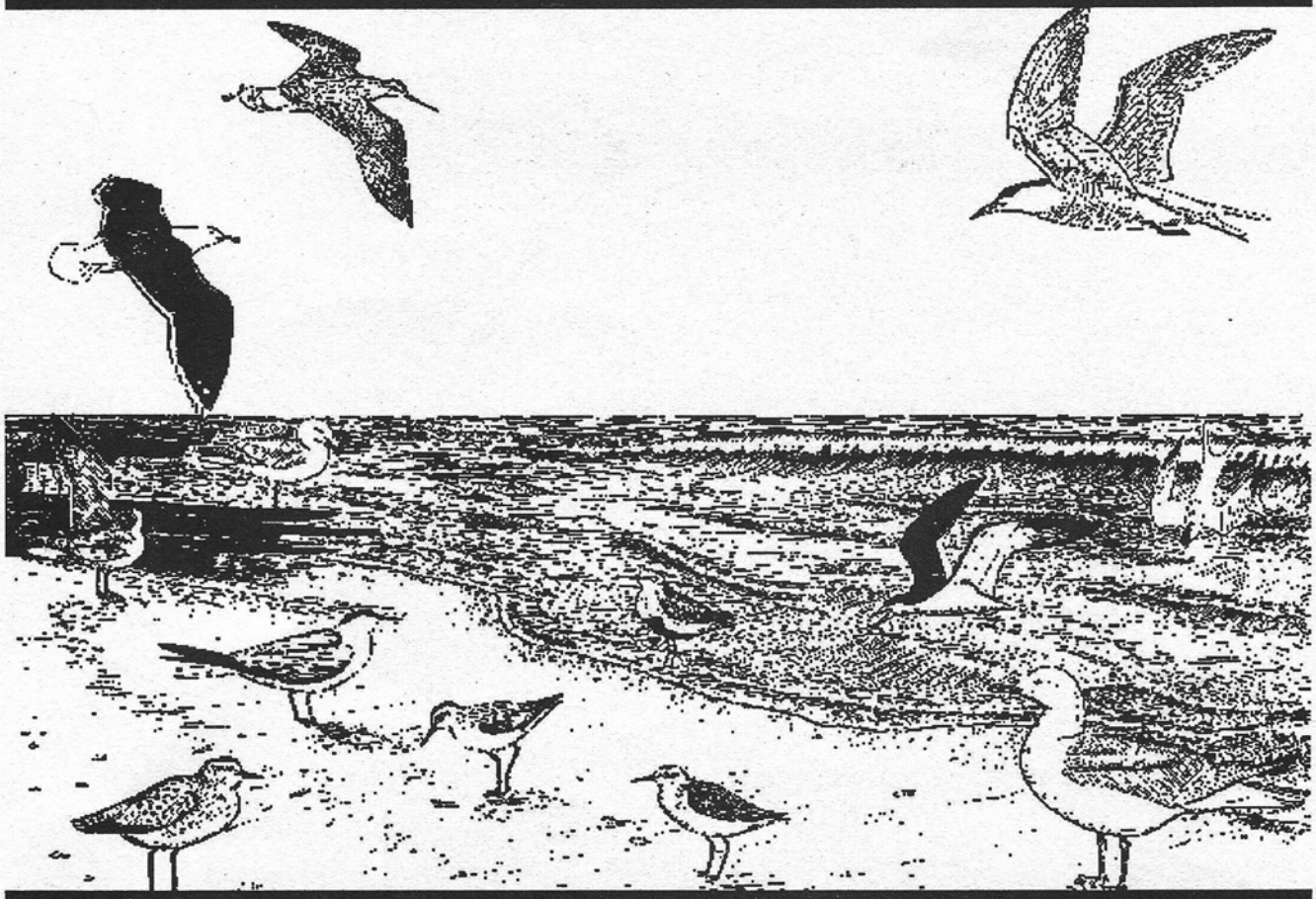
MANAGEMENT AGREEMENT



FOR SUBMERGED LANDS WITHIN BOUNDARIES OF THE KEY WEST AND GREAT WHITE HERON NATIONAL WILDLIFE REFUGES

COPY

MANAGEMENT AGREEMENT
FOR
CERTAIN LANDS IN MONROE COUNTY, FLORIDA

AGREEMENT NO. MA-44-088

WHEREAS, the Board of Trustees of the Internal Improvement Trust Fund holds title to certain sovereignty submerged lands in Monroe County Florida; and

WHEREAS, the Board may authorize the management of said lands by virtue of Chapter 253.03, Florida Statues; and

WHEREAS, the U.S. Fish and Wildlife Service possesses authority to enter into agreement by virtue of the National Wildlife Refuge Administration Act, 16 U.S.C. & 668dd et seq.; and

WHEREAS, the U.S. Fish and Wildlife Service desires to manage the subject lands for public purposes as outlined in Exhibit "A" attached hereto;

NOW, THEREFORE, THE BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND OF THE STATE OF FLORIDA, referred to herein as "Board", hereby grants to the U.S. Fish and Wildlife Service, herein referred to as "Grantee", the right to manage for public purposes all lands titled in the Board (including islands, tidal lands, and sovereignty submerged lands) which are located within the boundaries described in Exhibit "A" attached hereto and made a part hereof, for a period of twenty-five years from November 17, 1992, the effective date of this Agreement, on the following terms and conditions;

1. Grantee shall manage the subject properties as provided in the management plan attached as Exhibit "A" in a manner which will not conflict with the conservation, protection and enhancement of said lands and which will not interfere with the maintenance of public navigation projects or other public works projects authorized by the United States Congress.

2. Grantee shall manage said lands as part of Key West, Great White Heron National Wildlife Refuges, and National Key Deer Refuge. The wildlife management and public use programs of said lands will be administered according to the policies of the Fish and Wildlife Service, as well as the regulations set forth in the National Wildlife Refuge System Administration Act of 1966.

3. The management plan attached hereto as Exhibit "A" shall be reviewed jointly by the Board and the Grantee at no greater than five (5) year intervals and updated as necessary. The Grantee shall not alter the property or engage in any activity except as provided for the required plan without the prior written approval of the Board.

4. Upon execution of the Agreement, the Grantee shall have the right to enter and occupy the property for the purpose of fulfilling the activities designated in Paragraph 1 and Exhibit "A", subject to all pre-existing rights and interests.

5. The Board shall have the right at any time to inspect the works and operations of the Grantee in any matter pertaining to this Agreement.

6. This Agreement does not convey any title interest to the area described in Exhibit "A" attached hereto.

7. This Agreement may be unilaterally terminated by either party, with or without cause, by providing written notice of the intent to terminate this Agreement to the other party at least 60 days prior to the proposed date of termination.

8. The Board retains the right to enter the property and to engage in management activities other than those provided for herein following notification to and consultation with the Grantee and further retains the right to grant approval for compatible uses of the property to third parties during the term of this Agreement. The Board shall determine whether or not any proposed uses by a third party are compatible with the uses authorized herein.

9. This agreement may be renewed for succeeding additional ten-year terms by mutual agreement of the parties. The agreement to renew, together with all additions, deletions, and modifications to this management agreement, shall be affixed hereto.

10. This Agreement and any rights and privileges contained herein are for the sole use of the Grantee and shall not be assigned or transferred in whole or in part to any other party without the written consent of the Board.

11. The Grantee agrees to assist in the investigation of injury or damage claims either for or against the State of the Board and pertaining to Grantee's area of responsibility or arising out of Grantee's management programs hereunder and to contact the Board regarding whatever legal action Grantee deems appropriate to remedy same.

12. The liability of the Grantee for the acts and omissions of its employees pursuant to this instrument shall be governed by the Federal Tort Claims Act.

13. Section 267.061(1)(b), Florida Statues, specifies that title to all treasure trove, artifacts, and such objects of antiquity having intrinsic, scientific, or historical and archeological value, which have been abandoned on state-owned lands or state-owned sovereignty submerged lands is vested in the Division of Historical Resources (DHR) of the Department of State, for the purpose of administration and protection for the State of Florida. Execution of this Agreement in no way affects any of the parties' obligations pursuant to Chapter 267, Florida Statues. The disturbance of archeological and historical sites on state-owned lands is prohibited unless prior authorization has been obtained from DHR. All proposals for changes in the character or use of State lands shall be coordinated with DHR in order to mitigate potential damage or disturbance of, or to preserve archeological and historical sites and properties.

14. Upon termination or expiration of this Agreement, the Grantee agrees to leave all fixed improvements for the use of the Board and to put no claim upon said fixed improvements; or, at the option of the Board, the Grantee agrees to remove any or all improvements from the property at Grantee's expense.

15. The Grantee shall not discriminate against any individual because of the individual's race, color, religion, sex, national origin, age, handicap, or marital status with respect to any activity occurring within the area subject to this Agreement or upon lands adjacent to and used as an adjunct to the area.

16. In the event of litigation between the parties, arising out of this Agreement, the recovery by the Board of its attorney's fees and costs incurred in such litigation, including any appeal therefrom, shall be governed by the provision of the Equal Access to Justice Act, 28 U.S.C. & 2412.

17. All notices given under this Agreement shall be in writing, and shall be mailed to the last address of the party to whom notice is to be given, as designed by such party in writing. The Board and the Grantee hereby designate their respective address as follows:

BOARD: Division of State Lands
Bureau of Submerged Lands & Preserves
3900 Commonwealth Blvd.
Tallahassee, FL 32399

GRANTEE: Regional Director
U.S. Fish and Wildlife Service
75 Spring Street, S.W.
Atlanta, Georgia 30303

18. Unless specified herein to the contrary, this agreement shall be governed and interpreted according to the laws of the State of Florida.

WITNESSES:

Cathy Watkins
Original Signature

Cathy Watkins
Typed/Printed Name of Witness

Judith A. Booth
Original Signature

Judith A. Booth
Typed/Printed Name of Witness

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND OF THE STATE OF FLORIDA

(SEAL)

BY _____
Percy W. Mallison, Jr., Director, Division of State Lands, Agent for the Board of Trustees of the Internal Improvement Trust Fund

"GRANTOR"

STATE OF FLORIDA
COUNTY OF LEON

The foregoing instrument was acknowledged before me this 3rd day of December, 1992, by Percy W. Mallison, Jr., Division Director, who is personally known to me and who did not take an oath.

APPROVED AS TO FORM AND LEGALITY:

William C. Robinson
DNR Attorney

CATHY LYNN WATKINS
MY COMMISSION # CC 187822 EXPIRES
March 22, 1996
BONDED THRU TROY FAIN INSURANCE, INC.

Cathy Lynn Watkins
Notary Public, State of Florida

Printed, Typed or Stamped Name

My Commission Expires:

Commission/Serial No. _____

WITNESSES:

Beverly T. Lubben
Original Signature

Beverly T. Lubben
Typed/Printed Name of Witness

Thomas Turnipseed
Original Signature

Thomas Turnipseed
Typed/Printed Name of Witness

U.S. Fish and Wildlife Service (SEAL)
Grantee

BY John R. Eadie
Original Signature of Executing Authority

John R. Eadie
Typed/Printed Name of Executing Authority

Acting Regional Director
Title of Executing Authority

"GRANTEE"

STATE OF Georgia

COUNTY OF Fulton

The foregoing instrument was acknowledged before me this 14th day of October, 1992, by John R. Eadie, who is personally known to me and who did (did not) take an oath.

My Commission Expires:
Notary Public, Dekalb County, Georgia
My Commission Expires July 19, 1993

Commission/Serial No. _____

Carol L. Marbutt
Notary Public, State of Georgia

Carol L. Marbutt
Printed, Typed or Stamped Name

EXHIBITA

MANAGEMENTAGREEMENT

for

BACKCOUNTRYPORTIONS

of

KEYWESTNATIONALWILDLIFEREFUGE
GREATWHITEHERONNATIONALWILDLIFEREFUGE
and
NATIONALKEYDEERREFUGE

MonroeCounty,Florida

SEPTEMBER1992

UNITEDSTATESDEPARTMENTOFTHEINTERIOR

FISHANDWILDLIFESERVICE
75SPRINGSTREET,S.W.
ATLANTA,GEORGIA30303

and

STATEOFFLORIDA
DEPARTMENTOFNATURALRESOURCES
TALLAHASSEE,FLORIDA

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* Figures 7-29 were provided in the draft management plan and were not included in the final. Copies are on file at the National Key Deer Refuge, Big Pine Key, (305) 872-2239.

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EXECUTIVE SUMMARY

Recreational and commercial use of State waters surrounding islands of the three national wildlife refuges of the Lower Florida Keys - National Key Deer Refuge, Great White Heron National Wildlife Refuge (NWR) and Key West NWR - have risen concurrently with the dramatic increase in residential growth and tourism on mainline keys (islands linked by U.S. Highway 1). These refuges are administered by the U.S. Fish and Wildlife Service (Service) of the Department of the Interior. Attendant with this growth in recreational and commercial use has been an increase in human-wildlife interactions involving disruption of roosting, foraging, and nesting avifauna. The advent of shallow draft vessels, particularly jet-ski* type craft, has made previously inaccessible areas susceptible to the adverse impacts of increasing numbers of boaters, sometimes during the sensitive pre-nesting and incubation period.

In 1990, public use in some areas, notably in Great White Heron NWR, had increased to the point where the primary purpose of the refuges - protection of wildlife - could not be achieved because of unrestricted boater access on state-owned waters surrounding Service islands.

Included in this management plan are measures to be implemented by the Service in coordination with the State of Florida, Department of Natural Resources, for the purpose of protecting wildlife and their habitat. Management actions would be implemented on selected State-owned waters within the administrative boundaries of the refuges. Further, the Service will acquire the authority to manage State-owned lands on islands within the refuge boundaries.

If the management agreement is approved, the Service's resource protection in the area will involve:

1. A prohibition on the use of Personal Watercraft, airboats, water skiing, and aircraft landing (including hovercraft) within specified areas of Key West, Great White Heron, and National key Deer Refuges (Figures 1-6).

2. Establishment of idle speed, no motor, and no access buffer zones in appropriate areas for the protection of wildlife.

3. Increased public education for backcountry boaters through news releases, public service announcements, brochures, information maps, and educational panels at boat ramps.

4. Enhance enforcement of current regulations that require a permit for commercial use of refuge islands. Hold public meetings, develop policy, evaluate permit requests for compatibility with the purpose for which the refuges were established, and issue permits as appropriate.

* The term 'jet ski' is commonly applied to all types of shallow draft, jet drive watercraft in which the operator sits, kneels, or stands on the craft as opposed to inside the craft. Jet-ski is the trade name for this type of water craft which is manufactured by Kawasaki.

5. Increase Service enforcement with personnel to ensure compliance with the terms of this plan and existing rules covering camping, vegetation clearing, littering, and illegal structures.

6. Close mangrove islands, where public use opportunities are virtually nonexistent (no beaches present) and inherently incompatible with wildlife.

The Service does not intend to close backcountry areas to traditional sport and commercial fishing, diving, and recreational boating except when these activities are in conflict with the protection of refuge resources. Additional management actions will not be implemented without full public involvement and review. Locations and type of management action are outlined fully in this report.

INTRODUCTION

Background

The three national wildlife refuges of the Lower Florida Keys - National Key Deer, Great White Heron National Wildlife Refuge (NWR), and Key West NWR - include virtually all of the offshore islands that are not linked by U.S. Highway 1. These refuge islands extend for about 60 miles from East Bahia Honda Key west to the Marquesas Keys. There is some partial overlap in the administrative boundaries of the National Key Deer and Great White Heron NWR. The U.S. Fish and Wildlife Service (Service) administers the refuges from the National Key Deer Refuge headquarters on Big Pine Key.

Recreational and commercial use of the State-owned waters surrounding refuge islands and activities on some of the islands themselves have risen with the dramatic increase in residential growth and tourism on mainland keys. For example, the residential population of Big Pine Key increased 400 percent between 1970 and 1988 (Sedway Cooke Associates et al., 1989). Also, more than 3,000 additional boats were registered in Monroe county in 1989-90 than in 1985-86 (Florida Marine Patrol, Tallahassee).

Attendant with this growth has been an inevitable increase in wildlife-human interactions, involving disruption of roosting, foraging, and nesting avifauna over a widespread area. The advent of shallow-draft vessels, particularly personal watercraft (PWC) or jet skis, has made previously inaccessible areas susceptible to the adverse impacts of increasing numbers of boaters, often to the detriment of wildlife. Public use in many areas, most notably in the Great White Heron NWR, has increased to the point where the primary purpose of the refuges - protection of wildlife - can no longer be achieved under present management constraints.

Management Agreement

Management actions described here are to be implemented within the administrative boundaries of the refuges (Figure 1-6). This is needed since only the islands, not the surrounding waters, are under Service jurisdiction, and refuge regulations are enforceable only on islands owned by the Service. Thus, the Service is unable to adequately protect the wildlife resources of the refuges. This management agreement with the State of Florida includes protective wildlife management and law enforcement programs on the State-owned waters within the administrative boundaries of National Key Deer, Great White Heron, and Key West NWR. Further, the Service is granted authority to manage the State-owned islands (lands above mean high tide) within these boundaries. State authority granted to the Service through a management agreement is limited to the actions described in this plan.

Service Management Policies

The Service has formulated policies for coastal island refuges in Region 4, which includes Florida, governing public use management "...based on methods of access and sensitivity of the islands' wildlife" (see 8 RM1-002). Two of the three categories assigned to coastal refuges (Groups A and B) are germane to this document. Group A involves "...islands too fragile to

allow public use for all or part of a year." Group B "...includes those islands that can accommodate a moderate level of public use." In addition, the Refuge Recreation Act of 1962 (Public Law 87-714) authorizes the Secretary of Interior to administer national wildlife refuges for recreational use when "...such uses do not interfere with the areas' primary purposes."

Purpose and Scope of Management Agreement

The purpose of this document is to identify the resource problems specific to the protection of certain islands and their associated wildlife which require immediate attention. Management actions are provided for each of the problems identified. Broader issues involving aquatic habitat, such as propeller damage to seagrass meadows and an improved channel marking system, are not addressed. Such issues are deemed more appropriate for consideration as part of a comprehensive management plan for the recently created Florida Keys National Marine Sanctuary (Marine Sanctuary).

Because of the large area involved, this report represents a synthesis of information involving a variety of wildlife species, with attention focused on selected avian species and public use problems in specific areas. Observations on public use were collected incidentally to the Service's surveys of nesting ospreys, bald eagles, great white herons, and sea turtles from 1986-present. Because virtually all surveys of bald eagles and ospreys were conducted during weekends and holidays by the refuge biologist, public use was frequently observed during peak periods. Some of the problems identified are relatively infrequent but merit attention. The goal of this report is to protect wildlife, particularly avifauna, while not recommending unnecessary restrictions on boaters. A concerted effort has been made to accommodate public use where compatibility with wildlife was not considered a factor at this time.

Scientific names for species described in the text are provided in Appendix A.

PART I. BACKGROUND

1. Purposes for establishment of the National Wildlife Refuges in the Lower Florida Keys.

Key West NWR was established by Executive Order 923 in 1908 and is one of the oldest refuges in the United States. It was created as "...a preserve and breeding ground for native birds and other wildlife."

Great White Heron NWR was established by Executive Order 7993 in 1938, with additional islands acquired under the Migratory Bird Conservation Act (16 U.S.C., S. 715). This refuge was created to provide an "...inviolate sanctuary, or for any other management purpose, for migratory birds."

The National Key Deer Refuge was established in 1957 "...to protect and preserve in the national interest the Key deer and other wildlife resources in the Florida Keys" (Public Law 85-164).

The wilderness Act of 1964 (Public Law 88-577) established a National Wilderness Preservation System "...to be composed of federally owned areas designated by Congress as "wilderness

areas..." so as "... to provide protection of these areas...." In 1975, Public Law 93-632 designated all islands within the Key West NWR and many other islands within the National Key Deer Refuge and Great White Heron NWR as part of the National Wilderness Preservation System. Nearly 6,200 acres comprise the Florida Keys wilderness designated within these three refuges (see Figures 1, 2, and 3.)

2. **Management Authority**

The Service's wildlife management authority is provided by various Congressional Acts, including the Migratory Bird Treaty Act of 1918, Migratory Bird Conservation Act of 1929, Migratory Bird Hunting Stamp Act of 1934, Bald and Golden Eagles Protection Act of 1940, Refuge Trespass Act of 1948, Fish and Wildlife Act of 1956, Wilderness Act of 1964, National Wildlife Refuge System Administration Act of 1966, and the endangered Species Act of 1973.

3. **Environment**

A. Climate - The climate of the Lower Florida Keys is tropical (Jordan 1991) with a mean annual temperature of about 25 degrees C. The coldest average monthly temperature, 20.5 degrees C, occurs during January and the warmest mean monthly temperature, 28.8 degrees C, occurs in August (Thomas 1974). Temperatures below 4 degrees C are unusual due to the moderating effects of the Florida current. Freezing temperatures and frost have never been recorded. The mean annual rainfall is 99.1 cm, of which 80 percent falls from May through October (Hanson 1980).

B. Geology - The geology of the Lower Florida Keys has been described in detail by Hoffmeister (1974). Two limestone formations of marine origin are found in the Lower Florida Keys. Miami oolite overlays the Key Largo limestone formation. Miami oolite was formed during the Pleistocene era in a high energy, shallow water environment containing an abundance of calcium carbonate. On some islands (e.g., Little Pine Key), this formation is exposed and is characterized by numerous vertical solution holes. Any soils that are present are thin.

C. Physiography - The backcountry islands of the Lower Florida Keys range in size from less than an acre (e.g., Hurricane Key) to more than 900 acres (i.e., Howe Key). Relatively few islands are larger than 100 acres. Elevations range from sea level on inundated mangrove islands (e.g., Little Crane Key) to a few feet above sea level (e.g., pinelands on Little Pine Key). A complex network of narrow tidal creeks dissects many of the small mangrove islands in some areas (e.g., between Snipe Point and Outer Narrows).

4. **Traditional Uses**

Traditional uses include recreational and commercial fishing, scuba diving and snorkeling, photography, bird watching, and sightseeing. Some picnicking and walking also occur on a few islands such as the beaches in Key West NWR.

5. **Resources**

A. General Habitat Characteristics - The acreage of various habitat types for many islands in the Lower Keys backcountry have never been determined. Davis (1942) reported on the vegetation of Marquesas and Boca Grande Keys. Dickson (1955) provided a broad description of habitat types on 14 backcountry islands extending from Knockemdown Key northeast to Little Pine Key. Folk et al. (1992) determined areal coverage for habitat types on islands within the Key deer range. The information presented below is, by necessity, cursory and generalized and is based on an examination of aerial photographs augmented by visits to many of the backcountry islands. It is emphasized that appreciable uplands (an acre of more) are present on relatively few islands. Robertson and Kushlan (1974) noted that a slight difference in elevation often causes marked differences in plant communities of southern Florida.

a. Beaches - Extensive beaches, formed primarily of calcareous remains from various shallow water marine organisms, are found on Woman, Marquesas, and Boca Grande Keys in Key West NWR. Small beaches are present on Man, Sawyer, and Snipe Point.

b. Wetlands - A number of islands in the National Key Deer Refuge and Great White Heron NWR contain freshwater throughout all or most of the year (Klimstra et al., in prep). Freshwater wetlands are absent in the backcountry of the Great White Heron and Key West NWR's.

Salt ponds are shallow impoundments which were cut off from open water when storms created a berm, effectively blocking tidal flow except during intense storms. These impoundments also collect rainwater; thus, their salinity and water levels are highly variable. Of special note is the salt pond on Boca Grande Key, which is used seasonally by piping plovers, least and Forster's terns, black-necked stilts, and a variety of wading birds including reddish egrets.

Red mangrove forests constitute all or part of the vegetation on all backcountry islands except for one sand island and three dredged material islands in Key West NWR. The roots of these trees are usually either constantly submerged or inundated daily by the tides. Lugo and Snedaker (1974) described six mangrove forest types, of which five occur in the Florida Keys: overwash, riverine, basin, scrub (dwarf), and fringe forests. The latter are the most prominent type in the backcountry.

c. Uplands - Pinelands, consisting of slash pine with a diverse understory, are present only on Little Pine Key and on a small tract in Knockemdown Key. A few scattered pines are present on Howe Key.

Tropical hardwood hammocks are among the most imperiled habitats in the U.S. and occur in the Lower Keys backcountry in the form of low hammocks (Weiner 1979) consisting of vegetation primarily of West Indian origin. They are present on Little Pine, Johnson, Water (nearest Little Pine), Annette, Howe, Toptree Hammock, Knockemdown, and Johnston Keys. The largest of these hammocks is on Little Pine Key.

Berm hammocks, a form of low hammock that forms on beach berms, are found on Sawyer, Mud, Snipe Point, Boca Grande, Woman, and Marquesas Keys. Of these, the largest by far occurs on the north side of the Marquesas. It contains yellowheart, a tree known from only a few sites in the Florida Keys.

Salt prairies characterized by saltwort, glasswort, needlerush, and/or Key grass are present on a number of islands, inland of the mean sea level. The plants in this habitat type are tolerant of periodic tidal inundation and fluctuating salinity.

Invasive exotics, Australian pine (AP), Brazilian pepper (BP), Asiatic colubrina (AC), and/or jumbie bean (JB) are present on the following backcountry islands: Marquesas Keys (AP, BP, AC, JB), Woman Key (BP), (dredged material islands in Key West NWR (AP), East Harbor (AC), Snipe Point (State owned, AC), Toptree Hammock (AP), east Sawyer and an unnamed island in Niles Channel (AP). AP has been eradicated from Boca Grande Key and most of the Marquesas Keys. AC has been virtually eradicated by refuge personnel from Bay, west Content, and Marquesas Keys. The following privately-owned backcountry islands contain AP: Tank, Wisteria, Tarpon Belly, Howell, and Budd; west Sawyer Key contains AC.

B. Endangered and Threatened Species

a. Birds - Three federally-listed endangered or threatened birds are found in the backcountry of the Lower Florida Keys: bald eagle, piping plover, and peregrine falcon. State-listed threatened species or species of special concern which nest on the refuge islands include the white-crowned pigeon, little blue heron, tri-colored heron, reddish egret, snowy egret, osprey, brown pelican, and least tern. The roseate spoonbill, which is listed by Florida as a species of special concern, has been observed annually.

b. Mammals - Endangered or threatened mammals include the Key deer, silver rice rat, Lower Keys marsh rabbit, West Indian manatee, and sperm whale.

c. Reptiles and Amphibians - Federally listed endangered or threatened amphibians and reptiles within the management area include the Atlantic Ridley turtle, Atlantic loggerhead turtle, Atlantic hawksbill turtle, Atlantic green turtle, and eastern indigo snake.

d. Other Wildlife - More than 250 avian species have been recorded on the Lower Keys refuges, a rich and diverse assemblage of birds in a subtropical setting. In addition to providing nesting habitat for a variety of birds, the refuges provide important loafing and feeding areas for magnificent frigatebirds, migrant shorebirds, terns, raptors, and waterfowl such as the red-breasted merganser.

6. **Administration**

The headquarters for the four national wildlife refuges (including Crocodile Lake NWR in Key Largo) in the Florida Keys is located on Big Pine Key. Nine full time employees constitute the staff for these refuges, including a refuge manager, an assistant refuge manager, a biologist, two law enforcement officers, a secretary, and two maintenance workers.

7. **Land Status**

Virtually all of the islands in the Lower Florida Keys backcountry are in Service ownership. The only exceptions are privately held tracts on all or part of Budd, Tarpon Belly, Howell, Wahoo, Little Knockemdown, Marvin, Mallory, West Harbor, and Ballast Keys. The State of Florida owns small tracts on the Content Keys and a large tract on Snipe Point. Raccoon Key is a 200-acre island currently used for breeding free-roaming rhesus monkeys. A 25-acre tract owned by the Service was leased in 1982 to Charles River Breeding Laboratories in exchange for land on Cudjoe Key. The Service will be deeded all of Raccoon Key upon the termination of this 30-year lease or within 90 days of the facility's close of operation.

8. **Management Activities (1986 - present)**

The Service's involvement in the backcountry has historically been limited because of the lack of personnel and the need to focus on the endangered Key deer. Backcountry projects involving Key deer during the past five years have included radio telemetry, prescribed burning of pinelands, installation of guzzlers, excavation of waterholes, and eradication of exotic plants and animals.

In 1986, the Service initiated systematic surveys of nesting sea turtles and ospreys. That same year, aerial surveys were initiated to monitor the numbers and kinds of birds using the refuge islands. Bald eagle productivity has been monitored at all known nests: two new nests have been found since 1988. Efforts have been underway to address invading exotic plants. Australian pines were killed on Boca Grande Key and most of the Marquesas Keys, and Asiatic colubrina was removed from the Marquesas, west Content, and Bay Keys. Large metal panels known as Marston matting which were used as aircraft landing zones for military maneuvers by the Navy in the 1960's were removed in 1991 from a turtle nesting beach in the Marquesas.

"Area Closed" signs have been installed at several mangrove islands to prevent disturbance to nesting birds. "No Camping" signs have also been erected on several islands. There was little-to-no Service law enforcement of the backcountry between 1986-1990, but this situation improved slightly in 1991. Service personnel have provided more than 20 presentations on the backcountry to various groups, prepared a backcountry brochure to educate boaters on ethical boating, and participated in the boating Impact Work Group.

9. **Agreements and Permits**

The Service currently has a cooperative law enforcement agreement with the Florida Game and Freshwater Fish Commission. Efforts to enter into cooperative agreements with the Florida Marine Patrol and Marine Sanctuary officers are underway.

PART II - RESOURCE PROBLEMS

1. **Human Disturbance of Wildlife: A Literature Review**

A. Overview - Rapid, expanding development of coastal areas inevitably leads to increased recreational use of adjacent waters. As recreational activity increases, there is a concurrent rise in human interactions with wildlife, often to the detriment of the latter (Burger and Gochfeld 1991, Kaiser and Fritzell 1984, Vos et al. 1985, Bratton 1990, Burger 1991). Concern over this problem has generated a flurry of research since the 1970's on the effects of human disturbance on a wide variety of wildlife species, with an extensive literature of more than 300 references (Wildlife Review - Database). Of special interest in the Lower Florida Keys backcountry are the effects of human disturbance on colonial nesting birds (e.g., herons) and raptors. These topics are followed by a general discussion of the potential effects of human disturbance on avifauna with emphasis on colonial nesters and raptors.

