DRAFT COMPREHENSIVE CONSERVATION PLAN AND ENVIRONMENTAL ASSESSMENT

J.N. "DING" DARLING NATIONAL WILDLIFE REFUGE

Lee County, Florida

U.S. Department of the Interior
Fish and Wildlife Service

Southeast Region
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SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. Background

INTRODUCTION

Located along Florida's southwest Gulf coast in Lee and Charlotte counties, the J.N. "Ding" Darling National Wildlife Refuge (NWR) Complex includes the J.N. "Ding" Darling NWR and four satellite refuges: Pine Island, Matlacha Pass, Island Bay, and Caloosahatchee NWRs (Figure 1). J.N. "Ding" Darling NWR (Figure 2) was established in 1945 as Sanibel NWR and later renamed as a memorial to Jay Norwood "Ding" Darling, the noted editorial cartoonist; conservationist; and first Chief of the U.S. Biological Survey, the founding agency of the U.S. Fish and Wildlife Service (Service). The 6,406.79 acres [2,592.74 hectares (ha)] of the refuge support hundreds of species of wildlife and plants, providing protection for 14 federal-listed and 49 state-listed species, migratory birds, and native wildlife and habitat diversity through a mix of habitats, including tropical hardwood forests, beaches, mangrove swamps, mixed wetland shrubs, salt marshes, open waters and seagrass beds, and lakes and canals.

Comprising roughly half of Sanibel Island and most of Buck Key, the J.N. "Ding" Darling NWR provides key habitats supporting a variety of species in a highly developed landscape (Figure 2). The city of Sanibel, Lee County, Sanibel-Captiva Conservation Foundation (SCCF), and the Service work together on Sanibel Island -- one of the top birding hot spots in the nation with beautiful beaches, shelling, fishing, and wildlife -- to continue conservation work on Sanibel Island. This partnership has resulted in land use planning to guide growth and development ensuring that future generations will be able to enjoy the special ambience and quiet harmony that Sanibel Island offers.

This Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for J.N. "Ding" Darling NWR was prepared to guide future management actions and provide direction for the refuge. Fish and wildlife conservation will receive first priority in refuge management; wildlife-dependent recreation will be allowed and encouraged as long as it is compatible with, and does not detract from, the mission of the refuge or the purposes for which it was established.

The Service developed a range of alternatives that best met the goals and objectives of the refuge and that could be implemented within the 15-year planning period. This Draft CCP/EA describes the Service's proposed plan, as well as other alternatives considered and their effects on the environment. Both the Draft CCP and the EA will be made available to state and federal government agencies, conservation partners, and the general public for review and comment. Comments from each entity will be considered in the development of the final CCP.

PURPOSE AND NEED FOR THE PLAN

The purpose of the Draft CCP/EA is to fully develop the proposed action that best achieves the refuge's purposes; attains the vision and goals developed for the refuge; contributes to the National Wildlife Refuge System (Refuge System) mission; addresses key problems, issues, and relevant mandates; and is consistent with sound principles of fish and wildlife management.

Figure 1. J.N. “Ding” Darling NWR Complex

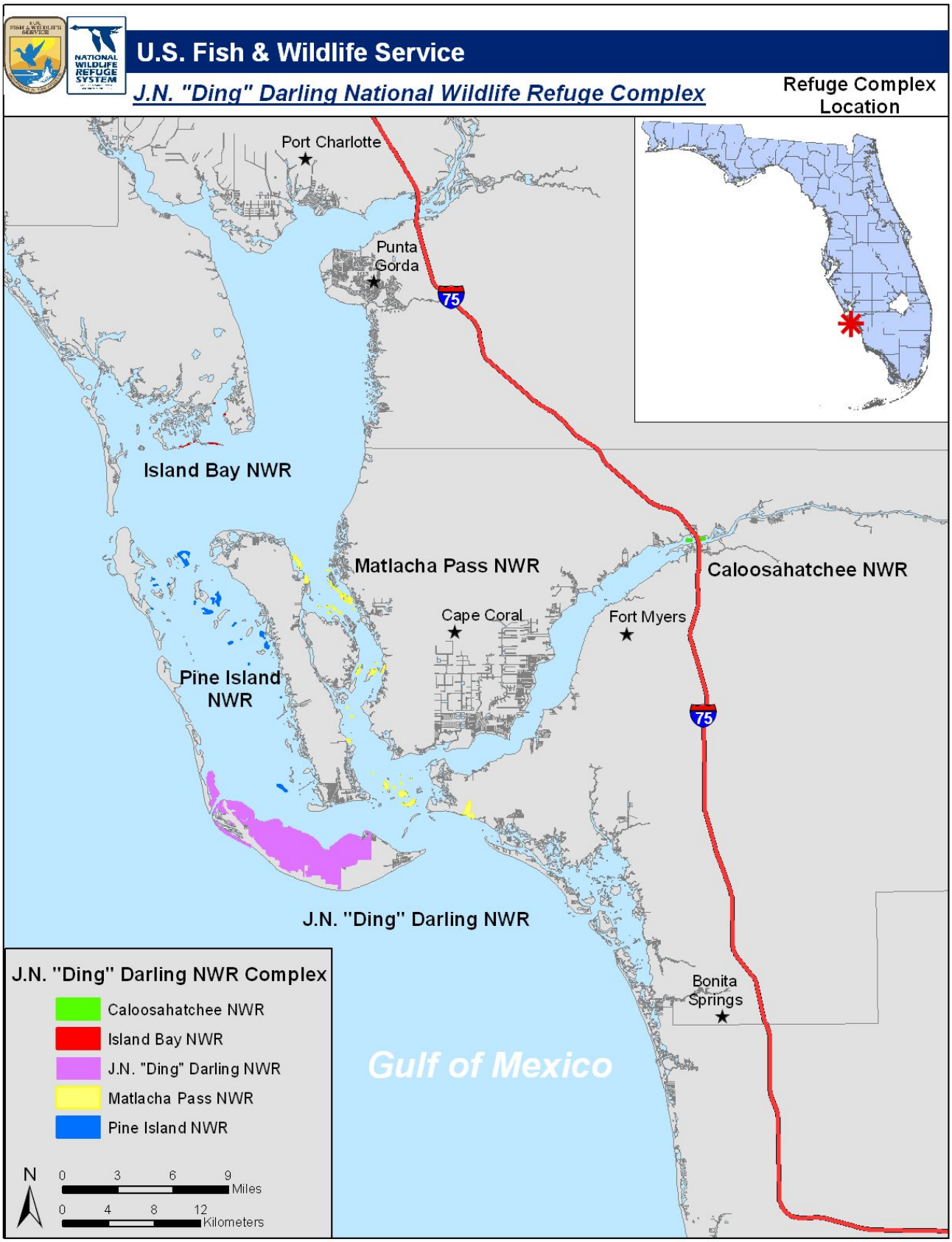
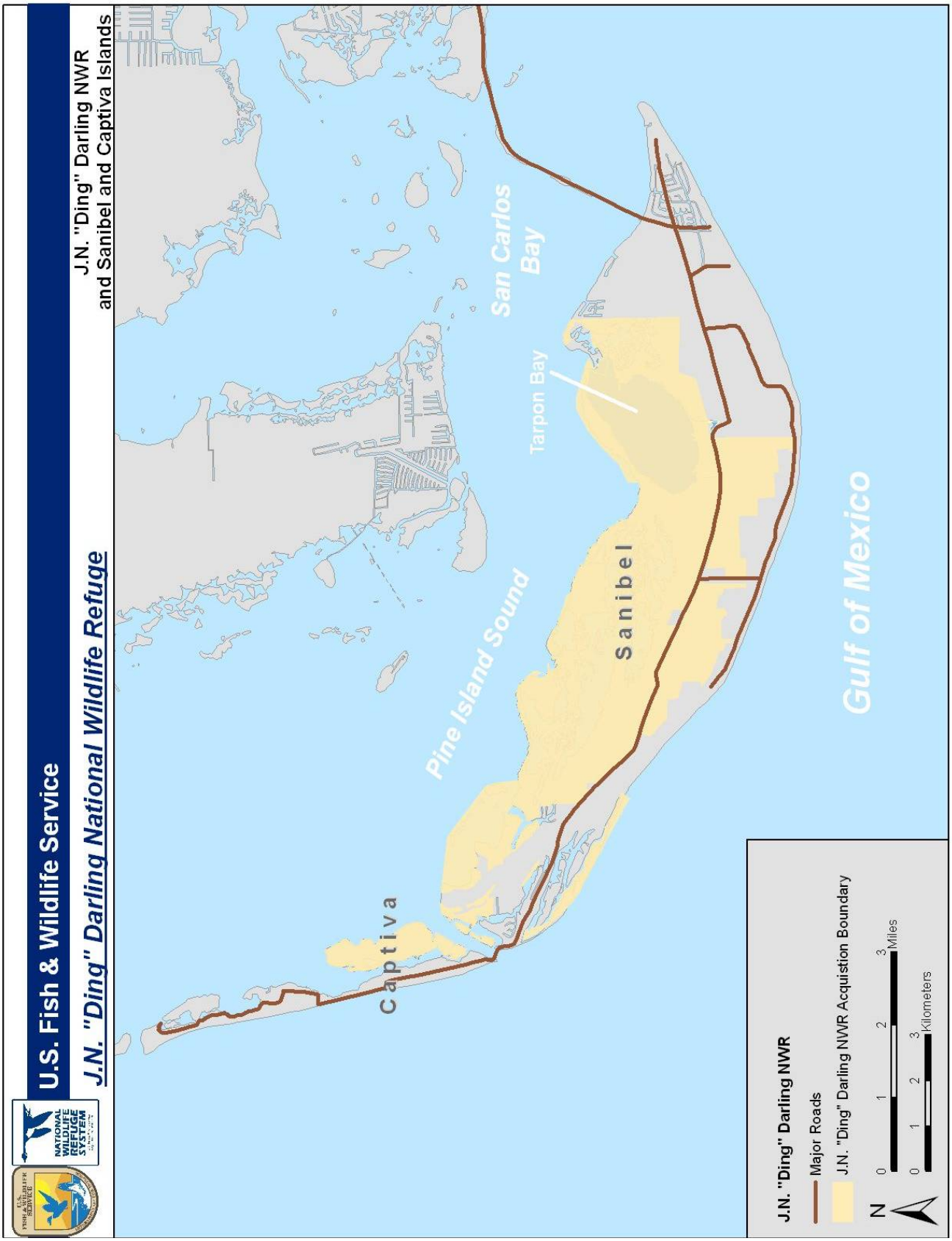


Figure 2. J.N. "Ding" Darling NWR



Specifically, the CCP is needed to:

- Provide a clear statement of refuge management direction;
- Provide refuge neighbors, visitors, and government officials with an understanding of Service management actions on and around the refuge;
- Ensure that Service management actions, including land protection and recreation and education programs, are consistent with the mandates of the Refuge System; and
- Provide a basis for the development of budget requests for operations, maintenance, and capital improvement needs.

FISH AND WILDLIFE SERVICE

The Service traces its roots to 1871 and the establishment of the Commission of Fisheries involved with research and fish culture. The once independent commission was renamed the Bureau of Fisheries and placed under the Department of Commerce and Labor in 1903.

The Service also traces its roots to 1886 and the establishment of a Division of Economic Ornithology and Mammalogy in the Department of Agriculture. Research on the relationship of birds and animals to agriculture shifted to delineation of the range of plants and animals so the name was changed to the Division of the Biological Survey in 1896.

The Department of Commerce, Bureau of Fisheries, was combined with the Department of Agriculture, Bureau of Biological Survey, on June 30, 1940, and transferred to the Department of the Interior as the Fish and Wildlife Service. The name was changed to the Bureau of Sport Fisheries and Wildlife in 1956 and finally to the Fish and Wildlife Service in 1974.

The Fish and Wildlife Service, working with others, is responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people through federal programs relating to wild birds, endangered species, certain marine mammals, fisheries, aquatic resources, and wildlife management activities (142 DM 1.1).

As part of its mission, the Service manages 551 national wildlife refuges and other units of the Refuge System covering 150 million acres (60.7 million ha). These areas comprise the National Wildlife Refuge System, the world's largest collection of lands and waters set aside specifically for fish and wildlife. The majority of these lands, 77 million acres (31 million ha), are in Alaska, while 54 million acres (21.8 ha) are part of three new marine national monuments in the Pacific Ocean. The remaining acres/hectares are spread across the other 49 states and several United States territories. In addition to refuges, the Service manages thousands of small wetlands, 37 wetland management districts, 70 national fish hatcheries, 65 fishery resource offices, and 81 ecological services field stations. The Service enforces federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

NATIONAL WILDLIFE REFUGE SYSTEM

The mission of the National Wildlife Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997 is:

> "...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

The National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) established, for the first time, a clear legislative mission of wildlife conservation for the Refuge System. Actions were initiated in 1997 to comply with the direction of this new legislation, including an effort to complete comprehensive conservation plans for all refuges. These plans, which are completed with full public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with the Improvement Act, approved plans will serve as the guidelines for refuge management for the next 15 years. The Improvement Act states that each refuge shall be managed to:

- Fulfill the mission of the National Wildlife Refuge System;
- Fulfill the individual purposes of each refuge;
- Consider the needs of wildlife first;
- Fulfill requirements of comprehensive conservation plans that are prepared for each unit of the Refuge System;
- Maintain the biological integrity, diversity, and environmental health of the Refuge System; and
- Recognize that wildlife-dependent recreation activities including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation are legitimate and priority public uses; and
- Allow refuge managers authority to determine compatible public uses.

The following are just a few examples of your national network of conservation lands. Pelican Island National Wildlife Refuge, the first refuge, was established in 1903 for the protection of colonial nesting birds in Florida, such as the snowy egret and the brown pelican. Western refuges were established for American bison (1906), elk (1912), prong-horned antelope (1931), and desert bighorn sheep (1936) after over-hunting, competition with cattle, and natural disasters decimated once-abundant herds. The drought conditions of the 1930s "Dust Bowl" severely depleted breeding populations of ducks and geese. Refuges established during the Great Depression focused on "waterfowl production areas" (i.e., protection of prairie wetlands in America's heartland). The emphasis on waterfowl continues today but also includes protection of wintering habitat in response to a dramatic loss of bottomland hardwoods. By 1973, the Service had begun to focus on establishing refuges for endangered species.

National wildlife refuges connect visitors to their natural resource heritage and provide visitors with an understanding and appreciation of fish and wildlife ecology -- helping them to understand their role in the environment. Wildlife-dependent recreation on refuges also generates economic benefits to local communities and as the number of visitors grows, significant economic benefits are realized. In 2006, approximately 87 million people, 16 years and older, fished, hunted, or observed wildlife, generating $120 billion. According to the report, *Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation*, approximately 35 million

people visited national wildlife refuges in 2006, generating almost $1.7 billion in total economic activity and creating almost 27,000 private sector jobs producing about $543 million in employment income (Carver and Caudill 2007). Additionally, recreational spending on refuges generated nearly $185.3 million in tax revenue at the local, county, state, and federal levels (Carver and Caudill 2007). As the number of visitors grows, significant economic benefits are realized by local communities. In 2006, 87 million people, 16 years and older, fished (30 million), hunted (12.5 million), or observed wildlife (71 million), generating $120 billion (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007). In a study completed in 2002 on 15 refuges, visitation had grown 36 percent in seven years. At the same time, the number of jobs generated in surrounding communities grew to 120 per refuge, up from 87 jobs in 1995, pouring more than $2.2 million into local economies. The 15 refuges in the study were Chincoteague (Virginia); National Elk (Wyoming); Crab Orchard (Illinois); Eufaula (Alabama); Charles M. Russell (Montana); Umatilla (Oregon); Quivira (Kansas); Mattamuskeet (North Carolina); Upper Souris (North Dakota); San Francisco Bay (California); Laguna Atacosa (Texas); Horicon (Wisconsin); Las Vegas (Nevada); Tule Lake (California); and Tensas River (Louisiana), the same refuges identified for the 1995 study. Other findings also validate the belief that communities near refuges benefit economically. Expenditures on food, lodging, and transportation grew to $6.8 million per refuge, up 31 percent from $5.2 million in 1995. For each dollar spent on the Refuge System, surrounding communities benefited with $4.43 in recreation expenditures and $1.42 in job-related income (Caudill and Laughland unpublished data).

Volunteers continue to be a major contributor to the success of the Refuge System. In 2006, over 36,000 volunteers contributed nearly 1.5 million hours on refuges nationwide. The value of their labor was more than $26 million; their in-kind services the equivalent of 696 full-time employees.

The wildlife and habitat vision for national wildlife refuges stresses that wildlife comes first; that ecosystems, biodiversity, and wilderness are vital concepts in refuge management; that refuges must be healthy and growth must be strategic; and that the Refuge System serves as a model for habitat management with broad participation from others.

The Improvement Act stipulates that comprehensive conservation plans be prepared in consultation with adjoining federal, state, and private landowners and that the Service develop and implement a process to ensure an opportunity for active public involvement in the preparation and revision (every 15 years) of the plans.

All lands of the Refuge System will be managed in accordance with an approved comprehensive conservation plan that will guide management decisions and set forth strategies for achieving refuge unit purposes. The plan will be consistent with sound resource management principles, practices, and legal mandates, including Service compatibility standards and other Service policies, guidelines, and planning documents (602 FW 1.1).

LEGAL AND POLICY CONTEXT

LEGAL MANDATES, ADMINISTRATIVE AND POLICY GUIDELINES, AND OTHER SPECIAL CONSIDERATIONS

Administration of national wildlife refuges is guided by the mission and goals of the National Wildlife Refuge System, congressional legislation, presidential executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the

Fish and Wildlife Service. Select legal summaries of treaties and laws relevant to administration of the Refuge System and management of the J.N. "Ding" Darling NWR are provided in Appendix C.

Treaties, laws, administrative guidelines, and policy guidelines assist the refuge manager in making decisions pertaining to soil, water, air, flora, fauna, and other natural resources; historical and cultural resources; research and recreation on refuge lands; and provide a framework for cooperation between J.N. "Ding" Darling NWR and other partners.

Lands within the Refuge System are closed to public use unless specifically and legally opened. No refuge use may be allowed unless it is determined to be compatible. A compatible use is a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge. All programs and uses must be evaluated based on mandates set forth in the Improvement Act. Those mandates are to:

- Contribute to ecosystem goals, as well as refuge purposes and goals;
- Conserve, manage, and restore fish, wildlife, and plant resources and their habitats;
- Monitor the trends of fish, wildlife, and plants;
- Manage and ensure appropriate visitor uses as those uses benefit the conservation of fish and wildlife resources and contribute to the enjoyment of the public; and
- Ensure that visitor activities are compatible with refuge purposes.

The Improvement Act further identifies six priority wildlife-dependent recreational uses. These uses are: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. As priority public uses of the Refuge System, they receive priority consideration over other public uses in planning and management.

BIOLOGICAL INTEGRITY, DIVERSITY, AND ENVIRONMENTAL HEALTH POLICY

The Improvement Act directs the Service to ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans (601 FW 3). The Biological Integrity Policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and the Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuges' contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, refuge's role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service.

NATIONAL AND INTERNATIONAL CONSERVATION PLANS AND INITIATIVES

Multiple partnerships have been developed among government and private entities to address the environmental problems affecting regions. There is a large amount of conservation and protection information that defines the role of the refuge at the local, national, international, and ecosystem levels. Conservation initiatives include broad-scale planning and cooperation between affected parties to address declining trends of natural, physical, social, and economic environments. The conservation guidance described below, along with issues, problems, and trends, was reviewed and integrated where appropriate into this Draft CCP/EA.

This Draft CCP/EA supports, among others, the North American Bird Conservation Initiative (including the North American Waterfowl Management Plan, the Partners-in-Flight Plan, North American Waterbird Conservation Plan, and the U.S. Shorebird Conservation Plan), the American Oystercatcher Conservation Plan, Office of Ocean and Coastal Resource Management, the Western Hemisphere Migratory Species Initiative, the Western Hemisphere Shorebird Reserve Network, the National Wetlands Priority Conservation Plan, and the National Oceanic and Atmospheric Administration's (NOAA's) Marine Debris Removal Program.

NORTH AMERICAN BIRD CONSERVATION INITIATIVE

Started in 1999, the North American Bird Conservation Initiative is a coalition of government agencies, private organizations, academic institutions, and private industry leaders in the United States, Canada, and Mexico working to ensure the long-term health of North America's native bird populations by fostering an integrated approach to bird conservation to benefit all birds in all habitats. Key international and national bird initiatives include the North American Waterfowl Management Plan, Partners-in-Flight Bird Conservation Plan, Waterbird Conservation for the Americas, North American Waterbird Conservation Plan, and the U.S. Shorebird Conservation Plan.

North American Waterfowl Management Plan

The North American Waterfowl Management Plan (NAWMP) is an international action plan to conserve migratory birds throughout the continent. The plan's goal is to return waterfowl populations to their 1970s' levels by conserving wetland and upland habitat. Canada and the United States signed the plan in 1986 in reaction to critically low numbers of waterfowl. Mexico joined in 1994, making it a truly continental effort. The plan is a partnership of federal, provincial/state and municipal governments, non-governmental organizations, private companies, and many individuals, all working towards achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species and people. Its purpose is to provide a forum for discussion of major, long-term international waterfowl issues and to make recommendations to directors of the participating countries' national wildlife agencies. Plan projects are international in scope, but implemented at regional levels. These projects contribute to the protection of habitat and wildlife species across the North American landscape. The refuge provides breeding habitat for mottled ducks (*Anas fulvigula*) and wintering habitat for the American wigeon (*Anas americana*), blue-winged teal (*Anas discors*), northern shoveler (*Anas clypeata*), northern pintail (*Anas acuta*), green-winged teal (*Anas crecca*), lesser scaup (*Aythya affinis*), hooded merganser (*Lophodytes cucullatus*), and red-breasted merganser (*Mergus serrator*). According to the NAWMP, the populations of northern pintail and lesser scaup are decreasing. The refuge's wildlife inventory plan, water quality monitoring, seagrass protection, and freshwater wetland restoration projects all support the goals and objectives of the North American Waterfowl Management Plan.

Partners-in-Flight Bird Conservation Plan

Managed as part of the Partners-in-Flight (PIF) Bird Conservation Plan, the Peninsular Florida physiographic area represents a scientifically based land bird conservation planning effort that ensures long-term maintenance of healthy populations of native land birds, primarily non-game land birds. Non-game land birds have been vastly under-represented in conservation efforts, and many are exhibiting significant declines. This plan is voluntary and non-regulatory, and focuses on relatively common species in areas where conservation actions can be most effective, rather than the frequent local emphasis on rare and peripheral populations. Plans for the refuge include providing suitable nesting, foraging, and/or resting habitats for many priority species identified for the peninsular and subtropical physiographic areas including the mangrove cuckoo (*Coccyzus minor*),

prairie warbler (*Dendroica discolor*), palm warbler (*Dendroica palmarum*), gray kingbird (*Tyrannus dominicensis*), black-whiskered vireo (*Vireo altiloquus*), wood stork (*Mycteria americana*), reddish egret (*Egretta rufescens*), white ibis (*Eudocimus albus*), mottled duck, American kestrel (*Falco sparverius*), short-tailed hawk (*Buteo brachyurus*), and the swallow-tailed kite (*Elanoides forficatus*). The refuge's wildlife inventory plan, exotic plant control plan, and mangrove forest, hardwood hammock, and freshwater wetland restoration projects all support the goals and objectives of the Partners-in-Flight Bird Conservation Plan.

North American Waterbird Conservation Plan

The North American Waterbird Conservation Plan (NAWCP) provides a framework for the conservation and management of 210 species of waterbirds in 29 nations. Threats to waterbird populations include destruction of inland and coastal wetlands, introduced predators and invasive species, pollutants, mortality from fisheries and industries, disturbance, and conflicts arising from abundant species. Particularly important habitats of the Southeast region include pelagic areas, marshes, forested wetlands, and barrier and sea island complexes. Fifteen species of waterbirds are federally listed, including breeding populations of wood storks, Mississippi sandhill cranes (*Grus canadensis*), whooping cranes (*Grus americana*), interior least terns (*Sterna antillarum*), and Gulf Coast populations of brown pelicans (*Pelecanus occidentalis*). A key objective of this plan is the standardization of data collection efforts to better recommend effective conservation measures.

The Southeastern U.S. Waterbird Conservation Plan stresses protection of nesting and foraging habitats for both colonial and non-colonial waterbirds. Charlotte Harbor and J.N. "Ding" Darling NWR support important colonies of beach-nesting species [including the brown pelican, sandwich tern (*Sterna sandvicensis*), royal tern (*Sterna maxima*), least tern, black skimmer (*Rynchops niger*), and laughing gull (*Larus atricilla*)], and provide important mangrove habitat for most long-legged wading species, such as reddish egrets. The refuge's wildlife inventory plan, impoundment management plan, and rookery protection activities all support the goals and objectives of the North American Waterbird Conservation Plan.

U.S. Shorebird Conservation Plan

The U.S. Shorebird Conservation Plan is a partnership effort throughout the United States to ensure that stable and self-sustaining populations of shorebird species are restored and protected. The plan was developed by a wide range of agencies, organizations, and shorebird experts for separate regions of the country, and identifies conservation goals, critical habitat conservation needs, key research needs, and proposed education and outreach programs to increase awareness of shorebirds and the threats they face. Primary objectives of this plan are the development of scientifically sound monitoring systems to provide practical information to researchers and land managers, the identification of principles upon which management plans can integrate shorebird habitat conservation with multiple species strategies, and the design of a strategy for increasing public awareness and information concerning wetlands and shorebirds.

Supporting the U.S. Shorebird Conservation Plan, the refuge is part of the Peninsular Florida area of the Southeastern Coastal Plains-Caribbean Region. The refuge provides breeding habitat for the snowy plover, killdeer, American oystercatcher, and black-necked stilt. The refuge also provides potential breeding habitat for the Wilson's plover and willet. The refuge provides wintering habitat for the black-bellied plover (*Pluvialis squatarola*), semipalmated plover (*Pluvialis squatarola*), piping plover (*Charadrius melodus*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), spotted sandpiper (*Actitis macularia*), marbled godwit (*Limosa fedoa*), ruddy turnstone (*Arenaria interpres*), red knot (*Calidris canutus*), sanderling (*Calidris alba*), western sandpiper

(*Calidris mauri*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), stilt sandpiper (*Calidris himantopus*), short-billed dowitcher (*Limnodromus griseus*), and common snipe (*Gallinago gallinago*). The refuge also provides migratory stop-over habitat for the solitary sandpiper (*Tringa solitaria*) and semipalmated sandpiper. The U.S. Shorebird Conservation Plan identifies two species that are in highest need for conservation attention ("extremely high") that breed on the refuge: snowy plover (*Charadrius alexandrinus*) and American oystercatcher (*Haematopus palliatus*). The U.S. Shorebird Conservation Plan also identifies two other species that are considered an "extremely high" priority that winter on the refuge: piping plover and red knot. The refuge's wildlife inventory plan, impoundment management plan, and potential land acquisition of beachfront habitat within the refuge's acquisition boundary all support the goals and objectives of the U.S. Shorebird Conservation Plan.

AMERICAN OYSTERCATCHER CONSERVATION PLAN

The American Oystercatcher Conservation Plan focuses on *H. p. palliatus* in the United States, referred to as "American Oystercatcher" or simply as "oystercatchers." The present plan addresses only the populations on the East and Gulf coasts and summarizes current knowledge of their life history, distribution, and population trends, describes current threats, lists research and management needs, and outlines recommended conservation actions. Conservation activities recommended to address these threats include: identification and protection of existing habitat; creation of new habitat through carefully designed use of dredge-spoil materials; management of existing protected areas to reduce predation and disturbance; and control of predator populations, especially in the nesting season. The refuge provides breeding and wintering habitat for American oystercatchers.

OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT

The Office of Ocean and Coastal Resource Management (OCRM) of the National Oceanic and Atmospheric Administration (NOAA) provides national leadership, strategic direction, and guidance to state and territory coastal programs and estuarine research reserves. OCRM oversees six major programs. Each program has a national reach, but is designed to focus on local resources and needs. The OCRM works with state and territory coastal resource managers to develop a scientifically based, comprehensive national system of marine protected areas (MPAs) and supports effective management and sound science to protect, sustain and restore coral reef ecosystems. These activities are mandated by the Coastal Zone Management Act (CZMA), the Marine Protected Area (MPA) Executive Order, and the Coral Reef Conservation Act. Numerous refuge management activities fall under the CZMA and the MPA designation of the refuge. The refuge would collaborate with OCRM's MPAs Center on marine related research and monitoring.

WESTERN HEMISPHERE MIGRATORY SPECIES INITIATIVE

The Western Hemisphere Migratory Species Initiative seeks to contribute significantly to the conservation of the migratory species of the Western Hemisphere by strengthening communication and cooperation among nations, international conventions, and civil society, and by expanding constituencies, and political support. All entities that support the vision, mission, and objectives of this initiative are invited to be partners in its implementation. Since the refuge supports migratory species of the Western Hemisphere, it plays a role in this initiative.

WESTERN HEMISPHERE SHOREBIRD RESERVE NETWORK

The mission of the Western Hemisphere Shorebird Reserve Network is to conserve shorebirds and their habitats through a network of key sites across the Americas. Sites are designated and managed to sustain all native shorebird species and their current populations throughout the Americas. The Network works to build a strong system of sites used by shorebirds throughout their migratory ranges; develop science and management tools that expand the scope and pace of habitat conservation at each site within the Network; establish local, regional and international recognition for sites, raising new public awareness and generating conservation funding opportunities; and, serve as an international resource, convener and strategist for issues related to shorebird and habitat conservation. Although the refuge is not currently a member of the Western Hemisphere Shorebird Reserve Network, it does play an important role for shorebirds in the Western Hemisphere.

NATIONAL WETLANDS PRIORITY CONSERVATION PLAN

The National Wetlands Priority Conservation Plan identifies the locations and types of wetlands, and interests in wetlands, that should receive priority for wetland acquisition projects by federal and state agencies using Land and Water Conservation Fund appropriations. The objective of the plan is to assist agencies in focusing their acquisition efforts on the more important, scarce, and vulnerable wetlands in the Nation. The plan is an ongoing program and continues to provide guidance for making decisions regarding wetland acquisition. The plan applies only to wetlands that would be acquired by federal agencies and states using Land and Water Conservation Fund (LWCF) appropriations; however, the plan also establishes priorities for wetlands protection that do not involve acquisition. Since the refuge involves wetlands of potentially international importance, LWCF funds might be applied to help meet refuge purposes and goals.

NOAA'S MARINE DEBRIS REMOVAL PROGRAM

NOAA's Marine Debris Removal Program provides funding to facilitate the implementation of locally driven, community-based marine debris prevention and removal projects that benefit coastal habitat; waterways; and NOAA trust resources, including anadromous fish. Projects have strong on-the-ground habitat components involving the removal of marine debris and derelict fishing gear that will provide educational and social benefits for people and their communities in addition to long-term ecological habitat improvements for NOAA trust resources. The Program identifies marine debris removal projects, strengthens the development and implementation of habitat restoration through the removal of marine debris within communities, and fosters awareness of the effects of marine debris to further the conservation of living marine resource habitats across a wide geographic area. Due to its estuarine location, refuge management activities already serve the goals of this Program.

RELATIONSHIP TO STATE WILDLIFE AGENCY

A provision of the Improvement Act, and subsequent agency policy, is that the Service shall ensure timely and effective cooperation and collaboration with other state fish and game agencies and tribal governments during the course of acquiring and managing refuges. State wildlife management areas and national wildlife refuges provide the foundation for the protection of species, and contribute to the overall health and sustainment of fish and wildlife species in the State of Florida. For J.N. "Ding" Darling NWR, state partners include: Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Environmental Protection (FDEP), and South Florida Water Management District (SFWMD). These state agencies are charged with enforcement responsibilities relating to migratory birds, trust species, and fisheries, as well as with management of natural resources of the state.

The more than 575 species of wildlife, more than 200 native species of freshwater fish, and more than 500 native species of saltwater fish; while balancing these species' needs with the needs of more than 18 million residents (U.S. Census Bureau 2007) and the over 84.5 million annual visitor trips to Florida (Florida Department of Transportation 2008) who share the land and water with Florida's wildlife.

The FWCs' responsibilities include the following:

- Law Enforcement – to protect fish and wildlife, keep waterways safe for millions of boaters and cooperate with other law enforcement agencies providing homeland security.
- Research – to provide information for the FWC and others to make management decisions based on the best science available involving fish and wildlife populations, habitat issues and the human-dimension aspects of conservation.
- Management – to manage the state's fish and wildlife resources based on the latest scientific data to conserve some of the most complex and delicate ecosystems in the world along with a wide diversity of species.
- Outreach – to communicate with a variety of audiences to encourage participation, responsible citizenship and stewardship of the state's natural resources.

Both FWC and FDEP manage state lands and waters. FWC manages 4.3 million acres/1.7 million ha of public lands and 220,000 acres/89,030 ha of private lands for recreation and conservation purposes. FDEP manages 150 state parks covering nearly 600,000 acres/242,811 ha and 57 coastal and aquatic managed areas, totaling over 5 million acres/2 million ha of submerged lands and coastal uplands. The SWFWMD and SFWMD are two of Florida's five water management agencies. They are responsible for managing ground and surface water supplies in all or part of southwest and south Florida. These two water management districts include all or parts of 29 counties and cover a total area of almost 28,000 square miles (17.9 million acres/7.25 million ha), largely consisting of wetlands or historically wet areas. The area is managed for the purposes of regional flood control, water supply and water quality protection as well as ecosystem restoration. Of less acreage, but not of less importance, are upland areas managed by the water management districts. These areas preserve wetlands, waters, and wildlife and provide critical buffers between rapidly encroaching development and important wetland areas.

The state's participation and contribution throughout this planning process will provide for ongoing opportunities and open dialogue to improve the ecological sustainment of fish and wildlife in the State of Florida. An essential part of comprehensive conservation planning is integrating common mission objectives where appropriate.

II. Refuge Overview

INTRODUCTION

The J.N. "Ding" Darling NWR is part of a larger Refuge Complex that includes four additional satellite refuges (Figure 1). The majority of the lands in these satellite refuges are nesting and roosting islands. The entire Refuge Complex is approximately 8,000 acres. The four satellite refuges within the Refuge Complex are described below.

- Pine Island NWR - contains approximately 602 acres (244 ha), including 18 mangrove islands or portions of islands with little upland habitat located in Pine Island Sound
- Matlacha Pass NWR – contains approximately 538 acres (218 ha) including 31 mangrove and coastal strand islands or portions of islands and the 145.61-acre (ha) Terrapin Creek (San Carlos Bay) Tract on the mainland near Bunche Beach, which also includes critical habitat for the piping plover
- Island Bay NWR - contains approximately 20 acres (8.19 ha) including six undeveloped and roadless tracts of mangrove and coastal strand habitats located east of Boca Grande where all of the Island Bay NWR has been designated as a Wilderness Area (Figure 3)
- Caloosahatchee NWR - 40 acres (16.19 ha) of four mangrove islands, located in the Caloosahatchee River underneath and near the Interstate-75 bridge in Fort Myers

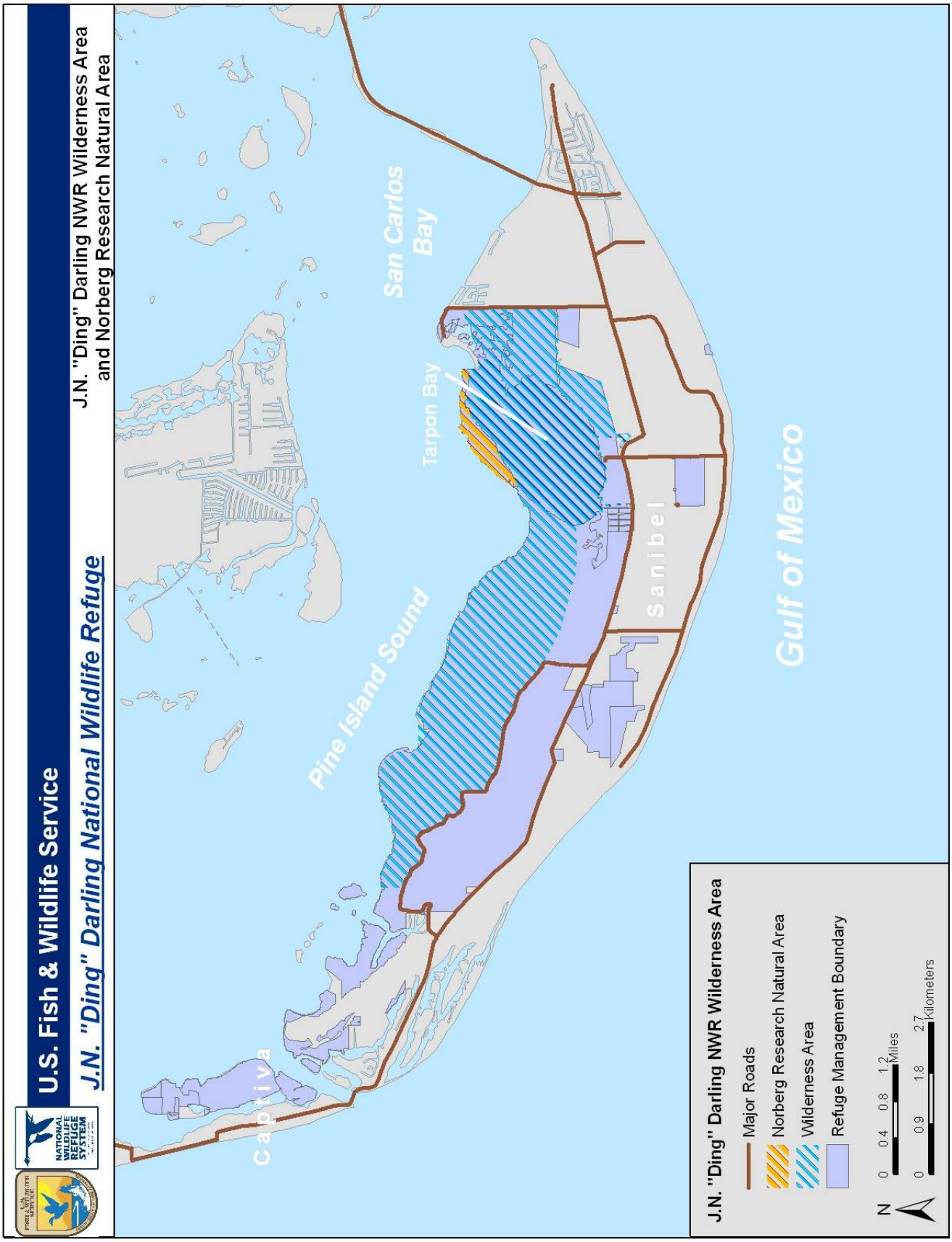
These satellite refuges are covered together in a separate CCP. This Draft CCP/EA focuses specifically on the J.N. “Ding” Darling NWR.

The J.N. "Ding" Darling NWR (Figure 2) is located along the southwest coast of Florida in Lee County, approximately 15 miles southwest of Ft. Myers, on the subtropical barrier island of Sanibel in the Gulf of Mexico. Currently, most of the island’s private lands (ca. 60 percent of the Island) are developed with single- and multiple-level single- and multi-family housing and low-density commercial establishments. The refuge is part of the largest undeveloped mangrove ecosystem in the United States and is world famous for its spectacular wading bird populations. Approximately 700,000 people annually visit the refuge.

The refuge’s management boundary covers approximately 6,406.79 acres/2,592.74 ha of estuarine habitats, including tropical hardwood forests, beaches, mangrove swamps, mixed wetland shrubs, salt marshes, open waters and seagrass beds, and lakes and canals. Approximately 44 percent or 2,619 acres (1,160 ha) of the refuge is designated as Wilderness Area (Figure 3). Approximately 272 species of birds (including accidentals), 60 species of reptiles and amphibians (including exotics species), 102 fish species (including exotic species), and 33 species of mammals (including exotic species) have been identified on or within the vicinity of the refuge.

On December 1, 1945, the Sanibel National Wildlife Refuge was established by agreement through a lease with the State of Florida under the authority of the Migratory Bird Conservation Act [16 U.S.C. 715d] at the urging of Jay Norwood "Ding" Darling (the multiple Pulitzer Prize - winning editorial cartoonist, co-creator of the Federal Duck Stamp Program and designer of the first duck stamp, founder of the Cooperative Fish and Wildlife Research Unit Program, Co-founder and first President of the National Wildlife Federation and former Chief of the U.S. Biological Survey, the forerunner of the U.S. Fish and Wildlife Service). Later, in 1967, the refuge was renamed to honor Jay Norwood “Ding” Darling's tireless and pioneering conservation efforts.

Figure 3. J.N. “Ding” Darling NWR Wilderness Area and Norberg Research Natural Area



In partnership with the residents of Sanibel Island, Captiva Island, Lee County, and the State of Florida, the refuge was created to safeguard and enhance habitat for wildlife; to protect endangered and threatened species; and to provide feeding, nesting, and roosting areas for migratory birds. The refuge protects and provides habitat for federally listed endangered, threatened, and candidate species including the American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), eastern indigo snake (*Drymarchon corais couperi*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), piping plover (*Charadrius melodus*), West Indian manatee (*Trichechus manatus*), wood stork (*Mycteria americana*), aboriginal prickly apple (*Harrisia aboriginum*), roasete tern (*Sterna dougallii dougallii*), red knot (*Calidris canutus rufus*), Miami blue butterfly [C*yclargus (=Hemiargus) thomasi bethunebakeri*], Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and smalltooth sawfish (*Pristis pectinata*); as well as other federal trust species, such as colonial-nesting waterbirds and neotropical migratory birds. Numerous state-listed species and species of special concern also occur within the refuge boundary, including, but not limited to Sanibel rice rat (*Oryzomys palustris sanibeli*), gopher tortoise (*Gopherus polyphemus*), Florida bonneted bat (*Eumops* floridanus), Southeastern snowy plover (*Charadrius alexandrinus tenuirostris*), and roseate spoonbill (*Ajaia ajaia*). The refuge implements management actions (e.g., prescribed fire) to mimic natural ecosystem processes and to provide feeding, nesting, breeding, foraging, and resting habitat for a variety of native fish and wildlife.

Work on the J.N. "Ding" Darling NWR Draft CCP/EA was initiated in 2007 and is scheduled for completion in 2010. The Draft CCP/EA contains concepts to guide further development and implementation of land use and management programs and associated facilities and management structures for the next 15 years. Consideration of the refuge's physical, biological, and cultural resources, along with the socioeconomic environment and refuge management and administration are taken into account and analyzed to produce an overview of the refuge and the challenges it faces. The EA was prepared in compliance with the National Environmental Protection Act (NEPA) guidelines. In addition to documenting the existing natural environmental and socio-economic setting, the EA evaluates the impact of the proposed and alternative actions and the no action alternative in order to facilitate selection of the CCP alternative most suitable for implementation.

REFUGE HISTORY AND PURPOSES

HISTORY

J.N. "Ding" Darling NWR occupies the north central portion of Sanibel Island, off the southwest coast of Florida in Lee County. Historians believe that Sanibel Island was formed 5 to 6 thousand years ago, as sediment rose from the sea after being shaped by centuries of hurricane and storm activity. What began as a sandbar is now a barrier island fringed with mangrove trees, shallow bays, and white sandy beaches. The Island is listed as one of the top ten birding areas in the country (U.S. Fish and Wildlife Service 2001).

Explorer Juan Ponce de Leon is believed to have discovered Sanibel Island – which he named "Santa Isybella" after Queen Isabella – in 1513 while searching for the "Fountain of Youth". The Spanish were unsuccessful in converting the Calusas and establishing any permanent settlement on Sanibel. By the late 1700s, the remaining Calusa immigrated to Cuba with the departing Spaniards. Florida traded hands between the Spanish and the British and was ceded to the United States in 1821. The first settlers arrived on Sanibel in 1833. By the 1870 Census, only two people registered for Sanibel. But, by 1889, 40 families lived on Sanibel Island. Agriculture, hit hard by hurricanes, gave way to winter homes and retreats on Sanibel Island, which continues today with a high tourism

component. (summarized from a variety of sources: Hammond, 1970; Hammond, 1970a; Sanibel and Captiva Islands Chamber of Commerce, 2009; and, Wikipedia, March 2009)

On December 1, 1945, the Service entered into agreement with the State of Florida through a lease, under the authority of the Migratory Bird Conservation Act of 1929, for 2,392 acres of land, creating Sanibel National Wildlife Refuge. Playing a large role in getting the refuge established, "Ding" Darling died on February 12, 1962, several months after suffering a stroke. Shortly after his death, the J. N. "Ding" Darling Foundation was formed with Trustees, including former Presidents Eisenhower and Truman. The Foundation supported expanding the refuge and renaming it in his honor. In 1967, Jay Norwood "Ding" Darling's longstanding and widespread conservation achievements were immortalized by renaming the refuge to J.N. "Ding" Darling National Wildlife Refuge. "Ding" Darling's posthumous influence didn't end there. His example inspired local conservationists to form the Sanibel-Captiva Conservation Foundation to continue conservation work on private lands. This became more imperative as Sanibel Island began rapidly changing.

PURPOSES

The refuge was established in 1945 by agreement through a lease with the State of Florida "…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act, 16 U.S.C. 715-715r, February 18, 1929, as amended). Secondary purposes were subsequently applied to the refuge, as listed.

> "…wilderness areas…shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness…" 16 U.S.C. 1131 (Wilderness Act)
>
> "…suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species" 16 U.S.C. 460k-1 (Refuge Recreation Act) "…the Secretary…may accept and use…real…property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors" 16 U.S.C. 460k-2 (Refuge Recreation Act)
>
> "…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions" 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act)
>
> "…for the development, advancement, management, conservation, and protection of fish and wildlife resources" 16 U.S.C. 742f(a)(4) (Fish and Wildlife Act) "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act)

SPECIAL DESIGNATIONS

The refuge holds several special designations, including Wilderness Area, Research Natural Area, Marine Protected Area, Florida Important Bird Area, and Outstanding Florida Water. A small portion appears to be within the Coastal Barrier Resources System. Further, several State aquatic

preserves, a State buffer preserve, the Charlotte Harbor National Estuary Program, and Wild and Scenic rivers are near the refuge.

WILDERNESS AREA

The Wilderness Act of 1964 established the National Wilderness Preservation System and established guidelines for management of those areas. The management boundary for J.N. “Ding” Darling NWR area is 6,406.79 acres (2,592.74 ha), of which 2,619.13 acres (1,059.92 ha) were designated as the J.N. “Ding” Darling Wilderness (Public Law 94-557) on October 19, 1976 (Figure 3). This acreage was determined by legal description calculations on June 20, 1977 and deviates from the bill’s original acreage of “approximately 2,825 acres.” The Wilderness Area designation provides an additional level of protection for this part of the refuge to ensure that it retains its wilderness character.

The J.N. “Ding” Darling Wilderness (Wilderness Area) is comprised of estuarine habitats, including mangroves, open water, seagrasses, tidal flats, and tidal creeks. Active management of the Wilderness Area follows guidelines contained in the Wilderness Act and generally seeks minimum impacts. Management activities within the Wilderness Area is generally limited to biological surveys and monitoring activities, law enforcement, boundary inspection and posting, and litter and debris removal (e.g., removing abandoned monofilament fishing line, fishing lures, abandoned crab traps, and dislodged buoys). The refuge replaces boundary signs and no motor zone signs as needed. The southern border of the Wilderness Area is the refuge’s Wildlife Drive. The Red Mangrove Overlook Boardwalk extends from the Wildlife Drive into the Wilderness Area and provides access for wildlife observation, photography, and environmental education and interpretation. The refuge signs and the Boardwalk are the only authorized and maintained man-made structures maintained within the Wilderness Area. Public use activities in this Wilderness Area include wildlife observation and photography, and environmental education and interpretation.

Prior to the designation of the Wilderness Area, sport fishing, sightseeing, commercial fishing, and the use of motorized boats associated with these activities were recognized as established uses that would continue after designation of the Wilderness Area. However, during 1993, the State of Florida established the J.N. “Ding” Darling NWR/Sanibel Conservation Zone (Florida Administrative Code 68B-4.017 as amended) and thecCity of Sanibel established a Slow Speed-Minimum Wake Zone (Ordinance Number 93-13, §1, 7-6-93). Both zones encompassed the entire refuge, including the Wilderness Area. The establishment of those zones restricted the harvest of any marine species utilizing nets to non-motorized vessels and restricted boaters to slow speeds with a minimum wake. During the same year, the refuge restricted motorized boat use to specific areas within the Wilderness Area to reduce or eliminate prop-scarring of seagrass beds and boat-related disturbance to feeding, resting, and breeding birds.

Threats to the Wilderness Area include high public use levels and activities along the adjacent Wildlife Drive and in adjacent estuarine waters, sea level rise, water quality degradation (including decreased dissolved oxygen, increased siltation, decreased water clarity, salinity imbalances, and increased chlorophyll a), contamination from local and regional freshwater discharges (including nitrogen, phosphorus, heavy metals, fecal coliform, pesticides, and pharmaceuticals), and invasive exotic plants and animals.

RESEARCH NATURAL AREA

A Research Natural Area (RNA) is part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on federal lands. RNAs are for non-manipulative research, observation, and study. The U.S. Forest Service created RNAs under the authority of the Organic Administration Act of 1897 (16 U.S.C. 551).

The objectives of establishing RNAs are listed.

- Preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geological, and similar natural situations that have special or unique characteristics of scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.
- Preserve and maintain genetic diversity.
- Protect against serious environmental disruptions.
- Serve as reference areas for the study of succession.
- Provide onsite and extension educational activities.
- Serve as baseline areas for measuring long-term ecological changes.
- Serve as control areas for comparing results from manipulative research.
- Monitor effects of resource management techniques and practices.

The refuge's Norberg Research Natural Area (RNA) (Figure 3) is a 150-acre island, which is located on the Norberg Tract along the north shore of Tarpon Bay, east of Shallow Pass (Shallow Cutoff). This RNA was nominated by the Society of American Foresters (SAF) for its significant stand of red and black mangroves. The dominant red mangroves (*Rhizophora mangle*) were measured at four inches diameter at breast height (DBH) with a height of 20 feet. The black mangroves (*Avicennia germinans*) were measured at 8 inches DBH with a height of 30 feet. This site was approved on November 6, 1975. The Norberg RNA is the only one of its kind in the country nominated for its mangrove trees (SAF Primary Forest Type 106). The Norberg RNA was designated because it represents the typical type of forest in this coastal area, is easily defined and well protected, and is available for studies and observation.

MARINE PROTECTED AREA

Internationally recognized for conserving natural, historical, and cultural marine resources, Marine Protected Areas (MPAs) are intended to protect marine species and habitats, while also providing for sustainable recreation, sustainable commercial activities, enhanced research opportunities, and expanded educational opportunities. On December 1, 2000, the refuge was listed as a Candidate MPA, as defined under Executive Order 13158 (signed May 26, 2000). Under this Executive Order, an MPA is defined as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein. Areas meeting this definition are intended to serve as the building blocks for a national MPA system. Such a system will form a network for addressing marine issues through pooled funding from the mix of MPA entities, shared research, increased available data, and enhanced protection across a system or throughout a species' range. The MPA system is expected to benefit marine species that utilize the refuge. A total of 225 nominations for the MPA were received, 99 of which are national wildlife refuges. Finding them to be eligible for the national system, the National Marine Protected Areas Center has accepted the nominations for 225 sites and placed them on the List of National System MPAs in April, 2009. J.N. "Ding" Darling NWR is one of the 225 charter MPAs.

FLORIDA IMPORTANT BIRD AREA

The Important Bird Area (IBA) Program is part of a global effort to conserve bird populations by identifying, preserving, and properly managing their habitats. Florida's IBA Program began formally in March 1999. As modified for the Florida program, an Important Bird Area is a site that is documented to support significant populations of one or more species of native birds, or a significant diversity of species. The primary goal of Florida's IBA Program is to help ensure the persistence of the State's native avifauna, which is under extreme pressure from habitat fragmentation and destruction, human disturbance, fire exclusion, and other factors. J.N. "Ding" Darling NWR was selected in June 2002 as one of 99 IBAs in the State of Florida. The categories for which the refuge qualified for selection included having:

- significant populations of State Species of Special Concern and species listed by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA);
- significant numbers of wading birds and shorebirds;
- significant diversity of mangrove forest species; and
- significant natural habitats.

OUTSTANDING FLORIDA WATER

The designation of "Outstanding Florida Water" (OFW) is given to waters that are "worthy of special protection due to their natural attributes" (403.061, Florida Statutes). These waters are listed in 62-302.700, Florida Administrative Code (FAC). The intent of an OFW designation is to maintain ambient water quality. All permanent water bodies within national parks, national wildlife refuges, and State parks have been designated as OFWs. Other OFWs may also be designated as "Special Waters" based on a finding that the waters are of exceptional recreational or ecological significance and are identified as such in Rule 62-302, FAC. The OFW designation affords the highest protection possible under state water quality rules by prohibiting degradation of water quality from the conditions existing at the time of designation. Including the refuge, national parks, national wildlife refuges, and state parks in the three-county area (Collier, Lee, and Charlotte Counties) are listed in Table 1 (Florida Department of Environmental Protection 2001, 2002, and 2003) along with their designation as lands containing OFWs.

COASTAL BARRIER RESOURCES SYSTEM

The Coastal Barrier Resources Act (CBRA), Public Law 97-348 (96 Stat. 1653; 16 U.S.C. 3501 et seq.), enacted October 18, 1982, designated various undeveloped coastal lands and barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System (CBRS). The CBRS is a collection of specific units of land and associated aquatic habitats that serve as barriers protecting the Atlantic, Gulf, and Great Lakes Coasts. Undeveloped coastal barriers were mapped by the Department of the Interior using specific criteria, and were then enacted by Congress as units of the CBRS. The affected areas are delineated on maps enacted by Congress and entitled "John H. Chafee Coastal Barrier Resources System." The CBRS currently includes 585 units, which comprise nearly 1.3 million acres/526,091 ha of land and associated aquatic habitat. An additional 271 otherwise protected areas are also designated under a category of coastal barriers already held for conservation purposes that include an additional 1.8 million acres/728,434 ha of land and associated aquatic habitat. Areas so designated are made ineligible for direct or indirect federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. The CBRA is the essence of free-market natural resource conservation; it in no way regulates how land can be developed, but it instead transfers the full cost from federal taxpayers to the individuals who choose to build. CBRS units P18 and P18P include the

refuge. The northwest tip of the refuge is covered under CBRS Unit P18, while the remainder of the refuge is considered otherwise protected and not part of the CBRS in Unit P18P.

STATE AQUATIC PRESERVES AND STATE BUFFER PRESERVE

The refuge is adjacent to and overlaps a portion of the Pine Island Sound Aquatic Preserve, which is administered as part of the larger Charlotte Harbor Aquatic Preserves. Other nearby state aquatic preserves include Matlacha Pass, Cape Haze, Gasparilla Sound-Charlotte Harbor, and Lemon Bay (all administered under the Charlotte Harbor Aquatic Preserves). In addition, Estero Bay Aquatic Preserve lies just seven miles east of J.N. “Ding” Darling NWR. One large state buffer preserve, Charlotte Harbor State Buffer Preserve is located about 10 miles north of the refuge.

Table 1. National parks, national wildlife refuges and state parks in Charlotte, Lee, and Collier Counties designated as lands containing Outstanding Florida Waters

Charlotte County:
- Stump Pass Beach State Park
- Camp Haze State Aquatic Preserve (and Lee County)
- Charlotte Harbor State Buffer Preserve (and Lee County)
- Don Pedro Island State Park
- Gasparilla Sound-Charlotte Harbor State Aquatic Preserve (and Lee County)
- Island Bay National Wildlife Refuge
- Lemon Bay Estuarine System (Special Waters)
- Lemon Bay State Aquatic Preserve
- Port Charlotte Beach State Recreation Area

Lee County:
- Cayo Costa State Park
- Gasparilla Island State Park
- J.N. "Ding" Darling National Wildlife Refuge
- Josslyn Island (Conservation and Recreation Lands)
- Matlacha Pass National Wildlife Refuge
- Matlacha Pass State Aquatic Preserve
- Pine Island National Wildlife Refuge
- Pine Island Sound State Aquatic Preserve
- Caloosahatchee National Wildlife Refuge
- Koreshan State Historic Site (and Mound Key Archeological State Park)
- Estero Bay State Aquatic Preserve
- Estero Bay (Special Waters)
- Estero Bay Tributaries and Acquisitions
- Lovers Key State Recreation Area

Collier County:
- Barefoot Beach Acquisitions
- Delnor-Wiggins Pass State Recreation Area
- Wiggins Pass/Cocohatchee River System (Special Waters)
- Rookery Bay State Aquatic Preserve
- Rookery Bay National Estuarine Research Reserve
- Rookery Bay Acquisitions

- Collier-Seminole State Park
- Cape Romano-Ten Thousand Islands State Aquatic Preserve
- Fakahatchee Strand State Preserve
- Florida Panther National Wildlife Refuge

Sources: Florida Department of Environmental Protection 2001, 2002, and 2003

CHARLOTTE HARBOR NATIONAL ESTUARY PROGRAM

Charlotte Harbor is recognized as an "estuary of national significance" and was added to the National Estuary Program (NEP) in 1995. The Charlotte Harbor basin supports a great diversity of subtropical plant and animal life. In 1990, 86 federal and state protected plant and animal species were identified in the Charlotte Harbor area (Florida Department of Environmental Protection 2002). The entire watershed of the greater Charlotte Harbor watershed has a total area of approximately 4,468 square miles. The estuary itself is the second largest open water estuary in the state. It is 30 miles long and 7 miles wide with a total area of 270 square miles. Three rivers feed freshwater into the estuary: the Myakka, Peace, and Caloosahatchee Rivers. This estuary is bordered by two counties and several local governments and the watershed contains at least portions of six additional counties and numerous local governments. The watershed is subdivided by a multitude of federal, state, and regional agencies with regulatory authorities. A series of resource management efforts have been conducted in the region over the past 25 years (Taken from Charlotte Harbor National Estuary Program 2009).

WILD AND SCENIC RIVERS

The Wild and Scenic Rivers Act of 1968 (Public Law 90-542), requires the identification of potential wild, scenic, and recreational river areas within the nation. Section 5(d) of the Wild and Scenic Rivers Act (16 U.S.C. 1271-1287) requires that "In all planning for the use and development of water and related land resources, consideration shall be given by all Federal agencies involved to potential national wild, scenic and recreational river areas." It further requires that "the Secretary of the Interior shall make specific studies and investigations to determine which additional wild, scenic and recreational river areas.....shall be evaluated in planning reports by all Federal agencies as potential alternative uses of water and related land resources involved." The National Park Service has identified four Wild and Scenic River segments in the vicinity of the J.N “Ding” Darling NWR: three in Lee County and one in Charlotte County. Details for these river segments are provided in Table 2.

Table 2. Nationwide rivers inventory, Florida segments in the J.N. "Ding" Darling NWR Complex area

River	County	Reach	Length (miles)	ORVs	Description
Estero River	Lee	RM 0, Estero Bay, to RM 8, US 41 and Koreshan State Park	8	S, R, F, W, H, C	Established canoe/nature trail; Koreshan State Historic Site, flows through mangrove swamp;.
Hendry Creek	Lee	RM 0, Estero Bay, to RM 5, FL 865 and Gladiolus Drive	5	S, R, F, W	Diverse estuarine ecosystem.
Orange River	Lee	RM 0, confluence with Caloosahatchee River, to RM 9, Lehigh Acres	9	S, R, F, W	State Endangered Manatee Marine Mammal Sanctuary.
Shell Creek	Charlotte	RM 3, US 17/FL 35 bridge, to RM 20, east of FL 31 bridge	17	S, R, H, C	Scenic stream with excellent water quality.

Outstandingly Remarkable Values (ORVs): Scenery (S); Recreation (R); Geology (G); Fish (F); Wildlife (W); Prehistory (P); History (H); Cultural (C); Other Values (O).

Source: National Park Service 2007

ECOSYSTEM CONTEXT

PENINSULAR FLORIDA LANDSCAPE CONSERVATION COOPERATIVE

Throughout the nation, Landscape Conservation Cooperatives (LCCs) are currently under development. Figure 4 shows the LCCs for the continental U.S., while additional LCCs are under development for the Pacific Islands, Alaska, and the Caribbean. LCCs are applied conservation science partnerships between the U.S. Fish and Wildlife Service and other federal agencies, states, tribes, nongovernmental organizations, universities, and other stakeholders within a geographically defined area. LCCs will help inform resource management decisions and actions to address landscape-scale planning and management. Collectively, LCCs will comprise a seamless national network of planning and adaptive science capacity, connecting site-specific protection, restoration, and management efforts to larger goals supporting fish and wildlife populations and the natural systems that sustain them. One of the major functions of LCCs will be to ensure that all of the partners, including the Service, have access to existing data, science, expertise, and resources to limit duplication and provide an effective use of limited financial resources. LCCs will provide a more centralized venue to pull together the resources needed to research a problem; plan a response; identify and pool the needed skills, abilities, and funding to address the problem; take action; and evaluate the results, thus implementing Strategic Habitat Conservation within the landscape across partners.

J.N. "Ding" Darling NWR is located within the Peninsular Florida LCC (Figure 4, label 12). Although Florida is part of three separate LCCs, much of the state is covered by the Peninsular Florida LCC. The Service is working with the State of Florida, the Miccosukee and Seminole Tribes of Florida, and other partners to develop the Peninsular Florida LCC to enhance decision-making, planning, and management across the landscape to better serve wildlife and habitat resources found in this area. The Peninsular

Florida LCC will complement Florida's Wildlife Action Plan and other landscape level conservation strategies to restore, manage, and conserve the biodiversity of the region in the face of both climate change and intense development pressure associated with a rapidly growing human population.

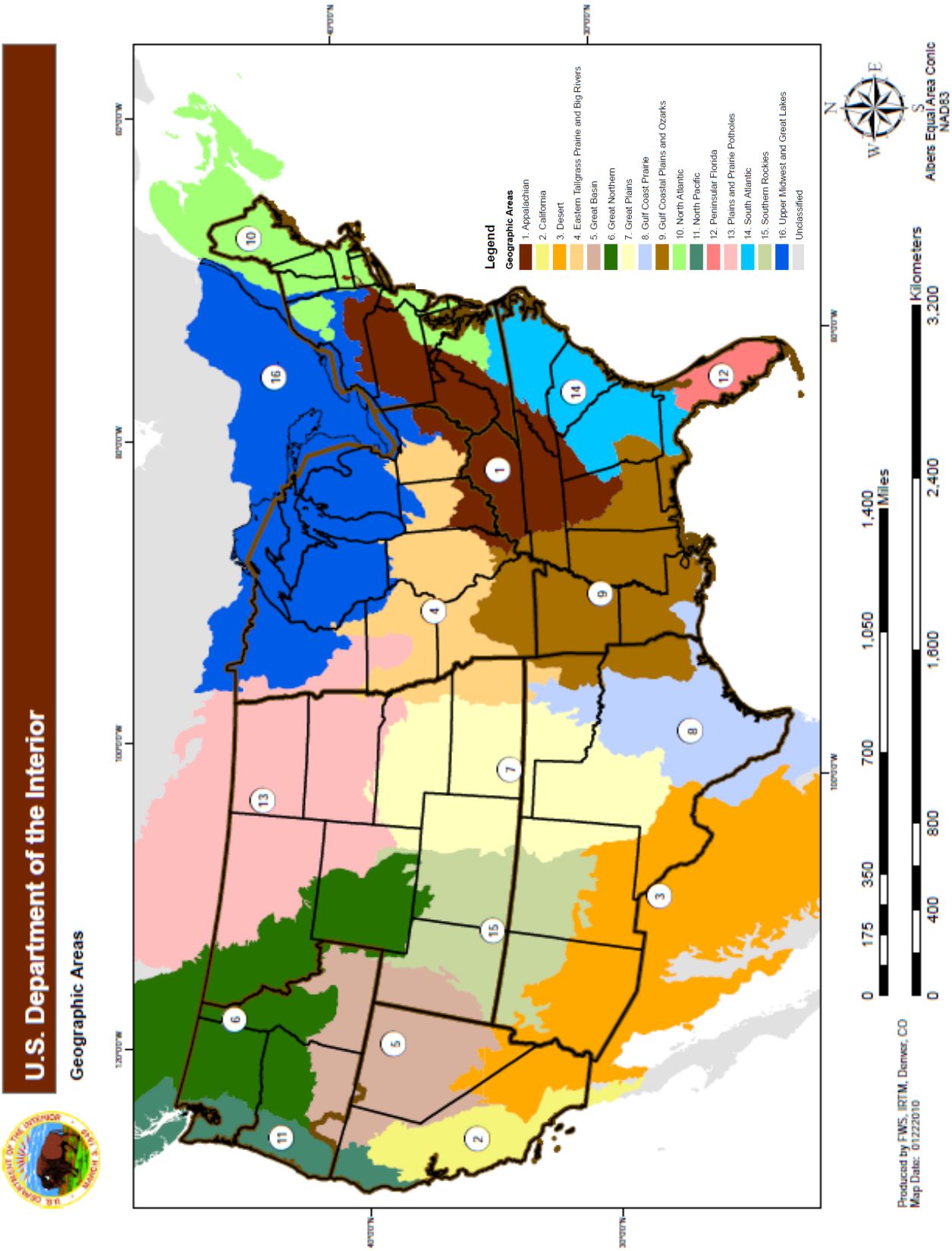
The Peninsular Florida area is unique and complex, connecting subtropical and temperate climate zones and featuring a mosaic of more than 40 habitat types. This biologically diverse region encompasses hundreds of miles of beach and dune habitats, the St. Johns River watershed, xeric scrub uplands of the Lake Wales Ridge, the freshwater marshes of the Kissimmee River and Lake Okeechobee, vast sawgrass and cypress wetlands of the Everglades, extensive coastal mangroves and salt marsh, expanses of seagrass beds, and the unique pine rocklands and tropical hardwood hammocks of the Florida Keys. Offshore, it includes the only living coral reef ecosystem in the continental United States. This region is home to approximately 700 species of mammals, birds, amphibians, and reptiles; over 1,000 species of freshwater and marine fish; over 4,000 species of plants; and about 50,000 species of invertebrates. More than 100 of these species are federally listed as endangered or threatened, and the State of Florida considers nearly 1,000 of them as Species of Greatest Conservation Need. Public interest in species conservation is intense regarding species such as the Florida manatee, Florida panther, wood stork, Florida scrub-jay, and several species of sea turtles. The primary conservation challenges include habitat destruction and conversion, invasive species, and management of fire and natural hydrological processes. However, the most critical challenge is time. Florida faces intense pressure from development and Peninsular Florida is extremely vulnerable to the impacts of sea level rise, saltwater intrusion, and aquifer depletion. An area the size of Vermont may be developed in Florida over the next 50 years and millions of human residents may be displaced by the impacts of climate change and sea level rise by the turn of the century. The effectiveness of the Peninsular Florida LCC will have far reaching implications.

SOUTH FLORIDA ECOSYSTEM

An ecosystem is a geographical area that includes and interconnects all the living (biotic) organisms, their physical (abiotic) surroundings, and the natural cycles that sustain them. The Outer Coastal Plain Ecological Province encompasses a large portion of the southeastern, coastal United States (Bailey 1978). The Outer Coastal Plain Ecological Province is an area of gentle slopes with abundant water resources. Estuaries, swamps, marshes, rivers, and lakes are abundant and provide habitat for a wide variety of plant and animal life. The J.N. "Ding" Darling NWR is located in the southern part of the Outer Coastal Plain Ecological Province, in an area designated as the South Florida Ecosystem, Figure 5, which is now fully contained in the Peninsular Florida LCC (U.S. Fish and Wildlife Service 2008).

The South Florida Ecosystem currently encompasses approximately 26,000 square miles, of which 77 percent is land and 23 percent is water, covering the 19 southernmost Florida counties. The ecosystem encompasses the Kissimmee River-Lake Okeechobee-Everglades drainage and the Peace River drainage, separated by the Central (Lake Wales) Ridge – the highest topographic feature of the Florida peninsula. The Ecosystem includes more than 10 major physiographic provinces. The South Florida Ecosystem includes over 20 areas managed by the federal government (not including the Brighton, Miccosukee, and Seminole Indian reservations). Several of these areas have protective designations. These include: 16 National Wildlife Refuges (including J.N. "Ding" Darling NWR); Big Cypress National Preserve; Biscayne National Park; Dry Tortugas National Park; Everglades National Park; and Florida Keys National Marine Sanctuary. Various other local and state conservation areas are also located within the South Florida ecosystem (U.S. Fish and Wildlife Service June 1998). See Figure 6 for the area conservation lands around the refuge.

Figure 4. Landscape conservation cooperatives



The South Florida Ecosystem represents a mixture of Caribbean-subtropical, southern temperate, and local influences resulting in a wide variety of habitats that support substantial ecological, community, taxonomic, and genetic diversity. In the vicinity of the refuge, the northern Charlotte Harbor region of the ecosystem is characterized by cypress and hardwood hammocks and extensive areas of poorly drained marshes. The central and southern regions of the ecosystem include marsh, dry, and wet prairies, pine flatwoods, and estuaries. Mesic flatwoods support a wide diversity of animals and represent the third highest species richness of vegetative communities in Florida. Dry prairie is one of the most widespread upland vegetative communities in the Charlotte Harbor region. Coastal areas contain seagrass beds, mangroves, and coastal strand communities, providing a variety of habitats and for resources for a diversity of flora and fauna. The South Florida Ecosystem serves a variety of native wildlife, including over 65 federally listed species, as well as interjurisdictional fishes, neotropical migratory birds, non-game waterbirds, and waterfowl. Table 3 describes the acreage and types of natural communities in the Charlotte Harbor NEP watershed and Table 4 lists imperiled animal species in the Charlotte Harbor NEP study area (Florida Department of Environmental Protection 2002a).

For 5,000 years, the greater South Florida Everglades ecosystem flourished, nurtured by sun and frequent rain. Runoff from the pinewoods and prairies of the Kissimmee River Basin flowed into Lake Okeechobee. The water then spilled over the south shore of the lake and flowed south in shallow sheets through vast stretches of sawgrass in a slow journey to Florida Bay. The Caloosahatchee River collected runoff and funneled water west into the Gulf of Mexico. At the river's mouth, where fresh and salt water mixed, a large, lush estuary evolved, providing shelter and forage for an array of fish, shellfish, birds, and wildlife. In 1881, a Philadelphia developer, Hamilton Disston, purchased from the state some 4 million acres around Lake Okeechobee and a year later he succeeded in cutting a canal that, for the first time, linked Lake Okeechobee to the Caloosahatchee River and the Gulf of Mexico, and opened the region to navigation and development. In the years since, the river's navigation channel has been enlarged and is now known as the C-43 canal, and for most purposes, the C-43 canal and Caloosahatchee River are one and the same (Figure 7). (U.S. Army Corps of Engineers 2003 and 2007)

Enhanced agricultural development due to the availability of irrigation water from the C-43 canal, urban development in the Ft. Myers/Cape Coral area, and regulatory releases of freshwater from Lake Okeechobee have all been linked to significant water quality changes in the Caloosahatchee Estuary. When water is discharged from Lake Okeechobee into the Caloosahatchee River following a heavy rain, it moves down the river and is quickly released into Charlotte Harbor, San Carlos Bay, and the Gulf of Mexico (Figure 8). This surge of freshwater changes delicate estuarine salinity levels and harms brackish marine habitats in the Lower Caloosahatchee River and adjacent estuaries. These releases of freshwater from Lake Okeechobee, increases in nonpoint source urban runoff associated with increased development, and agricultural runoff (drainage) are impacting the Caloosahatchee River, San Carlos Bay, Matlacha Pass, Pine Island Sound, Estero Bay, and Charlotte Harbor. Water quality parameters of concern include: salinity, nutrients, turbidity, trace organics, and metals. All of these negatively impact the flora and fauna of Sanibel Island and the J.N. "Ding" Darling NWR, (U.S. Army Corps of Engineers 2007 and South Florida Water Management District 2008). (For more information, see the "*Caloosahatchee River (C-43) West Basin Storage Reservoir Project"* discussion in the Regional Conservation Plans and Initiatives section.)

Figure 5. South Florida Ecosystem

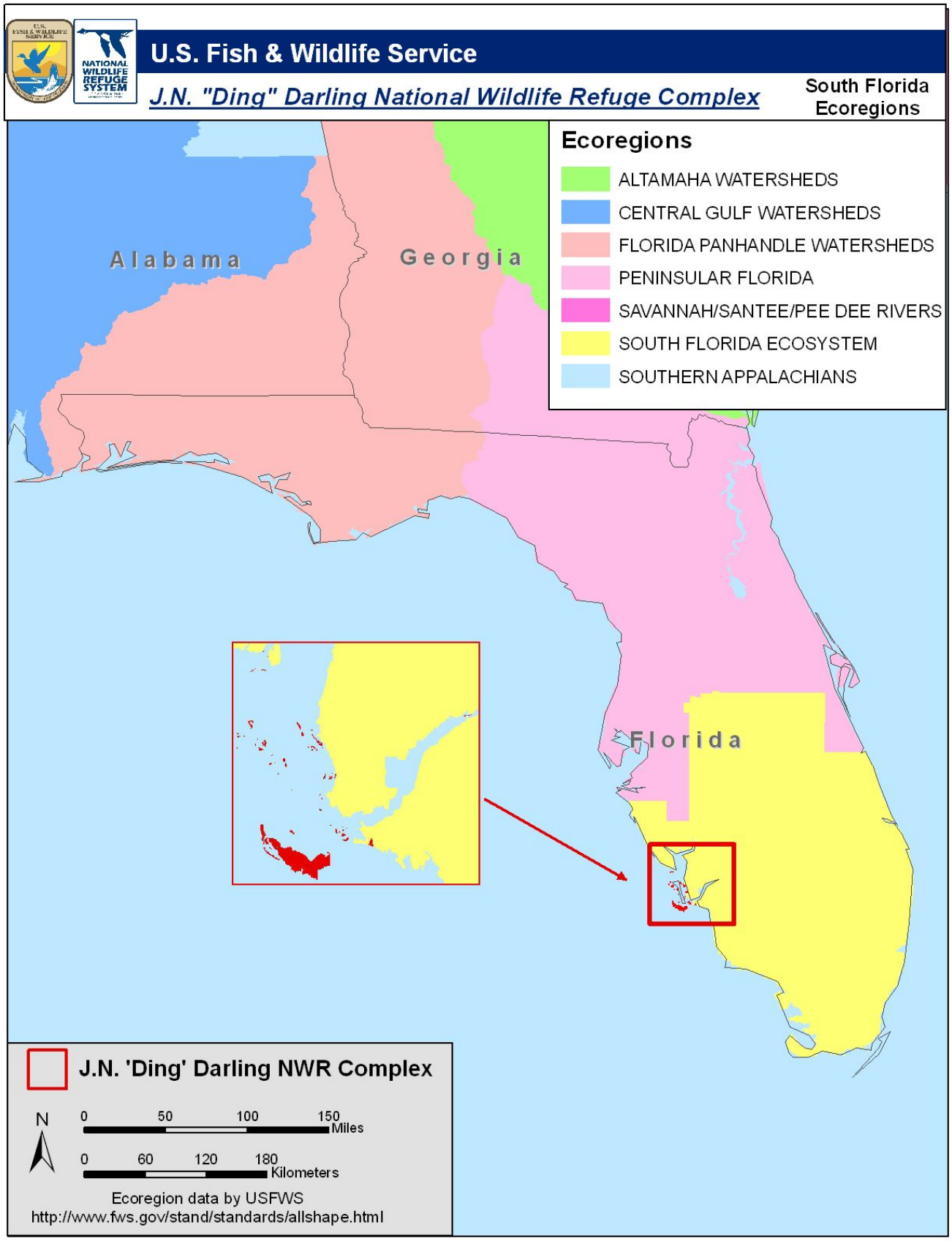


Figure 6. Area conservation lands

Table 3. Types of Natural Communities in the Charlotte Harbor Basin

Category	Community Type	Area in Acres	Total Area (%)	Characteristics
Upland				
1	Coastal strand	493.6	0.11	Occurs on well drained sandy coastlines and includes typically zoned vegetation of upper beach, nearby dunes, or coastal rock formations.
2	Dry prairie	26,864.7	6.30	Large treeless grasslands and shrub lands on very flat terrain interspersed with scattered cypress domes, cypress strands, isolated freshwater marshes, and hammocks.
3	Pinelands	47,797.4	11.20	Includes north and south Florida pine flatwoods, south Florida pine rocklands, scrubby flatwoods, and commercial pine plantations. Cypress domes, bayheads, titi swamps, and freshwater marshes are commonly interspersed in isolated depressions.
6	Oak scrub	224.4	0.05	Hardwood community consisting of clumps of low growing oaks interspersed with white sand. Occurs in areas of deep, well-washed sterile sand.
7	Mixed hardwood pine	1,441.6	0.34	Southern extension of the Piedmont southern mixed hardwoods, occurring mainly on clay soils of the northern Panhandle. Also includes upland forests in which a mixture of conifers and hardwoods dominate over story.
8	Hardwood hammock	7,933.4	1.86	Includes major upland hardwood associations that occur statewide on fairly rich sandy soils.
9	Tropical hammock	3,085.7	0.72	Cold-intolerant hardwood community with very high plant diversity that occurs on coastal uplands in extreme south Florida. Characterized by tropical trees and shrubs at the northern edge of their range, which extends into the Caribbean.
Wetland				
10	Coastal salt marsh	9,135.4	2.14	Herbaceous and shrubby wetland communities that include cordgrass, needlerush, and transitional or high salt marshes, occurring statewide in brackish waters along protected low energy estuarine shorelines.
11	Freshwater marsh	10,353.1	2.43	Wetland communities dominated by wide assortment of herbaceous plant species growing on sand, clay, marl, and organic soils in areas where water depths and inundation regimes vary.
12	Cypress swamp	4,251.3	1.00	Regularly inundated communities that form forested buffer along large rivers, creeks, and lakes, or occur in depressions as circular domes or linear strands. Strongly dominated by bald cypress or pond cypress.

Category	Community Type	Area in Acres	Total Area (%)	Characteristics
13	Hardwood swamp	1,170.6	0.27	Association of wetland adapted trees, composed either of pure stands of hardwoods or hardwood cypress mixture. Occurs on organic soils and forms forested floodplain of nonalluvial rivers, creeks, and broad lake basins.
15	Shrub swamp	93.2	0.02	Dominated by low-growing, woody shrubs or small trees, usually found in wetlands changed by natural or human perturbations such as altered hydroperiod, fire, clear-cutting or land clearing, and siltation.
16	Mangrove swamp	36,908.5	8.65	Dense, brackish water swamps, usually dominated by red, black, and white mangroves, that occur along low-energy shorelines and in protected, tidally influenced bays of southern Florida. Comprises freeze-intolerant tree species that are distributed south of a line from Cedar Key on the Gulf coast to St. Augustine on the Atlantic coast.
Open water				
18	Water	177,054	41.51	Open water areas of inland lakes, ponds, rivers, and streams and brackish and saline waters of estuaries, bays, and tidal creeks.
Disturbed				
19	Grass and agricultural land	23,645.9	5.54	Upland communities with very low-growing grasses and forbs. Intensively managed sites such as improved pastures, lawns, golf courses, road shoulders, cemeteries, or weedy fallow agricultural fields.
20	Shrub and brush	8,749.4	2.05	Includes different situations where natural upland communities have recently been disturbed and are recovering through natural successional processes.
21	Exotic plant communities	2,837.8	0.66	Upland and wetland areas dominated by invasive non-native trees that have invaded native plant communities.
22	Barren and Urban land	64,443.9	15.11	Unvegetated areas such as roads, beaches, active strip mines, borrow areas, cleared land on sandy soils, and urban areas (rooftops, parking lots, etc.).
TOTAL		**426,483**		

Source: Florida Department of Environmental Protection 2002

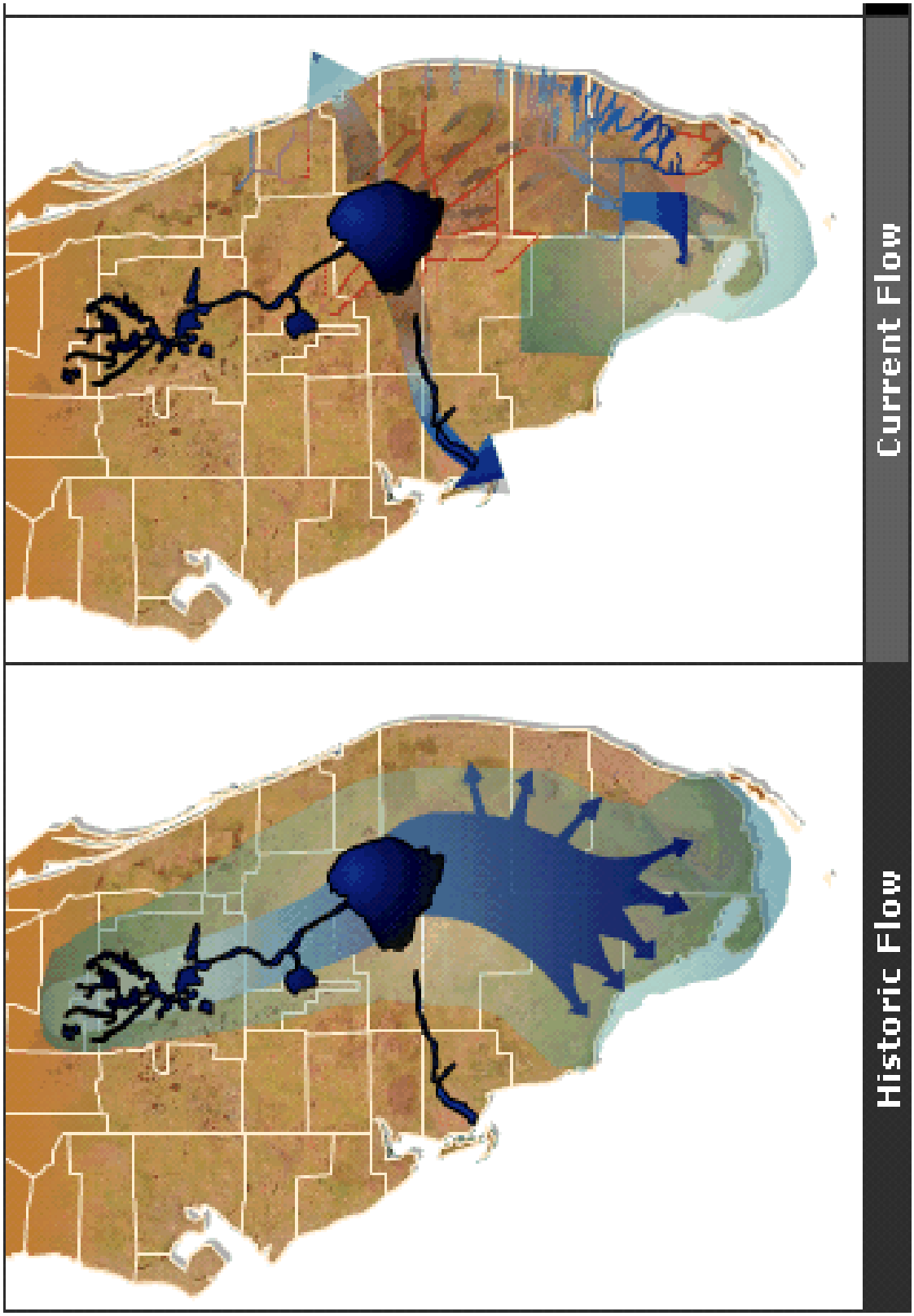
Table 4. Imperiled animal species of the Charlotte Harbor National Estuary Program study area

Common Name	Scientific Name	Federal Status	State Status
Fish			
Mangrove rivulus	*Rivulus marmoratus*		Special Concern
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	Special Concern
Smalltooth Sawfish	*Prisits pectinata*	Endangered	
Amphibians and Reptiles			
American crocodile	*Crocodylus acutus*	Threatened	Endangered
Atlantic green turtle	*Chelonia mydas mydas*	Endangered	Endangered
Atlantic hawksbill turtle	*Eretmochelys imbricata*	Endangered	Endangered
Kemp's ridley turtle	*Lepidochelys kempii*	Endangered	Endangered
Atlantic leatherback turtle	*Dermochelys coriacea*	Endangered	Endangered
Atlantic loggerhead turtle	*Caretta caretta caretta*	Threatened	Threatened
Eastern indigo snake	*Drymarchon corais couperi*	Threatened	Threatened
Gopher tortoise	*Gopherus polyphemus*	Threatened	Threatened
American alligator	*Alligator mississippiensis*	Threatened (s/a)	Special Concern
Florida gopher frog	*Rana capito*		Special Concern
Diamondback terrapin	*Malaclemys terrapin*	Special Concern	
Birds			
Wood stork	*Myctria americana*	Endangered	Endangered
Florida Everglades (snail) kite	*Rostrhamus sociabilis plumbeus*	Endangered	Endangered
Kirtland's warbler	*Dendroica kirtlandii*	Endangered	Endangered
Florida grasshopper sparrow	*Ammodtramussavannarum floridanus*	Endangered	Endangered
Piping Plover	*Charadris melodus*	Threatened	Threatened
Audubon's crested caracara	*Caracara cheriway auduboni*	Threatened	Threatened
Roseate tern	*Sterna dougallii dougallii*	Threatened	Threatened
Florida scrub jay	*Aphelocoma coerulescens coerulescens*	Threatened	Threatened
Southeastern American kestrel	*Falco sparverius paulus*	Special Concern	Threatened

Common Name	Scientific Name	Federal Status	State Status
Florida sandhill crane	*Grus canadensis pratensis*		Threatened
Least tern	*Sterna albifrons*		Threatened
Cuban snowy plover	*Charadrius alexandrinus tenuirostris*		Threatened
Red-cockaded woodpecker	*Picoides borealis*	Endangered	Special Concern
Reddish egret	*Dichromanassa rufescens*	Special Concern	Special Concern
American oystercatcher	*Haematopus palliatus*	Special Concern	Special Concern
Brown pelican	*Pelecanus occidentalis s*		Special Concern
Little blue heron	*Florida caerulea*		Special Concern
Snowy egret	*Egretta thula*		Special Concern
Tricolored heron	*Hydranassa tricolor*		Special Concern
Roseate spoonbill	*Ajaia ajaja*		Special Concern
Limpkin	*Aramus guarauna pictus*		Special Concern
Florida burrowing owl	*Athena cunicularia floridana*		Special Concern
Marian's marsh wren	*Cistothorus palustris marianae*		Special Concern
White ibis	*Eudocimus albas*		Special Concern
Mammals			
Florida manatee	*Trichechus manatus latirostris*	Endangered	Endangered
Florida panther	*Felis concolor coryi*	Endangered	Endangered
Mangrove fox squirrel	*Sciurus niger avicennia*		Threatened
Florida black bear	*Ursus americanus floridanus*		Threatened
Everglades mink	*Mustela vision-evergladensis*		Threatened
Sherman's fox squirrel	*Sciurus niger shermani*	Special Concern	Special Concern
Florida mouse	*Peromyscus floridanus*	Special Concern	Special Concern
Sanibel Island Rice Rat	*Oryzomys palustris sanibeli*		Special Concern

Sources: Florida Department of Environmental Protection 2002 and 2005a, Florida Fish and Wildlife Conservation Commission 2009, and U.S. Fish and Wildlfie Service 2009

Figure 7. Historic and current surface water flows – South Florida Ecosystem
(U.S. Army Corps of Engineers and South Florida Water Management District Undated and Lee County 2009)



ESTUARINE ECOSYSTEM

The J.N. "Ding" Darling NWR is part of the greater Charlotte Harbor and Caloosahatchee estuaries, an area where saltwater and freshwater mix. Estuaries create some of the most nutritionally rich habitat for thousands of species of plants and animals in an intricate food web. The basis of this food web in south Florida is the extensive mangrove forests and productive seagrass beds. Microorganisms thrive on the decaying leaves of seagrasses and mangroves, providing additional food for other animals. Rich in marine life, these shallow waters attract thousands of fish, shrimp, crabs, and snails, which are preyed upon by the numerous wading birds of the refuge. Seagrass beds and mangrove forests serve as shelter, nursery, and feeding areas for many fish species such as mullet (*Mugil*), snook (*Centropomus undecimalis*), red drum (*Sciaenops ocellata*), snapper (*Lutjanus*), and other marine organisms. Refuge waters provide essential habitat for fish that help to support the world class sport fishing of this estuary. Healthy seagrass beds are essential to grazing species such as the endangered West Indian manatee and green sea turtles. The estuary is also important to the thousands of shorebirds such as red knots, dunlin, and western sandpipers that use the refuge as resting and feeding grounds during their migrations. Great blue heron (*Ardea herodias*), reddish egret, roseate spoonbill (*Ajaia ajaja*), and other wading birds use the many islands as roosting sites, while many nest on the rookery islands found in the estuary. The refuge is also a haven for many threatened and endangered species, such as the American alligator, wood stork, and American crocodile (U.S. Fish and Wildlife Service, March 2007).

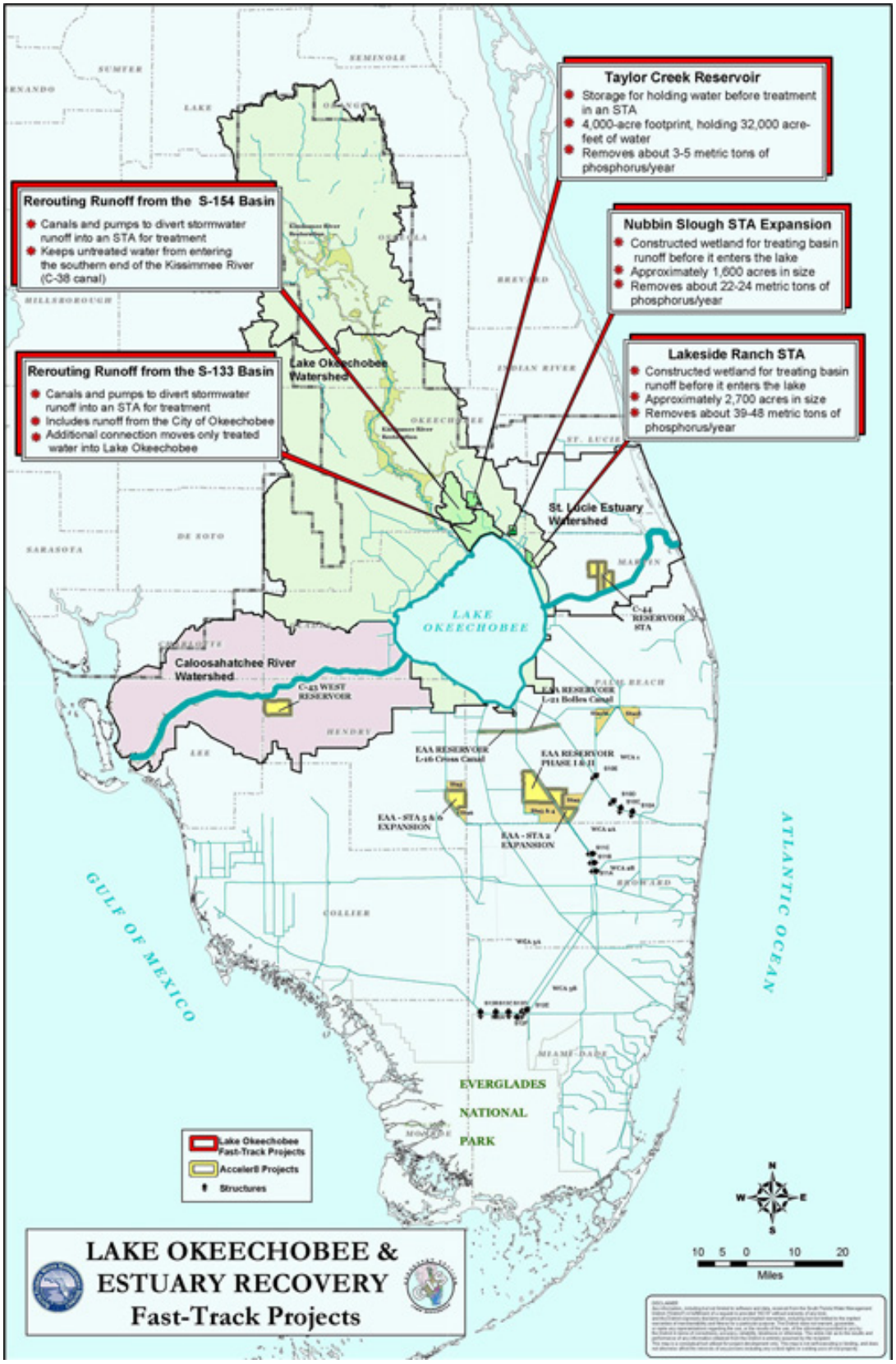
REGIONAL CONSERVATION PLANS AND INITIATIVES

Part of the Service's Southeast Region, J.N. "Ding" Darling NWR is located along Florida's Gulf coast and is part of the South Florida Ecosystem. As such, the refuge is a component of many regional conservation plans and initiatives, including the Charlotte Harbor National Estuary Program Comprehensive Conservation and Management Plan, Lower Charlotte Harbor Surface Water Improvement and Management Plan, Gulf of Mexico Program, Comprehensive Everglades Restoration Plan (including the Caloosahatchee River (C-43) West Basin Storage Reservoir Project and the Southwest Florida Feasibility Study), Northern Everglades and Estuaries Protection Program, South Florida Ecosystem Plan, South Florida Multi-Species Recovery Plan, Florida's Endangered and Threatened Species Management and Conservation Plan, the State Wildlife Action Plan, the Florida Natural Areas Inventory, and the Sanibel Plan.

CHARLOTTE HARBOR NATIONAL ESTUARY PROGRAM (NEP) AND COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN

The NEP was established as part of the 1987 amendments to the Clean Water Act (CWA) and seeks to protect and restore designated estuaries of national significance, that are deemed to be threatened by pollution, development, or overuse. The Charlotte Harbor NEP is one of the seven estuary programs in the Gulf of Mexico. Other NEP programs in the immediate area of the refuge are the Tampa Bay NEP and the Sarasota Bay NEP. Several federal agencies participate in planning and assessment efforts related to NEPs, including the Environmental Protection Agency (EPA), NOAA, U.S. Geological Survey (USGS), Department of Interior (DOI), and the U.S. Department of Agriculture (USDA).

Figure 8. Charlotte Harbor Watershed and Caloosahatchee River
(City of Sanibel 2009d)



The Charlotte Harbor NEP covers the Greater Charlotte Harbor Watershed from Venice to Bonita Springs to Winter Haven. It is a partnership of citizens, elected officials, resource managers, and commercial and recreational resource users who work to improve the water quality and ecological integrity of the Charlotte Harbor NEP study area. A cooperative decision-making process is used within the program to address diverse resource management concerns in the 4,700-square-mile Charlotte Harbor NEP study area. The 2008 update of Charlotte Harbor NEP's Comprehensive Conservation and Management Plan (CCMP) outlines four priority problems: hydrologic alterations, water quality degradation, fish and wildlife habitat loss, and stewardship gaps. The refuge is located within the Charlotte Harbor NEP Pine Island Sound subbasin, which has several key concerns, including freshwater runoff from Cape Coral; Caloosahatchee River outflows, especially concerns related to timing; water quality; salinity; water volumes; and impacts to seagrass beds, oyster beds, and other plants and animals. The CCMP contains six major goals for preserving and restoring Charlotte Harbor. These goals are: improve the environmental integrity of the Charlotte Harbor study area; preserve, restore and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands; reduce point and non-point sources of pollution to attain desired use of the estuary; provide the proper freshwater inflow to the estuary to ensure a balanced and productive ecosystem; develop and implement a strategy for public participation and education; and, develop and implement a formal Charlotte Harbor management plan with a specified structure and process for achieving goals for the estuary. The CCMP named the Service as a potential coordinating organization for the listed priority actions.

- Support public involvement programs addressing watershed management issues of hydrology, water resource issues, water conservation and water use;
- Restore freshwater and estuarine wetland areas, especially those adversely impacted by ditching, using methods such as the backfilling of ditches, the removal of spoil piles and the elimination of exotic vegetation;
- Enhance fish and wildlife habitat along shorelines, including canals, lakes, riverine systems, and artificial waterways;
- Assess the impacts of canal/lake management activities on fish and wildlife;
- Restore and protect a balance of native plant and animal communities;
- Provide additional support for environmental compliance and enforcement on land and water. Ensure uniform compliance and enforcement of environmental regulations and permitting criteria;
- Bring environmentally sensitive land under protection through ownership and/or management and expand conservation areas, reserves and preserves, including undeveloped platted lots;
- Promote local programs to research and eliminate nuisance exotic animal species;
- Provide education programs on the impacts of invasive exotic plants and exotic nuisance animals;
- Provide multifaceted environmentally responsible boater education programs; and
- Support public involvement programs in habitat and wildlife issues.

LOWER CHARLOTTE HARBOR SURFACE WATER IMPROVEMENT AND MANAGEMENT PLAN

In the late 1980s, it was determined that Florida had to do more to protect and restore its surface waters. While point sources (sewage and industrial wastes) were being controlled, non-point sources (pollutants that enter water bodies in less direct ways) were still a major concern. In 1987, the Florida Legislature created the Surface Water Improvement and Management (SWIM) program to address non-point pollutant sources. The SWIM program is the only program that addresses a waterbody's needs as a system of connected resources, rather than isolated wetlands or water bodies. To accomplish this, SWIM meshes across governmental responsibilities, forging important

partnerships in water resource management. While the state's five water management districts and the Florida Department of Environmental Protection are directly responsible for the SWIM program, they work in concert with federal, state, and local governments, as well as with the private sector.

Lower Charlotte Harbor (LCH) is defined as the basins of Pine Island Sound, Matlacha Pass, East and West Caloosahatchee, Estero Bay, and the lower portion of Charlotte Harbor proper. The plan's basic strategy is one of restoring, protecting, and managing the surface water resources of the Lower Charlotte Harbor Watershed. The Lower Charlotte Harbor SWIM Plan focuses on the listed six primary initiatives (South Florida Water Management District 2008).

