STATEMENT OF OBJECTIVES
MONITORING ALLIGATOR STATUS AS A SYSTEM-WIDE ECOLOGICAL INDICATOR
OF EVERGLADES RESTORATION
US ARMY CORPS OF ENGINEERS JACKSONVILLE DISTRICT

Article III, (D) of the following Cooperative Ecosystems Studies Units (CESU):
Gulf Coast, Piedmont–South Atlantic Coast, and South Florida-Caribbean
7 June 2021

1.0 PURPOSE

The Water Resources Development Act (WRDA) of 2000 authorized the Comprehensive Everglades Restoration Plan (CERP) as a framework for modifications and operational changes to the Central and Southern Florida Project needed to restore the South Florida ecosystem. Provisions within WRDA 2000 provide for specific authorization for an adaptive assessment and monitoring program. A Monitoring and Assessment Plan (MAP) (RECOVER 2004, 2006) has been developed as the primary tool to assess the systemwide performance of the CERP by the Restoration, Coordination and Verification (RECOVER) program. The MAP presents the monitoring and supporting research needed to measure responses of the South Florida ecosystem to CERP implementation.

The Florida Everglades is the only place in the world where both alligators and crocodiles occur. Crocodilians (American alligator, *Alligator mississippiensis*, and the American crocodile, *Crocodylus acutus*) are indicators of ecosystem health and restoration success, because at all life history stages, crocodilians integrate biological impacts of hydrologic conditions (Mazzotti and Brandt 1994, Rice et al. 2005, Mazzotti 1999, Mazzotti and Cherkiss 2003, Mazzotti et al. 2009). Research has linked three key aspects of Everglades' ecology to crocodilians:

(1) Top predators such as crocodilians are directly dependent on prey density, especially aquatic and semi-aquatic organisms, and thus they provide a surrogate for status of many other species.

(2) Drier (nests) and wetter (trails and holes) conditions created by ecosystem engineers like alligators provide habitat for plants and animals that otherwise would not be able to survive. This increases diversity and productivity of Everglades marshes (Kushlan and Kushlan 1980, Palmer and Mazzotti 2004) and, therefore, alligator monitoring can indicate overall health of the marsh.

(3) The distribution and abundance of crocodilians in estuaries is directly dependent on timing, amount, and location of freshwater flow (Dunson and Mazzotti 1989, Mazzotti and Dunson 1989); crocodiles and alligators exhibit an immediate response to changes in freshwater inputs into the estuaries. Regionally, lack of fresh water due to saltwater intrusion has been correlated with lower growth and survival of crocodiles (Moler 1992, Mazzotti and Cherkiss 2003, Mazzotti et al. 2007).

The short-term objective of the MAP is to obtain "baseline" documentation and understanding of alligator estimated abundance and body condition for long-term assessment by sampling new and historic sites. Long-term objectives include quantifying changes in alligator estimated abundance and body condition in relation to changes in water delivery and prey abundance; assessing long-term patterns of alligator nesting and relationship to hydrologic conditions; and linking trends in alligator estimated abundance, body condition, and nesting. This project will monitor and assess ecological response of alligators to changing hydrology within Water Conservation Area 3 (WCA3). This project will provide resource managers with results that are directly applicable and necessary to effectively evaluate CERP project objectives, as well as assess effects of hydrology on alligator estimated abundance and body condition in WCA3.

RECOVER Performance Measures

1. Greater Everglades Wetland Trophic Relationships – American Alligator Abundance, Body Condition, Hole Occupancy, and Production Suitability Index

2. Southern Coastal Systems - American Crocodile Growth and Survival

2.0 AUTHORITY

In agreement with the above stated purpose, the recipient/cooperator agrees to provide the necessary personnel, equipment, and materials required to implement, in part, the Unites States Army Corps of Engineers (USACE)-Jacksonville District objectives pursuant to the authority10 U.S.C. § 2358 - Research and Development.