B. Potential effects of human disturbance on avifauna - The effects of human disturbance on nesting birds vary according to species, but even within the same species, there are tremendous differences between individual birds in tolerance of the presence of man (Fyfe and Olendorff 1976). Raptors and colonial nesting waterbirds are among the more sensitive groups (Fyfe and Olendorff 1976, Buckley and Buckley 1976, Tremblay and Ellison 1979, Anderson and Keith 1980, Vos et al. 1985). Human interference can have adverse effects on nesting avifauna. The frequency, duration, proximity, and kind of disturbance; past experience with man; location of the nest and stage of the nesting cycle may influence a bird's response to human intrusion. It is well known that nesting birds are more prone to abandonment of nests during the courtship and incubation periods (Fyfe and Olendorff 1976, Buckley and Buckley 1976, Safina and Berger 1983).

Desertion of the nest, eggs broken, and eggs or young dislodged by a frightened parent, overheating or predation of nestlings or eggs when a parent is flushed from the nest, premature fledgling causing injury or death to nestlings, and missed feedings impacting growth are potential consequences of human interference to nesting birds (Gillett et al. 1975, Kury and Gochfeld 1975, Wetschkul et al. 1976, Fyfe and Olendorff 1976, Tremblay and Ellison 1978, Ellison and Cleary 1979, Parsons and Burger 1982, Safina and Burger 1983, Erwin 1989). Burger (1981) observed that human disturbance of birds resulted in decreased incubation and chick attendance, entanglement of chicks in vegetation, and greater energy expended by adults in territorial defense. Flemming (1988) believed that for piping plovers, "Human disturbance may be an important component of the species' population decline throughout its range." Drent (1975) reported that the range of temperatures for optimal development of eggs is especially narrow in terms of overheating.

Disruption of feeding or roosting birds can increase expenditure of energy, decrease foraging success, and alter foraging patterns. A bird in flight uses considerably more energy than for other activities (Tucker 1973 cited in Korschgen et al. 1985). Owen and Reinecke (1979) suggested that human disturbance of female waterfowl increased flight time and reduced feeding rates and thus was energetically costly. Kahl (1991) found that when slow-moving boats approached, canvasbacks flushed less readily and at much shorter distances than when fast-

moving boats approached. Korschgen et al. (1985) believed that boater disturbances resulted in as much as one hour of additional flight time for diving ducks. Kaiser and Fritzell (1984) found that feeding activity of green-backed herons was adversely affected by recreational canoeists. Based on a four year study of sanderlings, Burger and Gochfeld (1991) reported that an increase in the number of humans within 100 m decreased diurnal feeding rates and led to greater nocturnal feeding, resulting in an increase in intraspecific aggression at night. Burger's (1981) examination of shorebirds and wading birds in foraging and nesting areas revealed that birds were present 30 percent less when humans were present. Other studies have documented correlations between bird densities and human use of an area (Erwin 1980; Kahl 1991).

C. Colonially nesting waterbirds - Bratton (1990) documented Ciconiiformes (herons and egrets) in tidal creeks were more susceptible to boater disturbance than those along the shore as 74 percent and 83 percent of all disturbances in two tidal creeks resulted in birds flushing or altering their behavior. Buckley and Buckley (1976) provided comprehensive guidelines for the protection of colonial nesting waterbirds. Colonial birds are especially vulnerable to human disturbance because they nest proximally to one another (Buckley and Buckley 1976, Burger 1981). Thus, as noted by Buckley and Buckley (1976), "...whole populations are vulnerable to a single disturbance." Because colonial waterbirds do not nest singly, they are conspicuous and thus attract the attention of humans (Anderson and Keith 1980). These investigators also noted that human disturbance caused nest abandonment in brown pelicans - even from only one disturbance during the early nesting season - and territorial displacement of adult and nestling Heerman's gulls. Buckley and Buckley (1976) reported that species at the extreme of their ranges are inherently under greater stress than those toward the center of their range, thus requiring greater levels of protection. A perfect example of this in the Lower Florida Keys was the only U.S. nesting colony of magnificent frigatebirds which was active in the Marquesas Keys from 1969 to 1988. This colony abandoned the islands after being subjected to both aerial and water-based human disturbances from 1986 to 1988 (Wilmers, pers. obs.).

Buckley and Buckley (1976) also noted that relocation of a nesting colony may not result in success and that the suitability of a habitat must be assessed only by its use. Thus, if some islands are not used by a species, it cannot be assumed that those islands would provide suitable habitat for a displaced colony. Because the reproductive success of the great blue heron (principally the all-white form, the great white heron) is poor in the Florida Keys (Powell and Bjork 1990), closure of mangrove islands to protect nesting colonies on refuge lands is essential.

D. Raptors - Bald eagles, red-shouldered hawks, turkey vultures, and ospreys are the raptorial birds which nest in the Lower Florida Keys backcountry. Only ospreys and bald eagles are considered below.

a. Bald eagles - As with many other avian species, individual bald eagles vary in their response to human activity (see discussion by Green 1985). Bangs et al. (U982) believed bald eagles to be susceptible to human disturbance and that reproduction was less successful in areas of high human activity.

Others have correlated human disturbances at nests with lowered productivity and nest abandonment (Weekes 1974, Anthony and Issacs 1989). Fraser et al. (1985) (but see Grier

1969) noted the distance at which bald eagles flushed increased with repeated intrusions, suggesting some birds do not habituate to disturbance. Gerrard et al. (1975) observed that nesting density decreased when recreational activity was permitted. McGarigal et al. (1991) reported that bald eagles in Oregon avoided areas within an average 300-400 m of a single stationary boat, effectively displacing them from 28 to 50 ha of foraging habitat.

Buffer zones to protect bald eagles have been advocated widely (see Mathiesen et al.1977, Stalmaster and Newman 1978, Issacs and Silovsky 1981, USFWS 1986, USFWS 1987, McGarigal et al. 1991). The small eagle nesting population in the Lower Florida Keys (five nesting pairs) would benefit from buffer zones. Regrettably, sight-seeing tours by local aircraft at f1ight levels less than 200 feet have been observed over a bald eagle nest in the Key West NWR.

b. Ospreys - Ospreys are generally among the most tolerant of all raptorial birds to human activity (Fyfe and Olendorff 1976, Poole 1981), but there are notable exceptions. For example, Swenson (1979) found that nesting ospreys (during the last half of incubation) near camping areas were negatively affected when annual camping and fishing seasons commenced. These pairs had poorer reproductive success than those in an undisturbed setting. Two studies of ospreys nesting in Scandinavia found that spring boating traffic may negatively affect reproductive success of certain pairs (Haga 1981, Hallberg et al. 1983 cited in Poole 1989). Alt (1980, cited in Poole 1989) reported that boats operating parallel to a shoreline did not flush incubating ospreys, but the boats at the same distance heading directly at the nest caused the birds to flee.

2. **Special Considerations**

A. Bald eagles - Bald eagles require special consideration not only because of their endangered status and their relatively low population in the Lower Florida Keys but also because they can be highly sensitive to human disturbance (see Weekes 1974, Anthony and Issacs 1989). According to Grubb et al. (1982), for such an eagle population, there is justifiable cause for concern and intensive management. Prudence dictates that the precise locations of their nests and favored roost sites not be disclosed in this document. In all instances where protection of bald eagle nests and favored roosts were the reasons for management measures, other species (e.g., wading birds) on the same island warranted similar protective measures. Sufficient management flexibility must be allowed to immediately protect any new nesting pair of eagles discovered or any existing pair which builds its nest on a different island.

Regarding the latter scenario, although bald eagles have great fidelity to a nest site, nest trees may, for example, be struck by lightning or be blown down by winds. Two bald eagle nest trees in the Lower Florida Keys, one in the backcountry, are either dead or dying. At a third nest tree, one of the limbs supporting the nest has broken, and the tree may become unsuitable for nesting in the next few years. Sometimes, there may be one or more alternate nest sites within a nesting territory (see Green 1985), but these are not necessarily located on the same island.

Of five confirmed bald eagle nests on Federal lands in the Lower Florida Keys, four are on backcountry islands (one in the Key West NWR, one in the Great White Heron NWR, and two in

the National Key Deer Refuge). Two of these four nests are vulnerable to human encroachment; both are within 10 m of the edge of an island. These nests are visible from a boat, and one has been subjected to disturbance by boaters, including guide-led commercial trips.

B. Ospreys - Only in Monroe County is the osprey designated by the State as a Species of Special Concern. Many ospreys in the Lower Florida Keys backcountry nest on the edges of islands or in low isolated mangroves and thus are subjected to varying amounts of disturbance by boaters (Figures 7, 8 and 9).

Ospreys in the Lower Florida Keys differ dramatically in their tolerance of human activity near their nests. Those nesting on mainline keys on poles or platforms next to roads or residences are habituated to vehicular traffic or certain forms of other human activity. At such nests, the kind and degree of disturbance are somewhat uniform (e.g., traffic) or predictable thus allowing habituation. These nests are at least 25 feet above ground level, affording an elevational buffer compared to the many low nests in the backcountry (discussed below).

Since 1986, 28 osprey nests less than about four feet above "normal" high tide have been documented. The bottoms of three nests in shallow protected creeks are sometimes wet at high tides (Figures 7, 8 and 9). These birds are generally very wary of humans. All low nests are accessible by shallow-draft vessels including PWC. Boat and PWC wakes, at high tide, can overwash some of these nests. Such an event was once observed at a low nest in the Mud Keys.

Human disturbance at both high and low nests along tidal creeks (e.g., Mud and Snipe Keys), is of much concern, especially during sensitive nesting periods, including courtship and incubation. As Poole (1989) suggested, the "... timing of the disturbance and the extent to which ospreys are habituated to it" is an important factor in their response to human presence. In the Lower Florida Keys, most ospreys appear at old nests during October and November, when relatively few humans are in the backcountry. Eggs may be laid as early as the third week of November or as late as March, but most pairs lay during December, just when an influx of tourists and winter resident visitors begin arriving in the backcountry. Disturbance is often inadvertent but is inevitable.

A number of nesting ospreys in the backcountry are being disturbed during sensitive periods. On 12 occasions since 1986, boats have been observed anchored within about 10 m of osprey nests during incubation (Wilmers, pers. obs). In each instance, the parent bird was not on the nest but was either vocalizing while flying above the nest or calling from a perch. The extent to which a human lingers near a nest is a crucial factor as eggs may overheat when exposed. Drent (1975) reported that "...overheating of the egg is a real danger at any time."

At Snipe Keys in the tidal creeks south of Snipe Point and north of outer Narrows, there were six nesting ospreys in 1986. Boat traffic, notably PWC, in these tidal creeks increased noticeably during 1987 and thereafter. Abandonment of nests has been abnormally high and productivity abysmal (Table 1). During the 1990-91 nesting season, four pairs were at nests but none laid eggs. Ospreys have nested in the main tidal creek since 1987. While many factors such as food supply affect the reproductive success of ospreys, frequent or pro1onged human disturbance is clearly a key factor.

In the Mud Keys, high levels of boat traffic may be negatively influencing reproductive success. Productivity has been poor and nest shifts (abandonment) high (Table 2). Most boaters either do not realize they have flushed a nesting osprey or fail to realize the potential problems involved with a prolonged visit.

Table 1. Reproductive success of ospreys nesting in Snipe Keys tidal creeks, north of Outer Narrows.

YEAR					
Parameter	1986-87	1987-88	1988-89	1989-90	TOTALS
Occupied nests (% successful)	6 (50)	5 (0)	2 (0)	4 (0)	17 (18)
Active nests [1] (% successful)	5 (60)	5 (0)	1 (0)	0 (0)	11 (27)
Young/occupied nests	0.83	0	0	0	0.29
Young/active nests	1.00	0	0	0	0.46
Young/successful nests	1.67	0	0	0	1.67
Nest shifts [2]		1	4	2	7

[1] Nest in which one or more eggs were laid. Nests without eggs but with adults were considered "occupied."
[2] Nests not used, which had been occupied the preceding year.

Table 2. Reproductive success of Ospreys nesting in the Mud Keys.

YEAR					
Parameter	1986-87	1987-88	1988-89	1989-90	TOTALS
Occupied nests (% successful)	4 (50)	5 (0)	4 (25)	4 (25)	17 (24)
Active nests [1] (% successful)	3 (66)	4 (0)	4 (25)	4 (25)	15 (27)
Young/occupied nests	1.00	0	0.75	1.00	0.65
Young/active nests	1.30	0	0.75	1.00	0.73
Nest shifts [2]		1	3	1	5

[1] Nest in which one or more eggs were laid. Nests without eggs but with adults were considered "occupied."
[2] Nests not used, which had been occupied the preceding year.

c. Magnificent Frigatebirds - Buckley and Buckley (1976) reported that species at the extremes of their range are inherently under greater stress and thus require a greater measure of protection. The frigatebird nesting colony in the Marquesas Keys (active 1969-1988) is a classic example, having been subjected to both aerial and water-based disturbances from 1986-1988. Ornithologist Paul Sykes (18 September 1969) suggested that because "approximately 235 days are required for young frigatebirds to develop and fledge, it is essential that human disturbance be kept to a minimum." He recommended that signs be erected 200-300 yards from the colony to provide a protective zone.

Given that a frigatebird nesting colony appeared in the Dry Tortugas the year following the abandonment of the Marquesas Keys site, many of the birds from the latter site may have moved to the Tortugas. However, the Marquesas site still seems to be suitable for nesting, and, if it can be protected from aerial and water-based disturbances, it is possible the site can be reoccupied by nesting Frigatebirds. Because of the large number of islands in the Lower Keys and that nesting

has occurred only in the two referenced areas, it would seem that the Marquesas Keys possess special qualities lacking at other refuge-owned islands. Substantial numbers of figatebirds still roost in the Marquesas Keys, both at the old nesting area and, more recently, at an island on the southwest side. Both areas are occasionally subjected to high speed boat traffic. A commercial aircraft charter brochure touts visits to a "frigate island."

D. Mangrove Islands - Mangrove islands are composed largely of red and black mangroves. Upland vegetation is either absent or, in the case of a few keys, occurs on only a small fraction of the island, usually as a narrow sand berm landward of the mangrove fringe. Some of these islands are less than an acre in size, such as Hurricane Key.

Mangrove islands contain a diverse assemblage of vertebrates (see Odum et al. 1982), including a large number of birds (see Robertson and Kushlan 1974). Such islands are used heavily by birds as roosting, feeding, and nesting areas. Odum et al. (1982) lists more than 180 avian species known to occupy mangrove communities as migrants or breeders. Three of four bald eagle nests and many osprey nests in the management area are on mangrove islands. These islands constitute the most important nesting areas for wading birds such as the great white heron, little blue heron, tri-colored heron, green-backed heron, yellow-crowned night heron, great egret, snowy egret, reddish egret, and cattle egrets. Brown pelicans and double-crested cormorants also nest on these mangrove islands.

Human entry onto mangrove islands in the refuge is currently unrestricted, unlike those at nearby Everglades National Park (NP), where access is prohibited. Given the large number of the Service's mangrove islands and their importance as nesting sites in the management area, human disturbance is a potential problem over a wide area. Platforms (including one about 50 feet long on Horseshoe Key Mangrove Key), makeshift shelves, and small man-made clearings have been found on a few mangrove islands. Boaters have also been observed disembarking on a few mangrove islands, especially at Little Crane Key, which is the site of a great egret colony and a large magnificent frigatebird night roost.

3. **Personal Watercraft**

A. Definition - PWC are defined here as jet and air-powered watercraft operated by standing, sitting, or kneeling on or behind the vessel, in contrast to a conventional boat where the operator stands or sits inside the vessel. They are further defined as any watercraft which uses a two-cycle inboard engine to power a water jet pump for propulsion, instead of a propeller as in a conventional boat. PWC are known by such brand names as Bombardier, Sea Doo, Jet Ski, Wave Runner, etc., and are often referenced as jet skis, water bikes, jet bikes, and water scooters (Snow 1989). The registered trade name, Jet Ski (Kawasaki Motors Corporation) is widely used as a generic term for all brands of PWC.

B. Background - A literature search (Wildlife Review - Database) by the Service's Office of Information Transfer in Fort Collins, Colorado, revealed about 300 citations on the effects of human disturbance on wildlife, but none was specific to PWC. Literature germane to the potential impact of PWC to wildlife are discussed here, along with the observations of a Service biologist stationed in the Lower Florida Keys from September 1985 to the present. The following

information also borrows heavily from the work of Snow (1989) regarding the potential impact of PWC in Everglades NP, where their use has been prohibited for several years.

Technologically, PWC represent a unique type of recreational boating that is relatively recent in origin. Snow (1989) reported that they were first introduced in the U.S. in 1974. Thus, their operation is not a historical use of waters within the administrative boundaries of the refuges. Hence, they are considered separately from the conventional watercraft discussed elsewhere in this document.

Snow (1989) reported that regulation of PWC was a contentious issue on local, state, and national levels and that some states did not know how to classify them while others were attempting to preclude their use in certain waterways. In Monroe County, the only areas that are presently closed to PWC are Everglades NP, Biscayne NP, and Fort Jefferson National Monument, which are administered by the National Park Service.

c. Numbers - The number of PWC operating in the Lower Florida Keys backcountry is unknown. Information on the numbers of PWC registered in Monroe County was requested on 2 July 1991 from the Florida Marine Patrol, Bureau of Vessel Titling and Registration. The data provided are confounding, however, because PWC are combined with conventional boats in Class A-I (those 12 feet or less in length) of which 1,723 vessels were registered for 1989-90 in Monroe County compared to 974 in 1985-86.

However, several indicators suggest an increase in their use. First, Snow (1989) reported that the 30,000 to 40,000 PWC sold annually in the U.S. during the late 1980's was projected to increase to 100,000 units within 5 years. Second, it is noteworthy that PWC accidents in Monroe County (records available only since 1989) doubled between 1989 and 1990 (Florida Marine Patrol, Tallahassee). Third, the number of PWC dealers listed in the Key West telephone directory under "Boat Dealers" increased from 0 in 1983-84 to 3 in 1990-91, while listings for PWC rentals (under "Boat - Renting and Leasing") increased from 0 in 1983-84 to 7 in 1990-91. Two additional rental operations have opened in recent months. Fourth, the refuge biologist has observed a great increase in the use of PWC in the tidal creek areas in the Great White Heron NWR from 1986-91. In 1986, for example, no more than two PWC were observed simultaneously in the Snipe Keys; in September 1990, 17 were observed simultaneously in tidal creeks between Snipe Point and outer Narrows. Fifth, PWC operation has been banned in waters in nearby Everglades NP and Biscayne NP, with the likely result of a shift of that traffic elsewhere, including the Lower Florida Keys. Sixth, at least one national PWC magazine has published a cover story promoting the Florida Keys as a place for tour riding on a PWC (see Water Scooter, Vol. 4, August 1990).

D. Distribution in the Lower Florida Keys - PWC are operated throughout virtually the entire Lower Florida Keys backcountry. Aside from East Bahia Honda Key southwest to the Johnson Keys (north of Little Pine Key), PWC have been observed in operation adjacent to virtually all Service managed islands, including the Marquesas Keys, a distance of some 25 miles from Key West. Their use is greatest in the Great White Heron NWR in the Bay, Cayo Agua, Lower Harbor, East Harbor, Mud, and Snipe Keys.

Bratton (1990) reported that wading birds resting and feeding in tidal creeks were highly sensitive to boat traffic. In light of this finding, observations of PWC operation in Lower Florida Keys tidal creeks are germane. PWC have been observed flushing birds repeatedly in extensive networks of tidal creeks in Cayo Aqua, Lower Harbor, East Harbor, Mud, Snipe, Sawyer, and Content Keys.

E. Problems - In the maze of tidal creeks in the Snipe Keys between outer Narrows and Snipe Point, PWC have been observed in continuous operation running a circuitous route for more than 1 hour, resulting in wading birds and nesting ospreys chaotically fleeing. One incubating osprey was kept off of its nest for one hour; it alighted near the nest 11 times only to be flushed when PWC's passed by. Heat is stressful to eggs and young (Drent 1975). Direct sun may result in overheating of eggs in the absence of an incubating parent. Thus, even if all other factors were favorable, such as food supples, this event alone may result in the failure of the nest. It is reasonable to determine that excessive disturbance by boaters, especially those using PWC, contributes to the abnormally high number of abandoned osprey nests and poor productivity in Mud and Snipe Keys (Tables 1,2).

Rented PWC's, as based on commercial tags, have been observed as distant as Boca Grande Key and have also been observed near Woman, Cottrell, Little Mullet, Big Mullett, Man, and Mule Keys in Key West NWR. In Great White Heron NWR, rented PWC's have been observed adjacent to the Bay, Lower Harbor, Cayo Agua, East Harbor, Mud, and Snipe Keys. Commercial tags have been observed on PWC moored on Woman, Boca Grande, East Harbor (Figure 10), and Bay Keys. At least three commercial, guide-led tours visit refuge islands (frequency unknown) on PWC's, even though these operations have no permits to conduct commercial endeavors on refuge lands.

Snow (1989) suggests disturbance of wildlife by PWC is similar to that generated by conventional boats, but there are salient differences in these user groups in the Lower Florida Keys backcountry. First, in 5 years of observing PWC, the refuge biologist has observed only one instance (near Raccoon Key) where PWC operators were either fishing or transporting fishing gear. Second, users of PWC tend to travel in groups of two to five vessels (Figure 11) and occasionally 15 or more. This type of group use sets them apart from other boaters (Snow 1989). As many as six PWC have been observed on a single trailer, and they can be launched virtually anywhere where slope permits their sliding off into the water. Third, some PWC operators have a pronounced habit of driving at high speed and making repeated circuitous trips, sometimes in almost race-like fashion, through the narrow mangrove-lined creeks (Figure 12). This type of wave-pounding, high speed use is rare in conventional motorboats. The greater turning radius, slower handling, and larger mass of the conventional motorboat precludes its use even at planing speeds in some creeks regularly used by PWC. Fourth, the habit of some PWC users to repeatedly circumnavigate small islands (e.g., Bay Keys) in shallow water has not been observed for conventional motorboats. Fifth, as noted by Snow (1989), because of maneuverability, PWC may run "...circuits which are constantly changing and therefore unpredictable." This is in marked contrast to most operators of conventional boats, who, by necessity, must stay on course or risk running aground in shallow water.

4. **Airboats**

One commercial airboat is currently known to be operating within the administrative boundaries of Great White Heron NWR. The airboat operator lists "Back Country Island Tours" and "See Marine and Bird Life" in advertising brochures. This vessel is very loud (the operator and passengers wear headphones) and has been observed flushing birds in the Mud Keys.

Two other different airboats have been observed in the National Key Deer Refuge backcountry since 1986, one north of Howe Key and the other in Coupon Bight. A few local residents have complained about the use of these airboats to the National Key Deer Refuge staff. Airboats have been prohibited in the Florida Bay portion of Everglades NP for a number of years.

5. **Water Skiing**

The extent of water skiing adjacent to mainline keys (islands linked by roads) within the administrative boundaries of the refuge is not documented. It appears to be most frequent in Pine, Kemp, Niles, and Bow channels.

In the backcountry waters north of the mainline keys, water skiing is uncommon except for a commercial water skiing venture which frequently operates near the Bay Keys. Water skiing occurs occasionally in the tidal creeks in the Mud Keys (Figures 13, 14) and in nearby Waltz Key Basin. It has also been observed on at least two occasions in Turkey and Jewfish Basins, in Cudjoe, Johnston Key and Spanish Channels, and in several other unnamed areas, thus indicating that it has occurred at least infrequently over a widespread area. As with other recreational pursuits, this activity has the potential to become increasingly frequent and thus merits attention now. Water skiers pulled by PWC have been observed on two occasions in Key West NWR between Archer and Barracuda Keys.

Water skiing, unlike fishing, is not a traditional use in the backcountry waters of the Lower Florida Keys. It is believed a highly dangerous activity in the Mud Keys because of the narrowness and curvature of the creeks and the occasional high speeds of oncoming boat traffic. Water skiing has been observed for more than two consecutive hours in the Mud Key tidal creeks (Wilmers, pers. obs.). Such prolonged disturbance in a relatively confined area is disruptive to wildlife. Boufford (1982) noted that water skiing created considerable disturbance to waterfowl.

6. **Commercial Use: An Overview**

Advertising brochures and first-hand knowledge regarding the commercial users of the refuge islands indicate a broad spectrum of ongoing activities. Although the extent of commercial use is unknown, several known current activities are cause for concern. For example, at least two parties take visitors to bald eagle nesting sites on refuge lands. Several aircraft charter companies advertise "wildlife excursions" to backcountry islands in the Lower Florida Keys. PWC rentals involving guided backcountry tours, including landing on backcountry islands, operate from at least four facilities. A guided backcountry tour in an airboat is conducted by at least one individual whose craft passes near refuge islands.

One company advertises an all-day island party, complete with jet skiing, water skiing, wind surfing, and a five man waterslide on the northwest Bay Key. PWC launched from this island are known to flush birds on nearby Service managed islands. Another commercial venture moors a large catamaran near Woman Key, a designated wilderness island about 12 miles offshore of Key West. Up to 40 passengers then disembark and either snorkel or walk on the beaches. Terns and shorebirds, including piping plovers, are flushed en masse by such visitors.

7. **Law Enforcement Problems**

Several resource problems have been observed since 1986. Although their occurrence is not regular, these problems merit attention.

A. Camping - Camping has been observed on 21 islands within the refuges' administrative boundaries since 1986, but it occurs infrequently, except on Tarpon Belly (privately owned) and Boca Grande Keys, and, to a lesser extent, the Marquesas Keys. Camping (Figure 15) has been observed one or more times on 18 other keys: Woman, Man, Bay, East Harbor, Mud, Snipe (Snipe Point), Marvin, Johnston (Great White Heron NWR), Sawyer, Water (west), Content, Little Spanish, Little Pine, Coconut, Friend, Teakettle, and Horseshoe. There is one known instance of camping on a refuge island within 100 m of a bald eagle nest and a few instances where tents were near nesting ospreys, white-crowned pigeons or great white herons. On 23 May 1991, the remains of two campfires and ropes strung in trees (for unknown reasons) were observed within 50 m of a laughing gull colony which supported an estimated 400 breeding pairs in 1991. A similar incident was also observed in this same area on 13 August 1991.

Camping may occur during any month of the year, but is more common during the winter when mosquitoes are at their lowest levels and tourism is at its peak. Camping may be widespread during certain holiday weekends or special events such as the special sport-diver lobster season. Night patrols may be necessary to catch violators because campers, perhaps realizing that their activity is illegal, may arrive at islands near dusk and dismantle tents shortly after sunrise, escaping detection by law enforcement personnel. Dismantled tents, hidden in vegetation along with other stored gear, have been found on several occasions on Boca Grande Key.

Camping is a serious problem. At a State-owned lot in the west Content Keys, 19 campers (Figures 16, 17) spent one week on the island. They cut large red mangroves to create five boat slips and erected platforms to store provisions. They also shot firearms and set off fireworks and left behind a smoldering fire and a large amount of litter. An active osprey nest was located within 5 m of this campsite - the parents abandoned the nest.

Campfires and campers walking along a beach can deter sea turtles from nesting. Boca Grande, Woman, and the Marquesas Keys provide habitat for three species of nesting sea turtles; fire pits have been found within a few meters of nests in each of these areas.

Trash pits, associated with either camping or day use, have also been found near nests. In one instance, a green turtle attempted to nest in an old trash pit, but was possibly deterred by the litter beneath the sand, including broken beer and whiskey bottles.

Land clearings and poaching (discussed below) may also be associated with camping. Campfires have resulted in at least two wildfires (on Boca Grande and Johnston Keys) since 1986.

B. Fireworks - Bottle rockets and other fireworks have been found on Mud, Content, Marquesas, and Boca Grande Keys.

C. Firearms - Bullet-riddled cans (Figure 18) and signs and spent ammunition have been observed on eight keys: Marquesas, Boca Grande, Bay, Mud, Marvin, East Harbor (aka Lower Harbor), Content (west), and Little Pine Keys.

D. Land Clearings - Significant land clearings, the largest of which is about 0.5 acre (northwest Bay Key), are present on the Marquesas (four sites), Boca Grande (two areas), East Harbor (Figure 19), Mud, Marvin (privately owned), and west Content Keys. Some of these areas were cleared many years ago and are "maintained" by camping (firewood cutting) or day use activities which prevent natural succession. Chain saws, hand saws, hatchets, "weed wackers," and lawn mowers (Figure 20) have been used to cut vegetation for campsites or campfires.

E. Poaching - Hunters' blinds (Figure 21) have been found twice since 1988 on a backcountry island containing Key deer. The extent of poaching is unknown, but this illegal activity is very difficult to detect, even with adequate law enforcement personnel. Kushlan and Frohring (1985) reported four documented cases of poaching of brown pelicans during a four year period in Florida Bay.

F. Illegal Structures - A 6' x 6' x 6' pit lined with pressure- treated lumber and reinforced with a steel jacket and corner posts was found in the Marquesas Keys in 1990, but its purpose has never been determined (Figure 22). Plywood platforms (one about 50 feet long) and makeshift tables and shelves have been found on nine islands since 1986: Horseshoe Key, Contents, Upper Harbor, Lower Harbor, Marvin, Woman, Boca Grande, Marquesas, and an unnamed State-owned island south of Howe Key. Several of these structures were old and rotted when found. It appears that they were used either for drying sponges or to support tents on mangrove islands. It is disturbing that one of the most heavily used islands for wading birds, Upper Harbor Key, contained several small wooden platforms nailed into trees.

G. Crowds - Crowds, 10 or more persons on an island or 5 or more boats moored next to an island, have been observed on Marvin (privately owned), Content (west), Snipe (Snipe Point), Mud (northwest side), East Harbor (northernmost island), Bay (northernmost island), Woman, Boca Grande (northwest side), and Marquesas Keys. The largest crowds are typically found on Snipe Point, Woman, and Boca Grande Keys.

Snipe Point, where loggerhead turtles nest, has had a history of attracting large crowds on weekends since 1986 (Figure 23). On 21 June 1991, at least 150 persons and 7 unleashed dogs were present on or next to the island. High speed boats and a parade of at least 15 PWC were in seemingly continuous motion offshore. Both of these vessel types were also observed periodically running a circuit through the channels and creeks south of Snipe Point for at least one hour.

Boca Grande Key, which harbors three species of nesting sea turtles as well as wintering piping plovers, has had a chronic history of public use problems (large scale littering, vegetation clearing, and cooking f ires) and has had crowds in excess of 40 persons. When crowds are present on an island, because of the sheer numbers of people involved, there seemingly is a greater chance of degradation of natural resources and noncompliance with established regulations (e.g., prohibitions on campfires, pets, littering, etc.).