- Water Quality - the utilization of water quality monitoring data to evaluate sources of pollutants; the application of water quality models to evaluate the fate of water quality constituents; and the implementation of prioritized water quality enhancements for both 303(d) listed surface waters and other degraded waters.
- Stormwater Quantity - the reduction of sheet flow and the periodic discharge of large quantities of fresh stormwater runoff into the major river systems in the LCH results in ecologically damaging changes in salinity throughout the estuarine areas of the watershed. This plan focuses on mechanisms to reduce these excess flows and restore more natural timing and quantity of freshwater inflows to the watershed.
- Watershed Master Planning and Implementation - an evaluation of stormwater management and identification of problem areas, with detailed remedial actions generally derived using hydrologic models simulating water volumes and flows under a range of climatic conditions.
- Habitat Assessment, Protection and Restoration - evaluate ancillary data needed to identify and provide habitat protection and restoration in the LCH. Additional data collection efforts for parameters such as benthic organism diversity, submerged aquatic vegetation distribution, and shellfish areas will be evaluated and implemented as necessary.
- Outreach - The LCH watershed encompasses a diverse region of urban, agricultural and environmental lands, and it is managed and regulated by numerous agencies and municipalities. Outreach, including both communication and coordination, is vital tool for the SFWMD to efficiently and effectively meet the differing needs of these entities, while also meeting LCH SWIM goals. Through outreach, SFWMD can provide leadership with both the public and local governments.
- Funding - the need for long-term dedicated funding to reach plan goals. It also serves to coordinate funding within and across district areas of responsibility, as well as within each of the other initiatives in the LCH SWIM Plan.

Both the Lower Charlotte Harbor SWIM Plan and the Charlotte Harbor NEP's CCMP identified hydrologic alterations; water quality degradation; and, fish and wildlife habitat loss as significant management issues. The goals of the Lower Charlotte Harbor SWIM Plan are consistent with the goals identified by the Charlotte Harbor NEP and the SWIM Plan's management strategies for protecting and restoring Charlotte Harbor are based on the Charlotte Harbor NEP's CCMP.

GULF OF MEXICO PROGRAM

The Gulf of Mexico Program (GMP) was formed in 1988 by the Environmental Protection Agency as a non-regulatory, inclusive partnership to provide a broad geographic focus on the major environmental issues in the Gulf. The GMP provides a tool to leverage the resources of 18 different federal agencies; a variety of environmentally minded agencies from the States of Alabama, Florida, Louisiana, Mississippi, and Texas; and numerous public and private organizations. Under the umbrella of the GMP, Florida's Gulf Ecological Management Site (GEMS) Program, with the

cooperation of federal, state, local, and private programs, resources, and mechanisms, has identified 43 special ecological sites and provides information for each site in an informational database. Eighteen of these GEMS, including the J.N. “Ding” Darling NWR, are managed by the Service.

COMPREHENSIVE EVERGLADES RESTORATION PLAN

Starting in the 1940s, the Central and South Florida Project -- constructed in partnership between the U.S. Army Corps of Engineers (USACE) and the SFWMD -- is an elaborate and effective water management system providing flood protection and water supply for south Florida. The system caused unintended environmental impacts to the South Florida Ecosystem. In 1992 and 1996, Congress authorized the Restudy of the Central and South Florida Project to assess the measures necessary to restore the South Florida Ecosystem. The Comprehensive Everglades Restoration Plan (CERP) was completed in 1999. CERP was included in the Water Resources Development Act of 2000. Nearly 70 agencies and organizations came forward to support the implementation of CERP, with the USACE and the SFWMD taking the lead roles as the federal and local sponsors. The goal of CERP is to capture freshwater that now flows unused to the Atlantic Ocean and the Gulf and redirect it to areas that need it most. The majority of the water will be devoted to environmental restoration, reviving a dying ecosystem. The remaining water will benefit cities and farmers by enhancing water supplies for the south Florida economy.

Caloosahatchee River (C-43) West Basin Storage Reservoir Project

A major project for the J.N. ”Ding” Darling NWR, funded under the CERP, is the Caloosahatchee River (C-43) West Basin Storage Reservoir Project. The purpose of the project is to improve the timing and quantity of freshwater flows to the Caloosahatchee River Estuary. The West Basin Storage Reservoir will store freshwater from Lake Okeechobee and storm-water runoff that will be released slowly, as needed, to ensure a more natural, consistent flow of freshwater to the estuary. This will help to restore the estuary by eliminating salinity changes and improving the ecological health of flora and fauna on the refuge. (See the discussion of *“Freshwater Releases from the Caloosahatchee Watershed and Lake Okeechobee”* in the Water Quality section below.)

Southwest Florida Feasibility Study

The Comprehensive Everglades Restoration Plan (CERP) and the Southwest Florida Feasibility Study (SWFFS) provide a framework and guide to restore, protect, and preserve the water resources of central and southern Florida, including the Everglades. The goal of CERP and SWFFS is to capture freshwater that now flows unused to the Atlantic Ocean and the Gulf of Mexico and redirect it to areas that need it most. The majority of the water will be devoted to environmental restoration, reviving a dying ecosystem. The remaining water will benefit cities and farmers by enhancing water supplies for the south Florida economy. The USACE, in partnership with the South Florida Water Management District and numerous other federal, state, local and tribal partners, has developed this plan to save the Everglades. This study will provide a framework to improve water quality and address the health of aquatic ecosystems; water flows; water supply; wildlife, biological diversity, and natural habitat along the Gulf coast of southern Florida – all of which are important issues to the refuge.

NORTHERN EVERGLADES AND ESTUARIES PROTECTION PROGRAM

The Northern Everglades and Estuaries Protection Program recognizes the importance and connectivity of the entire Everglades ecosystem, both north and south of Lake Okeechobee. Implementation of this program will improve the quality, quantity, timing, and distribution of water to the natural system and reestablish salinity regimes suitable for maintaining healthy, naturally diverse, and

well-balanced estuarine ecosystems. The health of the Northern Everglades will be enhanced by improving land management to reduce nutrient run-off, by constructing treatment wetlands to improve water quality, and by completing water storage projects to better connect, manage, and distribute water to the natural system. Under this program, the State of Florida recognized the importance of protection and restoration of the Lake Okeechobee watershed and the Caloosahatchee and St. Lucie Rivers and estuaries. The South Florida Water Management District, Florida Department of Environmental Protection, and Florida Department of Agriculture and Consumer Services, in cooperation with Lee and Martin Counties and other affected municipalities, developed the Caloosahatchee and St. Lucie River Watershed Protection Plans. The Caloosahatchee River Watershed Protection Plan includes three components: a Construction Project; a Pollutant Control Program; and a Research and Water Quality Monitoring Program. The Construction Project and Pollutant Control Program include water quality projects, along with agricultural and urban best management practices (BMPs), to maximize nutrient loading reductions to meet Total Maximum Daily Loads (TMDLs) as they are established for the Caloosahatchee River Estuary. In addition, it includes water storage projects for improving quantity, timing, and distribution of water in the estuary and to re-establish salinity regimes suitable for maintaining a healthy, naturally diverse, and well-balanced estuarine ecosystem. The Research and Water Quality Monitoring Program describes the current state of knowledge regarding hydrology, water quality, aquatic habitat, and effects of Lake Okeechobee on delivery of water to the Caloosahatchee River Estuary. It builds upon the existing monitoring, research, and modeling efforts and makes recommendations and modifications to these efforts to better achieve and assess the water quality and quantity targets of the Caloosahatchee River Watershed Protection Plan (South Florida Water Management District March 2009 and March 2009a).

SOUTH FLORIDA ECOSYSTEM PLAN

The South Florida Ecosystem Plan (U.S. Fish and Wildlife Service June 1998) seeks to better manage federal trust resources, such as migratory birds, threatened and endangered species, freshwater wetlands, interjurisdicational fisheries, mangrove forests, estuaries and estuarine wetlands, seagrasses, hardbottom, and coral reefs in the South Florida Ecosystem (Figure 5), which encompasses the Kissimmee River, Lake Okeechobee, the Everglades, Peace River, Charlotte Harbor, Caloosahatchee River, Big Cypress Basin, Florida Keys, and the upper and lower east coast of Florida. The seven goals of the South Florida Ecosystem Plan are listed.

- Protect and manage Refuge System units and other national interest lands.
- Protect migratory birds and protect, restore, and manage their habitats.
- Protect, restore, and manage candidate, threatened, and endangered species and their habitats.
- Protect, restore, and manage wetlands and other freshwater habitats
- Protect, manage, and restore fish and other aquatic species, and their habitats.
- Protect, restore, and enhance coastal and estuarine habitats.
- Protect, restore, and manage for biodiversity.

The refuge's management supports all of the goals of the South Florida Ecosystem Plan and the refuge's exotic plant control plan and impoundment management plan also support specific objectives identified in the South Florida Ecosystem Plan.

SOUTH FLORIDA MULTI-SPECIES RECOVERY PLAN

The South Florida Multi-Species Recovery Plan is one of the first recovery strategies specifically designed to meet the needs of multiple species that do not occupy similar habitats. It is also one of the first designed to approach recovery by addressing the needs of entire watersheds: the

Kissimmee-Okeechobee- Everglades watershed, the Caloosahatchee River-Big Cypress watershed, and the Peace-Myakka River watershed. The refuge plays a role in the recovery of several federally listed species, including the American crocodile, loggerhead sea turtle, green sea turtle, Kemp's ridley sea turtle, hawksbill sea turtle, leatherback sea turtle, eastern indigo snake, piping plover, wood stork, roseate tern, and the West Indian manatee. The refuge is mentioned in the recovery actions for the American crocodile under the strategy to conduct surveys to determine the current distribution and abundance of American crocodiles.

FLORIDA'S ENDANGERED AND THREATENED SPECIES MANAGEMENT AND CONSERVATION PLAN

Florida's Endangered and Threatened Species Management and Conservation Plan is a plan for management and conservation of state-listed endangered and threatened species (Florida Fish and Wildlife Conservation Commission 2009a). It addresses research and management priorities, FWC's citizen's awareness program, and a progress report on agency actions for listed species. Thirty state-listed animals and 18 state-listed plants are known to occur on the refuge.

STATE WILDLIFE ACTION PLAN

As a requirement for participating in the federal State Wildlife Grants Program, each state and territory has created a Comprehensive Wildlife Conservation Strategy for conservation of a broad array of fish and wildlife. Throughout the development process, the objectives were to identify species of greatest conservation need and their habitats and to develop high-priority conservation actions to abate problems for those species and habitats. These objectives have been developed in a prudent effort to prevent declines before species become imperiled, thereby saving millions of tax dollars. In addition, the matching requirement has encouraged partnerships and cooperation among conservation partners. To meet the intent of the Service's State Wildlife Grants Program, the FWC created Florida's Wildlife Legacy Initiative (Initiative). The goal of the Initiative was to develop a strategic vision for conserving all of Florida's wildlife. Florida's Comprehensive Wildlife Conservation Strategy (FCWCS) was completed and approved in 2005. The FCWCS emphasizes the building of partnerships with other agencies and the private sector, uses a habitat-based conservation approach, incorporates a broad definition of wildlife (to include invertebrates, aquatic species, and other species), and favors non-regulatory methods in its effort to reach conservation goals and objectives, many of which provided useful guidance in developing CCP benchmarks. All 45 Florida habitat categories identified in this Initiative are worthy of attention and conservation effort; however, several (18) habitats are identified as being under the greatest threat. Of these eighteen, nine marine habitat categories were identified as having the highest relative threat status, eight of which are found on the refuge: Beach/Surf Zone, Bivalve Reef, Coastal Tidal River or Stream, Inlet, Mangrove Swamp, Salt Marsh, Submerged Aquatic Vegetation, and Tidal Flat (Florida Fish and Wildlife Conservation Commission 2005). The refuge supports many of these habitat categories.

Florida Coastal Wildlife Conservation Initiative

Florida's Coastal Wildlife Conservation Initiative is a FWC-led effort to develop an integrated approach that focuses on coastal wildlife and habitat needs, as well as on related socio-economic issues. This integrated approach includes participation by partners and input from stakeholders to address the range of activities that impact coastal wildlife in a balanced fashion. The vision is to ensure the long- term conservation of native wildlife in coastal ecosystems throughout Florida in balance with human activities (Florida Fish and Wildlife Conservation Commission 2010a).

Florida Bird Conservation Initiative

The Florida Bird Conservation Initiative is another wildlife initiative of the State of Florida. It was formed as a voluntary public-private partnership seeking to promote the sustainability of native Florida birds and their habitats through coordinated efforts that strategically address critical needs related to conservation planning, delivery of conservation programs, research and monitoring, education and outreach, and public policy. FWC works with the Atlantic Coast Joint Venture and a wide variety of conservation partners in the State of Florida to serve FBCI goals. The FBCI will address bird conservation over the entire state, including two joint ventures and two bird conservation regions (BCRs 27 and 31) (Florida Fish and Wildlife Conservation Commission 2010b).

FLORIDA NATURAL AREAS INVENTORY

The Florida Natural Areas Inventory (FNAI) is a non-profit organization dedicated to gathering, interpreting, and disseminating information critical to the conservation of Florida's biological diversity. The Inventory was founded in 1981 as a member of The Nature Conservancy's international network of natural heritage programs. The databases and expertise of FNAI facilitate environmentally sound planning and natural resource management to protect the plants, animals, and communities that represent Florida's natural heritage. The Florida Natural Areas Inventory is the primary source of information on Florida's conservation lands. The Inventory databases include boundaries and statistics for more than 1,600 federal, state, local, and privately managed areas, all provided directly by the managing agencies (Florida Natural Areas Inventory 2009).

Conservation lands identified by FNAI on Sanibel and Captiva Islands include: Bowman's Beach Regional Park, J.N. "Ding" Darling NWR, Sanibel-Captiva Conservation Foundation Conservation Lands, Norberg Research Natural Area (on the refuge), and Lighthouse Beach Park (FNAI Undated).

SANIBEL PLAN

The Sanibel Report prepared in 1974-75 reports on every facet of the Island's natural systems, such as beaches, mangroves, interior wetlands, hydrology, and wildlife information. Sanibel-Captiva Conservation Foundation staff and volunteers provided many of the reports, research, and existing data; recruited experts; and even supplied lodging and financial support for the visiting scientists. This report was incorporated into the Sanibel Plan, adopted in 1976, which is still used by the city of Sanibel as it balances orderly development with the preservation of ecological integrity (Clark 1976).

ECOLOGICAL THREATS AND PROBLEMS

The refuge and the surrounding area face numerous ecological threats and problems all related to growth of the human population and development of the landscape. The developed nature of the area is evident in the land cover depicted in Figure 9. The key ecological threats and problems include altered quantity, quality and timing of freshwater flows, including freshwater flows from Sanibel, freshwater flows from the Caloosahatchee River and watershed, and regulatory releases from Lake Okeechobee. These altered flows effect salinity levels and nutrient loads in the estuary, which impact seagrasses, oysters, and other habitat types and the fish and wildlife resources that use those habitats. Additional threats include the spread of exotic, invasive, and nuisance species and the impacts of climate change.

WATER QUALITY, QUANTITY, AND TIMING

The ecological health of J.N. "Ding" Darling NWR estuarine ecosystem is linked directly to the health of Charlotte Harbor and the Caloosahatchee River watershed (inclusive of the Kissimmee River and Lake Okeechobee watersheds). Coastal southwest Florida is one of the fastest urbanizing regions in the United States. Rapid urban development has radically changed the character and ecology of coastal waters. Mangroves have been removed or cut back, red tide events cause public health warnings, seagrass areas have declined or been damaged, and groundwater pumping has reached its maximum limit. Manmade canals and levees crisscrossing south Florida have altered the natural hydrology that formed and maintained the wetlands and estuaries of south Florida. Residential and commercial development along the bays and Caloosahatchee River have adversely impacted wildlife and habitat and increased point and non-point pollution into the waterways (e.g., increasing nutrient loads and turbidity). As a result of the hydrologic modifications, the quality, timing, duration, and volume of water releases from Lake Okeechobee into the Caloosahatchee River and runoff from within the Caloosahatchee watershed are specific problems and concerns for the health of the refuge (Figures 7 and 8). (See the discussion under the Ecosystem Context section for more information on the threats and problems associated with water quality, quantity, and timing.)

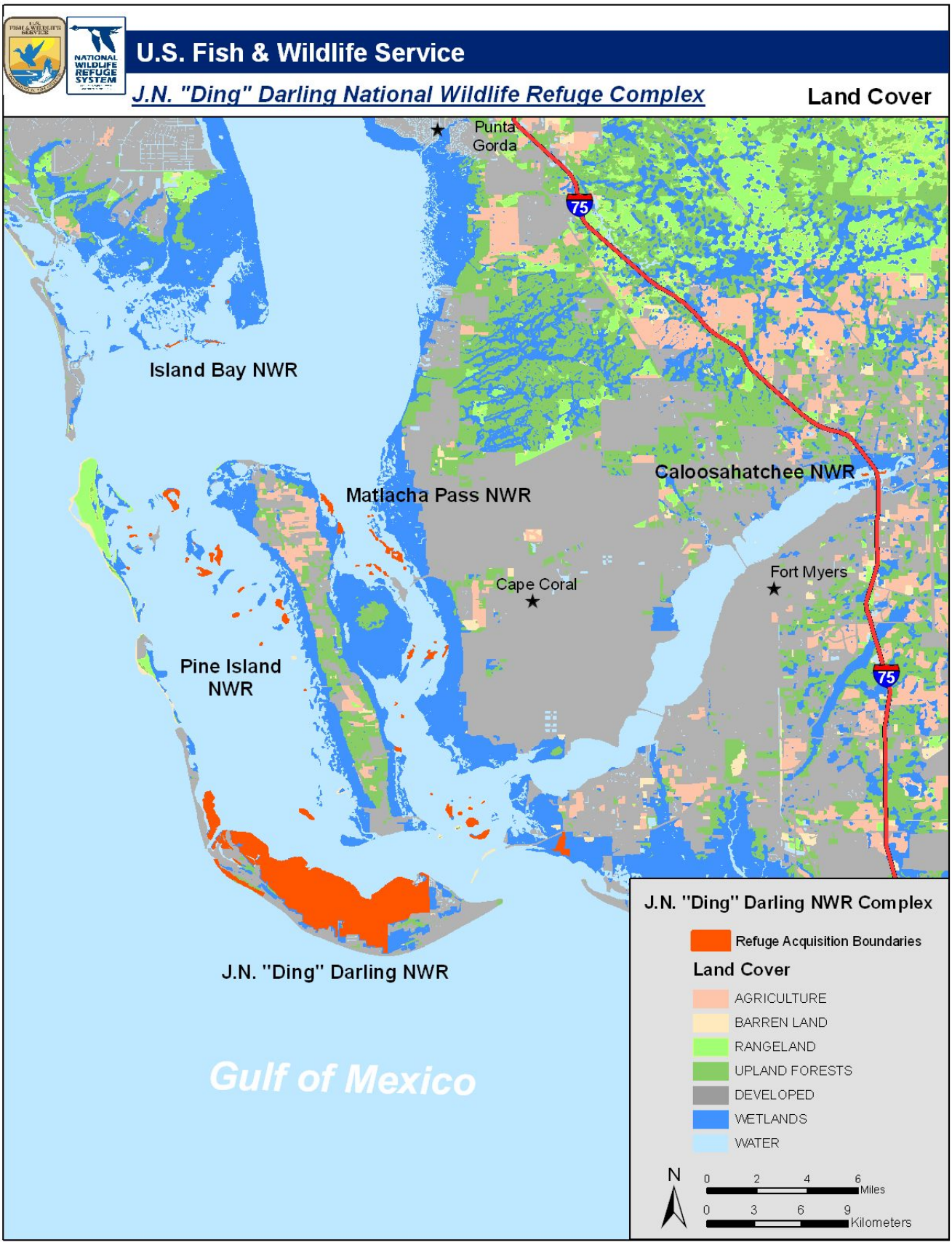
EXOTIC, INVASIVE, AND NUISANCE SPECIES

Florida's invasion by exotic species began with the first European explorers in the early 16th century. Because of its mild climate, international seaports, cultural diversity, and lenient importation laws, Florida has been the epicenter for more exotic species than almost any other region in the country. Currently, more than 31 percent of the plants found in Florida are non-native, as are over 26 percent of all animals (Ferriter et al. 2005). The Florida Exotic Pest Plant Council has outlined 67 Category I and 71 Category II exotic pest plants for Florida (Florida Exotic Pest Plant Council 2007). Category I plants are invasive exotics which are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused. Category II plants are invasive exotics that have increased in abundance or frequency, but have not yet altered Florida plant communities to the extent shown by Category I species. These species may become ranked Category I, if ecological damage is demonstrated.

The top seven exotic plant species in the South Florida ecosystem are: Australian pine *(Casuarina spp),* water hyacinth *(Eichornia crassipes),* hydrilla *(Hydrilla verticillata),* Old World climbing fern *(Lygodium microphyllum),* melaleuca *(Melaleuca quinquenervia),* torpedo grass *(Panicum repens)*, *and* Brazilian pepper *(Schinus terebinthefolius*) (U.S. Fish and Wildlife Service undated).

The exotic, invasive, and nuisance plant species of particular interest to J.N. "Ding" Darling NWR are: Japanese climbing fern (*L. japonicum*), West Indian marsh grass (*Hymenachne amplexicaulis*), cogongrass *(Imperata cylindrical),* rosary pea *(Abrus precatorius),* carrotwood *(Cupaniopsis anacardioides),* Java plum (*Syzygium cumini*), earleaf acacia (*Acacia auriculiformis*), beach naupaka (*Scaevola taccada*), air potato (*Dioscorea bulbifera*), guava (*Psidium guajava*), narrow-leaved cattail (*Typha angustifolia*), night-blooming cereus (*Hylocereus undata*), mother-in-law's tongue (*Sansevieria hyacinthoides*), climbing cassia (*Senna pendula*), lead tree (*Leucanea leucocephala*), umbrella tree (*Shefflera actinophylla*), lantana (*Lantana camara*), winged yam (*Dioscorea alatat*), and Guinea grass (*Panicum maximus*).

Figure 9. Land cover



This area also faces impacts from exotic, invasive, and nuisance wildlife species, including the black rat (roof rat, palm rat) (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), Eurasian collared-dove (*Streptopelia decaocto*), white-winged dove (*Zenaida asiatica*), monk parakeet (*Myiopsitta monachus*), green parakeet (*Aratinga holochlora*), Nile monitor lizard (*Varanus niloticus*), green iguana (*Iguana iguana*), black spiny-tailed iguana (*Ctenosaura similis*), brown anole *(Anolis sagrei)*, knight anole (*Anolis equestris*), red-headed agama (*Agama agama africana),* Indo-pacific gecko (*Hemidactylus garnotii*), tropical house gecko (*Hemidactylus mabouia),* tokay gecko (*Gekko gecko*), northern curly-tailed lizard (*Leiocephalus carinutus*), brahminy blind snake (*Ramphotyphlops braminus*), Burmese python (*Python molurus bivittatus*), red-eared slider (*Trachemys scripta elegans*), yellow-belly slider (*Trachemys scripta scripta*), Cuban treefrog *(Osteopilus septentrionalis),* qreenhouse frog (*Eleutherodactylus planirostris planirostris*), Mayan cichlid (*Cichlasoma urophthalmus*), Mozambique tilapia (*Oreochromis mossambicus*), walking catfish (*Clarias batrachus*), and green mussel (*Musculista senhousia*).

POTENTIAL EFFECTS OF CLIMATE CHANGE

Department of Interior Secretarial Order 3226 states that there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision-making. This order ensures that climate change impacts are taken into account in connection with departmental planning and decision-making. Additionally, it calls for the incorporation of climate change considerations into long-term planning documents, such as the CCP. Projecting the impacts of climate change is hugely complex. The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive.

Meteorological and climatological events, such as hurricanes (e.g., No-name storm) and sea level rise, pose challenges for refuge management. Further, climate change related stressors will likely enhance the negative impacts of other stressors. Climate change may exacerbate shoreline erosion due to rising seas (Doyle 1998, Natural Resources Defense Council 2001, Zhang et al. 2004, Bindoff et al. 2007, Holland and Webster 2007, Nicholls et al. 2007) and may result in an increase in the intensity and frequency of tropical cyclones (Emanuel 1987, Emanuel 2005, Webster et al. 2005, Mann and Emanuel 2006). Low-lying islands will face impacts from global climate change, particularly rising sea level and coastal storms. Such effects have already been experienced in the past; however, these events may become more frequent and severe within the 15-year time period covered by this CCP, based on recent projections by the Intergovernmental Panel on Climate Change (IPCC) (Intergovernmental Panel on Climate Change 2007). Saline intrusion into the subsurface freshwater lens from sea level rise and saltwater inundation of surface freshwaters from storm surges can alter coastal ecosystems and freshwater marshes resulting in more salt-tolerant aquatic plant communities. The most immediate action that the Service can take is to gather the best scientific data possible for understanding natural processes in their current state, modeling possible impacts and subsequent changes from sea level rise, and developing adaptive management strategies for future conservation needs.

Although direct impacts to refuge resources are currently unknown, likely changes and stressors include alterations in wildlife populations and ranges, including alteration of the composition of plant community types; increased storm intensity; increased drought severity and persistence; and increased density and diversity of exotic and invasive species. And, these are likely to exacerbate other stressors, potentially resulting in decreased water quality, altered water quantity and timing of flows, and increased pollution. On Sanibel Island, the prospect of global climate change could result in a wide variety of changes to the natural resources in and around the refuge. The full range and

degree of the direct and indirect effects would be very difficult to predict, but conjectures can be made. Sanibel is a coastal barrier island with gentle, low elevation topography that would be more likely to experience higher rates of coastline erosion. Rises in sea levels could shift marshes and beaches inland (Field et al. 2001), transitioning intertidal marshes into subtidal marshes (Galbraith et al. 2002) or open water. Sea level rise would also increase salt water intrusion resulting in the alteration of plant communities, particularly freshwater wetlands; and result in declines in mangrove and seagrass communities (Twilley et al. 2001). Changes to climate patterns could elevate sea surface temperatures resulting in increased storm frequencies and intensities (Erwin et al. 2004). If storms and hurricanes occur more frequently, besides increased local damage to mangrove forests, there would be temporary increases in sediments and organic material discharged to coastal waters (Twilley et al. 2001). Elevated air temperatures could also lead to increased drought durations resulting in altered and more intense fire seasons (Twilley et al. 2001). These changes would also present conditions likely to increase the incidence of algal blooms and red tide events and increase the spread of exotic and invasive species (Ogden et al. 2005), and negatively change the refuge's ecologically important diverse plant species (Browder et al. 2005). This would potentially increase the number of threatened and endangered species and further imperil those already at risk. Populations of native plants and animals – already stressed and greatly reduced in their ranges – could experience further stress from warmer temperatures, putting those species at increased risk for loss of local populations or even complete extinction (Harris and Cropper 1992). The potential effects of changing climate on isolated refuges could be substantial because of the limited opportunities for natural species to migrate (Twilley et al. 2001).

In 2006, the Sea Level Affecting Marshes Model (SLAMM) was run for several Florida refuges, including J.N. "Ding" Darling NWR. This modeling effort predicted that the refuge would transition to predominantly mangroves and open estuarine waters with limited uplands by 2100 (McMahon 2006). By 2100, total or near losses were modeled for ocean beach, tidal flat, and estuarine beach habitats of the refuge, while substantial losses were modeled for the refuge's inland open water and inland fresh marsh and losses between 43 percent and 67 percent were modeled for salt marsh, hardwood swamp, and dry land on the refuge (McMahon 2006). Refuge mangroves were modeled to increase by 75 percent and open estuarine waters by 119 percent by 2100 (McMahon 2006). Although limited data were used to develop this model, the model does predict changes based on recent trends. Increased baseline data, increased coordination with the partners and additional climate change related modeling efforts [e.g., Sea, Lake, and Overland Surges from Hurricanes (SLOSH) models accurately model area flooding levels under storm scenarios], and refinement of the SLAMM model would improve the refuge's ability to predict potential impacts and enhance decision-making for the refuge.

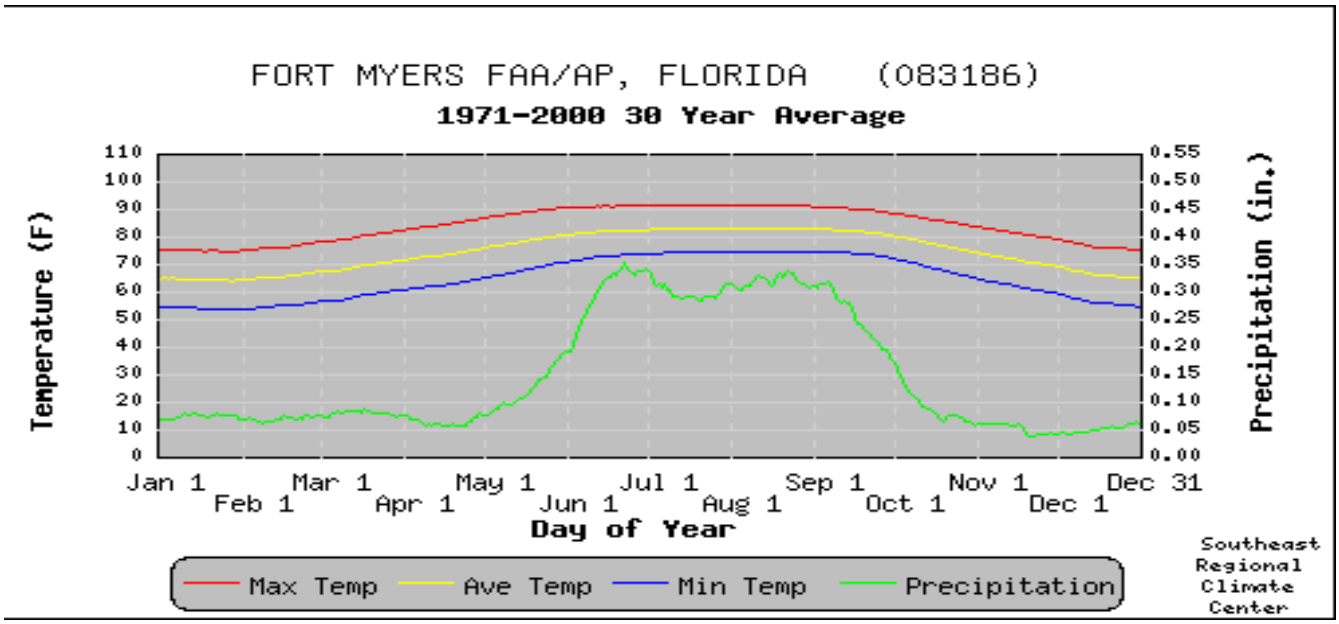
PHYSICAL RESOURCES

CLIMATE

The climate in the area of the refuge is subtropical and humid, with temperature extremes of both the summer and winter being tempered by the marine influence of the Gulf of Mexico. Much of peninsular Florida is in a latitudinal band that, globally, is desert. However, Florida and J.N. "Ding" Darling NWR are saved from this fate by being surrounded by water. Rising air, caused by heating of the Florida peninsula land surface, causes moist sea breezes to flow in from the coasts toward the center of the state, triggering thunderstorms and causing a summer rainy season. During the winter and spring months, when water off the coast is warm relative to the land and less heating of the ground surface occurs, the effect of the water is actually reversed, and rainfall tends to be suppressed, causing a distinct dry season. Cold northern air passing over water is warmed; hence the peninsula is also protected from the extremes of cold temperatures during the winter.

Air temperature and rainfall data collected at the Ft. Myers Federal Aviation Administration (FAA) Airport (Figure 10 and Table 5) were used to examine climatic conditions for the area around Sanibel Island. The Ft. Myers Airport is the nearest and longest running comprehensive meteorological weather station and is located about 15 air miles northeast of Sanibel Island on the mainland. At any period in time, Sanibel Island's temperatures and rainfall can vary from those at the Ft. Myers Airport. However, considering the over 75-year record of data at the Ft. Myers Airport, average temperatures and rainfall between the two locations are comparable. The average annual air temperature at the Airport is about 74 degrees Fahrenheit (^{o}F), and monthly averages range from 64°F in January to 83°F in August. Annual rainfall averages about 54-55 inches. Actual rainfall averages on Sanibel Island are about 42 inches per year, based on refuge rain gauge readings dating back 30 years. Almost two-thirds of the average annual rainfall occurs during the wet season (June-September), mostly the result of localized convective thunderstorms. Most summer thunderstorms are triggered by air rising off of the heated land surface and they often occur in the afternoon, especially where the sea breezes from the east and west coasts meet. Average temperature and rainfall data are presented in Table 5 and Figure 10.

Figure 10. Fort Myers Federal Aviation Administration Airport, Florida, 1971 - 2000 temperature and precipitation



- Maximum (Max) Temp. is the average of all daily maximum temperatures recorded for the day of the year
- Average (Ave) Temp. is the average of all daily average temperatures recorded for the day of the year
- Minimum (Min) Temp. is the average of all daily minimum temperatures recorded for the day of the year
- Precipitation is the average of all daily total precipitation recorded for the day of the year

Source:
Southeast Regional Climate Center Undated

Table 5. Temperature, precipitation, and snowfall summary Fort Myers Federal Aviation Administration Airport

Period of Record Monthly Climate Summary
Period of Record: 1/ 1/1931 to 6/30/2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (^{o}F)	74.7	76.1	79.9	84.2	88.6	90.5	91.1	91.4	89.7	85.7	80.2	76.0	84.0
Average Min. Temperature (^{o}F)	53.5	54.6	58.4	62.4	67.5	72.5	74.2	74.5	73.9	68.3	60.5	55.2	64.6
Average Total Precipitation (in.)	1.83	2.11	2.76	2.02	3.54	9.56	8.97	8.89	8.45	3.38	1.50	1.52	54.54
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Southeast Regional Climate Center Undated

Winters are mild, with many bright, warm days and moderately cool nights. There are frequent long periods during the winter when only very light, or no rain falls. Occasional cold snaps bring temperatures in the 30s^{o}F, but only rarely do temperatures drop into the 20s^{o}F. The lowest recorded temperature in the refuge area (at the Fort Myers weather station) was 26°F in December 1962. Frost occurs in the farming areas on the peninsula on only a few occasions each year, and usually is light and scattered. In the summer, temperatures have reached 100°F, but these occurrences are very rare. The highest recorded temperature in the area was 103°F in June 1981.

Summer thunderstorms are frequent. From June through September, they occur on two out of every three days on an average. Most rain during the summer occurs as late afternoon or early evening thunderstorms, which brings welcome cooling on hot summer days. These showers seldom last long, even though they yield large amounts of rain. During the late summer or fall, tropical storms or hurricanes may pass nearby and result in heavy downpours that may reach torrential proportions. Twenty-four-hour amounts from six to over 10 inches may occur. The highest one-day total at the Fort Myers weather station was 7.78 inches in September 1962.

The area in and around the refuge is hit periodically by tropical storms and hurricanes. Hurricanes are most likely in September and October, when the ocean temperature is warmest and humidity highest. Annually, over a hundred tropical waves develop in the Atlantic, Caribbean, and Gulf of Mexico, although generally fewer than ten develop into tropical storms, and only a handful become hurricanes. The landscape has repeatedly been sculpted by wind and waves from tropical cyclones.

Several major hurricanes (categories 3-5) have occurred in the area since 1900. The Great Miami Hurricane of 1926 first devastated Miami as a Category 4 storm then passed over San Carlos Bay and Captiva Island as a Category 3 storm. In 1944, an unnamed Category 3 storm passed west of the area, making landfall near the Sarasota County line. In 1960, Hurricane Donna made landfall as a Category 4 Hurricane near Naples and cut a path north to Ft. Myers and across the peninsula to re-enter the Atlantic Ocean near Daytona Beach. The storm track of the eye of Donna was east of the refuge, but the size of the storm was immense, and the Charlotte Harbor area was subjected to hurricane force winds for over four hours. Category 4 Hurricane Charley pounded the area in 2004. The right eyewall of Charley passed over North Captiva Island and severed it into two parts.

The prevailing wind direction is normally from the east and, except during the passage of tropical storms, high velocities are usually not experienced. During the winter and spring there may be a few days with 20 to 30-mile-per-hour (mph) winds and thunderstorms are sometimes accompanied by strong gusts for brief periods. Winds approximating 100 mph have been experienced with the passage of hurricanes during the fall months.

There is seldom a day without sunshine at some time. The sunniest months are April and May, with about a 75 percent of possible sunshine. Relative humidity is high during the night (~90 percent), dropping off in the middle of the day (~50 to 60 percent). Heavy fog is rather infrequent, occurring mostly in winter during the early mornings.

Measurable snowfall has never been recorded since records have been kept at Fort Myers, beginning in 1931.

CLIMATE CHANGE AND GLOBAL WARMING

According to NOAA and National Aeronautics and Space Administration (NASA) data, the Earth's average surface temperature has increased by about 1.2 to 1.4ºF since 1900 (U.S. Environmental Protection Agency June 16, 2009). In January 2008, NOAA reported that seven of the eight warmest years on record have occurred since 2001, part of a rise in temperatures of more than 0.6 degrees Celsius (°C) (1°F) since 1900. Within the past three decades, the rate of warming in global temperatures has been approximately three times greater than the century scale trend (NOAA 2008). If greenhouse gases, primarily carbon dioxide, methane, and nitrous oxide, continue to increase, climate models predict that the average temperature at the Earth's surface could increase from 3.2 to 7.2ºF above 1990 levels by the end of this century. (U.S. Environmental Protection Agency July 20, 2009)

The effect of climate change and global warming are anticipated to result in changes in weather/rainfall patterns, decreases in snow and ice cover, rising sea levels, and stressed ecosystems. For the southeastern United States and Gulf Coast, this could result in a variety of impacts, including increased loss of barrier islands and wetlands; increased risk of shoreline erosion and flooding due to sea level rise, storm surge, and extreme precipitation events; greater likelihood of warmer/dryer summers and wetter/reduced winter cold; and, alterations of ecosystems and habitats due to these changes in weather patterns.

Global warming, resulting in melting of glaciers and ice sheets, will cause sea levels to rise. NASA estimates that yearly, 50 billion tons of ice are melting from the Greenland ice sheet (National Aeronautics and Space Administration July 20, 2000). NASA aerial surveys show that more than 11 cubic miles of ice are disappearing from the Greenland ice sheet annually (Krabill et al. 2000). New satellite measurements reveal that the Greenland and West Antarctic ice sheets are shedding about 125 billion tons of ice per year (National Aeronautics and Space Administration August 12, 2009). Considering that land less than 10 meters above sea level contains two percent of the world's land

surface, but 10 percent of its population, major impacts in the U.S. will be felt by large numbers of people living on the low lying coastlands, particularly along the Gulf Coast. Worldwide measurements of sea level show a rise of about 0.17 meters (0.56 feet) during the twentieth century (National Aeronautics and Space Administration 2009).

The effects of rising sea levels are even more dramatic in Florida. Because of Florida's land subsidence, sea levels around south Florida have risen about 0.31 meters (1.0 feet) since 1846 and it is still rising today, at a rate that is equivalent to 0.20 to 0.40 meters (0.67 to 1.33 feet) per century (Ning et al. 2003 and U.S. Environmental Protection Agency Undated). That rate is 6 to 10 times faster than the average rate of sea level rise along the south Florida coast during the past 3,000 years. If the current trend continues without any additional global warming, the edge of the sea along the south Florida coast would climb another 7.6 centimeters (three inches) by 2025 and 25.4 centimeters (10 inches) by 2100. But, global warming is expected to accelerate this sea level rise even faster. During the next 15 years, the sea is likely to rise 12.7 centimeters (five inches), rather than 7.6 centimeters (three inches) (U.S. Environmental Protection Agency Undated). By 2100, the best available science indicates that south Florida seas will be approximately 20 inches higher than they were in 1990 (Ning et al. 2003 and U.S. Environmental Protection Agency Undated). At the very least, these rising sea levels will likely result in the loss of some refuge habitats and the transition of other refuge habitats to more open estuarine waters and mangroves (McMahon 2006) with increased beach erosion for Sanibel Island.

Consensus does not exist on how global warming will affect the frequency and severity of hurricanes and tropical storms, or change the frequency and strength of El Niño and La Niña events. Models suggest that tropical regions will probably receive less rain, but rain events will tend to be more intense. In Florida, rainfall patterns have changed in the last 100 years with rainfall declining in parts of south Florida, while increasing in central Florida and the panhandle; while El Nino events have coincided with periods of drought (U.S. Environmental Protection Agency Undated). Scientists are also not certain how global warming will affect the salinity of bays and estuaries. Warmer temperatures would increase evaporation, making them more saline. But if precipitation increases, more freshwater runoff would result in less salinity. Under either scenario, seagrasses, mangroves, and other native plants and animals on Sanibel Island and the refuge would likely be adversely impacted (U.S. Environmental Protection Agency Undated).

In addition to the rising seas, loss of wetlands, increased beach erosion, and changes in temperature and precipitation are also likely to affect south Florida's (and Sanibel Island's) plants and wildlife. To survive the climbing temperatures, both marine and land-based plants and animals have started to migrate towards the poles and towards higher elevations. Analysis of four decades of Christmas Bird Count observations reveal that birds seen in North America during the first weeks of winter have moved dramatically northward—toward colder latitudes—over the past four decades. Significant northward movement occurred among 58 percent of the observed species—177 of 305. More than 60 moved in excess of 100 miles north, while the average distance moved by all studied species—including those that did not reflect the trend—was 35 miles northward (National Audubon Society 2009). Those species that cannot migrate or adapt face extinction. The IPCC estimates that 20-30 percent of plant and animal species will be at risk of extinction if temperatures climb more than 1.5° to 2.5°C (National Aeronautics and Space Administration 2009). Computer models suggest that the overall climate of Florida may warm, resulting in more frequent extremely hot summer days and a longer growing season (U.S. Environmental Protection Agency Undated).

A warmer climate could allow heat-loving exotic plant species, such as the invasive Melaleuca, Chinese tallow, and Australian pine to expand their ranges. Rapid sea level rise could harm low-lying mangrove communities. Florida's mangrove forests also provide food, nesting, and nursery

areas for many animals—including more than 220 fish species, 24 reptile and amphibian species, 18 mammal species, and 181 bird species (U.S. Environmental Protection Agency Undated). In general, the response of mangroves to sea level rise depends on the type of mangroves, their environmental setting, the amount of freshwater available to maintain root growth, and the sediment supply. Mangrove communities in south Florida (including those on Sanibel Island and the refuge) already are affected by a number of stresses, including invasive Brazilian pepper plants, hurricanes, agricultural runoff, and human development. Climate change and a rise in sea level pose new stresses to these ecosystems, already in danger (U.S. Environmental Protection Agency Undated). In addition, the potential increased frequency of hurricanes or wildfires could accelerate the invasion of exotic, invasive, and nuisance species (Twilley et al. 2001). However, warmer winters lead to fewer frosts, consequently, tropical plants and trees that are vulnerable to cold temperatures may also benefit.

Warmer air or water temperatures can also impact animal species. Evidence suggests that the gender of sea turtles is determined by the surrounding temperature at critical stages in development, with warmer temperatures producing more females. Warmer temperatures could thus create reproductive problems for an already declining species (Mrosovsky and Provancha 1992). The majority of the native fish species in Florida are temperate species existing near the southern limit of their distribution range. However, almost all of the 28 exotic species established in Florida waters in recent years were subtropical or tropical (Courtenay 1994). A recent study of the effects of climate change on eastern U.S. bird species concluded that as many as 78 bird species could decrease by at least 25 percent while as many as 33 species could increase in abundance by at least 25 percent due to climate and habitat changes (Matthews et al. 2004).

GEOLOGY AND TOPOGRAPHY

The Florida plateau, which is the platform upon which Florida is perched, was formed about 530 million years ago by a combination of volcanic activity and marine sedimentation. Florida's geologic history begins deep beneath its surface where ancient rocks indicate that Florida was once a part of northwest Africa. As ancient supercontinents split apart, collided, and rifted again, a fragment of Africa remained attached to North America. Florida separated from the African Plat when the super-continent Pangaea rifted apart in the Triassic period (about 240 million years ago) and joined to the North American continent. This fragment formed the base for the overlying carbonate rocks which now include the Florida and Bahamas Platforms (Florida Department of Environmental Protection January 4, 2006).

The basement rocks of the Florida Platform include igneous, sedimentary, and volcanic rocks. A thick sequence of sediments lies upon the eroded surface of the basement rocks. Carbonate sedimentation predominated from mid-Jurassic until at least mid-Oligocene (186 to 38 million years ago) on most of the Florida Platform. From the mid-Oligocene to the Holocene (38 million years ago to recent time), renewed uplift and erosion in the Appalachian highlands to the north and sea-level fluctuations, resulted in deposits of quartz sand, silt, and clay sediments upon the carbonate-depositing environments of the Florida Platform. Numerous disconformities formed in response to episodic deposition and erosion resulting from sea-level fluctuations and Appalachian highland erosion.

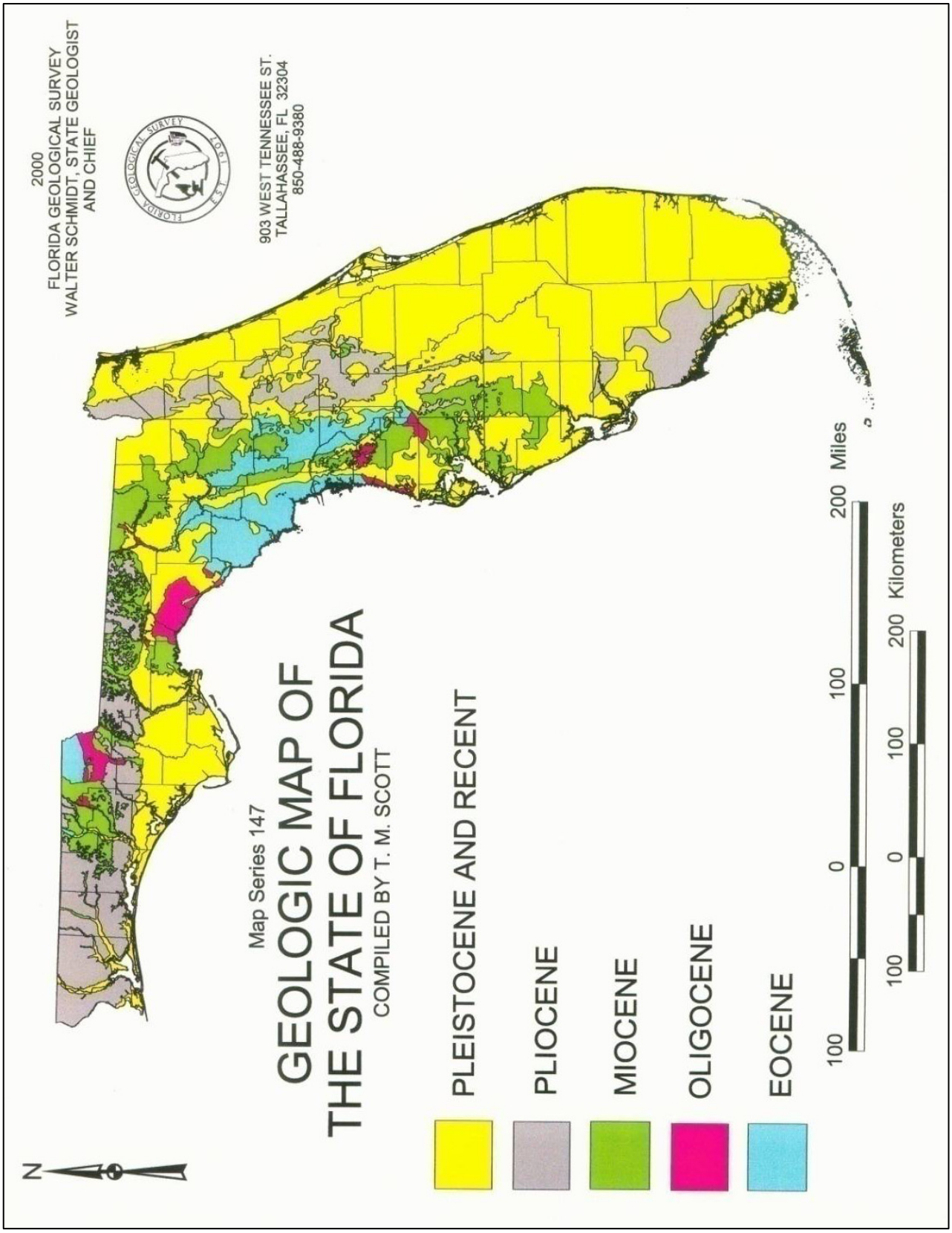
The oldest Florida sediments exposed at the modern land surface are Middle Eocene carbonates (60 million years old), called the Avon Park Formation, which crop out on the crest of the Ocala Platform in west-central Florida. Much of the state is blanketed by quartz sand, silt, and clay-bearing sediments that were deposited in response to Pliocene to Holocene (14 million years ago to recent time) sea-level fluctuations. The pattern of exposures of these younger sediments is obvious on Figure 11 (Scott, et al. 2001).

Florida experienced cycles of sediment deposition and erosion in response to sea-level changes throughout the last 65 million years. Florida's Cenozoic-aged sediments include two major groups. Older carbonate sediments formed due to biological activity that are mostly made up of whole or broken fossils including foraminifera, bryozoa, molluscs, corals and other forms of marine life. And more recent siliciclastic sediments (quartz sands, silts, and clays) eroded from the Appalachian Mountains which encroached upon the carbonate depositing environments. Thus, the sediments more recently deposited were primarily quartz sands, silts and clays with varying amounts of limestone, dolomite, and shell. In southern Florida, carbonate sediments still predominated because most of the siliciclastic sediments, moving south with the coastal currents, were funneled offshore. The area of the modern-day Everglades was a shallow marine bank where calcareous sediments and bryozoan reefs accumulated. These sediments compacted and eventually formed the limestone that floors the Everglades today (Florida Department of Environmental Protection 2006).

The land mass that is now southwest Florida remained shallowly submerged beneath the ocean until about fifteen million years ago when most of Collier and eastern Lee Counties emerged. Not until the Pleistocene Epoch, slightly more than one million years ago, did the coastal areas from southern Sarasota County to southern Collier County emerge and begin evolving into the coastline known today. (Most of Glades and Hendry counties also emerged during this epoch.) The emergence was caused principally by declining sea levels. Evidence exists however, that the global sea level has been rising since then. Sanibel Island is only about 5,000 years old (Clark 1976). It is located on a young marine plain (the Southern Florida Flatwoods Major Land Resource Area) underlain by Tertiary-age rocks, including very fine grained shale, mudstone, and limestone beds. A sandy marine deposit of Holocene age sediments occurs at the surface over most of Sanibel Island, as shown in Figure 12 (U.S. Department of Agriculture 2006).

Examination of Figure 13 allows identification of the major geologic subsurface formations occurring in the Sanibel Island region. The deposits at and near the surface include sand, shells, clay, and limestone generally less than 120 feet thick. Below these deposits is the Tamiami Formation of Pliocene Age which consists chiefly of gray and green clay and sandy clay. Thin beds of sandstone, sand, or limestone occur locally in the Tamiami and phosphorite is a common accessory mineral. Thickness of the Tamiami ranges from about 200 feet beneath central Sanibel to less than 100 feet beneath other parts of the Island. The Hawthorn Formation and Tampa Limestone of Miocene Age successively underlie the Tamiami Formation and range in thickness from about 300 feet beneath central Sanibel to about 400 feet beneath other parts of the Island. Both formations consist predominantly of gray and gray-white phosphatic limestone with interbedded marl or calcareous clay. Phosphorite is abundant with major concentrations in the lower part of the Hawthorn Formation. Below the Tampa Limestone, the Suwannee Limestone is usually penetrated 600 to 700 feet below land surface. This formation consists predominantly of tan limestone. The Suwannee Limestone may extend to 1,100 feet or more beneath Sanibel Island (U.S. Geological Survey 1982).

Figure 11. Geologic map of the State of Florida
(Scott 2000)



Southwest Florida can be divided into ten major physiographic provinces (Southwest Florida Regional Planning Council, June 2002). Four of these physiographic provinces surround and dominate the geology of Sanibel Island, as listed.

- Gulf Barrier Chain: The Gulf Barrier Chain is a string of barrier islands from Longboat Key to Cape Romano. It is believed that these islands formed as dune ridges and spits from sand supplied by coastal headlands, rivers, and formerly emergent areas of the continental shelf. As sea level rose during glacial retreat (beginning 6,000 to 8,000 years ago and ending between 3,000 and 5,000 years ago), the area flooded. Prior to this flooding the sea level was 100 meters lower than present and land extended 150 kilometers or more farther west. When the rise in sea level began to slow, 4,000 to 5,000 years ago, this sand was acted upon by winds, currents, and waves to form islands parallel to the shoreline. Sanibel Island which lies in this Province is believed to have formed from deltaic Holocene sediments and deposits composed chiefly of mollusk shells and is thought to be only 5,000 old (Clark 1976).
- Gulf Coastal Lowlands: Found in northwest Lee County, the Gulf Coastal Lowlands are composed primarily of marine sands and sediments, and are separated from the DeSoto Plain (to the north and east) by marine terraces that developed on the south side of the Peace River Valley. The transition from upland to shoreline occurs as a broad, gently southwestward sloping plain composed of depositional sediments of marine origin. These sediments are aligned generally parallel to the coastline, an arrangement that indicates their formation by marine forces. The Province ranges in elevation from sea level to about 50 feet above sea level. The generally flat lowland areas are characterized by wetlands interspersed with pine-palmetto flatwoods. The soils are deep and poorly drained. Streams and rivers are known as blackwaters (tea-colored) because of the presence of tannins (tannic acids) found in surface runoff due to local vegetation (including cypress, hardwood hammocks, flatwoods, and swamp and marsh vegetation) (Fernald and Purdum 1998).
- Caloosahatchee Valley: The Caloosahatchee Valley Province divides Lee County with the Gulf Coastal Lowlands province to the north and the Southwestern Slope Province to the south. It rises less than 15 feet in elevation. It extends east to west from Lake Okeechobee to the Lee County shoreline. It is underlain by clay, shell, and limestone deposits. The northern extent is marked by the descending scarp of the DeSoto Plain.
- Southwestern Slope: Southern Lee County is included in the Southwestern Slope Province. The Slope most likely originated as a marine terrace during periods of higher sea level. It varies in elevation from a high of 25 feet to sea level. The surface consists of shells, marls, and organic material underlain by limestone.

Topography is the result of natural forces acting upon regional geologic formations from ancient time until the present. It is an important aspect of a region's character and determines drainage patterns, flood limits, soil type, settlement history and potential, and vegetation and wildlife ranges. Sanibel Island itself is comprised of classical dune ridge and swale topography, with maximum elevation of less than 10 feet (Southwest Florida Regional Planning Council June 2002 and U.S. Geological Survey 2006).

Figure 12. Geologic map of the southern peninsula of the State of Florida
(Scott 2000)

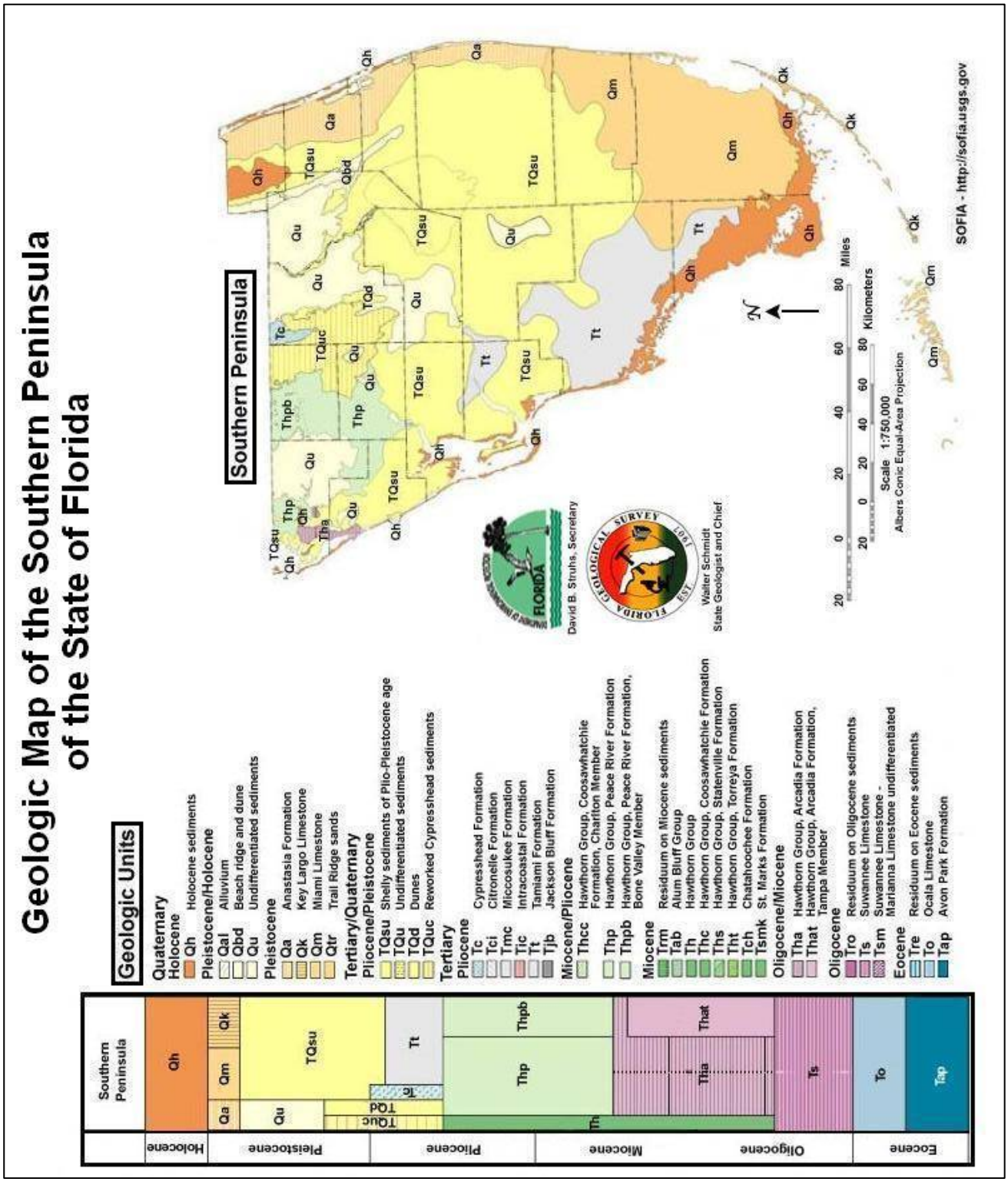
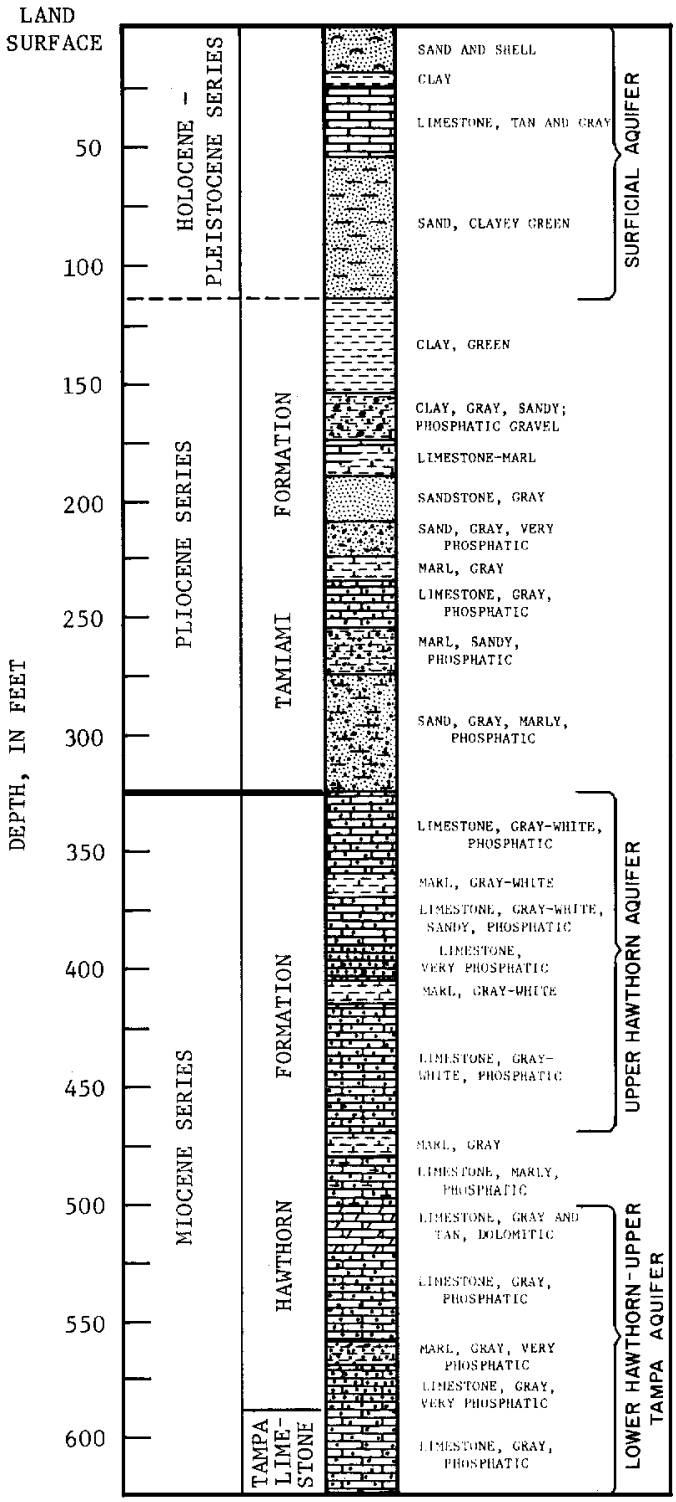


Figure 13. Generalized geology of Sanibel Island
(Boggess and O'Donnell 1982)



SOILS

Each type of soil is an indicator of preexisting conditions: (1) climate and (2) living organisms acting on (3) parent materials over (4) time as conditioned by (5) relief. In central and south Florida, the soils or uppermost sediments are geologically young and are surficial. The soil profiles reflect changes in sediment types, rather than development of chemically or mechanically produced horizons. One is likely to observe sands layered over marsh-produced calcareous marl, particularly in coastal areas. The taxonomic classification system of the U.S. Department of Agriculture, Natural Resources Conservation Service categorizes soil types by order, suborder, great group, subgroup, family, and soil series (U.S. Department of Agriculture 2008). Nationwide, there are 12 orders of soil, five of which dominate Florida's landscape: *Entisols* (7.5 million acres), *Spodosols* (8.4 million acres), *Ultisols* (6.9 million acres), *Alfisols* (4.6 million acres), and *Histosols* (4.0 million acres).

Narrow to broad bands of Sulfaquents and Hydraquents (both great groups of *Entisols*) and Sulfihemists (a great group of *Histosols*) occur along and near the west coast of Florida (U.S. Department of Agriculture 2006a and Collins 2009).

Most of the coastline of southwest Florida and the island of Sanibel is dominated by nearly level to sloping sandy beaches and adjacent sand dunes; and level, very poorly drained coastal marshes and swamps of variable-textured mineral and organic soils subject to frequent tidal flooding, primarily used for recreation and wildlife. The uppermost 20 to 25 feet of sediment on Sanibel Island is unconfined, consisting of quartz sand, shell, and some minor percentages of carbonate mud in lower beds. Because of extremely mobile conditions of the beach sediments, Sanibel's beaches have not developed soil strata. The western, Gulf side beaches consist of oxidized barrier sands and shells. The bay side beaches are composed of mud, organic materials, sands, and shells (Clark, 1976). Sanibel's soils are primarily *Entisols and Histosols.* The *Entisols* are the Canaveral soil series (Quartzipsamments great group) and the Captiva and Kesson soil series (Psammaquents great group) with marine deposits of sand and shell. These soils are characterized by rapid permeability (greater than 20 inches per hour) and a water table generally at depths of 10 to 40 inches below the surface for much of the year. Soils of the Canaveral series have developed in the interior (higher elevations) of the Island and refuge. They consist primarily of organic deposits over sands. Surface deposits of calcium carbonate soils (called marl) have helped seal the otherwise porous soil, thus impounding surface waters and retaining moisture – an important consideration for the flora and fauna communities on the Island. Captiva soils are fine sands that are found on broad low flat areas (often brushy areas) while Kesson soils are also fine sands but are found in lower lying tidal swamps and marsh areas. Within the boundaries of the refuge also exist *Histosols* of the Wulfert muck soil series (Sulfisaprists great group) consisting of well decomposed organic material and sand. These soils have high sulfur content and are typically found in the island's mangrove swamps (U.S. Department of Agriculture 2008) (Figure 14).

HYDROLOGY

The southwestern coast of Florida bordering the Gulf of Mexico is a low-energy, microtidal (less than 0.5 m tidal amplitude) region that is constantly changing as a result of active coastal processes that are directly linked to meteorological events. Wind-driven waves and tidal currents are the most important geological agents controlling sediment transport and evolution of the Gulf and bay shores. Astronomical tides in the Gulf of Mexico are mixed and typically have a range of less than 1 meter (m). More specifically, tides in Charlotte Harbor are a mixture of lunar (semidiurnal) and solar (diurnal) gravitational effects. Two unequal high and low tides occur daily, with an average range from about two to three feet. Water levels vary only about 0.5 m between high and low tide during a normal tidal cycle. Tide records around the Gulf since the turn of the century all show the same

general variations in sea level that coincide with droughts and periods of abnormally high rainfall. Averaging of the tide records shows that some areas, such as the west coast of Florida, are relatively stable because of the hard limestone substrates. Non-storm waves in the eastern Gulf of Mexico are normally less than 0.3 m high, and wave energy decreases to the north where the Gulf shore consists of marsh. Hurricane Charley in 2004 resulted in peak storm surges between 1.5 and 2 meters, mainly on the Lee County barrier Islands.

The surface water-ground water hydrology of large barriers islands, such as Sanibel Island, is complex. Only larger barrier islands have freshwater marshes in dune swales. Sanibel Island can be broken down into four distinct ecological zones: interior wetlands; mangroves; beaches; and upland-ridges (Figure 15). The interconnectedness of the surface/ground water hydrology is a major determining factor affecting the soils, habitats, and flora and fauna in all of these zones. The flow and exchanges of water between the zones determines the conditions that distinguish one zone from another (Clark 1976).

- Interior Wetland Basin Zone: The Interior Wetland Basin Zone is the interior bowl which serves as a freshwater reservoir. It is composed of parallel systems of ridges and swales with corresponding bands of vegetation. There are two sub-areas within this Zone - lowland and upland. The lowland area is composed of low ridges and wide swales, and it experiences extended periods of flooding each year. The upland area consists of higher, broader ridges and narrower swales, and is characterized by less frequent flooding and more upland vegetation types.
- Mangrove Zone: The Mangrove Zone includes all areas of red, black, and white mangroves, as well as the tidal flats and hardwood hammocks within them. Much of this Zone, including all areas of red mangrove, is subject to daily tidal flooding. Other areas of the Zone are subject to extended periods of flooding every year. The lower Mangrove Zone (red mangroves) is inundated daily by high tides; most of the upper Mangrove Zone (black mangroves) is flooded on spring tides; and the entire Zone is seasonally or annually flooded. Even the slightest amount of storm flooding will totally inundate this Zone.
- Beach Zone: The seawater in the Beach Zone rapidly percolates through the sand and shells into the water-table aquifer and into the shallow artesian aquifer. A 10-year storm flood inundates the entire beach and all other zones of the island, except the Gulf and Mid-island ridges. A 25-year flood inundates the entire Island.
- Upland-ridge: The Upland-ridge areas are inundated only during major hurricanes, and are the driest part of the Island. There is no naturally existing surface water here. All rain immediately percolates into the ground because of the high soil permeability and relatively high elevation.

Figure 14. Soil types of Sanibel Island
(U.S. Department of Agriculture 2009)

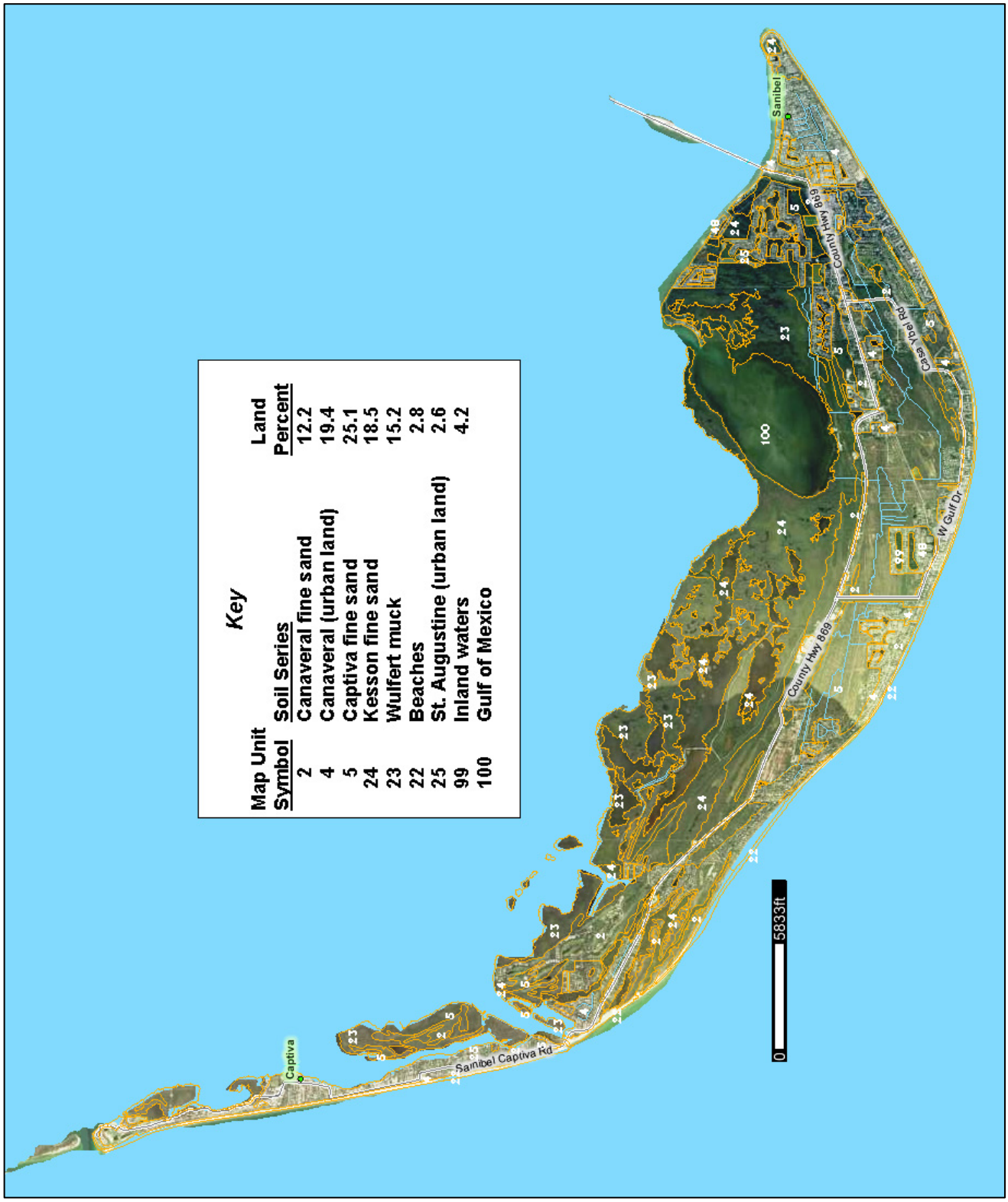
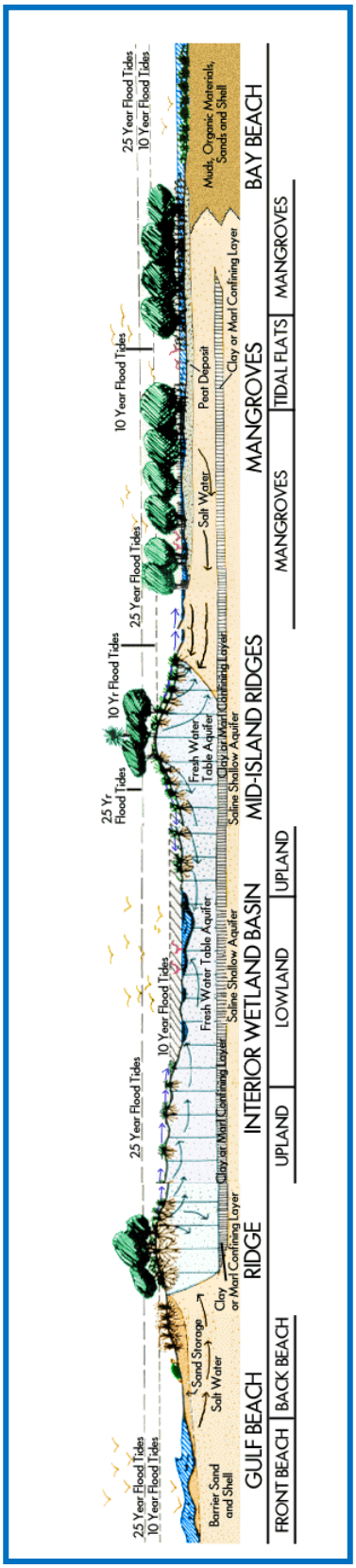


Figure 15. Physiography of Sanibel Island
(Clark 1976)



Surface Water

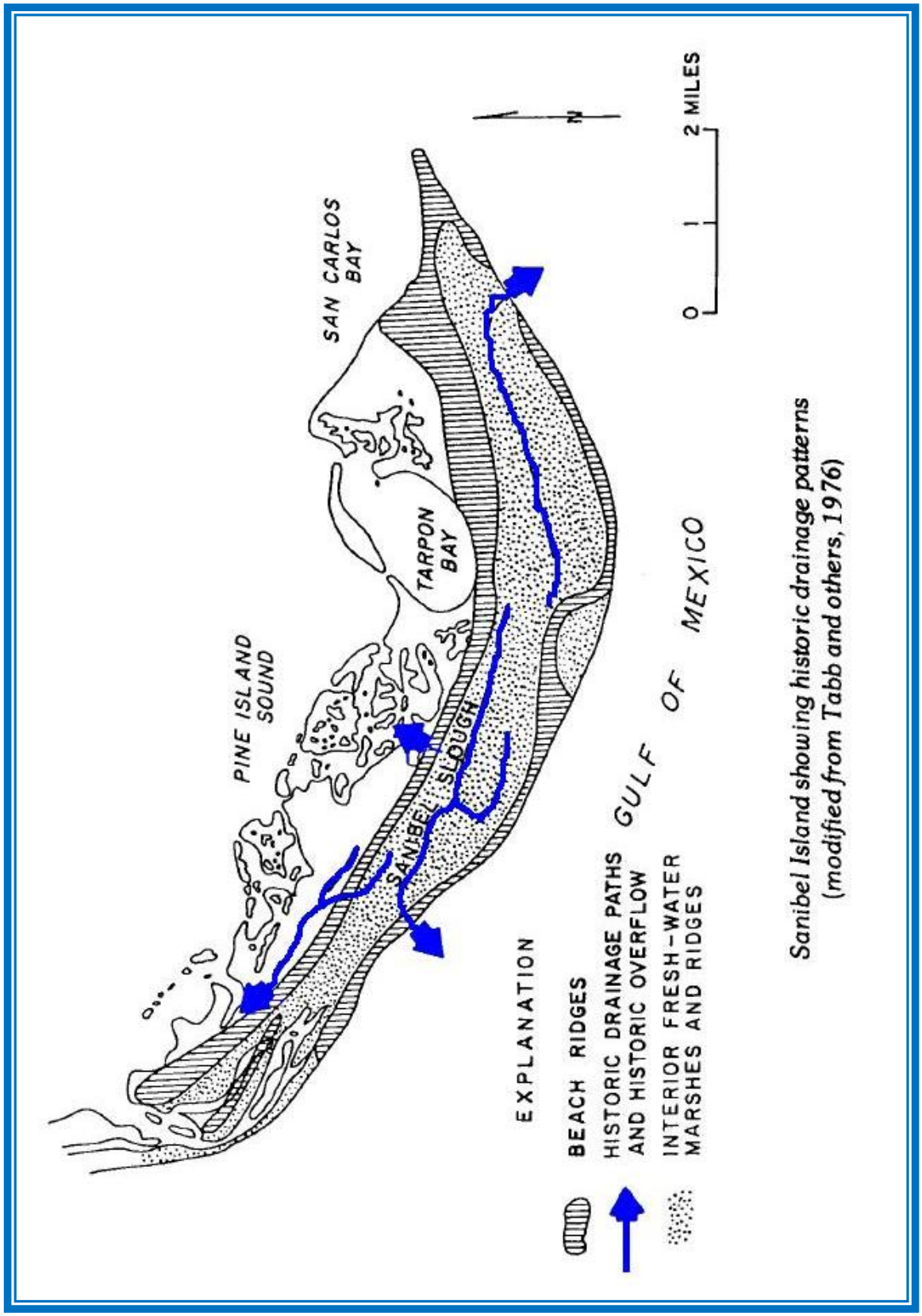
Because of the nearly instantaneous infiltration of rainwater, few barrier islands develop a natural type of channelized interior drainage system. Sanibel Island is different in that a partially channelized interior drainage system, the Sanibel River (more accurately a slough), developed rather late in its geologic history. Beach ridge geometry, variable permeability, and vegetation patterns all contributed to the formation of the Sanibel River at some time during the last 1,000 to 1,500 years of the Island's 5,000-year history. Before human alteration, the slough meandered over an irregular course nearly eight miles long. Two sub-basins were formed by segments of the slough. The western segment was separated by low beach ridges south of Tarpon Bay from the eastern segment. The system was unified only during the high water stages (Figure 16). The drainage characteristics of the eastern sub-basin differed considerably from the western sub-basin. In the east, the course of the Sanibel River was straighter, although it transected most of the low ridges at oblique angles. The only tributaries to the slough in the east were the natural swales transected by the slough. During low flow conditions, water in the eastern basin moved to the east, and during high water conditions it broke through the Gulf Beach Ridge and discharged into the Gulf of Mexico just west of Point Ybel. In the west, the slough meandered considerably because of the low relief of the ridges. There were several branches to the slough. During low flow conditions, water flowed to the west; and during high water, it broke through the Gulf Beach Ridge and discharged into the Gulf at a point about 2.5 miles east of the Blind Pass Bridge. Two other systems drained through mangroves to Pine Island Sound to the north, and through a series of interconnected ponds to tidewater to the west.

The Sanibel River was never a true stream but only a shallow drainage slough. Flow occurred only during times when the water table was high and infiltration of precipitation was inhibited. Under original conditions, the storage curve probably would have risen very slowly during May, June, and July because of spotty, generally light rains. In August through October, the generally heavier rains fell on a reservoir whose storage capacity was reduced substantially by fall high tides. If rains were sufficient, as they probably were nearly every year, washout occurred. If less substantial, the rise in interior storage would terminate in mid-to-late October and then decline through seepage and evapotranspiration until the next rainy season. Conceivably, in the eastern system, heavy rains of 10 or more inches could have raised the water table to four or five feet above mean sea level before washout. This freshwater drainage and storage system spawned the development of many wetland communities which depend on the seasonal changes and freshwater recharge to hold back the intruding saline waters.

Over the past 50 years, the natural drainage system of Sanibel Island has been channelized and expanded for a number of reasons. The former course of the Sanibel River has been modified – it was deepened and widened. A network of canals and ditches has been connected to the river. Apparently, the eastern sub-basin was terminated by a series of deep tidal canals at Beach Road, where a structure to control water level was built. The western sub-basin was extensively ditched, and the flow direction was reversed - discharge now occurs at Tarpon Bay through a water control structure. During high water conditions, water still may escape at the western part of the Island. Roads cross the channel at several locations, with small culverts running beneath them. The culverts do not provide adequate connections, and during high water conditions interior flooding sometimes occurs.

Sanibel Island's present drainage system has a pronounced effect on the water-table aquifer. Since the canals and ditches are dug through very permeable sand and shell, water in the water-table aquifer flows rapidly out of the aquifer and into the adjacent canal where there is a positive gradient. This discharge from the groundwater system has increased the rate of recession during the dry season, and has caused temporary depletion of storage in the aquifer. When the water table is high, a much greater quantity of freshwater is stored, and the wetland areas are filled with surface water. When the water table is low, the quantity of water in storage decreases and wetland areas tend to dry.

Figure 16. Natural surface drainage patterns of Sanibel Island
(Clark 1976)



Human activities have altered the surface hydrology in a large portion of the refuge as well by preventing tidal flow and fish passage and artificially impounding freshwater. During 1963, the Lee County Mosquito Control District, in cooperation with the refuge, built a dike through the estuary to create two impoundments to maintain water levels high enough to control salt marsh mosquito populations. As a result, the hydrology was dependent on local rainfall and runoff effectively impounding freshwater and reducing salinity levels.

During 2001, the refuge installed seven water control structures and box culverts along the levee which is now a paved, public-access road for wildlife viewing (i.e., Wildlife Drive) and the impoundments are passively managed during most of the year to allow tidal exchange from the north. Refuge staff conducts regular monitoring of hydrological and water quality conditions (i.e., conductivity, temperature, pH, and dissolved oxygen) in these impoundments and adjacent estuary bimonthly. Staff gauges have been installed and surveyed to sea level. Water level is recorded twice a month in each impoundment. Additionally, each impoundment is drawn down twice a year, once in the spring and once in the fall to coincide with the shorebird migrations in order to provide optimal feeding habitat. They are, however, not drawn down simultaneously. The East Impoundment is lowered in March and then again in September. The West Impoundment is lowered in April and then in October. During the draw-downs, water quality is monitored in the impoundment in draw-down and in the adjacent estuary at least weekly up to daily to preclude impacts to fisheries as result of low dissolved oxygen.

Additionally, a third impounded area was unintentionally created east of Alligator Curve on Wildlife Drive when a north-south powerline right-of-way (ROW) was constructed through the mangroves preventing hydrologic exchange from the east. Wildlife Drive prevents exchange from the west and natural ridges prevent exchange from the north and south. The impounded freshwater most likely contributes to the lack of seedling and sapling-sized mangroves in the area by preventing mangrove propagules and seedlings from becoming established. Mangrove propagules and seedlings cannot become established in standing water; they require tidal dry-downs (U.S. Geological Survey 2006). During 2004, Hurricane Charley caused catastrophic damage to the forest canopy resulting in degradation and loss of fish and wildlife habitat. Mortality of canopy-sized trees was in the range of 80 to 100 percent (Meyers et al. 2005). Loss of the canopy has allowed more light to reach the forest floor. However, the potential for natural mangrove regeneration in this area is low due to the lack of seedling and sapling sized individuals present at the time of the disturbance. The refuge seeks to install water control structures and culverts at Alligator Curve on Wildlife Drive and the powerline ROW to restore tidal flow and water movement in the project area and promote natural mangrove regeneration.

Groundwater

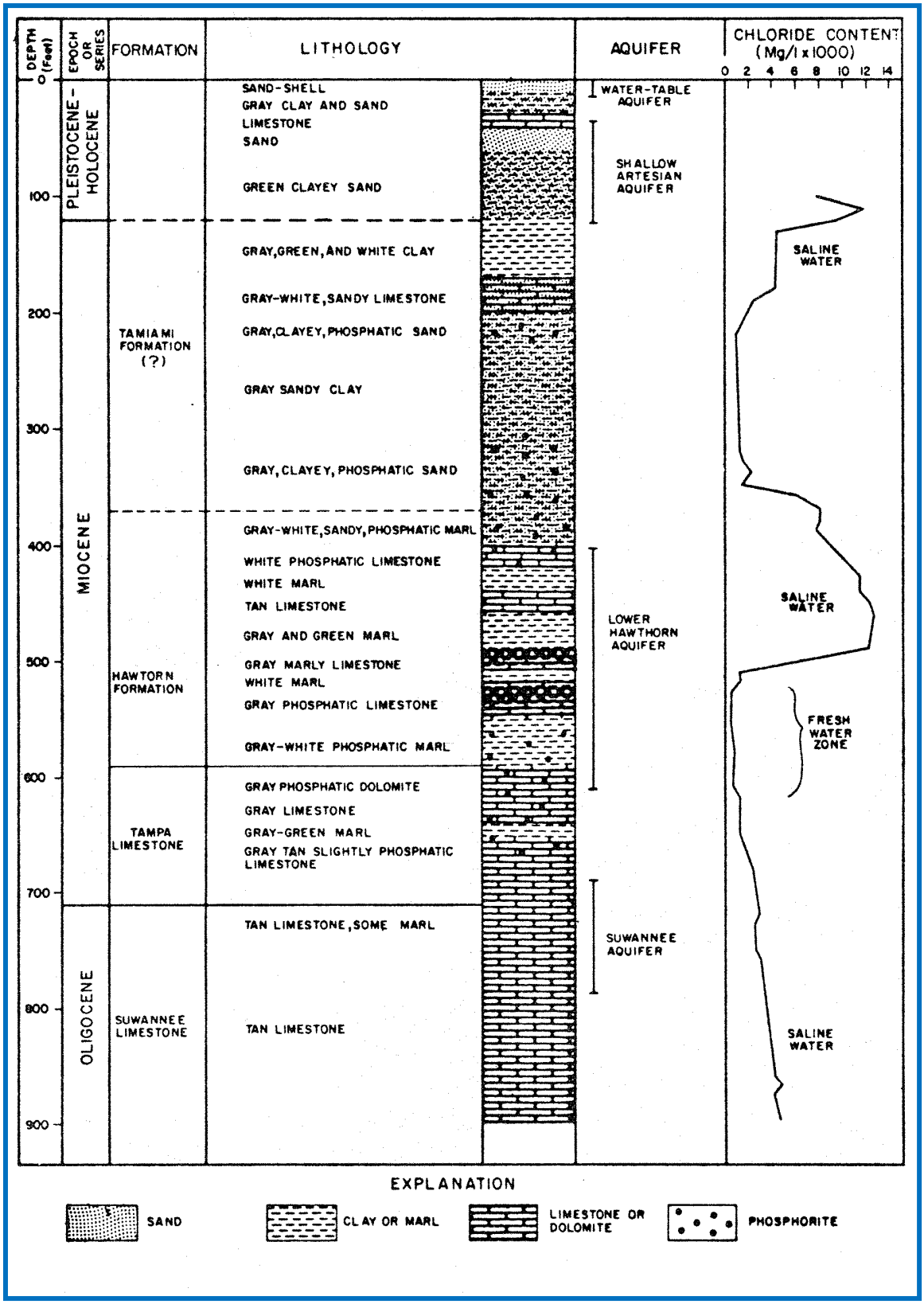
Table 6 lists the characteristics of the groundwater systems in Lee County (South Florida Water Management District 2000). There are at least four groundwater aquifers that underlay Sanibel Island (Figure 17). There is an unconfined surficial water table aquifer which is closely underlain by a shallow artesian aquifer in the Pleistocene Limestone. Collectively these two shallow aquifers are referred to as the Surficial Aquifer System (SAS). These shallow aquifers are underlain by at least two deep artesian aquifers: the Lower Hawthorn aquifer, and the underlying Suwannee aquifer. Collectively these two deep aquifers are referred to as the Floridan Aquifer System (FAS).

Table 6. Groundwater systems in Lee County

Aquifer System	Aquifer Unit	Thickness (feet)	Water Resource Potential
Surficial Aquifer System	Water Table Aquifer	20-80	Yields moderate amounts of high quality water but already heavily allocated. Susceptible to saltwater intrusion near the coast.
	Lower Tamiami Aquifer	0-140	Absent from northern Lee County. Where present, yields moderate to large amounts of high quality water. The coast is susceptible to saltwater intrusion.
Intermediate Aquifer System	Sandstone Aquifer	0-110	Yields large quantities of good quality water in south central Lee County, but is absent in the north and east.
	Mid-Hawthorn Aquifer	40-120	Yields small quantities of good quality water in Cape Coral and north of C-43. Elsewhere suitable only for microirrigation uses
Floridan Aquifer System	Lower Hawthorn/ Suwannee Aquifer	Insufficient data	Capable of high yields but requires desalination treatment. Some zones may be suited for aquifer storage and recovery.

Source: South Florida Water Management District 2000

Figure 17. Groundwater aquifers and lithology of Sanibel Island
(Clark 1976)



Unconfined, Surficial Water Table Aquifer

The uppermost 20 to 25 feet of sediment on Sanibel Island is unconfined, consisting of quartz sand, shell, and some minor percentages of carbonate mud in the lower beds. The saturated part of this layer is termed the Surficial Water Table Aquifer. Climatic factors primarily control water table fluctuations on Sanibel, with secondary effects caused by man's activities. The water table rises in response to recharge, and declines when water is discharged from the aquifer. The only natural source of freshwater recharge on the Island is rainfall. In the absence of freshwater recharge, saline water may recharge the aquifer laterally from the sea, through the surface water system, or from the underlying shallow artesian aquifer. Natural discharge from the aquifer includes evaporation, evapotranspiration, groundwater discharge to the sea, and discharge to streams or lakes. Some recharge to the aquifer results from man's activities, such as inflow from deep artesian wells; inflow of treated sewage effluent from golf course irrigation activities; and, to a lesser extent, septic tank discharges. Over 90 percent of Sanibel residents are hooked up to the central sewage system. Discharge from the aquifer also has been altered by man. A surface drainage system now discharges some water to the sea, and a minor amount of water is pumped for irrigation. When the water table is high on Sanibel, a much greater quantity of fresh water is stored, and the wetland areas are filled with surface water. When the water table is low, the quantity of water in storage decreases and wetland areas tend to dry. The freshwater stored in the Surficial Water Table Aquifer has a great natural variation in quality. Even small perturbations can result in upward pluming or other saline intrusions, and tidal overtopping sometimes occurs. Without an adequate quantity of freshwater stored within the Surficial Water Table Aquifer, the present flora and fauna on Sanibel Island could not exist.

Shallow Artesian Aquifer

The top of the Shallow Artesian Aquifer occurs between 25 and 30 feet below mean sea level in the Pleistocene Limestone. It is normally separated from the overlying Surficial Water Table Aquifer by a heterogeneous mud stratum, and separated from the lower artesian aquifers by carbonate clay beds in the Tamiami Formation. There are some areas where the upper confining bed is extremely thin, or does not exist. Leakage between the Shallow Artesian and the Surficial Water Table aquifers is possible in these areas. Water levels in the Shallow Artesian Aquifer fluctuate daily with the tides. The range of these fluctuations is a function of the distance to the nearest tidal water body, and the permeability of the Aquifer. Water levels in the Shallow Artesian Aquifer are not greatly responsive to seasonal water level variations in the overlying Surficial Water Table Aquifer. Water quality varies considerably in the Shallow Artesian Aquifer, but the entire Aquifer is saline. Chloride values often exceed concentrations in seawater, usually about 19,000 mg/l in the vicinity of Sanibel. These high chloride waters may have formed when the strata were originally deposited, or through downward leakage and selective osmotic differentiation. The lower chloride concentrations may be the result of partial flushing during deposition, or recent flushing. There is no known recharge to the Shallow Artesian Aquifer, other than possible downward leakage, which occurs only under special conditions. Leakage of water between the Shallow Artesian Aquifer and the Surficial Water Table Aquifer is strictly a function of head differential and vertical permeability. During high tide periods, the water level in the Shallow Artesian Aquifer usually stands above the water table, and potential leakage is upward. During the low part of the tidal cycle, the water level in the Shallow Artesian Aquifer usually drops below the water table, and possible leakage is downward. When the water table is high for an extended period, such as after heavy rainfall, the water table may remain above the artesian water level through numerous tidal cycles. To some degree, leakage between the two aquifers occurs continuously. The vertical permeability of the mud stratum is the primary control of the quantity leaked.

Lower Hawthorn and Suwannee Aquifers

Two deep artesian aquifers underlying Sanibel Island yield significant quantities of water: the Lower Hawthorn Aquifer and the Suwannee Aquifer. Neither aquifer is directly recharged on the Island. Regionally, the intermediate Lower Hawthorn Aquifer is the primary ground water resource in the Charlotte Harbor basin (Sarasota, Charlotte and Lee counties). The Lower Hawthorn Aquifer is positioned near the contact between the Hawthorn Formation and the underlying Tampa Limestone, while the Suwannee Aquifer lies near the contact between the Tampa Limestone and the underlying Suwannee Limestone. Artesian head pressure within these lower aquifers ranges from 16 to 32 feet above mean sea level on the Island. The highest head occurs on the eastern part of the Island and decreases to the west. Daily fluctuations of one to two feet occur due to tidal and atmospheric pressure variations. The Lower Hawthorn and Suwannee aquifers generally contain saline water - or water that has at least 1,000 milligrams per liter (mg/l) of dissolved solids. The water in the upper part of the Lower Hawthorn Aquifer is highly saline. A relatively thin zone of freshwater containing 600 mg/l to 1,000 mg/l of dissolved chloride occurs near the base of the Lower Hawthorn Aquifer. Dissolved chloride concentrations in the Suwannee Aquifer are nearly 1,000 mg/l at the top of the Aquifer, and increase progressively with depth. Extreme variations of water quality in each aquifer occur from well to well on the island. The freshwater zone occurs at different depth intervals in nearly every well, and sometimes does not occur at all. Little is known about other characteristics of these aquifers, such as transmissivity, storage coefficient, sustained yield, draw-down, or permanence of quality. Some artesian wells on Sanibel leak, discharging poor quality water into fresher zones.

AIR QUALITY

The Clean Air Act of 1970 (as amended in 1990 and 1997), required the EPA to implement air quality standards to protect public health and welfare. National Ambient Air Quality Standards (NAAQS) were established based on protecting health (primary standards) and preventing environmental and property damage (secondary) for six pollutants commonly found throughout the United States: lead, ozone, nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter less than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$).

The Florida Division of Air Resource Management operates National Ambient Monitoring Stations (NAMS) and State and Local Ambient Monitoring Stations (SLAMS) to measure ambient concentrations of these pollutants. In 2006, ambient air quality data were collected by 216 monitors (in 34 counties) strategically placed throughout the State (Florida Department of Environmental Protection 2006). Areas that meet the NAAQS are designated attainment areas, while areas not meeting the standards are termed non-attainment areas. While no pollutant monitoring data are being collected on the J.N. “Ding” Darling NWR per se, air quality is monitored on a regular basis by four monitors in the Charlotte Harbor (Lee County) area, and by 25 monitors in the counties within 100 miles of the refuge. Florida's 2006 monitoring results indicate that all of the Charlotte Harbor area (in fact all of Southwest Florida) qualifies as an attainment area for all monitored pollutants (Florida Department of Environmental Protection 2006).

The Air Quality Index (AQI) is a summary index developed by EPA for reporting daily air quality. It tells how clean or polluted the air is and what associated health effects of concern might be. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. (Lead is also considered a major air pollutant under the Clean Air Act. However, because all areas of the United States are currently attaining the NAAQS for lead, the AQI does not specifically address lead.) For each of these pollutants, EPA has established national air quality

standards to protect public health (AirNow 2009). Between 1999 and 2006, the Charlotte Harbor (Lee County) area averaged 337 days each year with good or better air quality, better than 80 percent of the counties where monitoring is now conducted. In addition the air quality index data show that air quality has been improving during these last several years (Florida Department of Environmental Protection 2006).

The current sources of air pollution in southwest Florida are area-wide resulting primarily from automobiles in urban areas and land clearing activities. Auto emissions per car are down, but the number of cars is increasing. Fortunately the number of large industrial polluters is limited in southwest Florida. Although the area has a small number of industrial smokestacks, there is considerable pollution from automobiles and smaller licensed emitters throughout the region.

WATER QUALITY AND QUANITY

Water Quality

Water quality concerns relate to freshwater releases from the Caloosahatchee watershed and from Lake Okeechobee, bacteriological quality in relation to Sanibel Island's beaches, shellfish harvesting and red tides, and cultural eutrophication, as well as to impaired water bodies, saltwater intrusion, mercury contamination, and pesticides and polychlorinated biphenyls.

Freshwater Releases from the Caloosahatchee Watershed and Lake Okeechobee

Historically, the Caloosahatchee River was a shallow, meandering 50-mile-long river originating in the natural marshlands west of Lake Okeechobee. This watershed includes a pristine mangrove-dominated estuary, a habitat unique in the continental United States. Mangroves support fish and macroinvertebrate communities by providing protected nursery areas and food for a multitude of important commercial and recreational marine species (U.S. Geological Survey 2006).

In 1881, a canal (C-43) was dredged to connect the Caloosahatchee River to Lake Okeechobee. After the initial dredging, three lock-and-dam structures were added to control flow and stage height in the lake and canal (South Florida Water Management District 2009, Florida Department of Environmental Protection 2008a). The Caloosahatchee Estuary is connected to Lake Okeechobee by the Caloosahatchee River (C-43 Canal), a man-made connection to the lake originally created in the late 19th century. As part of the "Central and Southern Florida Project for Flood Control and Other Purposes," the Caloosahatchee River was widened and deepened to ensure that high water levels in Lake Okeechobee can be managed to prevent harmful high water levels in the lake and flooding in adjacent areas (U.S. Army Corps of Engineers 2007). The river is no longer free-flowing and is operated as two "pools" maintained at different elevations between the major water control structures. These actions provided a navigable connection between the west coast of Florida and Lake Okeechobee, and also made the Caloosahatchee Estuary one of the major outlets for water draining from the vast Upper Kissimmee and Lake Okeechobee Basins (South Florida Water Management District 2009).

These changes opened the area to agricultural and urban development, increasing the demand for dry land, better flood protection, and consistent water supply. A limited network of local canals now provides flood control and water supply conveyance to accommodate citrus groves, sugar cane, cattle grazing, and rural/urban areas. Residents and businesses continue to rely on the river as a primary source for irrigation, drainage and potable water (South Florida Water Management District 2009).

