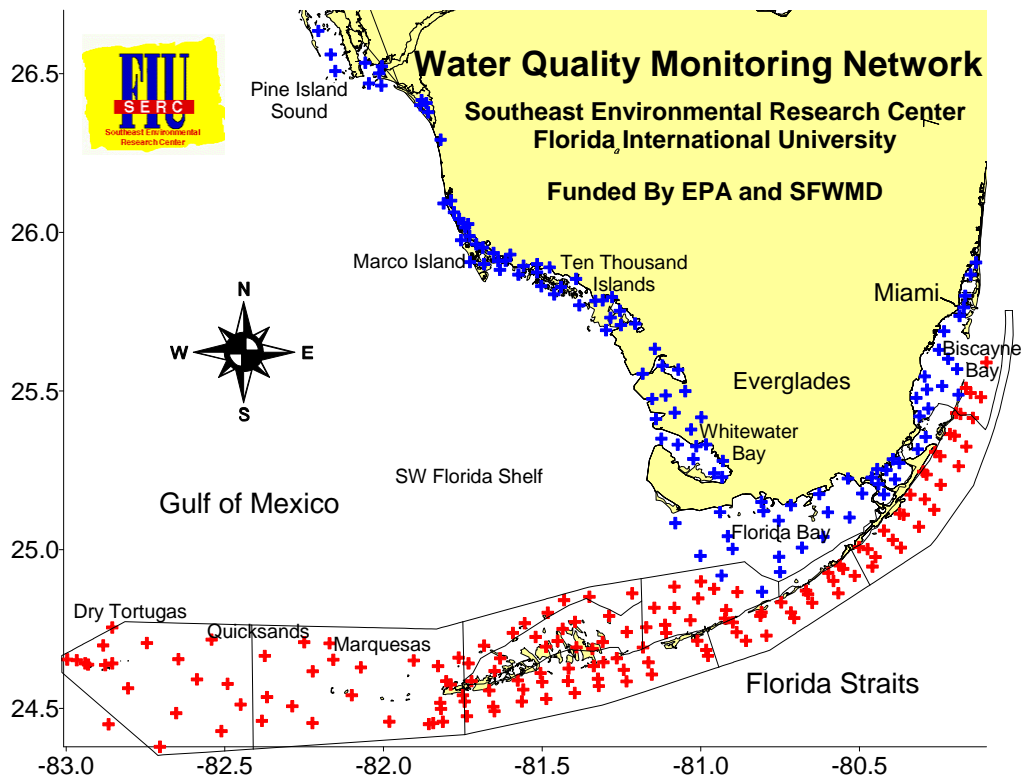


**2008 ANNUAL REPORT OF THE WATER
QUALITY MONITORING PROJECT
FOR THE WATER QUALITY PROTECTION PROGRAM
OF THE FLORIDA KEYS NATIONAL MARINE SANCTUARY**



Joseph N. Boyer and Henry O. Briceño

Southeast Environmental Research Center
Florida International University
Miami, FL 33199

<http://serc.fiu.edu/wqmnetwork/>

US EPA Agreement #X7-96410604-4

2008 ANNUAL REPORT OF THE WATER QUALITY MONITORING PROJECT FOR THE WATER QUALITY PROTECTION PROGRAM OF THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

Joseph N. Boyer and Henry O. Briceño
Southeast Environmental Research Center
Florida International University
Miami, FL 33199

Funded by the Environmental Protection Agency (X7-96410604-4)

EXECUTIVE SUMMARY

This report serves as a summary of our efforts to date in the execution of the Water Quality Monitoring Project for the FKNMS as part of the Water Quality Protection Program. The period of record for this report is Mar. 1995 – Dec. 2008 and includes data from 50 quarterly sampling events at 154 stations within the FKNMS including the Dry Tortugas National Park.

Field parameters measured at each station include salinity (practical salinity scale), temperature (°C), dissolved oxygen (DO, mg l⁻¹), turbidity (NTU), relative fluorescence, and light attenuation (K_d, m⁻¹). Water quality variables include the dissolved nutrients nitrate (NO₃⁻), nitrite (NO₂⁻), ammonium (NH₄⁺), dissolved inorganic nitrogen (DIN), and soluble reactive phosphate (SRP). Total unfiltered concentrations include those of nitrogen (TN), organic nitrogen (TON), organic carbon (TOC), phosphorus (TP), silicate (SiO₂) and chlorophyll *a* (CHLA, µg l⁻¹).

The EPA developed Strategic Targets for the Water Quality Monitoring Project which state that beginning in 2008 through 2011, they shall annually maintain the overall water quality of the near shore and coastal waters of the FKNMS according to 2005 baseline. For reef sites, chlorophyll *a* should be less than or equal to 0.2 micrograms/l and the vertical attenuation coefficient for downward irradiance (K_d, i.e., light attenuation) should be less than or equal to 0.13 per meter. For all monitoring sites in FKNMS, dissolved inorganic nitrogen should be less than or equal to 0.75 micromolar and total phosphorus should be less than or equal to 0.2 micromolar. Table 1 shows the number of sites and percentage of total sites exceeding these Strategic Targets for 2008.