In accordance with section 6305 – Using cooperative agreements of the Federal Grant and Cooperative Agreements Act of 1977 (31 U.S.C. § 6301 et seq.), all CESU projects must carry out a public purpose of support or stimulation, instead of acquiring goods or services for the exclusive direct benefit of the United States Government. Examples of carrying out a public purpose may include, but are not limited to, the following:

- Project results are made available to a wide audience (including nonfederal entities)
- Project results/outputs add to the scientific literature/knowledge base, with applicability and utility beyond the scope of the project footprint/study area
- Academic and other nonfederal partner institutions (and their personnel) gain professional experience, increase knowledge, and develop skills and abilities
- Students benefit from direct interaction with federal scientists, program and technical staff, and field unit managers

In accordance with section 6305 – Using cooperative agreements of the Federal Grant and Cooperative Agreements Act of 1977 (31 U.S.C. § 6301 et seq.), substantial involvement is expected between the Department of Defense and the recipient when carrying out the activity contemplated by the cooperative agreement. The DoD agrees to participate at a national level in support of the CESU program as accepted in the Master

MOU for the establishment and continuation of the CESU program Article II 1-4 and Article VI 1-7.

The USACE will participate in study site selections, design, and work plan development. USACE will participate in field data collection efforts as appropriate, will review quarterly status reports, and will provide input to data interpretation for final reports, as well as review quarterly, annual and final reports. USACE will incorporate the data and analysis into a system-wide database that assesses and evaluates ecosystem restoration efforts in central and southern Florida. Scientific and technical information generated from the project will be utilized to evaluate project/restoration performance and system responses to be used in the development of assessment reports describing and interpreting those responses.

3.0 DESCRIPTION OF OBJECTIVES

The purpose of this project is to fulfill monitoring objectives in the MAP (RECOVER 2004 and 2006):

I- Determine the status and trends of the alligator populations over short (body condition), medium (distribution and relative density) and Long-term (demography) temporal scales.

II- Detect unexpected responses of the ecosystem (alligator ecosystem attribute) to changes in stressors resulting from CERP activities

III- Support scientific investigations designed to increase ecosystem understanding, cause and effect, and interpret unanticipated results in alligator performance

PROJECT TASKS

3.1 Task 1 – Kick-off Meeting (**Mandatory**):

The PI shall conduct a Kick-off Meeting with the USACE within ten (10) business days of contract execution. This meeting shall be an informal discussion between the PI and USACE. At this meeting the PI shall introduce the project team and define the project chain of command. The USACE will communicate to the PI any methodological requirements to be used when sampling and reporting tasks as outlined. These methodologies are briefly described in this CA in the activities above. The MAP Assessment Strategy (RECOVER 2006) provides guidance in assessment methodologies. The Kick-off Meeting shall provide the opportunity for the PI and USACE to coordinate the project's tasks that outlined below.

Within ten (10) days following the Kick-off Meeting, the PI shall submit an electronic summary (Draft Work Plan) of the meeting. The RECOVER Project Manager (PM) will respond with comments to the PI within ten (10) business days after the receipt by the USACE of the Draft Work Plan. The PI shall address comments and submit a Final Work Plan, which will be submitted to the USACE

ten (10) days of its receipt by the PI. Upon its approval in writing by the USACE RECOVER PM, the Final Work Plan shall become the working document for this work order. The PI shall proceed with the performance of the work order in accordance with the approved Final Work Plan and the requirements of this CA. In the event of any conflict between this CA and the Final Work Plan, the Final Work Plan shall take precedence. The Final Work Plan will be updated as necessary at the beginning of each new Option Year.

The PI shall also begin preparations to execute field sampling within ten (10) days of work order execution. This includes acquiring and assembling any specialty equipment needed and working with USACE staff to become familiar with sampling protocols and equipment provided to the PI by the USACE.

