

RECOVER Evaluation Team: Northern Estuaries Performance Measure Synthesis

Gretchen Ehlinger¹, Dianne Hughes², and Ed Brown¹
¹U. S. Army Corps of Engineers, ²Florida Department of Environmental Protection



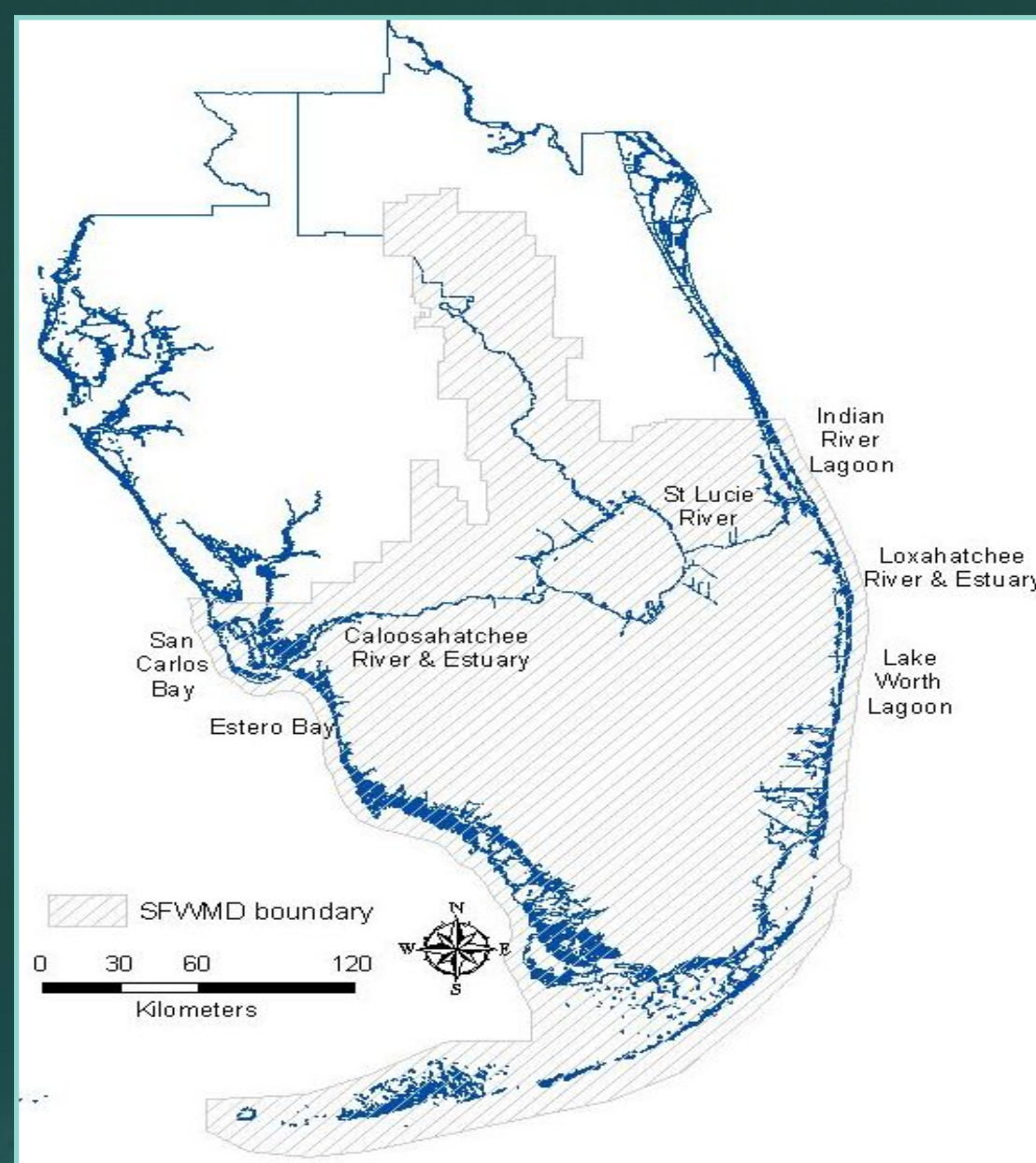
Background

- Historically, natural freshwater discharges into the Northern Estuaries sustained an ecologically appropriate range of salinity conditions to facilitate the presence of healthy flora and faunal communities
- Increased demand for water and flood protection has led to frequent high and low salinity extremes within the coastal water bodies which has resulted in a shift in the ecological community to species that are less desirable
- Conceptual ecological models (CEMs) identify key stressors and attributes and describe the cause and effect relationships of flora and fauna to human induced and natural conditions in the Northern Estuaries. The CEMs provide a suite of testable hypotheses that convert the broad policy-level objectives established for CERP into specific, measurable indicators of health of the natural and human systems, and predict regional responses to implementation of the restoration program
- Performance Measures (PMs) were developed for each of the indicators and are used for evaluating and assessing CERP success