The river now extends 71 miles from Lake Okeechobee to San Carlos Bay. The river is managed by the three locks, the most downstream of which also serves as a barrier to salinity and tide within the 26-mile-long estuarine portion of the Caloosahatchee River. Water releases from Lake Okeechobee occur through a series of locks when lake levels exceed the USACE criteria for flood protection (U.S. Geological Survey 2006). Over the last century, a number of factors have led to adverse changes in the hydrology and water quality of Lake Okeechobee, as well as to the Caloosahatchee and St. Lucie rivers and estuaries. These include changes in land use within the upstream Kissimmee River Basin; the construction of the regional water management network for flood control (the Central and Southern Florida public works project built by the USACE); loss of available surface water storage; and the subsequent flow of nutrient-enriched local runoff into the water bodies (South Florida Water Management District 2009).

While making way for growth, channelization of the Kissimmee River removed regional storage upstream of Lake Okeechobee. As nutrient-enriched runoff from agricultural and urban activities within the watershed flowed into the lake, its water quality suffered. Earlier, completion of the Herbert Hoover Dike in 1937 greatly reduced the extent of the lake's natural littoral or shoreline marsh areas, reducing overall lake surface area by a third and, thereby, significantly reducing the lake's available and historical storage capacity. Construction of the protective levee system, along with drainage and development efforts to the south, reduced the natural expanse of the Florida Everglades' wetland area by 50 percent, constraining flow south from Lake Okeechobee. Because the volume of water coming from the upstream basin has remained relatively constant, approximately 3.5 million-acre-feet per year, on average, equivalent to about 7.5 feet over the lake surface area, inflows have often exceeded Lake Okeechobee's limited present-day storage capacity. With discharge capacity to the southern part of the Everglades ecosystem reduced because of constructed alternations to the natural system, along with legal and environmental operating constraints, the need to discharge water from the lake to the east (via the St. Lucie River and Estuary) and west (via the Caloosahatchee River and Estuary) has increased. These coastal discharges of excess lake water – driven by the need to maintain safe lake levels in accordance with federal regulations and the USACE operating schedule for Lake Okeechobee – can cause detrimental fluctuations for the delicate estuarine environment (South Florida Water Management District 2009).

Adverse ecological impacts in the estuary have occurred as a result of hydrological changes in the timing, distribution, quality, and volume of freshwater released into the estuary from the watershed and Lake Okeechobee. Currently, two key conditions are negatively impacting the waterway's overall health. First is the delivery of freshwater to the estuary. The Caloosahatchee Estuary often receives excessive freshwater discharges from its local watersheds, especially during the wet season. This situation is sometimes exacerbated by regulatory discharges from Lake Okeechobee. Conversely, there are often periods during the dry season when flows from the Caloosahatchee River to the estuary stop completely. During drought periods when irrigation demands are high, little or no water is released to the river. Due to the deprivation of freshwater, estuarine salinity levels rise, which impacts seagrasses and oysters. The combination of an excess of freshwater during the wet season and a lack of discharge during the dry season lead to exaggerated seasonal and short-term fluctuations in salinity throughout the entire estuary. The fluctuations in salinity in any one region of the estuary can exceed the physiological tolerance limits of the organisms that normally live there, causing stress and/or mortality (South Florida Water Management District 2009).

Currently, there is not enough storage capacity in the regional water management system to minimize or prevent the possible harmful effects of periodic high volume discharges of freshwater to the Caloosahatchee Estuary. Conversely, during dry periods, there is sometimes not enough freshwater available in the regional system to maintain desirable salinity levels in the estuary. The combined result of too much and too little freshwater flowing to the Caloosahatchee Estuary

is a degraded estuarine ecological community, characterized by declines in the abundance and diversity of native finfish and shellfish populations and other marine and estuarine species, poor water quality, and reductions in the extent of submerged habitat suitable for sea grass and oysters (two primary indicators of healthy estuarine communities in south Florida) and other higher trophic level species, including threatened and endangered species (e.g., manatees, wood storks) (U.S. Army Corps of Engineers 2007).

Environmental conditions have declined sharply in the Caloosahatchee Estuary area due to flood control and water management actions in the study area. Without actions taken to reduce the effects of too much and too little freshwater entering the Caloosahatchee Estuary at the wrong times, the estuarine ecosystem will continue to be degraded with the potential for some estuarine species to disappear entirely. Ecologically damaging discharges of basin runoff and flood control releases from Lake Okeechobee will continue during wet periods, causing periodic unnatural low salinity levels in the Caloosahatchee Estuary and adjacent estuarine and marine areas, including adjacent parks, refuges, preserves, and other publicly owned and managed areas. The net ecological effect of continued degradation of the Caloosahatchee Estuary will be further loss and limited possibility for recovery of primary and secondary productivity, including forage and nursery areas in submerged habitats and adjacent wetlands. The reduction in the abundance and spatial distribution of primary organisms such as submerged vegetation, invertebrates, small fish, and other prey organisms normally part of a healthy estuarine community will continue to be adversely impacted and be magnified in higher-level organisms such as pelagic fish, marine mammals, birds, and other aquatic-dependent wildlife (including threatened and endangered species) (U.S. Army Corps of Engineers 2007).

Consequently, the quantity, quality, and timing of these freshwater discharges from Lake Okeechobee into the Caloosahatchee River and Estuary are dramatically impacting the ecosystems in San Carlos Bay, Matlacha Pass, Pine Island Sound, Tarpon Bay, and the J.N. “Ding” Darling Wilderness.

A second problem is excessive nutrient loading, which has resulted in eutrophication – typically indicated by blooms of algae, low dissolved oxygen and periodic fish kills. Excess nutrient loading has been a concern since at least the 1980s, when the state determined that the Caloosahatchee Estuary had reached its nutrient loading limits. More recently, blue-green algae blooms, red tides, and massive accumulation of drift algae have indicated that nutrient loads to the Caloosahatchee Estuary are too high (South Florida Water Management District 2009).

Land use changes and drainage practices within the watershed have contributed to elevated nutrient concentrations in the Caloosahatchee River Watershed. Nearly 35 percent of the drainage area is characterized as natural lands (e.g., upland forests, wetlands, barren and open lands). Key developed land uses include improved pasture, citrus, sugarcane, and other agricultural operations; urban areas; and open water. Today, nutrient-ladened surface water runoff from subdivisions, farms, and cities, along with underground septic tanks and discharges from sewage treatment plants, carry high amounts of nitrogen and phosphorus into the river and estuary (South Florida Water Management District 2009).

The result of nutrient loading combined with too much or too little freshwater flowing to the Caloosahatchee River is a degraded estuarine ecological community. Documented signs include declines in the abundance and diversity of marine and estuarine species, degradation of water quality, increased phytoplankton and benthic algae, and a reduction in submerged habitat such as oyster and seagrass beds. A lack of suitable habitat causes stress for seagrass and oysters (two primary indicators of healthy estuarine communities in south Florida), as well as threatened and endangered species such as manatees and wood storks. Urbanization and shoreline

development have also resulted in an extensive loss of mangrove habitat along the estuary. Mangrove destruction results in a chain of reactions that affect estuarine and offshore productivity (South Florida Water Management District 2009).

Freshwater releases from Lake Okeechobee in the San Carlos Bay area have degraded and damaged over 10,000 acres of seagrass beds near the mouth of the Caloosahatchee River. This negatively impacts habitat federally designated as critical to the endangered West Indian manatee and the endangered smalltooth sawfish, as well as negatively impacting sea turtles and numerous fisheries, including pink shrimp, sea trout, blue crab, and grouper; as well as destroying oyster beds, commercial clam beds, and virtually all other filter feeding organisms ranging from barnacles to sponges and corals (City of Sanibel 2009a).

A Case in Point

Releases of freshwater from Lake Okeechobee at rates of up to 22,000 cubic feet per second (cfs), into the Caloosahatchee River and subsequently into San Carlos Bay, occurred in 2004. The average discharge of freshwater from the Caloosahatchee River is approximately 2,000 cfs. Discharges greater than approximately 4,500 cfs lower salinity concentrations to 20 parts per thousand (ppt) or below in San Carlos Bay – lower than optimum for shoal grass and turtle grass survival. The 2004 freshwater releases from Lake Okeechobee not only lowered the salinity of San Carlos Bay, but also increased the nutrient levels (nitrogen and phosphorus) in the Bay and in waters of the refuge. The lower salinities reduced seagrass cover and higher nutrient concentrations initiated red, green, and blue-green algal blooms. The decomposition of dead and decaying algae and seagrasses lowered the dissolved oxygen concentrations in the water, resulting in the loss of fish habitat. In addition, nutrient induced algae blooms and the resulting hypoxia caused extensive fish kills in the Caloosahatchee River and San Carlos Bay. The carpet of filamentous red and green algae is not only unsightly on sandbars, beaches, mudflats, and seagrass beds, but in the long term the loss of habitat could adversely impact the refuge's bird, fish, and shellfish populations.

(City of Sanibel 2006a and 2009b)

Control of salinity, nutrient, and sediment concentrations to protect the habitat diversity and the health of aquatic ecosystems of San Carlos Bay and the refuge is complex. Ecosystems consist of literally hundreds of thousands of species of plants and wildlife that are interconnected in a complicated dance of life. Any man-made intervention can potentially have a domino effect on the entire system. All of which means there are no simple solutions to the effects of freshwater releases from Lake Okeechobee. The quantity, quality, and timing of releases from Lake Okeechobee and the subsequent effects must all be considered and management plans developed to address a variety of weather (wet and dry) conditions and coordinated with and amongst a variety of partners.

Bacteriological Quality and Sanibel Island's Beaches

The Florida Healthy Beaches Program has collected bacteriological data from Sanibel and Captiva beaches that included Blind Pass, Bowman's Beach, Lighthouse Beach, Sanibel Causeway, South Seas Plantation, and Tarpon Bay Beach from August 2000 to the present. Since August 2002 Enterococci and fecal coliform bacteria have been collected weekly (FDOH 2009a). Two Sanibel beaches (i.e., Bowman's Beach and South Clam Bayou) have occasionally been closed by the Lee

County Health Department when routine water quality tests indicated beach water quality did not meet the Enterococcus bacteria criteria recommended by EPA. Concentrations of Enterococcus bacteria exceeding 100 colonies per 100 milliliters of sample have been found at both beaches. Possible sources of the bacteria could be a local, privately owned leaking package plant; septic tanks; storm water run-off; and/or local wildlife -- and all are being studied (FDOH 2009b).

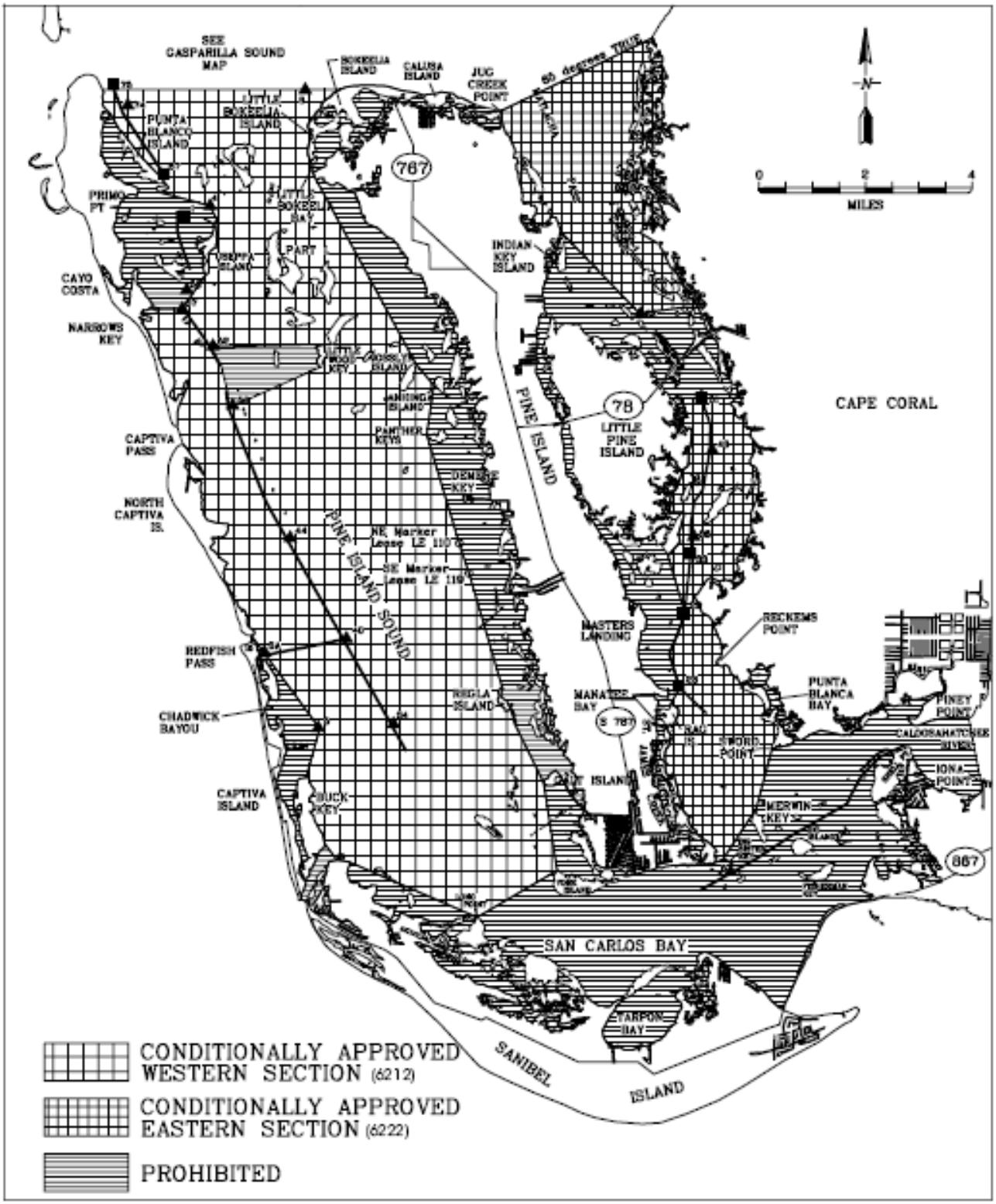
Approximately half of the homes on Captiva Island use septic tanks and the other half use four private sewer plants. The city of Sanibel recently invested $64 million in a central sewer collection and treatment system and is in the final phase of converting the entire Island from septic and privately owned package plants to a central sewer collection and treatment system. This upgrade and expansion includes a 2.4 million gallon per day water reclamation facility, and has an estimated completion date of 2010-2011. In the interim, Sanibel continues to monitor wastewater facilities to insure compliance with water quality regulations (City of Sanibel 2009c).

Shellfish Harvesting and Red Tides

Most of San Carlos Bay (including Tarpon Bay and the waters adjacent to the east coast of Sanibel Island) is closed to shellfish harvesting because of the risk of bacterial contamination from pollutants carried in runoff from the land and the Caloosahatchee River, Figure 18. Consuming shellfish from such waters could result in a variety of illnesses, ranging from diarrhea to infectious hepatitis. To protect public health, it is actually against the law to possess shellfish, such as oysters or clams, taken from waters that are closed to shellfish harvesting. In July 2006, 10 Sanibel visitors became ill from eating clams harvested from area waters. And the Lee County Health Department declared a local epidemic, requiring businesses to put up public warning notices (City of Sanibel 2006b). Two areas of lower Charlotte Harbor, Pine Island Sound and parts of Matlacha Pass, are conditionally approved for shellfish harvesting, however, these areas are typically closed to harvesting following heavy rains, which wash bacteria-laden pollutants into the water. Information about the status of these two conditionally approved harvesting areas is available by calling the state's Aquaculture Office, Mr. Sherman Wilhelm, Director, Division of Aquaculture (Florida Department of Agriculture and Consumer Services 2009).

Red tides occur in the Gulf of Mexico almost every year, generally in the late summer or early fall. They are most common off the central and southwestern coasts of Florida. The Florida red tide organism, *Karenia brevis*, produces a toxin that can kill marine animals and affect humans. Scientists have studied this organism for more than 50 years. The Florida red tide organism was identified in 1947, but anecdotal reports of the effects of red tide in the Gulf of Mexico date back to the 1530s. Most blooms last three to five months and may affect hundreds of square miles. Occasionally, however, blooms continue sporadically for as long as 18 months and may affect thousands of square miles. Red tides can kill fish, birds, and marine mammals; cause health problems for humans; and adversely affect local economies. When *K. brevis* reaches cell counts of 5,000 cells per liter of seawater, shellfish beds in the area are closed, sometimes for months at a time, until it is safe to harvest again. A protracted and intense red tide (*K. brevis*) bloom affected the west coast of Florida from Tampa to Fort Myers and surrounding waters during 2005 (Florida Fish and Wildlife Conservation Commission 2009b).

Figure 18. Shellfish harvesting in lower Charlotte Harbor
(Florida Department of Agriculture and Consumer Services, Division of Aquaculture 2004)



Cultural Eutrophication

The entire Charlotte Harbor watershed is contributing to the cultural eutrophication of the harbor's estuarine waters. The explosive population growth in the watershed has stimulated economic growth, resulting in stormwater runoff from residential development, intensive agriculture practices, and phosphate mining activities. Estuarine water quality in the Pine Island Sound-San Carlos Bay area has been impacted. Median concentrations of total nitrogen, ammonia ion-NH_4, organic nitrogen, and chlorophyll-a are all greater than statewide medians (Florida Department of Environmental Protection 2002a). Eutrophication links an array of ecological problems, including algal blooms, loss of seagrass, fish kills, and shellfish and benthic organism declines – all contributing to a serious disruption of the entire estuarine food web of flora and fauna (e.g., fish, birds, and mammals). Information collected during 2002 in EPA's National Estuary Program Coastal Condition Report rated the overall condition of Charlotte Harbor as fair, based on three indices. The water quality index rated poor; the sediment quality index rated good; and, the benthic quality index rated fair. The water quality index, which rated poor, was based on five indicators: nitrogen, phosphorus, chlorophyll a, water clarity, and dissolved oxygen. Elevated phosphorus and poor water clarity contributed to the Harbor's poor water quality condition. The report noted declines in dissolved oxygen levels and major increases in total suspended solids in the southern portion of the Harbor (EPA 2007c).

Impaired Water Bodies

Section 303(d) of the Clean Water Act (CWA) requires the State of Florida to list waters that do not meet applicable water quality standards so as to protect human health and aquatic life. In addition, the CWA requires the establishment of Total Maximum Daily Loads (TMDLs) for those waters on a prioritized schedule. Water bodies that do not meet water quality standards are identified as "impaired" for the particular pollutants of concern (e.g., nutrients, bacteria, and mercury). For impaired water bodies, TMDLs are developed to establish the maximum amount of a pollutant that a water body can assimilate without causing exceedances of water quality standards. As such, development of TMDLs is an important step toward restoring waters to their designated uses. In order to achieve the water quality benefits intended by the CWA, it is critical that TMDLs, once developed, be implemented as soon as possible.

The South Florida Water Management District has identified Sanibel Island as an impaired water body due to nutrient pollution (South Florida Water Management District 2008). The Sanibel River has for years received domestic wastewater and stormwater runoff from the Island's more developed areas, resulting in excessive growth of aquatic vegetation and depletion of dissolved oxygen. Although leachate from local package plants is being eliminated with the expansion and centralization of the city of Sanibel's wastewater collection system, stormwater runoff carrying large amounts of man made fertilizers remains a problem (Southwest Florida Regional Planning Council 2002). In 2007, the city of Sanibel approved a new city ordinance regulating the use of fertilizers containing nitrogen and/or phosphorus that provides specific management guidelines for fertilizer use to minimize potential negative aquatic impacts. (City of Sanibel 2007)

The water quality of the refuge and Sanibel Island is also impacted by the impaired upstream releases from Lake Okeechobee and the flows and runoff from the Caloosahatchee River watershed (as discussed above). Sections of Charlotte Harbor, Pine Island Sound, Matlacha Pass, Pine Island, and the Florida Gulf Coast, as well as segments of the Caloosahatchee River basin and Estuary and Lake Okeechobee, are also listed by the State of Florida as water quality impaired. TMDL development for Lower Charlotte Harbor Basin (including Sanibel Island) was initiated in 2008 for all of the parameters, except for mercury which is planned for

2011. TMDL development in the Caloosahatchee Basin was initiated in 2008 for nutrients and dissolved oxygen, and all other parameters in 2009. TMDL plans for phosphorous were initiated in 2001 for Lake Okeechobee.

Saltwater Intrusion

In addition to the nutrient additions, saltwater intrusion into Sanibel's ground and surface waters (predominantly the Sanibel River) is a major problem, and it has worsened as development has increased. The problem is caused principally by occasional high tidal surges which overtop the low beach ridges (especially on the northern, Tarpon Bay area of the Island) and by withdrawals of the freshwater from the interior basin of the Island, which reduces the hydrostatic head pressure, allowing saline groundwater water to intrude into the surficial freshwater aquifer. This was seen as early as 1926 when a severe hurricane hit Sanibel and Captiva Islands on September 18 and virtually ended commercial farming on the islands. Although this hurricane was not the most destructive hurricane to hit the islands, it was accompanied by 14-foot tides, which covered the entire land surface with salt water and salt deposits that took many years to leach out through the natural rain dilution processes. (Rhinesmith undated)

Mercury Contamination

The evidence of mercury contamination in fish and wildlife in south Florida freshwater and terrestrial ecosystems is extensive. Trends in mercury accumulation in south Florida, as evidenced by sediment profiles, show that atmospheric mercury deposition has increased approximately fivefold since 1900 (Rood et al. 1995). The deposition rate of mercury by rainfall measured today is at least double that of other remote sites in North America (Guentzel et al. 1995). Piscivorous freshwater sport fish and alligators in many watersheds, especially in the Everglades, have high mercury levels in their tissues (Ware et al. 1990, Eisler 1987). High mercury levels have been detected in the endangered wood stork and in other birds (Sundlof et al. 1994). There is concern that the 50-year decline in wading bird numbers in south Florida may be partially a result of increased mercury exposure; intensive studies are underway to further define this concern (USFWS 1999).

Excessive concentrations of mercury have been found in all of Florida's coastal waters, affecting commercial and sport-fishing interests. A much better understanding of local, regional, and global sources; amounts; and effects of mercury on Florida waters and fisheries is needed. Most Florida seafood contains low to medium levels of mercury. As a result, the State of Florida has issued human health advisories regarding consumption of fish for several species. "Do not Eat" advisories have been issued for all of Florida coastal and marine waters (including lower Charlotte Harbor) for king mackerel (*Scomberomorus cavalla*), all sharks, blackfin tuna (*Thunnus atlanticus*), cobia (*Rachycentron canadum*), jack crevalle (*Caranx hippos*), great barracuda (*Sphyraena barracuda*), and little tunny (*Euthynnus alletteratus*). Moderate risk and low risk fish consumption advisories have also been issued for a number of other marine and estuarine fish species. (More detailed information is available at the Florida Department of Health's website, http://doh.state.fl.us/floridafishadvice/.)

Pesticides and Polychlorinated Biphenyls

Pesticides have also been widely used in agricultural and urban areas in south Florida for more than 50 years to control insects, fungi, weeds, and other undesirable organisms. Because of year-round warm temperatures and a moist climate, Florida agriculture requires vigorous pest control, thus while Florida agricultural production ranks approximately 30th in the U.S., pesticide usage per acre is in the top five.

The compounds used vary in their toxicity, persistence, and transport. Since the late 1960s, persistent organochlorine pesticides have been detected in fish that are part of the Everglades food chain. Some more persistent pesticides, such as dichlorodiphenyltrichloroethane (DDT), Chlordane, Dieldrin, and Aldrin have been banned for use in the state, but their residues still occur in the environment. Although pesticides are usually applied to specific areas and directed at specific organisms, these compounds often become widely distributed and are potentially hazardous to nontarget species. Herbicides, including Atrazine, Bromocil, Simazine, 2-4-D, and Diuron, which have the highest rate of application, are among the most frequently detected pesticides in Florida's surface waters. By far the most frequently detected insecticides in surface waters are the chlorinated hydrocarbon ones that are no longer used in the state, such as dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), DDT, Dieldrin, and Heptachlor. These insecticides are also the most frequently detected pesticides in bottom sediments. Chlorinated chemicals, such as polychlorinated biphenyls (PCBs), dioxins, and furans, which are generated and used primarily in urban and industrial areas, pose serious concern to fish, wildlife, and human populations. Although most uses of PCBs have been banned since the late 1970s, these persistent chemicals are still found in the environment and continue to pose potential threats to fish, wildlife, and humans. In recent years, many organochlorine pesticides and PCBs have been linked to hormone disruption and reproductive problems in aquatic invertebrates, fishes, birds, and mammals (USFWS 1999).

Water Supply

Surface Waters

In a barrier island environment such as Sanibel Island, sufficient supply of freshwater is a major concern. Sanibel's available surface water is predominantly brackish water from shallow artesian wells or rainwater collected in cisterns and small ponds. The Surficial Aquifer is hydraulically connected with the streams, ponds, and canals in the interior of the Island. The Surficial Water Table Aquifer of the Island holds a very limited quantity and a poor and very variable quality of freshwater that is too salty to drink or to use as irrigation water. This surficial system is extremely vulnerable to dramatic changes primarily from three causes: saltwater intrusion (from flooding or groundwater), pollution from surface runoff, and sewage and septic tank effluent percolation. Every acre of land on Sanibel is washed with about 1.5 million gallons of rainfall each year; however, saline intrusion; pollutants washed from paved surfaces, roof tops, and fertilized lawn areas; and wastewater enter the soil and infiltrate the Surficial Water Table Aquifer. Under normal conditions, this is a shallow, unconfined aquifer, which contains freshwater, and exists just below the land surface. Under conditions of limited urban settlement, when the demand for water is minimal, this source of freshwater might supply most of the demand and be replenished by natural rainfall. However, with the development that the Island has experienced, excessive withdrawals from this freshwater reservoir have upset the hydrological balance of the surficial groundwater system, making it both unreliable and unsuitable for most domestic needs. Because of water demands, due to the brackish content of the surface water, and to lessen withdrawals from the Surficial Aquifer, the Island reclaims treated wastewater (2.4 million gallon per day) for irrigational use, such as on golf courses and lawns (The Haskell Company 2009).

Groundwater

At the present time the Island Water Association, Inc., withdraws water from at least 16 water production wells, the majority of which are located in the center of the Island adjacent to the Sanibel-Captiva Road. The wells are all about 750 feet deep, drawing groundwater from the Suwannee Aquifer and Lower Hawthorn Aquifer. Wells that tap the Suwannee and Lower Hawthorn aquifers yield as much as 160 gallons per minute. The Island Water Association treats

and produces about 4 million gallons of freshwater a day (for short periods of time) using reverse osmosis (The Island Water Association 2009).

BIOLOGICAL RESOURCES

HABITAT

The J.N. "Ding" Darling NWR provides a representation of a coastal subtropical barrier island system within an intertidal estuarine wetland system that encompasses unique vegetative communities (including managed wetlands, open water, tidal flats, seagrasses, mangrove habitats, beach and dune habitats, *Spartina* marshes, and hardwood hammocks) that create a diverse blend of habitat structure attracting a wide variety of wildlife during various stages of their life cycles, including migratory birds and federal- and state-listed threatened and endangered species. These habitats contain a mixture of temperate, subtropical, and tropical plants. More than 300 species of plants occur in hardwood hammock systems alone. Figure 15 illustrates the unique physiography of Sanibel Island (including the Gulf and bay beaches; the Gulf and mid-Island ridges; the inland wetlands; and the bay-side mangroves), which makes possible the diversity of habitats found on the island. Vegetation on Sanibel Island and the refuge varies according to salinity, elevation, and water levels. The sand and shell ridges of ancient beach berms provide relatively high and dry ground on the interior of Sanibel Island and are dominated by sea grapes and cabbage palms. Saw palmetto (*Serenoa repens*), wild coffee (*Colubrina arborescens*), Jamaica caper (*Capparis cynophallophora*), and other subtropical shrubs form the understory of this forest environment. Tracts of hardwood forests, called hammocks, are vegetated by gumbo limbo (*Bursera simaruba*), strangler fig (*Ficus aurea*), mastics (*Mastichodendron foetidissimum*), and other tropical trees. The upland vegetation provides essential food and shelter to songbirds during their long migratory journeys. Mammals such as bobcats (*Lynx rufus*), marsh rabbits (*Sylvilagus palustris*), and raccoons (*Procyon lotor elucus*), as well as reptiles, such as the gopher tortoise, green anole (*Anolis carolinensis*), and Southern black racer (*Coluber constrictor priapus*) find homes in this woodland environment. The freshwater wetlands on the Island's interior include the Sanibel River, which drains a depression of about 3,500 acres. Freshwater wetlands also exist as isolated strands of what historically was an extensive system of marshlands found throughout Sanibel Island. Marsh vegetation such as *Spartina*, leather fern, sedges, and cordgrass can be found. Alligators, river otters (*Lutra canadensis*), turtles, and frogs are among the many wildlife species that are commonly found in this habitat.

With an acquisition boundary 7,325 acres and a current management boundary of 6,407 acres, the J.N. "Ding" Darling NWR occupies the northernmost part of Sanibel Island. Two brackish water impoundments encompassing 850 acres are used extensively by waterfowl and wading birds. In addition, 2,619.13 acres/1,059.92 hectares of the refuge have been designated as Wilderness Area (Figure 3) and 950 acres of submerged habitat are located in the Tarpon Bay Recreation Area. Further, the Service owns 1,600 acres of submerged lands. Estimated current percentages of broad habitat types occurring in the refuge are presented in Table 7 and Figure 19, where over 51 percent of the refuge's acquisition boundary is classified as wetlands, 36 percent as waters and seagrass beds, and 9 percent as uplands. Primary management of refuge habitats includes prescribed fire (Figure 20), impoundment management, and control of exotic plants and animals.

The refuge's habitats are divided into four main categories (Table 7) and include tropical hardwood forests, beaches, mangrove swamps, mixed wetland shrubs, salt marshes, open waters and seagrass beds, and lakes and canals.

Table 7. Broad habitat categories of the J.N. "Ding" Darling NWR acquisition boundary

Land Cover Type	Acres	Hectares	Percent of Total Refuge Acquisition Boundary
Uplands	**700**	**283.28**	**9.6%**
Tropical Hardwood Forest	600	242.81	8.2%
Beach	100	40.47	1.4%
Wetlands	**3,755**	**1,519.59**	**51.3%**
Mangrove Swamp	2,520	1,019.81	34.4%
Mixed Wetland Shrub	1,200	485.62	16.4%
Salt Marsh	35	14.16	0.5%
Waters and Seagrass Beds	**2,670**	**1,080.51**	**36.4%**
Open Waters and Seagrass Beds	2,550	1,031.95	34.8%
Lakes and Canals	120	48.56	1.6%
Other	**200**	**80.94**	**2.7%**
Developed (urban/suburban)	200	80.94	2.7%
Total	**7,325**	**2,964.32**	**100%**

Tropical Hardwood Forest

About 8 percent of the refuge's acquisition boundary is comprised of tropical hardwood forest. The hardwood hammock forest class includes the major upland hardwood associations that occur Statewide on fairly rich sandy soils. Variations in species composition and the local or spatial distributions of these communities are due in part to differences in soil moisture regimes, soil type, and geographic location within the state. These hardwood forests comprise a diverse system that contains a mixture of temperate, subtropical, and tropical woody plants. These upland hardwood forests occur only in south Florida and are characterized by tree and shrub species on the northern edge of a range that extends southward into the Caribbean.

On Sanibel Island, West Indian tropical hardwood flora occurs on Wulfert Point and the narrow upland (inland) ridges. This cold-intolerant tropical community has very high plant species diversity. Characteristic tropical plants found on Sanibel Island associated with the West Indian hardwood hammock habitat include cabbage palm (*Sabal palmetto*) and seagrapes (*Coccoloba uvifera*).

Cabbage palm is the most ubiquitous plant on the Island. It appears as stands - lines of trees along ridges - and is especially common in transition areas between the upland ridges and the interior wetlands. Plants such as saw palmetto (*Serenoa repens*), wild coffee (*Psychotria nervosa*), and Jamaica caper (*Capparis cynophallophora*) form the undergrowth of this woodland environment. Tracts of hardwood hammocks vegetated by gumbo limbo (*Bursera simaruba*), strangler fig (*Ficus aurea*), mastics (*Mastichodendron foetidissimum*), and other tropical trees are protected in the refuge and contain many rare plants and animals. Other commonly occurring West Indian flora are Florida privet (*Forestiera segregata*), wild lime (*Zanthoxylum fagara*), myrsine, joewood (*Jacquinia keyensis*), wax myrtle (*Myrica cerifera*), sea oxeye (*Borrichia frutescens*), poison ivy (*Toxicodendron radicans*), vinewood, creepers, prickly pear cactus, mother-in-law's tongue (*Sansevieria hyacinthoides*), century plants, bustic, lancewood (*Nectandra coriacea*), ironwoods, poisonwood (*Metopium toxiferum*), pigeon plum (*Coccoloba diversifolia*), and Bahama lysiloma (*Lysimola bahamensis*). Live oak (*Quercus virginiana*) is also sometimes found within this community, while invasive Australian pine (*Casuarina spp*), Brazilian pepper (*Schinus terebinthefolius*), and melaleuca

(*Melaleuca quinquenervia*) have also been documented (Clark 1976, and Florida Fish and Wildlife Conservation Commission 2005). This upland, vegetated woodland provides essential habitat, food, and shelter to migrating songbirds during their long migratory journeys. The forest canopy offers the birds protection from predators and severe weather. Other woodland animals include gopher tortoises (*Gopherus polyphemus*); bobcats (*Lynx rufus*); raccoons (*Procyon lotor*); and reptiles, such as the green anole (*Anolis carolinensis*), coral snake (*Micrurus fulvius*), and the eastern indigo snake (*Drymarchon corais couperi*) (U.S. Fish and Wildlife Service 2007).

Each year the refuge treats hundreds of acres, including upland hardwood forests, for invasive and exotic plants, including Brazilian pepper and Australian pine, which displace native plants. The objective of these chemical and manual management activities is to protect and enhance the native subtropical habitats for indigenous flora and fauna.

The refuge's upland hardwood forests support nearctic-neotropical migratory birds and reptiles of conservation concern to the Service and the State of Florida. The most important threats and stressors to upland hardwood forests are habitat destruction; altered species composition and dominance; altered hydrologic regime; altered community structure; and fragmentation of habitats, communities, and ecosystems predominantly by development and roads, surface water withdrawals, and invasive plants (Florida Fish and Wildlife Conservation Commission 2005).

Beach

Non-vegetated beaches and dunes comprise only about 1.4 percent of the refuge's acquisition boundary. The sandy beaches are characterized by often inconspicuous and sparsely scattered herbaceous vegetation and shrubs. Historically, sea oats (*Uniola paniculata*), railroad vine (*Ipomoea pes-caprae*), sea spurges, beach plum (*Scaevola plumieri*), sea purslane (*Sesuvium portulacastrum*), bay cedar (*Suriana maritima*), yucca, salt bush (*Baccharis halimifolia*), and invasive Australian pine have been documented. The grasses, herbs, and shrubs on the beach have extensive root systems and offer limited shade to insects, crabs, and small reptiles. They usually produce an abundance of seeds which serve as food for many wildlife species. Some develop fruits which are eaten by birds and mammals. All of these plants are salt tolerant, and their extensive root systems stabilize dunes. They are an integral part of the Island's buffer system against storm waves and high tides. The beaches support the beach plum-railroad vine-sea oats association. The beach plum-railroad vine-sea oats association of species has been especially successful at adapting to beach conditions.

Figure 19. Refuge vegetation

Figure 20. Refuge burn units

They include low-growing perennials such as seaside primrose, railroad vine, sea ragweed, sea oats, beach madder, and sea purslane. They also include the semi-shrubs beach plum and bay cedar. Farther back from the water, where low dunes occur, are lantanas, crotons, and woody plants such as necklace pod (*Sophora tmoentosa*), Spanish dagger (*Yucca gloriosa*), and seagrape (*Coccoloba uvifera*). In many places, Australian pine, an introduced species, has displaced the native vegetation. Moving inland (eastward) away from the Gulf beach, one typically finds seagrape, yucca, bay, cedar, saltbush, marsh elder (*Iva frutescens*), cabbage palm (*Sabal palmetto*), wax myrtle, and coconut palm (*Cocos nucifera*) along the dunes and ridges. The Bay side of the Island is characterized by seagrass beds, muddy beaches, and red mangroves. Marine grasses cover much of the Bay beach just seaward of the intertidal zone, providing food and habitat for many marine species such as the West Indian manatee and green sea turtles (Clark 1976).

The beach system supports seabirds and shorebirds, reptiles, and invertebrates of conservation concern to the Service and the State of Florida. The most important threats and stressors to the beach system include habitat degradation and disturbance, erosion and sedimentation, excessive depredation and/or parasitism, altered soil structure and chemistry, insufficient size and extent of characteristic communities or ecosystems, incompatible recreational activities, sea level rise, shoreline hardening, beach nourishment activities, light pollution, invasive animals, and inlet relocation and dredging (Florida Fish and Wildlife Conservation Commission 2005).

Mangrove Swamp

Just over 34 percent of the refuge's acquisition boundary is comprised of mixed varieties and sizes of wetland mangrove swamps. Mangroves grow on the bayside of Sanibel Island and in the bayous at the west end of the Island. They are usually found wherever the shore is tidally influenced and protected from ocean waves. Dominant species include the red (*Rhizophora mangle*), black (*Avicennia germinans*), and white mangrove (*Languncularia racemosa)*, and the buttonwood (*Conocarpus erectus*). Mangroves are tropical trees that grow in the intertidal environment and are adapted to survive in water-saturated soils with high salt concentrations and periodic tidal inundations. Species of mangroves that are adapted to live with different salt tolerances include: red mangrove, black mangrove, and white mangrove. The red mangrove is the most common and distinctive mangrove in the refuge. It has arching prop roots and large cigar-shaped seedlings, called propagules, which can often be seen hanging from the branches. Red mangroves occur in the standing water or closest to the water's edge and filter salt through their roots. The black mangrove thrives a little further ashore than the red mangrove. The black mangroves respirate through specialized roots called pneumatophores, which thrust upwards through black marshy soil and help stabilize the tree. These trees excrete salt from the underside of their leaves. Here a shrub layer can develop, populated by saltwort and glasswort. Further from the water's edge is the white mangrove. White mangroves grow at higher elevations than red and black mangroves, so they don't need specialized root systems to help them anchor in the soil. White mangroves excrete salt through pores at the base of their leaves. Buttonwood also occurs on these higher elevations (Clark 1976 and U.S. Fish and Wildlife Service 1998).

The interior mangroves on the refuge south of Shell Mound Trail and east of Alligator Curve are old growth mangrove forests. The trees are quite large in diameter and height, and stem density is low. The crown was dense with little or no understory. The forest was dominated by very large red mangroves (≈ 30 to 50 centimeters diameter at breast height) with large black and a few white mangroves scattered throughout (Meyers *et al.* 2006). This area was heavily damaged by Hurricane Charley during 2004.

Mangroves play a vital role in the food chain of this marine environment. Microorganisms that feed on the decaying leaves of mangroves become food for animals such as shrimp, crabs, snails, and worms. Healthy mangroves, seagrasses, and shallow waters provide structural habitat, protection and nursery areas for young fish, such as mullet, snook, and snapper, as well as invertebrates and marine organisms, which are preyed upon by the numerous water birds of the refuge. The structure of mangrove islands makes them excellent breeding and roosting habitat for colonial wading birds. Mangrove islands provide elevated nesting and roosting structure and limited access to predators. The mangroves and seagrasses reduce the effects of flooding and serve to stabilize sediments, providing coastal protection against erosion and damaging stormwater runoff (U.S. Fish and Wildlife Service 1998).

Wetland mangrove swamps support a variety of species of mammals, wading birds, waterbirds, waterfowl, mangrove forest birds, nearctic-neotropical migratory birds, fish, reptiles, and invertebrates of conservation concern to the Service and to the State of Florida. The most important threats and stressors to mangrove swamps are altered hydrologic regime, habitat destruction, altered structure, alter water quality, altered weather regime and sea level rise, altered species composition, habitat disturbance, and habitat fragmentation predominantly from coastal development; roads, bridges, and causeways; harmful algal blooms; incompatible industrial operations; invasive plants; shoreline hardening; invasive animals; incompatible releases of water (including water quality, quantity, and timing); incompatible wildlife and fisheries management strategies; climate variability; parasites and pathogens; channel modification; incompatible aquaculture operations; and pollution and nutrient loading (Florida Fish and Wildlife Conservation Commission 2005).

Mixed Wetland Shrub

While mixed wetland shrubs comprise 16 percent of the refuge's acquisition boundary, they are highly important on this estuarine island. The refuge's interior consists of juxtaposed linear strands of old beach ridges and swales (Figure 19). Within this interior, mixed wetlands are nontidal wetlands dominated by vegetation.

Freshwater marshes in the interior low lying areas and swales are dominated by sand cordgrass (*Spartina bakeri*). Historically, Sanibel Island's low interior wetlands were open, grassy, and essentially treeless. Vegetation patterns were controlled by natural factors, including wind, water-table level, salinity, and elevation of the land. Because of the Island's periodically brackish water-table aquifer, almost all plant species are at least partially salt tolerant. Cordgrass's ability to prosper under a varying salinity regime permitted it to become the dominant plant community on much of the wetlands. Cordgrass is still common, though covering a much smaller area than it once did. Lack of proper water management has permitted various shrubs to infiltrate the open cordgrass meadows and endanger the entire interior wetlands subecosystem. In association with the cordgrass are sawgrass, bead grass, water-hyssop, and sea purslane. Also appearing in the swales are buttonwood, andropogon, cattails, spatterdock (*Nuphar lutea* subsp*. advena*), hydrilla (*Hydrilla verticillata*), chara, duckweed, and wigeon grass (*Ruppia maritima*). On the almost imperceptible slightly higher elevations are salt bush and a number of grasses and perennials, and cabbage palms are evident on the highest ridges. Today, along the Sanibel River and in low swales, the buttonwood-wax myrtle-sea oxeye association is very evident. Native vegetation of the low ridges includes marsh elder, cordgrass, leather fern, wax myrtle, and cabbage palmetto. The Brazilian pepper, a noxious weed, is rapidly dominating many areas in the interior basin. Altogether, these interior vegetative communities create an array of diverse habitats which attract a wide variety of wildlife. The freshwater cordgrass marshes are unusual on barrier islands and provide a haven for many wildlife species. Alligators, river otters, turtles, and frogs are commonly found in this habitat (Clark 1976, U.S. Fish and Wildlife Service 1998 and Coppen 2001).

Mixed wetland shrubs support a variety of species of wading birds, waterbirds, amphibians, and reptiles of conservation concern to the Service and to the State of Florida. Beyond sea level rise threats to the refuge, the most important threats and stressors to freshwater wetlands include altered hydrologic regime; fragmentation of habitats, communities, or ecosystems; altered fire regime; altered landscape mosaic or context; altered water quality; altered species composition and dominance; habitat destruction or conversion; altered community structure; habitat degradation and distribution; keystone species missing or lacking in abundance; insufficient size or extent of characteristic communities or ecosystems; invasive plants and animals; incompatible recreational activities; water control structures; and nutrient loading (Florida Fish and Wildlife Conservation Commission 2005).

Salt Marsh

Salt marsh makes up about 0.5 percent of the refuge's acquisition boundary. It is vegetated almost completely by herbaceous plants, primarily grasses, sedges, and rushes. This community type occurs within the intertidal zone of coastal areas and may be infrequently (high marsh) to frequently (low marsh) inundated by salt or brackish water. Salt marsh develops where wave energies are low and where mangroves are absent. Within salt marsh, plant species are often distributed unevenly, especially in transitional areas. Species distributions are affected by biotic and abiotic variables such as elevation, substrate type, degree of slope, wave energy, competing species, and salinity. The salt marsh habitat is among the most productive communities in the world. Primary production is greatly affected by soil salinity and tidal frequency. Salt marshes support a variety of species of wading birds, waterbirds, waterfowl, shorebirds, sea birds, fish, reptiles, and invertebrates of conservation concern to the Service and to the State of Florida. The most important threats and stressors to salt marsh habitats are habitat destruction and fragmentation, sedimentation, altered structure, altered water quality, altered water quantity, altered weather regime and sea level rise, erosion, altered hydrologic regime, altered primary production, and altered species composition predominantly from coastal development, incompatible releases of water (including water quality, water quantity, and timing), climate variability, inadequate stormwater management, surface water withdrawals, channel modification, management activities (e.g., beach nourishment), disruption of longshore transport of sediment, and invasive plants (Florida Fish and Wildlife Conservation Commission 2005).

The refuge's two impoundments, totaling 850 acres, are comprised of a mix of habitats, including salt marsh, and are managed for fish and aquatic food plants, providing foraging habitats for migratory birds. Water levels are manipulated using tidal (saltwater) flow and rainfall (freshwater). Water levels are manipulated in the fall and spring to provide foraging habitat for migrating shorebirds. Prescribed fires, controlled fires intentionally set by managers, are used to manage and enhance native subtropical habitats by mimicking historical natural fire events that functioned to maintain native plant communities. Prescribed fires reduce encroachment of woody plants and leather fern into the spartina marsh and help control young exotic plants. Prescribed burning reduces hazardous accumulations of flammable fuels and kills invasive woody vegetation, minimizing the likelihood of catastrophic fire and protecting neighboring properties.

Open Waters and Seagrass Beds

Open waters and seagrass beds make up 35 percent of the refuge. The refuge is located within an estuary, an area where saltwater and freshwater mix. Estuaries create some of the most nutritionally rich habitat for thousands of species of plants and animals in an intricate food web. The basis of this food web in south Florida is the extensive mangrove forests and productive seagrass beds. Microorganisms thrive on the decaying leaves of seagrasses and mangroves, providing additional food for other animals. Rich in marine life, these shallow waters attract thousands of fish, shrimp, crabs, and snails, which are preyed upon by the numerous wading birds of the refuges. Seagrass

beds and mangrove forests serve as shelter, nursery, and feeding areas for many fish species, such as mullet, snook, red drum, and snapper, as well as for other marine organisms. Waters surrounding these refuges provide important habitat for fish that help to support the world class sport fishing of this Estuary. Healthy seagrass beds are essential to grazing species, such as the endangered West Indian manatee and the endangered green sea turtle. The Estuary is also important to the thousands of shorebirds, such as red knots, dunlin (*Caldris alpine*), and Western sandpipers (*Calidris mauri*) that use the area as resting and feeding grounds during their migrations. Great blue heron (*Ardea Herodias*), reddish egret, roseate spoonbill, and other wading birds use the many islands as roosting sites, and many nest on the rookery islands found in the Estuary.

Seagrass is one of the most productive natural communities in the world, and it is a principal contributor to the marine food web. Hundreds of marine plants and animals live among seagrass and form a complex and fragile community. Seagrass beds around Sanibel Island are an important foraging habitat for a variety of refuge species, including recreational and commercial fisheries, waterbirds, manatees, and sea turtles. Seagrasses occur along the north shore of Sanibel Island, Tarpon Bay, and San Carlos Bay, primarily in the shallow depths of the waterways (less than two meters) (Figure 21).

Since 1950 the State of Florida has experienced over a 50 percent decline of seagrasses (U.S. Fish and Wildlife Service 2002). From 1944 to 1982, aerial photographs showed a 29 percent decrease in seagrass coverage in Charlotte Bay (National Oceanic and Atmospheric Administration 2001). As of 1995, large sections of seagrasses in Lee County were rated as degraded with light to severe scarring from propeller cuts of boats operating in the shallow waters (Meyers et al. 2006) and areas of scarred seagrass are scattered throughout the area.

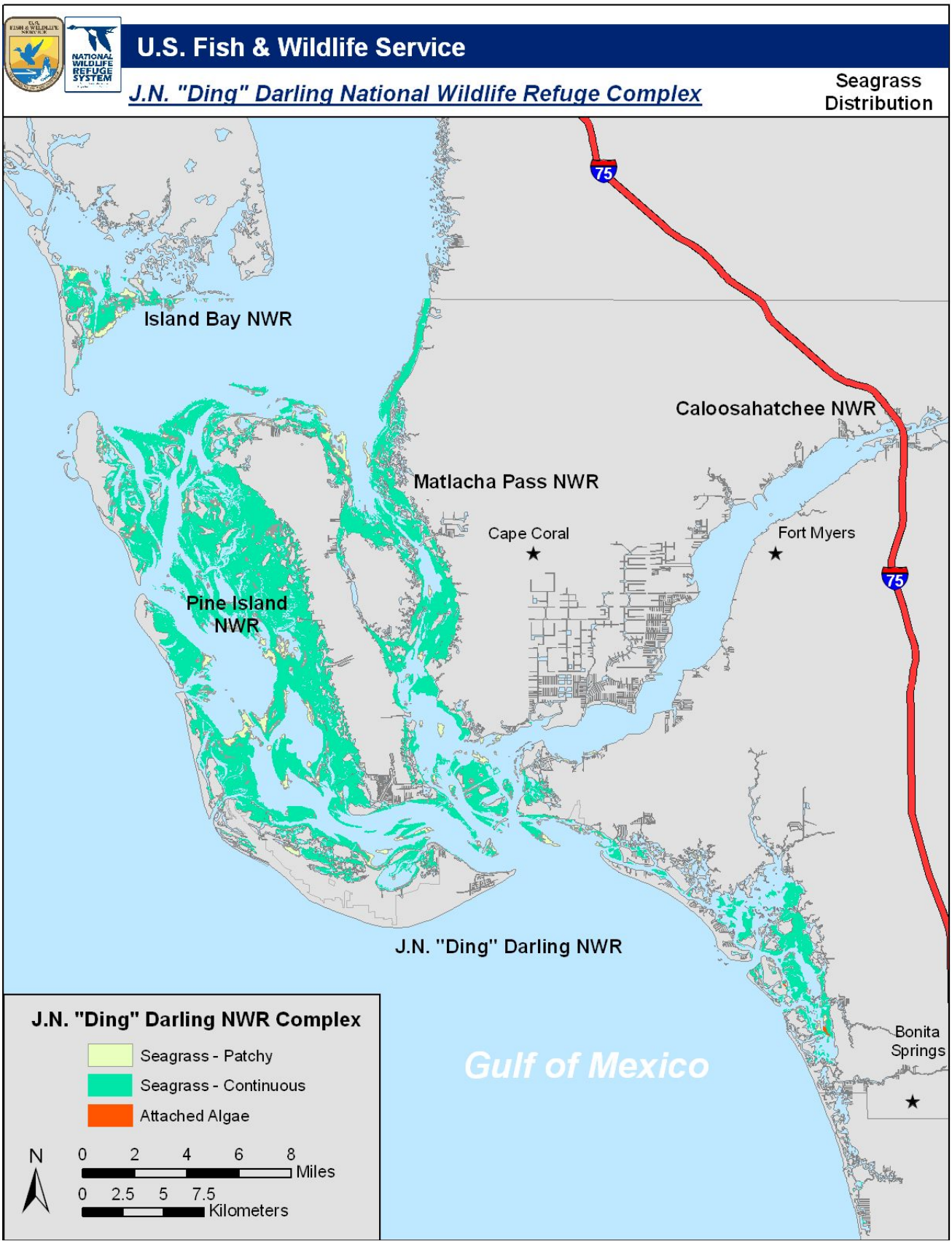
The examination of aerial survey data from the late 1990s shows that the distribution of seagrasses correlates fairly well with the distribution of manatees, with the greatest numbers of manatees found in the areas of Matlacha Pass and San Carlos Bay, Figure 22. The Sanibel Island seagrass beds support seasonally variable growths of submerged aquatic macrophytes, mostly consisting of four species: turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), and widgeon grass *(Ruppia maritima*) in areas with low salinity (U.S. Fish and Wildlife Service 2002).

The main threats and stressor to the Estuary and area seagrass beds revolve around water quality, quantity, and timing concerns, including freshwater releases from Lake Okeechobee and pollution in runoff within the Caloosahatchee watershed. Water management practices have resulted in the alteration of freshwater flow into the estuaries. Such discharges introduce contaminants and pollutants into these waterbodies. The frequency and timing of freshwater discharges have influenced the loss of seagrasses. Episodic voluminous freshwater releases (due to excessive rainfall events) through control structures on the Caloosahatchee River have a similar effect on the receiving Charlotte Harbor Estuary, because of the reduction in salinity for extended periods. In addition, such freshwater releases/discharges carry pollutants, primarily nutrients and sediments.

Lakes and Canals

Lakes and canals represent 1.6 percent of the refuge's acquisition boundary and include natural lakes and canals developed for mosquito control and drainage. A variety species of conservation concern to the Service and to the State of Florida use these lakes and canals, including mammals, reptiles, amphibians,

Figure 21. Seagrass distribution in the vicinity of Sanibel Island



invertebrates, and birds. The most important threats and stressors to these lakes and canals are altered water quality (including contamination and nutrients), erosion and sedimentation, nutrient loading from nearby development, invasive plants and animals, incompatible recreational activities, and incompatible construction activities (Florida Fish and Wildlife Conservation Commission 2005).

WILDLIFE

Sanibel Island and the refuge are home to approximately 272 species of birds (including accidentals), 60 species of reptiles and amphibians (including exotics species), 102 fish species (including exotic species), and 33 species of mammals (including exotic species). Appendix I provides lists of species known to occur on the refuge. Regular wildlife surveys are conducted to monitor populations of migratory birds and their production, and to establish trends for a number of species, primarily birds. The refuge monitors colonial nesting birds, breeding birds, shorebird populations, foraging waterbirds, and small mammal populations, and alligator abundance. And, water quality is monitored bimonthly. Shorebird monitoring is conducted from September through May, three times per month. And, the impoundments are surveyed weekly during drawdowns at high tides. Wildlife Drive surveys are conducted twice per month during low tide. Further, the refuge annually participates in the Christmas Bird Count. And breeding bird surveys are conducted in May.

Rare, Threatened and endangered species

Fourteen federal-listed and 49 state-listed species occur on and around the refuge (Table 8). These species are included in various surveys conducted by the partners and the refuge. And, these species benefit from refuge habitat management activities and exotic plant and animal control activities. The rare, threatened, and endangered species of particular concern to the refuge include the wood stork, roseate spoonbill, bald eagle (*Haliaeetus leucocephalus*), mangrove cuckoo, black-whiskered vireo, gray kingbird, Florida prairie warbler, eastern indigo snake, gopher tortoise, Florida bonneted bat, West Indian manatee, American crocodile, loggerhead sea turtle, green sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, hawksbill sea turtle, snowy plover, piping plover, red knot, Sanibel Island rice rat, ornate diamondback terrapin (*Malaclemys terrapin macrospilota*), and smalltooth sawfish, as well as the Aboriginal prickly apple.

The wood stork is listed by both the Service and the State of Florida (Florida Fish and Wildlife Conservation Commission 2009a) as an endangered species. Wood storks occur regularly on the refuge. However, the refuge lacks data to determine the status and trends for wood storks using the refuge.

The roseate spoonbill is considered a species of management concern by the Service and is listed as a species of special concern by the State of Florida due to its vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a state threatened species unless appropriate protective or management techniques are initiated or maintained and due to the fact that it has not sufficiently recovered from past population depletion (Florida Fish and Wildlife Conservation Commission 2009a). Roseate spoonbills occur regularly on the refuge. However, the refuge lacks data to determine the status and trends for spoonbills using the refuge.

Figure 22. Manatee abundance in the vicinity of Sanibel Island

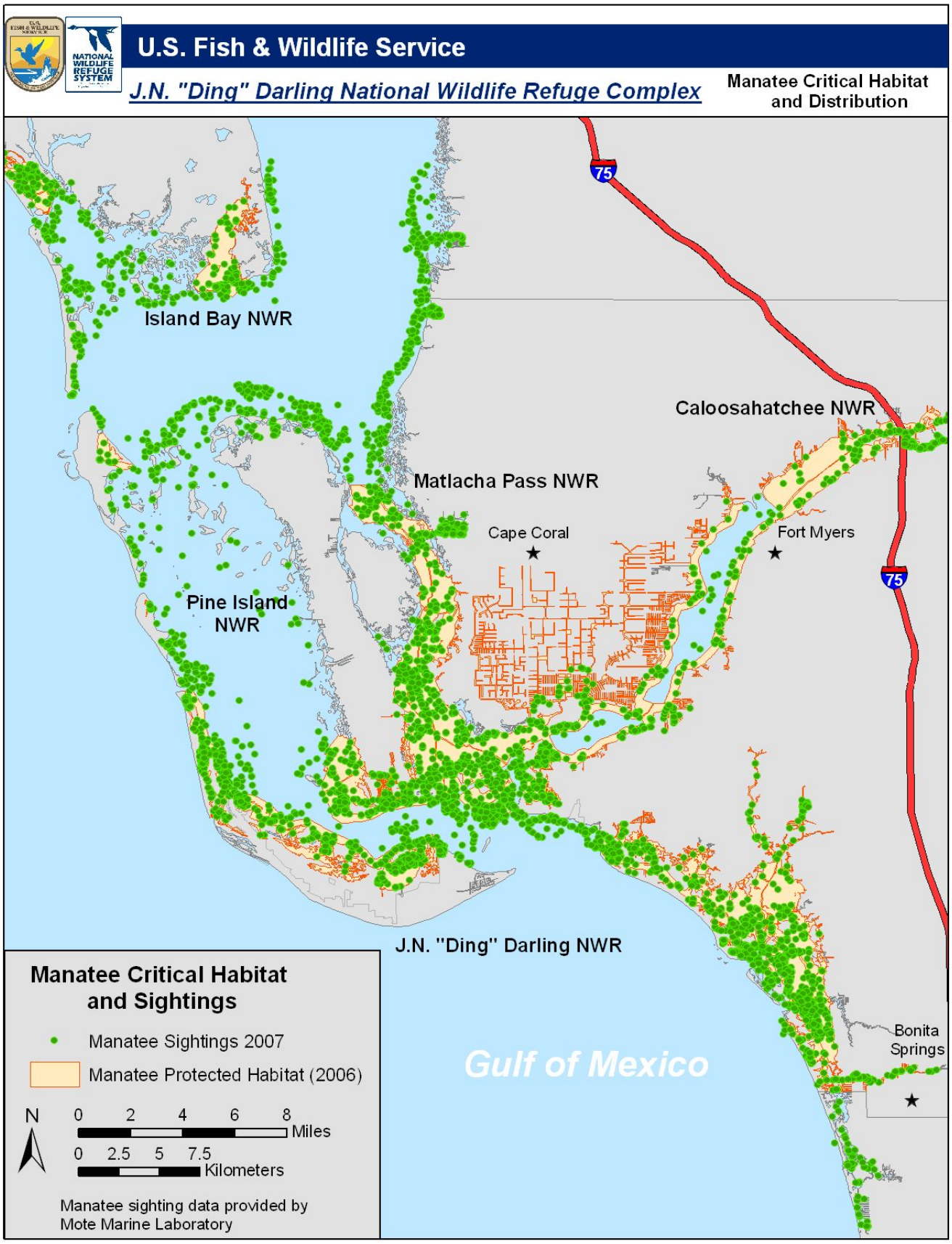


Table 8. Federal- and state-listed species of J.N. "Ding" Darling NWR

Key: FWC = Florida Fish and Wildlife Conservation Commission
FWS = U.S. Fish and Wildlife Service
SSC = Species of Special Concern
T = Threatened
T (S/A) = Threatened (Similarity of Appearance)
E = Endangered
CE = Commercially Exploited
C = Candidate for Listing
UR = Under Review for Listing

Common Name	Scientific Name	Designated Status	
		FWC	FWS
Fish			
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	SSC	T
Smalltooth Sawfish	*Prisits pectinata*	-	E
Birds			
Roseate Spooonbill	*Ajaia ajaja*	SSC	-
Limpkin	*Aramus guarauna pictus*	SSC	-
Snowy Plover	*Charadrius alexandrinus*	T	-
Piping Plover	*Charadrius melodus*	T	T
White Ibis	*Eudocimus albus*	SSC	-
Little Blue Heron	*Egretta caerulea*	SSC	-
Reddish Egret	*Egretta rufescens*	SSC	-
Snowy Egret	*Egretta thula*	SSC	-
Tricolored Heron	*Egretta tricolor*	SSC	-
Florida Sandhill Crane	*Grus Canadensis pratensis*	T	-
American Oystercatcher	*Haematopus palliatus*	SSC	-
Wood Stork	*Mycteria americana*	E	E
Brown Pelican	*Pelicanus occidentalis*	T	-

Common Name	Scientific Name	Designated Status	
		FWC	FWS
Roseate Tern	*Sterna dougallii dougallii*	T	T
Least Tern	*Sterna albifrons*	T	-
Reptiles			
American Alligator	*Alligator mississippiensis*	SSC	T (S/A)
American Crocodile	*Crocodylus acutus*	E	T
Loggerhead Sea Turtle	*Caretta caretta*	T	T
Green Sea Turtle	*Chelonia mydas mydas*	E	E
Leatherback Sea Turtle	*Dermochelys coriacea*	E	E
Eastern Indigo Snake	*Drymarchon punctatus acric*	T	T
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	E
Gopher Tortoise	*Gopherus polyphemus*	T	UR
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	E
Mammals			
Florida Bonneted Bat	*Eumops floridanus*	E	C
Everglades Mink	*Mustela vision evergladensis*	T	-
Sanibel Island Rice Rat	*Oryzomys palustris sanibeli*	SSC	-
Florida Mouse	*Peromyscus floridanus*	SSC	-
West Indian Manatee	*Trichechus manatus*	E	E
Invertebrates			
Miami Blue Butterfly	*Hermiargus thomasi bethunebakeri*	E	C
Florida Tree Snail	*Liguus fasciatus*	SSC	-

Common Name	Scientific Name	Designated Status	
		FWC	FWS
Plants			
Barbed-wire Cactus	*Acanthocereus pentagonus (tetragonus)*	T	-
West Indian Cock's Comb	*Celosia nitida*	E	-
Iguana Hackberry	*Celtis iguanaea*	E	-
Spiny Hackberry	*Celtis pallida*	E	-
Florida Butterfly Orchid	*Encyclia tampensis*	CE	-
Sanibel Lovegrass	*Eragostis tracyi*	E	-
Wild Cotton	*Gossypium hirsutum*	E	-
Aborginal Prickly Apple	*Harrisia aboriginum*	E	C
Spiked Crested Coralroot	*Hexalectris spicata*	E	-
Joewood	*Jacquinia keyensis*	T	-
West Coast Lantana	*Lantana depressa sanibelensis*	E	-
Florida Mayten	*Maytenus phyllanthoides*	T	-
Shell Mound Prickly-pear	*Opuntia stricta*	T	-
Inkberry	*Scaevola plumieri*	T	-
Inflated Wild-pine	*Tillandsia balbisiana*	T	-
Common Wild-pine	*Tillandsia fasciculata*	E	-
Twisted Air Plant	*Tillandsia flexuosa*	T	-
Giant Wild-pine	*Tillandsia utriculata*	E	-

Sources: U.S. Geological Survey 2006; U.S. Fish and Wildlife Service 1982, 2006 and 2007; Florida Fish and Wildlife Conservation Commission 2009a; Florida Department of Agriculture and Consumer Services 2003; Florida Museum of Natural History 2009; Gann 2001; Gann et al. 2002 and 2008; Wunderlin and Hansen 1980 and 2008; Florida Committee on Rare and Endangered Plants and Animals 1992a, 1992b, 1992c, 1994, and 1996; and Campbell 1988

Although the bald eagle was delisted in 2007, it is still protected under various acts and treaties, including the Bald and Golden Eagle Protection Act, the Lacey Act, and the Migratory Bird Treaty Act. Bald eagles also occur regularly and occasionally nest on the refuge, but the refuge does not currently survey for bald eagle nests. If a bald eagle nest does appear on the refuge, then the nest would be monitored and protected from disturbance.

Important mangrove forest birds using the refuge include mangrove cuckoo, black-whiskered vireo, gray kingbird, and Florida prairie warbler. The black-whiskered vireo and the Florida prairie warbler are considered by the Service to be species of management concern due to the small population or limited distribution of the black-whiskered vireo and due to the documented or apparent population decline of the Florida prairie warbler. The refuge conducts mangrove forest breeding bird surveys to determine presence and abundance of mangrove cuckoos, gray kingbirds, black-whiskered vireos, and Florida prairie warblers along the Wildlife Drive weekly from April to August.

The eastern indigo snake is listed by the Service and the state (Florida Fish and Wildlife Conservation Commission 2009a) as a threatened species. Although it historically occurred on the refuge, no eastern indigo snakes have been sighted on the refuge in recent years. However, the species is known to be difficult to observe and capture, even in areas where they are known to regularly occur.

The gopher tortoise is under review for listing in Florida by the Service under the Endangered Species Act and is listed by the State of Florida as a threatened species (Florida Fish and Wildlife Conservation Commission 2009a). In 1975 the gopher tortoise was listed by the state as a threatened species. In 1979, due to changes in the state's listing criteria, the species was downlisted to a species of special concern. Between 2002 and 2006, the state recognized the need to uplist the gopher tortoise to a threatened species; in 2008 it was uplisted by the state to threatened species status. Gopher tortoises occur regularly on the refuge and on Sanibel Island. The refuge lacks current data to determine population status and trends. A survey conducted in 1978 found 51 active burrows on the refuge. A follow-up survey conducted in 1987 found only 13 active burrows in the refuge. However, the most recent survey conducted in 2002 revealed 21 active burrows. This may have been a response to aggressive removal of invasive exotic plants. Further progress has been made in potential gopher tortoise habitat condition through exotic removal and prescribed burning. An updated gopher tortoise survey is needed to assess current habitat management practices, as well as to determine the population status on Buck Key.

The Florida bonneted bat is listed by the State of Florida as an endangered species (Florida Fish and Wildlife Conservation Commission 2009a) and is listed as a candidate species for listing under the Endangered Species Act. A colony of Florida bonneted bats is known to occur in Cape Coral and they are suspected to occur on and around the refuge.

The West Indian manatee is listed by the Service and the State of Florida as an endangered species (Florida Fish and Wildlife Conservation Commission 2009a). And, critical habitat for the manatee has been designated on the refuge (Figure 22). To help provide protection for and limit threats to this species, numerous federal manatee protection areas are located near the refuge. In 2008, three manatee deaths in nearby Charlotte County were attributed to watercraft, while 14 manatee deaths in Lee County were attributed to watercraft (Florida Fish and Wildlife Conservation Commission 2009c). The refuge coordinates with the partners to conduct regular law enforcement patrols of designated speed zones and no-motor zones, including the Service's Office of Law Enforcement, FWC, Lee County Sheriff's Office, and the Sanibel Police Department. The refuge manages 2,268 acres (918 ha) of estuarine waters, representing 35 percent of the refuge and benefiting a variety of wildlife, including manatees. All of these waters are either slow-speed/minimum wake zone, pole/troll zone, or no motor zone. Further, the refuge participates in the Florida Marine Mammal Stranding Network –

Southwest and coordinates with the Mote Marine Laboratory to facilitate quick response, care, and rehabilitation for injured manatees. The refuge also works with the partners, including Lee County's Manatee Park, to develop public awareness, understanding, and appreciation for manatees. A high frequency of manatees occurs regularly on and around the refuge year-round. Large numbers of manatees are seen in the winter months as they travel from the Ft. Myers Power Plant and Caloosahatchee River to graze on the abundant seagrass beds in and around the refuge. Regular sightings of manatees are made during the summer months and manatees are seen grazing, nursing young, courting, and breeding.

The American crocodile is listed by the Service as a threatened species in Florida and by the State of Florida as an endangered species (Florida Fish and Wildlife Conservation Commission 2009a). A single female American crocodile historically and consistently used Sanibel Island and the refuge until her death in early 2010, which was suspected to be due to exposure to extreme cold temperatures. The refuge works with the partners and local residents to minimize human-crocodile interactions and to educate the public about the differences between crocodiles and alligators and their important role in the ecosystem.

The Service and the State of Florida listed the loggerhead, green, leatherback, Kemp's ridley, and hawksbill sea turtles as endangered species (Florida Fish and Wildlife Conservation Commission 2009a). The sea turtle monitoring program on Sanibel Island began in 1959 by refuge biological science technician Charles LeBuff, at the urging of refuge manager Tommy Wood and "Ding" Darling himself. This program is the oldest uninterrupted loggerhead monitoring program in the United States. LeBuff, who was inspired by the writings of Archie Carr, became the first marine turtle permit holder in the State of Florida. When LeBuff began his sea turtle monitoring, the refuge included the Sanibel Lighthouse at Point Ybel on the east end of Sanibel Island. Most of the rest of the beach was uninhabited, so Charles LeBuff took the lead in monitoring and tagging sea turtles. In 1968, LeBuff established Caretta Research in partnership with SCCF and from 1973 to 1991 he led independent Caretta Research, Inc. Since 1992, SCCF has led the sea turtle monitoring program. Today, the refuge manages only a small beachfront property called the Perry Tract, which has approximately 550 linear feet (168 meters) along the Gulf beach. Sea turtle nesting historically occurred on the Perry Tract, but nesting has not been documented there within the last 10 years, although occasional false crawls are found.

The refuge currently supports the sea turtle nest monitoring efforts by SCCF. Loggerhead and green sea turtles regularly nest on Sanibel and Captiva Islands, with annual nesting in 2008 on Sanibel and Captiva Islands at 416 loggerheads and 3 greens (Sanibel-Captiva Conservation Foundation 2009a). From 1996-2008, Sanibel and Captiva Islands ranged between 212 and 537 nests per year, averaging 343 nests per year of predominantly loggerhead sea turtles (Sanibel-Captiva Conservation Foundation 2009a). The leatherback sea turtle was not known to nest on Sanibel or Captiva Islands until hatchlings were discovered on Sanibel in the summer of 2009. The nest was originally identified as a green turtle nest, but leatherback hatchlings were found post-hatching. In 1996, one case of a Kemp's ridley sea turtle nest was documented on Sanibel Island. And, during the cold stunning event in January 2010, two hawksbill sea turtles were found, confirming their occurrence on the refuge.

Beyond sea turtle nesting, in-water populations of sea turtles have been monitored in the greater Charlotte Harbor area since 2003 by Mote Marine Laboratory. Mote Marine and other partners have been conducting set netting and visual surveys of the Charlotte Harbor area, including the J.N. "Ding" Darling NWR, to evaluate species composition, developmental migrations, habitat use, and feeding ecology. So far, the survey results have yielded sightings and captures of loggerhead, Kemp's ridley, and green sea turtles. In order of abundance, loggerheads are typically found near tidal passes, ridleys congregate close to creek or bay mouths, and green turtles are often observed in seagrass

pastures in 6 to 8 feet of water. Annual catch per unit effort rates for visual transect sightings range from 0.011-0.021 turtles per hour and sighting densities drop during the winter months (Eaton et al. 2008). Another goal of this project is to evaluate post hurricane effects on turtle foraging ecology in Charlotte Harbor. Surveys conducted after Hurricane Charley in 2004 reported hypoxic conditions and a massive horseshoe crab die-off in that same area. Disturbances to seagrass beds and changes in crustacean populations after hurricanes are also being evaluated as having possible effects on sea turtle foraging ecology.

Snowy plovers are listed by the State of Florida as a threatened species (Florida Fish and Wildlife Conservation Commission 2009a). The Service considers the snowy plover as a species of management concern due to its dependence on vulnerable or restricted habitats. Snowy plovers and other shorebirds nest along the beaches of Sanibel and Captiva Islands. Recent estimates for the west coast of Florida, from the panhandle through Cape Sable, show about 200 pairs of snowy plovers (Sanibel-Captiva Conservation Foundation 2009b). By mid-June 2009, Sanibel Island had 15 snowy plover nests, 4 fledglings from earlier in the season, and 10 chicks (Sanibel-Captiva Conservation Foundation 2009b). However, the refuge includes only a very small portion of beachfront property, the Perry Tract, includes approximately 550 feet (168 meters) of shoreline along the Gulf of Mexico. Since the Perry Tract is located along the publicly accessible beach and since the Service only owns to the mean high water line, public access does occur across the beachfront portion of the property. The refuge currently coordinates with the partners to enhance management for and protection of snowy plovers and other shorebirds. Partially funded by the Service, SCCF surveys and monitors snowy plover nesting success and predation. Surveys are frequently conducted throughout the nesting season. Discovered nests are posted to exclude entry to the immediate nest site. Human disturbance is minimized during the nesting season through increased law enforcement presence by refuge law enforcement officers and Sanibel police officers. For publicly accessible beaches (e.g., the Perry Tract), all dogs on the beach must be leashed. The refuge participates in a snowy plover banding project with the partners.

In Florida, the piping plover is listed by both the Service and the State of Florida as a threatened species (Florida Fish and Wildlife Conservation Commission 2009a). Although piping plovers do not regularly use the shorelines of Sanibel and Captiva Islands, critical habitat for the piping plover is designated nearby at Terrapin Creek in Matlacha Pass NWR. Piping plovers occasionally winter on lands within the refuge's acquisition boundary, but not regularly enough to be included as critical habitat. Critical habitat designation was proposed for an area spanning Sanibel and Captiva Islands, including Bowman's Beach (which is within the refuge's acquisition boundary), but was excluded in the final rule because it did not show regular use of piping plovers.

In August 2006, the red knot was designated as a candidate species for consideration for listing under the Endangered Species Act. Red knots are fairly common to abundant in the winter and are regularly counted on the refuge's shorebird surveys and Christmas Bird Counts. But the refuge lacks sufficient long-term data to determine the status and trends for red knots using the refuge.

The Sanibel rice rat is a candidate species for listing by the Service under the Endangered Species Act and it is listed by the State of Florida as a species of special concern due to its vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a state threatened species unless appropriate protective or management techniques are initiated or maintained and since it may already meet certain criteria for designation as a state threatened species, but for which conclusive data are limited or lacking (Florida Fish and Wildlife Conservation Commission 2009a). Although the Sanibel rice rat is known to occur on the refuge and on Sanibel Island, the current status of this species is unknown.

According to the State of Florida, the status of the ornate diamondback terrapin is unknown and the population is considered declining (Florida Fish and Wildlife Conservation Commission 2005). Ornate diamondback terrapins are known to occur on the refuge and have recently been documented on the Wildlife Drive. However, the refuge lacks data to determine status and trends for this species.

The smalltooth sawfish is listed by the Service as an endangered species and critical habitat has been designated on and around the refuge (Figure 23). Records indicate that this species was once common throughout its historic range and that the smalltooth sawfish has declined dramatically in U.S. waters over the last century with a population decline of 95 percent or more (National Oceanic and Atmospheric Administration 2009b). Today, the largest numbers of smalltooth sawfish in the U.S. are found from Charlotte Harbor through the Dry Tortugas (National Marine Fisheries Service 2009). The smalltooth sawfish is known to occur in the Sanibel area and may be present on the refuge.

The Gulf sturgeon is listed by the Service as threatened and by the State of Florida as a species of special concern due to its significant vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a threatened species unless appropriate protective or management techniques are initiated or maintained (Florida Fish and Wildlife Conservation Commission 2009a). The Gulf sturgeon is known to occur in the area and is suspected to occur on the refuge.

The aboriginal prickly apple is a candidate species for federal listing. It occurs on shell mounds and tropical hammocks within the refuge. The refuge is one of only three conservation areas where this species occurs.

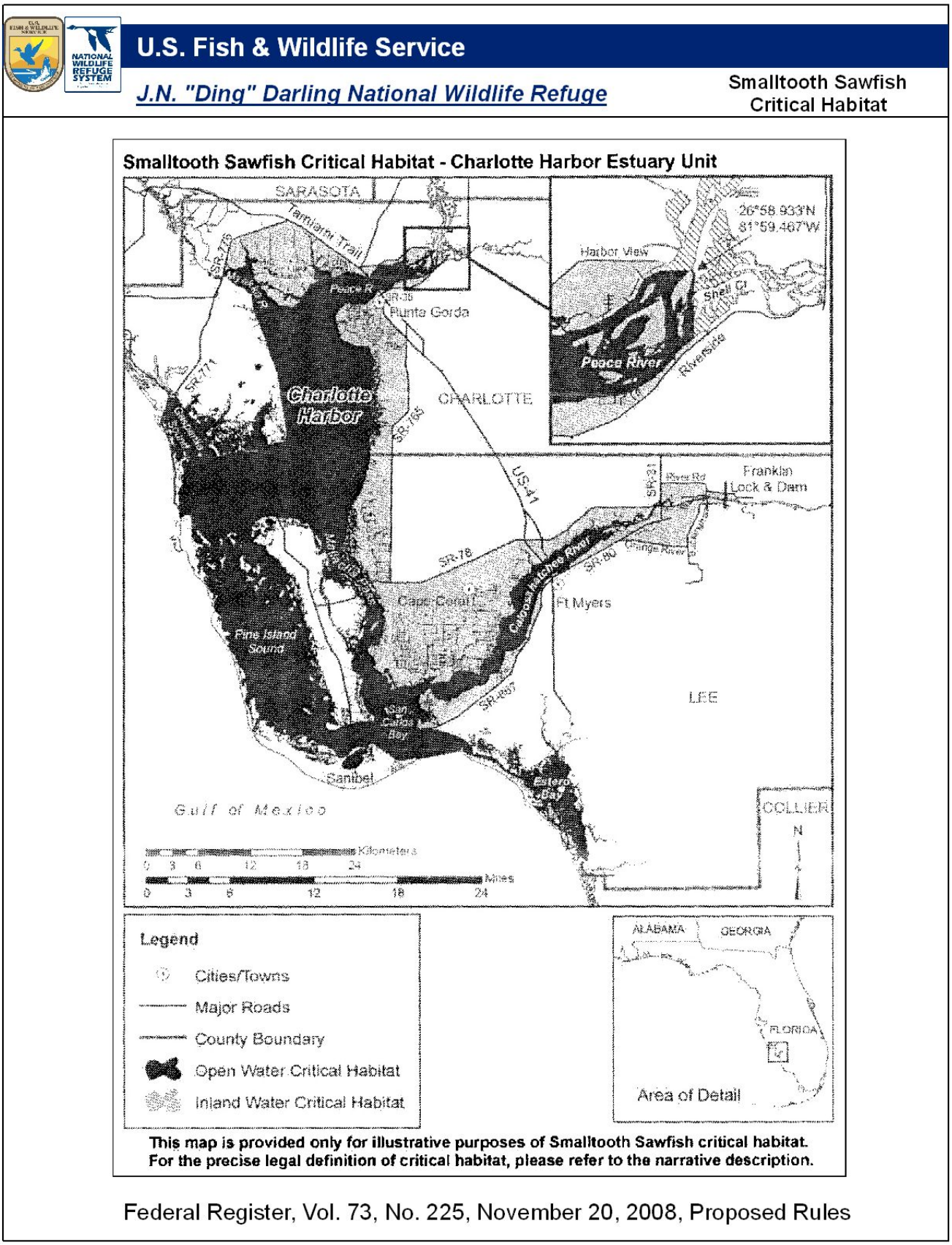
Bird Species Groups

Beyond rare, threatened, and endangered bird species, the refuge also serves key groups of birds, including raptors and birds of prey; nearctic-neotropical migratory birds; shorebirds and seabirds; and wading birds, waterbirds, and waterfowl. The refuge was established with the primary purpose of serving migratory birds and the refuge serves as an important stopover and overwintering site for numerous birds. Over 180 bird species are known to regularly occur on the refuge with an additional over 80 accidentals that are rarely sighted.

A mix of raptors and birds of prey both uses and breeds on the refuge. However, the refuge lacks sufficient data to assess status and trend for these birds. Several raptors and birds of prey are known to breed on or near the refuge, including ospreys (*Pandion haliaetus*), bald eagles, red-shouldered hawks (*Buteo lineatus*), eastern screech owls (*Megascops asio*), and great-horned owls (*Bubu virginianus*). The refuge is also used during migration by a variety of falcons, accipitors, hawks, kites, harriers, and eagles.

Numerous nearctic-neotropical migratory birds are known to use the refuge. Existing migration surveys have revealed that as many 27 species of migratory landbirds use the refuge and over 250 birds on any given day could be passing through the refuge.

Figure 23. Critical habitat designated for the smalltooth sawfish



The refuge supports a variety of shorebirds and seabirds. Shorebird monitoring is conducted from September through May, three times per month. As many as 15 different species of shorebirds have been documented on the refuge. And, the impoundments are surveyed weekly during drawdowns at high tides. Wildlife Drive surveys are conducted twice per month during lowtide. Further, the refuge manages water levels in the impoundments to serve a mix of species, including migrating shorebirds. The refuge manages very little beachfront, only at the Perry Tract, and subsequently plays a small role for beachfront shorebird and seabird nesting and resting.

In addition to shorebirds, the refuge also supports a mix of wading birds, waterbirds, and waterfowl. Surveys have documented 16 species of wading and waterbirds on the refuge.

Other Species

The refuge also serves a variety of other species, including over 100 fish species (including exotic species), and various sharks, skates, and rays. The refuge seines three times a year to determine the composition of juvenile and baitfish populations using the refuge. Mullet, snook, red drum, snapper, and tarpon are common on the refuge. Other animals commonly seen include alligators, frogs, snakes, lizards, turtles, rabbits, bobcats, otters, and dolphins (*Tursiops truncatus*).

Exotic, Invasive, and Nuisance Species

Most refuge habitats have been impacted by exotic, invasive, and nuisance species. Table 9 provides a list of those known exotic, invasive, and nuisance species on the refuge. Plant species of refuge management concern include Brazilian pepper, Australian pine, rosary pea (*Abrus precatorius*), air potato (*Dioscorea bulbifera*), guava (*Psidium guajava*), narrow-leaved cattail (*Typha angustifolia*), earleaf acacia (*Acacia auriculiformis*), Java plum (*Syzygium cumini*), mother-in-law's tongue (*Sansevieria hyacinthoides*), seaside mahoe (*Thespesia populnea*), Japanese climbing fern (*Lygodium japonicum*), West Indian marsh grass (*Hymenachne amplexicaulis*), cogongrass (*Imperata cylindrical*), carrotwood (*Cupaniopsis anacardioides*), beach naupaka (*Scaevola taccada*), night-blooming cereus (*Hylocereus undata*), climbing cassia (*Senna pendula*), lead tree (*Leucanea leucocephala*), umbrella tree (*Shefflera actinophylla*), lantana (*Lantana camara*), winged yam (*Dioscorea alatat*), and Guinea grass (*Panicum maximus*) (U.S. Fish and Wildlife Service 2001 and 2009). This area also faces impacts from exotic, invasive, and nuisance animal species, including black rat (roof rat, palm rat) (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), Eurasian collared-dove (*Streptopelia decaocto*), white-winged dove (*Zenaida asiatica*), monk parakeet (*Myiopsitta monachus*), green parakeet (*Aratinga holochlora*), green iguana (*Iguana iguana*), Savannah monitor lizards (*Varanus exanthematicus*), Nile monitor lizard (*Varanus niloticus*), brown anole (*Anolis sagrei*), knight anole (*Anolis equestris*), red-headed agama (*Agama agama africana*), Indo-Pacific gecko (*Hemidactylus garnotii*), tropical house gecko (*Hemidactylus mabouia*), tokay gecko (*Gekko gecko*), northern curly-tailed lizard (*Leiocephalus carinutus*), brahminy blind snake (*Ramphotyphlops braminus*), Burmese python (*Python molurus bivittatus*), red-eared slider (*Trachemys scripta elegans*), Cuban treefrog (*Osteopilus septentrionalis*), greenhouse frog (*Eleutherodactylus planirostris planirostris*), and green mussel (*Musculista senhousia*). Well-established exotic animals on the refuge include the brown anole, Cuban treefrog, greenhouse tree frog, Indo-Pacific gecko, tokay gecko, red fire ant (*Solenopsis invicta*), Mayan cichlid (*Cichlasoma urophthalmus*), walking catfish (*Clarias batrachus*), and Mozambique tilapia (*Oreochromis mossambicus*). And the Chinese mysterysnail (*Cipangopaludina chinensis malleate*) has been found nearby in a Cape Coral canal (Loren Coen, personal communications, 2009). The refuge has conducted numerous exotic plant treatments and annually treats exotic, invasive, and nuisance plants on about half of the refuge's lands. And, the refuge has removed and euthanized green iguanas and

Nile monitor lizards both on and off the refuge. Further, the refuge has trapped and euthanized black rats around refuge facilities and it has hazed nuisance raccoons, euthanizing when necessary.

Florida hosts the largest number of nonindigeneous fish species in the continental U.S. Examples of exotic fish found on Sanibel Island and in surrounding waters include Mayan cichlid, Mozambique tilapia, and walking catfish. While their effect on native aquatic organisms is not thoroughly known, some problems are evident. Mozambique tilapia are suspected to be a threat to native striped mullet in Hawaii and may compete with native centrarchid species, while Mayan cichlids are known to be voracious predators (U.S. Fish and Wildlife Service 1999 and U.S. Geological Survey 2009).

Table 9. Exotic, invasive, and nuisance species occurring on or in the vicinity of J.N. "Ding" Darling NWR

Common Name	Scientific Name
Fish	
Mayan Cichlid	*Cichlasoma urophthalmus*
Walking Catfish	*Clarias batrachus*
Mozambique Tilapia	*Oreochromis mossambicus*
Birds	
Green Parakeet	*Aratinga holochlora*
Canary-winged Parakeet	*Brotogeris versicolurus*
Rock Dove	*Columbo columbo*
Monk Parakeet	*Myiopsitta monachus*
House Sparrow	*Passer domesticus*
Rose-ringed Parakeet	*Psittacula krameri*
Eurasian Collared-Dove	*Streptopelia decaocto*
Ringed Turtle-Dove	*Streptopelia risoria*
European Starling	*Sturnus vulgaris*
White-winged Dove	*Zenaida asiatica*
Reptiles	
Red-headed Agama	*Agama agama Africana*
Knight Anole	*Anolis equestris*
Brown Anole	*Anolis sagrei*
Tokay Gecko	*Gekko gecko*

Common Name	Scientific Name
Indo-pacific Gecko	*Hemidactylus garnotii*
Tropical House Gecko	*Hemidactylus mabouia*
Green Iguana	*Iguana iguana*
Northern Curly-tailed Lizard	*Leiocephalus carinutus*
Burmese Python	*Python molurus bivittatus*
Brahminy Blind Snake	*Ramphotyphlops braminus*
Red-eared Slider	*Trachemys scripta elegans*
Savannah Monitor Lizard	*Varanus exanthematicus*
Nile Monitor Lizard	*Varanus niloticus*
Amphibians	
Greenhouse Frog	*Eleutherodactylus planirostris planirostris*
Cuban Treefrog	*Osteopilus septentrionalis*
Mammals	
House Mouse	*Mus musculus*
Norway Rat	*Rattus norvegicus*
Black Rat	*Rattus rattus*
Invertebrates	
Green Mussel	*Musculista senhousia*
Red Fire Ant	*Solenopsis invicta*
Plants	
Rosary Pea	*Abrus precatorius*
Earleaf Acacia	*Acacia auriculiformis*
Australian Pine	*Casuarina spp.*
Carrotwood	*Cupaniopsis anacardioides*
Winged Yam	*Dioscorea alatat*
Air Potato	*Dioscorea bulbifera*
Night-blooming Cereus	*Hylocereus undata*

Common Name	Scientific Name
West Indian Marsh Grass	*Hymenachne amplexicaulis*
Cogongrass	*Imperata cylindrical*
Lantana	*Lantana camara*
Lead tree	*Leucanea leucocephala*
Japanese Climbing Fern	*Lygodium japonicum*
Guinea Grass	*Panicum maximus*
Guava	*Psidium guajava*
Mother-in-Law's Tongue	*Sansevieria hyacinthoides*
Beach Naupaka	*Scaevola taccada*
Brazilian Pepper	*Schinus terebinthefolius*
Climbing Cassia	*Senna pendula*
Umbrella Tree	*Shefflera actinophylla*
Java Plum	*Syzygium cumini*
Seaside Mahoe	*Thespesia populnea*
Narrow-leaved Cattail	*Typha angustifolia*

Sources: U.S. Geological Survey 2008; Florida Fish and Wildlife Conservation Commission 2009; Lechowicz 2007; Sanibel-Captiva Conservation Foundation 2007; U.S. Fish and Wildlife Service 2007; Skip Snow 2009, personal communication; and William Thomas 2009, personal communication

CULTURAL RESOURCES

Southwest Florida has had a long, rich, and colorful cultural history over the past 8,000 years. As many as 6,000 years ago, Native Americans inhabited this coastal region. The shell mounds that occur along the coast of both Lee and Charlotte Counties were once utilized by the Calusa Indians, the fore bearers of one of the most powerful and complex Native American societies. Dating as far back as 2,500 years, the native Calusa Indians were the first-known residents of the barrier island. The Calusa skillfully utilized the abundant resources of the waterways around the island for food and tools. Whelks, conchs, clams, oysters, and other seafood were used for food, and their empty shells were crafted into tools, as were bones, turtle shells and shark teeth. The Calusa proved to be skilled builders and craftsmen, constructing their stilted huts high atop shell mounds to provide protection from storm tides. Some of their shell mounds, which were also used for ceremonial and burial rites, remain intact today.

Archaeological surveys of the refuge were conducted by William Kennedy in 1978 and New World Research, Inc., in 1982. Both of these surveys focused on proposed project impacts on Sanibel Island. Kennedy's survey was limited to upland and mangrove areas; he located 17 sites (6 historic and 11 prehistoric sites). The prehistoric sites were all shell middens. New World Research, Inc. surveyed a 150-acre tract on Sanibel Island to be impacted by Brazilian pepper tree control. The historic sites included the Sanibel Lighthouse and Keeper's Quarters (no longer part of the refuge) and the Gavin Household Site (pioneering African-American family). They located 7 new sites (6 historic and 1 prehistoric sites). The prehistoric site was also a shell midden. Marquardt (University of Florida) conducted intensive archaeological research of shell middens associated with the Calusa on several islands in the Charlotte Harbor area, including Buck Key, between 1985-1988. On Buck Key, Marquardt discovered 3 prehistoric sites (2 shell middens and 1 burial mound).

To date, twenty-seven known historic and prehistoric sites are on the refuge.

Explorer Juan Ponce de Leon is believed to have discovered Sanibel Island – which he named "Santa Isybella" after Queen Isabella – in 1513 while searching for the "Fountain of Youth." He and his Spanish sailors battled the hostile Calusas for years, and Ponce de Leon eventually suffered a mortal wound from a poison arrow attack at their hands in 1523, at which time he retreated to Cuba and died.

The Spanish were unsuccessful in converting the Calusas and establishing any permanent settlement on Sanibel. However, their infiltration brought European disease and slavery. Overcome by yellow fever, tuberculosis, and measles, the Calusa population all but became extinct by the late 1700s. Around 1763, when Spain traded Florida to Britain, most of the remaining Calusas immigrated to Cuba along with the departing Spaniards. South Florida remained largely ungoverned so Creek Indians from Georgia migrated into Florida and formed the Seminole Tribe. Spain retook Florida from Britain in 1784 at the conclusion of the American Revolutionary War, but did not attempt to re-colonize the territory. Instead, Spain offered land grants to American settlers.

In the early 1800s, the Florida's Seminole Indians (Seminole means "wild people") did not welcome Americans trying to colonize the territory. Attacks between American settlers and the Seminoles increased to the point that the United States Army led incursions into Florida to fight the First Seminole War in 1817-1818. Shortly thereafter, Spain ceded Florida to the United States in 1821. As settlements grew, so did conflicts with the Seminoles.

Europeans populated Sanibel Island in the 19th century with small fishing settlements. After extensive exploration and surveying, Sanibel Island was purchased in 1831 by the Florida Peninsular Land Company (a group of New York investors) as a settlement site because of its good harbor, climate, and general amenities. The first settlers, who arrived in 1833, lived temporarily in palmetto-thatched huts with floors of shell and sand. These early settlers envisioned the island as a paradise for recreation and health recuperation, but most of the settlers deserted because of a series of Indian raids in 1836 (Clark 1976). The Second Seminole War was fought from 1835 until 1842. The long-lasting war was brutal by any standard (as up to 1,500-2,000 U.S. soldiers were killed) and discouraged any permanent settlements in Florida for many decades.

In 1845, Florida was admitted to the Union and became the 27th State**.** In 1850, Fort Casey was erected on the site of a former settlement. A hurricane destroyed much of the fort two decades later. Florida joined the other Confederate States in seceding from the Union in 1861. Florida was the least populated southern state with only 140,424 people, of whom 44 percent were enslaved. After the Civil War the military increased its presence on Sanibel Island and as a result it was deemed safe for settlers. Colonists again returned under the provisions of the Homestead Act of 1862.

Only two persons registered in the 1870 U.S. Census. In 1870, the U.S. Government decided to locate a lighthouse on the eastern tip of Sanibel Island to protect ships from running aground at night and to mark the entrance to San Carlos Bay for ships calling at the port of Punta Rassa, in the eastern part of San Carlos Bay. On August 20, 1884, the Sanibel Lighthouse was first lit, and it remains a historic working lighthouse to this day. The Sanibel Island Light was the first lighthouse on Florida's Gulf coast north of Florida Keys.

Agricultural development on Sanibel started about 1883 and over the next 40 years encompassed most of the Island's arable land. The major agricultural products were citrus fruits and vegetables such as tomatoes, squash, and eggplants. By 1889, there were 21 houses and 40 families living on Sanibel. In 1892, with a population nearing 100, Sanibel built its first schoolhouse, which visitors can now see displayed at the Sanibel Historical Village. Agriculture took a hard hit with the hurricanes of 1921 and 1926; the first of which split the island in two, the latter which featured a 13- to 14-foot storm surge that completely flooded all low-lying areas. Island agriculture never recovered, effectively ended farming on Sanibel.

Wealthy industrialists from the north, such as Thomas Edison and Henry Ford, discovered the balmy climate and fishing paradise of Fort Myers and made their winter homes there, Edison in 1885 and Ford in 1916. They, along with mutual friends Harvey Firestone and famous nature writer John Burroughs (altogether known as The Vagabonds), made camping adventures into the Everglades and also made their way across the bay to Sanibel and Captiva Islands for fishing, shelling, and bird watching. Former President Theodore Roosevelt, also a friend of John Burroughs, visited Captiva in 1917, the last excursion before his death, to harpoon devilfish (manta rays), study gopher tortoises, and inspect the bird refuges he protected as President in 1908 (Pine Island, Matlacha Pass, and Island Bay). He stayed on a house barge in what is now called Roosevelt Channel. During his trip, Roosevelt observed and remarked how more abundant the bird life was as a result of the protection he granted them (Roosevelt 1917; Roosevelt 1917a). His friend, famed ornithologist Frank Chapman, observed very few birds in 1888 on a trip to Pine Island and Sanibel Island (Chapman 1933)

Other famous Americans continued to seek a tranquil retreat on the islands. Charles Lindbergh and his wife, Anne Morrow Lindbergh, frequently visited; in fact, Anne wrote her famous *"Gifts from the Sea"* while vacationing on Captiva Island. Poet Edna St. Vincent Millay, the first woman awarded the Pulitzer Prize for Poetry, also enjoyed visits to Sanibel Island.

Regarded as one of the island's most influential visitors, Jay Norwood "Ding" Darling first discovered Sanibel Island on a trip in 1935. A Pulitzer Prize-winning political cartoonist and noted conservationist, "Ding" wintered on Captiva, and actively campaigned for protection of Sanibel Island's fragile ecosystem. Creation of the refuge began in the late 1930s, when "Ding" Darling learned that the State of Florida was nearing agreement to sell 2,200 pristine acres of Sanibel's mangrove wetlands to developers for fifty cents an acre. In 1939, Darling received the support of local landowners and convinced Florida Governor Spessard Holland to establish a state wildlife refuge. Darling later arranged for the Service to further protect the threatened land by establishing a national wildlife refuge (J. N. "Ding" Darling Foundation, http://www.dingdarling.org/wildlife.html).

On December 1, 1945, the Service entered into agreement with the State of Florida through a lease, under the authority of the Migratory Bird Conservation Act of 1929, for 2,392 acres of land, creating Sanibel National Wildlife Refuge. "Ding" Darling died on February 12, 1962, several months after suffering a stroke. He left a significant conservation legacy, both on Sanibel Island and across the nation. His tremendous leadership inspired other leaders, including Presidents. Shortly after his death, the J. N. "Ding" Darling Foundation was formed with Trustees including former Presidents Eisenhower and Truman. The Foundation supported expanding the refuge and renaming it in his

honor. In 1967, Jay Norwood "Ding" Darling's longstanding and widespread conservation achievements were immortalized by renaming the refuge, J.N. "Ding" Darling National Wildlife Refuge. "Ding" Darling's posthumous influence didn't end there. His example inspired local conservationists to form the Sanibel-Captiva Conservation Foundation to continue conservation work on private lands. This became more imperative as Sanibel Island began rapidly changing.

The Sanibel Causeway was completed in 1963, (replacing the half-hour ferry ride from Fort Myers) and soon threatened to change the face of the island. Many were concerned that Sanibel would succumb to over-development and lose its charm and natural heritage. In 1974, Sanibel residents voted to establish "home rule" against much opposition from Lee County, the Chamber of Commerce, realtors and developers. The forming of their own city government allowed residents to control their own destiny in preserving the island. The new city would have zoning power and the authority to develop and implement a land-use plan that controlled growth and preserved environmental values. Land use restrictions enacted in 1976 continue to guide growth and development today, ensuring that generations of families will be able to enjoy the special ambience and quiet harmony that Sanibel Island has to offer.

Throughout its recent history, Sanibel's reputation as a sanctuary island attracted more and more visitors. Known as one of the top birding hot spots in the nation and drawn by beautiful beaches, shelling, fishing, and wildlife, approximately 700,000 visitors visit the refuge each year.

