

Agenda

Wading Bird Systematic Reconnaissance Flight (SRF) Synthesis Project Initial Steering Committee Meeting 8 November 2002

Project Name: SRF Synthesis Project (?)

Contract #: Joint Funding Agreement C-13427 (SFWMD) and 02-352345GA75JFA (USGS)

Contract period: 15 August 2002 - 15 November 2005

Introductions

Clint Moore, Mike Conway, Jim Peterson,

Background document (Gawlik)

Deliverables and timetables

Payment procedures

Personnel

- Steering Committee structure
- PIs
- Research Coordinator
- Post Doc
- Work location

Responsibilities and assignments

- Data needs
- Data contact person
- Personnel location
- Logistic support

Next Steering Committee Meeting date

*contact for
Send Mike G. - Darrell &
possible housing & vehicle*

Wading Bird Systematic Reconnaissance Flight (SRF) Synthesis Project

Background Material for Initial Steering Committee Meeting 8 November 2002

Overall guidance and interagency coordination will be provided by a steering committee. Membership on this committee will consist of appointed representatives of the four principal agencies that are involved in the collection and maintenance of the SRF survey data. This committee will meet approximately semi-annually throughout the duration of the project to review progress and set explicit goals for each new phase as the work progresses. Initial membership of the Steering Committee is shown with other project personnel in Table 1. Responsibility for the execution of this project in accordance with the contract between USGS and the SFWMD, lies with D. Gawlik and M. Conroy.

Table 1: Project Personnel

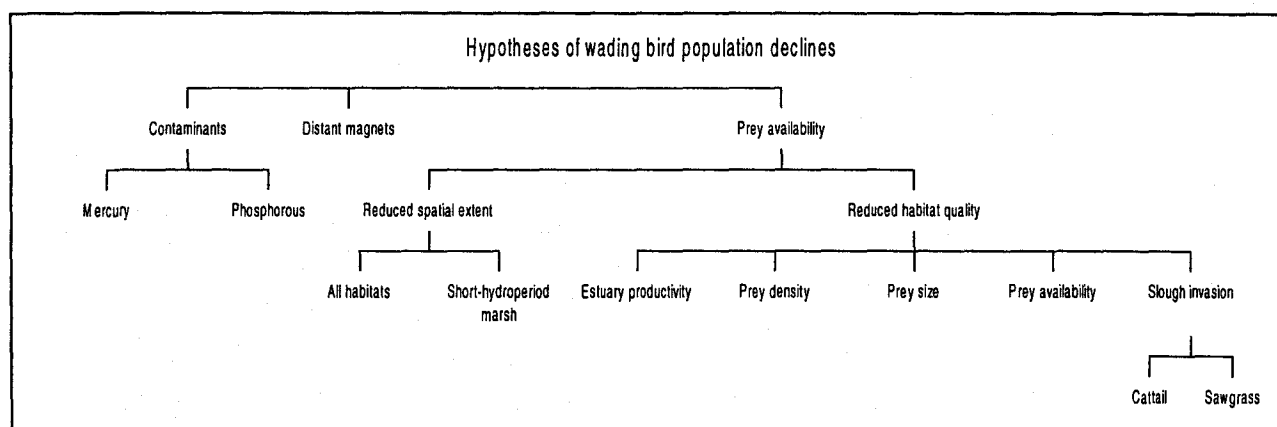
Role	Name	Responsibility	Affiliation
Project Manager and Steering Committee Member	Dale E. Gawlik	Develop proposal, Oversee research, assist in assembling data for WCAs, and participate in manuscript preparation.	South Florida Water Management District, West Palm Beach, FL 561-686-8800 ex 4539 dale.gawlik@sfwmd.gov
Steering Committee Member	Sonny Bass	Oversee research, collect data, assist in assembling data for ENP, and participate in manuscript preparation.	Everglades National Park, South Florida Natural Resources Center, Homestead, FL 305-242-7833 sonny_bass@nps.gov
Steering Committee Member	Jim Schortemeyer	Oversee research, assist in assembling data sets for Big Cypress National Preserve, and participate in manuscript preparation.	Florida Fish and Wildlife Conservation Commission, (Liaison) Naples, FL 941-455-5847 schortfire@aol.com
Steering Committee Member	Dave Nelson	Oversee research, conduct surveys, assist in assembling data for WCAs since 1995, and participate in manuscript preparation.	U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS 601-634-3816 nelsond@wes.army.mil
Principal Investigator	Mike Conroy	Conduct and direct research, oversee production of deliverables, and participate in manuscript preparation	USGS Georgia Cooperative Fish and Wildlife Unit, Athens, GA 706-542-1167 conroy@smokey.forestry.uga.edu
Co-principal Investigator	Clint Moore	✓ //	USGS Georgia Cooperative Fish and Wildlife Unit, Athens, GA ? cmoore@smokey.forestry.uga.edu
Co-principal Investigator	James Peterson	✓ //	USGS Georgia Cooperative Fish and Wildlife Unit, Athens, GA ? peterston@smokey.forestry.uga.edu
Research Coordinator	?	Assemble databases, assist with data mgt, and graphical output	?
Post-doctoral Research Associate	?	Conduct analyses, produce deliverables, and assist with manuscript preparation	?