3.2 Task 2 – Alligator Surveys **(Mandatory):**

The PI will survey four (4) routes (WCA3A-N41, WCA3A-Tower, WCA3A-Holiday, WCA3B, see **Figure 1**) for alligators as established in Mazzotti et al. 2010 and updated in Hart et al., 2012. Surveys along these routes will be performed by airboat. Alligator locations will be recorded using GPS equipment. Surveys will be conducted in marshes, in the dry (spring) and wet season (fall). Spotlight surveys for relative density in each area will be conducted twice each season at least 14 days apart to achieve independent counts (Woodward and Moore 1990, Mazzotti et al. 2010). Capture surveys will be conducted in the same general locations. Relative condition of alligators will be determined by conducting a condition factor analysis (Zweig 2003, Mazzotti et al. 2009).

Spotlight (or night-light) and capture surveys will be used to determine distribution and condition of alligators. Spotlight counts are an accepted means of monitoring alligator populations as an index to population size, but many assumptions need to be tested to make the surveys reliable. To develop reliable relative population estimates using spotlight counts, estimates of detection probability are being determined (Anderson 2003). Variation due to observer bias and environmental conditions are controlled by adherence to our developed protocols.

To determine condition of marsh alligator populations, semi-annual capture surveys will be performed in areas with spotlight survey routes. A minimum of 15 alligators greater than 1.25m total length in each area will be captured by hand, noose or tongs in the fall and spring of each year. Total length (TL), snout-vent length (SVL), head length (HL), tail girth (TG), and weight will be measured, sex determined, and any abnormalities/deformities noted. Alligators will be tagged using Florida Fish and Wildlife Conservation Commission web tags or by clipping scutes to identify recaptured individuals. Geographic location, habitat characteristics, and environmental characteristics including air/water temperature, water depth, muck depth, and salinity will be recorded where applicable. Capture

surveys will be used to provide data for a body condition factor analysis (Leslie 1997, Zweig 2003).

3.3 Task 3 – Data Analyses **(Mandatory**):

The PI will summarize, analyze, and report trends in both relative density and body condition of alligators on an annual basis for inclusion in the RECOVER Annual Assessment Report and the CERP System Status Reports. Any additional survey data generated from optional tasks must be summarized, analyzed, and reported. This is also an option year task.

3.4 Task 4 – Participation in RECOVER Regional Team Support **(Mandatory)**:

- The PI shall be required to work with the Greater Everglades Regional Team and the Regional Coordinator(s) to assist in the development of upcoming System Status Reports (SSRs).

- The PI will also provide a presentation to the Greater Everglades Regional Team or other science meetings as directed by the USACE RECOVER PM during the course of the contract. This presentation shall include an MS PowerPoint presentation that summarizes all work that has been done including data analysis and interpretations that highlight any and all spatial and statistical relationships found. Finally, the PI shall list recommendations for further data analysis and/or collection.

- The PI shall attend, and participate in, regular Greater Everglades Regional Team meetings and landscape sub-team meetings during the course of the contract.

- The PI shall provide up to ten (10) days to work with the Regional Coordinator(s) to assist in the development of the SSR as applicable. The majority of information provided will be drawn from the Annual Report submitted for Task 4. The USACE RECOVER PM will provide clear and concise instructions for the principal investigator to guide efforts for assistance with development of SSR.

- The PI will attend a Regional Team or other science meeting when scheduled by the Greater Everglades Regional Coordinator after the conclusion of field monitoring executed under this proposed CA. A presentation of the project will be made. The principal investigator shall provide the USACE an electronic copy via email of the MS PowerPoint presentation made at the scheduled Regional Team meeting. If electronic files are too large to submit via email, the principal investigator may choose to transfer such files through an FTP site or to provide it on a compact disc.

- The PI shall attend and participate in Greater Everglades Regional Team meetings (approximately three [3] in each fiscal year).

- The PI shall attend and participate in landscape sub-team meetings (approximately five [5] in each fiscal year).

