

### **Indicator 4.5 – Florida Bay Algal Blooms**

#### **What is the desired restoration condition?**

Sustain good water quality in Florida Bay, minimizing the magnitude, duration, and spatial extent of algal blooms in the bay such that light penetration is sufficient to sustain healthy and productive seagrass habitat. The interim goal for Florida Bay algal blooms is to prevent any increase in the intensity, duration, or spatial extent of such blooms in Florida Bay or adjacent waters.

#### **Why is this indicator important and why this is a good indicator of CERP restoration?**

The occurrence of algal blooms in the water column of central and western Florida Bay is a major ecological concern. Such blooms are often associated with nutrient inputs from human activities and can negatively impact the entire ecosystem. In particular, blooms decrease water clarity and decrease the penetration of light through the water. Decreased light penetration, in turn, decreases seagrass bed productivity and the health of this critical habitat. Thus, it is essential that Comprehensive Everglades Restoration Plan (CERP) implementation, which is intended to restore the Greater Everglades, including Florida Bay, does not increase nutrient inputs such that algal blooms are stimulated and harm the bay.

It is possible that increased freshwater flow through the Everglades toward Florida Bay, as planned by the CERP, could stimulate algal blooms in the bay (CROGEE 2002). Algal (phytoplankton) growth in central and western Florida Bay is frequently limited by the availability of nitrogen (Tomas et al. 1999). Freshwater flow from the Everglades is known to be a major source of nitrogen for the bay (Rudnick et al. 1999). Furthermore, the amount of nitrogen flowing into the bay from this source appears to increase with increasing freshwater flow. It is not certain that quality of this nitrogen (its “bioavailability”), which is contained dissolved organic compounds, is sufficient to fuel algal blooms, but a positive correlation of chlorophyll concentration in central Florida Bay and annual freshwater discharge has been documented (Brand 2001). Assessment of the bioavailability of Everglades’ nitrogen is part of the Restoration Coordination and Verification Team’s (RECOVER’s) Monitoring and Assessment Plan (RECOVER 2004) and is under way.

#### **How is the interim goal for this indicator predicted?**

Predictions of intensity, distribution, spatial coverage, and duration of Florida Bay algal blooms will be based on a water quality model (part of the Environmental Fluid Dynamics Code Model) that is being developed as a task of CERP’s Florida Bay and Florida Keys Feasibility Study. Modeling for the prediction of Florida Bay algal blooms will be based on chlorophyll concentration.

**What are the predictions for five-year increments?**

Predictions are not available for this report because the Florida Bay and Florida Keys Feasibility Study's water quality model has not been completed.

**How will we track whether the interim goals established for the indicator have been achieved?**

Monitoring for assessment of Florida Bay algal blooms will be based on chlorophyll concentration, which is an indicator of algal biomass. Components are as follows:

- Frequency of Florida Bay chlorophyll concentrations exceeding regional thresholds (2 parts per billion [ppb] in eastern and southern bay, 5 ppb in central bay, 3 ppb in western bay)
- Spatial extent (total area per bay region) where chlorophyll concentrations exceed these thresholds
- Duration (number of weeks per bay region) where chlorophyll concentrations exceed these thresholds

These metrics and associated thresholds are derived from the existing Florida Bay water quality monitoring program conducted by the South Florida Water Management District and the National Oceanic and Atmospheric Administration and the new programs described in the *CERP Monitoring and Assessment Plan: Part 1, Monitoring and Supporting Research* (RECOVER 2004).

**What additional work is needed to improve this interim goal?**

Causes of algal blooms in Florida Bay are complex, involving multiple sources of nutrient supply, the extent of bay water exchange with adjacent marine waters, grazing of algal cells, and other processes. Successful predictions of the relationship between CERP actions and bay water quality require synthesis of existing data (through modeling) and provision of new data on processes that influence algal blooms.

A predictive water quality model is under development and not yet functional. This model is being developed as part of CERP's Florida Bay and Florida Keys Feasibility Study and will have the capability of predicting the magnitude, duration, and spatial extent of algal blooms and assess their relationship to freshwater flow and nitrogen associated with this flow. Water quality models of other estuaries have successfully predicted algal bloom dynamics, but Florida Bay modeling is particularly challenging because of the bay's physical and chemical complexity. Thus, successful water quality predictions for Florida Bay depend on successful hydrodynamic modeling and provision of data on critical ecological processes (particularly regarding organic nitrogen bioavailability) by RECOVER, the National Oceanic and Atmospheric Administration's Coastal Ocean Program, and other research programs.

**References**

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