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14-January-2010

FACE Monitoring Program: Bimonthly Report for November and December, 2010

Summary: the bimonthly monitoring cruises for Hollywood and Broward have commenced. Cruises were performed for November (Broward and Hollywood) and for December (Broward). A malfunction occurred at the start of the December Hollywood cruise, it will be performed later. An overview of the data is presented, as well as other FACE news.

Monitoring Cruises

The November monitoring cruise commenced with gathering samples from the Hollywood sequence on 4-November. As this was the first full cruise, the plan was to complete the Hollywood sequence on Thursday and the Broward cruise immediately following. As the cruise progressed, it became clear that we had underestimate the time required to perform the sampling; the time required for actual operations precluded back-to-back sampling. A day for each sequence, e.g., Hollywood or Broward, each followed by a day for sample processing, was required. In addition, it was clear that obtaining good weather, ship readiness, and a crew of six for two days in succession was not a realistic plan. Consequently, the first November cruise (the Hollywood sequence) was completed on 4-November and the Broward sequence on 10-November.

For December, the first cruise (Broward sequence) was completed on 1-December. The Hollywood sequence was planned for 9-December but a cable problem (described below) terminated the cruise. A make-up cruise will be added at the end of the sequence to make the whole twelve months.

Cruise Data

Data from the November and December monitoring cruises is given in the Appendix. Some highlights are described below. Some data has not yet been fully readied for distribution.

To give a quick overview of the data set, we have selected several key analytes measured during the two cruises for presentation in Figure 1 and 2, plotted as concentration versus latitude. Measurements from all depths (surface, middle, and near-bottom) are plotted. Also, sample sites at different longitudes but similar latitudes will be conflated in these plot. Because only Broward was sampled in December, the latitude range for those data is smaller than for the November data. In general, there are regions where concentrations are elevated, and regions where concentrations attain what could be referred to as coastal 'background' levels. Some specific observations from these data:

- Concentrations from the same site generally did not change significantly from November to December.
- Concentrations of dissolved nutrients (N+N, Si) are quite elevated at the Inlets, but they drop down rapidly away from their sources. The same can be seen, but to a less pronounced effect, for the outfalls.
- Concentrations of all analytes are quite low in the span between the Port Everglades Inlet in the south, to the Hillsboro Inlet / Broward outfall latitude to the north.
- Many analytes (turbidity, total suspended solids (TSS), chlorophyll-a, phaeopigments) show little or no increase at the outfalls (Broward outfall and Hillsboro inlet are somewhat intermingled).

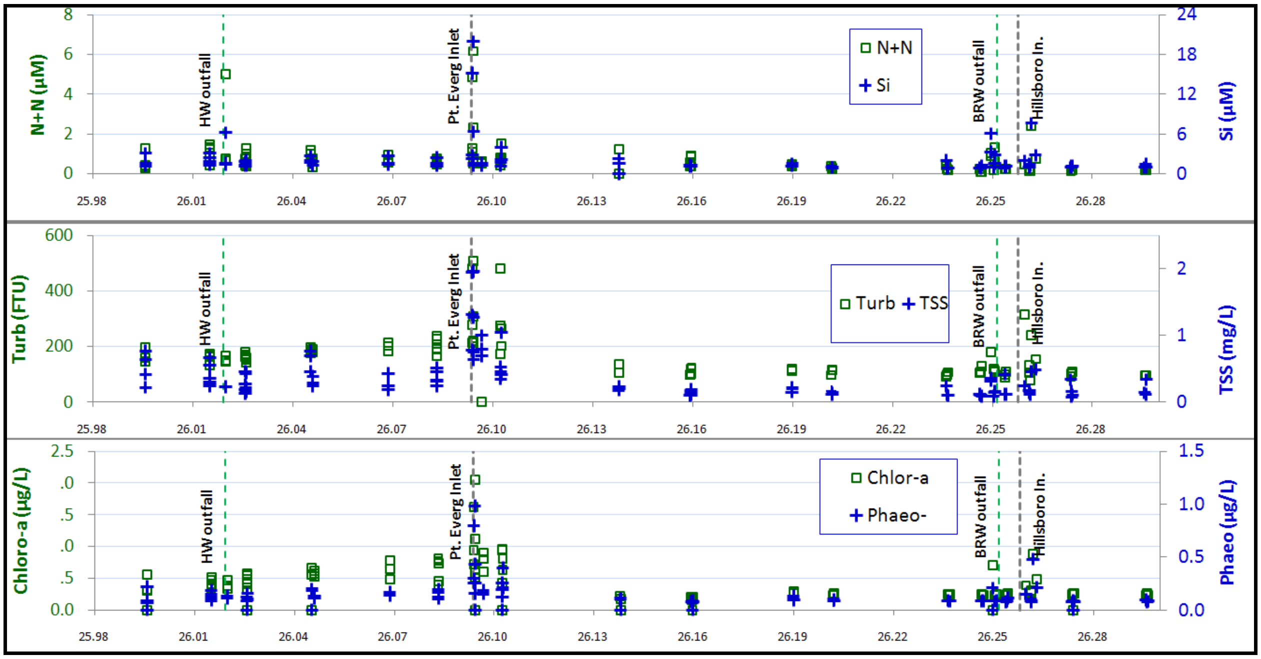

Figure 1. November cruise data plotted versus latitude (HLW and BRW). Note left and right vertical axes are not the same.

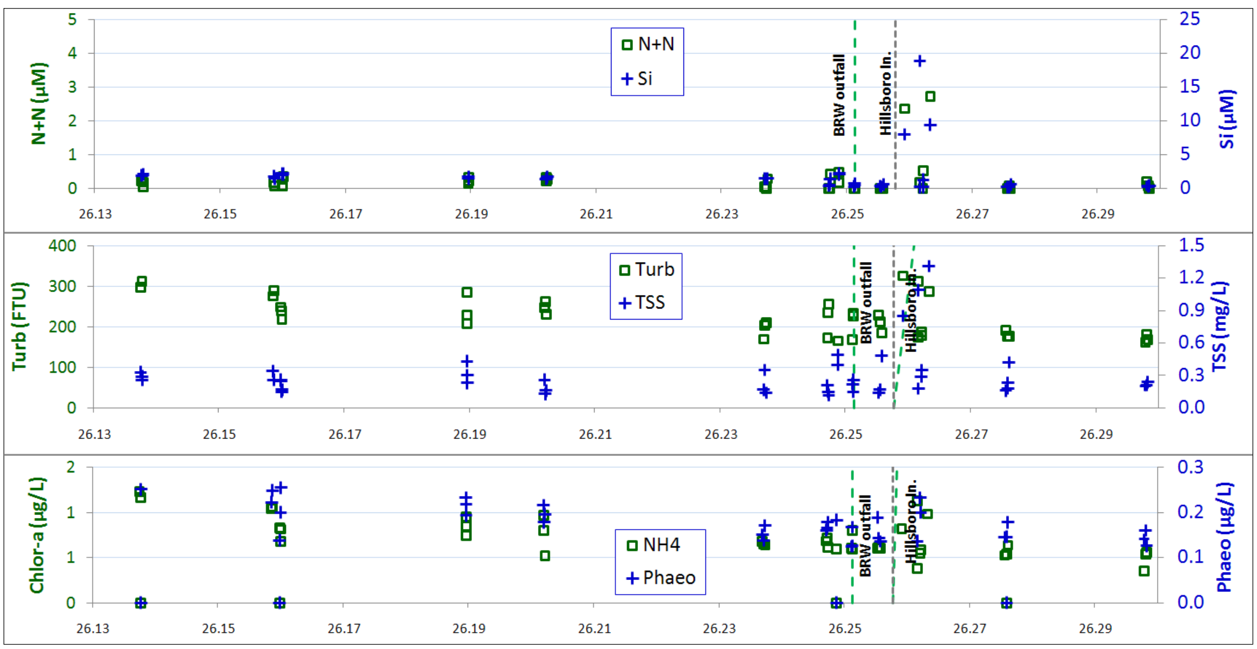

Figure 2 December cruise data (BRW only).

We have found it instructive to sort the data into regions, described in Table 1 and plotted in Figure 3. Each of the regions will be discussed separately.

Table 1. Region Descriptions

Number	REGION DESIGNATION	S. LAT	N. LAT	SAMPLE NUMBERS	Figure	Line
1	North of Hillsboro	26.27	26.30	BR17,18	3,BR	red
2	Hillsboro Inlet	26.24	26.27	BR12,13,14,15,16	3,BR	green
3	Broward Outfall	26.23	26.26	BR8,9,10,11	3,BR	magenta
4	N. Reef Track	26.13	26.21	BR3,4,5,6,7	3,BR	cyan
5	Pt. Everglades	26.08	26.11	BR1,2; HW 10,11,12,13,14,15	3,HW	red
6	S. Reef Track	26.04	26.09	HW 7,8,9	3,HW	green
7	Hollywood Outfall	26.00	26.03	HW 2 3 4 5 6	3,HW	magenta
8	South of Hollywood	25.98	26.00	HW 1	3,HW	cyan

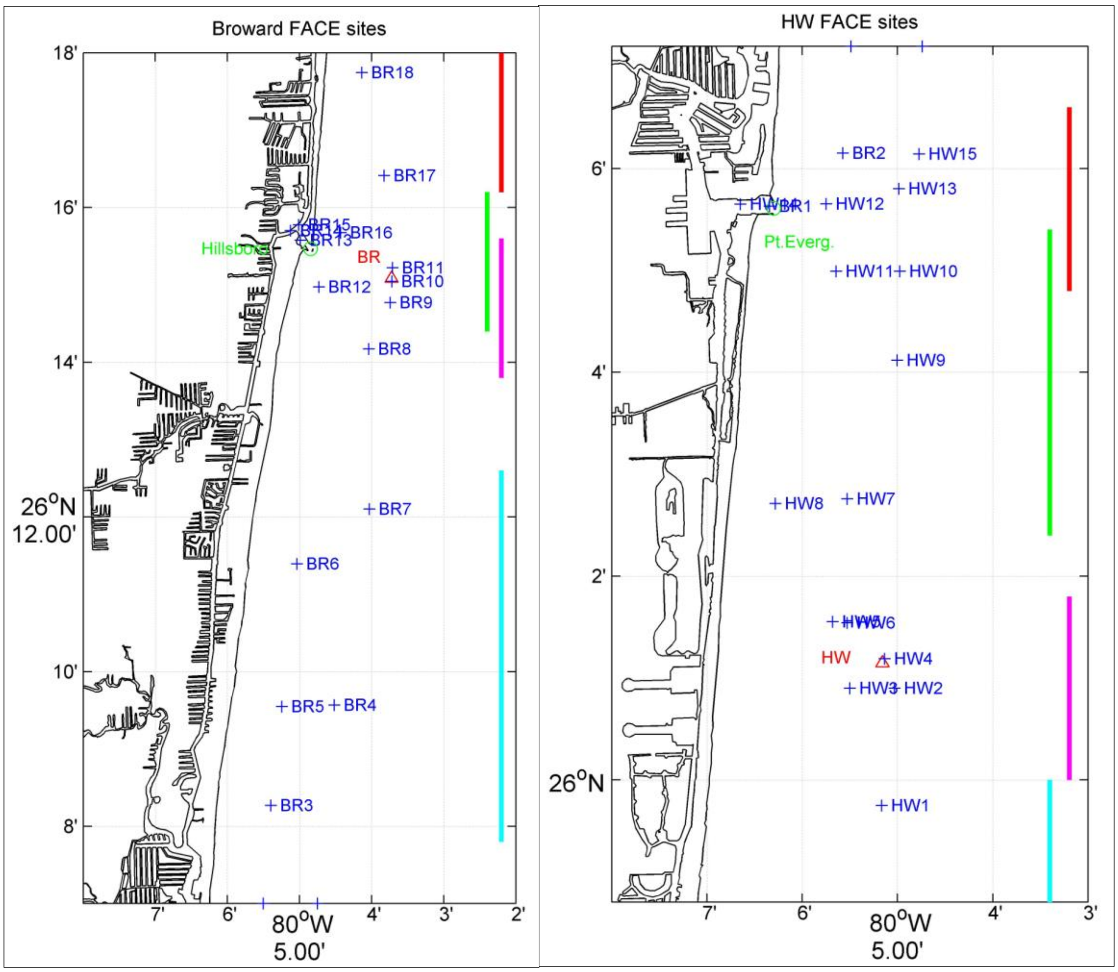

Figure 3. Sampling sites for Broward (left) and Hollywood (right) cruises. Sampling regions are denoted by the vertical colored lines, as denoted in Table 1. Outfalls (Broward, left, and Hollywood, right) are indicated by the red triangles. Inlets (Hillsboro, left, and Pt. Everglades, right), are indicated by the green circles.