H. Dogs

Dogs chase and can kill birds and Key deer and can quickly dig up a turtle nest. Although they are not permitted on refuge islands, dogs nonetheless have been observed one or more times on seven of eight keys (four in the Marquesas Keys) known to contain nesting sea turtles (Figure 24). On 22 September 1991, dog tracks followed to a known loggerhead turtle nest yielded evidence of the body pit being disturbed by digging. Dogs have been observed chasing birds on sand flats near the Marvin Keys and on Woman, Boca Grande, Sawyer, west Content, and Mud Keys and Snipe Point. Dogs killed a Key deer on Knockemdown Key in 1988.

I. Low-level Aircraft

Small tour planes were observed several times at low altitude above the magnificent frigatebird colony (when it was still active) in the Marquesas Keys. Such aircraft have been observed making passes in Key West NWR at very low level (less than 200 feet) over islands containing active bald eagle, osprey, little blue heron, and great white heron nests on numerous occasions. Stunt flying involving near vertical dives and ascents and flying upside down over Boca Grande and Woman Keys has been observed.

8. **Conflicts Between User Groups**

As public use increases on the refuges, competition between different user groups will increase and intensify. A conflict already exists between fishing guides and operators of PWC. Flats fishermen must pole quietly and arduously in shallow water to enable clients to sight cast for skittish gamefish such as permit tarpon and bonefish. Often these efforts are thwarted when fishing areas are invaded by PWC operators who scatter the fish, shatter the solitude, and degrade the quality of an outing, resulting in disgruntled clients and a loss of repeat business. Concern has also been voiced by those engaged in nature observation and other nonconsumptive activities.

9. **Loss of Wilderness Values**

The wilderness values in some areas of the refuges are being degraded by litter, noise, overcrowding, habitat degradation, and loss of solitude. Given the inevitable increase in public use on several wilderness designated islands having beaches such as Woman, Boca Grande, and Marquesas Keys, further losses in wilderness character and resource degradation are possible. Charter aircraft buzzing wilderness islands at low-levels, crowds of 30 or more on Woman and Boca Grande Keys, destruction of habitats in some areas, and the invasion of exotic plants are all indicators of potential future problems.

PART III. REFUGE OBJECTIVES AND MANAGEMENT STRATEGY

1. **Refuge Objectives**

A. Highest Priority

a. To prevent human disturbance at bald eagle nest sites, particularly at nests near the edges of islands where interference by boaters has been documented.

b. To provide safe nesting, feeding, and roosting areas for ospreys, wading birds, and brown pelicans in vulnerable, disturbance-prone areas, with particular emphasis on protection of rookeries.

c. To protect nesting laughing gulls at the only known colony in the Lower Florida Keys.

d. To minimize human disturbance to migrant shorebirds, particularly piping plovers, at known concentration areas.

e. To provide safe nesting beaches for sea turtles in Key West and Great White Heron NWR's.

f. To protect Key deer on backcountry islands.

g. To curtail incompatible or illegal public use activities, such as camping on refuge islands, through education and law enforcement efforts.

B. High Priority

a. To reduce human disturbance to nesting ospreys, particularly those activities which result in prolonged disturbance during the pre-nesting association and incubation periods.

b. To provide safe loafing areas for royal and least terns in areas of known concentration.

c. To minimize boater disruption to roosting magnificent frigatebirds.

d. To preclude dangerous boating activities in tidal creeks bordered by islands.

C. Moderate Priority

a. To provide day use opportunities for the public on selected islands where compatibility with wildlife is not a factor.

2. **Management strategy**

The goal of the management plan is to protect wildlife of the Lower Florida Keys without imposing unnecessary restrictions on boaters. It is recognized that greater enforcement of existing regulations is needed, and law enforcement efforts will be bolstered. But even if all existing

regulations were enforced, many of the refuges' management objectives may still not achieved. For example, PWC use in narrow tidal creeks is not illegal but it can nonetheless result in prolonged disturbance to birds and hazard to human safety.

Along with increased law enforcement, public education will play an increasingly important role in the protection of backcountry resources. Many backcountry boaters are apparently unaware that their activities can be disruptive to wildlife and cumulatively threaten the well being of protected species. Educational avenues that can be pursued include maps, brochures, public service announcements, newspaper and magazine articles, and interpretive signs at boat ramps and marinas. Slide programs, with narrated cassettes or videos detailing the fragile nature of the backcountry, will be provided to local schools, libraries, and interested organizations.

Certain areas can best be protected by establishing idle speed, no motor, and no access buffer zones. Idle speed and no motor zones will allow access to areas but reduce wildlife disruption by precluding high speed boat traffic.

Mangrove islands, which are important bird nesting and roosting areas, afford virtually no public use opportunities. Public entry on such islands is inherently incompatible with the protection of birds and must be prohibited.

Curtailing dangerous and disruptive boating activities in tidal creeks and other biologically sensitive areas near refuge islands is a priority. Water skiing, use of PWC, and operation of airboats are nontraditional uses in backcountry waters and present a human safety problem.

The regulations governing commercial use of refuge islands will be followed. Commercial use of refuge islands requires a permit (8RM1-OO2). Permit requests will be evaluated on a case-by-case basis for compatibility with the purposes for which the refuges were established.

PART IV. MANAGEMENT ACTIONS

1. **Idle Speed. No Motor, and No Access Buffer Zones**

A. Overview

In this section, idle speed, no motor, and no access buffer zones (defined below) or other signage are discussed. Prioritization of these measures is summarized in Table 3. The aerial photographs referenced in Table 3 provide detailed maps of each area. These aerial photographs are included in Appendix B. Copies are available for review at National Key Deer Refuge. Figures 1, 2, and 3 are large-scale locator maps of these areas. Because of the length of the management agreement and the inevitable increase of boaters in the backcountry, a long-term, comprehensive management strategy is warranted. The measures in this section are inextricably tied to implementation of recommendations contained in other chapters. For example, the lack of an area wide closure on PWC would require the implementation of additional management actions on other areas not currently impacted, may result in expanded buffer zone sizes, or both. Current protected areas represent the absolute minimum necessary for protection and are a compromise between wildlife protection needs and recreational use needs.

Table 3. Prioritized list of protected zones for wildlife.

AREA	MEASURE	FIGURE
HIGHEST PRIORITY		
Sawyer Key	Close tidal creeks on south side	11
Upper Harbor Key	No access buffer zone (300 feet) around island	14
East Harbor Key (northeast)	No access buffer zone (300 feet) around island	7
Little Mullet Key	No access buffer zone (300 feet) around island	4
Little Crane Key	No access buffer zone (300 feet) around island	12
Boca Grande Key	Close one-half of the beach	3
Woman Key	Close one-half of the beach and sand pit (southeast side)	3
Horseshoe Key	Post entire island off limits	
HIGH PRIORITY		
Cottrell Key	No motor zone (300 feet) around island	5
Marquesas Keys	No motor zones (300 feet) around 3 small islands; no access buffer zone (300 feet) around 1 island; idle speed zone through one tidal creek	1, 2
Snipe Key (tidal creeks north of outer narrows)	Idle speed zone in main creek; no motor zone elsewhere	9
Mud Keys	Idle speed zones in 2 main creeks; close 2 smaller creeks.	8
Big Mullet Key	No motor zone (300 feet) around island	5
Tidal flat south of Marvin Key	No access buffer zone	10
MODERATE PRIORITY		
West Content Keys	Idle speed zones in tidal creeks	13
East Content Keys	Idle speed zones in tidal creeks	14
Bay Keys	No motor zone (300 feet) around one island	6
Lower Harbor Keys	Idle speed zone	7
Cayo Agua Keys	Idle speed zone	7

B. Resources Available/Current Program

Prior to this agreement, the Service had no jurisdiction over the waters surrounding the backcountry refuge islands. All islands are open for day use except for the three areas described below. A few small mangrove islands on the west side of the Snipe Keys were posted closed in 1989 to protect the last of the remaining nesting ospreys there. In 1991, following the release of several rehabilitated deer and the subsequent discovery of a poacher's blind on Little Pine Key, the main access points (e.g., paths cut by visitors through the mangroves) were posted closed. That

same year, "Area Closed" signs in both English and Spanish were posted at the openings in the mangrove fringe on the southwest side of Horseshoe Key, following the discovery of ropes suspended in trees and fireplaces near a large laughing gull colony.

"No Camping" signs were replaced on the Marquesas Keys and erected at the clearing on west Content Key in 1991. Law enforcement is discussed in Section 4.

C. Management Actions

a. Definitions

Idle Speed Zones - Areas where boats must operate at a speed not greater than that needed to maintain forward progress; operation at planing speed is prohibited.

No Motor Zones - Areas where use of boat motors powered by gasoline or diesel fuel is prohibited. Boats with such motors are permitted access to no motor zones only through the use of a push pole, paddle, or electric motor.

No Access Buffer Zones - Areas closed to all types of vessels.

b. Organization of this section: For each island, the degree of accessibility to boater traffic is summarized, followed by a brief general description of the island's salient features. Separate subsections on the island's wildlife, problems, recommendations, and signage are then provided for each island. Aerial photographs delineating the area for each management measure are also provided for each island in Appendix B. The islands are listed by specific refuge and in the order in which they appear on the aerial photographs, beginning with the Marquesas Keys westward to Upper Harbor Key. A prioritized list of the wildlife protection zones is provided in Table 3.

c. Signage: The size and number of signs will vary according to location and purpose but will be no greater than that needed to effectively meet their intended purpose. Separate colors for signs delineating idle speed, no motor, and no access buffer zones will be used to allow instant, long-range recognition by boaters. Where mounting posts are used, they will be of the same color as the signs to further facilitate recognition by boaters. The color of lettering should contrast sharply with the background color of the sign. Because ultraviolet light fades red objects very quickly, this color will not be used for signs. Where practicable, anchored, floating signs (buoys) will be used on an experimental basis to mark a number of idle speed or no motor zones in deep tidal creeks coursing between adjacent islands. The U.S. Coast Guard will be consulted to ensure effective and safe marking of the referenced zones. U. S. Army Corps of Engineers, the State of Florida Department of Environmental Regulation, and Monroe County will also be consulted regarding placement of markers.

KEY WEST NATIONAL WILDLIFE REFUGE

Visitors at the Key West NWR will be allowed on all the man-made (unnamed, dredged material) islands, such as those southwest of Crawfish Key. These dredge islands provide loafing areas for

shorebirds, and one island was once used for nesting by ospreys. However, their closure seems unwarranted at this time.

Visitors will also be allowed on portions of Woman, Boca Grande, and Marquesas Keys. These are the only keys containing extensive beaches, and public use has historically centered around these islands. Other than the Dry Tortugas, Boca Grande and the Marquesas Keys are the only places where green sea turtles nest, and Boca Grande Key is one of only two confirmed nesting areas for hawksbill turtles.

The tiny beach on Man Key is largely inaccessible at most tides to all but shallow draft boats and receives little public use (only one known instance of camping). A great white heron colony (four pairs on 15 March 1991) on this island could be disturbed by public use on the beach. All the remaining refuge managed lands in the Key West NWR are essentially mangrove islands affording no compatible public use opportunities.

Marguesas Keys

This chain of islands, approximately 20 miles from Key West, constitutes the most distant location from the mainline keys (islands linked by U. S. Highway 1). An extensive network of low energy beaches and dunes characterizes the area, with narrow low hammock vegetation present in narrow strands on some islands. Yellowheart, a State-listed endangered species growing on fewer than five other sites in the Florida Keys, occurs on one of the islands. Deep-water channels course through the interior of the pseudo-atoll chain. Most of the beaches are accessible at high tide.

Wildlife - Nesting wildlife species include green and loggerhead turtles (the largest number in the Florida Keys), brown pelican, double-crested cormorants, little blue and great blue herons, yellow-crowned night heron, osprey, great egret, white-crowned pigeon, and the magnificent frigatebird which nested in the area from 1969-1988. Nesting by cattle, snowy, and reddish egrets - all of which have been observed regularly in the area - most likely occurs but has not been confirmed. Shorebirds use the shallow water habitats and beaches year-round.

Problems - Historically, public use of the area has been low due to its distant location and the notoriously rough waters of the Boca Grande Channel, a 6 mile passage. The area has a long history of camping, particularly on the west side, where clearings have been created in several places (Figure 25). Camping and campfires can deter nesting sea turtles. Large-scale littering, liveaboards moored next to islands, illegal structures (including a 6!x 6'x 6' pit, Figure 21), fire or trash pits dug within 2 m of turtle nests, pontoon airplanes flying at low altitudes, dogs roaming free on the beaches, grounding of large (>30 feet length) pleasure or commercial vessels in the interior channels, and bullet riddled cans and signs are among the problems observed since 1986. Disturbance to roosting magnificent frigatebirds, brown pelicans, and various wading birds is currently a problem on several small islands and along one tidal creek.

The beaches in the Marquesas are so narrow that they are sometimes inundated at high tide. During such times, visitors inevitably trample the dune vegetation when they come ashore - a few small areas have become damaged. Invasion of Asiatic colubrina, jumbe bean, and Australian pine has occurred, with most of the latter now eradicated.

Management Actions - Establish an idle speed zone in the southwest tidal creek. Create a no motor zone around one island and no access zones around a group of four tiny islands (Appendix B, Figures 1, 2). Enforcement of existing prohibitions on camping, campfires, littering, and pets will be enhanced. Monitor dune vegetation (e.g., sea oats), which is fragile and vulnerable to trampling (see McDonnell 1981). Damage to dunes is a serious potential problem if visitation increases. Install vandal-resistant no camping signs on four beaches at 100 m intervals. Search annually for invasive exotic plants and eradicate them.

Signage - No Motor Zone - 4 signs; Idle Speed Zone - 2 signs; No Access Buffer Zones - 8 signs; No Camping - 15 signs.

Boca Grande Key

Boca Grande Key has an extensive, narrow, low energy beach on the west and southwest side, with a relatively large interior pond on the shallow wash flats behind the dunes on the southwest side. Deep water near the beach on the northwest side provides access at any tide. The State-listed endangered sea lavender grows adjacent to the beach on the southwest side.

Wildlife - Green, loggerhead, and hawksbill turtles nest on the beach and dune areas. The hawksbill, in particular, has been recorded nesting in only one other area (Soldier Key) in the Florida Keys, with an average of only two nests found in the U.S. annually (Gordon 1983). Federally-listed endangered and threatened species which use the island include the piping plover, peregrine falcon (migrant), and bald eagle (nesting not confirmed). As many as nine peregrine falcons have been observed here simultaneously, suggesting the site is an important hunting/loafing area. A host of terns and shorebirds use the washflats seasonally. Nesting wildlife species include the reddish egret, great white heron, osprey, double-crested cormorant, white-crowned pigeon, least tern, and black-necked stilt. Other species of wading birds have been observed but not confirmed as nesters.

Problems - Camping, campfires (including one wildfire and a fire pit dug near a turtle nest), extensive littering (Figure 26), and cutting live vegetation are recurring problems on the northwest side. Damage to dune vegetation on the northwest side has occurred and may increase with greater visitation. The same area is sometimes the site of large-scale parties (40 or more persons). Unleashed dogs have been observed on the island on a number of occasions.

Management Actions - Close about one-half of the beach and the uplands behind it (Appendix B, Figure 3). This measure will provide an undisturbed area for wildlife, while still allowing for deep water access to the beach area most heavily used by people. Stringent enforcement is needed to curtail illegal camping during the turtle nesting season (May-August). The dune vegetation in the public use area will be monitored. Picnicking will be restricted to the beach or the two sites currently cleared to protect dune vegetation. Vandal-resistant no camping signs will be erected at existing clearings on the northwest side of the beach.

Signage - Area Closed - 6 signs; No Camping - 4 signs.

Woman Key

This island contains an extensive south-facing, low energy beach and associated dunes. A noteworthy profusion of sea lavender, a State-listed endangered plant, grows adjacent to the beach. Shallow water flats (hardbottom) border most of the beach.

Wildlife - Loggerhead turtles nest on the beach and dunes. Yellow- crowned night herons, great white herons, and ospreys are confirmed nesting species. Nesting by several other species of wading birds is likely. A large number of shorebirds, including the threatened piping plover, and three tern species use the sand spits on the southeast side of the island. This is the same area most frequented by people because of its wide beach and accessibility (navigable at virtually any tide).

Problems - Boats operating in the narrow channel between Woman and Ballast Keys flush birds from the sand spit mentioned above. When persons disembark from vessels on the east side of the beach, birds are usually flushed from the area. A commercial tour vessel regularly places 20 or more persons on the beach; this represents a non-traditional use of relatively recent origin. A clearing on the southeast corner in 1986 is now largely revegetated but is strewn with litter. Campfires, camping, and dogs are occasional problems here. The State-listed, endangered sea lavender has been burned in one area. Tramp1ing of dune vegetation by picnickers occurs occasionally, especially on the east corner of the beach. Invasion by Brazilian pepper has occurred on the west corner.

Management Actions - Close one-half of the beach on the east side and create a clearly delineated off limits area (Appendix B, Figure 3) on the aforementioned sand spit (southeast side) to protect terns and shorebirds from disturbance. The remainder of the beach can remain open to the public, with picnicking limited to the beach itself, not on the dunes. Prohibitions on dogs, camping, campfires, and littering must be strictly enforced. Vandal-resistant no camping signs will be installed at 200 m intervals on the beach.

Signage - Area Closed - 4 signs; No Camping - 6 signs.

Little Mullet Key

This small mangrove island is accessible at virtually any tide via a deep water channel extending westward from the island. With a shallow-draft boat and the motor tilted up, it is possible to circumnavigate the island at close range at virtually any tide.

Wildlife - The island contains nesting great white herons, a large number of great egrets (110 individuals on 4 December 1990), and a variety of other wading birds.

Problems - Vessel traffic, including PWC use, has been observed flushing wading birds from the island.

Management Actions - Create a no access buffer zone (300 feet) around the island (Appendix B, Figure 4).

Signage - Area Closed - 6 signs.

Big Mullet Key

This island has relatively deep, navigable water on the west and northwest sides with extensive flats extending outward. The island is accessible at most tides to shallow draft boats.

Wildlife - The island harbors nesting great white herons and double- crested cormorants, and a variety of other wading birds and mangrove terrapins are also present.

Problem - Boat/traffic, including PWC use, flushes wading birds.

Management Actions - Create a no motor zone (300 feet) around the island (Appendix B, Figure 5).

Signaqe - No Motor Zone - 6 signs.

Cottrell Key

This is a relatively large mangrove island that is accessible to shallow-draft vessels at most tides.

Wildlife - This island harbors the largest known great white heron rookery (n= 51 pairs during the 1989-90 nesting season) in the Lower Florida Keys backcountry. It contains a large magnificent frigatebird roost, nesting brown pelicans, a variety of other wading birds, and mangrove terrapins.

Problems - Vessel traffic, including PWC use, flushes nesting and roosting birds.

Management Actions - Create a no motor zone (300 feet) around island (Appendix B, Figure 5).

Signage - No Motor Zone - 6-to-8 signs.

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE

Visitors to Great White Heron NWR will be allowed only on the existing man-made clearings at the northern end of Mud Key and Snipe Point. These sites, as well as the illegal clearings on East Harbor and Bay keys, constitute the four main landing areas for boaters. Snipe Point and the northern end of Mud Key have had a history of public use problems (camping, campfires, dogs, littering, shooting, and/or cutting vegetation) and will require regular visits by law enforcement officers. The large size of the clearings on Bay and East Harbor Keys will be reduced by posting the areas as closed to allow natural succession to occur. It should be noted that three islands listed below, Little Crane, Content, and Upper Harbor Keys, are also within the overlapping administrative boundaries of the National Key Deer Refuge.

Bay Keys

The Bay Keys are a series of islands that are accessible at virtually any tide by a deep water channel. Aside from the northwest Bay Key, the islands are unspoiled and largely composed of red mangroves.

Wildlife - The northwest Bay Key receives heavy public use and is currently little used by avifauna. Nest of the mangrove clapper rail and Cuban yellow warbler have been observed once on this island. The other islands harbor wading birds: the largest of the Bay Keys harbors nesting great white herons (peak population = 36 pairs) and considerable numbers of tricolored and little blue herons.

Problems - A man-made clearing, present for more than a decade, exists on the northwest Bay Key. This island is used by a commercial tour group on a frequent basis (Figure 27, 28). The "tour package" includes transport on a large pontoon boat to the extensive existing clearing on the island. Once at the island, water skiing from a second boat, wind surfing, PWC use, and/or a five-man waterslide are used by visitors. One instance of "water baseball" (home plate, batter, pitcher, and catcher on island, outfielders in the water) has been observed (Figure 29). Unknown parties clear additional vegetation every year, including the cutting of large black mangroves in 1988. This island has literally been taken away from the wildlife. Lawn mowers or "string trimmers" have been used every year since 1988 to cut successional vegetation for camping. On the other Bay Keys, operation of PWC's and conventional boats flush birds.

Management Actions - Create idle speed zones in each of the channels leading to the islands (Appendix B, Figure 6). The northwest Bay Key will be closed to allow natural succession to occur.

Signage - Area Closed - 4 signs, Idle Speed - 6 signs.

Cava Agua Keys

This series of islands is dissected by tidal creeks and is accessible at high tides. A deep water channel from the north allows ready access once the shallow waters have been crossed. All of the Cayo Agua islands consist largely of red mangroves.

Wildlife - These islands are used for nesting by great white herons and ospreys. A variety of other wading birds have been observed, but nesting has not been confirmed.

Problems - Conventional boats and PWC flush birds, especially in the tidal creeks.

Management Actions - Create idle speed zones in each of the navigable tidal creeks (Appendix B, Figure 7).

Signaqe - Idle Speed - 4 signs.

East Harbor Keys

All but one of the East Harbor Keys are mangrove islands lacking dry land. Several are largely inaccessible at most low tides; others can be reached via deep water channels at virtually any tide. A large man-made clearing, present for many years, exists on the northernmost East Harbor Key, and the island has been invaded by Asiatic colubrina, an exotic pest plant, in one area. This site is heavily used by boaters on some weekends.

Wildlife - Several of the islands contain nesting great white herons and double-crested cormorants. The islands are used by a variety of other waterbirds, but it is not known if nesting occurs.

Problems - Camping, campfires, shooting, extensive littering, and vegetation clearing have been documented on the northernmost island. High speed boating, including PWC use, occurs in the tidal creeks and flushes birds on some of the islands. A nesting osprey has been flushed from its nest several times by boaters; one boat was observed anchored within about 10 m of the nest.

Management Actions - Create idle speed zones in tidal creeks (Appendix B, Figure 7). Close the large clearing on the northwest island and allow natural succession to occur. Eradicate Asiatic colubrina and monitor the island for its recurrence. Create a no access buffer zone of 300 feet around the smallest island.

Signaqe - Three or four Area Closed signs for the northwest island. Six signs for the No Access buffer zone around the smallest island.

Lower Harbor Keys

These islands are dissected by tidal creeks, lack dry land, and are composed primarily of red mangroves. Most of the islands are readily accessible by navigable channels. Boat traffic in the area is sometimes heavy on weekends.

Wildlife - The islands harbor nesting great white herons, double crested cormorants, and ospreys. A variety of other wading birds use the islands, but nesting has not been investigated.

Problems - High speed boats and PWC operate adjacent to the islands and flush the birds.

Management Actions - Create idle speed zones in selected tidal creeks (Appendix B, Figure 7).

Signage - Idle Speed - 8 signs.

Mud Keys

This series of islands is highly dissected by navigable tidal creeks accessible at virtually any tide. These creeks are heavily used by boaters, sometimes at very high, unsafe speeds. Relatively large boats up to 25 feet use these creeks regularly. Most of the islands consist almost wholly of red

mangroves, but the northernmost island contains considerable upland vegetation. The latter island contains a large, man-made clearing, present for many years, which is frequently used by boaters.

Wildlife - This series of islands contains nesting ospreys and a small great white heron rookery. Magnificent frigatebirds and a variety of wading birds sometimes roost on islands on the west side.

Problems - High speed boating and water skiing through the tidal creeks flush birds; nesting ospreys and other roosting birds are flushed from their nests. Camping, campfires, and littering occur on the northwest island.

Management Actions - Create idle speed zones for the two main tidal creeks; close two smaller creeks on the west side to provide a sanctuary for birds (Appendix B, Figure 8). Allow day use on the northernmost key, but rigorously enforce the current regulations on camping, campfires, and littering.

Signage - Five to seven Idle Speed Zone signs in the two main tidal creeks; four Area Closed signs in the other two tidal creeks.

Snipe Keys - (north of Outer Narrows)

This area consists of a large number of small islands dissected by a maze of tidal creeks between Snipe Point and the Outer Narrows. A deep, relatively wide tidal creek meandering from east to west is frequently used by boaters with craft as large as 27 feet long observed using the channel.

Wildlife - Aggregations of little blue herons are present on the east tidal creeks. Eight great white heron nests were documented in 1986. Of the six nesting ospreys observed in 1986, two pairs remain; in 1992, one pair produced one fledgling. Snipe Point is also used by least terns, various shorebirds, and loggerhead turtles.

Problems - High speed boats traveling through the main tidal creek have been a long-standing problem. Packs of as many as 17 PWC run through virtually all of the creeks, regardless of tide, and may run circuitous routes for more than an hour. As many as seven unleashed dogs have been observed on Snipe Point. Nesting by loggerhead turtles is jeopardized by overnight camping and roaming dogs which have been known to dig up turtle nests.

Management Actions - Create an idle speed zone in the main tidal creek; establish no motor zone for the remaining creeks (Appendix B, Figure 9).

Signaqe - Four signs for the Idle Speed. Zones; 8 to 10 signs for the No Motor Zone.

Tidal flats south of Marvin Keys

These flats comprise about 1-2 acres and are inundated at high tides. Boater access to the area is available via a nearby channel, with boats mooring and occupants then walking to the flats.

Wildlife - The flats are used for resting by large numbers of a variety of migrant shorebirds and by least and royal terns.

Problem - Humans walking the flats flush the birds.

Management Actions - Create a no access buffer zone to protect the birds resting on the flats (Appendix B, Figure 10).

Sawyer Keys

The Sawyer Keys consist of a series of islands dissected by relatively shallow tidal creeks that are navigable by shallow-draft vessels at high tide. The northwest side of the largest island is privately owned and contains a beach used by nesting turtles. The ruins of an old dwelling, possibly of historic significance, are present on the northeast island. Both of these islands contain upland vegetation; the remainder of the islands lack dry land.

Wildlife - This series of islands constitutes a premier area for wildlife and contains the largest number of nesting ospreys in the Lower Florida Keys (as many as seven active pairs). The waters and islands south of the two largest islands are an important staging area for migrant shorebirds in autumn. This area is used by 11 species of wading birds (four are listed as Species of Special Concern by the State of Florida) and contains a large magnificent frigatebird roost. Fourteen great white heron nests were active in 1991. Green and loggerhead turtles nest on the northwest beach.

Problems -Shallow-draft vessels flush nesting, foraging, and roosting birds. Camping has occurred in at least three areas on two islands.

Management Actions - Create a no access buffer zone on the south sides of the two largest islands (Appendix B, Figure 11) to create sanctuaries for wildlife.

Signage - Five or six Area Closed signs.

Little Crane Key

This is a very small island, one side of which has been blown apart by storms. A navigable channel provides access at most tides. Nearby coral heads attract divers.

Wildlife - Nesting great egrets and double-crested cormorants. The island contains a large magnificent frigatebird roost. Two great white heron nests were present in 1986, but no further nesting has been documented.

Problems - This island is too small to provide birds a place to hide when flushed by human intruders, and they may flush en masse. Boats can literally be piloted beneath the mangrove canopy.

Management Actions - Create a no access buffer zone (300 feet) around the island (Appendix B, Figure 12).

Signage - Four to six Area Closed signs.

West Content Keys

These islands, west of Content Passage, are accessible at most tides. A series of broad, shallow tidal creeks dissects the area.

Wildlife - Three to four pairs of nesting ospreys have been present since 1986. Aggregations of tri-colored, little blue, and great white herons are usually present in trees along the interior tidal creeks.

Problems - As many as 19 persons have camped for as long as a week on a small upland site on state land, where a clearing has been present for many years. Dogs, fireworks, shooting, and cutting of large red mangroves were associated with that group. Shallow-draft boats and PWC sometimes run at planing speeds through the tidal creeks, flushing birds including nesting ospreys.

Management Actions - Create idle speed zones in the tidal creeks (Appendix B, Figure 13). Rigorously enforce existing regulations on camping and vegetation clearing.

Signage - Eight Idle Speed Zone signs.

East Content Keys

These islands, east of Content Passage, are dissected by several shallow tidal creeks. The islands are inaccessible to most vessels at low tide.

Wildlife - Nesting green-backed herons and aggregations of little blue and tri-colored herons and white ibises are noteworthy along the interior tidal creeks. A great white heron rookery of four nests was active during 1989.

Problems - Shallow draft boats and PWC have been observed running at planing speed in the tidal creeks on several occasions.

Management Actions - Create idle speed zones in the tidal creeks (Appendix B, Figure 14).

Signage - Five Idle Speed signs.

Upper Harbor Key

This mangrove island is surrounded by flats but is accessible at high tides. It is one of the premier areas for wading birds.

Wildlife - This island is consistently used by a large number of birds. The island harbors nesting great white herons (24 pairs in 1989), double-crested cormorants, and ospreys. It usually contains roosting magnificent frigatebirds, large numbers of brown pelicans, great egrets, and little blue and tri-colored herons.

Problem - Boats approaching the island at planing speed flush the birds.

Management Actions - Create a no access buffer zone (300 feet) around the island (Appendix B, Figure 14).

Signage - Six No Access zone signs.

Horseshoe Key

Horseshoe Key is a relatively large island bordered entirely by red mangroves. Two large openings on the island's interior contain extensive salt prairies dominated by *Batis maritima* and *Sesuvium portulacastrum*. The island is readily accessible on the southwest side where the mangrove fringe is narrow.

Wildlife - This island contains the only known laughing gull nesting colony in the Lower Florida Keys, with documented nesting by great white herons, willets, and ospreys (three active nests in 1988).

Problems - Human activity is occurring near the laughing gull colony.

Management Actions - Close the island to public access; increase enforcement patrols from April through August to protect the gull nesting colony.

Signage - Twenty Area Closed signs.

D. Program Needs

Funding to purchase, install, and maintain the signs and posts is needed. Costs will vary substantially depending on the size, material, and kind of signage; the method of installation; and the contractor selected. Volunteers will be needed to assist refuge personnel in the installation of all signs on the islands, a measure that will greatly reduce labor costs. Volunteers are now available to help on such a project, and more could be readily recruited.

Some signs placed above the water will likely require special equipment that is currently lacking. It is suggested that a cooperative venture with another agency, such as the Coast Guard, be explored. Coast Guard personnel are knowledgeable about the special demands (e.g., corrosion) inherent in the maintenance of signs in a salt water environment. Regardless, the emphasis on signage will be ease of maintenance, visibility and effectiveness, and minimal impact on the environment (e.g., an absolute minimum of contact with the bay bottom).

2. **Closure of Mangrove Islands**

A. Resources Available/Current Program

Currently, aside from a few islands on the west side of the Snipe Keys, all mangrove islands are open for public use.

Management Actions

Kahl (1991) noted that creating inviolate areas is "...the most effective and most enforceable..." management alternative to address boater disturbances. Because of their importance as nesting sites for wading birds and bald eagles, mangrove islands merit full protection. Public use on these islands is virtually nonexistent and inherently incompatible with the stated objectives of preventing disturbance to nesting and roosting birds. If all mangrove islands were closed, it would eliminate what Kahl (1991) terms the "...subjectivity of interpretation..." regarding enforcement associated with other management alternatives: A person is either on an island or he is not. Observations of boaters on mangrove islands have been few; closing these islands will not significantly affect public use opportunities. It bears repeating that wooden platforms have been found on a number of islands containing wading bird colonies.

Because of the large number of mangrove islands in the management area, posting the islands will be prohibitively expensive and a maintenance nightmare. Instead, a list of only those islands open for public use (which contain beaches and/or uplands) will be made available to the public, similar to the program now in operation at Everglades NP. Because the number of islands open for public use is relatively small, they can be readily depicted on maps. Moreover, because the definition of a mangrove island is easy to understand, it is unlikely any confusion would result.

C. Program Needs

No major funding will be necessary to implement this measure. Widespread dissemination of information to the public regarding the new regulations, coupled with enforcement, will be needed.

3. **Public Education**

A. Resources Available/Current Program

Current education efforts are limited to a backcountry brochure, occasional slide programs, and infrequent newsletter and newspaper articles.

B. Management Actions

Public education efforts by the Service need to be bolstered in the following manner as staffing levels allow.

1. News Releases - News releases on the backcountry will be sent to newspapers Keys-wide. The news releases will contain information on selected backcountry regulations and be timed to appear shortly before anticipated periods of high levels of public use (e.g., opening day of lobster season, 3-day holiday weekends, etc.). A monthly wildlife column written by Service personnel would be beneficial. An article detailing the new regulations and the reasons for them will be written for the periodicals Salt Water, Sportsman, and Florida Sportsman.

2. Public service announcements - Public service announcements will be made available to local radio stations willing to broadcast the messages. The announcements will provide suggestions to minimize disturbance to nesting, feeding, and roosting birds. Additionally, some of the announcements will be geared to particular times of the year when certain species (e.g., ospreys) or groups of species (shorebirds) merit special consideration.

3. Backcountry brochure/map - Upon approval of the management agreement, new regulations and a detailed map will be incorporated into the existing backcountry brochure. The Service will provide funds for the printing and mailing of the revised brochure. Volunteers will also be recruited to distribute the brochures and the existing network of distributors (e.g., Reef Relief) will continue to be used. The Service will provide funding for brochure racks attached to the support posts of educational panels erected at public and private boat ramps in the Lower Keys (see next section). A vandal-resistant brochure dispenser will be tried on an experimental basis at Boca Grande Key at the existing clearing on the northwest side.

4. Revision of Nautical Charts/Notice to Mariners - New restrictions on vessel use will be included with Notice to Mariners, Coast Pilot, and navigational charts.

5. Educational Panels at Private and Public Boat Ramps - The Service will seek permission to erect illustrated educational panels on the backcountry at public and private boat ramps. Such panels have been used successfully by the Looe Key National Marine Sanctuary to educate boaters about the sanctuary's coral reefs. High priority locations include City Marina (Garrison Bight-Key West), Sigsbee Park (U.S. Navy), public ramps on U.S. Highway 1 at West Summerland and south of Shark Key, and private ramps at Sunshine Key Camping Resort, Big Pine Fishing Lodge, Old Wooden Bridge Fishing Camp, Venture Out, and Boyd's Key West Campground.

6. Volunteer Program - Volunteers can also play a pivotal role in the dissemination of information on the backcountry. During anticipated peak use weekends, volunteers could be stationed experimentally on Boca Grande and Woman Keys and Snipe Point, along with a small portable information booth displaying the Service logo. The booth would contain not only the

backcountry brochures, but brochures from other federal and state agencies and organizations on such topics as coral reefs, hardbottom communities, and State fishing regulations. Volunteers would be provided a radio, the standard Service volunteer shirt and cap, and would be trained to answer commonly asked questions on wildlife and refuge regulations. The volunteers would also record the number of visitors and visitor contacts, the numbers and kinds of vessels used to access the islands, and the number and kinds of violations observed. They would provide information only when asked and would not solicit visitors to the booths.

The mere presence of volunteers in uniform could be especially valuable in facilitating compliance with the recommended partial closure of Woman and Boca Grande Keys. This measure would particularly aid in the protection of migrant piping plovers which are known to use both islands.

Volunteers could also assist in a wide variety of other tasks such as beach cleanups, posting signs, etc. The formation of such a "Backcountry Brigade" is recommended and would promote morale and pride among volunteers and other supporters of refuge programs.

C. Program Needs

1. Funding for revision and printing of the existing backcountry brochure and for refuge specific brochure depicting locations of management areas and listing new regulations.

2. Funding for educational panels at public and selected private boat ramps.

4. **Law Enforcement**

A. Resources Available/Current Program

Currently, law enforcement efforts focus on peak use periods such as holiday weekends. Two new refuge law enforcement officers were recently hired, and they have begun activity in the backcountry. Refuge officers are occasionally assisted by the refuge staff and a Florida Game and Freshwater Fish Commission (FGFWFC) officer.

B. Management Actions

The presence of two officers will allow for increased patrol of the backcountry, with emphasis on weekend and holiday patrols. Assistance from other collateral duty Refuge Officers during peak use periods will be provided with additional assistance sought from FMP and FGFWFC. The Service will use a variety of marked (high visibility) and unmarked watercraft for law enforcement. Regular patrols will be made but will not be limited to current problem areas such as Snipe Point and Boca Grande and Woman Keys. The Service will rigorously enforce existing regulations regarding dogs and camping, particularly during the tur1e nesting season at Marquesas, Boca Grande, and Woman Keys. Commercial use on refuge islands without a permit will be curtailed, and companies taking visitors to a bald eagle nest will be prosecuted. Aircraft

tours involving low level flights below legal altitudes will be prosecuted through Federal Aviation Administration regulations. Personal contacts, public notice, and news releases will inform the public that commercial use of refuge islands requires a permit.

Enforcement personnel will not enter mangrove islands or no access buffer zones unless there is a clear reason to do so (e.g., violators observed) to avoid disturbance to birds. At those islands open for public use, the refuge officer will record the date, time, and number of persons, and number, approximate size, and type of vessels present as well as general weather conditions. This will require little time but will yield essential information on public use levels.

Volunteers, especially from such groups as the Coast Guard Auxiliary, could also assist by patrolling specified routes, recording public use levels, and reporting violators to enforcement personnel. They would not approach violators nor intercede in any manner other than contacting law enforcement personnel.

Because of the large areas involved, the use of aircraft is recommended for the enforcement of refuge regulations during special events or holiday weekends which draw large numbers of people to the backcountry. As a cost-saving measure, the refuge biologist would gather biological data on nesting birds and record public use levels from the aircraft. Observations of violators would be radioed to enforcement personnel patrolling the area in boats.

C. Program Needs

Increase law enforcement staff to include seasonal enforcement officers to work full time in the backcountry during peak season.

Deploy law enforcement aircraft during peak use periods.

Purchase an additional shallow draft boat.

5. **Commercial Use**

A. Resources Available/Current Program

A permit is required for commercial use involving refuge islands. Such commercial use is occurring but to date no permits have been issued for activities involving backcountry islands. It is likely that some commercial users are unaware that a permit is required.

B. Management Actions

Public notices will be developed to inform the public that commercial uses of refuge islands require a permit. A fee will be charged for each permit to cover costs of processing the permit and monitoring compliance with the permit conditions. Issuance of permits will be based on the proposed activity's compatibility with the purposes for which the refuges were established, public

use policies of the refuge and the Service, interpretive value of the public use, and other elements to be developed during public involvement. Commercial users will provide periodic information on the island(s) used, and dates and numbers of persons involved, and will be subject to periodic review for compliance with the terms of the permit.

Program needs above current

1. The hiring of a law enforcement officer to work full time in the backcountry (Chapter 4).

2. Development of commercial use guidelines and a process for permitting suitable commercial use applicants.

6. **Personal Watercraft (PWC)**

Resources Available/Current Program

PWC can currently operate anywhere within the refuges' administrative boundaries.

Management Actions

Problems associated with PWC were discussed in detail earlier. Management will consist of a prohibition on use of PWC within the boundary of Key West NWR and Great White Heron NWR with the exception of the following areas:

Township 66 South, Range 29 East, Sections 5, 11, 12, and 14;
Township 66 South, Range 28 East, Section 2;
Township 67 South, Range 26 East, Sections 16 and 20;
all Tallahassee Meridian.

In addition to the areas listed above, areas within the boundary of National Key Deer Refuge which do not overlap with the boundary of Great White Heron will remain open to the use of PWC's. These open areas will allow PWC users the opportunity to gain access to open areas from their residence.

The Service will also engage in an education program with PWC owners, dealers, and renters to direct use away from the backcountry on a voluntary basis.

Current management proposals represent a compromise between the need for free access expressed by PWC users and others and the need to protect refuge habitats.

Program Needs Above Current

Additional law enforcement personnel including use of aircraft and small boats will be needed initially and during peak periods of public use activity such as holiday weekends.

Effective dissemination of information regarding the new regulations will be needed to inform PWC users about the new regulation, the reasons for the regulation, and the penalties involved.

7. **Airboats**

A. Resources Available/Current Program

Airboats can currently operate anywhere within the refuge boundaries.

Management Actions

Management actions are the same as those described for PWC. These types of craft have similar impacts on the backcountry habitats and wildlife but have much greater noise impact. There is currently only one airboat regularly operating in the backcountry.

Program Needs Above Current

No major funding will be needed to implement this measure. Effective dissemination of information to the public and enforcement are the only measures necessary.

8. **Water Skiing**

A. Resources Available/Current Program

Currently, water skiing is permitted anywhere within the boundary of the refuges.

B. Management Actions

Management actions are the same as those described for PWC's.

C. Program Needs Above Current

No major funding is needed to implement this measure. Widespread dissemination of information to the public regarding the restricted areas will be necessary.

9. **Wildlife Inventories**

A. Resources Available/Current Program

Currently, an aerial survey is conducted five times per year at about 2 ½-month intervals over 37 named individual islands or chains of islands extending from East Bahia Honda Key to the Marquesas Keys. A bi-monthly bird survey is also conducted by boat at two-month intervals at 13 named islands or chains of islands extending from Upper Harbor Key southeast to Friend Key. Both the aerial and boat surveys provide information on the numbers and kinds of birds using the refuge islands, but they are ineffective in assessing the productivity of even highly visible species

such as great white herons because of the intervals between surveys. Thus, ground surveys of great white heron rookeries were initiated in 1989 to provide an index to productivity. This technique proved to be highly effective and was expanded to five colonies in 1990 and 1991.

The refuge biologist has conducted extensive surveys of nesting ospreys and bald eagles since 1986. Funding provided by the Florida Game and Fresh Water Fish Commission allowed an exhaustive search throughout the Lower Florida Keys for undocumented bald eagle nests during the 1990 nesting season.

A weekly check of seven sea turtle nesting beaches (five in the Marquesas Keys) in Key West NWR has been ongoing since 1986. For each species, data on numbers, characteristics, clutch sizes, and productivity of nests have been collected. Because of refuge budgetary constraints, Save-A-Turt1e has provided funds for turtle surveys during the past three nesting seasons. Since 1989, the refuge biologist has also conducted nesting sea turtle surveys on Sawyer Key during off-duty hours.

Casual observations have also been made on magnificent frigatebird night roosts, shorebird and tern aggregations, white-crowned pigeon colonies, wading bird feeding and roosting areas, etc.

A one-day migrant raptor survey has been conducted during October on Boca Grande Key for the past two years. Christmas bird counts on the refuge have been ongoing for more than a decade.

Management Actions

Productivity data are available only for bald eagles, ospreys, and great white herons. The current ground surveys for these species will be continued and augmented by monthly aerial surveys during October through March. There is a pressing need for information on other Ciconiiformes (long-legged waders), particularly the four State-listed Species of Special Concern (little blue and tri- colored herons, snowy and reddish egrets). Colony locations for these species are poorly understood with virtually nothing known for tri-colored or snowy egret rookeries. Such colonies must be identified if they are to be protected. Because aerial surveys are ineffective for detecting nests of these four species, flight-line counts (Erwin 1981) will be employed during the spring nesting season to obtain baseline information. Reddish egrets, which nest during about nine months of the year, will require a protracted survey effort.

A formal migrant shorebird census will be instituted to obtain a better understanding of the kinds and numbers of shorebirds, particularly piping plovers using refuge areas. As part of this census, further information on tern loafing areas will be collected.

Sea turtle nesting surveys have provided invaluable information and will be continued during summer months. Flight line counts of white-crowned pigeon colonies will be conducted during the summer nesting season. A standardized migrant raptor survey will be survey will be conducted at Boca Grande Key for one week in October.

Program Needs

1. As funds and staffing resources allow, a second biologist will be hired to work full-time on Key deer and other species or projects involving mainline refuge islands. The current biologist has an intimate knowledge of the backcountry and will be assigned the full-time biological responsibilities for that area, including designing and conducting referenced biological surveys on backcountry wildlife, writing survey reports, providing management recommendations, eradicating invasive exotic plants, etc.

2. Funding for additional aerial bird surveys.

10. **Permits for Backcountrv Islands Containing Key Deer**

A free permit will be required for visiting the following islands containing Key deer: Little Pine, Johnson, Water (off Little Pine), Mayo, Annette, Howe, and Water (west of Howe), and Knockemdown Keys. Visitors could request a permit by writing, phoning, or visiting the refuge headquarters and will be asked to supply their vessel type and registration number, the number and names of persons in their party, and the date and purpose of their visit.

Written and phone requests will be received at the refuge Monday through Friday, with permits mailed by the next business day. The permits will be of the same type used at Everglades NP. They will be attached to the bow of the visitor's vessel. This will facilitate prompt inspection by enforcement personnel. If implemented, this measure will provide information on the numbers and seasonality of visitors to the refuge islands. It will also promote protection for Key deer. Currently, a person could be dropped off on an island by an accomplice, who then leaves the area. If the former does not stay after dark, he is not violating a regulation. With the permit system, if a person is found on an island and no boat is present, he would be violation.

11. **Traditional Uses**

A. Resources Available/Current Program

Traditional uses of the backcountry waters include commercial and recreational fishing, scuba diving and snorkeling, and sightseeing. The Service does not currently regulate these water-based activities.

B. Management Actions

Aside from the no access buffer zones near the islands identified earlier, traditional water-oriented activities will be permitted throughout the backcountry.

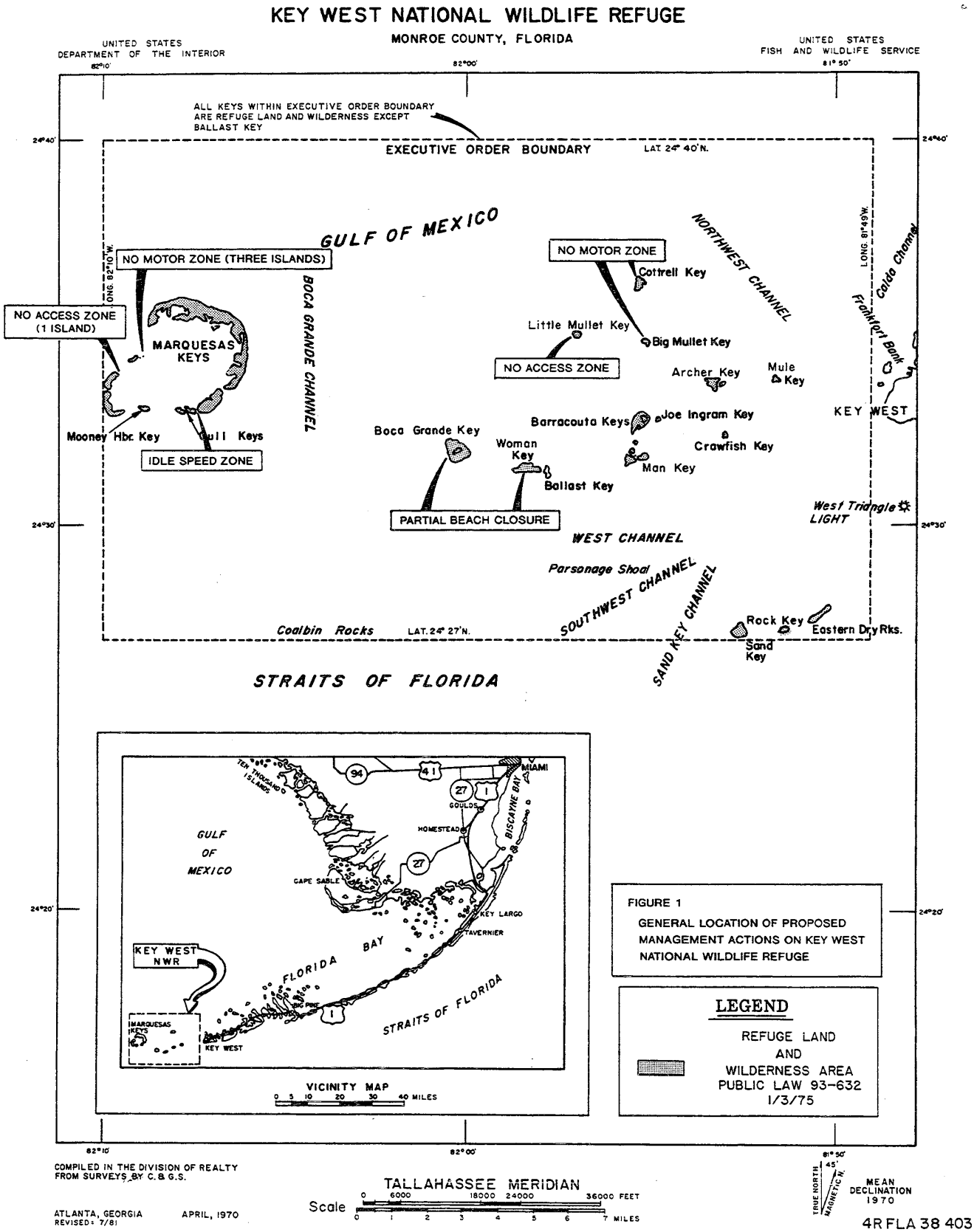
12. **Aircraft Landing Prohibition**

Resources Available/Current Program

Landing of aircraft is not specifically prohibited anywhere within the boundary of the refuges. Aircraft here is considered to include fixed wing, rotary, and hover type craft. Aircraft landing has occurred rarely, but various proposals to conduct commercial use have surfaced from time to time. Since this use is currently, and has traditionally been, very limited, a prohibition on this activity is considered to have negligible impact on users.

B. Management Actions

Landings of aircraft for recreational activity are prohibited. Exceptions include use of aircraft to conduct law enforcement investigations and surveillance, emergency landings, search and rescue operations, and other such activities as may be permitted by the Refuge Manager. The intent is to eliminate use of aircraft that will disturb wildlife and detract from the wilderness values and public use of the area.

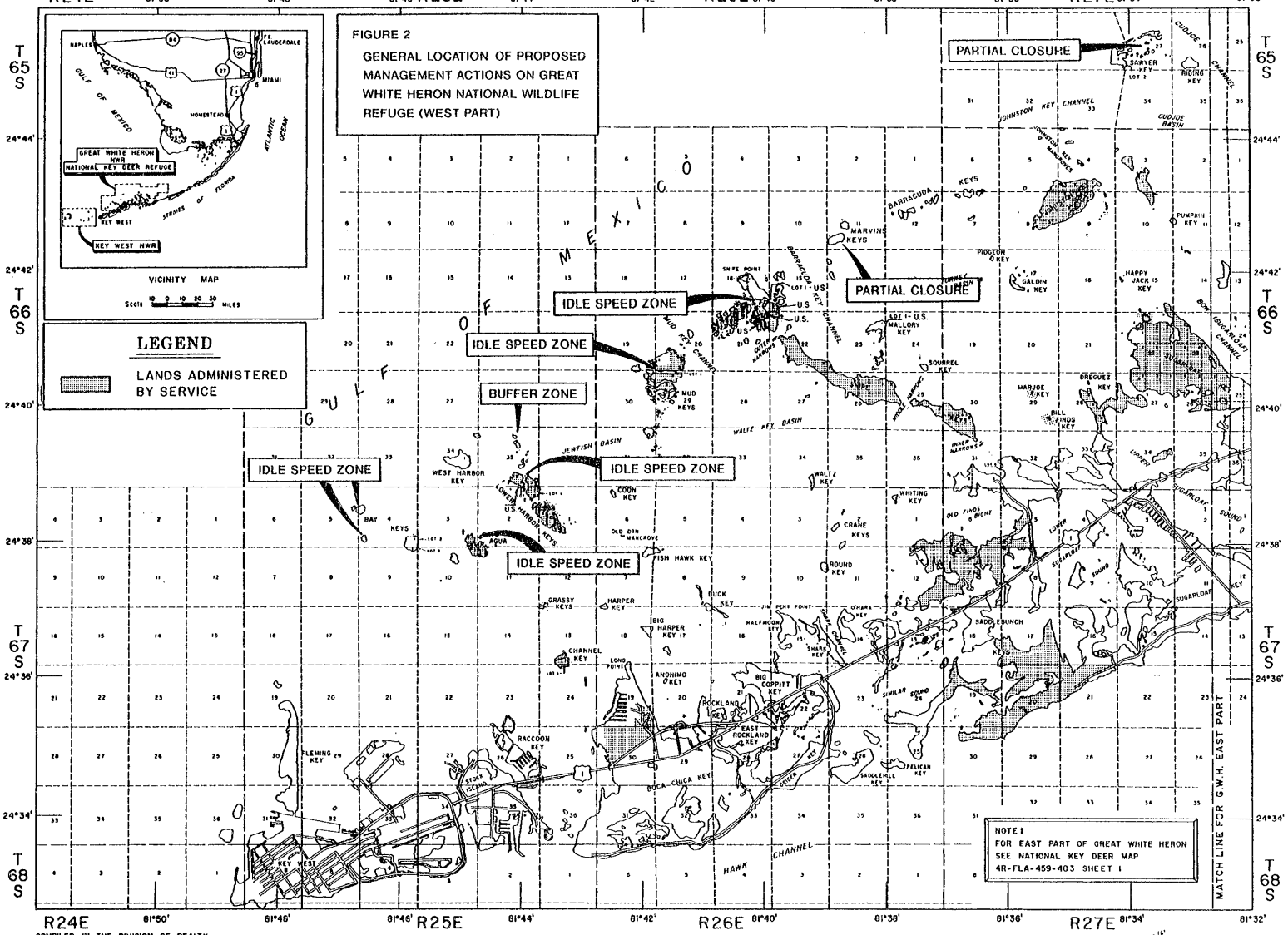

KEY WEST NATIONAL WILDLIFE REFUGE
MONROE COUNTY, FLORIDA
UNITED STATES DEPARTMENT OF THE INTERIOR
UNITED STATES FISH AND WILDLIFE SERVICE
ALL KEYS WITHIN EXECUTIVE ORDER BOUNDARY ARE REFUGE LAND AND WILDERNESS EXCEPT BALLAST KEY
EXECUTIVE ORDER BOUNDARY
LAT. 24° 40'N.
GULF OF MEXICO
NO MOTOR ZONE (THREE ISLANDS)
NO ACCESS ZONE (1 ISLAND)
MARQUESAS KEYS
Mooney Hbr. Key
Gull Keys
IDLE SPEED ZONE
BOCA GRANDE CHANNEL
NO MOTOR ZONE
Cottrell Key
NORTHWEST CHANNEL
Little Mullet Key
Big Mullet Key
NO ACCESS ZONE
Archer Key
Mule Key
Frankfort Bank
Caldo Channel
KEY WEST
Boca Grande Key
Barracouta Keys
Joe Ingram Key
Woman Key
Crawfish Key
Man Key
Ballast Key
PARTIAL BEACH CLOSURE
West Triangle LIGHT
WEST CHANNEL
Parsonage Shoal
SOUTHWEST CHANNEL
SAND KEY CHANNEL
Rock Key
Eastern Dry Rks.
Sand Key
Coalbin Rocks
LAT. 24° 27'N.
STRAITS OF FLORIDA
MIAMI
GULF OF MEXICO
CAPE SABLE
HOMESTEAD
GOULDS
BISCAYNE BAY
KEY LARGO
TAVERNIER
FLORIDA BAY
STRAITS OF FLORIDA
KEY WEST NWR
MARQUESAS KEYS
KEY WEST
VICINITY MAP
0 5 10 20 30 40 MILES
FIGURE 1
GENERAL LOCATION OF PROPOSED MANAGEMENT ACTIONS ON KEY WEST NATIONAL WILDLIFE REFUGE
LEGEND
REFUGE LAND AND WILDERNESS AREA PUBLIC LAW 93-632 1/3/75
COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.& G.S.
ATLANTA, GEORGIA
REVISED: 7/81
APRIL, 1970
TALLAHASSEE MERIDIAN
Scale
0 6000 18000 24000 36000 FEET
0 1 2 3 4 5 6 7 MILES
TRUE NORTH
MAGNETIC N.
MEAN DECLINATION 1970
4R FLA 38 403

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (WEST PART)

MONROE COUNTY, FLORIDA

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES FISH AND WILDLIFE SERVICE



COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.&G.S. & G.L.O.

ATLANTA, GEORGIA DECEMBER, 1971
REVISED 8/65

4R-FLA-267 403

NATIONAL KEY DEER REFUGE - AND GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (EAST PART)

MONROE COUNTY, FLORIDA

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES FISH AND WILDLIFE SERVICE

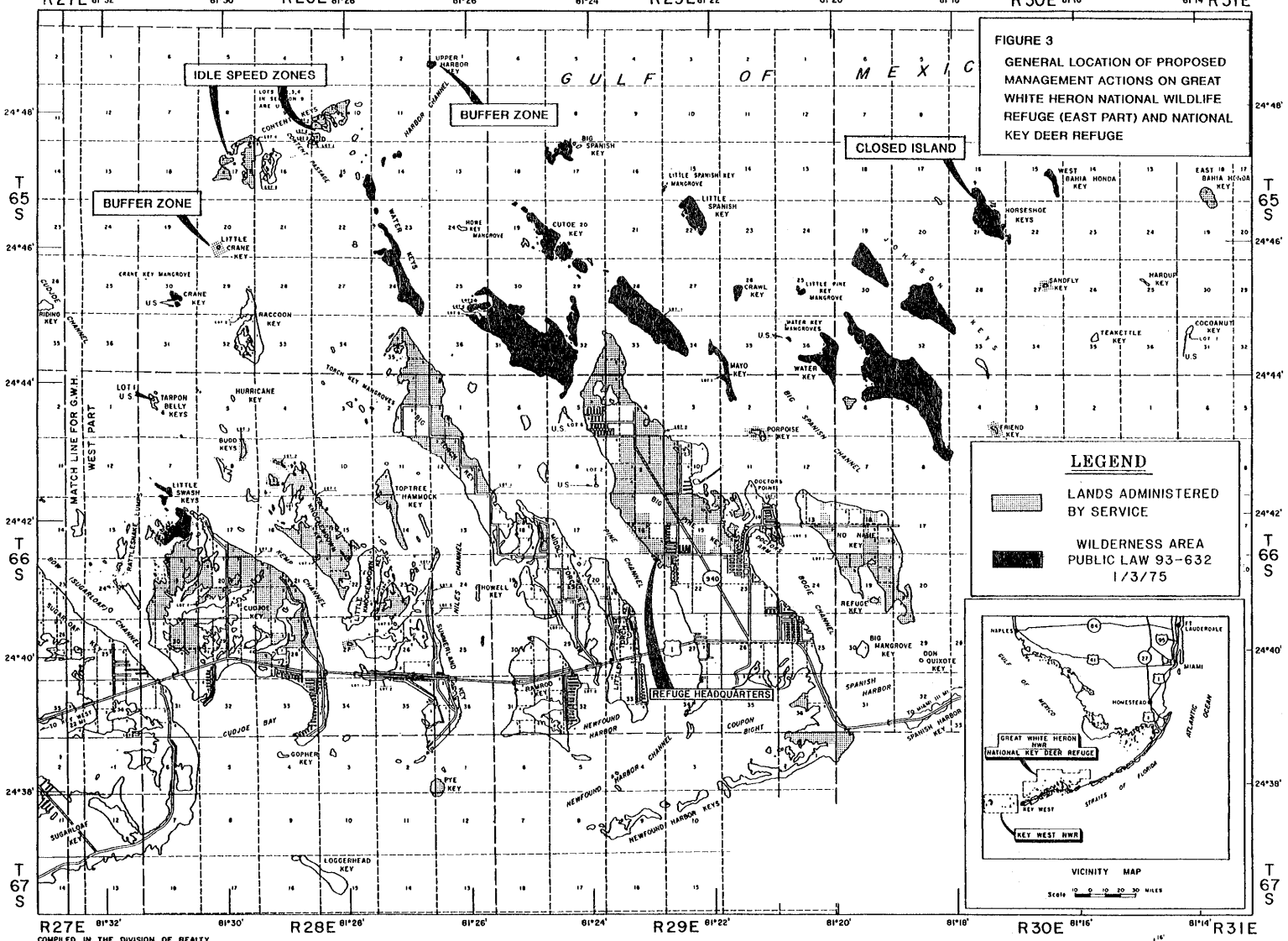


FIGURE 3
GENERAL LOCATION OF PROPOSED MANAGEMENT ACTIONS ON GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (EAST PART) AND NATIONAL KEY DEER REFUGE

COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.&G.S. & G.L.O.

ATLANTA, GEORGIA DECEMBER, 1971

TALLAHASSEE MERIDIAN

Scale 0 3000 6000 12000 18000 24000 FEET; 0 1/2 1 2 3 4 MILES

MEAN DECLINATION 1971

NATIONAL KEY DEER REFUGE - AND GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (EAST PART)

MONROE COUNTY, FLORIDA

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES FISH AND WILDLIFE SERVICE

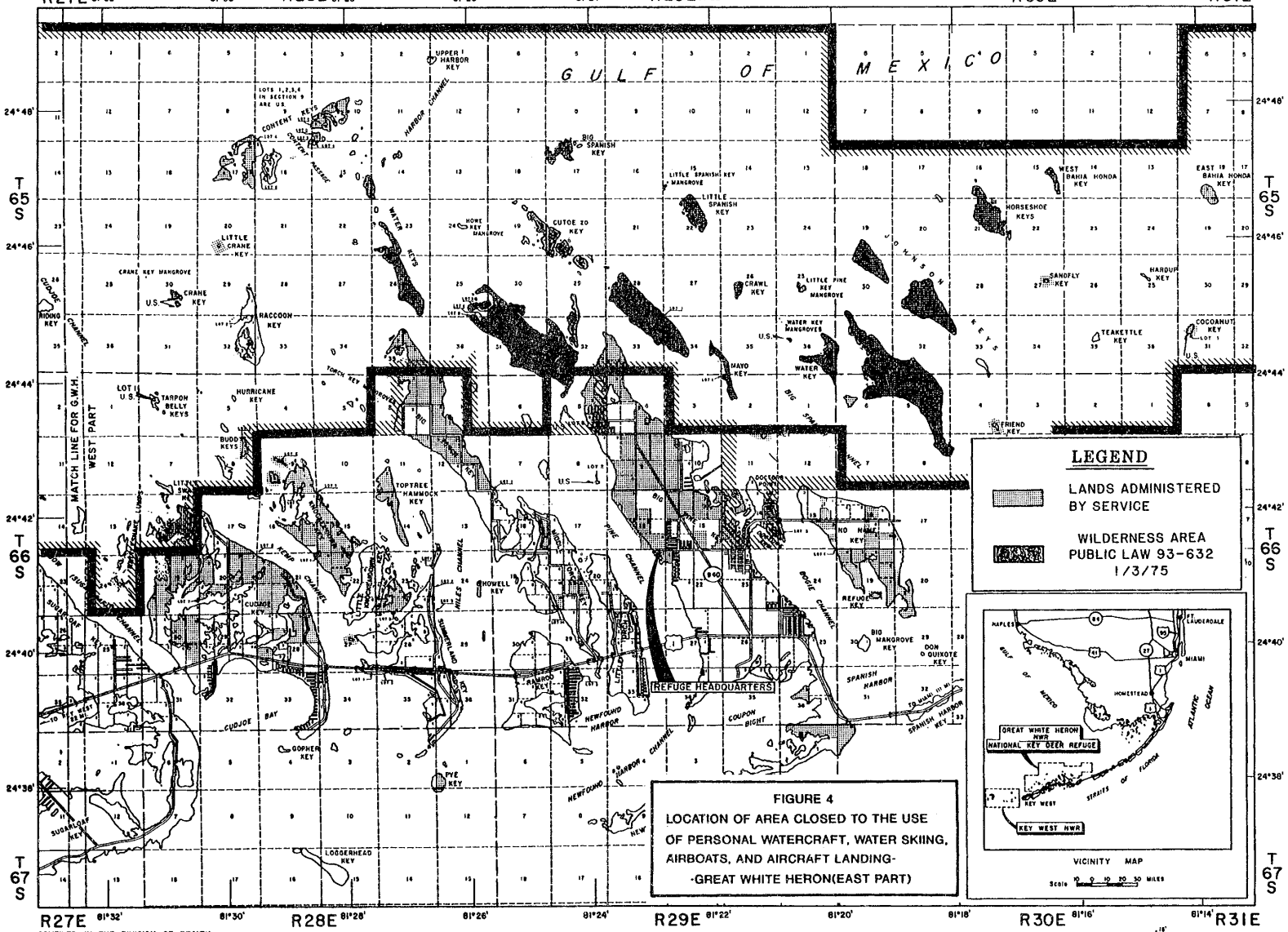


FIGURE 4
LOCATION OF AREA CLOSED TO THE USE OF PERSONAL WATERCRAFT, WATER SKIING, AIRBOATS, AND AIRCRAFT LANDING-
-GREAT WHITE HERON(EAST PART)

COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.&G.S. & G.L.O.

TALLAHASSEE MERIDIAN

Scale 0 3000 6000 12000 18000 24000 FEET; 0 1/2 1 2 3 4 MILES

MEAN DECLINATION 1971

ATLANTA, GEORGIA DECEMBER, 1971
REVISED: 2/88

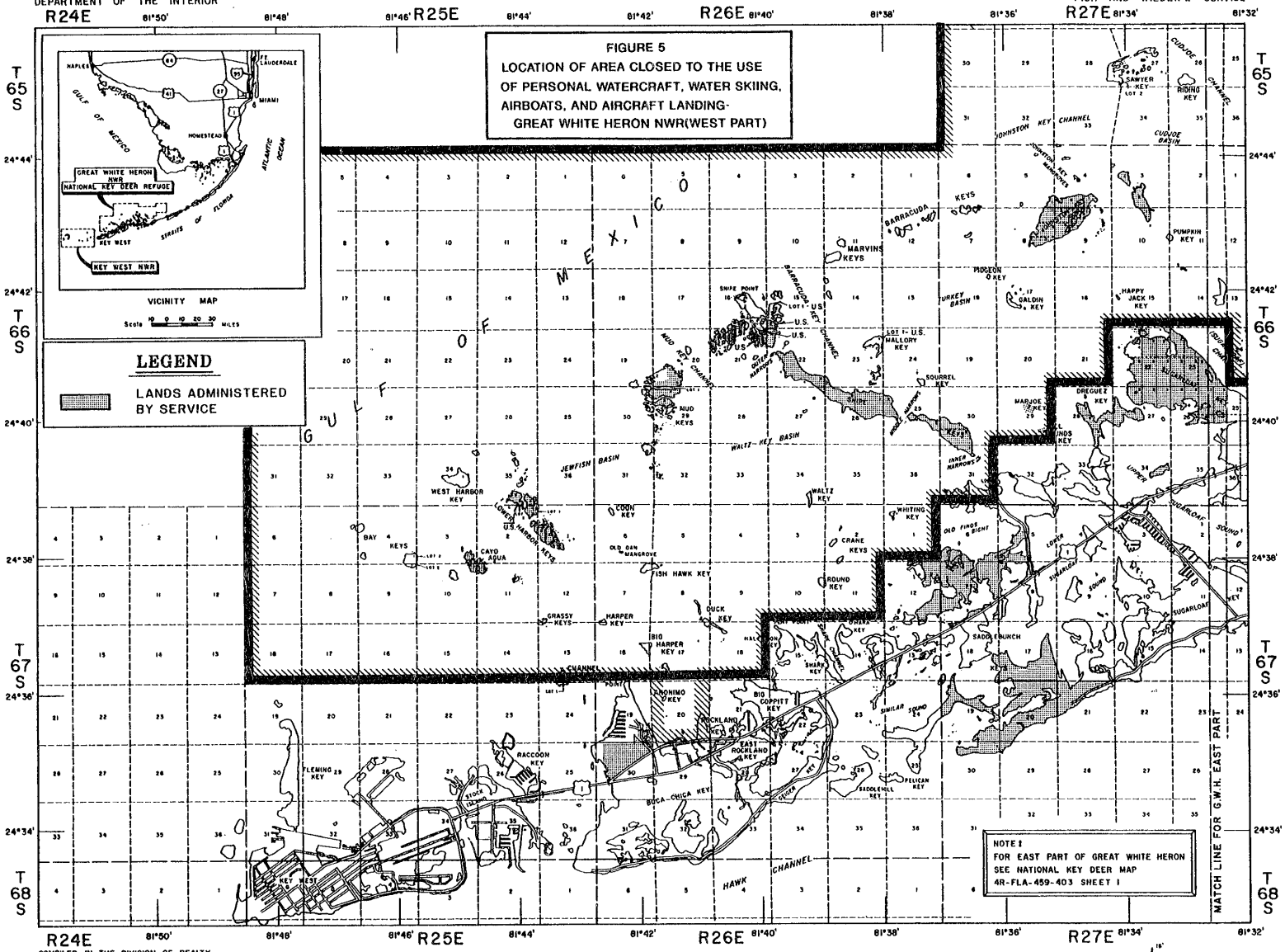
4R-FLA-459-403

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (WEST PART)

MONROE COUNTY, FLORIDA

UNITED STATES
DEPARTMENT OF THE INTERIOR

UNITED STATES
FISH AND WILDLIFE SERVICE



COMPILED IN THE DIVISION OF REALTY
FROM SURVEYS BY C.&G.S. & G.L.O.

TALLAHASSEE MERIDIAN

Scale 0 3000 6000 12000 18000 24000 FEET
0 1/2 1 2 3 4 MILES

ATLANTA, GEORGIA DECEMBER, 1971
REVISED 1/8/85

4R-FLA-267 403

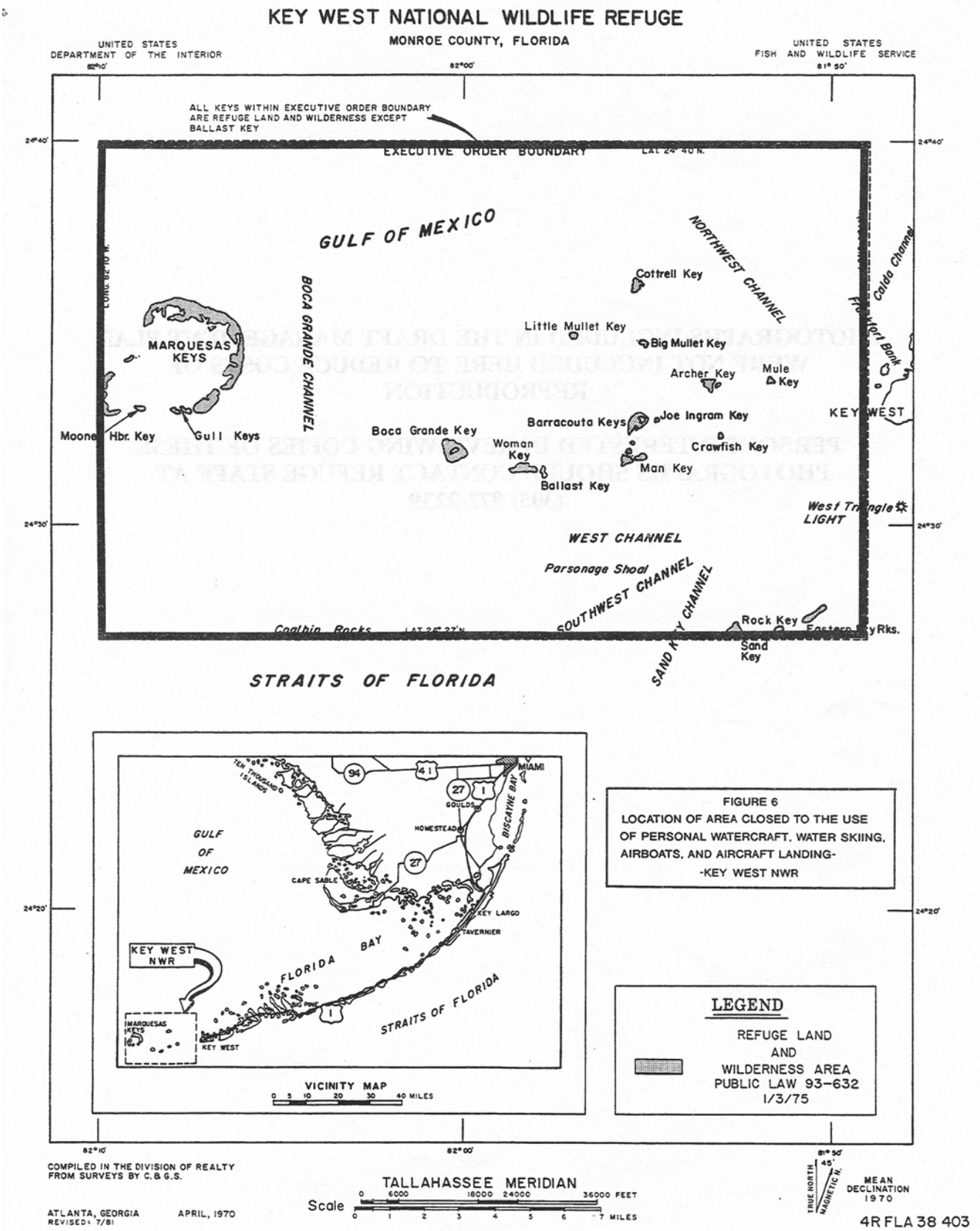


FIGURE 6
LOCATION OF AREA CLOSED TO THE USE OF PERSONAL WATERCRAFT, WATER SKIING, AIRBOATS, AND AIRCRAFT LANDING-
-KEY WEST NWR

PHOTOGRAPHS INCLUDED IN THE DRAFT MANAGEMENT PLAN WERE NOT INCLUDED HERE TO REDUCE COSTS OF REPRODUCTION.

PERSONS INTERESTED IN REVIEWING COPIES OF THESE PHOTOGRAPHS SHOULD CONTACT REFUGE STAFF AT (305) 872-2239.

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APPENDIX A

List of Scientific Names of Plants and Animals Mentioned in the Text

Common Name	Scientific Name
PLANTS	
Asiatic colubrina	Colubrina asiatica
Australian pine	Casuarina equisetifolia
Black mangrove	Avicennia germinans
Brazilian pepper	Schinus terebinthifolius
Glasswort	Salicornia spp.
Key Grass	Monanthochloe littoralis
Red Mangrove	Rhizophora mangle
Saltwort	Batis maritima
Sea Lavender	Tournefortia gnaphalodes
Slash pine	Pinus elliottii
Yellowheart	Zanthoxylum flavum
MAMMALS	
Key Deer	Odocoileus virginianus clavium
West Indian manatee	Trichechus manatus latirostris
Lower Keys rabbit	Sylvilagus palustris hefneri
Sliver rice rat	Oryzomys argentatus
Sperm whale	Physeter catodon
BIRDS	
Bald eagle	Haliaeetus leucocephalus
Black-necked stilt	Himantopus mexicanus
Brown pelican	Pelecanus occidentalis
Canvasback	Aythya valisineria
Cattle egret	Bubulcus ibis
Double crested cormorant	Phalacrocorax auritus
Forster's tern	Sterna forsteri
Great blue heron	Ardea herodias
Great egret	Casmerodius albus
Green-backed heron	Butorides striatus
Heerman's gull	Larus heermanni
Laughing gull	Larus atricilla
Least tern	Sterna antillarum
Little blue heron	Egretta caerulea
Magnificent frigatebird	Fregata magnificens
Osprey	Pandion haliaeetus
Peregrine falcon	Falco peregrinus
Piping plover	Charadrius melodus
Reddish egret	Egretta rufescens

List of Scientific Names of Plants and Animals Mentioned in the Text (cont.)

Common Name	Scientific Name
BIRDS (cont.)	
Red-breasted merganser	Mergus serrator
Red-shouldered hawk	Buteo lineatus
Roseate spoonbill	Ajaia ajaia
Royal tern	Sterna maxima
Sanderling	Calidris alba
Snowy egret	Egretta thula
Tri-colored heron	Egretta tricolor
Turkey vulture	Coragyps atratus
White-crowned pigeon	Columba leucocephala
Willet	Catoptrophorus semipalmatus
Yellow-crowned night heron	Nycticorax violaceus
REPTILES	
American alligator	Alligator mississippiensis
Eastern indigo snake	Orymarchon corais couperi
Green turtle	Chelonia mydas
Hawksbill turtle	Eretmochelys imbricata
Loggerhead turtle	Carretta carretta

APPENDIX B.

Proposed Management Actions in the Backcountry of Key West and Great White Heron National Wildlife Refuges As Depicted on Aerial Photographs of Management Areas.

FIGURE 1. Aerial photograph of the Marquesas Keys (south side) showing proposed idle speed zone (300 feet - ORANGE).

FIGURE 2. Aerial photograph of the Marquesas Keys (west side) showing proposed no access zone (300 feet - PINK) and no motor zones (300 feet -YELLOW).

FIGURE 3. Aerial photograph of Boca Grande Key and Woman Key showing proposed no access areas (PINK).

FIGURE 4. Aerial photograph of Little Mullet Key showing proposed no access zone (300 feet - PINK).

FIGURE 5. Aerial photograph showing proposed no motor zones (300 feet -YELLOW) around Cottrell and Mullet Keys.

FIGURE 6. Aerial photograph of the Bay Keys showing proposed idle speed zones (300 feet - ORANGE).

FIGURE 7. Aerial photograph of Cayo Agua, Lower Harbor, and East Harbor Keys showing proposed idle speed zones (ORANGE) and no access zone (300 feet around East Harbor Key - PINK).

FIGURE 8. Aerial photograph of the Mud Keys showing proposed idle speed zone (ORANGE) and no access zone (PINK).

FIGURE 9. Aerial photograph of the Snipe Keys, north of the Outer Narrows, showing proposed idle speed zone (ORANGE) and no motor zones (YELLOW).

FIGURE 10. Aerial photograph of the Marvin Keys showing proposed no access zone (YELLOW).

FIGURE 11. Aerial photograph of Sawyer Keys showing proposed no access zone.

FIGURE 12. Aerial photograph of Little Crane Key showing proposed no access zone (300 feet - PINK).

FIGURE 13. Aerial photograph of the Content Keys (west side) showing proposed idle speed zones (ORANGE) and no access zones (PINK).

FIGURE 14. Aerial photograph of Content Keys (east side) and Upper Harbor Keys showing proposed no access zone (300 feet) and idle speed zones (ORANGE).

UNITED STATES FISH AND WILDLIFE SERVICE
ENVIRONMENTAL ACTION MEMORANDUM

Within the spirit and intent of the Council on Environmental

FINDING OF NO SIGNIFICANT IMPACT

for the

MANAGEMENT OF "BACKCOUNTRY PORTIONS OF

KEY WEST NATIONAL WILDLIFE REFUGE
GREAT WHITE HERON NATIONAL WILDLIFE REFUGE
AND NATIONAL KEY DEER REFUGE

Monroe County, Florida

Based on a review and evaluation of the information contained in the supporting references below, I have determined that the proposed management agreement between the Fish and Wildlife Service and the State of Florida, Department of Natural Resources for the management of the Backcountry refuges of the Lower Florida Keys will not have a significant impact on the quality of the human environment within the context of Section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an environmental impact statement for the proposed action is not required.

Supporting References

Environmental Assessment, Management of "Backcountry Portions of the Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge and National Key Deer Refuge. This document evaluates four alternatives (including the preferred alternative) and environmental consequences for each.

Cooperative Management Plan for the "Backcountry Portions of the Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge and National Key Deer Refuge.

The assessment and management plan are on file at the Florida Keys National Wildlife Refuges, P. O. Box 510, Big Pine Key, FL 33043-0510 or the U. S. Fish and Wildlife Service, Division of Refuges and Wildlife Resources, 75 Spring St., SW, Atlanta, GA 30303. Copies may also be obtained from the Refuge Manager, Florida Keys National Wildlife Refuges at the above address.

12/23/92
Date

Regional Director

For Refuge Manager Date
Florida Keys
National Wildlife Refuges

ARD/FWE Date

ENVIRONMENTAL ASSESSMENT
for
MANAGEMENT OF "BACKCOUNTRY" PORTIONS OF KEY WEST NATIONAL WILDLIFE REFUGE, GREAT WHITE HERON NATIONAL WILDLIFE REFUGE, AND NATIONAL KEY DEER REFUGE

Monroe County, Florida

Prepared By:

U.S. Fish and Wildlife Service
National Key Deer Refuge
P. O. Box 510
Big Pine Key, FL 33043

September 1992

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Table 3-1. Presence of invasive exotic plants on Key West, Great White Heron, and National Key Deer Refuges, Monroe County, FL, adapted from refuge files.

Table 3-2. List of plants Federally threatened (THR), endangered (END), and review species (UR), and State of Florida Species of Special Concern which occur or probably occur in the Backcountry portions of Key West (KWNWR), Great White Heron (GWHNWR), and National Key Deer (NKDR) Refuges.

Table 3-3. List of animals Federally threatened (THR), endangered (END), and review species (UR), and State of Florida Species of Special Concern which occur or probably occur in the Backcountry portions of Key West (KWNWR), Great White Heron (GWHNWR) and National Key Deer (NKDR) Refuges.

Table 3-4. Major categories of civilian employment in Monroe County, FL, as of 1990. Summarized from U.S. Bureau of Census data and White (1991).

Table 3-5. The top 25 business or product sales categories in Monroe County, FL. Figures are rounded to the nearest million dollars. Adapted from White (1991), original data from Florida Dept. of Revenue.

APPENDICES

Appendix A: Management Plan for Backcountry portions of Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge, and National Key Deer Refuge.

Appendix B: Federal Laws and Regulations Applicable to Management of Fish and Wildlife Resources.

Appendix C: Summary of Public Involvement for the Draft Environmental Assessment and Draft Management Plan for the Backcountry portions of Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge, and National Key Deer Refuge.

1.0 NEED AND PURPOSE FOR THE PROPOSED ACTION

1.1 Proposal

The U.S. Fish and Wildlife Service (Service) proposes to acquire authorization from the State of Florida to conduct specific management activities on State sovereignty submerged lands and lands above mean high water as described in a Management Agreement prepared pursuant to Section 18-21.005(1) (e), F.A.C. The lands in question are within the administrative boundaries of National Wildlife Refuges (Refuges) in the Lower Florida Keys.* .The refuges involved are: Key West National Wildlife Refuge (NWR), Great White Heron NWR, and portions of National Key Deer Refuge (Figure 1, 2, and 3). The lands included in the Management Agreement would remain under the ownership of the State of Florida. Specific authorities described in the Management Agreement would be granted to the Service.

This Environmental Assessment addresses implementation of the proposed Management Agreement between the Service and the State of Florida. Other actions including management plans for the Florida Keys National Marine Sanctuary (Marine Sanctuary) and development of a channel marking system are not addressed here.

1.2 Need for Proposed Action

The refuges of the Lower Florida Keys were established primarily for the benefit of wildlife. Language in the legislation and Executive Orders establishing these refuges refers to them as "inviolate sanctuaries" (Executive Order 7993, Great White Heron NWR), or as a "preserve and breeding ground for birds..." (Key West NWR, Executive Order 923). Purposes for establishment

* A Management plan has been prepared. This Plan provides detailed background information and a specific description of the proposed management actions, authorities granted to the Fish and Wildlife Service, and the general terms of the agreement. It is summarized in Section 2.0, Description of the Alternatives, and should be considered the Service preferred alternative.

vary, but generally these lands were set aside as a haven for wildlife, e.g., to "preserve and protect" wildlife and their habitats (Public Law 85-164, National Key Deer Refuge). The National Wildlife Refuge System as a whole is managed under federal laws and regulations which provide a priority for the protection of wildlife and require that all activities which occur on refuge lands be compatible with the purposes for which the refuge was established (See Appendix B).

KEY WEST NATIONAL WILDLIFE REFUGE

MONROE COUNTY, FLORIDA

UNITED STATES
DEPARTMENT OF THE INTERIOR

UNITED STATES
FISH AND WILDLIFE SERVICE

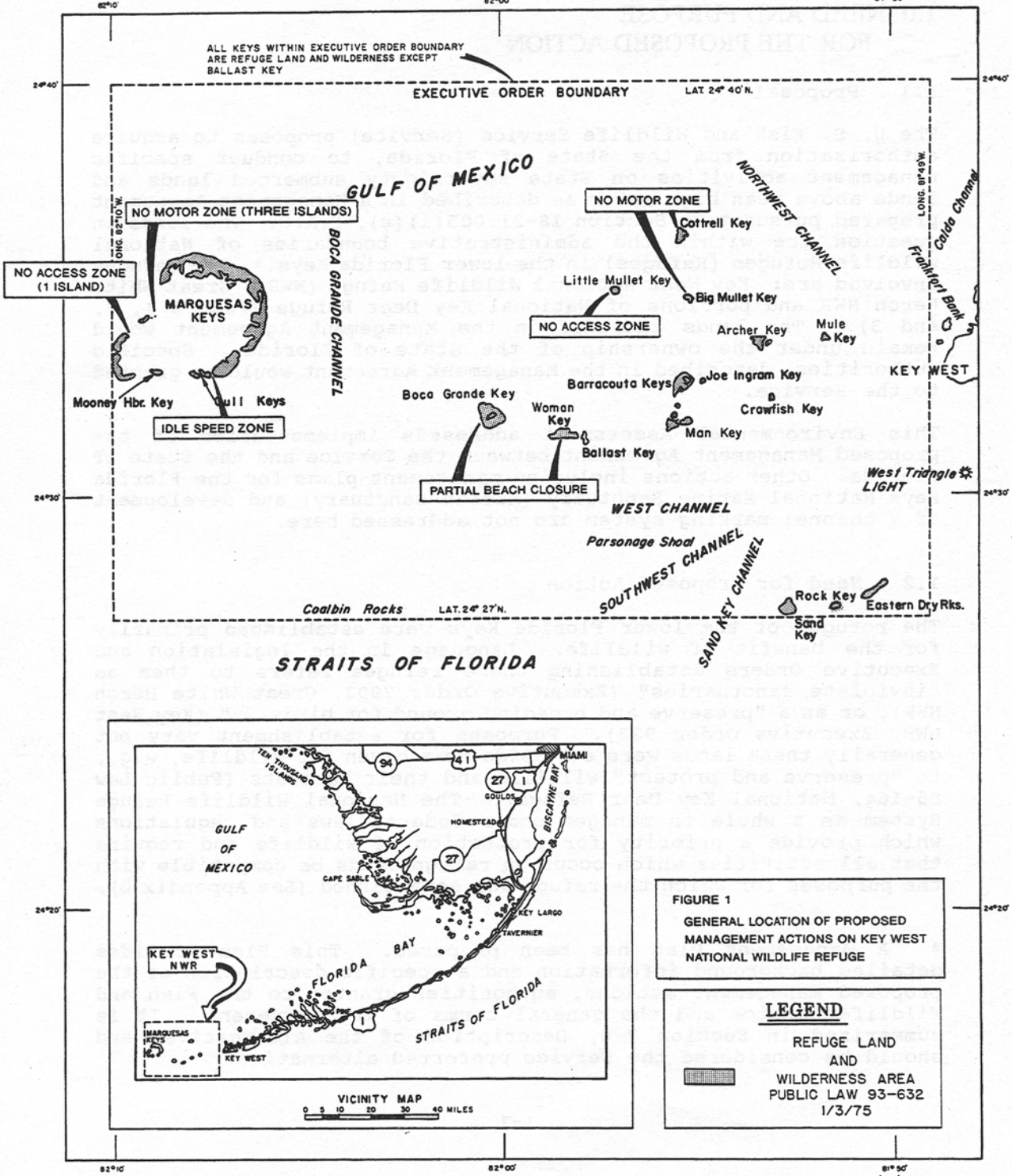


FIGURE 1
GENERAL LOCATION OF PROPOSED MANAGEMENT ACTIONS ON KEY WEST NATIONAL WILDLIFE REFUGE

LEGEND

REFUGE LAND AND WILDERNESS AREA PUBLIC LAW 93-632 1/3/75

COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.& G.S.

ATLANTA, GEORGIA APRIL, 1970
REVISED: 7/81

TALLAHASSEE MERIDIAN

Scale 0 6000 18000 24000 36000 FEET
0 1 2 3 4 5 6 7 MILES

TRUE NORTH
MAGNETIC N.
45'
MEAN DECLINATION 1970

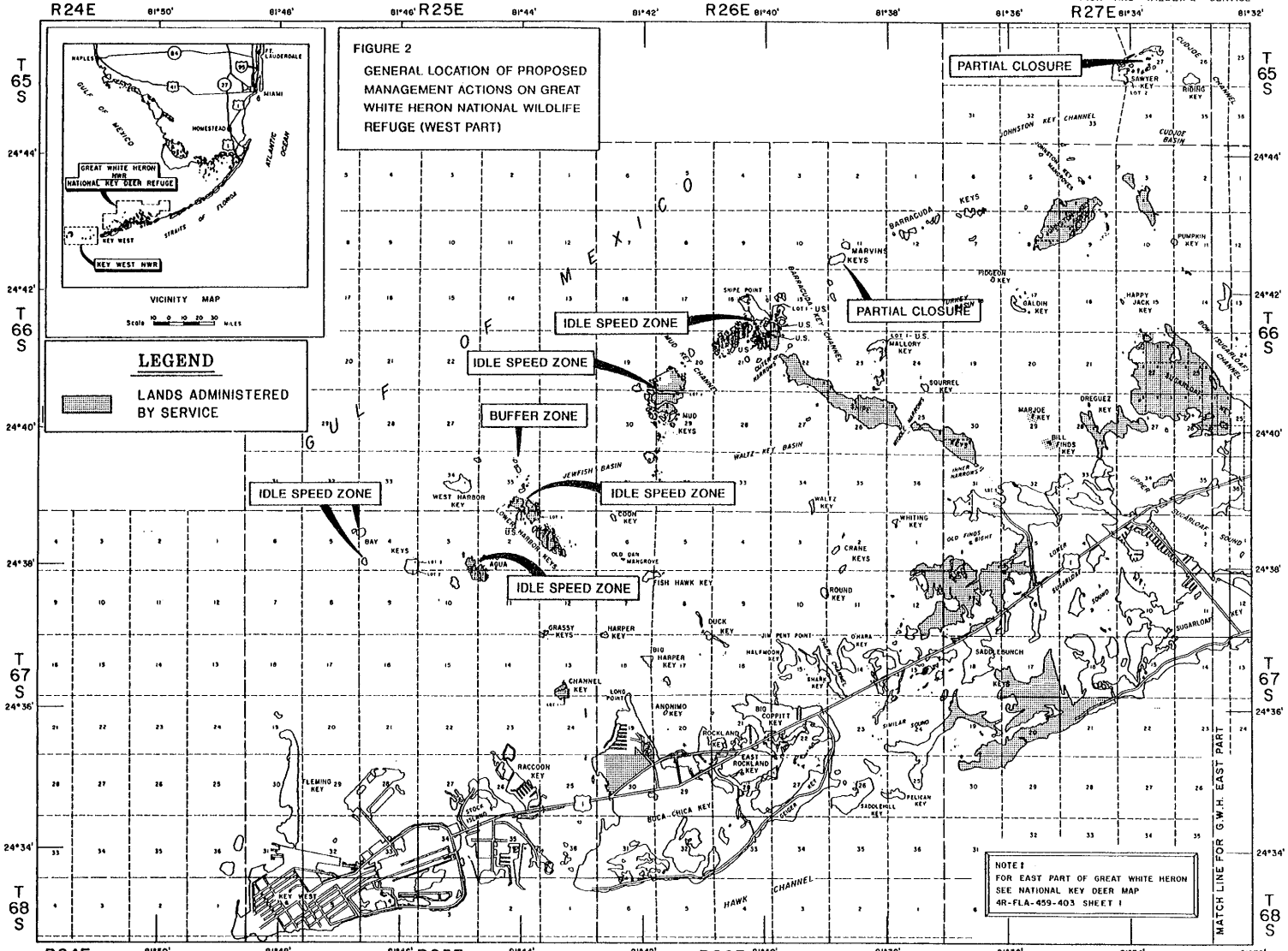
4R FLA 38 403

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (WEST PART)

MONROE COUNTY, FLORIDA

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES FISH AND WILDLIFE SERVICE



COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.&G.S. & G.L.O.

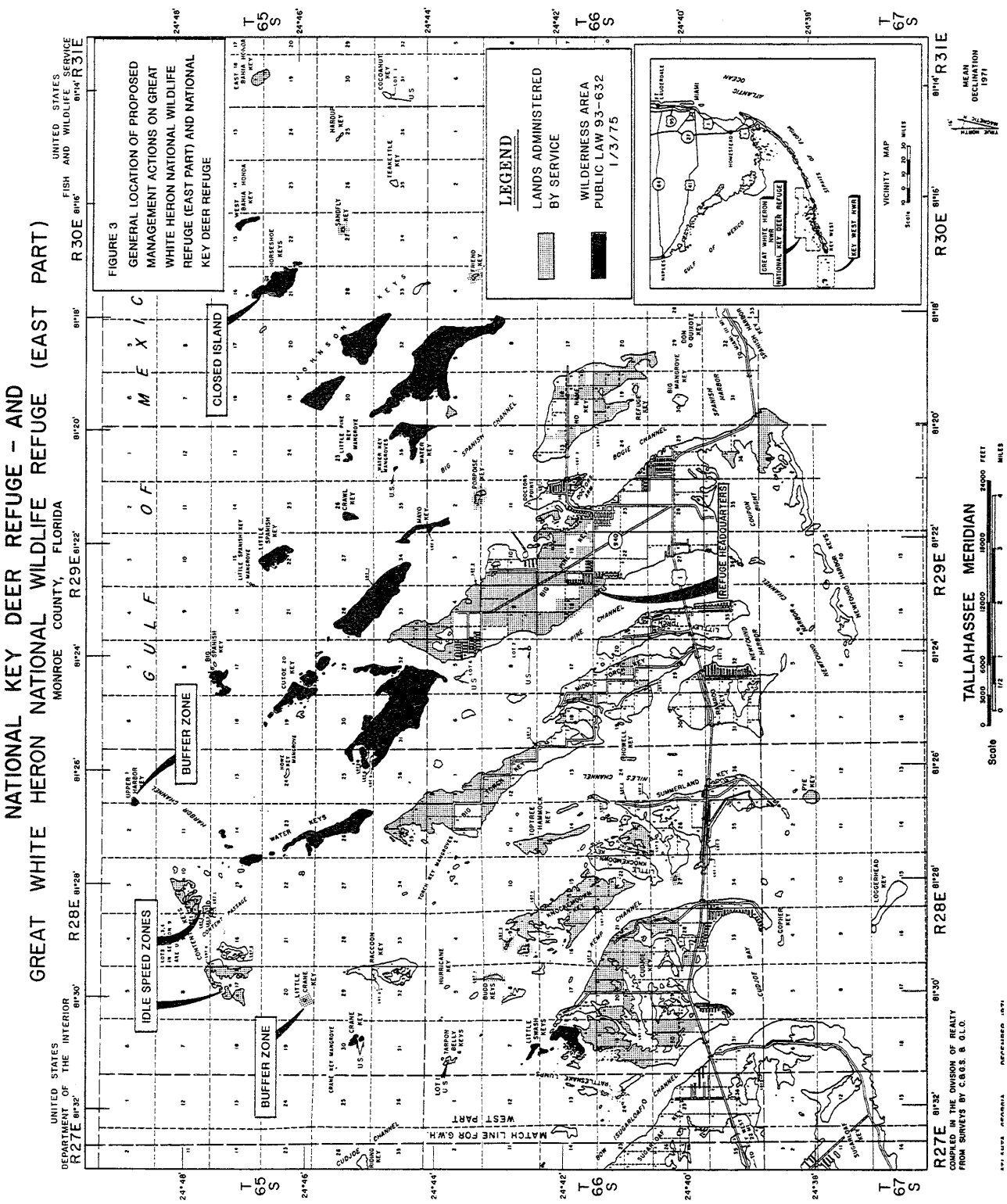
TALLAHASSEE MERIDIAN

Scale 0 3000 6000 12000 18000 24000 FEET; 0 1/2 1 2 3 4 MILES

MEAN DECLINATION 1971

ATLANTA, GEORGIA DECEMBER, 1971
REVISED: 8/85

4R-FLA-267 403



1.0 NEED AND PURPOSE FOR THE PROPOSED ACTION

Refuge policies and procedures also are designed to provide specific protection to wildlife and their habitats (Service Refuge Manual, 8 RM 1-002).

In keeping with the growth of the resident population of Florida, the degree and type of public use of the refuge "backcountry"* has increased and changed substantially in the last five years. Florida leads all coastal states in population growth with numbers projected to continue increasing through 2010 to more than twice the State's 1960 population (World Resources Institute, 1991). A local indicator of this growth is the rate of boat registrations for Monroe County. Approximately 3,000 more boats were registered in Monroe County in the five year period 1985 to 1990. In addition to boats used by residents, an unknown but substantial number of boats are trailered to the Keys from the adjacent mainland.

Attendant with the increase in the number of people and boats is an increase in impacts on refuge wildlife and habitats. Camping and associated vegetation clearing have increased dramatically over this time period. Disturbance activities of this type have been documented on a number of refuge islands. In most instances, the size of cleared areas has increased to accommodate greater numbers of campers, more frequent use, or both.

Wildlife disturbance resulting from increased public use is more difficult to document due to its ephemeral nature. Nevertheless, disturbance to nesting bald eagles (Haliaeetus leucocephalus) has been documented at one nest site (there are five known sites in the Florida Keys backcountry), and guide led trips have featured visits to bald eagle nest sites. Impacts on nesting ospreys (Pandion haliaetus) have been documented in the Snipe and Mud Keys with some historic nesting areas abandoned and productivity reduced or eliminated in other areas. Abandonment of a nest colony by magnificent frigatebirds (Fregata magnificens) is suspected to have resulted from increased human activity. For a detailed analysis and summary of human disturbance to wildlife, see Appendix A.

Parallel with the growth in population and public use is the advent of new ways to recreate. Most notable among these new forms of recreation are personal watercraft (PWC) which were originally introduced in 1974. These watercraft are variously known as jet bikes, water bikes, and water scooters or by the trade names Jet Skis, Wave Runners or Sea-Doos. The most frequently used name is Jet Ski which is the registered trade name of the PWC manufactured by Kawasaki Motors Corporation. PWC's are distinguished from other recreational craft by their water jet-propulsion engines, shallow draft, and position of the operator standing, sitting, or kneeling on the craft.

Use of PWC's has increased significantly in the past five years. There are now seven licensed rental businesses and three dealers in the Lower Keys whereas none were present in 1983-84 (Key West Telephone Directories). Observations by refuge staff and professional sportfishing guides strongly indicate marked increases in PWC activity in new areas. Another indicator is the doubling of the number of PWC related accidents from 1989 to 1990 (Florida Marine Patrol statistics).

* "Backcountry" is a term used to define that portion of the uplands and submerged lands of the Florida Keys that can not be reached by road.

Concern over this increase in PWC activity and the related impact on refuge wildlife and habitat is primarily a function of the way in which these watercraft may be used. Due to their design, PWC's are capable of accessing shallow waters adjacent to backcountry keys, some of which are critical bird nesting habitat. Routes of travel, mode of use, and speed are all different than the traditional shallow draft "flats boats." The potential for damaging submerged sea grass beds also exists should the PWC stall or the operator stop or operate the craft in very shallow water.

Given the continued increase in the resident population of Florida and the associated increase in boat registration, the impacts described here are expected to increase. Management of these problems is necessary now to arrest current impacts on refuge resources and to avoid future impacts on wildlife since recovery of populations and habitats, when this is possible, would take considerable time.

Addressing the concerns listed above has been difficult in light of the current mixture of federal and state jurisdictions. The backcountry of the Florida Keys lie in an area of submerged and tidal lands which are under the ownership of the State of Florida. The Division of State Lands Department of Natural Resources administers and manages submerged lands as staff to the Governor and Cabinet sitting as the Board of Trustees of the Internal Improvement Trust Fund. Lying among these State owned, submerged lands are Federally owned and managed uplands. Management of the lands above the mean high water line, the refuge portion of the backcountry, is thus complicated by a split in management jurisdiction and legislative authorities and purpose. Currently, activities which take place adjacent to the refuge, but outside the boundary, do not fall within the management authority of the Service. While many of these activities are entirely appropriate, in some areas, their presence adjacent to sensitive wildlife habitat results in damage to refuge wildlife.

Despite this split in jurisdiction, there is currently no provision for cooperative, unified management of Federal uplands and submerged lands under the control of the State of Florida. Development of an agreement to address this split in authority would provide a means whereby management and law enforcement actions would be implemented.

Granting of specific, limited authorities would allow the Service to manage human activity in and around important habitats so as to eliminate impacts on nesting, roosting, and feeding birds; other wildlife; and their habitats. (See Section 2.0 for a full description of the Management Agreement alternative).

1.3 Purpose

The purposes of the proposed agreement are:

1) To assure continued health of refuge populations of nesting, roosting, and feeding birds;

2) To create an environment where previously abandoned nesting or roosting areas may be re-occupied and where habitats previously impacted may be allowed to revegetate;

3) To foster close cooperation between the Service and the State of Florida Department of Natural Resources and the Florida Game and Freshwater Fish Commission with respect to conservation of the natural resources of the "backcountry;"

4) To provide management protection for refuge wildlife during development of management plans for the Marine Sanctuary and to foster close cooperation with Sanctuary staff;

5) To simplify implementation of management and programs for critical wildlife habitats within the administrative boundaries of the Lower Florida Keys Refuges; and

6) To provide a framework for implementation of educational activities aimed at reducing impacts to wildlife, through voluntary compliance with regulations and "interpretive" law enforcement.

1.4 Proposed Management

The specific actions proposed are described in the Management Agreement contained in Appendix A. In general, management will be focused on assuring that established traditional uses of the backcountry be conducted in such a way as to be compatible with the purposes for which the refuges were established. Existing authorities for lands above mean high water will be fully exercised as staff and funds allow.

Management will consist of a two-pronged approach of education and enforcement. Education programs are expected to include signage at key points of entry to the refuge including boat ramps, existing channels, and other areas. A variety of signage will also be put in place in the backcountry to inform users about management actions. An enhanced media program will be coupled with this to include pamphlets, radio, TV, and newspaper coverage and hiring of a Refuge Education Specialist.

Refuge signs will be used to inform the public that they are near an area of importance to wildlife and that they should adhere to the specific instructions stated. Instructions might include proceeding at idle speed, shutting off motors, and in especially critical cases, no access at all.

It is believed that broad compliance with the terms of the management plan will only occur through voluntary cooperation by the public. However, a law enforcement program will be simultaneously implemented to contact and cite individuals not in compliance with the newly established regulations. Simplification of jurisdiction will greatly enhance enforcement activity by allowing apprehension and citing of individuals disturbing refuge wildlife by their activity in buffer areas which are under State ownership.

Specific management actions are fully described under section 2.0. Generally, these consist of three types of zones: idle speed zones, no motor zones, and no access zones. These management actions would affect traditional uses over less than 1percent of the area within the administrative boundaries of the refuges. Broader closure areas wi1l apply for specific activities such as water skiing, PWC, airboat, and aircraft use.

1.5 Relationship to Other Projects

In November of 1990, the U.S. Congress established the Florida Keys National Marine Sanctuary (PL 101-605). Plans are now being developed for management of the Marine Sanctuary. These plans are not expected to be finalized for approximately 18 months and implementation would occur at some time subsequent to this. Although it is believed that the Sanctuary management plans will address concerns about disturbance to wildlife and their habitat, the need for protection of these areas is immediate. The proposed action therefore represents an interim action to address management problems in the near-term. Throughout development of the Sanctuary Management Plan, the Service will be invo1ved to assure that proposed management actions are coordinating with Sanctuary planning.

It is anticipated that law enforcement personnel will be jointly deputized and will be capable of enforcing both Marine Sanctuary and Refuge regulations.

The State of Florida owns the submerged lands surrounding refuge areas. The State is seeking to address its management concerns through this management agreement and has been involved in development throughout.

A variety of alternatives were initially considered to address protection of refuge habitats and wildlife. The development of these alternatives was based on expertise within the Service, the Florida Department of Natural Resources, the Florida Game and Freshwater Fish Commission, and various forms of public involvement. Public involvement and scoping activity is summarized in Appendix C.

The alternatives considered here represent the feasible array of alternatives that are available to the Service. Described in this section are: Alternative A, the No Action Alternative; Alternative B, a Management Agreement with the State of Florida for selected areas and activities in Great White Heron NWR and Key West NWR; Alternative C, a Management Agreement with the State of Florida for the area within the administrative boundaries of Great White Heron NWR, Key West NWR, and National Key Deer Refuge, the Service Preferred Alternative; and Alternative D, a Submerged Lands Lease from the State of Florida for the same area and actions covered in Alternative C. All of the alternatives, except the No Action Alternative, deal with transfer of some degree of State of Florida jurisdiction to the Federal Government for the purpose of improving protection of refuge resources.

2.1 Alternative A - No Action

Under the No Action Alternative, the Service would not enter into a submerged lands lease or cooperative management agreement with the State of Florida. Placement of buffer zones, no motor zones, or other types of management areas would not be developed by the Service and would not be implemented. Such activities could be handled by the Florida DNR or through regulations developed in relation to the Marine Sanctuary. Differing jurisdictions over upland and submerged lands would remain. Implementation of actions under this alternative would probably be delayed for one to two years or until completion of Marine Sanctuary planning.

The Service would attempt to implement protection efforts as it has in the past, with questionable authority to limit damaging activities which occur on adjacent lands or waters. It would be the responsibility of the Florida Department of Natural Resources or the Marine Sanctuary to implement management actions aimed at protection of refuge resources. Protection of refuge resources from activities taking place outside Federal jurisdiction would rely on existing regulations and authorities which have to date proven inadequate and difficult to implement. Those activities harmful to refuge resources taking place on refuge lands will be addressed through increased enforcement efforts.

2.2 Alternative B - Management Agreement with the State of Florida on Key West and Great White Heron National Wildlife Refuges

Under Management Agreement Alternative B, the Service would be designated manager of the specific State jurisdiction submerged lands and uplands inside the administrative boundaries of the refuge (Figures 1, 2 and 3). Management actions would be restricted to the locations listed below in Table 2-1. These management actions could be modified, eliminated, or new actions taken depending on future activities. Implementation of additional management actions would be through a public process which would include opportunities for comment. Under this alternative, the listed actions would become a part of the Management Agreement and would comprise the sum of management actions to be implemented by the Service. The specific actions to be included in the Management Agreement are incorporated by reference and made a part of this Environmental Assessment as Appendix A, Management Plan for Backcountry Portions of Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge, and National Key Deer Refuge.

General conditions of the agreement are as follows:

1. Term of the agreement is 25 years, with reviews every 5 years. However, termination of the agreement may be made by either party with written notice 60 days prior the termination date.

2. Changes in the agreement described here must be approved jointly by the State of Florida and the Service after written notice to each other.

3. Public involvement will include an announcement of the proposed change, a 30 day review period, and at least one public meeting. Public involvement will take place for all amendments to the Management Plan and Agreement, e.g., additions, changes, or deletions of areas subject to management.

4. This agreement will not authorize the Service to regulate commercial fishing, sport fishing, or other traditional uses which do not impact refuge resources.

5. The specific management actions to be taken by the Service are described briefly below. Rationale and specific details regarding each action are provided in Appendix A, Management Plan for Backcountry Portions of Key West NWR, Great White Heron NWR, and National Key Deer Refuge.

Summary of Management Actions - Alternative B

This summary lists measures the Service would implement under Management Agreement - Alternative B. Also listed are steps the Service would take, using its existing authority, to regulate public use on certain offshore refuge islands where refuge wildlife and habitat is being damaged by incompatible public use activities.

The goal of these measures is to protect wildlife, particularly nesting, feeding, and roosting birds, without imposing unnecessary restrictions on the general public. A concerted effort has been made to accommodate public use where compatibility with wildlife is not considered a factor at this time. These restrictions would affect less than 1percent of the waters and lands within the administrative boundaries of the refuge.

Management Actions

1. Establish idle speed, no motor, and no access buffer zones in appropriate areas for the protection of wildlife. These zones are defined as follows (see below and Figures 1, 2, and 3 for general locations):

   Idle speed zones - Areas where boats must operate at a speed not greater than that needed to maintain forward progress; operating at planing speed is prohibited.

   No motor zones - Areas where use of boats powered by internal combustion engines is prohibited. Boats with such motors are permitted access to motor zones only through the use of a push pole, paddle, or electric motor.

   No access buffer zones - Areas closed to all types of vessels and human activity.

2. Provide increased public education for backcountry boaters through news releases, public service announcements, brochures, and educational panels at boat ramps.

3. Implement the current regulation that requires a permit for commercial use of refuge islands. Conduct scoping meetings, establish local policies, and evaluate permit requests for compatibility with the purpose for which the refuges were established to determine if specific commercial use is compatib1e.

4. Provide increased Service enforcement personnel to ensure compliance with the regulations listed here and existing rules governing camping, vegetation clearing, littering, and illegal structures.

5. Require a permit (no fee) to visit backcountry islands containing Key deer.

6. Mangrove islands would remain closed except where specifically opened when the opening is shown to be compatible with the purposes for which the refuge was established. In most cases, public use opportunities are virtually nonexistent and inherently incompatible with wildlife on mangrove islands.

The general location of the areas listed below are identified in Figures 1-3. Specific locations are depicted on aerial photographs on file at the refuge headquarters on Big Pine Key. Due to the expense of reproduction, a limited number of copies were made. Please contact the Refuge Manager at (305) 872-2239 if you would like to examine these photographs.

Table 2-1. List of management actions for Great White Heron and Key West National Wildlife Refuges under Alternative B.

AREA	MANAGEMENT ACTION
1. Sawyer Key	Close tidal creeks on south side.
2. East Harbor Key	No access buffer zone (300 feet) around island.
3. Little Mullet Key	No access buffer zone (300 feet) around island.
4. Upper Harbor Key	No access buffer zone (300 feet) around island.
5. Little Crane Key	No access buffer zone (300 feet) around island.
6. Boca Grande Key	Close one-half of the beach (south side).
7. Woman Key	Close one-half of the beach and sand spit (southeast side).
8. Horseshoe Key	Post entire island off-limits.
9. Cottrell Key	No motor zone (300 feet) around island.
10. Marquesas Keys	No motor zones (300 feet) around the three smallest islands; no access buffer zone (300 feet) around one mangrove island; idle speed zone through one tidal creek.
11. Snipe Keys (tidal creeks north of Outer Narrows	Idle speed in main creek. No motor zone elsewhere.
12. Mud Keys	Idle speed zones in two main creeks; close two smaller creeks.
13. Big Mullet Key	No motor zone (300 feet) around island.
14. Tidal flat south of Marvin Key	No access buffer zone.
15. West Content Keys	Idle speed zones in tidal creeks and one no access buffer zone.
16. East Content Keys	Idle speed zones in tidal creeks.
17. Bay Keys	Idle speed zone (300 feet) around one island.
18. Lower Harbor Keys	Idle speed zone in tidal creeks.
19. Caya Agua Keys	Idle speed zone in tidal creeks.

This Management Agreement will be signed by the Regional Director, U.S. Fish and Wildlife Service, Atlanta, GA, and the Director, Division of State Lands, Florida Department of Natural Resources, after approval by the Governor and Cabinet sitting as the Board of Trustees.

Amendments to the plan resulting from public involvement and subsequent agreement between the State of Florida and the Service must be made by the same parties.

2.3 Alternative C - Management Agreement with the State of Florida for Key West and Great White Heron National Wildlife Refuges and National Key Deer Refuge - The U.S. Fish and Wildlife Service Preferred Alternative.

This Alternative is identica1to Alternative B except for three additional management actions to be implemented over a wide area. These actions are:

(1) Prohibit personal watercraft and airboats from operation within the administrative boundaries of Key West and Great White Heron NWR's (see Figures 4, 5 and 6). Selected areas within this boundary are excluded from this closure to provide for access to open areas, e.g., Port Pine Heights on Big Pine Key. The areas excluded are as follows:

Township 66 South, Range 29 East, Sections 5, 11, 12 and 14;
Township 66 south, Range 28 East, Section 2;
Township 67 South, Range 26 East, Sections 16 and 20,
all Tallahassee Meridian.

(2) Prohibit water skiing within the administrative boundaries of Key West and Great White Heron NWR's (see Figures 4, 5 and 6).

(3) Prohibit aircraft (including hovercraft) landing within the administrative boundaries of Great White Heron and Key West Refuges.

Terms of the Management Agreement would be the same and the same list of protective measures included in Alternative B, Table 2-1, would be implemented.

2.4 Alternative D - Submerged Lands Lease with the State of Florida

Under the Submerged Lands Lease alternative, management actions would be the same as described under Alternative C except that the actions would be included in the terms of a Submerged Lands Lease as opposed to a Management Agreement.

Under the Submerged Lands Lease Alternative, the Service would request from the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida, a long term lease (25 years) of State owned tide and submerged lands. In addition to tide and submerged lands, the Service would request management of State owned lands above mean high water within the boundary of the refuges. The lands and waters are the same as those considered under Alternative C.

A Submerged Lands Lease must receive the approval of the Governor and Cabinet of the State of Florida and the Regional Director of the Service. Likewise, changes in the agreement must be agreed to by these parties. The Submerged Lands lease Alternative thus represents a longer term, less flexible means of management. The Submerged Lands Lease is similar to Alternative C in

that actions which would be taken by the Service are only those specifically granted to the Service and included in a management plan attached thereto.

KEY WEST NATIONAL WILDLIFE REFUGE

MONROE COUNTY, FLORIDA

UNITED STATES
DEPARTMENT OF THE INTERIOR

UNITED STATES
FISH AND WILDLIFE SERVICE

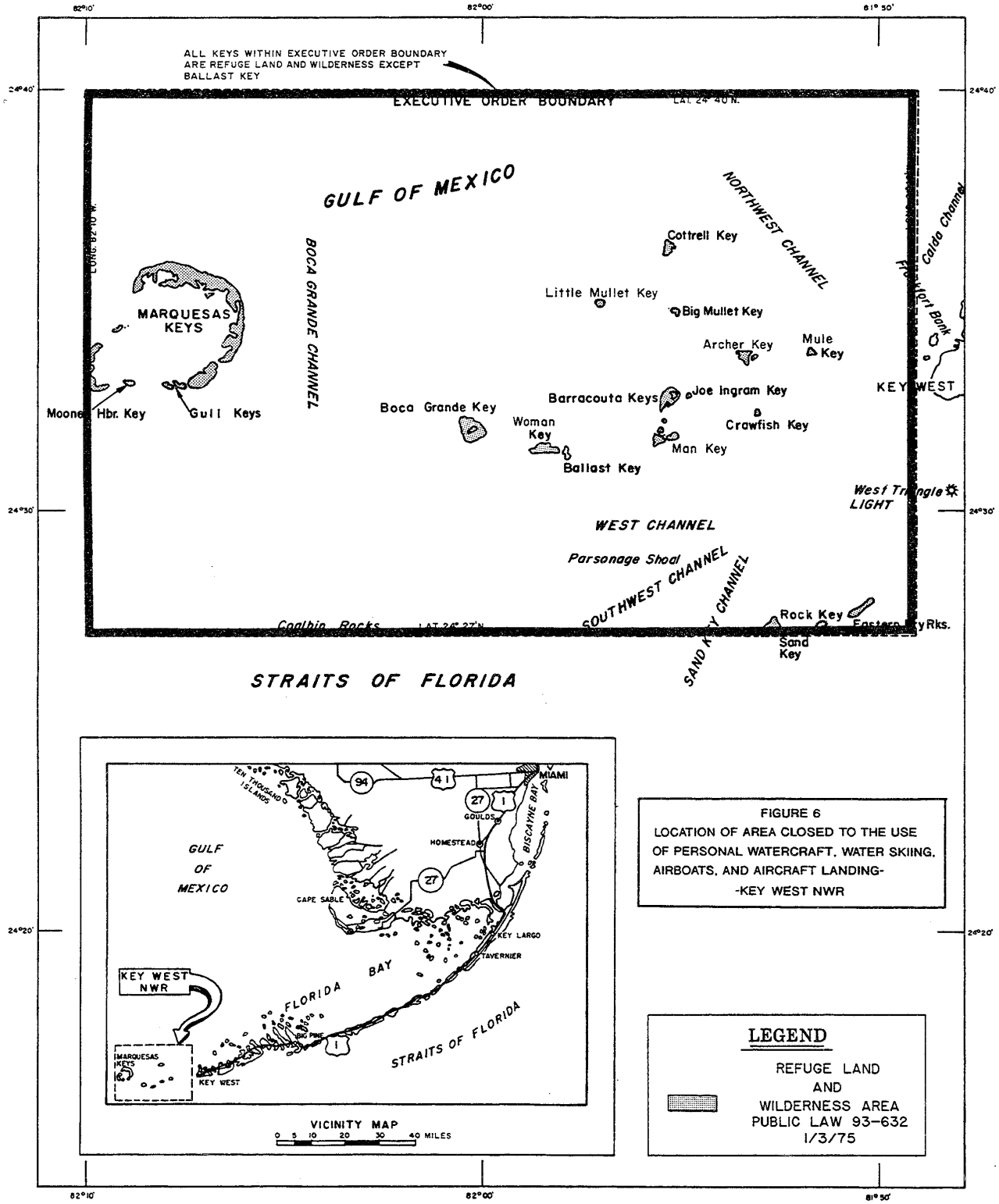


FIGURE 6
LOCATION OF AREA CLOSED TO THE USE OF PERSONAL WATERCRAFT, WATER SKIING, AIRBOATS, AND AIRCRAFT LANDING-
-KEY WEST NWR

LEGEND

REFUGE LAND AND WILDERNESS AREA PUBLIC LAW 93-632 1/3/75

COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C. & G.S.

ATLANTA, GEORGIA
REVISED: 7/81

APRIL, 1970

TALLAHASSEE MERIDIAN

Scale 0 6000 18000 24000 36000 FEET
0 1 2 3 4 5 6 7 MILES

TRUE NORTH
MAGNETIC N.
81° 50' 45'
MEAN DECLINATION 1970

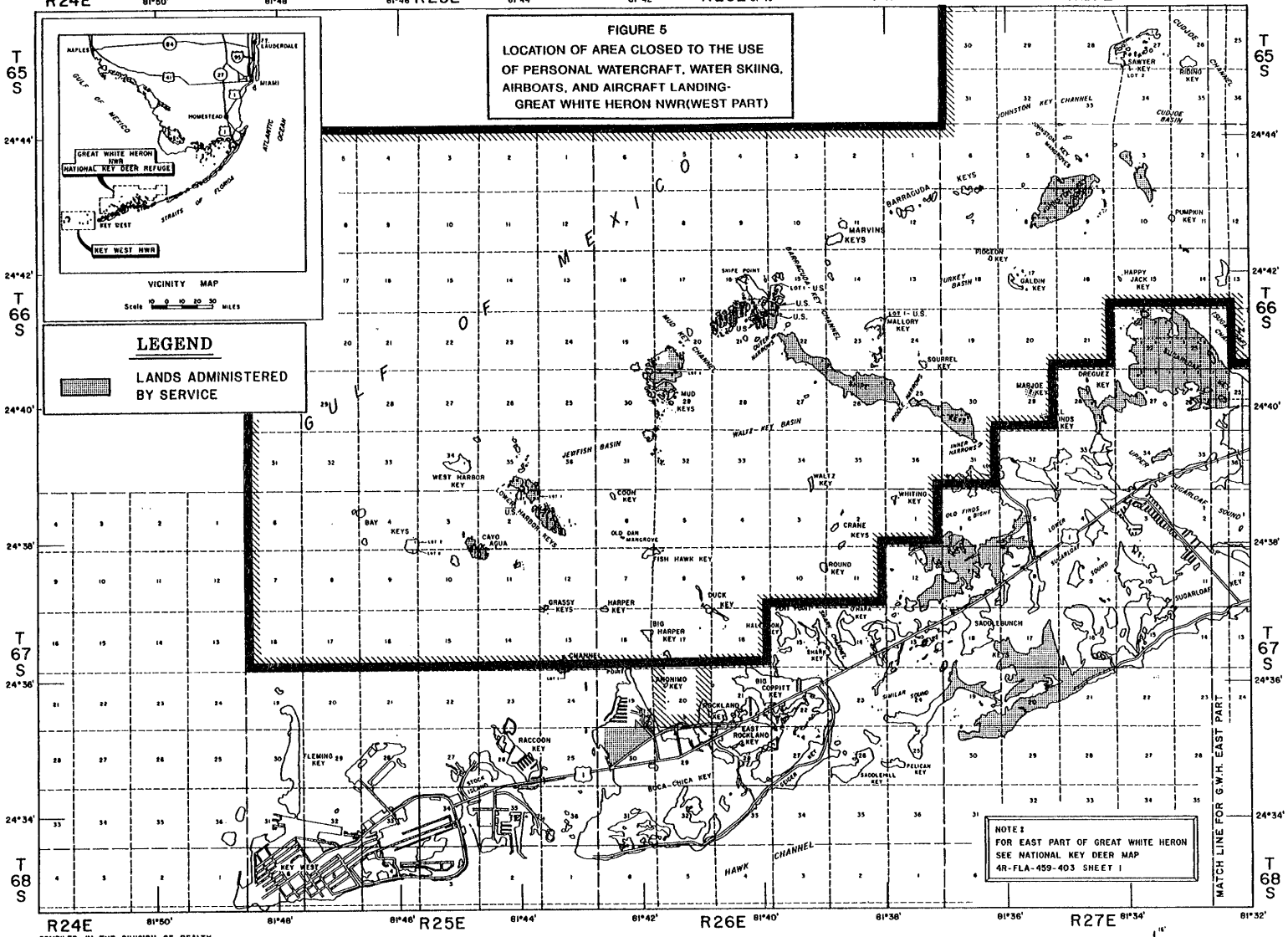
4R FLA 38 403

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE (WEST PART)

MONROE COUNTY, FLORIDA

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES FISH AND WILDLIFE SERVICE



COMPILED IN THE DIVISION OF REALTY FROM SURVEYS BY C.&G.S. & G.L.O.

TALLAHASSEE MERIDIAN

Scale 0 3000 6000 12000 18000 24000 FEET; 0 1/2 1 2 3 4 MILES

ATLANTA, GEORGIA DECEMBER, 1971

REVISED 8/85

4R-FLA-267 403

3.0 AFFECTED ENVIRONMENT

3.1 Climate

Climate of the Lower Florida Keys is characterized as Tropical-Maritime. The highest temperature on record was 97 degrees and the lowest 41. The southern latitude and maritime influences contribute to minimal seasonal variation in temperatures with average annual highs of 81 degrees and lows of 72 degrees and average winter temperatures that are about 16 degrees lower than in summer. Differences in daily highs and lows average 10 degrees.

The Florida Keys experience the highest level of solar radiation in the State of Florida. During spring (April), the sun shines 84% of the possible sunlight hours.

There are no records of snow, sleet, or ice from the Florida Keys. Rainfall is seasonal with wet periods extending from May through October. There are two peaks in rainfall, the first in June and the second in September-October. Annual precipitation totals about 39 inches with 80 percent of this falling from May to October.

The Florida Keys are within an area with high probability for tropical storms (39-74 mph winds) and hurricanes (greater than 74 mph winds). There is a one in seven chance of a hurricane striking the Keys in any given year. Prevailing winds are from the east, varying from due east in fall to east-southeast in spring and summer. Wind speeds average 10 to 12 mph (Monroe County Environmental Education Task Force 1991).

3.2 Physiography, Geology, and Soils

Elevations range from sea level for many of the mangrove keys to a few feet above sea level. The highest points in the Florida Keys are less than 20 feet above sea level. Sea depths are extremely shallow with large areas covered by less than 5 feet of water at high tide. Low tides typically expose large intertidal areas with the amount of exposed area varying with wind and weather conditions and the phase of the tidal cycle.

Lower Florida Keys backcountry islands range in size from less than one acre to over 900 acres. Most keys are less than 100 acres. Tidally flushed "creeks" occur on some of the mangrove islands.

The geology of the Lower Florida Keys has been described in detail by Hoffmeister (1974). Geologic features are comprised primarily of two limestone components of marine origin. Key Largo Limestone is the remnant of a former coral reef and underlies much of the study area. This component reaches the surface in the southern portion of National Key Deer Refuge. Most of the remainder of the backcountry is overlain with Miami Oolite. Both Key Largo and Miami Oolite were in the process of being formed until about 100,000 years ago when sea levels dropped during the Wisconsin Glaciation. Soil layer is thin when present. Both limestone components have been partially dissolved by rainfall, leaving characteristic solution holes or sinkho1es.

3.3 Water Resources

Water resources of the Florida Keys backcountry are dominated by a marine environment. In much of the backcountry, shallow water depths result in fairly rapid changes in daily and seasonal water temperature. Annually temperatures may vary by as much as 25 degrees, from 65 to 90 degrees in winter and summer respectively.

Tidal cycles are extremely difficult to predict due to the shallow water area and the combination of winds, local topography, and tidal currents. The effect of wind is especially important in shallow water areas and may overshadow affects of tidal influence. Differences in the number of tidal changes per day further complicate prediction. There are four tides each day, two high and two low, although the degree of these tides is affected greatly by location. Lower Keys mean tide range is about 1.3 feet, spring tide range is about 3 feet.

On some of the larger backcountry keys in National Key Deer Refuge, freshwater lenses may occur. These lenses are relatively small in size and float on top of saline groundwater. They are fed entirely by rainfall and in some cases are present during the wet season only. Permanence of these lenses is dependent on amount of rainfall and the permeability of the substrate.

3.4 Vegetation Communities

Distribution of vegetation communities of the refuge backcountry have never been determined and have not been mapped. Davis (1942) reported on vegetation on the Marquesas and Boca Grande Keys. Dickson (1955) provided a broad description of habitat types on 14 backcountry islands extending from Knockemdown Key northeast to Little Pine Key. From these studies and from general knowledge of refuge areas acquired through site visits, several plant communities have been identified. The general community types described are: beach, wetland, and upland. Names of plants and distributional information are from Long and Lakela (1976), Tomlinson (1986), and Scurlock (1987).

Beach Community

Beaches, formed primarily of calcareous remains from various shallow water marine organisms, occur as narrow strips, often with a landward berm of sand which has accumulated through wind and wave action. Good examples of these beaches are found on Woman, Marquesas, and Boca Grande Keys in Key West National Wildlife Refuge. Smaller beaches are present on Man, Sawyer, and west Content Keys and Snipe Point. Characteristic herbaceous plants of this community are sea oats (Uniola paniculata), railroad vine (Ipomoea pes-caprae), sea purslane (Sesuvium spp.) and puncture weed (Tribulus spp.). As these plants pioneer and become established, additional sand and sediment accumulates, allowing the establishment of other beach plants including bay bean (Canavalia spp.), sea lavender (Mallotonia gnaphalodes), sand spur (Cenchrus spp.), saltbush (Baccharis spp.), bay cedar (Suriana maritima), wild lantana (Lantana spp.), sea oxeye daisy (Borrichia arborescens), and golden beach creeper (Ernodea littoralis). Eventually, larger woody plants may become established on the landward side of the beach berm. Examples of these plants are: sea grape (Coccoloba uviflera), black bead (Pithecellobium

quadalugense), buttonwood (Conocarpus erectus), seven-year apple (Casasia clusifolia), black torch (Erithalus fruticosa), and joewood (Jacguinia keyensis).

Wetland Community

Wetland communities are predominantly marine and estuarine with limited areas of freshwater wetland. For example, freshwater wetlands are restricted to the larger islands (e.g., Little Pine Key) and are absent in the Great White Heron and Key West Refuge backcountry. In almost all cases, Lower Florida Keys wetlands occur in association with the freshwater lenses described above. Typical plants of freshwater wetlands include sawgrass (Cladium jamaicensis), buttonwood, white mangrove (Laguncularia racemosa), and pond apple (Annona glabra).

Saltwater wetlands are more extensive and consist of transitional wetlands and mangrove wetlands and, in a few locations, saltwater ponds.

Transitional wetlands are wet only part of the time. Most of these wetlands are subject to flooding from tides at certain times of the year. This community frequently occurs between the beach community and the higher elevation pineland and hammock community. Characteristic plant species of this community are salt tolerant and include glasswort (Salicornia spp.), sea purslane (Sesuvium portulacastrum), key grass (Monanthochloe littoralis), saltgrass (Distichlis spicata), saltwort, sea oxeye daisy, various airplants (Tilandsia spp.), beach carpetweed (Philoxerus vermicularis), joewood, sea lavender, saffron plum (Bumelia celastrina), red mangrove (Rhizophora mangle), black mangrove (Avicenni germinans), christmas berry (Lycium carolinianum), and buttonwood. An excellent example of transitional wetland community is found on Water Key. Red mangrove forest is the predominant vegetation community on all backcountry islands except for one sand island and three dredged material islands in Key West National Wildlife Refuge. The roots of these trees are usually either constantly submerged or inundated daily by the tides. Buttonwood, white mangrove, and black mangrove may occur in close proximity to red mangrove but are generally confined to more upland areas. Lugo and Snedaker (1974) described six mangrove forest types, of which five occur in the Florida Keys: overwash, riverine, basin, scrub (dwarf), and fringe forests. Fringe forest is the most common type in the backcountry, occurring around the edges of keys and extending inland varying distances. Some islands are comprised almost entirely of mangrove forest with no upland.

Saltwater ponds are shallow impoundments which were cut off from open water when storms created a berm, effectively blocking tidal flow except during intense storms. The impoundments also collect rainwater, and salinities and water levels are highly variable. Due to the widely varying salinities, vegetation is restricted to the occasional black mangrove on the fringes of the pond.

Uplands

Uplands may be divided broadly into two plant communities: pine rockland and hardwood hammock. Neither of these communities is extensive in the refuge backcountry. Both are restricted to upland sites which are not influenced by tides or intrusion of saltwater into freshwater lenses.

Pine rocklands are dominated by the South Florida slash pine (Pinus elliottii). Other characteristic plants include silver palm (Coccothrinax arqentata) and brittle thatch palm (Thrinax morrisii), saw palmetto (Serenoa repens), poisonwood (Metopium toxiferum), black bead, myrsine (Myrsine quianensis), pisonia (Pisonia rotundata), and wild guava (Psidium longipes). This community is heavily influenced by periodic fires which burn away leaf litter, cycle nutrients, and suppress growth of hardwood species. Backcountry pine rocklands are present only on Little Pine Key and on a small tract in Knockemdown Key. A few scattered pines are present on Howe Key.

The tropical hardwood hammock is a highly diverse plant community with vegetation primarily of West Indian origin. Hammocks are also structurally diverse with tall growing forest species (overstory) and a variety of lower growing (understory) species. This community is very restricted in distribution occurring (in the United States) only in the Florida Keys and a few other mainland locations. A few examples of the more common members of the hammock plant community are gumbo limbo (Bursara simaruba), poisonwood, Jamaica dogwood (Piscidia piscipula), willow bustic (Dipholis salicifolia), in the overstory; pigeon plum (Coccoloba diversifolia), and cinnamon bark (Canella winterana) in the midstory levels; and Spanish stopper (Eugenia foetida), white stopper (Eugenia axillaris), hog plum (Ximenia americana), false boxwood (Gyminda latifolia), and limber caper (Capparis flexuosa) in the understory.

Hammocks of the refuge backcountry are present on Little Pine, Johnson, Water (nearest Little Pine), Annette, Howe, Toptree Hammock, Knockemdown, and Johnston Keys. By far the largest of these hammocks is on Little Pine Key. Berm hammocks, a form of low hammock that forms on beach berms, are found on Sawyer, Mud, Snipe Point, Boca Grande, Woman, and Marquesas Keys.

Invasive exotic vegetation in the form of Australian pine (Casuarina equisetifolia), Brazilian pepper (Schinus terebinthifolius) and Asiatic colubrina (Colubrina asiatica) are the three principle invasive exotics.

Table 3.1 Presence of invasive exotic plants on Key West, Great White Heron, and National Key Deer Refuges, Monroe County, FL, adapted from refuge files.

AREA	Colubrina asiatica	Casuarina equisetifolia	Schinus terebinthifolius
Marquesas	X	X	X
Boca Grande	X		
Woman Keys			X
Key West NWR dredge islands		X	
Bay Key	X		
East Harbor Key	X		
Snipe Point (State-owned)	X		
TopTree Hammock		X	
East Sawyer Key		X	
West Content Keys		X	
Unnamed island Niles channel		X	

Australian pine is present on backcountry islands, including Tank, Wisteria, Tarpon Belly, Howell, and Budd; the privately owned portion of Sawyer Key contains Asiatic colubrina.

Threatened and Endangered Plants

Few of the unique plants of the Florida Keys have been designated as threatened or endangered under the Federal Endangered Species Act. However, the flora of the Keys are unique and have very limited distributions. This limited distribution coupled with habitat loss have resulted in a large number of plants being listed as Species of Special Concern by the State of Florida. Species known or expected to occur on refuge backcountry islands that are of special concern are listed below.

Table 3.2 List of plants federally threatened (THR), endangered (END) and review species (UR) and State of Florida Species of Special concern which occur or probably occur in the backcountry portions of Key West (KWNWR), Great White Heron (GWHNWR) and National Key Deer Refuge (NKDR).

SPECIES	STATUS		ENDEMIC	NKDR	GWH	KW
	FED	STATE	TO KEYS		NWR	NWR
Golden Leather Fern		THR		X		
Leather Fern		THR		X		
Pine Fern		THR		X		
Pine Pink Orchid		THR		X		
Strap Fern		THR		X		
Key Cassia	UR	END	YES	X		
Small Flowered Lily Thorn		END		X		
Prickly Apple Cactus	THR	END		X		
Barb Wire Cactus		THR		X	X	X
Satinleaf		THR		X		
Silver Palm		END		X		
Geiger Tree		THR		X	X	X
Cupania		END		X		
Dollar Orchid	UR	END		X	X	X
Butterfly Orchid		THR		X	X	X
Michaux's Orchid		THR		X		
Manchineel		THR		X		
Joewood		THR		X	X	X
Sea Lavender		END		X	X	X
Vine Fern		THR		X		
Prickly Pear Cactus		THR		X	X	X
Ladder Brake		THR		X		
Scaevola		END				X
Pride of Big Pine		END		X		
Bay Cedar		END		X	X	X
Mahogany		THR		X		X
Florida Thatch Palm		THR		X	X	X
Key Thatch Palm		THR		X	X	X

SPECIES	STATUS		ENDEMIC	NKDR	GWH	KW
	FED	STATE	TO KEYS		NWR	NWR
Reflexed Airplant		THR		X	X	X
Twisted Airplant		THR		X	X	X
Wild Airplant		THR		X	X	X
Banded Wild Pine Airplant		THR		X	X	X
Needle-leaved Airplant		THR		X	X	X
Giant Airplant		THR		X	X	X
Soft-leaved Airplant		THR		X	X	X
Worm Vine Orchid		THR		X		X
Shoestring Fern		THR		X		

3.5 Wildlife

Wildlife populations of the Lower Florida Keys are characterized by their uniqueness and limited distribution. Although the vegetation is predominantly West Indian in origin, wildlife populations have, for the most part, originated from mainland Florida. Many species, left in isolation from mainland habitats, have evolved into separate subspecies from their mainland counterparts. Examples of this include many of the endangered forms such as the Key deer (Odocoileus virginianum clavium), Lower Keys marsh rabbit, (Sylvilagus palustris hefneri), Key mud turtle (Kinosternon bauri), and the silver rice rat (Oryzomys palustris argentatus). Diversity of resident species is low. An exception to this occurs during bird migration in spring and fall when a variety of species may be found using mangroves, shorelines, and upland habitats for feeding and resting.

Amphibians and reptiles are represented by more than 40 species. Diversity is limited by the lack of freshwater habitats, especially for amphibians. Many of the amphibians and reptiles found in the Keys are found nowhere else in the United States. As with other wildlife species, many reptiles and amphibians require a source of freshwater or upland habitat to complete some portion of their life cycle. Many backcountry areas have limited hammock or freshwater resources and therefore have a low diversity of reptiles and amphibians. Exceptions are the larger islands such as Little Pine. On these islands, diamondback rattlesnakes (Crotalus adamanteus) may be present. Diamondbacks may also move among islands. Alligators (Alligator mississippiensis) may also be present on the larger islands which have freshwater habitats. Common species found on backcountry mangrove islands include the mangrove water snake (Nerodia fasciata compressicauda) and diamondback terrapins (Malaclemys terrapin). Cuban tree frogs (Osteophilus septentrionalis) may be present on many of the islands although some upland habitat is necessary for year round residence.

Of special significance in the refuge backcountry are wading birds, the herons and egrets. There are 12 species of wading birds known to nest in the project area. It is extremely difficult to estimate populations sizes since the birds are secretive and frequent visits to nesting areas may result in abandonment of eggs or young. These birds use backcountry islands for nesting due to the remote setting and the freedom from human disturbance and predators such as the raccoon (Procyon lotor). Nesting areas are also chosen on the basis of nearness to shallow water feeding areas. Locations of these feeding areas change as tide and wind conditions expose or submerge

tidal flats. The combined requirements of suitable vegetation, lack of disturbance and predators, and the closeness of feeding habitats restricts the number of acres available for nesting.

Two other common nesting species are the double-crested cormorant (Phalacrocorax auritus) and the brown pelican (Pelecanus occidentalis). Both of these species use backcountry islands for nesting and feed throughout the backcountry.

Raptors are another important group of nesting birds in the backcountry. Ospreys and bald eagles are linked with the marine ecosystem. Bald eagles are discussed under the next section. Ospreys nest throughout the backcountry, sometimes at very high densities. Ospreys may adapt to high levels of human disturbance under the right conditions. However, ospreys using backcountry habitats are subject to highly variable levels of disturbance ranging from no human presence for extended periods, mixed intermittently with intense levels of activity for brief periods. Red-shouldered hawks (Buteo lineatus) may be present in pine rocklands and hammock and have been documented nesting on at least two backcountry islands.

There are very few mammal species present in the project area with only 10 terrestrial species recorded for the entire Keys. Most of the species present are endangered and are discussed under the following section.

Endangered and Threatened Wildlife

Federally endangered or threatened species and State of Florida Species of Special concern are listed below (Table 3-3). There are 5 (Federa1) threatened and 10 (Federal) endangered species known to occur in refuge backcountry areas.

Table 3.3 List of animals federally threatened (THR), endangered (END) and review species (UR) and State of Florida Species of Special concern which occur or probably occur in the backcountry portions of Key West (KWNWR), Great White Heron (GWHNWR) and National Key Deer Refuge (NKDR).

SPECIES	STATUS		ENDEMIC	NKDR	GWH	KW
	FED	STATE	TO KEYS		NWR	NWR
Keys Silverside		END	YES	X		
American Alligator	THR/SA*	SSC		X	X	
Loggerhead Turtle	THR	THR		X	X	X
Atlantic Green Turtle	END	END		X	X	X
American Crocodile	END	END		X		
Indigo Snake	THR	END		X		
Atlantic Hawksbill Turtle	END	END		X	X	X
Key Mud turtle	UR	END	YES	X	X	
Atlantic Ridley Turtle	END	END		X	X	X
Key Ringneck Snake	UR	THR	YES	X		
Florida Brown Snake	UR	THR	YES	X		
Florida Ribbon Snake		THR	YES	X		
Brown Pelican		SSC		X	X	X
SE Snowy Plover	UR	END		X	X	X

SPECIES	STATUS		ENDEMIC	NKDR	GWH	KW
	FED	STATE	TO KEYS		NWR	NWR
Piping Plover	THR	THR		X	X	X
White Crowned Pigeon	UR	THR		X	X	X
Peregrine Falcon	THR	END		X	X	X
Bald Eagle	END	THR		X	X	X
Osprey		SSC		X	X	X
Wood Stork	END	END		X	X	
Roseate Tern	THR	END			X	X
Least Tern		THR		X	X	X
Lower Keys Marsh Rabbit	END	END		X		
Silver Rice Rat	END	END		X	X	
Key Deer	END	END	YES	X	X	
Manatee	END	END		X		

* SA = similarity of appearance. This species, although not endangered itself, received the same protection to avoid unintentional killing or disturbing of the actual endangered or threatened species.

Federally listed endangered or threatened amphibians and reptiles within the management area include the Atlantic loggerhead turtle (Caretta caretta), Atlantic hawksbill turtle (Eretmochelys imbricata), Atlantic green turtle (Chelonia mydas), and Eastern indigo snake (Drymarchon corais couperi). The marine turtles require sand beaches for nesting and therefore make limited use of the refuge. However, use that occurs is essential. Successful nesting must occur largely in the absence of human activity, e.g., camping. The indigo snake is limited to upland habitats of the larger backcountry islands.

Five federally endangered or threatened bird species are present in the Lower Keys backcountry. The bald eagle (Haliaeetus leucocephalus) is known to nest in five locations. The population is believed to remain in the area year round, with the exception of dispersing young birds. Habitats used include mangrove forest, hammocks, and pine rockland for nesting, feeding perches, and roosting.

The piping plover (Charadrius melodus) winters in the Florida Keys and is dependent on beaches and wetland areas for feeding and resting. Accurate population estimates for this species are lacking, but it may be present, at one time or another, on almost any sand beach or open wetland in the Florida Keys from September to April.

Peregrine falcons (Falco peregrinus) migrate throughout the Keys in spring and fall with some individuals remaining through the winter. Peregrines range widely in search of birds which are their primary prey item. Peregrines therefore are encountered in areas of high bird concentrations such as sand spits, beaches, and wetlands.

Wood storks (Mycteria americana) occur rarely in the backcountry as post breeding wanderers. Roseate terns (sterna dougallii) may nest in the backcountry in some years and are present in small numbers for a short period before and after the breeding season.

Other bird species which have been listed by the State of Florida as species of Special Concern and which nest on refuge islands include white-crowned pigeon (Columba leucocephala), roseate spoonbill (Ajaia ajaja), little blue heron (Egretta caerulea), tri-colored heron (Egretta tricolor), reddish egret (Egretta rufescens), snowy egret (Egretta thula), osprey (Pandion haliaetus), brown pelican (Pelecanus occidentalis), and least tern (Sterna antillarum).

Federally listed endangered or threatened mammalian species include three terrestrial species: Key deer, silver rice rat (Oryzomys argentatus), Lower Keys marsh rabbit, and two marine species: the West Indian manatee (Trichechus manatus), and sperm whale (Physeter catodon). The terrestrial mammals are restricted to larger islands with at least some upland habitat. The Key deer are present in pine rockland habitat with some source of freshwater. The marine species occur throughout the Lower Keys.

3.6 Archeological and Historical Resources

A review of the Lower Florida Keys for archeological and historical resources was funded by the National Park Service and completed in 1990 (Carr and Fay 1990). The summary presented here is derived primarily from this report. Known archeological-sites are present on Little Pine, Water Key, and Sawyer Key. Due to the sensitive nature of this information, specific data are being withheld to protect the sites. A copy of this assessment was been provided to the State Historic Preservation Officer for review.

An on site inventory was not conducted for this project since the area was recently surveyed, since the management actions would result in increased protection, and since management activities would have negligible potential for impacting archeological or historical resources.

3.7 Land Use and Socioeconomics

Backcountry islands are comprised primarily of wetland habitats and thus are protected by a variety of land use regulations and policies at the county, state and federal levels. Because of these limitations and the largely public ownership of the islands, significant development in backcountry areas is not anticipated.

There is a total of 6,170 acres of designated wilderness in the project area. Land use restrictions are greater in these areas. Generally, human activity is restricted to temporary uses such as day visits. No clearing of vegetation, construction of buildings, or use in a nontraditional way is allowed. The objective of wilderness management is to maintain the land in as nearly a pristine state as is possible.

Almost all of the upland lands above mean high water in the project area are under Federal management as part of the National wildlife Refuge System. As such, these areas are managed primarily for wildlife and public recreation that is compatible with the purposes for which the refuge was established. Most of the islands are uninhabited and remain in their natural condition.

Current public use consists of recreational activities such as: boating, fishing, snorkeling, scuba diving, photography, and bird watching. These activities are increasing as reflected by the greater

number of boat registrations in Monroe County and the increase in commercially led tours in the Florida Keys backcountry.

A significant amount of commercial fishing takes place in the waters surrounding the refuge islands. Impacts associated with these activities such as deposition of trap debris and prop-dredging are not addressed specifically in this plan.

The human population of the Florida Keys is growing rapidly. Total population for Monroe County now stands at 78,024 (U. S. Census data for 1990) with about 43,000 of these residing in the Lower Keys (south of the Seven-mile Bridge). Since 1970, the resident human population has increased 48 percent from 52,586 to its current level. Most of this growth (75-80 percent) is a result of migration into the Florida Keys as opposed to births from residents (White 1991).

In addition to the resident population, there is a sizable transient population present during the winter months, peaking in February and March. The number of transient residents is estimated at 56,643 (Monroe County 1992). This figure includes about 25,000 persons residing on a seasonal basis and 21,000 present in tourist facilities. The total "functional" population for the County is 134,667. Population projections made by the U.S. Department of Commerce for Monroe County indicate a population of nearly 100,000 by the year 2010 (Monroe County 1992).

Visitation to public lands in the Florida Keys is growing rapidly. Visitors to state parks alone neared 2 million in 1990, an increase of about 240 percent since 1980 (Monroe County 1992). Visitation to the headquarters of National Key Deer Refuge averages 80,000 annually based on traffic counts and counts of visitors to the refuge office and areas such as the Blue Hole and Watson Nature Trail. These figures reflect the recorded visits at staffed locations and are considered conservative estimates of actual public use. For example, volunteers have tallied visits by several thousand individuals at the Blue Hole on Big Pine in a single day. No information is available on the number of backcountry visits that are occurring although it is clear that visitation has greatly increased in recent years based on observations of refuge staff and others with extensive experience in those areas.

Boat registration is closely related to population growth. Since 1971, the number of boats registered in Monroe County has nearly tripled from 6, 740 to 18,236. The trend is slowly increasing, 500-1000 boats/year is expected to continue.

Employment is comprised primarily of private sector jobs (about 80 percent) with the remaining 20 percent made up of federal, state, and local governments and the military. Total annual payroll was slightly more than $500,000,000 in 1989. Unemployment rates average well below the state and national averages.

Cost of living in Monroe County has traditionally been the highest in the state of Florida. Per capita income for Monroe County was $16,626 in 1988, slightly more than the national average. In 1980, the percentage of persons below the federally defined poverty level was 13 percent.

Table 3-4. Major categories of civilian employment in Monroe County, Florida, as of 1990. Summarized from U.S. Bureau of Census and White 1991.

Private Industry	
Retail Trade	9,114
Services	8,526
Contract Construction	1,838
Transport., Comm., and Util.	1,585
Finance, Insurance, and Real Estate	1,391
Manufacturing	590
Wholesale Trade	586
Agriculture and Fisheries	355
TOTAL	**23,985**
Government	
Federal	1,285
State of Florida	605
Local	3,685
TOTAL	**5,575**
GRAND TOTAL	29,560

Gross annual sales for Monroe County totaled 1.6 billion dollars in 1990. About 630 million dollars of this total consisted of grocery, restaurant, and motel/hotel sales, indicating the general economic environment of the region as a tourist and retirement economy (Table 3-5). In fact, the retail trade and service industries (heavily tourism based) accounted for a little more than two-thirds of the private sector employment in Monroe County.

Table 3-5. The top 25 business or product sales categories in Monroe County, Florida. Figures are rounded to the nearest million dollars. Adapted from White 1991, original data from Florida Department of Revenue.

Hotel/Motel	324
Grocery Stores	175
Restaurants/Catering	134
Utilities-Electric/Gas	82
Motor Vehicle	55
Building Materials	55
Service Stations	51
Communications	49
Marine	47
Leasing Commercial Space	44
Wholesale	39
Drug Stores	39
Bars/Liquor Stores	38
Jewelry/Sports	37
Department Stores	36
Clothing/Alterations	35
Park/Marinas	33

Gift Shops	32
Property Rental	31
Seafood Dealers	31
Variety Stores	29
Fuel and LP Gas	16
Manufacturing	13
Repair	12

Permits for residential housing in the Florida Keys have averaged about 85 units during the period April 1990 to October 1991. Approximately one-third of these units were located in the Lower Keys. This provides some indication of the rate of growth that has been occurring in recent years. If the 1992 Monroe County Comprehensive Plan is adopted, permitting will be limited to approximately 250 residential building permits per year for the next decade. 'These permits would be allocated as follows: 99 for the Upper Keys, 41 for the Middle Keys, and 110 for the Lower Keys.

Economic uses of the refuge are comprised entirely of recreational activities such as nature tours and recreational boating. Economic value on a county wide basis is thought to be minor at this time, but growth of these activities is continuing. Estimates of the income from these activities are not available. However, on a County wide basis, a study conducted by the U.S. Minerals Management Service estimated the value of marine based recreation in the Florida Keys at $22 billion, and visitors in 1990 had a direct spending impact of nearly three-quarters of a billion dollars (Kearney and Centaur 1990).

4.0 ENVIRONMENTAL CONSEQUENCES

This section compares and contrasts the environmental consequences of implementing each of the alternatives described in Section 2.0.

The alternatives are listed below for reference along with a brief over view of the alternatives. For a thorough discussion of the Preferred Alternative, see Appendix A.

2.1 Alternative A - No Action

2.2 Alternative B - Management Agreement
Great White Heron/Key West Refuges
Specific Areas

2.3 Alternative C - Management Agreement
Great White Heron/Key West Refuges, National Key Deer Refuge
<u>Service Preferred Alternative</u>

2.4 Alternative D - Submerged Lands Lease
Great White Heron/Key West Refuges, National Key Deer Refuge

Overview of Environmental Consequences

The alternatives and environmental consequences assessed here vary in two principle ways: (1) the method used to convey management authority to the Service - e.g., submerged land lease or management agreement, and (2) the level of management authority that the Service would acquire from the State, e.g., the size of the area to be managed by the Service.

Although the method of obtaining management authority varies between Alternative C and D, it should be noted that the actual management is the same. Therefore, the only difference between these two alternatives is the type of agreement and its term. A longer, less flexible agreement under terms of a lease in Alternative D and a more flexible, shorter term agreement under Alternative C.

The level of authority acquired by the Service would be the lowest under Alternative A (No Action), broadest under Alternatives C and D (management actions on 19 sites and area wide closures on PWC's, airboats, water skiing, and aircraft landing) and intermediate under Alternative B (which would include actions on 19 sites but no area wide closures on PWC's or airboats, aircraft, or water skiing).

4.1 Climate

None of the alternatives is expected to have an effect on area climate.

4.2 Physiography, Geology, and Soils

Impacts are expected to be minimal under all alternatives.

Under the No Action alternative, the Service would not implement any additional protective measures for soils or geologic features. Impacts would be addressed through existing regulations or regulations developed through the Marine Sanctuary planning process. Sufficient regulations exist to protect soils on refuge lands at the present time; however, implementation of protection measures has been complicated by an inability to manage adjacent incompatible uses. This would continue under the No Action alternative.

Alternative B would focus management actions on the specific islands needing protection. Any indirect benefits to soils or local geology of refuge islands resulting from increased management control would therefore be focused on the problem management areas.

Alternatives C and D would provide the greatest level of control over activities which could impact soils and geology by providing better control over public use activity and by allowing management authority on areas above the mean high water line now managed by DNR. It is believed this better control would provide a minor indirect benefit to local geology and soils. Alternative D would assure long term management control in the form of a lease, while Alternative C would provide essentially the same level of authority in the form of a more flexible Management Agreement.

4.3 Vegetation

Under the No Action alternative, use would continue as it has in the past. Enforcement of impacts on refuge uplands will still be prosecuted, but implementation of management actions to prevent damage to vegetation before it happens would be complicated by a lack of authority over adjacent waters. On islands managed in part by the State and in part by the Service, implementation of corrective measures would continue to be complicated and impractical to carry out. It is reasonable to expect that vegetation clearing would expand in currently impacted areas if no action is taken. It should be noted that vegetation clearing is currently illegal. Future vegetation clearing would be prosecuted under all alternatives since the authority to do so currently exists.

Under Alternative B, protection would be restricted to specific areas surrounding refuge islands and would have somewhat less beneficial impacts on vegetation than alternatives C and D, although this difference is difficult to quantify. Impacts on existing public use would be minimal. State owned uplands would still be transferred to the Service for management.

Under Alternatives B, C, and D, refuge vegetation would indirectly receive increased protection. Alternatives C and D would provide essentially the same level of protection since the only differences between these alternatives is the method of establishing authority. These alternatives would be restrictive in terms of the use of airboats, water skiing, PWC's, and aircraft landing and would change the basic nature of public use in the backcountry to a much lower level of impact on upland environments. Therefore, it is likely that these alternatives would result in the least amount of damage to vegetation.

On islands now partially managed by DNR, unification of management authority would enhance and simplify management controls aimed at protection of vegetation.

4.4 Water Resources

Water resources on upland areas are limited and are unlikely to be affected significantly by any of the alternatives.

Under the No Action alternative, it is possible that water resources could be impacted by continued vegetation clearing and unregulated public use on some of the larger islands with freshwater lenses or wetland habitats. This is more likely on islands managed in part by the State and partly by the Service where adjacent authorities have caused problems in implementing protective measures. For the most part, the Service would rely on existing authorities to address these concerns under the No Action alternative.

As with other resource management problems, the Service has been hampered by a lack of unified authority to implement management actions. Alternatives B, C, and D would allow management authority on upland area now partially managed by the State and the Service. This would simplify and enhance the ability of the Service to implement protective measures if needed.

4.5 Wildlife

Under the No Action alternative, the Service would continue to attempt to protect refuge resources using existing regulations and management authorities. Efforts to date have proven to be ineffective. It is considered unlikely that the Service will be able to address current impacts with existing authorities. It is anticipated that impacts and displacement of nesting, roosting, and feeding birds and other wildlife would continue. It is also likely that such impacts would increase without implementation of an active public use management and enforcement program, given the current trends of population growth and development and growth of backcountry public use.

Under the No Action alternative, the Service could attempt to incorporate the necessary management actions into the Marine Sanctuary planning process. This process is not expected to be completed for at least one year. Use of the Marine Sanctuary process would still leave a mixture of management authority on some islands which are in parts managed by the DNR and the Service.

Alternative B would focus on specific problem areas where conflicts with public use activity have been clearly identified.

Alternative C and D would provide the same level of protection for refuge wildlife, differing from each other only in the way in which authority would be transferred to the Service. Specific management actions would be implemented to address impacts of boat traffic adjacent to important bird habitats. Areas previously impacted would also be managed so as to allow habitats to be re-occupied by previously displaced wildlife.

The area wide closure on the use of PWC's, water skiing, airboats, and aircraft landing included in Alternatives C and D would provide the maximum level of protection for wildlife resources. Enforcement of such regulations and an area-wide closure would be more effective and simple to enforce. Area wide closures of this type have already been implemented in Florida Bay by the National Park Service and have proven to be feasible and effective in reducing impacts and managing public use. This alternative wou1d also have the greatest negative impact on a growing recreational activity, e.g., elimination of PWC use. Conversely, elimination of these uses from large backcountry areas would enhance other types of public use activities such as sportfishing and ecotourism.

Alternatives C and D would provide the highest level of protection among the alternatives considered and the greatest impact on current public use activities. Alternative C represents a focused and flexible Management Agreement that could be revised more easily than the longer term submerged lands lease alternative.

Additional restrictions, if necessary, could be pursued through the Marine Sanctuary planning process by adopting zoning measures on a broad area basis. It is unknown whether this type of action would be included in the final Marine Sanctuary plan.

It should be noted that all of the Alternatives considered here may be considered dynamic. It is likely that whatever course of action is adopted it, will be necessary to modify management actions to adjust to changes in public use activities and wildlife use patterns.

4.6 Archaeological and Historical Resources

Under the No Action alternative, archaeological and historical resources would continue to receive protection under Federal laws on lands now under Federal jurisdiction.

On lands under State ownership (submerged and upland sites), Federal management authority would provide an increased level of protection for these resources. Management and protection of these areas would also be simplified since the management authorities would be under one agency.

Under all alternatives, management authority obtained by the Service would be conducted in a manner consistent with the provisions of the Archaeological Resources Protection Act of 1979 (PL 96-95) and applicable Florida Statutes and Administrative Codes. The State of Florida has reviewed this management plan and has determined that there will be no adverse impacts on archeological resources (letter on file).

4.7 Land Use and Socioeconomics

Current land use in the backcountry is primarily recreation based. Under the No Action alternative, these activities would continue and probably increase with little restriction. Some restrictions in the form of zoning of public use could come about through the Marine Sanctuary planning process. It is unlikely that any development in the backcountry would occur since the area is primarily owned and managed by the State or Federal government.

Commercial and recreational fishing are major "land uses" in the backcountry. These uses would continue essentially unaffected under all alternatives since they occur on areas away from refuge islands. However, under Alternatives B, C, and D, access to a small percentage of the refuge backcountry (less than 1 percent) would be managed under no motor, idle speed, and, in some cases, no access zones. Negligible impact is expected, but users should examine the management areas described in Appendix A to determine impact on individual activities.

Under Alternatives C and D, there would be an area-wide closure on the use of PWC’s, water skiing, airboats, and aircraft landing. This would obviously preclude some types of use of the refuge backcountry, resulting in the movement of these activities to other areas. Overall impact is expected to be minor since the entire refuge backcountry covered by this restriction totals about 17 percent of the Marine Sanctuary planning area. It is believed other areas are available for this type of use which would have negligible impact on refuge resources and still provide viable options for PWC use.

Socioeconomics

The predominant social and economic elements of the backcountry are recreational activities and commercial fishing. Commercial fishing is expected to be impacted negligibly since access by commercial boats would not be affected and no regulations on commercial fishing are included in this proposal. Significant impacts on population, area employment, land values, and income are not anticipated. The following analysis therefore concentrates on the potential socioeconomic impacts on public use and recreational activities.

Under the No Action alternative, these current activities would continue, as is, with no change in access or use levels. Economic use would probably continue to grow. At the same time, impacts on the environment would continue and grow. These impacts are expected to adversely affect the backcountry environment that is the principle reason for the interest in visitation. Management actions could eventually be developed through the Marine Sanctuary planning process, but it is not known when these actions would be implemented and whether they would be more or less restrictive than those described here.

Alternative B would allow for elimination of activities which are directly impacting refuge habitat and wildlife resources. Activities occurring away from refuge islands would not be affected. The management under Alternative B consists of a redirection of activity rather than an elimination of activity on an area-wide basis. For example, PWC's and airboats would be directed away from sensitive areas rather than excluded entirely from an area. Existing types and levels of public visitation are therefore not expected to be significantly changed under this alternative.

Alternatives C and D would have similar impacts on recreational activities. These alternatives would adversely impact certain types of recreational activity, e.g., PWC's, water skiing, and airboats by excluding them from the refuge backcountry. It is possible that elimination of these uses would positively affect other recreational uses such as sportfishing and "ecotourism" which have been displaced or adversely impacted. Since PWC and possibly airboat users could relocate their activities to other areas, economic impacts are not thought to be significant.

5.0 CONSULTATION AND COORDINATION

The Fish and Wildlife Service coordinated the proposed management plan with various local, State, and Federal agencies throughout development of the plan and assessment. Coordination and communication activities are summarized in Appendix C. Public meetings and workshops were held in August and December of l991 to discuss proposals and gather public comment.

Draft copies of this cooperative management plan and environmental assessment were sent to all parties participating in public meetings and workshops.

Especially close coordination has been maintained with Planning and Management staff of the Florida Keys National Marine Sanctuary to assure activities were in concert with Sanctuary activities.

6.0 LIST OF PREPARERS

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APPENDIX A

MANAGEMENT PLAN
FOR THE BACKCOUNTRY PORTIONS OF
KEY WEST NATIONAL WILDLIFE REFUGE,
GREAT WHITE HERON NATIONAL WILDLIFE REFUGE, AND
NATIONAL KEY DEER REFUGE

September 1992

PREPARED BY

FLORIDA KEYS NATIONAL WILDLIFE REFUGE
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APPENDIX B

FEDERAL LAWS AND REGULATIONS APPLICABLE TO PRESERVATION AND MANAGEMENT OF FISH AND WILDLIFE RESOURCES

DRAFT
ENVIRONMENTAL ASSESSMENT
AND
DRAFT MANAGEMENT PLAN
FOR THE BACKCOUNTRY PORTIONS OF
KEY WEST NATIONAL WILDLIFE REFUGE,
GREAT WHITE HERON NATIONAL WILDLIFE REFUGE,
AND NATIONAL KEY DEER REFUGE

September 1992

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FEDERAL LAWS AND REGULATIONS APPLICABLE TO PRESERVATION AND MANAGEMENT OF FISH AND WILDLIFE RESOURCES.

Antiquities Act of 1906 (34 Stat. 225). Provides for protection of artifacts and historical objects and their recovery by accredited institutions.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; 40 Stat. 755). Implements treaties with Great Britain (for Canada), Mexico, Japan, and Soviet Union for protection of migratory birds whose welfare is a Federal responsibility; provides for regulations to control taking, possessing, selling, transporting, and importing of migratory birds and provides penalties for violations.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715r; 45 Stat. 1222). Authorizes acquisition, development, and maintenance of migratory bird refuges; cooperation with other agencies in conservation; and investigations and publications on North American Birds.

Migratory Bird Hunting Stamp Act 1934 (16 U.S.C. 718 - 718h; 48 Stat. 451). Requires that all waterfowl hunters, sixteen (16) years of age or older, possess a valid "duck stamp;" requires use of "duck stamp" net revenue to acquire migratory bird refuges and waterfowl production areas.

Criminal Code Provisions of 1940 (18 U.S.C. 41) as amended. States the intent of Congress to protect all wildlife within Federal sanctuaries, refuges, fish hatcheries, and breeding grounds and provides that anyone, except in compliance with rules and regulations promulgated by authority of law, who hunts, traps, or willfully disturbs any such wildlife or willfully injures, molests, or destroys any property of the United States on such land or water shall be fined up to $500.00 or imprisoned for not more than six (6) months or both.

Bald and Golden Eagles Protection Act of 1940 (16 U.S.C. 668- 668d; 54 Stat. 250). Provides for protection of the bald eagle (the national emblem) and the golden eagle.

Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 stat. 686). The Act makes it unlawful to hunt, trap, capture, willfully disturb, or kill any bird or wild animal, or take or destroy the eggs of any such birds on any lands of the United States set apart or reserved as refuges or breeding grounds for such birds or animals by any law, proclamation, or executive order, except under rules and regulations of the Secretary. The Act also protects Government property on such lands.

Fish and Wildlife Act of 1956 (16 U.S.C. 742 a-742j; 70 Stat. 1119). Approved August 8, 1956, the Act established a comprehensive fish and wildlife policy and directed the Secretary to provide continuing research, extension and information services, and directed development, management, and conservation of fish and wildlife resources.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653). Authorizes appropriate, incidental, or secondary recreational use on conservation area administered by the Secretary of the Interior for fish and wildlife purposes.

Wilderness Act (16 U.S.C. 1131; 78 Stat. 890), Establishes the wilderness system as a supplement to the purposes for which units of the National Wildlife Refuge System are established.

Land and Water Conservation Fund Act of 1965. This Act provides financial assistance to the states for outdoor recreation, primarily in (1) planning, (2) acquisition of land, water, or interests in land or waters, or (3) development.

In addition to assistance to the states, the Land and Water Conservation Fund Act provides that not less than 40 percent of the annual appropriation shall be available for Federal purposes. Funds appropriated for Federal purposes shall be made available for the acquisition of land, waters, or interests in land or waters for the (1) National Park System, (2) National Forest System, (3) National Wildlife Refuge System, and (4) Bureau of Land Management.

The appropriations provided by Land and Water Conservation Fund Act are derived from Outer Continental Shelf leases, tax on motorboat fuels, and sale of certain surplus Federal lands. The Act also increased Land and Water Conservation Fund authorization for FY 1978 and the following years through FY 1989.

The Fish and Wildlife Service utilizes four basic acquisition authorities which are allowed through the funding authority of Land and Water Conservation Fund Act to purchase land and water, including (1) Endangered Species Act of 1973, (2) Recreation Act of 1962, (3) Fish and Wildlife Act of 1956, except for migratory waterfowl areas, and (4) any areas authorized as additions to the National Wildlife Refuge System by specific Congressional Acts.

National Historic Preservation Act of 1966 (16 U.S.C. 470, et seq., 80 Stat. 915). The Act provides for the preservation of significant historical features (buildings, objects, etc.) through a grant-in-aid program to the states. Establishes a National Register of Historic Places. Federal Agencies are required to consider the effects of their actions on buildings, etc., included or eligible for inclusion in the National Register.

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927). Consolidates the authorities for the various categories of areas previously established that are administered by the Secretory of the Interior for the conservation of fish and wildlife, including species that are threatened with extinction. All lands, waters, and interests therein administered by the Secretary as wildlife refuges, etc., are hereby designated as the National Wildlife Refuge System. Provides, according to the Act, that the Secretary may authorize hunting and fishing to the extent practicable and consistent with State fish and wildlife laws and regulations.

National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq.; 83 Stat. 852). Declares the national policy to encourage a productive and enjoyable harmony between man and his environment. Section 102 of that Act directs that "to the fullest extent possible: (1) the policies, regulations, and public laws of the United states shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall * * * insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations * * *."

Section 102 (2)c of the National Environmental Policy Act requires all Federal Agencies, with respect to major Federal actions significantly affecting the quality of the human environment, prepare a detailed statement on:

(i) The environmental impact of the proposed action,

(ii) Any adverse environmental effect which cannot be avoided should the proposal be implemented,

(iii) Alternatives to the proposed action,

(iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity,

(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Use of Off-Road Vehicles on Public Lands (Executive Order 11644, as amended by Executive Order 11989). Provides policy and procedures for regulating off-road vehicles.

Endangered Species Act of 1973 (16 U.S.C. 1531, et seq.; 87 Stat. 884). This Act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging state programs. Specific provisions include: (1) authorizes the listing and determination of critical habitat of endangered or threatened species and requires consultation with the Service on any Federally funded or licensed project that could affect any of these species or their habitat; (2) prohibits unauthorized taking, possession, sale, transport, etc. of endangered species; (3) authorizes an expanded program of habitat acquisition; (4) authorizes the establishment of cooperative agreements and grant-in-aid to states which establish and maintain an active, adequate program for endangered and threatened species; and (5) authorizes the assessment of civil and criminal penalties for violating the Act or regulations.

Refuge Revenue Sharing Act of 1935, as amended in 1978, (16 U.S.C. 715s; 92 Stat. 1319). Makes revenue sharing applicable to all lands solely or primarily administered by the Service, whereas previously it was applicable only to areas in the National Wildlife Refuge System. The new law makes payments available for any governmental purpose, whereas the old law restricted the use of payments to roads and schools. For fee (acquired) lands, the new law provides a payment of 75 cents per acre, 3/4 of 1 percent of fair market value, or 25 percent of net receipts, whichever is greater, whereas the old law provided a payment of 3/4 of 1 percent adjusted cost or 25 percent of net receipts, whichever was greater. For reserve (public domain) lands, the law provides for a payment of 25 percent of net receipts. The new law authorizes appropriations to make up any short-fall in net receipts to make payments in the full amount for which counties are eligible. The old law provided that if the net receipts were insufficient to make the full payment, the payment to each county would be reduced proportionately.

National Wildlife Refuge Regulations for the most recent fiscal year (50 CFR Subchapter C; 43 CFR 3101.3-3). Provides regulations for administration and management of wildlife refuge areas including mineral leasing, exploration, and development.

Emergency Wetland Resources Act of 1986. (S.B.740). Provides for 1) an extension of Wetlands Loan Act until September 30, 1988, 2) sale of admission permits at certain National Wildlife Refuges, 3) increasing the price of the Migratory Bird Hunting and Conservation Stamp to $10.00 in hunting years 1987 and 1988, $12.50 for hunting years 1989 and 1990, and $15.00 for each hunting year thereafter; 4) transfers import duties collected on arms and ammunition to Migratory Bird Conservation Fund, 5) establishment of National Wetlands Priority Conservation Plan, 6) use of Land and Water Conservation Fund monies for acquisition of wetlands for migratory birds, 7) inclusion of wetlands in statewide outdoor recreation plans, 8) acquisition of wetlands, 9) certain restrictions on use of eminent domain wetland acquisition, and 10) continuation of National Wetlands Inventory Project.

North American Wetlands Conservation Act of 1990. Encourage partnership among public agencies and other interests to: (1) protect, restore, and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife; (2) maintain distribution of migratory bird populations; and (3) sustain an abundance of waterfowl and other migratory birds consistent with the goals of the North American Waterfowl Management Plan.

Appropriations provided by the North American Wetland Conservation Act are derived from Federal Aid in Wildlife Restoration Act (Pittman-Robertson) funds and proceeds from migratory bird fines, penalties, and forfeitures under the Migratory Bird Treaty Act. Appropriations are not to exceed $15 million beginning in FY 1991 and continuing through 1994. Allocation of funding from the Act provides at least 50 percent but not more than 70 percent of available funds for projects in Canada and Mexico. At least 30 percent but not more than 50 percent of available funds will be appropriated for projects in the United States.

Food Security Act (Farm Bill) of 1990 as amended (HR2100). The provisions of the 1990 farm bill makes the goals of the U.S. Department of Agriculture farm and conservation programs more consistent. The conservation reserve, conservation compliance, and sodbuster and swampbuster provisions of the bill encourage reduction of soil erosion, retention of wetlands, and reduces protection of surplus commodities.

APPENDIX C

SUMMARY OF PUBLIC INVOLVEMENT FOR THE

DRAFT ENVIRONMENTAL ASSESSMENT AND DRAFT MANAGEMENT PLAN FOR THE BACKCOUNTRY PORTIONS OF KEY WEST NATIONAL WILDLIFE REFUGE, GREAT WHITE HERON NATIONAL WILDLIFE REFUGE, AND NATIONAL KEY DEER REFUGE

September 1992

PREPARED BY
FLORIDA KEYS NATIONAL WILDLIFE REFUGES
P.O. Box 510
Big Pine Key, FL 33043

PREFACE TO PUBLIC COMMENT SUMMARY

Public involvement activities conducted by the Fish and Wildlife Service in coordination with the State of Florida Department of Natural Resources related to the management of the backcountry portions of Key West and Great White Heron National Wildlife Refuges and National Key Deer Refuge are summarized in this Appendix.

Public involvement began with a proposal to lease submerged lands from the State of Florida for the purpose of improving management of refuge islands. These meetings were sponsored jointly by the Fish and Wildlife Service and the State of Florida, Dept. of Natural Resources. The meetings were held in August of 1991.

Following the August 1991 meetings, it was found that sufficient concern existed about the proposed lease that the Service should reconsider the lease proposal, prepare a management plan outlining the specific proposed actions, and then conduct another series of public meetings/involvement to receive comment on the revised proposal.

However, before commencing work on the plan and revised proposal, the Fish and Wildlife Service felt an additional set of public meetings were in order to more fully scope the issue. This second round of public involvement was sponsored by the Fish and Wildlife Service and consisted o£ a one-day workshop held on December 5, 1991. This meeting was designed to bring all affected parties together to discuss management options and strategies and hopefully gain some consensus on management actions.

Public input received at the August and December 1991 meetings was used to scope and identify issues, identify viable alternatives, and prepare both the Management Plan and Environmental Assessment. In addition to input obtained during these meetings, public comment was received from countless sources as the plan and assessment was in preparation. These sources included formal and informal meetings with conservation and civic groups, comments received from the general public, conservation groups, industry, development interests, and numerous other interested parties.

Following these meetings, the Fish and Wildlife Service set about preparing a Management Agreement and Plan to be presented to the State of Florida for its consideration. In conjunction with this, the Service prepared an Environmental Assessment in compliance with the National Environmental Policy Act. The purpose of this Environmental Assessment was to determine the environmental impact of the proposed management plan and cooperative agreement. After preparation of a draft plan and assessment, copies were circulated to interested parties, and a 45 day public review period followed. Two public meetings were scheduled to receive comment on the draft proposal. The meetings were held in Key West on June 22 and in Key Colony Beach on June 24.

Following these meetings, the Service redrafted the proposal and developed the final Environmental Assessment, Management Plan, and Agreement for review and approval by the Regional Director of the Service in Atlanta, GA, and the Director, Division of State Lands, Department of Natural Resources, State of Florida.

Individuals contacted by the Fish and Wildlife Service or who testified at public meetings, wrote to the Fish and Wildlife Service or did both are listed below. Copies of written comments and oral testimony are on file at National Key Deer Refuge, P. O Box 510, Big Pine Key, Florida, 33043, (305) 872-2239, and are available for public review.

MEETINGS AND PRESENTATIONS

Public meetings on proposed submerged lands lease with the State of Florida, Key West, August 8,1991, and Marathon, August 9,1991.

Public workshop and scoping meeting for development of a Backcountry Management Plan, Key West, December 5, 1991.

Florida Keys National Marine Sanctuary, slide presentation for Billy Causey, Sanctuary Manager, Marathon, May 5, 1992.

Last Stand Board Meeting, slide presentation, Key West, May 6, 1992.

Key Deer Protection Alliance, slide presentation, Big Pine Key, May 7, 1992.

Florida Keys Audubon Society, slide presentation, Key West, May 11, 1992.

Key West Lion's Club, oral presentation, Key West, June 2, 1992.

Florida Keys National Marine Sanctuary Advisory Committee Meeting, slide presentation, Key Largo, June 4, 1992.

TCI, Channel 5, Cable Television, Conservation in the Florida Keys, Key West, June 18, 1992.

U.S. 1 Radio News, Key Issues, Big Pine Key, June 21, 1992.

Murphy in the Morning, WIIS, Radio Talk Show, June 22, 1992.

Public Meeting on proposed plan, Key West., June 22, 1992.

Public Meeting on proposed plan, Key Colony Beach, June 24, 1992.

Sugarloaf Shores Homeowners Association, discussion of plan and other refuge issues, Sugarloaf Key, June 30, 1992.

LIST OF ORGANIZATIONS AND INDIVIDUALS SUBMITTING WRITTEN COMMENTS

Federal Agencies

United States Department of Commerce, NOAA, Washington, D.C.
United states Department of the Interior, Fish and Wildlife Service
Fish and Wildlife Enhancement, Vero Beach, FL
District Wildlife Management Biologist, Jacksonville, FL

State Agencies

Office of the Governor, Florida State Clearinghouse, Tallahassee, FL
Department of Natural Resources, Division of State Lands, Marathon, FL
Department of Natural Resources, Bureau of Sanctuaries and Research Reserves

Local Government

Monroe County, Planning Department, Marine Resources, Key West, FL

Citizen Organizations

Big Pine Key Civic Association, Big Pine Key, FL
Coral Reef Coalition, Washington, D. C. and Marathon, FL
Defender's of Wildlife, Washington, D. C.
Dolphin Research Center, Marathon Shores, FL
Florida Keys Guides Association, Islamorada, FL
Friends of Florida, Key West, FL
Last Stand, Key West, FL
Marathon Guides Association, Marathon, FL
National Audubon Society, Dept. of Scientific and Policy Research, Florida Keys Office, Tavernier, FL
National Audubon Society, Washington, D. C.
The Izaak Walton League of America, Florida Keys Chapter, Islamorada, FL
The Wilderness Society, Washington, D. C.

List of citizens submitting written comment (alphabetic order)

George Anderson, Yellowstone Angler, Livingston, MT
Scott Benevento, FL
William and Elizabeth Botts, Key Largo, FL
Del Brown, S. Martinelli and Co., Martinsville, GA
Margaret Rulon Brown, Summerland Key, FL
Sally Buehler, Marathon, FL
Jimmy Buffett, Margaritaville
Ross Stafford Burnaman, Tallahassee, FL
Dora L. Carter, Marathon FL

List of citizens submitting written comment (alphabetic order) (continued)

Helen R. Chapman, Key West, FL
Dr. Michael D. Coe, New Haven, CT
J. P. Cosgrove, Tavernier, FL
Alfred J. Coyle, Tequesta, FL
Ellie Crane, Key West, FL
Dan Crowley, Big Pine Key, FL
Capt. Marshall Cutchin, Key West, FL
Franklin M. Denison, Islamorada, FL
Edward S. DeSalvio, Glen Rock, NJ
Jean Dillon, Big Pine Key, FL
Gil Drake, Key West, FL
E. F. Dwyer, Summerland Key, FL
James Ellis, Islamorada, FL
Bruce Etshman, Key West, FL
Alan Farago, Key West, FL
F. Feldman, Key Largo, FL
E. P. Fennell, S. Newport, KY
Jean and Eugene Ferriez, Key West, FL
Joy Fiore, Key West, FL
Frank Foster, Islarnorada, FL
Dr. G. L. Freed, Summerland, Key, FL
Henry S. Gartner, Key Largo, FL
Lou and Geraldine Greene, Islamorada, FL
Dieter P. Gerlach, Big Pine Key, FL
Harold H. Harms, Miami, FL
Ron Heroux, Big Pine Key, FL
George Hommnell, Jr., World Wide Sportsman, Inc., Islamorada, FL
Isidro G. Huerta, Miami, FL
T. Huot, Key West, FL
Steve Huff, Duck Key, FL
Mark B. Hyatt, Key West, FL
Timothy S. Karr, Villager Realty, Inc., Lewisburg, PA
Douglas Keen, Key Colony Beach, FL
Robert W. Kilgore, Key Biscayne, FL
Kathleen E. Koury, Islamorada, FL
Micheline B. Krech, Big Pine Key, FL
Curtis Kruer, Summerland Key, FL
George Kundtz, Key Largo, FL
Paul Labbe, Key West, FL
William Levy, Marathon, FL and Conway, NH
Henry Lippolt, Manhasset, NY
Jim and Ruth Locke, Scarborough, Ontario, Canada
Marabeth Lomazzo, Islamorada, FL
Marcia Ludevig, Miami Beach, FL
Ken March, Islamorada, FL

List of citizens submitting written comment (alphabetic order) (continued)
Scott McLendon, Key West, FL
A. Ewan Macdonald, Del Monte Foods, San: Francisco, CA
Mr. and Mrs. Wm. McNulty, Marathon, FL
Bernice E. McQuaide, Miami, FL
Fred C. Mannillo, Big Pine Key, FL
Anthony R. Marchione, Key West, FL
Raymond Mendez, New York, NY
Norine and Don Meng, Big Pine Key, FL
Richard C. Mikkelsen, Summerland Key, FL
David J. Moret, Miami, FL
Sanford W. Moret, Florida Keys Outfitters, Islamorada, FL
Henry Lee Morgenstern, Key West, FL
George Morrice, Granville, OH and Islamorada, FL
John H. Morrell, Islamorada, FL
Barry Morris, Duck Key, FL
Eric Mueller, Big Pine Key, FL
Gil Muratori, Miami, FL
Frank Nelkin, Summerland Key, FL
William E. Nevin, III, Key West, FL, (also included petition)
Capt. Zach Nichols, Charleston, SC
Wayne Niskanen, Front Royal, VA
Rick Nobregas, Islamorada, FL
A. Louis O'Connor, Key West, FL
Tina Odenbaugh, Key West, FL
(Two unreadable first names), O'Neil, Key Largo, FL
Debra Pansire, Key West, FL
Perk Perkins, Orvis, Manchester, VT
John Perrotti, Key Largo, FL
Capt. Albert Ponzoa, Marathon, FL
H. T. Pontin, Ramrod Key, FL
Eloise Pratt, Key West, FL
Michael C. Price, Peoria, IL
Marilyn Rayside, Key Largo, FL
E. Nelson Read, Key West, FL
Nathaniel Pryor Reed, Hobe Sound, FL
Capt. John Redman, Tavernier, FL
George Reeder, Key West, FL
Michael W. Riedel, Riedel and Associates, Ketchum, ID
Jacky Robinson, Miami, FL
Howard Robinson, Big Pine Key, FL
Joe Robinson, Miami, FL
Ford Scott Rollo, The Scott Agency, Ketchum, ID
John Riley, Fort Myers, FL
Lois Robison, Big Pine Key, FL
Mr. and Mrs. William A. Ross, Big Pine Key, FL

List of citizens submitting written comment (alphabetic order) (continued)
Linda and Don Rubino, Big Pine Key, FL
Marcel L. Seguin, Tavernier, FL
Mr. and Mrs. Richard P. Skehan, Hebron, CT
John and Karen Slater, Davison, MI
Ronald E. Solomon, Fort Lauderdale, FL
J. B. Spence, Miami, FL
Carlos B. Solis, Miami, FL
Ann Sutherland, Key Colony Beach, FL
Scott Swanton, Islamorada, FL
Tanya S. Taylor, Tavernier, FL
Jacques S. Theriot, New York, NY
Cheri Tindall, Islamorada, FL
Marin Topal, Woodmere, NY
Pamela S. Viele, Summerland Key, FL
J. R. Walters, Melbourne Beach, FL
Capt. Richard P. Waltman, Big Pine Key, FL
Elizabeth B. Warner, Islamorada, FL
Jeanne and Millard Wells, Islamorada, FL
Sharon Wells, Key West, FL
James C. Wilborn, Western Springs, IL
Kathy Williams, Big Pine Key, FL
Capt. Craig (unreadable last name), Islamorada, FL

Speakers at Public Meetings in Key West June 22 and Key colony Beach, June 24, 1992. (In order of appearance at the meeting. Affiliation included if noted during presentation).

Key West

Alan Farago
Shamus Etheridge
Capt. Michael Vaughan
H. T. Pontin
Maureen Eldredge, Coral Reef Coalition
William Wehrman, Bombardier, Sea-Doo
Daniel Morrison
Joan Borel, Friends of Florida
Irving Weinman
Jim McLernan
Mr. Gatewood
Al Crockett
Peter Bacle
Chris Belland
Mike Laudicina, Organized Fisherman of Florida
Daniel McConnell
Steve Carrier

Speakers at Public Meetings in Key West June 22 and Key colony Beach, June 24, 1992. (Cont.)
Jeff Stotts
Joyce Newman
James Farrell, Last Stand
Don Kincaid
Ellie Crane
Michael Logun
Tim Carlisle
Al Griffin, Monroe County United
Bruce Wachob
Michele Hardin
John Donaldson, Personal Watercraft Industry Association
Billy Causey, Florida Keys National Marine Sanctuary
Bob Wallace

Key Colony Beach

Vern Pokorski, Big Pine Key Civic Association
Karen Roberts, Dolphin Research Center
Capt. Ben Taylor
Bill Grimes
H. T. Pontin
Buddy LaPointe
Kathy Baier
Debbie Harrison, The Wilderness Society
John Grodzinski
Fernan Braun
Phyllis Rosen
Joyce Newman
John Kipp
Richard Grathwohl
Rick Nobregas
Tony Nobregras
Barry Morris
Kathy Koury
George Kundtz, Florida Keys Citizens Coalition
Sandy Moret
Steve Huff
Alan Farago
Nancy Morrell
Mike Collins
George Barley, Florida Keys National Marine Sanctuary Advisory Committee
Rich Keating
Joe Robinson
Dr. Douglas Graham
John Morrell