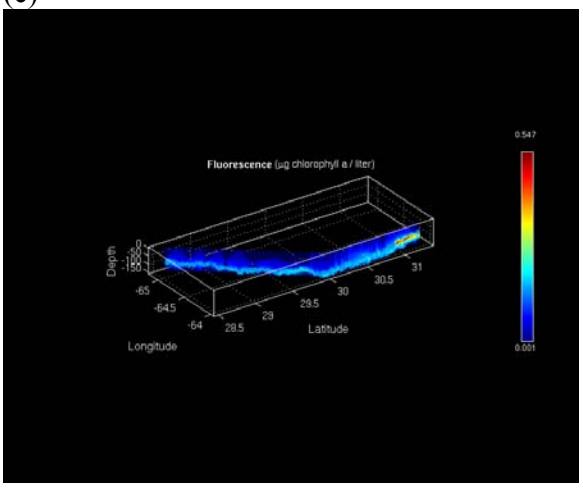


(c)



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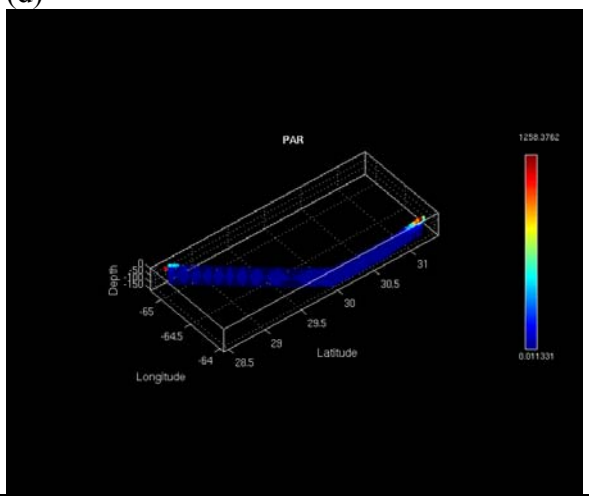

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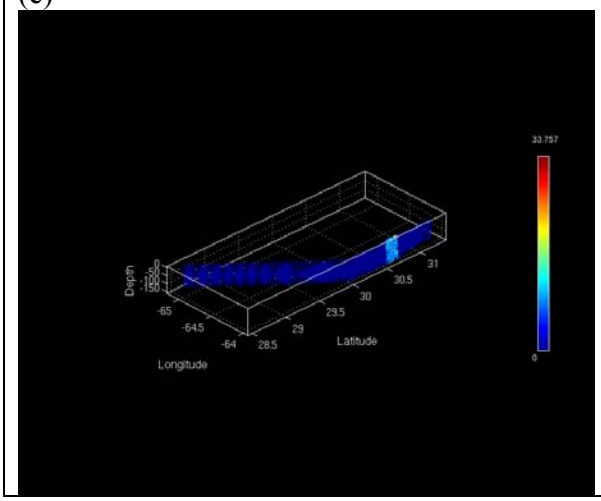
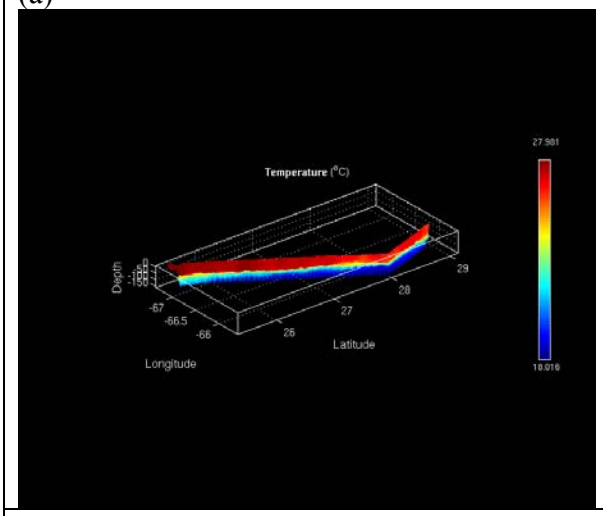


Figure 5. (a) Temperature, (b) salinity, (c) fluorescence, (d) PAR, and (e) concentration of *Trichodesmium* rafts from VPR Survey 1. Note that the *Trichodesmium* raft concentrations are a placeholder only, as image classification needs further refinement.

(a)



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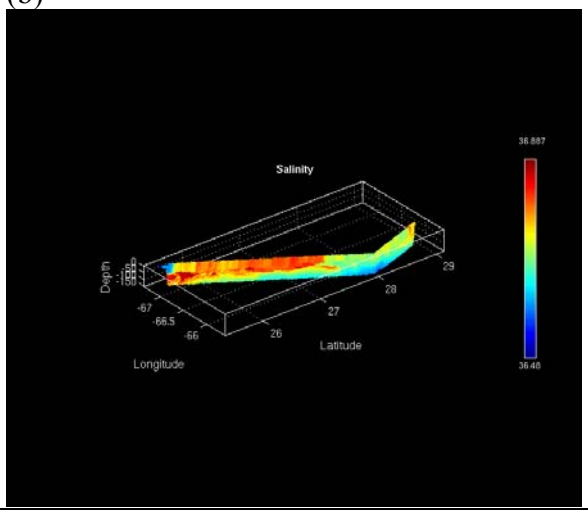

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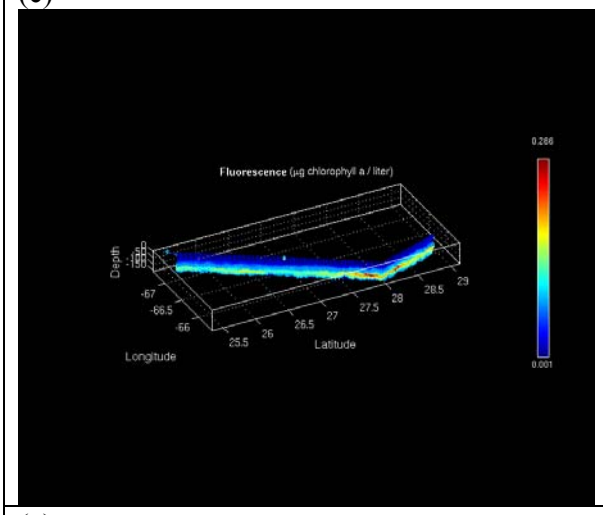

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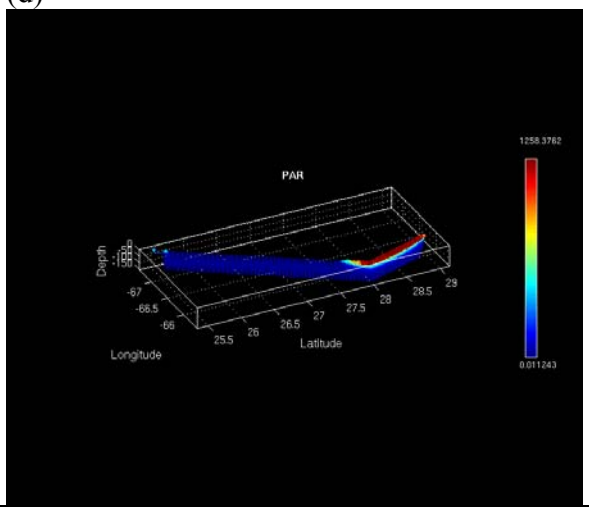

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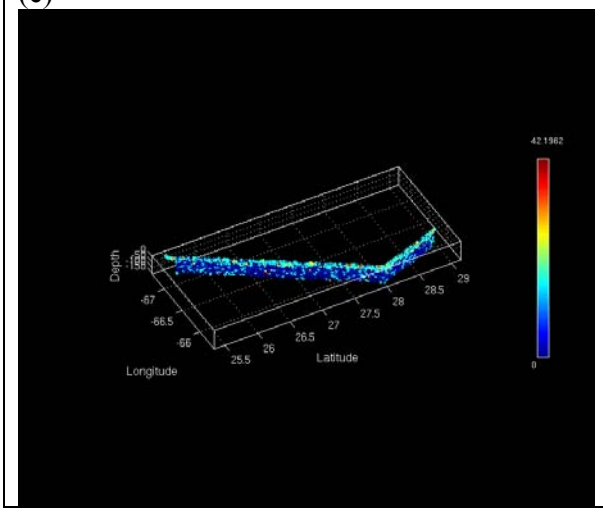


Figure 6. (a) Temperature, (b) salinity, (c) fluorescence, (d) PAR, and (e) concentration of *Trichodesmium* rafts from VPR survey 2. Note that the *Trichodesmium* raft concentrations are a placeholder only, as image classification needs further refinement.

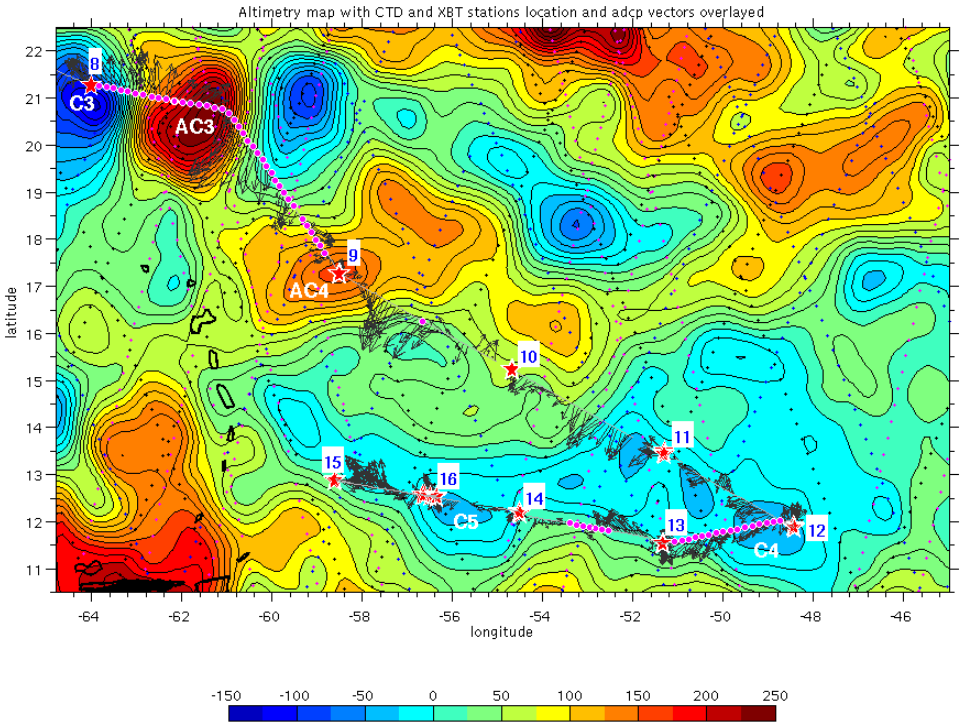


Figure 7: OC469 sampling for stations 8-16 overlayed on a satellite altimetric map for the central time for this subset of observations. Hydrographic stations indicated by stars, each consisting of one or more CTD casts. XBTs along VPR transects are shown as magenta dots. Velocity vectors derived from a vertical average (0-240m) of shipboard ADCP measurements.

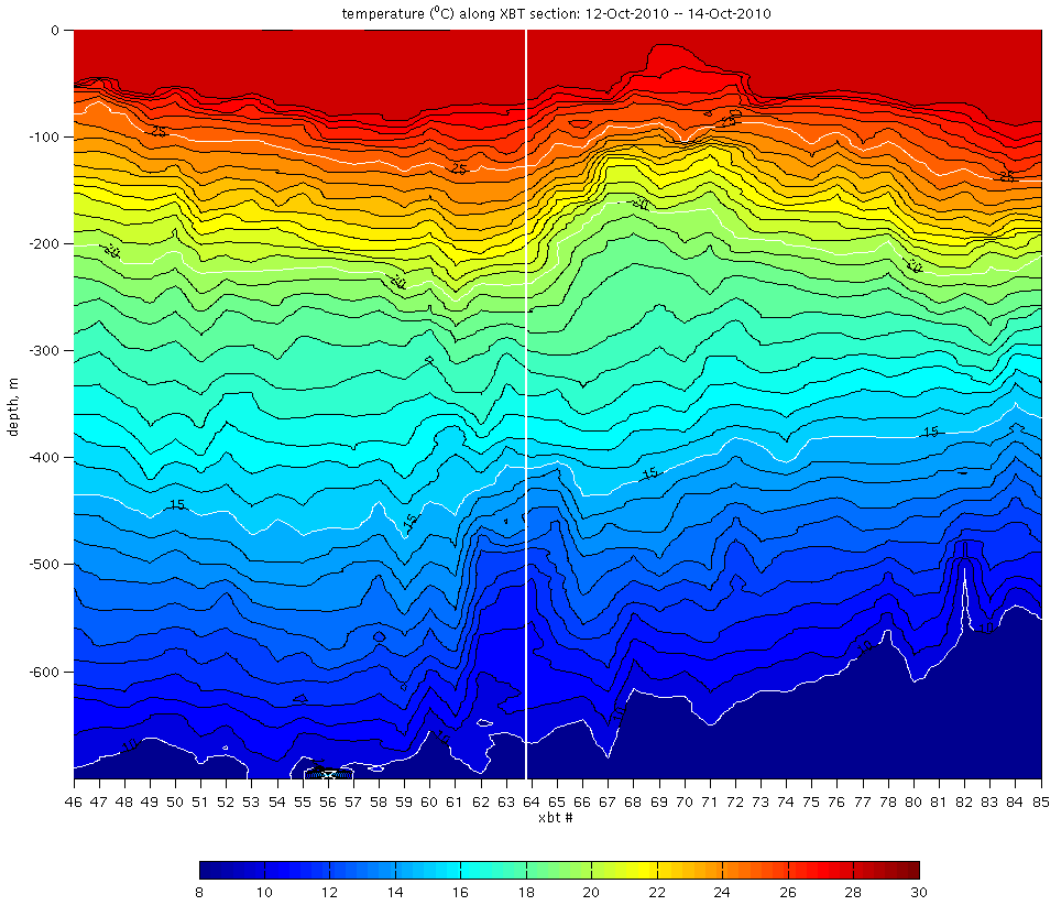
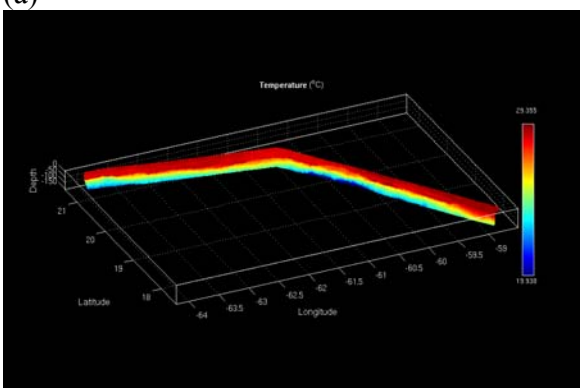


Figure 8. XBT section for VPR/XBT Survey 4 (Figure 7). The white vertical line indicates the turning point of the transect through AC3.

(a)



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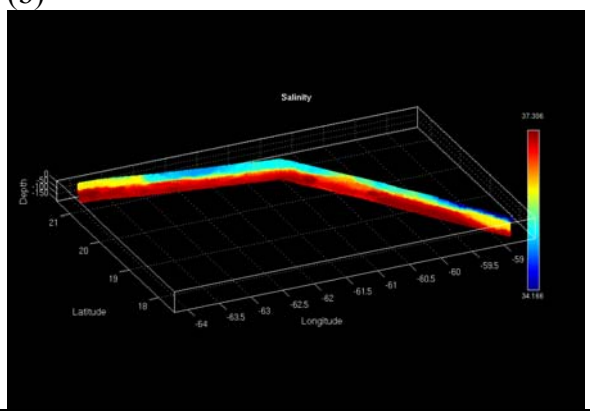

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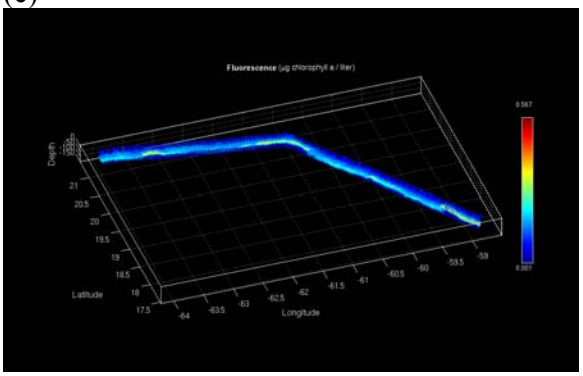

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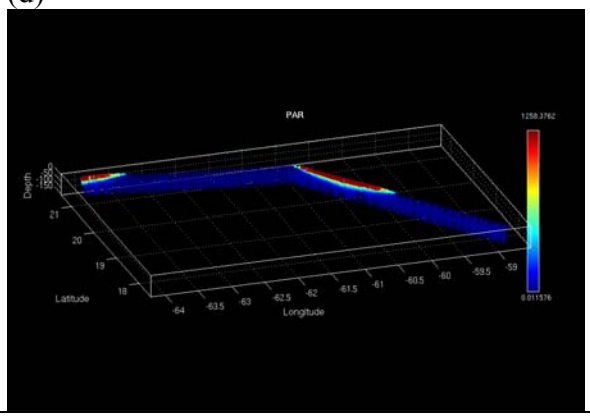

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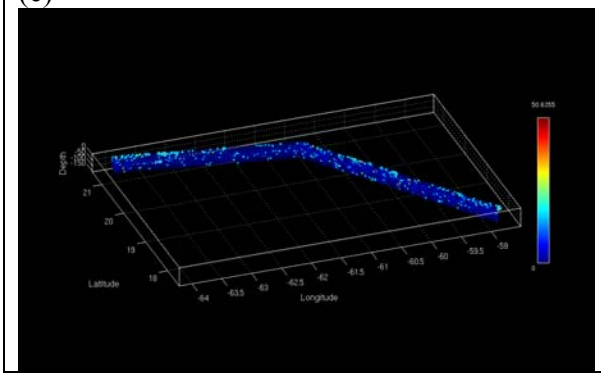


Figure 9. (a) Temperature, (b) salinity, (c) fluorescence, (d) PAR, and (e) concentration of *Trichodesmium* rafts from VPR survey 4 [survey 3 was abbreviated and therefore not shown]. Note that the *Trichodesmium* raft concentrations are a placeholder only, as image classification needs further refinement.

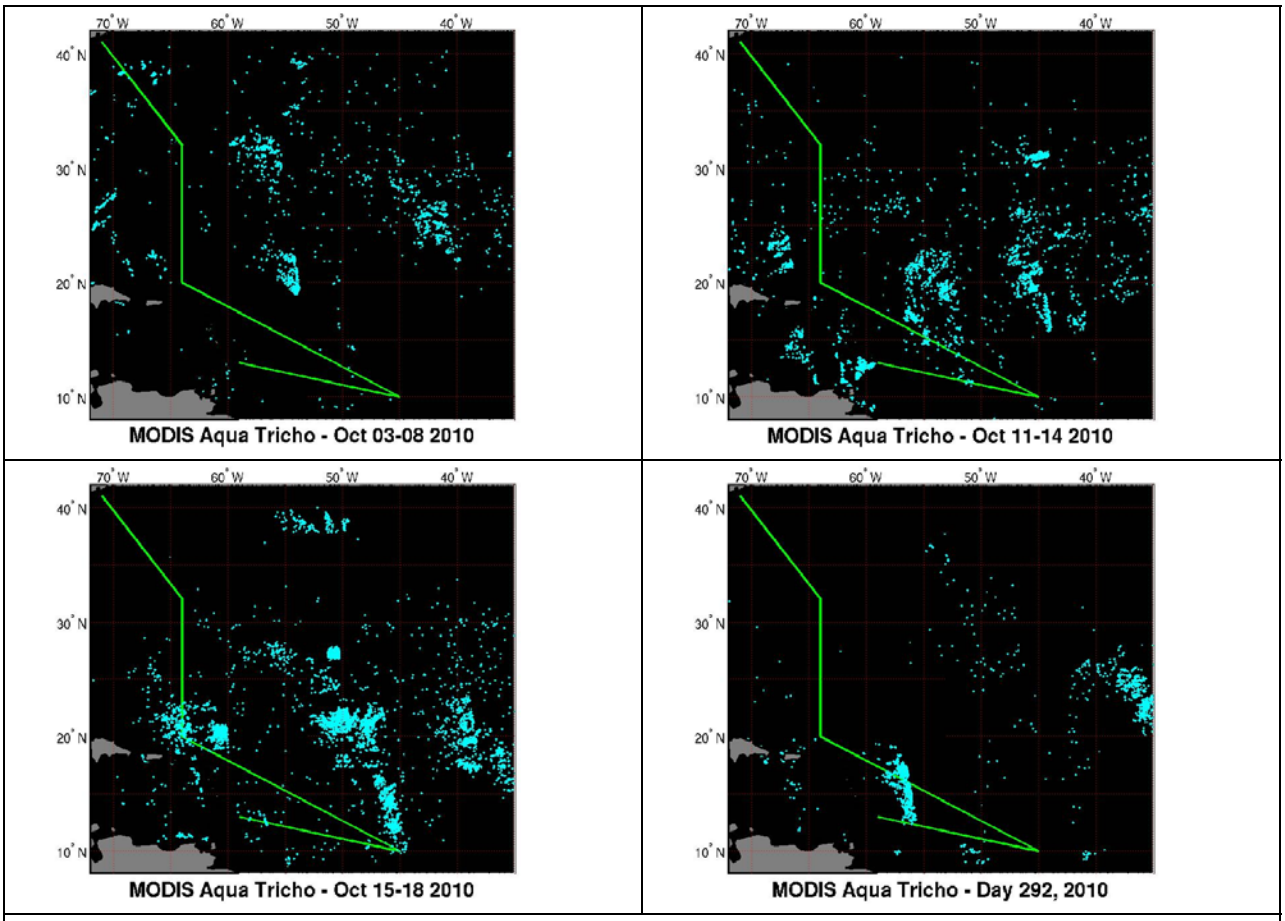


Figure 10: Remotely sensed *Trichodesmium*, courtesy Toby Westberry, OSU. Date of lower right panel is October 19.

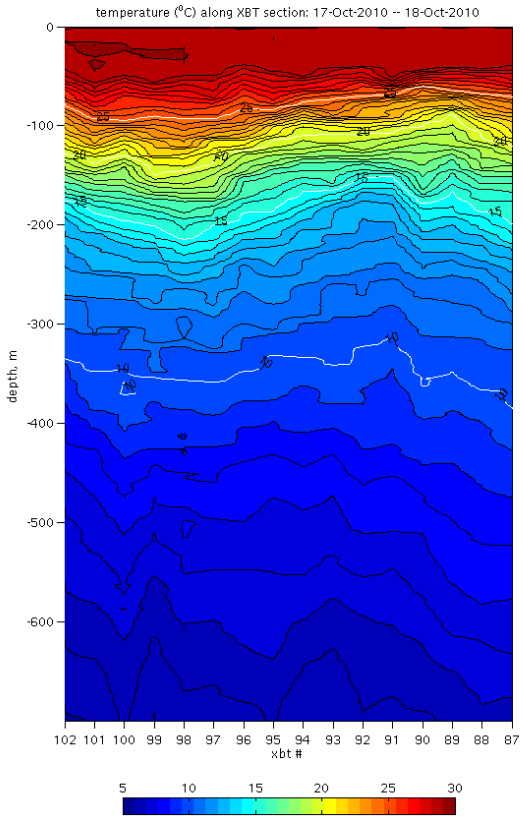


Figure 11. XBT section for VPR/XBT Survey 7 (Figure 7).

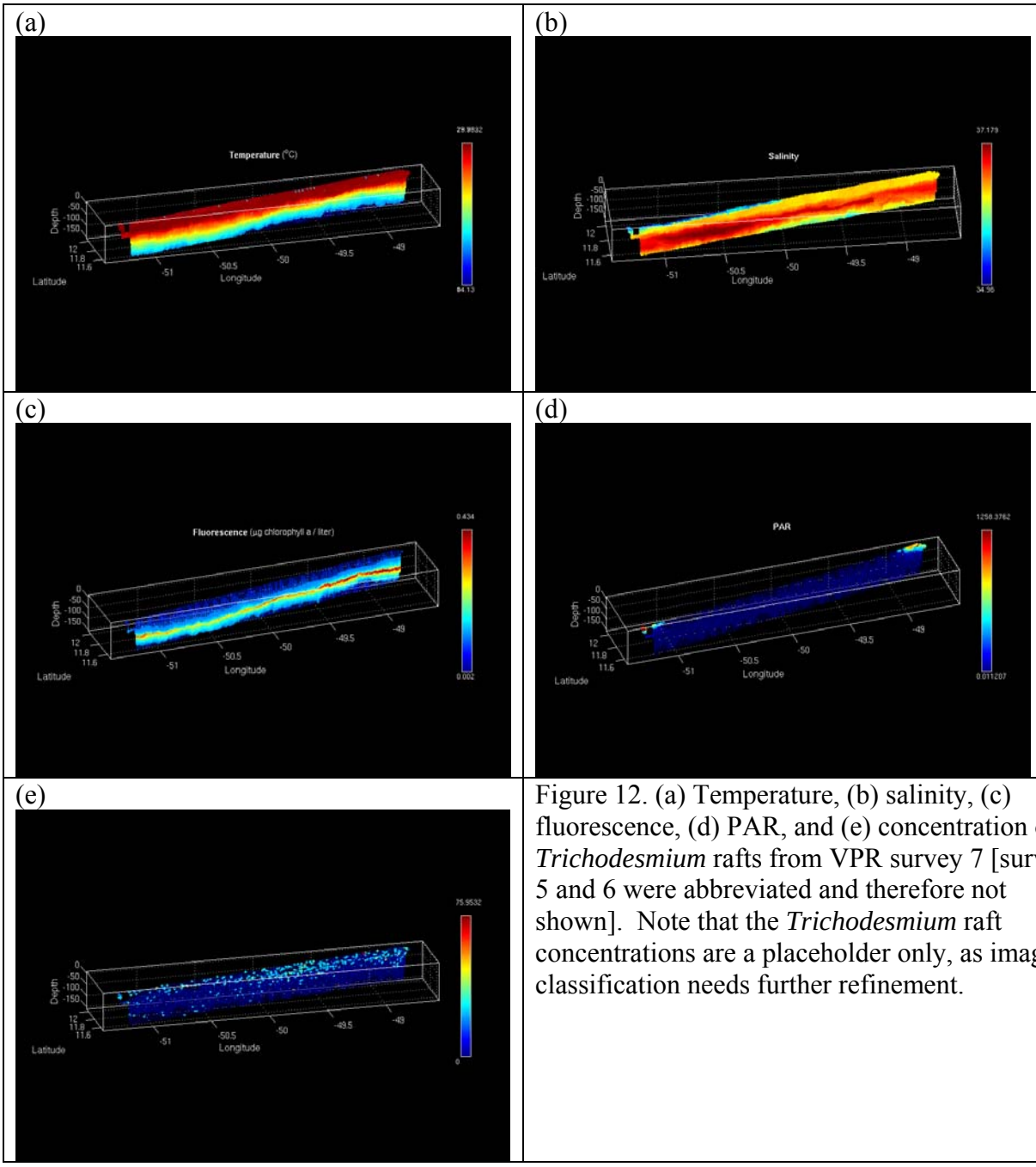


Figure 12. (a) Temperature, (b) salinity, (c) fluorescence, (d) PAR, and (e) concentration of *Trichodesmium* rafts from VPR survey 7 [surveys 5 and 6 were abbreviated and therefore not shown]. Note that the *Trichodesmium* raft concentrations are a placeholder only, as image classification needs further refinement.

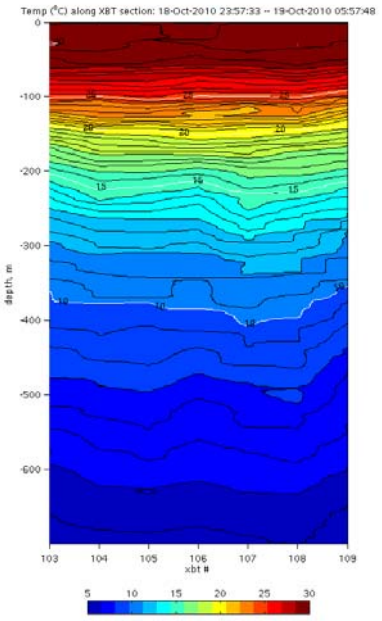
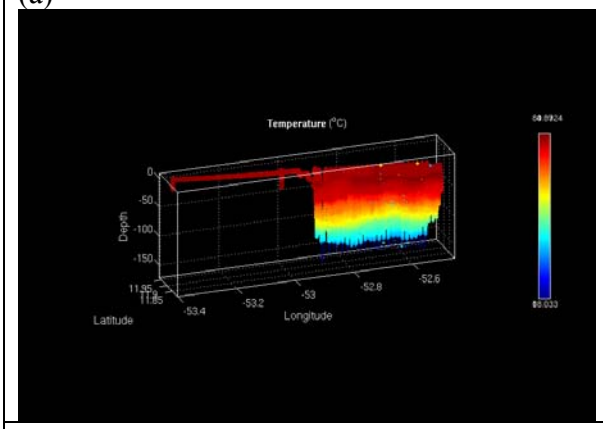
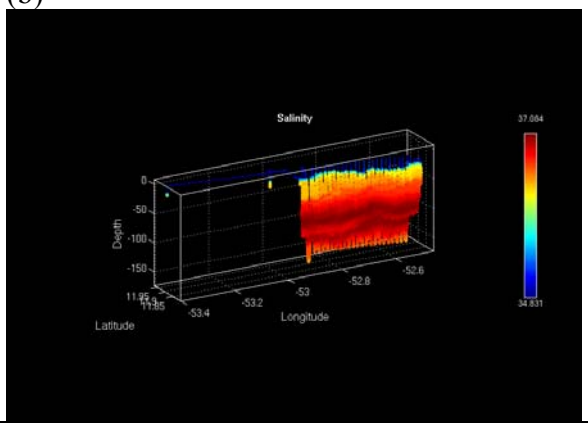


Figure 13. XBT section for VPR/XBT Survey 8 (Figure 7).