North of Hillsboro Inlet

We first examine the northernmost region, north of the Hillsboro inlet, sampled by BR17 and BR18 (see red line in Figure 3, left panel). Some selected discrete sample results are given in Figure 4, plotted versus latitude. Vertical profiles of selected measurements from the CTD instrumentation are given in Figure 5.

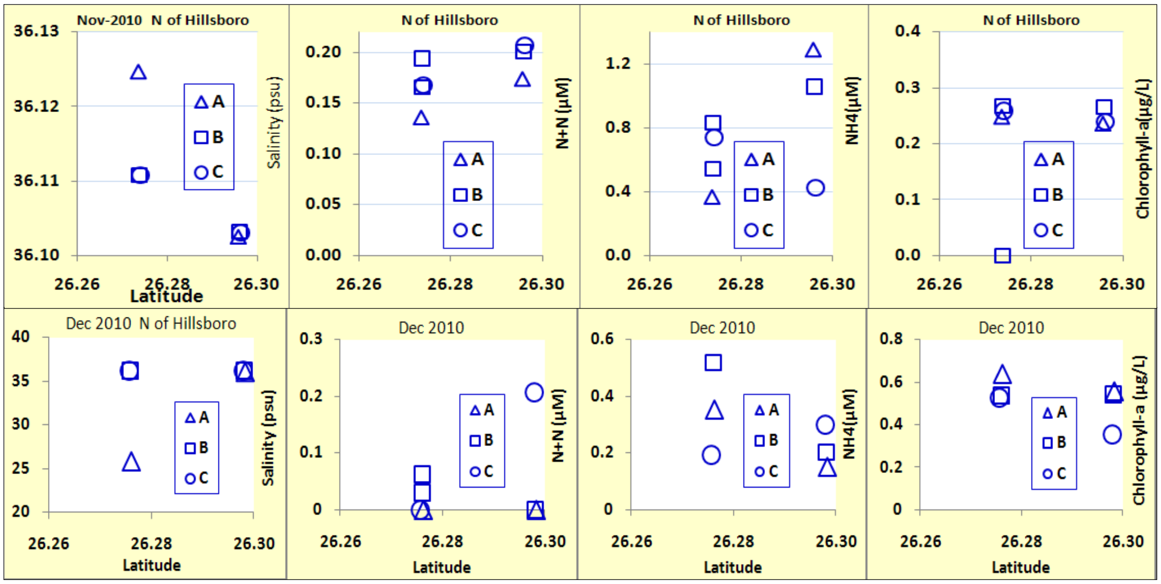

Figure 4. Concentration data from north of the Hillsboro Inlet (BR17 and 18), plotted versus latitude. The three depths are indicated by A (surface), B (middle), and C (bottom) depths. A concentrations below the detection limit of the instrument is plotted as a concentration of zero. Sites with the same latitude but different longitudes will be conflated in this presentation.

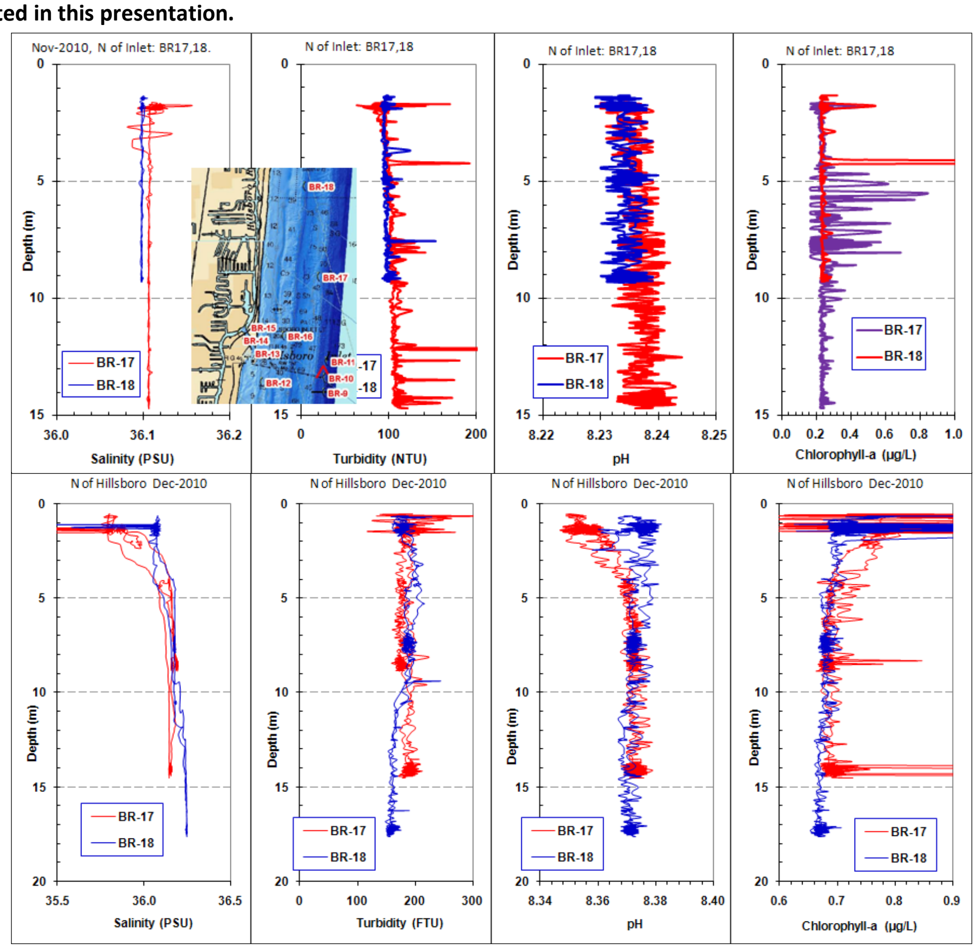

Figure 5. CTD results from BR17 and 18, plotted with depth as vertical axis. Casts on different cruises have different depths due to inability to maintain station in variable wind and current conditions. Location of the two sites in relation to other nearby sites is shown in the inset.

These results will be seen to parallel those of regions 4, 7, and 8, namely, generally exhibiting ‘background’ coastal water characteristics due to their distance from an inlet or outfall. Salinities are near the oceanic value (~35 psu), turbidities (in FTU) were low. The pH values are in the oceanic range; inlet waters are more acidic (see below). An exception is the December surface salinity of BR17, 2.7 km from the inlet, of only 25.85 psu. This can be compared to an oceanic value of ~35 psu, (Figure 4, lower left plot), indicating a contribution of fresher inlet waters in this sample (but not with other analytes from that sample).

The CTD data (Figure 5) indicate a well-mixed water profile, with no significant stratification. Note that these data (and subsequent data in this report) have not been processed for noise reduction and may also be subjected to minor calibration corrections subsequently. Some data from the near surface (<2 m), may be affected by noise generated from the instruments as they equilibrate in the water; these data may be disregarded. In general, however, the data provides an excellent characterization of the water column characteristics.

Hillsboro Inlet Region

For this discussion we have attempted to separate the influences of the Hillsboro Inlet and the Broward outfall on the data, albeit problematic due to their close proximity. In Figure 6 are plotted selected discrete sample concentrations of BR12-16 (versus longitude). These samples were taken during ebb tide. Many of the samples in this group are surface samples, as the lagoon (BR14 and 15) and the inlet (BR13) sites were too shallow for deeper casts. We see dramatic increases in salinity and temperature, and decreases in N+N and NH4 (as well as other analytes not plotted) going from lagoon to inlet to coastal ocean, as water characteristics rapidly change to the ‘coastal background’ concentrations seen in Figure 2. The east-west extent of the sites BR12-16 is ~1.3 km (e.g., from the longitude of BR14 to that of BR16). Of course, inlet waters are only partially fresh, depending on the volume of continental waters compared to recycled marine waters.

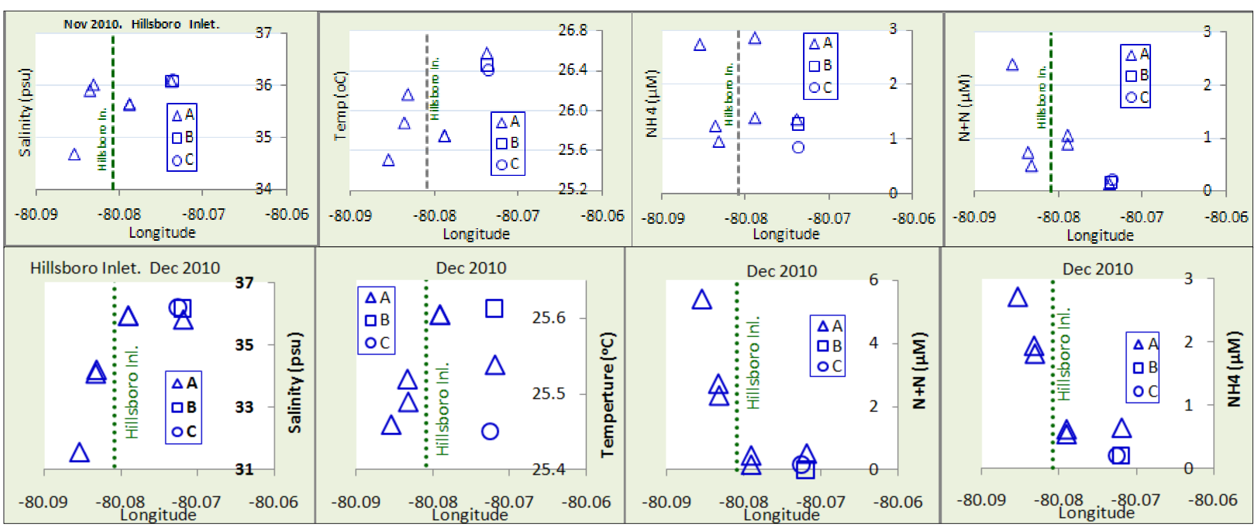

Figure 6. Various measured concentrations from the Hillsboro Inlet region (BR12-16), plotted versus longitude, from the November and December cruises as noted. Format is similar to Figure 4. Sites in shallow waters have surface sample results only. The location of the Hillsboro inlet is denoted by the vertical green line.

