Comments for Reef Relief on FKNMS Management Plan

By

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The FKNMS has experienced accelerated eutrophication since the early 1990s when FKNMS officials and water managers implemented a water quality "restoration plan" that involved increased flows of nitrogen-rich water from Shark River Slough and Taylor Slough into the Florida Bay/Florida Keys region (Lapointe et al. 2002). Previous research in the 1980s and early 1990s had focused on local near-field impacts from septic tanks in the Florida Keys (Lapointe et al. 1990, Lapointe and Clark, 1992, Lapointe et al. 1994, Lapointe and Matzie, 1996). However, the regional increase in land-based nutrient enrichment from increased Everglades runoff resulted in widespread phytoplankton and benthic algal blooms, hypoxia, anoxia, and sanctuary-wide coral reef die-off (Lapointe et al. 2002). The Pew Oceans Commission subsequently declared the Florida Bay/Florida Keys region a "dead zone" in their 2003 report, as a result of increased nutrient inputs from agricultural sources. Long-term water quality monitoring at Looe Key indicated that concentrations of dissolved inorganic nitrogen (DIN = ammonium + nitrate + nitrite) increased by ~ 100% from the 1980s to the 1990s, much of this due to increases in highly reactive ammonium from fertilizers used in agriculture on the South Florida mainland (Lapointe et al. 2004; Lapointe et al. 2007a,b). The increases in ammonium supported widespread cyanobacterial blooms (eg *Synechococcus* in Florida Bay), which were carried by tidal currents into downstream waters of the FKNMS (Lapointe and Barile 2004). Consequently, chlorophyll *a* concentrations increased by over 100% from the 1980s to the 1990s (eg from ~ 0.15 µg/l in the 1980s to 0.43 µg/l in the 1990s). The chlorophyll *a* concentration is a particularly good indicator of long-term water quality (Lapointe et al. 2004), as it relates directly to the optical properties of the water that is key to coral growth and survival (Yentsch et al. 2002).

The FKNMS Management Plan needs to develop a meaningful water quality restoration plan if the trend of resource decline in the FKNMS is to be reversed. Most importantly, DIN and soluble reactive phosphorus (SRP) concentrations need to be decreased to concentrations that existed in the 1980s when FKNMS resources were still in "good" condition. The FDEP was mandated to establish "Outstanding Florida Waters" in 1985, which was intended to protect the status of existing water quality at that time from any further degradation. Obviously, that has not happened and sanctuary-wide water quality degradation has occurred, largely due to the flawed FKNMS management policies promoting increased flows of nitrogen-rich water from the Everglades in the 1990s. The

only successful water quality restoration plan implemented in Florida to date is in Tampa Bay, where managers set an endpoint goal of restoring seagrass cover to what existed in the 1950s. By reducing nitrogen inputs from sewage, chlorophyll *a* concentrations have decreased and seagrasses have expanded towards the cover that existed historically in the 1950s.

A similar resource endpoint needs to be developed in the FKNMS Management Plan. This should begin by rejecting the recently approved numerical nutrient criteria (NNC) that FDEP developed for the FKNMS and Florida Bay. These NNCs are based on data collected between 1995 and 2005 when increased Everglade's flows in this time frame were causing FKNMS-wide eutrophication and resource degradation. Obviously, adoption of the NNCs from this period would insure continued degradation of Florida Bay and FKNMS resources, and not protection or restoration. The NNC targets need to be those nutrient and chlorophyll *a* concentrations that existed in the 1980s, or earlier. The available data indicates that DIN and SRP concentrations averaged ~ 0.5 µM and 0.04 µM in the 1980s, and chlorophyll *a* averaged ~ 0.15 µg/l (Lapointe et al. 2002, Lapointe et al. 2004, Lapointe et al. 2007a). Appropriate average total nitrogen (TN) and total phosphorus (TP) concentrations for offshore bank reefs in the FKNMS should be no more than 9 µM (= 0.13 mg/l) and 0.16 µM (=0.005 mg/l); all the FDEP proposed geometric means for exceedance of TN and TP NNCs are above these concentrations. The proposed chlorophyll *a* geometric mean standards for exceedance range from 0.2-0.3 µg/l for offshore reefs from the Upper Keys to the Lower Keys, which are considerably higher than the mean values (0.15 µg/l) for Looe Key in the 1980s. Obviously, adoption of the NNCs as proposed will allow the "status quo" of water quality degradation continue as it has since the early 1990s.

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