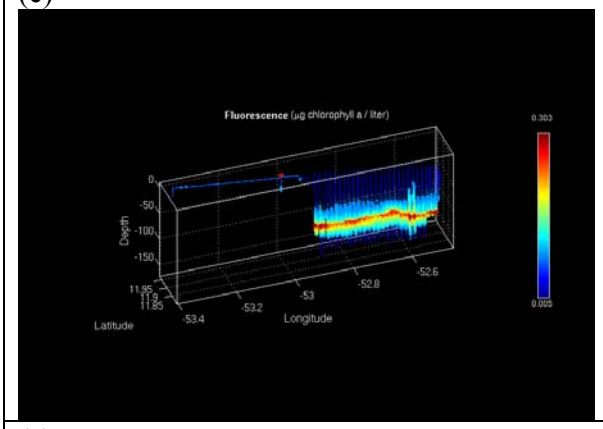
(a)



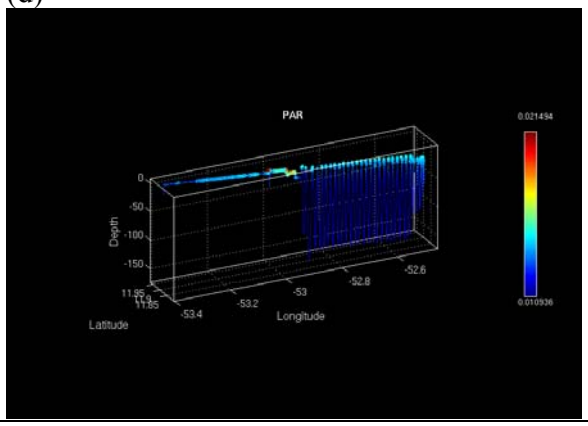
(b)



(c)



(d)



(e)

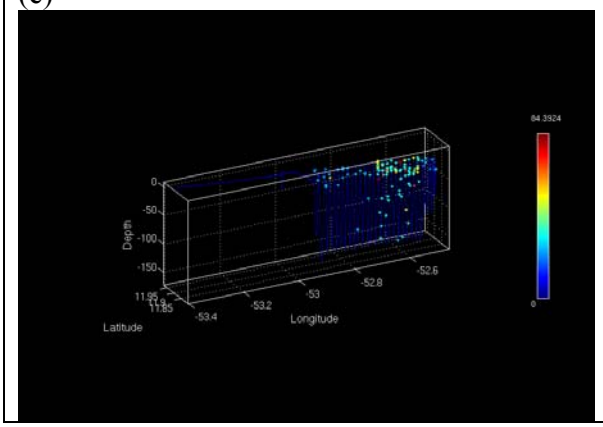


Figure 14. (a) Temperature, (b) salinity, (c) fluorescence, (d) PAR, and (e) concentration of *Trichodesmium* rafts from VPR survey 8. Note that the *Trichodesmium* raft concentrations are a placeholder only, as image classification needs further refinement.

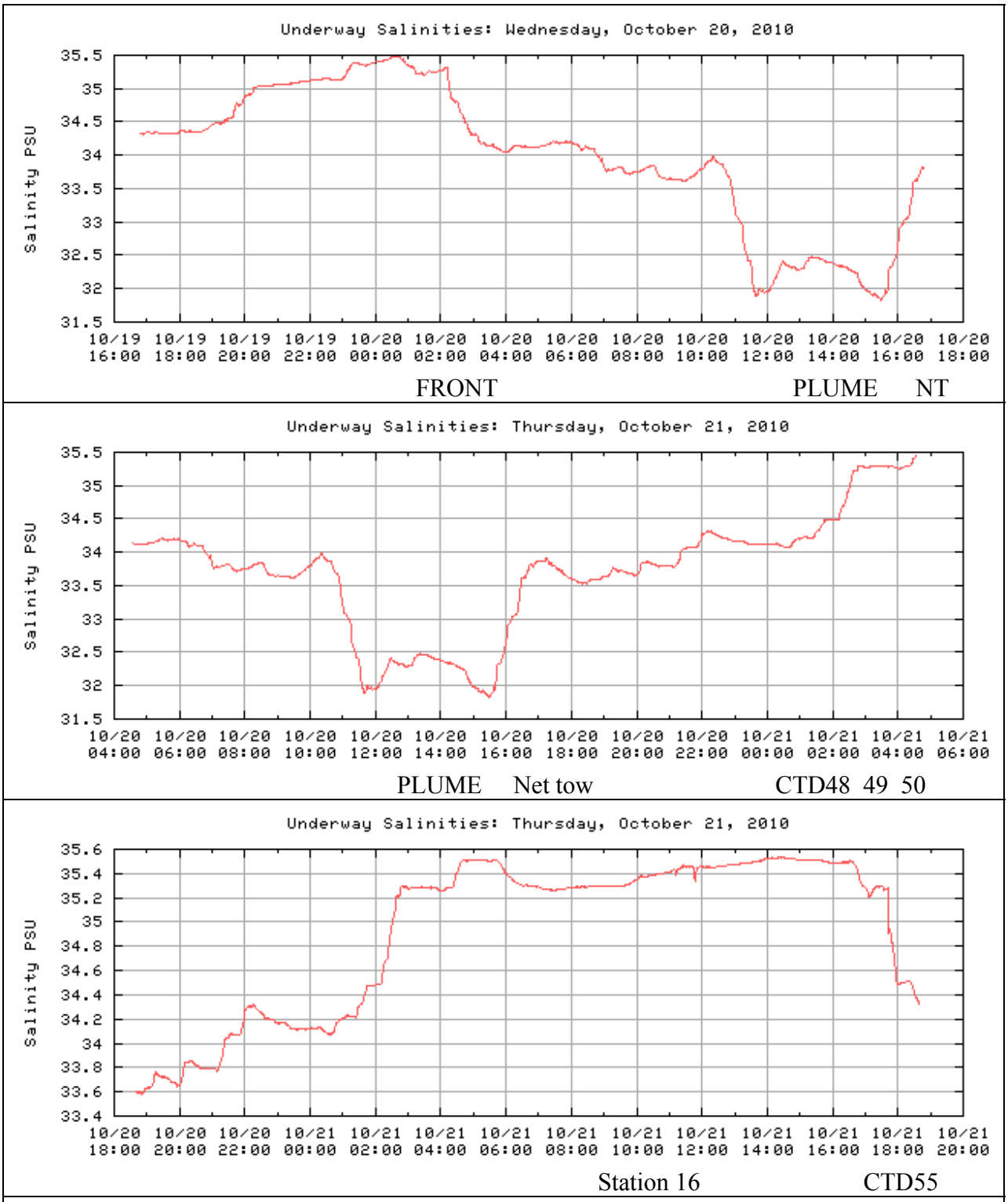


Figure 15. Time series of underway salinity showing locations of a salinity front, the Orinoco River plume, surface net tows (NT) and CTD/net tow stations. Note overlap of 0400 to 1630 in the top two panels, and 1800 to 0400 in the bottom two panels.

Appendix A. Cruise participants

1. Dennis McGillicuddy
2. Elise Olson
3. Larry Anderson
4. Valery Kosnyrev
5. Sonya Dhyrman
6. John Waterbury
7. Abby Heithoff
8. Cabell Davis
9. John Bailey
10. Louis Wurch
11. Lily Momper

Appendix B. Typical station schedule

CTD/Pump Operation

CTD operator: Larry
CTD launch/recovery: Dennis, Valery
Pump: Dennis; volunteers needed on deck to handle the hose

Target depths:

High light – 390, 210 μE
Low light - 15 μE or the depth of the subsurface Tricho max
Typical I_0 - 1200 μE

Cast 1

pump shallow – standard depth closest to high light target
organisms for incubation and nifH sample
Abby and Sonya process

Louie and Elise surface net tow

pump deep – standard depth closest to low light target
organisms for incubation and nifH sample
Louie and Elise process

If sufficient abundance at 60m, pump at 100m for nifH

Cast 2

Descend to 150m to rinse bottles
Upcast: trip bottles at standard depths 80m and above
water for microscopy and PCR
John and Lilly process Niskins; ca. 30 min required for gravity filtration

Turnaround of holocam/VPR: Cabell

Cast 3 – 700m

Hydrocast; nutrients, chl, alk phosphatase, etc.
Elise + Louie: Chl and alk phosphatase sampled first

Estimated timing

0900 CTD/pump hose deployed
0905 Shallow pump starts
0940 Shallow pump ends / Shallow pump #2 begins
1010 Shallow pump #2 ends
1020 Deep pump begins
1100 Deep pump ends
1115 Instrument on deck

1120 Cast #2 begins
Pump put away
1130 Cast #2 ends
1210 gravity filtration complete

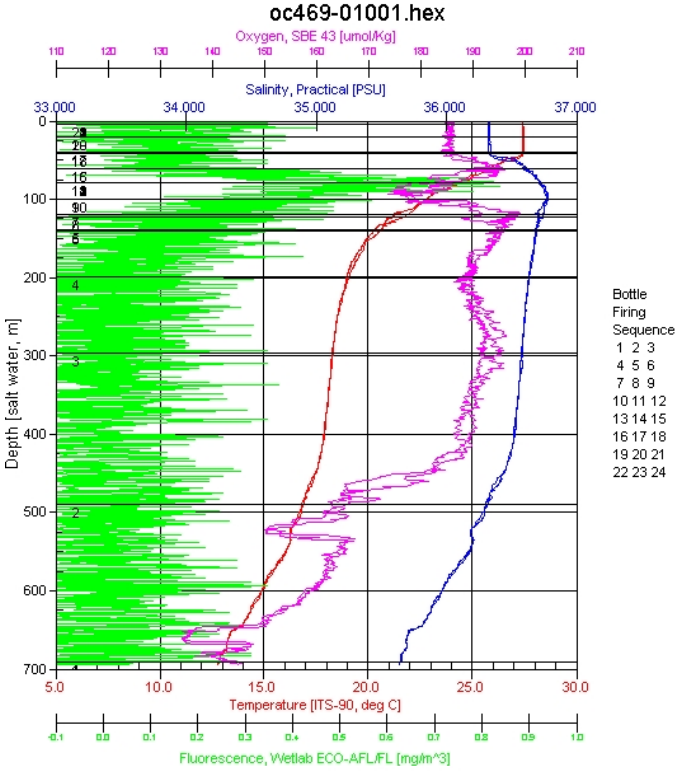
1215 Cast #3 begins
1300 Cast #3 completed

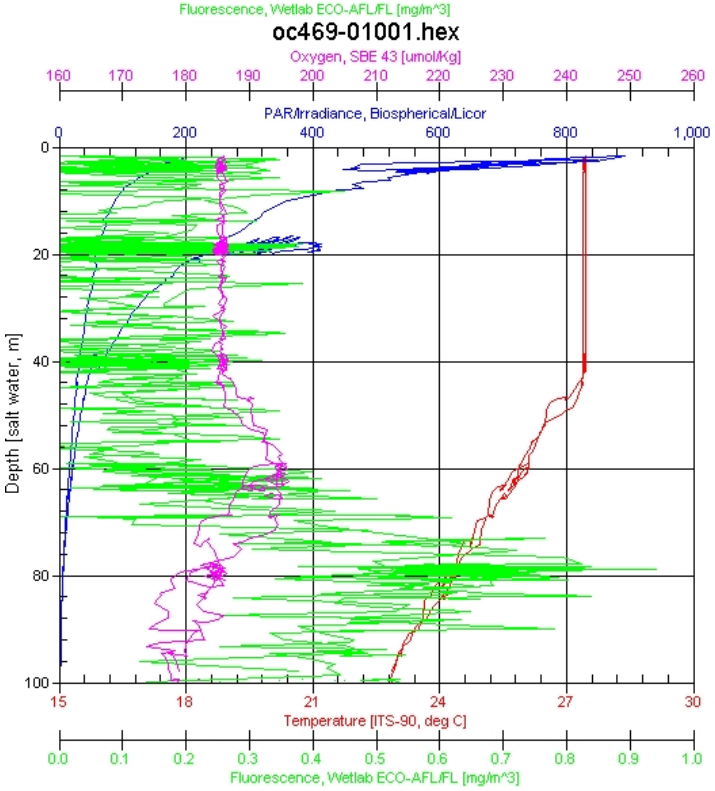
Appendix C. Table of station numbers and CTD casts

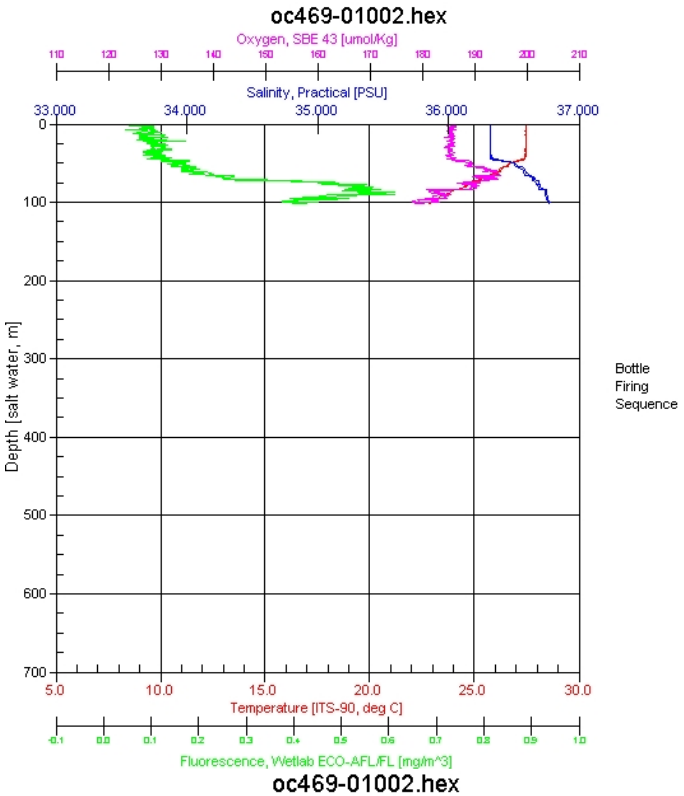
Station Number	Lily stations	CTD casts
		1,2
1		3
2		4,5
3		6,7,8
4		10,11,12
5		13,14,15
6		16,17,18
7		19,20,21
8		22,23,24
9		25,26
10		27,28,29
11		30,31,32,33
12		34,35,36,37
13		38,39,40
14		41,42,43,44
15		45,46,47
	15a, 15b, 15c	48,49,50
16		51,52,53,54
		55

Appendix D. CTD profiles.

Each cast is plotted in two formats: 0-700m (T,S,F,O_2, bottle depths) and 0-100m (T,F,O_2, PAR)



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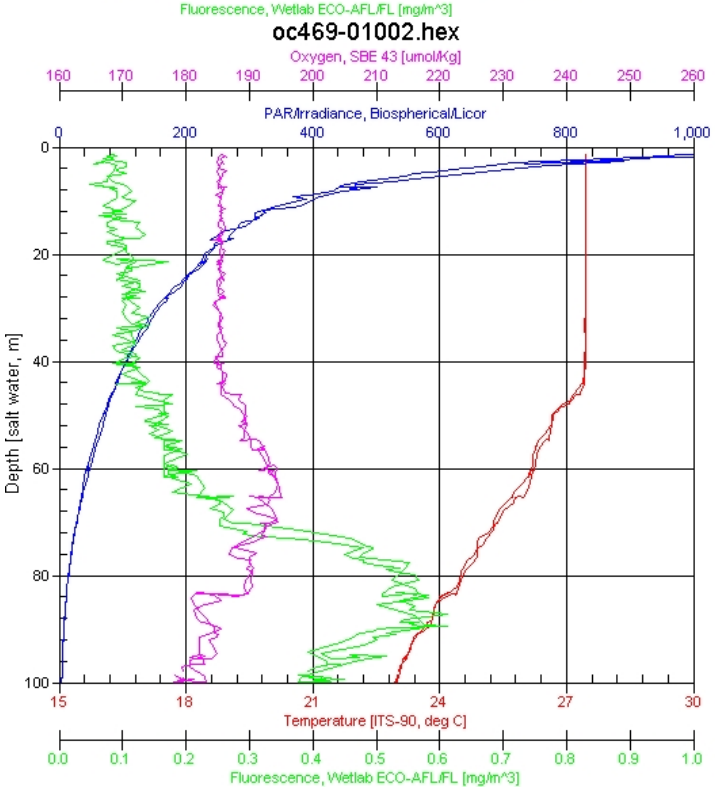
Oxygen, SBE 43 [umol/Kg]
110 120 130 140 150 160 170 180 190 200 210
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
0 100 200 300 400 500 600 700
Depth [salt water, m]
Bottle
Firing
Sequence
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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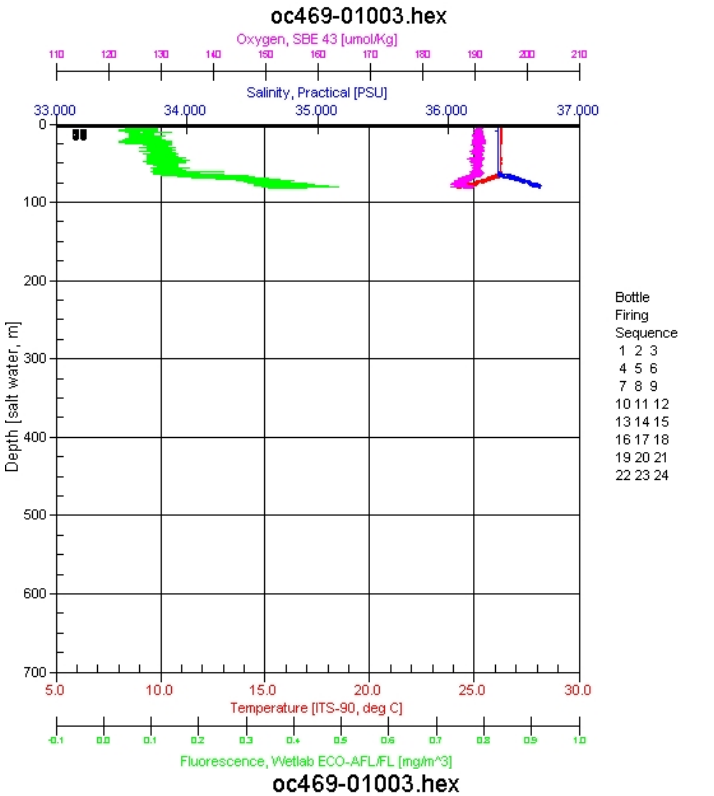
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
0 20 40 60 80 100
Depth [salt water, m]
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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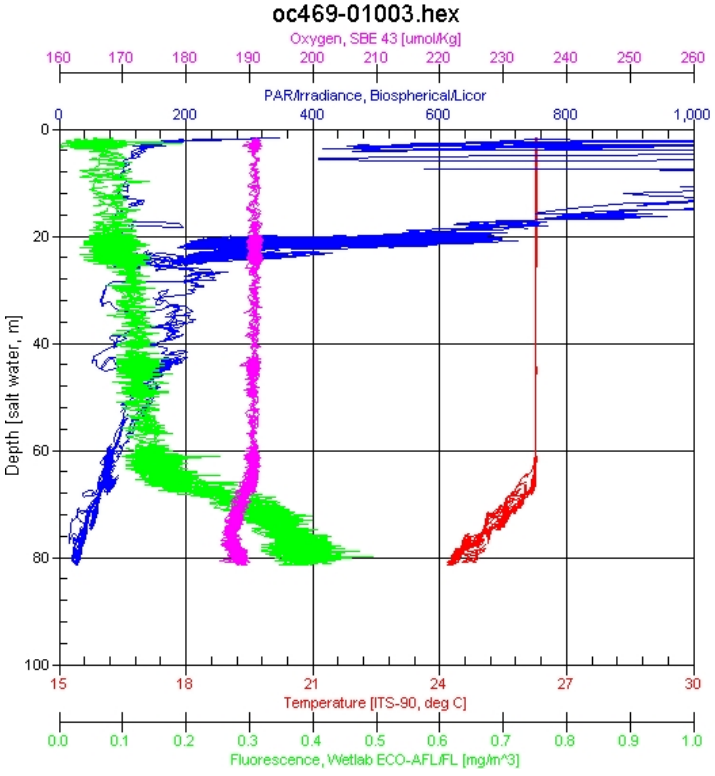
Oxygen, SBE 43 [umol/Kg]
110 120 130 140 150 160 170 180 190 200 210
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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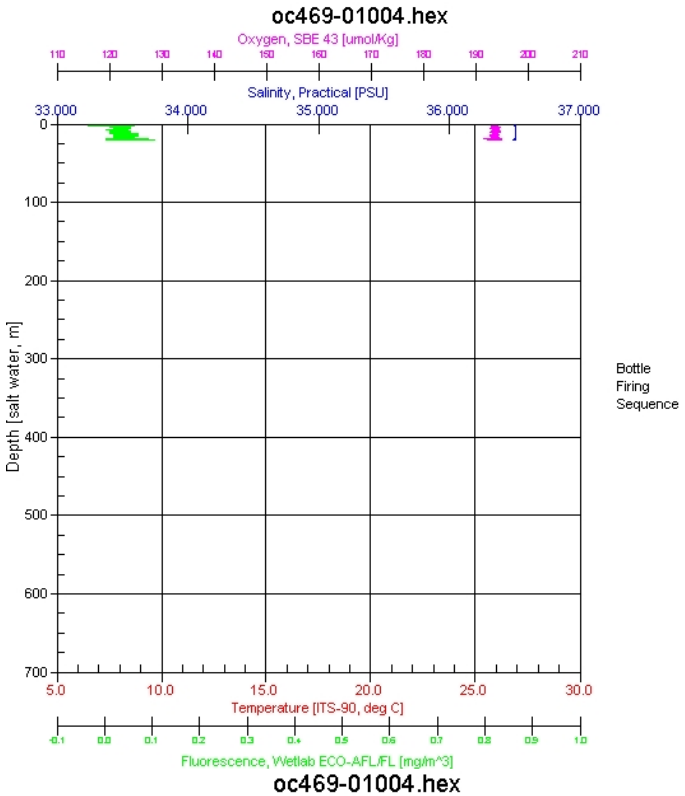
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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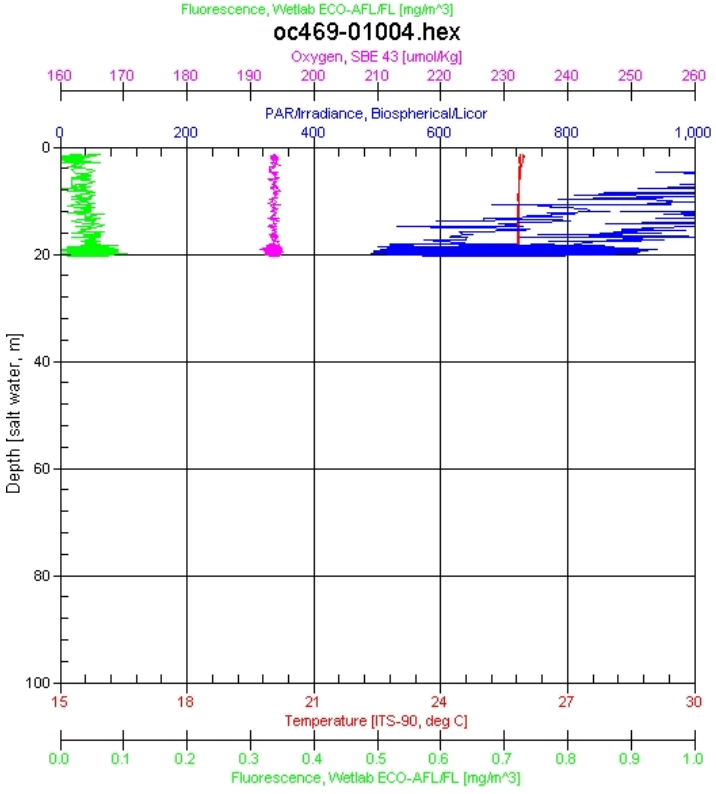
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
0 100 200 300 400 500 600 700
Depth [salt water, m]
Bottle
Firing
Sequence
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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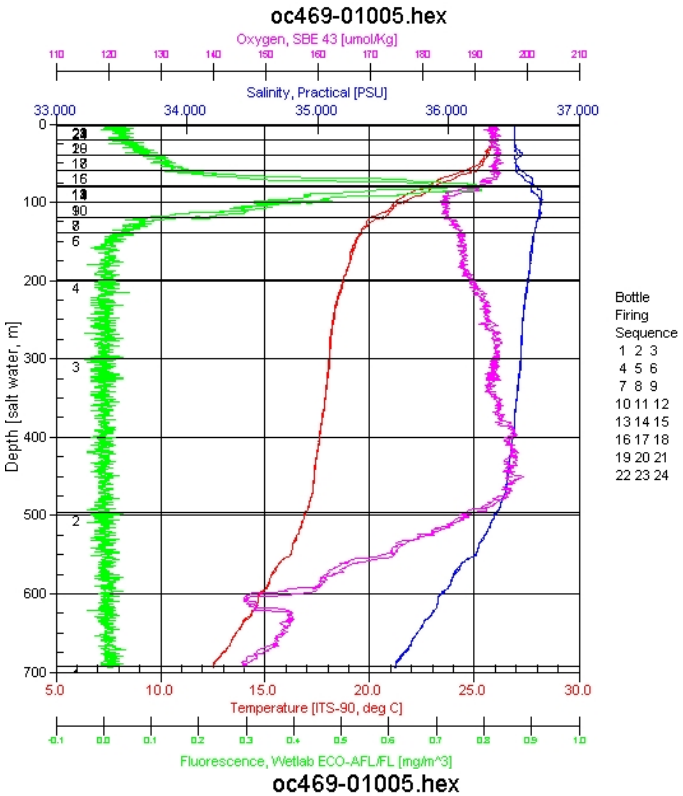
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
0 20 40 60 80 100
Depth [salt water, m]
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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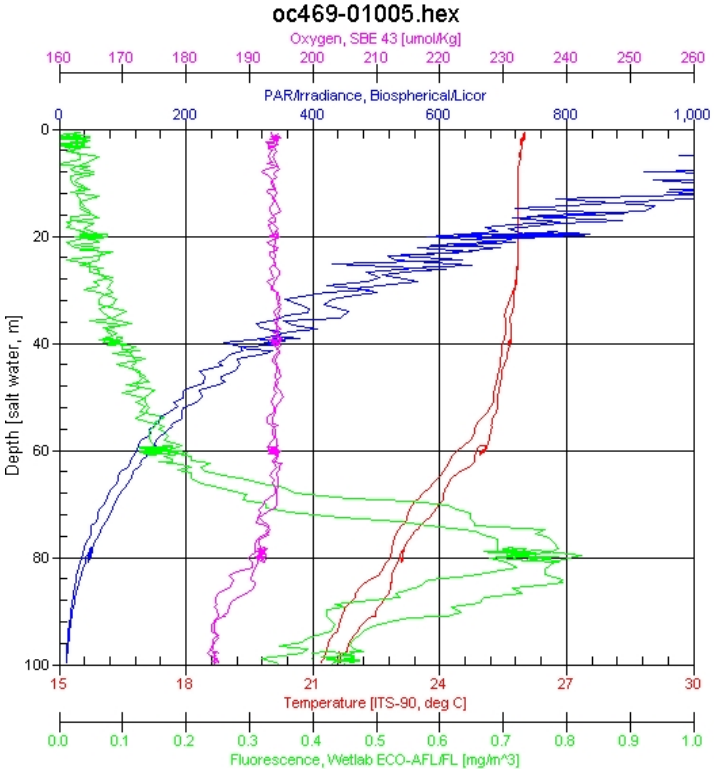
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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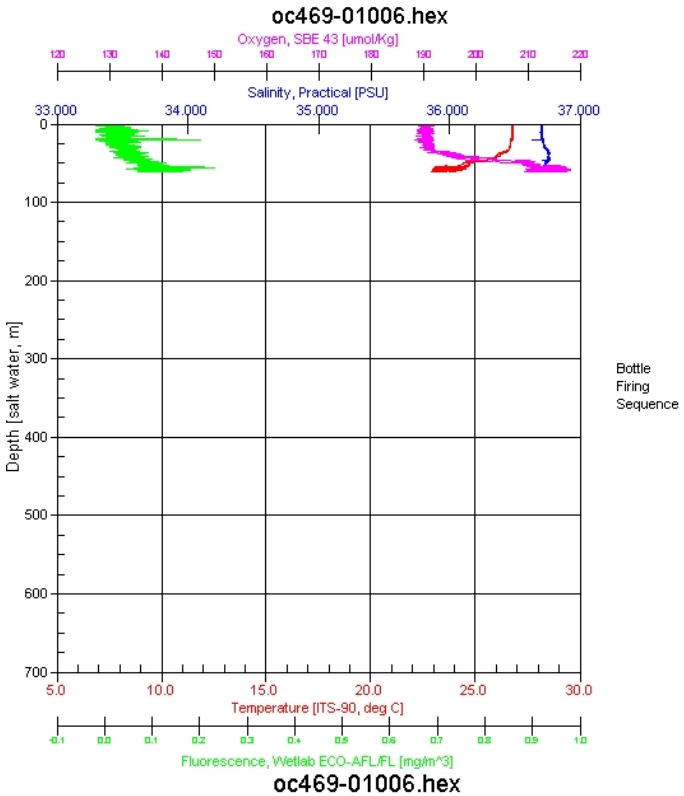
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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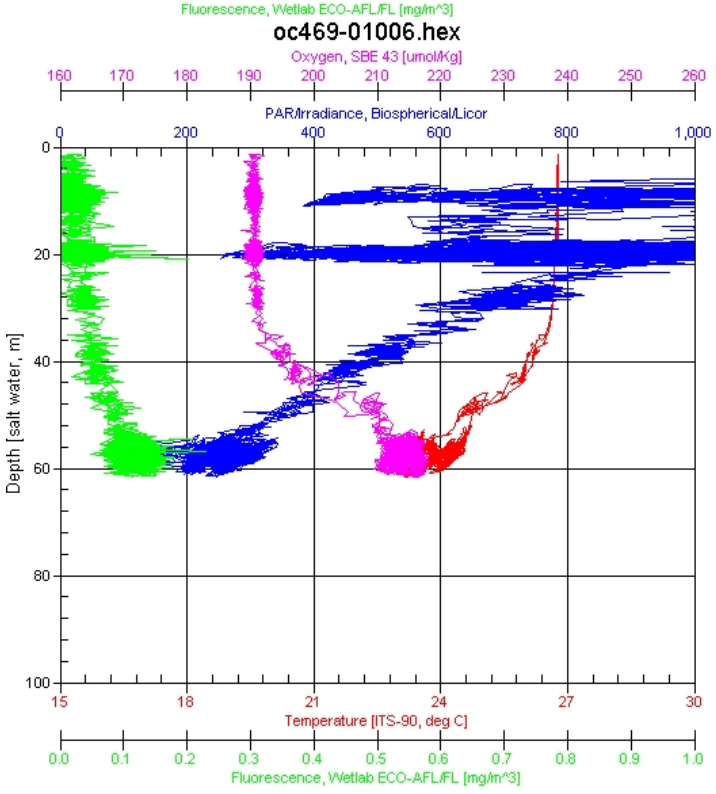
Oxygen, SBE 43 [umol/Kg]
120 130 140 150 160 170 180 190 200 210 220
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
0 100 200 300 400 500 600 700
Depth [salt water, m]
Bottle
Firing
Sequence
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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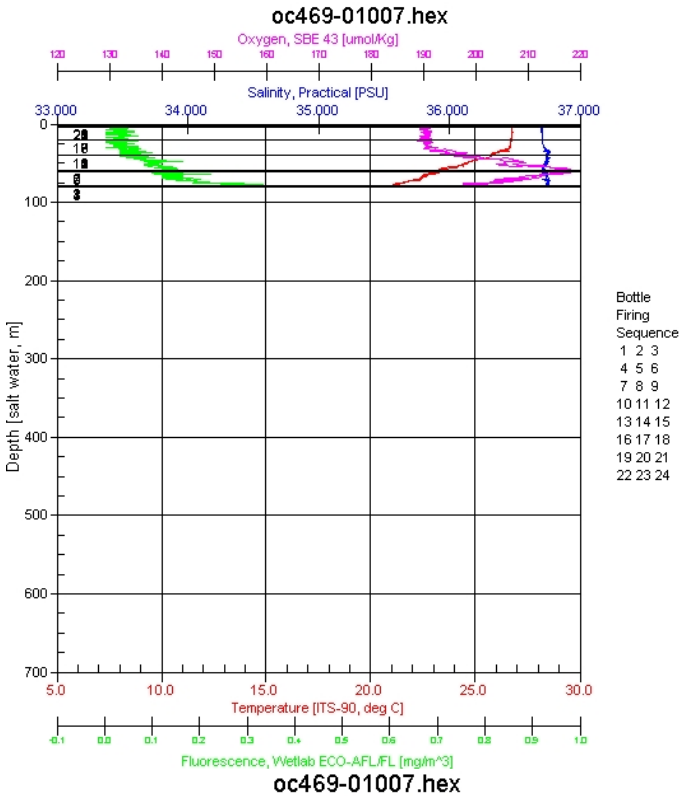
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
0 20 40 60 80 100
Depth [salt water, m]
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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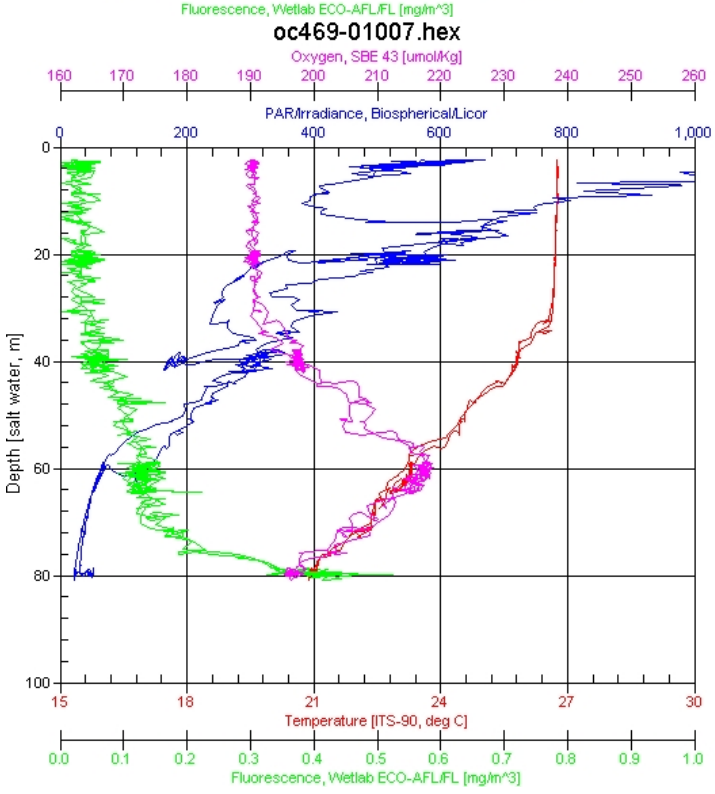
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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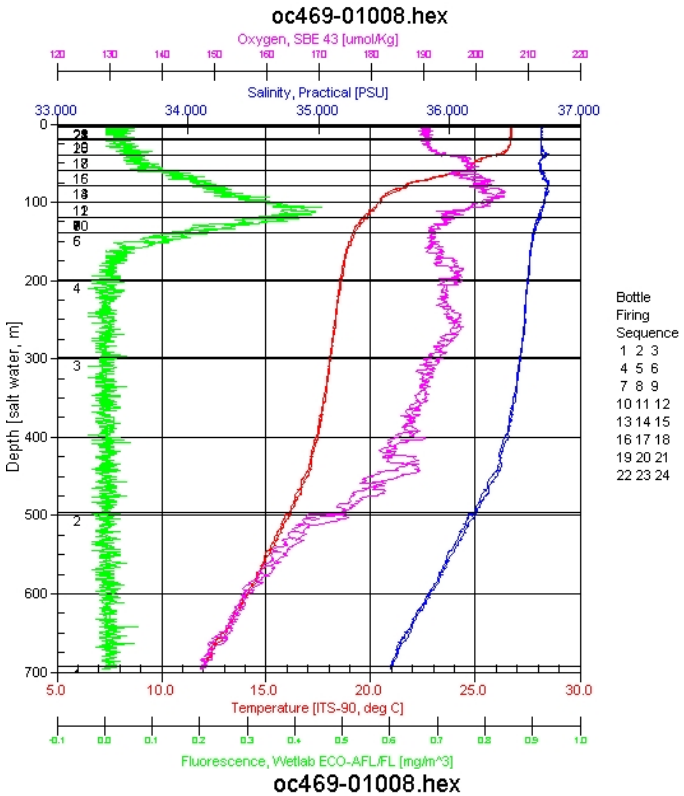
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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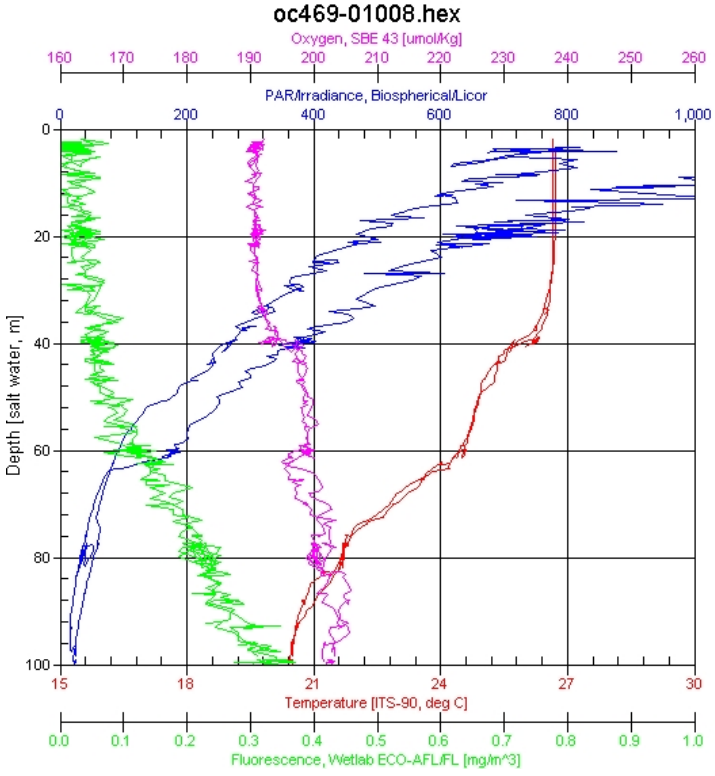
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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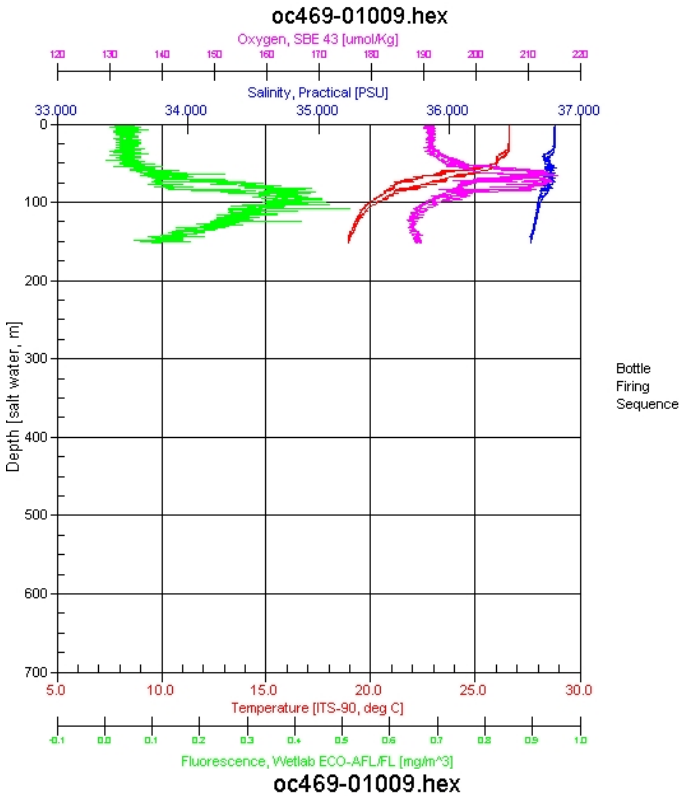
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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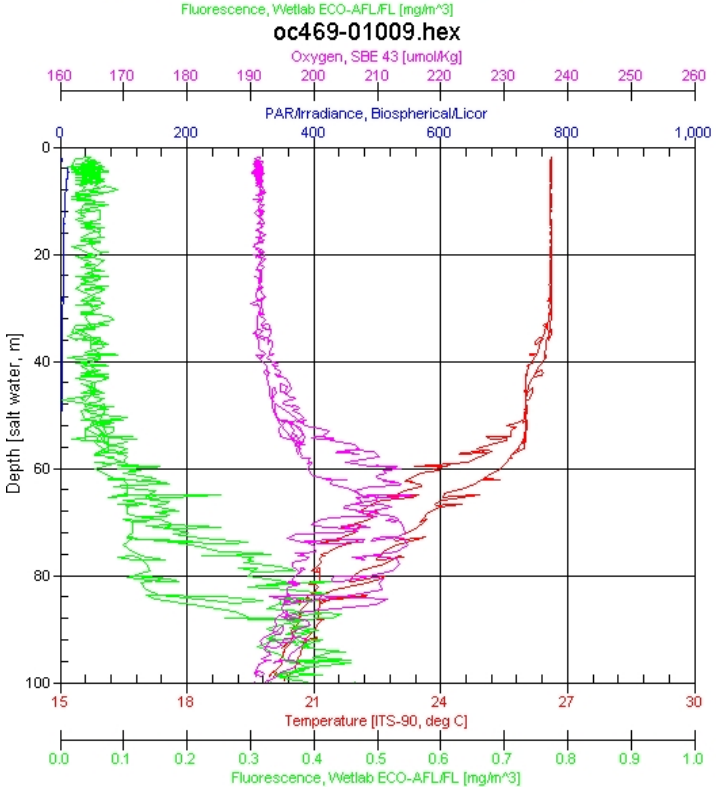
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence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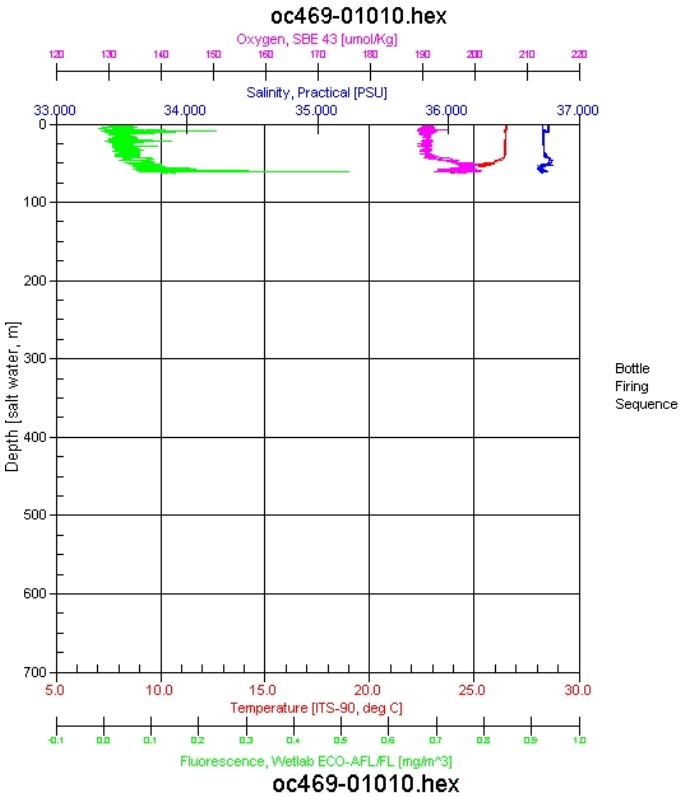
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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Salinity, Practical [PSU]
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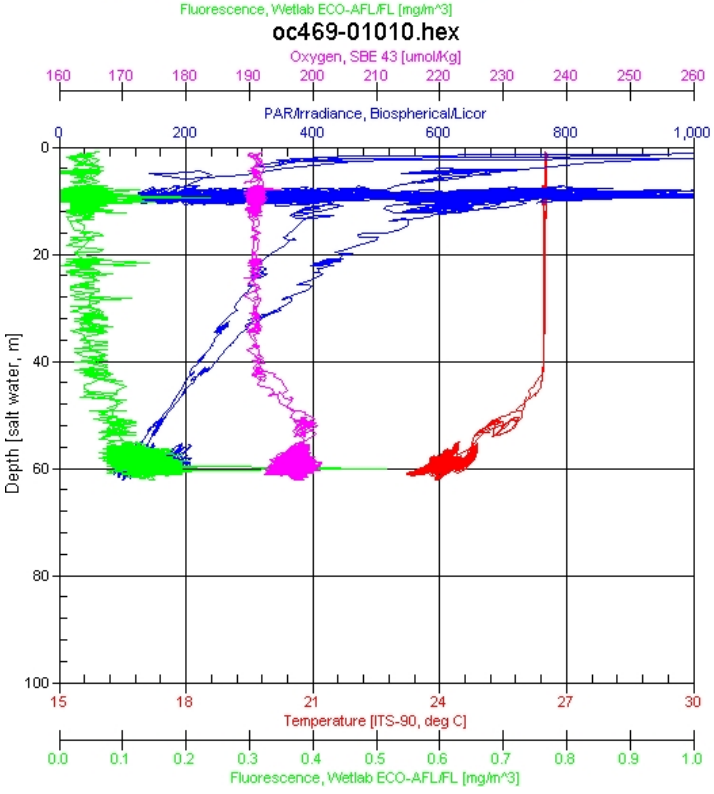
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence


oc469-01010.hex
Oxygen, SBE 43 [umol/Kg]
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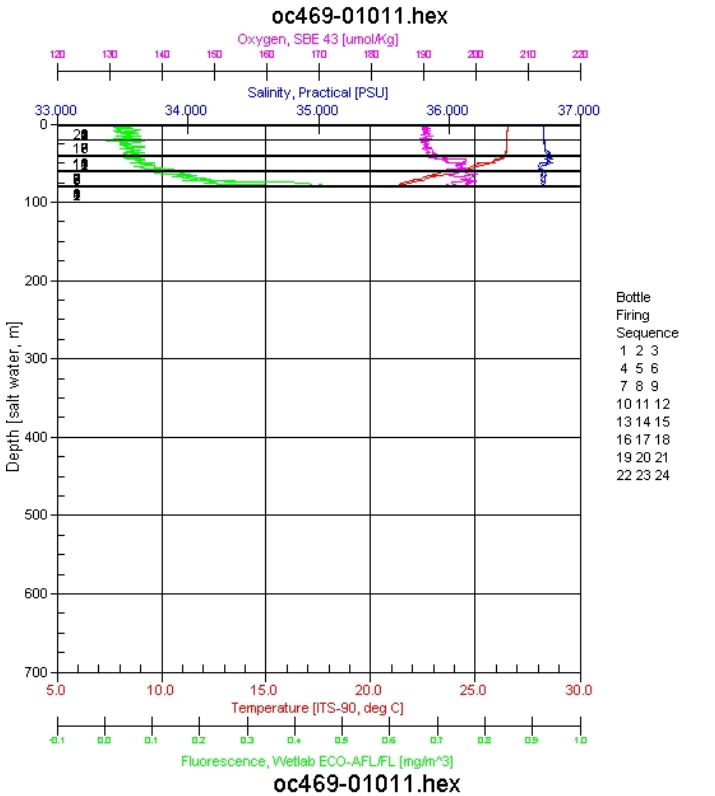
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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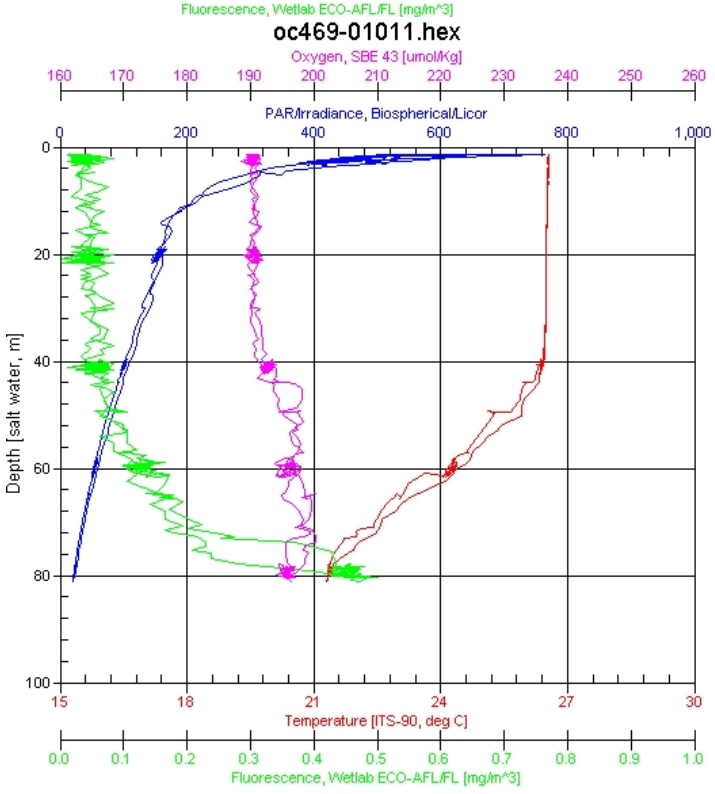
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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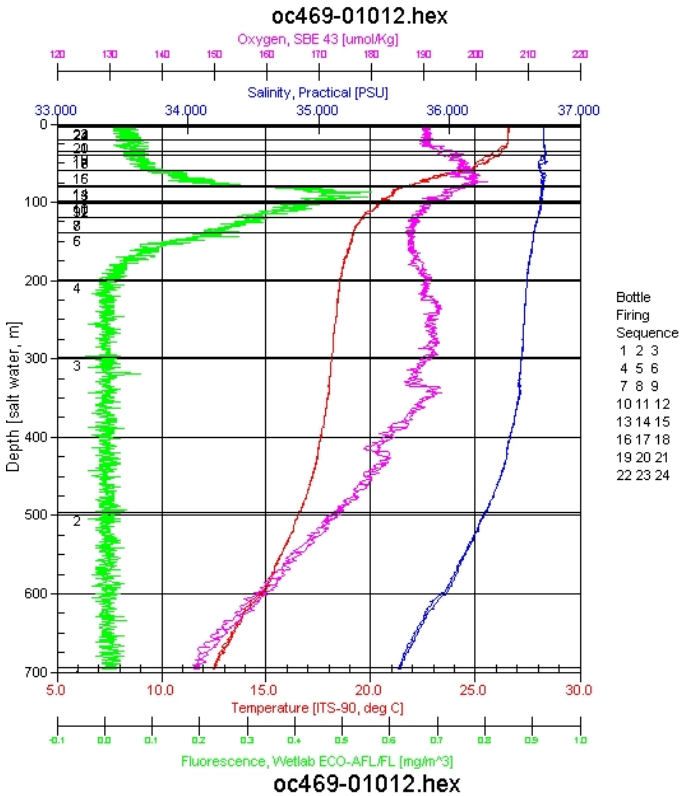
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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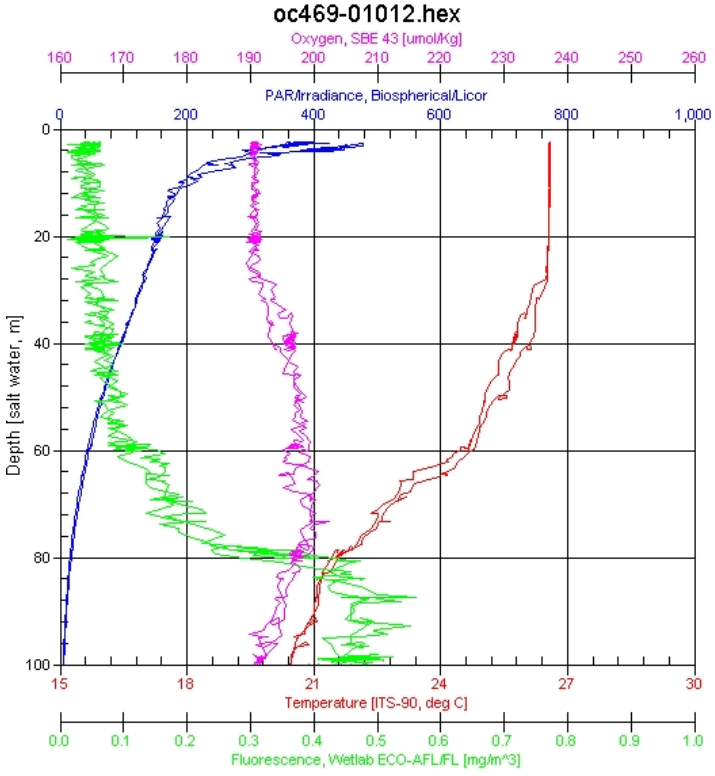
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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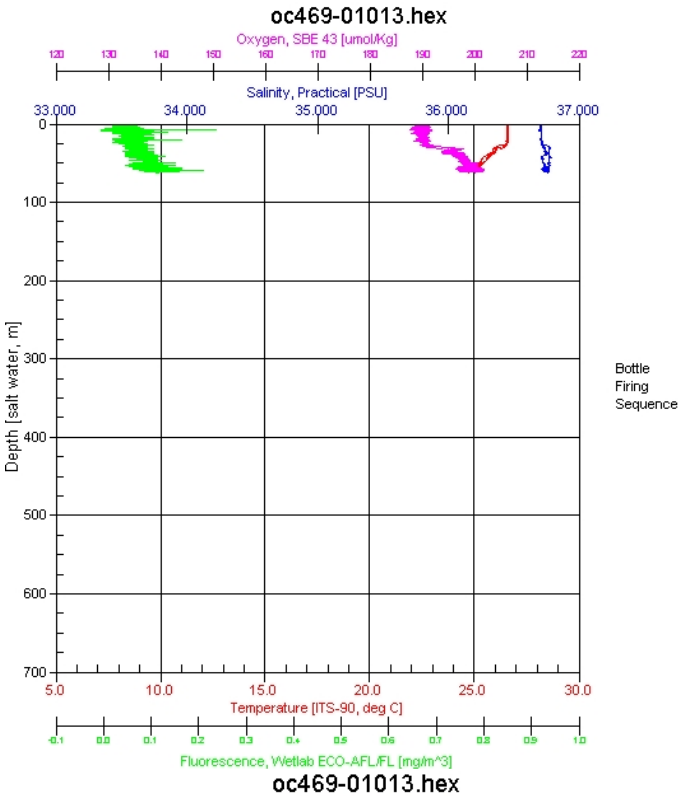
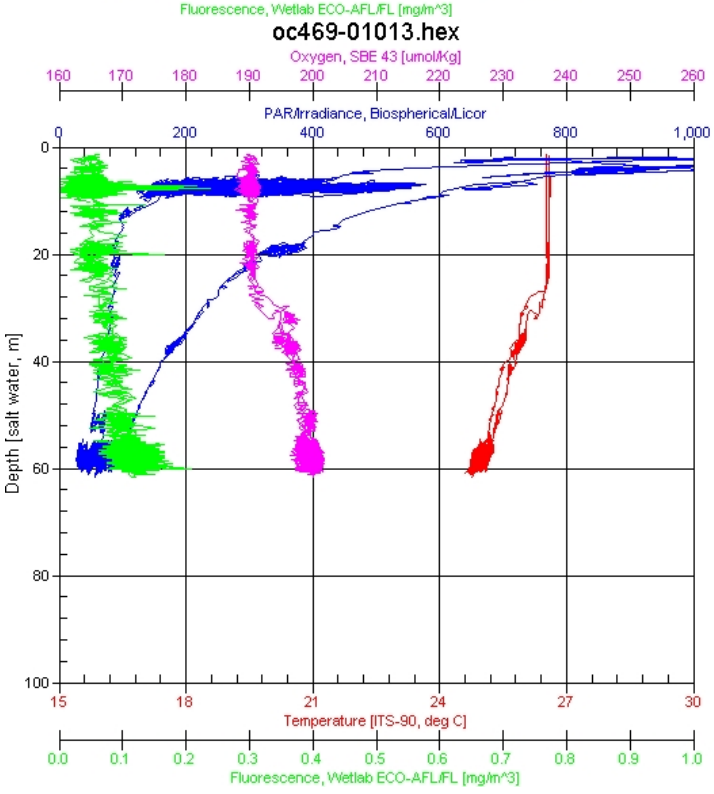
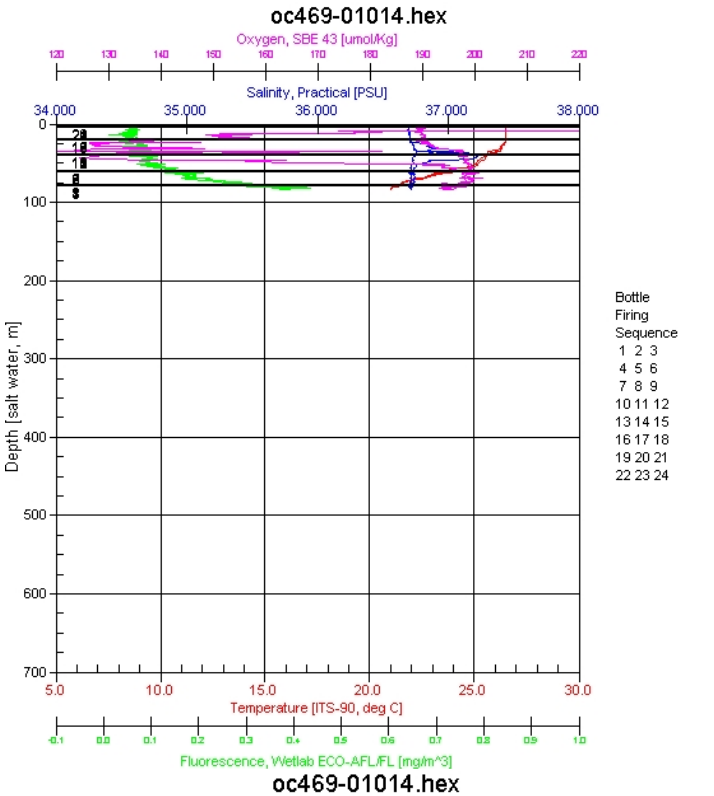
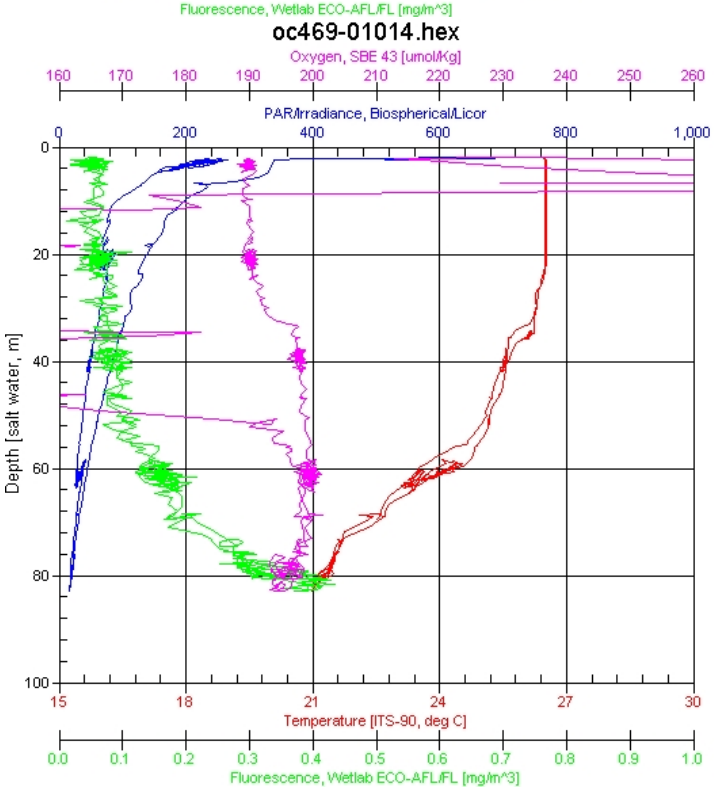
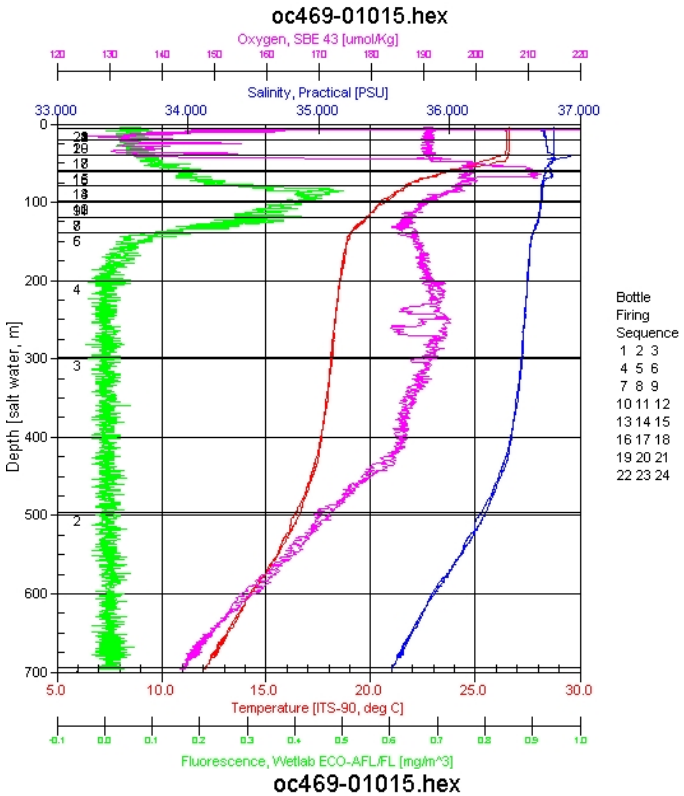
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