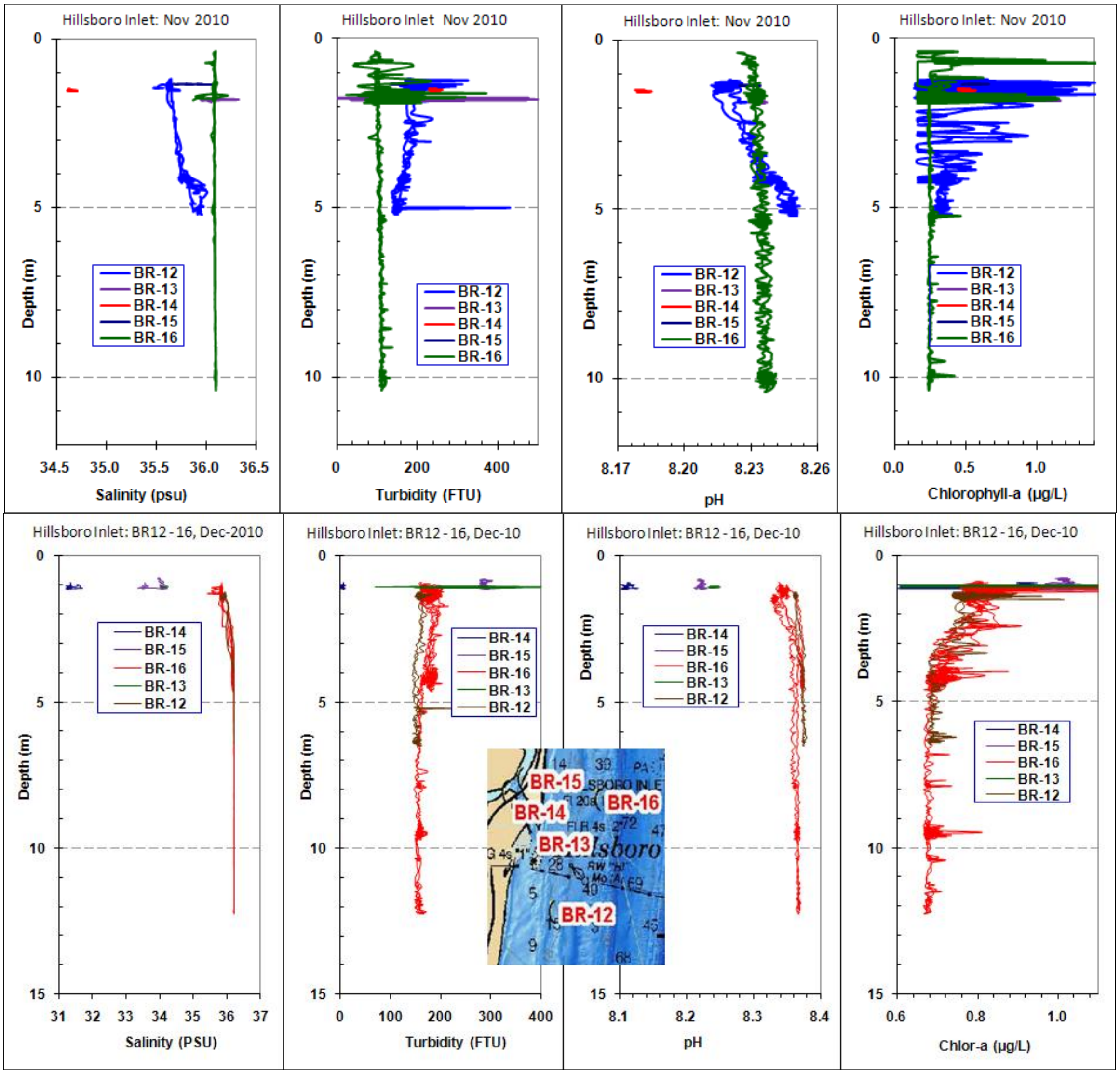

Figure 7. Salinity, turbidity, pH, and chlorophyll-a data, plotted with depth along the vertical axis, from sites around the Hillsboro Inlet (BR12-16). Data for November 2010 are shown in the upper panels and for December 2010 in the lower panels. Sampling depths reflect different water depths for each cast. . Locations of casts are shown in the insert.

In Figure 7 we have plotted salinity, turbidity, pH, and chlorophyll-a data from sampling sites near the inlet for the two cruises. Overall, the water column was well mixed (as would be expected for this time of year), with essentially no stratification. Sites 13, 14, and 15, associated with the inlet, were predictably low in salinity and pH, and, for BR14, high in turbidity. Data from the sites away from the inlet (BR12 and BR16) suggested a rapid return to coastal marine water characteristics.

<u>Broward Outfall Region</u>

Iin this discussion we attempt to separate the effects of the Inlet from that of the Broward outfall. In Figure 8, we see that nutrients and salinity are elevated at the boil, especially in surface samples, but decrease dramatically so that the samples from north of the inlet (BR11, ~0.3 km north) are nearly the same concentration, at all depths, as those from just south of the inlet (BR9, ~0.5 km south). Concentrations of chlorophyll-a, TSS, and turbidity (last two not shown) did not have elevated values near the outfall, except for BR11, which had elevated TSS (surface) and chlorophyll-a (bottom) values.

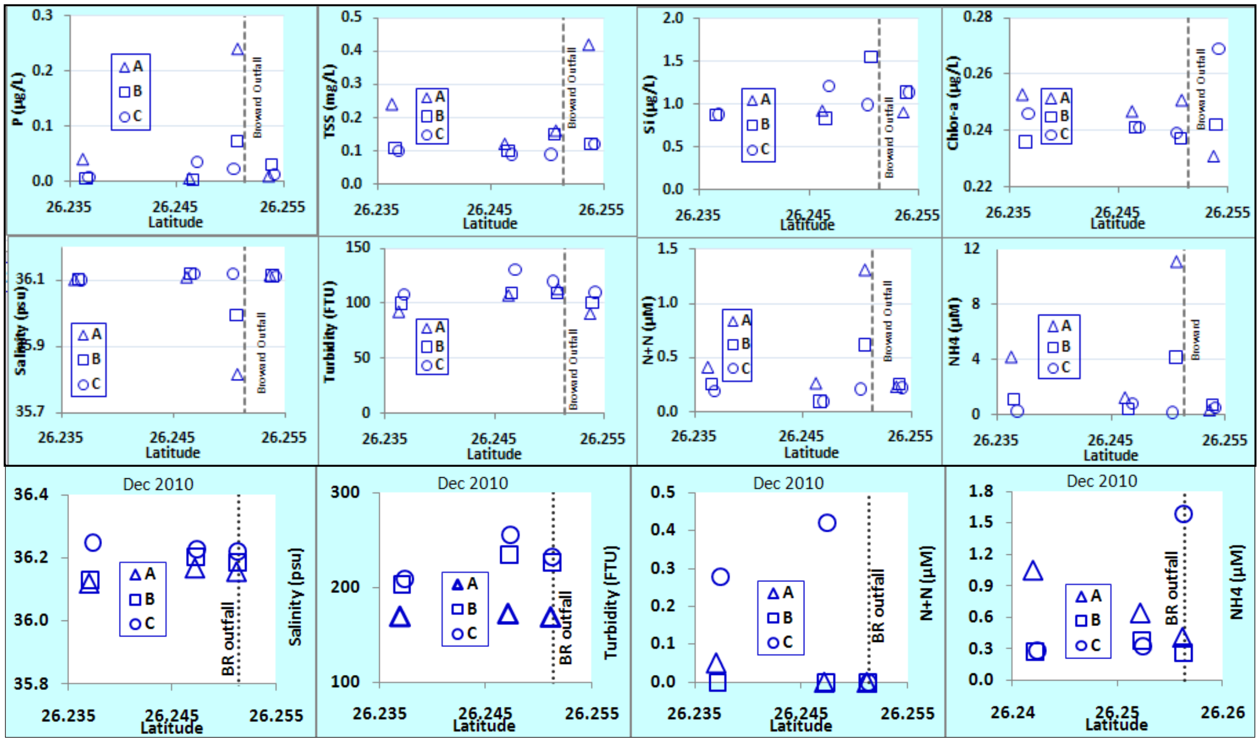

Figure 8. Concentrations from samples south, on, and north of the Broward Outfall (BR-9, -10, -11 respectively), from the November cruise (top two panels) and the December cruise (bottom panel), plotted versus latitude. Format is similar to Figure 4.

Water column characteristics were assessed by examination of CTD data from site BR9, 10, and 11 and are shown in Figure 9. These data show generally marine characteristics except for what must certainly be the sampling of the outfall plume just beyond 20 meters in the December data in BR10 (and to a lesser extent in BR11), characterized by lower salinity and pH (but not in turbidity). The plume appeared to be elevated in chlorophyll-a in December but not in November. Complicating the sampling strategy is the well-known difficulty in successfully sampling the plume, due to its mercurial nature. In this case, the BR10 sample bottle reached the bottom of the plume (see Figure 6, leftmost panel). The core of the outfall plume was not sampled in November (although we made our best efforts). We do see an effect of the fresh water from the outfall plume on salinity in November (Figure 9, upper left panel), in the reduced salinity above 20 m of depth, but note the scale compared to that from the December cruise.