The main challenge of the SRF Synthesis Project, and where previous analyses have fallen short, is to capture the realism of how wading birds use a dynamic landscape with key variables that are changing at different time scales. Landscape features such as basin and elevation are essentially static; dominant vegetation types change, but very slowly. Overlain on top of those relatively static features is water, which pulses daily and seasonally. Wading birds move across that matrix of static features and pulsing water to locate places where the combination of variables is suitable for their individual foraging apparatus (Maurer 1996). If we follow the hierarchical habitat selection process outlined in (Holling 1992) then birds are responding to variables at a variety of scales when making choices of where to forage. The 2-km sampling grain of the SRF is only fine enough to reflect some of those variables. Capturing the interactions among the important variables are the appropriate scales, which reflect the choices faced by birds, is basis for our approach.

Underlying mechanisms of population changes

There are three major groups of hypotheses explaining wading bird population declines in the Everglades: (A) decreased prey availability, (B) contaminants, and (C) "distant magnets". Several lines of evidence mitigate against hypotheses B and C in favor of A (i.e., decreased prey availability), associated with changes in overall ecosystem function. This project focuses on the prey availability hypothesis, see diagram below.

The contaminant hypothesis (B) is that high concentrations of mercury have increased mortality or reduced feeding success (Sundlof et al. 1994, Frederick and Spalding 1994,



Hallam et al. 1996). *Note that contamination from phosphorous leading to change in vegetation is considered under the food availability hypothesis* because the shift toward dense vegetation reduces the vulnerability of prey and thus their availability. As yet, there is no definitive evidence that directly links contamination of soil or water to declines in wading bird populations. Several studies have examined the effects of methylmercury on various species of Everglades wading birds (Frederick et al. 1997, Frederick et al 1999.). High concentrations of mercury have been found in the tissue and organs of the Great Egret. Risk assessments based on estimated rates of exposure to methylmercury suggest that wading birds feeding in a localized "hot spot" are only at the threshold of significant

toxic effects (Rumbold et al. 1999). Methylmercury does not pose a risk to wading birds feeding elsewhere in the Everglades. As yet, research has failed to demonstrate a significant relationship between methylmercury exposure rates or body burdens and reproductive success.

The distant magnet hypothesis (C) is that wading birds have been attracted away from the Everglades because conditions have improved elsewhere (Walters et al. 1992). This hypothesis, like the others, assumes that the overall quality of Everglades habitat has been reduced **relative** to other areas, but it differs in that it assumes the quality of the Everglades has not been degraded; the other areas have simply improved. We find this hypothesis unlikely because in certain years, like 2000, the Everglades can still produce large numbers of wading birds (Crozier et al. 2000). This cannot be completely explained as a situation whereby birds found conditions elsewhere unsuitable then returned to the Everglades to nest because the nesting season in the Everglades begins before other regions of the southeast. Thus, factors driving nesting effort were most likely found within the Everglades.