(Sources: Hammond, 1970; Hammond, 1970a; Sanibel and Captiva Islands Chamber of Commerce, 2009; and, Wikipedia, March 2009)

SOCIOECONOMIC ENVIRONMENT

REGIONAL DEMOGRAPHICS AND ECONOMY

Although Native Americans inhabited the area about 6,000 years ago and although more modern settlement of the area began to prosper in the 1850s, much of the development of the area did not occur until post WWII with the influx of war veterans. The refuge is located on Sanibel Island in Lee County, Florida. Close to 10 million people – about two-thirds of the State of Florida's 2000 Census population – live within a 150-mile radius of Lee County, and that number is expected to increase to more than 13 million by the year 2010 (Bureau of Economic and Business Research 1999). Three metropolitan areas (Lee, Collier, and Charlotte Counties) contribute a high number of visitors to the refuge. The populations of Lee and Charlotte Counties have grown to be currently estimated at about 796,000 with an additional nearly 381,000 for Collier County (Zwick and Carr 2006). Lee County encompasses the entire Cape Coral-Fort Myers, FL Metropolitan Statistical Area (MSA); Collier County encompasses the entire Naples-Marco Island MSA; and, Charlotte County encompasses the entire Punta Gorda MSA. All three counties are highly developed, with 88-90 percent of their populations living in urban areas (City Data 2008). The U.S. Census Bureau, in its 2006 American Community Survey, estimated the populations of these MSAs, as listed (U.S. Census Bureau 2006).

- Cape Coral-Fort Myers, FL MSA - 571,344
- Naples-Marco Island MSA - 314,649
- Punta Gorda MSA - 154,438

Within the 15-year life of the CCP and by 2025, Charlotte County is expected to grow 26 percent to 224,577 (gaining about 47,000 people during the 15 years), while Lee County is expected to grow 36 percent to 838,209 (gaining 220,000 people during the 15 years) and Collier County is expected to grow 45 percent to 553,762 (Zwick and Carr 2006). By 2060, Charlotte County is expected to reach

335,713 (increasing 2.4 times since 2000 and 1.9 times since 2010), while Lee County would be nearly 1.4 million (more than tripling since 2000 and more than doubling since 2010) and Collier County would reach 963,051 (increasing 3.8 times since 2000 and 2.5 times since 2010) (Zwick and Carr 2006). The State of Florida is anticipated to reach 21 million by 2015, nearly 26 million by 2030, and nearly 36 million by 2060 (Zwick and Carr 2006).

Population growth in Florida is the State's primary engine of economic growth, fueling both employment and income growth (Florida Legislature 2007). From 1960 to 2008, population in the State of Florida increased from just fewer than 5 million to over 18 million, an increase of over 260 percent. In addition, the J.N. "Ding" Darling NWR area of coastal southwest Florida is one of the fastest urbanizing regions in the U.S. Between 1960 and 2000, area population increased from 90,000 to 900,000, a 10-fold increase (Main and Allen 2008). The U.S. Census Bureau estimates that of the 25 U.S. counties with the largest numerical increases in population from 2000 to 2006, six of them are Florida counties. Between 2000 and 2006, Lee County's population increase of over 130,000 (an approximate 30 percent increase in population) ranked 25th nationally in terms of numerical population growth (U.S. Census 2006b). During the same 6-year period, the population of Collier and Charlotte Counties increased just over 25 percent and 9 percent, respectively.

Per-capita incomes in the three counties are above the State and national averages. Approximately 9 percent, 9.7 percent, and 7.5 percent of individuals live at or below the poverty level in Lee, Collier, and Charlotte Counties, respectively (see Table 10), which are lower than the state (12.6 percent) and national (13.3 percent) rates. Unemployment levels in Lee, Collier, and Charlotte Counties recently have risen above the national average. In September 2007, unemployment rates for Lee, Collier, and Charlotte Counties were 5.2 percent, 5.3 percent, and 5.9 percent, respectively, compared to the state and national unemployment rates of 4.3 percent and 4.7 percent, respectively (Regional Economic Research Institute 2007). Demographic and economic information of the three counties is given in Table 10.

The economy of Lee County is large and diversified. Once a retirement haven, Lee County is now dominated by working-age people. The service industry (33 percent), retail trade (14 percent), construction (13 percent), governmental (federal, state, and local 12 percent), and financial activities (5 percent) are the five largest employment sectors (Southwest Florida Economic Development Office 2009). Although these statistics show a low percentage of residents being employed in commercial fishing industry and the recreational sport fishing business, they directly and indirectly affect several other employment sectors by having a positive impact on the area's tourism. Table 11 shows the growth rates and industry employment projections for Lee County from 2007 to 2015.

Table 10. Demographics of the Charlotte Harbor region

Characteristic	Lee County[b]	Collier County[c]	Charlotte County[d]	State of Florida	United States
Demographic					
Population, 2006	571,344	314,649	154,438	18,089,888	299,398,485
Total Land Area (square miles)	803.6	2,025.3	693.6	53,926.8	3,537,438.0
Population Increase (%), since 2000	29.6%	25.2%	9.1%	13.2%	6.4%
Population Density (population/square mile)	711	155	223	335	85
Race/Ethnicity (% of Population)					
White	84.6	83.7	90.5	76.1	73.9
Black/African American	7.3	5.5	5.5	15.4	12.4
Hispanic/Latino (of any race)	16.1	25.2	4.7	20.1	14.8
Asian	1.3	1.0	0.9	2.2	4.4
Education (% of population over 25)					
High School degree	85.6	83.8	88.6	84.1	84.1
College degree	24.1	29.0	21.1	27.0	27.0
Economic					
Median Household Income	$ 48,553	$ 55,888	$ 44,166	$ 45,495	$ 48,451
Per capita Income	$ 29,069	$ 34,650	$ 26,538	$ 25,297	$ 25,267
Families below poverty level (%)	6.0%	6.3%	5.6%	9.0%	9.8%
Individuals below poverty level (%)	9.0%	9.7%	7.5%	12.6%	13.3%

[a] Source: U.S. Census Bureau 2006
[b] The Cape Coral-Fort Myers, FL Metropolitan Statistical Area (MSA)
[c] The Naples-Marco Island, FL Metropolitan Statistical Area (MSA)
[d] The Punta Gorda, FL Metropolitan Statistical Area (MSA)

Table 11. Lee County employment projections, 2007-2015

Industry	2007 Employment	2015 Employment	Annual Growth Rate
Agriculture, Forestry, and Fishing	1,626	1,492	-1.0%
Construction	34,443	38,665	1.53%
Manufacturing	7,712	8,226	0.83%
Wholesale Trade	7,195	8,605	2.45%
Retail Trade	37,779	44,450	2.21%
Transportation and Warehousing	3,802	4,471	2.20%
Information	4,123	4,373	0.76%
Financial Activities	13,969	15,807	1.64%
Professional and Business Services	29,322	37,494	3.48%
Education and Health Services	21,562	26,976	3.14%
Leisure and Hospitality	28,945	34,094	2.22%
Other Services	9,427	11,343	2.54%
Federal Government	2,311	2,400	0.48%
State Government	4,430	5,310	2.48%
Local Government	27,397	31,692	1.96%
Self-Employed and unpaid Family Workers	26,385	28,845	1.17%
Totals	**273,589**	**305,192**	**2.09%**

Source: Southwest Florida Economic Development Office 2009

RECREATION AND TOURISM

Not only does Florida have a high number of residents and high growth rates, it also experiences high tourism. Nearly 84 million people visited Florida in 2006 (Florida Department of Transportation and University of South Florida 2008). Given the growth, proximity, and the socioeconomic impacts of the MSAs, strong development pressures are being felt by the refuge. An estimated 3.6 million tourists visit the 3-county area and spend an estimated 2.1 billion dollars each year, based on 2005 data for Lee and Charlotte Counties and 2003 data for Collier County [Lee County Visitors and Convention Bureau 2005, Charlotte County Visitors Bureau 2005, and Collier County Tourist Development Council 2003].

Popular area recreational activities include boating, swimming, sunbathing, and fishing. In addition to the economic activity provided by recreation and tourism; commercial fishing, citrus agriculture and beef cattle production, and phosphate mining are of economic importance in the three-county area. 1996 dollar estimates for these four economic activities are listed for the Charlotte Harbor NEP study area (Hazen and Sawyer 1998).

- Tourism and Recreation $2,196.9 million
- Agriculture $671.6 million
- Mining $270.3 million
- Commercial Fishing $22.6 million

The J.N. "Ding" Darling NWR hosts an estimated 700,000 visitors a year. Table 12 provides details of recreation visits in 2004, while Table 13 provides recreation expenditure information for 2004 (note: the refuge experienced lower visitation numbers in 2004 due to Hurricane Charley and subsequent closures). As Table 12 shows, the 2004 estimated 723,365 visitors accounted for 1.5 million visits participating in various activities on the refuge. Non-consumptive activities (e.g., wildlife observation, photography, and hiking) accounted for about 94 percent of total refuge recreation visits. About 25 percent of recreation visits are undertaken by area residents, while about 75 percent of recreation visits were by non-residents. Total expenditures by visitors to the refuge were almost 32 million dollars in 2004, with non-residents accounting for 92 percent of these expenditures. Non-consumptive activities accounted for about 91 percent of these expenditures, with the remaining 9 percent of these expenditures for fishing (Caudill and Henderson 2005).

Table 12. J.N. "Ding" Darling NWR: 2004 recreation visits

Activity	Residents	Non-Residents	Total
Non-Consumptive:			
Nature Trails	130,794	523,174	653,968
Observation Platforms	24,352	137,995	162,347
Other Wildlife Observation	49,397	279,350	328,647
Beach /Water Use	1,538	13,839	15,377
Other Recreation	140,441	140,441	280,882
Hunting:			
Big Game	0	0	0
Small Game	0	0	0
Migratory Birds	0	0	0
Fishing:			
Freshwater	210	52	262
Saltwater	44,837	44,837	89,674
Total Visitation	***391,468***	***1,139,689***	***1,531,156***
Total Visitors			***723,365***

Source: Caudill and Henderson 2005

Table 13. J.N. "Ding Darling" NWR: visitor recreation expenditures (2004 $,000's)

Activity	Residents	Non-Residents	Total
Non-Consumptive:	$1,664.3	$27,118.1	$28,782.4
Hunting:			
Big Game	–	–	–
Small Game	–	–	–
Migratory Birds	–	–	–
Total Hunting	–	–	–
Fishing:			
Freshwater	$0.9	$2.5	$3.5
Saltwater	$727.9	$2,245.7	$2,973.5
Total Fishing	$728.8	$2,248.2	$2,977.0
Total Expenditures	***$2,393.1***	***$29,366.3***	***$31,759.4***

Source: Caudill and Henderson 2005

Outdoor Recreational Economics

The wildlife resources of the J.N. "Ding" Darling NWR are economically important. In addition to the commercial and recreational fishing, ecotourism, including wildlife viewing and photography and environmental interpretation, is increasingly being seen as economically important to local businesses. As the population increases and the number of places left to enjoy wildlife decreases, the refuge is anticipated to become even more important to the local community. It benefits the community directly by providing recreational and employment opportunities for the local population and indirectly by attracting tourists from outside the area to generate additional income to the local economy. Table 14 presents this information and summarizes the economic value of wildlife watching in Florida by U.S. residents.

Table 14. Activities in Florida by U.S. residents - wildlife watching (observing, photographing, or feeding wildlife)

Total wildlife-watching participants	**4,240,000**
Away-from-home participants	1,560,000
Around-the-home participants	3,274,000
Days of participation away from home	16,551,000
Average days of participation away from home	11
Total expenditures	$3,081,496,000
Trip-related	.$887,942,000
Equipment and other	$2,193,554,000
Average per participant	$720
Average trip expenditure per day	$54
Total trip and equipment expenditures by non-residents in Florida	**$653,278,000**
Average per non-resident participant	$858
Average trip expenditure per day	.$104

Source: U.S. Fish and Wildlife Service and U.S. Census Bureau 2006

REFUGE ADMINISTRATION AND MANAGEMENT

The J.N. "Ding" Darling NWR Complex serves as the headquarters for the Refuge Complex and all Refuge Complex staff offices are located at the refuge on Sanibel Island. The refuge is currently managed:

- To join in partnership with the residents of Sanibel Island and Captiva Island, Lee County, and State of Florida to safeguard and enhance over 6,400 acres of pristine habitat for the benefit of wildlife;
- To protect and provide suitable habitat for federal endangered and threatened species, including the American crocodile, West Indian manatee, wood stork, eastern indigo snake, and loggerhead sea turtle;
- To implement sound wildlife management techniques to provide feeding, nesting, loafing, and roosting habitat for a wide diversity of shore birds, wading birds, waterfowl, raptors, and neo-tropical migratory species;
- To provide quality interpretive and environmental education programs in order to develop within each refuge visitor an appreciation of fish and wildlife ecology and to provide quality wildlife-dependent recreation compatible with the purposes for which the refuge was established;
- To maintain native fish populations to contribute to the ecological integrity of the estuary, provide a food source to sustain wildlife foraging opportunities and to support a recreational sport fishery;
- To maintain native wildlife and plant populations to contribute to the ecological diversity and integrity of the refuge; and
- To maintain healthy and diverse natural habitats through protection, restoration, exotic plant control, and fire management.

LAND PROTECTION AND CONSERVATION

The J.N. "Ding" Darling NWR was established on December 1, 1945, and encompasses 5,232 fee title acres located in Lee County, Florida, including 1,600 acres of submerged lands. In addition, management agreements with the State of Florida include 950 acres for Tarpon Bay and the 186-acre State (Sanibel) Botanical Site. The refuge's current management boundary is 6,407 acres (2,592.8 ha). Most of the inholdings within the refuge's acquisition boundary are already held in conservation, including by the Sanibel-Captiva Conservation Foundation, Lee County, and the National Audubon Society. Figure 24 and Table 15 provide the status for the refuge.

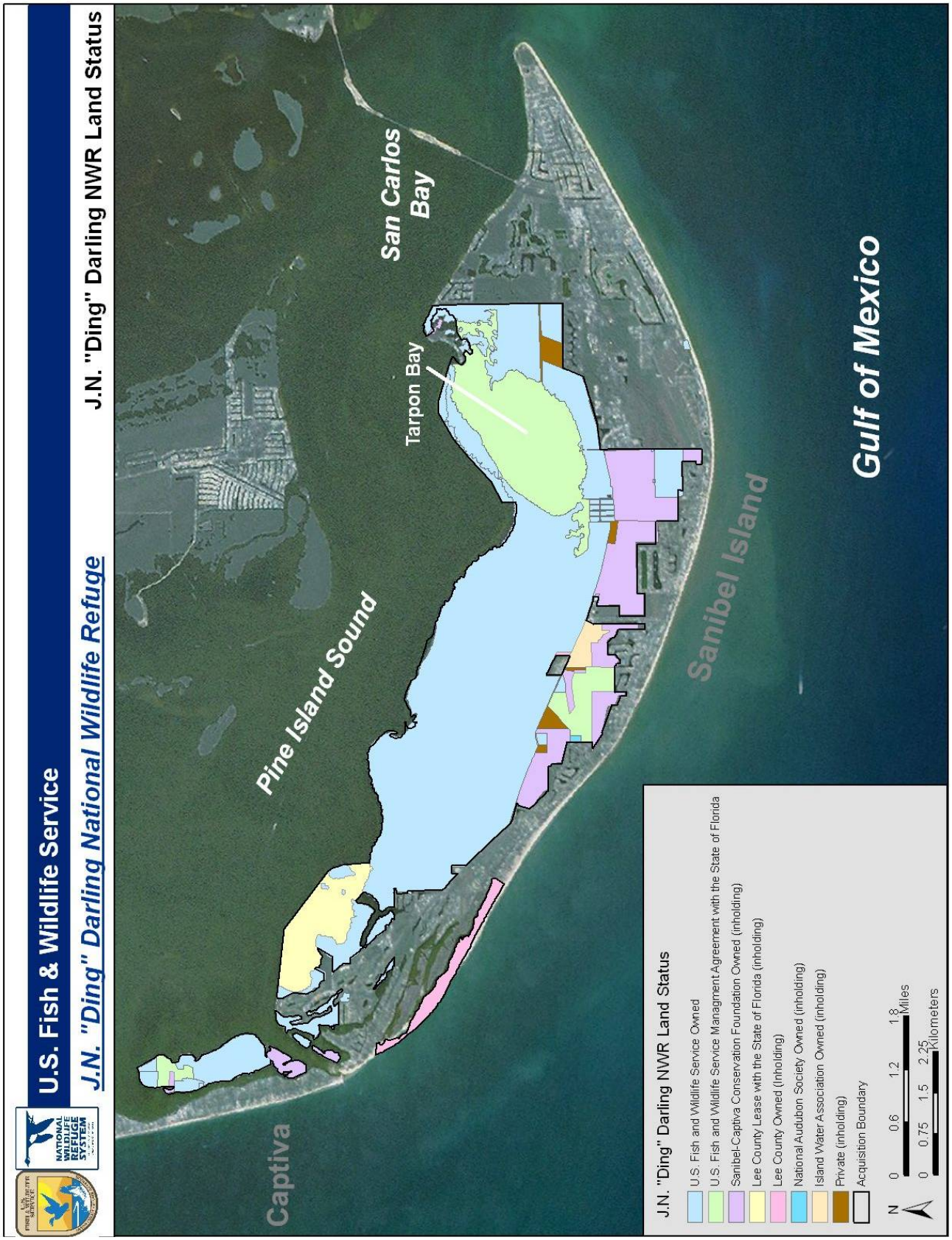
Table 15. Land status for J.N. "Ding" Darling NWR

Land Status	Acres	Hectares
FWS Owned	5,232	2,117.3
Management Agreement with the State of Florida (including Tarpon Bay and the State Botanical Site)	1,175	475.5
Subtotal (Management Boundary)	**6,407**	**2,592.8**
Inholdings (including 211.84 acres owned by SCCF and 706.16 acres of other inholdings)	918	371.5
Total (Acquisition Boundary)	**7,325**	**2,964.3**

The refuge includes several notable tracts of land, as listed.

- Darling Tract: The Darling Tract is approximately 4,000 acres, consists of primarily mangrove wetlands and mudflats on the bay side of the Island, and contains two brackish impoundments totaling 850 acres used by migratory and wading birds. Over 2,600 acres of this Tract are designated as a Wilderness Area.
- Sanibel Botanical Site: The Sanibel Botanical Site is managed under an agreement with the State of Florida and is dominated by the Sanibel River, spartina marsh, and leather fern in the lower areas with cabbage palm on the ridges. The tract is located on the south side of the Sanibel-Captiva Road, across from the refuge's maintenance center.
- Bailey Tract: The Bailey Tract is located in the central part of the Island and contains several small, dredged ponds, freshwater sloughs dominated by spartina marsh, and low dikes.
- Perry Tract: The Perry Tract is a heavily visited Gulf side beach front with native dune vegetation and a small freshwater pond surrounded by coastal scrub.
- Wulfert Point: Wulfert Point is located on the west end of the Island and is property that was donated to the Service by the U.S. Army Corps of Engineers. The tract is primarily mangrove.

Figure 24. Status map for J.N. “Ding” Darling NWR



- Buck Key: Buck Key is the only refuge tract not located within the city limits of Sanibel. The island is west if Wulfert Point near Captiva and contains a mixture of mangroves and West Indian hardwood hammock habitat. Buck Key is one of the largest undeveloped barrier islands in Lee County.

VISITOR SERVICES

Many educational and recreational opportunities are available on the refuge, including fishing, boating, kayaking/canoeing, bicycling, nature photography, bird watching, environmental education, and interpretive programs and tours. Figures 25 and 26 identify some of the more popular visitor sites on the refuge. The refuge's 620,910 annual visitors in 2008 participated in wildlife observation and photography (536,000), fishing (27,000), environmental education (6,000), interpretation (43,000), visitor center activities (178,000), special events (9,000), and other recreational activities (51,000), resulting in 850,000 visits for the year.

Education Center

The refuge's visitor center features interactive exhibits on refuge ecosystems, the work of "Ding" Darling, migratory flyways, the Refuge System, an auditorium, and a hands-on area for children. Annual visitation to the Education Center is estimated to be 178,000. The Center is open daily, except for most federal holidays. The Center hours are January - April from 9:00 a.m. to 5:00 p.m. and May - December from 9:00 a.m. to 4:00 p.m. The Center is located two miles west of Tarpon Bay Rd. on Sanibel-Captiva Road. A bookstore is located in the Education Center and is operated by the "Ding" Darling Wildlife Society. Visitors can find numerous field guides, nature books, children's books, shirts, postcards, and many other items. Revenues from the bookstore help to fund many refuge programs.

Wildlife Drive

The refuge's Wildlife Drive is open to vehicular, bicycle, and foot traffic Saturday through Thursday from sunrise to 1/2 hour before sunset. Annually, about 350,000 people visit the Wildlife Drive. The Drive is closed every Friday to all public access, allowing wildlife an opportunity to feed along the Drive with minimal human disturbance, allowing refuge staff the opportunity to do maintenance along the road without endangering the public, and allowing biologists to do surveys and other research without human interference. The Wildlife Drive is open on all federal holidays unless those holidays fall on a Friday. Dogs are allowed on the Drive as long as they are kept on a leash no longer than 6 feet at all times. There are two designated kayak/canoe launch sites along the Wildlife Drive. Guided kayak and canoe tours are offered from Canoe Adventures along the Drive and in Tarpon Bay through the Tarpon Bay Explorers concession. There is also kayaking/canoeing around Buck Key off of Captiva Island. Visitors may also tour the Wildlife Drive and most of the trails by bicycle. All bicyclists must obey the one-way rule of the road. From the Education Center, it is an 8-mile loop along the Wildlife Drive and returning along the main bike path along Sanibel-Captiva Road, or a 4-mile loop along Wildlife Drive returning along the Indigo Trail. The Wildlife Drive entrance is located in the Education Center parking lot. Entrance fees for 2008 were $5 per vehicle and $1 per walker/biker over 15 years of age. The America the Beautiful National Parks and Federal Recreation Lands Pass and the current year's Federal Duck Stamp are accepted and may be purchased at the entrance gate or in the Education Center.

Figure 25. J.N. "Ding" Darling NWR visitors map

Figure 26. J.N. "Ding" Darling NWR visitors map: Wildlife Drive-Indigo Trail and Shell Mound Trail viewing areas

Hiking Trails

There are three trails that can be accessed from the Wildlife Drive. The 4-mile, round-trip Indigo Trail leaves from the Education Center parking lot and ends at the cross-dike, which extends from the Drive. Along the Indigo Trail, visitors often spot wildlife, including alligators, night herons, and white ibises. The Wulfert Keys Trail off the Drive is a 1/4-mile trail leading to a view of Pine Island Sound. The Shell Mound Trail is a 1/4-mile, universally accessible, interpretive boardwalk. The vegetation along the Shell Mound Trail sustained a lot of damage in 2004 from Hurricane Charley, but visitors can still learn about the ancient Calusa Indians and the native vegetation while reading interpretive panels along the boardwalk. The Bailey Tract is located off Tarpon Bay Rd. This 100-acre parcel is a unique area of the refuge with its interior wetlands where freshwater plants and wildlife dominate. The 3 miles of trails on the Bailey Tract can be accessed by walking or biking at any time.

Fishing

Saltwater fishing, freshwater fishing, and crabbing are all popular activities in and around the refuge. Saltwater fishing is popular along the Wildlife Drive, in Tarpon Bay, and in the backwaters of the refuge. Commonly caught fish include sheepshead, snook, redfish, and spotted sea trout. All Florida state fishing laws apply for saltwater and freshwater fishing and crabbing. Boating is allowed in the refuge in designated areas and all refuge waters are slow speed/minimum wake zones. The refuge has over 2,600 acres of designated Wilderness Area that are a non-motorized zone. The refuge also manages a pole/troll zone at Wulfert Flats. An estimated 90,000 users annually participate in fishing on the refuge. While some special use permits have been issued in the past to fishing guides operating on the refuge, none have been issued recently.

Interpretive Programs and Tours

Interpretive programs and tours are offered to the public during the winter season, January 1 through March 31. Refuge staff, volunteers, and concessionaire provide interpretation for over 84,000 visitors per year. The tours include excursions to explore the Bailey Tract, birding on the refuge, biking the Wildlife Drive and Indigo Trail, and wandering through the Shell Mound Trail. The birding tours are conducted along the Wildlife Drive and are car caravan tours. The programs are generally given at the Cross-dike Pavilion and are done on various topics including crocodilians, birds, manatees, and endangered species. Programs on Fridays are done in the Education Center Auditorium. Two programs popular with school age children are listed.

- Reading in the Refuge -- A naturalist relates stories about the refuge. Participants hear an exciting book followed by a program highlighting the estuarine ecosystem. Story time is appropriate for pre-K through 8th grade, but everyone is welcome.
- Jr. Refuge Manager Activity – This activity offers the chance to get a Jr. Refuge Manager's Badge. Worksheets are picked up at the Information Desk in the Education Center and participants explore the estuary and navigate through the exhibits in the Education Center to answer the questions. This activity is geared for children ages 7-16.

Tours throughout the year are also offered by the refuge's concessionaire, Tarpon Bay Explorers. It offers guided tram tours along the Wildlife Drive leaving from the Education Center's parking lot. At the Tarpon Bay Recreation Area, Tarpon Bay Explorers (the refuge's concessionaire) provides kayak/canoe and sea life interpretive tours, and visitors can view refuge marine life up close. Visitors may also rent bicycles, kayaks, canoes, pontoon boats, and fishing equipment; purchase bait and fishing licenses; or book a charter fishing trip.

Environmental Education

Individually tailored environmental education field trips to the refuge are available for schools classes, scout groups, home school students, and community groups. Annually the refuge supports about 17,000 visitors for formal environmental education programs. Refuge staff members are also available to visit school classrooms as part of the school outreach program. A variety of school programs for grades K-12 (which incorporate Florida's Sunshine State Standards in their curriculum) are offered by the refuge education staff. Over 15 different programs are available and can be adapted to any grade and ability level. Topics for these programs include: Introduction to the J.N. "Ding" Darling National Wildlife Refuge and Refuge System; Importance of the Estuary; Reading in the Refuge; Our Feathery Friends; Nocturnal Animals; and Florida's Wacky Wildlife.

Concessionaire

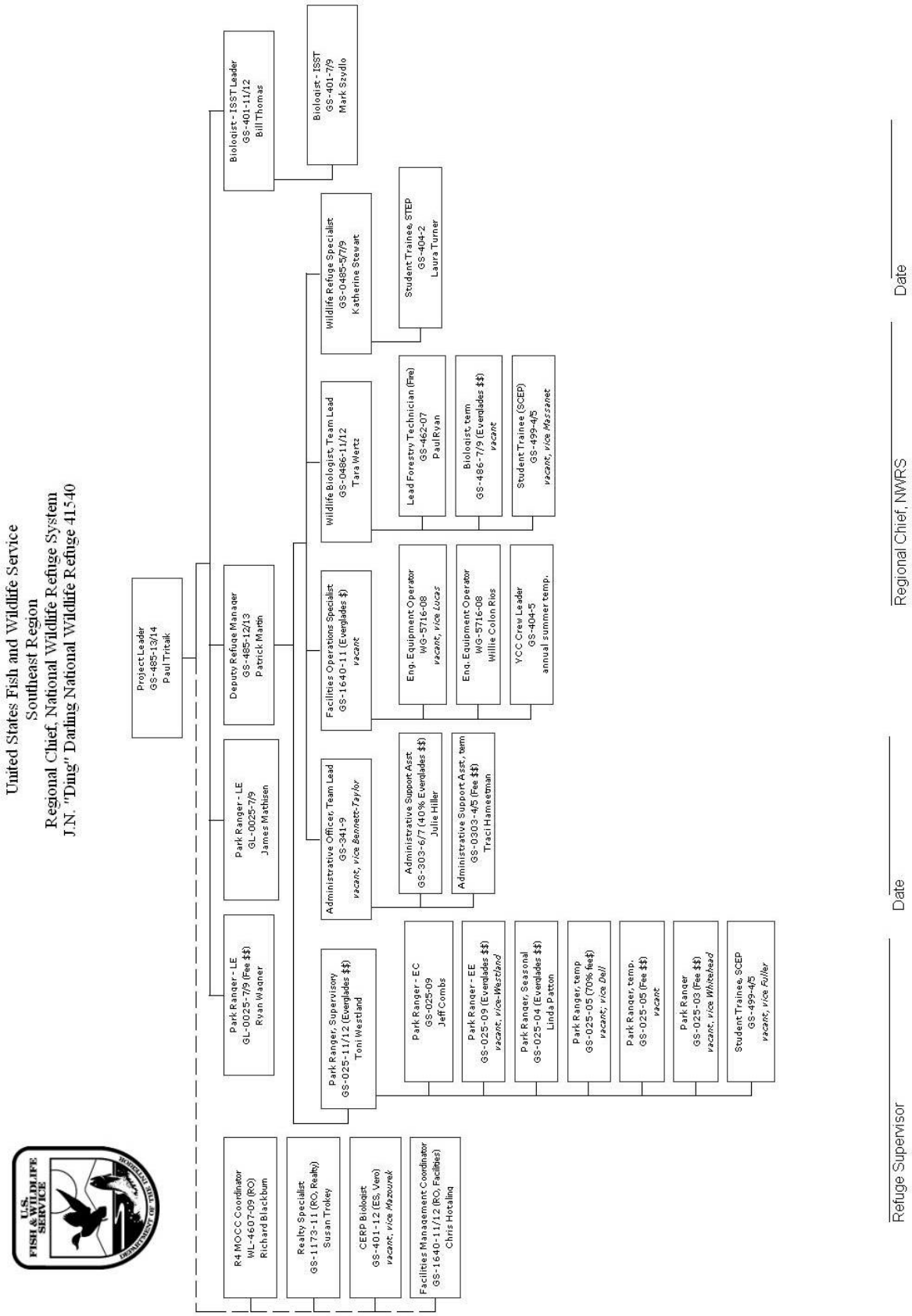
The refuge works closely with its concessionaire to provide quality visitor use activities and experiences. The current concessionaire, Tarpon Bay Explorers, began operations in 2002. The concessionaire operates the Wildlife Drive fee booth and tram tours and provides visitor services at the Tarpon Bay Recreation Area. Facilities for the concessionaire include a tram tour ticket booth in the parking lot of the Education Center; an entrance fee booth at the beginning of the Wildlife Drive; a building with a gift shop, offices, and living quarters at the Tarpon Bay Recreation Area; and a boat ramp and dock at the Tarpon Bay Recreation Area. The concessionaire provides welcome and orientation materials; tram, boat, and kayak tours; guided fishing trips; outfitted rental boats; canoe and kayak rentals; outdoor deck talks; and touch tank programs, as well as assists with special education, interpretation, and outreach events. The concessionaire agreement will be competitively rebid in 2013.

PERSONNEL, OPERATIONS, AND MAINTENANCE

Five refuges are administered as part of the J.N. "Ding" Darling NWR Complex: J.N. “Ding” Darling NWR and four satellite refuges (i.e., Pine Island, Matlacha Pass, Island Bay, and Caloosahatchee NWRs) (Figure 1). Covering all five refuges in the J.N. "Ding" Darling NWR Complex, J.N. “Ding” Darling NWR staff includes 14.5 permanent full-time employees (FTEs), three temporary full-time employees, five student interns, nine seasonal/temporary employees, and three student employees (Figure 27). Another five seasonal interns are housed at the Refuge Complex’s Maintenance Shop. In addition, over 240 volunteers annually contribute services equivalent to an additional 10 full-time employees.

Located near the J.N. “Ding” Darling NWR Visitor/Education Center and Administration Headquarters on Sanibel Island, the Refuge Complex’s Maintenance Shop has earth-moving, vegetation control, and water management machinery and equipment; staff housing; equipment and boat storage; and maintenance facilities that are vital to fulfilling the purposes of these refuges. The refuge maintains 36 miles of roads and 4 miles of dikes on the refuge. Of this, there are roughly 4 miles of paved roads, 1 mile of gravel roads, 31 miles of dirt roads and trails (fire breaks), and 2 miles of gravel trails (Indigo Trail). The headquarters for the Refuge Complex and all Refuge Complex staff are housed at the J.N. “Ding” Darling NWR on Sanibel Island. The annual budget of the Refuge Complex varies, but has averaged about $2,500,000 over the past few years.

Figure 27. Current organizational chart for J.N. "Ding" Darling NWR



Community partnerships play an important part in the daily operations of the Refuge Complex. Locally the Service provides fiscal support for Partners for Fish and Wildlife projects that restore fish and wildlife habitat. Also, the Refuge Complex has cooperative agreements with the city of Sanibel and the Sanibel-Captiva Conservation Foundation that allow for the sharing of equipment, personnel, and material for the restoration of fish and wildlife habitat on and off the Refuge Complex. The Refuge Complex also has a cooperative agreement with the "Ding" Darling Wildlife Society. The Society assists with funding projects that directly contribute to the purposes, vision, goals, and objectives of the Refuge Complex.

III. Plan Development

SUMMARY OF ISSUES, CONCERNS, AND OPPORTUNITIES

The comprehensive planning process officially began in February 2007. A Service Core Planning Team was assembled and began preplanning activities such as gathering data and information and meeting with J. N. "Ding" Darling NWR staff. Public scoping commenced with a notice in the *Federal Register* on June 27, 2007. Due to various issues, this process was restarted January 2008 with visioning and preparation for the public scoping phase of the planning process. To include the governmental partners in the planning process, an Intergovernmental Coordination meeting was held on April 7, 2008, and included representatives from the Seminole Tribe of Florida, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Services, South Florida Water Management District, Southwest Florida Regional Planning Council, Lee County, Lee County Mosquito Control District, and the city of Sanibel. The Intergovernmental Coordination Planning Team identified items such as existing and needed data, refuge resources, issues, concerns, affected members of the public, vision ideas, and public participation issues. As a group, this Intergovernmental Team prioritized its top issues to be addressed by the refuge over the 15-year life of the plan (Appendix IV).

Public scoping commenced in spring of 2008, including a notice in the *Federal Register* on April 2, 2008, and in local newspapers. Additional information about the planning process and public scoping was provided through informational flyers, several articles in the local newspapers, and postings on the refuge's Internet web site (http://www.fws.gov/dingdarling/CCP/CCP.html). Information was also included in the Ding Darling Wildlife Society newsletter. Given the proximity of the refuges, several shared issues, and many overlapping interested parties, joint public meetings were held for J.N. "Ding" Darling NWR and the satellite refuges (i.e., Pine Island, Matlacha Pass, Island Bay, and Caloosahatchee NWRs). Using the refuge's growing CCP public mailing list, as well as public mailing lists from various governmental partners, informational flyers were mailed to invite participation in the planning process through a variety of means, including public meetings, letters, faxes, telephone calls, e-mail messages, and personal visits. The flyer also announced the times and locations of the public meetings, provided other information, and described the purposes of the five refuges. Three neighborhood public meetings were conducted during the week of April 7, 2008: on April 8 at the Sanibel School, Sanibel Island, FL; on April 9 at Cypress Lake Middle School, Ft. Myers, FL; and on April 10 at Pine Island Elementary School, Pine Island, FL.

The public meetings were attended by a total of over 40 individuals representing a variety of interests and organizations. Beyond the verbal comments recorded at these public meetings, over 90 written comments were also submitted by individuals, organizations, and governmental entities regarding future management of these five refuges. Letters, faxes, email messages, and phone calls were received from across the country.

Experts from the Service, Florida Fish and Wildlife Conservation Commission, Lee County, Indian River County Mosquito Control District, City of Sanibel, and the Sanibel-Captiva Conservation Foundation participated in a Wildlife and Habitat Management Review of the Refuge Complex in 2000. The Wildlife and Habitat Management Review document was completed in 2001. A Visitor Services Review was also completed in 2001 by Service staff from other refuges and regions. A Wilderness Review for the Refuge Complex was updated in 2008. The information garnered from these reviews helped the Service analyze and develop recommendations for the Draft CCP/EA.

During the preplanning and public scoping phases of plan development, a myriad of issues, concerns, and opportunities were raised by the public, the Service, and other public agencies. The identification of issues is a major factor in determining future management goals and objectives, as well as future projects. In addition to the general public scoping meetings, an intergovernmental meeting was conducted with federal, state, and local government agencies. Coordination with government partners and the public is essential to ensure support for the plan and identified projects. While some of the issues and concerns raised during scoping are important to the future of the refuge, many are not within the Service's management jurisdiction or authority, and some are outside of its control. Several opportunities raised during scoping are addressed by the Service in this plan. The Service evaluated the long list of issues raised, identified the priority issues to be addressed over the next 15 years, evaluated steps to rectify these issues and resource needs, and measured the impact of plan implementation. From these priority issues, the Service developed a list of goals, objectives, and strategies to shape the management of the refuge for the 15-year life of the plan. The priority issues for the refuge to address during the 15-year life of the plan are listed.

- Increasing and Changing Human Population, Development of the Landscape, Recreational Uses and Demands, and Associated Impacts
- Issues and Impacts Associated with Water Quality, Water Quantity, and Timing of Flows
- Invasion and Spread of Exotic, Invasive, and Nuisance Species
- Climate Change Impacts
- Need for Long-term Protection of Important Resources
- Declines in and Threats to Rare, Threatened, and Endangered Species
- Insufficient Baseline Wildlife and Habitat Data and Lack of Comprehensive Habitat Management Plan
- Lack of Resources to Address Refuge Needs

These management priorities were identified in response to the challenges facing this barrier island refuge. Although some of the challenges span more than one category, these priority issues are divided into four management categories: wildlife and habitat management, resource protection, visitor services, and refuge administration. The issues of the increasing and changing human population, development of the landscape, recreational uses and demands, and associated impacts span all four categories. Lee County had an estimated 571,344 residents in 2006 (U.S. Census Bureau 2007). Population growth projections estimate that Lee County will grow to 838,209 by 2025 and nearly 1.4 million by 2060 (Zwick and Carr 2006). It is anticipated that Lee County will be built out before 2060 as part of a nearly continuous band of urban development along Florida's southwest coast (Zwick and Carr 2006). Further, exemplifying current high waterway use in and around the refuge, in 2006, Charlotte and Lee Counties had over 71,000 registered recreational vessels (Florida Fish and Wildlife Conservation Commission 2007). This growth in the population and use of the landscape will continue to impact the refuge into the future.

WILDLIFE AND HABITAT MANAGEMENT

The fish and wildlife resources within and adjacent to the refuge have been affected by increasing development pressure and associated habitat loss; altered quality, quantity, and timing of freshwater flows; the spread of exotic, invasive, and nuisance species; sea level rise and climate change; and the declines in and threats to rare, threatened, and endangered species. The refuge is unable to evaluate the status and trends of many fish and wildlife species and their habitats within the refuge due to the lack of sufficient baseline data and the lack of a comprehensive habitat management plan. Additionally, the demand for recreational uses and the resultant impacts on fish and wildlife resources within the refuge increase and change along with changes in the human population and development.

Changes in the regional and local landscape have altered the quality, quantity, and timing of freshwater flows to the Caloosahatchee Estuary, including the refuge. Extreme variations in salinity levels and poor water quality have reduced the health and productivity of the Caloosahatchee Estuary and are linked to the volume and timing of freshwater flows at the Franklin Lock and Dam (S-79) on the Caloosahatchee River that originate from the Caloosahatchee watershed and regulatory releases from Lake Okeechobee. Those releases deviate from the historical quality, quantity, and timing of freshwater flows into the river and estuary. Additional concerns include light attenuation, sedimentation, and contaminants from upstream and their effects on seagrasses, oyster beds, and algal blooms within the refuge. Further, surface hydrology and tidal flow within the refuge was altered when the impoundments and a powerline right-of-way were constructed

The refuge is currently and will continue to be affected by the spread of exotic, invasive, and nuisance species. Primary species of concern for the refuge include Brazilian pepper, Australian pine, rosary pea, Sanseveria spp., air potato, winged yam, umbrella tree, night blooming cereus, java plum, guinea grass, giant reed, nicker bean, earleaf acacia, lead tree, green iguana, raccoon, the Nile monitor lizard, and the black rat.

Rare, threatened, and endangered species and species of management concern for the refuge include West Indian manatee, ornate diamondback terrapin, snowy and piping plovers, red knot and other shorebirds, wood stork and other wading birds, Sanibel Island rice rat, gopher tortoise, mangrove cuckoo, black-whiskered vireo, gray kingbird, prairie warbler, smooth-billed ani, American alligator, American crocodile, aboriginal prickly apple, Sanibel lovegrass, West Coast lantana, spiked cresed coralroot, spiny hackberry, West Indian Cock's comb, wild cotton, common wild-pine, giant wild-pine, inflated wild-pine, barbed-wire cactus, joewood, Florida mayten, shell mound prickly-pear, inkberry, twisted air plant, Florida butterfly orchid, and iguana hackberry. Primary habitats of management concern for the refuge include colonial bird roosting and nesting sites, waterbird foraging habitat, shorebird migratory stopover sites, fish nursery and settlement sites, oyster beds, scallops, seagrass beds, tropical hardwood hammocks, cordgrass marshes, and mangroves. Recreational uses cause disturbance to colonial nesting birds. Altered hydrology and altered fire ecology negatively impact the cordgrass marshes. Seagrasses, fisheries, and oysterbeds are negatively affected by altered hydrology, as well as by quality, quantity, and timing of freshwater outflows and by recreational uses, including prop scarring from boating activities. Mangrove species and habitats and rookery islands are negatively impacted by altered tidal flows, hurricanes and other storm events, and predicted sea level rise. Hurricane and storm events and exotic, invasive, and nuisance species are threats to the integrity of hardwood hammocks within the refuge.

The refuge is unable to evaluate the status and trends of many fish and wildlife species and their habitats within the refuge due to the lack of sufficient baseline data and the lack of a comprehensive habitat management plan to help guide management, monitor results, and adapt management as necessary to achieve refuge goals and objectives.

Climate change factors also impact the refuge, its resources, and future management, while also exacerbating the other wildlife and habitat management issues.

RESOURCE PROTECTION

The refuge contains a mix of cultural resources, including shell mounds, middens, and historic home sites, some of which have had little or no active management and have deteriorated over time. Off the refuge, on Captiva Island, J.N. "Ding" Darling's fish camp cabin survives today under private ownership. Concerns exist for the long-term protection and preservation of this historic structure of importance to the refuge and to the Service. Further, the refuge lacks a comprehensive inventory of

cultural resources, making protection difficult and making integration of cultural resources into all refuge management programs difficult.

The refuge lacks clarity regarding its ownership boundary, including the lack of complete, clearly defined surveys defining the refuge's management boundary in key locations. The lack of this information results in the possibility for issues with encroachment from adjoining private properties and expansion of rights-of-way.

In a 2002 Final EA and Land Protection Plan (LPP), the Service developed a proposed boundary expansion for J.N. "Ding" Darling NWR. The proposed action for the LPP and EA outlined expanding the refuge's total acquisition boundary to 8,205 acres (3,320.45 ha) by adding 330 acres (133.55 ha) of upland habitat adjacent to the refuge's existing management boundary and approximately 550 acres (222.58 ha) of waters, just north of the refuge's existing management boundary in Pine Island Sound, to coincide with the jurisdictional line of the city of Sanibel. However, this LPP was never approved.

VISITOR SERVICES

The priority visitor services management issues at the refuge are directly linked to the increasing and changing human population, development of the landscape, increasing recreational uses and demand for recreational and educational activities, and the associated wildlife and habitat impacts of all of these. The 2007 visitation to the refuge was about 700,000. In 2006 nearly 50,000 recreational watercraft were registered in the home county of the refuge, Lee County, with another nearly 22,000 registered in adjacent Charlotte County (Florida Fish and Wildlife Conservation Commission 2007). With the existing and anticipated increasing visitation during the 15-year life of the CCP, numerous issues and concerns arise, including traffic and congestion on the refuge and on the Island; parking; carrying capacity of the refuge's natural resources and facilities for visitation and consumptive uses; commercial uses; increased wildlife and habitat disturbance, especially to nesting and roosting birds; and lack of sufficient staff and facilities to address visitor services activities and needs. Beyond these issues, the refuge faces the broader societal issues of the decreased connection between people and natural resources and the decreased participation in wildlife-oriented, environmentally responsible outdoor activities.

REFUGE ADMINISTRATION

Several refuge administration concerns arise when looking at the current and future management needs to serve the purposes, vision, and goals of the refuge. Key concerns relate to the lack of resources to address refuge needs, including the need for several key staff positions, which were identified in a 2008 Service minimum staffing exercise. The highest priority for the Complex is to secure permanent, consistent funding for the existing law enforcement officer position at J.N. "Ding" Darling NWR that is currently funded through entrance fees. Within the Complex, the specific priorities for J.N. "Ding" Darling NWR are listed with the priority rank for the Complex in parentheses: wildlife refuge specialist (assistant refuge manager) (3), part-time park ranger for environmental education and outreach (6), and law enforcement officer (14). The refuge lacks the resources and projects needed to pursue its purposes, vision, and goals. The lack of sufficient housing for seasonal employees, interns and visiting researchers, and partners further impacts the refuge's ability to accomplish stated goals and objectives. Since the Island is small, has such high visitation, and is a desirable place to live, purchase prices and rental rates are quite high, further complicating the ability to serve staffing needs.

WILDERNESS REVIEW

Refuge planning policy requires a Wilderness Review as part of the comprehensive conservation planning process. A Wilderness Review for the refuge was updated in 2008. In summary, no additional areas of the refuge were found to be suitable for designation as Wilderness at this time. The results of the Wilderness Review are provided in Appendix VIII.

PUBLIC REVIEW AND COMMENT

Postcards were mailed to those parties on the CCP mailing list to enable interested parties to request a compact disk (CD) or paper copy of the Draft CCP/EA for review. Copies were also provided to the State Clearinghouse for review, as well as to other interested governmental agencies. The Draft CCP/EA was also made available to the public for review on the Internet and through the refuge's Education Center.

IV. Management Direction

INTRODUCTION

The Service manages fish and wildlife habitats considering the needs of all resources in decision-making. But first and foremost, fish and wildlife conservation assumes priority in refuge management. A requirement of the Improvement Act is for the Service to maintain the ecological health, diversity, and integrity of refuges. Public uses are allowed if they are appropriate and compatible with refuge purpose(s) and wildlife and habitat conservation. The Service has identified six priority wildlife-dependent public uses. These uses are: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

Described below is the proposed CCP for managing the refuge over the next 15 years. This proposed management direction contains the goals, objectives, and some strategies that would be used to achieve the refuge's vision and serve its purposes.

Four alternatives for managing these refuges were considered: Alternative A [Current Management, (No Action)], Alternative B (Native Wildlife and Habitat Diversity), Alternative C (Migratory Birds), and Alternative D (Rare, Threatened, and Endangered Species). Each of these alternatives is described in the Alternatives section of the EA. The Service chose Alternative C (Migratory Birds) as the proposed management direction.

Implementing the proposed action would result in increased protection for breeding, nesting, resting, roosting, foraging, and migrating birds on the refuge. Increased information on a variety of species, suites of species, and habitats would enhance decision-making for the refuge. Further benefits would be realized from increased control of exotic, invasive, and nuisance species. The refuge would coordinate with the partners to address concerns related to the impacts from water quality, quantity, and timing of flows and from climate change and sea level rise. Resource protection would be enhanced, including through increased information about cultural resources on the refuge, increased protection of cultural resources, additional special designations, improved management of the J.N. "Ding" Darling Wilderness Area, improved coordination with the partners to increase ethical outdoor behavior, enhanced visitor services programs, and addition of visitor facilities. To achieve this, the refuge would work with governmental and non-governmental partners, area communities, the "Ding" Darling Wildlife Society, and local businesses and the refuge would pursue the addition of staff to address management concerns.

VISION

The J.N. "Ding" Darling National Wildlife Refuge is an interwoven system where salt water meets fresh, where shorelines disappear within the tangle of mangrove roots, where coastal and freshwater marshes meet tropical hardwood hammocks, and where submerged aquatic vegetation thrives. These diverse habitats will be managed, conserved, and protected to support a wide array of native birds, fish, mammals, and other wildlife. Visitors will be able to hear songbirds whistling in the hammocks, watch wading birds blanketing the tidal flats during a feeding frenzy, or find solitude in the backwaters of the Wilderness Area.

The refuge will continue to serve as a gateway to the National Wildlife Refuge System, providing educational awareness of this national network of lands and waters to thousands of visitors annually. As a memorial to Jay Norwood "Ding" Darling, the refuge will continue his legacy where

environmental education and conservation through art continue in earnest and reflect the grass roots environmental efforts that established the refuge. The refuge will be utilized as a world class living laboratory to foster excellence in biological and ecological research and to enable integrated and adaptive management. The refuge will continue to be a premier example of building partnerships to accomplish the greatest of goals.

GOALS, OBJECTIVES, AND STRATEGIES

The goals, objectives, and strategies presented are the Service's response to the issues, concerns, and needs expressed by the planning team, the refuge staff, governmental and non-governmental partners, and the public and are presented in hierarchical format. Chapter V identifies the projects associated with the various objectives and strategies.

The outlined goals, objectives, and strategies reflect the Service's commitment to achieve the mandates of the Improvement Act, the mission of the Refuge System, and the purposes and vision of J.N. "Ding" Darling NWR. The Service intends to accomplish these goals, objectives, and strategies within the next 15 years.

WILDLIFE AND HABITAT MANAGEMENT

Wildlife and habitat management activities would be expanded during the 15-year life of the Plan, including addressing rare, threatened, and endangered species; wildlife and habitat diversity; exotic, invasive, and nuisance species; water quality, quantity, and timing of flows; and climate change. During the 15-year life of the CCP, numerous wildlife and habitat surveys would continue or be expanded and others would be added, while the refuge would work with the partners to increase the scientific rigor of these data collection and analysis efforts.

Discussion: The refuge supports 14 federal listed species and 49 state listed species. Further, the State of Florida identified 974 species of mammals, birds, amphibians, reptiles, fish, and invertebrates as those of greatest conservation need in the State (Florida Fish and Wildlife Conservation Commission 2005). This list includes species that are of specific management concern to J.N. "Ding" Darling NWR, including the wood stork, roseate spoonbill, roseate tern, black skimmer, American oystercatcher, snowy plover, Wilson's plover, red knot, piping plover, bald eagle, mangrove cuckoo, black-whiskered vireo, gray kingbird, Florida prairie warbler, eastern indigo snake, gopher tortoise, West Indian manatee, American crocodile, loggerhead sea turtle, green sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, hawksbill sea turtle, snowy plover, piping plover, red knot, Sanibel Island rice rat, ornate diamondback terrapin, and smalltooth sawfish.

Goal 1: Rare, Threatened, and Endangered Species

Minimize the threats to and promote the recovery of the rare, threatened, and endangered species occurring on Sanibel and Captiva Islands and in adjacent waters.

Objective 1.a: Wood Stork

Objective 1.a(1): Throughout the life of the CCP, continue working with the partners to conduct rookery surveys to monitor the numbers of work storks and work with the partners to minimize human disturbance and impacts to the wood storks using the lands and waters of J.N. "Ding" Darling NWR to support wood stork recovery efforts.

Objective 1.a(2): During the life of the CCP, work with the partners and foster research to determine the colony origin and foraging range and location for those wood storks using the refuge.

Discussion: The wood stork is listed by both the Service and the State of Florida (Florida Fish and Wildlife Conservation Commission 2009a) as an endangered species. The 2009 State of the Birds report considers the wood stork to be a bird in trouble (North American Bird Conservation Initiative, U.S. Committee 2009).

The United States breeding population of wood storks declined from an estimated 20,000 nesting pairs in the 1930s to a low of around 5,000 nesting pairs in the late 1970s (Ogden et al. 1987). The lowest recorded annual total was 2,500 pairs in 1978, a result of poor nesting conditions in conjunction with the low population. From the 1960s to the mid-1980s, the wood stork nesting population declined in southern Florida and increased in northern Florida, Georgia, and South Carolina (Ogden et al. 1987). Prior to 1970, a majority (70 percent) of the population nested south of Lake Okeechobee and declined from 8,500 pairs in 1961 to fewer than 500 pairs in the late 1980s and early 1990s. More recently, synoptic surveys were completed in 1999 and 2001 to 2006. These surveys documented a population ranging between 5,560 and 11,279 pairs. The 2006 survey documented 11,279 pairs. This was the first time the nesting population was greater than 10,000 pairs since the early 1960s. Additionally, the majority of the population now breeds north of Lake Okeechobee. [Taken from the wood stork recovery plan five-year review (U.S. Fish and Wildlife Service 2007a).]

Wood storks occur regularly on the refuge. However, the refuge lacks data to determine the status and trends for wood storks using the refuge. Although wood storks are not known to currently nest at J.N. “Ding” Darling NWR, they should be monitored to determine when and where nesting does occur on the refuge.

To support wood stork recovery, the refuge would continue coordinating with the partners to survey area and refuge rookeries. Further, the refuge would improve and conduct habitat management and restoration activities. As needed, the refuge would coordinate with the state to provide buffers around key nesting, roosting, resting, and foraging sites. Rodgers and Schwikert (2002) recommended a minimum buffer size for wood storks of 118 meters to minimize impacts from outboard-powered boats and personal watercraft. The refuge would also coordinate with the Service’s lead on wood storks at the Jacksonville Ecological Services Field Office to help develop an understanding of the colony origin and the foraging range and location for the wood storks using the refuge. Adaptive management could include assessing valuable foraging wetlands used by the wood stork for protection, manipulating impounded water levels to enhance foraging opportunities, assessing valuable roosting and nesting sites used by the wood stork for protection, and forming or enhancing collaboration(s) with other agencies managing lands and waters used by the wood stork. The refuge would work with the partners to address water quality, quantity, and timing concerns to benefit a variety of resources, including wood storks.

Objective 1.b: Roseate Spoonbill

Objective 1.b(1): Throughout the life of the CCP, continue working with the partners to conduct rookery surveys to monitor the numbers of roseate spoonbills using the refuge and work with the partners to minimize human disturbance and impacts to roseate spoonbills using the refuge.

Objective 1.b(2): During the life of the CCP, work with the partners and foster research to determine the colony origin and foraging range and location for those roseate spoonbills using the refuge.

Discussion: The roseate spoonbill is considered a species of management concern by the Service and is listed as a Species of Special Concern by the State of Florida due to its vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a state threatened species unless appropriate protective or management techniques are initiated or maintained and due to the fact that it has not sufficiently recovered from past population depletion (Florida Fish and Wildlife Conservation Commission 2009a).

Prior to the 1850s, thousands of spoonbills likely existed along the Gulf Coast in Texas, Louisiana, and Florida. By 1920, plume hunting and colony disturbance largely depleted the spoonbill population in the United States. In the 1960s, the birds were showing signs of recovery from plume hunting and other impacts on their population. A total of 266 roseate spoonbill nests were identified in 1963. This increased to 1,260 pairs in 1979, but commensurate with the completion of modern water management infrastructure in 1984, nest numbers began to plummet. A total of 700 nests were found in 1991. A 1999 survey of nesting populations estimated 408 pairs in Florida Bay in the Florida Keys, at Merritt Island, in Tampa Bay, and at two freshwater sites in the Everglades. By 2006 it was at 460, but in 2007 only 292 nests were been identified, indicating a 37 percent drop in spoonbill nests in just one year. The Florida Bay population represents the majority of the spoonbills that nest in the state. During the summer, roseate spoonbills are also found in Louisiana, Texas, Mexico, Central America, and South America. Though plume hunting has ceased, spoonbills are still vulnerable today to habitat loss and alteration. In Florida Bay, freshwater inflows from the Everglades adversely affect the salinities of coastal wetlands and the populations of fish and other prey of spoonbills. [Taken from FWC roseate spoonbill overview (Florida Fish and Wildlife Conservation Commission 2009c).]

Roseate spoonbills occur regularly on the refuge. However, the refuge lacks data to determine the status and trends for spoonbills using the refuge.

To help protect roseate spoonbills using the Sanibel-Captiva area, the refuge would expand existing coordination efforts with the partners to survey rookeries. Proposed habitat management and restoration activities would also support spoonbills. Adaptive management could include assessing valuable foraging wetlands used by the spoonbills for protection, manipulating impounded water levels to enhance foraging opportunities, assessing valuable roosting and nesting sites used by the spoonbills for protection, and forming or enhancing collaboration(s) with other agencies managing lands and waters used by spoonbills. As needed, the refuge would coordinate with the state to provide buffers around spoonbill roosting and nesting sites. Rodgers and Schwikert (2002) recommended a minimum buffer size for roseate spoonbills of 98 meters to minimize impacts from outboard-powered boats and personal watercraft. The refuge would work with the partners to address water quality, quantity, and timing of flow concerns to benefit a variety of resources, including roseate spoonbills.

Objective 1.c: Bald Eagle

Objective 1.c(1): Throughout the life of the CCP, continue protecting active and inactive bald eagle nest trees on the refuge. Where nest sites are detected, minimize disturbance during the nesting season.

Discussion: Although the bald eagle was delisted in 2007, it is still protected under various acts and treaties, including the Bald and Golden Eagle Protection Act, the Lacey Act, and the Migratory Bird Treaty Act. The dramatic recovery of the bald eagle over the past 35 years has been one of the greatest conservation success stories of our nation. The bald eagle population increased from its 1963 low of 487 breeding pairs in the lower 48 states to 9,789 breeding pairs in 2007 (U.S. Fish and

Wildlife Service 2007c). The state conducts annual aerial surveys to identify bald eagle nest sites and Florida had 1,133 breeding pairs in 2007 (U.S. Fish and Wildlife Service 2007c). When and where bald eagle nest sites are discovered on the refuge, the refuge would work with the partners to protect these sites by: (1) keeping a distance between the activity and the nest (distance buffers), (2) maintaining preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and (3) avoiding certain activities during the breeding season. The buffer areas would serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees. Bald eagles included in existing and proposed refuge surveys. Further benefitting bald eagles and numerous other species, the refuge would coordinate with partners to address concerns related to water quality, quantity, and timing of flows.

Objective 1.d: Mangrove Forest Birds

Objective 1.d(1): Throughout the life of the CCP, continue conducting mangrove bird surveys and within 10 years of CCP approval, research the effectiveness of survey protocols with nesting cycles and timing to better determine the status of the mangrove cuckoo, black-whiskered vireo, gray kingbird, and Florida prairie warbler using the refuge.

Discussion: Important mangrove forest birds using the refuge include mangrove cuckoo, black-whiskered vireo, gray kingbird, and Florida prairie warbler. The black-whiskered vireo and the Florida prairie warbler are considered by the Service to be species of management concern due to the small population or limited distribution of the black-whiskered vireo and due to the documented or apparent population decline of the Florida prairie warbler. To help protect these mangrove forest birds using the refuge, the refuge would conduct a variety of management actions. Other existing and proposed surveys would also benefit mangrove forest birds and enhance refuge management decision-making. The refuge would continue conducting surveys from April through June with weekly call-back surveys. Past surveys have yielded as many as 27 species of migrating birds and as many as seven mangrove cuckoos. The refuge would continue implementing breeding bird protocol on the Wildlife Drive and at nesting sites. Restoring mangrove habitat at Alligator Curve and hardwood hammock on refuge ridges and Shell Mound Trail would also benefit mangrove forest birds.

Objective 1.e: Eastern Indigo Snake

Objective 1.e(1): Throughout the life of the CCP, continue working with the partners to monitor presence/absence and study the movements of the eastern indigo snake on Sanibel Island.

Objective 1.e(2): Within 10 years of CCP approval, work with the Service's Ecological Services Vero Beach Field Office and the partners to evaluate the translocation of eastern indigo snakes from donor sites to the refuge.

Discussion: The eastern indigo snake is listed by the Service and the State (Florida Fish and Wildlife Conservation Commission 2009a) as a threatened species. Although it historically occurred on the refuge, no eastern indigo snakes have been sighted on the refuge in recent years. However, the species is known to be difficult to observe and capture, even in areas where they are known to regularly occur.

Due to its relatively large home range, the eastern indigo snake is especially vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977, Moler 1985). In the southern part of its range, including the refuge, the eastern indigo snake may occupy areas of low density residential housing, but this represents additional threats with the increased likelihood of mortality due to the acts of

homeowners and pets. Additional threats to these snakes in and around the refuge also include highway mortality, pesticides, and herbicides. The expectation is that over time, some populations of eastern indigo snakes have experienced declines and some have likely been extirpated. [Taken from eastern indigo snake five-year review (U.S. Fish and Wildlife Service 2008b).]

Proposed gopher tortoise management activities and proposed upland habitat management activities would also benefit indigo snakes. Throughout the life of the CCP, the refuge would work with the partners to enhance upland habitat for indigo snakes and other species. The refuge would continue to work with SCCF and the city of Sanibel to remove invasive exotic vegetation, conduct prescribed burning to maintain and improve habitat, and thin understory where needed.

Objective 1.f: Gopher Tortoise

Objective 1.f(1): Throughout the life of the CCP, work with the partners to maintain posted gopher tortoise crossing signs in and around the refuge.

Objective 1.f(2): Within 10 years of CCP approval, work with the partners to survey gopher tortoise abundance and distribution, and estimate population density and habitat carrying capacity within the refuge and on Sanibel Island .

Objective 1.f(3): Throughout the life of the CCP, work with the partners to evaluate the feasibility of translocating gopher tortoises to the refuge from healthy populations which are at risk of habitat loss.

Objective 1.f(4): Within 10 years of CCP approval, develop interpretive signs and materials to educate the public about the ecological importance of these unique animals.

Discussion: Gopher tortoises are under review for listing in Florida by the Service under the Endangered Species Act and are listed by the State of Florida as a threatened species (Florida Fish and Wildlife Conservation Commission 2009a). In 1975, the gopher tortoise was listed by the state as a threatened species. In 1979, due to changes in the state's listing criteria, the species was downlisted to a species of special concern. Between 2002 and 2006, the state recognized the need to uplist the gopher tortoise to threatened. In 2008, it was uplisted by the state to threatened.

The primary threats to gopher tortoises in Florida are habitat destruction, fragmentation, and degradation, particularly from urbanization and development, agriculture, and phosphate/heavy metals mining (Diemer 1986, 1987; Berish [Diemer] 1991; McCoy and Mushinsky 1995; Berish 2001, Smith *et al.* 2006). In south Florida, gopher tortoise habitat has been destroyed or degraded by urbanization, intensive agriculture, and invasive exotic plant species (Berish [Diemer] 1991, Berish 2001). Habitat fragmentation by roads and increased vehicular traffic due to development result in increased roadway mortality of gopher tortoises, which are often drawn to roadsides because of available forage (Franz and Auffenberg 1978; Landers and Buckner 1981; Landers and Garner 1981; Lohoefener 1982; Diemer 1986, 1987; Berish 2001; Mushinsky *et al.* 2006). Lack of prescribed fire and/or the suppression of natural fires also result in canopy closure and reduced gopher tortoise forage plants (Landers and Speake 1980; Landers and Garner 1981; Auffenberg and Franz 1982; Diemer 1986, 1987; Berish 2001). Local isolated populations of gopher tortoises may persist for decades in overgrown habitat, but recruitment of young into these populations decline as the canopy increases and habitat quality decreases (McCoy and Mushinsky 1992, Mushinsky and McCoy 1994). On Sanibel Island, 87 percent of gopher tortoises tested were seropositive for exposure to the pathogen responsible for upper respiratory tract disease, and at least one population on the Island appears to have experienced a 25-50 percent reduction in breeding age adults (McLaughlin 1997,

McLaughlin *et al.* 2000). [Taken from FWC's Gopher Tortoise Management Plan (Florida Fish and Wildlife Conservation Commission 2007).]

Proposed upland habitat management activities would also benefit gopher tortoises. Throughout the life of the CCP, the refuge would work with the partners to enhance upland habitat for gopher tortoises and other species. The refuge would continue to work with SCCF and the city of Sanibel to remove invasive exotic vegetation, conduct prescribed burning to maintain and improve habitat, and thin understory where needed. To help minimize roadway mortality, the partners would continue to maintain gopher tortoise crossing signs off the refuge and the refuge would continue to maintain them on the refuge. The refuge would work with the partners to increase information about gopher tortoises, their abundance and distribution, their movements, and carrying capacity. Further, the refuge would work with the partners to evaluate the feasibility of translocating gopher tortoises to the refuge.

Objective 1.g: West Indian Manatee

Discussion: The West Indian manatee is listed by the Service and the State of Florida as an endangered species (Florida Fish and Wildlife Conservation Commission 2009a). To help provide protection for and limit threats to this species, numerous federal manatee protection areas are located near the refuge.

The greatest threats to manatee survival are collisions with boats and loss of warm water habitat. Other threats to manatees include declines in water and habitat quality, habitat loss, loss of natural springs and spring flows due to human development and demand for water, flood gates and canal locks, monofilament fishing line and other discarded trash, red tide blooms, and harassment. A 2009 survey counted at least 3,800 manatees in Florida. Although population numbers are currently higher than previous surveys, over the long term the trend is anticipated to slowly decline. The southwest subpopulation, which includes the refuge, represents about 41 percent of the state's manatee population. The primary factors causing mortality in the southwest subpopulation are collisions with watercraft, which represent 32 percent of deaths in southwest Florida and red tide blooms, which represent 24-28 percent of deaths in southwest Florida. Key habitat related concerns for the southwest subpopulation include: manatee dependence on industrial warm-water discharges, storm-related impacts on habitat and adult survival, periodic red tide events, water quality and submerged aquatic vegetation, human disturbance, increasing boat traffic, and water control structure-related deaths. This subpopulation may be declining while other subpopulations seem to be increasing. [Taken from the West Indian manatee five-year review (U.S. Fish and Wildlife Service 2007b).]

Objective 1.g(1): Throughout the life of the CCP, continue working with the partners to support recovery of the West Indian manatee, including participating in the Marine Mammal Stranding Network and conducting law enforcement of designated speed and no-motor zones.

Discussion: In 2008, three manatee deaths in nearby Charlotte County were attributed to watercraft, while 14 manatee deaths in Lee County were attributed to watercraft (Florida Fish and Wildlife Conservation Commission 2009d). To help minimize watercraft collisions with manatees, the refuge would continue to work with the partners to conduct regular law enforcement patrols of designated speed zones and no-motor zones, including the Service's Office of Law Enforcement, FWC, Lee County Sheriff's Office, and the Sanibel Police Department. The refuge manages 2,268 acres (918 ha) of estuarine waters, representing 35 percent of the refuge and benefiting a variety of wildlife, including manatees. All of these waters are either slow-speed/minimum wake zone, pole/troll zone, or no motor zone. The refuge would continue to participate in the Florida Marine Mammal Stranding Network – Southwest and with the Mote Marine Laboratory to facilitate quick response, care, and rehabilitation. The refuge would also coordinate with the National Marine Fisheries Service (NMFS)

and FWC on necropsies, potentially using the refuge's Gavin Site, if necessary. Critical habitat for manatees has been designated on the refuge (Figure 22) and the refuge would continue to protect this area. Further benefitting manatees, the refuge would also protect and restore refuge seagrass beds. Proposed habitat management and restoration activities would also benefit manatees.

Objective 1.g(2): Throughout the life of the CCP, continue working with the partners to support recovery of the West Indian manatee, including providing environmental education, interpretation, and outreach.

Discussion: To help develop public awareness, understanding, and appreciation for manatees and related management activities, the refuge would continue working with the partners, including working with Lee County's Manatee Park by providing interpretive assistance on manatees and information on these refuges. Several Visitor Services objectives would help support this objective, including those addressing public awareness, understanding, and appreciation; wildlife observation and photography; environmental education and interpretation; outreach; monofilament fishing line.

Objective 1.h: American Crocodile

Objective 1.h(1): Throughout the life of the CCP, coordinate with the partners and local residents to protect American crocodiles using Sanibel Island.

Discussion: The American crocodile is listed by the Service as a threatened species in Florida and by the State of Florida as an endangered species (Florida Fish and Wildlife Conservation Commission 2009a).

The current distribution of the American crocodile is limited to extreme south Florida, including coastal areas of Miami-Dade, Monroe, Collier, and Lee Counties. Along Florida's southwest coast, several small groups and individual crocodiles have been documented from Sanibel Island, Lee County, south to Collier Seminole State Park, Collier County. The lowest estimated population levels apparently occurred sometime during the 1960s or 1970s, when Ogden (1978) estimated the Florida population of the American crocodile to be between 100 and 400 non-hatchlings. P. Moler [GFC, personal communication 1996, as referenced in the South Florida Multi-Species Recovery Plan (U.S. Fish and Wildlife Service 1999)] believes between 500 and 1,000 individuals (including hatchlings) persist in South Florida. Habitat loss and fragmentation due to increased urbanization and agricultural land uses are threats to this species. In Florida, changes in the distribution, timing, and quantity of water flows also have affected the American crocodile, although the specifics of these effects are not clear. The crocodile population in Florida, although small, appears to be stable. The status throughout the remainder of its range is less certain. Future threats in Florida include stochastic natural disasters such as hurricanes and cold weather, road mortality, and continued habitat degradation. The American crocodile is a valuable indicator species of the health of south Florida's estuarine environments. [Taken from the Multi-Species Recovery Plan (U.S. Fish and Wildlife Service 1999b).]

Although the refuge seems to be at the northern extent of the range of the American crocodile, a single female American crocodile historically consistently used Sanibel Island and the refuge until her death in early 2010, which was suspected to be due to exposure to extreme cold temperatures. To ensure protection for any crocodiles on Sanibel Island, the refuge would continue to work with the partners to educate residents to proactively address crocodile-human interactions. The refuge would continue to send staff or volunteers to observe any crocodile when it is in public use areas to minimize crocodile-human interactions. Proposed habitat management and restoration activities would also benefit crocodiles.

Objective 1.i: Sea Turtles

Discussion: The Service and the State of Florida list the loggerhead sea turtle as an endangered species, the green sea turtle as an endangered species, the leatherback sea turtle as an endangered species, the Kemp's ridley sea turtle as an endangered species, and the hawksbill sea turtle as an endangered Species (Florida Fish and Wildlife Conservation Commission 2009a). Loggerhead and green sea turtles regularly nest on Sanibel and Captiva Islands, with annual nesting in 2008 on Sanibel and Captiva Islands at 416 loggerheads and three greens (Sanibel-Captiva Conservation Foundation 2009a). From 1996-2008, Sanibel and Captiva Islands ranged between 212 and 537 nests per year, averaging 343 nests per year of predominantly loggerhead sea turtles (Sanibel-Captiva Conservation Foundation 2009a). The leatherback sea turtle was not known to nest on Sanibel or Captiva Islands until hatchlings were discovered on Sanibel in the summer of 2009. The nest was originally identified as a green turtle nest, but leatherback hatchlings were found post-hatching. In 1996, one case of a Kemp's ridley sea turtle nest was documented on Sanibel Island. And, during the cold stunning event in January 2010, a single hawksbill sea turtle was found. However, no nests have been recorded on the refuge's Perry Tract for the last decade.

From 1989 to 2006, the South Florida Nesting Subpopulation had a mean of 65,460 loggerhead nests per year, representing approximately 15,966 females nesting per year (Florida Fish and Wildlife Conservation Commission unpublished data). From 1989 to 2005, the number of nests decreased 22.3 percent. From 1996 to 2006, a 39.5 percent decline was reported (McRae 2006). [Taken from the loggerhead sea turtle five-year review (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a).]

Exhibiting an increasing trend, green sea turtles in Florida were estimated to average 5,055 annual nests from 2001-2005 (Meylan et al. 2006). However, nesting abundance numbers may begin to decline due to a change in juvenile recruitment rates from over 40 years ago. [Taken from the green sea turtle five-year review (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b)]

During the mid 20th century, the Kemp's ridley sea turtle was abundant in the Gulf of Mexico. The population experienced a devastating decline between the late 1940s and the mid 1980s. The principal cause of the decline in the Kemp's ridley nesting population was due to the taking of eggs from nesting beaches. Today the population seems to be increasing, but it is still well below historic and recovery figures. Most Kemp's ridley nests occur in Mexico. The bulk of the nests in the U.S. occur in Texas (although, these are a magnitude less than the numbers for Mexico). [Taken from the Kemp's ridley sea turtle five-year review (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c).]

Pritchard (1982) estimated 115,000 female leatherback sea turtles worldwide, where 60 percent nested along the Pacific coast of Mexico. Spotila et al. (1996) estimated that only 34,500 females remained worldwide (with confidence limits of 26,200 to 42,900 females). However, a recent estimate of the population size for leatherback sea turtles in the North Atlantic ranges between 34,000 and 94,000 total adults (Turtle Expert Working Group 2007). Analysis of Index Nesting Beach Survey data has shown a substantial increase in leatherback nesting in Florida since 1989 (Florida Fish and Wildlife Conservation Commission, unpublished data; Turtle Expert Working Group 2007). [Taken from the leatherback sea turtle recovery plan five-year review (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007d).]

The main sea turtle nesting threats from human activities include coastal development and construction, placement of erosion control structures and other barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach nourishment, beach

pollution, dredging, removal of native vegetation, and planting of non-native vegetation (Baldwin 1992, National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998, and Margaritoulis et al. 2003). Additional nesting threats include increased distribution and abundance of raccoons due to human activities (e.g., increased garbage and mosquito control impoundments) resulting in raccoons being the most important predator of loggerhead eggs. Shifts in marine ecosystem dynamics have resulted from increased human consumption of marine organisms, subsequently depleting the diversity and abundance of marine predators' prey (Pauly et al. 1998 and Trites et al. 1997). Global impacts to sea turtles include climate change, potentially altering natural sex ratios of sea turtles and causing shifts in ranges and changes in prey abundance (Intergovernmental Panel on Climate Change 2007), and fisheries bycatch, potentially damaging and killing sea turtles. Although fibropapillomatosis occurs in sea turtles, it has a much higher frequency in green sea turtles. It is characterized by internal and/or external tumors that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators (Herbst 1994). [Taken from the five-year reviews for loggerhead, green, Kemp's ridley, and leatherback sea turtles (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a, 2007b, 2007c, and 2007d, respectively).]

Objective 1.i(1): Throughout the life of the CCP, continue coordinating with the partners to support sea turtle recovery.

Objective 1.i(2): Within 5 years of CCP approval, assign refuge volunteers to work for SCCF under its marine turtle permit to specifically survey the refuge's Perry Tract for sea turtle nesting.

Discussion: The sea turtle monitoring program on Sanibel Island began in 1959 by refuge biologist Charles LeBuff, at the urging of refuge manager Tommy Wood and "Ding" Darling himself. This program is the oldest uninterrupted loggerhead monitoring program in the United States. LeBuff, who was inspired by the writings of Archie Carr, became the first marine turtle permit holder in the State of Florida. When LeBuff began his sea turtle monitoring, the refuge included the Sanibel Lighthouse at Point Ybel on the east end of Sanibel Island. Most of the rest of the beach was uninhabited, so Charles LeBuff took the lead in monitoring and tagging sea turtles. In 1968, LeBuff established Caretta Research in partnership with SCCF and from 1973 to 1991 he led independent Caretta Research, Inc. Since 1992, SCCF has led the sea turtle monitoring program. Today, the refuge manages only a small beachfront property called the Perry Tract, which has approximately 550 linear feet (168 meters) along the Gulf beach. Sea turtle nesting historically occurred on the Perry Tract, but nesting has not been documented there within the last 10 years, although occasional false crawls are found.

To support sea turtle recovery and survey efforts, the refuge would coordinate more closely with SCCF to conduct nest surveys and stranding response, particularly at the Perry Tract. Further, the refuge would continue coordinating with SCCF and the city of Sanibel, which have been very active minimizing impacts to sea turtles from lighting issues, beach furniture, and beach activities. Sea turtles using the refuge are primarily loggerheads, but occasionally green, and rarely Kemp's ridley turtles will nest on the refuge. Migratory bird protection needs would continue to be a priority on the refuge, unless a listed species, like loggerheads, were at risk. The refuge would continue to play a supporting role for SCCF, which is the principal sea turtle permit holder, conducting surveys along the 18 miles of beaches on Sanibel and Captiva Islands from May 30 to September 30th.

Objective 1.i(3): Throughout the life of the CCP, work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge.

Discussion: In-water populations of sea turtles have been monitored in the greater Charlotte Harbor area since 2003 by Mote Marine Laboratory. Mote Marine and other partners have been conducting set netting and visual surveys of the Charlotte Harbor area, including the J.N. "Ding" Darling NWR, to

evaluate species composition, developmental migrations, habitat use, and feeding ecology. So far, the survey results have yielded sightings and captures of loggerhead, Kemp's ridley, and green sea turtles. In order of abundance, loggerheads are typically found near tidal passes, ridleys congregate close to creek or bay mouths, and green turtles are often observed in seagrass pastures in six to eight feet of water. Annual catch per unit effort rates for visual transect sightings range from 0.011-0.021 turtles per hour and sighting densities drop during the winter months (Eaton et al. 2008). Another goal of this project is to evaluate post hurricane effects on turtle foraging ecology in Charlotte Harbor. Surveys conducted after Hurricane Charley in 2004 reported hypoxic conditions and a massive horseshoe crab die-off in that same area. Disturbances to seagrass beds and changes in crustacean populations after hurricanes are also being evaluated as having possible effects on sea turtle foraging ecology. This information would enable the refuge and partners to adapt management as necessary to protect these turtles.

Objective 1.j: Snowy Plover

Objective 1.j(1): Throughout the life of the CCP, continue working with the partners to survey and monitor snowy plover nesting success and predation, providing protection to all discovered nesting sites on Sanibel and Captiva Islands.

Objective 1.j(2): Throughout the life of the CCP, continue to coordinate with the partners to manage the Perry Tract to minimize impacts to snowy plovers and to understand and manage beach habitats and disturbances.

Discussion: Snowy plovers are listed by the State of Florida as a threatened species (Florida Fish and Wildlife Conservation Commission 2009a). The Service considers the snowy plover as a species of management concern due to its dependence on vulnerable or restricted habitats. The 2009 State of the Birds report considers the snowy plover to be a bird in trouble (North American Bird Conservation Initiative, U.S. Committee 2009).

Snowy plovers and other shorebirds nest along the beaches of Sanibel and Captiva Islands. Recent estimates for the west coast of Florida, from the panhandle through Cape Sable, show about 200 pairs of snowy plovers (Sanibel-Captiva Conservation Foundation 2009b). By mid-June 2009, Sanibel Island had 15 snowy plover nests, four fledglings from earlier in the season, and 10 chicks (Sanibel-Captiva Conservation Foundation 2009b). However, the refuge includes only a very small portion of beachfront property, the Perry Tract, includes approximately 550 feet (168 meters) of shoreline along the Gulf of Mexico. Since the Perry Tract is located along the publicly accessible beach and since the Service only owns to the mean high water line, public access does occur across the beachfront portion of the property. The refuge currently coordinates with the partners to enhance management for and protection of snowy plovers and other shorebirds. Partially funded by the Service, SCCF surveys and monitors snowy plover nesting success and predation. Surveys are frequently conducted throughout the nesting season. Discovered nests are posted to exclude entry to the immediate nest site. Human disturbance is minimized during the nesting season through increased law enforcement presence by refuge law enforcement officers and Sanibel police officers. For publicly accessible beaches (e.g., the Perry Tract), all dogs on the beach must be leashed. The refuge participates in a snowy plover banding project with the partners.

To continue to provide protection for snowy plovers, the refuge would continue to work with SCCF and other partners to minimize impacts to snowy plovers and to beach habitats. The refuge would work with the partners to provide, manage, and protect shorebird and seabird beach nesting and resting habitat, including creating and enforcing closed area buffers around discovered nesting areas to minimize negative impacts. The refuge would work with the partners to monitor beach profile

changes over time as related to climate change and sea level rise. The refuge would also work with partners to alter sea turtle nest survey methods to minimize impacts to nesting shorebirds, if necessary. The refuge would also work with the partners to evaluate the need for and develop a plan to address seasonal nesting closures on the Perry Tract. The refuge would adapt management as necessary, working with partners to protect nesting sites.

Objective 1.k: Piping Plover

Objective 1.k(1): Throughout the life of the CCP, work with the partners to determine presence/absence of the piping plover on Sanibel Island. If piping plovers are discovered using Sanibel Island, coordinate with the partners to increase public awareness and understanding and to adapt management as necessary to minimize negative impacts to the plovers and their habitat.

Discussion: In Florida, the piping plover is listed by both the Service and the State of Florida as a threatened species (Florida Fish and Wildlife Conservation Commission 2009a). The 2009 State of the Birds report considers the piping plover to be a bird in trouble (North American Bird Conservation Initiative, U.S. Committee 2009).

Although piping plovers do not regularly use the shorelines of Sanibel and Captiva Islands, critical habitat for the piping plover is designated nearby at Terrapin Creek in Matlacha Pass NWR. To support piping plover recovery, the refuge would increase management activities, including conducting winter surveys, minimizing impacts and disturbances, and increasing public awareness. The refuge would work with the partners to survey and monitor for presence/absence of piping plover on Sanibel and Captiva Islands during the winter. Further, the refuge would work with the partners to minimize impacts to piping plovers and to understand and manage beach habitats and disturbances. Sea turtle nest survey methods would be altered, where necessary, to minimize impacts to piping plovers and other shorebirds. The refuge would work with the partners to ensure no human disturbance on beach nesting areas. To serve piping plovers, as well as other shorebirds and seabirds, the refuge would work with the partners to monitor beach profile changes over time as related to climate change and sea level rise. The refuge would work with the partners to establish seasonal closed areas buffers around piping plover roost areas, if necessary.

Objective 1.l: Red Knot

Objective 1.l(1): Throughout the life of the CCP, continue conducting shorebird monitoring from September through May and survey impoundments for shorebird use during drawdowns at high tides, reporting banded red knots whenever they are seen.

Discussion: In August 2006, the red knot was designated as a candidate species for consideration for listing under the Endangered Species Act. Breeding in the central Canadian arctic and predominantly wintering in Tierra del Fuego at the southern tip of South America, the main population of red knots has declined by a magnitude over 25 years to about 17,000 birds in 2006 (Niles et al. 2007). An additional 7,000 birds are estimated to winter in Florida (Niles et al. 2007). Conservation goals target red knot levels to the early 1980s of 100,000-150,000 birds: 70,000-80,000 in the Tierra del Fuego wintering population, 20,000-25,000 in the Brazilian wintering population, 20,000-25,000 in the Florida wintering population, and 15,000-20,000 at other sites (Niles et al. 2007). The refuge is considered an important site for wintering red knots.

To support red knot conservation, the refuge would increase management activities. The refuge would continue to conduct shorebird monitoring in the east and west impoundments from September through May, three times per month. Whenever red knots are seen on the refuge, bands would

continue to be reported to the Migratory Bird Banding Laboratory at Patuxent Wildlife Research Center. Refuge impoundments would continue to be managed to provide shorebird foraging habitat during the fall and spring migrations. The refuge would also continue to survey impoundments weekly during drawdowns at high tides. The refuge would coordinate with the partners to address water quality, quantity, and timing of flows.

Objective 1.m: Sanibel Rice Rat

Objective 1.m(1): Within 5 years of CCP approval, develop and implement an intensive survey and monitoring program for the Sanibel rice rat to determine population status and trends on the refuge, adapting management as necessary to provide for the Sanibel rice rat.

Discussion: The Sanibel rice rat is a candidate species for listing by the Service under the Endangered Species Act and it is listed by the State of Florida as a species of special concern due to its vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a state threatened species unless appropriate protective or management techniques are initiated or maintained and since it may already meet certain criteria for designation as a state threatened species, but for which conclusive data are limited or lacking (Florida Fish and Wildlife Conservation Commission 2009a). The current status of the Sanibel rice rat is unknown. To increase information about the Sanibel rice rat, the refuge would conduct intensive monitoring and permanent marking to determine the population status and trends. It would expand trapping effort to additional areas to determine habitats used by the rice rat. If necessary, the refuge would alter surveys to minimize impacts to migratory birds. Since Sanibel rice rats require moderate to abundant herbaceous cover across the landscape, transitioning from uplands to wetlands to marine communities, proposed habitat management and restoration activities would also benefit the rice rat.

Objective 1.n: Ornate Diamondback Terrapin

Objective 1.n(1): Within 5 years of CCP approval, coordinate with the partners to initiate surveys to develop baseline data for the ornate diamondback terrapin and determine population status and trends within the refuge, including nesting success and bycatch mortality.

Discussion: According to the State of Florida, the status of the ornate diamondback terrapin is unknown and the population is considered declining (Florida Fish and Wildlife Conservation Commission 2005). Ornate diamondback terrapins are known to occur on the refuge and have recently been documented on the Wildlife Drive. Diamondback terrapins are susceptible to bycatch in crab traps (particularly smaller males and juvenile females), raccoon predation, and roadkill. To help protect this species and enhance decision-making, the refuge would develop baseline data to better understand population and status and trends and address threats.

Objective 1.o: Smalltooth Sawfish

Objective 1.o(1): Within 5 years of CCP approval, work with the partners to determine presence/absence of smalltooth sawfish on the refuge, adapting management as necessary to protect this species.

Discussion: The smalltooth sawfish is listed by the Service as an endangered species. Records indicate that this species was once common throughout its historic range and that the smalltooth sawfish has declined dramatically in U.S. waters over the last century with a population decline of 95 percent or more (National Oceanic and Atmospheric Administration 2009b). The primary factor in this

decline has been bycatch in commercial and recreational fisheries (National Marine Fisheries Service 2009). Other threats include entanglement in marine debris, injury from saw removal, pollution of coastal waters, loss of wetland and estuarine habitats, and disturbance of natural behavior by divers and other marine activities (National Marine Fisheries Service 2009 and National Oceanic and Atmospheric Administration 2009b). Keys to recovery include rebuilding and monitoring the population, while managing and eliminating the threats (National Marine Fisheries Service 2009).

Today, the largest numbers of smalltooth sawfish in the U.S. are found from Charlotte Harbor through the Dry Tortugas (National Marine Fisheries Service 2009). The smalltooth sawfish is known to occur in the Sanibel area and may be present on the refuge. The recovery plan states that protecting nursery areas within southwest Florida is important to the recovery of the species (National Marine Fisheries Service 2009). Juvenile sawfish use mangrove shorelines as nursery habitat. Red mangroves and adjacent shallow euryhaline habitats are key elements of smalltooth sawfish conservation. The Charlotte Harbor Estuary nursery area contains the features important to the conservation of smalltooth sawfish because they facilitate recruitment into the adult population. The NMFS proposes to designate the Charlotte Harbor Estuary [totaling 221,459 acres (89,621 ha)], along with Ten Thousand Islands/Everglades Estuary [totaling 619,013 acres (250,506 ha)] as two critical habitat ‘‘units’’ for the smalltooth sawfish. This designation was proposed in November 2008 and a final designation is anticipated in September 2009 (Figure 23).

To enhance management for this and other species, the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows. Proposed management activities would also benefit the smalltooth sawfish.

Goal 2: Wildlife and Habitat Diversity

Conserve, restore, enhance, and manage the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands to maintain and enhance their biological integrity and to support species diversity and abundance of native plants and animals, with an emphasis on migratory birds.

Objective 2.a: Canals and Ditches

Objective 2.a(1): Within 15 years of CCP approval, evaluate all ditches on the refuge and fill in those that negatively impact refuge wildlife and habitats.

Objective 2.a(2): Within 10 years of CCP approval, evaluate and clear those canals needed to support refuge management goals and objectives.

Discussion: Numerous canals and ditches exist throughout Sanibel Island and the refuge, negatively impacting natural sheet flow and water tables, which can negatively impact refuge habitats, including mangroves, hardwood hammocks, and freshwater wetlands. Further, some canals were impacted by Hurricane Charley in 2004 and still require clearing. During the life of the CCP, the refuge would evaluate the ditches and canals on the refuge to support refuge management goals and objectives. In developing approaches to address canals and ditches, the refuge would prioritize the needs of migratory birds.

Objective 2.b: Uplands

Objective 2.b(1): Throughout the life of the CCP, maintain approximately 756 acres (306 ha) of upland habitats on the refuge to support a variety of species, with a management focus on migratory birds.

Objective 2.b(2): Within 15 years of CCP approval, restore 567 acres (229 ha) of hardwood hammock habitat on the refuge on ridges and around Shell Mound Trail to support mangrove forest birds and neotropical migratory birds.

Objective 2.b(3): Within 5 years of CCP approval, evaluate the habitat restoration needs at the refuge's Buck Key, conducting any needed restoration resulting from this evaluation.

Discussion: Upland habitats currently represent about 12 percent of the refuge and include hardwood hammock forests (567 acres/229 ha); hardwood hammock shrublands (126 acres/51 ha); and non-vegetated, rock, beach, and dune habitats (63 acres/25 ha). Wildlife surveys and exotic plant control would continue to be conducted within the refuge's upland habitats. An assessment on the condition of the hardwood hammock forests would also be conducted. The refuge would prioritize the needs of migratory birds in all uplands restoration plans. Proposed restoration includes the hammocks in the Shell Mound Trail area and the assessment of the need for habitat restoration at Buck Key. Further, the refuge would address canals and drainage ditches that negatively impact the desired habitat. Proposed upland management activities would benefit a variety of species, including bobcats, marsh rabbits, raccoons, cotton rats, ground doves, Chuck-will's-widows, white-eyed vireos, great crested flycatchers, pileated woodpeckers, red-bellied woodpeckers, eastern screech-owls, northern cardinals, common yellow-throats, eastern indigo snakes, eastern coachwhip snakes, southern black racers, yellow rat snakes, Florida brown snakes, coral snakes, southern ring-necked snakes, gopher tortoises, Florida box turtles, green anoles, southeast five-lined skinks, six-lined racerunners, green tree frogs, squirrel tree frogs, and southern toads.

Objective 2.c: Interior Wetlands and Impoundments

Objective 2.c(1): During the life of the CCP, maintain approximately 189 acres (76 ha) of interior wetlands and 850 acres (344 ha) of impoundments to support a variety of species, with a management focus on migratory birds.

Objective 2.c(2): Within 15 years of CCP approval, work with city of Sanibel to control water levels in the State Botanical Site to enhance refuge management activities.

Objective 2.c(3): Within 10 years of CCP approval, develop the ability to control water levels and cattails at Smith Pond on the Bailey Tract.

Objective 2.c(4): Within 10 years of CCP approval, improve water management capabilities in the refuge's two impoundments to better serve the needs of fish, wading birds, waterbirds, waterfowl, and shorebirds.

Objective 2.c(5): Within 5 years of CCP approval, evaluate the timing and depth of water level manipulation in the refuge's two impoundments to better serve the needs of wading birds, waterbirds, waterfowl, and shorebirds.

Objective 2.c(6): Within 5 years of CCP approval, evaluate the need to remove or modify delta sandbars to prevent the restriction of flows between the impoundments and the estuary.

Discussion: Interior wetlands and impoundments represent 16.6 percent of the refuge (1,039 acres/420 ha) and include estuarine mangrove forest, hydric shrubland, and herbaceous marsh. An assessment on the condition of the wetlands would also be conducted. The capability to manage water on the State Botanical Site would help the refuge meet other goals and objectives and would help support a variety of species, including the Sanibel rice rat, otters, least bitterns, mottled ducks, common moorhen, black-necked stilts, American alligators, Florida softshell turtles, Florida redbelly turtles, striped mud turtles, eastern narrow-mouthed toads, and southern leopard frogs. Management of the Bailey Tract would be improved by the ability to control water levels and cattails, providing benefits to a variety of species, including the American alligator. Further, the refuge would evaluate the feasibility of adding water control structures to the refuge's two impoundments to enhance management for a variety of species, including fish, wading birds, waterbirds, waterfowl, and shorebirds. For spartina areas, the refuge would implement prescribed fire on a 3- to 5-year rotation. Further, the refuge would conduct fuel and fire-effects monitoring and exotic plant control in interior wetlands. Water quality monitoring would be conducted in the ponds on the Bailey Tract. The refuge would work with the city of Sanibel and SCCF to control water levels in the State Botanical Site to enhance refuge management activities. Coordinating with the partners the refuge would evaluate restoration of sheet flow on the State Botanical Site, including the filling of ditches. The refuge would develop the ability to control water levels and cattails on the Bailey Tract. The refuge would prioritize the needs of migratory birds in all restoration plans.

Objective 2.d: Mangroves

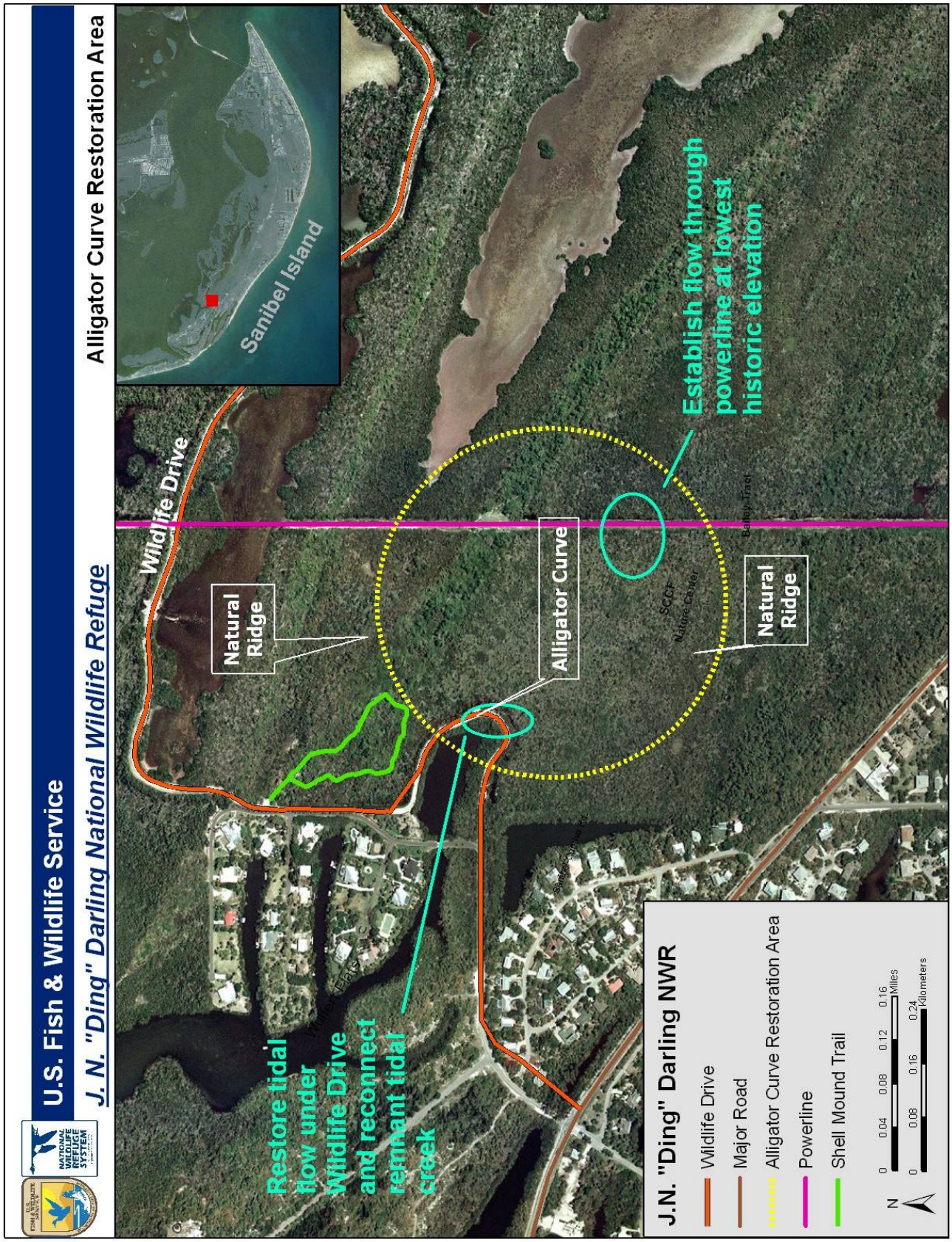
Objective 2.d(1): Throughout the life of the CCP, maintain approximately 1,944 acres (787 ha) of estuarine mangrove forest habitat to support a variety of species, with a management focus on migratory birds.

Objective 2.d(2): Throughout the life of the CCP, continue working with the partners to conduct research on impounded and unimpounded mangroves on Sanibel Island to evaluate relative productivity.

Objective 2.d(3): Within 5 years of CCP approval, restore 125 acres (50 ha) of mangrove habitat at Alligator Curve.

Discussion: Estuarine mangrove forests currently represent about 31 percent of the refuge, supporting a host of species, including mangrove cuckoos, black-whiskered vireos, gray kingbirds, Florida prairie warblers, yellow-crowned night-herons, neotropical migratory birds, wading birds, snook, tarpon, snapper, mangrove crabs, fiddler crabs, and pink shrimp. An assessment on the condition of the mangrove forests would also be conducted. An old growth mangrove restoration project for Alligator Curve is currently in the planning phases and the refuge is pursuing funding for this project (Figure 28). Monitoring the response of the mangrove community to the restoration would be coordinated with the partners. Research is currently being conducted on impounded and unimpounded mangroves on Sanibel Island to determine relative productivity. Ditch clearing would be a component of restoration activities, after reconnection with the estuary. Water depth and quality measurements would be taken to assess changes in hydrology. The refuge would work with partners to address drainage ditches and canals that negatively impact the hydrology and desired habitat condition. The refuge would prioritize the needs of migratory birds in all restoration plans.

Figure 28. Alligator Curve Restoration Area



Objective 2.e: Seagrass Beds

Objective 2.e(1): Throughout the life of the CCP, continue to protect and maintain seagrass beds within the 2,268 acres (918 ha) of open estuarine waters on the refuge, including enforcing no-motor and slow speed zones.

Objective 2.e(2): Within 5 years of CCP approval, work with partners to map historic and existing seagrass beds on the refuge, particularly at Wulfert Flats.

Objective 2.e(3): Within 5 years of CCP approval, work with the partners to reinstate the seagrass monitoring program in Tarpon Bay.

Discussion: In 1998, a baseline survey was conducted for seagrass beds in Tarpon Bay. An assessment on the condition of the seagrass beds in and around the refuge would be conducted. In addition to this information, fish seining activities help the refuge to assess habitat quality. No-motor and speed zones help protect seagrasses in those restricted areas. The refuge would continue to protect and restore refuge seagrass beds. The refuge would work with the partners to establish new water quality monitoring stations to assess changes in estuarine conditions. Seagrasses were negatively impacted by the 2006 red drift algae outbreak, following major freshwater releases from the Caloosahatchee River. To address concerns related to water quality, quantity, and timing of flows, the refuge would continue to coordinate with SCCF, USGS, USACE, FDEP, SWFWMD, city of Sanibel, and other partners. The refuge would work with the partners to reinstate the monitoring program for seagrass beds. Currently this project is funded for 18 months. The refuge would work with partners to map historic and existing seagrass beds, evaluating changes over time.