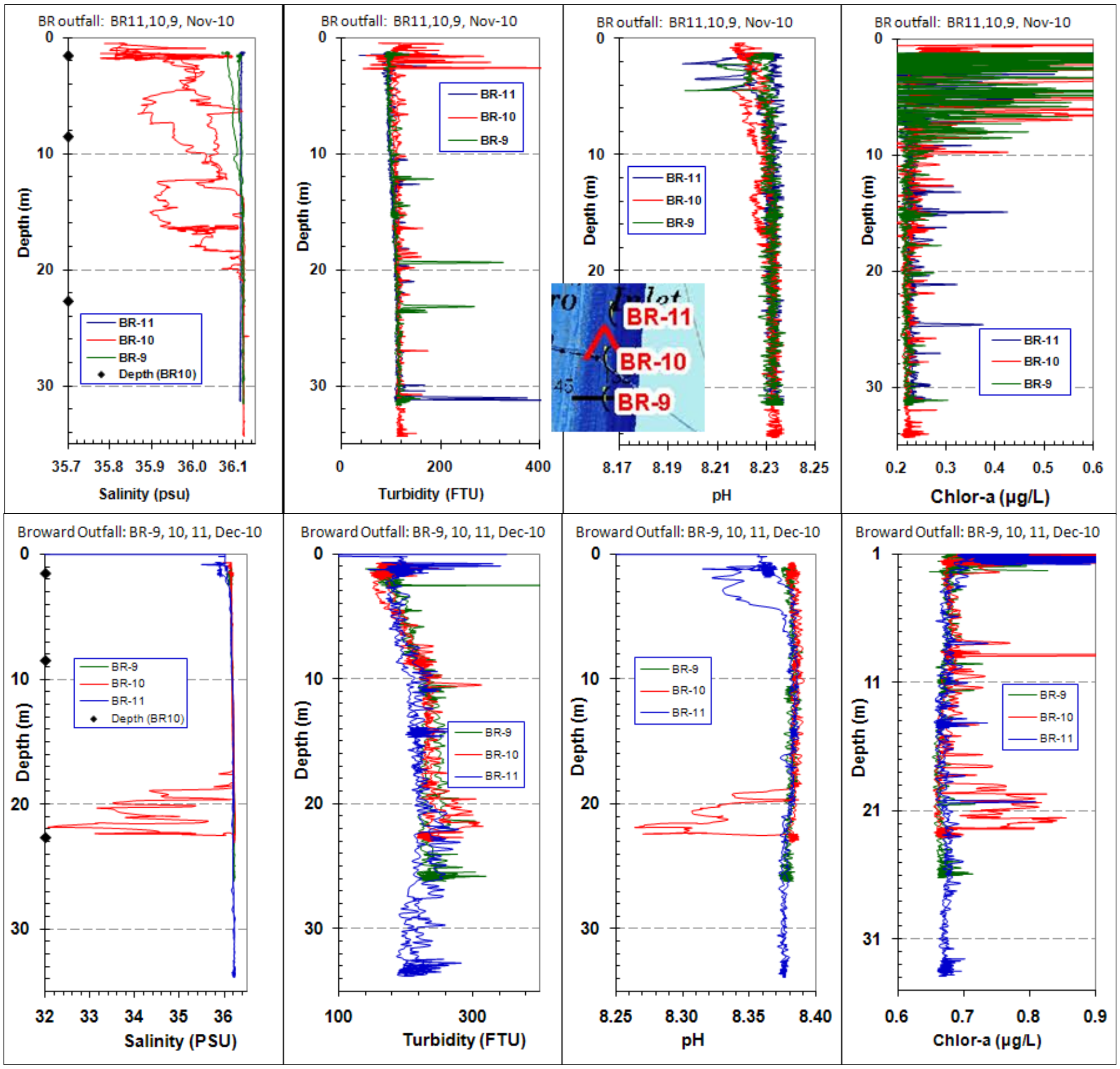

Figure 9. CTD data (salinity, turbidity, and pH) from the November cruise (upper panel) and the December cruise (lower panel) for the sites directly north (BR11), on (BR10), and south (BR11) of the Broward outfall. Format is similar to Figure 5, except that the bottle opening depths are indicated in the leftmost panels by black diamonds. Sampling site locations are shown in the inset (outfall location denoted by red arrowhead).

<u>North Gap</u>

There is a span between the Hillsboro Inlet/Broward Outfall to the north, and the Port Everglades to the south of ~18-km. While the area does not have significant point sources of anthropogenic input, it does contain significant SE Florida reefs (see e.g., Banks *et al,* 2007). We denoted this area as the North Gap in Table 1, including BR3, -4, -5, -6, -7. Nutrient concentrations from this region are given in Figure 10 and CTD measurements in Figure 11.

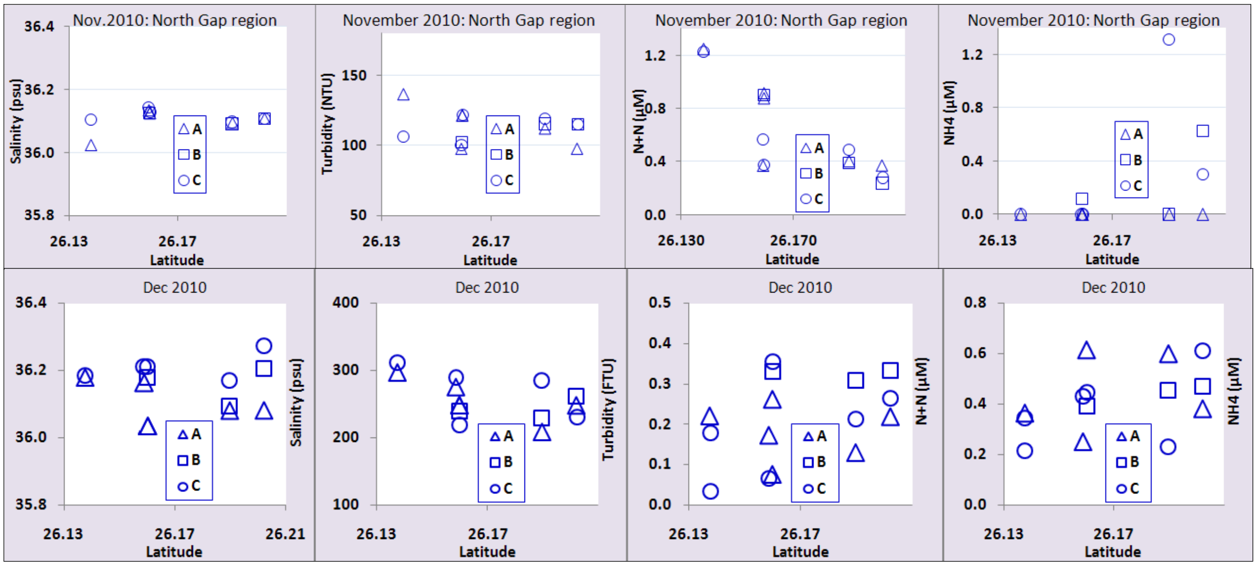

Figure 10. Nutrient concentrations from the North Gap region samples, BR3, -4, -5, -6, -7, plotted versus latitude. Format is similar to that of Figure 4.

Salinity values are near oceanic and do not change dramatically. Ammonium concentrations were quite low; most of the measurements were below detection limit (plotted as zero in Figure 4). Both N+N and Si (not shown) showed a notable decrease in concentration south to north (orthophosphate, also not shown, did not). The southernmost sample (BR3) is about 5 km north of the Pt. Everglades Inlet, where N+N was measured at nearly 5 µM.

Water column characteristics for this region (Figure 11) generally indicate well-mixed marine-like waters. Sample BR3, noted above, again was anomalous, exhibiting lower salinity and pH than the other sites in November, but higher than the other sites in December.

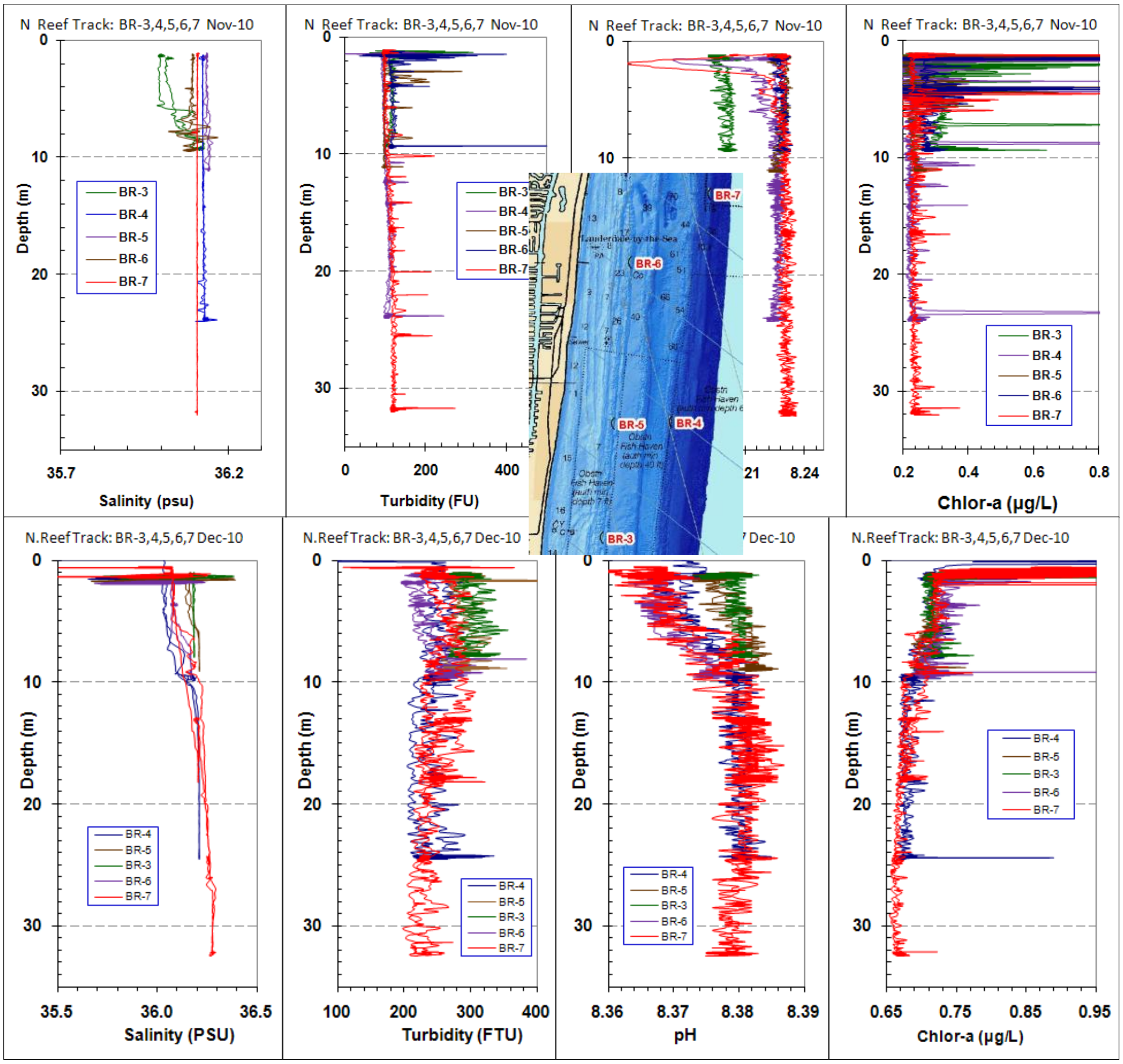

Figure 11. CTD data from the North Gap region (BR3, -4, -5, -5, -6, -7). Upper panels: November data; lower panels: December data. Format is similar to Figure 5. Sample sites shown in the inset.

Port Everglades Inlet Region

This region includes samples in the inlet (HR14, BR1), south of the Inlet (HW10,11), and north of the inlet (BR2, HW15), as well as BR3 of the N. Reef Track sequence included for comparison purposes. It is instructive to view the data versus latitude as well as versus longitude (a proxy for distance from the shore), shown in Figure 12. Both the latitude and longitude range in Figure 9 is ~5 km. CTD data is shown in Figure 13. Only November data is available due to equipment difficulties during the December cruise. Dramatically evident is the rapid drop in concentrations (increase in salinity away from the inlet), on both latitude and longitude representations.

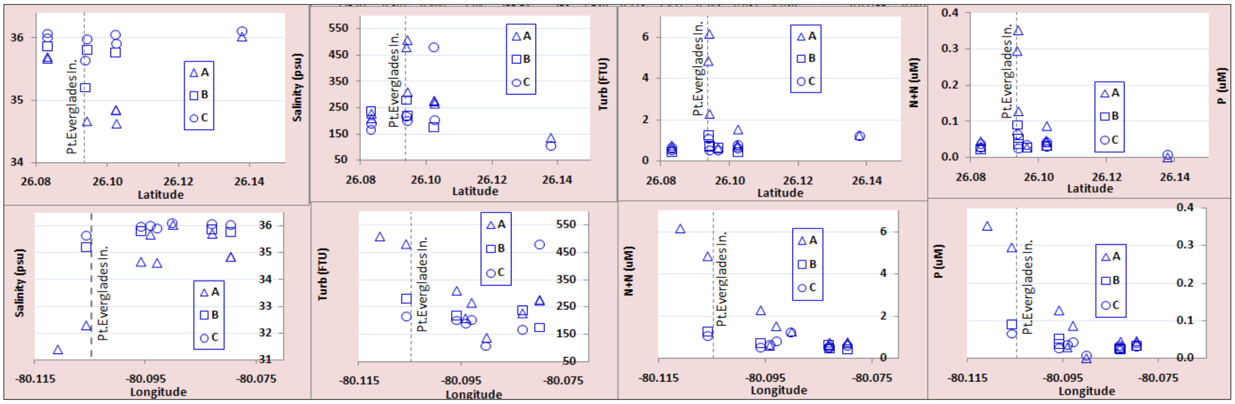

Figure 12. Data from the Port Everglades region from the December cruise, plotted versus latitude (upper panels) and versus longitude (lower panels). A vertical line denotes the coordinate of the inlet. Samples east of the inlet (left of line in lower panel) are from HW14, a surface-only sample taken in the Pt. Everglades lagoon (26.0942°N, -80.1108°W). Format is similar to that of Figure 4 except that sample site longitude is plotted along the x-axis.