Geographic Domain

The RECOVER Northern Estuaries module includes:

- Caloosahatchee River and Estuary
- San Carlos Bay
- Estero Bay
- St. Lucie Estuary
- Southern Indian River Lagoon
- Loxahatchee River estuary
- Lake Worth Lagoon



Hydrology Performance Measures

Predictive Salinity Envelope

- Predictive targets based on SFWMM outputs, natural variation that would occur from 1965 - 2000 and desirable salinity conditions for aquatic resources
- The restoration goal for the Northern Estuaries is to re-establish salinity regimes suitable for the maintenance of naturally-diverse, well-balanced estuarine ecosystems
- Post-processing methodologies of data allow estimations of ecological attributes to assist in selection of plans
- Current evaluation tools are able to determine the amount of time projected in the salinity envelope in the Northern Estuaries and the impact on oysters, SAV, fish and macroinvertebrates

Water Quality Performance Measures

Water Quality PM

- Predicted reductions in nutrients correspond to expected reductions in sediment loads and turbidity, decreases in algal bloom frequency and severity, reduction in contaminant transport, increases in water clarity and dissolved oxygen regime
- The tools necessary to predict these associated improvements directly have not been fully developed
- An interim methodology is being used to delineate the effect of CERP on nutrient loading (TP and TN) to the Northern Estuaries
- Ed Brown will be presenting this methodology during the Coastal and Mangrove Ecosystem Session Tuesday at 4:40 PM in Royal Palm VIII

Ecology Performance Measures

Oyster Habitat

- Currently based on the salinity envelope PM
- A Habitat Suitability Index (HSI) model currently under optimization will be used to determine exact numbers of live oyster reef acreage increase and suitable locations for reef development
- In the future, a variety of ecological and physiological responses of oysters will be used to determine the health of oysters and oyster reefs including density of living oysters, condition index, reproductive activity, larval recruitment, disease prevalence and intensity of *Perkinsus marinus* (and MSX in east coast estuaries)



Submerged Aquatic Vegetation

- Currently based on the salinity envelope PM for each species of SAV
- SAV models for key species including *Vallisneria*, *Syringodium* and *Halodule* are being developed to predict effects of freshwater inputs (light, nutrients, and salinity) on SAV growth

Fish

- Currently based on the salinity envelope PM in order to maintain or enhance suitable habitat for juvenile fish, adult spawning sites and larval recruitment sites



Benthic Macroinvertebrates

- Currently based on the salinity envelope PM
- Uses a multivariate approach to elucidate changes or improvements within the benthic communities and identify the major causes for those observed changes (salinity, oxygen, sediment, nutrients)

Relationship of Performance Measures to Interim Goals

- Interim Goals are defined in the Programmatic Regulations as "a means by which the restoration success of CERP may be evaluated throughout the implementation process".
- Interim Goals provide a means of tracking the performance of CERP toward achieving expected environmental benefits, as well as a basis for reporting to Congress at five-year intervals on progress made towards restoration.
- The Interim Goals are our predictions about how the indicators will change as the CERP projects are built.
- As projects are built, we will measure the indicators to see how they are actually changing compared to the interim predictions.
- The following indicators from the Northern Estuaries region were deemed important indicators of CERP success and they were incorporated into the 2007 Interim Goals Agreement

- American oysters in the Northern Estuaries
- Submerged aquatic vegetation in the Northern Estuaries

Next Steps

- Develop predictive performance measures for water quality, oysters, SAV, fish and macroinvertebrates
- Develop regional and local models to quantify flows reaching structures and the downstream tributaries
- Develop the tools to predict nutrient reductions and water quality to the Northern Estuaries
- Finish the development of the oyster HSI and develop the SAV HSI
- Integration of Northern Estuaries indicators into CERP Total System Performance Measures

Conclusions and Lessons Learned

- Flow metrics provide a theoretical basis for judging the ecological effects of CERP on estuarine ecosystems; the recovery of keystone species (such as oysters and seagrass) that have defined lethal salinity thresholds and their recovery can be related to salinity regime management
- Performance measure flow metrics can be applied to period of record model results to discern CERP effects and provide periods of recovery against future base conditions
- Performance measures can be used to leverage model data to discern effects of nutrient loads on Northern Estuaries ecosystems