The mechanism first hypothesized to cause the Wood Stork population decline, and the one that has the most support today, was reduced prey availability (A) because of hydrologic changes in the ecosystem (Kahl 1964, Gawlik 2002). This hypothesis specifically posits that either the density of prey has been reduced (through either changes in the small scale concentration of prey or changes to overall prey population sizes), or the vulnerability of prey to capture has been reduced (see Gawlik 2002 for a detailed discussion of this hypothesis).

During the 1970s, correlations were established between the hydrologic function of the Everglades and wading bird feeding success (Kushlan 1976, Ogden et al. 1976, Kushlan 1977, Kushlan 1979). The first experimental evidence linking prey availability with a numerical response (Gawlik 2002) resulted in the hypothesis that birds were not responding to average prey availability at large spatial scales but rather small-scale high-quality patches. The quality of these patches is driven largely by physical features of the landscape, hydrology, and microtopography.

In the mid 1980s, the first radio-telemetry study of individual birds (Strong et al. 1997) confirmed earlier population studies (Kushlan 1977, Kushlan 1979), showing that individual birds used habitats across the entire landscape based on seasonal hydrologic patterns. Over the course of a bird's lifetime, movements could occur throughout the entire southeastern United States (Melvin et. al, 1999).

Such large-scale movements called for system-wide studies and in 1985, a systematic reconnaissance flight survey (SRF) was initiated to quantify feeding patterns and population sizes. Because of its size, the responsibilities for funding and conducting the SRF was divided among ENP, the South Florida Water Management District (SFWMD), and Florida Fish and Wildlife Conservation Commission (FFWCC). Since 1995, the U.S. Army Corp of Engineers has assumed responsibility for the FFWCC and SFWMD portions of the survey. Analyses of data for only the northern Everglades showed that

vegetation and hydrology affected wading bird distribution and abundance patterns (Bancroft et al. 1994, Hoffman et al. 1994, Bancroft and Sawicki 1995). A weakness of the studies was that when bird abundance was low it was unclear whether birds were simply shifting to southern portions of the system or whether they left the system entirely.

An effort to link nesting directly to hydrologic properties showed that nesting was affected by drying rate, but the effects were inconsistent among years and species (Kushlan 1986, Frederick and Collopy 1989, Bancroft et al. 1990, Frederick 1994, Frederick and Spalding 1994). This pattern suggested that the effects of hydrology on nesting were mediated by other processes. A harmonic analysis of the annual hydrologic cycle showed that Wood Stork nesting effort and hydrology were related and that lower-order processes were already captured in that relationship (Nuttall 1997). The first experimental evidence clearly linking food availability with reproductive output was for Great White Herons (*Ardea Occidentalis*) in Florida Bay (Powell 1983).

Current wading bird research in the Everglades

Current research includes ongoing system-wide nesting surveys, ongoing system-wide SRF surveys, the development of individual-based simulation models (ATLSS; Wolff 1994), and feeding experiments (Gawlik 2002).

The SRF's are conducted 6-7 times per year (Dec-Jun) by the U.S. Army Corp of Engineers and Everglades National Park. These surveys provide detailed information on the distribution and abundance of wading birds in the WCAs, Holey Land Wildlife Management Area, Stormwater Treatment Area 1 West, Big Cypress National Preserve, and ENP.

Nesting surveys are conducted by a variety of agencies in south Florida for individual management units. Data are voluntarily pooled by investigators each year and reported in the South Florida Wading Bird Report (Gawlik 2001). These data provide information on the status of the overall ecosystem because birds at each individual colony are integrating information across tens of kilometers. Historical nesting data date back to 1903, when wardens in the southern Everglades began counting nesting wading birds to show that they were in need of protection and thus provided the baseline for subsequent population comparisons. Wood Stork nests in the coastal Everglades were monitored since then, except for a period during the 1940s and 1950s. Nest surveys for other wading bird species have been sporadic and restricted to the coastal Everglades until the late 1970s. System-wide nest surveys began in the mid-1980s and continue today (Crozier et al. 2000).