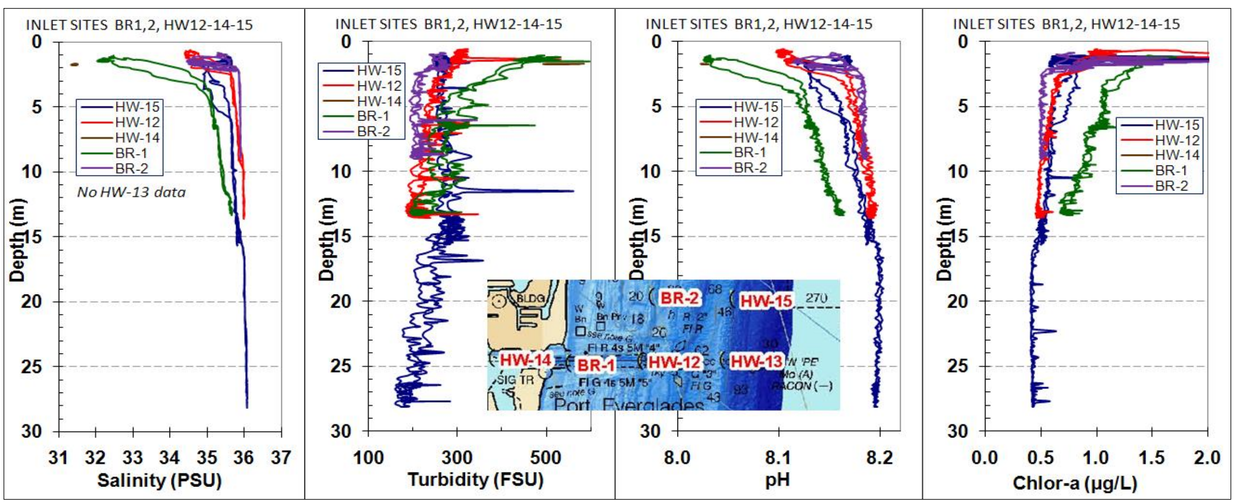

Figure 13. CTD Data from the Port Everglades region, sampling sites NH14, BR1, BR2, HW-12, HW15 (see inset). No data was obtained for HW13. Format is similar to that of Figure 5.

Figure 12 indicates how, in both plots, a rapid decrease in concentration away from the inlet (or increase in salinity, as inlet waters are fresher than the ocean). As both axes cover about the same distance, it appears that this distance is approximately the point in which the plume from the inlet is indistinguishable from the surrounding coastal ocean water.

South Gap

This region comprises sites HW-7, -8, -9, -10, and -11, bridging the span between the Port Everglades Inlet and the Hollywood Outfall. As in above, the nutrient concentrations versus latitude and longitude are given in Figure 14, and selected CTD water column results are given in Figure 15. As with the North Gap, the concentrations are low and essentially define the 'background' coastal water characteristics.

There are suggestions of increases, from south to north, in surface turbidity, orthophosphate, and ammonium; these trends await additional data for conformation.

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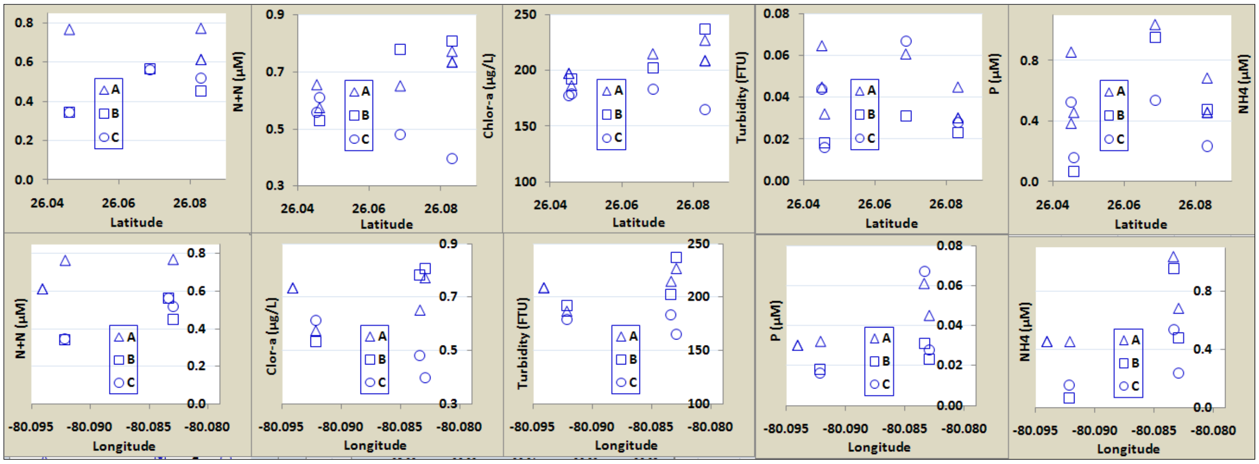

Figure 14 Data from the South Gap region (sitesHW7, -8, -9, -10, -11) from the December cruise, plotted versus latitude (upper panels) and versus longitude (lower panels). Format is similar to that of Figure 4.

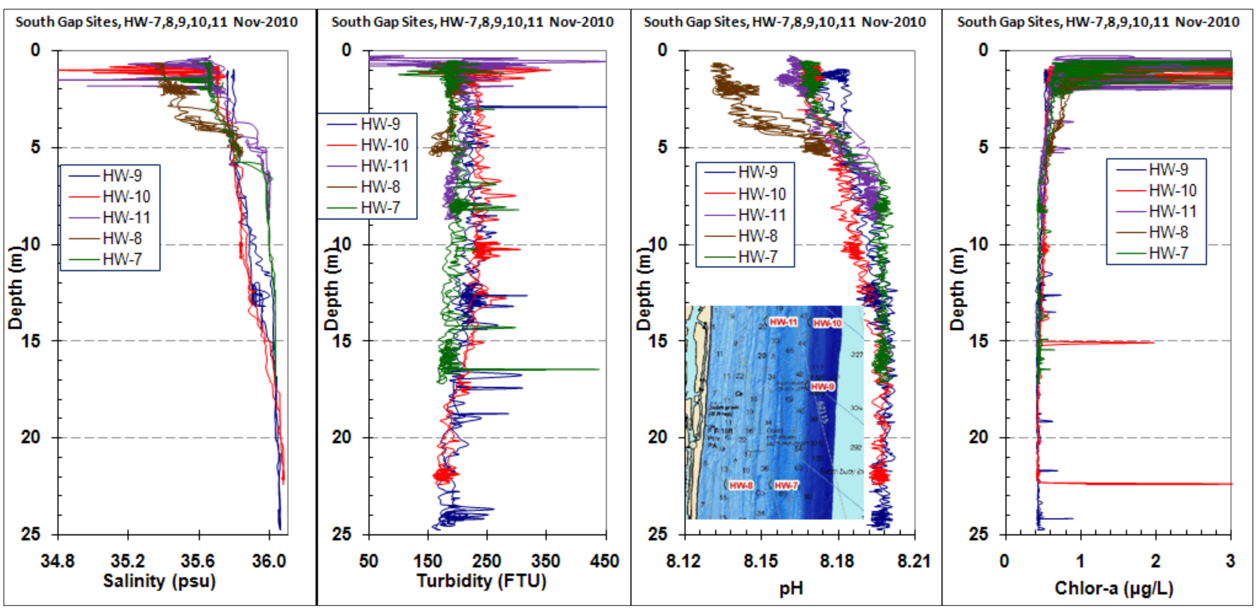

Figure 15. Data from the South Gap region (sitesHW7, -8, -9, -10, -11) from the December cruise, plotted versus latitude (upper panels) and versus longitude (lower panels). Site locations are plotted in the insert. Format is similar to that of Figure 5.

Hollywood Outfall Region

This region is sampled at sites HW-1, -2, -3,-4, -5, -6, shown as above in Figures 16 and 17. Examination of the CTD data in the latter figure indicates that the heart of the outfall plume was not sampled. The outfall location sample (HW4, brown line in Figure 17) shows evidence of the plume in less than ten meters of water with slightly lower salinity and pH, and elevated chlorophyll-a. The plume seems to be better sampled at site 5 (green line in Figure 17). There is no clear indication of concentration trends away from the outfall, in neither the latitude or longitude presentations. .

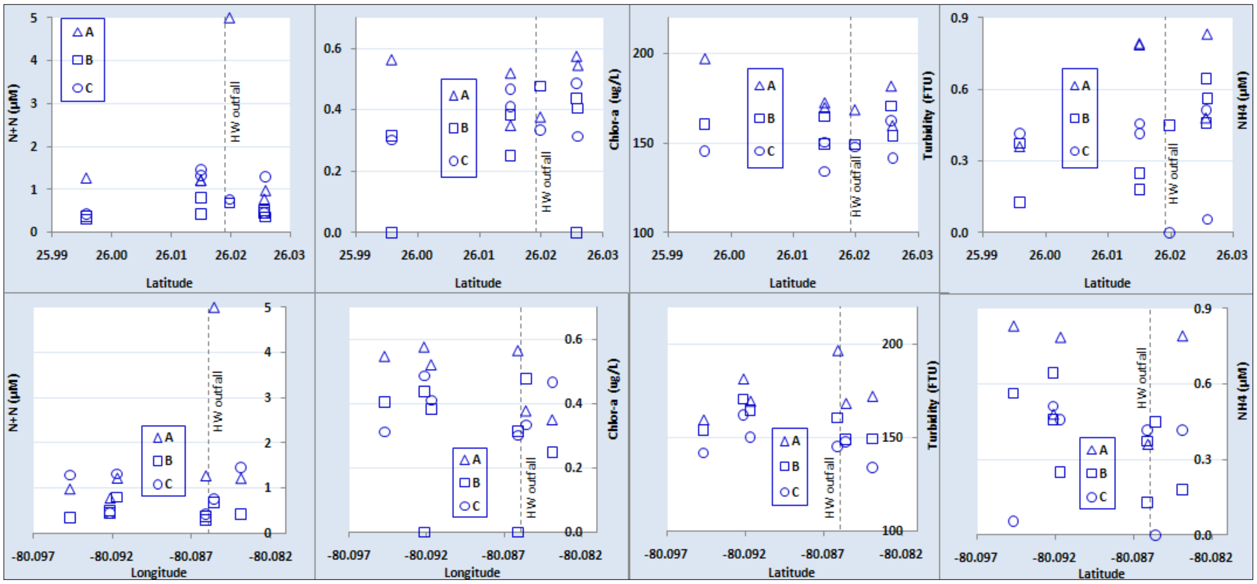

Figure 16. Data from the Hollywood Outfall region (sitesHW1-6), from the December cruise, plotted versus latitude (upper panels) and versus longitude (lower panels). Format is similar to that of Figure 4. The coordinate of the outfall is denoted by the vertical dotted line.