Objective 2.f: Baseline Wildlife Data

Objective 2.f(1): During the life of the CCP, expand existing baseline data to determine the full range of species using the refuge.

Discussion: Although the refuge does have baseline data for the bulk of species using the refuge, it lacks comprehensive data (e.g., the refuge lacks complete data for plants, invertebrates, fish, and herpetological species). Having these data would enhance decision-making.

Objective 2.g: Raptors and Birds of Prey

Objective 2.g(1): Throughout the life of the CCP, continue conducting breeding bird surveys in the summer and migratory bird surveys in the fall and spring to document the raptors and birds of prey using the refuge.

Objective 2.g(2): Throughout the life of the CCP, continue maintaining nest platforms for ospreys and nest boxes for owls on the refuge.

Objective 2.g(3): Within 15 years of CCP approval, identify, manage, and restore the nesting, breeding, roosting, and foraging habitat needs for raptors and birds of prey.

Discussion: A mix of raptors and birds of prey use and breed on the refuge. However, the refuge lacks data to assess status and trend for these birds. To better serve these birds, the refuge would increase management activities. The refuge would work with the partners to restore and maintain habitat for raptors and birds of prey. The refuge would continue to survey for breeding kestrels in the spring. The breeding population of kestrels in Florida is rare. FWC needs help in mapping the

current distribution of southeastern American kestrels in peninsular Florida south of Orlando from April through June. Other breeding raptors to watch for would include short-tailed hawks and great-horned owls. The refuge would work with partners in conducting hawk watches. Raptor surveys in fall and spring would be valuable to document migrating falcons, accipitors, hawks, kites, harriers, and eagles. The refuge would continue to participate in the Christmas Bird Count. The refuge would consider extending monitoring periods for raptors and birds of prey. And the refuge would continue to maintain nest platforms for ospreys and nest boxes for owls. Osprey nests on Sanibel Island are currently monitored by the Osprey Foundation. The refuge would evaluate the effectiveness of nest box and platform locations and reposition or remove as warranted. Further, the refuge would evaluate the need to relocate osprey nesting platforms away from roadways. Raptors and other birds of prey would benefit from proposed habitat restoration activities, especially of hardwood hammocks, Shell Mound Trail, and Alligator Curve. Benefitting a variety of species, including raptors and birds of prey, the refuge would coordinate with partners to address concerns related to water quality, quantity, and timing of flows.

Objective 2.h: Nearctic-Neotropical Migratory Birds

Objective 2.h(1): Throughout the life of the CCP, continue conducting breeding bird surveys in the summer and migratory bird surveys in the fall and spring to document the nearctic-neotropical migratory birds using the refuge.

Objective 2.h(2): Within 10 years of CCP approval, work with partners to evaluate the feasibility and benefits of mist-netting and banding nearctic-neotropical migratory birds using the refuge to expand information about their movement and abundance across the landscape, contributing to national and international conservation initiatives.

Objective 2.h(3): Within 10 years of CCP approval, identify, manage, and restore the nesting, breeding, roosting, and foraging habitat needs for those nearctic-neotropical migratory birds using the refuge.

Objective 2.h(4): During refuge habitat management and restoration activities, select for certain shrubs and trees as food sources and potential migration and nesting habitats to support nearctic-neotropical migratory birds.

Discussion: The refuge was established with the primary purpose of serving migratory birds and the refuge serves as an important stopover and overwintering site for numerous birds. To inform and enhance decision making, the refuge would continue existing and increase management activities to support nearctic-neotropical migratory birds. The refuge would continue to conduct breeding bird surveys in the summer and migratory bird surveys in the fall and spring. The migration surveys have revealed that as many 27 species of migratory landbirds use the refuge and over 250 birds on any given day could be passing through the refuge. The refuge would also continue to participate in the Christmas Bird Count. To provide additional information, the refuge would consider extending monitoring periods and it would consider using mist nets and banding. Further, the refuge would identify and manage for the habitat needs of those nearctic-neotropical migratory birds using the refuge, selecting for certain shrubs and trees as food sources and potential migration and nesting habitats (e.g., hardwood hammocks, Shell Mound Trail, and Alligator Curve). The refuge would work with the partners to restore and maintain migratory bird habitat on the refuge and on Sanibel and Captiva Islands. Mangrove habitat would be restored at Alligator Curve. Netting and banding would provide data to serve as barometer to help identify potential shifts in abundance, distribution, and phenology that may correspond to impacts from climate change. The refuge would coordinate with the partners, including the Banding Lab and Partners-in-Flight, to develop an understanding of the status and trends of nearctic-neotropical migratory birds using the refuge.

Objective 2.i: Shorebirds and Seabirds

Objective 2.i(1): Throughout the life of the CCP, continue seasonally managing 850 acres (344 ha) of impoundments to support shorebird foraging habitat during fall and spring migrations.

Objective 2.i(2): Within 5 years of CCP approval, work with partners to provide, manage, and protect shorebird and seabird beach nesting and roosting habitat, including creating and enforcing closed area buffers around discovered nesting and roosting areas to minimize negative impacts.

Discussion: According to the 2009 State of the Birds report, half of all coastally migrating shorebirds have declined and at least 39 percent of seabirds are declining (North American Bird Conservation Initiative, U.S. Committee 2009). The refuge was established with the primary purpose of serving migratory birds and the refuge serves as an important stopover and overwintering site for numerous birds. To support shorebirds and seabirds, the refuge would increase management activities.

The impoundments would continue to be specifically managed to support multiple species, including shorebirds, wading birds, waterbirds, and waterfowl. The refuge would continue to conduct shorebird monitoring from September through May, three times per month. Whenever seen on refuge, bands would continue to be reported. The refuge would continue to manage the impoundments for shorebird foraging habitat during fall and spring migrations. The impoundments would continue to be surveyed weekly during drawdowns at high tides. The refuge would continue to survey seabirds during Wildlife Drive surveys, which are twice per month during low tide. The refuge would continue to survey the Wildlife Drive during drawdowns at low tide weekly. To better serve shorebirds, the refuge would improve water management capabilities in the impoundments. The refuge would work with the partners to manage water levels to better benefit migrating shorebirds.

The refuge manages very little beachfront, only at the Perry Tract, and subsequently plays a small role for beachfront shorebird and seabird nesting and resting. Working with the partners, the refuge would provide, manage, and protect beach nesting habitat, including creating and enforcing appropriately sized closed area buffers around nesting areas. Buffer sizes would depend on the species using the sites, based upon current research (e.g., Rodgers and Schwikert 2002). Sea turtle nest survey methods would be altered to minimize impacts to shorebirds, if necessary. The refuge would work with the partners to minimize human disturbance on beach nesting areas.

Further, the refuge would continue to participate in the Christmas Bird Count. And breeding bird surveys would continue to be conducted in May.

Objective 2.j: Wading Birds, Waterbirds, and Waterfowl

Objective 2.j(1): Throughout the life of the CCP, continue seasonally managing 850 acres (344 ha) of impoundments to support foraging opportunities for wading birds, waterbirds, and waterfowl.

Objective 2.j(2): Throughout the life of the CCP, continue conducting surveys to monitor the numbers of wading birds, waterbirds, and waterfowl using the refuge.

Objective 2.j(3): Within 5 years of CCP approval, coordinate with the State of Florida and other partners to establish appropriately sized closed area buffers around rookeries.

Discussion: To better support wading birds, waterbirds, and waterfowl using the refuge, the refuge would expand management activities. The impoundments would continue to be specifically managed to support multiple species, including shorebirds, wading birds, waterbirds, and waterfowl. The

refuge would continue to conduct surveys from March through September, every two weeks. Wildlife Drive surveys would continue to be conducted twice per month during low tide. These surveys have documented as many as 15 different species of shorebirds, 16 species of wading and waterbirds, and as many as 4,000 birds on any given day on the refuge. The Wildlife Drive would continue to be surveyed during drawdowns at low tide weekly and the refuge would continue to conduct weekly impoundment surveys at high tide. The refuge would continue to participate in the Christmas Bird Count. Breeding bird surveys would continue to be conducted in May. Colonial nesting bird surveys would continue to be conducted monthly from February through July. The refuge would coordinate with the partners to protect and maintain refuge seagrass beds. The refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows. Further, the refuge would coordinate with the State of Florida and other partners to establish appropriately sized closed area buffers around rookeries. Buffer sizes would depend on the species using the sites, based upon current research (e.g., Rodgers and Schwikert 2002). Distances for proposed closed area buffers would be from refuge boundaries (which are identified at mean high water along shorelines) out into adjacent waterways. The refuge would work with the partners to maintain healthy fish populations to support bird needs. Proposed habitat management and restoration activities would also benefit wading birds, waterbirds, and waterfowl.

Objective 2.k: American Alligator

Objective 2.k(1): Within 5 years of CCP approval, pursue various funding opportunities to restore and enhance alligator habitat on the refuge.

Objective 2.k(2): Within 5 years of CCP approval, work with the city of Sanibel to evaluate the impacts of the nuisance alligator program.

Discussion: The refuge would increase management activities to better support alligators. The refuge has an old growth mangrove restoration project for Alligator Curve that is currently in the planning phases and for which the refuge is pursuing funding. The Alligator Curve project would restore tidal flow and alter existing alligator habitat. Ditch clearing would occur in some areas, providing benefits for alligators. The refuge would evaluate the potential for deeper freshwater habitat to serve alligator needs during times of drought. The refuge would develop the ability to control water levels on the Bailey Tract. Further, the refuge would create additional basking areas for alligators to use. To support these activities, the refuge would pursue funding to restore and enhance alligator habitat. The refuge would coordinate with the partners to increase education and enforcement on and off-refuge to eliminate alligator feeding and harassment. The refuge would continue to support the removal of nuisance alligators, but it would work with the city of Sanibel and FWC to change the open harvest policy on Sanibel Island so that only nuisance alligators are removed.

Objective 2.l: Fish

Objective 2.l(1): Throughout the life of the CCP, work with the partners to maintain healthy fish populations in the area to support migratory birds.

Discussion: Healthy fish populations would support a variety of species, including wood storks. The refuge would continue to seine three times a year to determine the composition of juvenile and baitfish populations using the refuge. Until the activity is phased out and as an additional sampling method, the refuge would work with the existing commercial fisherman with grandfathered permission for trawling baitfish and cast netting mullet to share landing and bycatch data. To support a variety of species, including fish, the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows.

Objective 2.m: Plants

Objective 2.m(1): During the 15-year life of the CCP, conduct a plant inventory to assess species diversity, maintain healthy native plant populations, and inspect and protect unique specimens.

Discussion: The refuge is home to a wide variety of native subtropical plants. An inventory and map of natural communities by dominant species would provide valuable habitat information for wildlife and habitat management. Inspecting unique specimens, such as national champion big trees would allow the refuge to update their statuses. The refuge recently had five national champion trees (i.e., red mangrove, spiny hackberry, coral bean, Jamaica caper, and Geiger-tree) and one State champion big tree (i.e., myrsine). The national champion red mangrove blew down in Hurricane Charley. An inspection of the others would be in order. Documenting plant phenology (budding, flowering, and fruiting) would contribute valuable information to refuge management for assessing changes over time that may correspond to impacts from climate change. Understanding plant response to micro-climate changes could aid in facilitating adaptive management.

Goal 3: Exotic, Invasive, and Nuisance Species

Eliminate existing and future exotic, invasive, and nuisance species on the refuge to maintain and enhance the biological integrity of the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands.

Objective 3.a. Control of Exotic, Invasive, and Nuisance Plants

Objective 3.a(1): Throughout the life of the CCP, continue conducting exotic plant control on about half of the refuge lands each year.

Objective 3.a(2): Throughout the life of the CCP, continue working with the partners to control exotic plants on conservation properties on Sanibel and Captiva Islands with a focus on high-priority habitats serving migratory birds.

Objective 3.a(3): Within 5 years of CCP approval, work with the partners to identify and locate new infestations of Florida Exotic Pest Plant Council Category I and Category II exotic, invasive, and nuisance plants, focusing initial attack on eradication.

Discussion: Most refuge habitats have been impacted by exotic, invasive, and nuisance species. Priority species of management concern include Brazilian pepper, Australian pine, rosary pea, air potato, guava, and narrow-leaved cattail. The refuge would focus exotic plant control efforts on high priority habitats for migratory birds. The refuge would identify and locate new infestations of Category I and Category II invasive upland plants, conducting initial attack with an emphasis on eradication. Further, the refuge would work with the partners to control the spread of existing, invasive, exotic, and nuisance plants to reduce adverse impacts to migratory birds and their habitats.

Objective 3.b: Control of Exotic, Invasive, and Nuisance Animals

Objective 3.b(1): During the life of the CCP, continue to work with partners to control and eradicate exotic, invasive, and nuisance animals threatening the refuge.

Objective 3.b(2): Within 5 years of CCP approval, work with the partners to increase education and awareness to build support for management activities to eradicate invasive exotic animals, to minimize impacts from nuisance animals, and to minimize raccoon feeding activities.

Discussion: Exotic, invasive, and nuisance species currently impact refuge habitats and wildlife. Current priority exotic, invasive, and nuisance species include black rats, green iguanas, and Nile monitor lizards. The refuge would continue to partner with the city of Sanibel to remove and euthanize iguanas and monitor lizards both off-site and on-site. The refuge would continue to conduct small mammal trapping and evaluate euthanasia of black rats. The refuge would continue to conduct pest control at refuge facilities for black rats. The refuge would continue to haze and/or euthanize nuisance raccoons.

The refuge would increase management activities to address exotic, invasive, and nuisance species. The refuge would coordinate with the partners to increase education on and off the refuge to minimize raccoon feeding and to increase awareness of negative impacts of exotic, invasive, and nuisance animals. The refuge would evaluate more effective means of trapping and euthanizing exotic, invasive, and nuisance animals and it would evaluate methods to reduce well-established exotic animals, such as the brown anole, Cuban tree frog, greenhouse tree frog, Indo-pacific gecko, tokay gecko, red fire ant, blue tilapia, and Mozambique tilapia. The refuge would work with the Service's Migratory Bird Office to consider control techniques for removing European starlings, house sparrows, and Eurasian collared doves. Focusing on eradication, the refuge needs to be regularly informed and updated to be able to adapt management quickly to respond to new locations and species to minimize impacts to refuge resources, with an emphasis on protecting migratory birds. To help do this the refuge would increase involvement and actively participate with Southwest Florida Cooperative Invasive Species Management Area (SWFL CISMA), including creating an alert network to notify partners of the presence and spread of exotic, invasive, and nuisance species, focusing efforts on early detection and rapid response. Current information indicates that the range of the Burmese python has extended north to the Myakka River, potentially including the refuge (Skip Snow, personal communication, 2009). An active alert network would help to detect their presence. The green mussel was recently discovered on the refuge in Tarpon Bay.

Goal 4: Water Quality, Quantity, and Timing of Flow

Work with the partners to address and resolve the water quality, quantity, and timing of flow concerns associated with the watershed of the refuge; Lake Okeechobee releases to the west; and the Gulf of Mexico.

Objective 4.a: Water Quality, Quantity, and Timing of Flow

Objective 4.a(1): Throughout the life of the CCP, continue working with partners on Lake Okeechobee regulation schedules to optimize water quality, quantity, and timing of flows to support the estuarine ecosystem in which the refuge exists.

Discussion: Lake Okeechobee regulation schedules are set by USACE. The Service's Vero Beach Ecological Services Field Office coordinates regularly with the USACE on these regulation schedules. The refuge would increase efforts to work with the partners to address concerns related to water quality, quantity, and timing of flows, including coordinating with the Vero Beach Ecological Services Field Office to address management concerns on those activities impacting the refuge's ecology, with an emphasis on the needs of migratory birds and their habitats. Several strategies would be needed, including those listed.

Strategies:

- Coordinate with Service's Vero Beach Ecological Services Field Office for Fish and Wildlife Coordination Act input on new regulation schedules for Lake Okeechobee.
- Work with USACE Operations and other the partners to install a water quality monitoring station in Tarpon Bay.

Objective 4.a(2): Within 1 year of CCP approval, work with the partners to address water quality, quantity, and timing of flow concerns; including evaluating water quality impacts on algal blooms, bird usage, seagrasses, and fish populations on the refuge.

Discussion: The partners already have water quality monitoring stations in and around the refuge. To increase information and to enhance refuge management decision making, water quality monitoring stations would be needed at the mouth of Tarpon Bay, at the mouth of MacIntyre Creek, and just outside of the culverts at the east impoundment. The refuge would work with the partners to monitor water depth, flow, salinity, temperature, DO, turbidity, CDOM, nutrients, pH, and chlorophyll to help address concerns related to water quality, quantity, and timing. Fish seining, seagrass surveys, and bird counts would be conducted in conjunction with water sampling activities to document any correlations. Species that would be targeted for surveying would include juvenile species of tarpon, snook, seatrout, mangrove snapper, sheepshead, mullet, menhaden, pink shrimp, and blue crabs. Bird counts would target wading birds and shorebirds. The refuge would focus management concerns on those activities impacting migratory birds and their habitats.

Goal 5: Climate Change

Identify, understand, and ameliorate the impacts of climate change on refuge resources to plan for and adapt management as necessary to protect the native wildlife; the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands; and the cultural resources of the refuge.

Objective 5.a: Climate Change Impacts

Objective 5.a(1): During the life of the CCP, work with the partners to refine and run appropriate climate change models and foster needed research to understand the impacts on refuge resources, with a focus on the potential impacts on migratory birds.

Discussion: The impacts from climate change and sea level rise are already being seen around the globe. Understanding the impacts of climate change on refuge resources would be an important part of future management. The refuge would evaluate refuge management activities that could adapt to these changes and/or minimize their impacts. One key concept would be to build resilience/flexibility in natural systems to enable them and the wildlife that use them to better cope with a range of conditions that might occur. Finding ways to decrease vulnerability and increase adaptive capacity of these systems and wildlife are measures that would likely be employed in varying degrees. Strategies to accomplish this objective include those listed.

Strategies:

- Work with the Service's South Florida Ecosystem Team and Massachusetts Institute of Technology to develop a climate change and sea level rise model.
- Partner with the SCCF Marine Lab to model climate change impacts to the refuge.

- Re-run the SLAMM model when high resolution Light Detecting and Ranging (LiDAR) data become available.
- Work with partners to establish benchmarks and monitoring in relation to sea level rise, shoreline change, saltwater intrusion, and habitat changes and shifts. Monitor beach profile changes over time as related to climate change and sea level rise. Develop benchmark water depth in Tarpon Bay with the new water quality monitoring station. Monitor changes manifested in shoreline erosion, saltwater intrusion into aquifer, decreased vitality of mangroves and other edge species, increased prevalence of disease, increased level of pH in the marine environment, and increased frequency and duration of drought and fire.
- Use Service's fire weather station Located at J.N. "Ding" Darling NWR on Sanibel Island to compare changes in local climate especially with regard to rainfall and temperature.
- Work with Cornell to track changes in migratory bird presence, timing of migration, and timing of breeding bird nesting, as well as the timing of associated flora.
- Work with partners, particularly SCCF and Bailey-Matthews Shell Museum to monitor the pH of surrounding waters and any associated changes in shellfish organisms.
- Work with the partners to monitor subtle shifts in species abundance, productivity, range, and phenology.
- Anticipate increased invasion of exotic species.
- Monitor succession of natural communities to include more tropical dominant species.

RESOURCE PROTECTION

Resource protection management activities would be expanded during the 15-year life of the Plan, including improving cultural resource information, protecting "Ding" Darling's fishing cabin, developing management agreements to implement protective buffers, pursuing additional special designations, and enhancing wilderness area information.

Goal 1: Cultural Resources

Protect the archaeological and historical resources of the refuge exemplifying the natural and cultural history of Sanibel and Captiva Islands and connect refuge staff, visitors, and the community to the area's past.

Objective 1.a: Archaeological and Historic Resources

Objective 1.a(1): During the life of the CCP, continue evaluating cultural resource issues when projects are proposed; patrolling known sites; addressing issues as they arise; and including cultural resources in refuge environmental education and interpretive programs.

Objective 1.a(2): Within 15 years of CCP approval, coordinate with the Service's Regional Archaeologist and the State Historic Preservation Officer to develop a comprehensive survey of all cultural resources of the refuge to update existing information.

Discussion: In addition to wildlife and habitats, the refuge also provides for protection of cultural resources. Refuge law enforcement staff currently patrols known cultural resource sites. The refuge would adapt management as necessary to protect any newly identified sites.

Objective 1.b: "Ding" Darling's Fishing Cabin

Objective 1.b(1): Within 5 years of CCP approval, actively work with the landowners and other partners to acquire or otherwise protect in perpetuity and manage the historically significant site of "Ding" Darling's fishing cabin, including seeking National Historic Register designation.

Discussion: Located just offshore of Captiva Island, "Ding" Darling's Fish House is currently in private ownership. The refuge would work with the landowners and other partners to protect this important site in perpetuity and incorporate it into an interpretive program. The elevated Fish House with counterbalanced drawbridge was built by Darling in 1942 to use a winter residence and work studio. He would raise the drawbridge to keep from being disturbed. He most likely conceived the idea and strategy for the refuge that would become his namesake in that cabin. The Fish House is probably eligible for the National Historic Register and is reportedly in good condition and retains its original appearance.

Goal 2: Management Agreements and Special Designations

Work with the partners to acquire, manage, or otherwise protect all remaining properties within the refuge's acquisition boundary to protect the upland, transitional, and estuarine habitats of the Sanibel and Captiva area.

Objective 2.a: Management Agreements

Objective 2.a(1): Within 5 years of CCP approval, work with the State of Florida and other partners to develop management agreements to implement appropriately sized refuge-managed closed area buffers around sensitive resources.

Discussion: The waters around much of the refuge, not including Tarpon Bay, are state-owned sovereign submerged lands. Tarpon Bay is state waters that are managed by the Service as part of the refuge under an agreement with the state. In order to develop, post, and enforce closed area buffers to protect sensitive resources and serve shared goals and objectives between the Service and the state, the refuge would need to coordinate with the state to develop appropriate management agreements for these areas. Further, the refuge would also need to develop a companion minor expansion proposal (MEP) in order to include any of these areas not currently within the approved acquisition boundary under refuge management. Thesee buffers would help protect nesting, resting, roosting, and foraging birds. Buffer size would depend on the species using each site. Current research (e.g., Rodgers and Schwikert 2002) would help determine the proper size needed to minimize negative impacts.

Objective 2.b: Additional Special Designations

Objective 2.b(1): Within 10 years of CCP approval, pursue additional special designations for J.N. "Ding" Darling NWR, including Western Hemisphere Shorebird Reserve Network and Ramsar Wetlands of International Importance. As lands and waters are added to the refuge, evaluate the applicability of these special designations to those additions.

Discussion: The refuge appears to meet the criteria of these designations; however, a past application was not accepted for the Western Hemisphere Shorebird Reserve Network. The refuge would investigate the criteria used to qualify for inclusion in the Western Hemisphere Shorebird Reserve Network and, if warranted, resubmit a stronger application to receive this designation. Also, the refuge would apply for consideration as a Ramsar Wetland of International Importance. This application to Ramsar would include all five refuges in the Refuge Complex.

Goal 3: J.N. "Ding" Darling Wilderness

Protect the J.N. "Ding" Darling Wilderness, promote an understanding of its wilderness values and *Leave No Trace* principles, and enhance awareness of the Wilderness Area among visitors to preserve the opportunity for outstanding coastal wilderness experiences in southwest Florida.

Objective 3.a: J.N. "Ding" Darling Wilderness

Objective 3.a(1): During the life of the CCP, continue managing the J.N. "Ding" Darling Wilderness for appropriate uses, as provided for in the designation of the J.N. "Ding" Darling Wilderness, in subsequent state and local laws, and in accord with refuge management.

Objective 3.a(2): Within 5 years of CCP approval, work with the partners to provide information regarding the J.N. "Ding" Darling NWR and Island Bay NWR wilderness areas, wilderness stewardship, and wilderness principles to area visitors and in environmental education and interpretation programs and materials and depict wilderness areas on refuge maps.

Discussion: Designated on October 19, 1976 under Public Law 94-557, the J.N. "Ding" Darling Wilderness (Wilderness Area) totals 2,619 acres (1,059.92 ha) (Figure 3). The listed acreage was determined by legal description calculations on June 20, 1977 and deviates from the bill's original acreage of approximately 2,825 acres (1,143 ha). During the establishment of the Wilderness Area, sport fishing, sight seeing, commercial fishing, and the use of motorized boats associated with these uses were recognized as established uses that would continue after designation of the Wilderness Area. However, during 1993, the State of Florida established the J.N. "Ding" Darling NWR/Sanibel Conservation Zone (Florida Administrative Code 68B-4.017, as amended) and the City of Sanibel established a Slow Speed-Minimum Wake Zone (Ordinance Number 93-13, §1, 7-6-93). Both zones encompassed the entire refuge, including the Wilderness Area. The establishment of those zones restricted the harvest of any marine species utilizing nets to non-motorized vessels and restricted boaters to slow speeds with a minimum wake. During the same year, the refuge restricted motorized boat use to specific areas within the Wilderness Area (Figure 3) to reduce or eliminate prop-scarring of seagrass beds and boat-related disturbance to feeding, resting, and breeding birds. Other public use activities in this Wilderness Area include wildlife observation and photography, commercial tours, and environmental education and interpretation. For clarification, the vast majority of the public use activities occurring within the Wilderness Area are fishing, boating, and wildlife observation and photography. The Wildlife Drive hosts the vast majority of the annual visitors and is directly adjacent to the Wilderness Area. The Red Mangrove Overlook Boardwalk, accessed from the Wildlife Drive, extends into the Wilderness Area and provides access for a variety of minor uses. Within this Wilderness Area, management activities are limited and include wildlife surveys and monitoring activities, water quality monitoring, law enforcement, boundary inspection and posting activities, and cleanup activities (e.g., removing abandoned monofilament and lures).

The second Wilderness Area of the Refuge Complex is at Island Bay NWR. Totaling 20.24 acres (8.19 ha), the Island Bay Wilderness Area is a closed area, protecting shorebirds, wading birds, and waterbirds and protecting archaeological resources. Management activities within this Wilderness Area include boundary inspection and posting, law enforcement, and wildlife surveys and monitoring activities.

To better serve the two wilderness areas and to better serve the plant and animal species that are dependent upon the habitats within and protection of these wilderness areas, the Refuge Complex would expand refuge management activities. The Refuge Complex would provide information about the two wilderness areas, wilderness stewardship, and wilderness principles to visitors at the "Ding" Darling Education Center and in environmental education and interpretation programs and materials.

The Refuge Complex would update refuge materials (e.g., maps, brochures, and internet) to include the two wilderness areas. The refuge would include J.N. "Ding" Darling Wilderness information and interpretation at the Tarpon Bay Recreation Area. The refuge would coordinate with the concessionaire to include wilderness information in its programs. Further, the refuge would evaluate methods to improve the wilderness experience. As provided for in the CCP for Pine Island, Matlacha Pass, Island Bay, and Caloosahatchee NWRs, the Refuge Complex would incorporate the Island Bay Wilderness Area into environmental education and interpretation programs and materials conducted or provided for Island Bay and/or J.N. "Ding" Darling NWRs. Further, the Refuge Complex would continue evaluating all public use and refuge management activities, as well as temporary and permanent structures that occur in or are proposed for the two wilderness areas, including conducting any needed minimum requirement analyses.

VISITOR SERVICES

Visitation to J. N. "Ding" Darling National Wildlife Refuge has grown tremendously in recent decades. To facilitate this refuge visitation, the refuge is managed for five priority public uses: fishing, wildlife observation, wildlife photography, and environmental education and interpretation. As visitor use increases on the refuge, the refuge would continue to evaluate the appropriateness and compatibility of all uses, modifying or eliminating uses as needed to ensure the minimization of impacts to wildlife and habitat to ensure that the uses remain compatible with the purposes of the refuge. In order to adequately protect refuge wildlife and their habitats, thresholds may need to be established for public use types, activities, and levels where impacts are determined to be unacceptable. During the 15-year life of the Plan, the refuge would continue to work with the partners to understand these thresholds, monitor wildlife and habitat impacts from public use activities, and monitor the quality of public use opportunities and experiences. Further, the refuge would continue to work with the partners (e.g., through the current Alternative Transportation in Parks and Public Lands study, now called the Paul S. Sarbanes Transit in Parks Program) to address traffic congestion issues on Sanibel Island and refuge visitor use levels and impacts. These actions would help the refuge to ensure the quality of its visitor services program.

Visitor services would be enhanced during the 15-year life of the CCP, including enhancing and expanding publications, materials, information, programs, exhibits, and web sites; developing additional visitor facilities; enhancing visitor welcome and orientation; improving the quality of the fishing, wildlife observation, and photography opportunities and programs; expanding and improving environmental education and interpretation; improving ethical outdoor behavior; increasing outreach; and continuing concessionaire operations. Figure 29 shows the existing and proposed visitor facilities.

Goal 1: Welcome and Orient Visitors

Visitors will feel welcome and find accurate, timely, and appropriate orientation material and information on refuge visitor facilities, programs, and management activities.

Objective 1.a: Welcome and Orient Visitors

Objective 1.a(1): Throughout the life of the CCP, continue to coordinate with the partners to provide refuge welcome and orientation materials to the Sanibel Island and Captiva Island area visitors.

Discussion: The refuge was established to protect migratory birds and this is part of the welcome and orientation message conveyed to visitors. The refuge would continue existing management activities to welcome and orient visitors, enhancing the migratory bird messages delivered. The refuge annually hosts over 700,000 visitors. The "Ding" Darling Education Center would continue to be the

primary facility to welcome and orient visitors to the refuge. The Education Center includes a visitor information desk and a refuge orientation film. A kiosk in the parking lot for the Education Center would continue to display a map of the refuge, a map of the National Wildlife Refuge System, and a listing of what the concessionaire offers. The concessionaire's tram booth is also located in the parking lot for the Education Center. It is staffed daily, except Fridays, and it would continue to provide general brochures and maps. The Wildlife Drive fee booth would continue to provide welcome and orientation information, maps, and materials. A kiosk would also continue to provide refuge information at the Chamber of Commerce located at the entrance to Sanibel Island. The Tarpon Bay Recreation Area, located two miles east of the Education Center on Tarpon Bay, would continue to be where the concessionaire facility provides welcome and orientation information and other materials. Maps and brochures would continue to be available on the refuge's and "Ding" Darling Wildlife Society's websites and in free local visitor guide publications. Local media would continue to frequently cover the refuge, also providing welcome and orientation. Refuge staff, volunteers,"Ding" Darling Wildlife Society, and partners would continue to provide refuge information and enhance the outdoor opportunities available to visitors.

Goal 2: Fishing

Members of the fishing public will enjoy their fishing experiences, behave ethically, and support refuge management and wildlife and habitat protection.

Objective 2.a: Fishing Opportunities

Objective 2.a(1): During the life of the CCP, continue to work with the partners and concessionaires to provide quality fishing opportunities on the refuge, including providing information on boating, fishing, crabbing, and related regulations; boat/canoe/kayak launch facilities; fishing piers; interpretive signage about the impacts from fishing and monofilament fishing line; and monofilament fishing line recycling receptacles.

Objective 2.a(2): During the life of the CCP, continue to work with the partners to provide updated fishing information and refuge messages at partner sites.

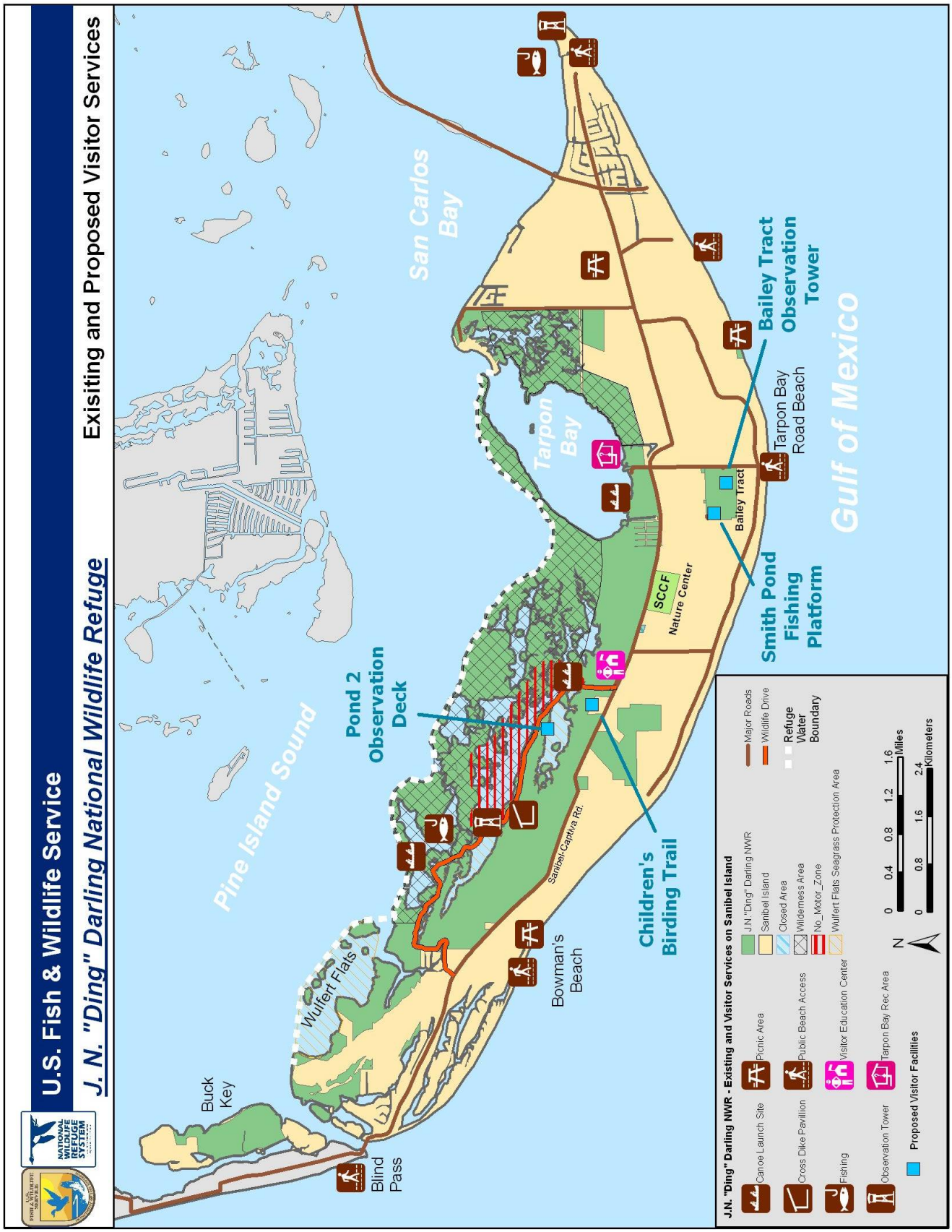
Objective 2.a(3): Within 5 years of CCP approval, work with the partners to increase awareness and understanding regarding the potential impacts from fishing activities, with an emphasis on migratory birds to help minimize disturbance and impacts.

Objective 2.a(4): Within 15 years of CCP approval, coordinate with the local fishing guides to ensure that all guided trips conducted on the refuge are covered by refuge special use permits with stipulations addressing ethical behavior and messages delivered.

Objective 2.a(5): Within 15 years of CCP approval, work with the partners to provide a handicapped-accessible fishing pier at Smith Pond on the refuge's Bailey Tract.

Objective 2.a(6): Within 5 years of CCP approval, expand the monofilament fishing line program on the refuge to minimize the impacts to fish and wildlife.

Figure 29. Existing and proposed visitor facilities



Discussion: The refuge would continue existing management activities related to fishing. The refuge annually supports approximately 85,000 visitors for fishing, shell-fishing, and crabbing. The refuge would continue to provide two motorized boat launch facilities and three canoe/kayak launch locations. The concessionaire would continue to provide guided fishing tours and outfitted rental boats. Nationally televised fishing shows would continue to highlight the fishing opportunities at the refuge. Fishing tournaments originate off the refuge, but participants frequently fish on the refuge. The refuge would continue to provide information on boating, fishing, crabbing and related regulations. In addition, interpretive signage would continue to be posted on the Wildlife Drive about crabbing. Additional signage on Wildlife Drive would continue to provide information about the impacts from monofilament fishing line, while also providing a refuge phone number to report monofilament and wildlife entanglement. Multiple receptacles would continue to be provided for monofilament recycling. Volunteers would continue to conduct monofilament removal by kayak bi-weekly, throughout the year. Saltwater fishing would continue to occur from fishing piers and water control structures on the Wildlife Drive and from motorized and non-motorized boats throughout the refuge. Freshwater fishing would continue to occur at the Bailey Tract. An interpretive fishing program would continue to be provided from January through March, including providing information about game fish, bait and gear, ethical outdoor behavior, and importance of the estuary and its resources. The refuge would continue to annually provide at least two Youth Fishing Days at the Tarpon Bay Recreation Area. The refuge would continue to support the strong Service partnership with the Bass Pro Shops. The Bass Pro Shop in Ft. Myers features the Service and the Refuge System with exhibits. The refuge would continue to provide an information booth at Bass Pro Shop events. The refuge would continue to participate in the local cast-net rodeo, held each year in November, at the Bait Box store. The refuge would continue to work with the partners to install fish-waste disposal tubes at area fishing piers located off the refuge. The refuge would continue to follow State of Florida regulations for fishing and has more restrictive regulations for crabbing.

The refuge would expand management activities to enhance fishing on the refuge. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on migratory birds, (e.g., disturbance of shorebirds and impacts of monofilament fishing line). The refuge would coordinate with local fishing guides to ensure that all guided trips are covered by special use permits with stipulations about ethical behavior and compliance with refuge regulations. The refuge would provide a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract. This pier would also support youth fishing events.

Goal 3: Wildlife Observation and Photography

Wildlife observers and photographers of all abilities will enjoy and value the diversity of area wildlife, will behave ethically, and will support refuge management and wildlife and habitat protection.

Objective 3.a: Wildlife Observation and Photography

Objective 3.a(1): During the life of the CCP, continue to work with the partners, concessionaire, and guides to provide quality opportunities for wildlife observation and photography on refuge and partner properties.

Objective 3.a(2): Within 5 years of CCP approval, to help minimize wildlife and habitat impacts, develop orientation materials for commercial photographers, where participation in this orientation is a mandatory element of the required refuge special use permit.

Objective 3.a(3): Within 10 years of CCP approval, to help minimize wildlife and habitat impacts, develop orientation materials for individual and amateur photographers.

Objective 3.a(4): Within 15 years of CCP approval, work with the partners to locate and develop an observation tower at the refuge's Bailey Tract.

Objective 3.a(5): Within 10 years of CCP approval, work with partners to evaluate the need to modify operation of the refuge's Wildlife Drive.

Discussion: The refuge annually hosts over 700,000 visitors. The refuge would continue to offer over 40 interpretive programs and tours weekly from January through March and opportunistically during the rest of the year, including staff- and volunteer-led wildlife observation walks, car caravan tours, and bike tours. Additionally concessionaire-led tram, boat, and kayak tours, as well as outdoor deck talks and touch-tank programs at Tarpon Bay Recreation Area would continue to be offered. Facilities would include: the "Ding" Darling Education Center; the Wildlife Drive with four trails, a handicapped-accessible observation tower, and the Cross-Dike pavilion; five trails at the Bailey Tract; the Commodore Creek and Buck Key canoe trails; and the Tarpon Bay Recreation Area deck for deck talks, as well as new facilities. New wildlife observation and photography facilities would include: the Children's Birding Trail to link Indigo Trail to Sanibel School, which is currently underway; a bird observation deck in Pond 2, which is also currently underway; and an observation tower at the Bailey Tract.

The refuge would work with the partners to develop informational materials on migratory birds and enhance ethical outdoor behavior. The refuge would modify existing refuge brochures, websites, displays, kiosks, and signs to reflect ethical user information and pursue the creation of an ethical wildlife observation and photography video with the Service's National Conservation Training Center (NCTC) and the partners to improve user behavior. The refuge would incorporate North American Nature Photography Association ethical standards, as applicable. In order for commercial photographers to obtain a refuge special-use permit, they would be required to participate in specially designed orientation to minimize impacts and improve ethical behavior. The refuge would also develop similar orientation materials for individual and amateur photographers. The refuge would evaluate options to improve operation of the Wildlife Drive, including evaluating the option to close the Wildlife Drive to vehicles one additional day per week and evaluating the option to open the Wildlife Drive at sunrise to help minimize user conflicts and negative impacts.

Goal 4: Environmental Education and Interpretation

Participants in quality environmental education and interpretation programs and activities will develop an understanding and awareness of the legacy of Jay Norwood "Ding" Darling, the value and history of the refuge and the Refuge System, the natural resources of the refuge, the role of the refuge in the landscape, and the human influences on ecosystems, and will support refuge management and wildlife and habitat protection.

Objective 4.a: Environmental Education and Interpretation

Objective 4.a(1): During the life of the CCP, continue to work with the partners to provide quality on-site and off-site curriculum-based environmental education programs with messages focused on the role and importance of the refuge in the landscape and the minimization of wildlife and habitat impacts from human activities.

Discussion: All environmental education programs would continue to be linked to Florida State standards and would be conducted by staff, teachers, partners, "Ding" Darling Wildlife Society, and volunteers. The refuge would continue to pursue funding to bring students onto the refuge (e.g., the refuge annually writes a grant for funds to transport over 3,000 students onto the refuge for field trips

during November through April). The refuge would continue to work with home-school groups and Scouting groups as requested. The refuge would continue the Summer Teachers Assisting Refuge (STAR) program that began in the summer of 2009 to conduct train-the-teacher workshops and expand interpretative programs. The refuge would continue to provide programs and presentations to various local organizations and clubs and incorporate all refuges within the Refuge Complex into environmental education and interpretation programs and materials.

Objective 4.a(2): Within 5 years of CCP approval, work with the partners to better incorporate migratory bird messages into their environmental education and interpretation programs and materials.

Objective 4.a(3): Within 5 years of CCP approval, work with the Southwest Florida International Airport and the Service's Office of Law Enforcement to increase airport visitors' understanding and awareness of wildlife trade, wildlife products, and their impacts.

Objective 4.a(4): Within 5 years of CCP approval, expand the environmental education and interpretation program at J.N. "Ding" Darling NWR to more fully incorporate messages focused on the roles and importance of all the refuges of the Refuge Complex in the landscape and the minimization of wildlife and habitat impacts from human activities.

Objective 4.a(5): Within 15 years of CCP approval, work with the partners to ensure that all Lee County 6th grade students attend environmental education programs at the refuge.

Discussion: Historically, all Lee County 6th grade students attended environmental education programs at the refuge. Due to funding issues, Lee County has pared this program back. To help support environmental education and interpretation, the refuge would hire a Park Ranger to assist with this program. Further, the refuge would work with the partners to seek additional funding sources to support the attendance at environmental education activities on the refuge by Lee County students and provide funds for busing. The refuge would also train education volunteers from the refuge to conduct programs and field trips.

Objective 4.a(6): During the life of the CCP, continue to incorporate technology-based programs into the refuge's environmental education programs.

Discussion: In order to reach more students, the refuge would continue to pursue methods to incorporate technology-based programs into the refuge's environmental education programs. In 2009, fifth-grade gifted students from three schools helped develop the refuge's virtual earth-cache program that promotes responsible orienteering, navigating, and searching on the refuge for clues and information that teach wildlife conservation concepts without impacting refuge resources.

Objective 4.b. Interpretive Programs and Facilities

Objective 4.b(1): During the life of the CCP, continue to work with the partners and concessionaires to provide quality interpretive programs, tours, and facilities.

Discussion: To ensure quality programs, tours, and facilities and to ensure that refuge messages are delivered, the refuge would continue to work with the concessionaire to evaluate concessionaire-led tram, boat, and kayak tours, as well as touch-tank programs and outdoor deck talks at Tarpon Bay.

Objective 4.b(2): Within 5 years of CCP approval, work with the partners to develop on-site and off-site interpretive programs with messages focused on migratory birds and on the minimization of human impacts.

Discussion: To help minimize impacts across the landscape, the refuge would work with the partners to incorporate migratory bird messages and messages minimizing human impacts into area programs. The refuge would provide programs and presentations to various local organizations and clubs.

Objective 4.b(3): Within 5 years of CCP approval, fully develop interpretive themes for the refuge and train staff, volunteers, teachers, and tour operators to incorporate these interpretive themes into programs.

Discussion: Currently the refuge offers over 40 programs and tours weekly from January through March and opportunistically during the rest of the year, including staff- and volunteer-led wildlife observation walks and bike tours. The refuge would help train staff, volunteers, teachers, and tour operators to incorporate refuge messages and interpretive themes into their programs.

Objective 4.b(4): Within 10 years of CCP approval, evaluate the need for and ability to provide improved programs, signage, and parking at the Shell Mound Trail.

Discussion: Interpretive signage currently exists throughout Shell Mound Trail and weekly volunteer-led programs are conducted at the Trail from January through March. Opportunistic staff-led programs are conducted there year-round. to the refuge would improve the interpretive messages regarding Calusa culture and resource use and the refuge would replace deteriorating signage at Shell Mound Trail, as funding permits. Currently, ad-hoc parking for Shell Mound Trail is currently causing traffic congestion on the Wildlife Drive. The refuge would evaluate options to address the parking and congestion issues associated with Shell Mound Trail.

Objective 4.b(5): Within five years of CCP approval, continue to improve interpretive signs and kiosks throughout the refuge.

Discussion: The refuge would continue to maintain interpretive signs throughout the refuge, including at the “Ding” Darling Education Center, throughout Wildlife Drive and its hiking trails, at the Bailey Tract, and at Tarpon Bay. Additional interpretive signs would be installed as part of the planned Children’s Birding Trail. The e-Bird kiosk, in partnership with Cornell, would provide Education Center visitors the opportunity to report bird sightings and learn detailed information about birds. The invasive species kiosk, also to be located at the Education Center, would provide detailed information about invasive plants and animals.

Objective 4.c: Ethical Behavior

Objective 4.c(1): Within 10 years of CCP approval, coordinate with the Society for Ethical Ecotourism, Southwest Florida Chapter, of which the refuge is a member, to regularly evaluate area ecotours that operate in and around the refuge to ensure adherence to ethical behavior standards.

Objective 4.c(2): Within 10 years of CCP approval, work with other Florida refuges to engage them in the Society for Ethical Ecotourism to help improve outdoor user ethical behavior.

Objective 4.c(3): Within 10 years of CCP approval, work with partners to develop informational materials to enhance the ethical behavior criteria and program of the refuge to find more effective means to convey ethical behavior messages to the public.

Discussion: Currently, ethical behavior information is incorporated in existing refuge programs, brochures, signage, websites, and exhibits. As the population increases and as visitation to the refuge increases, ethical outdoor behavior is likely to become much more important, helping to minimizing wildlife and habitat impacts and disturbances. During the life of the CCP, the refuge would find more effective means to convey ethical outdoor behavior messages to the public. As previously outlined, the refuge would work with to create an ethical wildlife observation and photography video with NCTC and the partners to improve ethical behavior around wildlife and their habitat. Further, the refuge would incorporate North American Nature Photography Association ethical standards into programs and materials, as applicable.

Goal 5: Outreach

Communicate key messages and issues with off-site audiences to build support within the local community and beyond for the refuge, its purposes, and its management.

Objective 5.a: Outreach

Objective 5.a(1): During the life of the CCP, continue to work with the partners to provide information about all refuges in the Refuge Complex at local festivals, conservation events, and the annual "Ding" Darling Days.

Discussion: To increase outreach activities, the refuge would participate in and host events throughout the year. Annually, the refuge hosts "Ding" Darling Day, where visitors can gain a variety of experiences related to the refuge, Refuge System, wildlife, habitat, and the minimization of human impacts. Each booth vendor would offer hands-on activities for children and engage the whole family, thus promoting the refuge and the protection of wildlife and habitat.

Objective 5.a(2): During the life of the CCP, continue to work with partners to provide information to the media about all refuges in the Refuge Complex.

Discussion: The refuge would continue to regularly provide information to the media (e.g., newspapers, magazines, TV, and internet) about the refuge, posting information on the refuge's website. The refuge would use the Service's Southeast Region website to help exchange information and provide outreach materials to the media and the public. The refuge would continue to provide special-use permits and tours to the tourism bureau for national and international tourism visitors.

Objective 5.a(3): Within 5 years of CCP approval, increase the outreach efforts and activities of the staff, volunteers, and the "Ding" Darling Wildlife Society, with a focus on migratory birds, the roles of all refuges in the Refuge Complex in the landscape, and the minimization of wildlife and habitat impacts from human activities.

Discussion: The refuge would provide educational field trips for the staff, volunteers, and the "Ding" Darling Wildlife Society board members to increase knowledge and foster an espirit de corps. The refuge would work with the Regional Office in developing an outreach website to exchange information amongst employees and provide outreach materials to the public.

Goal 6: Fee Program and Concession Operations

Continue to provide quality wildlife-dependent activities through a single concessionaire to support refuge management goals and objectives.

Objective 6.a: Fee Program

Objective 6.a(1): Within 5 years of CCP approval and every five years thereafter, evaluate the need to increase refuge fees to help maintain appropriate and compatible visitor services and to help offset program costs.

Discussion: Current fees for the fee area entry are: $5 per car, $1 per hiker or biker. The fee for a special use permit is $150 per occurrence or per year for commercial activities. In fiscal year 2008, the refuge issued 27 special use permits, five of which were for commercial activities. Of the fees collected, 80 percent are returned to the refuge to support the Visitor Services program. Included in this 80 percent is 20 percent of the total that is returned to the concessionaire under its agreement with the Service to cover the costs of fee collection. The remaining 20 percent goes into the Service's general fund and is used to help support refuges that are not open to the public.

Objective 6.b: Quality of Concession Operations

Objective 6.b(1): During the life of the CCP, continue to work with the refuge concessionaire to provide quality facilities, programs, services, materials, and events.

Objective 6.b(2): In 2013, the concessionaire agreement will be rebid. At that time, evaluate the need to add additional tram tours and coordinate future concession operations with recommendations of the area Alternative Transportation in Parks and Public Lands study, now called the Paul S. Sarbanes Transit in Parks Program.

Discussion: The refuge started utilizing a concession agreement in the 1980s. The current concessionaire, Tarpon Bay Explorers, began operations in 2002. The concessionaire operates on the refuge at the Tarpon Bay Recreation Area. Beyond collecting fees, the concessionaire provides: guided kayak, tram, and pontoon boat tours; guided fishing trips; rentals for canoes, kayaks, pontoon boats, and bicycles; gift shop; and boat ramp. The concessionaire also provides a variety of interpretive services (e.g., outdoor deck talks and touch-tank programs). Under the agreement, the concessionaire assists refuge staff with special educational events throughout the year. The refuge works with the concessionaire on interpretative tour and program scripts and modifies as necessary. The current concessionaire provides quality programs and services. The refuge receives 20 percent of the net proceeds of the concessionaire operation. These funds go towards the Refuge Revenue Sharing Program that supports payments to the county.

In 2013, the concessionaire agreement will expire and will be competitively rebid. For the next agreement, the refuge would evaluate the need to add additional tram tours and it would coordinate future concession operations with recommendations from the “Ding” Darling Alternative Transportation in Parks and Public Lands (ATPPL) study (now called the Paul S. Sarbanes Transit in Parks Program) that is anticipated to be completed in the 2009 with planning and implementation scheduled to begin in 2010, depending on funding. This study is a collaborative effort between the refuge, the city of Sanibel, and Lee County’s Department of Transportation (LeeTran) that was funded through a grant from the Federal Department of Transportation to enable gateway communities to work with federal land management agencies to evaluate transportation options aimed at reducing impacts of high visitation to land and natural resources, while improving visitor experiences.

REFUGE ADMINISTRATION

Refuge administration activities would be expanded during the 15-year life of the CCP, including adding staff and facilities, improving and expanding intergovernmental coordination, enhancing partnerships with non-governmental partners and the "Ding" Darling Wildlife Society, improving the refuge's volunteer program, and phasing out commercial harvesting activities from the refuge.

Goal 1: **Refuge Operations and Management**

Provide sufficient infrastructure, operations, volunteers, and staff to implement a comprehensive refuge management program to protect and manage refuge resources and the natural and cultural values of Sanibel and Captiva Islands.

Objective 1.a: Staff

Objective 1.a(1): Throughout the life of the CCP, continue to use refuge staff to support management activities and programs at the four satellite refuges.

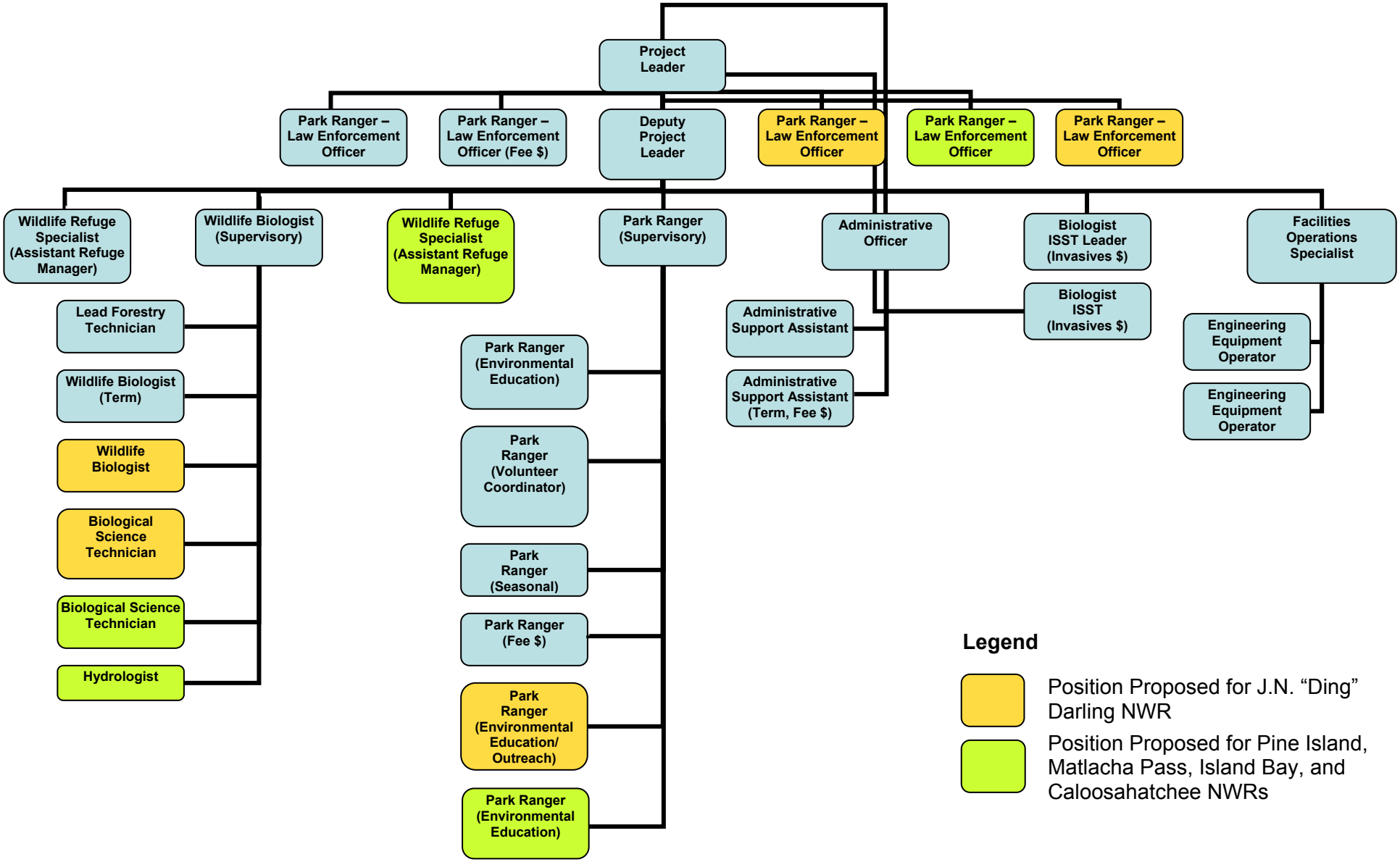
Objective 1.a(2): Within 10 years of CCP approval, hire four additional refuge-specific staff: biologist, biological science technician, law enforcement officer, and park ranger (environmental education/outreach).

Discussion: The refuge has 14.5 permanent FTEs, 3 temporary FTEs, 5 student interns, 9 seasonal/temporary employees, and 3 student employees specific to the refuge, but these positions also serve the four satellite refuges (i.e., Pine Island, Matlacha Pass, Island Bay, and Caloosahatchee NWRs), which are currently unstaffed (Figure 27): project leader (refuge manager), deputy project leader (deputy refuge manager), wildlife refuge specialist (assistant refuge manager), wildlife biologist, wildlife biologist (term), park ranger (lead), park ranger (environmental education), park ranger (volunteer coordinator), park ranger (fee booth, 0.5 FTE, seasonal), two law enforcement officers (one of which is paid for by fee dollars), administrative officer, two administrative support assistants (one term position, which is paid for by fee dollars), forestry technician (lead), facility operations specialist, and two engineering equipment operators. The six regional staff members that are also located at the refuge (six FTEs): regional facility operations specialist, Region 4 Invasive Species Strike Team biologist (leader), Region 4 Invasive Species Strike Team biologist (assistant), Comprehensive Everglades Restoration Project biologist, realty specialist, and Motorboat Operator Certification Course coordinator. The current budget for the salaries, benefits, and fixed costs for the 19.5 FTEs (17.5 FTEs for the refuge and the two Southeast Region ISST FTEs), including the recreation fee, and fire positions, is $1,702,300. With the 25 percent operating margin, this total would be $2,065,000.

The refuge would convert the temporary fee-funded law enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions) (Figure 30): wildlife biologist, biological science technician, two law enforcement officers, and park ranger (environmental education). The estimated annual recurring cost for these additional five positions is $530,705. With the 25 percent operating margin, this total is $663,381.

Objective 1.b: Administrative Facilities, Utilities, Equipment, and Signs

Figure 30. Proposed organizational chart for the J.N. "Ding" Darling NWR Complex



Objective 1.b(1): As staff are added to the Refuge Complex, as visitation increases, and as facilities and other infrastructure are expanded, ensure that office, support facilities, and other infrastructure are sufficient to support Refuge Complex management, programs, staff, and volunteers.

Discussion: Existing administrative facilities are extensive and include an office building, Education Center, concession building with an apartment, six maintenance shop and storage buildings, two government quarters, four mobile homes for interns and volunteers, and four recreational vehicle pads for volunteers. Further, the refuge maintains several roads, trails, and parking areas, including the Wildlife Drive (a paved 4-mile road), Indigo Trail (a 2-mile hiking/biking trail), the Shell Mound boardwalk trail, and the trail complex at the Bailey Tract. Additional visitor facilities include the observation tower on the Wildlife Drive; Red Mangrove Overlook; Tarpon Bay docks and boat ramp; six automatic gates; the education pavilion at cross-dike and numerous kiosks, signs, and interpretive panels. Further, an observation platform is already planned at Water Control Structure #2 in Pond 2 and the planned Children's Birding Trail would also include interpretive signs. The refuge would improve and update existing facilities as needed. Additional facilities would include the "Ding" Darling fishing cabin, the observation tower at the Bailey Tract, and the handicapped-accessible fishing pier at Smith Pond on the Bailey Tract. The potential exists for the refuge to expand or create new parking for Shell Mound Trail.

Goal 2: Partners

Foster strong and effective working relationships with existing and new governmental and non-governmental partners for the purposes of accomplishing refuge management goals and objectives and protecting the natural and cultural resources of Sanibel and Captiva Islands.

Objective 2.a: Intergovernmental Coordination

Objective 2.a(1): During the life of the CCP, continue to coordinate with existing governmental partners and develop new governmental partnerships to help serve common interests; to help protect the natural and cultural resources of Sanibel and Captiva Islands; and to further the vision, purposes, goals, and objectives of the refuge.

Discussion: In order to serve common goals and objectives, the refuge would continue to work with a variety of governmental partners. Existing governmental partners include the city of Sanibel, Lee County, Lee County Mosquito Control District, Florida Department of Agriculture and Consumer Services, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, SWFWMD, SFWMD, USACE, USGS, Charlotte Harbor Aquatic Preserve, and Charlotte Harbor National Estuary Program.

Objective 2.b: Non-governmental Partners, Volunteers, and Friends Group

Objective 2.b(1): During the life of the CCP, continue to engage non-governmental partners, volunteers, and the "Ding" Darling Wildlife Society and develop new partnerships to help serve common interests and to further the vision, purposes, goals, and objectives of the refuge.

Objective 2.b(2): Within 10 years of CCP approval, increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other volunteer activities and increase and enhance staff-led volunteer training.

Discussion: Non-governmental partners, the volunteers, and the "Ding" Darling Wildlife Society are a key part of existing and future management. The refuge would focus volunteer activities and the "Ding" Darling Wildlife Society on migratory bird projects, programs, and activities. Volunteers and the "Ding" Darling Wildlife Society would continue to directly support the Visitor Services program and help run the "Ding" Darling Education Center. The refuge would hire a park ranger to support volunteer coordination and environmental education. The refuge would increase and enhance staff-led volunteer training. The refuge would increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other activities. The refuge would work to increase number of volunteers available throughout year. Further, the refuge would increase interactions between the staff and volunteers to enhance the cohesiveness of the refuge team.

Goal 3: Commercial Harvesting

Limit the impacts to the natural resources and waters of the refuge from commercial harvesting activities to current levels until these activities can be phased out from the refuge.

Objective 3.a: Commercial Harvesting

Objective 3.a(1): Within 15 years of CCP approval, phase out the one grandfathered commercial bait fishing operation from the refuge.

Discussion: One commercial bait fishing operator has historically operated on the refuge. Under compatibility guidance, these types of operations are to be eliminated from refuges. Previous management authorized continuation of this individual historic commercial fisherman until retirement because of his pre-existing dependence on Tarpon Bay, where he is based. His retirement is anticipated to occur within the 15-year life of the Plan. At the latest, this use would sunset on the refuge within 15 years of final CCP approval.

V. Plan Implementation

INTRODUCTION

As required by the Improvement Act, the Service will manage all refuges in accordance with an approved Comprehensive Conservation Plan, which, when implemented, will achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the biological integrity, diversity, and environmental health of the refuge; help achieve the goals of the National Wilderness Preservation System; and meet other mandates.

This chapter summarizes the implementation strategy for the purposes, vision, goals, and objectives outlined in the CCP, addressing refuge projects, funding and personnel needs, volunteer and partnerships opportunities, step-down management plans, a monitoring and adaptive management plan, and plan review and revision.

PROPOSED PROJECTS

The proposed projects reflect the basic needs identified by Service staff, the public, and the planning team members for the management of fish and wildlife populations, habitats, cultural resources, land protection, public use, outreach, and environmental education to address the identified priority issues and to serve the vision and goals developed for the refuge. Among these projects is a list of step-down management plans to be developed. Step-down plans are individual and specific and are the blueprints under which refuges operate. The step-down plans would provide more detail and specific tasks, stepping down from the CCP. Some existing plans, with revisions, would continue to function, while other plans would need to be developed. The Service prepares step-down plans in conjunction with the provisions set forth in the National Environmental Policy Act of 1969.

Annual funding for staff, facilities, operations, and maintenance is an integral part of project implementation. The general cost estimates provided will be updated and adjusted annually. Essential needs are addressed, such as eliminating biological threats and problems, meeting National Wildlife Refuge System mission requirements, and fulfilling the purposes for which the refuge was established. There are no assurances that these projects would be either partially or fully funded. However, with the help and cooperation of conservation partners, the Service would use the final CCP to focus attention on funding the operations and maintenance needs of the refuge.

Implementing the proposed management activities would result in increased protection for breeding, nesting, resting, roosting, foraging, and migrating birds on the refuge. Increased information on a variety of species, suites of species, and habitats would enhance decision-making for the refuge. Further benefits would be realized from increased control of exotic, invasive, and nuisance species. The refuge would coordinate with the partners to address concerns related to the impacts from water quality, quantity, and timing of flows and from climate change and sea level rise. Resource protection would be enhanced, including through increased information about cultural resources on the refuge, increased protection of cultural resources, additional special designations, improved management of the J.N. “Ding” Darling Wilderness Area, improved coordination with the partners to increase ethical outdoor behavior, enhanced visitor services programs, and addition of visitor facilities. To achieve this, the refuge would work with governmental and non-governmental partners, area communities, the “Ding” Darling Wildlife Society, and local businesses. The refuge would pursue the addition of staff to address management concerns.

For the purpose of achieving the goals and objectives developed for the refuge, we have grouped management strategies into specific projects. The Draft CCP/EA describes 22 projects for development and management. Additional staff would be needed to implement these projects. All projects would require the close coordination with partner agencies and organizations. Partnership agreements that would facilitate project implementation are also discussed.

WILDLIFE AND HABITAT MANAGEMENT

Project 1. Work with the partners to standardize survey and monitoring and to increase the scientific rigor or these efforts.

The refuge would work with the partners, including SCCF, Charlotte Harbor Aquatic Preserve, FWC, and others, to conduct surveys and foster research to determine presence/absence, colony origins, foraging ranges, and other population information for species such as wood storks, roseate spoonbills, mangrove forest birds, raptors, gopher tortoise, snowy plover, piping plover, Sanibel rice rat, ornate diamondback terrapin, and smalltooth sawfish. Further, the refuge would work with the partners to increase the scientific rigor of these survey and monitoring efforts. Systematic surveys based on standardized protocols would be conducted to determine presence and distribution of priority wildlife species and to provide baseline data to assist managers in habitat management practices. A full-time biological science technician would be employed to assist in implementing the monitoring program. Information to be collected is the foundation for implementing the CCP, formulating habitat management, and developing adaptive management strategies for species of conservation concern.

Wildlife and Habitat Management Objectives: 1.a(2), 1.b(2), 1.c(1), 1.d(1), 1.f(2), 1.j(2), 1.k(1), 1.m(1),1.n(1), 1.o(1), and 2.h(2)
Resource Protection Objective: 2.a(1)
Visitor Services Objectives: 2.a(1), 2.a(3), 3.a(2), 4.a(4), and 4.c(3)
Refuge Administration Objectives: 1.a(2), 2.a(1), and 2.b(1)

Project 2. Coordinate with the partners to address concerns related to water quality, quantity, and timing of flows released into and through the Caloosahatchee River.

The refuge would work with the partners to seek Lake Okeechobee regulation schedules which optimize water quality, quantity, and timing of flows to support the estuarine ecosystem in which the refuge exists. The refuge would increase efforts to work with the partners to address concerns related to this issue, including coordinating with the Service's Vero Beach Ecological Services Field Office to address management concerns regarding those activities impacting the refuge's ecology, with an emphasis on the needs of migratory birds. The refuge would also work with partners to install water quality monitoring station(s) at the mouths of Tarpon Bay and MacIntyre Creek, and outside of the first set of culverts at the east impoundment. Fish seining, seagrass and benthic organism surveys, and bird counts would be conducted in conjunction with water sampling activities to document any correlations.

Wildlife and Habitat Management Objectives: 1.a(2), 1.c(1), 1.g(1), 1.l(1), 1.o(2), 2.e(3), 1.g(3), 1.f, 2.b(2), 2.e(1), 4.a(1), and 4.a(2)
Resource Protection Objectives: 2.b(1) and 3.a(1)
Visitor Services Objectives: 2.a(1), 4.a(1), 4.a(4), 4.a(5), 4.b(2), 4.b(3), 4.b(5), 4.c(3), 5.a(1), 5.a(2), and 5.a(3)
Refuge Administration Objectives: 1.a(2), 2.a(1), and 2.b(1)

Project 3. Work with partners to provide closed area buffers around key nesting, roosting, resting, and foraging sites.

The refuge would identify islands and areas in need of closed area buffers to minimize disturbance and impacts to protect nesting, roosting, resting, and foraging wildlife. Where necessary, the refuge would work with the partners to develop management agreements to implement appropriately sized refuge-managed closed area buffers around sensitive resources. The refuge would develop a companion MEP in order to include any of these areas not currently within the approved acquisition boundary under refuge management.

Wildlife and Habitat Management Objectives: 1.a(1), 1.a(2), 1.b(1), 1.b(2), 1.c(1), 1.i(1), 1.j(2), 1.k(1), 2.g(3), 2.i(2), and 2.j(3)
Resource Protection Objectives: 2.a(1) and 2.b(1)
Refuge Administration Objective: 2.a(1)

Project 4. Protect and manage refuge hardwood hammock habitat, interior wetlands, impoundments, estuarine mangrove forest habitat, and seagrass beds.

Restore hardwood hammock habitat on the refuge on ridges and around Shell Mound Trail to support mangrove forest birds and neotropical migratory birds.

Work with city of Sanibel to control water levels in the State Botanical Site to enhance refuge management activities. Evaluate ditches and canals on the refuge and fill or clear to raise water tables in interior freshwater wetlands. Install water level staff gauges at *Spartina* marshes to monitor water levels and develop test wells in freshwater sloughs for water sources (get baseline data to monitor future changes). Develop the ability to control water levels and cattails at Smith Pond on the Bailey Tract. Plug the borrow ditch next to the LCEC powerline right-of-way levee where it cuts through the hardwood hammock ridge separating freshwater wetlands from the mangrove swamp.

Improve water management capabilities in the refuge's two impoundments to better serve the needs of fish, wading birds, waterbirds, waterfowl, and shorebirds. Consider additional water level manipulations to enhance foraging opportunities for shorebirds, nesting wading birds, and waterfowl. Evaluate dredging sand deltas at the mouths of water control structures in the interest of balancing improved flow with loafing habitat.

Restore 125 acres (50 ha) of mangrove habitat at Alligator Curve by installing a double box culvert under Wildlife Drive between Kesson Bayou and Alligator Curve, install a culvert under the LCEC powerline right-of-way levee, and clear the drainage creek of dead and downed mangroves.

Work with partners to map historic and existing seagrass beds on the refuge, particularly at Wulfert Flats. Enforce Pole/Troll Zone at Wulfert Flats, No Motor Zone around Wildlife Drive, and the Slow Speed Zone in Tarpon Bay to better protect seagrass beds. Work with partners to reinstate the seagrass monitoring program in Tarpon Bay and to establish new water quality monitoring stations to assess changes in estuarine conditions.

Wildlife and Habitat Management Objectives: 1.a(2), 1.b(2), 1.c(1), 1.d(1), 2.b(1)(2)(3), 2.c(1)(2)(3)(4)(5)(6), 2.e(1), 2.g(3), 2.i(2), 2.j(3) and 4.a(1) and 4.a(2)]
Resource Protection Objectives: 2.a(1)

Project 5. Continue to identify, locate, control, and eliminate, where possible, exotic, invasive, and nuisance plants and animals.

Work with the partners to identify and locate new infestations of Florida Exotic Pest Plant Council Category I and Category II exotic, invasive, and nuisance plants, focusing initial attack on eradication. Focus exotic plant control efforts on high priority habitats for migratory birds. Work with the partners to increase education and awareness to build support for management activities which eradicate invasive exotic animals, to minimize impacts from nuisance animals, and to discourage feeding of raccoons and other wildlife. Increase management activities to address exotic, invasive, and nuisance species, including evaluating effective and appropriate means of trapping and euthanizing. Increase involvement and actively participate with Southwest Florida Cooperative Invasive Species Management Area (SWFL CISMA), including creating an alert network to notify partners of the presence and spread of exotic, invasive, and nuisance species, focusing efforts on early detection and rapid response.

Wildlife and Habitat Management Objectives: 1.a(1), 1.b(1), 1.c(1), 1.d(1), 1.e(1), 1.f(2), 1.g(1), 1.i(1), 1.j(1), 1.j(2), 1.k(1), 1.l(1), 1.m(1), 1.n(1), 2.b(1), 2.b(2), 2.b(3), 2.c(1), 2.c(3), 2.d(1), 2.d(3), 2.e(1), 2.g(3), 2.h(3), 2.h(4), 2.i(1), 2.i(2), 2.j(1), 2.k(2), 2.l(1), 2.m(1), 3.a(1), 3.a(2), 3.a(3), 3.b(1), 3.b(2), and 5.a(1)
Resource Protection Objective: 2.b(1)
Visitor Services Objectives: 4.a(1), 4.a(3), 4.a(4), 4.a(5), 4.b(2), 5.a(1), and 5.a(3)
Refuge Administration Objectives: 1.a(1), 1.a(2), 2.a(1), and 2.b(1)

Project 6. Use prescribed fire and other techniques to maintain and restore spartina and interior wetlands habitats.

The refuge would implement prescribed fire on a 3- to 5-year rotation combined with fuel and fire-effects monitoring and exotic plant control in interior wetlands. In order to provide the desired habitat conditions for target species it is critical that refuge lands be burned on a regular schedule and under controlled conditions. Restoring and maintaining these habitats, through the use of controlled burns and other techniques, reduces the potential of wildfire, while enhancing habitat for these priority species. Prescribed burning is also an effective tool to reduce the numbers or slow the spread of invasive exotic plant species.

Wildlife and Habitat Management Objectives: 2.c(1), 2.i(1), 2.j(1), 2.k(1), and 3.a(1)
Refuge Administration Objectives: 1.a(2)

Project 7. Consider potential climate change impacts when evaluating habitat management goals and objectives and establish monitoring procedures to assess potential changes.

Work with the partners to refine and run climate change models and foster needed research to predict and understand the impacts on refuge resources, with a focus on the potential impacts on migratory birds. Install water level staff gauges at *Spartina* marshes to monitor water levels and develop test wells in freshwater sloughs for water sources (get baseline data to monitor future changes). Establish new water quality monitoring stations to assess changes in estuarine conditions (sea level, salinity, pH, and other water quality parameters) at Tarpon Bay, MacIntyre Creek, East Impoundment, and Alligator Curve.

Wildlife and Habitat Management Objectives: 1.a(1), 1.a(2), 1.b(1), 1.b(2), 1.d(1), 1.e(1), 1.f(2), 1.i(3), 1.j(1), 1.k(1), 1.l(1), 1.m(1), 1.n(1), 2.e(2), 2.e(3), 2.f(1), 2.g(1), 2.h(1), 2.j(2), 2.l(1), 2.m(1), 3.a(3), 3.b(1), 4.a(1), 4.a(2), and 5.a(1)
Resource Protection Objectives: 1.a(1) and 2.b(1)
Refuge Administration Objectives: 2.a(1) and 2.b(1)

RESOURCE PROTECTION

Project 8. Protect archaeological resources through surveys, enforcement, and planning.

Coordinate with the Service's Regional Archaeologist and the State Historic Preservation Officer to assess past cultural resource surveys and develop a comprehensive survey of all cultural resources of the refuge to fill gaps in site-specific data. Increase patrols at archaeological sites to monitor any changes and identify any violations of the Archaeological Resources Protection Act. Delineate and map boundaries of archaeological sites with global positioning system digital locations and on-site marking to avoid impacts to cultural resources when planning restoration or other management activities.

Resource Protection Objectives: 1.a(1) and 1.a(2)

Project 9. Expand refuge management activities in relation to its wilderness area.

Work with the partners to provide information regarding the J.N. "Ding" Darling Wilderness (and the Island Bay Wilderness), wilderness stewardship, and wilderness principles to refuge and area visitors and area residents. Include these topics in environmental education and interpretation programs and materials and depict wilderness areas on refuge maps. Provide information about the two wilderness areas, wilderness stewardship, and wilderness principles to visitors at the "Ding" Darling Education Center and in environmental education and interpretation programs and materials. Update refuge materials (e.g., maps, brochures, and internet) to include the two wilderness areas. Coordinate with the concessionaire to include wilderness information in its programs. Evaluate methods to improve the wilderness experience.

Resource Protection Objectives: 3.a(1) and 3.a(2)

Project 10. Protect refuge resources and visitors.

Over 700,000 people annually visit the refuge. Wildlife and habitat disturbance, vandalism, encroachment activities, speeding in Manatee Zones, wildlife poaching, fusing violations, illegal feeding of wildlife, vehicle break-ins, speeding on the Wildlife Drive, littering, illegal access into closed areas, and other inappropriate and illegal activities continue to occur. Two additional law enforcement officers would help protect refuge resources and visitors, helping improve visitor services and safety. Regular law enforcement patrols would deter wildlife take, vandalism, trespass, loitering, and other illegal activities, also providing increased response to violations, complaints, and incidents when they occur.

Wildlife and Habitat Management Objectives: 1.a(1), 1.b(1), 1.c(1), 1.g(1), 1.j(1), 1.k(1), 2.i(1), and 2.j(3)
Resource Protection Objectives: 1.a(1) and 2.a(1)
Visitor Services Objectives: 1.a(1), 2.a(1), 2.a(4), 3.a(5), and 4.a(3)
Refuge Administration Objectives: 1.a(1), 1.a(2), and 2.a(1)

Project 11. Protect "Ding" Darling's fishing cabin.

Actively work with the landowners and other partners to acquire or otherwise protect in perpetuity and manage the historically significant site of "Ding" Darling's fishing cabin, including seeking National Historic Register designation. Located just offshore of Captiva Island, "Ding" Darling's Fish House is currently in private ownership. The refuge would work with the landowners and other partners to protect this important site in perpetuity and incorporate it into an interpretive program. The elevated

Fish House with counterbalanced drawbridge was built by Darling in 1942 to use a winter residence and work studio. He would raise the drawbridge to keep from being disturbed. He most likely conceived the idea and strategy for the refuge that would become his namesake in that cabin. The Fish House is probably eligible for the National Historic Register and is reportedly in good condition and retains its original appearance.

Resource Protection Objective: 1.b(1)
Visitor Services Objectives: 4.b(1) and 4.b(2)
Refuge Administration Objective: 2.b(1)

VISITOR SERVICES

Project 12. Work with the partners to minimize the impacts from wildlife observation and photography.

Develop mandatory orientation materials for commercial photographers and photography workshop participants to help minimize wildlife and habitat impacts. Incorporate North American Nature Photography Association ethical standards, as applicable. Develop orientation materials for individual and amateur photographers. Work with the partners to locate and develop an observation tower at the refuge's Bailey Tract; to evaluate the need to modify operation of the refuge's Wildlife Drive; and to develop informational materials on migratory birds and enhance ethical outdoor behavior. Modify existing refuge brochures, websites, displays, kiosks, and signs to reflect ethical user information. Pursue the creation of an ethical wildlife observation and photography video with the Service's National Conservation Training Center (NCTC) and the partners to improve user behavior.

Wildlife and Habitat Management Objectives: 1.a(1), 1.b(1), 1.c(1), 1.g(1), 1.g92), 1.j(1), 1.j(2), 1.k(1), 2.i(2), 2.j(3), and 3.b(2)
Visitor Services Objectives: 3.a(2), 3.a(3), 3.a(5), 4.a(1), 4.a(4), 4.a(6), 4.b(2), 4.b(3), 4.b(4), 4.b(5), 4.c(1), 4.c(3), 5.a(1), 5.a(2), 5.a(3), and 6.b(1)
Refuge Administration Objectives: 1.a(2), 2.a(1), and 2.b(1)

Project 13. Minimize the impacts of fishing.

Work with the partners to increase awareness and understanding of the potential impacts from fishing activities, with an emphasis on migratory birds. Coordinate with the local fishing guides to ensure that all guided trips conducted on the refuge are covered by refuge special use permits. Work with the partners to provide a handicapped-accessible fishing pier at Smith Pond on the refuge's Bailey Tract. Expand the monofilament fishing line clean up program on the refuge.

Wildlife and Habitat Management Objectives: 1.a(1), 1.g(1), 1.i(1), 1.j(1), 1.j(2), 1.k(1), 1.n(1), 1.o(1), 2.i(2), 2.j(3), and 2.l(1)
Visitor Services Objectives: 2.a(1), 2.a(2), 2.a(3), 2.a(4), 2.a(6), 4.c(3), 5.a(1), and 5.a(3)
Refuge Administration Objectives: 1.a(2) and 2.b(1)

Project 14. Enhance the refuge's environmental education and interpretation programs and materials and work with the partners to better incorporate migratory bird messages into their environmental education and interpretation programs and materials.

Emphasize the need to protect declining species that use the refuge and explain the migratory link with other countries where they winter and breed. Promote more use of the eBird kiosk by visitors. Plan special events focusing on migratory birds such as International Migratory Bird Day and the Big

Sit. Update the refuge's Bird Checklist and create a nature calendar highlighting wintering species arrival and departure months, breeding months, and months of spring and fall migration.

Wildlife and Habitat Management Objectives: 1.a(1), 1.b(1), 1.c(1), 1.d(1), 1.j(1), 1.j(2), 1.k(1), 1.l(1), 2.i(1), 2.j(3), 2.l(1), 3.a(1), 3.a(2), 3.b(1), 3.b(2), 4.a(1), and 4.a(2)
Resource Protection Objectives: 2.a(1) and 2.b(1)
Visitor Services Objectives: 3.a(1), 3.a(2), 3.a(3), 3.a(4), 3.a(5), 4.a(1), 4.a(2), 4.a(3), 4.a(4), 4.a(5), 4.a(6), 4.b(1), 4.b(2), 4.b(3), 4.b(4), 4.b(5), 4.c(3), and 6.b(1)
Refuge Administration Objectives: 1.a(2), 2.a(1), and 2.b(1)

Project 15. Expand the refuge's environmental education program to all Lee County 6th grade students.

Historically, all Lee County 6th grade students attended environmental education programs at the refuge. Due to funding issues, Lee County has pared this program back. To help support environmental education and interpretation, the refuge would hire a park ranger to assist with this program. Further, the refuge would work with the partners to seek additional funding sources to support the attendance at environmental education activities on the refuge by Lee County students and provide funds for busing. The refuge would also train education volunteers from the refuge to conduct programs and field trips. In order to reach more students, the refuge would continue to pursue methods to incorporate technology-based programs into the refuge's environmental education programs. In 2009, fifth-grade gifted students from three schools helped develop the refuge's virtual earth-cache program that promotes responsible orienteering, navigating, and searching on the refuge for clues and information that teach wildlife conservation concepts without impacting refuge resources.

Visitor Services Objectives: 4.a(1), 4.a(2), 4.a(4), 4.a(5), 4.a(6), and 4.b(3)
Refuge Administration Objectives: 1.a(2), 2.a(1), and 2.b(1)

Project 16. Enhance the refuge's Ethical Behavior Program.

Currently, ethical behavior information is incorporated in existing refuge programs, brochures, signage, websites, and exhibits. As the population increases and as visitation to the refuge increases, ethical outdoor behavior is likely to become much more important, helping to minimizing wildlife and habitat impacts and disturbances. During the life of the CCP, the refuge would find more effective means to convey ethical outdoor behavior messages to the public. As previously outlined, the refuge would work with to create an ethical wildlife observation and photography video with NCTC and the partners to improve ethical behavior around wildlife and their habitat. Further, the refuge would incorporate North American Nature Photography Association ethical standards into programs and materials, as applicable. The refuge would work with other Florida refuges to engage them in the Society for Ethical Ecotourism to help improve outdoor user ethical behavior. Develop orientation materials for commercial photographers, where participation in this orientation is a mandatory element of the required refuge special use permit.
Wildlife and Habitat Management Objectives: 1.a(1), 1.b(1), 1.c(1), 1.f(4), 1.g(1), 1.g(2), 1.j(1), 1.j(2), 1.k(1), 1.n(1), 1.o(1), 2.i(2), 2.j(3), and 3.b(2)
Resource Protection Objectives: 3.a(1) and 3.a(2)
Visitor Services Objectives: 2.a(1), 2.a(2), 2.a(3), 2.a(4), 2.a(6), 3.a(2), 3.a(3), 3.a(5), 4.a(2), 4.a(3), 4.a(4), 4.a(5), 4.a(6), 4.b(1), 4.b(2), 4.b(3), 4.b(4), 4.b(5), 4.c(1), 4.c(2), 4.c(3), 5.a(1), 5.a(3), and 6.b(1)
Refuge Administration Objectives: 1.a(1), 2.a(1), and 2.b(1)

Project 17. Develop a handicapped accessible fishing pier at Smith Pond on the Bailey Tract.

The refuge would expand management activities to enhance fishing on the refuge. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on migratory birds (e.g., disturbance of shorebirds and impacts of monofilament fishing line). The refuge would provide a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract. This pier would also support youth fishing events.

Visitor Services Objectives: 2.a(1), 2.a(3), 2.a(5)
Refuge Administration Objective: 1.b(1)

Project 18. Develop an observation tower at the Bailey Tract.

This tower would replace an old observation tower that was built on the Bailey Tract shortly after the refuge was first established, but demolished due to its deteriorated condition several years ago. The new tower would again provide visitors a bird's eye view of the Bailey Tract wetlands as well as a view of the different habitats on Sanibel Island from the Gulf to the Bay.

Visitor Services Objectives: 3.a(1), 3.a(4), 4.a(4), 4.a(5), 4.b(2), 4.b(5), and 4.c(3)
Refuge Administration Objective: 1.b(1)

Project 19. Expand the monofilament fishing line program on the refuge to minimize the impacts to fish and wildlife.

The refuge annually supports approximately 85,000 visitors for fishing, shell-fishing, and crabbing. The refuge would continue to provide information on boating, fishing, crabbing and related regulations. Additional signage on Wildlife Drive would continue to provide information about the impacts from monofilament fishing line, while also providing a refuge phone number to report monofilament and wildlife entanglement. Multiple receptacles would continue to be provided for monofilament recycling. Volunteers would continue to conduct monofilament removal by kayak bi-weekly, throughout the year. The refuge would expand management activities to enhance fishing on the refuge. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on migratory birds, (e.g., disturbance of shorebirds and impacts of monofilament fishing line).

Wildlife and Habitat Management Objectives: 1.a(1), 1.g(1), 1.g92), 1.i(1), 1.j(2), 1.n(1), 1.o(1), 2.i(2), and 2.j(3)
Resource Protection Objective: 3.a(1)
Visitor Services Objectives: 2.a(1), 2.a(3), 2.a(4), 2.a(5), 2.a(6), 4.c(3), 5.a(1), 5.a(2), and 6.b(1)
Refuge Administration Objectives: 1.a(2), 2.a(1), and 2.b(1)

Project 20. Work with the Southwest Florida International Airport and Service's Office of Law Enforcement to increase airport visitors' understanding and awareness of wildlife trade, wildlife products, and their impacts.

Work with the partners to develop and install an exhibit highlighting the plight of wildlife species that are declining due the illegal trade in wildlife. This exhibit would educate travelers to foreign destinations to beware of purchasing illegal wildlife (or wildlife products) that would be lead to confiscation and prosecution, and worse yet, contribute to the demand for killing rare wildlife.

Wildlife and Habitat Management Objective: 3.b(2)
Visitor Services Objectives: 4.a(3), 4.c(1), and 4.c(3)
Refuge Administration Objectives: 1.a92) and 2.b(1)

Project 21. Increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other volunteer activities and increase and enhance staff-led volunteer training.

Hire a park ranger to support volunteer coordination, outreach, and environmental education. Increase and enhance staff-led volunteer training. Increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other activities. Work to increase number of volunteers available throughout year. Increase interactions between the staff and volunteers to enhance the cohesiveness of the refuge team.

Wildlife and Habitat Management Objectives: 1.a(1), 1.b(1), 1.d(1), 1.e(1), 1.f(1), 1.f(2), 1.g(2), 1.i(1), 1.i(2), 1.j(1), 1.j(2), 1.k(1), 1.l(1), 1.m(1), 1.n(1), 1.o(1), 2.f(1), 2.g(1), 2.g(2), 2.h(1), 2.h(2), 2.j(2), and 5.a(1)
Resource Protection Objectives: 1.b(1), 3.a(1), and 3.a(2)
Visitor Services Objectives: 1.a(1), 2.a(1), 2.a(6), 4.a(1), 4.a(3), 4.a(5), 4.b(1), 4.b(2), 4.b(3), 4.b(4), 4.b(5), 4.c(3), 5.a(1), and 5.a(3)
Refuge Administration Objectives: 1.a(2), 1.b(1), and 2.b(1)

REFUGE ADMINISTRATION

Project 22. Coordinate with the local fishing guides to ensure that all guided trips conducted on the refuge are covered by refuge special use permits with stipulations addressing ethical behavior and messages delivered.

Visitor Services Objectives: 2.a(1), 2.a(3), 2.a(4), 4.c(3), 5.a(1), and 5.a(3)
Refuge Administration Objectives: 1.a(2) and 2.b(1)

FUNDING AND PERSONNEL

Implementation of the CCP, when final, would require increased funding and personnel support from a variety of internal and external sources. New refuge projects are identified in the Refuge Operating and Needs System (RONS), while maintenance needs for existing facilities and projects are identified through the Service Asset and Maintenance Management System (SAMMS). This Draft CCP/EA outlines proposed projects that are substantially above current budget allocations. Once a final CCP is approved, the refuge would update its RONS and SAMMS lists to account for the proposed management actions and outlined projects. The final CCP would not constitute a commitment (from Congress) for staffing increases, operational and maintenance increases, or funding for future land acquisition, but would provide direction for future management, provide a basis for priorities, and represent wildlife resource needs based on sound biological science and input from the public.

To achieve the goals, objectives, and strategies and to complete the projects outlined in this Draft CCP/EA, additional personnel, operations, maintenance, facilities, and funds would be needed. To support implementation of the final CCP, five additional refuge-specific staff would be needed: wildlife biologist, biological science technician, two law enforcement officers, and park ranger (environmental education/outreach).

The current budget for the salaries, benefits, and fixed costs for the 19.5 FTEs (17.5 FTEs for the refuge plus the two Southeast Region Invasive Species Strike Team FTEs), including the recreation fee and fire positions, is $1,702,300. With the 25 percent operating margin, this total would be $2,065,000.

The refuge would convert the temporary fee-funded law enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions) (Figure 30): wildlife biologist, biological science technician, two law enforcement officers, and park ranger (environmental education/outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25 percent operating margin, this total is $663,381. This increase in staff would necessitate an increase in base funding above standard yearly increases that allow only for inflation.

PARTNERSHIP OPPORTUNITIES

J.N. "Ding" Darling NWR functions as a partnership refuge where a variety of partners help further the purposes, vision, goals, and objectives of the refuge and the Refuge Complex through wildlife and habitat management activities, outreach, environmental education, other visitor services, cultural resource protection, law enforcement, and coordination. The Service would continue to work with existing and new partners, including public, non-profit, research-oriented, and private entities.

STEP-DOWN MANAGEMENT PLANS

The refuge has prepared several step-down plans, as listed.

- Emergency Response (Hurricane) Action Plan 2009
- Environmental Management Plan 2007
- Mosquito Control Operations Plan 2005
- Impoundment Management Plan 2003
- Fire Management Plan 2001
- Safety Plan 2001
- Spill Prevention, Containment, and Countermeasure Plan 2001
- Wildlife Inventory Plan 2001
- Public Use Management Plan 1994
- Exotic Control Plan 1990

To help serve the CCP's goals and objectives and to provide the detail necessary for implementation of many of the proposed actions, the Service would prepare several step-down management plans, as outlined in Table 16, which lists the needed step-down management plans and their anticipated completion dates.

Table 16. Step-down management plans to be developed during the 15-year life of the CCP

Step-down Management Plan	Anticipated Completion Date
Visitor Services Plan	2011
Wildlife and Habitat Management Plan	2013
Cultural Resources Management Plan	2013

MONITORING AND ADAPTIVE MANAGEMENT

Monitoring the Service's performance, while implementing this CCP, is critical to successful implementation of this CCP. Monitoring and evaluation allow the Service, other government agencies, the public, and the partners to measure and evaluate progress. Following approval of the final CCP and public notification of the decision, the Service would begin implementing the proposed actions. The Service would monitor, evaluate, and determine whether or not progress is being made towards achieving the refuge's purposes, vision, and goals. Monitoring would address habitat or population objectives and the effects of management activities. Through adaptive management and evaluation of monitoring and research, results may indicate the need to modify refuge objectives and/or strategies.

PLAN REVIEW AND REVISION

The Service would review this CCP annually to decide if it requires any revisions. It would be modified along with associated management activities whenever this review or other monitoring and evaluation determine that changes are needed to achieve refuge purposes, vision, and goals. The Service would revise this CCP when significant new information becomes available, ecological conditions change, major refuge expansion occurs, or when the Service identifies the need to do so during CCP review. At a minimum, CCP revision would occur every 15 years. All revisions would follow the procedures outlined in current policy and would require compliance with the National Environmental Policy Act. The Service would conduct ongoing public involvement and continue informing and involving the public regarding management of this refuge.

SECTION B. ENVIRONMENTAL ASSESSMENT

I. Background

INTRODUCTION

The Fish and Wildlife Service prepared this Environmental Assessment (EA) for J.N. "Ding" Darling National Wildlife Refuge (NWR) (Figure 2) in compliance with the National Environmental Policy Act (NEPA) and the National Wildlife Refuge System Improvement Act (Improvement Act). The Improvement Act requires the development of comprehensive conservation plans for all refuges. Following a public review and comment period on this Draft CCP/EA, a final decision will be made by the Service that will guide J.N. "Ding" Darling NWR management actions and decisions over the next 15 years, provide understanding about the refuge and management activities, and incorporate information and suggestions from the public and refuge partners.

The Draft CCP proposes a management direction, which is described in detail through a set of goals, objectives, and strategies. The Draft CCP addresses current management issues, provides long-term management direction and guidance for the refuge, and satisfies the legislative mandates of the Improvement Act. While the Draft CCP provides general management direction, subsequent step-down plans will provide more detailed management direction and actions.

The EA determines and evaluates a range of reasonable management alternatives. The intent is to support informed decision-making regarding future management of the refuge. Each alternative presented in this EA was generated with the potential to be fully developed into a final CCP. The predicted biological, physical, social, and economical impacts of implementing each alternative are analyzed in this EA. This analysis assists the Service in determining if the alternatives represent no significant impacts, thus requiring the preparation of a Finding of No Significant Impact (FONSI), or if the alternatives represent significant impacts, thus requiring more detailed analysis through an Environmental Impact Statement (EIS) and a Record of Decision (ROD). Following public review and comment, the Service will select an alternative to be fully developed for this refuge. During the planning process, the Service identified issues, concerns, and needs through discussions with the public, other governmental agencies, conservation partners, and others. To address these issues, serve the purposes of the refuge, and provide management direction for the refuge over the 15-year life of the CCP, the Service identified Alternative C: Migratory Birds, as the proposed management action. In the opinion of the Service, Alternative C is the best approach to guide the refuge's future direction.

The CCP is needed to address current management issues, to provide long-term management direction for the refuge, and to satisfy the legislative mandates of the Improvement Act, which requires the preparation of a CCP for all national wildlife refuges.

PURPOSE AND NEED FOR ACTION

The purpose of the EA is to ensure that the Service adopts a CCP for J.N. "Ding" Darling National Wildlife Refuge as mandated in the Improvement Act and that the refuge continues the legacy of Jay Norwood "Ding" Darling; serves as a gateway to the Refuge System; provides an inviolate sanctuary for migratory birds; conserves wetlands to help fulfill international obligations contained in migratory bird treaties and conventions; minimizes the threats to and promotes the recovery of the rare, threatened, and endangered species; conserves, restores, enhances, and manages a diversity of native wildlife and habitat to enhance the biological integrity, diversity, and environmental health of

the refuge; controls and eliminates existing and future exotic, invasive, and nuisance species; addresses and resolves water quality, quantity, and timing concerns; strives to understand and ameliorate the impacts of climate change on refuge resources; serves the values of Marine Protected Areas; protects the water quality of these Outstanding Florida Waters; contributes to the objectives of the Charlotte Harbor National Estuary Program; particularly as it pertains to the Pine Island Sound Sub-basin; protects the qualities that signify the refuge as an Important Bird Area; preserve the wilderness character of the J. N. “Ding” Darling Wilderness; promotes understanding and awareness of wilderness values and principles; protects and interprets cultural resources; provides vistas of undeveloped, protected coastal islands, waterways, tidal swamps, subtropical hardwood hammocks, freshwater wetlands, and sand flats; minimizes human impacts to refuge resources; develops public awareness, understanding, and appreciation of the refuge, its history and purpose, the resources protected, and the roles of the refuge in the landscape; facilitates opportunities for quality, appropriate and compatible, wildlife-dependent public use; supports active environmental education and interpretation programs; strives for outdoor ethical behavior by users; pursues the protection of lands and waters within the refuge’s approved acquisition boundary; fosters strong and effective working relationships with existing and new partners; phases out commercial harvesting activities; and ensures that the refuge is utilized as a world class living laboratory to foster excellence in biological and ecological research and to enable integrated and adaptive management.

This EA addresses the need to adopt a 15-year management plan for J.N. “Ding” Darling NWR that provides guidance for future refuge management; identifies priorities; ensures consistent and integrated management; protects the biological integrity, diversity, and environmental health of the refuge; evaluates the appropriateness and compatibility of public uses; and meets the requirements of the Improvement Act.

DECISION FRAMEWORK

Based on the assessment described in this document, the Service will select an alternative to implement the CCP for J.N. “Ding” Darling NWR. The final CCP will include a FONSI, which is a statement explaining why the selected alternative will not have a significant effect on the quality of the human environment. This determination is based on an evaluation of the Service and Refuge System missions, the purposes for which the refuge was established, and other legal mandates. Assuming no significant impact is found; implementation of the CCP would then begin, would be monitored annually, and would be revised when necessary.