3.5 Task 5 – Expand Spatial Scope of Alligator Monitoring **(Optional)**:

Additional surveys of alligator abundance and body condition, as outlined in Task 2, at locations considered relevant to CERP projects at the discretion of USACE in consultation with the PI. The capacity to conduct additional surveying is subject to funding availability. Specific (task-level) objectives will be identified, reviewed, and approved by USACE and the PI prior the initiation of this Task.

3.6 Task 6 – Modeling of CERP project performance **(Optional)**:

PI will assist the modeling efforts of CERP projects by utilizing the Greater American Alligator Abundance, Body Condition, Hole Occupancy, and Production Suitability Index and American Crocodile Growth and Survival performance measures to quantitively compare project alternative scenarios.

3.7 Task 7 – Performance Measure Updates (**Optional**):

Information generated from Tasks 2-4 outlined above may be used to update current RECOVER Performance Measures (Greater Everglades Wetland Trophic Relationships – American Alligator Abundance, Body Condition, Hole Occupancy, and Production Suitability Index; Southern Coastal Systems - American Crocodile Growth and Survival). Initiation of this task is subject to the availability of funding and must be submitted as part of the annual project work plan.

4.0 CONSIDERATION

The PI is not required to perform services on federal holidays:

New Year's Day	Labor Day
Martin Luther King Jr.'s Birthday	Columbus Day
Washington's Birthday	Veteran's Day
Memorial Day	Thanksgiving Day
Independence Day	Christmas Day

5.0 QUALIFICATIONS

Biographical sketches are required for each of the personnel supporting this project. The NFE will coordinate with USACE before any key personnel changes or hiring.

6.0 GOVERNMENT FURNISHED MATERIALS OR PROPERTY

6.1 Physical Data: Data sets and information associated with this project are the property of USACE and the DOD. No release of information or data is allowed without a written approval from USACE.

6.2 Equipment, Supplies, and Materials:
Government furnished materials or property is governed by 2 C.F.R. Part 200.312 which states that a) Title to federally-owned property remains vested in the Federal government. The non-Federal entity must submit annually an inventory listing of federally-owned property in its custody to the Federal awarding agency. Upon completion of the Federal award or when the property is no longer needed, the non-Federal entity must return the property to the Federal awarding agency for further Federal agency utilization.

7.0 OPTION PERIODS

Four (4), twelve (12) month option periods are anticipated subject to availability of funds

8.0 PERIOD OF PERFORMANCE

8.1 Base Period (Mandatory Tasks) will be for a 12-month period from the award of cooperative agreement.
8.2 Base Period (Optional Tasks) will be for a 12-month period from the award and shall be exercised prior to expiration of the Base Period (Mandatory Tasks).
8.3 Option Period 1 (Mandatory Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of the Base Period (Mandatory Tasks).
8.4 Option Period 1 (Optional Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 1 (Mandatory Tasks).
8.5 Option Period 2 (Mandatory Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 1 (Mandatory Tasks).
8.6 Option Period 2 (Optional Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 2 (Mandatory Tasks).
8.7 Option Period 3 (Mandatory Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 2 (Mandatory Tasks).
8.8 Option Period 3 (Optional Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 3 (Mandatory Tasks).
8.9 Option Period 4 (Mandatory Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 3 (Mandatory Tasks).
8.10 Option Period 4 (Optional Tasks) will be for a 12-month period from the award and shall be exercised prior to the expiration of Option Period 4 (Mandatory Tasks)

9.0 COORDINATION

Greg Bonnell
Project Manager
Regional Planning and Environmental Center
U.S. Army Corps of Engineers
Gregory.W.Bonnell@usace.army.mil

Cell. (918) 951-0591

Javier Cortez
Contracting Officer Representative
Jacksonville District
US Army Corps of Engineers
701 San Marco Blvd.
Jacksonville, FL 32207
Javier.Cortes@usace.army.mil

Danette Goss
RECOVER Project Manager
Planning and Policy Division
Jacksonville District
US Army Corps of Engineers
701 San Marco Blvd.
Jacksonville, FL 32207
Danette.B.Goss@usace.army.mil