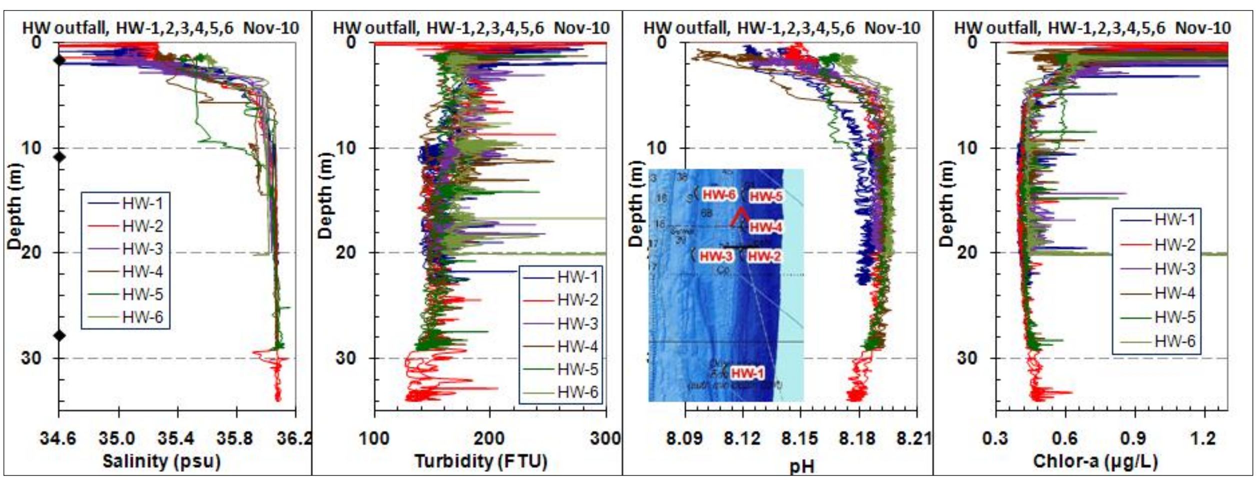

Figure 17. CTD data from the Hollywood Outfall region (Sites HW1-6). Format is similar to Figure 5. Location of sample sites is shown in the inset, with the Hollywood outfall denoted by the red arrowhead.

Summary

The above is a subset of the data collected during the November and December monthly monitoring cruises aboard the R/V Hildebrand. Instruments performed well (except as noted below), data was generated, and compliance with certification requirements was met. Data from FIU has not been fully received and is only partially included in this report.

Hildebrand equipment failure

During the operation at site HW1 of the second December cruise, 9-December-2010, during rough seas, the CTD cable jumped out of its guides, causing a crimp in the line. Our ship coordinator, LTCMD Hector Casanova, determined that the incident made the continuance of the cruise impossible, because of the possible hazard to the crew.. It was considered that the 500' line could be cut and the end re-terminated onto the CTD; however, examination of the remaining line after cutting and after extending the line out to the maximum likely operational extent, that the remaining line on the drum was not sufficient to keep the line from sliding off the drum. A 2500-foot length of cable had been ordered immediately after the incident; this cable is scheduled to arrive on 14-January. It will be installed on the Hildebrand so that the monthly cruises can continue. We will conduct a make-up cruise for Hollywood after the sequence of monthly cruises has otherwise been completed, so that an entire twelve-month data set can be obtained.

FACE events and outreach

- FACE directors Thomas Carsey and Jack Stamates attended the fall Southeast Florida Coral Reef Initiative (SEFCRI, http://www.dep.state.fl.us/coastal/programs/coral/sefcri.htm) meeting at Nova Southeast University on November 18-19. FACE work was discussed and it was decided that a presentation of FACE science would be made in the spring 2011 SEFCRI meeting sometime in May.

- A number of FACE scientists met with Katharine Tzadik, Environmental Project Coordinator from the FDEP Coral Reef Conservation Program, and Troy Craig, also of FDEP, on 14-Dec at AOML. The meeting was to inform Ms. Tzadik of the FACE field work plans and its coordination with the SEFCRI, including having a FACE presentation at next spring's SEFCRI meeting.

The FACE program is part of the NOAA-AOML-OCD web presence, and can be viewed at http://www.aoml.noaa.gov/themes/CoastalRegional/projects/FACE/faceweb.htm

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14-January-2011
Thomas Carsey
Jack Stamates

ATTACHMENTS.

1. November cruise data.
2. December cruise data.

NOV-10 Station		Lat	Lon	D m	Sal Units	T °C	O_2s mg/L	pH	ORP mV	Chl-a µg/L	Pha µg/L	TSS mg/L	Turb FTU	N+N µM-N	NO_2 µM-N	NO_3 µM-N	NH4 µM-N	P µM-P	Si µM-Si
BR-1A	A	26.0938	-80.1057	1.2	32.29	26.73	6.66	7.81	230.7	1.62	0.80	1.94	480.5	4.855	0.515	4.340	1.276	0.295	15.148
BR-1B	B	26.0938	-80.1057	6.4	35.20	26.61	6.57	7.90	231.0	0.94	0.30	1.31	279.0	1.261	0.156	1.105	0.146	0.090	2.772
BR-1C	C	26.0938	-80.1057	13.1	35.64	26.94	6.51	8.04	230.9	0.72	0.26	0.78	215.1	1.074	0.113	0.961	0.183	0.065	2.284
BR-2A	A	26.1025	-80.0929	1.3	34.62	26.94	6.55	7.92	226.9	0.81	0.40	1.04	265.5	1.539	0.118	1.421	0.243	0.087	4.039
BR-2C	C	26.1025	-80.0929	8.6	35.91	27.16	6.48	7.97	227.2	0.63	0.21	0.41	202.3	0.801	0.097	0.704	0.300	0.042	2.116
BR-3A	A	26.1378	-80.0900	1.6	36.02	25.91	6.62	8.11	231.5	0.22	0.10	0.18	136.6	1.247	0.043	1.204	BDL	BDL	2.225
BR-3C	C	26.1379	-80.0901	9.3	36.10	26.03	6.59	8.11	230.0	0.17	0.11	0.23	106.2	1.223	0.058	1.165	BDL	0.008	1.505
BR-3CX	C	26.1379	-80.0901	9.3	36.10	26.03	6.59	N/A	230.0	N/A	N/A	0.20	106.2	N/A	N/A	N/A	N/A	N/A	N/A
BR-4A	A	26.1595	-80.0753	1.5	36.13	26.52	6.54	8.12	208.8	0.20	0.09	0.17	121.4	0.915	0.021	0.894	BDL	BDL	1.125
BR-4AX	A	26.1595	-80.0753	1.5	36.13	26.52	6.54	8.12	208.8	N/A	N/A	0.13	121.4	0.877	0.024	0.853	BDL	0.002	1.102
BR-4B	B	26.1595	-80.0754	12.2	36.13	26.52	6.54	7.94	209.9	0.20	0.07	0.11	101.9	0.899	0.004	0.895	0.115	0.002	1.151
BR-4C	C	26.1596	-80.0755	23.6	36.13	26.41	6.56	8.11	212.8	0.18	0.08	0.19	121.5	0.372	0.003	0.369	BDL	BDL	1.240
BR-5A	A	26.1592	-80.0874	1.3	36.13	26.28	6.57	8.13	207.3	0.21	0.08	0.11	97.3	0.369	0.010	0.359	BDL	BDL	1.142
BR-5C	C	26.1592	-80.0875	11.0	36.14	26.13	6.58	8.12	208.7	0.15	0.08	0.10	100.0	0.568	BDL	0.568	BDL	0.006	1.298
BR-6A	A	26.1899	-80.0839	1.5	36.09	26.22	6.58	8.11	220.6	0.28	0.10	0.22	112.0	0.404	0.003	0.401	BDL	BDL	1.352
BR-6B	B	26.1899	-80.0840	4.0	36.09	26.17	6.58	8.12	220.7	0.29	0.13	0.20	115.2	0.387	0.026	0.361	BDL	BDL	1.527
BR-6C	C	26.1898	-80.0841	9.2	36.10	25.72	6.63	7.90	219.9	0.27	0.11	0.15	119.2	0.489	0.073	0.416	1.313	0.061	1.179
BR-7A	A	26.2017	-80.0672	1.2	36.11	26.52	6.54	8.12	223.6	0.23	0.08	0.17	97.4	0.371	0.045	0.326	BDL	BDL	1.203
BR-7B	B	26.2019	-80.0674	16.5	36.11	26.51	6.54	8.13	223.4	0.26	0.10	0.12	114.9	0.235	0.006	0.229	0.629	0.001	0.962
BR-7C	C	26.2020	-80.0675	31.5	36.11	26.52	6.54	8.12	223.4	0.23	0.09	0.14	114.6	0.278	BDL	0.278	0.301	BDL	0.879
BR-8A	A	26.2362	-80.0673	1.3	36.10	26.58	6.53	8.12	232.6	0.25	0.09	0.24	91.9	0.407	0.008	0.399	4.219	0.040	2.036
BR-8B	B	26.2365	-80.0675	8.4	36.10	26.57	6.54	8.13	231.9	0.24	0.08	0.11	99.7	0.253	BDL	0.253	1.137	0.006	0.870
BR-8C	C	26.2367	-80.0676	16.4	36.10	26.57	6.54	8.13	231.1	0.25	0.08	0.10	107.7	0.194	0.049	0.145	0.269	0.008	0.880
BR-9A	A	26.2462	-80.0624	1.7	36.11	26.65	6.53	8.12	234.5	0.25	0.08	0.12	107.0	0.258	0.078	0.180	1.279	0.005	0.923
BR-9B	B	26.2465	-80.0625	15.1	36.12	26.65	6.53	8.13	233.4	0.24	0.09	0.10	109.0	0.095	BDL	0.095	0.448	0.004	0.833
BR-9C	C	26.2469	-80.0626	31.1	36.12	26.63	6.53	8.12	233.1	0.24	0.08	0.09	130.9	0.095	0.002	0.093	0.855	0.035	1.219
BR-10A	A	26.2507	-80.0620	0.9	35.82	26.64	6.53	8.11	233.1	0.25	0.09	0.16	112.8	1.311	0.747	0.564	11.13	0.241	2.795
BR-10B	B	26.2507	-80.0621	16.2	36.00	26.64	6.53	8.11	232.4	0.24	0.08	0.15	109.1	0.618	0.318	0.300	4.161	0.074	1.555
BR-10C	C	26.2503	-80.0618	33.9	36.12	26.64	6.53	8.11	232.6	0.24	0.08	0.09	119.8	0.210	0.034	0.176	0.178	0.023	0.997
BR-11A	A	26.2537	-80.0619	1.5	36.12	26.68	6.53	8.11	230.9	0.23	0.08	0.42	90.1	0.225	0.053	0.172	0.354	0.009	0.901
BR-11B	B	26.2539	-80.0619	13.0	36.11	26.65	6.53	8.12	229.9	0.24	0.09	0.12	100.6	0.252	0.085	0.167	0.720	0.030	1.141
BR-11C	C	26.2542	-80.0619	30.9	36.11	26.64	6.53	8.12	229.5	0.27	0.11	0.12	110.1	0.221	0.033	0.188	0.498	0.013	1.141
BR-12A	A	26.2496	-80.0788	1.2	35.65	25.75	6.64	8.10	247.7	0.70	0.21	0.36	180.4	1.056	0.102	0.954	2.856	0.148	6.065
BR-12AX	A	26.2496	-80.0788	1.2	35.65	25.75	6.64	8.10	247.7	N/A	N/A	0.32	180.4	0.894	0.185	0.709	1.389	0.091	3.280
BR-13A	A	26.2596	-80.0831	1.8	36.02	26.17	6.58	8.12	238.1	0.39	0.15	0.24	315.9	0.487	0.098	0.389	0.957	0.050	1.947
BR-14A	A	26.2617	-80.0854	1.5	34.69	25.51	6.71	8.05	231.7	0.88	0.48	0.46	241.2	2.384	0.177	2.207	2.732	0.205	7.603
BR-15A	A	26.2629	-80.0836	1.3	35.91	25.88	6.61	8.11	238.0	0.48	0.21	0.49	155.0	0.737	0.095	0.642	1.244	0.075	2.777
BR-16A	A	26.2612	-80.0738	1.6	36.08	26.58	6.54	8.12	241.1	0.28	0.08	0.12	79.2	0.147	0.084	0.063	1.364	0.048	1.246
BR-16B	B	26.2612	-80.0737	5.3	36.08	26.46	6.55	8.13	240.3	0.31	0.09	0.14	107.3	0.164	0.038	0.126	1.277	0.016	1.435
BR-16C	C	26.2611	-80.0736	9.9	36.10	26.41	6.55	8.13	240.0	0.28	0.10	0.18	131.8	0.223	0.036	0.187	0.851	0.007	0.966
BR-17A	A	26.2735	-80.0638	1.8	36.12	26.77	6.51	8.13	234.2	0.25	0.08	0.34	91.1	0.136	0.060	0.076	0.364	0.024	0.968
BR-17B	B	26.2738	-80.0638	7.4	36.11	26.64	6.53	8.13	234.1	0.27	0.09	0.08	101.5	0.166	0.069	0.097	0.541	0.030	1.126
BR-17BX	B	26.2738	-80.0638	7.4	36.11	26.64	6.53	8.14	234.1	N/A	N/A	0.16	101.5	0.194	0.097	0.097	0.829	0.011	0.960
BR-17C	C	26.2741	-80.0638	14.3	36.11	26.64	6.53	8.13	233.8	0.26	0.08	0.11	108.1	0.168	0.083	0.085	0.742	0.041	1.176