Table 1. 2008 Comparison to Strategic Targets.

| | | |
|---------------------------|---------------------------------------|---------|
| 88 of 136 reef values | >0.2 ug/l CHLA | (64.7%) |
| 33 of 129 reef values | >0.13/m Kd | (25.6%) |
| 106 of 1,003 total values | >0.75 uM NH ₄ ⁺ | (10.6%) |
| 530 of 1,005 total values | >0.20 uM TP | (52.7%) |

Several important results have been realized from this monitoring project. First, is documentation of elevated nitrate in the inshore waters of the Keys (Fig. 1). This result was evident from our first sampling event in 1995 and continues to be a characteristic of the ecosystem. Interestingly, this gradient was not observed in a comparison transect from the Tortugas (no human impact). This type of distribution implies an inshore source which is diluted by low nutrient Atlantic Ocean waters. Presence of a similar gradient in TOC and decreased variability in salinity from land to reef also support this concept. There were no trends in either TP or CHLA with distance from land.

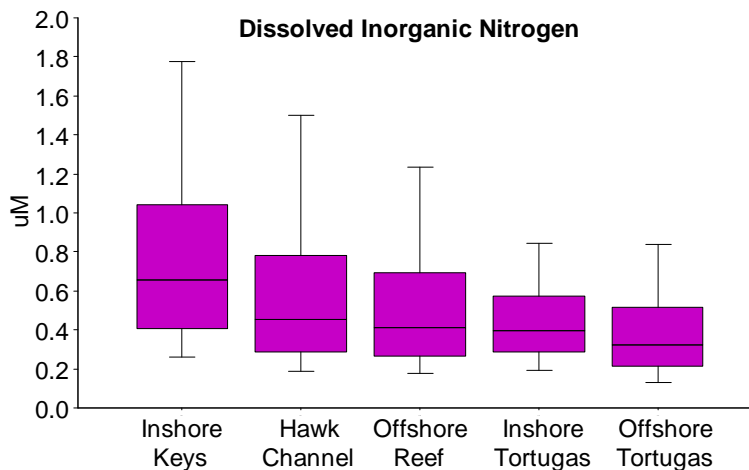


Figure 1.

Some variables showed noteworthy differences over the period of record (Fig 2). Since the 2005 hurricane season, water quality on the reef, especially DIN, have been elevated but have mostly returned to normal levels.

