

Role of American Alligator (*Alligator mississippiensis*) in Measuring Restoration Success in the Florida Everglades

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ABSTRACT



The American alligator (*Alligator mississippiensis*) was abundant in the pre-drainage Everglades in Southern Florida, USA. The largest populations occurred in broad marl prairies to the east and west of the southern ridge and slough and in the freshwater mangrove zone (Figure 1). Development and water management practices have reduced the spatial extent and changed the hydro patterns of these habitats. As a result of these activities, alligator populations have decreased.

Currently, restoration of hydrologic pattern and ecological function is beginning in the Everglades. Due to the alligator's ecological importance and sensitivity to hydrology, salinity, habitat and system productivity, the species was chosen as an indicator of restoration success. A number of biological attributes (relative density, relative body condition, nesting effort, and nesting success) can be measured, standard methods for monitoring have been developed, and historical information exists for alligator populations in the Everglades. These attributes can be used as success criteria at different spatial and temporal scales and to construct ecological models used for predicting restoration effects. Here, we discuss Everglades alligator population status and its role in evaluating restoration success of the Southern Everglades.



Figure 1.

INDEX OF CONDITION

Developing an index of alligator condition

Historically, condition factors have been calculated as a function of...



Weight and Length

...to establish a range of healthy body conditions for wildlife populations.

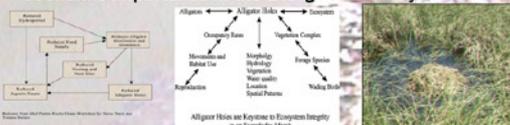
Additional measurements including head length, hind foot length, chest girth, and tail girth have been taken. **Using condition factor, we can compare:**

- health of alligators in the Everglades to alligators in other locations (see bottom center)
- health of alligators within different areas of the Everglades (see bottom center)
- which measurements are prone to the least error?
 - Measurements with the least error are head length, snout-vent length, total girth, and mass
- Which indices are best for condition analysis?
 - Snout-vent length/mass ANCOVA are best for comparison populations over time
 - Head length/mass Fulton's K are best for comparison populations at different locations.

Ultimately we will be able to relate alligator condition to other measures of alligator population health, such as growth and survival parameters (see top right) and relative density (see middle right).

ECOLOGICAL IMPORTANCE

- Alligators have always been of significant ecological and economic importance in the Everglades ecosystem



Keystone species

Ecosystem engineer



Top predator



- Alligators have a significant role in evaluating Everglades restoration.

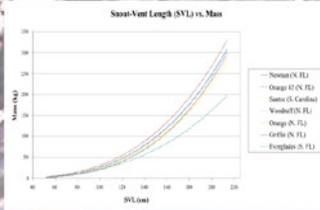
ALLIGATORS AS INDICATORS OF RESTORATION SUCCESS

- An identified challenge in determining restoration success will be the selection of biological indicators that can be used to measure success. An indicator should have some relation to the management questions, be able to show trends, provide reliable results, relate to the scale of the questions, and have some baseline data to which future data can be compared.
- Alligators meet these requirements and therefore can be used as indicators of restoration success. They are sensitive to hydrology, salinity, habitat, and system productivity. There are a number of biological attributes of alligators and alligator populations that can be used as success criteria at different temporal scales, and there is existing data for population densities and nesting in some areas that can provide baseline data for assessing changes.

ALLIGATORS EVERYWHERE – HOW DO THEY COMPARE?

The Everglades are a nutrient-poor environment and it is possible that alligators here have always been smaller than those of other regions.

We are concerned that human disturbance has worsened this trend.



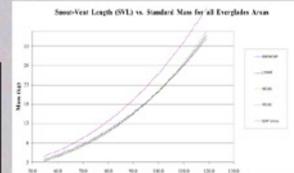
Implication: Everglades alligators are not only smaller in length but also thinner than alligators of equal length in other geographical areas.

We compared alligators captured from Everglades wetlands to alligators captured from lakes in north Florida and coastal areas of South Carolina. At a given length alligators from the Everglades weigh less than alligators from other locations.

EVERGLADES ALLIGATORS: A CLOSER LOOK

Everglades alligators are smaller compared to other geographical areas, but what about within different areas of the Everglades?

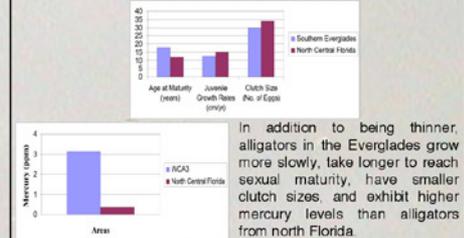
- Alligators from different Everglades wetlands have been captured during the past three years.
- There is little difference in the condition of alligators from different parts of the Everglades ecosystem.



Implication: Alligators in the freshwater Everglades are in poorer condition than anywhere else. However, crocodiles in neighboring estuaries are in better condition. We hypothesize that these patterns are the result of low nutrients and a disturbed hydrology.

ECOLOGICAL CORRELATES

What else do we know about the health of alligator populations in the Everglades?



In addition to being thinner, alligators in the Everglades grow more slowly, take longer to reach sexual maturity, have smaller clutch sizes and exhibit higher mercury levels than alligators from north Florida.

Implication: Performance measures for Everglades Restoration should reflect the importance of monitoring the health and condition of alligator populations.

ALLIGATOR SURVEY DATA

Relative density is an excellent indicator of health of alligator populations. An alligator survey network is one of the most important tools for Everglades restoration analysis. Standard survey routes have been established in A.R.M. Loxahatchee National Wildlife Refuge (LNWR), Water Conservation Areas (WCA2 and WCA3), and Everglades National Park (ENP). Preliminary data is currently available from these areas

- Although there was little difference in the condition of alligators from different areas in the Everglades, there is a marked difference in relative density.



Implication: Relative density is an effective way to measure alligator abundance and can be used to evaluate restoration success.

SUMMARY OF PERFORMANCE MEASURES

Spatial and temporal patterns in alligator populations can be used to develop performance measures:

- Population size – relative abundance
- Nesting effort and success
- Growth and survival
- Health and condition

To help develop protocols for performance measures USGS and UF have begun a series of studies on alligators in the Everglades Ecosystem such as:

- American Alligator Distribution, Thermoregulation, and Biotic Potential Relative to Hydroperiod in the Everglades
- Relative Distribution, Abundance, and Demographic Structure of the American Alligator in Relation to Habitat, Water Levels and Salinities
- Compilation of Alligator Data Sets in South Florida for Restoration Needs
- Parameter Estimation and Population-Based Simulation Modeling of American Alligator Populations in Support of ATLSS

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