Table 2. Hypotheses for wading bird population declines in the Everglades.

Hypothesis name	Stressor	Description	Citation
Contaminants	Increased mercury input	High concentrations of mercury have increased mortality or reduced feeding success	Sundlof et al. 1994, Frederick and Spalding 1994, Hallam et al. 1996
Distant magnets	None	Habitat conditions outside of the Everglades have improved and birds are attracted away from the Everglades rather than being driven from it	Walters et al. 1992
Prey availability			
Reduced spatial extent			
All habitats	Urban and agriculture development	A reduction in the overall spatial extent of marsh decreased the availability of prey on a landscape scale	Fleming et al. 1994
Short-hydroperiod	Urban and agriculture development	The loss of short-hydroperiod wetlands had a disproportionate affect on food availability early in the dry season	Fleming et al. 1994 Gawlik 2002
Reduced habitat quality			
Estuary productivity	Altered hydrology – reduced flow to estuary	The productivity of the coastal Everglades has been reduced	Powell et al. 1989, Walters et al. 1992
Prey density	Altered hydrology – cumulative changes	Reduced prey density in the freshwater marsh because of hydrologic changes	Frederick and Collopy 1989, Bancroft et al. 1994
Prey size	Altered hydrology – shortened hydroperiods	Shortened hydropatterns have resulted in fewer large prey fishes	Ogden et al. 1976, Bancroft et al. 1994, Hoffman et al. 1994
Prey availability	Altered hydrology – reduced fluctuations, reversals in water recession	Reduced prey availability because of altered water recession rates. Does not specify whether from decreased prey density or reduced prey vulnerability.	Kushlan 1986, Frederick and Collopy 1989, Bancroft et al. 1990, Frederick and Spalding 1994, Gawlik 2002
Slough invasion			
Cattail	Increased phosphorous input	Feeding habitat degraded because of invasion of open slough habitat by cattail	Bancroft and Sawicki 1995
Sawgrass	Altered hydrology – shortened hydroperiod	Feeding habitat degraded because of invasion of open slough habitat by sawgrass	Hoffman et al. 1994, Bancroft and Sawicki 1995

The U.S. Geological Survey for South Florida (<http://atlss.org>) is developing an individual-based, spatially-explicit model (ATLSS). This model simulates individual movement and reproduction for four wading bird species across the landscape. The spatially-explicit model includes processes at several levels, including fine-scale spatiotemporal hydrologic dynamics, estimated fish population densities, and colony

sizes and locations. Such complex behavioral models require a large amount of data for calibration and validation. The ATLSS model explicitly calls for validation with the SRF data set (Huston et al. 1996).

A series of wading bird foraging experiments were conducted in a set of 15 replicate 0.2-ha ponds directly adjacent to, and NW of, Arthur R. Marshall Loxahatchee National Wildlife Refuge in Palm Beach County, Florida. The ponds were built within a 1545-ha wetland constructed as a prototype for a large-scale nutrient removal project. Ponds were rectangular with a peat substrate and were arranged in a row adjacent to one another. Ponds were drained between each experiment and restocked with prey of known sizes and species. In addition water depths were manipulated independently among ponds. The response variables were bird density and foraging success of free-ranging wading birds. Experiment 1 examined the relative effects of water depth and fish density on the feeding tactics and density of wading birds at feeding sites. The results provided the mechanistic foundation for the hypothesis examined in this proposal, that the spatial patterns of wading birds in the landscape is linked to nesting effort. Experiment 2 examined the relative effects of fish size, fish density, and water depth on the density of birds. Experiment 3 examined the relative effect of fish species, fish density, and water depth on the density of wading birds. The analyses of these data are currently ongoing.

