ATLSS SESI Documentation Sheet.

Draft v1.0 May 5, 2003

ATLSS SESI Model Number and Name

AT.CFI.v0. Crayfish Spatially-Explicit Species Index Model

Justification

The ATLSS Crayfish Index Model incorporates information about crayfish habitat preferences and hydrologically-driven aspects of crayfish ecology to assess the relative impacts of hydrologic scenarios proposed for Everglades Restoration on the occurrence potential for two species of crayfish, the Everglades crayfish (*Procambarus alleni*) and the slough crayfish (*Procambarus fallax*).

Crayfish have been identified as key food web components in the wetlands of South Florida and possible indicator species for wetland integrity. Crayfish are omnivorous, consuming snails, insect larvae, worms, tadpoles, dead organisms, and a significant amount of vegetation. They are in turn an important constituent in the diets of wading birds (contributing half the diet of white ibis), young alligators, fishes, raccoons, snakes, and pig frogs, linking primary production with higher trophic levels. The reproductive timing of *P. alleni* makes it one of the first abundant prey early in the Everglades' wet season.

Until recently, crayfish studies in the Everglades reported a single species, the endemic *Procambarus alleni*, ascribing different behavior patterns in sloughs vs. wet prairies to the plasticity of the species. A recent investigation found that a second species, *Procambarus fallax*, is also present (Hendrix and Loftus 2000). Differences in habitat and hydrologic affinities for the two species modeled are reflected in patterns of crayfish densities.

CERP Target

Rather than specifying a single "performance measure" for each model, it is the objective of ATLSS to provide a rational basis for different stakeholders to determine their own criteria for comparing different hydrologic plans based upon their own choices of trade-offs between species, spatial regions and time horizons.

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Evaluation Protocol

The index for crayfish is computed at year's end from 3 factors:

(1) hydroperiod for the current year

(2) pattern of drydowns over the past 3 years

(3) a static habitat factor, which measures the % of 30-m cells in each 500-m cell that is of suitable FGAP habitat type.

Differences in habitat and hydrologic affinities for the two species modeled are reflected in patterns of crayfish densities. Conditions that favor one species typically are sub-optimal for the other. Crayfish density and biomass estimates are generally higher for wet prairies, where *P. alleni* predominates, than for slough habitats, where *P. fallax* are more commonly found. *P. alleni* tends to occupy more complex habitats that provide more food resources and refuge from predators (e.g. higher plant biomass, higher stem density). Plant biomass is positively correlated with *P. alleni* densities in wet prairies, but not with densities of *P. fallax* in sloughs, while water depth is generally negatively correlated with *P. fallax* densities in sloughs, but not with densities of *P. alleni* in wet prairies. Densities of *P. fallax*, associated with slough habitats, decreases with increasing depth and prolonged hydroperiod, due in part to increased predation from fish. Potential for *P. alleni* reproduction is increased by slow water turnover times, seasonally fluctuating water tables, high levels of algal production, complex vegetative stands, and rich substrates.

Separate indices are computed for *P. alleni* and *P. fallax*, since their habitat and hydrologic affinities differ markedly.

Details of the SESI are available at: http://:www.atlss.org/d_cray.html .

We express the effects of proposed scenarios as changes in the spatial pattern of apple snail potential over the model area at a 500-m scale of resolution. Our sub-area reporting units are based on a combination of public area, drainage basin, and management unit subregion maps, shown in http://www.atlss.org/repunits.pdf .

Model output includes summary tables and three-panel maps displaying landscape results for (a) proposed hydrologic modification scenario on the left, (b) base scenario on the right, and (c) a cell-by-cell difference between index values for the two compared scenarios in the center panel, enabling the reader to make comparisons between alternatives.

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Source and History of Evaluation Protocol

The ATLSS modeling group has worked with field biologists to explore conceptual models and develop spatially-explicit species index models that reflect relationships between hydrologic factors and breeding/foraging potentials for key Everglades species. This SESI was one of 8 identified for development and was developed by Noble Hendrix, Bill Loftus, and Jane Comiskey.

Selected References:

DeAngelis, D.L., W.F. Loftus, J.C. Trexler, and R.E. Ulanowicz. 1997. Modeling fish dynamics and effects of stress in a hydrologically pulsed ecosystem. Journal of Aquatic Ecosystem Stress and Recovery 6:1-13.

Hendrix, A.N. and W.F. Loftus. 2000. Distribution and relative abundance of the crayfishes Procambarus alleni (Faxon) and P. fallax (Hagen) in southern Florida. Wetlands 20(1).

Jordan, F., K.J. Babbitt, C.C. McIvor, S.J. Miller. 1996. Spatial ecology of the crayfish, Procambarus alleni , in a Florida wetland mosaic. Wetlands 16: 134 - 142.

Kushlan, J.A. and M.S. Kushlan. 1979. Observations on crayfish in the Everglades Crustaceana, Supplement 5: 115-120.

http://www.atlss.org/d_overview.html

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