

1.0 Performance Measure Title

Wetland Trophic Relationships – Wading Bird Foraging Patterns on Overdrained Wetlands

Last Date Revised: December 2006

2.0 Justification

Over the past several decades, wading bird reproduction in the Everglades has declined dramatically, although the area is still an important feeding ground (Ogden, 1994). Changing water management strategies for South Florida, which have coincided with decreases in colonial wading bird populations, affect many of the processes implicated in these declines. The historic numbers and locations of wading bird breeding colonies are a defining characteristic of the Everglades ecosystem and restoration of these colonies and numbers is one of the primary objectives of the CERP (Weaver and Brown, 1993). Evaluation of CERP's effects on long-legged wading birds, including the endangered wood stork (*Mycteria americana*) is essential in assessing plan success. The Endangered Species Act requires the USACE to evaluate the effects of the CERP on listed species.

Experimental studies have demonstrated a close link between feeding aggregation size of wading birds and prey availability (Gawlik 2002). In the Everglades, large feeding aggregations of some species of wading birds do tend to occur in years when large numbers of those species choose to nest. The years in which large feeding aggregations occur differs among species, supporting the idea that ideal hydrologic conditions are species specific. The spatial arrangement of flocks also provides information on the prey resources available to wading birds. This relationship appears to be the mechanism that links fish populations and wading bird nesting patterns.

3.0 Relationship to CEMs and Adaptive Assessment Hypotheses

Southern Marl Prairies Conceptual Ecological Model attribute (RECOVER 2004b)

Ecological Premise: The collapse of wading bird nesting colonies in the southern Everglades is attributed to declines in population densities and seasonal concentrations of marsh fishes and other aquatic prey organisms.

Persistent pools of fresh water, with multi-year hydroperiods and gradual water recession rates, occurred in ridge and slough landscapes and adjacent coastal ecotones of the southern Everglades under pre-drainage conditions. The wet-season density, size structure, and relative abundance of marsh fishes and other aquatic wading bird prey are directly related to the time since the last dry-down and the length of time the marsh was dry.

Wading bird biologists have proposed that southern marl prairies provided foraging opportunities for wading birds during unusually wet years, and early in the dry season, when water is too deep to allow successful foraging elsewhere in the southern Everglades (Fleming pers. comm. in Ogden 1994). Early dry season foraging opportunities possibly contributed to early formation of nesting colonies and consequent nesting success.

Restoration of natural hydrologic conditions will re-establish distributions of prey densities and concentrations across the landscape that in turn will support the return of large, successful wading bird nesting colonies to the southern Everglades.

Resumption of natural volume, timing, and distribution of freshwater flow will restore historical hydroperiods and salinity distributions to the southern Everglades. These changes are expected to increase wet-season density and size structure of wading bird prey in the southern Everglades.

Greater Everglades Wetlands Module Predator-Prey Interactions of Wading Birds and Aquatic Fauna Forage Base hypotheses:

Hypothesis 3:

The collapse of wading bird nesting colonies in the tributary headwaters and southern mainland of the Everglades, the abandonment of Roseate Spoonbill nesting colonies in islands of northeast Florida Bay, and delay in the annual initiation of Wood Stork nesting have been caused by:

- decreased population densities of marsh fishes and other aquatic prey organisms in the southern Everglades, as described under Hypothesis 1
- a shift in the location and timing of seasonal concentrations of marsh fishes and other aquatic prey organisms, as described under Hypothesis 2
- reduced shallow-water foraging options for wading birds along elevation gradients

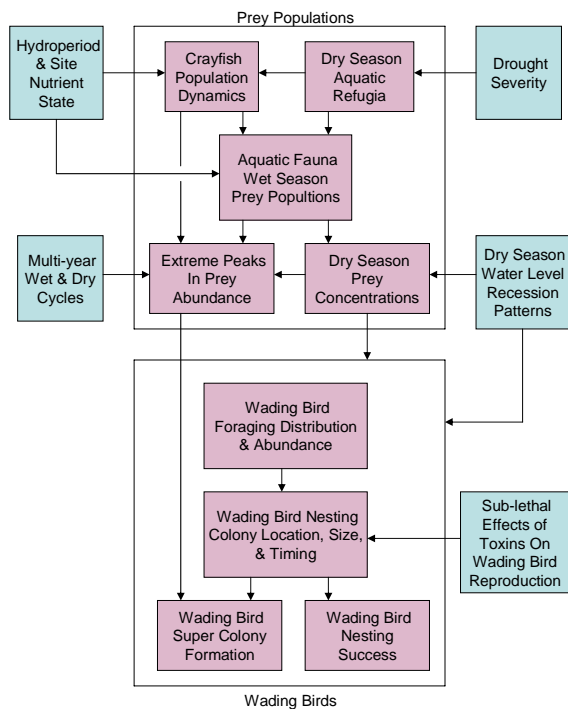
Rationale. Increased prey densities in artificial pools of the Water Conservations Areas have attracted wading bird nesting colonies to those areas after the collapse of the coastal colonies. Restoration of historic spatio-temporal patterns of prey production and concentration is expected to reestablish wading bird nesting colonies in the coastal and tributary regions of the southern Everglades and Roseate Spoonbill nesting colonies in northeast Florida Bay. This restoration is also expected to increase numbers and success of nesting wading birds, Wood Storks, and Roseate Spoonbills and to cause Wood Storks to initiate nesting no later than January in most years.