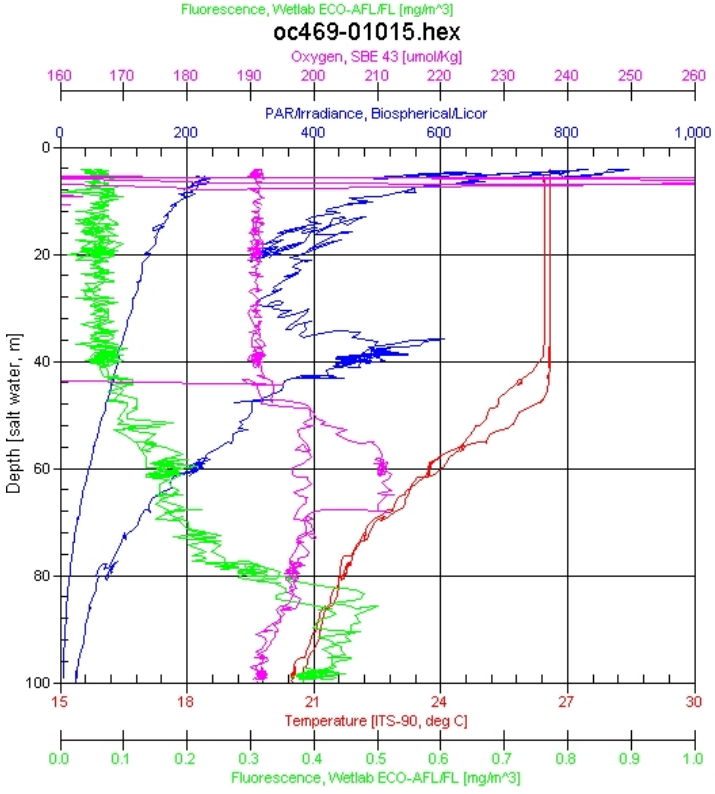

oc469-01013.hex
Oxygen, SBE 43 [umol/Kg]
120 130 140 150 160 170 180 190 200 210 220
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence


oc469-01013.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01014.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24


oc469-01014.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01015.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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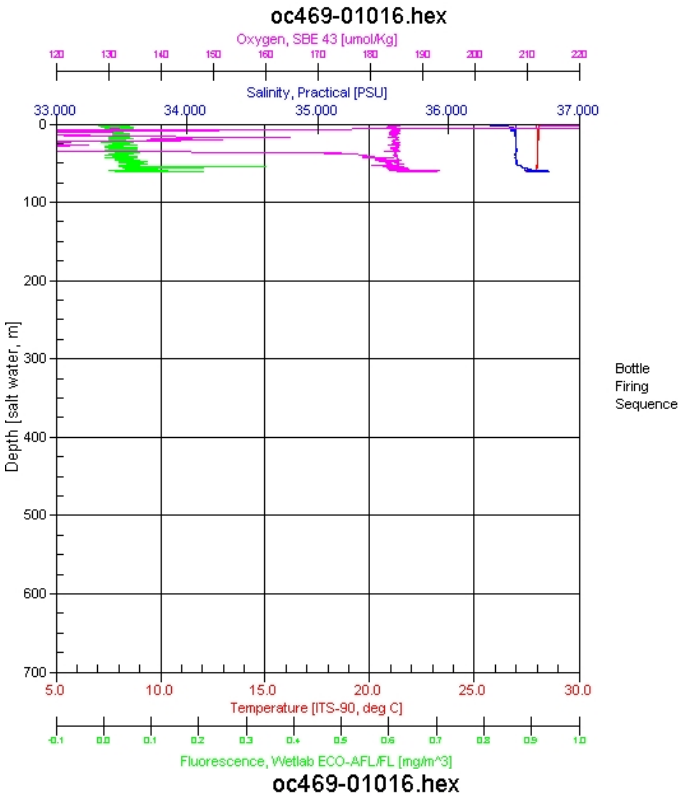
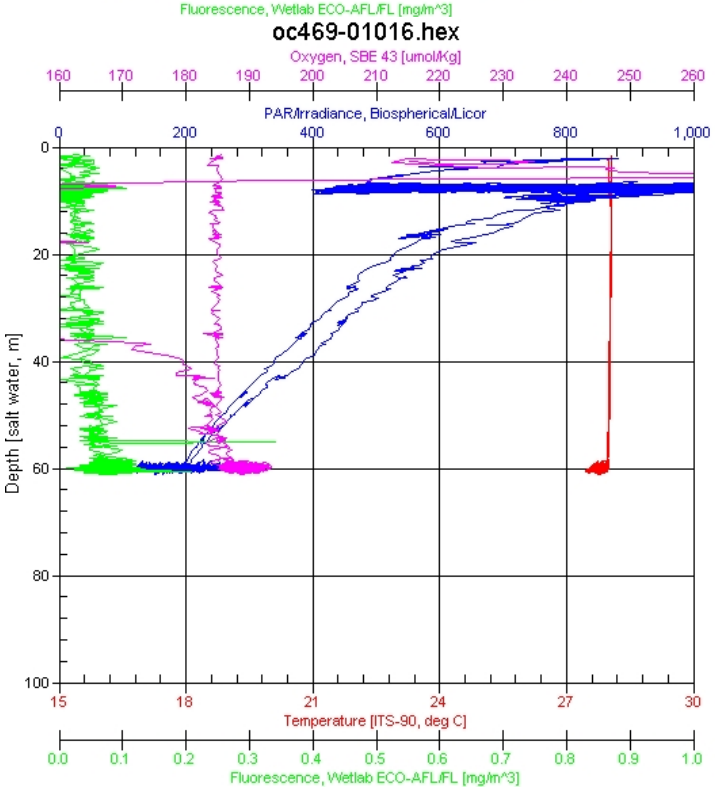
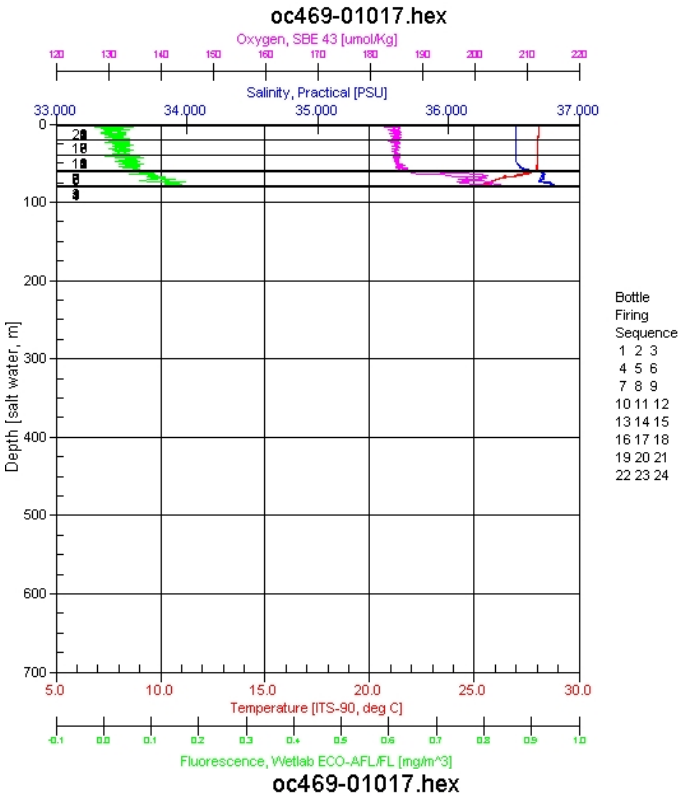
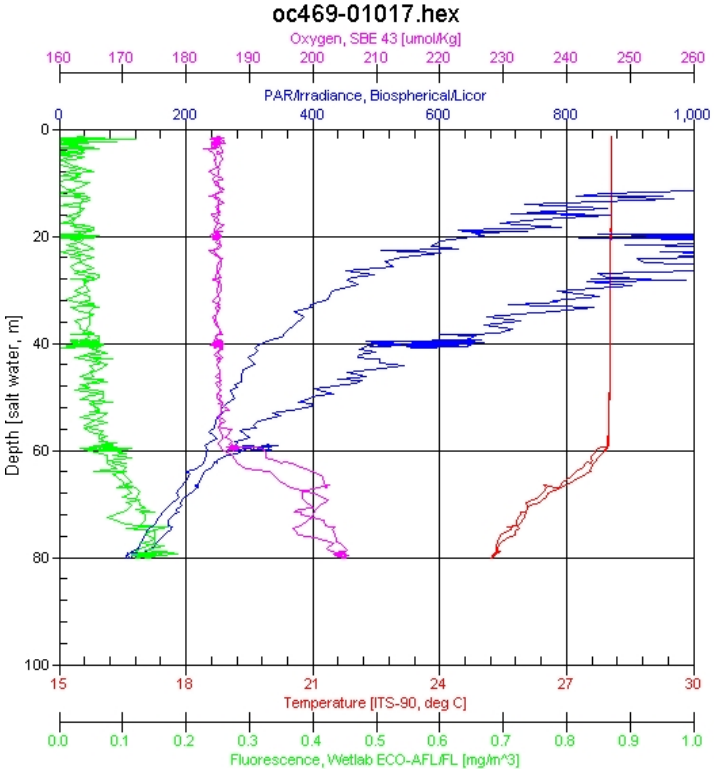
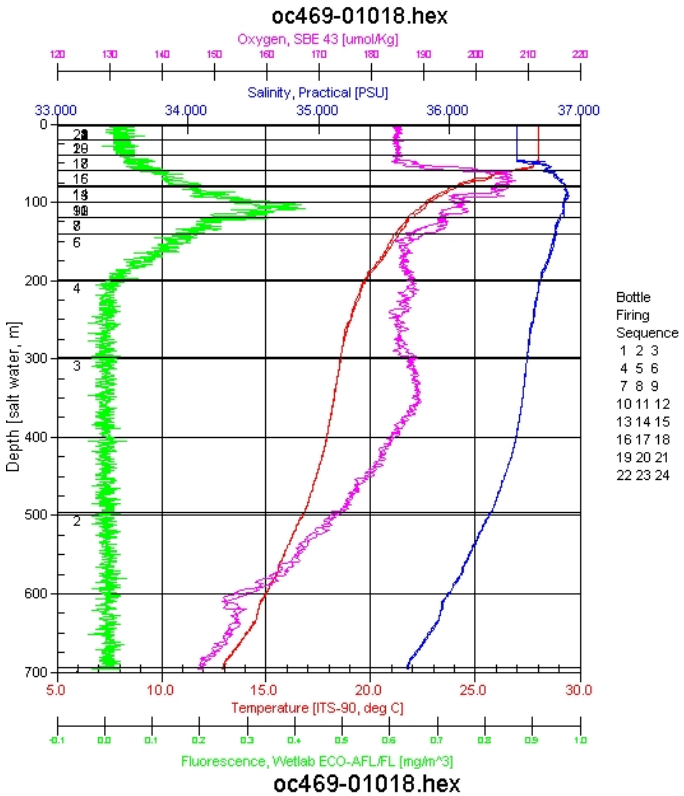
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

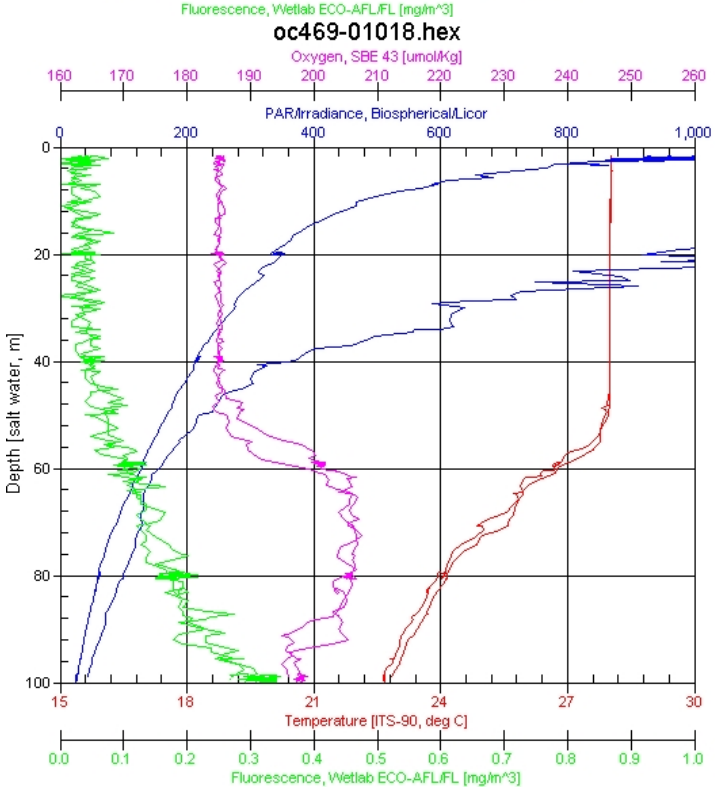

oc469-01016.hex
Oxygen, SBE 43 [umol/Kg]
120 130 140 150 160 170 180 190 200 210 220
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence

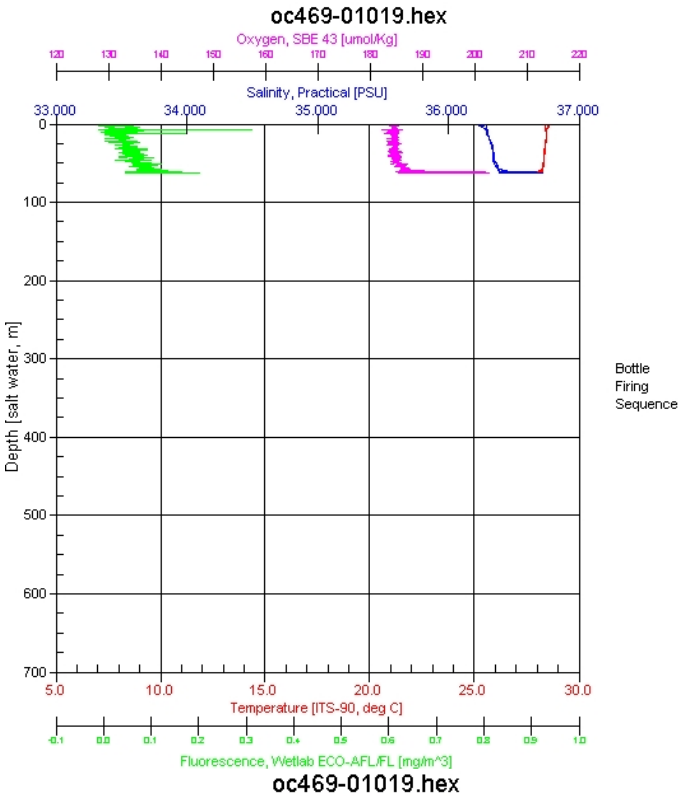

oc469-01016.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

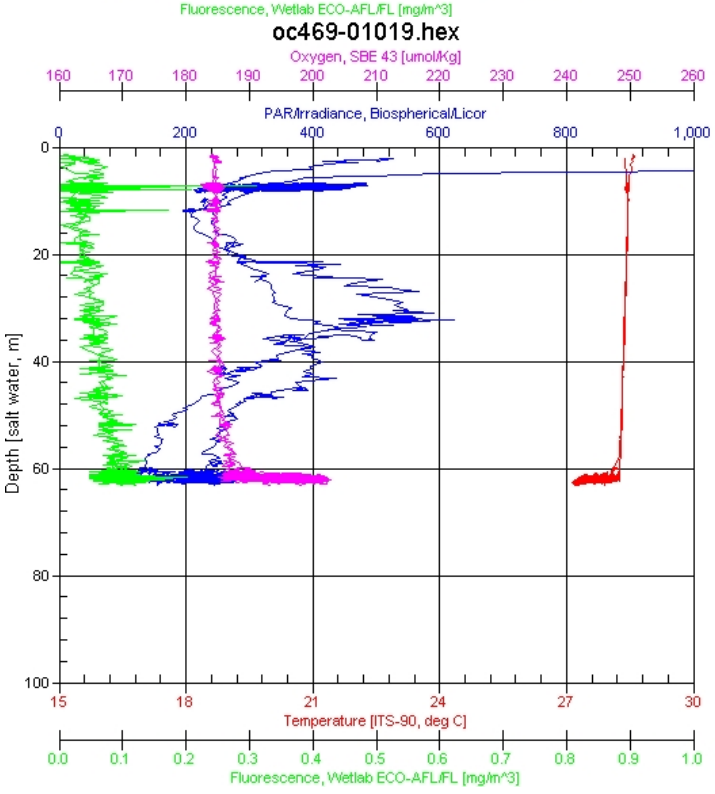

oc469-01017.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

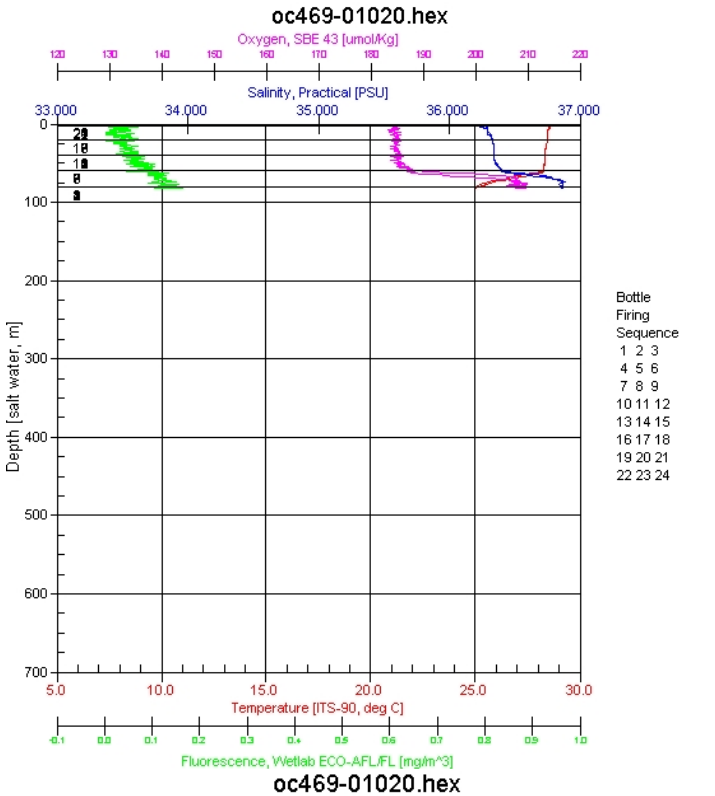

oc469-01017.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

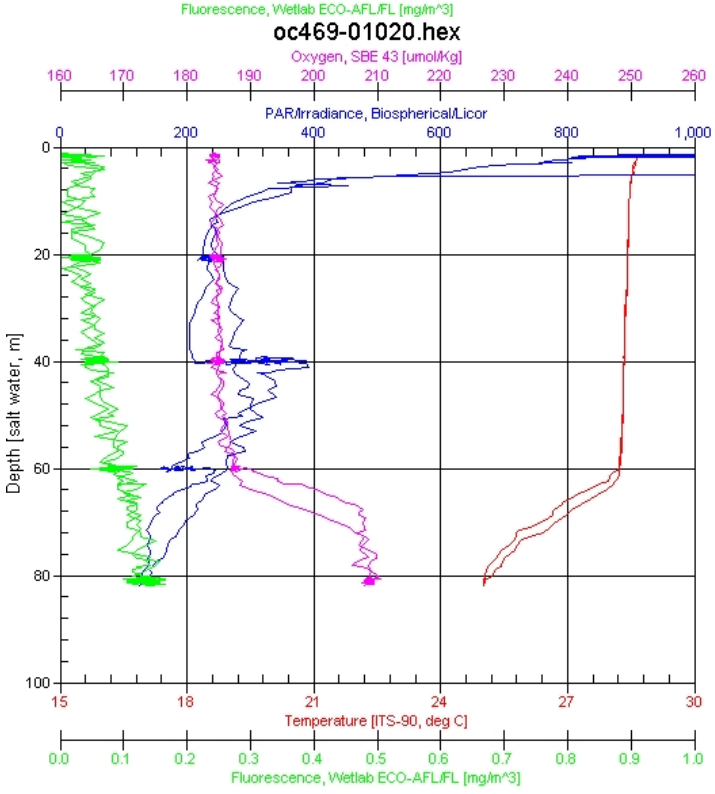

oc469-01018.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

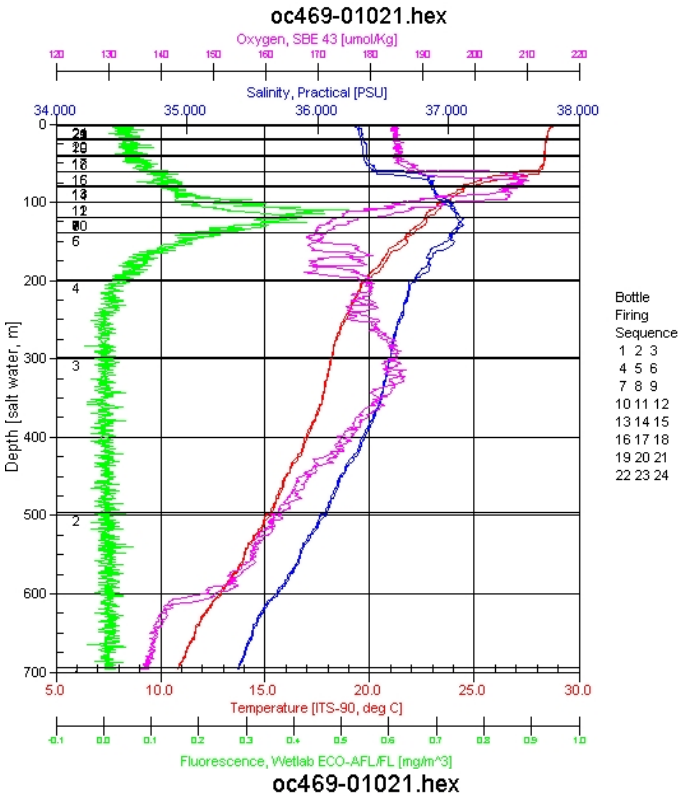

oc469-01018.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

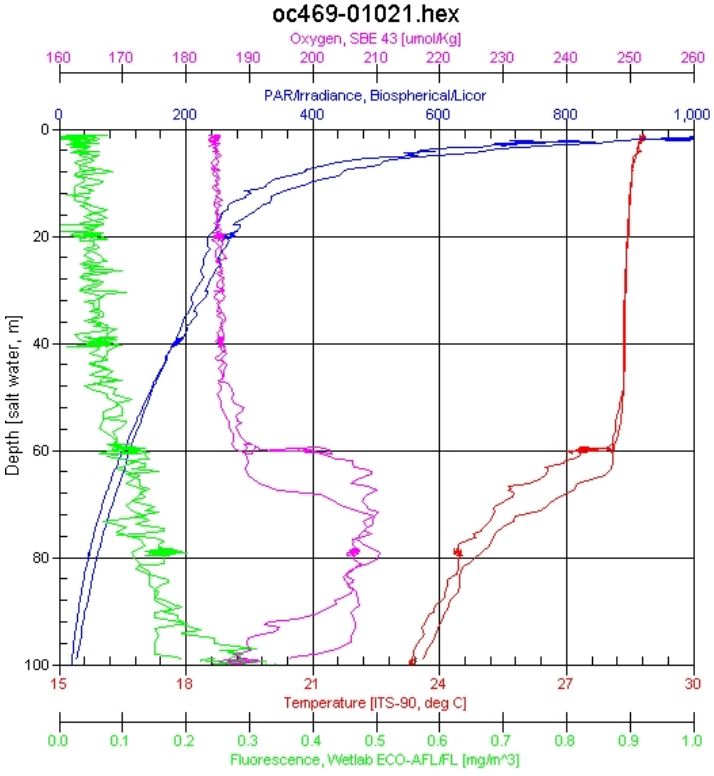

oc469-01019.hex
Oxygen, SBE 43 [umol/Kg]
120 130 140 150 160 170 180 190 200 210 220
Salinity, Practical [PSU]
33.000 34.000 35.000 36.000 37.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
Bottle
Firing
Sequence
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

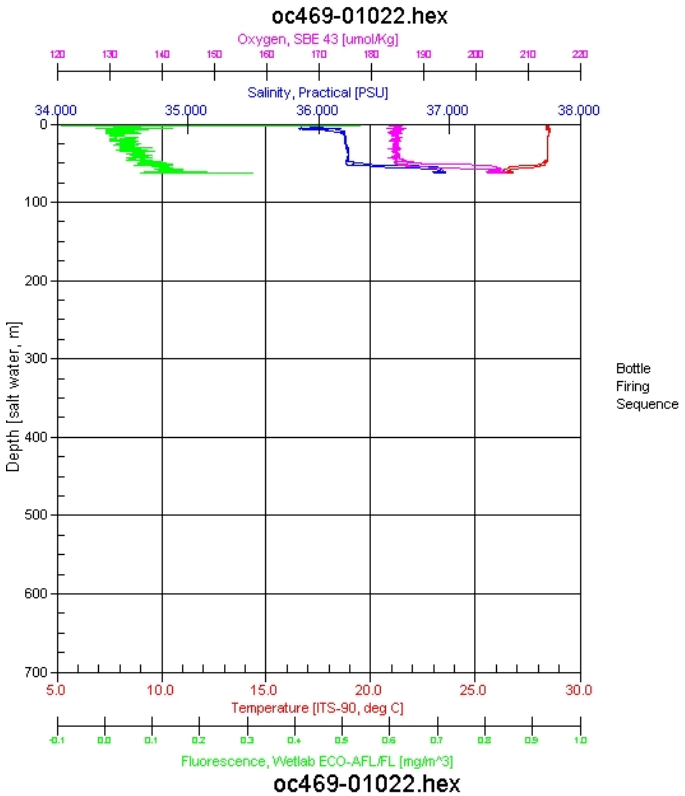

oc469-01019.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

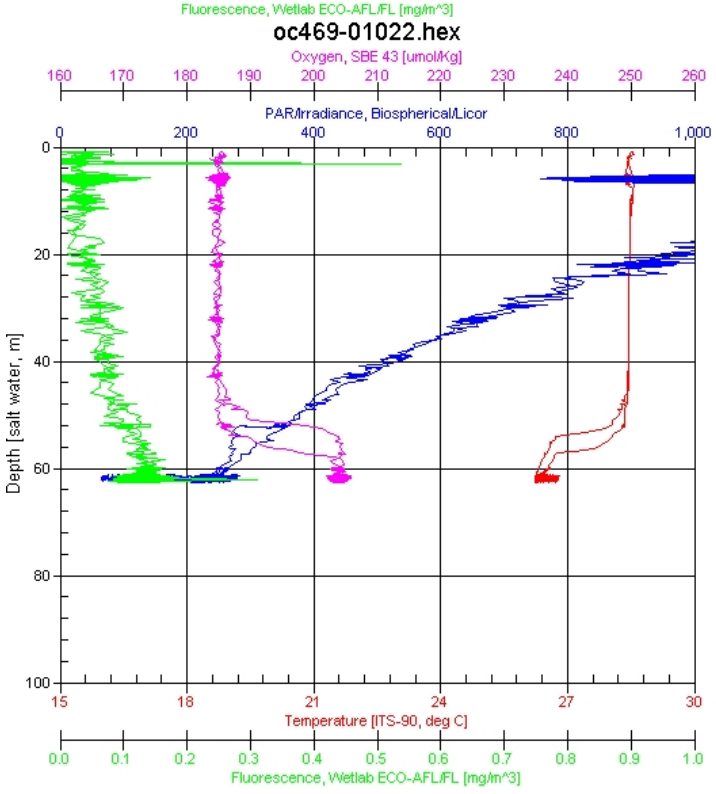

oc469-01020.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

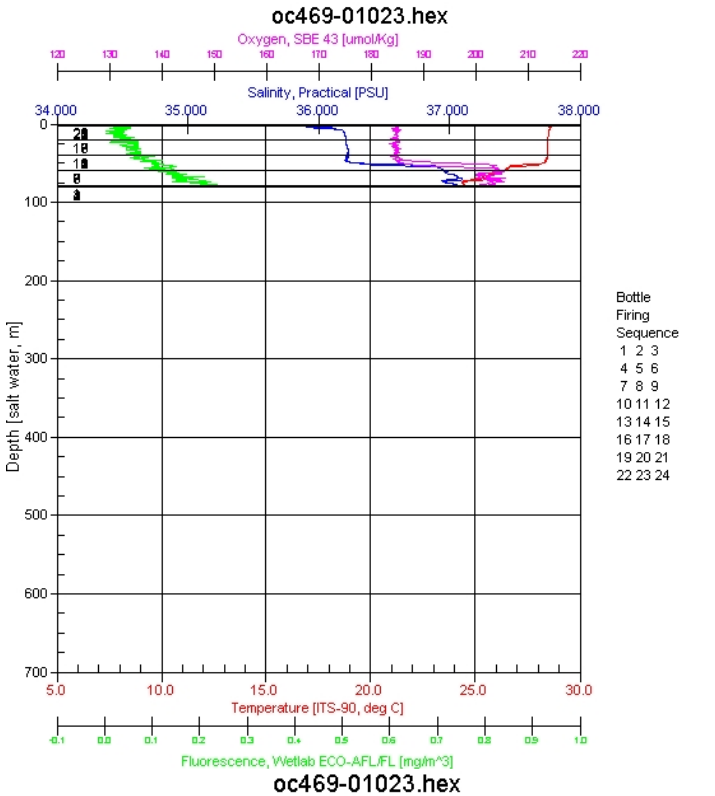

oc469-01020.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01021.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24