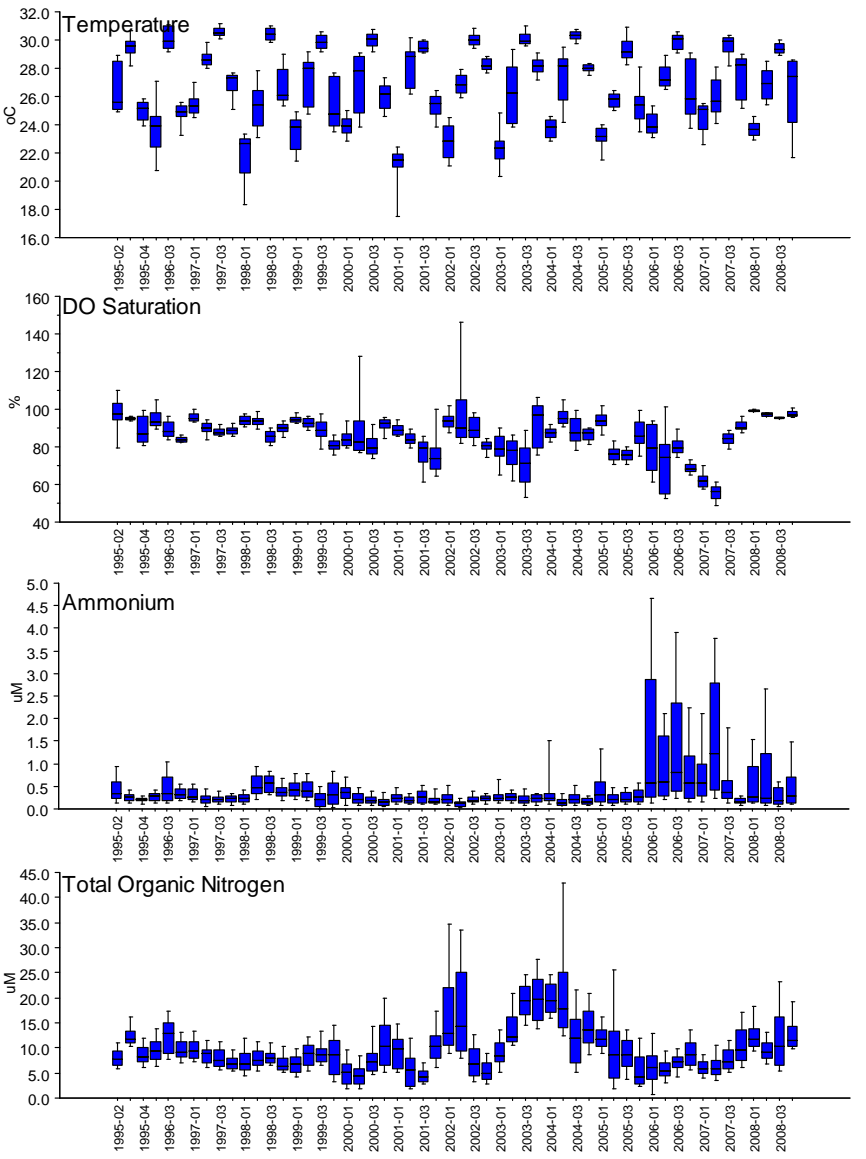
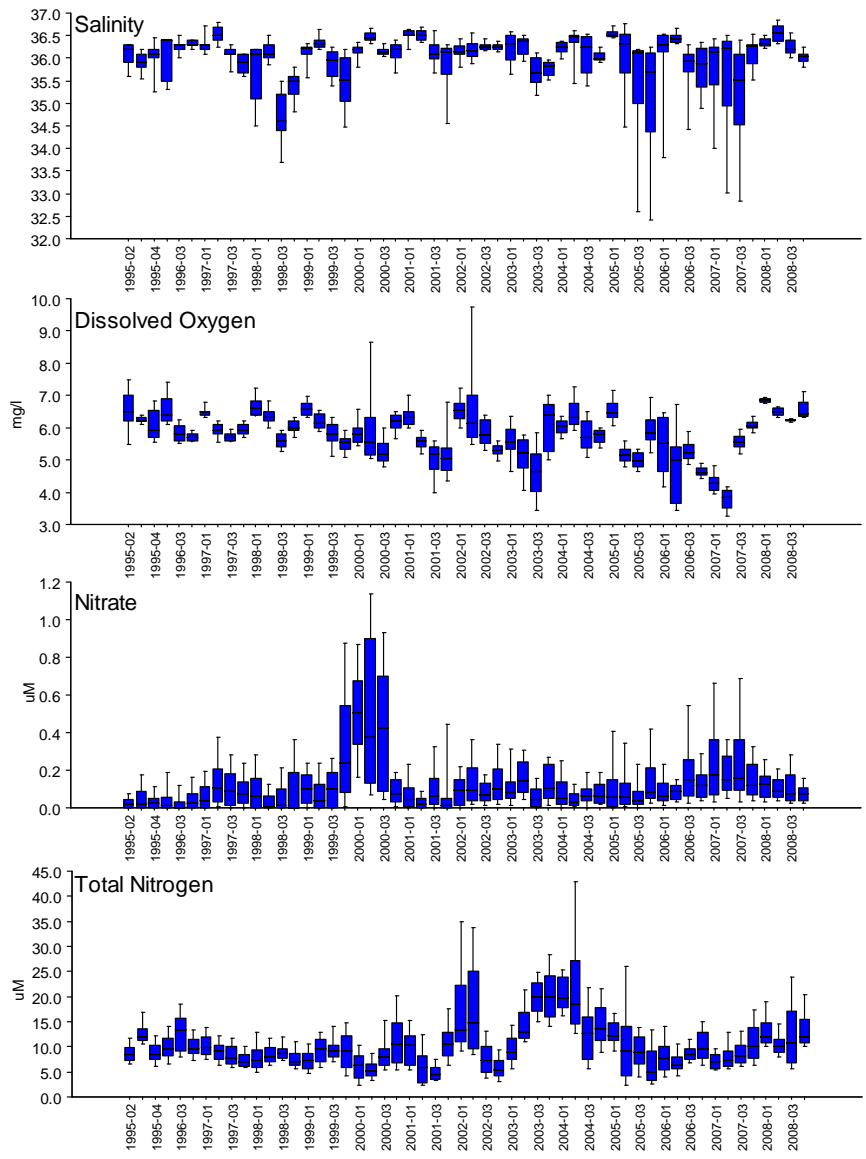


Figure 2. Selected water quality variables from the reef tract/Tortugas

This brings up another important point; when looking at what are perceived to be local trends, we find that they seem to occur across the whole region but at more damped amplitudes. This spatial autocorrelation in water quality is an inherent property of highly interconnected systems such as coastal and estuarine ecosystems driven by similar hydrological and climatological forcing. It is clear that trends observed inside the FKNMS are influenced by regional conditions outside the Sanctuary boundaries.

For 2008, in all regions of the FKNMS, water quality has returned to conditions prior to 2005 hurricane season (Fig. 3). Overall, TOC remains lower than the long term median mostly because it has been declining over the years. DO and light penetration were better than the norm.

Keys Reef Tract

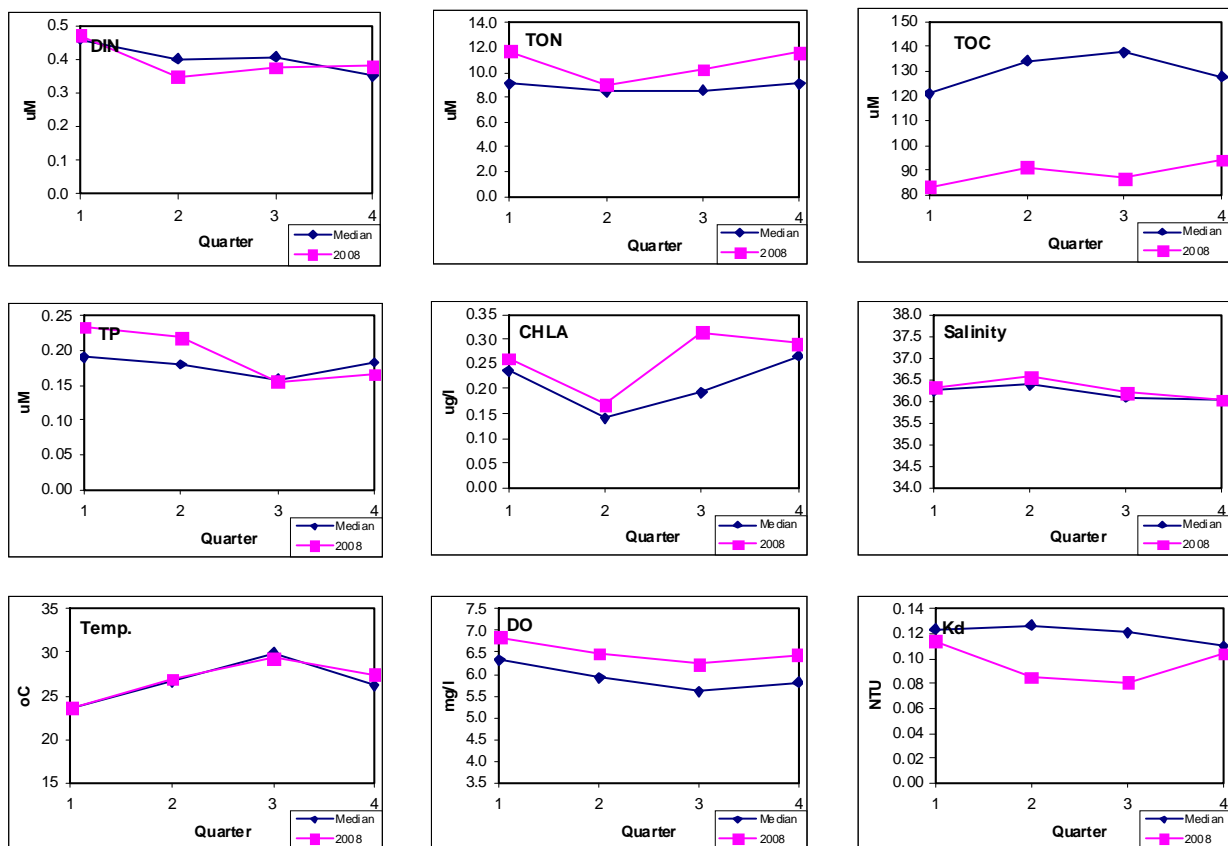


Figure 3.

The large scale of this monitoring program has allowed us to assemble a much more holistic view of broad physical/chemical/biological interactions occurring over the South Florida hydroscape. Much information has been gained by inference from this type of data collection program: major nutrient sources have been confirmed, relative differences in geographical determinants of water quality have been demonstrated, and large scale transport via circulation pathways have been elucidated. In addition we have shown the importance of looking "outside the box" for questions asked within. Rather than thinking of water quality monitoring as being a static, non-scientific pursuit it should be viewed as a tool for answering management questions and developing new scientific hypotheses.

We continue to maintain a website (<http://serc.fiu.edu/wqmnetwork/>) where data from the FKNMS is integrated with the other parts of the SERC water quality network (Florida Bay, Whitewater Bay, Biscayne Bay, Ten Thousand Islands, and SW Florida Shelf) and displayed as downloadable contour maps, time series graphs, and interpretive reports.

One final note of importance is that the South Florida Water Management District did not renew funding to FIU for estuary water quality monitoring effective Sep. 30, 2008.