Hypothesis 4:

Unusually large aggregations of nesting wading birds (super colonies) consisting of mostly White Ibis formed in the pre-drainage system in response to the effects of extreme, natural patterns of drought prior to colony formation.

Rationale. Super colonies periodically formed along the freshwater-estuarine transition zone (sawgrass-mangrove ecotone) at the lower reaches of the Everglades and Big Cypress basins. A substantial reduction in frequency of super colonies is attributed to disrupted multi-year wet and dry cycles, due to altered volume, timing, and distribution of flow in the managed system, and a reduction in the size of super colonies may be related to reductions in wading bird prey populations due to the effects of the reduced hydroperiods and disrupted water level recession patterns on wading bird prey populations (PM GE-19 Wetland Trophic Relationships - Regional Populations of Fishes, Crayfish, Grass Shrimp and Amphibians).

Predator-prey interactions of wading birds and aquatic fauna forage base conceptual ecological model



4.0 Restoration Expectation
Restoration of natural hydrologic conditions will re-establish distributions of prey densities and concentrations across the landscape that in turn will support the return of large, successful wading bird nesting colonies to the southern Everglades as predicted by predrainage hydropatterns and salinities.
4.1 Predictive Metric and Target
For the total CERP project, the evaluation target is to improve total foraging conditions relative to the 2050 base. For implementation runs, the evaluation target is to exceed 2000 base foraging conditions levels. Efforts to refine and update a predictive model are in development with an expected completion date beyond 2008.
4.2 Assessment Parameter and Target
The assessment parameter is to achieve foraging distributions consistent with the expectations for pre-drainage distributions. The specific targets will be set once a Natural System Model [NSM] is updated and supporting research is conducted. This parameter is assessed along with the complete hypothesis cluster 9.2.6 (RECOVER 2006).
5.0 Evaluation Application
5.1 Evaluation Protocol
Predictive models to evaluate this performance measure are still under development and refinement. At this time, this performance measure should not be used to conduct evaluations.
5.2 Normalized Performance Output
5.3 Model Output (example attached)
5.4 Uncertainty
Recognition of model uncertainty is needed when interpreting the ecological significance of model output. The Model Uncertainty Workshop Report provides guidance on the potential implications of uncertainty on model output interpretation (RECOVER 2002).
6.0 Monitoring and Assessment Approach
See <i>CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research - Greater Everglades Wetlands</i> Module sections 3.1.3.10 – 3.3.3.11 (RECOVER 2004a) See RECOVER Team’s Recommendations for Interim Goals and Interim Targets for the Comprehensive Everglades Restoration Plan – Interim Goal 3.9 Aquatic Fauna Regional Populations in Everglades Wetlands (RECOVER 2005) See RECOVER Team’s 2006 Assessment Strategy for the Monitoring and Assessment Plan. Final Draft (RECOVER 2006)
7.0 Future Tool Development Needed to Support Performance Measure
7.1 Evaluation Tools Needed
An ATLSS model based on sound science has been developed for this performance measure and has been judged by the USGS as appropriate for use in some model-to-model comparisons. However, it is in need of further calibration and validation and peer review.
7.2 Assessment Tools Needed

Accessibility to the various data sources through an integrated database is needed for the complete evaluation of these hypotheses and for parameter refinement.

8.0 Notes

This Performance Measure supersedes and addresses GE-20 Wetland Trophic Relationships – Wading Bird Foraging Patterns on Overdrained Wetlands (Last Date Revised: October 20, 2005).

9.0 Working Group Members

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10.0 Acceptance Status

GE Working Group October 20, 2005

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Public Review

Final Acceptance Date

11.0 References

Bancroft, G.T., D.E. Gawlik, and K. Rutchey. 2002. Distribution of wading birds relative to vegetation and water depths in the northern Everglades of Florida, USA. *Waterbirds* 25: 265-277.

Gawlik, D.E. 2002. The effects of prey availability on the numerical response of wading birds. *Ecological Monographs* 72: 329-346.

RECOVER 2002. Model Uncertainty Workshop Report: Quantifying and Communicating Model Uncertainty for Decision Making in the Everglades, Restoration Coordination and Verification Program (RECOVER), United States Army Corps of Engineers, Jacksonville District, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida.

RECOVER. 2004a. CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research. Restoration Coordination and Verification Program, c/o United States Army Corps of Engineers, Jacksonville District, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida.

RECOVER. 2004b. Draft Conceptual Ecological Models. In: RECOVER. CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research, Restoration Coordination and Verification Program, c/o United States Army Corps of Engineers, Jacksonville District, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida, Appendix A.

RECOVER. 2006. 2006 Assessment Strategy for the Monitoring and Assessment Plan. Final Draft. c/o United States Army Corps of Engineers, Jacksonville District, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida.