

ANNUAL RESEARCH PLAN  
FISCAL YEAR 1981

National Park Service  
South Florida Research Center  
Everglades National Park  
Homestead, Florida 33030

Report Series No. M-594  
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PROJECT TITLE: Research Administration

PROBLEM STATEMENT: The South Florida Research Center provides the priority research for Everglades National Park, Biscayne National Monument, Big Cypress National Preserve, and Fort Jefferson National Monument, and administratively functions under the direction of the Superintendent, Everglades National Park. The research program is designed to investigate and monitor the natural resources and processes of a geographically integrated ecosystem and to apply knowledge of that ecosystem in making recommendations for optimal environmental management of the park system units.

Because the park areas in south Florida encompass approximately 2.1 million acres of diverse habitats, and the environmental problems are ecologically complex, the research program requires alert coordination of manpower, facilities, and budget to maintain cost-effectiveness and achieve program objectives.

OBJECTIVES: Provide overall direction and coordination of the research efforts in the South Florida units of the national park system, develop the skills and professional standing of the research staff, and organize manpower, facilities, and budget to provide the most cost-effective research information.

PROJECT SCHEDULE - FY 81:

1. Publish a report series, consisting of varied technical reports, final project reports, final contract reports, management reports, and professional journal publications.
2. Submit a formal Annual Report summarizing research activities for all research projects conducted during FY 80.
3. Participate with other park personnel in up-dating the resource management plans for EVER, BICY, FOJE, and BISC.
4. Submit an Assessment of Research Needs and Priorities for Everglades National Park, Biscayne National Monument, Big Cypress National Preserve, and Fort Jefferson National Monument for fiscal years 1982-1984.
5. Coordinate division budget accounting for all projects including preparation of 10-561's, 10-575's, 10-237's and ZBB documents. Provide monthly financial status report on all accounts.
6. Coordinate all personnel actions including preparation of job description and recruitment requests. Prepare necessary pay period documents. Assist in preparation of accident/injury reports, performance evaluations, incentive awards actions, and EO matters.

7. Maintain inventory records. Monitor monthly motorized equipment mileage, fuel, and maintenance costs. Manage all amortization, maintenance records and related vouchers. Monitor helicopter scheduling and attendant financial accounting. Coordinate division requests for equipment survey and replacement.
8. Manage research facilities including arrangement and accounting for all utilities and necessary maintenance. Coordinate assignment of space, storage, and housekeeping requirements. Coordinate use of conference, library, and computer facilities.
9. Provide research contracting assistance including development of Request for Proposals correspondence, arrangement of contract committee reviews, Statements of Finding and Determination, awards, accounting review, and contract records.
10. Maintain division central files pertaining to budget, personnel, inventory, contracts, collaborator research, and correspondence.

Personnel

Research Biologist (Hendrix), #5297-05  
 Research Biologist (Robertson), #5297-03  
 Research Biologist (Taylor), #5297-01  
 Research Biologist (Loope), #5297-16  
 Research Wildlife Biologist (Kushlan),  
     #5297-15  
 Research Hydrologist. (Rosendahl), #5297-14  
 Wildlife Biologist (Bass), #5297-17  
 Marine Research Biologist (Davis), #5297-23  
 Marine Biologist (Schmidt), #5297-21  
 Administrative Technician (Phelan), #5297-28  
 Editorial Assistant (Anderson), #5297-29  
 Hydrologist (Rose), #5297-40  
 Biological Technician, Fisheries (Thue),  
     #5297-100 (LTFT)  
 Librarian (Bradley), #5297-101 (LTFT)  
 Computer Specialist (TBA), #5297-208 (LTFT)  
 Word Processing Assistant (Curl), #5297-215  
     (LTFT)  
 Division Secretary (Setnicka), #5297-216  
     (LTFT)

\$405,780

Travel

Administrative activities (public hearings,  
 water management meetings, Federal Inter-  
 agency Recovery Team meetings NIE, POV  
 mileage

5,100

Services

Aircraft:		\$ - 0 -	
Computer:		- 0 -	
Contract:		- 0 -	
Rents:	Telephone @ \$1000/mo (RC, HQ, TC)	\$12,000	
	Photocopier @ \$450/month	5,400	
	Word Processors, 2 @ \$400/mo.	<u>9,600</u>	
			27,000
Other:	Tuition and fees	\$ 400	
	Printing (Technical Report Series)	10,800	
	Trail Center (BICY)-grounds and septic maintenance, office utilities, trash service	<u>1,300</u>	
			<u>12,500</u>

39,500

FY 81

BUDGET SUMMARY: RESEARCH ADMINISTRATION (continued)

2b

Supplies

Word processing supplies @ \$100/mo	\$ 1,100	
Division office supplies @ \$250/mo	<u>2,750</u>	3,850

Capitalized Equipment

- 0 -

Amortized Equipment Costs

IBM Selectric Typewriters, 3 @ \$7/mo	\$ 260	
AMC Station Wagon @ \$65/mo	<u>780</u>	1,040

Motorized Equipment Operation

Fuel: AMC Wagon (PN50083), 10000 mi/625 gal	\$ 1,188	
4.5hp OB Engine (PN50149), 50 hr/ 200 gal	<u>360</u>	
	\$ 1,548	
Maintenance:		
AMC Wagon	\$ 132	
OB Engine	<u>50</u>	
	<u>182</u>	
		<u>1,730</u>

TOTAL PROJECT COST

\$457,000

PROJECT TITLE: Everglades Library

PROBLEM STATEMENT: The Everglades Library serves all divisions of the park, is operated administratively by the Research Division, and is housed at the Research Center. It has evolved from a small but diversified facility of largely donated items to a substantial information resource keyed to the planning needs of interpretive, resource management and research programs. It now includes more than 10,000 technical and general periodicals, catalogued books and pamphlets, an indexed map collection (both aerial and topographical), and a steadily increasing amount of microformed information.

OBJECTIVES: Provide a library facility that serves all park divisions while further developing specific reference capabilities to meet resource management and research information needs.

PROJECT SCHEDULE - FY 81:

1. Continue to strengthen the park library as a reference center for information pertaining to south Florida ecosystems.
2. Continue acquisition of microformed reference material as a space-reduction action. Conduct training sessions for microform reader to encourage its use, and evaluate use levels of microform versus regularly-printed materials to determine effectiveness of the former as an information resource.
3. Utilize capabilities of Interior Library to assist park users in the areas of inter-library loans and literature searches, and implement where beneficial and cost-effective such services for EVER personnel.
4. Recruit and train Library Aide (temporary, part-time) to assist in cataloguing, inter-library loans, and circulation activities.
5. Complete reorganization of museum collections to insure appropriate curatorial attention and usefulness as reference materials.

FY 81  
BUDGET SUMMARY: EVERGLADES LIBRARY

3a

Personnel

Librarian (Bradley), 240 m.d.	\$ - 0 -*	
Library Aide, 156 m.d.	<u>5,690</u>	\$ 5,690

Travel

Interagency Librarians Workshop, 11/80	\$ 600	
FL Librarians Annual Meeting, 5/81	160	
In-park (annual) inventory of branch libraries	<u>50</u>	810

Services

Aircraft:	\$ - 0 -	
Computer:	- 0 -	
Contract:	- 0 -	
Other:		
Binding Services	\$ 100	
NTIS/GPO	100	
DI-NRL: cataloguing services	<u>300</u>	
	<u>500</u>	500

Supplies

Book purchases (Research Division only)	\$ 2,000	
Library of Congress catalog cards	200	
Periodicals (Research Division only)	5,100	
Microforms	1,200	
Office and museum supplies	<u>300</u>	8,800

Capitalized Equipment

- 0 -

Amortized Equipment Costs

- 0 -

Motorized Equipment Operation

- 0 -

TOTAL PROJECT COST

\$ 15,800

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\* salaries of all permanent personnel are included in the Budget Summary for  
 Research Administration



PROJECT TITLE: Computer Center

PROBLEM STATEMENT: One of the primary needs of a large environmental research program is the ability to systematically record, store, analyze, and correctly interpret large volumes of complex data in a relatively short period of time. With the data processing capabilities available at Everglades consisting of a modular, expandable mini-computer system and terminal access to larger, remote computers, a variety of data manipulations and management options are possible.

OBJECTIVES: Provide the Everglades research staff with the in-house capability to: (1) store data acquired through research, reduce information loss, and eliminate data redundancy; (2) statistically analyze and interpret research data; and, (3) simulate ecosystem processes for current and future resource management planning.

PROJECT SCHEDULE - FY 81:

1. Provide administration of the computer facility, including:
  - . assistance in hardware and software contracting
  - . basic mini-computer training
  - . maintenance of systems documentation and files
  - . development of long-term hardware specifications for system modification
2. Provide technical assistance in editing and debugging software utilizing BASIC, BASIC II, COBOL, and other high level technical languages.
3. Assist in reviewing word processing capabilities for possible inclusion in computer system.
4. Arrange necessary routine maintenance of equipment. Maintain stock of supplies necessary to the standard operation of equipment and file maintenance.

FY 81  
BUDGET SUMMARY: COMPUTER CENTER

4a

Personnel

Computer Specialist, GS-9, 208 m.d. \$ - 0 -\* \$ - 0 -

Travel

Development of computer system 1,000

Services

Aircraft: \$ - 0 -  
Computer: - 0 -  
Contract: - 0 -  
Other:  
Annual lease, mini-computer system (\$47,600)\*\*  
Annual rental, data terminal 300  
Software development 900  
1,200

Supplies

Flexible diskettes and hard disks \$ 600  
Ribbons for terminal and printer, pens and  
assembly unit for plotter, paper 400  
Reference manuals and supply storage units  
(caddies, trays, etc.) 600  
1,600

Capitalized Equipment - 0 -

Amortized Equipment Costs - 0 -

Morotized Equipment Operation - 0 -

TOTAL PROJECT COST \$ 3,800

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\* salaries of all permanent personnel are included in the Budget Summary for  
Research Administration

\*\* non-add entry; priority #1 if additional funds available in FY 81

PROJECT TITLE: Hydrological Monitoring

PRINCIPAL INVESTIGATOR: Paul Rose

PROBLEM STATEMENT: Throughout recent times the hydrologic regime of Everglades National Park (EVER) and the Big Cypress National Preserve (BICY) has been impacted by developments external to their boundaries. An elaborate South Florida water management scheme containing numerous canals, structures and levees has interrupted the natural overland sheet flow of surface waters in these NPS units. Both the quantity and quality of the waters which enter EVER and BICY have been affected necessitating the accurate and comprehensive hydrological data monitoring, storage and retrieval.

The National Park Service, in cooperation with the U.S. Geological Survey, has established an extensive hydrologic monitoring network throughout Everglades National Park and the Big Cypress National Preserve. Both the NPS and USGS personnel monitor over 150 stations which includes satellite data collection platforms, continuous water level recorders, staff gauges, rain gauges, discharge measurements and the collection of water quality samples at selected locations.

Data collected throughout Everglades National Park and Big Cypress National Preserve are of extreme importance to all phases of research. The Hydrological Monitoring Project serves as a vital link in furnishing hydrological data to the wildlife program, marine biology program, plant and fire ecology programs, Resources Management Division, Superintendent's Office, the Deputy Director's Office, Southeast Regional Office, Big Cypress and Everglades Administrative Offices and to various local, state and federal agencies which have requested data. The reliance on these data and the nature of these specialized data requests by the various programs for their successful research thrust dictates that those hydrologic data collected be accurate, clearly organized, comprehensive and available on a timely basis.

Presently, the U.S. Geological Survey is, in many cases, unable to provide current hydrological data to the National Park Service on a timely basis for the specialized application required by these various research programs. In-house monitoring at several stations currently contracted to the USGS as an alternative to the historic park program would benefit the NPS by making the transfer of data more efficient both through a reduction in the number of personnel and agencies involved and by allowing in-house prioritization of data reduction and analysis.

During FY 81, a transfer of data control will begin whereby the National Park Service shall install, monitor and maintain single and permanent multi-parameter hydrologic recording devices throughout Everglades National Park and the Big Cypress National Preserve. The program will be initiated in FY 81 with the installation of 4 multi-parameter and 20 stage

recording gauges. It is anticipated that this will reduce the hydro-records budget once the purchase of monitoring devices is completed and will provide a means whereby current hydrological data could be furnished to research programs and other groups upon immediate request.

**OBJECTIVES:** Monitor and store ENP and BICY water quantity and quality data and publish these data annually.

**PROJECT SCHEDULE - FY 81:**

1. Publish Annual Hydrology Report summarizing 1979 data for all EVER and BICY data.
2. Prepare a weekly hydrology synopsis.
3. Maintain all hydrology data records including water levels, rainfall, conductivity, temperature, velocity studies, and water quality.
4. Collect hydrologic data including:
  - Continuous water level data at 24 automatic recorders, 4 of which utilize satellite telemetry platforms.
  - Hourly rainfall, conductivity, air and water temperatures at satellite station #NP 203.
  - Surface water flow at 6 discharge stations.
5. Install 4 permanent continuous multi-parameter hydrologic devices to monitor water level, rainfall, temperature and conductivity.
6. Pending availability of funds, install 8 permanent continuous multi-parameter hydrologic devices in estuary locations to assess influence of freshwater flow on estuarine salinity conditions.
7. Install 20 continuous recording water level gauges.
8. Monitor water quality at 15-20 selected locations semi-annually for the following parameters:
  - Field: Dissolved oxygen, temperature, specific conductivity, pH, and alkalinity
  - Nutrients: Nitrate, nitrite, ammonium, organic nitrogen, orthophosphate, total phosphorus, organic carbon, and inorganic carbon
  - Major Inorganic Ions: Calcium, magnesium, sodium, potassium, chloride, fluoride, sulfate, bicarbonate, hardness, total dissolved solids, color, and turbidity

9. Develop and maintain an automated data retrieval system to read and store data including USGS data, in-house.
10. Monitor water level, rainfall and conductivity bimonthly at 50 locations in Taylor Slough.
11. Measure surface water discharge at Context Road and Taylor Slough Bridges biweekly and construct stage-discharge hydrographs.
12. Monitor the Big Cypress hydrologic networks established within all study areas as needed. This encompasses the monitoring of the study areas established in FY 79, if required, FY 80, and FY 81 when surveying is completed.
13. Measure surface water discharge at Tamiami flow sections 40 Mile Bend to Monroe, and Monroe to Carnestown biweekly and construct stage-discharge hydrographs.
14. Monitor bulk precipitation stations for nutrients and field parameters at the South Florida Research Center within the National Park Service/National Atmospheric Deposition Program, Cooperative Program and at Tamiami Ranger Station and Fort Jefferson within the NPS/EPA/University of Florida Cooperative Program.
15. Prepare annual project report.

FY 81

BUDGET SUMMARY: HYDROLOGICAL MONITORING

7a

Personnel

Research Hydrologist (Rosendahl), GS-12, 40 m.d.	\$ - 0 -*	
Hydrologist (Rose), GS-11, 156 m.d.	- 0 -*	
Hydrologist, GS-7/9, 260 m.d.	<u>18,096</u>	\$ 18,096

Travel

American Water Resources Workshop	\$ 700	
Annual Program Planning Meeting	450	
EROS Data Center	<u>650</u>	1,800

Services

Aircraft: Helicopter, 90 hrs @ \$160	\$14,400	
Fixed-wing, Widgeon, 4 hrs	<u>700</u>	
	\$15,100	
Computer:	2,000	
Contract: USGS Collection & Analysis	66,929	
Other: Publication-related drafting	\$ 700	
NPS/NADP Bulk Precipitation Analysis	<u>3,000</u>	
	<u>3,700</u>	87,729

Supplies

Lumber & stilling wells (24 @ \$100)	\$ 2,400	
Field supplies	365	
Office/drafting supplies	300	
Airboat and motorboat supplies	<u>500</u>	3,565

Capitalized Equipment

Contunuous-recording gauges, 20 @ \$650	\$13,000	
Calculators (2)	140	
Multi-parameter data loggers, 4 @ \$5,000	20,000	
Multi-parameter data loggers (additional), 8 @ \$5,000 plus platform fabrication	( <u>45,600</u> )**	33,140

Amortized Equipment Costs

Van (PN54250)		1,194
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Motorized Equipment Operation

Van (PN54250): Fuel: 16,000 mi/1,230 gals	\$ 2,336	
Maintenance:	<u>140</u>	
		<u>2,476</u>

FY 81

BUDGET SUMMARY: HYDROLOGICAL MONITORING (continued)

7b

TOTAL PROJECT COST

\$148,000

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration

\*\* non-add entry; priority #3 if additional funding is available in FY 81



**PROJECT TITLE:** Water Quantity Studies

**PRINCIPAL INVESTIGATOR:** Peter Rosendahl

**PROBLEM STATEMENT:** A major portion of the last remaining freshwater wetlands within the United States are found in Everglades National Park and the Big Cypress National Preserve in South Florida. These National Park Service lands encompass over 2 million acres which have unique sheet-flow hydraulic flow regimes characterized by extremely low flow velocities and hydraulic gradients. Because these NPS lands are located downstream within a regional hydrologic setting, they are subjected to flow perturbations originating from water management practices external to their boundaries. The U.S. Congress in 1970 mandated that Everglades National Park should receive a minimum annual delivery of 315,000 acre-feet (103 billion gallons) to be supplied to Shark River Slough (260,000 acre-feet), Taylor Slough (37,000 acre-feet) and the eastern panhandle (18,000 acre-feet). The Shark and Taylor Slough systems contain nominal areas of 197,000 and 25,000 acres respectively providing major natural drainageways for waters flowing from the controlled upland impoundments and canals to the extensive downstream estuarine and bay systems.

In order for the National Park Service to intelligently manage park water resources it is necessary to understand the basic hydrology of these wetland systems. Included within these needs are the quantification of various elements of the hydrologic cycle such as rainfall, surface water inflows and outflows, evapotranspiration and storage as determined from water distribution and depth. Beyond the basic monitoring of many of these parameters, rigorous and sophisticated data analysis is often required spanning the spectrum from simple spatial linear regression analysis to mathematical modelling utilizing 3-dimensional, time dependent differential equations.

Data analysis work elements coupled with basic data collection from the Hydrological Monitoring Project and field set-up tasks such as a surveying and gauge installation allows park hydrologists to develop water management plans. These plans will serve as the technical basis for park managers to develop strategies and policies designed to protect the park from external forces.

The hydraulic link between park wetlands and upstream water management practices is apparent which also forces a political linkage between the park and the other regional water management forces. Park managers will be better able to represent NPS needs within the arena of regional water managers by utilizing the products of this Water Quantity Analysis Project.

**OBJECTIVES:** Determine the hydrologic relationships within Everglades National Park and Big Cypress including the impacts of adjacent water management practices on park wetlands from such structures as the S-12 gates, S-332 pumping station, Canal C-III and the Turner Canal.



**PROJECT SCHEDULE - FY 81:**

1. Renegotiate Shark Slough computer model contract.
2. Prepare field data and perform data analyses as needed for input, calibration or verification parameters for Shark Slough computer model. Construct scenarios for computer use in simulations/prediction runs. Provide direction and overview on Shark Slough model development.
3. Expand Shark Slough model to cover Northeast Shark Slough and finish calibration and verification modes. Run various scenarios of natural slough conditions and alternative management strategies.
4. Study surface water recession rates on water level and flow volumes in the Rookery Branch region of Shark Slough by monitoring water stage transects, performing dye flow studies of velocity vectors, measuring diurnal water level changes and bi-directional flow volumes at representative locations in the creek system and constructing seasonal and diurnal conductivity profiles in the streams.
5. Prepare a technical report on the distribution of waters entering EVER at the S-12 control structures based upon field flow measurements taken in the old Tamiami and L-67 Ext canals.
6. Prepare a report on the seasonal fluctuations in discharge of waters to the estuarine regions of Shark Slough based upon cross-sectional analysis at the southern transect and dye flow studies conducted at representative locations in south Shark Slough.
7. Install a staff gauge network at the C-111 cut-outs, each surveyed to MSL and analyze flow characteristics north of and adjacent to this delivery canal.
8. Construct Taylor Slough water depth cross-sections for two-week intervals through FY 81.
9. Prepare a Technical Report analyzing rainfall contributions into the Taylor Slough region.
10. Complete a water resources management plan for Everglades National Park.
11. Draft a water management plan for Big Cypress.
12. Complete a technical report (on Turner River, Pinecrest Hammocks, and L-28) relating water level fluctuations along the line transects established in FY 79.

13. Draft a technical report describing the effects of the Turner River canal on ground and surface water level conditions in areas adjacent to the canal.
14. Survey water level transects within selected Big Cypress areas, originating from known bench mark elevations, including the installation of staff gauges, ground wells, and rain gauges where needed.
15. Prepare annual project report.

FY 81  
BUDGET SUMMARY: WATER QUANTITY STUDIES

10a

Personnel

Research Hydrologist (Rosendahl), GS-12, 109 m.d.	\$ - 0 -*	
Hydrologist (Rose), GS-11, 50 m.d.	- 0 -*	
Hydrologist, GS-9/11 (TERM), 260 m.d.	18,096	
Hydrologist, GS-9, 260 m.d.	18,096	
Hydrologist, GS-9, 260 m.d.	<u>18,096</u>	
		\$ 54,288

Travel

Annual Planning Meeting	\$ 450	
Travel to West Palm Beach/Jacksonville	450	
American Water Resources Workshop	700	
National Water Management Meetings	<u>1,400</u>	
		3,000

Services

Aircraft: Helicopter: 75 hrs @ \$160	\$12,000	
Computer:	400	
Contract: Shark Slough Model (3rd year)	40,000	
Other: Publications drafting	\$ 1,450	
Photographic services	650	
LANDSAT imagery	<u>750</u>	
	<u>2,850</u>	
		55,250

Supplies

Gauging boat supplies	\$ 400	
Airboat supplies	600	
Field supplies	921	
Drafting supplies	450	
Reinforcing bar	500	
Well pipe	<u>522</u>	
		3,393

Capitalized Equipment

Calculators (3)		210
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Amortized Equipment Costs

Truck (PN50190), 50%	\$ 1,176	
Airboat hull (PN52086), engine (PN52087) and trailer (PN52088), 100%	858	
Gauging boat (PN54806), engine (PN54811) and trailer (PN54807), 100%	<u>637</u>	
		2,671

Motorized Equipment Operation

Fuel:	Truck (PN50190), 10000 mi/769 gal	\$ 1,461		
	AB Engine (PN52087), 91 hr/673 gal	1,346		
	OB Engine (PN54810), 40 hr/42 gal	80		
	OB Engine (PN54811), 100 hr/170 gal	323		
	Honda ATCs (PN54275,76), 100 hr/20 gal	<u>38</u>		
			\$ 3,248	
Maintenance:				
	Truck	\$ 140		
	Honda ATCs, 2 @ \$50	<u>100</u>		
			<u>240</u>	
				<u>3,488</u>
TOTAL PROJECT COST				<u>\$122,300</u>

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration

PROJECT TITLE: Water Quality Studies

PRINCIPAL INVESTIGATOR: Peter Rosendahl

PROBLEM STATEMENT: The unique biological assemblages inhabiting South Florida National Park Service lands depend on physico-chemical cycles and relationships which characterize these semi-tropical wetlands. Progress is being made in understanding how variable hydroperiods influence floral and faunal communities but the effects of suspended and dissolved chemical constituents within the water column still remain a mystery. In addition to the scientific interest of water quality relationships within the parks there are overriding water management activities external to the park boundaries which have great potential for adversely affecting park waters. Surface waters are delivered to Everglades National Park based on an annual minimum delivery schedule which also requires adherence to minimum standards as to allowable constituent concentrations. The need thus becomes apparent to analyze both delivery surface waters and slough waters within the park to determine compliance with established standards and note trends should they occur. A more complicated and less direct work element within this project is to stay alert as to changes in water quality outside the parks but at upstream locations which have the potential to impact park waters due to the interconnected hydraulic network. Many water management options are available within the larger South Florida Water System posing the threat of water quality degradation. Some of the options include backpumping urban and agricultural polluted surface water into the conservation areas and adjacent canals, changing agricultural practices, operation changes in backpumping to Lake Okeechobee, and urban and agricultural expansion into wetlands upstream and/or adjacent to park lands.

Activities initiated within this project will rely on data collected within the Hydrological Monitoring Projects and those work elements will play a significant role in formulating water management plans identified within the Water Quantity Analysis Project.

OBJECTIVES: Determine the physico-chemical properties of both park waters and delivery waters noting trends, comparisons with established standards, and relative significance of observed concentrations.

PROJECT SCHEDULE - FY 81:

1. Report on concentrations of the selected 36 chemical and 21 pesticide parameters at the three major discharge locations to Everglades National Park with those values which were developed as standards in FY 79. This will require close scrutiny of the U.S. Army Corps monitoring program in addition to the historic in-park monitoring sites.

2. Analyze regional water quality of South Florida based on existing data bases collected within multi-agency programs including the NPS, USGS, SFWMD, and Army Corps. This study should include waters which currently impact Everglades National Park or have the potential for such impacts.
3. Prepare a technical report on inorganic ion concentrations within delivery and in-slough waters for Shark Slough. Relate these ions to measured specific conductivities at staff gauge locations and construct iso-conductivity contours on a seasonal basis for the slough. Shifts in conductivities are to be correlated with delivery schedules at the S-12 structures.
4. Analyze USGS/NPS water quality data base as to macronutrient inputs from uplands to downstream estuarine system.
5. Complete a report relating the water quality conditions of the Turner River canal and meander area. This will include the conductivity and water level conditions found during FY 79 and FY 80 at the field monitoring sites between Bridge 84 and Bridge 77.
6. Compile and report on results of bulk precipitation monitoring within and adjacent to Everglades National Park. Included within this task will be USGS data from the early 1970's, the 2-year NPS/USGS data base from 1978 and 1979 and the current NPS/NADP program and the EPA/University of Florida efforts.
7. Conduct a review of available pesticide reports and monitoring efforts within EVER and BICY and make recommendations as to future monitoring needs.
8. Review data on inorganic ion concentrations within Taylor Slough and relate these to measured specific conductance values. Develop an effective monitoring network within Taylor Slough to document shifts in ion concentrations and ratios as a result of pumping at S-332.
9. Prepare annual project report.

FY 81

BUDGET SUMMARY: WATER QUALITY STUDIES

12a

Personnel

Research Hydrologist (Rosendahl), GS-12, 40 m.d.	\$ - 0 -*	
Hydrologist (Rose), GS-11, 10 m.d.	- 0 -*	
Hydrologist, GS-9/11, 254 m.d. (TERM)	<u>18,262</u>	\$ 18,262

Travel

National Water Quality Conference	\$ 700	
Annual Planning Meeting	150	
Travel to West Palm Beach (WMD)	100	
Travel to Jacksonville, FL (Army Corps)	<u>150</u>	1,100

Services

Aircraft: Helicopter: 37 hrs @ \$160	\$ 5,920	
Fixed-wing: Widgeon, 4 hrs	<u>700</u>	
	\$ 6,620	
Computer:	- 0 -	
Contract:	- 0 -	
Other:	<u>- 0 -</u>	6,620

Supplies

Drafting supplies	\$ 486	
Field supplies	500	
Laboratory supplies	396	
Publication-related supplies (slides, maps, etc.)	<u>650</u>	2,032

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Truck (PN50191), 100%		1,176
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Motorized Equipment Operation

Fuel: Truck (PN50191), 8000 mi/616 gal	\$ 1,170	
Maintenance: Truck, 50%	<u>140</u>	
		<u>1,310</u>

TOTAL PROJECT COST

\$ 30,500

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration



PROJECT TITLE: Endangered Species Studies

PRINCIPAL INVESTIGATOR: James A. Kushlan

PROBLEM STATEMENT: The National Park Service areas in south Florida contain a number of wildlife species of special concern, including 16 that are officially listed by the Federal Government as being endangered or threatened in the United States. Thirty species are also officially listed by the State of Florida as endangered or threatened within the State. The National Park Service has a legislated responsibility to insure that no Federally-listed species suffers a substantial decline through the Service's action or its lack of action and to undertake conservation programs for each such species within areas under its jurisdiction. It also is responsible for providing support for interagency recovery team efforts. There is, therefore, a special need for research and assessment of the status of endangered and threatened species and for instituting monitoring efforts. There also is a need to carry out the mandates of approved recovery plans.

It is necessary therefore to conduct and maintain an assessment of the status of each listed species. Certain species, because of uncertainty as to their status, declining populations or special management requirements, require additional attention. These high priority species include the Cape Sable sparrow, loggerhead sea turtle, Florida panther, West Indian manatee and American crocodile. Activities required for these species differ. For the Cape Sable sparrow, distributional surveys must be completed and a recovery plan completed. For the loggerhead sea turtle, a reassessment of nesting population status is needed. For the Florida panther, additional information on distribution and numbers is needed. For the manatee, a monitoring technique needs to be perfected and a management report written. For the crocodile, it is necessary to determine its status and assess potential constraints on recruitment and population growth.

OBJECTIVES: Provide the assessment, research and monitoring required to conserve endangered and threatened animal populations in the national parks of south Florida. Provide management recommendations for the preservation of these species and their ecosystems. Maintain endangered species data bases.

PROJECT SCHEDULE - FY 81

1. Maintain the official list and data bases on endangered and threatened animal species in south Florida national parks.
2. Complete Cape Sable Sparrow Recovery Plan. Publish as a Management Report and submit to U.S. Fish and Wildlife Service.
3. Pending availability of funds, conduct distribution surveys for endangered Cape Sable sparrow from April to May. Write 3-year distribution status report. Maintain data base.



4. Conduct weekly aerial surveys of loggerhead turtles nesting on the primary rookeries at Cape Sable and Highland Beach from May to September. Write Technical Report on present status of sea turtle nesting in Everglades National Park.
5. Conduct surveys of Florida panther in National Park Service areas and vicinity. Write Technical Report on status of Florida panther in National Park Service areas.
6. Conduct monthly aerial surveys of West Indian manatee in estuaries of Everglades National Park. Write Management Report on the protection needs of manatees in Everglades National Park.
7. For the American crocodile:
  - a. Monitor success of known nest sites.
  - b. Write report on nesting biology of crocodiles in Everglades National Park (M.S. Thesis of P. Patty, Univ. Florida).
  - c. Write Technical Report on the distribution of crocodiles in Everglades National Park.
  - d. Continue to study recruitment into breeding population, locate and determine growth rates and habitat use of the 1 to 6 year age classes in main study area (Taylor River, Little Madeira Bay, Joe Bay).
  - e. Collect food samples from captured animals. Determine food availability in habitats of crocodile use. Determine digestive rate and efficiency of crocodiles at different temperatures. Use those data to write report on seasonal food needs of crocodiles.
  - f. Conduct weekly radio tracking of crocodiles and alligators from fixed wing aircraft, concentrating in major study areas.
  - g. Adopt a statistic for estimating population size using capture, recapture and sighting data. Assess population data for applicability in developing a model of population dynamics.
  - h. Analyze the genetic identity of park animals through electrophoretics, in collaboration with Dr. R. Menzies.
8. Submit annual project report.

Personnel

Research Wildlife Biologist (Kushlan), GS-12, 30 m.d.	\$ - 0 -*	
Wildlife Biologist (Bass), GS-9, 260 m.d.	- 0 -*	
Wildlife Biologist (Mazzotti), GS-7, 260 m.d.	14,768	
Park Technician, Wildlife, GS-5, 91 m.d.	( 4,140)**	
Night differential, 1248 hours	<u>1,997</u>	
		\$ 16,765

Travel

Wildlife Society Meeting	\$ 450	
FL Ornithological Society Meetings (2)	300	
Panther Recovery Team Meeting	300	
Crocodile Recovery Team Meeting	300	
Cape Sable Sparrow Consultation with State personnel, Gainesville, FL	270	
Meeting at Pennsylvania State University, PA (Doctoral dissertation, Mazzotti)	400	
Meeting at University of Florida (Doctoral dissertation, Patty)	<u>200</u>	
		2,220

Services

Aircraft: Helicopter, 52 hr @ \$160	\$ 8,320	
Helicopter, 54 hr @ \$160	( 8,640)**	
Fixed-wing: 262 hr @ \$45	<u>11,790</u>	
		\$20,110
Computer:	- 0 -	
Contract:	- 0 -	
Other: Publications-related costs	\$ 1,200	
Crocodile electrophoretic analysis	2,000	
Illustrations/drafting	<u>1,000</u>	
		<u>4,200</u>
		24,310

Supplies

Radio telemetry supplies	\$ 2,000	
Field supplies	350	
Boat supplies	700	
Crocodile capture and tagging supplies	300	
Crocodile food requirement supplies	<u>549</u>	
		3,899

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Van (PN50183), 100%	\$ 1,400	
17' Mako (PN52043), engine (PN52968) and trailer (PN52044), 75%	585	
13' Whaler (PN50035), engine (PN54280) and trailer (PN50036), 50%	275	
Honda ATCs (2), PN54808, 09), 100%	<u>400</u>	
		2,660

Motorized Equipment Operation

Fuel: Van (PN50183), 10500 mi/811 gal	\$ 1,540	
115 hp engine (PN52968), 350 hr/ 1751 gal	3,327	
40 hp engine (PN54280), 66 hr/198 gal	376	
Honda ATCs (PN54808,09), 50 hr/10 gal	<u>19</u>	
		\$ 5,262
Maintenance:		
Van, 100%	\$ 75	
17' Mako, engine and trailer	75	
13' Whaler, engine, and trailer	50	
Honda ATCs, 100%	<u>84</u>	
		<u>284</u>
		<u>5,546</u>

TOTAL PROJECT COST \$ 55,400

\* salaries of all permanent personnel are included in the Budget Summary for Research Administration

\*\* non-add entries representing Cape Sable Sparrow monitoring costs; priority #2 if additional funds available in FY 81

PROJECT TITLE: Wading Bird Studies

PRINCIPAL INVESTIGATOR: James A. Kushlan

PROBLEM STATEMENT: Management of water conditions in south Florida parks to preserve biological processes is one of the most critical and fundamental resource management problems facing the National Park Service in southern Florida. Wading birds, one of the foremost wildlife resources of south Florida national parks have suffered substantial population decreases in recent years. These birds are among the reasons for the establishment of Everglades National Park and continue to dominate visitor interest because of their size and showiness, and because of public awareness of and concern for their conservation problems. Most importantly, they are necessary for the natural function of the aquatic ecosystems and especially play a vital role in the pathways of energy flow within the Everglades.

The southern Everglades was once a primary foraging habitat for most south Florida wading birds during nesting. However, these populations have decreased markedly in recent years, and nesting failure has become frequent. Within Everglades National Park, this population reduction has been accentuated by a shift of a large number of the remaining birds to other areas of south Florida for nesting. The decreases and shifts in bird populations in the past decade appear to be in response to changes in food availability. This implies that the southern Everglades, the Shark Slough ecosystem, that traditionally supported these species is now relatively inferior to other areas of south Florida and that the system is no longer preserved in its natural state.

The shifts in wading bird nesting is related to their use of foraging habitat and to environmental changes within the park and neighboring areas. Birds that attempt to nest at colonies near Shark Slough fluctuate in numbers yearly and are subjected to repeated nesting failure, apparently caused by adverse water conditions. As has been demonstrated for the Wood Stork, these conditions are probably related in part to water management. These species then, although themselves worthy of concern because of their decreasing status in the park, are tools useful in providing an understanding of the relation of water management to biological processes in the aquatic ecosystems managed by the National Park Service.

OBJECTIVES: Assess and monitor the status of wading bird populations in south Florida park areas and determine the relation of environmental conditions, especially those affected by water management, to wading bird numbers, foraging success, and nesting success in south Florida.

PROJECT SCHEDULE - FY 81:

1. Assess the present status of wading birds nesting in and near south Florida national parks by conducting fixed-wing surveys of Park

Service colonies during the spring-summer nesting season, by conducting annual helicopter and ground censuses of park area colonies, and by conducting an annual fixed-wing survey throughout south Florida at peak nesting. Maintain colonial bird index. Prepare annual Technical Report on status of wading bird populations.

2. Determine and write report on the numbers of wading birds using south Florida in winter by conducting a fixed-wing census.
3. Study the use of Shark Slough for foraging by wading birds in relation to seasonal water conditions by conducting monthly fixed-wing censuses during drying and early wet season.
4. Examine the relationship of water conditions to foraging effectiveness of wading birds by observational study.
5. Analyze and write report on the food habits of 4 species of herons during nesting.
6. Analyze and write report on nesting success of 4 species of herons in relation to water conditions. If dry season is not abnormally wet, determine nesting success, survival and growth rates of herons in Everglades colonies. Determine feeding sites used and prey available at these sites.
7. Submit annual project report.

FY 81  
BUDGET SUMMARY: WADING BIRD STUDIES

16a

Personnel

Wildlife Research Biologist (Kushlan), GS-12, 70 m.d.	\$ - 0 -*	
Wildlife Biologist (Frohling), GS-7, 260 m.d.	14,768	
Biolog. Technician (Wildlife), GS-5, 260 m.d.	<u>11,960</u>	
		\$ 26,728

Travel

American Ornithologists Union Meeting, 8/81	\$ 500	
FL Ornithological Society Meeting, 4/81	200	
Wading Bird Conference, 9/81	<u>500</u>	
		1,200

Services

Aircraft: Helicopter, 68 hrs @ \$160	\$10,880	
Fixed-wing, 162 hrs @ \$45	<u>7,290</u>	
	\$18,170	
Computer:	- 0 -	
Contract:	- 0 -	
Other:		
Publication-related costs	\$ 2,670	
Airboat rental, 10 days @ \$120	1,200	
Statistical consultation	1,000	
Software development	2,000	
Key-punching	<u>3,000</u>	
	6,870	
		28,040

Supplies

Maps, slide development, charts, film	\$ 300	
Bottles, laboratory supplies	300	
Nets	300	
Tagging materials	500	
Capture equipment	300	
Miscellaneous field supplies	<u>137</u>	
		1,837

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Van (PN50166), 100%	\$ 718	
17' Mako (PN52043), engine (PN52968) and trailer (PN52044), 15%	117	
13' Whaler (PN50035), engine (PN54280) and trailer (PN50036), 50%	275	
Airboat hull (new), 20%	<u>144</u>	
		1,254

FY 81

BUDGET SUMMARY: WADING BIRD STUDIES (continued)

16b

Motorized Equipment Operation

Fuel: Van, 9300 mi/715 gal	\$ 1,359	
115 hp Engine, 65 hr/325 gal	618	
40 hp Engine, 52 hr/156 gal	296	
Airboat engine (PN14291), 96 hr/576 gal	<u>1,152</u>	
		\$ 3,425
Maintenance:		
Van, 100%	\$ 396	
17' Mako, trailer and engine	35	
13' Whaler, trailer and engine	35	
Airboat hull and trailer (new) and engine (PN14291)	<u>50</u>	
		<u>516</u>
		<u>3,941</u>
TOTAL PROJECT COST		<u>\$ 63,000</u>

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration



PROJECT TITLE: Alligator Study

PRINCIPAL INVESTIGATOR: James A. Kushlan

PROBLEM STATEMENT: Management of the water conditions in south Florida parks to preserve biological processes is one of the most critical and fundamental resource management problems facing the National Park Service in south Florida. The American alligator is the dominant organism of the Everglades. It is the top predator of the system and impacts the population levels of aquatic organisms that comprise its prey. Alligators alter and maintain Everglades habitat. They influence the development of plant communities by creating trails, digging dens, and constructing nest mounds, which afford high ground for other animals. During the dry season aquatic organisms concentrate in alligator ponds and are eaten by predators such as wading birds that breed at this time. Thus their pond maintenance activities are critical to preserving the natural ecological function in the southern Everglades.

Because of their dominating influence, alligator populations must be maintained to perpetuate the biological function of the Everglades. Hydrologic conditions affect alligators directly. During nesting, elevation of water levels, including that caused by discharge, can flood alligator nests and decrease production. Alligators appear to depend on certain water conditions for courtship, mating, and nesting. Predation during low water may nearly eliminate year classes. Canals concentrate alligators artificially in the dry season which may result in increased predation on small size classes and siphoning of alligators from the marsh to the canal. As a result, ponds may not be maintained with subsequent impact on other components of the Everglades system.

Developing a management strategy for maintaining a biologically sound hydrological regime within Shark Slough requires knowledge of the relation of water conditions to alligator biology, to wildlife populations dependent on alligators, and to the ecologic role played by alligators in the Everglades. As a threatened species subject to legal and illegal hunting, alligator population levels must be known with sufficient precision to allow assessment of the existence, direction, and causes of population changes.

OBJECTIVES: Determine the role of water conditions in maintaining alligator populations in Shark Slough. Determine the ecological role of this species in the Everglades, especially in relation to water conditions. Develop a technique to monitor population levels of this threatened species.

PROJECT SCHEDULE - FY 81:

1. Continue long-term monthly census of alligators in L-67 canal.
2. Maintain data base and provide material and training for problem alligator control program.



3. Continue to study relation of water conditions to population levels, conduct monthly capture and tagging study of alligators in the main Everglades study area and for 3 consecutive months in spring in the estuary study area. Update computerized data base and analyze and write report on population parameters from Everglades study area.
4. Continue to study relation of water conditions to alligator movements and interactions, observe alligator behavioral interactions at a natural pond site, locate radio telemetered animals once per week in 2 main study areas, conduct more intensive telemetry during courtship, hatching, dry season and times of rapid water level changes.
5. Continue to study alligator impacts, document, by aerial photography, physical changes in ponds in main study area.
6. Analyze and write report on food of alligators. Determine food preference and requirements using captive animals.
7. Continue to study the relation of water conditions to nesting success, locate, measure, determine timing and nesting success of all nests in main Everglades and estuary study areas. Do same for all nests visible from air in 4 other Everglades study areas. Document changes to and effects on vegetation of all old nest sites in 2 main study areas. Determine relation of water conditions to timing of nesting from embryos collected from nests over 3 years.
8. Submit annual project report.

Personnel

Research Wildlife Biologist (Kushlan), GS-12, 70 m.d.	\$ - 0 -*	
Wildlife Biologist (TERM-Patterson), GS-7, 254 days	15,600	
Wildlife Biologist, GS-7, 260 m.d.	14,768	
Night Differential, 1660 hours	<u>2,324</u>	\$ 32,692

Travel

Meeting with FL Game & Fish Commission and U.S. Fish & Wildlife Service personnel		300
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Services

Aircraft: Helicopter, 30 hrs @ \$160	\$ 4,800	
Fixed-wing, 22 hrs @ \$45	<u>990</u>	
	\$ 5,790	
Computer:	750	
Contract:	- 0 -	
Other:		
Publication-related costs	\$ 1,000	
Statistical consulting	1,700	
Software development	2,700	
Illustrations/drafting	<u>1,500</u>	
	<u>6,900</u>	13,440

Supplies

Radio-telemetry supplies	\$ 4,000	
Airboat supplies	700	
Tags	250	
Aerial Photos, lighting supplies	300	
Alligator capture supplies	200	
Nuisance alligator supplies	<u>301</u>	
		5,751

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Van (PN54424), 100%	\$ 1,520	
17' Mako (PN52043), trailer (PN52044 and engine (PN52968), 10%	78	
Airboat hull (new), 70%	<u>504</u>	
		2,102

FY 81

BUDGET SUMMARY: ALLIGATOR STUDY (continued)

18b

Motorized Equipment Operation

Fuel: Van (PN54424), 13000 mi/1000 gal	\$ 2,000	
115 hp engine (PN52968), 24 hr/120gal	216	
Airboat engine (PN14291), 272 hr/ 1632 gal	<u>3,264</u>	\$ 5,480
Maintenance:		
Van, 100%	\$ 100	
17' Mako, engine, and trailer, 10%	40	
Airboat hull and trailer (new), 70%	<u>95</u>	
		<u>235</u>
		<u>5,715</u>
TOTAL PROJECT COSTS		<u>\$ 60,000</u>

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\* salaries for all permanent personnel are included in the Budget Summary for  
Research Administration

**PROJECT TITLE:** Freshwater Fish Studies

**PRINCIPAL INVESTIGATOR:** James A. Kushlan

**PROBLEM STATEMENT:** Management of water conditions in south Florida parks to preserve biological processes is one of the most critical and fundamental resource management problems facing the National Park Service in south Florida. Freshwater fish populations are important links in the food chain of the freshwater ecosystems of south Florida. Densities of fish populations respond directly to seasonal and annual changes in water conditions. Water levels and water management procedures appear to influence composition, standing crop, sizes, growth and reproduction of the fishes and, especially, their availability as prey to other components of the food chain such as wading birds and alligators. Thus, understanding the relation of Everglades fishes to water conditions is required to achieve biologically sound water management of the southern Everglades.

Current water management practices may affect fish communities in several ways. The legislated mandate requiring that Everglades National Park accept all discharge when water in the Conservation Areas exceed scheduled levels can result in localized rapid water level rises and in extended periods of high water. Elevation of water level disperses wading bird feeding concentrations and appears to inhibit their nesting. The direct cause of this is thought to be changes in fish density. Extended periods of high water of several years duration cause the fish community to undergo changes from that characteristic of a marsh environment to that more characteristic of a lake environment. Such changes may significantly alter ecosystem function. Canals provide artificial refugia from predators, and levees may interrupt the dry season movement of fish toward areas where they become available to park wildlife. The levee-canal system on the border of the park may accentuate the impact of natural rainfall events on fish density and dry season concentration patterns, and so affect other food chain components.

The natural biological structure of the fish community is also threatened by the invasion of exotic species, particularly the black acara and walking catfish. The distribution and potential impact of these species need to be determined, as does the natural functioning of the fish community without their presence.

**OBJECTIVES:** Determine the relation between water conditions and the freshwater fish community. Determine the composition of freshwater fish communities and examine the effect of water level fluctuations and exotics on their biology and standing crop.

**PROJECT SCHEDULE - FY 81:**

1. Publish paper on fish fauna and biogeography of the freshwater fishes of south Florida.

2. Publish paper on throw-trap sampling technique.
3. Conduct monthly sampling at 2 long-term monitoring sites in Shark Slough. Conduct monthly sampling at 6 Everglades sites having different water regimes. Prepare technical report on lengths, weights and seasonal condition of Everglades fishes.
4. Analyze the relation of environmental parameters to the reproduction and growth of Everglades fishes. Write paper on reproductive cycles of livebearers and sunfish. For 4 species in which growth is not analyzable by currently used methods, contract a study on the use of otoliths to determine growth patterns.
5. Collect exotic fishes in canals and borrow pits to analyze food habits, reproductive cycle, and ecological role. Collect data on range expansions of exotics.
6. Analyze food habits and write papers on food habits of selected groups of Everglades fishes.
7. Submit annual project report.

Personnel

Research Wildlife Biologist (Kushlan), GS-12, 30 m.d.	\$ - 0 -*	
Fishery Biologist (Loftus), GS-9, 254 m.d.	19,463	
Biological Technician, Fisheries, GS-5, 260 m.d.	<u>11,960</u>	\$ 31,423

Travel

FL State Museum, Gainesville, FL	300	
Meeting with Otolith contractor	<u>400</u>	700

Services

Aircraft: Helicopter, 72 hrs @ \$160	\$11,520	
Computer:	- 0 -	
Contract: Otolith Analysis	8,000	
Other:		
Publication-related costs	\$ 1,500	
Data key-punching	3,000	
Statistical consultation	1,000	
Software development	2,000	
Illustrations/drafting	<u>3,125</u>	
	<u>10,625</u>	30,145

Supplies

Chemicals	\$ 500	
Field supplies	320	
Electroshocking and boat supplies	<u>300</u>	1,120

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Truck (PN52175), 100%	\$ 901	
AB Engine (PN14291), 10%	<u>72</u>	973

Motorized Equipment Operation

Fuel: Truck (PN52175), 10000 mi/667 gal	\$ 1,267	
AB Engine (PN14291), 48 hr/288 gal	<u>576</u>	
	\$ 1,843	
Maintenance:		
Truck, 100%	\$ 100	
Airboat trailer, hull and engine	<u>96</u>	
	<u>196</u>	
		<u>2,039</u>
TOTAL PROJECT COST		\$ 66,400

\* salaries of all permanent personnel are included in the Budget Summary for  
Research Administration

PROJECT TITLE: Estuarine Fish Studies

PRINCIPAL INVESTIGATORS: Gary E. Davis, and Thomas W. Schmidt

PROBLEM STATEMENT: In addition to being large and significant natural ecosystems worthy of national park status and protection, the estuaries in Everglades National Park and Biscayne National Monument support significant portions of Florida's most valuable fisheries. Juvenile pink shrimp and spiny lobsters use these estuaries as nurseries. Stone crabs inhabit these areas both as juveniles and adults. Mullet and nearly all of the popular gamefish sought by recreational fishermen in southern Florida are estuarine dependent.

Some, if not all, of the estuaries in the park are threatened by human activities. The primary threats appear to be disrupted freshwater flow in the Shark and Taylor Sloughs, and changes in the circulatory pattern of water in Florida Bay and adjacent areas. The entire watershed of southern Biscayne Bay has been altered by urbanization and agricultural development. Relative to these areas, the estuarine portion of the Big Cypress drainage and the Gulf of Mexico coastal waters in Everglades National Park could be considered natural and undisturbed.

In addition to these physical threats to the estuaries, the removal of fishery resources from them is encouraged by National Park Service policy. Fishing is considered a compatible use of park resources as long as the harvest is completely replaced by natural reproduction. Both Everglades National Park and Biscayne National Monument support extensive commercial and recreational fisheries. The commercial net fisheries tend to concentrate on herbivorous and omnivorous species at the base of the food web, such as mullet and pink shrimp, while the trap fisheries remove large percentages of middle and higher level carnivores such as blue crabs, stone crabs and spiny lobsters. The recreational fisheries also tend to concentrate on fishes high in the food web such as snook, spotted seatrout, red and black drum, groupers, and snappers. The selective removal of these higher carnivores may be causing disruptions in the ecosystem far beyond the mere removal of their biomass.

OBJECTIVES: This project will determine the effects of water quality on the abundance, size, growth and reproduction of mullets, Mugil curema, and M. cephalus, spotted seatrout, Cynoscion nebulosus, gray snapper, Lutjanus griseus, and sharks, Negaprion brevirostris, Sphyrna tiburo, Carcharhinus leucas and C. limbatus in northern Florida Bay, Whitewater Bay, and the Shark River Estuary, and provide seasonal information on the population dynamics of these species. Water quality is defined for this project as salinity, temperature, turbidity, pH, dissolved oxygen, total carbon (dissolved and suspended particulate), total nitrogen, and total phosphorus.



PROJECT SCHEDULE - FY 81:

1. Establish three transects across the salinity gradient in the Shark River-Whitewater Bay estuary and northern Florida Bay. Each transect will consist of three sampling sites representing low, moderate, and high salinities. The sites will be located: in Tarpon Bay, central Whitewater Bay, and Ponce de Leon Bay on the Whitewater Bay transect; in Seven Palm Lake, west of Sapphire Keys, and in Whipray Basin on the north central Florida Bay transect; and in Taylor River, in Little Madeira Bay, and east of the Black Betsy Keys on the northeast Florida Bay transects.
2. Estimate seasonal abundance and size of spotted seatrout and gray snapper using catch per unit of effort with trawls, gill and trammel nets, traps, and hook and line.
3. Estimate seasonal abundance and size of mullets using catch per unit of effort with gill, trammel and cast nets, and bag seines.
4. Estimate seasonal abundance and size of sharks using catch per unit of effort with gill nets, trammel nets and longlines.
5. Ascertain the seasonality of reproduction, fecundity and size of first maturity of spotted seatrout, mullets, and sharks.
6. Measure growth rates of gray snapper, spotted seatrout, and mullets using the scale technique.
7. Estimate growth rates of mullets and sharks using the Peterson length distribution technique.
8. Obtain seasonal knowledge of white mullet, gray snapper, spotted seatrout, and shark food habits by gut inspections.
9. Pending availability of funds, let contract to investigate relationship of salinity to survival of select fish species. Conduct laboratory test of salinity tolerances for juvenile forms of fishes utilizing estuaries.
10. Prepare an annual report summarizing the results of fiscal 1981 sampling at the nine sites on Shark River-Whitewater Bay and northern Florida Bay transects.



FY 81  
BUDGET SUMMARY: ESTUARINE FISH STUDIES

22a

Personnel

Marine Research Biologist (Davis), GS-12, 99 m.d.	\$ - 0 -*	\$ - 0 -*	
Marine Biologist (Schmidt), GS-9, 260 m.d.	- 0 -*	- 0 -*	
Biological Technician, Fisheries (Thue), GS-6, 240 m.d.	- 0 -*	- 0 -*	
Biological Technician, Fisheries, GS-7, 260 m.d.		14,768	
Biological Technician, Fisheries, GS-7, 260 m.d.		14,768	
Night Differential		1,000	
Overtime		<u>1,500</u>	
			\$ 32,036

Travel

American Fisheries Society (or ERF Biennial)		\$ 700	
GERS Regional Meeting		<u>200</u>	
			900

Services

Aircraft:		\$ - 0 -	
Computer:		- 0 -	
Contract: Salinity/ Fish Physiology Studies		(60,400)**	
Other:			
Drafting and photo processing	\$ 1,100		
Publication-related costs	2,000		
Data key-punching	<u>2,600</u>		
		<u>5,700</u>	
			5,700

Supplies

Flexible diskettes		\$ 100	
Office supplies		170	
3M R/P paper (for fish scale prints)		300	
Slides and envelopes for fish scale impressions and storage		400	
Preservatives, dissecting tools, and bags for fish stomach analyses		850	
Field supplies for fish sampling and labeling		300	
Fish tags and tagging materials		2,120	
Fishing materials (nets, hooks, line)		1,485	
Shark set lines		250	
Boat supplies		250	
Fuel for BISC 175 hp engine (PN54995)		<u>344</u>	
			6,569

FY 81

BUDGET SUMMARY: ESTUARINE FISH STUDIES (continued)

22b

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Van (PN50199), 100%	\$ 1,833	
20' Boat (PN50145), trailer (PN50146) and engine (PN54477), 100%	1,480	
Monroe Calculator (PN12391)	263	
Dictating Machine IPN14149)	18	
Calculator (PN54268)	<u>50</u>	
		3,644

Motorized Equipment Operation

Fuel: Van (PN50199), 8000 mi/727 gal	\$ 1,381	
150 hp Engine (PN54477), 400 hr/ 2000 gal	<u>3,800</u>	
		\$ 5,181

Maintenance:

Van	\$ 10	
150 hp engine (PN54477)	972	
Boat (PN50145) and trailer (PN50146)	<u>88</u>	
		<u>1,070</u>

6,251

TOTAL PROJECT COST

\$ 55,100

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration

\*\* non-add entry; priority #4 if additional funds available in FY 81

**PROJECT TITLE:** Estuarine Crustacean Studies

**PRINCIPAL INVESTIGATORS:** Gary E. Davis and Deborah A. White

**PROBLEM STATEMENT:** Crustacean populations are critical links in the detritus based food chains of Everglades National Park estuaries. They are frequently the first level of macroscopic consumers, and in turn, provide food for many other estuarine predators. Many of the crustaceans found in the park are dependent on estuarine water conditions for part or all of their life cycles. Portunid crabs, such as the blue crab (Callinectes sapidus) and the ornate crab (C. ornatus) are capable of completing their life cycles within park waters. Under natural conditions, penaeid shrimp utilize park estuaries only as post-larvae and juveniles, migrating offshore to spawn and enter Florida's major commercial fishery near the Dry Tortugas. Two decapod crustaceans, pink shrimp (Penaeus duorarum) and blue crabs, represent these two patterns of estuarine dependence, support valuable commercial fisheries, are biologically well known, and are very abundant in the park. These two species may be used as indicators of biological conditions and to reflect changes in ecological processes occurring in park estuaries.

Park estuaries are threatened by a number of human activities. Fishery harvest, boating activity, pesticide contamination, and altered freshwater inflow all have considerable potential to disrupt the essential primitive natural conditions for which the park was established to protect. Fishery harvest has been monitored in the park since 1959, and as presently managed, does not appear to threaten future productivity of exploited stocks. The ecological impacts of fishery harvest on natural predators or by altering food webs are generally unknown. Boating activity is negatively correlated with both specific and general catch rates by recreational fishermen, but the extent to which these observations reflect habitat destruction, reduced populations, or disturbance is unknown. During the past 10 years, all of the investigations of pesticides in biota and sediments in park estuaries found no significant contamination. Extensive applications of pesticides continue on agricultural fields in park watersheds, and for mosquito control in marshes adjacent to park waters. Agricultural, suburban, and urban development in historical park watersheds, and subsequent water management activities to provide water supplies and flood protection for these developments, have altered natural freshwater inflows to park estuaries. The extent to which these alterations have occurred or affected ecological processes and biological productivity in park estuaries are unknown. Management of water conditions in the southern Everglades to preserve ecological processes is one of the most critical and fundamental resource management problems facing the National Park Service in south Florida.

**OBJECTIVES:** This project will determine the effects of water quality on the abundance, size, growth, and reproduction of pink shrimp, Penaeus duorarum, and blue crab, Callinectes sapidus, in the Shark River-Whitewater Bay estuary and in northern Florida Bay, and provide seasonal

information on the population dynamics of those two species. Water quality for this project is defined as salinity, temperature, turbidity, pH, dissolved oxygen, total carbon (dissolved and total particulate), total nitrogen, and total phosphorus.

#### PROJECT SCHEDULE - FY 81:

1. Establish three transects across the salinity gradient in the Shark River-Whitewater Bay estuary and northern Florida Bay. Each transect will consist of three sampling sites representing low, moderate, and high salinities. The sites will be located: in Tarpon Bay, central Whitewater Bay, and Ponce de Leon Bay on the Whitewater Bay transect; in Seven Palm Lake, west of Sapphire Keys, and Whipray Basin on the northcentral Florida Bay transect; and in Taylor River, in Little Madeira Bay, and east of the Black Betsy Keys on the northeast Florida Bay transect.
2. Estimate seasonal abundance and size of juvenile and adult pink shrimp using catch per unit effort with roller-frame trawls.
3. Estimate seasonal abundance and size of juvenile and adult blue crabs using catch per unit effort with traps and roller-frame trawls.
4. Investigate seasonality of reproduction, fecundity, and size at first maturity of pink shrimp using roller-frame trawl caught shrimp.
5. Investigate seasonality of reproduction, fecundity, and size at first maturity of blue crabs using trap catches.
6. Investigate seasonal food habits of juvenile and adult pink shrimp and blue crabs by gut analysis.
7. Estimate growth rates of juvenile and adult pink shrimp and blue crabs using the Peterson Length Frequency technique.
8. Estimate seasonal abundance, size, and growth of post larval shrimp and larval crabs using catch per unit of effort with plankton nets.
9. Measure salinity, water temperature, pH, dissolved oxygen, and turbidity diurnally twice each quarter at each sampling site.
10. Measure nutrient concentrations at each sampling site twice each quarter.
11. Measure monthly rainfall at each sampling site.
12. Prepare and submit for publication a paper on the food habits of the pink shrimp.
13. Prepare an annual report summarizing the results of fiscal 1981 sampling at the nine sites on the three transects in the Shark River-Whitewater Bay estuary and Florida Bay.

Personnel

Marine Research Biologist (Davis), GS-12, 161 m.d.	\$ - 0 -*	
Oceanographer (TERM-White), GS-9, 208 m.d.	15,652	
Physical Sciences Technician, GS-5, 260 m.d.	11,960	
Physical Sciences Technician, GS-5, 260 m.d.	11,960	
Supplemental pay - regular and over-time	2,000	
Night differential	<u>1,000</u>	
		\$ 42,572

Travel

Estuarine Research Foundation Meeting		700
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Services

Aircraft:	\$ - 0 -	
Computer:	- 0 -	
Contract: Nutrient Analysis	1,600	
Other:		
Publication-related costs	\$ 400	
Instrument repair services	<u>1,000</u>	
		<u>1,400</u>
		3,000

Supplies

Laboratory equipment	\$ 251	
Electronic equipment	300	
Boat supplies	300	
Construction supplies	1,600	
Maintenance supplies for electronic equipment	400	
Plankton nets (504 mesh)	900	
Crab traps	2,700	
Rain gauges	400	
Buoys and line	250	
Crab bait	<u>750</u>	
		7,851

Capitalized Equipment

Salinometer (replacement)	\$ 2,600	
Microscope (compound)	<u>1,000</u>	
		3,600

Amortized Equipment Costs

Van (PN50200), 90%	\$ 1,390	
20' boat, trailer, and engine (new), 100%	1,650	
Water Quality Monitors (PN54819-25, 54289-95)	3,000	
Microscope (new)	<u>100</u>	
		6,140

Motorized Equipment Operation

Fuel: Van (PN50200), 9000 mi/692 gal	\$ 1,315		
150 hp engine (new), 400 hr/2000 gal	<u>3,800</u>		
		\$ 5,115	
Maintenance:			
Van	\$ 31		
150-hp engine	817		
20' boat and trailer	<u>74</u>		
		<u>922</u>	
			<u>6,037</u>
 TOTAL PROJECT COST			 <u>\$ 69,900</u>

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration



PROJECT TITLE: Coral Reef Studies

PRINCIPAL INVESTIGATORS: James Tilmant and Richard Curry

PROBLEM STATEMENT: The reef study is needed to provide management recommendations for protecting the coral reefs in Biscayne NM from adverse impacts of human activities. A major natural resource of the Monument is its tropical coral reefs. These reefs comprise the approximate northern limit of coral reefs along the mainland coast of the Western Hemisphere. They are a fringe population and, therefore, are under natural stresses aside from any that may be imposed by man's activities. However, the coral reefs in Biscayne National Monument and the adjacent John Pennekamp State Park support a multitude of recreational activities. These activities are undoubtedly resulting in additional stress. Knowledge of the impacts of various recreational activities is of utmost importance in attempting to manage and insure preservation of these reefs.

Physical damage to corals has been observed on many reefs within Biscayne National Monument. This damage is believed to stem from the dragging of boat anchors across sections of reef and from visitors touching or climbing onto corals while snorkeling or scuba diving. The level of visitor use and types of recreational activities known to be occurring on the Monument's reefs (through prior visitor activity studies) indicate additional impacts in terms of disturbance of organisms, disruption of fish behavior patterns or changes in ecological balances may also be occurring. The question of coral-reef survival under heavy recreational pressure has also been a concern of investigators working at John Pennekamp State Park. The possible impact of human activity on Florida's coral reefs was documented several years ago during a coral reef workshop held in Miami (October, 1974).

Surface symptoms of ecological deterioration of the coral reef tract are limited to such qualitative indices as a decline in fish catches or obvious increases in water turbidity. Comprehensive surveys have not been made of the park's reefs to establish "normal" or "natural" conditions as a benchmark from which the extent of any deterioration can be scientifically expressed. In addition, the desire to provide interpretation of coral reef ecosystems and directed opportunities for park visitors to view this fascinating tropical marine environment dictate the need for additional knowledge of possible impacts.

OBJECTIVES: Determine the effects of human activities on selected coral reefs in Biscayne National Monument and establish procedures for long-term monitoring of the reef ecosystem. Document physical changes in the reef structure and the chemical perturbations in its surrounding marine environment which are associated with human activities. Document biological trends in the reef ecosystem that are attributable to human activities.



PROJECT SCHEDULE - FY 81:

1. Conduct surveys of reef fish populations on each study reef during the fall, spring, and summer periods.
2. Conduct comparative surveys of reef fish populations on a historically heavily used park reef and on deep water outer reefs.
3. Conduct surveys of coral damage on each study reef during winter and summer periods.
4. Conduct sampling of macro algal communities and selected invertebrate populations during the fall and spring periods.
5. Conduct a monthly collection of selected species of coral for analysis of reproductive activity.
6. Conduct an annual survey of previously established coral line transects and sample quadrats, and analyze data for change.
7. Photograph all established photo plots to document coral growth, recruitment, and other change.
8. Conduct reef plankton population surveys during fall, spring, and summer periods.
9. Document human activity that is potentially influencing the reefs selected for study.
10. Document the occurrence of coral diseases.
11. Document water currents flowing around and over the study reefs and analyze in relation to chemical, physical and biological parameters monitored. Evaluate current data for indication of major flow patterns over the reef area and in relation to potential threats to the reef system.
12. Document at least once monthly the chemical and physical characteristics of the water (including salinity, conductivity, pH, turbidity, dissolved oxygen, nitrogen, phosphorus, and ammonium) at each study reef.
13. Produce a publishable report summarizing observations of coral damage.
14. Produce a publishable report summarizing investigations of reef invertebrate populations.
15. Produce an interim progress report on monitoring of physical and chemical water parameters.

16. Produce an interim progress report on investigations of reef plankton.
17. Produce final technical report summarizing all investigations of sponge reproduction and recruitment.

Personnel

Management Biologist (Tilmant), GS-11 100 m.d.	\$ - 0 -*	
Oceanographer (TERM-Curry), GS-9, 254 m.d.	19,032	
Park Technician, GS-5, 180 m.d.	8,280	
Park Technician, GS-5, 180 m.d.	8,280	
Park Technician, GS-4, 180 m.d.	7,380	
Park Technician, GS-3, 96 m.d.	<u>3,495</u>	\$ 46,467

Travel

Florida Field Biologists Meeting	\$ 200	
Coastal and Estuarine Research Conference	<u>400</u>	600

Services

Aircraft:	\$ - 0 -	
Computer:	- 0 -	
Contract:	- 0 -	
Other:		
Thermograph rental	\$ 700	
Photographic services	150	
Publication-related costs	<u>500</u>	
	<u>1,250</u>	1,250

Supplies

Diving equipment (repair/replacement)	\$ 400	
Laboratory supplies	113	
Computer diskettes	40	
Compressor parts and repair, boat supplies	400	
Hydro lab parts and maintenance	<u>500</u>	1,453

Capitalized Equipment

Compressor (replacement)		700
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Amortized Equipment Costs

23' boat (PN52048), trailer (PN52049) and 175 hp engine (PN54995)		1,650
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Motorized Equipment Operation

23' boat, trailer, and engine, 310 hrs/2170 gal**		<u>2,880</u>
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TOTAL PROJECT COST		<u>\$ 55,000</u>
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\* salary for Management Biologist is included in BISC operating budget

\*\* cost estimate includes both fuel and maintenance at BISC

PROJECT TITLE: Vegetation Documentation

PRINCIPAL INVESTIGATORS: Lloyd L. Loope, Ingrid C. Olmsted, Lance Gunderson

PROBLEM STATEMENT: Vegetation patterns in South Florida are continually undergoing subtle change. Factors triggering vegetation changes include: fire, hurricanes, frosts, sea level rise, year-to-year variations in precipitation, fluctuations or alteration of the hydrologic regime, and invasion of exotic plant species. Some of these factors are due to natural causes, some are man-caused, and some (fire) are modified in frequency and intensity by man's activity. Management strategies must be developed for minimizing the adverse impacts to natural plant communities by hydrologic changes, fire, and exotic plant invasions, for protection of rare plant species, and (in Big Cypress National Preserve) for management of off-road vehicle use, grazing, and oil exploration.

We must obtain as much understanding as possible regarding cyclic or unidirectional changes in vegetation within South Florida parks as well as causes underlying these changes. We must understand the change induced by natural causes in order that impacts such as man's alteration of natural cycles of water and fire can be appreciated. An important way of obtaining this understanding is to document vegetation which exists at this point in time. This documentation must be in sufficient detail in order that it can serve as a baseline for evaluation of changes which occur through future decades as well as to determine alterations which have occurred in past decades (for which, unfortunately, baseline information is poor).

OBJECTIVES: Determine vegetation/environment relationships and establish baseline data on vegetation and flora in selected study areas as a reference point for evaluating long-term and short-term trends of change taking place in South Florida parks. Determine the impact upon native vegetation and flora caused by changes in water and fire regimes and invasion of exotic plant species. Gather necessary baseline information on rare plant species and develop appropriate strategies for preservation.

PROJECT SCHEDULE - FY 81:

Everglades National Park:

1. Complete field work and prepare technical report and publication on prairie vegetation of Everglades National Park, including distribution map of prairie vegetation types, description of vegetation-substrate and hydroperiod relationships, quantitative description of each type, and establishment of baseline quadrats.
2. Complete field work, technical report, and map of vegetation of Shark Slough.

3. Complete field work and prepare technical report on vegetation-environment relationships along transects in Long Pine Key pinelands. Analyze pineland and hammock vegetation-substrate relationships and substrate differences through dissection (using destructive excavation) of a narrow transect along a pinelands hammock ecotone.
4. Complete publication on vegetation zonation in relation to elevation, moisture, and salinity in the vicinity of Coot Bay hammock.
5. Complete and publish maps of Long Pine Key/Hole-in-the-Donut and mangrove zone of south-central Everglades National Park.
6. Complete data analysis and prepare technical report and publication on tropical hardwood hammock vegetation of Everglades National Park.
7. Continue to monitor vegetation change on bulldozed (1979) area in Hole-in-the-Donut.
8. Refine Vegetation Management Plan for Everglades National Park, drafted in FY 80.
9. Continue to inventory and monitor populations of selected rare plant species of Long Pine Key.

Fort Jefferson National Monument:

10. Prepare publication (with W. B. Robertson) on changes in the vegetation and flora of the Dry Tortugas during the past century. Gather baseline data on vegetation cover within tern colony on Bush Key along three established transects.

Biscayne National Monument:

11. Develop (assisted by J. Tilmant and BISC staff) a method for monitoring the population status of Colubrina asiatica at BISC.

Big Cypress National Preserve:

12. Complete the following work and prepare reports for each of 3 study areas (5 km x 10 km) started in FY 80 including Deep Lake Strand, Raccoon Point, and Roberts Lake Strand.
  - a. Map vegetation in as much detail as appears practical, using 1:8,000 color aerial photography.
  - b. Relate vegetation to hydroperiod and soil nature and depth along selected transects.
  - c. Update plant species list for BICY.

- d. In collaboration with the Fire Ecologist and with the aid of old aerial photography (1940, 1952, 1960, etc.), determine logging history to extent possible and determine vegetation change in recent decades. Identify areas which have not been logged.
  - e. Establish permanently marked 15 x 40 m quadrats (with smaller nested quadrats for detail of shrubs and herbaceous vegetation) to document long-term successional trends and evaluate fire impacts. In the course of the 4-year study, five 15 x 40 m quadrats per major vegetation type will be established.
  - f. Relate cypress and pine height, diameter, and age to environmental and historical factors.
  - g. Survey each study area intensively for the presence of exotic plant species and map the pattern encountered.
13. Initiate, if possible, the work described above in 5 x 10 km study areas at Lostmans Pines/Gum Slough, Bear Island and Gator Hook Strand. Complete the surveying of transects in these areas.
  14. Resample selected vegetation quadrats which burn during the course of the study to document impact of and recovery from fire.
  15. Submit annual project report.

FY 81

BUDGET SUMMARY: VEGETATION DOCUMENTATION

30a

Personnel

Research Biologist (Loope), GS-12, 70 m.d.	\$ - 0 -*	
Botanist (TERM-Olmsted), GS-9, 254 m.d.	19,032	
Botanist (TERM-Gunderson), GS-9, 254 m.d.	19,032	
Park Technician, GS-5, 180 m.d.	8,280	
Park Technician, GS-5, 180 m.d.	8,280	
Park Technician, GS-5, 180 m.d.	<u>8,280</u>	\$ 62,904

Travel

FL Field Biologists Meeting, 4/81	\$ 350	
Ft. Jefferson plant survey	100	
Other meetings related to endangered plants, exotic species, wetland ecology	<u>550</u>	1,000

Services

Aircraft: Helicopter, 52 hr @ \$160	\$ 8,320	
Computer:	- 0 -	
Contract:	- 0 -	
Other:		
Publication-related costs (including vegetation maps)	\$ 9,000	
Photographic services	400	
Data key-punching and software	<u>2,500</u>	
	<u>11,900</u>	20,220

Supplies

Quadrat poles @ \$2/10' length	\$ 1,100	
Film (photographic)	250	
Mapping supplies	650	
Laboratory supplies	<u>320</u>	2,320

Capitalized Equipment

- 0 -

Amortized Equipment Costs

Van (PN50185), 100%	\$ 1,538	
Van (PN54251), 100%	<u>1,161</u>	2,699



Motorized Equipment Operation

Fuel: Van (PN50185), 11,800 mi/843 gal	\$ 1,602	
Van (PN54251), 12,000 mi/1000 gal	1,900	
Honda ATCs (PN54274, 77), 250 hr/ 50 gal	<u>95</u>	\$ 3,597
Maintenance:		
Van (PN50185)	\$ 180	
Van (PN54251)	180	
Honda ATCs, 2 @ \$50	<u>100</u>	<u>460</u>
		<u>4,057</u>
<b>TOTAL PROJECT COST</b>		<u>\$ 93,200</u>

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\* salaries for all permanent personnel are included in the Budget Summary for  
Research Administration

PROJECT TITLE: Fire Ecology Studies

PRINCIPAL INVESTIGATOR: Dale Taylor

PROBLEM STATEMENT: Fire is an important factor in the Big Cypress National Preserve and in Everglades National Park where an average of more than 40,000 acres burn each year. Most Big Cypress fires are incendiary while Everglades fires currently are prescribed or prescribed natural fires. Everglades National Park managers have 32 years of fire management experience while Big Cypress managers have completed only one year.

Everglades National Park management is primarily based upon non-consumptive use, whereas, Big Cypress allows consumptive uses such as grazing, burning for livestock management, trapping, off-road vehicle use, hunting, hunting camps, exploration for and extraction of gas and oil, and traditional Indian use. Historically, many of these users purposely set fires in the Big Cypress and continue to do so at the present time.

Fires occur primarily in three community types: pinelands, prairies, and the cypress prairies of Big Cypress. Pinelands of Everglades National Park are cut-over forest on Miami oolite rock which have a high number of endemic plant species. They represent a 20,000 acre remnant of a once extensive pine forest. Prescribed fires are set to keep hardwoods in check and to protect the endemic plants from loss due to shading. Big Cypress pine forests are primarily small islands of pine scattered among other vegetation types on a sand substrate. They lack numbers of endemic plants found in Everglades National Park. Incendiary fires are set from November through April.

The complex of sparse sawgrass/Muhlenbergia prairie covers over 400,000 acres in the two parks. It is strongly influenced by fire with some areas burning on an annual basis. Fuels build up quickly in these prairies and fires can spread rapidly. Incendiary fires are set in Big Cypress prairies from November through May with largest acreages burning in March and April. Because fires can be extensive the Everglades fire management plan has included boundary burns to prevent fires from moving across boundaries. Frequent prairie fires caused by boundary burns and by incendiary fires may result in biological degradation of Muhlenbergia prairies, but such damage has not been documented.

Large acreages of cypress prairies occur only in Big Cypress and are burned in much the same manner as prairies. Other Big Cypress vegetation types such as cypress strands, cypress domes, mixed swamp forest, and hammock forest are potentially destroyed by fire, or else fire plays a nonsignificant role. These fire sensitive areas are normally surrounded by or are inundated by water, but during severe drought, destructive fires can occur.

The two parks have similar problems in that most fires occur during the dry season (November-April). By contrast, it is generally believed that prior to man's influence most fires occurred during the wet season (May-October) or just before the dry season when lightning occurs. Little is known about the effect of season of fire on vegetation. In addition, nothing is known of the effect of fire frequency or season of fire on species composition and nutrient cycling.

**OBJECTIVES:** Determine the optimum frequency for prescribed fire. Determine the season of year best suited for prescribed fire. Determine effects of fire on selected flora and fauna.

PROJECT SCHEDULE - FY 81:

Big Cypress

1. Continue to establish the 21 study plots in cypress prairies, prairies, and pinelands. Burn approximately 50 acres in each vegetation type during three seasons of the year and at one and three year intervals. Vegetation on each plot will be sampled before fire and at four month intervals after fire.
2. Vegetation biomass samples will be collected from 10 one-meter square subplots before fire and at four month intervals the first year post-fire. Samples will be separated into live-dead components by size and dominant species.
3. Each area will be observed for phenology and relative populations of flowering plants at weekly intervals for the first 10-weeks post-fire and at biweekly intervals for the next 10 weeks. Adjacent unburned areas will be observed on a monthly basis for phenological and plant population changes.
4. Fire temperatures generated at soil level, 3 feet, and 6 feet above soil, will be measured on temperature sensitive paint spots placed on sheet metal and attached to conduit poles.
5. Water level measurements will be made within the study sites from newly established wells that have been tied into an existing hydrological system. Water levels will be correlated with levels at Bridge 105 and Bridge 84 where records are available from 1958 and 1960, respectively.
6. Nesting avifauna will be censused by a transect method during the April-May breeding season.
7. Studies of post-fire succession in cypress domes south of canal L-28 extended will be conducted using a belt transect method.

8. Reports to be completed:
  - a. Monthly report on fires in Big Cypress.
  - b. Annual report summarizing fires in Big Cypress.
  - c. A report summarizing post-fire recovery by flowering plants.
  - d. An annual progress report summarizing the project accomplishments throughout the year.

#### Everglades Pinelands

1. Examine the effect of season of burn and fire frequency on nutrient cycling by:
  - a. conducting summer burns and winter burns in areas that have had different fire history.
  - b. measuring nutrient pool of six elements (Ca, Mg, K, Na, P, N) in above-ground organic matter including (subsampling) pines, understory herbs, shrubs and litter before fire and 2, 6, and 12 months post-fire.
  - c. measuring apparent nutrient loss due to leaching by sampling ground water pre-fire, and 2, 6, and 12 months post-fire.
  - d. measuring nutrients in precipitation and throughfall to indicate yearly input into the community.
  - e. estimate soil volume.
  - f. sample six soil nutrients before burning and one year post-fire.
2. Collect vegetation biomass samples at six month intervals from:
  - a. a low elevation pine block burned during the summer.
  - b. a low elevation pine block burned during the winter.
  - c. a higher elevation pine block burned during the winter.
  - d. a high elevation pine block burned during the summer.
3. Measure rate of decomposition of pine needle litter, grasses, herbaceous plants, and hardwood stems.
4. Monitor breeding bird populations by spot-map census and monitor non-breeding birds by numerical counts on a permanent 50-acre grid in a burned pine block.

5. Reports to be completed include:
  - a. An annual progress report summarizing project accomplishments throughout the year.
  - b. A project status report on recovery rate of post-fire vegetation.
  - c. A project status report on decomposition rate of fuel.

Everglades Muhlenbergia Prairies

1. Continue work on nine sites established for intensive study. One site will be maintained as a control, three sites will be burned during December with one burned at one year, one at three year, and one at five year intervals, three sites burned during February with one site burned at one year, one at three year and one at five year intervals and two sites burned during the wet season with one site burned annually and the other burned at three year intervals.
2. Sample vegetation every four months. Photographs of photopoints will be taken on each vegetation plot at annual intervals.
3. Birds will be censused on the study plots during the April-May breeding season. Additional census transects are located on a 3800 acre area burned during December 1977 and on a contiguous unburned prairie.
4. Fuel biomass samples will be collected before each fire and at four month intervals for the first year post-fire. Samples will be collected at four month intervals from areas unburned for more than one year.
5. Reports to be completed:
  - a. A report on small mammal population changes.
  - b. A report on avifauna changes associated with post-fire recovery.
  - c. An annual progress report summarizing project accomplishments throughout the year.

FY 81  
BUDGET SUMMARY: FIRE ECOLOGY STUDIES

34a

Personnel

Research Biologist (Taylor), GS-11, 260 m.d.	\$ - 0 -*	
Ecologist (TERM-Rochefort), GS-7, 254 m.d.	15,600	
Ecologist, GS-7, 191 m.d.	11,076	
Ecologist, GS-7, 254 m.d.	14,768	
Park Technician, GS-4/5, 180 m.d.	8,280	
Park Technician, GS-4/5, 74 m.d.	3,680	
Park Technician, GS-4/5, 180 m.d.	8,280	
Park Technician, GS-4/5, 74 m.d.	<u>3,680</u>	
		\$ 65,364

Travel

National meeting	\$ 500	
State of Florida meetings and Interagency Fire Council	300	
Tree Ring Laboratory, Arizona	<u>500</u>	
		1,300

Services

Aircraft: Helicopter, 20 hr @ \$160	\$ 3,200	
Computer:	- 0 -	
Contract:	- 0 -	
Other:		
Data key-punching services	\$ 800	
ORV rental	750	
Chemical analyses (vegetation, soil, water -N, Ca, Mg, K, Na, P)	<u>2,500</u>	
		<u>4,050</u>
		7,250

Supplies

Film for photopoints and illustrations	\$ 595	
Transect supplies	450	
Insect collection supplies	165	
Mammal collection supplies	415	
Collecting bags, bottles	450	
Soil sample preparation materials	250	
Nitrogen analysis supplies	250	
Precipitation collectors	75	
Well water sampling stations	150	
Litter decomposition supplies	300	
Fuel sampling supplies	<u>152</u>	
		3,252

Capitalized Equipment

Drying oven		2,000
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FY 81

BUDGET SUMMARY: FIRE ECOLOGY STUDIES (continued)

34b

Amortized Equipment Costs

Truck (PN50189), 100%	\$ 1,174	
Van (PN52176), 100%	<u>1,304</u>	
		2,478

Motorized Equipment Operation

Fuel: Truck (PN50189), 12000 mi/923 gal	\$ 1,754	
Van (PN52176), 12500 mi/1000 gal	1,900	
Honda ATCs (PN54274, 77), 400 hr/ 80 gal	<u>152</u>	
		\$ 3,806
Maintenance:		
Truck	\$ 200	
Van	200	
Honda ATCs	<u>50</u>	
		<u>450</u>
		<u>4,256</u>

TOTAL PROJECT COST \$ 85,900

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\* salaries for all permanent personnel are included in the Budget Summary for Research Administration



APPENDIX I: AIRCRAFT USE SUMMARY, FY 81

<u>Program/Project</u>	<u>Helicopter</u>		<u>Fixed-Wing</u>	
	<u>Hrs</u>	<u>Cost</u>	<u>Hrs</u>	<u>Cost</u>
<b>HYDROLOGY PROGRAM</b>				
Hydrological Monitoring	90	\$14,400	16*	\$ 700
Water Quantity Studies	75	12,000		
Water Quality Studies	37	5,920	16*	700
<b>WILDLIFE ECOLOGY PROGRAM</b>				
Endangered Species Studies	52	8,320	262	11,790
Wading Bird Studies	68	10,880	162	7,290
Alligator Study	30	4,800	22	990
Freshwater Fish Studies	72	11,520		
<b>PLANT ECOLOGY PROGRAM</b>				
Vegetation Documentation	52	8,320		
<b>FIRE ECOLOGY PROGRAM</b>				
Fire Ecology Studies	<u>20</u>	<u>3,200</u>	<u>    </u>	<u>    </u>
	496	\$79,360	478	\$21,470

\* 4.5 hrs Widgeon time, converted to Lake time @ 1 Widgeon hr = 3.5 Lake hrs

APPENDIX II: CONTRACTED SERVICES, FY 81

<u>Project Title</u>	<u>Type of Contract</u>	<u>Proposed Work</u>	<u>\$ Amount</u>	<u>Award Date</u>
Hydrological Monitoring	Interagency Service	Water Data Collection and Analysis (USGS)	\$ 66,929	10/80
Water Quantity Studies	Scientific Research	Modeling Marsh System (3rd year of existing contract)	40,000	01/81
Freshwater Fish Studies	Scientific Research	Otolith Analysis	8,000	10/80
Estuarine Fish Studies	Scientific Research	Salinity/Fish Physiology Studies	(60,400)*	10/80
Estuarine Crustacean Studies	Scientific Research	Nutrient Analyses	<u>1,600</u>	01/81
FY TOTAL . . . . .			<u>\$108,529</u>	

\* non-add entry; priority #4 if additional funding available in FY 81

APPENDIX III: CAPITALIZED EQUIPMENT, FY 81

<u>Project Title</u>	<u>Equipment Item</u>	<u>\$ Amount</u>
Hydrological Monitoring	Continuous-recording gauges, 20 @ \$650	\$ 13,000
	Calculators, 2 @ \$70	140
	Multi-parameter data loggers, 4 @ \$5000	20,000
	Multi-parameter data loggers, add'l 8 @ \$5000 plus platforms	(45,600)*
Water Quantity Studies	Calculators, 3 @ \$70	210
Estuarine Crustacean Studies	Compound microscope	1,000
	Salinometer (replacement)	2,600
Coral Reef Studies	Air compressor (replacement)	700
Fire Ecology	Drying oven	<u>2,000</u>
FY TOTAL . . . . .		<u>\$ 39,650</u>

\* non-add entry; priority #3 if additional funding available in FY 81

APPENDIX IV: MOTORIZED EQUIPMENT OPERATION, FY 81

Program	Equip Item	PN	Est. Use	Fuel (gal)	Contracted Maintenance	Total Cost
Administration	Station Wagon	50083	10,000 mi	625	\$ 132	\$ 1,320
	OB Engine	50149	50 hr	200	50	410
Hydrology	Truck	50190	10,000 mi	769	140	1,601
	Truck	50191	8,000	616	140	1,310
	AB Engine	52087	91 hr	673(Av)	0	1,346
	Van	54250	16,000 mi	1,230	140	2,476
	Honda ATC	54275	50 hr	10	50	69
	Honda ATC	54276	50 hr	10	50	69
	OB Engine	54810	40 hr	42	0	80
	OB Engine	54811	100 hr	170	0	323
Wildlife Ecology	Van	50166	9,300 mi	715	396	1,755
	Van	50181	10,500 mi	811	75	1,615
	Truck	52175	10,000 mi	667	100	1,367
	OB Engine	52968	439 hr	2,196	150 <sup>a/</sup>	4,161
	OB Engine	54280	118 hr	354	85 <sup>a/</sup>	757
	Van	54424	13,000 mi	1,000	100	2,100
	Honda ATC	54808	25 hr	5	42	51
	Honda ATC	54809	25 hr	5	42	52
	AB Engine	14291	416 hr	2,496(Av)	241 <sup>a/</sup>	5,233
	Marine Ecology	Van	50199	8,000 mi	727	10
Van		50200	9,000 mi	692	31	1,346
OB Engine		54477	400 hr	2,000	1,060 <sup>a/</sup>	4,860
OB Engine		54995 <sup>b/</sup>	310 hr	(2,170)	-	3,224
OB Engine		(new)	400 hr	2,000	891 <sup>a/</sup>	4,691
Plant Ecology	Van	50185	11,800 mi	843	180	1,782
	Van	54251	12,000 mi	1,000	180	2,080
	Honda ATC	54274	325 hr <sup>c/</sup>	65 <sup>c/</sup>	75 <sup>c/</sup>	199 <sup>c/</sup>
	Honda ATC	54277	325 hr <sup>c/</sup>	65 <sup>c/</sup>	75 <sup>c/</sup>	200 <sup>c/</sup>
Fire Ecology	Truck	50189	12,000 mi	923	200	1,954
	Van	52176	12,500 mi	1,000	200	2,100
FY TOTALS				18,740	\$ 4,855	\$ 49,922
				3,169(Av)		

a/ includes maintenance costs on attendant boat hull and trailer

b/ engine use and fuel at DISC; fuel is not included in EVER allotment

c/ includes Fire Ecology use in BICY

APPENDIX V: TEMPORARY PERSONNEL REQUIREMENTS, FY 81

Project Title	Position Title	Estimated Workdays					
		GS-3	GS-4	GS-5	GS-7	GS-9	GS-11
Everglades Library	Library Aide	156					
Hydrological Monitoring	Hydrologist					260	
Water Quantity Studies	Hydrologist (TERM)					260	
	Hydrologist					260	
	Hydrologist					260	
Water Quality Studies	Hydrologist (TERM)						254
Endangered Species Studies	Wildlife Biologist				260		
	Park Tech, Wildlife			(91)*			
Wading Bird Studies	Wildlife Biologist				260		
	Biological Technician, Wildlife			260			
Alligator Study	Wildlife Biologist (TERM)				254		
	Wildlife Biologist				260		
Freshwater Fish Studies	Fishery Biologist (TERM)					254	
	Biological Technician, Fisheries			260			
Estuarine Fish Studies	Biological Technician, Fisheries				260		
	Biological Technician, Fisheries				260		
	Biological Technician, Fisheries				260		
Estuarine Crustacean Studies	Oceanographer (TERM)					208	
	Physical Sciences Tech			260			
	Physical Sciences Tech			260			
Coral Reef Studies	Oceanographer (TERM)					254	
	Park Technician			180			
	Park Technician			180			
	Park Technician		180				
	Park Technician	96					
Vegetation Documentation	Botanist (TERM)					254	
	Botanist (TERM)					254	
	Park Technician			180			
	Park Technician			180			
Fire Ecology Studies	Park Technician					180	
	Park Technician					74	
	Park Technician					180	
	Park Technician					74	
	Park Technician					180	
	Park Technician					74	
TOTALS (in work days)		252	180	2448	2251	2010	254
(in work years)		(1.0)	(.7)	(9.4)	(8.7)	(7.7)	(1.0)

\* non-add entry; priority #2 if additional funding available in FY 81

APPENDIX VI: BUDGET SUMMARY, FY 81

PROGRAM/ PROJECT	PERSONNEL	TRAVEL	SERVICES	SUPPLIES	CAP.EQP.	AMORT	SHOP	TOTAL
<b>ADMINISTRATION</b>								
Research Administration	\$405,780	\$ 5,100	\$ 39,500	\$ 3,850	\$ 0	\$ 1,040	\$ 1,730	\$ 457,000
Everglades Library	5,690	810	500	8,800	0	0	0	15,800
Computer Center	0	1,000	1,200 <sup>a/</sup>	1,600	0	0	0	3,800
	\$411,470	\$ 6,910	\$ 41,200	\$14,250	\$ 0	\$ 1,040	\$ 1,730	\$ 476,600
<b>HYDROLOGY</b>								
Hydrological Monitoring	\$ 18,096	\$ 1,800	\$ 87,729	\$ 3,565	\$33,140 <sup>c/</sup>	\$ 1,194	\$ 2,476	\$ 148,000
Water Quantity Studies	54,288	3,000	55,250	3,393	210	2,671	3,488	122,300
Water Quality Studies	18,262	1,100	6,620	2,032	0	1,176	1,310	30,500
	\$ 90,646	\$ 5,900	\$149,599	\$ 8,990	\$33,350	\$ 5,041	\$ 7,274	\$ 300,800
<b>WILDLIFE ECOLOGY</b>								
Endangered Sp Studies	\$ 16,765 <sup>b/</sup>	\$ 2,220	\$ 24,320 <sup>b/</sup>	\$ 3,889	\$ 0	\$ 2,660	\$ 5,546	\$ 55,400
Wading Bird Studies	26,728	1,200	28,050	1,827	0	1,254	3,941	63,000
Alligator Study	31,860	300	14,300	5,723	0	2,102	5,715	60,000
Freshwater Fish Studies	31,423	700	30,145	1,120	0	973	2,039	66,400
	\$106,776	\$ 4,420	\$ 96,815	\$12,559	\$ 0	\$ 6,989	\$ 17,241	\$ 244,800
<b>MARINE ECOLOGY</b>								
Estuarine Fish Studies	\$ 32,036	\$ 900	\$ 5,700 <sup>d/</sup>	\$ 6,569	\$ 0	\$ 3,644	\$ 6,251	\$ 55,100
Estuarine Crustacean Sts	42,572	700	3,000	7,851	3,600	6,140	6,037	69,900
Coral Reef Studies	46,467	600	1,250	1,453	700	1,650	2,880	55,000
	\$121,075	\$ 2,200	\$ 9,950	\$15,873	\$ 4,300	\$11,434	\$ 15,168	\$ 180,000
<b>PLANT ECOLOGY</b>								
Vegetation Documentation	\$ 62,904	\$ 1,000	\$ 20,220	\$ 2,320	\$ 0	\$ 2,699	\$ 4,057	\$ 93,200
<b>FIRE ECOLOGY</b>								
Fire Ecology Studies	\$ 65,364	\$ 1,300	\$ 7,250	\$ 3,252	\$ 2,000	\$ 2,478	\$ 4,256	\$ 85,900
<b>TOTALS</b>	<b>\$858,235</b>	<b>\$21,730</b>	<b>\$325,034</b>	<b>\$57,244</b>	<b>\$39,650</b>	<b>\$29,681</b>	<b>\$ 49,726</b>	<b>\$1,181,300</b>

Additional funding priorities: #1 = a/ lease of computer system @ \$47,600  
 #2 = b/ Cape Sable Sparrow Studies @ \$12,800  
 #3 = c/ hydrologic monitoring equipment @ \$45,600  
 #4 = d/ Salinity/Fish physiology contract @ \$60,400