

NUTRIENT MASS FLUXES BETWEEN FLORIDA BAY AND THE FLORIDA KEYS NATIONAL MARINE SANCTUARY THROUGH FLORIDA KEYS PASSES

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Abstract

This proposal describes a one-year field study within a two-year investigation that is designed to quantify nutrient fluxes through two major tidal channels that connect Gulf and Atlantic waters through the Middle Florida Keys. Simultaneous measurements of nutrients will be combined with volume transport calculations to quantify instantaneous and cumulative net transports of nutrients. The field study will be conducted in Long Key Channel and the Seven Mile Bridge channels. Historical data show that these two channels serve as major conduits for the export of water from Florida Bay to Hawk Channel on the Atlantic side of the Keys. Measurements in each channel will provide a one-year record of nutrient transport. An ancillary component of the study will involve the collection of current profiles at a study site in the middle of Hawk Channel. Vertical profiles measured under winter (dry season) and summer (wet season) conditions will define both the along- and across-shelf structure of the current. The across-shelf component of the current is of particular interest because results will provide an observational basis for the selection of a single- or multi-layer hydrodynamic model to track the movement of Florida Bay water to the reef tract.

The **rationale** for the study is that nutrient-rich water threatens the coral reef tract, and that water exported from Florida Bay through the major tidal channels is the primary source of nutrients impacting the reef. Local upwelling at the reef tract is hypothesized to be of secondary importance. Volume transport rates, in $\text{m}^3 \text{s}^{-1}$, have been determined for most of the tidal channels of the Upper and Middle Keys, and nutrient levels have been monitored throughout the Keys. But nutrient sampling has been infrequent, and the two data bases cannot be combined to characterize the long-term export of nutrients from Florida Bay.

The primary **objective** of the transport component of the study is to obtain a one-year time series of hourly volume transport rates for each channel that can be combined with nutrient concentration values to provide instantaneous nutrient fluxes and cumulative nutrient transport values over time scales ranging from hours to seasons. Attention will be focused on wind-induced events that may be short-lived, but nevertheless represent a major percentage of the total export. A secondary objective of the transport study is to characterize current shear at study sites in the middle of Hawk Channel, directly seaward of the two tidal channels. Results will be of fundamental importance in the selection of an appropriate hydrodynamic model to track the across-shelf movement of Florida Bay water across Hawk Channel.

The **field work** will begin after a three-month period of preparation. Analysis will start as data become available, but the bulk of the analysis will be conducted during the second year. Mid-channel flow measurements will be made at study sites used previously in Long Key Channel and in Moser Channel, the largest of the Seven Mile Bridge channels. Results from extensive channel calibration studies are available to

convert mid-channel measurements of current speed and water level into full-channel volume transport values. Study sites will be visited and recording instrumentation will be downloaded approximately bimonthly during the field study. Current profiles from Hawk Channel will be recorded hourly off both channels in seasonal studies lasting approximately eight weeks, and under both summer and winter meteorological and hydrographic conditions.

Results of this study will allow us to quantify and compare nutrient fluxes over annual, seasonal and tidal cycles, and to characterize the response to weather-related events. Results will be well suited for comparison with terrestrial loading numbers, as well as nutrient loading estimates from deep-water upwelling at the reef tract.