PLANNING STUDY AREA

The J.N. "Ding" Darling NWR is located along the southwest coast of Florida in Lee County, approximately 15 miles southwest of Ft. Myers, on the subtropical barrier islands of Sanibel and Captiva in the Gulf of Mexico (Figure 2). Including hardwood hammocks, freshwater marsh, stream and ponds, mangrove wetlands, and estuarine waters on Sanibel and Captiva Islands, the refuge includes Tarpon Bay, the Wulfert Keys, and Buck Key and covers roughly half of Sanibel Island, including the Bailey Tract, the Perry Tract, and the Botanical Site (Figure 2). This EA identifies management for lands and waters currently under refuge management [totaling approximately 6,407 acres (2,592.8 ha)] and some lands and waters within the refuge’s approved acquisition boundary of 7,325 acres (2,964.3 ha), as well as for any lands and waters proposed for acquisition from willing sellers by the Service or otherwise added by an agreement. Further, the EA proposes refuge management actions to support management activities by the partners to further the purposes and management goals of the refuge.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY

The Service developed the Draft CCP/EA in compliance with the Improvement Act and Part 602 of the Fish and Wildlife Service Manual (National Wildlife Refuge System Planning). The actions described within the Draft CCP/EA also meet the requirements of the NEPA. The Service complied with NEPA through the involvement of the public and the incorporation of an EA with a description of the alternatives considered and an analysis of the environmental consequences of the alternatives. When fully implemented, the CCP will strive to achieve the purposes, vision, and goals of J.N. "Ding" Darling NWR.

The CCP's overriding consideration will be to carry out the purposes for which the refuge was established. Fish and wildlife management is the first priority in refuge management, and the Service allows and encourages public use (wildlife-dependent recreation) as long as it is compatible with, or does not detract from, the refuge's mission and purposes.

COMPATIBILITY

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that wildlife and their habitats are protected and that Americans can safely enjoy Refuge System lands and waters. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use "...will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." In addition, "wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety."

An interim compatibility determination is a document that assesses the compatibility of an activity during the period of time the Service first acquires a parcel of land to the time a formal, long-term management plan for that parcel is prepared and adopted. The Service has completed an interim compatibility determination for the six priority general public uses of the system, as listed in the Improvement Act. These uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

J.N. "Ding" Darling NWR has several existing compatibility determinations allowing for a variety of public use activities on the refuge, including fishing, wildlife observation, wildlife photography, and environmental education and interpretation by foot, by bicycle, by private vehicle, by tour, by canoe, by kayak, and by boat. Refuge compatibility determinations address commercial activities, including commercial tours, commercial photography, and commercial harvesting, as well as research and mosquito control. Visitor facilities include the Education Center, Wildlife Drive, Tarpon Bay Recreation Area, observation tower, trails, boat and canoe/kayak launches, boardwalks, interpretive signage and kiosks, and an education pavilion.

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

In accordance with Service guidelines and NEPA recommendations, public involvement has been a crucial factor throughout the development of the Draft CCP/EA for J.N. "Ding" Darling NWR. The Draft CCP/EA has been written with input and assistance from interested citizens, conservation organizations, employees of local and state agencies, and tribal governments. The participation of these stakeholders and their ideas has been of great value in setting the management direction for J.N. "Ding" Darling NWR. The Service, as a whole, and the refuge staff, in particular, are very grateful to each one who has contributed time, expertise, and ideas to the planning process. The

staff remains impressed by the passion and commitment of so many individuals for the lands and waters administered by the refuge.

The comprehensive planning process officially began in February 2007 with the assembly of a Service Core Planning Team and the continuation of preplanning activities, such as gathering data and information. Public scoping commenced with a notice in the *Federal Register* on June 27, 2007. Due to various issues, this process was restarted in January 2008 with visioning and preparation for the public scoping phase of the planning process. An Intergovernmental Coordination Planning Team meeting was held in April 2008 and those governmental agencies present identified priorities for future management of the refuge.

Public scoping continued in spring 2008, including notices in the *Federal Register* and in local newspapers. Additional information about the planning process and public scoping was provided through informational flyers, articles in local newspapers, postings on the refuge's Internet web site, and the "Ding" Darling Wildlife Society newsletter. Using the refuge's CCP public mailing list flyers were mailed inviting participation in the planning process through a variety of means, including public meetings, letters, faxes, telephone calls, email messages, and personal visits. Joint public meetings were held for J.N. "Ding" Darling NWR and the satellite refuges (i.e., Pine Island, Matlacha Pass, Island Bay, and Caloosahatchee NWRs) in April 2008. Verbal and written comments were submitted at these public meetings and also by letters, faxes, email messages, and phone calls both locally and from across the country from individuals, organizations, and governmental entities.

A wide range of issues, concerns, and opportunities were identified and addressed during the planning process. Many issues that are very important to the public often fall outside the scope of the decision to be made within this planning process. In some instances, the Service cannot resolve issues some people have communicated to us. We have considered all issues raised throughout the planning process and have developed plans that attempt to utilize the best available scientific information, employ the best management practices, and address the competing opinions in the context of supporting the purposes of the refuge.

A complete summary of the issues and concerns is provided in Appendix D.

II. Affected Environment

For a description of the affected environment, see Section A, Chapter II, Refuge Overview.

III. Description of Alternatives

FORMULATION OF ALTERNATIVES

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the refuge's purposes and vision, and the goals identified in the CCP; the priorities and goals of the South Florida Ecosystem Team; the goals of the Refuge System; and the mission of the Fish and Wildlife Service. Alternatives are formulated to address the priority issues, concerns, and problems identified by the Service and the public during public scoping.

The four alternatives identified and evaluated represent different approaches to provide permanent protection, restoration, and management of the refuge's fish, wildlife, plants, habitats, and other resources, as well as appropriate and compatible wildlife-dependent recreation. Refuge staff assessed the biological conditions and analyzed the external relationships affecting the refuge. This information contributed to the development of refuge goals and, in turn, helped to formulate the alternatives. As a result, each alternative presents different sets of objectives for reaching refuge goals. Each alternative was evaluated based on how much progress it would make and how it would address the identified issues, problems, and threats related to fish and wildlife populations, habitat management, resource protection, visitor services, and refuge administration.

All of the alternatives incorporate several concepts and management techniques intended to achieve the goals for management programs and activities conducted on the refuge, including management goals for: wildlife and habitat management, resource protection, visitor services, and refuge administration. Four alternatives were evaluated: Alternative A (Current Management, the No Action Alternative), Alternative B (Native Wildlife and Habitat Diversity), Alternative C (Migratory Birds, the Proposed Action Alternative), and Alternative D (Rare, Threatened, and Endangered Species). The No Action Alternative (Alternative A) is a description of ongoing refuge management activities and may not, in all cases, meet the outlined goals. The No Action Alterative is described as a basis of comparison for the action alternatives (i.e., alternatives B, C, and D).

DESCRIPTION OF ALTERNATIVES

Alternative A (Current Management, the No Action Alternative) continues current management similar to recent activities and levels on the refuge. Alternative B (Native Wildlife and Habitat Diversity) focuses refuge management actions on maintaining and enhancing native wildlife and habitat diversity. Alternative C (Migratory Birds, the Proposed Action) emphasizes management of migratory birds. Alternative D (Rare, Threatened, and Endangered Species) focuses refuge management actions on the needs of rare, threatened, and endangered species. The four alternative management approaches take into consideration criteria developed as a result of issue identification and are organized under the broad management categories: Wildlife and Habitat Management, Resource Protection, Visitor Services, and Refuge Administration.

Wildlife and Habitat Management Goals

- Goal 1. Minimize the threats to and promote the recovery of the rare, threatened, and endangered species occurring on Sanibel and Captiva Islands and in adjacent waters.
- Goal 2. Conserve, restore, enhance, and manage the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands to maintain and enhance their biological integrity and to support species diversity and abundance of native plants and animals, with an emphasis on migratory birds.

- Goal 3. Eliminate existing and future exotic, invasive, and nuisance species on the refuge to maintain and enhance the biological integrity of the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands.
- Goal 4. Work with the partners to address and resolve the water quality, quantity, and timing concerns associated with the watershed of the refuge; Lake Okeechobee releases to the west; the watershed of the Caloosahatchee River; and, the Gulf of Mexico.
- Goal 5. Identify, understand, and ameliorate the impacts of climate change on refuge resources to plan for and adapt management as necessary to protect the native wildlife; the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands; and the cultural resources of the refuge.

Resource Protection Goals

- Goal 1. Protect the archaeological and historical resources of the refuge exemplifying the natural and cultural history of Sanibel and Captiva Islands and connect refuge staff, visitors, and the community to the area's past.
- Goal 2. Work with the partners to acquire, manage, or otherwise protect all remaining properties within the refuge's acquisition boundary to protect wildlife and the upland, transitional, and estuarine habitats of the Sanibel and Captiva area.
- Goal 3. Protect the J.N. "Ding" Darling Wilderness Area, promote an understanding of its wilderness values and *Leave No Trace* principles, and enhance awareness of the Wilderness Area among visitors to preserve the opportunity for outstanding coastal wilderness experiences in southwest Florida.

Visitor Services Goals

- Goal 1. Visitors will fee welcome and find accurate, timely, and appropriate orientation material and information on refuge visitor facilities, programs, and management activities.
- Goal 2. Members of the fishing public will enjoy their fishing experiences, behave ethically, and support refuge management and wildlife and habitat protection.
- Goal 3. Wildlife observers and photographers of all abilities will enjoy and value the diversity of area wildlife, will behave ethically, and will support refuge management and wildlife and habitat protection.
- Goal 4. Participants in quality environmental education and interpretation programs and activities will develop an understanding and awareness of the legacy of Jay Norwood "Ding" Darling, the value and history of the refuge and the Refuge System, the natural resources of the refuge, the role of the refuge in the landscape, and the human influences on ecosystems, and will support refuge management and wildlife and habitat protection.
- Goal 5. Communicate key messages and issues with off-site audiences to build support within the local community and beyond for the refuge, its purposes, and its management.
- Goal 6. Continue to provide quality wildlife-dependent activities through a single concessionaire to support refuge management goals and objectives.

Refuge Administration Goals

- Goal 1. Provide sufficient infrastructure, operations, volunteers, and staff to implement a comprehensive refuge management program to protect and manages refuge resources and the natural and cultural values of Sanibel and Captiva Islands.
- Goal 2. Foster strong and effective working relationships with existing and new governmental and non-governmental partners for the purposes of accomplishing refuge management goals and objectives and protecting the natural and cultural resources of Sanibel and Captiva Islands.
- Goal 3. Limit the impacts to the natural resources and waters of the refuge from commercial harvesting activities to current levels until these activities can be phased out from the refuge.

ALTERNATIVE A (CURRENT MANAGEMENT, NO ACTION ALTERNATIVE)

Alternative A would continue refuge management activities and programs at levels similar to past management.

Wildlife and Habitat Management

Under Alternative A, the refuge would conduct a variety of wildlife surveys, predominantly for birds; protect key rare, threatened, and endangered species; enhance wildlife and habitat diversity; control exotic, invasive, and nuisance species; coordinate with the partners to address water quality, quantity, and timing concerns; and work with a variety of partners to develop an understanding of the impacts of climate change on refuge resources.

The refuge and its partners would conduct several surveys providing information for a variety of birds, including rare, threatened, and endangered birds (e.g., wood storks, roseate spoonbills, bald eagles, mangrove cuckoos, black-whiskered vireos, gray kingbirds, Florida prairie warblers, snowy plovers, piping plovers, and red knots); raptors and birds of prey; nearctic-neotropical migratory birds; shorebirds and seabirds; wading birds; waterbirds; and waterfowl. Working with the partners, such as the Sanibel-Captiva Audubon Society, and volunteers, each year all birds would be counted during the annual Audubon Christmas Bird Count. From March through September, Wildlife Drive bird surveys would be conducted at the rookery islands of Tarpon Bay, twice per month during low tide. During impoundment drawdowns, Wildlife Drive surveys would also be conducted weekly during low tide, plus impoundment surveys would be conducted weekly at high tide. Weekly call-back surveys would be conducted from April through June and breeding bird protocols would be implemented on the Wildlife Drive and near nesting sites for mangrove cuckoo and other mangrove forest birds (i.e., black-whiskered vireo, gray kingbird, and Florida prairie warbler). Shorebirds would be monitored three times per month from September through May, and whenever seen on the refuge, bands would be reported. Refuge impoundments would be managed for shorebird foraging habitat during the fall and spring and impoundments would be surveyed weekly during drawdowns during high tides. The refuge would work with partners to band snowy plovers and to monitor nesting success and predation of the snowy plover to include preventing disturbances (e.g., from humans and dogs) during the nesting season. Bald eagle nest surveys would be conducted annually by the State. Breeding bird surveys would be conducted in the summer and migratory bird surveys would be conducted in the fall and spring. The refuge would maintain nest platforms for ospreys and nest boxes for owls, with nesting on Sanibel Island monitored by the International Osprey Foundation. Other partners, such as the Audubon Society of Southwest Florida, would also conduct an annual Hawk watch. Colonial nesting bird surveys would be conducted monthly from February through July.

Beyond birds, the refuge would also conduct management activities to benefit other key rare, threatened, and endangered species, including the West Indian manatee, American crocodile, sea turtles, Sanibel rice rat, and gopher tortoise. West Indian manatee protection activities would include coordinating with the partners to enforce speed zones and no-motor zones; participating in the Marine Mammal Stranding Network; protecting designated critical habitat; protecting seagrass beds; and supporting manatee recovery actions, especially through public education and outreach, including the partnership with Manatee Park. American crocodile management activities would include working with the partners to educate residents to minimize crocodile-human interactions and protecting any crocodiles using the area. Sea turtle (i.e., loggerhead, green, Kemp's ridley, and hawksbill) activities would be led by the partners and include conducting loggerhead nest surveys and addressing lighting and beach furniture issues and conducting in-water surveys. The refuge would work with the partners to conduct habitat management and monitoring of the Sanibel rice rat, for which the status is unknown. Prescribed fire management benefits gopher tortoises and eastern

indigo snakes. Management specifically for gopher tortoises would include posting and maintaining crossing signs on the Wildlife Drive. Staff would work with partners to monitor presence/absence and study the movement of eastern indigo snakes on Sanibel Island, supporting the recovery plan.

In addition to birds and other rare, threatened, and endangered species, the refuge would also survey for fish, frogs, and American alligators. The refuge would seine three times per year to determine the composition of juvenile and baitfish populations using the refuge. And, surveys would be conducted to monitor the American alligator population on Sanibel Island.

Habitat management activities on the refuge would include an impounded wetland reconnection/mangrove restoration project, prescribed fire, and exotic plant control. An old growth mangrove restoration project would be designed for Alligator Curve. Differences between impounded and unimpounded mangroves would continue to be researched. Limited ditch clearing would occur. Prescribed fires would be conducted on a three- to five-year rotation for Spartina wetlands. Further, fuel and fire-effects monitoring and exotic plant control activities would also occur in these wetlands. Water quality monitoring would occur on the Bailey Tract and along Wildlife Drive. Generally, the upland habitats of the refuge would not be actively managed beyond exotic plant control activities. The refuge would nearly be at a maintenance stage for most exotic, invasive, and nuisance plants, with treatments addressing about half the refuge each year. Further, the refuge would work with the partners to control exotic plants on island conservation areas. The refuge would opportunistically remove exotic plants from the Shell Mound Trail area about five times per year.

Beyond exotic plants, the refuge would also addressing exotic, invasive, and nuisance animals, including partnering with the city of Sanibel to remove and euthanize iguanas and Nile monitor lizards both off-site and on-site; conducting small mammal trapping and pest control at refuge facilities for black rats; evaluating euthanasia of black rats; and hazing and/or euthanizing nuisance raccoons.

The refuge would work with the partners to address water quality, quantity and timing concerns by: coordinating with the U.S. Army Corps of Engineers (USACE), Operations Division on implementation of Lake Okeechobee regulation schedule; coordinating with Ecological Services for Fish and Wildlife Coordination Act input on new regulation schedules for Lake Okeechobee; and planning with USACE operations to install water quality monitoring station in Tarpon Bay.

The refuge has limited management activities related to the impacts of climate change. The Service's South Florida Ecosystem Team would develop a climate change model with MIT. The refuge would partner with the SCCF Marine Lab to model climate change impacts on Sanibel Island. The refuge would develop water depth benchmarks in Tarpon Bay to better understand potential impacts on refuge resources.

Resource Protection

Current resource protection management activities on Sanibel and Captiva Islands would focus on natural and cultural resource protection, management and cooperative agreements, and the J. N. “Ding” Darling Wilderness Area.

The refuge would provide protection for and interpretation of a variety of cultural resources (e.g., Wightman Site). Known cultural resource sites would be regularly patrolled by law enforcement officers. When any project is proposed, cultural resources would be investigated and evaluated. Further, the refuge’s environmental education and interpretation programs would include archaeological and historical resources.

The refuge would have several management and cooperative agreements to further refuge management goals and objectives. Tarpon Bay, including the water bottoms, would be managed by the refuge under a management agreement with the State of Florida. The State Botanical Site would also be managed by the refuge through a management agreement with the State of Florida. Cooperative agreements with the city of Sanibel and Sanibel-Captiva Conservation Foundation (SCCF) would address resource management, fire management, exotic plant and animal control, and research. A management agreement with Lee County authorizes the refuge to manage Wulfert Flats as a pole/troll zone. Further, the refuge would work with the partners on a variety of items, including sharing resource management responsibilities, conducting surveys, facilitating and conducting research, and sharing geographic information system (GIS) data.

Public use of the 2,619-acre Wilderness Area would include fishing, boating, wildlife observation, photography, and research. Motorized boat use would be restricted in specific portions of the Wilderness Area. The “No Motor Zone” in the waters adjacent to Wildlife Drive restricts vessels to using manual propulsion only. Other areas of the Ding Darling Wilderness allow motorboats as a pre-existing use. Management activities within the Wilderness Area would be limited and include wildlife surveys and monitoring activities, water quality monitoring, law enforcement activities, boundary inspection and posting activities, and cleanup activities (e.g., removing abandoned monofilament line and fishing lures).

The refuge employs two full-time law enforcement officers for the protection of the refuge’s fish, wildlife, plants and their habitats, as well as for the protection of cultural resources and public safety.

Visitor Services

The refuge annually welcomes and hosts approximately 700,000 visitors who travel to the refuge to fish; observe and photograph wildlife and landscapes; participate in environmental education and interpretive activities and programs; and experience, enjoy, and appreciate the unique natural resources of the refuge.

To welcome and orient visitors, the refuge and its partners would provide signs, orientation materials, and information on refuge visitor facilities, programs, and management activities through a variety of means. The “Ding” Darling Education Center, the primary refuge facility to welcome and orient visitors to the refuge, would provide a visitors’ information and an orientation film. A kiosk in the parking lot of the Education Center would provide visitors with maps and brochures. A concession tram booth would be staffed daily (except Fridays, when the Wildlife Drive would be closed), also providing welcome information and maps. In addition, the Wildlife Drive fee booth would provide welcome and orientation information and materials. Located at the entrance to Sanibel Island, a Chamber of Commerce kiosk would provide refuge information. The Tarpon Bay Recreation Area concession facility would also provide welcome and orientation information and materials. Further, maps and brochures would be available on refuge and visitor-related websites and in free local visitor guide publications. Local media would regularly cover the refuge, providing visitors with information. The refuge also would work with volunteers, “Ding” Darling Wildlife Society, and partners to provide refuge information and enhance the opportunities available to visitors.

The refuge annually supports approximately 85,000 annual fishing visits. The refuge would provide information on boating, fishing, crabbing, and related regulations (the refuge would follow State of Florida regulations for fishing and would have more restrictive regulations for crabbing). Fishing would occur from motorized and non-motorized boats (the refuge would provide one motorized boat launch and three canoe/kayak launch facilities); from a fishing pier off Wildlife Drive; from various shorelines and water control structures along the Wildlife Drive; and at the Bailey Tract. A concessionaire would

provide guided fishing tours and outfitted rental boats. Annually, at least two Youth Fishing Days events would occur at the Tarpon Bay Recreation Area. Interpretive fishing programs would be provided from January 1 to March 31 every year. The Service and the refuge have established a strong partnership with the Bass Pro Shops. The Bass Pro Shop in Ft. Myers has featured the refuge and the Service with exhibits, photographs, and a portable junior duck kiosk; while the refuge would provide an information booth at Bass Pro Shop events. A local cast-net rodeo would be held each year in November at the local Bait Box store, highlighting the refuge. Media and national fishing shows would often feature the fishing opportunities at the refuge. While numerous fishing tournaments originate off the refuge, participants in these tournaments fish on the refuge. Interpretive signage on the Wildlife Drive would provide information about crabbing and about the negative impacts of monofilament fishing line. The refuge would provide a phone number to report monofilament entanglement and receptacles for monofilament recycling. Volunteers would remove monofilament weekly from January 1 to March 31 and opportunistically during the rest of year. The refuge also would work with partners to install fish-waste disposal tubes at area fishing piers off of the refuge.

All visitors to the refuge participate in some form of wildlife observation, and many enjoy photography. Programs and tours would be offered weekly from January 1 to March 31 and opportunistically during the rest of the year to provide opportunities for wildlife viewers and photographers. Tours would include staff and volunteer-led wildlife observation walks and bike tours; concessionaire-led tram, boat, and kayak tours; and a touch-tank at the Tarpon Bay Recreation Area. Facilities that support wildlife observation and photography would include: the “Ding” Darling Education Center birding room; the Wildlife Drive and its four trails; the handicapped-accessible observation tower and cross-dike pavilion off the Wildlife Drive; four trails at Bailey Tract; the Commodore Creek and Buck Key water trails; and the Tarpon Bay Recreation Area deck. Planned facilities would include a Children’s Birding Trail to the Sanibel School and a bird observation deck in Pond 2 off the Wildlife Drive. Orientation sessions would also be provided for commercial photographers as part of their refuge special-use permit requirement to improve ethical behavior in photography. .

Environmental education and interpretation programs and activities would include: curriculum-based environmental education programs, interpretive tours and programs, interpretive signs, and an interpretive kiosk.

The refuge would work with the partners to conduct on-site and off-site curriculum-based programs (in local schools) with messages focused on the role and importance of the refuge and the Refuge System in protecting wildlife and the impacts of human activities on wildlife and habitat. Environmental education programs would be linked to Florida State standards and would be conducted by staff, partners, the “Ding” Darling Wildlife Society, and volunteers. The refuge annually would write grants for funds to transport about 3,300 students onto Sanibel Island for field trips to the refuge during November-April. Refuge staff would work with home-school groups and Scouting groups, as requested. The Summer Teachers Assisting Refuge (STAR) program kicked off in the summer of 2009 would include train-the-teacher workshops. Fifth-grade gifted students from three area schools would participate with the refuge on a virtual earth-cache program.

Over 40 interpretive programs and tours would be offered weekly from January 1 to March 31 and opportunistically during the rest of the rear. Interpretive tours would include staff and volunteer-led wildlife observation walks and bike tours; concessionaire-led tram, boat, and kayak tours; and a touch-tank at the Tarpon Bay Recreation Area. Refuge staff and volunteers would provide program presentations to various local organizations and clubs. Interpretive signs would exist at the “Ding” Darling Education Center, throughout the Wildlife Drive and its hiking trails, at the Bailey Tract, and at Tarpon Bay. The Shell Mound Trail would have interpretive signage throughout its length. Additional interpretive signs would be installed as part of the planned Children’s Birding Trail.

In addition, an E-Bird kiosk (in partnership with the Cornell Lab of Ornithology) for reporting bird sightings and learning detailed information about birds and a new invasive species kiosk would be located at the “Ding” Darling Education Center, supporting education and interpretive activities on the refuge. Also, the refuge would be a member of the Society for Ethical Ecotourism, Southwest Florida Chapter, and would incorporate ethical behavior information in existing educational programs, brochures, signage, websites, and exhibits.

Beyond environmental education and interpretive programs and activities, community outreach activities would communicate important messages and issues with off-site audiences to build support for the refuge within the local and regional/national communities. Refuge employees and volunteers would staff booths with hands-on activities for children at local festivals and conservation events and would work with the partners for the annual “Ding” Darling Day. Information would be provided on the refuge's website and to local media (e.g., newspapers, magazines, and TV) about refuge activities. In addition, the Service's Southeast Region would develop an outreach website to exchange information and provide outreach materials to the public. The Lee County Visitor and Convention Bureau would hold a special use permit to conduct various activities to promote the refuge and the area to national and international tourism visitors.

To help support refuge management goals and objectives and to help the refuge manage the volume of visitors, a single concessionaire would operate on the refuge at the Tarpon Bay Recreation Area. The concessionaire would collect refuge entry fees; provides guided kayak, tram, and boat tours; provide guided fishing trips; manage the boat ramp and rentals for canoes, kayaks, pontoon boats, and bicycles; and operate a gift shop at Tarpon Bay. The concessionaire would assist the refuge with special educational events throughout year (e.g., working with refuge staff on concessionaire program scripts and modifying activities as necessary) and would provide a variety of interpretive services (e.g., deck talk and touch-tank experience).

To help cover administration of the areas and programs, refuge fees would be charged for the Wildlife Drive and commercial special use permits. Of the entrance fees collected by the concessionaire, 20 percent would be returned to the refuge to help support the Refuge Revenue Sharing Payment to Lee County and to help support refuge management activities and programs.

Refuge Administration

Administration and management of the refuge's staff, volunteers, facilities, equipment, and programs provides the means by which the refuge provides a comprehensive program to accomplish refuge management goals and to protect the natural and cultural resources of Sanibel and Captiva Islands.

Covering all five refuges in the J.N. "Ding" Darling NWR Complex, J.N. “Ding” Darling NWR staff would include 14.5 permanent full-time employees (FTEs), 3 temporary full-time employees, 5 student interns, 9 seasonal/temporary employees, and 3 student employees (Figure 27). Refuge staff would include: project leader (refuge manager); deputy project leader (deputy refuge manager); wildlife refuge specialist (assistant refuge manager); wildlife biologist (lead); wildlife biologist (term), supervisory park ranger; park ranger (environmental education specialist); park ranger (volunteer coordinator); park ranger (fee booth, 0.5 FTE, seasonal); 2 law enforcement officers-one of which would be paid for by fee dollars); administrative officer (lead); 2 administrative support assistants (one of which would be term and paid for by fee dollars); forestry technician (lead); a facility operations specialist; and 2 engineering equipment operators. Another 5 seasonal interns would continue to be housed at the Refuge Complex’s Maintenance Shop. In addition, over 240 volunteers would continue to annually contribute services equivalent to an additional 10 full-time employees. Six regional staff members would also be located at the refuge (6 FTEs): regional facility operations specialist, Region

4 Invasive Species Strike Team leader, Region 4 Invasive Species Strike Team sssistant, Comprehensive Everglades Restoration Project biologist, realty specialist, and Motorboat Operator Certification Course coordinator.

Administrative facilities would be extensive and include an office building, Education Center, concession building with an apartment, six maintenance shop and storage buildings, two government quarters, four mobile homes for interns and volunteers, and four recreational vehicle pads for volunteers. Further, the refuge would maintain several roads, trails, and parking areas, including the Wildlife Drive (a paved, open-grade 4-mile road), Indigo Trail (a 2-mile hiking/biking trail), Shell Mound Trail (boardwalk trail), and the dirt trail/boardwalk complex at the Bailey Tract. Additional visitor facilities would include the observation tower on Wildlife Drive; Red Mangrove Overlook; Tarpon Bay docks and boat ramp; six automatic gates; the education pavilion at Cross-dike; and numerous kiosks, signs, and interpretive panels. Further, an observation platform would be planned at Water Control Structure #2 and the planned Children's Birding Trail would also include interpretive signs.

One commercial bait fishing operator has historically operated on the refuge under a pre-existing use authorization.

The refuge would work with numerous governmental agencies, non-governmental organizations, and other partners to foster and promote refuge management goals. Key governmental partners would include the city of Sanibel, Lee County, Lee County Mosquito Control District, the Florida Department of Agriculture and Consumer Services, the Florida Fish and Wildlife Conservation Commission, the Charlotte Harbor Aquatic Preserve, and the Charlotte Harbor National Estuary Program.

ALTERNATIVE B (NATIVE WILDLIFE AND HABITAT DIVERSITY)

Alternative B would focus on increasing refuge management actions for the needs of native wildlife and habitat diversity.

Wildlife and Habitat Management

Under Alternative B, the refuge would expand current wildlife and habitat management activities of the refuge to better serve native wildlife and habitat diversity.

Additional management activities would be expanded or initiated to benefit rare, threatened, and endangered species. The refuge would restore and improve mangrove habitat at Alligator Curve to benefit the mangrove cuckoo and other mangrove forest birds. It would include Eastern indigo snakes in fire management monitoring activities. The refuge would minimize disturbances to bald eagle nesting sites. To benefit gopher tortoises, the refuge would restore and maintain suitable habitat and would consider using barriers to movement and wildlife underpasses to help minimize vehicular collisions. Further, the refuge would survey and document gopher tortoise burrow locations. Ornate diamondback terrapin population surveys would be initiated. The refuge would work with the partners to minimize impacts to manatees and sea turtles. Further, the refuge would also work with the partners to manage the nearshore habitats to benefit sea turtles. Monitoring of seagrass beds and beach profile changes would also yield information that would benefit sea turtles, as well as shorebirds, seabirds, and fish species. To also benefit shorebirds, the refuge would work with the partners to minimize impacts to snowy and piping plovers, conduct winter surveys to monitor presence/absence of piping plovers, and improve water management capabilities in the impoundments to better serve the needs of shorebirds (e.g., red knots). To expand management for the Sanibel rice rat, the refuge would restore Sanibel rice rat habitats and conduct intensive population trends monitoring, permanent marking, and expanded trapping efforts to determine

habitats used. The refuge would work with the city of Sanibel to control water levels and evaluate the restoration of sheet flow on the State Botanical Site. Management for eastern indigo snakes and gopher tortoises would continue, especially prescribed burning, as outlined under Alternative A. The refuge would pursue recovery efforts for eastern indigo snakes and other federally listed species, where it does not conflict with migratory bird protection.

In addition to management actions to better serve rare, threatened, and endangered species, under Alternative B the refuge would expand management activities to benefit a variety of native wildlife and habitats. The refuge would improve and restore the nesting, breeding, roosting, foraging, and habitat needs of raptors and birds of prey and nearctic and neotropical migratory birds. The refuge would select certain shrubs and trees as food sources and potential migration and nesting sites for migratory birds (e.g., in hardwood hammocks, at Shell Mound, and along Alligator Curve). To benefit a variety of fish species, the refuge would work with the partners and researchers to identify fish spawning, settlement, and nursery sites on and adjacent to the refuge. The refuge would pursue funding to restore and enhance alligator habitat, and it would study and improve alligator habitat needs during times of drought, evaluating the need for deeper freshwater. To also benefit alligators, the refuge would increase education and enforcement efforts to minimize alligator feeding and harassment and develop better methods to control water levels and cattails on Bailey Tract. The refuge would restore upland habitat at Shell Mound and assess the need to restore Buck Key. It would also fill and/or clear historic drainage ditches that negatively impact habitat or natural flow. The existing ridge along the powerline easement would be restored. The refuge would work with the city of Sanibel and other partners regarding the operation of the city's weir, controlling water levels in the State Botanical Site, and evaluating the restoration of sheet flow. The refuge would work with the partners to reinstate the seagrass beds monitoring program, while also mapping historic and existing seagrass beds in and around the refuge.

Control of exotic, invasive, and nuisance plants and animals would be expanded under Alternative B. The refuge would update its list of priority species to control. It would identify and locate new infestations of Category I and Category II invasive upland plants, emphasizing elimination during initial attack and controlling the spread to minimize impacts to native wildlife and habitat diversity. Further, the refuge would work with the partners to increase the public's awareness of the negative impacts of exotic, invasive, and nuisance animals, including educating visitors not to feed raccoons and evaluating more effective means of trapping and euthanizing exotic, invasive, and nuisance animals.

Benefitting numerous species and habitats of management concern, the refuge would expand activities to better coordinate with the partners to address water quality, quantity, and timing of flows related to Lake Okeechobee regulatory releases, drainage in the Caloosahatchee Basin, and local runoff issues. Further, the refuge would work with the USACE to install a water quality monitoring station in Tarpon Bay. Water quality monitoring would be expanded by adding nutrients to the monitoring program and by expanding the number of water quality monitoring locations on the refuge. The refuge would work with the city of Sanibel regarding the operation of its weir.

Alternative B would include plans to work with the partners to refine and run appropriate climate change models to understand the impacts of climate change on refuge resources [e.g., re-run the Sea Level Affecting Marshes Model (SLAMM) model when high resolution Light Detection and Ranging (LiDAR) data become available]. The refuge would continue to work with the MUSIC [Massachusetts Institute of Technology (MIT)-USGS Science Impact Collaborative] partners (FWS/MIT/USGS) to address climate change scenarios under a Strategic Habitat Conservation framework. The refuge would coordinate with researchers and partners to conduct wildlife inventories to establish wildlife population baselines and then identify parameters to measure changes that could affect wildlife diversity, health, abundance, productivity, survival, predator/prey interactions,

parasite/host interactions, spatial and temporal distribution, dispersal, migration patterns, phenology, and ultimately population viability. The refuge would also coordinate with researchers and partners to establish habitat benchmarks and then identify parameters to measure changes that could affect environmental health, hydrology, biological integrity, natural community structure, habitat succession, vegetation stratification, habitat diversity, parasite/host interactions, pest abundance, pathogen outbreaks, primary plant productivity, pollination, phenology, and ultimately ecosystem viability. The refuge would also work with researchers and partners to establish landscape benchmarks to measure changes sea level rise, tidal range, storm surges, subsidence, sedimentation, and shoreline change. As additional data and better models become available, the refuge would consider the impacts of climate change on natural resources and the potentially mitigating or compounding effects of anthropogenic stressors. The refuge would utilize the best available science and employ a strategic habitat conservation approach to anticipate wildlife and habitat adaptation tendencies and to target management actions to facilitate successful adaptation responses to the impacts of climate change. Such actions may include land acquisition, providing wildlife migration corridors, translocating populations, increasing genetic diversity among small isolated populations, manually dispersing seeds, restoring or modifying habitats, altering prescribed fire regimes, adjusting water level management in impoundments, plugging ditches that contribute to saltwater intrusion, aggressively controlling invasive exotics and pests, and participating in carbon sequestration.

Resource Protection

Alternative B would allow the refuge to better protect the archaeological and historical resources of the refuge on Sanibel and Captiva Islands; complete the approved acquisition boundary; develop management agreements to protect key resources; and pursue additional special designations for the refuge.

The refuge would coordinate with the State Historic Preservation Officer and the Regional Archaeologist to conduct a complete archaeological and historical survey of the refuge, protecting any newly identified sites. The refuge would actively work with the landowners and other partners to acquire or otherwise protect in perpetuity the historically significant site of “Ding” Darling’s fishing cabin off Captiva Island. Further, the refuge would work with the landowners and other partners to incorporate this site into an interpretive program, and would seek National Historic Register designation for the site.

To better protect native wildlife and habitat diversity, the refuge would pursue completion of the refuge's approved acquisition boundary, develop management agreements for key resources; and pursue additional special designations. Working with the partners and landowners, the refuge would attempt to complete the approved acquisition boundary for those properties with high wildlife and habitat values. To do this, the refuge would work with willing sellers. The refuge would work with the State of Florida to develop appropriate management agreements to implement refuge-managed closed area buffers around sensitive resources (e.g., rookeries). If needed, the refuge would expand the acquisition boundary to include these closed area buffers in the refuge [e.g., through a Minor Expansion Proposal (MEP)]. The refuge would also pursue special designations for the refuge, including Western Hemisphere Shorebird Reserve Network and RAMSAR Wetlands of International Importance.

In addition, the refuge would expand its Wilderness Area program. The refuge would provide Wilderness Area, wilderness stewardship, and wilderness principles information to visitors at the “Ding” Darling Education Center and in environmental education and interpretation programs and materials. Further, it would update refuge materials (e.g., maps, brochures, and websites) to include the Wilderness Area, include Wilderness Area information and interpretation at Tarpon Bay

Recreation Area, coordinate with the concessionaire to include wilderness information in its programs, and evaluate methods to improve the wilderness experience on the refuge.

Visitor Services

Although the refuge currently has a robust visitor services program, Alternative B would expand existing visitor services activities to focus messages of all visitor and outreach activities and programs on native wildlife and habitat diversity and the minimization of human impacts on these resources and to increase the ethical natural resource behavior of refuge users. In general, existing visitor uses would continue, including fishing, wildlife observation and photography, and environmental education and interpretation, while refuge staff would increase efforts to improve ethical behavior, expand and enhance outreach activities, and maintain the concession approach to facilitating visitor activities and experiences.

To improve welcome and orientation for refuge visitors, the refuge would work with the volunteers, "Ding" Darling Wildlife Society, and partners to modify existing and develop new informational materials that enhance the wildlife and habitat diversity and minimization of human impacts messages that would be delivered to the public at the Visitor Center and through all brochures, kiosks, signs, displays, and programs.

The fishing program would continue with improvements regarding ethical behavior. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on wildlife and habitat diversity in an effort to minimize these impacts (e.g., from monofilament fishing line). Further, the refuge would coordinate with the local fishing guides to ensure that all guided trips on the refuge would be covered by a refuge special use permit, which would include stipulations about ethical behavior and messages delivered to clients.

To improve wildlife observation and photography opportunities and activities, the refuge would work with the partners to develop informational materials to promote wildlife and habitat diversity, the minimization of human impacts, and ethical natural resource behavior. To provide additional opportunities for wildlife observation and photography, the refuge would locate and develop an observation tower at the Bailey Tract. The Wildlife Drive would be evaluated for any needed changes, including evaluating the potential for a bike-only lane on the Wildlife Drive, the potential to close the Wildlife Drive to vehicles one additional day per week, and the potential to open the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts. Further, the refuge would evaluate the fees over the 15-year life of the CCP to maintain appropriate and compatible visitor services, and evaluate the potential to add additional tram tours.

To enhance the existing ethical behavior criteria and program, the refuge would evaluate and modify existing or create new brochures, websites, displays, kiosks, signs, and other materials. The refuge would work with the partners to find ways to more effectively convey ethical behavior messages to the public. Working with the Service's National Conservation Training Center (NCTC) and other partners, the refuge would pursue the creation of an ethical wildlife observation and photography video to help improve user behavior. North American Nature Photography Association ethical standards would be incorporated into ethical behavior materials as applicable. The refuge would coordinate with the Society for Ethical Ecotourism, Southwest Florida (SEE SWFL) Chapter to evaluate area ecotours for adherence to ethical behavior standards and to ensure adherence to ethical behavior standards. The refuge would coordinate with other area refuges to engage them in SEE SWFL.

The refuge would enhance the existing environmental education and interpretive opportunities and programs. The refuge would work with the partners to help ensure that all Lee County 6th grade students attend environmental education programs at the refuge. A park ranger would be hired to

assist with this program. The refuge would develop on- and off-site interpretive programs with messages focused on native wildlife and habitat diversity and the minimization of human impacts. Staff, volunteers, teachers, and tour operators would be trained to incorporate refuge interpretive themes into programs. The refuge would evaluate the need for and ability to provide parking at the Shell Mound Trail to address existing ad hoc parking and Wildlife Drive congestion issues at this site.

Beyond these programs and activities, the refuge would increase the outreach efforts and activities of the staff, volunteers, and the "Ding" Darling Wildlife Society, focusing outreach efforts and messages on wildlife and habitat diversity and the minimization of impacts from human activities.

In 2013 the refuge's concessionaire agreement would be rebid. At this time, the refuge would evaluate the need to add tram tours to the agreement. Further, the refuge would coordinate future concession operations with the recommendations of the Alternative Transportation in Parks and Public Lands study, now called the Paul S. Sarbanes Transit in Parks Program.

Refuge Administration

To help accomplish the outlined actions, Alternative B would be similar to alternatives C and D and the refuge would convert the temporary fee-funded law enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions): wildlife biologist, biological science technician, two law enforcement officers, and park ranger (environmental education/outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25 percent operating margin, this total is $663,381. Activities of the volunteers and the "Ding" Darling Wildlife Society would be enhanced. A park ranger would be hired to help support coordination with both groups, whose duties would include staff-led training of volunteers, tours, education, interpretation, outreach, and other activities. The refuge would strive to increase the number of volunteers available throughout the year and increase the interaction between refuge staff and volunteers to enhance cohesiveness of the refuge team.

Throughout the life of the CCP, the refuge would improve and update facilities as needed. Additional facilities to be developed through the CCP would include the "Ding" Darling fishing cabin and an observation tower at the Bailey Tract, while the potential exists for an expanded or new parking area for Shell Mound Trail. The refuge would work with SCCF to replace the existing Marine Research Lab, located at Tarpon Bay.

To accomplish the outlined activities and to support common goals, the refuge would foster strong and effective working relationships with existing and new partners to meet refuge management goals and protect the natural and cultural resources of Sanibel and Captiva Islands.

Historically, a single commercial bait fisherman has operated on the refuge. In line with regional compatibility guidance and to limit the impacts from commercial fishing activities, the refuge would phase out commercial bait fishing activities from the refuge during the life of the CCP.

ALTERNATIVE C (MIGRATORY BIRDS, PROPOSED ACTION)

Alternative C would focus on increasing refuge management actions with a focus on migratory birds. This alternative addresses the management needs of all birds covered under the Migratory Bird Treaty Act, including resident species of native birds that are found using the refuge year-round.

Wildlife and Habitat Management

Alternative C would expand the current wildlife and habitat management activities of the refuge to better serve migratory birds. The refuge would prioritize migratory birds in all restoration plans.

Although the management focus would be on migratory birds under Alternative C, the refuge would also continue to serve rare, threatened, and endangered species. Specifically for wood storks, the refuge would work with the partners to support recovery, including by conducting surveys, improving habitat management, and conducting habitat restoration activities. The refuge would also coordinate with the Service's lead on wood storks at the Jacksonville Ecological Services Field Office to help develop an understanding of the colony origin and the foraging range and location for the wood storks using the refuge. Key activities would include the identification, protection, restoration, and enhancement of wood stork and roseate spoonbill foraging and roosting habitats. During the life of the CCP, the refuge would work with the partners and foster research to determine the colony origin and foraging range and location for those roseate spoonbills using the refuge. Where bald eagle nesting is discovered, the refuge would work to minimize disturbance to these sites. For mangrove forest birds, including mangrove cuckoos, black-whiskered vireos, gray kingbirds, and Florida prairie warblers; the refuge would restore and maintain mangrove habitat at Alligator Curve, restore and maintain hardwood hammocks on the ridges at Shell Mound; and work with the partners to research the effectiveness of survey protocols with nesting cycles and timing. The refuge would work with the partners to alter sea turtle surveys, when and where these survey activities conflict with migratory bird management. For snowy plovers and piping plovers, the refuge would work with the partners to minimize impacts, understand and manage beach habitats and disturbances, and monitor beach profile changes over time in relation to climate change and sea level rise. For snowy plover beach nesting areas, the refuge would work with the partners to ensure that no human disturbances negatively impact them. Also for snowy plovers, the refuge would work with the partners to evaluate the need for and develop a plan to address seasonal beach nesting closures on the Perry Tract. Although piping plovers do not currently occur on the refuge, the refuge would work with the partners to conduct winter surveys to monitor for presence/absence and would ensure that no human disturbances negatively impacted any site in use by piping plovers. To better serve red knots and other shorebirds, the refuge would improve water management capabilities in the impoundments. To expand management for the Sanibel rice rat, the refuge would restore Sanibel rice rat habitats and conduct intensive population trends monitoring, permanent marking, and trapping efforts to determine habitats used. If necessary, rice rat surveys would be altered to minimize impacts to migratory birds. Management for eastern indigo snakes and gopher tortoises would continue, especially prescribed burning, as outlined under Alternative A. The refuge would pursue recovery efforts for eastern indigo snakes and other federally listed species, where it does not conflict with migratory bird protection; and, the refuge would continue to coordinate with the partners to minimize human impacts to West Indian manatees. The refuge would work with the partners to survey gopher tortoise abundance and distribution, and estimate population density and habitat carrying capacity within the refuge and on Sanibel Island; work with the partners to evaluate the feasibility of translocating gopher tortoises to the refuge from healthy populations which are at risk of habitat loss; and, develop interpretive signs and materials to educate the public about the ecological importance of these unique animals. Refuge volunteers would be assigned to work for SCCF under its marine turtle permit to specifically survey the refuge's Perry Tract for sea turtle nesting; and, staff would work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge. Ornate diamondback terrapins are known to occur on the refuge and have recently been documented on the Wildlife Drive. Diamondback terrapins are susceptible to bycatch in crab traps (particularly smaller males and juvenile females), raccoon predation, and roadkill. To help protect this species and enhance decision-making, the refuge would develop baseline data to better understand population and status and trends and address threats. To enhance management for smalltooth sawfish, Gulf

sturgeon, and other species, the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows.

Under Alternative C, the refuge would expand migratory bird management activities. The refuge would work with partners to identify, manage, and restore the nesting, breeding, roosting, and foraging habitat needs of raptors and birds of prey and nearctic-neotropical migratory birds. Further, the refuge would consider extending the time periods during which raptors and birds of prey and nearctic-neotropical migratory birds would be monitored. The refuge would evaluate the need to relocate osprey nesting platforms away from roadways. To better serve nearctic-neotropical migratory birds, the refuge would select certain shrubs and trees as food sources and potential migrating and nesting sites (e.g., in hardwood hammocks, at Shell Mound, and along Alligator Curve). The refuge would consider using mist nets and banding to help monitor migratory birds. The refuge would work with the partners to better manage and protect nesting and roosting habitat for seabirds, shorebirds, wading birds, waterfowl, and water birds, including creating and enforcing any needed closed area buffers. Water management capabilities would be improved in the impoundments to better serve shorebirds, water birds, and wading birds. The refuge would work with the partners to help maintain healthy fish populations to support migratory bird needs. The refuge would pursue funding to restore and enhance alligator habitat, and it would study and improve alligator habitat needs during times of drought, evaluating the need for deeper freshwater. To also benefit alligators, the refuge would increase education and enforcement efforts to minimize alligator feeding and harassment and develop better methods to control water levels and cattails on the Bailey Tract. The refuge would restore upland habitat at Shell Mound and assess the need to restore Buck Key. It would also fill and/or clear historic drainage ditches that negatively impact habitat or natural flow. The existing ridge along the powerline easement would be restored. The refuge would work with the city of Sanibel and other partners regarding the operation of the city's weir, controlling water levels in the State Botanical Site, and evaluating the restoration of sheet flow. The refuge would work with the partners to reinstate the seagrass beds monitoring program, while also mapping historic and existing seagrass beds in and around the refuge.

Control of exotic, invasive, and nuisance plants and animals would be expanded under Alternative C, with a focus on migratory birds. The refuge would update its list of priority species to control. It would identify and locate new infestations of Category I and Category II invasive upland plants, emphasizing elimination during initial attack and controlling the spread to minimize impacts to migratory birds. Further, the refuge would work with the partners to increase the public's awareness of the negative impacts of exotic, invasive, and nuisance animals, including educating visitors not to feed raccoons and evaluating more effective means of trapping and euthanizing exotic, invasive, and nuisance animals.

Benefitting migratory birds, while also serving numerous species and habitats of management concern, the refuge would expand activities to better coordinate with the partners to address water quality, quantity, and timing of flows related to Lake Okeechobee regulatory releases, drainage in the Caloosahatchee Basin, and local runoff issues. Further, the refuge would work with the USACE to install a water quality monitoring station in Tarpon Bay. Water quality monitoring would be expanded by adding nutrients to the monitoring program and by expanding the number of water quality monitoring locations on the refuge. The refuge would work with the city of Sanibel regarding the operation of its weir. The refuge would work with the partners to evaluate water quality impacts on algal blooms, bird usage, seagrasses, and fish populations in and around the refuge.

Alternative C would include plans to work with the partners to refine and run appropriate climate change models to understand the impacts of climate change on refuge resources with a focus on migratory birds (e.g., re-run the SLAMM model when high resolution LiDAR data become available). The refuge would coordinate with researchers and the partners to understand the impacts of climate change on

refuge resources with a focus on migratory birds, fostering and conducting research as possible. The refuge would continue to work with the MUSIC (MIT-USGS Science Impact Collaborative) partners (FWS/MIT/USGS) to address climate change scenarios under a Strategic Habitat Conservation framework. The refuge would coordinate with researchers and partners to conduct wildlife inventories to establish wildlife population baselines and then identify parameters to measure changes that could affect wildlife diversity, health, abundance, productivity, survival, predator/prey interactions, parasite/host interactions, spatial and temporal distribution, dispersal, migration patterns, phenology, and ultimately population viability. The refuge would also coordinate with researchers and partners to establish habitat benchmarks and then identify parameters to measure changes that could affect environmental health, hydrology, biological integrity, natural community structure, habitat succession, vegetation stratification, habitat diversity, parasite/host interactions, pest abundance, pathogen outbreaks, primary plant productivity, pollination, phenology, and ultimately ecosystem viability. The refuge would also work with researchers and partners to establish landscape benchmarks to measure changes in sea level rise, tidal range, storm surges, subsidence, sedimentation, and shoreline change. As additional data and better models become available, the refuge would consider the impacts of climate change on natural resources and the potentially mitigating or compounding effects of anthropogenic stressors. The refuge would utilize the best available science and employ a strategic habitat conservation approach to anticipate wildlife and habitat adaptation tendencies and to target management actions to facilitate successful adaptation responses to the impacts of climate change. Such actions may include land acquisition, providing wildlife migration corridors, translocating populations, increasing genetic diversity among small isolated populations, manually dispersing seeds, restoring or modifying habitats, altering prescribed fire regimes, adjusting water level management in impoundments, plugging ditches that contribute to saltwater intrusion, aggressively controlling invasive exotics and pests, and participating in carbon sequestration.

Resource Protection

Resource protection management activities and programs under Alternative C would be similar to alternatives B and D, but Alternative C would focus on migratory birds.

Alternative C would allow the refuge to better protect the archaeological and historical resources of the refuge on Sanibel and Captiva Islands; complete the approved acquisition boundary; develop management agreements to protect key resources; and pursue additional special designations for the refuge.

The refuge would coordinate with the State Historic Preservation Officer and the Regional Archaeologist to conduct a complete archaeological and historical survey of the refuge, protecting any newly identified sites. The refuge would actively work with the landowners and other partners to acquire or otherwise protect in perpetuity the historically significant site of “Ding” Darling’s fishing cabin off Captiva Island. Further, the refuge would work with the landowners and other partners to incorporate this site into an interpretive program. The refuge and the partners would seek National Historic Register designation for this site.

To better protect migratory birds, the refuge would pursue completion of the refuge's approved acquisition boundary, develop management agreements for key resources; and pursue additional special designations. Working with the partners and landowners, the refuge would attempt to complete the approved acquisition boundary for those properties with high migratory bird values. To do this, the refuge would work with willing sellers. The refuge would work with the State of Florida to develop appropriate management agreements to implement refuge-managed closed area buffers around sensitive resources (e.g., rookeries). If needed, we would expand the refuge’s acquisition boundary to include these buffers. The refuge would also pursue special designations for the refuge, including Western Hemisphere Shorebird Reserve Network and RAMSAR Wetlands of International Importance.

In addition, the refuge would expand its Wilderness Area program. The refuge would provide Wilderness Area, wilderness stewardship, and wilderness principles information to visitors at the "Ding" Darling Education Center and in environmental education and interpretation programs and materials. Further, it would update refuge materials (e.g., maps, brochures, and websites) to include the Wilderness Area, include Wilderness Area information and interpretation at Tarpon Bay Recreation Area, coordinate with the concessionaire to include wilderness information in its programs, and evaluate methods to improve the wilderness experience on the refuge.

Visitor Services

Although the refuge currently has a robust visitor services program, Alternative C would expand existing visitor services activities to focus messages of all visitor and outreach activities and programs on migratory birds and the minimization of human impacts on these resources and to increase the ethical natural resource behavior of refuge users. In general, existing visitor uses would continue, including fishing, wildlife observation and photography, and environmental education and interpretation, while refuge staff would increase efforts to improve ethical behavior, expand and enhance outreach activities, and maintain the concession approach to facilitating visitor activities and experiences.

To improve welcome and orientation for refuge visitors, the refuge would work with the volunteers, "Ding" Darling Wildlife Society, and partners to modify existing and develop new informational materials that enhance the migratory bird and minimization of human impacts messages that would be delivered to the public at the Visitor Center and through all brochures, kiosks, signs, displays, and programs.

The fishing program would continue with improvements regarding ethical behavior. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on migratory birds in an effort to minimize these impacts (e.g., impacts to shorebirds from fishing activities and impacts to a variety of birds from monofilament fishing line). Further, the refuge would coordinate with the local fishing guides to ensure that all guided trips on the refuge would be covered by a refuge special use permit, which would include stipulations about ethical behavior and messages delivered to clients. The refuge would expand fishing opportunities under Alternative C by developing a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract. This pier would also support youth fishing events.

To improve wildlife observation and photography opportunities and activities, the refuge would work with the partners to develop informational materials to promote migratory birds, the minimization of human impacts, and ethical natural resource behavior. To provide additional opportunities for wildlife observation and photography, the refuge would locate and develop an observation tower at the Bailey Tract. The Wildlife Drive would be evaluated for any needed changes, including evaluating the potential for a bike-only lane on the Wildlife Drive, the potential to close the Wildlife Drive to vehicles one additional day per week, and the potential to open the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts. Further, the refuge would evaluate the fees over the 15-year life of the Plan to maintain appropriate and compatible visitor services, evaluate the potential to add additional tram tours.

To enhance the existing ethical behavior criteria and program, the refuge would evaluate and modify existing or create new brochures, websites, displays, kiosks, signs, and other materials. The refuge would work with the partners to find ways to more effectively convey ethical behavior messages to the public. Working with the Service's NCTC and other partners, the refuge would pursue the creation of an ethical wildlife observation and photography video to help improve user behavior. North American Nature Photography Association ethical standards would be incorporated into ethical behavior materials as applicable. The refuge would coordinate with the SEE SWFL Chapter to evaluate area ecotours for

adherence to ethical behavior standards and to ensure adherence to ethical behavior standards. Further, the refuge would coordinate with other area refuges to engage them in SEE SWFL.

The refuge would enhance the existing environmental education and interpretive opportunities and programs. The refuge would work with the partners to incorporate migratory bird messages into education programs and help ensure that all Lee County 6th grade students attend environmental education programs at the refuge. A park ranger would be hired to assist with this program. The refuge would develop on- and off-site interpretive programs with messages focused on migratory birds and the minimization of human impacts. Staff, volunteers, teachers, and tour operators would be trained to incorporate refuge interpretive themes into programs. The refuge would evaluate the need for and ability to provide parking at the Shell Mound Trail to address existing ad hoc parking and Wildlife Drive congestion issues at this site.

Beyond these programs and activities, the refuge would increase the outreach efforts and activities of the staff, volunteers, and the "Ding" Darling Wildlife Society, focusing outreach efforts and messages on migratory birds and the minimization of impacts from human activities.

In 2013 the refuge's concessionaire agreement would be rebid. At this time, the refuge would evaluate the need to add tram tours to the agreement. Further, the refuge would coordinate future concession operations with the recommendations of the Alternative Transportation in Parks and Public Lands study, now called the Paul S. Sarbanes Transit in Parks Program.

Refuge Administration

To help accomplish the outlined actions, Alternative C would be similar to alternatives B and D and the refuge would convert the temporary fee-funded law enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions): wildlife biologist, biological science technician, two law enforcement officers, and park ranger (environmental education/outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25 percent operating margin, this total is $663,381.

Activities of the volunteers and the "Ding" Darling Wildlife Society would be enhanced. A park ranger would be hired to help support coordination with both groups, including acting as the volunteer coordinator whose duties would include staff-led training of volunteers, and oversight of the volunteer program, tours, education, interpretation, outreach, and other activities. The refuge would strive to increase the number of volunteers available throughout the year and increase the interaction between refuge staff and volunteers to enhance cohesiveness of the refuge team.

Throughout the life of the CCP, the refuge would improve and update facilities as needed. Additional facilities to be developed through the CCP would include the "Ding" Darling fishing cabin, an observation tower at the Bailey Tract, and a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract, while the potential exists for an expanded or new parking area for Shell Mound Trail. The refuge would work with SCCF to replace the existing Marine Research Lab, located at Tarpon Bay.

To accomplish the outlined activities and to support common goals, the refuge would foster strong and effective working relationships with existing and new partners to meet refuge management goals and protect the natural and cultural resources of Sanibel and Captiva Islands.

Historically, a single commercial bait fisherman has operated on the refuge. In line with regional compatibility guidance and to limit the impacts from commercial fishing activities, the refuge would phase out commercial bait fishing activities from the refuge during the life of the CCP.

ALTERNATIVE D (RARE, THREATENED, AND ENDANGERED SPECIES)

Alternative D would focus on increasing refuge management actions that promote the recovery of rare, threatened, and endangered species occurring on Sanibel and Captiva Islands and adjacent waters.

Wildlife and Habitat Diversity

Alternative D would expand the current wildlife and habitat management activities of the refuge to better serve rare, threatened, and endangered species.

Under Alternative D, key rare, threatened, and endangered species for the refuge include wood storks; roseate spoonbills; bald eagles; mangrove cuckoos; black-whiskered vireos; gray kingbirds; Florida prairie warblers; eastern indigo snakes; gopher tortoises; West Indian manatees; American crocodiles; loggerhead, green, Kemp's ridley, and hawksbill sea turtles; snowy and piping plovers; red knots; Sanibel rice rat; and ornate diamondback terrapins. Specifically for wood storks, the refuge would work with the partners to support recovery, including by conducting surveys, fostering research, improving habitat management, conducting habitat restoration activities, increasing public awareness, and minimizing disturbances. Key activities would include the identification, protection, restoration, and enhancement of wood stork and roseate spoonbill foraging and roosting habitats. For both wood storks and roseate spoonbills, the refuge would work with the partners to identify colony origins to help develop a better understanding of their habitat needs and movement in the landscape. Where bald eagle nesting is discovered, the refuge would work to minimize disturbance to these sites. For mangrove forest birds, including mangrove cuckoos, black-whiskered vireos, gray kingbirds, and Florida prairie warblers; the refuge would restore and maintain mangrove habitat at Alligator Curve, restore and maintain hardwood hammocks on the ridges at Shell Mound; and work with the partners to research the effectiveness of survey protocols with nesting cycles and timing. To benefit eastern indigo snakes, the refuge would improve support of recovery through surveys, monitoring, and translocations. The refuge would work with the partners to translocate Eastern indigo snakes from off the refuge (e.g., from the C-43 Basin Storage Reservoir), particularly from nearby populations that have similar phenotypes (lacking the reddish-orange throat). To increase benefits to and protection of gopher tortoises, the refuge would evaluate the use of barriers to movement and wildlife underpasses to minimize vehicle collisions and the refuge would work with the partners to research the population movement on Sanibel Island. Surveys would be conducted to document gopher tortoise burrow locations and use by a variety of other species, including eastern indigo snakes. Active management would help restore and maintain suitable habitat for gopher tortoises. The refuge would also work with the partners to increase protection and awareness of manatees and to minimize negative impacts. Increasing public awareness, understanding, and education of residents and alligator trappers of American crocodiles, their habitat needs, and the differences between American alligators and American crocodiles would help to minimize threats to crocodiles and to humans. The refuge would work with the partners to minimize impacts, understand and manage nearshore habitats, and better coordinate data would benefit sea turtles using Sanibel Island. The refuge would work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge. The refuge would also work with the partners to monitor beach profile changes over time in relation to climate change impacts and sea level rise. For snowy plovers and piping plovers, the refuge would work with the partners to minimize impacts, understand and manage beach habitats and disturbances, and monitor beach profile changes over time in relation to climate change and sea level rise. For snowy plover beach nesting areas, the

refuge would work with the partners to ensure that no human disturbances negatively impact them. Also for snowy plovers, the refuge would work with the partners to evaluate the need for and develop a plan to address seasonal beach nesting closures on the Perry Tract. Although piping plovers do not currently occur on the refuge, they do occur in the area and the refuge would work with the partners to conduct winter surveys to monitor for presence/absence and would ensure that no human disturbances negatively impacted any site in use by piping plovers. To better serve red knots, the refuge would improve water management capabilities in the impoundments. To expand management for the Sanibel rice rat, the refuge would restore Sanibel rice rat habitats and conduct intensive population trends monitoring, permanent marking, and expanded trapping efforts to determine habitats used. The refuge would work with the city of Sanibel to control water levels and evaluate the restoration of sheet flow on the State Botanical Site to better serve rice rats. The refuge would coordinate with the partners to initiate surveys for the ornate diamondback terrapin to determine its population status on Sanibel Island. Further, the refuge would work with the partners to determine the threats to ornate diamondback terrapins and minimize negative impacts.

Under Alternative D, the refuge would expand management activities to benefit other rare, threatened, and endangered species using the refuge. The refuge would work with the partners to better manage and protect nesting and roosting habitat for rare, threatened, and endangered wading birds, waterfowl, and water birds, including creating and enforcing any needed closed area buffers. The refuge would pursue funding to restore and enhance alligator habitat. It would study and improve alligator habitat needs during times of drought, evaluating the need for deeper fresh water. To also benefit alligators, the refuge would increase education and enforcement efforts to minimize alligator feeding and harassment and develop better methods to control water levels and cattails on the Bailey Tract. The refuge would restore upland habitat at Shell Mound and assess the need to restore Buck Key. It would also fill and/or clear historic drainage ditches that negatively impact habitat or natural flow. The existing ridge along the powerline easement would be restored. The refuge would work with the city of Sanibel and other partners regarding the operation of the city's weir, controlling water levels in the State Botanical Site, and evaluating the restoration of sheet flow. The refuge would work with the partners to reinstate the seagrass beds monitoring program, while also mapping historic and existing seagrass beds in and around the refuge. The refuge would take a more active role in protecting, restoring, and maintaining seagrass beds.

Control of exotic, invasive, and nuisance plants and animals would be expanded under Alternative D, with a focus on high priority habitats serving rare, threatened, and endangered species. The refuge would update its list of priority species to control. It would identify and locate new infestations of Category I and Category II invasive upland plants, emphasizing elimination during initial attack and controlling the spread to minimize impacts to rare, threatened, and endangered species. Further, the refuge would work with the partners to increase the public's awareness of the negative impacts of exotic, invasive, and nuisance animals, including educating visitors not to feed raccoons and evaluating more effective means of trapping and euthanizing exotic, invasive, and nuisance animals.

Benefitting rare, threatened, and endangered species, while also serving numerous species and habitats of management concern, the refuge would expand activities to better coordinate with the partners to address water quality, quantity, and timing of flows related to Lake Okeechobee regulatory releases, drainage in the Caloosahatchee Basin, and local runoff issues. Further, the refuge would work with the USACE to install a water quality monitoring station in Tarpon Bay. Water quality monitoring would be expanded by adding nutrients to the monitoring program and by expanding the number of water quality monitoring locations on the refuge. The refuge would work with the city of Sanibel regarding the operation of its weir. The refuge would work with the partners to evaluate water quality impacts on algal blooms, bird usage, seagrasses, and fish populations in and around the refuge to better understand the impacts on rare, threatened, and endangered species.

Alternative D includes plans to work with the partners to refine and run appropriate climate change models to understand the impacts of climate change on refuge resources with a focus on rare, threatened, and endangered species (e.g., re-run the SLAMM model when high resolution LiDAR data become available). The refuge would coordinate with researchers and the partners to understand the impacts of climate change on refuge resources with a focus on rare, threatened, and endangered species, fostering and conducting research as possible. The refuge would work with the partners to establish benchmarks in relation to sea level rise and shoreline change. As additional data and better models become available, the refuge would adapt management as necessary to respond to the impacts of climate change.

Resource Protection

Resource protection management activities and programs under Alternative D would be similar to alternatives B and C, but Alternative D would focus on rare, threatened, and endangered species.

Alternative D would allow the refuge to better protect the archaeological and historical resources of the refuge on Sanibel and Captiva Islands; complete the approved acquisition boundary; develop management agreements to protect key resources; and pursue additional special designations for the refuge.

The refuge would coordinate with the State Historic Preservation Officer and the Regional Archaeologist to conduct a complete archaeological and historical survey of the refuge, protecting any newly identified sites. The refuge would actively work with the landowners and other partners to acquire or otherwise protect in perpetuity the historically significant site of “Ding” Darling’s fishing cabin off Captiva Island. Further, the refuge would work with the landowners and other partners to incorporate this site into an interpretive program. The refuge and the partners would seek National Historic Register designation for this site.

To better protect rare, threatened, and endangered species, the refuge would pursue completion of the refuge's approved acquisition boundary, develop management agreements for key resources; and pursue additional special designations. Working with the partners and landowners, the refuge would attempt to complete the approved acquisition boundary for those properties with high values for rare, threatened, and endangered species. To do this, the refuge would work with willing sellers. The refuge would work with the State of Florida to develop appropriate management agreements to implement refuge-managed closed area buffers around sensitive resources serving rare, threatened, and endangered species (e.g., rookeries). If needed, management would expand the refuge’s acquisition boundary to include these closed area buffers in the refuge (e.g., through a MEP). The refuge would also pursue special designations for the refuge, including Western Hemisphere Shorebird Reserve Network and RAMSAR Wetlands of International Importance.

In addition, the refuge would expand its Wilderness Area program. The refuge would provide Wilderness Area, wilderness stewardship, and wilderness principles information to visitors at the “Ding” Darling Education Center and in environmental education and interpretation programs and materials. Further, it would update refuge materials (e.g., maps, brochures, and websites) to include the Wilderness Area, include Wilderness Area information and interpretation at Tarpon Bay Recreation Area, coordinate with the concessionaire to include wilderness information in its programs, and evaluate methods to improve the wilderness experience on the refuge.

Visitor Services

Although the refuge currently has a robust visitor services program, Alternative D would expand existing visitor services activities to focus messages of all visitor and outreach activities and programs on rare, threatened, and endangered species and the minimization of human impacts on these resources and to increase the ethical natural resource behavior of refuge users. In general, existing visitor uses would continue, including fishing, wildlife observation and photography, and environmental education and interpretation, while refuge staff would increase efforts to improve ethical behavior, expand and enhance outreach activities, and maintain the concession approach to facilitating visitor activities and experiences.

To improve welcome and orientation for refuge visitors, the refuge would work with the volunteers, "Ding" Darling Wildlife Society, and partners to modify existing and develop new informational materials that enhance the rare, threatened, and endangered species and minimization of human impacts messages that would be delivered to the public at the Visitor Center and through all brochures, kiosks, signs, displays, and programs.

The fishing program would continue with improvements regarding ethical behavior. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on rare, threatened, and endangered species in an effort to minimize these impacts (e.g., from monofilament fishing line). Further, the refuge would coordinate with the local fishing guides to ensure that all guided trips on the refuge would be covered by a refuge special use permit, which would include stipulations about ethical behavior and messages delivered to clients.

To improve wildlife observation and photography opportunities and activities, the refuge would work with the partners to develop informational materials to promote rare, threatened, and endangered species; the minimization of human impacts; and ethical natural resource behavior. To provide additional opportunities for wildlife observation and photography, the refuge would locate and develop an observation tower at the Bailey Tract. The Wildlife Drive would be evaluated for any needed changes, including evaluating the potential for a bike-only lane on the Wildlife Drive, the potential to close the Wildlife Drive to vehicles one additional day per week, and the potential to open the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts. Further, the refuge would evaluate the fees over the 15-year life of the CCP to maintain appropriate and compatible visitor services, and evaluate the potential to add additional tram tours.

To enhance the existing ethical behavior criteria and program, the refuge would evaluate and modify existing or create new brochures, websites, displays, kiosks, signs, and other materials. The refuge would work with the partners to find ways to more effectively convey ethical behavior messages to the public. Working with the Service's NCTC and other partners, the refuge would pursue the creation of an ethical wildlife observation and photography video to help improve user behavior. North American Nature Photography Association ethical standards would be incorporated into ethical behavior materials as applicable. The refuge would coordinate with the SEE SWFL Chapter to evaluate area ecotours for adherence to ethical behavior standards and to ensure adherence to ethical behavior standards. The refuge would coordinate with other area refuges to engage them in SEE SWFL.

The refuge would enhance the existing environmental education and interpretive opportunities and programs. The refuge would work with the partners to incorporate rare, threatened, and endangered species messages into education programs and help ensure that all Lee County 6th grade students attend environmental education programs at the refuge. A park ranger would be hired to assist with this program. The refuge would develop on- and off-site interpretive programs with messages focused on rare, threatened, and endangered species and the minimization of human impacts. Staff,

volunteers, teachers, and tour operators would be trained to incorporate refuge interpretive themes into programs. The refuge would evaluate the need for and ability to provide parking at the Shell Mound Trail to address existing ad hoc parking and Wildlife Drive congestion issues at this site.

Beyond these programs and activities, the refuge would increase the outreach efforts and activities of the staff, volunteers, and the “Ding” Darling Wildlife Society, focusing outreach efforts and messages on migratory birds and the minimization of impacts from human activities.

In 2013 the refuge’s concessionaire agreement would be rebid. At this time, the refuge would evaluate the need to add tram tours to the agreement. Further, the refuge would coordinate future concession operations with the recommendations of the Alternative Transportation in Parks and Public Lands study, now called the Paul S. Sarbanes Transit in Parks Program.

Refuge Administration

To help accomplish the outlined actions, Alternative D would be similar to alternatives B and C and the refuge would convert the temporary fee-funded law enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions): wildlife biologist, biological science technician, two law enforcement officers, and park ranger (environmental education/outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25 percent operating margin, this total is $663,381.

Activities of the volunteers and the “Ding” Darling Wildlife Society would be enhanced. A park ranger would be hired to help support coordination with both groups, including acting as the volunteer coordinator whose duties would include staff-led training of volunteers, and oversight of the volunteer program, tours, education, interpretation, outreach, and other activities. The refuge would strive to increase the number of volunteers available throughout year and increase the interaction between refuge staff and volunteers to enhance cohesiveness of the refuge team.

Throughout the life of the CCP, the refuge would improve and update facilities as needed. Additional facilities to be developed through the CCP would include the “Ding” Darling fishing cabin and an observation tower at the Bailey Tract, while the potential exists for an expanded or new parking area for Shell Mound Trail. The refuge would work with SCCF to replace the existing Marine Research Lab, located at Tarpon Bay.

To accomplish the outlined activities and to support common goals, the refuge would foster strong and effective working relationships with existing and new partners to meet refuge management goals and protect the natural and cultural resources of Sanibel and Captiva Islands.

Historically, a single commercial bait fisherman has operated on the refuge. In line with regional compatibility guidance and to limit the impacts from commercial fishing activities, the refuge would phase out commercial bait fishing activities from the refuge during the life of the CCP.

FEATURES COMMON TO ALL ALTERNATIVES

Many elements of refuge management are common to all of the alternatives. All management activities that could impact natural resources, utility easements, soil, water, air, contaminants, and archaeological and historical resources would be managed to comply with all applicable laws, regulations, and policies. All alternatives are subject to all applicable future permit requirements. Individual projects may require consultation with the Service's Regional Archaeologist and the State

of Florida's Historic Preservation Office. Additional consultation, surveys, and clearance may be required where project development would be conducted on the refuge or when activities would affect properties eligible for the National Historic Register.

COMPARISON OF THE ALTERNATIVES BY ISSUE

Each alternative is different in the type and level of management and protection it would offer to achieve long-term wildlife and habitat management, resource protection, visitor services, and refuge administration goals. However, each is similar in its approach to managing the refuge. Each alternative would pursue the goals outlined in the CCP; would acquire, protect, and enhance a diverse assemblage of habitat; and would pursue the recovery plans for those federally listed threatened and endangered species occurring on the refuge. Each alternative would be consistent with the purposes of the refuge and with the mission and goals of the Refuge System.

Table 17 identifies and compares the management actions under each alternative as a means of responding to the issues raised by Service managers, the public, and government partners. These management actions were summarized under the four alternatives previously described to accomplish the Refuge System mission and the purposes, vision, and goals of the refuge and to address the priority threats and issues raised by government agencies, private citizens, local businesses, and interested organizations.

Table 17. Comparison of alternatives by management issues for J.N. "Ding" Darling NWR

Impact Topics	Alternative A Current Management (No Action Alternative)	Alternative B Native Wildlife and Habitat Diversity	Alternative C Migratory Birds (Proposed Action)	Alternative D Rare, Threatened, and Endangered Species
Wildlife and Habitat Management				
Rare, Threatened, and Endangered Species Goal 1: Minimize the threats to and promote the recovery of the rare, threatened, and endangered species occurring on Sanibel and Captiva Islands and in adjacent waters.				
Wood Stork	Surveys conducted from March through September, every two weeks. Wildlife Drive surveys are conducted twice per month during low tide. During drawdowns, survey the Wildlife Drive during low tide weekly, plus conduct impoundment surveys at high tide weekly. Participate in the Christmas Bird Count. Support Recovery Plan through surveys.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows, improving support of Recovery Plan.	Expand Alternative A. Improve support of Recovery Plan, including conducting surveys, improving habitat management, and conducting habitat restoration. Coordinate with partners to address water quality, quantity, and timing of flows. Work with partners to identify, protect, restore, and enhance wood stork foraging and roosting habitats. The refuge would also coordinate with the Service's lead on wood storks at the Jacksonville Ecological Services Field Office to help develop an understanding of the colony origin and the foraging range and location for the wood storks using the refuge.	Expand Alternative A. Improve support of Recovery Plan, including conducting surveys, fostering research, improving habitat management, conducting habitat restoration, increasing public awareness, and minimizing disturbances. Coordinate with partners to address water quality, quantity, and timing of flows. Work with partners to identify, protect, restore, and enhance wood stork foraging and roosting habitats. Foster research to identify colony origin. Increase awareness and understanding of the impact of disturbance to wood stork foraging and roosting habitat.
Roseate	Surveys conducted from	Expand Alternative A.	Expand Alternative A.	Expand Alternative A.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Spoonbill	March through September, every two weeks. Wildlife Drive surveys are conducted twice per month during low tide. During drawdowns, survey the Wildlife Drive during low tide weekly, plus conduct impoundment surveys at high tide weekly. Participate in the Christmas Bird Count.	Coordinate with partners to address water quality, quantity, and timing of flows.	Coordinate with partners to address water quality, quantity, and timing of flows. Work with partners to identify, protect, restore, and enhance spoonbill foraging and roosting habitats. During the life of the CCP, the refuge would work with the partners and foster research to determine the colony origin and foraging range and location for those roseate spoonbills using the refuge.	Coordinate with partners to address water quality, quantity, and timing of flows. Work with partners to identify, protect, restore, and enhance spoonbill foraging and roosting habitats. Foster research to identify colony origin. Increase awareness and understanding of the impact of disturbance to spoonbill foraging and roosting habitat.
Bald Eagle	Include in Wildlife Drive surveys. Participate in the Christmas Bird Count.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Where nesting is discovered, minimize disturbance to these sites.	Same as Alternative B.	Same as Alternative B.
Mangrove Cuckoo	Survey from April through June with weekly call-back surveys. Breeding bird protocol implemented on the Wildlife Drive and nesting sites.	Expand Alternative A. Restore mangrove habitat at Alligator Curve.	Expand Alternative A. Restore mangrove habitat at Alligator Curve. Research the effectiveness of survey protocols with nesting cycles and timing.	Same as Alternative C.
Other Mangrove Forest Birds (black-whiskered vireo, gray kingbird, and Florida prairie warbler)	Survey from April through June with weekly call-back surveys. Breeding bird protocol implemented on the Wildlife Drive and nesting sites.	Expand Alternative A. Restore mangrove habitat at Alligator Curve.	Expand Alternative A. Restore mangrove habitat at Alligator Curve. Research the effectiveness of survey protocols with nesting cycles and timing. Maintain and restore hardwood hammock habitat on ridges and at Shell Mound.	Same as Alternative C.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Eastern Indigo Snake	Prescribed fire management. No individuals sighted on the refuge recently. Historic surveys by refuge. Working with partners to monitor presence/absence and study the movements of the Eastern Indigo snake on Sanibel Island, supporting the Recovery Plan	Expand Alternative A. Include in fire management monitoring activities.	Same as Alternative A.	Expand Alternative A. Improve support of Recovery Plan through surveys, monitoring, and translocations. Include in fire management monitoring activities. Work with partners to translocate Eastern indigo snakes from off refuge (e.g., C-43 Basin Storage Reservoir). Survey gopher tortoise burrows for presence of indigo snakes.
Gopher Tortoise	Prescribed fire management. Have posted gopher tortoise crossing signs.	Expand Alternative A. Consider barriers to movement to minimize vehicle collisions. Work with partners to consider wildlife underpasses. Survey and document locations of burrows. Restore and maintain suitable habitat.	Expand Alternative A. The refuge would work with the partners to survey gopher tortoise abundance and distribution, and estimate population density and habitat carrying capacity within the refuge and on Sanibel Island; work with the partners to evaluate the feasibility of translocating gopher tortoises to the refuge from healthy populations which are at risk of habitat loss; and, develop interpretative signs and materials to educate the public about the ecological importance of these unique animals.	Expand Alternative A. Consider barriers to movement to minimize vehicle collisions. Work with partners to consider wildlife underpasses. Survey and document locations of burrows. Restore and maintain suitable habitat. Work with partners to research population movement on Sanibel Island.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
West Indian Manatee	Conduct regular law enforcement patrols with partners of speed zones and no-motor zone. Participate in Marine Mammal Stranding Network. Critical habitat designated on the refuge. Protect and maintain refuge seagrass beds. Support Recovery Plan, including Marine Mammal Stranding Network, law enforcement, intergovernmental coordination, environmental education and interpretation, and outreach.	Expand Alternative A. Improve support of Recovery Plan. Coordinate with partners to address water quality, quantity, and timing of flows. Work with partners to minimize impacts to manatees.	Same as Alternative A.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Protect, restore and maintain refuge seagrass beds. Work with partners to minimize impacts to manatees. Increase awareness and understanding of manatees, their habitat needs, and minimizing negative impacts. Improve support of Recovery Plan.
American Crocodile	Work with partners to educate residents to proactively address crocodile-human interactions. Refuge sends staff or volunteer when a crocodile is in public use areas to minimize crocodile-human interactions. Support Recovery Plan.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows.	Same as Alternative B.	Expand Alternative A. Improve support of recovery plan, including establishing a breeding population, increasing public awareness and minimizing threats. Coordinate with partners to address water quality, quantity, and timing of flows. Increase awareness and education of residents and trappers of the differences between alligators and crocodiles. Increase awareness and understanding of crocodiles, habitat needs, and minimizing threats to crocodiles and humans.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Sea Turtles (including loggerhead, green, Kemp's Ridley, and hawksbill sea turtles)	Coordinate with partners to conduct nest surveys for loggerheads. Coordinate with partners on lighting issues and beach activities. Partners very actively address lighting and beach furniture issues. Support the Recovery Plan.	Expand Alternative A. Improve support of Recovery Plan. Work with partners to minimize impacts to sea turtles and to understand and manage nearshore habitats. Monitor beach profile changes over time as related to climate change and sea level rise.	Expand Alternative A. Assign refuge volunteers to work for SCCF under its marine turtle permit to specifically survey the refuge's Perry Tract for sea turtle nesting. And work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge. (Where conflicts exist, sea turtle surveys would be secondary to migratory bird management needs.)	Expand Alternative B. Improve support of Recovery Plan, including minimizing impacts, managing nearshore habitats, and better coordinating data. Work with partners to minimize impacts to sea turtles and to understand and manage nearshore habitats. Monitor beach profile changes over time as related to climate change and sea level rise. Work more closely with partners to obtain monitoring data for refuge. And work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge.
Snowy Plover	Work with partners to survey and monitor nesting success and predation. Prevent human disturbance during nesting season. Dogs on beach must be leashed. Banding project with partners.	Expand Alternative A. Work with partners to minimize impacts to snowy plovers. Monitor beach profile changes over time as related to climate change and sea level rise.	Expand Alternative A. Work with partners to minimize impacts to snowy plovers and to understand and manage beach habitats and disturbances. Monitor beach profile changes over time as related to climate change and sea level rise. Alter sea turtle nest survey methods to minimize impacts, if necessary. Work with partners to ensure no human disturbance on beach nesting areas. Work with partners to evaluate need for and develop plan to address seasonal nesting closures on the Perry Tract.	Same as Alternative C.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Piping Plover	No current management. Although in the area, piping plovers are not currently known to be using the shorelines of Sanibel Island.	Expand Alternative A. Support Recovery Plan, including conducting winter surveys and minimizing impacts. Work with partners to survey and monitor for presence/absence during winter. Work with partners to minimize impacts to piping plovers. Monitor beach profile changes over time as related to climate change and sea level rise.	Expand Alternative A. Support Recovery Plan, including conducting winter surveys, minimizing impacts and disturbances, and increasing public awareness. Work with partners to survey and monitor for presence/absence during winter. Work with partners to minimize impacts to piping plovers and to understand and manage beach habitats and disturbances. Alter sea turtle nest survey methods to minimize impacts, if necessary. Work with partners to ensure no human disturbance on beach areas being used by piping plovers. Monitor beach profile changes over time as related to climate change and sea level rise.	Same as Alternative C.
Red Knot	Conduct shorebird monitoring from September through May, three times per month. Whenever red knots are seen on the refuge, bands are reported. Manage impoundments for shorebird foraging habitat during fall and spring. Survey impoundments weekly during drawdowns during high tides.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Improve water management capabilities in impoundments to better serve the needs of shorebirds.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Sanibel Rice Rat	Work with partners to conduct habitat management (e.g., prescribed fire) and monitoring activities. Current status is unknown.	Expand Alternative A. Modify and restore habitats to serve rice rats. Conduct intensive monitoring and permanent marking for population trends. Expand trapping effort to additional areas to determine habitats used. Work with city of Sanibel to control water levels in Botanical Site to enhance refuge management activities. Coordinate with partners to evaluate restoration of sheet flow on the Botanical Site, including filling ditches.	Alter Alternative A. If necessary, alter surveys to minimize impacts to migratory birds. Modify and restore habitats to serve rice rats. Conduct intensive monitoring and permanent marking for population trends. Expand trapping effort to additional areas to determine habitats used.	Same as Alternative B.
Ornate Diamondback Terrapin	No current management.	Expand Alternative A. Coordinate with partners to initiate surveys and determine population status on Sanibel Island.	Expand Alternative A. Coordinate with the partners to initiate surveys to develop baseline data for the ornate diamondback terrapin and determine population status and trends within the refuge, including nesting success and bycatch mortality.	Expand Alternative A. Coordinate with the partners to initiate surveys to develop baseline data for the ornate diamondback terrapin and determine population status and trends within the refuge, including nesting success and bycatch mortality. Determine threats and minimize negative impacts.
Smalltooth Sawfish	No current management. Critical habitat is designated on the refuge.	Same as Alternative A.	Expand Alternative A. To enhance management for smalltooth sawfish (and other species), the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows.	Same as Alternative C.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Gulf Sturgeon	No current management.	Same as Alternative A.	Expand Alternative A. The refuge would increase coordination with the partners to minimize impacts to Gulf sturgeon in and around the refuge. The refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows.	Same as Alternative C.
Wildlife and Habitat Diversity Goal 2: Conserve, restore, enhance, and manage the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands to maintain and enhance their biological integrity and to support species diversity and abundance of native plants and animals, with an emphasis on migratory birds.				
Raptors and Birds of Prey	Breeding bird surveys in summer, migratory bird surveys in fall and spring. Wildlife Drive surveys twice per month during low tide. Participate in Christmas Bird Count. Maintain nest platforms for ospreys and nest boxes for owls. Osprey nests on Sanibel Island monitored by Osprey Foundation. Partners conduct hawk watch.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Identify, manage, and restore the nesting, breeding, roosting, and foraging habitat needs of raptors and birds of prey (e.g., hardwood hammocks, Shell Mound, and Alligator Curve).	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Identify, manage, and restore the nesting, breeding, roosting, and foraging habitat needs of raptors and birds of prey (e.g., hardwood hammocks, Shell Mound, and Alligator Curve). Consider extending monitoring periods. Work with partners to restore and maintain habitat for raptors and birds of prey. Evaluate need to relocate osprey nesting platforms away from roadway.	Same as Alternative A.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Nearctic-Neotropical Migratory Birds	Breeding bird surveys conducted in summer, migratory bird surveys conducted in fall and spring. Participate in Christmas Bird Count.	Expand Alternative A. Identify and manage the habitat needs of neartic-neotropical migratory birds. Select for certain shrubs and trees as food sources and potential migration and nesting habitats (e.g., hardwood hammocks, Shell Mound, and Alligator Curve).	Expand Alternative A. Consider extending monitoring periods. Consider using mist nets and banding. Identify and manage for the habitat needs of those neartic-neotropical migratory birds using the refuge. Select certain shrubs and trees as food sources and potential migration and nesting habitats (e.g., hardwood hammocks, Shell Mound, and Alligator Curve). Work with partners to restore and maintain migratory bird habitat. Restore mangrove habitat at Alligator Curve.	Same as Alternative A.
Shorebirds and Seabirds	Conduct shorebird monitoring from September through May, three times per month. Whenever seen on refuge, bands are reported. Manage impoundments for shorebird foraging habitat during fall and spring. Survey weekly during drawdowns during high tides. Survey seabirds during Wildlife Drive surveys, which are twice per month during low tide. During drawdowns survey Wildlife Drive at low tide weekly. Participate in Christmas Bird Count. Breeding bird surveys conducted in May.	Expand Alternative A Coordinate with partners to address water quality, quantity, and timing of flows. Improve water management capabilities in impoundments to better serve shorebirds.	Expand Alternative A. Improve water management capabilities in impoundments to better serve shorebirds. Work with partners to manage water levels to benefit migrating shorebirds. With partners, provide, manage, and protect beach nesting habitat, including creating and enforcing closed area buffers around nesting areas. Alter sea turtle nest survey methods to minimize impacts to shorebirds, if necessary. Work with partners to ensure no human disturbance on beach nesting areas.	Same as Alternative A.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Wading Birds, Water Birds, and Waterfowl (except for wood storks and roseate spoonbills)	Surveys conducted from March through September, every two weeks. Wildlife Drive Surveys conducted twice per month during low tide. During drawdowns survey Wildlife Drive at low tide weekly, plus conduct impoundment surveys at high tide weekly. Participate in the Christmas Bird Count. Breeding bird surveys conducted in May. Colonial nesting bird surveys conducted monthly from February through July. Protect and maintain refuge seagrass beds.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Coordinate with partners to establish closed area buffers around the rookeries.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Restore refuge seagrass beds.
Fish Spawning, Settlement, and Nursery Sites	Current status is unknown. Seine three times a year to determine composition and juvenile and baitfish populations.	Expand Alternative A. Work with partners and researchers to identify important spawning, settlement, and nursery sites on the refuge. Coordinate with partners to address water quality, quantity, and timing of flows.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Maintain healthy fish populations to support migratory bird needs.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows.
Areas Affected by Hurricane Charley	Old growth mangrove restoration project for Alligator Curve currently in planning phases and pursuing funding. Ditch clearing occurring in some areas.	Expand Alternative A. Restore Shell Mound. Complete ditch clearing. Assess need for habitat restoration at Buck Key.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
American Alligator	Alligator Curve project will restore tidal flow and alter existing alligator habitat. Haze and/or move habituated alligators. Alligator survey and monitoring activities conducted to monitor the population on Sanibel. The 2005 change in the city of Sanibel's nuisance alligator policy has reduced the alligator population on Sanibel Island.	Expand Alternative A. Pursue funding to restore and enhance alligator habitat. Evaluate need for deeper fresh water habitat to serve alligator needs during times of drought. Develop the ability to control water levels on the Bailey Tract. Coordinate with partners to increase education and enforcement on and off-refuge to minimize alligator feeding and harassment.	Same as Alternative B.	Same as Alternative B.
Mangrove Habitat	Old growth mangrove restoration project for Alligator Curve currently in planning phases and pursuing funding. Monitoring on success of restoration. Research being conducted on impounded and unimpounded mangroves on Sanibel Island. Ditch clearing occurring in some areas.	Expand Alternative A. Conduct and coordinate with partners to achieve mangrove restoration and research activities. Fill in historic drainage ditches that negatively impact the desired habitat.	Same as Alternative B.	Same as Alternative B.
Uplands Habitat	No active management. Wildlife surveys and exotic plant control conducted within uplands.	Expand Alternative A. Restore Shell Mound. Assess need for habitat restoration at Buck Key. Restore existing ridge along powerline easement. Restore gopher tortoise habitat. Fill in historic drainage ditches that negatively impact the desired habitat.	Expand Alternative A. Prioritize the needs of migratory birds in all restoration plans. Restore Shell Mound. Assess need for habitat restoration at Buck Key. Fill in historic drainage ditches that negatively impact the desired habitat.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Interior Wetlands Habitat	For spartina areas, implement prescribed fire on a 3-5-year rotation. Conduct fuel and fire-effects monitoring and exotic plant control in interior wetlands. Water quality monitoring conducted in ponds on Bailey Tract.	Expand Alternative A. Work with city of Sanibel to control water levels in Botanical Site to enhance refuge management activities. Coordinate with partners to evaluate restoration of sheet flow on the Botanical Site, including filling ditches. Develop the ability to control water levels and cattails on the Bailey Tract.	Same as Alternative B.	Same as Alternative B.
Seagrass Beds	Historically surveyed seagrass beds. Fish seining activities help assess habitat quality. No-motor and speed zones help protect seagrasses. Protect and maintain refuge seagrass beds. Seagrasses negatively impacted by 2006 algae outbreak.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Reinstate monitoring program for seagrass beds. Work with partners to map historic and existing seagrass beds.	Same as Alternative B.	Expand Alternative A. Coordinate with partners to address water quality, quantity, and timing of flows. Reinstate monitoring program for seagrass beds. Work with partners to map historic and existing seagrass beds. Protect, restore, and maintain refuge seagrass beds.
<u>Exotic, Invasive, and Nuisance Species</u> Goal 3: Eliminate existing and future exotic, invasive, and nuisance species on the refuge to maintain and enhance the biological integrity of the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands.				
Control of Exotic, Invasive, and Nuisance Plants	Treat half upland acreage annually. Work with partners to control exotic plants on Island conservation lands. Limited treatment of native invasive plants. Opportunistically remove exotics on Shell	Expand Alternative A. Update list of refuge priority species to control. Identify and locate new infestations of Category I and Category II invasive upland plants. Conduct initial attack with an emphasis on elimination.	Expand Alternative A. Focus exotic plant control efforts on high priority habitats for migratory birds. Identify and locate new infestations of Category I and Category II invasive upland plants. Conduct	Expand Alternative A. Focus exotic plant control efforts on high priority habitats for rare, threatened, and endangered species. Identify and locate new infestations of Category I and Category II invasive

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	Mound trail, about 5 times per year.	Control spread of existing, invasive, exotic, and nuisance plants to reduce adverse impacts to wildlife and habitat diversity.	initial attack with an emphasis on elimination. Control spread of existing, invasive, exotic, and nuisance plants to reduce adverse impacts to migratory birds and their habitats.	upland plants. Conduct initial attack with an emphasis on elimination. Control spread of existing, invasive, exotic, and nuisance plants to reduce adverse impacts to rare, threatened, and endangered species and their habitats.
Control of Exotic, Invasive, and Nuisance Animals	Partner with city of Sanibel to remove and euthanize iguanas and monitor lizards both off-site and on-site. Conduct small mammal trapping and evaluate euthanasia of black rats. Conduct pest control at refuge facilities for black rats. Haze and/or euthanize nuisance raccoons.	Expand Alternative A. Coordinate with partners to increase education on and off the refuge to minimize raccoon feeding. Work with partners to increase awareness of negative impacts of exotic, invasive, and nuisance animals. Evaluate more effective means of trapping and euthanizing exotic, invasive, and nuisance animals.	Same as Alternative B.	Same as Alternative B.
<u>Water Quality, Quantity, and Timing of Flows</u> Goal 4: Work with the partners to address and resolve the water quality, quantity, and timing of flow concerns associated with the watershed of the refuge; Lake Okeechobee releases to the west; the watershed of the Caloosahatchee River; and the Gulf of Mexico.				
Impacts from Water Quality, Quantity, and Timing (including Lake Okeechobee regulatory releases,	Coordinate with USACE, Operations Division on implementation of Lake Okeechobee regulation schedule. Coordinate with Ecological Services for Fish and Wildlife Coordination Act input on new regulation	Expand Alternative A. Work with the partners to address water quality, quantity, and timing concerns. Add nutrients to and expand water quality monitoring locations in the refuge. Coordinate with city	Expand Alternative A. Work with the partners to address water quality, quantity, and timing concerns. Add nutrients to monitoring program and expand water quality monitoring locations in the	Expand Alternative A. Work with the partners to address water quality, quantity, and timing concerns. Add nutrients to monitoring program and expand water quality monitoring locations in the

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Caloosahatchee Basin drainage, and local runoff issues)	schedules. Plan with USACE Operations to install water quality monitoring station in Tarpon Bay.	of Sanibel on operation of its weir. Restore sheet flow to the State Botanical Site.	refuge. Evaluate water quality impacts on algal blooms, bird usage, seagrasses, and fish populations in refuge.	refuge. Evaluate water quality impacts on algal blooms, bird usage, seagrasses, and fish populations in refuge. Coordinate with city of Sanibel on operation of its weir. Restore sheet flow to the State Botanical Site.
<u>Climate Change</u> Goal 5: Identify, understand, and ameliorate the impacts of climate change on refuge resources to plan for and adapt management as necessary to protect the native wildlife; the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands; and cultural resources within the refuge.				
Climate Change Impacts	The Service's South Florida Ecosystem Team is developing a climate change model with MIT. Partner with SCCF Marine Lab to model climate change impacts to Sanibel Island. Developing benchmark water depth in Tarpon Bay with a new water quality monitoring station. The Service ran a SLAMM model for the refuge in 2006.	Expand Alternative A. Work with the partners to refine and run appropriate climate change models to understand the impacts on refuge resources (e.g., re-run the SLAMM model when high resolution LiDAR data become available). Coordinate with researchers and partners to understand the impacts of climate change on wildlife and habitat diversity. Foster and conduct needed research. Work with partners to establish benchmarks in relation to sea level rise and shoreline change. Adapt management as necessary.	Expand Alternative A. Work with the partners to refine and run appropriate climate change models to understand the impacts on refuge resources (e.g., re-run the SLAMM model when high resolution LiDAR data become available). Coordinate with researchers and partners to understand the impacts of climate change on migratory birds using the refuge. Foster and conduct needed research. Work with partners to establish benchmarks in relation to sea level rise and shoreline change. Adapt management as necessary.	Expand Alternative A. Work with the partners to refine and run appropriate climate change models to understand the impacts on refuge resources (e.g., re-run the SLAMM model when high resolution LiDAR data become available). Coordinate with researchers and partners to understand the impacts of climate change on rare, threatened, and endangered species using the refuge. Foster and conduct needed research. Work with partners to establish benchmarks in relation to sea level rise and shoreline change. Adapt management as necessary.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Resource Protection				
Cultural Resources Goal 1: Protect the archaeological and historical resources of the refuge exemplifying the natural and cultural history of Sanibel and Captiva Islands and connect refuge staff, visitors, and the community to the area's past.				
Archaeological and Historic Resources	When projects are proposed, cultural resource issues are evaluated. Regular patrols conducted of known sites. Cultural resources are included in environmental education and interpretive programs.	Expand Alternative A. Coordinate with State Historic Preservation Officer and Regional Archaeologist to conduct complete archaeological and historical survey of the refuge. Adapt management as necessary to protect newly identified sites.	Same as Alternative B.	Same as Alternative B.
"Ding" Darling's Fishing Cabin	Currently under private ownership and management. No formal refuge association.	Expand Alternative A. Actively work with the landowners and other partners to acquire or otherwise protect in perpetuity and manage the historically significant site. Work with the landowners and other partners to incorporate this site into an interpretive program. Work with the partners to seek National Historic Register designation.	Same as Alternative B.	Same as Alternative B.

Impact Topics	Alternative A Current Management (No Action Alternative)	Alternative B Native Wildlife and Habitat Diversity	Alternative C Migratory Birds (Proposed Action)	Alternative D Rare, Threatened, and Endangered Species
Refuge Boundary, Management Agreements, and Additional Special Designations Goal 2: Work with the partners to acquire, manage, or otherwise protect all remaining properties within the refuge's acquisition boundary to protect wildlife and the upland, transitional, and estuarine habitats of the Sanibel and Captiva area.				
Land Acquisition	Work with partners to acquire, manage, or otherwise protect all remaining properties within the refuge's acquisition boundary.	Expand Alternative A. Pursue completion of the acquisition boundary from willing sellers on those properties with high native wildlife and habitat values. Evaluate the expansion areas for appropriate and compatible public use activities.	Expand Alternative A. Pursue completion of the acquisition boundary from willing sellers on those properties with high migratory bird values. Evaluate the expansion areas for appropriate and compatible public use activities.	Expand Alternative A. Pursue completion of the acquisition boundary from willing sellers on those properties with high rare, threatened and endangered species values. Evaluate the expansion areas for appropriate and compatible public use activities.
Management Agreements – Protection of Resources	The refuge has a management agreement with the State of Florida for management of Tarpon Bay, including the water bottoms and for the State Botanical Site. The refuge also has cooperative agreements with the City of Sanibel and SCCF addressing resource management, fire management, exotic plant and animal control, and research. Further, the refuge works with the partners on a variety of items, including sharing resource management responsibilities, conducting surveys, facilitating and conducting research, and sharing GIS.	Expand Alternative A. Work with the State of Florida to develop appropriate management agreements to implement refuge-managed closed area buffers around sensitive resources (e.g., rookeries). Where needed, use MEPs to expand the refuge's acquisition boundary to include these closed area buffers in the refuge.	Same as Alternative B.	Expand Alternative A. Work with the State of Florida to develop appropriate management agreements to implement refuge-managed closed area buffers around sensitive resources serving rare, threatened, and endangered species (e.g., rookeries). Where needed, use MEPs to expand the refuge's acquisition boundary to include these closed area buffers in the refuge.