NOV-10 Station		Lat	Lon	D m	Sal Units	T °C	O_2s mg/L	pH	ORP mV	Chl-a µg/L	Pha µg/L	TSS mg/L	Turb FTU	N+N µM-N	NO_2 µM-N	NO_3 µM-N	NH4 µM-N	P µM-P	Si µM-Si
BR-18A	A	26.2957	-80.0689	1.7	36.10	26.66	6.53	8.12	225.0	0.236	0.10	0.14	95.1	0.174	0.045	0.129	1.289	0.021	0.966
BR-18B	B	26.2960	-80.0688	4.9	36.10	26.65	6.53	8.13	224.8	0.27	0.08	0.12	97.3	0.201	0.036	0.165	1.057	0.043	1.416
BR-18C	C	26.2962	-80.0687	9.2	36.10	26.66	6.53	8.12	225.0	0.24	0.08	0.34	97.7	0.207	0.042	0.165	0.426	0.024	1.006
HW-1A	A	25.9958	-80.0861	1.8	35.14	26.52	6.58	8.06	246.0	0.56	0.22	0.77	197.1	1.273	0.136	1.137	0.358	0.044	3.076
HW-1B	B	25.9958	-80.0861	11.0	36.04	27.31	6.46	8.11	244.3	0.31	0.07	0.22	160.7	0.372	0.021	0.351	0.373	0.020	1.210
HW-1BX	B	25.9958	-80.0861	11.0	36.04	27.31	6.46	8.11	244.3	N/A	N/A	0.64	160.7	0.296	BDL	0.296	0.128	0.053	1.216
HW-1C	C	25.9958	-80.0861	21.4	36.06	27.29	6.46	8.12	243.4	0.30	0.09	0.42	145.4	0.421	0.024	0.397	0.415	0.027	1.515
HW-2A	A	26.0150	-80.0839	1.7	35.25	26.58	6.57	7.94	222.8	0.35	0.09	0.27	172.4	1.216	0.144	1.072	0.790	0.041	3.098
HW-2B	B	26.0150	-80.0839	17.0	36.06	27.32	6.46	8.02	222.1	0.25	0.10	0.24	149.3	0.418	BDL	0.418	0.181	0.017	1.326
HW-2C	C	26.0150	-80.0839	33.4	36.08	26.78	6.51	8.01	222.8	0.47	0.15	0.55	134.2	1.464	0.069	1.395	0.416	0.069	1.872
HW-3A	A	26.0150	-80.0917	2.9	35.31	26.66	6.56	7.95	221.0	0.52	0.18	0.66	169.7	1.222	0.138	1.084	0.784	0.041	2.395
HW-3B	B	26.0150	-80.0917	10.2	36.00	27.23	6.47	7.99	220.9	0.38	0.15	0.30	164.8	0.798	0.051	0.747	0.249	0.031	1.505
HW-3C	C	26.0150	-80.0917	17.5	36.04	27.26	6.46	8.00	220.8	0.41	0.13	0.36	150.4	1.314	0.041	1.273	0.457	0.031	1.595
HW-4A	A	26.0198	-80.0856	1.6	35.28	27.16	6.50	7.86	221.0	0.38	0.12	0.23	168.5	4.991	1.767	3.224	8.665	0.372	6.200
HW-4B	B	26.0198	-80.0856	10.8	36.06	27.30	6.46	7.96	220.5	0.48	0.11	0.23	149.2	0.679	0.085	0.594	0.450	0.073	1.572
HW-4C	C	26.0198	-80.0856	27.8	36.07	27.10	6.48	7.98	220.9	0.33	0.13	0.23	147.8	0.762	BDL	0.762	BDL	0.034	1.390
HW-5A	A	26.0259	-80.0947	1.3	35.43	26.79	6.54	8.07	221.5	0.55	0.16	0.43	159.6	0.983	0.201	0.782	0.829	0.053	2.039
HW-5B	B	26.0259	-80.0947	13.9	36.05	27.24	6.47	7.98	221.6	0.41	0.09	0.16	153.9	0.355	0.048	0.307	0.563	0.022	1.178
HW-5C	C	26.0259	-80.0947	27.5	36.06	26.96	6.49	7.97	221.7	0.31	0.10	0.22	141.8	1.290	BDL	1.290	0.055	0.056	1.582
HW-6A	A	26.0257	-80.0922	1.3	35.63	26.96	6.51	7.96	224.3	0.58	0.08	0.46	181.7	0.783	0.059	0.724	0.478	0.044	1.800
HW-6B	B	26.0257	-80.0922	9.5	36.01	27.24	6.47	8.10	223.6	0.44	0.12	0.27	170.7	0.502	0.031	0.471	0.458	0.034	1.198
HW-6BX	B	26.0257	-80.0922	9.5	36.01	27.24	6.47	8.10	223.6	N/A	N/A	0.13	170.7	0.454	0.093	0.361	0.644	0.035	1.238
HW-6C	C	26.0257	-80.0922	17.6	36.02	27.24	6.47	7.98	223.9	0.49	0.12	0.19	162.4	0.443	0.076	0.367	0.512	0.020	1.280
HW-7A	A	26.0460	-80.0922	1.8	35.65	26.92	6.51	7.94	231.4	0.58	0.13	0.39	186.5	0.767	0.125	0.642	0.455	0.032	1.780
HW-7B	B	26.0460	-80.0922	7.9	35.98	27.24	6.47	8.10	231.0	0.53	0.11	0.29	192.2	0.344	0.010	0.334	0.065	0.018	1.251
HW-7C	C	26.0460	-80.0922	15.7	36.03	27.27	6.46	7.98	230.5	0.61	0.13	0.24	179.2	0.345	0.014	0.331	0.156	0.016	1.233
HW-8A	A	26.0452	-80.1047	1.5	35.46	26.76	6.54	8.05	235.2	0.66	0.19	0.69	197.4	1.199	0.122	1.077	0.383	0.065	2.629
HW-8AX	A	26.0452	-80.1047	1.5	35.46	26.76	6.54	8.05	235.2			0.77	197.4	1.195	0.178	1.017	0.855	0.045	2.055
HW-8C	C	26.0452	-80.1047	5.2	35.80	27.10	6.49	7.96	234.6	0.56	0.20	0.46	177.3	0.974	0.127	0.847	0.525	0.044	1.651
HW-9A	A	26.0687	-80.0834	1.3	35.79	27.02	6.50	7.95	231.9	0.65	0.14	0.43	214.9	0.942	0.201	0.741	1.037	0.061	2.651
HW-9B	B	26.0687	-80.0834	12.5	36.01	27.25	6.47	7.98	231.4	0.78	0.17	0.19	202.3	0.565	0.103	0.462	0.953	0.031	1.431
HW-9C	C	26.0687	-80.0834	24.1	36.05	27.26	6.47	7.98	231.7	0.48	0.15	0.25	183.1	0.562	0.028	0.534	0.537	0.067	1.496
HW-10A	A	26.0832	-80.0830	1.1	35.70	26.88	6.52	7.95	238.2	0.77	0.17	0.45	226.9	0.772	0.137	0.635	0.683	0.045	2.404
HW-10B	B	26.0832	-80.0830	10.1	35.86	27.10	6.49	8.07	237.3	0.81	0.17	0.33	236.7	0.451	0.110	0.341	0.477	0.023	1.501
HW-10C	C	26.0832	-80.0830	21.6	36.07	27.13	6.48	7.98	237.3	0.40	0.12	0.24	165.0	0.517	0.031	0.486	0.235	0.028	1.193
HW-10A	A	26.0832	-80.0830	1.1	35.70	26.88	6.52	7.95	238.2	0.77	0.17	0.45	226.9	0.772	0.137	0.635	0.683	0.045	2.404
HW-10B	B	26.0832	-80.0830	10.1	35.86	27.10	6.49	8.07	237.3	0.81	0.17	0.33	236.7	0.451	0.110	0.341	0.477	0.023	1.501
HW-10C	C	26.0832	-80.0830	21.6	36.07	27.13	6.48	7.98	237.3	0.40	0.12	0.24	165.0	0.517	0.031	0.486	0.235	0.028	1.193
HW-11A	A	26.0832	-80.0941	1.6	35.67	26.83	6.52	7.94	227.8	0.74	0.20	0.51	208.7	0.615	0.126	0.489	0.456	0.030	1.550
HW-11C	C	26.0832	-80.0941	7.2	36.00	27.25	6.47	7.98	227.8	0.45	0.11	0.32	190.5	0.651	0.203	0.448	BDL	0.036	1.290
HW-11A	A	26.0832	-80.0941	1.6	35.67	26.83	6.52	7.94	227.8	0.74	0.20	0.51	208.7	0.615	0.126	0.489	0.456	0.030	1.550
HW-11A	A	26.0832	-80.0941	1.6	35.67	26.83	6.52	7.94	227.8	0.74	0.20	0.51	208.7	0.615	0.126	0.489	0.456	0.030	1.550