oc469-01021.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01022.hex
Oxygen, SBE 43 [umol/Kg]
120 130 140 150 160 170 180 190 200 210 220
Salinity, Practical [PSU]
34.000 35.000 36.000 37.000 38.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence


oc469-01022.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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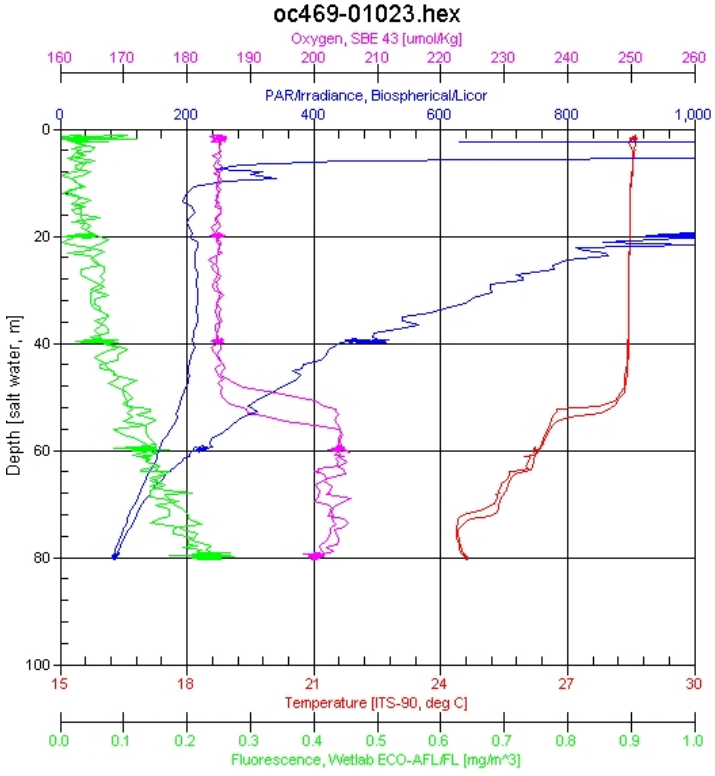
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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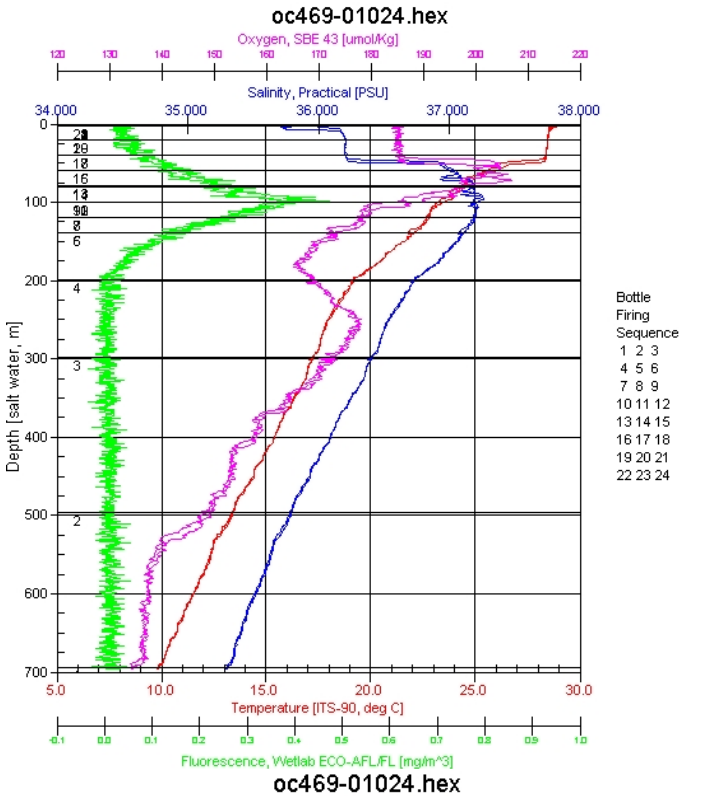
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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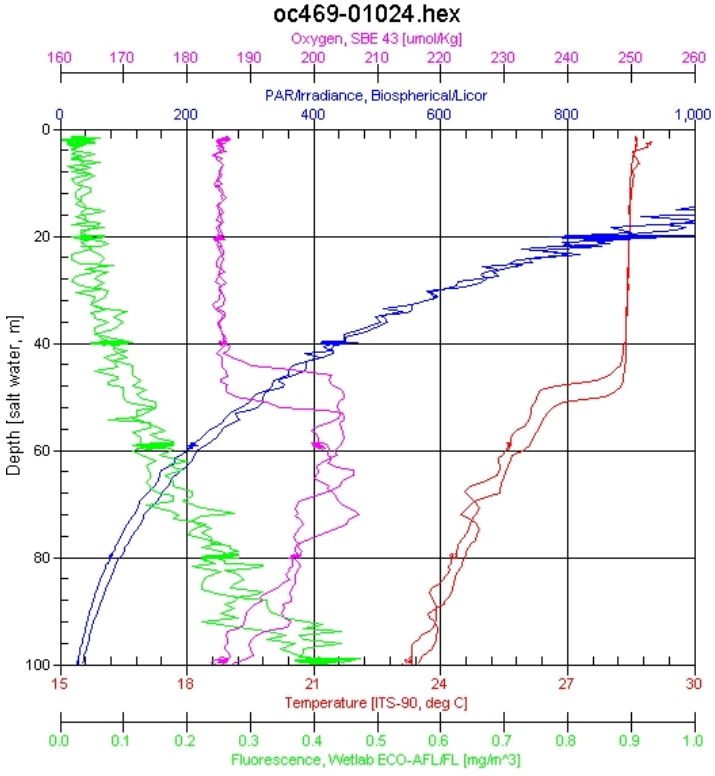
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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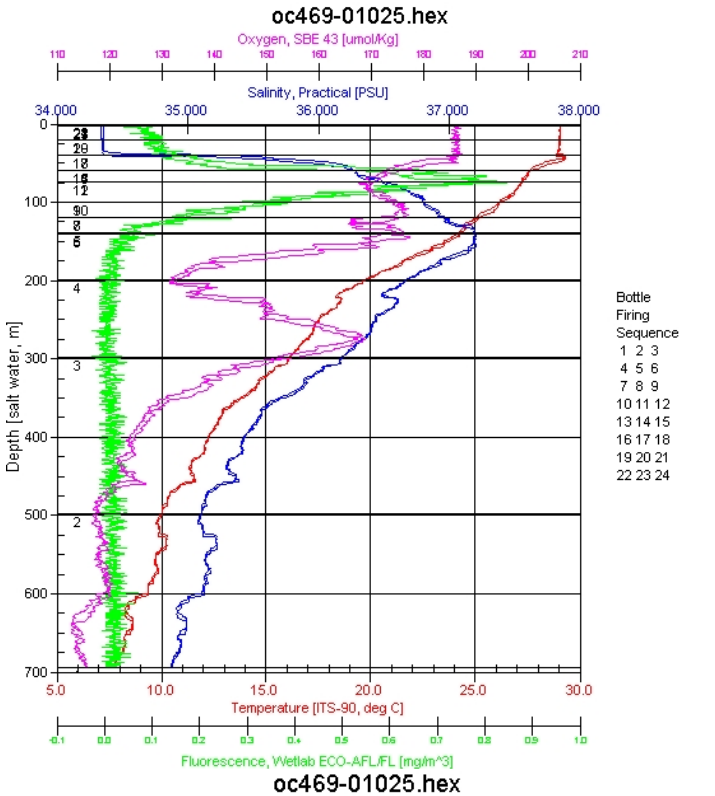
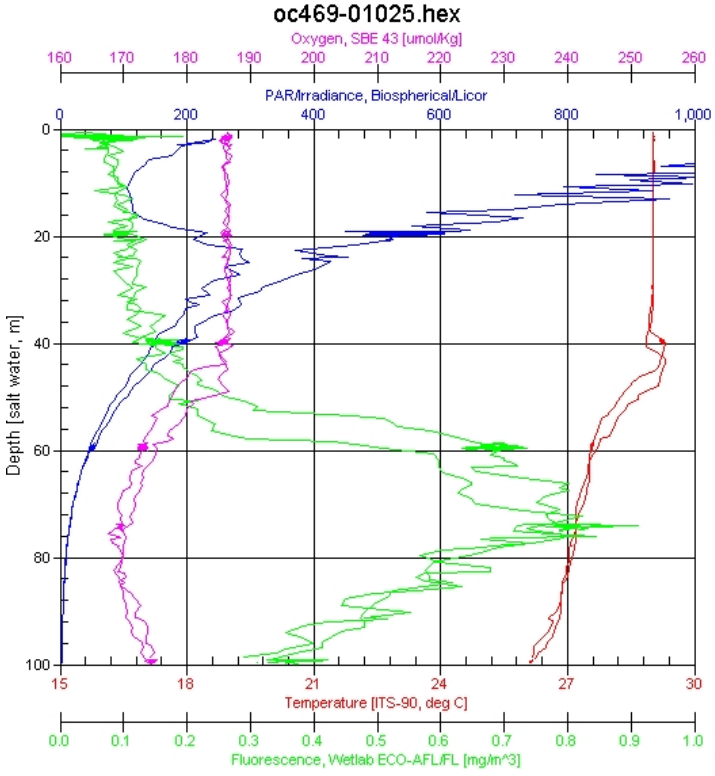
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01025.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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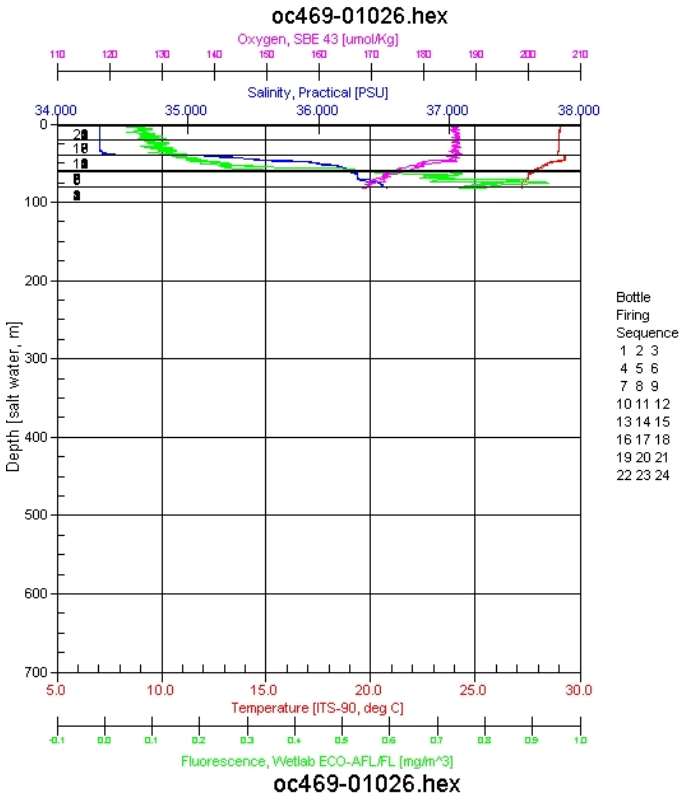
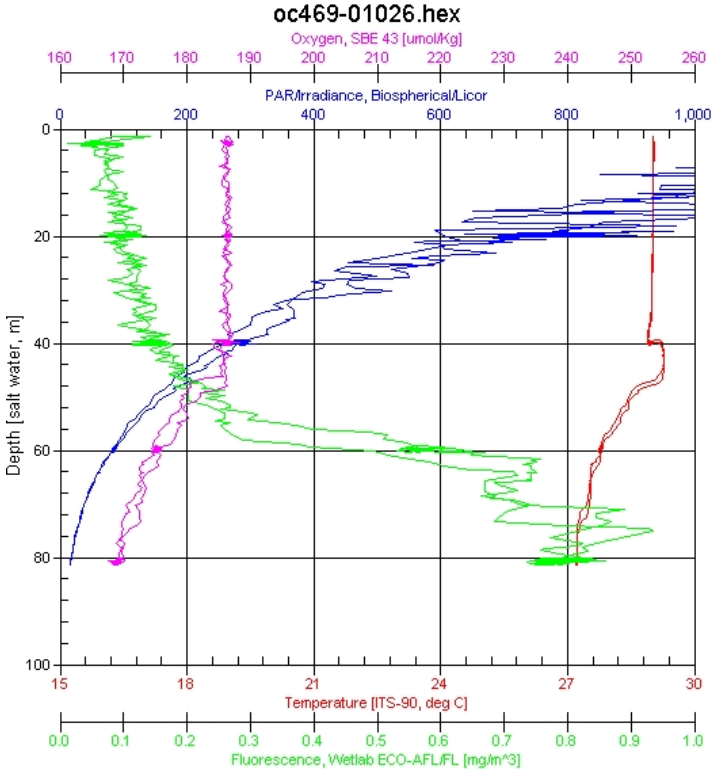
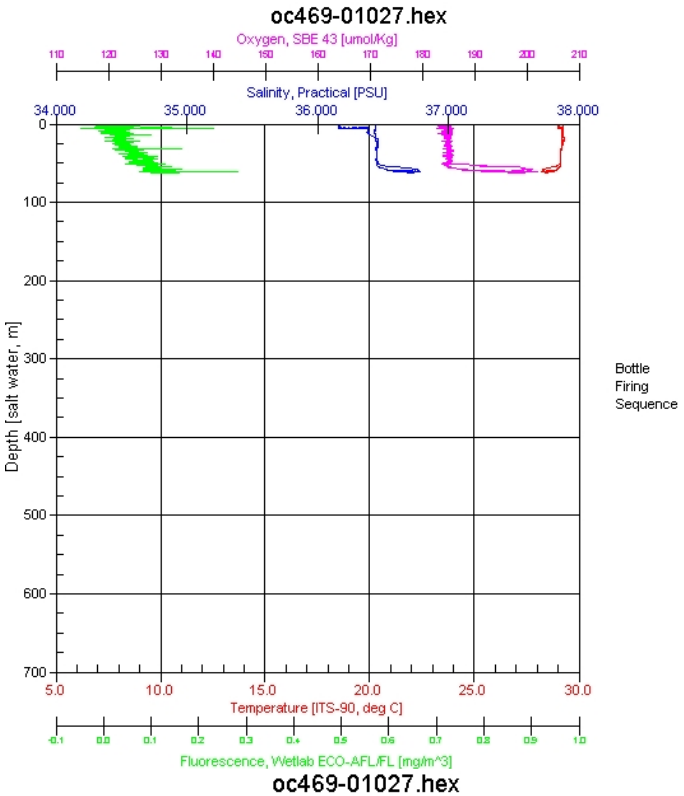
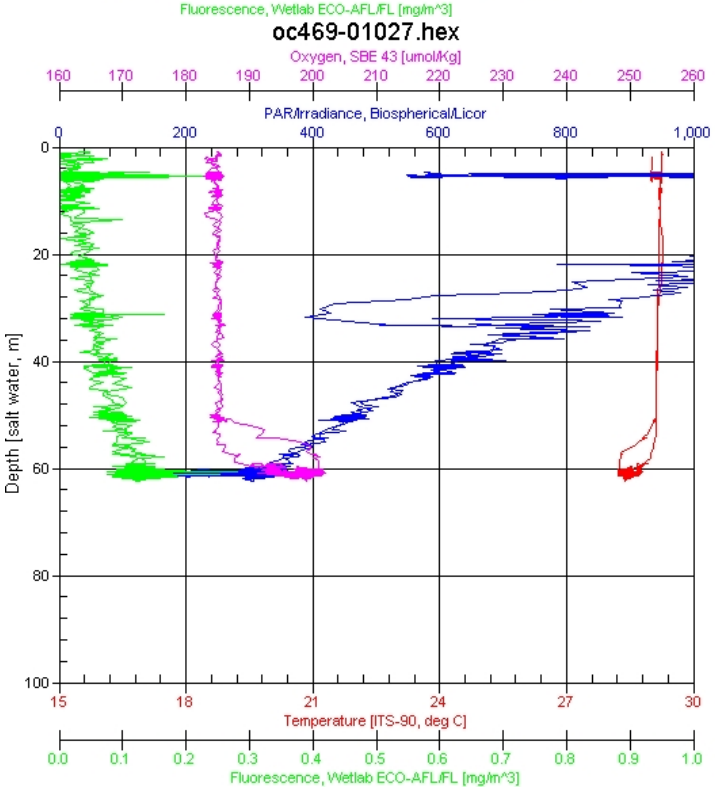
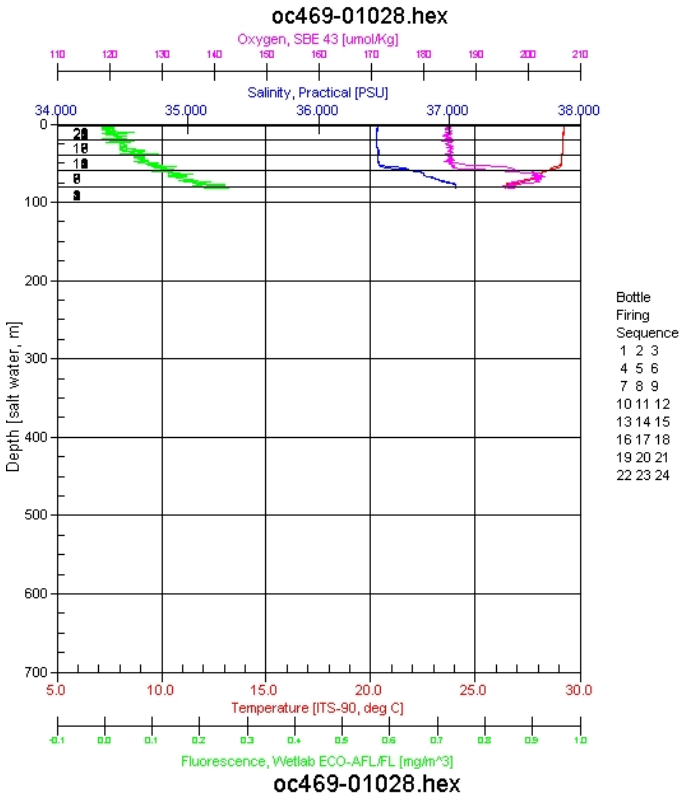
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

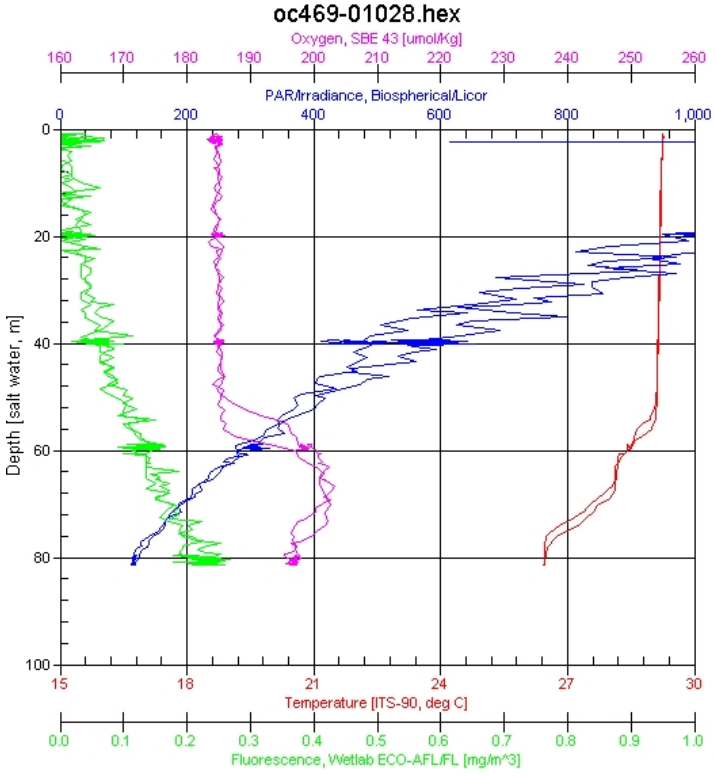

oc469-01026.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

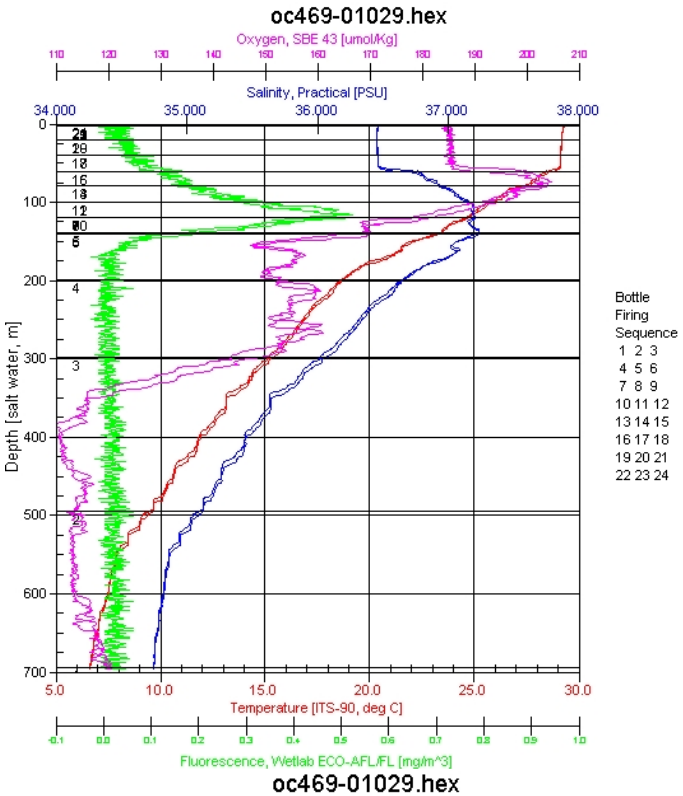

oc469-01026.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

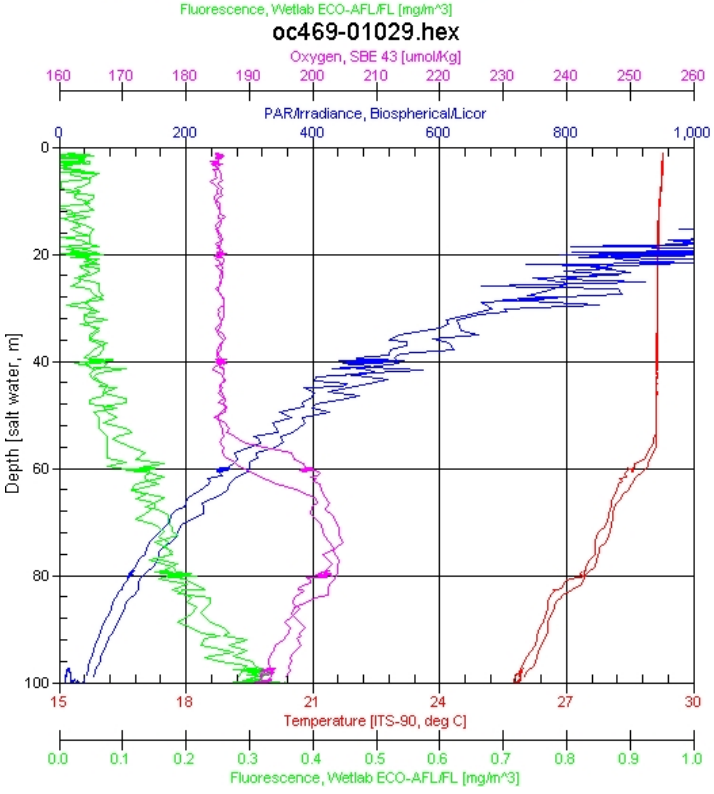

oc469-01027.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Bottle
Firing
Sequence
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

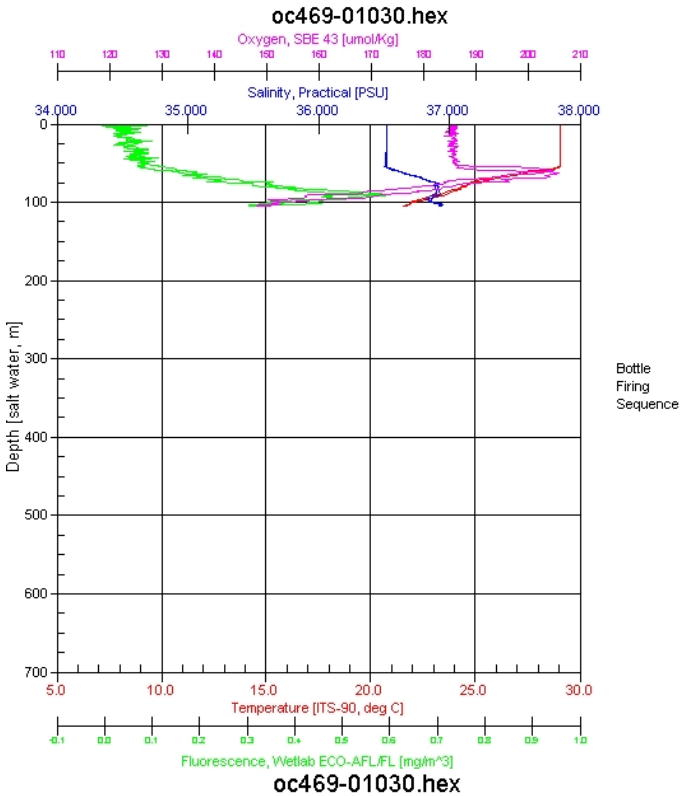

oc469-01027.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

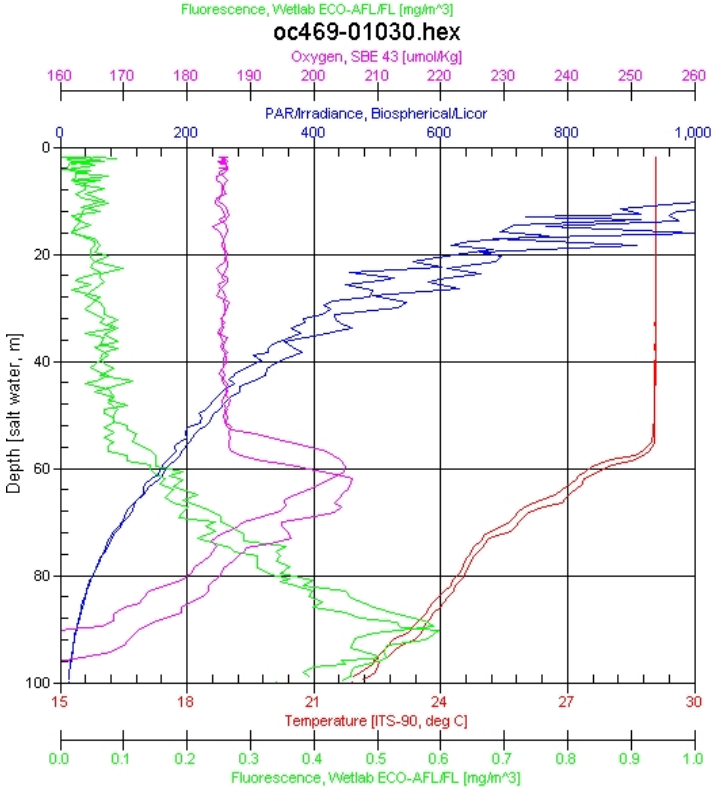

oc469-01028.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

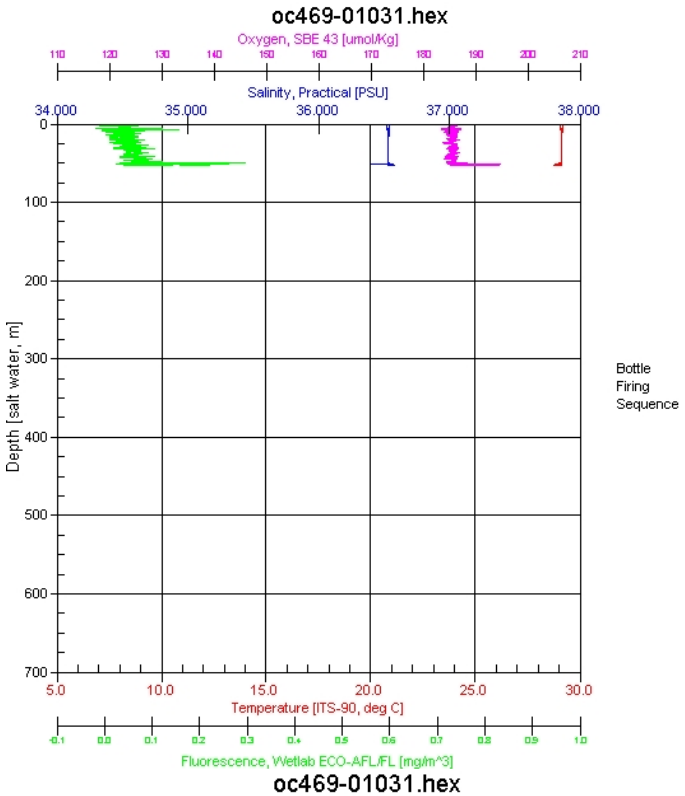

oc469-01028.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

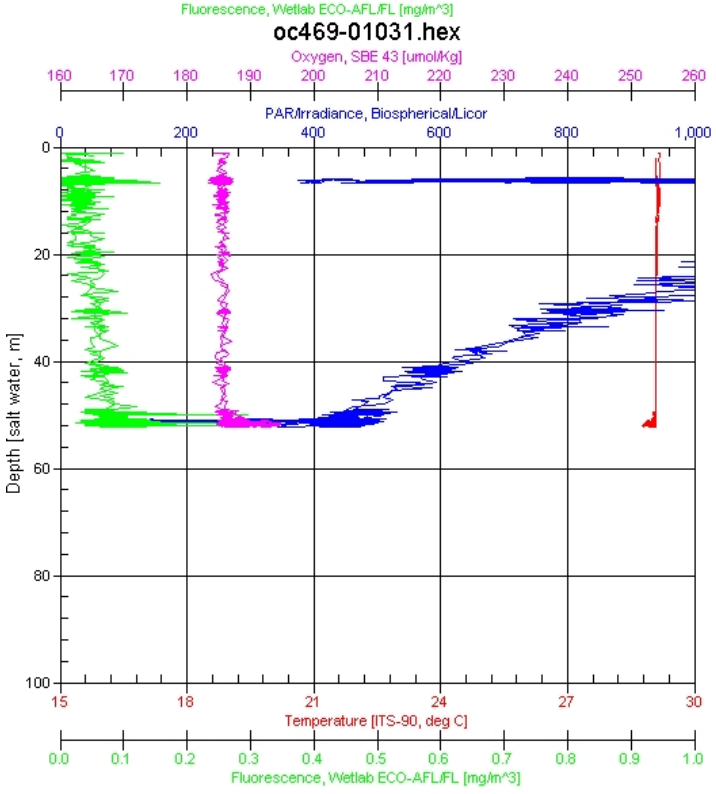

oc469-01029.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle Firing Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