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Benefits of Additional Special Designations	No current management. No additional special designations for the J.N. "Ding" Darling NWR.	Expand Alternative A. Pursue special designations, including Western Hemisphere Shorebird Reserve Network and RAMSAR Wetlands of International Importance.	Same as Alternative B.	Same as Alternative B.
J.N. "Ding" Darling Wilderness Area Goal 3: Protect the J.N. "Ding" Darling Wilderness Area, promote an understanding of its wilderness values and *Leave No Trace* principles, and enhance awareness of the Wilderness Area among visitors to preserve the opportunity for outstanding coastal wilderness experiences in southwest Florida.				
J.N. "Ding" Darling Wilderness Area	The Wilderness Area is 2,619 acres. Only non-motorized boats are allowed in Lady Finger Lakes area. Motorized boat use is restricted in specific portions of the Wilderness Area. Uses that occur in the Wilderness Area including fishing, boating, and wildlife observation and photography. Management activities are limited and include wildlife surveys and monitoring activities, water quality monitoring, law enforcement, boundary inspection and posting activities, and cleanup activities (e.g., removing abandoned monofilament and lures).	Expand Alternative A. Provide Wilderness Area, wilderness stewardship, and wilderness principles information to visitors at the "Ding" Darling Education Center and in environmental education and interpretation programs and materials. Update refuge materials (e.g., maps, brochures, and internet) to include the Wilderness Area. Include Wilderness Area information and interpretation at Tarpon Bay Recreation Area. Coordinate with concessionaire to include wilderness information in its programs. Evaluate methods to improve the wilderness experience.	Same as Alternative B.	Same as Alternative B.

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Visitor Services				
Welcome and Orient Visitors Goal 1: Visitors will feel welcome and find accurate, timely, and appropriate orientation material and information on refuge visitor facilities, programs, and management activities.				
Welcome and Orient Visitors	The refuge conducts a robust visitor services program with various facilities, materials, programs, and activities, annually hosting over 700,000 visitors: 27,000 fishing, 536,000 wildlife observation and photography, 6,000 environmental education, 43,000 interpretation, 178,000 visitor center activities, 9,000 special events, and 51,000 other recreational activities. The "Ding" Darling Education Center is the primary facility to welcome and orient visitors to the refuge. It includes a visitors' desk and orientation film. Kiosk at parking lot for Education Center with maps and brochures. Concession tram booth is staffed daily except Fridays and provides welcome and maps. The Wildlife Drive fee booth provides welcome and orientation information and	Expand Alternative A. Work with volunteers, Friends group, and partners to enhance the wildlife and habitat diversity messages delivered at the Visitor Center, all brochures, kiosks, and programs.	Expand Alternative A. Work with volunteers, Friends group, and partners to enhance the migratory bird messages delivered at the Visitor Center, all brochures, kiosks, and programs.	Expand Alternative A. Work with volunteers, Friends group, and partners to enhance the rare, threatened, and endangered species messages delivered at the Visitor Center, all brochures, kiosks, and programs.

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	materials. Chamber of Commerce kiosk provides refuge information. Tarpon Bay Recreation Area Concession facility provides welcome and orientation information and materials. Maps and brochures available on refuge and visitor-related websites and in free local visitor guide publications. Local media regularly cover the refuge. Work with volunteers, Friends group, and partners to provide refuge information and enhance the opportunities available to visitors.			
<u>Fishing</u> Goal 2: Members of the fishing public will enjoy their fishing experiences, behave ethically, and support refuge management and wildlife and habitat protection.				
Fishing Opportunities	Annually support approximately 27,000 fishing visits. Provide one motorized boat launch facilities and three canoe/kayak launch facilities. Concessionaire provides guided fishing tours and outfitted rental boats. National fishing shows often highlight the fishing opportunities at the refuge. Fishing tournaments	Expand Alternative A. Work with partners to provide information to the fishing public regarding the impacts of fishing activities on wildlife and habitat diversity. Coordinate with local fishing guides to ensure that all guided trips are covered by special use permits with stipulations about ethical behavior and messages delivered.	Expand Alternative A. Work with partners to provide information to the fishing public regarding the impacts of fishing activities on migratory birds, (e.g., disturbance of shorebirds and impacts of monofilament fishing line). Coordinate with local fishing guides to ensure that all guided trips are covered by special use permits with stipulations	Expand Alternative A. Work with partners to provide information to the fishing public regarding the impacts of fishing activities on rare, threatened, and endangered species (e.g. entanglement in monofilament fishing line). Coordinate with local fishing guides to ensure that all guided trips are covered by special use permits with

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	originate off the refuge, but participants fish on the refuge. Refuge provides information on boating and fishing, crabbing and related regulations. Interpretive signage on Wildlife Drive about crabbing. Additional signage on Wildlife Drive provides information about impacts from monofilament and refuge phone number to report monofilament and entanglement. Provide receptacles for monofilament recycling. Volunteers remove monofilament weekly from January 1 to March 31 and opportunistically during rest of year. F Fishing occurs from fishing pier and water control structures on Wildlife Drive, from motorized and non-motorized boats, and at the Bailey Tract (interior freshwater). Interpretive fishing program provided from January 1 to March 31. Annually provide at least two Youth Fishing Days at Tarpon Bay Rec. Area. The Service and the refuge have a strong partnership with the Bass Pro Shops. The Bass Pro Shop in Ft. Myers features the refuge and the Service with exhibits,		about ethical behavior and messages delivered. Provide handicapped-accessible fishing pier at Smith Pond on Bailey Tract. This pier would also support youth fishing events.	stipulations about ethical behavior and messages delivered.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	photographs, and portable Junior Duck kiosk. Refuge provides information booth at Bass Pro Shop events. Highlighting the refuge, local cast-net rodeo held each year in November at Bait Box store. Work with partners to install fish-waste disposal tubes at area fishing piers (off refuge). Refuge follows State of Florida regulations for fishing and has more restrictive regulations for crabbing.			
Wildlife Observation and Photography Goal 3: Wildlife observers and photographers of all abilities will enjoy and value the diversity of area wildlife, will behave ethically, and will support refuge management and wildlife and habitat protection.				
Wildlife Observation and Photography Opportunities	Annually host over 536,000 visits. Offer over 40 programs and tours weekly from January 1 to March 31 and opportunistically during the rest of the year, including staff and volunteer-led wildlife observation walks and bike tours. Plus additional concessionaire-led tram, boat, and kayak tours, as well as a touch-tank at Tarpon Bay. Facilities include: "Ding" Darling Education Center birding room; Wildlife Drive and 4 trails, handicapped-	Expand Alternative A. Work with partners to develop informational materials on wildlife and habitat diversity messages of the refuge. Enhance ethical behavior criteria and program. As necessary modify existing refuge brochures, websites, displays, kiosks, and signs to reflect ethical user information. Pursue the creation of an ethical wildlife observation and photography video with the NCTC and	Expand Alternative A. Work with partners to develop informational materials on migratory bird messages of the refuge. Enhance ethical behavior criteria and program. As necessary modify existing refuge brochures, websites, displays, kiosks, and signs to reflect ethical user information. Pursue the creation of an ethical wildlife observation and photography video with the NCTC and partners to improve user	Expand Alternative A. Work with partners to develop informational materials on rare, threatened and endangered messages of the refuge. Enhance ethical behavior criteria and program. As necessary modify existing refuge brochures, websites, displays, kiosks, and signs to reflect ethical user information. Pursue the creation of an ethical wildlife observation and photography video with the NCTC and

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	accessible observation tower, and cross-dike pavilion; 4 trails at Bailey Tract; Commodore Creek and Buck Key water trails; Tarpon Bay Recreation Area deck for duck talks. Proposed facilities include the Children's Birding Trail to link to Sanibel School and a bird observation deck in Pond 2. Orientation for commercial photographers to obtain special-use permit.	partners to improve user behavior in this area. Incorporate North American Nature Photography Association ethical standards as applicable. Locate and develop an observation tower at the Bailey Tract. Evaluate need for bike-only lane on the Wildlife Drive. Evaluate need to close Wildlife Drive to vehicles one additional day per week. Evaluate opening the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts.	behavior in this area. Incorporate North American Nature Photography Association ethical standards as applicable. Locate and develop an observation tower at the Bailey Tract. Evaluate need for bike-only lane on the Wildlife Drive. Evaluate need to close Wildlife Drive to vehicles one additional day per week. Evaluate opening the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts.	partners to improve user behavior in this area. Incorporate North American Nature Photography Association ethical standards as applicable. Locate and develop an observation tower at the Bailey Tract. Evaluate need for bike-only lane on the Wildlife Drive. Evaluate need to close Wildlife Drive to vehicles one additional day per week. Evaluate opening the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts.
<u>Environmental Education and Interpretation</u> Goal 4: Participants in quality environmental education and interpretation programs and activities will develop an understanding and awareness of the legacy of Jay Norwood "Ding" Darling, the value and history of the refuge and the Refuge System, the natural resources of the refuge, the role of the refuge in the landscape, and the human influences on ecosystems, and will support refuge management and wildlife and wildlife and habitat protection.				
Environmental Education and Interpretation Opportunities	Conduct on-site and off-site curriculum-based programs with messages focused on the role and importance of the refuge in the landscape and the minimization of wildlife and habitat impacts from human activities for 6,000 annual participants. Environmental education	Expand Alternative A. Work with partners to ensure all Lee County 6th grade students attend environmental education program(s) at refuge. Hire a park ranger to assist with this program.	Expand Alternative A. Work with partners to incorporate migratory bird messages into education programs. Work with partners to ensure all Lee County 6th grade students attend environmental education program(s) at refuge. Hire a park ranger to	Expand Alternative A. Work with the partners to incorporate rare, threatened, and endangered species messages into education programs. Work with partners to ensure all Lee County 6th grade students attend environmental education program(s) at

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	programs linked to Florida state standards and are conducted by staff, partners, ”Ding” Darling Wildlife Society, and volunteers. Also programs in local schools conducted by staff. Annually write grant for funds to transport about 3,300 students onto Sanibel Island for field trips during Nov.-April. Work with home-school groups as requested. Work with Scouting groups. STAR kicked off in summer 2009. Conducting train-the-teacher workshops. Fifth-grade gifted students from 3 schools are participating with the refuge on a virtual earth-cache program.		assist with this program.	refuge. Hire a park ranger to assist with this program.
Interpretive Programs and Facilities	About 43,000 visitors participate in interpretive activities on the refuge annually. The refuge offers over 40 programs and tours weekly from Jan. 1 to Mar. 31 and opportunistically during the rest of the year, including staff and volunteer-led wildlife observation walks and bike tours. Plus additional concessionaire-led tram, boat, and kayak tours, as well as a touch-tank at Tarpon Bay. Provide programs and	Expand Alternative A. Develop on- and off-site interpretive programs with messages focused on habitat and diversity and the minimization of human impacts. Train staff, volunteers, teachers, and tour operators to incorporate interpretive themes into programs.	Expand Alternative A. Develop on- and off-site interpretive programs with messages focused on migratory birds and the minimization of human impacts. Train staff, volunteers, teachers, and tour operators to incorporate interpretive themes into programs.	Expand Alternative A. Develop on- and off-site interpretive programs with messages focused on rare, threatened and endangered species and the minimization of human impacts. Train staff, volunteers, teachers, and tour operators to incorporate interpretive themes into programs.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	presentations to various local organizations and clubs. Interpretive signs exist at the "Ding" Darling Education Center, throughout Wildlife Drive and hiking trails, at Bailey Tract, and at Tarpon Bay. Additional interpretive signs are to be installed as part of the planned Children's Birding Trail. E-Bird kiosk, partnership with Cornell Dept. of Ornithology, for reporting bird sightings and learning detailed information about birds. New invasive species kiosk at "Ding" Darling Education Center to provide information.			
Ethical Behavior	Member of the Society for Ethical Ecotourism, Southwest FL Chapter. Have ethical behavior information incorporated in existing programs, brochures, signage, internet, and exhibits.	Expand Alternative A. Coordinate with the Society for Ethical Ecotourism to regularly evaluate area ecotours to ensure adherence to ethical behavior standards. Work with other refuges to engage them in Society. Find more effective means to	Same as Alternative B.	Same as Alternative B.

Impact Topics	Alternative A Current Management (No Action Alternative)	Alternative B Native Wildlife and Habitat Diversity	Alternative C Migratory Birds (Proposed Action)	Alternative D Rare, Threatened, and Endangered Species
		convey ethical behavior messages to public. Pursue the creation of an ethical wildlife observation and photography video with the NCTC and partners to improve user behavior in this area. Incorporate North American Nature Photography Association ethical standards as applicable.		
Shell Mound Trail	Existing interpretive signage throughout trail. Weekly volunteer-led programs from Jan. 1-Mar. 31. Opportunistic staff-led programs year round. Improve interpretive messages and replace deteriorating signage as funding permits. Ad hoc parking causing traffic congestion on the Wildlife Drive.	Expand Alternative A. Evaluate the need for and ability to provide parking at Shell Mound Trail.	Same as Alternative B.	Same as Alternative B.
<u>Outreach</u> Goal 5: Communicate key messages and issues with off-site audiences to build support within the local community and beyond for the refuge, its purposes, and its management.				
Outreach Activities	About 9,000 people annually participate in refuge special events. Provide refuge booths at local festivals and conservation events. Each booth has hands-on children related activities. Work with	Expand Alternative A. Increase the outreach efforts and activities of the staff, volunteers, and the “Ding” Darling Wildlife Society. Focus outreach efforts on wildlife and habitat diversity	Expand Alternative A. Increase the outreach efforts and activities of the staff, volunteers, and the “Ding” Darling Wildlife Society. Focus outreach efforts on migratory birds and the	Expand Alternative A. Increase the outreach efforts and activities of the staff, volunteers, and the “Ding” Darling Wildlife Society. Focus outreach efforts on rare, threatened, and

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	partners for annual "Ding" Darling Day. Information on refuge website. We regularly provide information to media (newspapers, magazines, TV, internet) about refuge. Special-use permit held by Lee County Visitor and Convention Bureau for national and international tourism visitors. The Service's Southeast Region is developing an outreach website to exchange information and provide outreach materials to public.	and the minimization of wildlife and habitat impacts from human activities.	minimization of wildlife and habitat impacts from human activities.	endangered species and the minimization of wildlife and habitat impacts from human activities.
<u>Fee Program and Concession Operations</u> Goal 6: Continue to provide quality wildlife-dependent activities through a single concessionaire to support refuge management goals and objectives.				
Fee Program	Fee area entry: $5 per car, $1 per hiker or biker. Special use permit fee is $150 per occurrence or per year for commercial activities. Unaware of guided fishing on refuge. Issued 27 special use permits in fiscal year 2008, 5 of which were for commercial activities. Fees returned to refuge (60%) are committed to Visitor Services.	Expand Alternative A. Evaluate refuge fees to ensure that they help offset some of the administrative costs of managing these activities, facilities, and programs	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Concession Operations	The refuge started utilizing a concession agreement in the 1980s. The current concessionaire began operations in 2002. A single concessionaire operates on the refuge at the Tarpon Bay Recreation Area. Beyond fee booths, concessionaire provides: guided kayak, tram, and boat tours; guided fishing trips; rentals for canoes, kayaks, pontoon boats, and bicycles; gift shop; and boat ramp. Concessionaire provides a variety of interpretive services, e.g. deck talk and touch-tank experience. Under agreement the concessionaire assists refuge with special educational events throughout year. The concessionaire works with refuge on scripts and modifies activities as necessary. Refuge receives 20% of profit of Concessionaire operation. (These funds go towards revenue sharing payment to County.)	Expand Alternative A. In 2013 the concessionaire agreement will be rebid. Evaluate the need to add additional tram tours. Coordinate future concession operations with recommendations of Transportation Study.	Same as Alternative B.	Same as Alternative B.

Impact Topics	Alternative A Current Management (No Action Alternative)	Alternative B Native Wildlife and Habitat Diversity	Alternative C Migratory Birds (Proposed Action)	Alternative D Rare, Threatened, and Endangered Species
Refuge Administration				
Refuge Operations and Management Goal 1: Provide sufficient infrastructure, operations, volunteers, and staff to implement a comprehensive refuge management program to protect and manages refuge resources and the natural and cultural values of Sanibel and Captiva Islands.				
Staff	Covering all five refuges in the J.N. "Ding" Darling NWR Complex, J.N. “Ding” Darling NWR staff includes 14.5 permanent full-time employees (FTEs), three temporary full-time employees, five student interns, nine seasonal/temporary employees, and three student employees. Project Leader (Refuge Manager); Deputy Project Leader (Deputy Refuge Manager); Wildlife Refuge Specialist (Assistant Refuge Manager); Wildlife Biologist (Lead); Wildlife Biologist (term), Supervisory Park Ranger; Park Ranger (Environmental Education Specialist); Park Ranger (Volunteer Coordinator); Park Ranger (fee booth, 0.5 FTE, seasonal); two law enforcement officers- one of which would be paid for by fee dollars); Administrative Officer (Lead); two administrative support assistants (one of which	Expand Alternative A. The refuge would convert the temporary fee-funded Law Enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions): Wildlife Biologist, Biological Science Technician, two law enforcement officers, and Park Ranger (Environmental Education/Outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25% operating margin, this total is $663,381.	Expand Alternative A. The refuge would convert the temporary fee-funded Law Enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions): Wildlife Biologist, Biological Science Technician, two law enforcement officers, and Park Ranger (Environmental Education/Outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25% operating margin, this total is $663,381.	Expand Alternative A. The refuge would convert the temporary fee-funded Law Enforcement officer position to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge, including the two fee dollar positions): Wildlife Biologist, Biological Science Technician, two law enforcement officers, and Park Ranger (Environmental Education/Outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25% operating margin, this total is $663,381.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	would be term and paid for by fee dollars); Forestry Technician (Lead); a Facility Operations Specialist; and two engineering equipment operators. Another five seasonal interns are housed at the Refuge Complex's Maintenance Shop. In addition, over 240 volunteers annually contribute services equivalent to an additional 10 full-time employees. Six regional staff members are also located at the refuge (six FTEs): Regional Facility Operations Specialist, Region 4 Invasive Species Strike Team Leader, Region 4 Invasive Species Strike Team Assistant, Comprehensive Everglades Restoration Project Biologist, Realty Specialist, and Motorboat Operator Certification Course Coordinator. The current budget for the salaries, benefits, and fixed costs for the 19.5 FTEs (17.5 FTEs for the refuge and the two Southeast Region ISST FTEs), including the Recreation fee, and fire positions, is $1,702,300. With the 25% operating margin, this total would be $2,065,000.			

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Volunteers and Friends Group	Staff multi-task public use activities. Most of volunteer training is conducted by volunteers.	Expand Alternative A. Hire a Park Ranger to serve as full-time volunteer coordinator. Increase and enhance staff-led volunteer training. Increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other activities. Increase number of volunteers available throughout year. Increase interaction between staff and volunteers to enhance cohesiveness of refuge team.	Expand Alternative A. Focus volunteer activities and the Friends Group on migratory bird projects, programs, and activities. Hire a Park Ranger to serve as full-time volunteer coordinator. Increase and enhance staff-led volunteer training. Increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other activities. Increase number of volunteers available throughout year. Increase interaction between staff and volunteers to enhance cohesiveness of refuge team.	Expand Alternative A. Focus volunteer activities and the Friends Group on projects, programs, and activities supporting rare, threatened, and endangered species. Hire a Park Ranger to serve as full-time volunteer coordinator. Increase and enhance staff-led volunteer training. Increase and enhance staff oversight and evaluation of volunteer programs, tours, education, interpretation, outreach, and other activities. Increase number of volunteers available throughout year. Increase interaction between staff and volunteers to enhance cohesiveness of refuge team.
Administrative Facilities, Utilities, Equipment, and Signs	Administrative facilities are extensive and include an office building, Education Center, concession building with an apartment, six maintenance shop and storage buildings, two government quarters, four mobile homes for interns and volunteers, and four RV pads for volunteers. Further, the refuge maintains several roads, trails, and parking areas, including Wildlife Drive (a paved 4-mile road), Indigo	Expand Alternative A. Improve and update facilities as needed. Additional facilities would include the “Ding” Darling fishing cabin and the observation tower at the Bailey Tract. The potential exists to expand or create new parking for Shell Mound Trail. The existing Marine Research Lab would be repaired/replaced.	Expand Alternative A. Improve and update facilities as needed. Additional facilities would include the “Ding” Darling fishing cabin, the observation tower at the Bailey Tract, and the handicapped-accessible fishing pier at Smith Pond on the Bailey Tract. The potential exists to expand or create new parking for Shell Mound Trail. And, the existing Marine Research Lab would be repaired/replaced.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	Trail (a 2-mile hiking/biking trail), the Shell Mound boardwalk trail, and the trail complex at the Bailey Tract. Additional visitor facilities include the observation tower on Wildlife Drive; Red Mangrove Overlook; Tarpon Bay docks and boat ramp; six automatic gates; the education pavilion at cross-dike and numerous kiosks, signs, and interpretive panels. Further, an observation platform is planned at Water Control Structure #2 and the planned Children's Birding Trail will also include interpretive signs.			
Partners - Intergovernmental Coordination Goal 2: Foster strong and effective working relationships with existing and new governmental and non-governmental partners for the purposes of accomplishing refuge management goals and objectives and protecting the natural and cultural resources of Sanibel and Captiva Islands.				
Intergovernmental Coordination	Regularly coordinate with city of Sanibel, Lee County, Lee County Mosquito Control District, Florida Dept. of Agriculture and Consumer Services, Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Aquatic Preserve, and Charlotte Harbor National Estuary Program.	Expand Alternative A. Foster strong and effective working relationships with existing and new partners for the purposes of accomplishing refuge management goals and protecting the natural and cultural resources of Sanibel and Captiva Islands.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Commercial Harvesting Goal 3: Limit the impacts to the natural resources and waters of the refuge from commercial harvesting activities to current levels until these activities can be phased out from the refuge.				
Commercial Harvesting	One commercial bait fishing operator has historically occurred on the refuge.	Within the life of the CCP, phase out commercial bait fishing activities from the refuge.	Same as Alternative B.	Same as Alternative B.

IV. Environmental Consequences

OVERVIEW

The Service assessed the environmental impacts of implementing the alternatives on the biological, physical, social, economic, archaeological, and historical resources of the refuge. The anticipated impacts over the 15-year life of the CCP that could result from the implementation of the actions described in alternatives A, B, C, and D are discussed. Implementation of any of the action alternatives (i.e., alternatives B, C, and D) is anticipated to have positive impacts to area land values, related employment and income, outdoor recreation, environmental education opportunities, cultural resources, environmental justice, soils, water quality, wetlands, floodplains, aesthetics, and visitor services, as well as increased information regarding climate change to enhance management decisions.

In general, parks and refuges provide numerous benefits, including a sense of community, improved quality of life, a shared environment in which people can connect and interact, and a channel for positive community participation by getting diverse people to work together towards a shared vision (Francis 2002), as well as provide for increased property values and municipal revenues; attraction and retention of affluent retirees; and attraction of knowledgeable workers, talent, and home buyers (Lewis 2002).

EFFECTS COMMON TO ALL ALTERNATIVES

A few potential effects will be similar under each of the alternatives and are summarized under seven categories: environmental justice, climate change, other management, land acquisition, cultural resources, refuge revenue-sharing, and other effects.

ENVIRONMENTAL JUSTICE

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The Order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities with access to public information and opportunities for participation in matters relating to human health or the environment.

None of the management alternatives described in this EA will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. Implementation of any action alternative that includes public use and environmental education is anticipated to provide benefits to the residents residing in the surrounding communities.

CLIMATE CHANGE

U.S. Department of the Interior Secretarial Order 3226 states that “there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making…This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making”. Additionally, it calls for the

incorporation of climate change considerations into long-term planning documents such as the CCP. Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use changes, while those of methane and nitrous oxide are primarily due to agricultural operations (Bindoff et al. 2007). The increase of carbon within the Earth's atmosphere has been linked to the gradual rise in surface temperatures commonly referred to as global warning. In relation to comprehensive planning for national wildlife refuges, carbon sequestration is one of the primary climate-related impacts to be considered in planning. The U.S. Department of Energy's *Carbon Sequestration Research and Development* (U.S. Department of Energy 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere." The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts—grasslands, forests, wetlands, tundra, perpetual ice, and desert—are effective both in preventing carbon emissions and in acting as a biological "scrubber" of atmospheric carbon monoxide. The conclusions of the Department of Energy's report noted that ecosystem protection is important to carbon sequestration and may reduce or prevent the loss of carbon currently stored in the terrestrial biosphere.

The Wildlife Society (TWS) published an informative technical review report in 2004 titled "Global Climate Change and Wildlife in North America" (Inkley et al. 2004). It interprets results and details from such publications as the Intergovernmental Panel on Climate Change (IPCC) reports (1996-2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because not only is it important to predict changing precipitation and temperature patterns, but more importantly, to predict their rate of change, as well as the exacerbated effects of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses, pollution, ozone depletion, exotic species, disease, and other factors. Projections over the next 100 years indicate such major impacts as extensive warming in most areas, changing patterns of precipitation, and significant acceleration of sea level rise. According to the TWS report, "…other likely components of on-going climate change include changes in season lengths, decreasing range of nighttime versus daytime temperatures, declining snowpack, and increasing frequency and intensity of severe weather events" (Inkley et al. 2004). The TWS report details known, and possible influences on, habitat and wildlife including changes in primary productivity, changes in plant chemical and nutrient composition, changes in seasonality, sea level rise, snow, permafrost, and sea ice decline, increased invasive species, pests and pathogens, and impacts on major vertebrate groups. The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises. Species with small and/or isolated populations and low genetic variability will be least likely to withstand impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al. 2004). The TWS report, emphasizes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses and to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only imprecise generalizations can be made about the implications of our refuge management on regional climate change.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions outlined in the proposed action would conserve or restore land and water, and would thus enhance carbon sequestration. This, in turn, contributes positively to efforts to mitigate human-induced global climate changes. Further, while the No Action Alternative currently pursues information to better understand climate change and its impacts on the resources of the refuge, all the action alternatives propose additional management and coordination to increase this understanding and to adapt management as necessary to better respond to these impacts.

OTHER MANAGEMENT

All management activities that could affect the refuge's natural resources, including subsurface mineral reservations, utility lines and easements, soils, water and air, and historical and archaeological resources, would be managed to comply with all laws and regulations. In particular, any existing and future oil and gas exploration, extraction, and transport operations on the refuge would be managed identically under each of the alternatives. Thus, the impacts would be the same.

LAND ACQUISITION

Funding for land acquisition from willing sellers within the approved acquisition boundary of J. N. "Ding" Darling NWR would likely come from the Land and Water Conservation Fund, the Migratory Bird Conservation Fund, or donations from conservation and private organizations. Conservation easements and leases could also be used to obtain the minimum interests necessary to satisfy refuge objectives, if the refuge staff can adequately manage uses of the areas for the benefit of wildlife. The Service can negotiate management agreements with local, state, and federal agencies and can accept conservation easements. Some tracts within the refuge's acquisition boundary may be owned by other public or private conservation organizations. The Service would work with interested organizations to identify additional areas needing protection and provide technical assistance if needed. The acquisition of private lands is entirely contingent on the landowners and their willingness to participate. This approach would be the same under any of the alternatives.

CULTURAL RESOURCES

The Service is responsible for managing archaeological and historical resources found on refuge lands. All alternatives afford additional land protection and low levels of development, thereby producing little negative effect on the refuge's cultural resources. Potential negative effects to cultural resources could come from construction of new trails or facilities, restoration of Alligator Curve, restoration of water flows, and further development of impoundments. In most cases, these management actions would require review by the Service's Regional Archaeologist in consultation with the State of Florida Historic Preservation Office, as mandated by Section 106 of the National Historic Preservation Act. Therefore, the determination of whether a particular action within an alternative has the potential to affect cultural resources is an on-going process that would occur during the planning stages of every project.

Service acquisition of land with known or potential archaeological or historical sites provides two major types of protection for these resources: protection from damage by federal activity and protection from vandalism or theft. The National Historic Preservation Act requires that any actions by a federal agency which may affect archaeological or historical resources be reviewed by the State Historic Preservation Office, and that the identified effects must be avoided or mitigated. The Service's policy is to preserve these cultural resources in the public trust, and avoid any adverse effects wherever possible. All action alternatives propose the protection of J.N. "Ding" Darling's fishing cabin.

Land acquisition, within the current acquisition boundary, by the Service would provide some degree of protection to significant cultural and historic resources. If acquisition of private lands does not occur and these lands remain under private ownership, the landowner would be responsible for protecting and preserving cultural resources. Development of off-refuge lands has the potential to destroy archaeological artifacts and other historical resources, thereby decreasing opportunities for cultural resource interpretation and research.

As a whole, positive impacts are expected for the cultural resources due to management and protection of these resources under all of the alternatives. However, the level of positive impacts to cultural resources varies by alternative.

OTHER EFFECTS

Each of the alternatives would have similar effects or minimal to negligible effects on soils, water quality and quantity, aesthetics, visitor services, socioeconomic environment, and public health and safety.

All alternatives are anticipated to positively impact soil formation processes on lands that the refuge acquires and manages. Some disturbances to surface soils and topography would occur at those locations selected for administrative, maintenance, and visitor facilities, as well as in areas targeted for exotic and invasive species removal and eradication. However, these limited impacts would be at discrete sites.

All alternatives are anticipated to positively impact water quality. Positive impacts are anticipated from protecting groundwater recharge, preventing runoff, retaining sediment, minimizing nonpoint source pollution in select areas, and restoring and mimicking historic flow. The management alternatives are not anticipated to have any adverse effects on the area's wetlands, pursuant to Executive Orders 11990 and 11988. Further, the refuge provides protection to lands and waters that would otherwise be developed into commercial and residential uses in the near future.

Each alternative would protect the aesthetic characteristics associated with natural habitats. Minor, short-term, discrete negative aesthetic impacts may result from habitat management, restoration, and facility development activities, but these are short lived and are offset by refuge management and resultant native habitats.

Under any of the alternatives, the Service would consult with local and state officials and the public during detailed planning for and construction of any new facilities. Each of the action alternatives is anticipated to positively impact visitor services.

Each of the alternatives is anticipated to positively impacts socioeconomic factors of the community. Although the refuge does occupy lands that might provide income to the local tax base, those lost tax revenues are offset by enhanced property values on adjacent lands and by improved aesthetics related to conservation lands and open space. Further, the refuge does provide Lee County with refuge revenue sharing act payments in lieu of property tax income. Conservation lands require less expenditure of local taxes to fund infrastructure and other services than required by developed lands.

Based on the nature of each alternative, the location of the refuge, and current land use, the four alternatives are not anticipated to have any significant negative impacts on the quality of the human environment, including public health and safety.

SUMMARY OF EFFECTS BY ALTERNATIVE

Each of the action alternatives is anticipated to result in net positive environmental benefits. Impacts under each of the four refuge management alternatives are summarized under the broad management categories: Wildlife and Habitat Management, Resource Protection, Visitor Services, and Refuge Administration. Table 18 addresses the likely environmental consequences from implementation of the alternatives.

Table 18. Summary of environmental consequences of implementation of the alternatives for J.N. "Ding" Darling NWR

Impact Topics	Alternative A Current Management (No Action Alternative)	Alternative B Native Wildlife and Habitat Diversity	Alternative C Migratory Birds (Proposed Action)	Alternative D Rare, Threatened, and Endangered Species
Wildlife and Habitat Management				
Rare, Threatened, and Endangered Species Goal 1: Minimize the threats to and promote the recovery of the rare, threatened, and endangered species occurring on Sanibel and Captiva Islands and in adjacent waters.				
Wood Stork	Neutral to positive. Stable numbers of wood storks using the refuge. Increased information to enhance decision-making.	Neutral to positive. Potential for stable to increased numbers of wood storks using the refuge. Increased information to enhance decision making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Positive. Increased habitat quantity and quality. Potential for stable to increased numbers of wood storks using the refuge. Increased information to enhance decision-making. Decreased disturbance. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Positive. Increased habitat. Increased habitat quantity and quality. Potential for stable to increased numbers of wood storks using the refuge. Increased information to enhance decision-making. Decreased disturbance. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.
Roseate Spoonbill	Neutral to positive. Stable numbers of spoonbills using the refuge. Increased information to enhance decision-making.	Neutral to positive. Potential for stable to increased numbers of spoonbills using the refuge. Increased information to enhance decision-making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Positive. Increased habitat quantity and quality. Potential for increased numbers of spoonbills using the refuge. Increased information to enhance decision-making. Decreased disturbance. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Same as Alternative C.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Bald Eagle	Neutral. Stable numbers of eagles using the refuge.	Neutral to positive. Stable numbers of eagles using the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Same as Alternative B.	Same as Alternative B.
Mangrove Cuckoo	Negative to positive. Stable to decreased numbers of mangrove cuckoos using historic habitats. Habitats altered by Hurricane Charley. Birds expected to occur in less accessible portions of the refuge. Increased information to enhance decision making.	Positive. Increased information to enhance decision-making. Increased habitat quantity and quality. Potential for stable to increased numbers of mangrove cuckoos using the refuge.	Same as Alternative B.	Same as Alternative B.
Other Mangrove Forest Birds (black-whiskered vireo, gray kingbird, and Florida prairie warbler)	Negative to positive. Stable to decreased numbers of mangrove forest birds using historic habitats. Habitats altered by Hurricane Charley. Birds expected to occur in less accessible portions of the refuge. Increased information to enhance decision-making.	Positive. Increased information to enhance decision-making. Increased habitat quantity and quality. Potential for stable to increased numbers of mangrove forest birds using the refuge.	Same as Alternative B.	Same as Alternative B.
Eastern Indigo Snake	Neutral to negative. No individuals sighted on the refuge recently.	Positive. Increased information to enhance decision-making. Indigo snakes moved to sustainable population.	Neutral to positive. Increased information to enhance decision-making.	Positive. Increased information to enhance decision-making. Increased numbers of indigo snakes on the refuge due to translocation efforts.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Gopher Tortoise	Neutral to negative. Stable to decreased numbers of gopher tortoises using the refuge.	Positive. Stable to increased numbers of gopher tortoises using the refuge. Potential for decreased mortality due to vehicle collisions. Increased information to enhance decision-making. Increased habitat quantity and quality.	Positive. Stable to increased numbers of gopher tortoises using the refuge. Enhanced decision making from increased information related to tortoise abundance, distribution, population density, habitat carrying capacity, and feasibility of translocating gopher tortoises to the refuge. Increased awareness and understanding by the public. Decreased impacts.	Same as Alternative B.
West Indian Manatee	Neutral to positive. Stable numbers of manatees using the refuge. Increased protection of manatees.	Positive. Stable numbers of manatees using the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Decreased impacts.	Neutral to positive. No change from current management. Stable numbers of manatees using the refuge. Increased protection of manatees.	Positive. Stable numbers of manatees using the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Decreased impacts. Increased awareness. Enhanced and increased seagrass beds.
American Crocodile	Neutral to negative. Only one crocodile is known to have historically used the area until her death in early 2010, at the northern end of its range.	Neutral to positive. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Same as Alternative B.	Neutral to positive. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased awareness. Decreased threats. Potential for increased numbers.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Sea Turtles (including loggerhead, green, leatherback, Kemp's ridley, and hawksbill sea turtles)	Neutral. No recorded nesting in the last 10 years. Increased information to enhance decision-making. Minimized impacts from lighting and beach activities.	Neutral to positive. Stable numbers of sea turtles using the area. Increased information to enhance decision-making. Enhanced habitat quality. Decreased impacts. Potential for increased production.	Neutral to positive. Stable numbers of sea turtles using the area. Increased information to enhance decision-making. Minimized impacts from lighting.	Neutral to positive. Stable numbers of sea turtles using the area. Increased coordination and information to enhance decision-making. Enhanced habitat quality. Decreased impacts. Potential for increased production.
Snowy Plover	Neutral to positive. Surveys from 2002-2008 range from 1 to 6 nests of snowy plovers on the Perry Tract of the refuge. Increased information to enhance decision-making. Decreased disturbances.	Neutral to positive. Stable numbers of snowy plovers using the refuge. Increased information to enhance decision-making. Decreased disturbances.	Positive. Stable to increased numbers of snowy plovers using the refuge. Potential for increased production. Increased information to enhance decision-making. Decreased disturbances and impacts. Increased habitat quality.	Same as Alternative C.
Piping Plover	Neutral. Unknown trends and impacts.	Neutral to positive. Stable numbers of piping plovers using the refuge. Increased coordination and information to enhance decision-making. Decreased impacts and disturbances.	Neutral to positive. Potential for stable to increased numbers of piping plovers using the refuge. Increased coordination and information to enhance decision-making. Decreased impacts and disturbances. Increased habitat quality.	Same as Alternative C.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Red Knot	Neutral to positive. Refuge is regularly used by wintering and migrating red knots. Increased information to enhance decision-making.	Positive. Stable to increased numbers of red knots using the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased habitat management, availability, and quality.	Same as Alternative B.	Same as Alternative B.
Sanibel Rice Rat	Neutral to positive. Unknown trends and impacts.	Positive. Potential increased numbers of rise rats using the refuge. Increased habitat quantity and quality, including ability to control water levels at the Botanical Site. Increased information to enhance decision making and understand population trends.	Positive. Potential increased numbers of rise rats using the refuge. Increased habitat quantity and quality. Increased information to enhance decision making and understand population trends.	Same as Alternative B.
Ornate Diamondback Terrapin	Negative to positive. Unknown trends and impacts.	Neutral to positive. Increased information to enhance decision-making.	Positive. Enhanced decision-making from increased information related to population trends, nesting success, and mortality.	Positive. Enhanced decision-making from increased information related to population trends, nesting success, and mortality. Decreased threats.
Smalltooth Sawfish	Neutral. Unknown trends and impacts.	Neutral. No change from current management. Unknown trends and impacts.	Neutral to positive. Increased coordination to minimize impacts. Enhanced decision-making from increased information.	Same as Alternative C.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Gulf Sturgeon	Neutral. Unknown trends and impacts.	Neutral. No change from current management. Unknown trends and impacts.	Neutral to positive. Increased coordination to minimize impacts. Enhanced decision-making from increased information.	Same as Alternative C.
Wildlife and Habitat Diversity Goal 2: Conserve, restore, enhance, and manage the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands to maintain and enhance their biological integrity and to support species diversity and abundance of native plants and animals, with an emphasis on migratory birds.				
Raptors and Birds of Prey	Neutral to positive. Stable numbers of raptors and birds of prey using the refuge. Increased information to enhance decision-making.	Positive. Stable to increased numbers of raptors and birds of prey using the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased habitat quantity and quality. Increased information to enhance decision-making.	Positive. Stable to increased numbers of raptors and birds of prey using the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased habitat quantity and quality. Increased information to enhance decision-making. Decreased disturbances.	Same as Alternative A.
Nearctic-Neotropical Migratory Birds	Neutral. Neartic-neotropical migratory birds regularly use the refuge. Increased information to enhance decision-making.	Positive. Potential for stable to increased numbers of neartic-neotropical migratory birds using the refuge. Increased habitat quality and available food sources. Increased information to enhance decision-making.	Positive. Potential for stable to increased numbers of neartic-neotropical migratory birds using the refuge. Increased habitat quality, quantity, and available food sources. Increased information and coordination to enhance decision-making.	Same as Alternative A.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Shorebirds and Seabirds	Neutral to positive. Shorebirds and seabirds regularly use the refuge. Increased information to enhance decision making.	Positive. Potential for stable to increased numbers of shorebirds and seabirds using the refuge. Increased information to enhance decision-making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Improved water level management.	Positive. Potential for stable to increased numbers of shorebirds and seabirds using the refuge. Increased information and coordination to enhance decision-making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Decreased disturbances. Improved water level management.	Same as Alternative A.
Wading Birds, Water Birds, and Waterfowl (except for wood storks and roseate spoonbills)	Neutral to positive. Wading birds, water birds, and waterfowl regularly use the refuge. Increased information to enhance decision-making.	Neutral to positive. Potential for stable to increased numbers of wading birds, water birds, and waterfowl using the refuge. Increased information to enhance decision-making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Neutral to positive. Potential for stable to increased numbers of wading birds, water birds, and waterfowl using the refuge. Increased information to enhance decision-making. Decreased disturbances.	Neutral to positive. Stable to increased numbers of wading birds, water birds, and waterfowl using the refuge. Increased information to enhance decision-making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.
Fish Spawning, Settlement, and Nursery Sites	Neutral to negative. Current status is unknown.	Positive. Increased information to enhance decision-making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Neutral to positive. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.	Same as Alternative C.
Areas Affected by Hurricane Charley	Positive. Improved habitat quantity and quality.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
American Alligator	Neutral to negative. Decreased numbers of alligators using the refuge. Improved habitat quantity and quality.	Neutral to positive. Increased habitat quantity and quality, including during droughts. Increased education to minimize disturbances.	Same as Alternative B.	Same as Alternative B.
Mangrove Habitat	Positive. Increased habitat quantity and quality. Increased information to enhance decision-making.	Positive. Increased habitat quantity and quality. Increased information and coordination to enhance decision-making.	Same as Alternative B.	Same as Alternative B.
Uplands Habitat	Neutral to positive. Increased information to enhance decision-making. Decreased presence of exotic plants.	Positive. Increased habitat quantity and quality. Increased information to enhance decision-making. Decreased presence of exotic plants.	Same as Alternative B.	Same as Alternative B.
Interior Wetlands Habitat	Neutral to positive. Increased information to enhance decision-making. Potential for improved habitat quality.	Positive. Increased information and coordination to enhance decision-making. Increased habitat quality. Increased ability to manage water levels.	Same as Alternative B.	Same as Alternative B.
Seagrass Beds	Neutral. Seagrass beds currently recovering from 2006 algae outbreak on the refuge.	Neutral to positive. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased information to enhance decision-making.	Same as Alternative B.	Neutral to positive. Stable seagrass beds on the refuge. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased information to enhance decision-making. Increased habitat quantity and quality.

Impact Topics	Alternative A Current Management (No Action Alternative)	Alternative B Native Wildlife and Habitat Diversity	Alternative C Migratory Birds (Proposed Action)	Alternative D Rare, Threatened, and Endangered Species
Exotic, Invasive, and Nuisance Species Goal 3: Eliminate existing and future exotic, invasive, and nuisance species on the refuge to maintain and enhance the biological integrity of the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands.				
Control of Exotic, Invasive, and Nuisance Plants	Neutral to positive. Stable to decreased existence of exotic, invasive, and nuisance plants on the refuge.	Positive. Decreased existence of exotic, invasive, and nuisance plants on the refuge.	Positive. Decreased existence of exotic, invasive, and nuisance plants on the refuge, especially in high priority habitats for migratory birds.	Positive. Decreased existence of exotic, invasive, and nuisance plants on the refuge, especially in high priority habitats for rare, threatened, and endangered species.
Control of Exotic, Invasive, and Nuisance Animals	Neutral to positive. Stable to decreased numbers of exotic, invasive, and nuisance animals on the refuge.	Positive. Stable to decreased numbers of exotic, invasive, and nuisance animals on the refuge. Increased awareness to minimize impacts and nuisance behaviors.	Same as Alternative B.	Same as Alternative B.
Water Quality, Quantity, and Timing Goal 4: Work with the partners to address and resolve the water quality, quantity, and timing concerns associated with the watershed of the refuge; Lake Okeechobee releases to the west; the watershed of the Caloosahatchee River;; and, the Gulf of Mexico.				
Impacts from Water Quality, Quantity, and Timing (including Lake Okeechobee regulatory releases, Caloosahatchee Basin drainage,	Negative to positive. Increased information and coordination to enhance decision-making. Potential for negative wildlife and habitat impacts from freshwater discharges from Lake Okeechobee. Potential for negative wildlife and habitat impacts from	Negative to positive. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Increased information and coordination to enhance decision-making. Potential for negative wildlife and habitat impacts from freshwater discharges from	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
and local runoff issues)	Caloosahatchee Basin drainage and local runoff.	Lake Okeechobee. Potential for negative wildlife and habitat impacts from Caloosahatchee Basin drainage and local runoff.		
<u>Climate Change</u> Goal 5: Identify and understand the impacts of climate change on refuge resources to plan for and adapt management as necessary to protect the native wildlife; the upland, transitional, and estuarine habitats of Sanibel and Captiva Islands; and cultural resources within the refuge.				
Climate Change Impacts	Negative. Increased information to enhance decision-making, but currently available data and models lack sufficient detail at the local scale. Potential for changes to salinity, shorelines, precipitation, and wildlife ranges, as well as potential for decreased habitats and available freshwater and increased exotic, invasive, and nuisance species.	Negative to positive. Increased coordination, information, and detailed data to enhance modeling efforts and decision-making. Potential to adapt management to minimize negative impacts. Potential for changes to salinity, shorelines, precipitation, and wildlife ranges, as well as potential for decreased habitats and available freshwater and increased exotic, invasive, and nuisance species.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Resource Protection				
Cultural Resources Goal 1: Protect the archaeological and historical resources of the refuge exemplifying the natural and cultural history of Sanibel and Captiva Islands and connect refuge staff, visitors, and the community to the area's past.				
Archaeological and Historic Resources	Neutral to positive. Ongoing protection, education, and interpretation.	Positive. Improved protection, education, and interpretation. Increased information and coordination to enhance decision-making and protection.	Same as Alternative B.	Same as Alternative B.
"Ding" Darling's Fishing Cabin	Negative to positive. Lack of protection of the property and potential for loss of this historic site.	Positive. Protection of the site in perpetuity. Increased awareness and interpretation.	Same as Alternative B.	Same as Alternative B.
Refuge Boundary, Management Agreements, and Additional Special Designations Goal 2: Work with the partners to acquire, manage, or otherwise protect all remaining properties within the refuge's acquisition boundary to protect wildlife and the upland, transitional, and estuarine habitats of the Sanibel and Captiva area.				
2002 Land Protection Plan – Impacts of Approval and Implementation	Positive. Increased habitat protection. Decreased wildlife and habitat disturbances. Increased coordination with partners. Increased habitat quantity.	Positive. Increased habitat protection. Decreased wildlife and habitat disturbances. Increased coordination with partners. Increased habitat quantity. Potential for increased appropriate and compatible public use activities.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Management Agreements – Protection of Resources	Positive. Increased protection of wildlife and habitat, both on and off the refuge.	Positive. Increased habitat protection. Decreased wildlife and habitat disturbances.	Same as Alternative B.	Same as Alternative B.
Benefits of Additional Special Designations	Neutral. No additional special designations for the J.N. "Ding" Darling NWR.	Positive. Increased protection of resources.	Same as Alternative B.	Positive. Increased protection of resources.
J.N. "Ding" Darling Wilderness Area Goal 3: Protect the J.N. "Ding" Darling Wilderness Area, promote an understanding of its wilderness values and *Leave No Trace* principles, and enhance awareness of the Wilderness Area among visitors to preserve the opportunity for outstanding coastal wilderness experiences in southwest Florida.				
J.N. "Ding" Darling Wilderness Area	Neutral to negative. Wilderness experience is impacted by high visitation and presence of motorized boats. Increased awareness of Wilderness Area through interpretive and education materials and programs.	Neutral to positive. Increased Wilderness Area, stewardship, and principles information provided to increase awareness. Potential for increased quality of wilderness experience.	Same as Alternative B.	Same as Alternative B.
Visitor Services				
Welcome and Orient Visitors Goal 1: Visitors will feel welcome and find accurate, timely, and appropriate orientation material and information on refuge visitor facilities, programs, and management activities.				
Welcome and Orient Visitors	Positive. Increased numbers of visitors. Ongoing coordination to provide sufficient welcome and orientation to area visitors.	Positive. Increased numbers of visitors. Ongoing and improved coordination to provide sufficient welcome and orientation to area	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
	Welcome and orientation materials are regularly updated.	visitors. Improved and regularly updated welcome and orientation materials.		
<u>Fishing</u> Goal 2: Members of the fishing public will enjoy their fishing experiences, behave ethically, and support refuge management and wildlife and habitat protection.				
Fishing Opportunities	Negative to positive. Increased fishing use of the refuge. Potential for increased conflicts and decreased quality of fishing experience.	Positive. Increased quality of fishing opportunities and minimized impacts and associated wildlife and habitat disturbances.	Positive. Increased facilities to support fishing, increased quality of fishing opportunities, and minimized impacts and associated wildlife and habitat disturbances.	Same as Alternative B.
<u>Wildlife Observation and Photography</u> Goal 3: Wildlife observers and photographers of all abilities will enjoy and value the diversity of area wildlife, will behave ethically, and will support refuge management and wildlife and habitat protection.				
Wildlife Observation and Photography Opportunities	Negative to positive. Increased use of the refuge for wildlife observation and photography. Potential for increased conflicts and decreased quality of experience.	Positive. Increased quality of wildlife observation and photography experiences. Improved ethical behavior of users. Decreased conflicts. Increased facilities. Decreased wildlife and habitat disturbances.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Environmental Education and Interpretation Goal 4: Participants in quality environmental education and interpretation programs and activities will develop an understanding and awareness of the legacy of Jay Norwood "Ding" Darling, the value and history of the refuge and the Refuge System, the natural resources of the refuge, the role of the refuge in the landscape, the human influences on ecosystems, and support refuge management and wildlife and wildlife and habitat protection.				
Environmental Education and Interpretation Opportunities	Positive. Increased quality, information, training, and number of environmental education and interpretive programs.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Interpretive Programs and Facilities	Neutral to positive. Increased interpretive programs and facilities.	Positive. Increased quality, information, training, and number of interpretive programs and facilities.	Same as Alternative B.	Same as Alternative B.
Ethical Behavior	Neutral to negative. Increased conflicts between users. Decreased ethical behavior of visitors.	Positive. Increased adherence to ethical behavior standards by area ecotours. Increased awareness and increased ethical behavior by area visitors.	Same as Alternative B.	Same as Alternative B.
Shell Mound Trail	Positive. Increased use of Shell Mound Trail. Increased negative impacts from ad hoc parking.	Positive. Increased use of Shell Mound Trail. Potential to provide additional marked parking, limiting maximum use of Shell Mound Trail at any one time and minimizing impacts of ad hoc parking.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
<u>Outreach</u> Goal 5: Communicate key messages and issues with off-site audiences to build support within the local community and beyond for the refuge, its purposes, and its management.				
Outreach Activities	Neutral to positive. Stable to increased outreach activities.	Positive. Increased outreach activities to area visitors and local residents by increased numbers of staff, volunteers, and friends group. Increased awareness and decreased impacts.	Same as Alternative B.	Same as Alternative B.
<u>Fee Program and Concession Operations</u> Goal 6: Continue to provide quality wildlife-dependent activities through a single concessionaire to support refuge management goals and objectives.				
Fee Program	Neutral. Stable fee program.	Neutral to positive. Evaluate fee program to maintain appropriate and compatible visitor services.	Same as Alternative B.	Same as Alternative B.
Quality of Concession Operations	Negative to positive. In 2013 the concessionaire agreement will be rebid. The current concessionaire offers quality programs and services.	Negative to positive. In 2013 the concessionaire agreement will be rebid. Coordinate future concession operations with recommendations of Transportation Study.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Refuge Administration				
Refuge Operations and Management Goal 1: Provide sufficient infrastructure, operations, volunteers, and staff to implement a comprehensive refuge management program to protect and manages refuge resources and the natural and cultural values of Sanibel and Captiva Islands.				
Staff	Neutral. Stable levels of staff and wildlife and habitat management.	Positive. Increased staffing levels, information, programs, and wildlife and habitat management.	Same as Alternative B.	Same as Alternative B.
Volunteers and Friends Group	Neutral to positive. Stable to increased numbers of volunteers and members of friends group.	Positive. Increased coordination and oversight of volunteers and friends group. Increased volunteer training. Increased cohesiveness of refuge team. Increased programs, projects, and activities supported by volunteers and friends group.	Same as Alternative B.	Same as Alternative B.
Administrative Facilities, Utilities, Equipment, and Signs	Neutral. Maintain existing facilities, equipment, utilities, and signs.	Positive. Increase and enhance facilities, equipment, utilities, and signs.	Same as Alternative B.	Same as Alternative B.

Impact Topics	**Alternative A** Current Management (No Action Alternative)	**Alternative B** Native Wildlife and Habitat Diversity	**Alternative C** Migratory Birds (Proposed Action)	**Alternative D** Rare, Threatened, and Endangered Species
Intergovernmental Coordination Goal 2: Foster strong and effective working relationships with existing and new governmental and non-governmental partners for the purposes of accomplishing refuge management goals and objectives and protecting the natural and cultural resources of Sanibel and Captiva Islands.				
Intergovernmental Coordination	Positive. Increased numbers of governmental partners coordinating with the refuge on a variety of issues, activities, programs, and projects.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Commercial Harvesting Goal 3: Limit the impacts to the natural resources and waters of the refuge from commercial harvesting activities to current levels until these activities can be phased out from the refuge.				
Commercial Harvesting Impacts	Neutral. One commercial bait fishing operation occurs on the refuge.	Positive. Eliminate all commercial harvesting activities from the refuge during the life of the CCP.	Same as Alternative B.	Same as Alternative B.

UNAVOIDABLE IMPACTS AND MITIGATION MEASURES

Under Alternative A (Current Management, No Action Alternative), there are numerous unavoidable impacts, including: law enforcement that is not adequate for protecting increasing visitor use, especially unauthorized and illegal activities; continued degradation of the biological functions of native plant communities and wildlife habitat due to the invasion of exotic and nuisance plants and animals; and, a continued decrease in biodiversity. Without funding and staffing to support needed programs and to provide protection for the resources, Alternative A provides the least support for long-term productivity and sustainability of the refuge. Over time, if these issues are not addressed, they would continue to impact refuge resources.

The action alternatives, including Alternative C (Migratory Birds, Proposed Action), also have some unavoidable impacts. These impacts are expected to be minor and/or short-term in duration. However, the refuge would attempt to minimize these impacts whenever possible. The following sections describe the measures the refuge would employ to mitigate and minimize the potential impacts that would result from implementation of the proposed action. However, none of these impacts rises to the level of significance. All would be mitigated, so there would in fact be no significant unavoidable adverse impacts under any of the alternatives.

EFFECTS ON WATER QUALITY FROM SOIL DISTURBANCE AND USE OF HERBICIDES

Soil disturbance and siltation due to water management activities; road and levee maintenance; and the construction of an observation tower at the Bailey Tract, a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract, and an expanded or new parking area for Shell Mound Trail is expected to be minor and of short duration. To further reduce potential impacts, the refuge would use best management practices to minimize the erosion of soils into water bodies.

Foot traffic on new and extended foot trails is expected to have a negligible impact on soil erosion. To minimize the impacts from public use, the refuge would include informational signs that request trail users to remain on the trails, in order to avoid causing potential erosion problems.

Long-term herbicide use to control exotic plants could result in a slight decrease in water quality. Through proper application of select herbicides and adjuvants appropriate to site specific conditions, herbicidal control of exotic plants seeks to benefit the environmental health and integrity of the refuge. Appropriately used herbicides and adjuvants may have a minimal, short term impact on water quality in the immediate vicinity of the application where significant and unexpected rain events or high winds may move recently applied, highly mobile herbicides. The use of site appropriate herbicides is a proven, standard methodology to control and manage exotic plant infestations presently degrading native plant and wildlife habitats throughout Florida and proper application following label requirements greatly reduces risks to water quality. Every effort would be employed to ensure proper and appropriate application of herbicides to control noxious weeds throughout the refuge. Through the proper application of herbicides, it is expected to have a minor impact on the environment, with the benefit of reducing or eliminating exotic plant infestations.

WILDLIFE DISTURBANCE

Disturbance to wildlife is an unavoidable consequence of any public use program, regardless of the activity involved. While some activities such as wildlife observation may be less disturbing than others, all of the public use activities proposed under the proposed action would be planned to avoid unacceptable levels of impact.

The known and anticipated levels of disturbance from the proposed action are not considered to be significant. Nevertheless, the refuge would manage public use activities to reduce impacts. Providing access for fishing opportunities allows the use of a renewable natural resource without adversely impacting other resources. General wildlife observation may result in minimal disturbance to wildlife. If the refuge determines that impacts from the expected additional visitor uses are above the levels that are anticipated, those uses would be discontinued, restricted, or rerouted to other less sensitive areas to minimize or eliminate the impacts.

VEGETATION DISTURBANCE

Negative impacts could result from the creation, extension, and maintenance of trails that require the clearing of non-sensitive vegetation along their lengths. This is expected to be a minor, short-term, and discrete impact.

Increased visitor use may increase the potential for the introduction of new exotic species into areas when visitors do not comply with boating regulations at the boat ramps and other access points or with requests to stay on trails. The refuge would minimize this impact by enforcing the regulations for access to the refuge's water bodies and by installing informational signs that request users to stay on the trails.

USER GROUP CONFLICTS

As public use increases, unanticipated conflicts between different user groups could occur. If this should happen, the refuge would adjust its programs, as needed, to eliminate or minimize any public use issues. The refuge would use methods that have proven to be effective in reducing or eliminating public use conflicts. These methods include establishing separate use areas, different use periods, and limits on the numbers of users in order to provide safe, quality, appropriate, and compatible wildlife-dependent recreational opportunities.

EFFECTS ON ADJACENT LANDOWNERS

Implementation of the proposed action is not expected to negatively affect the owners of private lands adjacent to the refuge. In contrast, positive impacts would be expected, including higher property values, increased aesthetics, less intrusion of invasive exotic plants, and increased opportunities for viewing more diverse wildlife.

However, some negative impacts that may occur include a higher frequency of trespass onto adjacent private lands and noise associated with increased traffic. To minimize these potential impacts, the refuge would provide informational signs that clearly mark refuge boundaries; maintain the refuge's existing parking facilities; use law enforcement; and provide increased educational efforts at the Education Center.

LAND OWNERSHIP AND SITE DEVELOPMENT

Land acquisition efforts by the Service could lead to changes in land use and recreational use patterns. If lands are acquired as additions to the refuge, they would be maintained in a natural state, managed for native wildlife populations, and opened to wildlife-compatible public uses, where feasible. All four alternatives propose to acquire the remaining properties within the refuge's original acquisition boundary. The commitment of resources to acquire and maintain these lands is small compared to the benefits derived from the increased biodiversity – with the acquired lands providing

nesting, foraging, and migrating habitat for many migratory bird species of conservation concern. These lands would also benefit refuge visitors by providing wildlife observation.

Potential development of the refuge's buildings, trails, and other improvements could lead to minor short-term negative impacts on plants, soils, and some wildlife species. When building the observation towers, efforts would be made to use recycled products and environmentally sensitive treated lumber. All construction activities would comply with applicable laws, policies, and treaties, including the requirements of Section 404 of the Clean Water Act; the National Historic Preservation Act; Executive Order 11988, Floodplain Management; and other applicable regulatory requirements.

CUMULATIVE IMPACTS

A cumulative impact is defined as an impact on the natural or human environment, which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such other actions (40 Code of Federal Regulations, 1508.7). Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can "accumulate" spatially, when different actions impact different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. A series of seemingly minor impacts could accumulate to create major problems over a period of time. Occasionally, different actions counterbalance one another, partially canceling out each other's impact on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall impact is greater than merely the sum of the individual impacts, such as when one more reduction in a population crosses a threshold of reproductive sustainability, and threatens to extinguish the population.

A thorough analysis of impacts always considers their cumulative aspects, because actions do not take place in a vacuum: there are virtually always some other actions that have affected that resource in some way in the past, or are affecting it in the present, or will affect it in the reasonably foreseeable future. So any assessment of a specific action's effects must in fact be made with consideration of what else has happened to that resource, what else is happening, or what else will likely happen to it.

The refuge is not aware of any past, present, or future planned actions that would result in significant cumulative impacts when added to the refuge's proposed management, as outlined in the proposed action. None of the alternatives are expected to have significant cumulative adverse impacts on air quality, hydrology, water quality, floodplains, biological resources, cultural resources, climate change, or the local economy.

None of the alternatives are expected to have significant cumulative adverse impacts on air quality locally or regionally. Some short-term, local deterioration in air quality would be expected from air emissions of motor vehicles and motorboats used by refuge visitors and staff both on and off the refuge. With our partners, we would continue to contribute to improving air quality through cooperative land conservation and management of natural vegetation and wetlands. Protecting and maintaining lands and waters in native habitats assures these areas would continue to filter out many air pollutants harmful to humans and the environment.

None of the alternatives are expected to have significant cumulative adverse impacts on hydrology, water quality, or floodplains. All alternatives include measures to increase coordination with the partners to address concerns related to water quality, quantity, and timing, especially in relation to Lake Okeechobee releases to the west and the Caloosahatchee River watershed.

None of the alternatives are expected to have significant cumulative adverse impacts to biological resources, since all alternatives would maintain or improve biological resources and protect the biological integrity of the refuge. The combination of refuge management actions with other organizations (e.g., city of Sanibel, Lee County, and State of Florida) are expected to result in beneficial cumulative effects by: (1) increasing conservation and management for rare, threatened, and endangered species; (2) improving habitats, especially those for migratory birds; and (3) preventing the spread of or reducing exotic, invasive, and nuisance plants and animals. Further, proposed management actions also focus on the minimization of negative impacts associated with exotic, invasive, and nuisance species and with visitor services.

None of the alternatives are expected to have significant cumulative adverse impacts to cultural resources. Beneficial impacts for cultural resources would occur at different levels under the alternatives, based upon the effort of survey and protection and based upon the inclusion of cultural resources in refuge programs and materials.

The management activities in the proposed action are not anticipated to have significant adverse impacts on climate change. The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises. Species with small and/or isolated populations and low genetic variability will be least likely to withstand impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al. 2004). One measure that the Service is undertaking nationwide is the effort to reduce the carbon footprint of the agency. The refuge will also strive to reduce its carbon footprint through a variety on conservation measures that could include alternative energy, energy saving appliances, energy efficient vehicles (e.g., hybrid and solar), and recycled and recyclable materials. The proposed management actions include working with the partners to understand and ameliorate the impacts of climate change on refuge and area resources.

Nor are significant cumulative adverse impacts expected from the proposed action regarding the local economy. Instead, the proposed management activities are anticipated to help support area property values, aesthetics, and the local economy.

A few activities in the proposed action are anticipated to have negligible cumulative impacts, including fishing, increased visitation, prescribed burning, predator control, and exotic plant control.

The negative cumulative impacts of fishing, a consumptive resource use, are anticipated to be minimal. Fishing is not anticipated to cause any significant adverse cumulative effects. Fishing is popular along the Wildlife Drive, in Tarpon Bay, at the Bailey Tract (interior freshwater), and in backwaters of the refuge, as well as on adjacent lands and waters. Special use permits for local fishing guides and state fishing regulations and catch limits would help ensure that fish stocks in the area and on the refuge would not be depleted. Further, many anglers use catch and release methods to avoid the elevated levels of mercury found in many fish in southern Florida. On the refuge, fishing would be limited to areas that minimize any associated wildlife disturbance. The monofilament line recycling and education program would help reduce the amount of waste and impacts from fishing line littering the area and on the refuge.

The negative cumulative impacts of increased visitation are anticipated to be minimal. Although nonconsumptive users can impact wildlife through disturbance, the management activities for visitor services under the proposed action are not considered to have significant impacts and anticipated impacts are well within the tolerance level of known wildlife species and populations present in the visited areas. Further, the ethical behavior educational activities, the seasonal closure of vulnerable areas (e.g., where wildlife are foraging or nesting), and the use of natural screens (e.g., vegetation barriers) would all help to minimize these adverse effects. Further, the refuge would continue to work with the partners to minimize impacts from increased visitation to the refuge and to Sanibel and Captiva Islands, including traffic congestion, noise, and littering. (It is important to note that while visitation in the area is anticipated to increase, the proposed action would not include activities to specifically increase visitation.)

There would be no significant adverse cumulative impacts from refuge management activities to hydrology or water quality under any of the alternatives. All alternatives would work with partners (e.g., USACE, State of Florida, Charlotte Harbor NEP, and local communities) to manage releases from Lake Okeechobee, regulate freshwater flows in the Caloosahatchee River watershed, and install water quality monitoring instrumentation in Tarpon Bay. On the refuge, best management practices (BMPs) and erosion and sediment control measures would be used on building, road, trail, and other infrastructure construction sites to ensure impacts are minimized. These on site projects would be widely dispersed in space and time so that their local effects would not be additive.

Negative cumulative effects from prescribed burning of interior wetlands and motor boat and motor vehicle emissions from increased visitation are anticipated to be minimal. The use of relatively small scale, prescribed burns on a 3- to 5-year rotation conducted in accordance with agency policies and under an approved Fire Management Plan and the improvement of motor vehicle emission controls over time would help maintain local air pollution at acceptable levels. Managed burns reduce fuel loads and help prevent catastrophic wildfires that would otherwise have the potential to cause serious reductions in short term air quality.

Proposed exotic plant control activities are not expected to have significant adverse cumulative effects. These activities involve mechanical removal, application of approved herbicides, release of biological control agents, incineration, and prescribed burning, or a combination of these activities. Herbicides used for exotic plant control are used and managed to target specific exotic plants or infestations, are approved for use in natural areas to control exotic plants, and generally do not have long-lasting residual effects to the environment as their chemical nature provides for relatively quickly break down of the product upon application. Further, use of herbicides is inherently limited based on label rates and approved application practices on refuge lands and natural areas in the State of Florida, further minimizing any negative impact. All exotic plant chemical applications would be conducted in accordance with Service policy and under an approved refuge specific Integrated Pest Management Plan.

Proposed predator control activities that seek to minimize the predation of migratory birds and sea turtle nests are not expected to have significant adverse cumulative effects. A relatively small number of raccoons have developed a search image for sea turtle, terrapin or bird eggs while other species such as exotic Nile monitor lizards naturally target eggs. Raccoons exhibiting sick or aggressive behavior would also be subject to control activities. So, removing these individuals can greatly increase survival for migratory birds and sea turtles or safety of the public. Since relatively few animals are removed, this management practice does not jeopardize local populations of native species. Further, since the range and number of the animals are relatively large compared to the size of the refuge, the proposed action poses negligible impacts on the native species throughout their

ranges. For those non-native species, predator control activities are anticipated to have positive benefits both on and off the refuge, helping to limit the further invasion and spread of these species.

DIRECT AND INDIRECT EFFECTS OR IMPACTS

Direct effects are caused by an action and occur at the same time as the action. Indirect effects are caused by an action, but are manifested later in time or further removed in distance, but still reasonably foreseeable.

The actions proposed for implementation under the proposed action include facility development, wildlife and population management, resource protection, public use, and administrative programs. These actions would result in both direct and indirect effects. Facility development, for example, would most likely lead to increased public use, a direct effect; and it, in turn, would lead to indirect effects, such as increased littering, noise, and vehicular traffic.

Other indirect effects that may result from implementing the proposed action include minor impacts due to the disturbance of soils and vegetation during construction activities for an observation tower at the Bailey Tract, a handicapped-accessible fishing pier at Smith Pond, and an expanded or new parking for Shell Mound Trail, as well as expanding or creating new foot trails; and providing greater visitor access through improvements to the boat ramps.

None of the proposed management activities would lead, directly or indirectly, to a violation of federal, state, or local laws imposed for the protection of the environment; and, none of the direct or indirect impacts are anticipated to be significant. Adaptive management is a key component of each alternative. As such, the actions outlined would not establish a precedent for future actions with significant negative effects nor represent a decision in principle about future considerations. Refuge management activities would constantly be adapted as new research, data, and information become available to protect resources and minimize impacts.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

All of the alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge. The alternatives strive to conserve our rederal trust species and the habitats upon which they depend. The habitat protection and management actions under the proposed action are dedicated to maintaining the long-term productivity of refuge habitats. The benefits of this CCP for long-term productivity far outweigh any impacts from short-term actions, such as prescribed burns, the construction of observation towers, or the creation of new trails. The dedication of certain areas for roads, trails, visitor facilities, and other facilities on the refuge represents a loss of long-term productivity on localized areas, but is not considered significant given the comparative refuge land base. While invasive exotic plant removal or prescribed burns would produce unsightly results for a time, they would also provide long-term wildlife and habitat benefits to the refuge.

Proposed visitor services activities related to fishing, wildlife observation, photography, environmental education, interpretation, and outreach strive to increase ethical outdoor behavior, minimize impacts from human disturbances, and encourage visitors and participants in refuge programs to be better stewards of the environment. The short-term negative impacts associated with public use activities produce long-term benefits for the refuge's entire ecosystem and provide an improved visitor experience and understanding of ecological processes.

The key to protecting and ensuring the refuge's long-term productivity is to find the threshold where public uses do not degrade or interfere with the refuge's natural resources. The management actions outlined under the proposed action have been carefully conceived to achieve that threshold. Therefore, implementing the proposed action would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term impacts. Further, the refuge would employ adaptive management to constantly allow refuge management to change in response to changing conditions and new information. The compatibility determination process ensures that all public use of the refuge is compatible with refuge purposes. When thresholds are passed and unacceptable impacts are experienced from public use activities, the refuge would modify or eliminate the use or uses in question to ensure compatibility and to ensure that impacts are below unacceptable levels. In summary all alternatives would contribute positively to maintaining or enhancing the long-term productivity of the refuge's environment.

V. Consultation and Coordination

OVERVIEW

This chapter summarizes the consultation and coordination that has occurred to date in identifying the issues, alternatives, and proposed alternative, which are presented in this Draft CCP/EA. It lists the meetings that have been held with the various agencies, organizations, and individuals who were consulted in the preparation of the Draft CCP/EA.

The CCP process for J.N. "Ding" Darling NWR involved a wide variety of participants, including federal, state, and local governments; tribal governments; universities and other researchers; private non-profit groups; and the "Ding" Darling Wildlife Society, as well as a wide variety of local residents, local businesses, concerned citizens, local schools, and state and national organizations. The list of participants, beyond those individuals, agencies, and organizations providing comments during the public scoping process, includes the Core CCP Team, the Wildlife and Habitat Management Review Team, the Visitor Services Review Team, the Wilderness Review Team, and the Intergovernmental Coordination Planning Team.

CORE CCP TEAM

The Core Planning Team included representatives from the Service and the CCP contractor, the Tennessee Valley Authority. The Team met as a whole to review the all the issues, determine the priority issues, and identify potential solutions or approaches.

U.S. Fish and Wildlife Service

- Paul Tritaik, Wildlife Refuge Manager (Project Leader), J.N. "Ding" Darling NWR Complex
- Cheri M. Ehrhardt, AICP, Natural Resource Planner
- Patrick Martin, Deputy Project Leader, J.N. "Ding" Darling NWR Complex
- Kevin Godsea, Supervisory Park Ranger, J.N. "Ding" Darling NWR Complex
- Joyce Mazourek, Biologist, J.N. "Ding" Darling NWR Complex
- Toni Westland, Park Ranger-Environmental Education, J.N. "Ding" Darling NWR Complex
- Jeff Combs, Park Ranger-Volunteer Coordinator, J.N. "Ding" Darling NWR Complex
- Spencer Simon, Ecological Services

Contractor to the U.S. Fish and Wildlife Service

- Charles McEntyre, Contractor, Tennessee Valley Authority

WILDLIFE AND HABITAT MANAGEMENT REVIEW TEAM

The Wildlife and Habitat Management Review Team included a core group of Service staff with invited participants. The invited participants included local and regional experts, researchers, and individuals with intimate knowledge of and expertise with the resources of the refuge. The Wildlife and Habitat Management Review was conducted during April 2000.

U.S. Fish and Wildlife Service (non-Refuge)

- Frank Bowers, Southeast Regional Office, Atlanta, GA
- Chuck Hunter, Southeast Regional Office, Atlanta, GA
- David Brownlie, Fire Ecologist, Tallahassee, FL
- Doug Fruge, Southeast Region, Gulf Coast Fisheries Resource Office
- Mark Musaus, A.R.M. Loxahatchee NWR

U.S. Fish and Wildlife Service (Refuge Staff)

- Lou Hinds, Wildlife Refuge Manager, J.N. “Ding” Darling NWR Complex
- Layne Hamilton
- Jorge L. Coppen
- Allison Baker
- Susan Trokey
- Steve Alvarez
- Mike Ward
- Carol Pratt

Non-Service Personnel

- Jim Beever, Florida Fish and Wildlife Conservation Commission, Office of Environmental Services
- Jeff McGrady, Fish and Wildlife Conservation Commission
- Dave Ceilley, Sanibel-Captiva Conservation Foundation
- Rob Loflin, City of Sanibel, Natural Resources Department
- George Wichterman, Lee County Mosquito Control District
- Doug Carlson, Indian River Mosquito Control District

VISITOR SERVICES REVIEW TEAM

The Visitor Services Review Team consisted of Service staff from the Southeast Regional Office and other refuges. The Visitor Services Review for the refuge was completed in 2001.

U.S. Fish and Wildlife Service

- Cheryl Simpson, Southeast Regional Office
- Diana Trujillo, Southwest Regional Office
- Richard Mattison, Southeast Regional Office
- Jim Burkhart, Okefenokee NWR
- Dorn Whitmore, Merritt Island NWR

At the time of the Visitor Services Review, the Refuge Staff was led by:

- Lou Hinds, Project Leader
- Layne Hamilton, Deputy Project Leader
- Steve Alvarez, Supervisory Refuge Ranger

WILDERNESS REVIEW TEAM

The Wilderness Review Team involved the Wildlife Refuge Manager and the Natural Resource Planner. The Review was completed in 2008.

U.S. Fish and Wildlife Service

- Paul Tritaik, Wildlife Refuge Manager (Project Leader), J.N. “Ding” Darling NWR Complex
- Cheri M. Ehrhardt, AICP, Natural Resource Planner
- Patrick Martin, Deputy Project Leader, J.N. “Ding” Darling NWR Complex
- Joyce Mazourek, Biologist, J.N. “Ding” Darling NWR Complex

INTERGOVERNMENTAL COORDINATION PLANNING TEAM

The Intergovernmental Coordination Planning Team included local, state, and federal government field staff representatives involved with the resources at the local level. A letter inviting participation by the Florida Fish and Wildlife Conservation Commission (FWC) in the CCPs for the Refuge Complex was sent to the FWC Director in January 2008. Additional invitation letters were also sent to: Seminole Tribe of Florida, Miccosukee Tribe of Indians of Florida, Seminole Nation of Oklahoma, Poarch Band of Creek Indians, Muscogee (Creek) Nation of Oklahoma, United South and Eastern Tribes, Charlotte Harbor National Estuary Program, South Florida Water Management District, Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Services, Southwest Florida Regional Planning Council, Lee County, Lee County Mosquito Control District, and City of Sanibel. To gather together the various local, State, and federal agencies, an Intergovernmental Coordination Planning Team meeting was conducted in April 2008 with attendees representing 11 local, state, and federal agencies, as listed.

U.S. Fish and Wildlife Service
- Cheri M. Ehrhardt, AICP, Natural Resource Planner
- Kevin Godsea, Supervisory Park Ranger
- Laura Housh, Regional Planner
- Patrick Martin, Deputy Project Leader, J.N. “Ding” Darling NWR Complex
- Joyce Mazourek, Wildlife Biologist, J.N. “Ding” Darling NWR Complex
- Bill Miller, Fish and Wildlife Biologist
- Jim Serfis, Acting Project Leader, J.N. “Ding” Darling NWR Complex
- Paul Tritaik, Project Leader, J.N. “Ding” Darling NWR Complex

Contractor to the U.S. Fish and Wildlife Service
- Charlie McEntyre, Tennessee Valley Authority

Seminole Tribe of Florida
- Marion Smith, Tribal Historic Preservation Office

Florida Fish and Wildlife Conservation Commission
- Ron Mezich, Biological Scientist IV, Aquatic Habitat Restoration and Conservation Section, Marine Habitat Management

Florida Department of Environmental Protection
- Jennifer L. Nelson, Environmental Manager, Watershed Projects/Biological Monitoring & Research
- Heather Stafford, Manager, Charlotte Harbor Aquatic Preserves and Estero Bay Aquatic Preserve

South Florida Water Management District
- Judith Nothdurft, Project Manager, Lower West Coast Service Center

Florida Department of Agriculture and Consumer Services
- Micahel Weston, County Forester, Caloosahatchee District, Florida Division of Forestry

Southwest Florida Regional Planning Council
- Jim Beever, Senior Planner

Lee County
- Steve Boutelle, Operations Manager, Marine Services, Division of Natural Resources
- Roger Clark, Land Stewardship Manager, Parks and Recreation

Lee County Mosquito Control District
- T. Wayne Gale, Executive Director
- Katie Heggemeir, Manager, Mosquito Control
- Bryan Smith, Supervisor, Aerial Larviciding

City of Sanibel
- Robert J. Duffy, AICP, Planning Director
- Robert K. Loflin, PhD, Natural Resources Director

PUBLIC SCOPING MEETINGS

The Core Planning Team hosted open houses/public scoping meetings in Lee and Charlotte Counties in April 2008 at the Sanibel School, the Cypress Lake Middle School in Ft. Myers, and the Pine Island Elementary School. The refuge complex's draft vision, goals, and issues were presented and public input was requested. Comment forms were made available at the meetings as well as at the J.N. "Ding" Darling NWR Visitor Center and the Tarpon Bay Concessionaire headquarters. The completed forms were submitted to the Service by mail or e-mail. Public input is greatly appreciated and was incorporated into the CCP.

"DING" DARLING WILDLIFE SOCIETY--FRIENDS OF THE REFUGE

The "Ding" Darling Wildlife Society, a non-profit Friends of the Refuge organization, was established in 1982. It supports environmental education and services at J.N. "Ding" Darling National Wildlife Refuge. The "Ding" Darling Wildlife Society currently has over 1,400 members. Many members of the "Ding" Darling Wildlife Society have participated in the CCP in some capacity, but the entire "Ding" Darling Wildlife Society has regularly provided input on a variety of issues that have been incorporated into the CCP.

Appendix A. Glossary

Adaptive Management: Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in a management plan. Analysis of results helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alluvial: Sediment transported and deposited in a delta or riverbed by flowing water.

Alternative: 1. A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). 2. Alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1.6B).

Anadromous: Migratory fishes that spend most of their lives in the sea and migrate to fresh water to breed.

Biological Diversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1. 12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as biodiversity.

Carrying Capacity: The maximum population of a species able to be supported by a habitat or area.

Categorical Exclusion: A category of actions that does not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

CFR: Code of Federal Regulations.

Compatible Use: A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge [50 CFR 25.12 (a)]. A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan:	A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6 E).
Concern:	See Issue
Cover Type:	The present vegetation of an area.
Craton	A stable relatively immobile area of the earth's crust that forms the nuclear mass of a continent or the central basin of an ocean.
Cultural Resource Inventory:	A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).
Cultural Resource Overview:	A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office's background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).
Cultural Resources:	The remains of sites, structures, or objects used by people in the past.
Designated Wilderness Area:	An area designated by the U.S. Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).
Disturbance:	Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).
Ecosystem:	A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Ecosystem Management:	Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.
Endangered Species (Federal):	A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.
Endangered Species (State):	A plant or animal species in danger of becoming extinct or extirpated in the state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.
Environmental Assessment (EA):	A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).
Environmental Impact Statement (EIS):	A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).
Eocene	An epoch of the Tertiary period lasting from about 56 to 34 million years ago.
Estuary:	The wide lower course of a river into which the tides flow. The area where the tide meets a river current.
Euryhaline	Refers to organisms that are able to adapt to a wide range of salinities.
Finding of No Significant Impact (FONSI):	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).
Goal:	Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 620 FW 1.6J).
Habitat:	Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Restoration:	Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.
Habitat Type:	See Vegetation Type.
Holocene	A geological epoch of the Quaternary period which began approximately 11,000 years ago. According to traditional geological thinking, the Holocene continues to the present.
Improvement Act:	The National Wildlife Refuge System Improvement Act of 1997.
Informed Consent:	The grudging willingness of opponents to "go along" with a course of action that they actually oppose.
Issue:	Any unsettled matter that requires a management decision [e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K)].
Lithified	Changed into stone; petrified.
Management Alternative:	See Alternative
Management Concern:	See Issue
Management Opportunity:	See Issue
Migration:	The seasonal movement from one area to another and back.
Milocene	A geological epoch of the Tertiary period and extends from about 23 to 5 million years before the present.
Mission Statement:	Succinct statement of the unit's purpose and reason for being.
Monitoring:	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (40 CFR 1500).

National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57):	Under the Refuge Improvement Act, the Fish and Wildlife Service is required to develop 15-year comprehensive conservation plans for all national wildlife refuges outside Alaska. The Act also describes the six public uses given priority status within the Refuge System (i.e., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation).
National Wildlife Refuge System Mission:	The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.
National Wildlife Refuge System:	Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.
National Wildlife Refuge:	A designated area of land, water, or an interest in land or water within the Refuge System.
Native Species:	Species that normally live and thrive in a particular ecosystem.
Noxious Weed:	A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (P.L. 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Untied States and to the public health.
Objective:	A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Making objectives attainable, time-specific, and measurable (Service Manual 602 FW 1.6N).
Oligocene	A geologic epoch of the Tertiary period and extends from about 34 million to 23 million years before the present.
Plant Association:	A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.

Plant Community: An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community.

Pleistocene The epoch of the Quaternary period from about 2 million to 11,000 years ago covering the world's recent period of repeated glaciations. The end of the Pleistocene corresponds with the retreat of the last continental glacier.

Pliocene The period in the geologic timescale that extends from about 5 million to 2 million years before present. A period of cooler, drier climate and the beginning of the formation of ice sheets and glaciations.

Preferred Alternative: This is the alternative determined (by the decision-maker) to best achieve the refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Prescribed Fire: The application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7). May occur from natural ignition or intentional ignition.

Priority Species: Fish and wildlife species that require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.

Public Involvement Plan: Broad long-term guidance for involving the public in the comprehensive conservation planning process.

Public Involvement: A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public: Individuals, organizations, and groups; officials of federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in service issues and those who do or do not realize that Service decisions may affect them.

Purposes of the Refuge:	"The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge sub-unit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge (Service Manual 602 FW 106 S).
Recommended Wilderness:	Areas studied and found suitable for wilderness designation by both the Director of the Fish and Wildlife Service and the Secretary of the Department of the Interior, and recommended for designation by the President to Congress. These areas await only legislative action by Congress in order to become part of the Wilderness System. Such areas are also referred to as "pending in Congress" (Draft Service Manual 610 FW 1.5).
Record of Decision (ROD):	A concise public record of decision prepared by the federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).
Refuge Goal:	See Goal
Refuge Purposes:	See Purposes of the Refuge
Songbirds: (Also Passerines)	A category of birds that is medium to small, perching landbirds. Most are territorial singers and migratory.
Step-down Management Plan:	A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, and safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives (Service Manual 602 FW 1.6 U).
Strategy:	A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6 U).
Study Area:	The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP, the study area includes the lands within the currently approved refuge boundary and potential refuge expansion areas.
Threatened Species (Federal):	Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Threatened Species (State): A plant or animal species likely to become endangered in the state within the near future if factors contributing to population decline or habitat degradation or loss continue.

Tiering: The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues (40 CFR 1508.28).

U.S. Fish and Wildlife Service Mission: The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.

Unit Objective: See Objective

Vegetation Type, Habitat Type, Forest Cover Type: A land classification system based upon the concept of distinct plant associations.

Vision Statement: A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6 Z).

Wilderness Study Areas: Lands and waters identified through inventory as meeting the definition of wilderness and undergoing evaluation for recommendation for inclusion in the Wilderness System. A study area must meet the following criteria:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation; and
- Has at least 5,000 contiguous roadless acres or is sufficient in size as to make practicable its preservation and use in an unimpaired condition (Draft Service Manual 610 FW 1.5).

Wilderness: See Designated Wilderness

Wildfire: A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildland Fire: Every wildland fire is either a wildfire or a prescribed fire (Service Manual 621 FW 1.3

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsuis
°F	degrees Fahrenheit
ATPPL	Alternative Transportation in Parks and Public Lands
AQI	Air Quality Index
BCR	Bird Conservation Region
BEBR	Bureau of Economic and Business Research (at the University of Florida)
BMP	Best Management Practice
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CCMP	Comprehensive Conservation and Management Plan
CCP	Comprehensive Conservation Plan
CERP	Comprehensive Everglades Restoration Plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHNEP	Charlotte Harbor National Estuary Program
CISMA	Cooperative Invasive Species Management Area
CO	carbon monoxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DBH	diameter at breast height
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DM	Department Manual
DOI	Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FAC	Florida Administrative Code
FAS	Floridan Aquifer System
FBCI	Florida Bird Conservation Initiative
FCREPA	Florida Committee on Rare and Endangered Plants and Animals
FCWCS	Florida's Comprehensive Wildlife Conservation Strategy
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FNAI	Florida Natural Areas Inventory
FONSI	Finding of No Significant Impact
FTE	full-time employee
FW	Fish and Wildlife Service Manual
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish and Wildlife Service (also USFWS or Service)
FY	Fiscal Year
GEMS	Gulf Ecological Management Site
GIS	Global Information System
GMP	Gulf of Mexico Program
ha	hectares
IBA	Important Bird Area

IFAS	Institute of Food and Agricultural Sciences (at the University of Florida)
IPCC	International Panel on Climate Change
IPMP	Integrated Pest Management Plan
LCC	Landscape Conservation Cooperative
LCH	Lower Charlotte Harbor
LCMCD	Lee County Mosquito Control District
LiDAR	Light Detecting and Ranging
LPP	Land Protection Plan
LWCF	Land and Water Conservation Fund
m	meters
Max	Maximum
Min	Minimum
MIT	Massachusetts Institute of Technology
MLRA	Major Land Resource Area
MPA	Marine Protected Area
mph	mile per hour
MSA	Metropolitan Statistical Area
MUSIC	MIT-USGS Science Impact Collaborative
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NAMS	National Ambient Monitoring Stations
NASA	National Aeronautics and Space Administration
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge (also Refuge)
NWRS	National Wildlife Refuge System (also NWRS or Refuge System)
OCRM	Ocean and Coastal Resource Management
OFW	Outstanding Florida Water
ORV	Outstandingly Remarkable Value
PCB	polychlorinated biphenyls
PIF	Partners-in-Flight
PM	particulate matter
RA	Refuge Administration
RP	Resource Protection
RNA	Research Natural Area
ROD	Record of Decision
RONS	Refuge Operating Needs System
SAF	Southern American Foresters
SAMMS	Service Asset and Maintenance Management System
SAS	Surficial Aquifer System
SCCF	Sanibel-Captiva Conservation Foundation
SEE	Society for Ethical Ecotourism
SFWMD	South Florida Water Management District
SLAMM	Sea Level Affecting Marshes Model
SLAMS	State and Local Ambient Monitoring Stations
SLOSH	Sea, Lake, and Overland Surges from Hurricanes

SO_2	sulfur dioxide
STAR	Summer Teachers Assisting Refuge
SWFFS	Southwest Florida Feasibility Study
SWFL	Southwest Florida
SWFRPC	Southwest Florida Regional Planning Council
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management Program
TMDL	Total Maximum Daily Load
TWS	The Wildlife Society
U.S.	United States
UASCE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service (also FWS or Service)
USGS	U.S. Geological Survey
VS	Visitor Services
WHM	Wildlife and Habitat Management

Appendix B. References and Literature Citations

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Appendix C. Relevant Legal Mandates and Executive Orders

STATUE	DESCRIPTION
Administrative Procedures Act (1946)	Outlines administrative procedures to be followed by federal agencies with respect to identification of information to be made public; publication of material in the Federal Register; maintenance of records; attendance and notification requirements for specific meetings and hearings; issuance of licenses; and review of agency actions.
American Antiquities Act of 1906	Provides penalties for unauthorized collection, excavation, or destruction of historic or prehistoric ruins, monuments, or objects of antiquity on lands owned or controlled by the United States. The Act authorizes the President to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the Unites States.
American Indian Religious Freedom Act of 1978	Protects the inherent right of Native Americans to believe, express, and exercise their traditional religions, including access to important sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.
Americans With Disabilities Act of 1990	Intended to prevent discrimination of and make American society more accessible to people with disabilities. The Act requires reasonable accommodations to be made in employment, public services, public accommodations, and telecommunications for persons with disabilities.
Anadromous Fish Conservation Act of 1965, as amended	Authorizes the Secretaries of Interior and Commerce to enter into cooperative agreements with states and other non-federal interests for conservation, development, and enhancement of anadromous fish and contribute up to 50 percent as the federal share of the cost of carrying out such agreements. Reclamation construction programs for water resource projects needed solely for such fish are also authorized.
Archaeological Resources Protection Act of 1979, as amended.	This Act strengthens and expands the protective provisions of the Antiquities Act of 1906 regarding archaeological resources. It also revised the permitting process for archaeological research.
Architectural Barriers Act of 1968	Requires that buildings and facilities designed, constructed, or altered with federal funds, or leased by a federal agency, must comply with standards for physical accessibility.
Bald and Golden Eagle Protection Act of 1940, as amended	Prohibits the possession, sale or transport of any bald or golden eagle, alive or dead, or part, nest, or egg except as permitted by the Secretary of the Interior for scientific or exhibition purposes, or for the religious purposes of Indians.

STATUE	DESCRIPTION
Bankhead-Jones Farm Tenant Act of 1937	Directs the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and thus assist in such things as control of soil erosion, reforestation, conservation of natural resources and protection of fish and wildlife. Some early refuges and hatcheries were established under authority of this Act.
Cave Resources Protection Act of 1988	Established requirements for the management and protection of caves and their resources on federal lands, including allowing the land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on federal lands.
Clean Air Act of 1970	Regulates air emissions from area, stationary, and mobile sources. This Act and its amendments charge federal land managers with direct responsibility to protect the "air quality and related values" of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	This Act and its amendments have as its objective the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. Section 401 of the Act requires that federally permitted activities comply with the Clean Water Act standards, state water quality laws, and any other appropriate state laws. Section 404 charges the U.S. Army Corps of Engineers with regulating discharge of dredge or fill materials into waters of the United States, including wetlands.
Coastal Barrier Resources Act of 1982 (CBRA)	Identifies undeveloped coastal barriers along the Atlantic and Gulf Coasts and included them in the John H. Chafee Coastal Barrier Resources System (CBRS). The objectives of the act are to minimize loss of human life, reduce wasteful federal expenditures, and minimize the damage to natural resources by restricting most federal expenditures that encourage development within the CBRS.
Coastal Barrier Improvement Act of 1990	Reauthorized the Coastal Barrier Resources Act (CBRA), expanded the CBRS to include undeveloped coastal barriers along the Great Lakes and in the Caribbean, and established "Otherwise Protected Areas (OPAs)." The Service is responsible for maintaining official maps, consulting with federal agencies that propose spending federal funds within the CBRS and OPAs, and making recommendations to Congress about proposed boundary revisions.
Coastal Wetlands Planning, Protection, and Restoration (1990)	Authorizes the Director of the Fish and Wildlife Service to participate in the development of a Louisiana coastal wetlands restoration program, participate in the development and oversight of a coastal wetlands conservation program, and lead in the implementation and administration of a national coastal wetlands grant program.

STATUE	DESCRIPTION
Coastal Zone Management Act of 1972, as amended	Established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans and requires that “any federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone” shall be “consistent to the maximum extent practicable with the enforceable policies” of a state’s coastal zone management plan. The law includes an Enhancement Grants Program for protecting, restoring, or enhancing existing coastal wetlands or creating new coastal wetlands. It also established the National Estuarine Research Reserve System, guidelines for estuarine research, and financial assistance for land acquisition.
Emergency Wetlands Resources Act of 1986	This Act authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act requires the Secretary to establish a National Wetlands Priority Conservation Plan, required the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amounts equal to import duties on arms and ammunition. It also established entrance fees at national wildlife refuges.
Endangered Species Act of 1973, as amended	Provides for the conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging the establishment of state programs. It provides for the determination and listing of threatened and endangered species and the designation of critical habitats. Section 7 requires refuge managers to perform internal consultation before initiating projects that affect or may affect endangered species.
Environmental Education Act of 1990	This Act established the Office of Environmental Education within the U.S. Environmental Protection Agency to develop and administer a federal environmental education program in consultation with other federal natural resource management agencies, including the Fish and Wildlife Service.
Estuary Protection Act of 1968	Authorized the Secretary of the Interior, in cooperation with other federal agencies and the states, to study and inventory estuaries of the United States, including land and water of the Great Lakes, and to determine whether such areas should be acquired for protection. The Secretary is also required to encourage state and local governments to consider the importance of estuaries in their planning activities relative to federal natural resource grants. In approving any state grants for acquisition of estuaries, the Secretary was required to establish conditions to ensure the permanent protection of estuaries.

STATUE	DESCRIPTION
Estuaries and Clean Waters Act of 2000	This law creates a federal interagency council that includes the Director of the Fish and Wildlife Service, the Secretary of the Army for Civil Works, the Secretary of Agriculture, the Administrator of the Environmental Protection Agency and the Administrator for the National Oceanic and Atmospheric Administration. The council is charged with developing a national estuary habitat restoration strategy and providing grants to entities to restore and protect estuary habitat to promote the strategy.
Food Security Act of 1985, as amended (Farm Bill)	The Act contains several provisions that contribute to wetland conservation. The Swampbuster provisions state that farmers who convert wetlands for the purpose of planting after enactment of the law are ineligible for most farmer program subsidies. It also established the Wetland Reserve Program to restore and protect wetlands through easements and restoration of the functions and values of wetlands on such easement areas.
Farmland Protection Policy Act of 1981, as amended	The purpose of this law is to minimize the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses. Federal programs include construction projects and the management of federal lands.
Federal Advisory Committee Act (1972), as amended	Governs the establishment of and procedures for committees that provide advice to the federal government. Advisory committees may be established only if they will serve a necessary, nonduplicative function. Committees must be strictly advisory unless otherwise specified and meetings must be open to the public.
Federal Coal Leasing Amendment Act of 1976	Provided that nothing in the Mining Act, the Mineral Leasing Act, or the Mineral Leasing Act for Acquired Lands authorized mining coal on refuges.
Federal-Aid Highways Act of 1968	Established requirements for approval of federal highways through national wildlife refuges and other designated areas to preserve the natural beauty of such areas. The Secretary of Transportation is directed to consult with the Secretary of the Interior and other federal agencies before approving any program or project requiring the use of land under their jurisdiction.
Federal Noxious Weed Act of 1990, as amended	The Secretary of Agriculture was given the authority to designate plants as noxious weeds and to cooperate with other federal, State and local agencies, farmers' associations, and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds. The Act requires each Federal land-managing agency, including the Fish and Wildlife Service, to designate an office or person to coordinate a program to control such plants on the agency's land and implement cooperative agreements with the states, including integrated management systems to control undesirable plants.

STATUE	DESCRIPTION
Fish and Wildlife Act of 1956	Establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry but also includes the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, it authorizes the Secretary of the Interior to take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources including, but not limited to, research, development of existing facilities, and acquisition by purchase or exchange of land and water or interests therein.
Fish and Wildlife Conservation Act of 1980, as amended	Requires the Service to monitor non-gamebird species, identify species of management concern, and implement conservation measures to preclude the need for listing under the Endangered Species Act.
Fish and Wildlife Coordination Act of 1958	Promotes equal consideration and coordination of wildlife conservation with other water resource development programs by requiring consultation with the Fish and Wildlife Service and the state fish and wildlife agencies where the “waters of a stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted…or otherwise controlled or modified” by any agency under federal permit or license.
Improvement Act of 1978	This act was passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.
Fishery (Magnuson) Conservation and Management Act of 1976	Established Regional Fishery Management Councils comprised of federal and state officials, including the Fish and Wildlife Service. It provides for regulation of foreign fishing and vessel fishing permits.
Freedom of Information Act, 1966	Requires all federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions; official, published and unpublished policy statements; final orders deciding case adjudication; and other documents. Special exemptions have been reserved for nine categories of privileged material. The Act requires the party seeking the information to pay reasonable search and duplication costs.
Geothermal Steam Act of 1970, as amended	Authorizes and governs the lease of geothermal steam and related resources on public lands. Section 15 c of the Act prohibits issuing geothermal leases on virtually all Service-administrative lands.

STATUE	DESCRIPTION
Lacey Act of 1900, as amended	Originally designed to help states protect their native game animals and to safeguard U.S. crop production from harmful foreign species, this Act prohibits interstate and international transport and commerce of fish, wildlife or plants taken in violation of domestic or foreign laws. It regulates the introduction to America of foreign species.
Land and Water Conservation Fund Act of 1948	This Act provides funding through receipts from the sale of surplus federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities. Appropriations from the fund may be used for matching grants to states for outdoor recreation projects and for land acquisition by various federal agencies, including the Fish and Wildlife Service.
Marine Mammal Protection Act of 1972, as amended	The 1972 Marine Mammal Protection Act established a federal responsibility to conserve marine mammals with management vested in the Department of the Interior for sea otter, walrus, polar bear, dugong, and manatee. The Department of Commerce is responsible for cetaceans and pinnipeds, other than the walrus. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals, as well as products taken from them.
Migratory Bird Conservation Act of 1929	Established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The role of the commission was expanded by the North American Wetland Conservation Act to include approving wetlands acquisition, restoration, and enhancement proposals recommended by the North American Wetlands Conservation Council.
Migratory Bird Hunting and Conservation Stamp Act of 1934	Also commonly referred to as the “Duck Stamp Act,” requires waterfowl hunters 16 years of age or older to possess a valid federal hunting stamp. Receipts from the sale of the stamp are deposited into the Migratory Bird Conservation Fund for the acquisition of migratory bird refuges.
Migratory Bird Treaty Act of 1918, as amended	This Act implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Except as allowed by special regulations, this Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, barter, export or import any migratory bird, part, nest, egg, or product.
Mineral Leasing Act for Acquired Lands (1947), as amended	Authorizes and governs mineral leasing on acquired public lands.