Need for the SRF Synthesis Project

This research project is one of the rare examples of a project that spans the entire Everglades basin and is directly linked to a restoration performance measure. The large spatial scale of this project is necessary because that is the scale at which wading birds use the ecosystem. Wading birds forage over the entire Everglades landscape on a seasonal basis, and the way in which they use that landscape is linked to successful nesting. It is likely that the linkage between the northern and southern portions of the landscape may in fact be an important mechanism to sustain wading bird populations during short-term fluctuations in hydrologic conditions. The SRF program was innovative and unique in that it was established more than a decade ago to evaluate landscape-level responses of birds to hydrologic processes at that scale. Indeed, the project was executed and the data were collected in accordance with the original goals. Unfortunately, the final stage of the project was never completed and to date, **no full landscape-level analysis has been conducted**. Previous analyses have examined either the northern portion of the landscape (e.g., Bancroft et al. 1994, Hoffman et al. 1994, Bancroft and Sawicki 1995, Bancroft et al. 2002) or the southern portion (Russell and Portier 1999). As a result, no study has been able to quantify the important landscape linkages needed to support wading bird populations in the Everglades. This project is needed to bridge that gap and provide resource managers with the tools and understanding to restore the Everglades ecosystem at its full spatial extent. One key product will be a wading bird "performance measure" that can be used to guide and evaluate CERP through the Adaptive Assessment Process.

Problems - Cloud cover,

Quality Assurance Statement

The strength of this project is that it synthesizes a wide variety of unique data sets, one of them dating back nearly 100 years. Any time such a large-scale synthesis is attempted, there are challenges for quality assurance because of the differences in parameters and data collection techniques. To ensure the highest level of data integrity in this project, all data sets will be built into an Oracle® relational database. This allows for data screening and flagging for out-of-range values and for identifying inconsistencies and breaks in time sequences. The SFWMD and ENP already use this approach extensively with ongoing research projects so it will be easy to apply it here. For SRF surveys, out-of-range flags will be issued when an observation is outside the mean 2 standard errors of known values for that region. Some of the SFWMD data sets (e.g., hydrology data) already undergo extensive QA/QC procedures (see below). Others, such as the high-resolution vegetation maps are scheduled for validation within the next few months.

The SRF database for the WCAs and ENP was proofed against the raw data forms when it was converted to an electronic form. When these data are combined into a relational database, out-of-range values will be flagged, examined individually, and cross-referenced against any comments that might be on data sheets or field notebooks. Out-of-range flags will be issued when an observation is outside the mean 2 standard errors of known values for a given region. The portions in the WCAs and ENP have already undergone extensive scrutiny because of individual analyses for those portions of the wading bird survey data. Wading bird feeding experiments have also undergone intense scrutiny as part of the internal review process at SFWMD. Wading bird nesting data for south Florida will be used to characterize years of good or poor nesting effort to link with annual characterizations of foraging distributions from SRF data. Data are direct observations and counts of nests that were compiled from published literature, reports, government documents, and unpublished data for 1903 to 2000. There was no way to verify the original data collection methods so best professional judgement was used, and only sources that were credible and reliable, were included (i.e., data collected by people with local bird identification skills).

Hydrology data will be used to supplement surface water classifications of each SRF grid cell. Data are available from gages in South Florida and extend from the present back to around 1950. These data undergo an extensive quality review process (see below). In addition to the gage data, water level data are available as output from the South Florida Water Management Model (SFWMM) for the entire Everglades. The SFWMM is a spatially-explicit computer model that simulates the hydrology of South Florida (Fennema et al. 1994, South Florida Water Management District 1997). It is regional in spatial extent and uses a 3.2km-by-3.2km fixed-resolution gridded model domain. The SFWMM assumes homogeneity in hydrologic characteristics within each grid cell and runs at a fixed time step of one day.

Elevation data will be used to characterize the elevation of SRF grid cells and define general physiographic areas. Elevation data points are being collected in ENP and WCA3 every

400 m in a grid pattern. The vertical accuracy specification for these elevation data is 15 cm, and they are referenced to the North American Vertical Datum of 1988.