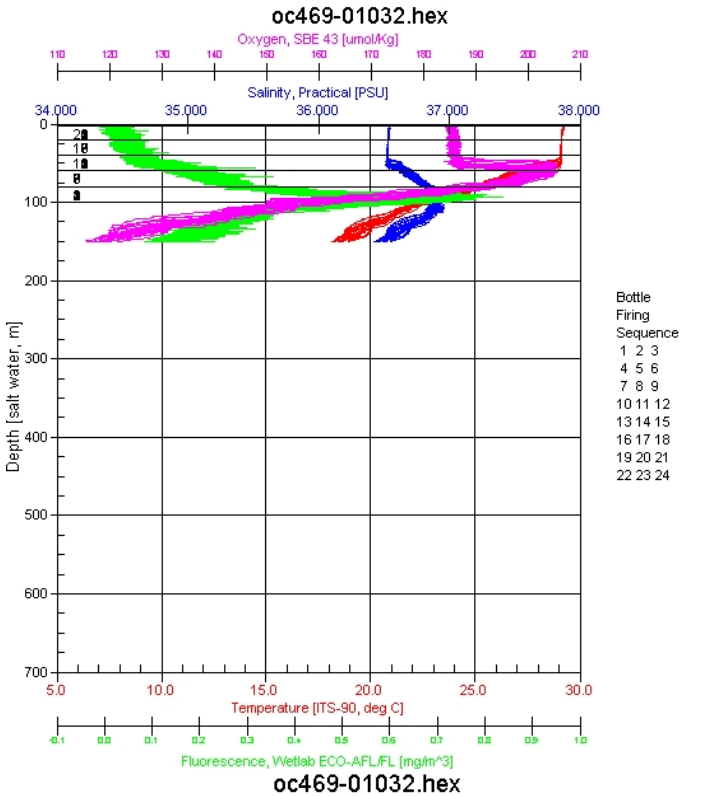

oc469-01029.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

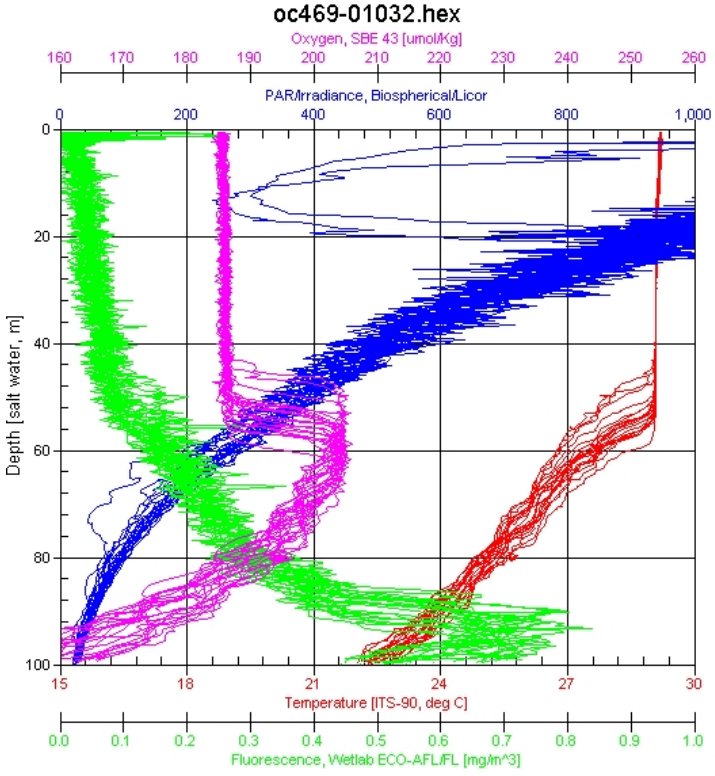

oc469-01030.hex
Oxygen, SBE 43 [umol/Kg]
110 120 130 140 150 160 170 180 190 200 210
Salinity, Practical [PSU]
34.000 35.000 36.000 37.000 38.000
0 100 200 300 400 500 600 700
Depth [salt water, m]
Bottle
Firing
Sequence
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

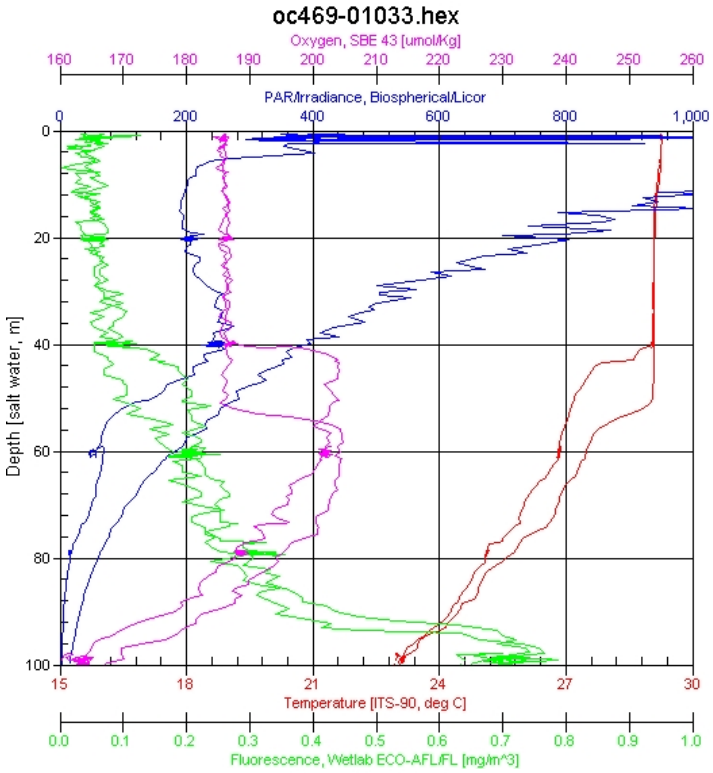

oc469-01030.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
0 20 40 60 80 100
Depth [salt water, m]
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

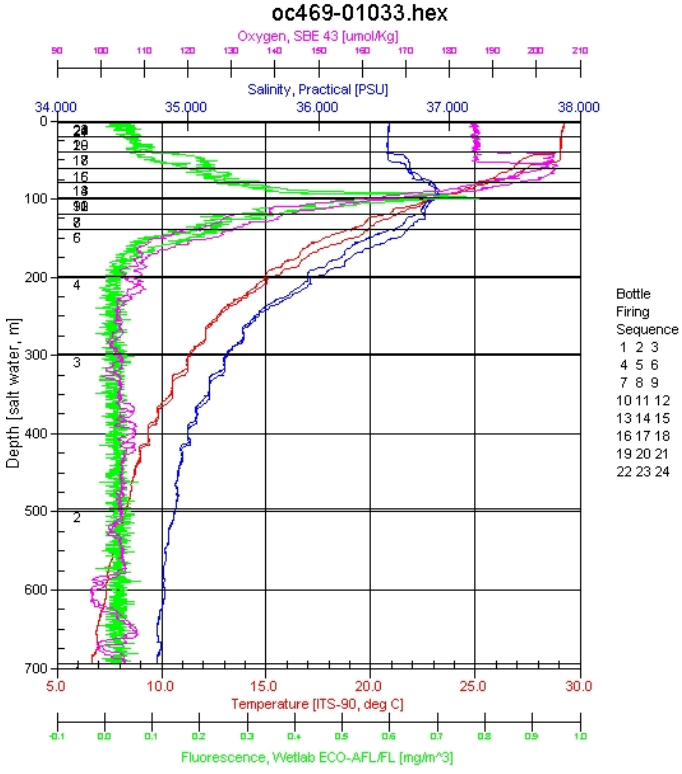

oc469-01031.hex
Oxygen, SBE 43 [umol/Kg]
110 120 130 140 150 160 170 180 190 200 210
Salinity, Practical [PSU]
34.000 35.000 36.000 37.000 38.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
Bottle
Firing
Sequence
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

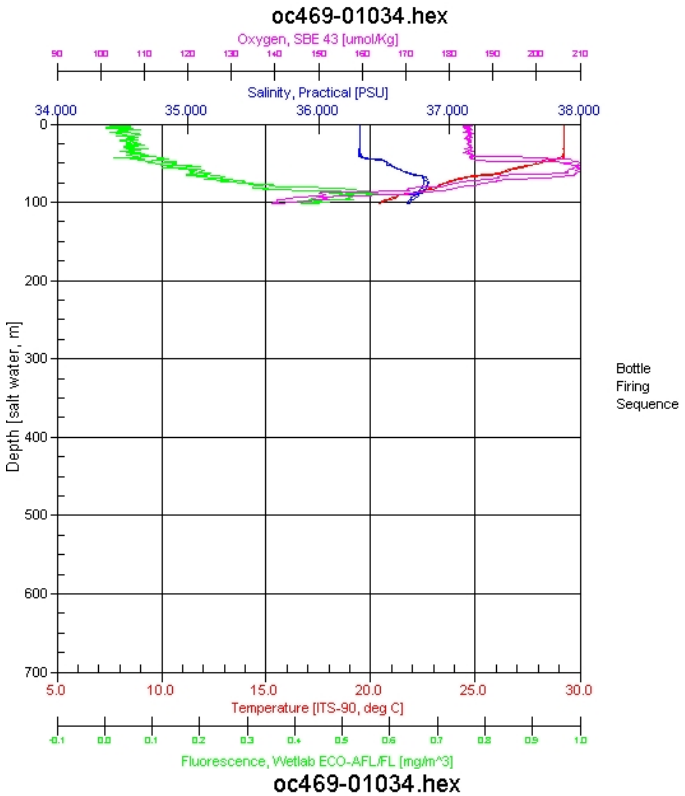

oc469-01031.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

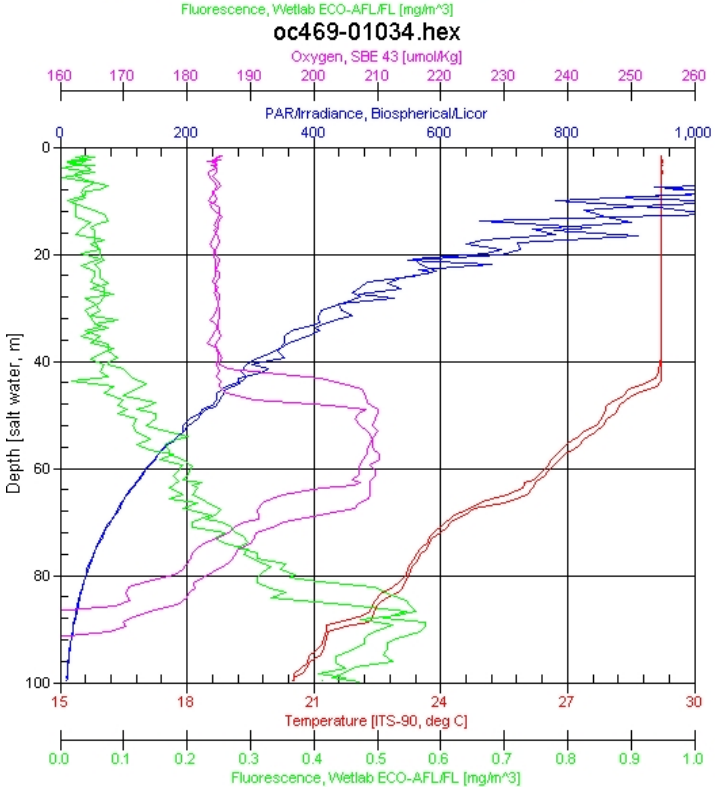

oc469-01032.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

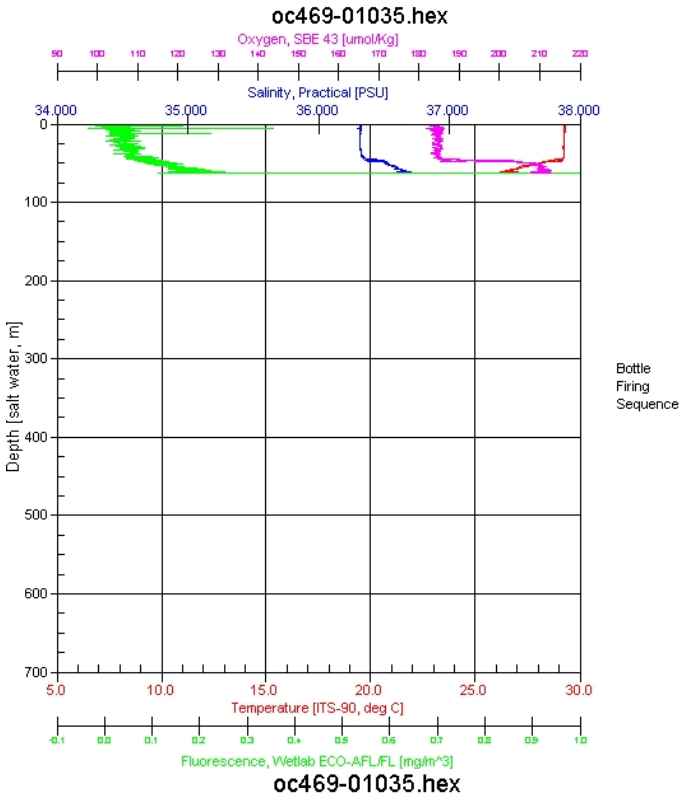

oc469-01032.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

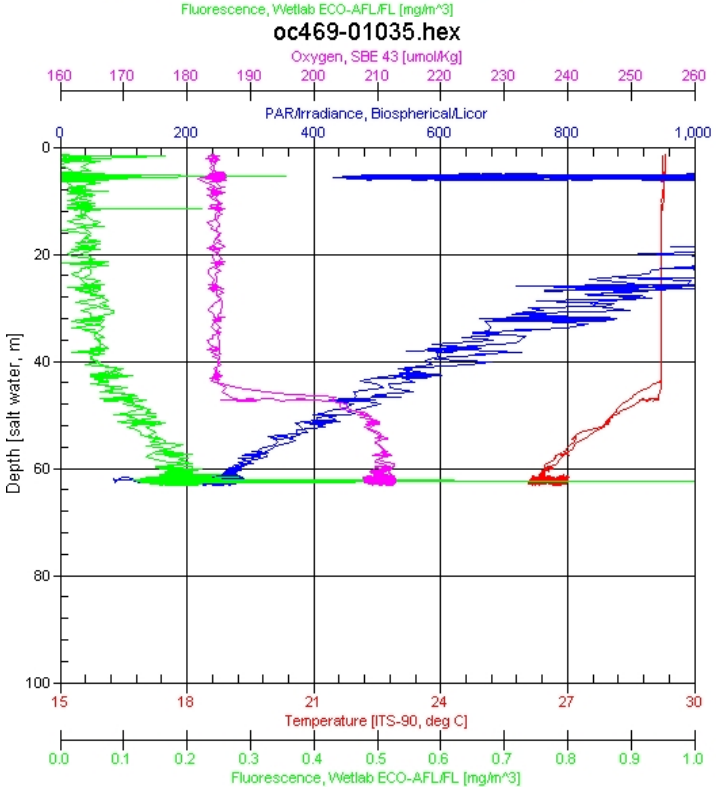

oc469-01033.hex
Oxygen, SBE 43 [umol/Kg]
160 170 180 190 200 210 220 230 240 250 260
PAR/Irradiance, Biospherical/Licor
0 200 400 600 800 1,000
Depth [salt water, m]
0 20 40 60 80 100
15 18 21 24 27 30
Temperature [ITS-90, deg C]
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

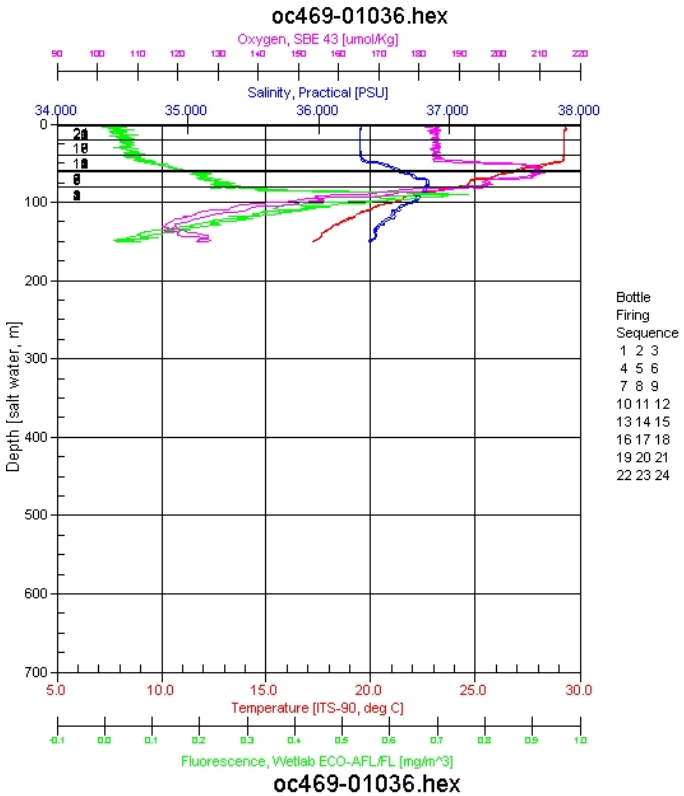

oc469-01033.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000 35.000 36.000 37.000 38.000
Depth [salt water, m]
0 100 200 300 400 500 600 700
5.0 10.0 15.0 20.0 25.0 30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24

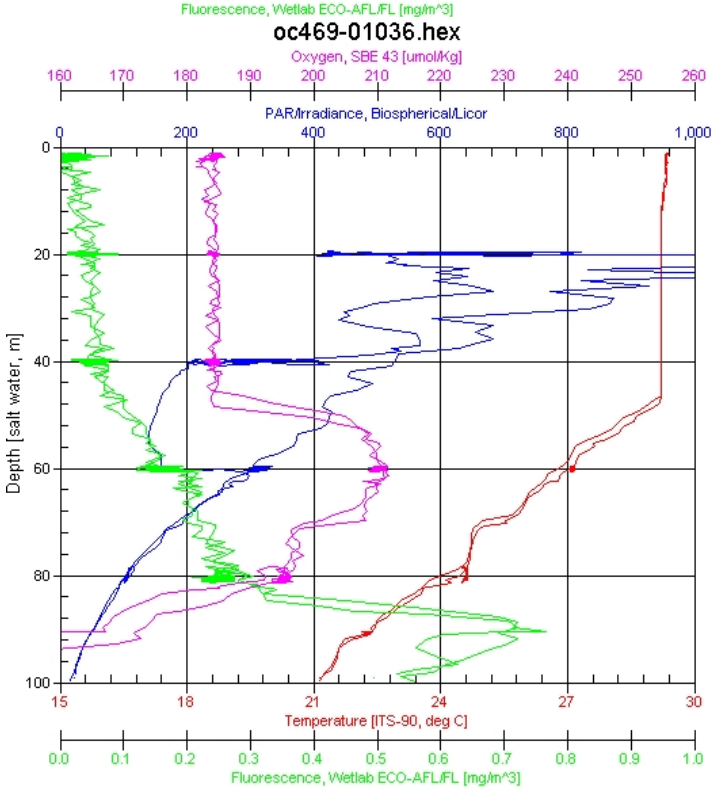

oc469-01034.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

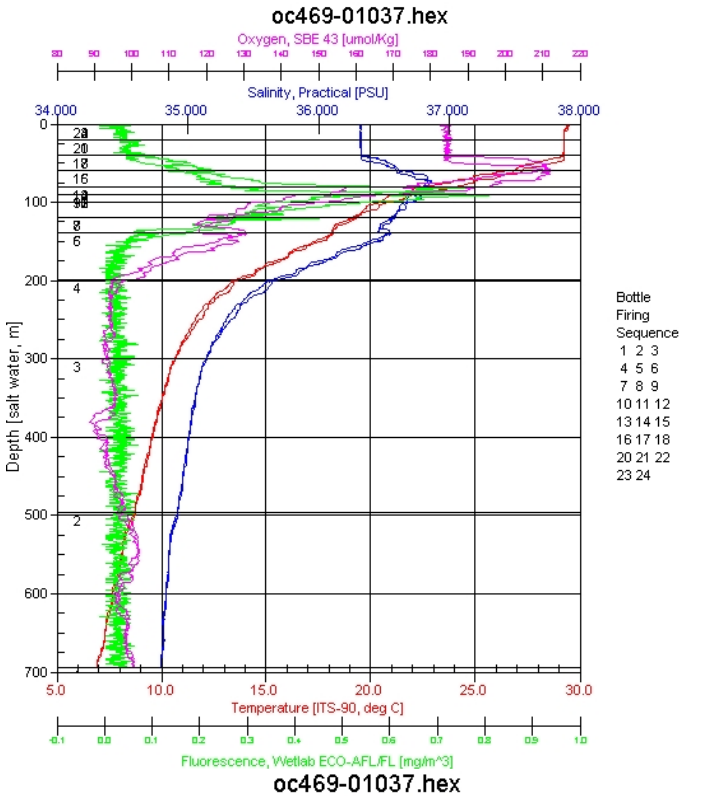

oc469-01034.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
15
18
21
24
27
30
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

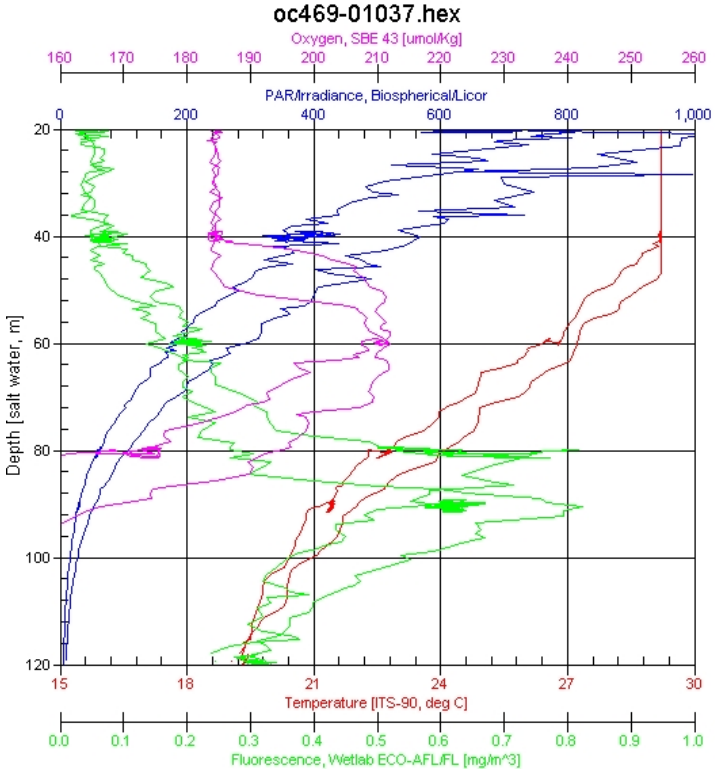

oc469-01035.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

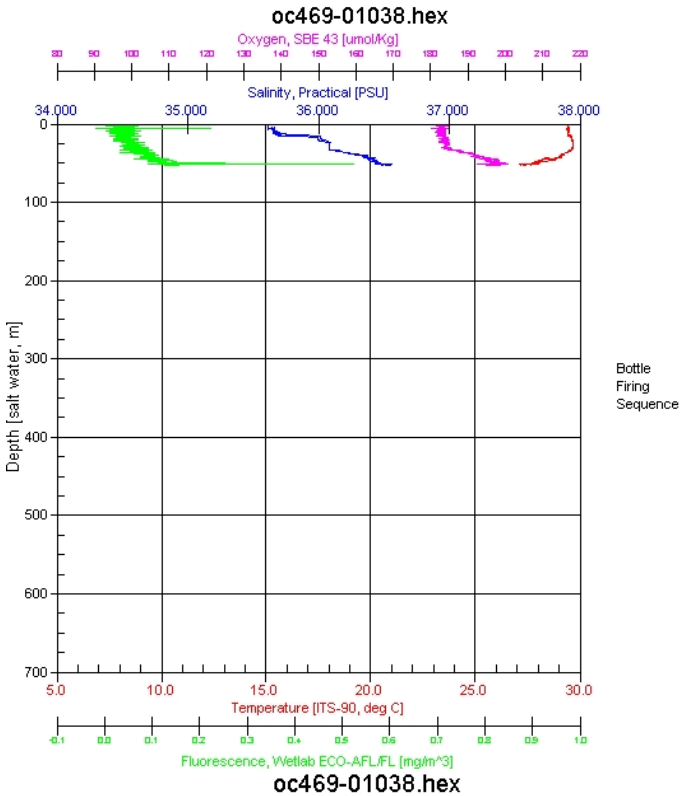

oc469-01035.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

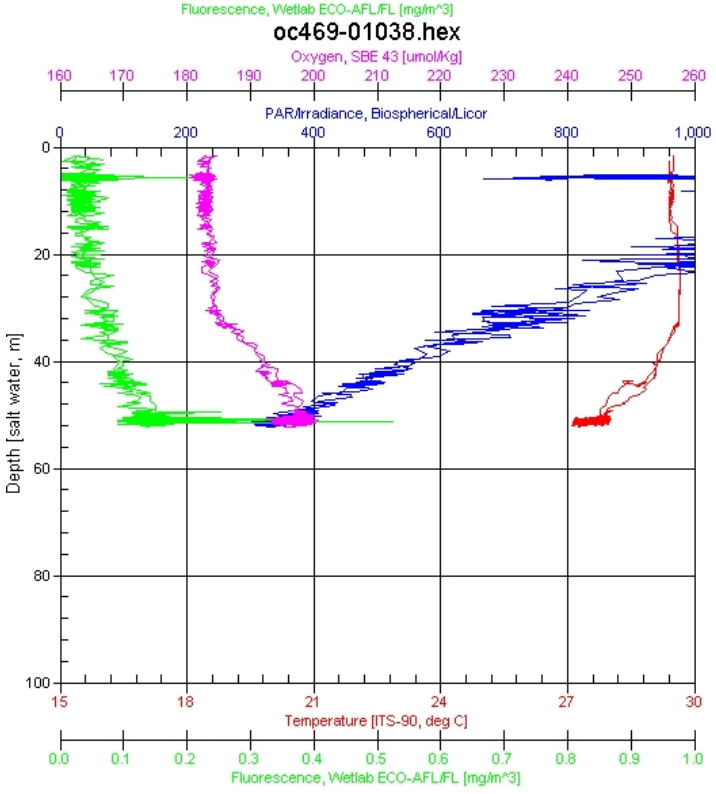

oc469-01036.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

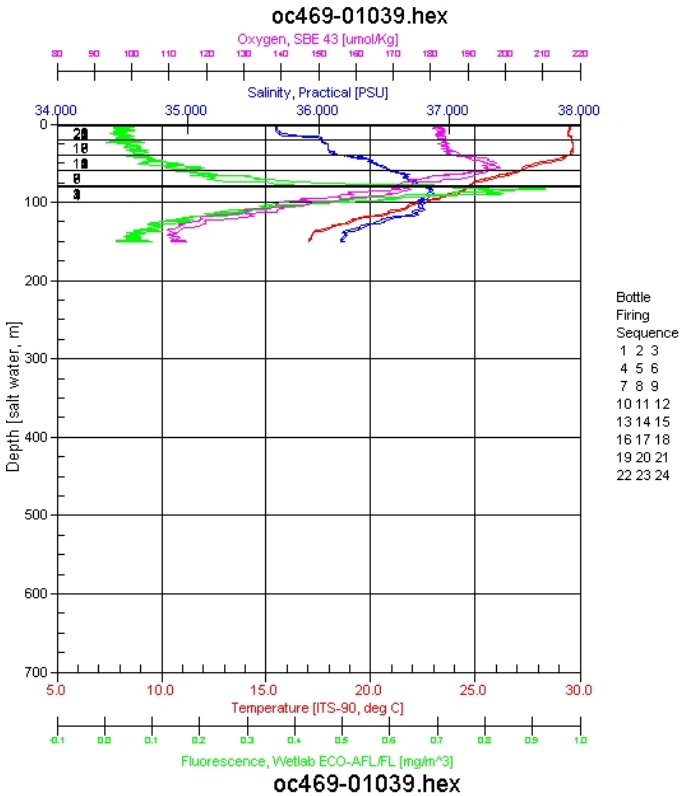

oc469-01036.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

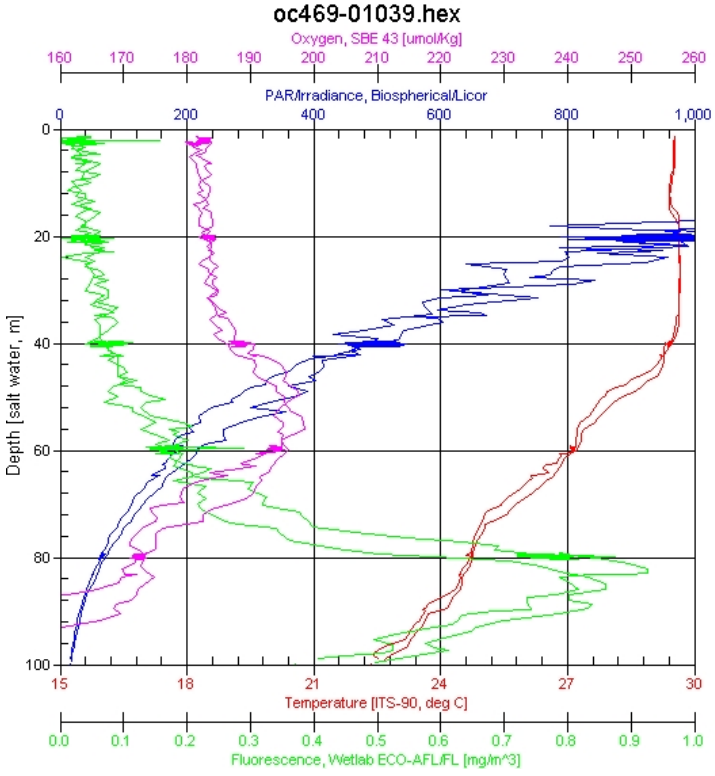

oc469-01037.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
20 21 22
23 24
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