Tasso Cocoves, MS
Biologist
Planning and Policy Division
Jacksonville District
US Army Corps of Engineers
701 San Marco Blvd.
Jacksonville, FL 32207
Tasso.C.Cocoves@usace.army.mil

10.0 DELIVERABLES

Detailed descriptions of any required deliverables required (reports, plans, etc.) and formats. Provide delivery schedules. At a minimum these deliverables should include:

10.1 Work Plans (see Task 1)

10.1.1 One (1) electronic copy (email attachment in MS Word format) of a Draft Work Plan shall be submitted within ten (10) days after the execution of the work order.

10.1.2 One (1) electronic copy (email attachment in MS Word format) of the Final Work Plan shall be submitted within thirty (30) days after the execution of the work order.

10.2 Three (3) Quarterly Status Reports (QSRs) will be submitted every December, March, and June of the base period and every subsequent performance period of the CA. These QSRs will summarize progress made on data acquisition and analysis, update budget status, and point out any problems that may have arisen

during the previous three months, suggesting how the CA might be modified to address the problems. The September quarterly report will be included in the annual report.

10.2.1 Deliverable 1.1: Electronic copy (email attachment in Microsoft [MS] Word format) of the QSR every December, March, and June.

10.3 Annual Reports will be submitted in September of each year and will present results from the year's data collection and analyses of spatial and temporal trends in the parameters. In particular, the Annual Reports will integrate information regarding these patterns and their relationships to hydrological conditions. The Annual Reports will include raw data, summaries of analyses, discussion of results, and conclusions. The Annual Reports will summarize results to date, provide the information needed to develop the next System Status Report (SSR), and include an assessment and/or analysis of the data as it relates to CERP hypotheses from the MAP. The Draft Annual Report will be reviewed by the USACE RECOVER Technical POC and the RECOVER Greater Everglades Regional Coordinators within fifteen (15) days upon submission. Comments will be provided for the PI to address in the Final Annual Report. A data file (Microsoft Excel Spreadsheet or CSV file) of all quality assured raw data will accompany each Annual Report.

10.3.1 Deliverable 2.1: Electronic copy (email attachment in MS Word format) of a Draft Annual Report will be submitted in September of each year.

10.3.2 Deliverable 2.2: Electronic copy (email attachment in MS Word format) of a Final Annual Report will be submitted in September of each year.

10.3.3 Deliverable 2.3: Electronic copy of all data collected and quality assured submitted as a Microsoft Excel or CSV file.

10.4 Annual Inventory – Federally owned property - an annual inventory listing Federal property (to include description of the property and a serial number or other identification number) that is in the custody of the recipient; Copies to be sent to USACE – SWF.

10.5 Annual Inventory – Acquired Property purchased with funding from award - property records must be maintained that includes description of the property, serial number or other identification number, source of funding, who holds title, acquisition date, cost of property, percentage of Federal participation in project costs, location, use and condition of property, and ultimate disposition including date of disposal and sale price. A physical inventory must be taken and results reconciled every two years. Electronic copies of the inventory must be sent annually to USACE – SWF.

10.6 PI Contribution to the System Status Report (SSR) – Results of the work performed under this proposed CA will be used to develop the cumulative annual findings outlined in the System Status Report (SSR). The SSR provides a system-wide assessment of results from the MAP and impacts of the CERP implementation. The PIs of this proposed CA will be required to work with the Greater Everglades Regional Coordinator(s) in developing the SSR and their participation will be included as a task in this work breakdown structure.

The Annual Reports and SSRs will be used to develop a RECOVER Technical Report at five-year intervals, as pursuant to the regulations [Section 385.31 (b)(4)]. The Technical Report presents an assessment of whether the goals and purposes of the CERP are being achieved. The Report will also include an assessment of whether the Interim Goals and Interim Targets are being achieved, or likely to be achieved, and an evaluation of whether corrective actions should be considered based on scientific findings of system-wide or regional ecological needs.