NOV-10 Station		Lat	Lon	D m	Sal Units	T °C	O_2s mg/L	pH	ORP mV	Chl-a µg/L	Pha µg/L	TSS mg/L	Turb FTU	N+N µM-N	NO_2 µM-N	NO_3 µM-N	NH4 µM-N	P µM-P	Si µM-Si
HW-12A	A	26.0942	-80.0958	0.9	34.66	26.64	6.58	7.88	250.6	1.12	0.44	1.27	309.7	2.298	0.223	2.075	0.387	0.128	6.334
HW-12B	B	26.0942	-80.0958	7.2	35.81	27.10	6.49	8.07	248.7	0.64	0.25	0.64	219.5	0.719	0.042	0.677	0.332	0.053	1.521
HW-12BX	B	26.0942	-80.0958	7.2	35.81	27.10	6.49	8.07	248.7	N/A	N/A	0.75	219.5	0.726	0.065	0.661	0.178	0.037	1.633
HW-12C	C	26.0942	-80.0958	13.3	35.98	27.22	6.47	7.98	247.1	0.52	0.15	0.64	200.5	0.525	0.004	0.521	BDL	0.025	1.218
HW-13A	A	26.0967	-80.0831	N/A	N/A	N/A	N/A	7.95	N/A	0.80	0.17	0.80	N/A	0.635	0.030	0.605	BDL	0.027	1.487
HW-13B	B	26.0967	-80.0831	N/A	N/A	N/A	N/A	7.96	N/A	0.91	0.19	1.00	N/A	0.640	0.025	0.615	BDL	0.027	1.554
HW-13C	C	26.0967	-80.0831	N/A	N/A	N/A	N/A	7.98	N/A	0.60	0.15	0.69	N/A	0.526	0.005	0.521	0.225	0.034	1.271
HW-14A	A	26.0942	-80.1108	1.7	31.39	26.67	6.70	7.79	136.9	2.06	0.98	1.96	508.2	6.162	0.430	5.732	1.339	0.352	19.960
HW-15AX	A	26.1024	-80.0796	13.8	34.84	26.86	6.55	8.06	232.3	N/A	N/A	0.53	276.7	0.793	0.094	0.699	0.221	0.042	1.953
HW-15A	A	26.1024	-80.0796	1.3	34.84	26.86	6.55	8.07	232.6	0.95	0.26	0.46	273.3	0.720	0.085	0.635	0.009	0.047	2.050
HW-15B	B	26.1024	-80.0796	13.8	35.76	27.03	6.50	7.98	232.3	0.94	0.19	0.35	174.6	0.438	0.015	0.423	0.081	0.033	1.752
HW-15C	C	26.1024	-80.0796	26.1	36.05	27.16	6.47	7.98	231.9	0.43	0.13	0.46	480.5	0.607	BDL	0.607	0.014	0.030	1.169

DEC-10	Lat	Long	D	Sal	Temp	O_2s		ORP	Chl	Pha	TSS	Turb	N+N	NO_2	NO_3	NH4	P	Si
Station	Deg	Deg	m	psu	0C	mg/L	pH	mV	µg/L	µg/L	mg/L	FTU	µM-N	µM-N	µM-N	µM-N	µM-P	µM-Si
BR-3A	26.138	-80.090	1.2	36.18	25.38	6.67	8.38	197.39	1.232	0.820	0.33	297.55	0.222	0.068	0.154	0.365	0.110	1.896
BR-3C	26.138	-80.090	7.7	36.19	25.40	6.66	8.38	195.63	1.170	0.251	0.26	311.55	0.180	0.067	0.113	0.216	0.007	2.061
BR-3CX	26.138	-80.090	7.7	36.19	25.40	6.66	8.38	195.63	N/A	N/A	0.29	311.55	0.034	0.034	BDL	0.344	0.011	1.959
BR-4A	26.160	-80.075	1.3	36.04	25.55	6.65	8.38	206.25	0.830	0.139	0.26	248.46	0.077	0.091	BDL	0.614	0.011	1.976
BR-4AX	26.160	-80.075	1.3	36.04	25.55	6.65	8.38	206.25	N/A	N/A	0.25	248.46	0.263	0.039	0.224	4.277	0.046	2.156
BR-4B	26.160	-80.076	9.5	36.18	25.47	6.66	8.38	204.97	0.815	0.200	0.15	239.95	0.332	0.055	0.277	0.391	0.012	2.036
BR-4C	26.160	-80.076	24.1	36.21	25.42	6.66	8.38	203.57	0.679	0.256	0.17	219.20	0.355	0.067	0.288	0.447	0.014	2.158
BR-5A	26.159	-80.088	1.2	36.16	25.45	6.66	8.38	204.34	1.047	0.223	0.34	275.69	0.174	0.060	0.114	0.252	0.012	1.762
BR-5C	26.159	-80.088	8.7	36.21	25.42	6.66	8.38	203.27	1.065	0.249	0.26	289.77	0.066	0.066	BDL	0.432	0.010	1.448
BR-6A	26.190	-80.084	1.2	36.08	25.51	6.65	8.37	189.16	0.749	0.233	0.43	208.21	0.131	0.083	0.048	0.599	0.023	1.702
BR-6B	26.190	-80.084	3.6	36.09	25.50	6.66	8.37	187.43	0.846	0.194	0.30	229.23	0.309	0.051	0.258	0.456	0.022	1.632
BR-6C	26.190	-80.084	9.2	36.17	25.49	6.65	8.37	184.30	0.951	0.218	0.23	285.19	0.213	0.029	0.184	0.232	0.009	1.429
BR-7A	26.202	-80.066	1.3	36.08	25.48	6.66	8.37	195.41	0.967	0.217	0.26	248.30	0.220	0.059	0.161	0.382	0.006	1.358
BR-7B	26.202	-80.066	12.9	36.21	25.44	6.66	8.38	191.62	0.801	0.178	0.13	262.46	0.333	0.038	0.295	0.472	0.012	1.435
BR-7C	26.202	-80.066	30.4	36.27	25.11	6.69	8.38	188.20	0.525	0.197	0.16	231.02	0.264	0.059	0.205	0.611	0.025	1.657
BR-8A	26.237	-80.068	1.6	36.12	25.54	6.65	8.38	219.05	0.680	0.151	0.17	169.34	0.050	0.059	BDL	1.049	0.014	1.436
BR-8B	26.237	-80.067	6.7	36.13	25.53	6.65	8.38	218.83	0.647	0.138	0.35	203.29	BDL	0.036	BDL	0.269	0.015	1.445
BR-8C	26.237	-80.068	14.0	36.25	25.25	6.68	8.38	218.72	0.642	0.171	0.14	209.35	0.279	0.049	0.230	0.280	0.014	1.433
BR-9A	26.247	-80.063	1.1	36.17	25.58	6.64	8.38	208.02	0.684	0.161	0.21	172.24	BDL	0.056	BDL	0.642	0.005	0.379
BR-9B	26.247	-80.063	10.9	36.20	25.47	6.65	8.38	207.28	0.719	0.166	0.15	234.99	BDL	0.029	BDL	0.378	BDL	0.459
BR-9C	26.247	-80.063	25.3	36.23	25.19	6.69	8.38	206.77	0.615	0.179	0.12	255.25	0.421	0.053	0.368	0.324	0.024	1.378
BR-10A	26.251	-80.062	1.6	36.16	25.67	6.63	8.38	195.41	0.602	0.125	0.22	168.57	BDL	0.027	BDL	0.409	0.006	0.260
BR-10B	26.251	-80.062	8.5	36.19	25.53	6.65	8.38	192.94	0.594	0.168	0.15	226.67	BDL	0.032	BDL	0.263	0.007	0.699
BR-10C	26.251	-80.062	22.7	36.22	25.41	6.66	8.39	189.38	0.799	0.126	0.26	232.59	BDL	0.094	BDL	1.582	0.013	0.509
BR-11A	26.256	-80.061	1.2	36.03	25.58	6.65	8.37	215.26	0.604	0.136	0.48	185.32	BDL	0.060	BDL	0.612	0.030	0.537
BR-11B	26.256	-80.061	14.6	36.19	25.54	6.65	8.38	214.30	0.613	0.144	0.17	212.14	BDL	0.038	BDL	0.460	0.022	0.217
BR-11C	26.255	-80.061	33.1	36.23	25.15	6.69	8.37	213.61	0.604	0.189	0.14	228.24	BDL	0.075	BDL	0.692	0.039	0.346
BR-12A	26.249	-80.079	1.3	35.95	25.60	6.65	8.36	218.86	0.599	0.184	0.49	165.37	0.463	0.071	0.392	0.623	0.038	2.167
BR-12AX	26.249	-80.079	1.3	35.95	25.60	6.65	8.36	218.86	N/A	N/A	0.40	165.37	0.172	0.058	0.114	0.546	0.041	2.070
BR-13A	26.259	-80.083	1.0	34.21	25.49	6.73	8.25	225.22	0.818	0.488	0.85	325.66	2.355	0.157	2.198	1.819	0.260	7.965
BR-14A	26.262	-80.085	1.0	31.56	25.46	6.83	8.11	221.00	1.131	0.675	1.09	311.97	5.395	0.267	5.128	2.718	0.537	18.86
BR-15A	26.263	-80.083	1.1	34.09	25.52	6.73	8.22	226.80	0.984	0.694	1.31	287.25	2.727	0.195	2.532	1.944	0.334	9.408
BR-16A	26.262	-80.072	1.2	35.82	25.54	6.66	8.35	226.03	0.583	0.200	0.35	187.95	0.525	0.098	0.427	0.647	0.065	1.259

DEC-10 Station	Lat Deg	Long Deg	D m	Sal psu	Temp 0C	O_2s mg/L	pH	ORP mV	Chl µg/L	Pha µg/L	TSS mg/L	Turb FTU	N+N µM-N	NO_2 µM-N	NO_3 µM-N	NH4 µM-N	P µM-P	Si µM-Si
BR-16B	26.262	-80.072	4.2	36.17	25.61	6.64	8.37	226.33	0.551	0.232	0.29	178.87	BDL	0.021	BDL	0.201	0.026	0.187
BR-16C	26.262	-80.073	9.4	36.20	25.45	6.66	8.36	227.83	0.380	0.136	0.18	173.61	0.167	0.034	0.133	0.201	0.028	0.195
BR-17A	26.276	-80.063	1.4	25.85	25.55	6.66	8.36	218.28	0.639	0.178	0.42	176.39	BDL	0.044	BDL	0.354	0.021	0.561
BR-17B	26.276	-80.063	8.6	36.16	25.38	6.67	8.37	218.50	0.538	0.146	0.18	176.28	0.030	0.049	BDL	0.682	0.041	0.180
BR-17BX	26.276	-80.063	8.6	36.16	25.38	6.67	8.37	218.50	N/A	N/A	0.23	176.28	0.060	0.057	0.003	0.519	0.026	0.187
BR-17C	26.276	-80.064	14.0	36.15	25.41	6.66	8.37	217.94	0.525	0.145	0.16	190.89	BDL	0.028	BDL	0.193	0.017	0.186
BR-18A	26.298	-80.066	0.7	36.08	25.56	6.65	8.37	217.65	0.556	0.126	0.24	167.66	BDL	0.023	BDL	0.150	0.010	0.359
BR-18B	26.298	-80.067	7.5	36.17	25.40	6.66	8.37	217.17	0.543	0.160	0.21	180.40	0.063	0.047	0.016	0.203	0.012	0.272
BR-18C	26.298	-80.067	17.4	36.25	25.12	6.69	8.37	215.63	0.354	0.141	0.20	161.44	0.207	0.051	0.156	0.300	0.029	0.365