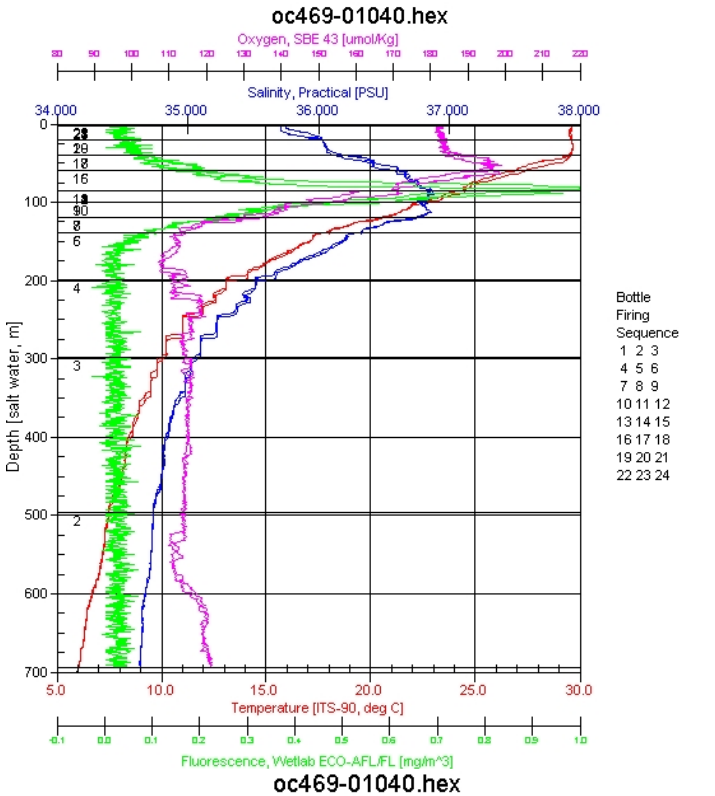

oc469-01037.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

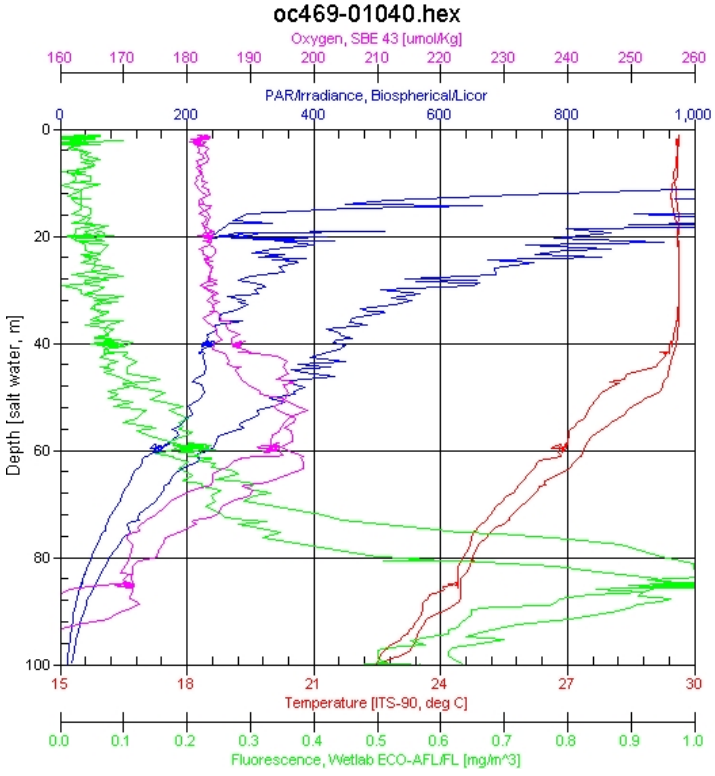

oc469-01038.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

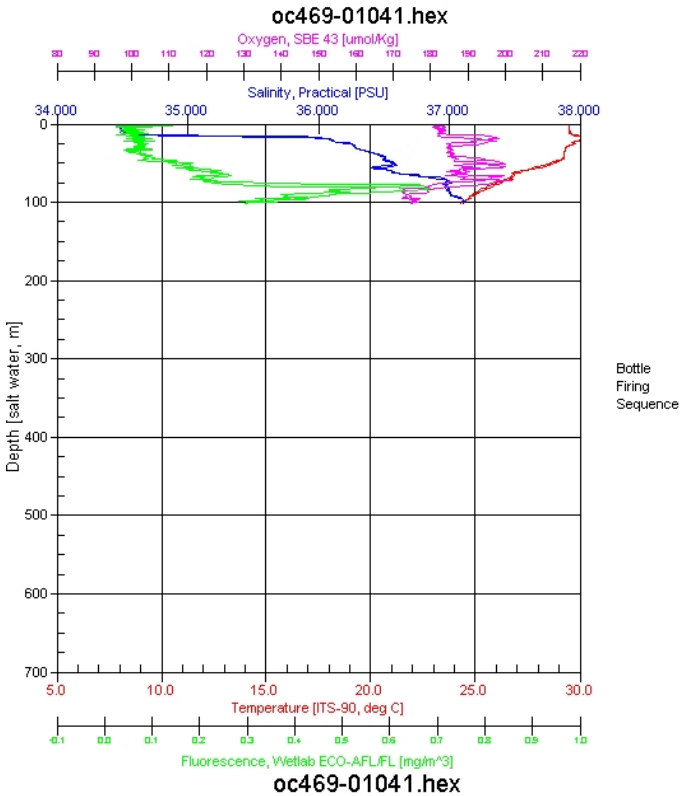

oc469-01038.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

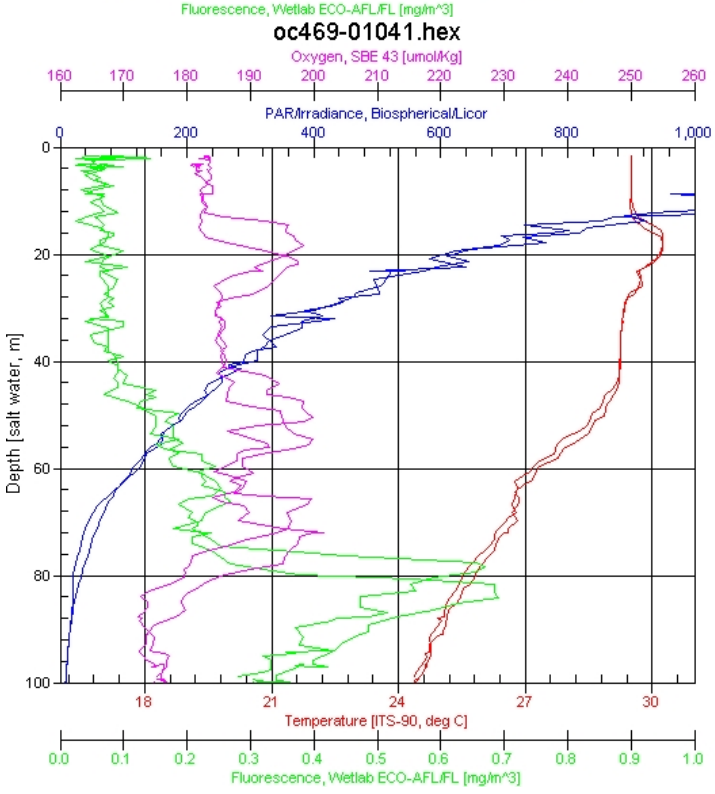

oc469-01039.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

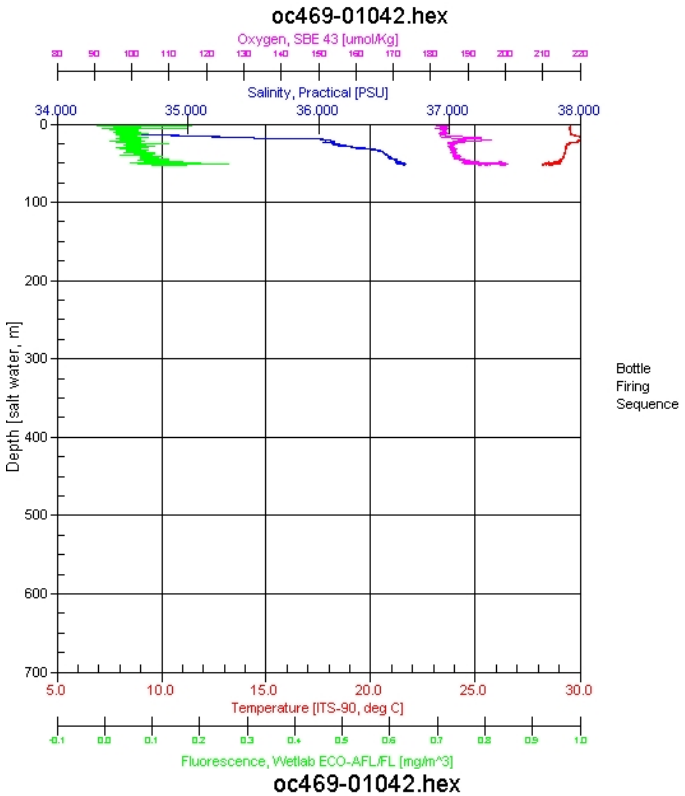

oc469-01039.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

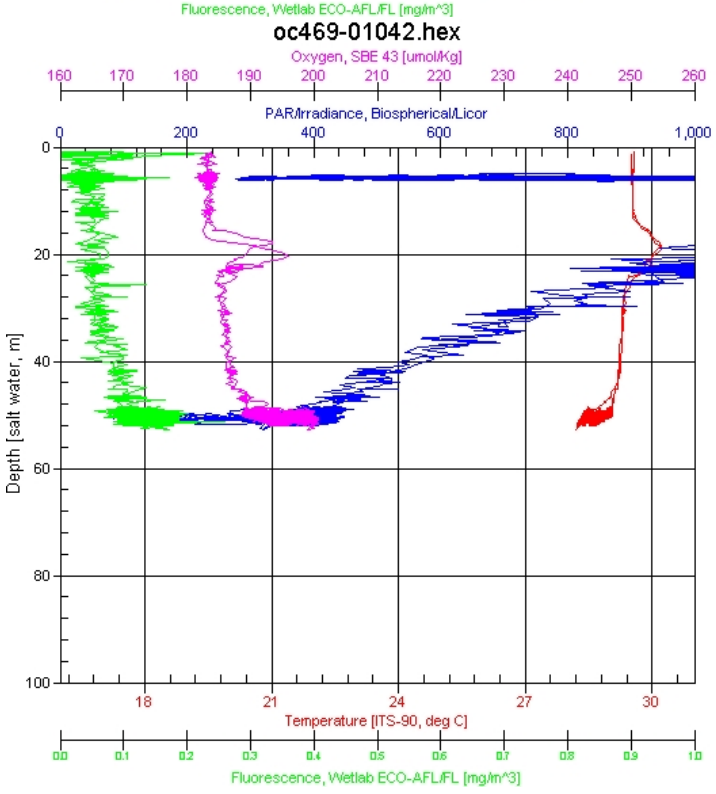

oc469-01040.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

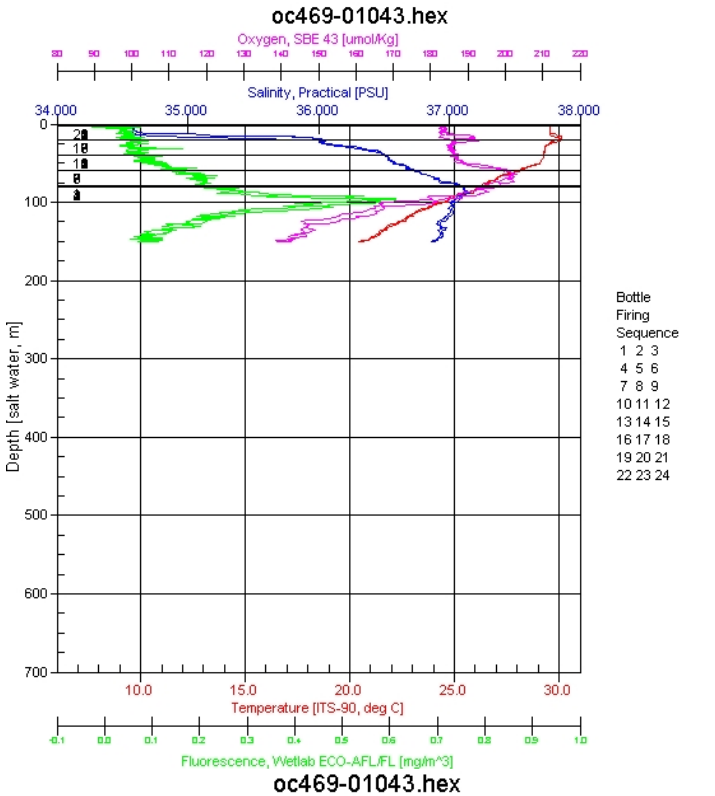

oc469-01040.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

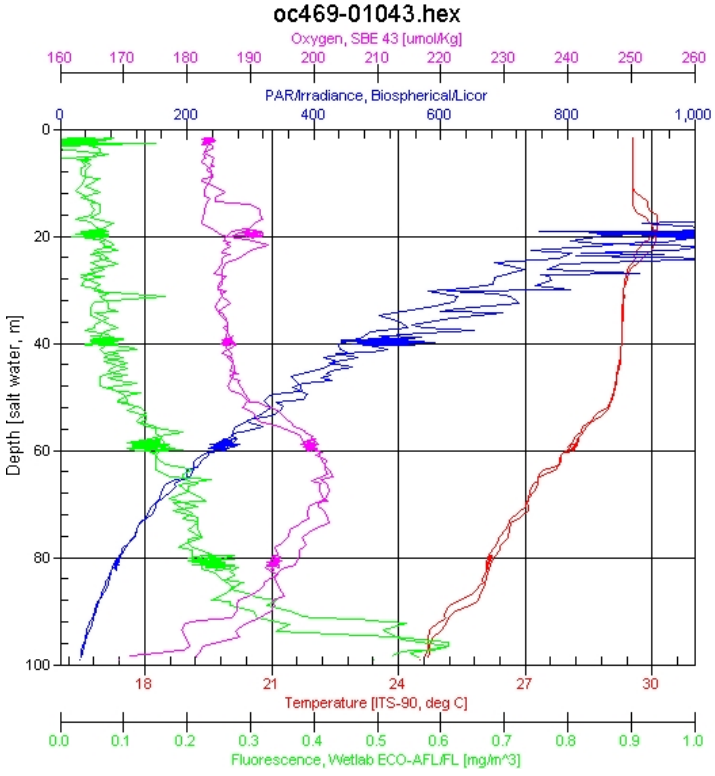

oc469-01041.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

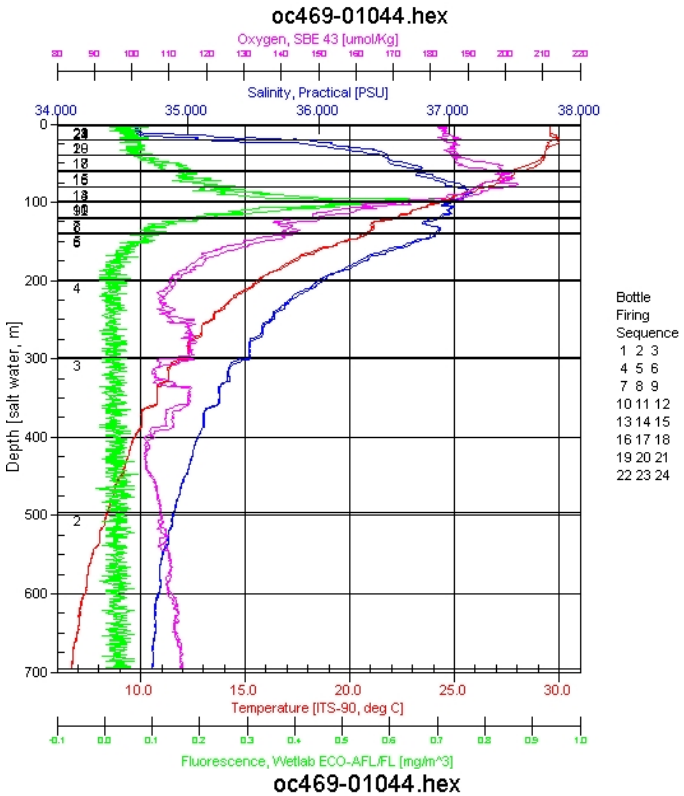

oc469-01041.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
18
21
24
27
30
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

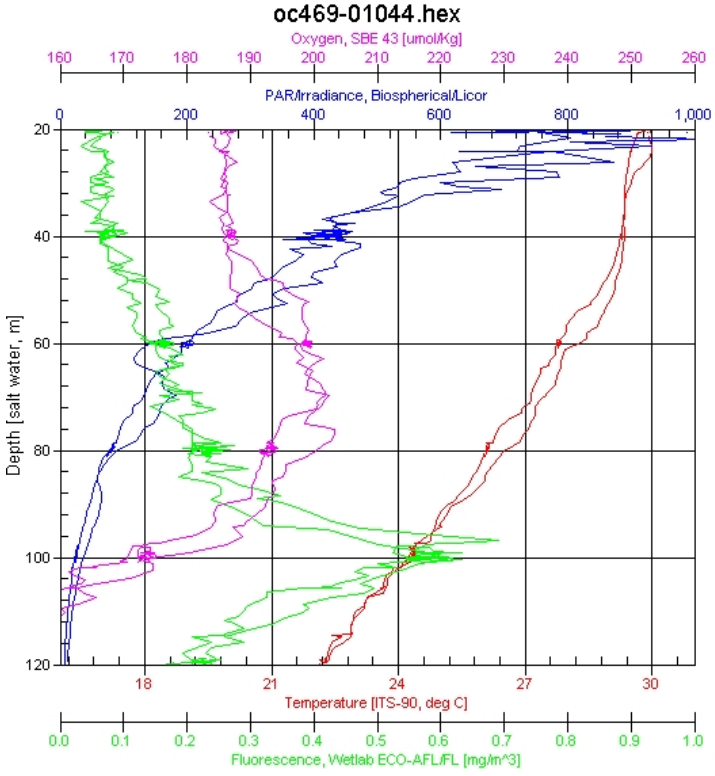

oc469-01042.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

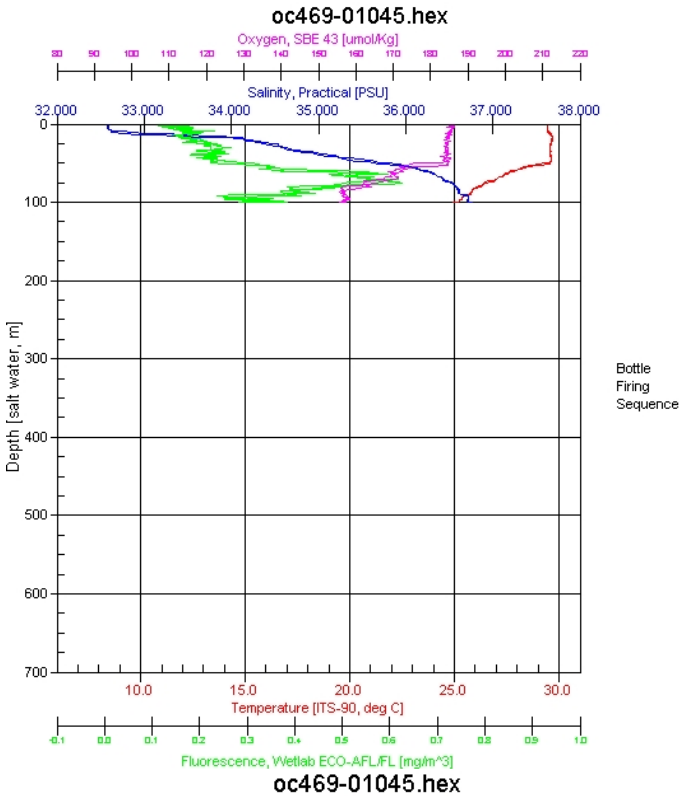

oc469-01042.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
18
21
24
27
30
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

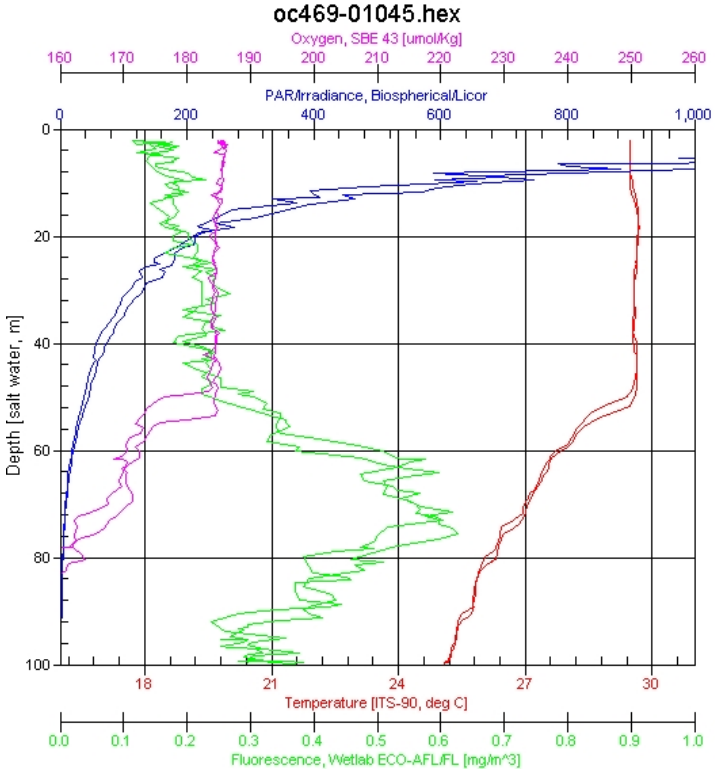

oc469-01043.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

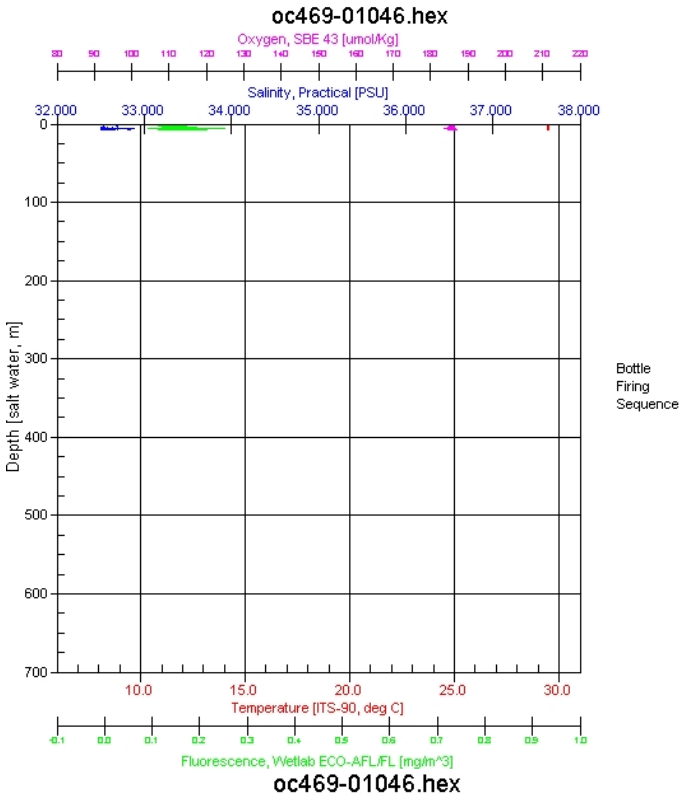

oc469-01043.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

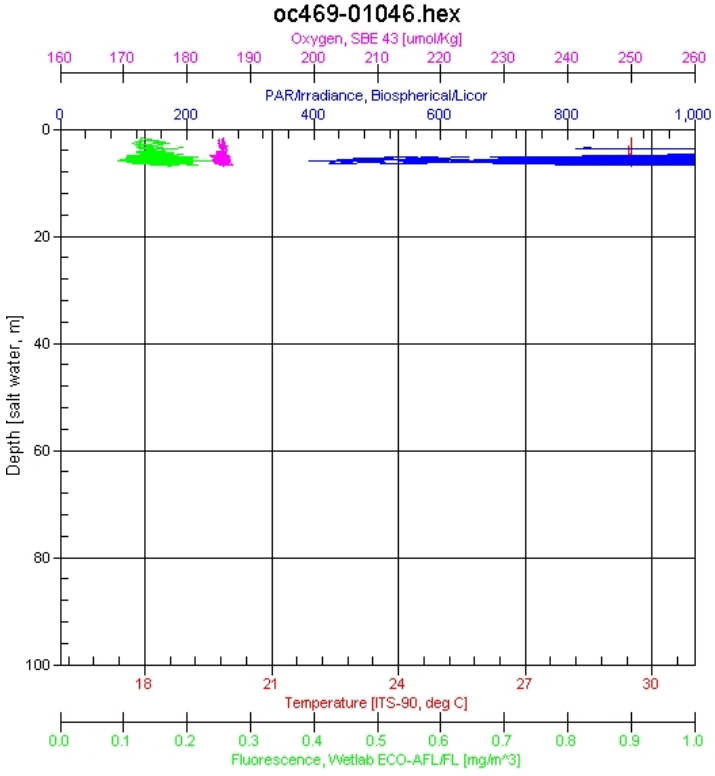

oc469-01044.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

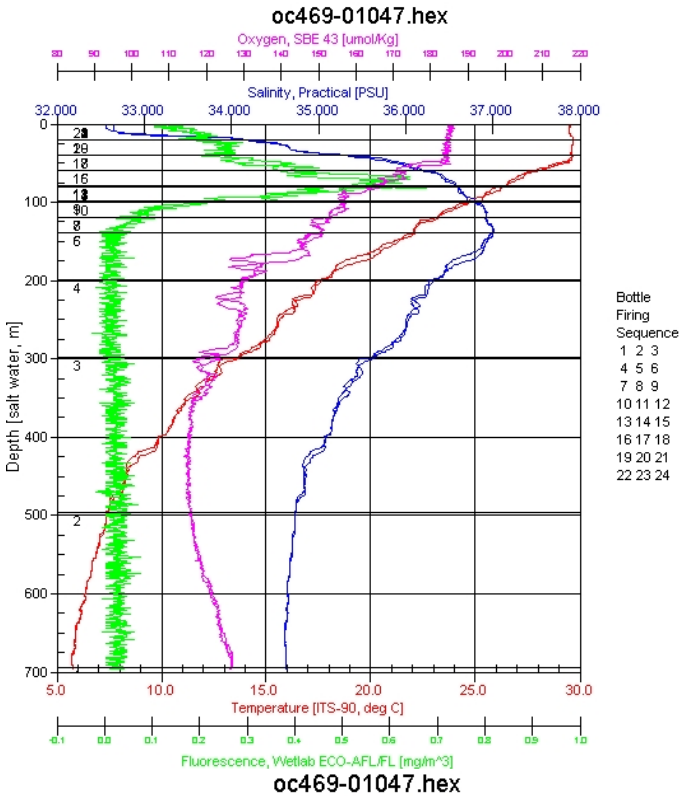

oc469-01044.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
0
200
400
600
800
1,000
Depth [salt water, m]
18
21
24
27
30
Temperature [ITS-90, deg C]
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

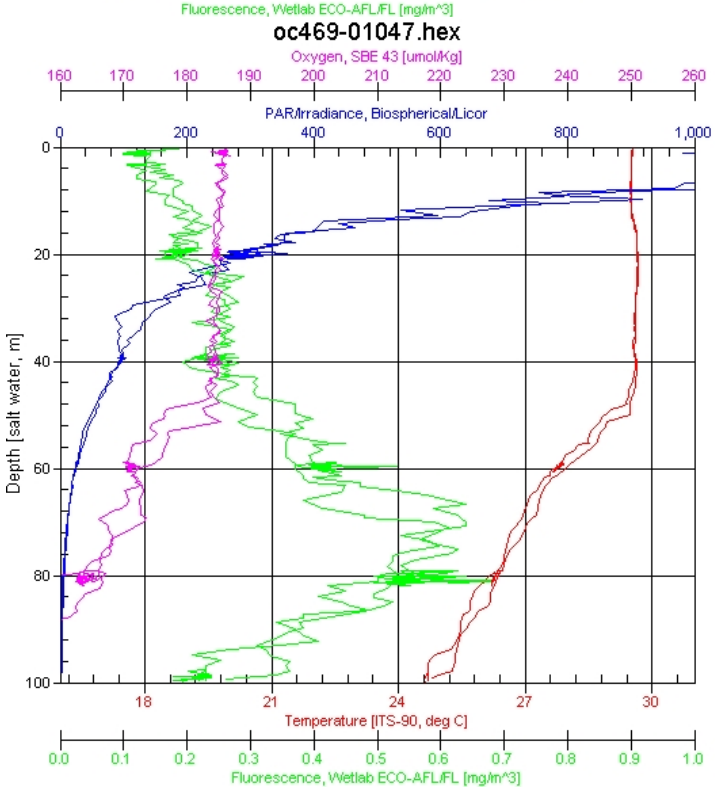

oc469-01045.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
32.000
33.000
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
0
100
200
300
400
500
600
700
Bottle
Firing
Sequence
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