10.7 Draft Final Project Report. Electronic copy as well as (1) paper copy of a draft final report should be submitted no later than one month before end of the project. At a minimum, the report shall contain an introduction section, and one section for each Task identified in your proposal. For each Task, the report shall summarize work accomplished for the Task. USACE POC staff will review and provide comments, if any, within fifteen (15) calendar days after receipt.

10.8 Final Project Report. One (1) paper copy of the final report, incorporating USACE POC review comments on the draft, if any, shall be submitted no later than fifteen (15) days after receipt of the USACE POC comments. Additionally, one (1) copy of the final report shall be submitted in a MSWord file(s), on digital media. All data gathered for project tasks shall be submitted with the Final Project Report as a Microsoft Excel or Comma Separated Value (CSV) file.

11.0 This cooperative agreement may be administered through a CESU only upon mutual agreement and official authorization by both parties of the acceptance of the application of the CESU Network Indirect Cost Rate (17.5%).

Any resulting cooperative agreement will be subject to and recipient/cooperator shall comply with 2 CFR 200.313 “Equipment”, 200.314 “Supplies”, and 200.315 “Intangible Property” which includes use of research data.

12.0 FIGURES

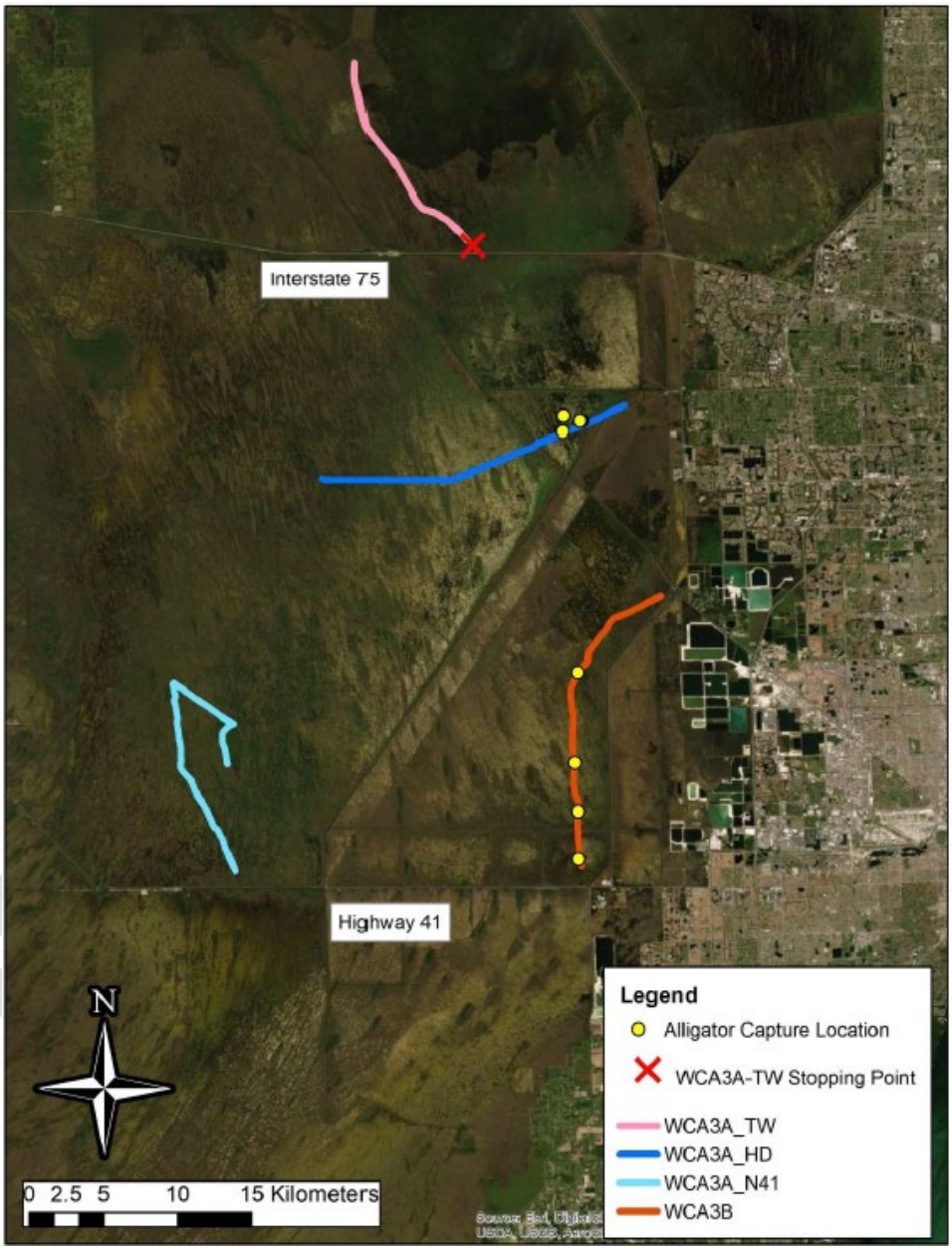

Figure 1: Location of American alligator spotlight survey routes in Water Conservation Area 3A and 3B in southern Florida.

13.0 REFERENCES:

Dunson, W.A., and F.J. Mazzotti. 1989. Salinity as a limiting factor in the distribution of reptiles in Florida Bay: A theory for the estuarine origin of marine snakes and turtles. Bulletin of Marine Science 44: 229-244.

Hart, K.M., F.J. Mazzotti, and L.A. Brandt. 2012. Comprehensive Everglades Restoration Plan (CERP): American alligator density, size and hole occupancy and American crocodile juvenile growth & survival. Comprehensive Everglades Restoration Plan (CERP): Monitoring and Assessment Plan (MAP) Annual Assessment Update.