Hi-resolution vegetation maps are currently being developed from remote sensing for ENP and WCA 3. They are scheduled to be validated at the end of this year. Also, there are data available on fire occurrence, severity, and extent for ENP and some portions of the WCAs. Data for ENP since 1982 have been summarized in (Lockwood et al. 2000).

Hydrology data from the SFWMM have gone through an extensive testing process and water patterns predicted by the model match observed patterns well (South Florida Water Management District 1997). The hydrologic data extracted from SFWMD gages are subjected to rigid quality assessment and control measures (Crowell and Mtundu 2000). After the raw data are retrieved, they are loaded into a Data Collection/Validation Preprocessing System (DCVP). The DCVP system verifies the station name and checks the period of record for ascending dates/times, gaps, and overlaps. The DCVP system also screens the data for values outside of the min/max and rate of change tolerances. The data are then graphically analyzed by skilled personnel trained in the interpolation of hydrologic data. During the graphical review, comparison data sources are also used to identify errors. Any inconsistencies are corrected and/or tagged by the data processors. The data are then updated and filtered against daily minimum/maximum and rate of change tolerances. Daily averages are computed, extracted, and reviewed.

The elevation data from USGS have been evaluated extensively. USGS did a feasibility study in late 1994 and early 1995 to determine if state-of-the-art techniques using the Global Positioning System (GPS) could be used to meet the stringent vertical accuracy specifications of the elevation data. The feasibility study successfully demonstrated that differential GPS techniques, using airboats to navigate transects, could meet the data accuracy requirement. USGS developed a helicopter-based instrument, known as the Airborne Height Finder (AHF) that is able to measure the terrain surface elevation in a noninvasive, nondestructive manner. Accuracy tests have shown that the AHF system can consistently measure elevation points to within 3 to 5 cm. An accuracy test in May 2000 measured 17 National Geodetic Survey (NGS) benchmarks twice with the AHF. The average difference between the AHF measured elevations and the NGS published data sheet values was 3.3 cm. The largest difference was 8.6 cm, and the smallest difference was 0.2 cm. These accuracy test results provide confidence that the elevation dataset being produced meets the 15-cm vertical accuracy specification.

BUDGET AND TIMETABLE

TASK NO.	DELIVERABLE	DUE DATE*	DUE DATE**	FISCAL YEAR	AMOUNT (\$1000)
1	1. Project Orientation letter	1 Month	15 Sep 02	2002	10
2	2. Draft Project Work Plan	1.5 Months	1 Oct 02	2003	0
2	3. Final Project Work Plan	3 Months	15 Nov 02	2003	68.36
3	4. Draft Oracle database structure	12 Months	15 Aug 03	2003	0
3	5. Documentation for finalized database	14 Months	15 Oct 03	2004	10
3	6. Electronic copy of Oracle database	14 Months	15 Oct 03	2004	10
4	7. Graphic image files	14 Months	15 Oct 03	2004	10
4	8. Electronic copy of ArcView Project files	14 Months	15 Oct 03	2004	13.56
5	9. Draft Statistical Summary Report	18 Months	15 Feb 04	2004	0
5	10. Final Statistical Summary Report	20 Months	15 Apr 04	2004	50
5	11. Electronic copy of SAS statistical programs, output, and data sets	20 Months	15 Apr 04	2004	50
6	12. Draft Model Summary Report	26 Months	15 Oct 04	2005	0
6	13. Final Model Summary Report	28 Months	15 Dec 04	2005	8.08
6	14. Electronic copy of SAS statistical programs, output, and data sets	28 Months	15 Dec 04	2005	10
6	15. Statement describing potential manuscripts	28 Months	15 Dec 04	2005	0
7	16. Draft Manuscript(s)	32 Months	15 Apr 05	2005	0
7	17. Final Draft Manuscript(s)	34 Months	15 Jun 05	2005	50
8	18. Draft Final Report	34 Months	15 Jun 05	2005	0
8	19. Final Report	36 Months	15 Aug 05	2005	50
Project end	.	39 Months	15 Nov 05	2006	340

*Time after contract execution date

**Start date of August 15, 2002