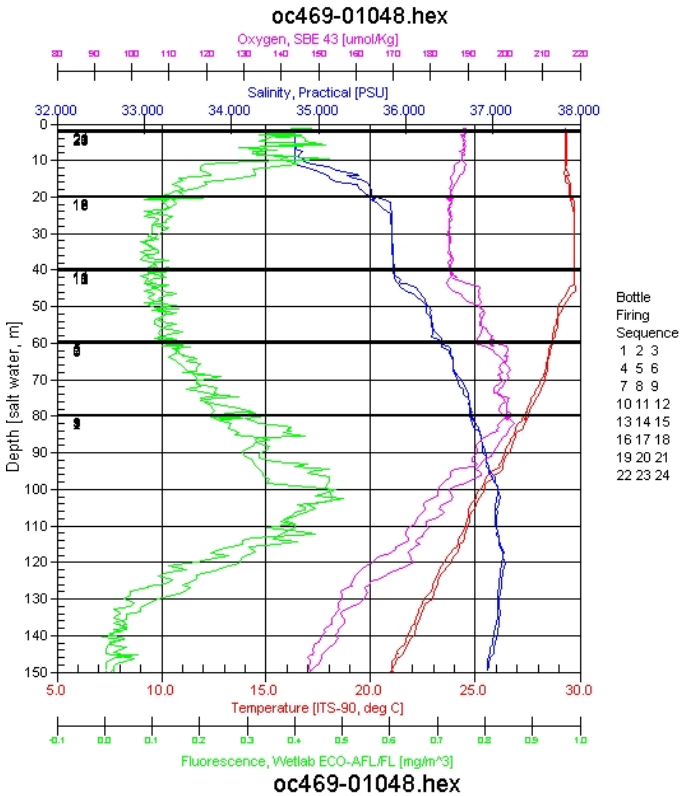

oc469-01045.hex
Oxygen, SBE 43 [umol/Kg]
160
170
180
190
200
210
220
230
240
250
260
PAR/Irradiance, Biospherical/Licor
0
200
400
600
800
1,000
Depth [salt water, m]
0
20
40
60
80
100
18
21
24
27
30
Temperature [ITS-90, deg C]
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

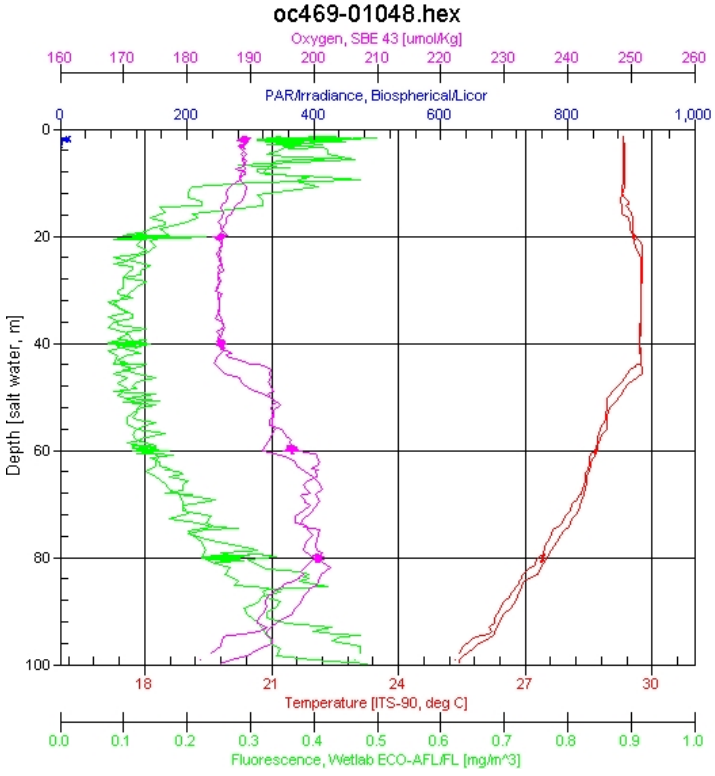

oc469-01046.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
32.000
33.000
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
0
100
200
300
400
500
600
700
Bottle
Firing
Sequence
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

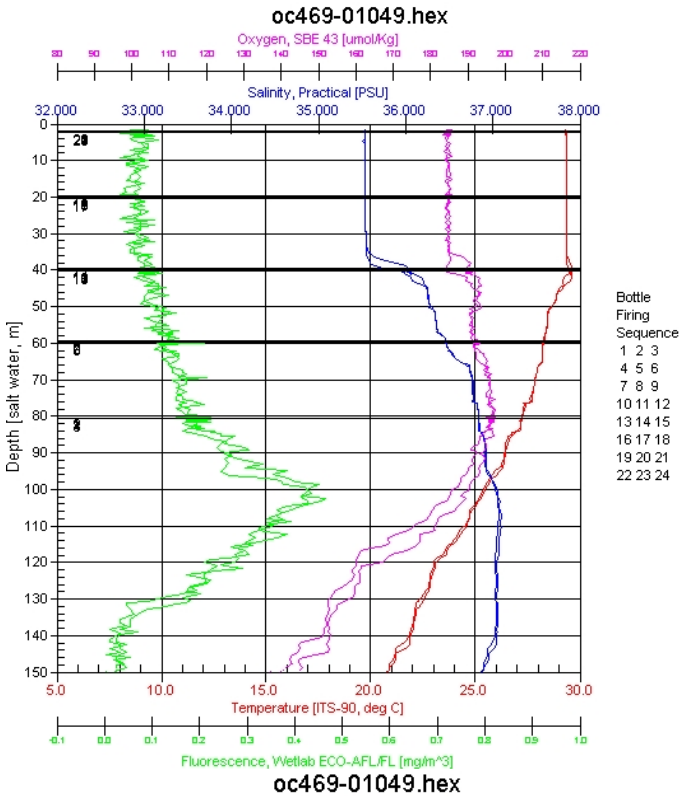

oc469-01046.hex
Oxygen, SBE 43 [umol/Kg]
160
170
180
190
200
210
220
230
240
250
260
PAR/Irradiance, Biospherical/Licor
0
200
400
600
800
1,000
Depth [salt water, m]
0
20
40
60
80
100
18
21
24
27
30
Temperature [ITS-90, deg C]
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

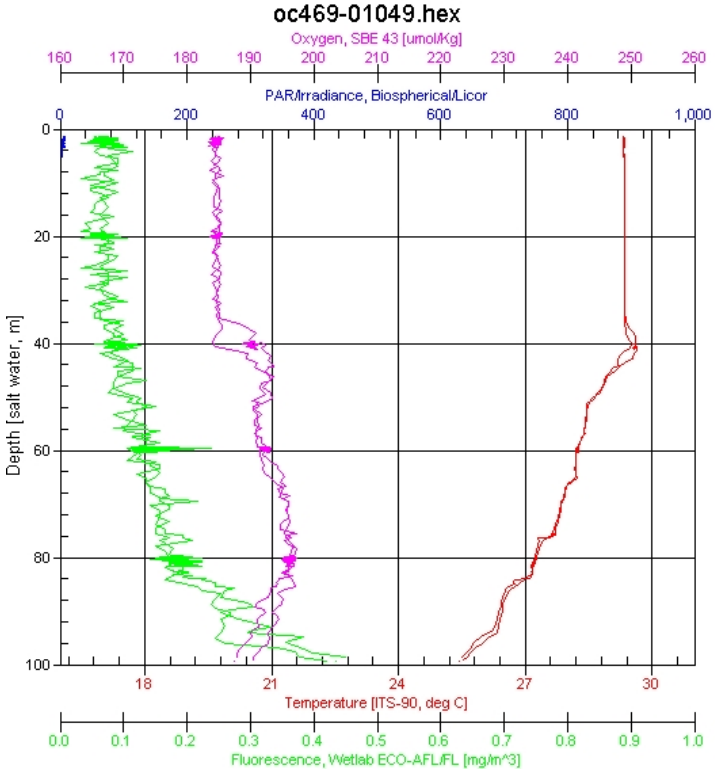

oc469-01047.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
32.000
33.000
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
5.0
10.0
15.0
20.0
25.0
30.0
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

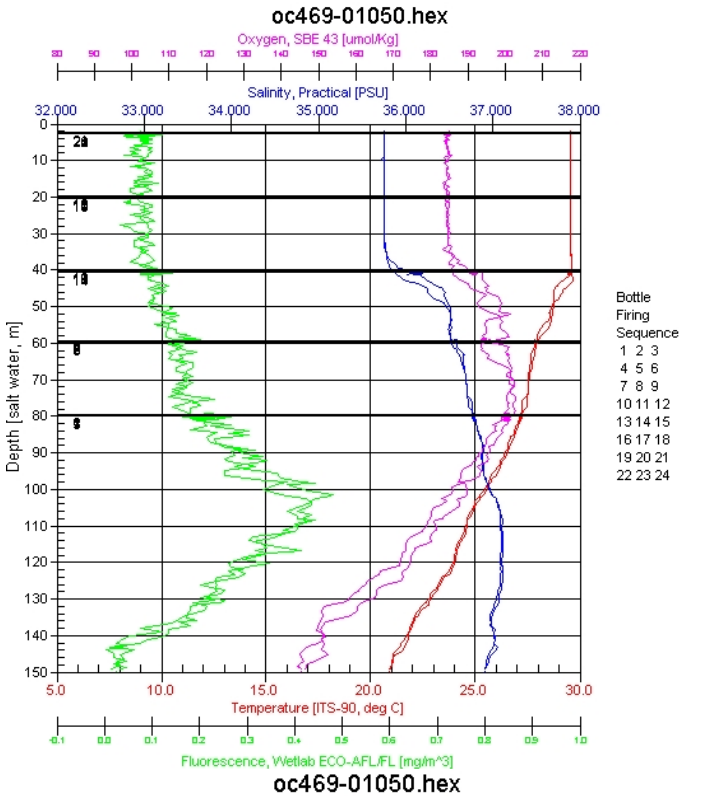

oc469-01047.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
0
200
400
600
800
1,000
Depth [salt water, m]
18
21
24
27
30
Temperature [ITS-90, deg C]
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

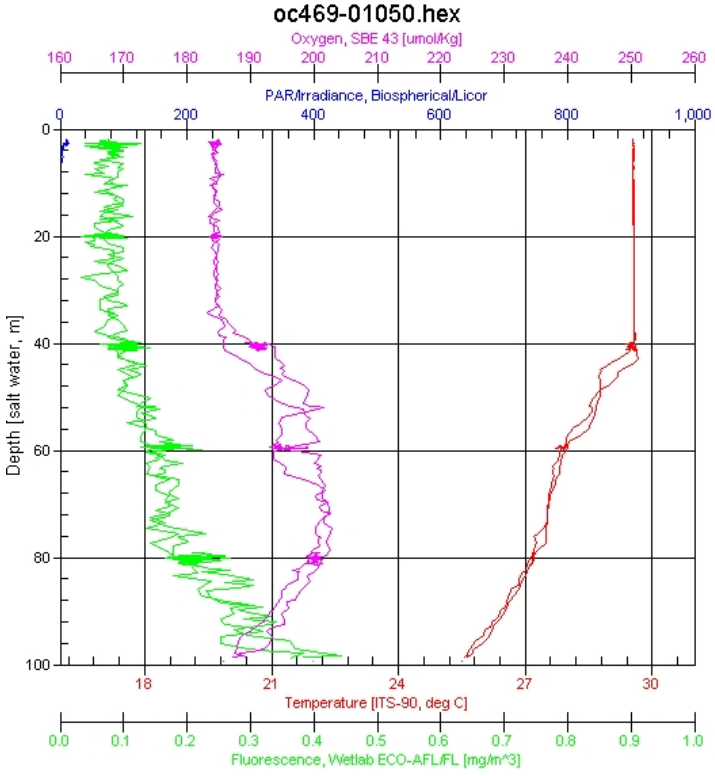

oc469-01048.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24


oc469-01048.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01049.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24


oc469-01049.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01050.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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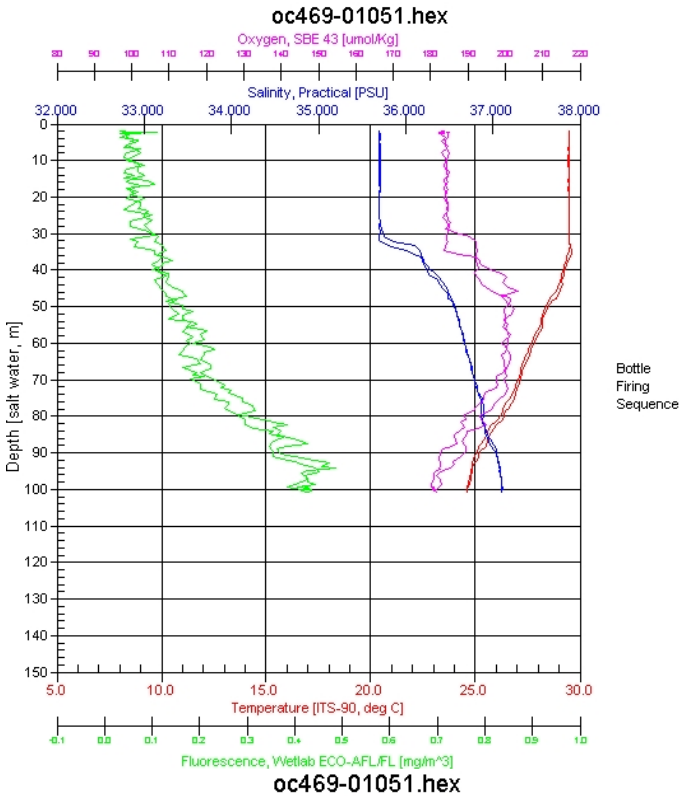
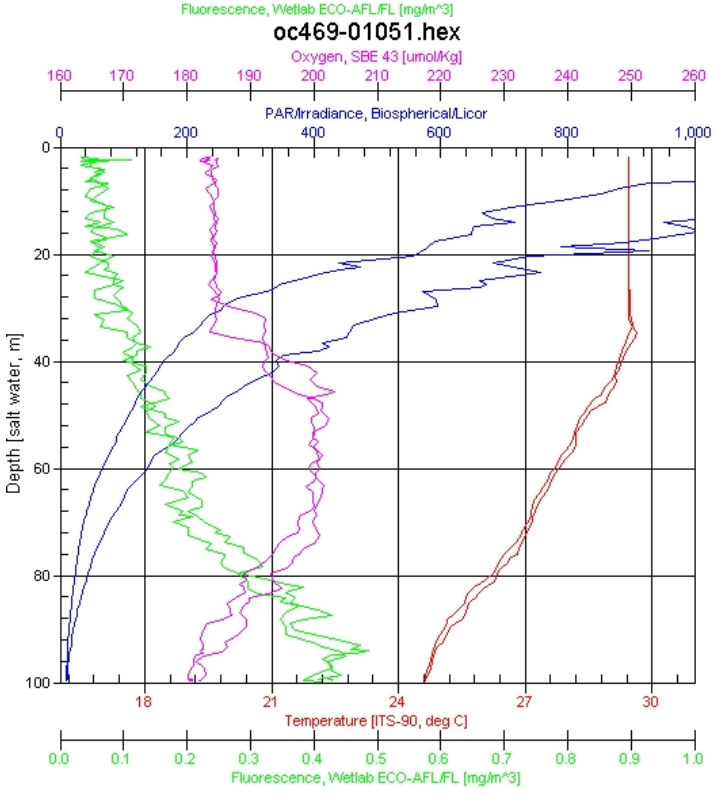
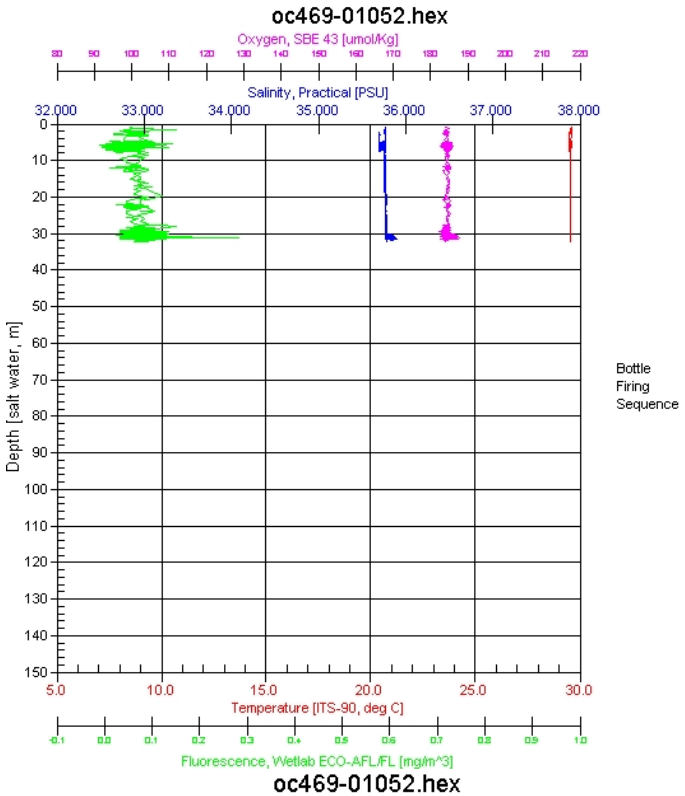
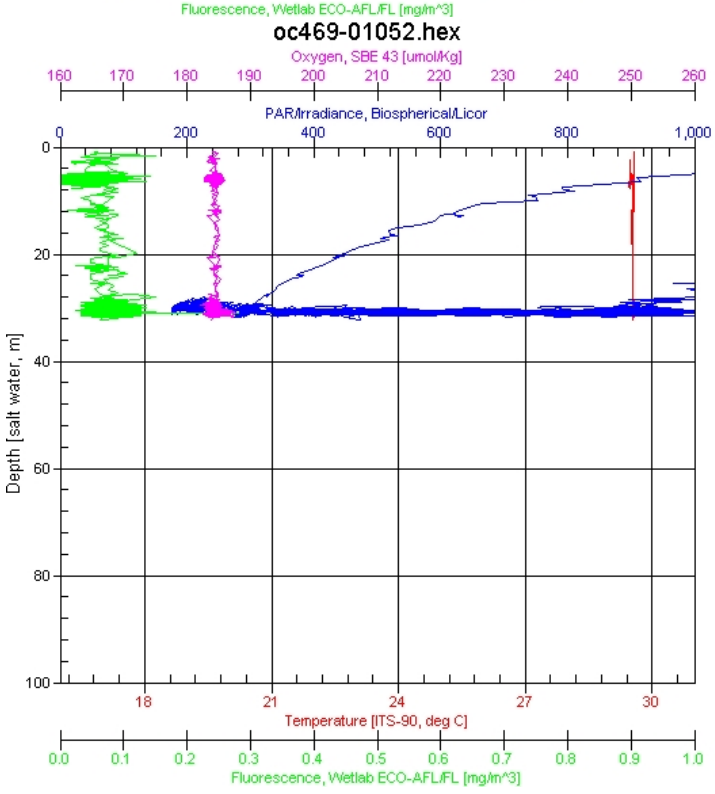
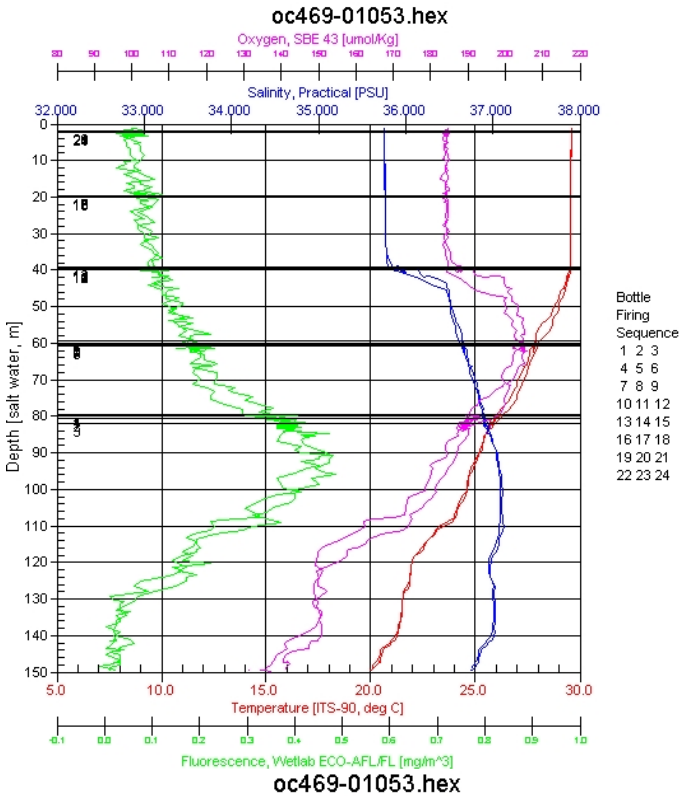
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01051.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Bottle
Firing
Sequence
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01051.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01052.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Bottle
Firing
Sequence
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01052.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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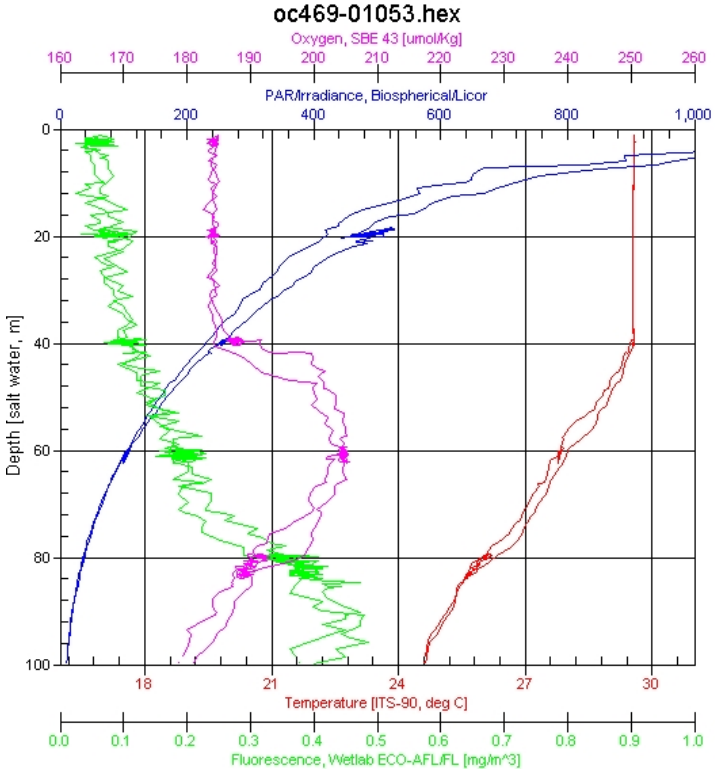
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24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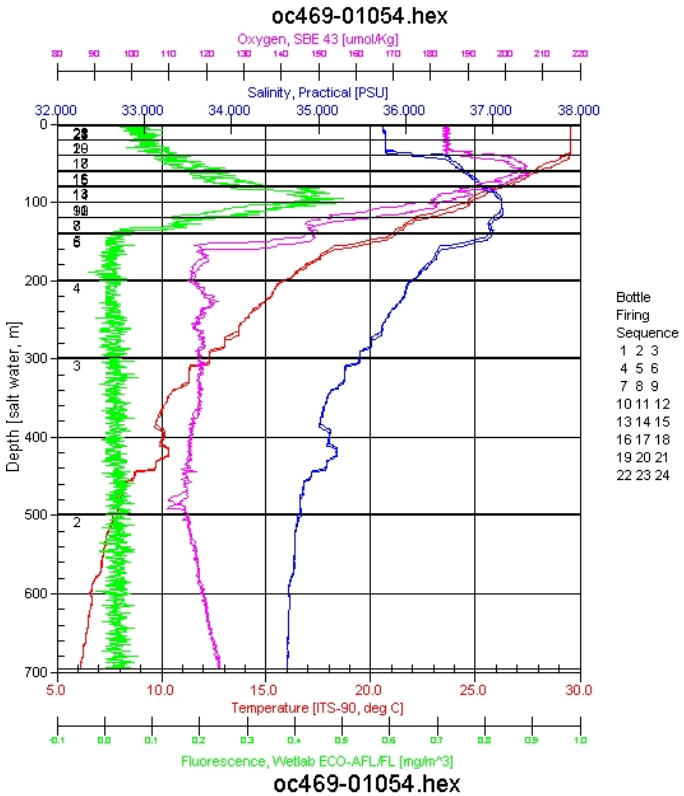
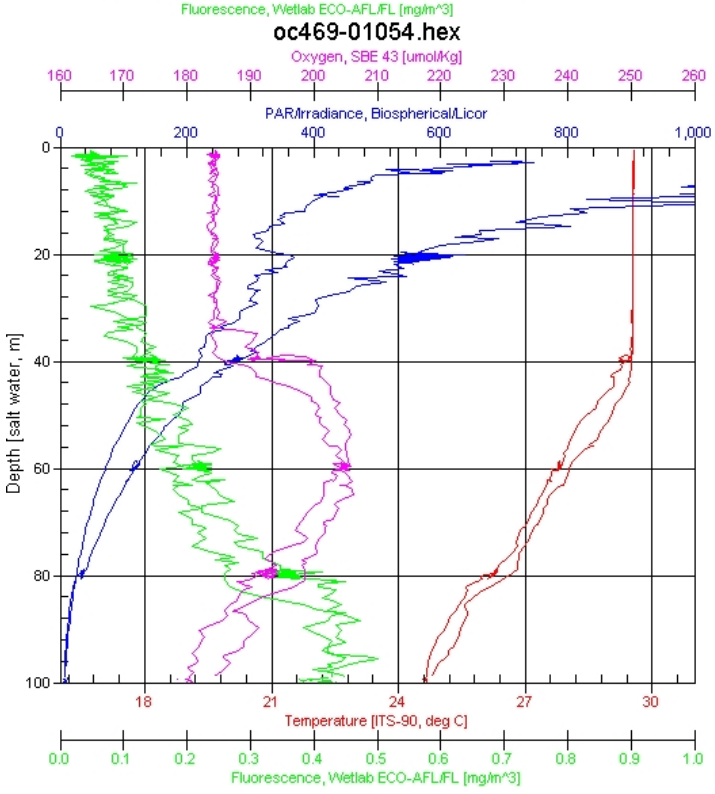
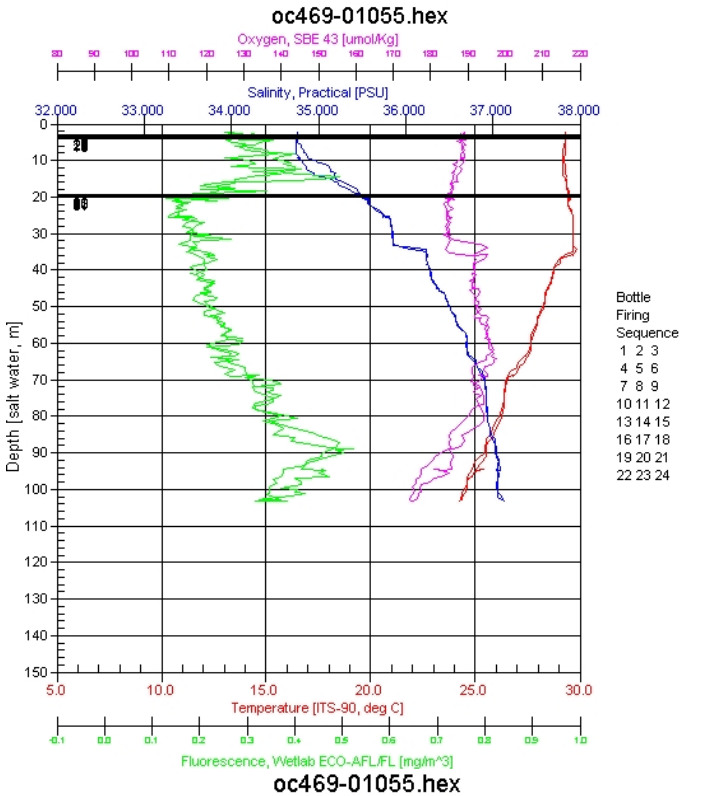
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01054.hex
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
32.000
33.000
34.000
35.000
36.000
37.000
38.000
Depth [salt water, m]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]


oc469-01054.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]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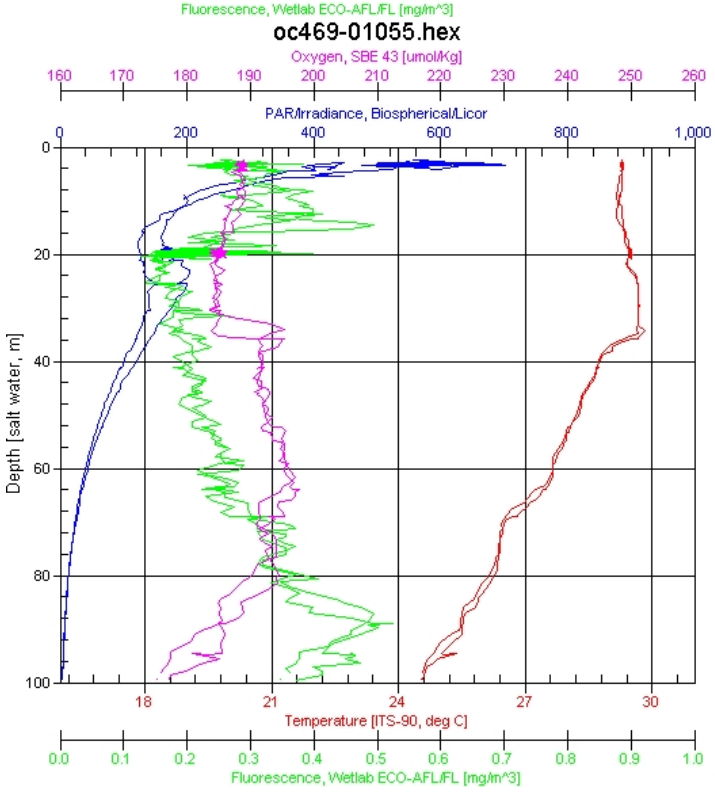
Oxygen, SBE 43 [umol/Kg]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence
1 2 3
4 5 6
7 8 9
10 11 12
13 14 15
16 17 18
19 20 21
22 23 24


oc469-01055.hex
Oxygen, SBE 43 [umol/Kg]
PAR/Irradiance, Biospherical/Licor
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]

References

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Westberry, T.K. and Siegel, D.A., 2006. Spatial and temporal distribution of *Trichodesmium* blooms in the world's oceans. Global Biogeochemical Cycles, 20(GB4016).

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