Kushlan, J.A. and M.S. Kushlan. 1980. Everglades alligator nests: nesting sites for marsh reptiles. Copeia 1930-1932

Mazzotti, F.J., and L.A. Brandt. 1994. Ecology of the American alligator in a seasonally fluctuating environment, In: Davis S, Ogden J, editors. Everglades: the ecosystem and its restoration. Delray Beach (FL): St. Lucie Press. pp 485-505.

Mazzotti, F. J., G. R. Best, L. A. Brandt, M. S. Cherkiss, B. M. Jeffery, and K. G. Rice, 2009. Alligators and crocodiles as indicators for restoration of Everglades ecosystems. *Ecological Indicators,* (9): S137-S149.

Mazzotti, F.J. and W.A. Dunson. 1989. Osmoregulation in crocodilians. American Zoologist. 29:903-920.

Moler, P. 1992. American Crocodile Population Dynamics. Final Report. Study Number:7532. Bureau of Wildlife Research Florida Game and Fresh Water Fish Commission.

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

RECOVER. 2006. Monitoring and Assessment Plan (MAP), Part 2, 2006 Assessment Strategy for the Monitoring and Assessment Plan. Restoration Coordination and Verification Program c/o US Army Corps of Engineers, Jacksonville District, Jacksonville, FL, and South Florida Water Management District, West Palm Beach, FL.

Rice, K.G., F.J. Mazzotti, L.A. Brandt, and K.C. Tarboton. 2004. Alligator habitat suitability index. Pages 93–110 in K.C. Tarboton, M.M. Irizarry-Ortiz, D.P. Loucks, S.M. Davis, and J.T. Obeysekera, editors. Habitat suitability indices for evaluating water management alternatives. Unpublished report. South Florida Water Management District, West Palm Beach, Florida.

Woodward, A.R. and C.T. Moore. 1990. Statewide alligator surveys. Florida Game and Fresh Water Fish Commission Final Report, Tallahassee, Florida, USA.

Zweig, C.L. 2003. Body condition index analysis for the American alligator (*Alligator mississippiensis*). Doctoral dissertation, University of Florida.

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