STATUE	DESCRIPTION
Minerals Leasing Act of 1920, as amended	Authorizes and governs leasing of public lands for development of deposits of coal, oil, gas, and other hydrocarbons; sulphur; phosphate; potassium; and sodium. Section 185 of this title contains provisions relating to granting rights-of-way over federal lands for pipelines.
Mining Act of 1872, as amended	Authorizes and governs prospecting and mining for the so-called "hardrock" minerals (i.e., gold and silver) on public lands.
National and Community Service Act of 1990	Authorizes several programs to engage citizens of the U.S. in full- and/or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Among other things, this law establishes the American Conservation and Youth Service Corps to engage young adults in approved human and natural resource projects, which will benefit the public or are carried out on federal or Indian lands.
National Environmental Policy Act of 1969	Requires analysis, public comment, and reporting for environmental impacts of federal actions. It stipulates the factors to be considered in environmental impact statements, and requires that federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unqualified environmental values are given appropriate consideration, along with economic and technical considerations.
National Historic Preservation Act of 1966, as amended	It establishes a National Register of Historic Places and a program of matching grants for preservation of significant historical features. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.
National Trails System Act (1968), as amended	Established the National Trails System to protect the recreational, scenic, and historic values of some important trails. National recreation trails may be established by the Secretaries of Interior or Agriculture on land wholly or partly within their jurisdiction, with the consent of the involved state(s), and other land managing agencies, if any. National scenic and national historic trails may only be designated by Congress. Several national trails cross units of the National Wildlife Refuge System.
National Wildlife Refuge System Administration Act of 1966	Prior to 1966, there was no single federal law that governed the administration of the various national wildlife refuges that had been established. This Act defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of a refuge provided such use is compatible with the major purposes(s) for which the refuge was established.

STATUE	DESCRIPTION
National Wildlife Refuge System Improvement Act of 1997	This Act amends the National Wildlife Refuge System Administration Act of 1966. This Act defines the mission of the National Wildlife Refuge System, establishes the legitimacy and appropriateness of six priority wildlife-dependent public uses, establishes a formal process for determining compatible uses of Refuge System lands, identifies the Secretary of the Interior as responsible for managing and protecting the Refuge System, and requires the development of a comprehensive conservation plan for all refuges outside of Alaska.
Native American Graves Protection and Repatriation Act of 1990	Requires federal agencies and museums to inventory, determine ownership of, and repatriate certain cultural items and human remains under their control or possession. The Act also addresses the repatriation of cultural items inadvertently discovered by construction activities on lands managed by the agency.
Neotropical Migratory Bird Conservation Act of 2000	Establishes a matching grant program to fund projects that promote the conservation of neotropical migratory birds in the united States, Latin America, and the Caribbean.
North American Wetlands Conservation Act of 1989	Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, the United States, and Mexico. The North American Wetlands Conservation Council was created to recommend projects to be funded under the Act to the Migratory Bird Conservation Commission. Available funds may be expended for up to 50 percent of the United States' share cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on federal lands).
Refuge Recreation Act of 1962, as amended	This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife-oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.
Partnerships for Wildlife Act of 1992	Establishes a Wildlife Conservation and Appreciation Fund to receive appropriated funds and donations from the National Fish and Wildlife Foundation and other private sources to assist the state fish and game agencies in carrying out their responsibilities for conservation of non-game species. The funding formula is no more that 1/3 federal funds, at least 1/3 foundation funds, and at least 1/3 state funds.

STATUE	DESCRIPTION
Refuge Revenue Sharing Act of 1935, as amended	Provided for payments to counties in lieu of taxes from areas administered by the Fish and Wildlife Service. Counties are required to pass payments along to other units of local government within the county, which suffer losses in tax revenues due to the establishment of Service areas.
Rehabilitation Act of 1973	Requires nondiscrimination in the employment practices of federal agencies of the executive branch and contractors. It also requires all federally assisted programs, services, and activities to be available to people with disabilities.
Rivers and Harbors Appropriations Act of 1899, as amended	Requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States. The Fish and Wildlife Coordination Act provides authority for the Service to review and comment on the effects on fish and wildlife activities proposed to be undertaken or permitted by the Corps of Engineers. Service concerns include contaminated sediments associated with dredge or fill projects in navigable waters.
Sikes Act (1960), as amended	Provides for the cooperation by the Departments of Interior and Defense with state agencies in planning, development, and maintenance of fish and wildlife resources and outdoor recreation facilities on military reservations throughout the United States. It requires the Secretary of each military department to use trained professionals to manage the wildlife and fishery resource under his jurisdiction, and requires that federal and state fish and wildlife agencies be given priority in management of fish and wildlife activities on military reservations.
Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948	This Act provides that upon determination by the Administrator of the General Services Administration, real property no longer needed by a federal agency can be transferred, without reimbursement, to the Secretary of the Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes.
Transportation Equity Act for the 21st Century (1998)	Established the Refuge Roads Program, requires transportation planning that includes public involvement, and provides funding for approved public use roads and trails and associated parking lots, comfort stations, and bicycle/pedestrian facilities.
Uniform Relocation and Assistance and Real Property Acquisition Policies Act (1970), as amended	Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.

STATUE	DESCRIPTION
Water Resources Planning Act of 1965	Established Water Resources Council to be composed of Cabinet representatives including the Secretary of the Interior. The Council reviews river basin plans with respect to agricultural, urban, energy, industrial, recreational and fish and wildlife needs. The act also established a grant program to assist States in participating in the development of related comprehensive water and land use plans.
Wild and Scenic Rivers Act of 1968, as amended	This Act selects certain rivers of the nation possessing remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values; preserves them in a free-flowing condition; and protects their local environments.
Wilderness Act of 1964, as amended	This Act directs the Secretary of the Interior to review every roadless area of 5,000 acres or more and every roadless island regardless of size within the National Wildlife Refuge System and to recommend suitability of each such area. The Act permits certain activities within designated wilderness areas that do not alter natural processes. Wilderness values are preserved through a "minimum tool" management approach, which requires refuge managers to use the least intrusive methods, equipment, and facilities necessary for administering the areas.
Youth Conservation Corps Act of 1970	Established a permanent Youth Conservation Corps (YCC) program within the Departments of Interior and Agriculture. Within the Service, YCC participants perform many tasks on refuges, fish hatcheries, and research stations.

EXECUTIVE ORDERS	DESCRIPTIONS
Executive Order (EO) 11593, Protection and Enhancement of the Cultural Environment (1971)	States that if the Service proposes any development activities that may affect the archaeological or historic sites, the Service will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.
EO 11644, Use of Off-road Vehicles on Public Land (1972)	Established policies and procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 11988, Floodplain Management (1977)	The purpose of this Executive Order is to prevent federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In the course of fulfilling their respective authorities, federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains."
EO 11989 (1977), Amends Section 2 of EO 11644	Directs agencies to close areas negatively impacted by off-road vehicles.
EO 11990, Protection of Wetlands (1977)	Federal agencies are directed to provide leadership and take action to minimize the destruction, loss of degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.
EO 12372, Intergovernmental Review of Federal Programs (1982)	Seeks to foster intergovernmental partnerships by requiring federal agencies to use the state process to determine and address concerns of state and local elected officials with proposed federal assistance and development programs.
EO 12898, Environmental Justice (1994)	Requires federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations.
EO 12906, Coordinating Geographical Data Acquisition and Access (1994), Amended by EO 13286 (2003). Amendment of EOs and other actions in connection with transfer of certain functions to Secretary of DHS.	Recommended that the executive branch develop, in cooperation with state, local, and tribal governments, and the private sector, a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data. Of particular importance to comprehensive conservation planning is the National Vegetation Classification System (NVCS), which is the adopted standard for vegetation mapping. Using NVCS facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.
EO 12962, Recreational Fisheries (1995)	Federal agencies are directed to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities in cooperation with states and tribes.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 13007, Native American Religious Practices (1996)	Provides for access to, and ceremonial use of, Indian sacred sites on federal lands used by Indian religious practitioners and direction to avoid adversely affecting the physical integrity of such sites.
EO 13061, Federal Support of Community Efforts Along American Heritage Rivers (1997)	Established the American Heritage Rivers initiative for the purpose of natural resource and environmental protection, economic revitalization, and historic and cultural preservation. The Act directs Federal agencies to preserve, protect, and restore rivers and their associated resources important to our history, culture, and natural heritage.
EO 13084, Consultation and Coordination With Indian Tribal Governments (2000)	Provides a mechanism for establishing regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications.
EO 13112, Invasive Species (1999)	Federal agencies are directed to prevent the introduction of invasive species, detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, accurately monitor invasive species, provide for restoration of native species and habitat conditions, conduct research to prevent introductions and to control invasive species, and promote public education on invasive species and the means to address them. This EO replaces and rescinds EO 11987, Exotic Organisms (1977).
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. (2001)	Instructs federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.
EO 13443, Facilitation of Hunting Heritage and Wildlife Conservation (2007)	Directs federal agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitats.

Appendix D. Public Involvement

SUMMARY OF PUBLIC SCOPING COMMENTS

Through the Intergovernmental Coordination Planning Team, the State of Florida and other governmental partners (i.e., Seminole Tribe of Florida, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Services, South Florida Water Management District, Southwest Florida Regional Planning Council, Lee County, Lee County Mosquito Control District, and the City of Sanibel) identified the top priority issues for the refuge to address over the 15-year life of the CCP.

- Need for Enhanced Habitat Management
- Need for Improved Water Quality, Quantity, and Flows
- Need to Control and Eliminate Exotic, Invasive, and Nuisance Species
- Need to address Existing and Increasing Wildlife and Habitat Impacts
- Need to Enhance Environmental Education
- Need for Improved Land Acquisition Efforts
- Need for Environmental Indicators and Models to Improve Refuge Management
- Declines in and Threats to Rare, Threatened, and Endangered Species
- Need for increased Staffing and Funding to Address Existing and Future Needs
- Need for Enhanced Intergovernmental Coordination and Management to Improve Management Activities across the Landscape
- Need for Continued Coordination Regarding Mosquito Control
- Need to Analyze Cumulative Impacts of Proposals
- Need to Integrate Cultural Resource Protection into all Refuge Management Activities

A representative of the Seminole Tribe of Florida participated in the Intergovernmental Coordination Planning Team. The main issues for future management of the refuge identified by the Seminole Tribe of Florida are listed.

- Need to Integrate Cultural Resource Protection into all Refuge Management Activities
- Need for Cultural Resource Training for Refuge Complex Staff
- Need for Baseline Cultural Resource Information
- Need for Comprehensive Inventory of all Cultural Resources
- Need for Enhanced Consultation in Relation to Cultural Resources

Three neighborhood public meetings were conducted during the week of April 7, 2008: on April 8 at the Sanibel School, Sanibel Island, FL; on April 9 at Cypress Lake Middle School, Ft. Myers, FL; and on April 10 at Pine Island Elementary School, Pine Island, FL. The public meetings were attended by a total of over 40 individuals representing a variety of interests and organizations. Beyond the verbal comments recorded at these public meetings, over 90 written comments were also submitted by individuals, organizations, and governmental entities regarding future management of these five refuges. Letters, faxes, email messages, and phone calls were received from across the country. The issues, ideas, concerns, and comments raised by the public addressed a wide range of topics, as summarized.

- Wildlife and Habitat Management – including controlling exotic, invasive, and nuisance species; keeping dogs off of key sites; minimizing take of alligators to restore the population and

advocating a sensible control plan to the community; addressing water quality, water quantity, and flow concerns; minimizing impacts from Lee County Mosquito Control activities; conducting a comprehensive inventory of flora and fauna on all five refuges; increasing closed areas to protect wildlife and habitat; and minimizing regulations

- Resource Protection – including addressing management of the future acquisition areas (from 2002 proposed Land Protection Plan); prioritizing land acquisition efforts, especially to protect the satellite island refuges; posting and buffering rookery areas; installing appropriate manatee zones; and increasing law enforcement presence and visibility, especially for the San Carlos Bay Tract and the satellite island refuges
- Visitor Services – including developing a required photographer's code of conduct; providing better access to key areas; providing more brochures and handouts, especially on key wildlife and plant species; developing interpretive signage to better explain key management activities (e.g., impoundment management); controlling high speed motor boating; providing recreational opportunities on Caloosahatchee, Pine Island, and Matlacha Pass NWRs; allowing only appropriate and compatible public use activities; determining whether or not visitation to J.N. "Ding" Darling NWR is overwhelming refuge resources; decreasing motorized traffic on the Wildlife Drive; increasing the Wildlife Drive closure; developing alternative parking for the Visitor Center and Wildlife Drive; developing alternative transportation (e.g., electric trams) for the Wildlife Drive; and addressing congestion on the J.N. "Ding" Darling NWR and Sanibel Island
- Refuge Administration – including increasing staff, especially in law enforcement, biology, and maintenance; increasing funding, especially for the unfunded satellite refuges; changing the name of the Refuge Complex to be more inclusive of all refuges in the Complex; improving the Service's image, especially in the communities surrounding the satellite refuges; enhancing intergovernmental coordination; and enhancing coordination with other partners

Appendix E. Appropriate Use Determinations

J.N. "DING" DARLING NATIONAL WILDLIFE REFUGE APPROPRIATE USE DETERMINATIONS

An appropriate use determination is the initial decision process a refuge manager follows when first considering whether or not to allow a proposed use on a refuge. The refuge manager must find that a use is appropriate before undertaking a compatibility review of the use. This process clarifies and expands on the compatibility determination process by describing when refuge managers should deny a proposed use without determining compatibility. If a proposed use is not appropriate, it will not be allowed and a compatibility determination will not be undertaken.

Except for the uses noted below, the refuge manager must decide if a new or existing use is an appropriate refuge use. If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility. Uses that have been administratively determined to be appropriate are:

- Six wildlife-dependent recreational uses - As defined by the National Wildlife Refuge System Improvement Act of 1997, the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) are determined to be appropriate. However, the refuge manager must still determine if these uses are compatible.
- Take of fish and wildlife under state regulations - States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. The Service considers take of wildlife under such regulations appropriate. However, the refuge manager must determine if the activity is compatible before allowing it on a refuge.

Appropriate use determinations developed for J.N. "Ding" Darling NWR are:

- research,
- commercial services,
- commercial photography,
- commercial bait fishing (phase out use),
- walking and hiking,
- bicycling,
- non-motorized trail use,
- motorized trail use,
- non-motorized boating,
- motorized boating, and
- mosquito control.

Statutory Authorities for this Policy:

National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. §668dd-668ee. This law provides the authority for establishing policies and regulations governing refuge uses, including the authority to prohibit certain harmful activities. The Act does not authorize any particular use, but rather authorizes the Secretary of the Interior to allow uses only when they are compatible and "under such regulations as he may prescribe." This law specifically identifies certain public uses that, when compatible, are legitimate and appropriate uses within the Refuge System. The law states ". . . it is the policy of the

United States that . . .compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System . . .compatible wildlife-dependent recreational uses are the priority general public uses of the System and shall receive priority consideration in refuge planning and management; and . . . when the Secretary determines that a proposed wildlife-dependent recreational use is a compatible use within a refuge, that activity should be facilitated . . . the Secretary shall . . . ensure that priority general public uses of the System receive enhanced consideration over other general public uses in planning and management within the System . . . ." The law also states "in administering the System, the Secretary is authorized to take the following actions: . . . issue regulations to carry out this Act." This policy implements the standards set in the Act by providing enhanced consideration of priority general public uses and ensuring other public uses do not interfere with our ability to provide quality, wildlife-dependent recreational uses.

Refuge Recreation Act of 1962, 16 U.S.C. 460k. The Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

Other Statutes that Establish Refuges, including the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) (16 U.S.C. §410hh - 410hh-5, 460 mm - 460mm-4, 539-539e, and 3101 - 3233; 43 U.S.C. 1631 et seq.).

Executive Orders. The Service must comply with Executive Order 11644 when allowing use of off-highway vehicles on refuges. This order requires the Service to designate areas as open or closed to off-highway vehicles in order to protect refuge resources, promote safety, and minimize conflict among the various refuge users; monitor the effects of these uses once they are allowed; and amend or rescind any area designation as necessary based on the information gathered. Furthermore, Executive Order 11989 requires the Service to close areas to off-highway vehicles when it is determined that the use causes or will cause considerable adverse effects on the soil, vegetation, wildlife, habitat, or cultural or historic resources. Statutes, such as ANILCA, take precedence over executive orders.

Definitions:

Appropriate Use
An appropriate use is a proposed or existing use on a refuge that meets at least one of the following four conditions.

1) The use is a wildlife-dependent recreational use as identified in the Improvement Act.
2) The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
3) The use involves the take of fish and wildlife under state regulations.
4) The use has been found to be appropriate as specified in section 1.11.

Native American. American Indians in the conterminous United States and Alaska Natives (including Aleuts, Eskimos, and Indians) who are members of federally recognized tribes.

Priority General Public Use. A compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

Quality. The criteria used to determine a quality recreational experience include:

- Promotes safety of participants, other visitors, and facilities.
- Promotes compliance with applicable laws and regulations and responsible behavior.
- Minimizes or eliminates conflicts with fish and wildlife population or habitat goals or objectives in a plan approved after 1997.
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation.
- Minimizes conflicts with neighboring landowners.
- Promotes accessibility and availability to a broad spectrum of the American people.
- Promotes resource stewardship and conservation.
- Promotes public understanding and increases public appreciation of America's natural resources and the Service's role in managing and protecting these resources.
- Provides reliable/reasonable opportunities to experience wildlife.
- Uses facilities that are accessible and blend into the natural setting.
- Uses visitor satisfaction to help define and evaluate programs.

*Wildlife-Dependent Recreational Use***.** As defined by the Improvement Act, a use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Research

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Commercial Services

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Commercial Photography

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Commercial Bait Fishing (phase out use)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Walking and Hiking

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Bicycling

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Non-motorized Trail Use

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Motorized Trail Use

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Non-motorized Boating

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Motorized Boating

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Use: Mosquito Control

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes __X__No ____**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate____ **Appropriate__X**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

Appendix F. Compatibility Determinations

J.N. "DING" DARLING NATIONAL WILDLIFE REFUGE COMPATIBILITY DETERMINATIONS

Uses: The listed uses were found to be appropriate and evaluated to determine their compatibility with the mission of the Refuge System and the purposes of the refuge.

- Wildlife Observation and Photography – including walking, hiking, motorized and non-motorized boating, and motorized and non-motorized trail use
- Environmental Education and Interpretation – including walking, hiking, motorized and non-motorized boating, and motorized and non-motorized trail use
- Fishing – including motorized and non-motorized boating and non-motorized trail use
- Research
- Commercial Services
- Commercial Photography
- Mosquito Control
- Commercial Bait Fishing – including phasing out this use within the 15-year life of the CCP

Refuge Name: J.N. "Ding" Darling National Wildlife Refuge

Date Established: December 1, 1945

Establishing and Acquisition Authorities: Migratory Bird Conservation Act, Refuge Recreation Act, Emergency Wetlands Resources Act, and Fish and Wildlife Act

Refuge Purposes: The refuge was established in 1945 by agreement through a lease with the State of Florida "…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act, 16 U.S.C. §§ 715-715r, February 18, 1929, as amended). Secondary purposes were subsequently applied to the refuge, as listed.

> "…wilderness areas…shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness…" 16 USC §1131 (Wilderness Act)
>
> "…suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species" 16 USC §460k-1 (Refuge Recreation Act) "…the Secretary…may accept and use…real…property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors" 16 USC §460k-2 (Refuge Recreation Act)
>
> "…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions" 16 USC §3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act)

"…for the development, advancement, management, conservation, and protection of fish and wildlife resources" 16 USC §742f(a)(4) (Fish and Wildlife Act) "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" 16 USC §742f(b)(1) (Fish and Wildlife Act)

National Wildlife Refuge System Mission:

The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Other Applicable Laws, Regulations, and Policies:

Antiquities Act of 1906 (34 Stat. 225)
Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)
Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)
Criminal Code Provisions of 1940 (18 U.S.C. 41)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)
Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 Stat. 686)
Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat.1119)
Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)
Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)
Land and Water Conservation Fund Act of 1965
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)
National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq; 83 Stat. 852)
Use of Off-Road Vehicles on Public Lands (Executive Order 11644, as amended by Executive Order 10989)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq; 87 Stat. 884)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year (50 CFR Subchapter C; 43 CFR 3101.3-3)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of the U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of the U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System. March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33
Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

Compatibility determinations for each description listed were considered separately. Although for brevity, the preceding sections from “Uses” through “Other Applicable Laws, Regulations and Policies” and the succeeding sections, “Literature Cited,” “Public Review and Comment,” and the “Approval of Compatibility Determinations” are only written once within the Plan, they are part of each descriptive use and become part of that compatibility determination if considered outside of the CCP.

Description of Use:
Wildlife Observation and Photography

Wildlife observation and photography are priority public uses under the National Wildlife Refuge System Improvement Act. Commercial photography is considered separately under the determination for that use. The refuge annually hosts over 700,000 visitors, most of who participate in wildlife observation and photography activities. Facilities for wildlife observation and photography include the Education Center, Wildlife Drive, the handicapped accessible observation tower along the Wildlife Drive, Indigo Trail, Cross Dike Pavilion, Shell Mound Trail, Wulfert Keys Trail, five trails on the Bailey Tract, Commodore Creek and Buck Key canoe trails, the planned Children’s Birding Trail, and the currently underway bird observation deck in Pond 2, as well as the proposed facilities, including the fishing pier at Smith Pond on the Bailey Tract and the observation tower at the Bailey Tract. Additional activities that support wildlife observation and photography include driving licensed vehicles, walking, hiking, bicycling, motorized and non-motorized boating, motorized and non-motorized trails, and commercial services.

Wildlife observation and photography on the refuge are limited to daylight hours in the open areas of the refuge and are further restricted by hours of operation of the Wildlife Drive. Closed areas are posted and identified on maps to minimize wildlife and habitat impacts. Further restrictions are also provided at the Education Center and through refuge brochures and maps, including fishing and crabbing restrictions and restrictions for the Wilderness Area. Refuge brochures and maps provide the public with the locations of visitor facilities and associated restrictions.

Availability of Resources: Annual refuge operation and maintenance funds support the Visitor Services program and activities, including wildlife observation and photography. Additional funds come from fee money and from grants. Staff to administer environmental education and interpretation includes park rangers, law enforcement officers, and maintenance workers. Salaries for these positions come from fee money and from the refuge’s operating budget, which are adequate to sustain the existing program. Volunteers and the “Ding” Darling Wildlife Society are a major component of the refuge’s Visitor Services program, providing staffing for the Education Center and bookstore, providing funding for refuge projects, conducting and supporting various programs and tours, and serving other functions. Funding would be required for proposed improvements and facilities (e.g., the proposed observation tower at the Bailey Tract). These funds might come from the Service, grants, and/or the “Ding” Darling Wildlife Society.

Anticipated Impacts of the Use: Each activity has the potential to have impacts, but the focus is to minimize impacts to within acceptable limits. This is based on the impacts at the existing and projected levels of use. Both short-term and long-term impacts are addressed.

Short-term Impacts: Impacts associated with wildlife observation activities can be divided into two categories, based on whether the activity occurs within or outside of a vehicle. In general, activities that occur outside of vehicles tend to increase disturbance potential for most wildlife species (Klein 1993; Gabrielson and Smith 1995; Burger 1981; Pease et al. 2005). Wildlife observation trails and

pullouts along the Wildlife Drive have a greater potential for disturbing wildlife species. Among wetland habitats, out-of-vehicle approaches can reduce time spent foraging and can cause waterbirds to avoid foraging habitats adjacent to the out-of-vehicle disturbance (Klein 1993). One possible reason for this result is that vehicle activity is usually brief, while walking requires a longer period of time to cover the same distance. Similarly, walking on wildlife observation trails tends to displace birds and can cause localized declines in the richness and abundance of wildlife species (Riffell et al. 1996). Bicycling and people walking causes more disturbances to waterfowl than vehicles (Pease et al. 2005).

Wildlife photographers tend to have the largest disturbance impacts (Klein 1993; Morton 1995; Dobb 1998). While wildlife observers frequently stop their vehicles to view wildlife, wildlife photographers are much more likely to leave their vehicles and approach wildlife on foot (Klein 1993). Even a slow approach by wildlife photographers tends to have behavioral consequences to wildlife (Klein 1993). Other impacts include the potential for some photographers to remain close to wildlife for extended periods of time (Dobb 1998) and the tendency of casual photographers with low-power lenses to get much closer to their subject than other activities would require (Morton 1995).

Boating impacts on wildlife can be classified based on the form of boating activity (Korschgen and Dahlgren 1992; Knight and Cole 1995); the season of use (Burger 1995); and species tolerance to the activity (Jahn and Hunt 1964). For example, motorboat activity likely has more disturbances on wildlife than non-motorized boat travel because motorboats produce a combination of movement and noise (Knight and Cole 1995). Even canoes can cause disturbance based on the ability to access shallower areas of the marsh (Speight 1973). However, compared to motorboats and airboats, canoe travel appears to have the least disturbance (Jahn and Hunt 1964).

Long-term Impacts: Considering the high level of use and variety of activities occurring at the refuge, appropriate solutions to minimize impacts need to be developed and monitored. For example, during the fall migration and overwintering season, wildlife observation, photography, environmental education, and interpretation are all occurring simultaneously and are at the highest levels of the year. Techniques to limit disturbance must be evaluated, implemented, and monitored. This stems from the hypothesis that prolonged and extensive disturbance may cause migratory birds to abandon the wetlands most disturbed by humans and winter elsewhere. Current public use may not be at a level to cause this shift, but anticipated increases relative to the expansion of the population and growth of visitor opportunities could result in seasonal shifts in migratory bird use of the refuge's wetland habitats.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: By design, wildlife observation and photography activities should have minimal wildlife and habitat impacts. Further, the refuge proposes to develop orientation materials for individual and amateur photographers to help minimize impacts and increase ethical outdoor behavior. However, as use increases, wildlife impacts are more likely to occur. Evaluation of the sites and programs will be conducted annually to assess if objectives are being met, if habitat impacts are minimized, and if wildlife populations are not being adversely affected. If evidence of unacceptable impacts begins to appear, it will be necessary to change the activity or the program, move the activity or program, or eliminate the program or activity. Stipulations that may be employed include the listed items.

- Establishing buffer zones that minimize disturbance around sensitive areas and establishing additional no-entry zones.
- Providing information regarding ethical outdoor behavior for refuge visitors.
- Vegetation that effectively conceals visitors and provides cover for birds can help minimize impacts of people in busy areas such as the Wildlife Drive.
- Impacts from wildlife viewing and photography can be reduced by providing observation blinds.
- The establishment of stay-in-your-vehicle zones could further reduce disturbance on the Wildlife Drive.
- Rerouting, modifying, or eliminating activities which have demonstrated direct wildlife impacts should also be employed.
- Education is critical for making visitors aware that their actions can have negative impacts on birds.

The refuge will modify or eliminate any use that results in unacceptable impacts, including modifying operation of the Wildlife Drive.

Justification: Wildlife observation and photography are priority public uses of the National Wildlife Refuge System. Providing quality, appropriate, and compatible opportunities for these activities contributes toward fulfilling the provisions of the National Wildlife Refuge System Improvement Act and supports the vision and goals of the refuge. Wildlife observation and photography provide excellent forums for promoting increased awareness, understanding, and support of refuge resources and programs and of the Service, as well as increased ethical outdoor behavior. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. At the current level of visitation, these wildlife-dependent uses would not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date:

Description of Use:
Environmental Education and Interpretation

Environmental education and interpretation consist primarily of youth and adult education and interpretation of the natural resources of the refuge. Environmental education activities on the refuge primarily occur at the Education Center, along the Wildlife Drive, and at the Cross Dike Pavilion along Indigo Trail. Additional activities that support environmental education and interpretation include walking, hiking, bicycling, motorized and non-motorized boating, motorized and non-motorized trails, and commercial services. Activities include onsite staff-led or teacher-led environmental education programs; offsite teacher-led classroom programs; teacher workshops; and interpretation of wildlife, habitat, other natural features, and/or management activities occurring on the refuge. These activities seek to increase the public's knowledge and understanding of wildlife and their habitats and

to contribute to wildlife conservation and support of the refuge. Environmental education and interpretation have been identified in the National Wildlife Refuge System Improvement Act as priority public use activities.

All environmental education programs would continue to be linked to Florida State standards and would be conducted by staff, teachers, partners, ”Ding” Darling Wildlife Society, and volunteers. The refuge would continue to pursue funding to bring students onto the refuge (e.g., the refuge annually writes a grant for funds to transport over 3,000 students onto the refuge for field trips during November through April). The refuge would continue to work with home-school groups and Scouting groups as requested. The refuge would continue the Summer Teachers Assisting Refuge (STAR) program that began in the summer of 2009 to conduct train-the-teacher workshops and expand interpretative programs. The refuge would continue to provide programs and presentations to various local organizations and clubs and incorporate all refuges within the Refuge Complex into environmental education and interpretation programs and materials. In order to reach more students, the refuge would continue to pursue methods to incorporate technology-based programs into the refuge’s environmental education programs. In 2009, fifth-grade gifted students from three schools helped develop the refuge’s virtual earth-cache program that promotes responsible orienteering, navigating, and searching on the refuge for clues and information that teach wildlife conservation concepts without impacting refuge resources.

Currently the refuge offers over 40 interpretive programs and tours weekly from January through March and opportunistically during the rest of the year, including staff- and volunteer-led wildlife observation walks and bike tours. The tours include excursions to explore the Bailey Tract, birding on the refuge, biking the Wildlife Drive and Indigo Trail, and wandering through the Shell Mound Trail. The birding tours are conducted along the Wildlife Drive and are car caravan tours. The programs are generally given at the Cross Dike Pavilion and are done on various topics including crocodilians, birds, manatees, and endangered species. The concessionaire offers a variety of interpretive programs and tours, including tram tours on the Wildlife Drive and programs from the deck at the Tarpon Bay Recreation Area. The refuge would help train staff, volunteers, teachers, and tour operators to incorporate refuge messages and interpretive themes into their programs.

The refuge would continue to maintain interpretive signs throughout the refuge, including at the “Ding” Darling Education Center, throughout Wildlife Drive and its hiking trails, at the Bailey Tract, and at Tarpon Bay. Additional interpretive signs would be installed as part of the planned Children’s Birding Trail. The e-Bird kiosk, in partnership with Cornell, would provide Education Center visitors the opportunity to report bird sightings and learn detailed information about birds. The invasive species kiosk, also to be located at the Education Center, would provide detailed information about invasive plants and animals. Interpretive signage currently exists throughout Shell Mound Trail and weekly volunteer-led programs are conducted at the Trail from January through March. Opportunistic staff-led programs are conducted there year-round. to the refuge would improve the interpretive messages regarding Calusa culture and resource use and the refuge would replace deteriorating signage at Shell Mound Trail, as funding permits.

Availability of Resources: Annual refuge operation and maintenance funds support the Visitor Services program and activities, including environmental education and interpretation. Additional funds come from fee money and from grants. Staff to administer environmental education and interpretation includes park rangers, law enforcement officers, and maintenance workers. Salaries for these positions come from fee money and from the refuge’s operating budget, which are adequate to sustain the existing program. Volunteers and the “Ding” Darling Wildlife Society are a major component of the refuge’s Visitor Services program, providing staffing for the Education Center and bookstore, providing funding for refuge projects, conducting and supporting various programs and

tours, and serving other functions. Funding would be required for proposed improvements and facilities (e.g., the proposed observation tower at the Bailey Tract). These funds might come from the Service, grants, and/or the "Ding" Darling Wildlife Society.

Anticipated Impacts of the Use: Impacts from environmental education activities are considered short-term and discrete due to the low anticipated frequency of use and the ability to move sites to a new area if the habitat showed signs of impacts. Vegetation trampling, altering structure and species composition, and temporal wildlife impacts to species would be at a minimal level. This unavoidable impact associated with running the environmental educational program is determined to be acceptable.

Impacts associated with interpretive activities generally occur at developed facilities, such as the Education Center, Cross Dike Pavilion, Shell Mound Trail, boardwalks, Wildlife Drive, or other improved faculties, including the proposed fishing pier and observation tower at the Bailey Tract. Adding new interpretive facilities will have some wildlife or habitat impacts, but these impacts would be discrete and would be minimized.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: While anticipated impacts are expected to be minimal, stipulations are required to ensure that wildlife resources are adequately protected. The environmental education program activities will avoid sensitive sites and sensitive wildlife populations. Built into all curriculums will be a section on ethical outdoor behavior. Environmental education programs and activities will be held at or near established facilities where impacts may be minimized. Evaluations of sites and programs should be conducted annually to assess if objectives are being met and that the natural resources are not being adversely impacted.

Impacts associated with interpretive programs are also anticipated to be minimal. One overarching aspect of the interpretive program is to build understanding and appreciation for the refuge and its natural resources. As use increases, wildlife disturbances are unavoidable, but through interpretive materials (e.g., brochures, signs, and kiosk panels) ethical outdoor behavior will be stressed. Education is critical for making visitors aware that their actions can have negative impacts on wildlife. Interpretive activities and programs will be conducted at developed sites where impacts can be minimized. Wildlife impacts on the Wildlife Drive will be carefully monitored. If impacts are detected, adaptive strategies will be developed to lessen wildlife disturbance. Annual evaluations will be conducted to assess if objectives are being met and that the natural resources are not being adversely affected.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Environmental education and interpretation are priority public uses under the National Wildlife Refuge System and they further the purposes, vision, and goals of the refuge and the mission of the National Wildlife Refuge System. Environmental education and interpretation are used to encourage all citizens to act responsibly in protecting natural resources. They are tools the refuge can use to help build understanding, appreciation, and support for the refuge and the National Wildlife Refuge System. Resources required to run the programs are minimal and are built into the refuge's operation and maintenance budget. Identified improvements will not be

developed until adequate staff and budget are available to develop and operate them. As long as stipulations to ensure compatibility are followed, the programs should remain compatible with the purposes of the refuge. At such time that monitoring identifies that unacceptable wildlife impacts are occurring, the refuge will modify the activity to minimize or eliminate the impacts.

Both programs allow the education of the public on the missions of the Service and Refuge System and on the refuge's purposes. They highlight the areas that are most in line with the refuge's management philosophy proposed under the CCP. Considering the minimal anticipated impacts through implementation of the environmental education and interpretation programs and the benefits that should arise through public education, participation, and involvement, the program is deemed compatible.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date:

Description of Use:
Fishing

Fishing is a priority wildlife-dependent public use activity under the National Wildlife Refuge System Improvement Act. This determination covers recreational fishing. Guided fishing trips are covered under the determination for commercial services, which support fishing on the refuge.

Fishing is a traditional use on the refuge. The refuge annually supports approximately 85,000 visitors for fishing, shell-fishing, and crabbing. Freshwater and saltwater fishing activities on the refuge occur on land and water from shorelines, boardwalks, water control structures, motorized and non-motorized boats, and motorized and non-motorized trails. Further, although area fishing tournaments originate off the refuge, participants frequently fish on the refuge. The proposed fishing pier at Smith Pond on the refuge's Bailey Tract would also support fishing activities on the refuge, including providing handicapped-accessible fishing and supporting youth fishing events.

Fishing on the refuge is allowed in accordance with applicable federal, State, County, and City regulations, including the Conservation Zone of the City, State, and Marine Fisheries Commission and the Sanibel Vessel and Boating Law. The refuge has more restrictive regulations for crabbing. Refuge fishing areas include at Smith Pond on the Bailey Tract, in Tarpon Bay, along the Wildlife Drive, and in the backwaters of the refuge, including the refuge's Wilderness Area, which has additional restrictions regarding boats and boat speeds. The refuge has two motorized boat launch facilities and three canoe/kayak launch locations. The concessionaire also provides outfitted rental boats to support fishing activities.

The refuge would continue to provide information on boating, fishing, crabbing, and related regulations. In addition, interpretive signage would continue to be posted on the Wildlife Drive about crabbing. Additional signage on Wildlife Drive would continue to provide information about the impacts from monofilament fishing line, while also providing a refuge phone number to report monofilament and wildlife entanglement. Multiple receptacles would continue to be provided for

monofilament recycling. An interpretive fishing program would continue to be provided from January through March. The refuge would continue to annually provide at least two Youth Fishing Days at the Tarpon Bay Recreation Area. The refuge would continue to support the strong Service partnership with the Bass Pro Shops. The Bass Pro Shop in Ft. Myers features the Service and the Refuge System with exhibits. The refuge would continue to provide an information booth at Bass Pro Shop events. The refuge would continue to participate in the local cast-net rodeo, held each year in November, at the Bait Box store. The refuge would continue to work with the partners to install fish-waste disposal tubes at area fishing piers located off the refuge.

Availability of Resources: Operation and maintenance funds to support fishing are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Funds are needed annually to mow, grade, and fix roads, parking lots, and boat ramps open to fishing; replace gravel on roads leading to boat ramps; paint, repair, and replace signs; and develop and print brochures. Staff to administer this use includes law enforcement officers and maintenance workers. Salaries for these positions come from fee money and from the refuge's operating budget, which are adequate to sustain the existing program. Funding would be required for proposed improvements and facilities (e.g., the proposed fishing pier at Smith Pond). These funds might come from the Service, grants, and/or the "Ding" Darling Wildlife Society.

Anticipated Impacts of the Use: Anticipated impacts were identified and evaluated based on best professional judgment and published scientific papers, as well as by analyzing refuge fishing data. Overfishing has been known to cause ecological extinction of certain fish species and precedes all other human disturbance (Jackson et al. 2001). In recent history, overfishing in Florida has led to the decline of certain species, such as redfish and sea trout. But, today the State monitors fish populations and has set seasons, slot and size limits, and total bag limits for most sport fish, making the likelihood of overfishing depleting fish stocks minimal. The closed areas of the refuge also serve to recharge local waters.

Wildlife responds differently to boats based on their size, speed, the amount of noise they make, and how close the crafts get to wildlife. Boats increase the access of visitors to areas not open to most other visitors, thus having a greater potential to cause wildlife disturbance if not managed properly. The speed and manner in which a boat approaches wildlife can influence wildlife responses. Rapid movement directly toward wildlife frightens them, while movement away from or at an oblique angle to the animal is less disturbing (Knight and Cole 1995). Dahlgren and Korschgen (1992) categorized the following human activities in order of decreasing disturbance to waterfowl:

1. Rapid overwater movement and loud noise (e.g., power boating, water skiing, and aircraft);
2. Overwater movement with little noise (e.g., sailing, wind surfing, rowing, and canoeing);
3. Little overwater movement or noise (e.g., wading and swimming); and
4. Activities along shorelines (e.g., fishing, birdwatching, hiking, and traffic).

Hume (1976, as cited by Dahlgren and Korschgen 1992) observed a similar differential response of waterfowl to human activities. Common goldeneyes often flew when people on the shore approached within 100 or 200 meters, but settled elsewhere on the water. A single sailing dingy was sufficient to cause more than 60 common goldeneyes to take flight and for most to leave the vicinity within a few minutes. Remaining birds then flew up each time the boat approached to within 300 to 400 meters and generally left the area within an hour. The appearance of a powerboat caused instantaneous flight by most birds. If the boat traversed the length of the reservoir, all remaining birds left within minutes. Hume reported that waterfowl abundance decreased over time as a result of the increased frequency of boating.

Rodgers and Schwikert (2002) compared the flushing distance of birds in response to a slow versus fast approach using the same outboard-powered boat. A fast approach resulted in significantly larger flush distances for brown pelicans, anhingas, and great egrets. They concluded that waterbird staging areas along migratory corridors and frequently used foraging sites of resident birds merit protection from human activity. In another study Rodgers and Smith (1997) recommended that the establishment of 150-meter buffer zones around colonial bird rookeries would help minimize disturbance. Increasing the predictability of boating patterns to help wildlife habituate to nonthreatening human disturbance can also be accomplished by establishing well-marked routes of travel.

Boating has been shown to alter distribution, reduce use of particular habitats by waterfowl and other birds, alter feeding behavior, and cause premature departure from areas. Impacts of boating can occur even at low densities, given the ability of powerboats to cover extensive areas in a short amount of time, the noise they produce, and their speed (Sterling and Dzubin 1967; Bergman 1973; Speight 1973; Skagen 1980; Korschgen et al. 1985; Kahl 1991; Bauer et al. 1992; Dahlgren and Korschgen 1992).

Because the quality of fishing is high within the refuge, tournament fishermen originating from a tournament outside the refuge travel into refuge waters. Tournaments have become big businesses and can substantially increase the level of fishing activity in the refuge. Further, tournament fishing behavior is different than other recreational fishing activities, with an emphasis on acquiring a winning fish in a short period of time. This can have negative impacts on other sport fishermen, wildlife, and habitat.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Fishing on the refuge is allowed in accordance with applicable federal, State, County, and City regulations, including the Conservation Zone of the City, State, and Marine Fisheries Commission and the Sanibel Vessel and Boating Law. Additionally, the refuge has implemented refuge-specific fishing regulations, which can be updated annually in Title 50 of the Code of Federal Regulations. Restrictions are listed.

General:

- Fishing is allowed only during daylight hours.
- Harvesting of horseshoe crabs is prohibited.
- Fishermen must attend their lines.
- Lead fishing tackle is prohibited in refuge waters.
- All refuge waters, including Tarpon Bay, are zoned slow speed/minimum wake. Caution: Watch for Endangered manatees.
- Motorized boats must pole or paddle through the non-motorized boat areas of the refuge.
- Boats over 14 feet in length are not permitted to launch off of the Wildlife Drive. This rule does not apply to non-motorized canoes and kayaks.
- All waters on the left side of the Wildlife Drive are closed to all boating.
- Personal watercraft (e.g., jet skis and waverunners) are prohibited in refuge waters, including Tarpon Bay.
- The refuge provides guidance for catch and release to minimize injury and subsequent death to fish released.
- Commercial fishing activities are not allowed from the Wildlife Drive.

Saltwater Fishing:

- Residents between 16 and 64 years old must have a saltwater license to fish from a boat. Residents also need a license to fish for saltwater fish from the bank.
- All non-residents (except those under 16) must have a saltwater license to fish for saltwater fish in all locations.
- Saltwater fishing from shore is allowed on both sides of the Wildlife Drive. Sport cast netting is also permitted, but is limited to personal use of bait fish and 50 mullet per person, per day.
- Most areas of water on the left side of the Wildlife Drive are closed to the public. These areas are posted as closed areas.

Freshwater Fishing:

- Residents between 16 and 64 years old must have a freshwater license to fish for freshwater fish. Residents of Lee County may take freshwater fish without a license if they use a cane/bamboo pole without a reel and are fishing within Lee County.
- All non-residents 16 years of age and older must have a freshwater license to fish for freshwater fish.
- Freshwater fishing on the refuge is allowed at Island Inn Pond, Smith Pond, and Airplane Canal at the Bailey Tract.

Crabbing:

- Non-residents are required to have a saltwater fishing license to crab. Blue crabs may be harvested only with hand-held dip nets.
- Use of bait or traps is prohibited.
- There is a limit of 20 crabs per person per day, where only 10 may be female. The harvest of egg bearing crabs prohibited.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Fishing is a priority wildlife-dependent use under the National Wildlife Refuge System Improvement Act. Fishing, as described, was determined to be compatible, in view of the potential impacts that fishing and its supporting activities (e.g., boating) can have on the Service's ability to achieve the purposes and goals of the refuge, because: fishing densities and use levels are relatively low during most days; sufficient restrictions have been established to ensure the protection of manatees and that an adequate amount of high quality feeding and resting habitat would be available to accommodate the needs of waterfowl, migratory birds, and other resident birds using the refuge; and sufficient opportunities are available for other priority wildlife-dependent recreation.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date:

Description of Use:
Research

Research is the planned, organized, and systematic gathering of data to discover or verify facts. In principle, research conducted on the refuge by universities, co-op units, non-profit organizations, and other research entities furthers refuge management and serves the purposes, vision, and goals of the refuge. The refuge hosts research from a variety of research institutions, including various universities and private research groups. All research activities, whether conducted by governmental agencies, public research entities, universities, private research groups, or any other entity, shall be required to obtain special use permits from the refuge. Approved refuge special use permits will contain conditions under which researchers must operate to help minimize negative impacts to refuge resources. All research activities will be overseen by the Refuge Biologist and Refuge Manager. Projects that are fish and wildlife management-oriented, which will provide needed information to refuge operation and management, will receive priority consideration and will even be solicited.

Availability of Resources: The refuge provides a building for use as a marine lab for scientists from SCCF under a memorandum of understanding. The Refuge Biologist and Refuge Manager oversee research activities on the refuge. Salaries for these positions come from the refuge's operating budget, which is adequate to sustain the existing program.

Anticipated Impacts of the Use: Generally, adverse impacts from research are minimal. Occasionally, slight or temporary wildlife or habitat disturbances may occur (e.g., minor trampling of vegetation may occur when researchers access monitoring plots). However, these impacts are not significant, nor are they permanent. Also, a small number of individual plants or animals might be collected for further scientific study, but these collections are anticipated to have minimal impact on the populations from which they came. All collections will adhere to the Service's specimen collection policy (Director's Order 109, dated March 28, 2005).

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: All research conducted on the refuge must further the purposes of the refuge and the mission of the National Wildlife Refuge System. All research will adhere to established refuge policy on research and policy on collecting specimens (Directors Order Number 109). The memorandum of understanding with SCCF requires that SCCF comply with all refuge regulations, provide an annual report of the research conducted, and provide the refuge a role in determining which research projects will be conducted. To ensure that other research activities are compatible, the refuge requires that a special use permit be obtained before any research activity may occur. Research proposals and/or research special use permit applications must be submitted in advance of the activity to allow for review by refuge staff to ensure minimal impacts to the resources, staff, and programs of the refuge. Each special use permit may contain conditions under which the research will be conducted. Each special use permit holder will submit annual reports or updates to the refuge on research activities, progress, findings, and other information. Further, each special use permit holder will provide copies of findings, final reports, publications, and/or other documentation at the end of each project. The refuge will deny permits for research proposals that are determined to not serve the purposes of the refuge and the mission of the National Wildlife Refuge System. The refuge will also deny permits for research proposals that

are determined to negatively impact resources or that materially interfere with or detract from the purposes of the refuge. All research activities are subject to the conditions of their permits.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Research activities provide important benefits to the refuge and to the natural resources supported by the refuge. Supporting management, research conducted on the refuge can lead to new discoveries, new facts, verified information, and increased knowledge and understanding of resource management, as well as track current trends in fish and wildlife habitat and populations to enable better management decisions. Research has the potential to further the purposes and goals of the refuge and the mission of the National Wildlife Refuge System.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date:

Description of Use:
Commercial Services

While not one of the six priority wildlife-dependent recreational uses named in the National Wildlife Refuge System Improvement Act, commercial services on the refuge support wildlife observation and photography, environmental education and interpretation, and fishing, which are priority public uses. Further, commercial services assist the refuge in providing quality wildlife-dependent recreational activities. The refuge authorizes commercial services through the issuance of special use permits. For the purpose of this document, the term “commercial” is defined as an entity that charges a client a fee for a program or service to generate a profit. This does not include individuals who perform these services for no fee, not-for-profit groups, schools, colleges, or other governmental agencies.

This activity provides recreational and educational opportunities for the public who desire a quality wildlife-dependent experience, but who may lack the necessary equipment, skills, knowledge, ability, or resources to obtain it themselves. Commercial services on the refuge include motor vehicle tours; boat, canoe and kayak tours; and guided sportfishing trips. Except for the fee charged to the customer by the commercial provider, the impacts associated with these activities are generally no different than other activities, which are already occurring on the refuge. The named activities covered by this compatibility determination are similar to the activities covered by the wildlife observation and photography, environmental education and interpretation, and fishing determinations, but this compatibility determination provides additional guidance specific to commercial services. Most commercial services would be permitted in the open areas of the refuge under a special use permit. Interpretive training and further guidelines may be developed and required in the future.

The refuge’s concessionaire is also covered by this determination. The concessionaire collects entrance fees at the fee booth for the Wildlife Drive. Guided tram tours along the refuge’s Wildlife Drive are offered by the concessionaire from the Education Center. Through its facility at the Tarpon Bay Recreation Area, the concessionaire offers canoe, kayak, and sealife interpretive tours; interpretive programs; rentals for

bicycles, canoes, kayaks, pontoon boats, and fishing equipment; a shop with goods for sale, including bait and fishing licenses; and the opportunity to book a charter fishing trip.

Availability of Resources: Costs to refuge operations to administer commercial services include, but are not limited to: development and review of policy and procedure; administration of annual permits (e.g., addressing inquires, screening applicants, checking on insurance, and issuing permits); and enforcement and monitoring of permit holders. Existing facilities, such as boat ramps and other infrastructure, are adequate to accommodate this use at existing levels. The refuge receives 20% of the net proceeds of the concessionaire's operations. These funds go towards the Refuge Revenue Sharing Program that supports payments to Lee County. Staff to administer this use includes park rangers, law enforcement officers, maintenance workers, Refuge Biologist, and Refuge Manager. Salaries for these positions come from fee money and from the refuge's operating budget, which are adequate to sustain the existing program.

Anticipated Impacts of the Use: To date, the largest single component of the commercial services program is the concessionaire. The refuge annually issues five permits for commercial service operations on the refuge, including photography workshops, interpretive guided tours, and filming.

Guided tour activities have the potential to disturb wildlife and habitat, more so than an individual user, due to the increase in the number of people involved in the activity. And, guided tour activities have the potential to conflict with other refuge visitors. For example, commercial tours will use the same areas as other visitors engaged in wildlife observation and photography, canoeing, kayaking, and fishing. Unregulated, commercial operations could adversely affect the safety of other visitors and the quality of their experience, and could contribute to wildlife disturbance. However, each commercial services activity is required to obtain a refuge special use permit and that permit will contain conditions to help minimize impacts and ensure compatibility.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Commercial operators shall be permitted only in the areas open to the public. Seasonal or permanent closures in certain areas may be imposed on commercial operators if the level of use becomes excessive, conflicts occur with other users engaged in priority wildlife-dependent recreation, or wildlife impacts occur. In the future, interpretive training and other stipulations may be required of commercial operators to help the refuge achieve its outreach and educational objectives. Further, permits for fishing guides will contain stipulations addressing ethical behavior and messages delivered to clients.

Commercial service providers follow all refuge regulations along with additional special conditions stipulated in their permits. The special conditions listed below are common to many commercial service providers.

- The permittee will provide proof of general liability insurance in the amount of $300,000.
- The permittee will provide proof of a State charter license and/or Coast Guard Captain's license.
- The provider will supply the refuge with his/her fee schedule charged per client.
- The provider will supply the refuge with the number of trips provided per year (this will include the number of clients).
- The vessels used by fishing guides will be required to bear the annual guide permit decal.

Motor vehicle tours are allowed on the Wildlife Drive. Participants of these tours may use the Education Center, but this use must be scheduled in advance.

Boat, canoe, and kayak tours may use designated boat launch sites. Tour routes will be approved in the permit. These tours must occur in accordance with conditions of the refuge special use permit, as well as in accord with applicable federal, State, County, and City regulations, including the Conservation Zone of the City, State, and Marine Fisheries Commission and the Sanibel Vessel and Boating Law.

Guided fishing trips in Tarpon Bay must occur in accordance with conditions of the refuge special use permit, as well as in accord with applicable federal, State, County, and City regulations, including the Conservation Zone of the City, State, and Marine Fisheries Commission and the Sanibel Vessel and Boating Law.

All conditions of special use permits must be met. A special use permit may be revoked for failure to comply with the conditions or for repeat violations of applicable regulations.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Commercial services support wildlife observation and photography, environmental education and interpretation, and fishing. They provide recreational and educational opportunities for the public who desire a quality wildlife-dependent experience, but who may lack the necessary equipment, skills, knowledge, ability or resources to obtain it themselves. Providing opportunities for these activities would contribute toward fulfilling provisions of the National Wildlife Refuge System Improvement Act. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. At the current level of visitation, commercial operations would not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date:

Description of Use:
Commercial Photography

Commercial photography includes still photography and filming and is often difficult to distinguish from recreational photography. While recreational photography is a priority public use under the National Wildlife Refuge System Improvement Act, commercial photography is not. Commercial photography is where an individual or company takes photographs or films for commercial gain. Photography classes, television news crews, and photographic production shoots are examples of commercial photography. These activities are varied in their scopes and impacts, ranging from a single individual in a single vehicle to numerous people and associated support vehicles (e.g., trucks with aerials).

Permits for commercial photography activities are currently $150/occurrence. Eighty percent of the collections return to the specific refuge site of collection to offset program costs and enhance visitor facilities and programs.

Availability of Resources: Operation and maintenance funds to support commercial photography are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Funds are needed to mow, grade, and fix roads and trails open to the public; fix, repair, and replace boardwalks and trails; and paint, repair, and replace signs. Further, staff time is required to review, process, and monitor special use permits issued for these activities, including monitoring specific activities to ensure that impacts are minimized and to ensure adherence to conditions of the permits. Staff to administer this use includes park rangers, law enforcement officers, maintenance workers, Refuge Biologist, and Refuge Manager. Salaries for these positions come from fee money and from the refuge's operating budget, which are adequate to sustain the existing program.

Anticipated Impacts of the Use: Commercial photography activities might occur along the Wildlife Drive, along trails, and from the water. Potential impacts include minor trampling of vegetation, disturbance of nesting, foraging and resting waterbirds.

Since these activities generally occur outside of vehicles, they tend to have a greater impact. In general, activities that occur outside of vehicles tend to increase the potential for disturbance for most wildlife species (Klein 1993; Gabrielson and Smith 1995; Burger 1981; Pease et al. 2005). Among wetland habitats, out-of-vehicle approaches can reduce time spent foraging and can cause waterbirds to avoid foraging habitats adjacent to the out-of-vehicle disturbance (Klein 1993). One possible reason for this result is that vehicle activity is usually brief, while walking requires a longer period of time to cover the same distance. Similarly, walking on wildlife observation trails tends to displace birds and can cause localized declines in the richness and abundance of wildlife species (Riffell et al. 1996). Bicycling and people walking causes more disturbances to waterfowl than vehicles (Pease et al. 2005).

Wildlife photographers tend to have the largest disturbance impacts (Klein 1989, 1993; Morton 1995; Dobb 1998). While wildlife observers frequently stop their vehicles to view wildlife, wildlife photographers are much more likely to leave their vehicles and approach wildlife on foot (Klein 1993). Even a slow approach by wildlife photographers tends to have behavioral consequences to wildlife (Klein 1993). Other impacts include the potential for some photographers to remain close to wildlife for extended periods of time (Dobb 1998) and the tendency of casual photographers with low-power lenses to get much closer to their subject than other activities would require (Morton 1995).

Boating impacts on wildlife can be classified based on the form of boating activity (Korschgen and Dahlgren 1992; Knight and Cole 1995); the season of use (Burger 1995); and species tolerance to the activity (Jahn and Hunt 1964). For example, motorboat activity likely has more disturbances on wildlife than non-motorized boat travel because motorboats produce a combination of movement and noise (Knight and Cole 1995). Even canoes can cause disturbance based on the ability to access shallower areas of the marsh (Speight 1973). However, compared to motorboats and airboats, canoe travel appears to have the least disturbance (Jahn and Hunt 1964).

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Commercial photography approved on the refuge must have a primary focus on education and information related to the refuge's primary purposes, the resources protected by the refuge, and/or the National Wildlife Refuge System mission. Where the Refuge Manager can identify commercial photography activities, they can be regulated and monitored through special use permits. These permits will contain conditions under which the activities are allowed to operate. Special use permits for commercial photography will be issued on a per event basis, often limited to a single day's or a week's activities. Further, the refuge will develop mandatory orientation materials for commercial photographers as part of the conditions of the special use permit to help limit wildlife and habitat impacts, to help limit conflicts with other visitors, and to help increase the ethical behavior of commercial photographers on the refuge.

Conditions under which commercial photography could occur are listed.

- Requests are considered if they demonstrate a means to enhance education, appreciation, and/or understanding of the National Wildlife Refuge System.
- Commercial photographers would be managed under special use permits stipulating dates, times and general locations that can be photographed. In many cases, the photographer is limited to the same areas in which the general public is allowed to go, but this can evaluated on a case by case basis.
- Commercial photographers should ensure proper credit is given to the refuge and the U.S. Fish and Wildlife Service.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Under certain circumstances, commercial photography can support priority public uses of the refuge, including environmental education and interpretation, as well as vicarious wildlife observation. Commercial photography can help the refuge and the National Wildlife Refuge System increase awareness, understanding, and support for the refuge and its management, natural resources, the National Wildlife Refuge System, and the U.S. Fish and Wildlife Service. Conditions imposed in required special use permits will help ensure that these activities minimize impacts.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date:

Description of Use:
Mosquito Control

The Lee County Mosquito Control District (LCMCD) conducts mosquito control activities through an integrated pest management approach on the refuge, on Sanibel and Captiva Islands, and throughout Lee County. The mission of the LCMCD is that the Lee County Mosquito Control District is committed to improving the quality of life, facilitating outdoor activities and protecting the public health in our community by implementing environmentally sound practices that control mosquitoes throughout Lee County.

The LCMCD conducts surveillance on the refuge and is authorized to trim vegetation to safely conduct surveillance activities and maintain helicopter landing sites. Mosquito traps may be deployed to determine mosquito population levels. Sentinel chickens may be used with the approval of the Refuge Manger. LCMCD helicopter and fixed wing aircraft will comply with the flight restrictions listed in the Special Conditions section of the Special Use Permit. LCMCD are required to notify the Refuge Biologist prior to any mosquito control treatments.

The LCMCD focuses on larviciding. Larviciding refers to the control of mosquitoes in the larval, aquatic stage. Its efforts are focused toward controlling mosquitoes in this stage, because the insects are confined to the aquatic environment and can be efficiently targeted with minimal effect on other organisms. Mosquitoes remain in the larval stage for as little as four days, which requires an intense effort to locate and treat them before they become adults. Larval inspections are conducted by trained LCMCD personnel capable of identifying mosquitoes to genera and larval stage. Aircraft are used to expedite locating and treating larval mosquitoes in remote areas and large acreages, while ground inspections and treatments are performed in residential and small areas using vehicle-mounted spraying equipment. All larvicide applications are based on a demonstrated presence of mosquito larvae. Aerial, and ground larviciding by helicopter, truck, and boat are conducted on and around the refuge.

The following larvicides are approved for use on the refuge: Bti, VectBac, VectoLex, AquaBac, Agnique, Arosurf, and Altosid. Golden Bear can only be applied under certain circumstances and only with Refuge Manger's prior approval. Abate or ProVext (temephos) are not approved for use on the refuge.

The LCMCD also uses adulticiding treatments to control mosquitoes. Adulticiding does not occur on the refuge, but does occur near the refuge. Adulticiding refers to the control of mosquitoes in the adult, terrestrial flying stage. Despite all efforts to prevent adult mosquito populations from reaching annoyance levels, it is inevitable that outbreaks will occur. All of LCMCD adulticiding activity is based on surveillance data and no adulticide spraying is performed on a scheduled basis. Each weekday, LCMCD inspectors are busy monitoring Lee County's adult mosquito populations. Ground adulticiding trucks use Ultra-Low-Volume technology with equipment that atomizes or creates many tiny droplets which drift through the air and contact a mosquito in flight. The method achieves excellent results in areas with a good network of roads. Aerial adulticiding is conducted by helicopters or fixed-wing aircraft with Ultra-Low-Volume spray systems, usually between 10:00 pm and 2:00 am or at sunrise.

After the U.S. Environmental Protection Agency (EPA) determines that an insecticide can be registered for use in the United States, the Florida Department of Agriculture and Consumer Services (FDACS) determines which pesticides can be registered and applied in the State of Florida. The primary aerial adulticide material used by the LCMCD is Naled. FDACS states the Naled, sold under the name Dibrom, when applied in accordance with the label, can be used to kill mosquitoes without posing unreasonable risks to human health or the environment. FDACS further notes that the EPA recently conducted preliminary risk assessments for Naled. These assessments calculated risks under a number of different scenarios, including assumptions of several Naled spraying events over a period of weeks and toddlers ingesting some Naled in soil and grass along with exposure through the skin and inhalation exposure. Because of the very small amount of active ingredient released per acre of ground, the EPA found that for all scenarios considered, exposures were hundreds or even thousands of times below an amount that might pose a health concern. FDACS further states that when applied for mosquito control in accordance with the label, Naled is not harmful to animals.

Availability of Resources: The Lee County Mosquito Control District funds and implements these mosquito control activities. Thus, no refuge resources are required to administer this use, other than reviewing management plans and the operations and pesticides to be used. Staff to administer this use includes the Refuge Biologist and Refuge Manager. Salaries for these positions come from the refuge's operating budget, which is adequate to sustain the existing program.

Anticipated Impacts of the Use: Mosquito control activities have the potential for a variety of impacts. Potential impacts of chemicals on non-target organisms are a concern and are considered prior to mosquito control operations. Potential negative impacts to invertebrates from chemical applications may result in decreases in density and diversity of insects, arachnids, and/or crustaceans, thus negatively impacting food sources for various birds. Further, temporary wildlife or habitat disturbances may occur during actual operations (e.g., wildlife disturbance and temporary trampling of vegetation during pesticide applications by ground vehicles).

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Mosquito control management plans were developed for all impoundments of the refuge. These management plans provide conditions under which mosquito control operations are approved. Additional stipulations to ensure compatibility of this use are listed.

- A refuge special use permit is required and must be renewed annually.
- Overflights are restricted to areas with low migratory bird use.
- Larval control may only be conducted when breeding is widespread, as documented by sampling conducted by the LCMCD.
- Priority for treatments will be given to those chemicals with the least effect on non-target organisms.
- The Refuge Manager has final approval for all pesticide treatments.
- The LCMCD shall submit to the refuge a final report at the end of each year.
- No flights shall be conducted over the refuge's Wilderness Area.
- The LCMCD shall notify the Refuge Manager or Refuge Biologist by phone of all pesticide applications, including areas and acreages to be treated, pesticide to be applied, date and time of planned treatment, method of application, and data supporting the need for treatment.
- In developing approaches to specific treatments, consideration will be given to avoiding or minimizing impacts to the resources of the refuge.
- Refuge staff shall be allowed to inspect operations at any time.
- All pesticides used must be included in the refuge's Pesticide Use and Disposal Management Plan. If a pesticide proposed for use is not included in this step-down plan, the Refuge Manager must review and approve its use before any application occurs.
- The LCMCD shall immediately notify the Refuge Manager of any chemical spills, threats to human safety on the refuge, human disturbance, or wildlife disturbance that may occur as a consequence of its mosquito control operations.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Under the right environmental conditions, the impoundments, swales, and other areas of the refuge are productive habitats for population explosions of mosquitoes. The refuge exists in a developed human landscape, where mosquitoes represent a potential disease threat to public health, as well as to wildlife. Mosquito control activities address health safety issues for the refuge and the community. Further, these mosquito control management activities support wildlife and habitat management activities by providing key foraging sources and areas for wading birds. The use, with the listed stipulations, does not materially interfere with the purposes of the refuge.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date:

Description of Use:
Commercial Bait Fishing (phase out use)

Harvesting commercial resources from the marine environment has been a historic use on the refuge well before the refuge was established. One commercial bait fish operator has historically operated on the refuge. This use involves a small trawling vessel with double rigged, roller beam trawls used to catch live bait shrimp (pink shrimp). This activity will be covered under a refuge special use permit.

Availability of Resources: The permitting process requires oversight by the Refuge Manager. A single permit will be issued annually and expire on September 30 of each year. Administrative oversight is required to process the permit. The refuge has sufficient resources to oversee this one permit. However, resources are not sufficient to monitor the specific environmental impacts. Staff to administer this use includes the Refuge Biologist and Refuge Manager. Salaries for these positions come from the refuge's operating budget, which is adequate to sustain the existing program.

Anticipated Impacts of the Use: Inherent impacts result from the operation of motorized boats in the marine environment, which include motor exhaust, disturbance to wildlife, turbidity of the water, prop scarring, risk of injury and death of West Indian manatees, reduction in forage fish food base for many species, and alteration of the marine bottoms. However because roller trawls are designed to reduce seagrass fragment collection, minimal impacts were found on shoot density, structure, or biomass of turtlegrass by intensive short-term (18 trawls within three hours) trawling (Meyer et al, 1999). Direct competition could occur between recreational and commercial fishing efforts. With this use limited to a single operator and with conditions in the special use permit, impacts from this use are anticipated to be minimal.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Only one commercial bait fishing operator will be permitted to operate on the refuge, as has historically occurred. This use will sunset at the retirement of the current operator or within the 15-year life of the CCP (by September 30, 2025), whichever is sooner. A refuge special use permit will be required. That permit will be reviewed and updated annually and will include conditions to provide quarterly harvest data to ascertain benthic conditions and to help minimize impacts from this use. Further, all laws and/or special regulations set forth by the Marine Fisheries Commission, the State of Florida, the City of Sanibel, and the U.S. Fish and Wildlife Service regulating or governing the harvest of finfish, boat speeds, closed areas, and any other restrictions must be observed and would be included as a condition of the refuge special use permit. This would include the City, State, and Marine Fisheries Commission Conservation Zone (1992 and 1993) and the Sanibel Vessel and Boating Law (1993).

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: The refuge recognizes the historic dependence on being a waterman in this area. And, previous actions of the City of Sanibel, the State of Florida, the Marine Fisheries Commission, and the U.S. Fish and Wildlife Service have helped to minimize impacts from this type of use. However, the Service's Southeast Region's guidance indicates that commercial harvesting will not typically be allowed on refuges. In order to not place an undue hardship on the commercial bait fishing operator, the phased approach to eliminating this use was selected as fair and equitable.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date:

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Public Review and Comment:
The compatibility determinations for J.N. “Ding” Darling NWR will be available for public review as part of the Draft CCP/EA review, scheduled during 2010. The public will be notified through a notice of availability in the *Federal Register*, the refuge’s website, postings, and newspaper articles. In addition, the “Ding” Darling Wildlife Society will assist in the outreach effort.

Approval of Compatibility Determinations

The signature of approval is for all compatibility determinations considered within the Comprehensive Conservation Plan for J.N. “Ding” Darling National Wildlife Refuge. If one of the descriptive uses is considered for compatibility outside of the comprehensive conservation plan, the approval signature becomes part of that determination.

Refuge Manager: _____
(Signature/Date)

Regional Compatibility Coordinator: _____
(Signature/Date)

Refuge Supervisor: _____
(Signature/Date)

Regional Chief, National Wildlife Refuge System, Southeast Region: _____
(Signature/Date)

Appendix G. Intra-Service Section 7 Biological Evaluation

SOUTHEAST REGION
INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Paul Tritaik, Wildlife Refuge Manager (Project Leader), J.N. "Ding" Darling NWR Complex

Telephone Number: 239/472-1100 X 223 **E-Mail:** paul_tritaik@fws.gov

Date: 9/28/2009

PROJECT NAME: J.N. "Ding" Darling National Wildlife Refuge's Comprehensive Conservation Plan

I. Service Program:

___ Ecological Services

___ Federal Aid

___ Clean Vessel Act

___ Coastal Wetlands

___ Endangered Species Section 6

___ Partners for Fish and Wildlife

___ Sport Fish Restoration

___ Wildlife Restoration

___ Fisheries

_X_ Refuges/Wildlife

II. State/Agency:
n/a

III. Station Name:
J. N. "Ding" Darling National Wildlife Refuge, FL

IV. Description of Proposed Action:
The proposed project is to implement the Comprehensive Conservation Plan (CCP) for the U.S. Fish and Wildlife Service (Service) J.N. "Ding" Darling National Wildlife Refuge (refuge) as required under the National Wildlife Refuge System Improvement Act of 1997. The purpose of a CCP is to describe the desired future conditions of a refuge and provide long-range guidance and management direction to accomplish the purposes of a refuge, to contribute to the mission of the Refuge System, and to meet other relevant mandates.

The CCP details the proposed action to improve refuge management in the following areas: wildlife and habitat management, resource protection, visitor services, and refuge administration. The proposed action (Alternative C) focuses refuge management actions on the needs of migratory birds.

Wildlife and Habitat Management

Alternative C would expand the current wildlife and habitat management activities of the refuge to better serve migratory birds. And, the refuge would prioritize migratory birds in all restoration plans.

Although the management focus would be on migratory birds under Alternative C, the refuge would also continue to serve rare, threatened, and endangered species. Specifically for wood storks, the refuge would work with the partners to support recovery, including by conducting surveys, improving habitat management, and conducting habitat restoration activities. The refuge would also coordinate with the Service's lead on wood storks at the North Florida Ecological Services Field Office to help develop an understanding of the colony origin and the foraging range and location for the wood storks using the refuge. Key activities would include the identification, protection, restoration, and enhancement of wood stork and roseate spoonbill foraging and roosting habitats. During the life of the Plan, the refuge would work with the partners and foster research to determine the colony origin and foraging range and location for those roseate spoonbills using the refuge. Where bald eagle nesting is discovered, the refuge would work to minimize disturbance to these sites. For mangrove forest birds, including mangrove cuckoos, black-whiskered vireos, gray kingbirds, and Florida prairie warblers; the refuge would restore and maintain mangrove habitat at Alligator Curve, restore and maintain hardwood hammocks on the ridges at Shell Mound; and work with the partners to research the effectiveness of survey protocols with nesting cycles and timing. The refuge would work with the partners to alter sea turtle surveys, when and where these survey activities conflict with migratory bird management. For snowy plovers and piping plovers, the refuge would work with the partners to minimize impacts, understand and manage beach habitats and disturbances, and monitor beach profile changes over time in relation to climate change and sea level rise. For snowy plover beach nesting areas, the refuge would work with the partners to ensure that no human disturbances negatively impact them. Also for snowy plovers, the refuge would work with the partners to evaluate the need for and develop a plan to address seasonal beach nesting closures on the Perry Tract. Although piping plovers do not currently occur on the refuge, the refuge would work with the partners to conduct winter surveys to monitor for presence/absence and would ensure that no human disturbances negatively impacted any site in use by piping plovers. To better serve red knots and other shorebirds, the refuge would improve water management capabilities in the impoundments. To expand management for the Sanibel Island rice rat, the refuge would restore Sanibel Island rice rat habitats and conduct intensive population trends monitoring, permanent marking, and trapping efforts to determine habitats used. If necessary, rice rat surveys would be altered to minimize impacts to migratory birds. Management for eastern indigo snakes and gopher tortoises would continue, especially prescribed burning, as outlined under Alternative A. The refuge would pursue recovery efforts for eastern indigo snakes and other federally listed species, where it does not conflict with migratory bird protection; and, the refuge would continue to coordinate with the partners to minimize human impacts to West Indian manatees. The refuge would work with the partners and the public to evaluate the potential recovery benefits, success, and feasibility of translocating additional individuals to establish a breeding population of American crocodiles on the refuge. The refuge would work with the partners to survey gopher tortoise abundance and distribution, and estimate population density and habitat carrying capacity within the refuge and on Sanibel Island; work with the partners to evaluate the feasibility of translocating gopher tortoises to the refuge from healthy populations which are at risk of habitat loss; and, develop interpretative signs and materials to educate the public about the ecological importance of these unique animals. Refuge volunteers would be assigned to work for Sanibel-Captiva Conservation Foundation (SCCF) under its marine turtle permit to specifically survey

the refuge's Perry Tract for sea turtle nesting; and, staff would work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge. Ornate diamondback terrapins are known to occur on the refuge and have recently been documented on the Wildlife Drive. Diamondback terrapins are susceptible to bycatch in crab traps (particularly smaller males and juvenile females), raccoon predation, and roadkill. To help protect this species and enhance decision making, the refuge would develop baseline data to better understand population and status and trends and address threats. To enhance management for smalltooth sawfish (and other species), the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows

Under Alternative C the refuge would expand migratory bird management activities. The refuge would work with partners to identify, manage, and restore the nesting, breeding, roosting, and foraging habitat needs of raptors and birds of prey and nearctic-neotropical migratory birds. Further, the refuge would consider extending the time periods during which raptors and birds of prey and nearctic-neotropical migratory birds would be monitored. And, the refuge would evaluate the need to relocate osprey nesting platforms away from roadways. To better serve nearctic-neotropical migratory birds, the refuge would select certain shrubs and trees as food sources and potential migration and nesting sites (e.g., in hardwood hammocks, at Shell Mound, and along Alligator Curve). And, the refuge would consider using mist nets and banding to help monitor migratory birds. The refuge would work with the partners to better manage and protect nesting and roosting habitat for seabirds, shorebirds, wading birds, waterfowl, and water birds, including creating and enforcing any needed closed area buffers. Water management capabilities would be improved in the impoundments to better serve shorebirds, water birds, and wading birds. The refuge would work with the partners to help maintain healthy fish populations to support migratory bird needs. The refuge would pursue funding to restore and enhance alligator habitat. And, it would study and improve alligator habitat needs during times of drought, evaluating the need for deeper fresh water. To also benefit alligators, the refuge would increase education and enforcement efforts to minimize alligator feeding and harassment and develop better methods to control water levels and cattails on Bailey Tract. The refuge would restore upland habitat at Shell Mound and assess the need to restore Buck Key. It would also fill and/or clear drainage ditches that negatively impact habitat or natural flow. The existing ridge along the powerline easement would be restored. The refuge would work with the City of Sanibel and other partners regarding the operation of the City's weir, controlling water levels in the State Botanical Site, and evaluating the restoration of sheet flow. The refuge would work with the partners to reinstate the seagrass beds monitoring program, while also mapping historic and existing seagrass beds in and around the refuge.

Control of exotic, invasive, and nuisance plants and animals would be expanded under Alternative C, with a focus on migratory birds. The refuge would update its list of priority species to control. It would identify and locate new infestations of Florida Exotic Pest Plant Council (FLEPPC) Category I and Category II invasive upland plants, emphasizing elimination during initial attack and controlling the spread to minimize impacts to migratory birds (FLEPPC 2009). Further, the refuge would work with the partners to increase the public's awareness of the negative impacts of exotic, invasive, and nuisance animals, including educating visitors not to feed raccoons and evaluating more effective means of trapping and euthanizing exotic, invasive, and nuisance animals.

Benefiting migratory birds, while also serving numerous species and habitats of management concern, the refuge would expand activities to better coordinate with the partners to address water quality, quantity, and timing of flows related to Lake Okeechobee regulatory releases, drainage in the Caloosahatchee Basin, and local runoff issues. Further, the refuge would work with the U.S. Army Corps of Engineers (USACE) to install a water quality monitoring station in Tarpon Bay. Water quality monitoring would be expanded by adding nutrients to the monitoring program and by expanding the

number of water quality monitoring locations on the refuge. And the refuge would work with the City of Sanibel regarding the operation of its weir. The refuge would work with the partners to evaluate water quality impacts on algal blooms, bird usage, seagrasses, and fish populations in and around the refuge.

Alternative C would include plans to work with the partners to refine and run appropriate climate change models to understand the impacts of climate change on refuge resources with a focus on migratory birds (e.g., re-run the Sea Level Affecting Marshes Model (SLAMM) when high resolution Light Detection and Ranging (LIDAR) data become available). The refuge would coordinate with researchers and the partners to understand the impacts of climate change on refuge resources with a focus on migratory birds, fostering and conducting research as possible. The refuge would continue to work with the Massachusetts Institute of Technology (MIT)-U.S. Geological Survey (USGS) Science Impact Collaborative (MUSIC) partners (Service/MIT/USGS) to address climate change scenarios under a Strategic Habitat Conservation framework. The refuge would coordinate with researchers and partners to conduct wildlife inventories to establish wildlife population baselines and then identify parameters to measure changes that could affect wildlife diversity, health, abundance, productivity, survival, predator/prey interactions, parasite/host interactions, spatial and temporal distribution, dispersal, migration patterns, phenology, and ultimately population viability. The refuge would also coordinate with researchers and partners to establish habitat benchmarks and then identify parameters to measure changes that could affect environmental health, hydrology, biological integrity, natural community structure, habitat succession, vegetation stratification, habitat diversity, parasite/host interactions, pest abundance, pathogen outbreaks, primary plant productivity, pollination, phenology, and ultimately ecosystem viability. The refuge would also work with researchers and partners to establish landscape benchmarks to measure changes in sea level rise, tidal range, storm surges, subsidence, sedimentation, and shoreline change. As additional data and better models become available, the refuge would consider the impacts of climate change on natural resources and the potentially mitigating or compounding effects of anthropogenic stressors. The refuge would utilize the best available science and employ a strategic habitat conservation approach to anticipate wildlife and habitat adaptation tendencies and to target management actions to facilitate successful adaptation responses to the impacts of climate change. Such actions may include land acquisition, providing wildlife migration corridors, translocating populations, increasing genetic diversity among small isolated populations, manually dispersing seeds, restoring or modifying habitats, altering prescribed fire regimes, adjusting water level management in impoundments, plugging ditches that contribute to saltwater intrusion, aggressively controlling invasive exotics and pests, and participating in carbon sequestration.

Resource Protection

Resource protection management activities and programs under Alternative C would be similar to alternatives B and D, but Alternative C would focus on migratory birds.

Alternative C would allow the refuge to better protect the archaeological and historical resources of the refuge on Sanibel and Captiva Islands; complete the approved acquisition boundary; develop management agreements to protect key resources; and pursue additional special designations for the refuge.

The refuge would coordinate with the State Historic Preservation Officer and the Regional Archaeologist to conduct a complete archaeological and historical survey of the refuge, protecting any newly identified sites. The refuge would actively work with the landowners and other partners to acquire or otherwise protect in perpetuity the historically significant site of “Ding” Darling’s fishing cabin off Captiva Island. Further, the refuge would work with the landowners and other partners to

incorporate this site into an interpretive program. And, the refuge and the partners would seek National Historic Register designation for this site.

To better protect migratory birds, the refuge would pursue completion of the refuge's approved acquisition boundary, develop management agreements for key resources; and pursue additional special designations. Working with the partners and landowners, the refuge would attempt to complete the approved acquisition boundary for those properties with high migratory bird values. To do this, the refuge would work with willing sellers. The refuge would work with the State of Florida to develop appropriate management agreements to implement refuge-managed closed area buffers around sensitive resources (e.g., rookeries). If needed, the refuge would expand the refuge's acquisition boundary to include these closed area buffers in the refuge (e.g., through a Minor Expansion Proposal). The refuge would also pursue special designations for the refuge, including Western Hemisphere Shorebird Reserve Network and Ramsar Convention Wetlands of International Importance.

In addition, the refuge would expand its Wilderness Area program. The refuge would provide Wilderness Area, wilderness stewardship, and wilderness principles information to visitors at the "Ding" Darling Education Center and in environmental education and interpretation programs and materials. Further, it would update refuge materials (e.g., maps, brochures, and websites) to include the Wilderness Area, include Wilderness Area information and interpretation at Tarpon Bay Recreation Area, coordinate with the concessionaire to include wilderness information in its programs, and evaluate methods to improve the wilderness experience on the refuge.

Visitor Services

Although the refuge currently has a robust visitor services program, Alternative C would expand existing visitor services activities to focus messages of all visitor and outreach activities and programs on migratory birds and the minimization of human impacts on these resources and to increase the ethical natural resource behavior of refuge users. In general, existing visitor uses would continue, including fishing, wildlife observation and photography, and environmental education and interpretation, while refuge staff would increase efforts to improve ethical behavior, expand and enhance outreach activities, and maintain the concession approach to facilitating visitor activities and experiences.

To improve welcome and orientation for refuge visitors, the refuge would work with the volunteers, "Ding" Darling Wildlife Society, and partners to modify existing and develop new informational materials that enhance the migratory bird and minimization of human impacts messages that would be delivered to the public at the Visitor Center and through all brochures, kiosks, signs, displays, and programs.

The fishing program would continue with improvements regarding ethical behavior. The refuge would work with the partners to provide information to the fishing public regarding the impacts of fishing activities on migratory birds in an effort to minimize these impacts (e.g., impacts to shorebirds from fishing activities and impacts to a variety of birds from monofilament fishing line). Further, the refuge would coordinate with the local fishing guides to ensure that all guided trips on the refuge would be covered by a refuge special use permit, which would include stipulations about ethical behavior and messages delivered to clients. The refuge would expand fishing opportunities under Alternative C by developing a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract. This pier would also support youth fishing events.

To improve wildlife observation and photography opportunities and activities, the refuge would work with the partners to develop informational materials to promote migratory birds, the minimization of human impacts, and ethical natural resource behavior. To provide additional opportunities for wildlife observation and photography, the refuge would locate and develop an observation tower at the Bailey Tract. The Wildlife Drive would be evaluated for any needed changes, including evaluating the potential for a bike-only lane on the Wildlife Drive, the potential to close the Wildlife Drive to vehicles one additional day per week, and the potential to open the Wildlife Drive before sunrise to help minimize user conflicts and negative impacts. Further, the refuge would evaluate the fees over the 15-year life of the Plan to maintain appropriate and compatible visitor services, evaluate the potential to add additional tram tours.

To enhance the existing ethical behavior criteria and program, the refuge would evaluate and modify existing or create new brochures, websites, displays, kiosks, signs, and other materials. And, the refuge would work with the partners to find ways to more effectively convey ethical behavior messages to the public. Working with the Service's National Conservation Training Center and other partners, the refuge would pursue the creation of an ethical wildlife observation and photography video to help improve user behavior. North American Nature Photography Association ethical standards would be incorporated into ethical behavior materials as applicable. The refuge would coordinate with the Society for Ethical Ecotourism, Southwest Florida (SEE SWFL) Chapter to evaluate area ecotours for adherence to ethical behavior standards and to ensure adherence to ethical behavior standards. And, the refuge would coordinate with other area refuges to engage them in SEE SWFL.

The refuge would enhance the existing environmental education and interpretive opportunities and programs. The refuge would work with the partners to incorporate migratory bird messages into education programs and help ensure that all Lee County 6th grade students attend environmental education programs at the refuge. A Refuge Ranger would be hired to assist with this program. The refuge would develop on- and off-site interpretive programs with messages focused on migratory birds and the minimization of human impacts. Staff, volunteers, teachers, and tour operators would be trained to incorporate refuge interpretive themes into programs. And, the refuge would evaluate the need for and ability to provide parking at the Shell Mound Trail to address existing ad hoc parking and Wildlife Drive congestion issues at this site.

Beyond these programs and activities, the refuge would increase the outreach efforts and activities of the staff, volunteers, and the "Ding" Darling Wildlife Society, focusing outreach efforts and messages on migratory birds and the minimization of impacts from human activities.

In 2013 the refuge's concessionaire agreement would be re-bid. At this time, the refuge would evaluate the need to add tram tours to the agreement. Further, the refuge would coordinate future concession operations with the recommendations of the Alternative Transportation in Parks and Public Lands study, now called the Paul S. Sarbanes Transit in Parks Program.

Refuge Administration

To help accomplish the outlined actions, Alternative C would be similar to alternatives B and D and the refuge would convert the temporary fee-funded law enforcement Full Time Employee (FTE) to a permanent 1264-funded FTE and would add five refuge-specific staff (for a new total of 20.5 permanent FTEs for the refuge): Wildlife Biologist, Biological Science Technician, two Law Enforcement Officers, and Refuge Ranger (Environmental Education/Outreach). The estimated annual recurring cost for these additional five positions is $530,705. With the 25% operating margin, this total is $663,381.

Activities of the volunteers and the "Ding" Darling Wildlife Society would be enhanced. A Park Ranger would be hired to help support coordination with both groups, including acting as the Volunteer Coordinator whose duties would include staff-led training of volunteers, and oversight of the volunteer program, tours, education, interpretation, outreach, and other activities. The refuge would strive to increase the number of volunteers available throughout year and increase the interaction between refuge staff and volunteers to enhance cohesiveness of the refuge team.

Throughout the life of the Plan, the refuge would improve and update facilities as needed. Additional facilities to be developed through the Plan would include the "Ding" Darling fishing cabin, an observation tower at the Bailey Tract, and a handicapped-accessible fishing pier at Smith Pond on the Bailey Tract, while the potential exists for an expanded or new parking area for Shell Mound Trail. And, the refuge would work with SCCF to replace the existing Marine Research Lab, located at Tarpon Bay.

To accomplish the outlined activities and to support common goals, the refuge would foster strong and effective working relationships with existing and new partners to meet refuge management goals and protect the natural and cultural resources of Sanibel and Captiva Islands.

Historically, a single commercial bait fisherman has operated on the refuge. In line with regional compatibility guidance and to limit the impacts from commercial fishing activities, the refuge would phase out commercial bait fishing activities from the refuge during the life of the Plan.

V. Pertinent Species and Habitat:

A. Refuge Location & Habitats:

Critical habitat maps are provided in the CCP for the West Indian manatee and the smalltooth sawfish. General species occurrence maps are included in the South Florida Multi-Species Recovery Plan (Service 1999). The proposed project area is located on Sanibel and Captiva Islands in Lee County, on the southwest coast of Florida. Refuge habitats include tropical hardwood forests, beaches, mangrove swamps, mixed wetland shrubs, salt marshes, open waters and seagrass beds, and lakes and canals.

B. Federally Listed Species:

The refuge currently serves 14 federally threatened or endangered species, as listed.

SPECIES	CRITICAL HABITAT	STATUS
West Indian manatee (*Trichechus manatus*)	designated / present	endangered
Atlantic green sea turtle (*Chelonia mydas*)	designated / not present	endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	designated / not present	endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	none designated	endangered
Leatherback sea turtle	none designated	endangered

SPECIES	CRITICAL HABITAT	STATUS
(*Dermochelys coriacea*)		
Loggerhead sea turtle (*Caretta caretta*)	none designated	threatened
Eastern indigo snake (*Drymarchon corais copueri*)	none designated	threatened
American alligator (*Alligator mississippiensis*)	none designated	threatened (s/a)
American crocodile (*Crocodylus acutus*)	designated / not present	threatened
Piping plover (*Charadrius melodus*)	designated / present	threatened
Wood stork (*Mycteria americana*)	designated / not present	endangered
Roseate tern *(Sterna dougallii dougallii)*	none designated	threatened
Smalltooth sawfish (*Pristis pectinata*)	designated / present	endangered
Gulf sturgeon (*Acipenser oxyrinchus oxyrinchus*)	designated / not present	threatened

VI. Location:

A. Ecoregion Number and Name:
Ecoregion 75b, Southwestern Florida Flatwoods Sub-Ecoregion

B. County and State:
Lee County, Florida.

C. Latitude and longitude:

North 26° 26' 56" West 82° 06' 50"

D. Distance and direction to nearest town:
0 miles to Sanibel, FL

E. Species/habitat occurrence:

Wood Stork

Wood storks occur regularly on the refuge. However, the refuge lacks data to determine the status and trends for wood storks using the refuge. Although wood storks are not known to currently nest at the refuge, they should be monitored to determine when and where nesting does occur on the refuge.

To support wood stork recovery, the refuge would continue coordinating with the partners to survey area and refuge rookeries. Further, the refuge would improve and conduct habitat management and restoration activities. As needed, the refuge would coordinate with the state to provide buffers around key nesting, roosting, resting, and foraging sites. Rodgers and Schwikert (2002) recommended a minimum buffer size for wood storks of 118 meters to minimize impacts from outboard-powered boats and personal watercraft. The refuge would also coordinate with the Service's lead on wood storks at the Jacksonville Ecological Services Field Office to help develop an understanding of the colony origin and the foraging range and location for the wood storks using the refuge. Adaptive management could include assessing valuable foraging wetlands used by the wood stork for protection, manipulating impounded water levels to enhance foraging opportunities, assessing valuable roosting and nesting sites used by the wood stork for protection, and forming or enhancing collaboration(s) with other agencies managing lands and waters used by the wood stork. And, the refuges would work with the partners to address water quality, quantity, and timing concerns to benefit a variety of resources, including wood storks.

Piping Plover

Although piping plovers do not regularly use the shorelines of Sanibel and Captiva Islands, critical habitat for the piping plover is designated nearby at Terrapin Creek in Matlacha Pass National Wildlife Refuge. To support piping plover recovery, the refuge would increase management activities, including conducting winter surveys, minimizing impacts and disturbances, and increasing public awareness. The refuge would work with the partners to survey and monitor for presence/absence of piping plover on Sanibel and Captiva Islands during the winter. Further, the refuge would work with the partners to minimize impacts to piping plovers and to understand and manage beach habitats and disturbances. Sea turtle nest survey methods would be altered, where necessary, to minimize impacts to piping plovers and other shorebirds. The refuge would work with the partners to ensure no human disturbance on beach nesting areas. To serve piping plovers, as well as other shorebirds and seabirds, the refuge would work with the partners to monitor beach profile changes over time as related to climate change and sea level rise. And, the refuge would work with the partners to establish seasonal closed areas buffers around piping plover roost areas, if necessary.

West Indian Manatee

A 2009 survey counted at least 3,800 manatees in Florida. Although population numbers are currently higher than previous surveys, over the long term the trend is anticipated to slowly decline. The southwest subpopulation, which includes the refuge, represents about 41 percent of the state's manatee population. The primary factors causing mortality in the southwest subpopulation are collision with watercraft, which represent 32 percent of deaths in southwest Florida and red tide blooms, which represent 24-28 percent of deaths in southwest Florida. Key habitat related concerns for the Southwest subpopulation include: manatee dependence on industrial warm-water discharges, storm-related impacts on habitat and adult survival, periodic red tide events, water quality and submerged aquatic vegetation, human disturbance, increasing boat traffic, and water control structure-related deaths. This subpopulation may be declining while other subpopulations seem to be increasing.

The refuge will continue working with the partners to support recovery of the West Indian manatee, including participating in the Marine Mammal Stranding Network and conducting law enforcement. In 2008, three manatee deaths in nearby Charlotte County were attributed to watercraft, while 14 manatee deaths in Lee County were attributed to watercraft (Florida Fish and Wildlife Conservation Commission [FWC] 2009a). To help minimize watercraft collisions with manatees, the refuge would continue to work with the partners to conduct regular law enforcement patrols of designated speed

zones and no-motor zones, including the Service's Office of Law Enforcement, FWC, Lee County Sheriff's Office, and the Sanibel Police Department. The refuge manages 2,268 acres (918 ha) of estuarine waters, representing 35 percent of the refuge and benefiting a variety of wildlife, including manatees. All of these waters are either slow-speed/minimum wake zone, pole/troll zone, or no motor zone. The refuge would continue to participate in the Florida Marine Mammal Stranding Network – Southwest and with the Mote Marine Laboratory to facilitate quick response, care, and rehabilitation. The refuge would also coordinate with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA NMFS) and FWC on necropsies, potentially using the refuge's Gavin Site, if necessary. Critical habitat for manatees has been designated on the refuge and the refuge would continue to protect this area. Further benefitting manatees, the refuge would also protect and restore refuge seagrass beds. Proposed habitat management and restoration activities would also benefit manatees

The refuge will continue working with the partners to support recovery of the West Indian manatee, including providing environmental education, interpretation, and outreach. To help develop public awareness, understanding, and appreciation for manatees and related management activities, the refuge would continue working with the partners, including working with Lee County's Manatee Park by providing interpretative assistance on manatees and information on these refuges. Several Visitor Services objectives would help support this objective, including those addressing public awareness, understanding, and appreciation; wildlife observation and photography; environmental education and interpretation; outreach; monofilament fishing line.

Sea Turtles

The Service and the State of Florida list the loggerhead sea turtle as an endangered species, the green sea turtle as an endangered species, the leatherback sea turtle as an endangered species, the hawksbill sea turtle as endangered, and the Kemp's ridley sea turtle as an endangered species (FWC 2009b). Loggerhead and green sea turtles regularly nest on Sanibel and Captiva Islands, with annual nesting in 2008 on Sanibel and Captiva Islands at 416 loggerheads and three greens (SCCF 2009). From 1996-2008, Sanibel and Captiva Islands ranged between 212 and 537 nests per year, averaging 343 nests per year of predominantly loggerhead sea turtles (SCCF 2009). The leatherback sea turtle was not known to nest on Sanibel or Captiva Islands until hatchlings were discovered on Sanibel in the summer of 2009. The nest was originally identified as a green turtle nest, but leatherback hatchlings were found post-hatching. And in 1996, one case of a Kemp's Ridley sea turtle nest was documented on Sanibel Island. However, no nests have been recorded on the refuge's Perry Tract for the last decade.

From 1989 to 2006 the South Florida Nesting Subpopulation had a mean of 65,460 loggerhead nests per year, representing approximately 15,966 females nesting per year (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2008). From 1989 to 2005, the number of nests decreased 22.3 percent. And, from 1996 to 2006, a 39.5 percent decline was reported (McRae 2006). (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a).

Exhibiting an increasing trend, green sea turtles in Florida were estimated to average 5,055 annual nests from 2001-2005 (Meylan et al. 2006). However, nesting abundance numbers may begin to decline due to a change in juvenile recruitment rates from over 40 years ago. (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007b).

During the mid 20th century, the Kemp's Ridley sea turtle was abundant in the Gulf of Mexico. The population experienced a devastating decline between the late 1940s and the mid 1980s. The principal cause of the decline in the Kemp's Ridley nesting population was due to the taking of eggs

from nesting beaches. Today the population seems to be increasing, but it is still well below historical and recovery figures. Most Kemp's Ridley nests occur in Mexico. The bulk of the nests in the U.S. occur in Texas (although, these are a magnitude less than the numbers for Mexico). (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007c).

Pritchard (1982) estimated 115,000 female leatherback sea turtles worldwide, where 60 percent nested along the Pacific coast of Mexico. Spotila et al. (1996) estimated that only 34,500 females remained worldwide (with confidence limits of 26,200 to 42,900 females). However, a recent estimate of the population size for leatherback sea turtles in the North Atlantic ranges between 34,000 and 94,000 total adults (Turtle Expert Working Group 2007, FWC 2009c). And, analysis of Index Nesting Beach Survey data has shown a substantial increase in leatherback nesting in Florida since 1989 (Florida Fish and Wildlife Conservation Commission, unpublished data; Turtle Expert Working Group 2007). (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007d).

The main sea turtle nesting threats from human activities include coastal development and construction, placement of erosion control structures and other barriers to nesting, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach nourishment, beach pollution, dredging, removal of native vegetation, and planting of nonnative vegetation (Baldwin 1992, National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998, Margaritoulis et al. 2003). Additional nesting threats include increased distribution and abundance of raccoons due to human activities (e.g., increased garbage and mosquito control impoundments) resulting in raccoons being the most important predator of loggerhead eggs. And, shifts in marine ecosystem dynamics have resulted from increased human consumption of marine organisms, subsequently depleting the diversity and abundance of marine predators' prey (Trites et al. 1997, Pauly et al. 1998). Global impacts to sea turtles include climate change, potentially altering natural sex ratios of sea turtles and causing shifts in ranges and changes in prey abundance (Intergovernmental Panel on Climate Change 2007), and fisheries bycatch, potentially damaging and killing sea turtles. Although fibropapillomatosis occurs in sea turtles, it has a much higher frequency in green sea turtles. It is characterized by internal and/or external tumors that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators (Herbst 1994). (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a, 2007b, 2007c, and 2007d).

The refuge will continue coordinating with the partners to support sea turtle recovery. The refuge will assign refuge volunteers to work for SCCF under its marine turtle permit to specifically survey the refuge's Perry Tract for sea turtle nesting.

The sea turtle monitoring program on Sanibel Island began in 1959 by refuge biologist Charles LeBuff, at the urging of refuge manager Tommy Wood and "Ding" Darling himself. This program is the oldest uninterrupted loggerhead monitoring program in the United States. LeBuff, who was inspired by the writings of Archie Carr, became the first marine turtle permit holder in the State of Florida. When LeBuff began his sea turtle monitoring, the refuge included the Sanibel Lighthouse at Point Ybel on the east end of Sanibel Island. Most of the rest of the beach was uninhabited, so Charles LeBuff took the lead in monitoring and tagging sea turtles. In 1968, LeBuff established Caretta Research in partnership with SCCF and from 1973 to 1991 he led independent Caretta Research, Inc. Since 1992, SCCF has led the sea turtle monitoring program. Today, the refuge manages only a small beachfront property called the Perry Tract, which has approximately 168 linear meters along the Gulf beach. Sea turtle nesting historically occurred on the Perry Tract, but nesting has not been documented there within the last 10 years, although occasional false crawls are found.

To support sea turtle recovery and survey efforts, the refuge would coordinate more closely with SCCF to conduct nest surveys and stranding response, particularly at the Perry Tract. Further, the refuge would continue coordinating with SCCF and the City of Sanibel, which have been very active minimizing impacts to sea turtles from lighting issues, beach furniture, and beach activities. Sea turtles using the refuge are primarily loggerheads, but occasionally green, and rarely Kemp's Ridley turtles will nest on the refuge. Migratory bird protection needs would continue to be a priority on the refuge, unless a listed species, like loggerheads, were at risk. The refuge would continue to play a supporting role for SCCF, which is the principal sea turtle permit holder, conducting surveys along the 29 kilometers of beaches on Sanibel and Captiva Islands from May 30 to September 30.

The refuge will work with the partners to determine the relative abundance of in-water populations of juvenile sea turtles using the refuge. In-water populations of sea turtles have been monitored in the greater Charlotte Harbor area since 2003 by Mote Marine Laboratory. Mote Marine and other partners have been conducting set netting and visual surveys of the Charlotte Harbor area, including the refuge, to evaluate species composition, developmental migrations, habitat use, and feeding ecology. So far, the survey results have yielded sightings and captures of loggerhead, Kemp's ridley, and green sea turtles. In order of abundance, loggerheads are typically found near tidal passes, ridleys congregate close to creek or bay mouths, and green turtles are often observed in seagrass pastures in six to eight feet of water. Annual catch per unit effort rates for visual transect sightings range from 0.011-0.021 turtles per hour and sighting densities decrease during the winter months (Eaton et al. 2008). Another goal of this project is to evaluate post hurricane effects on turtle foraging ecology in Charlotte Harbor. Surveys conducted after Hurricane Charley in 2004 reported hypoxic conditions and a massive horseshoe crab die-off in that same area. Disturbances to seagrass beds and changes in crustacean populations after hurricanes are also being evaluated as having possible effects on sea turtle foraging ecology. This information would enable the refuge and partners to adapt management as necessary to protect these turtles.

Two hawksbill sea turtles were found in the waters of the refuges in early 2010 following a period of colder than normal temperatures, and were suffering from cold stress. Prior to this event, hawksbills had not been observed within the refuges.

American Crocodile

The American crocodile is listed by the Service as a threatened species in Florida and by the State of Florida as an endangered species (FWC 2009b). The current distribution of the American crocodile is limited to extreme South Florida, including coastal areas of Miami-Dade, Monroe, Collier, and Lee counties. Along Florida's southwest coast, several small groups and individual crocodiles have been documented from Sanibel Island, Lee County, south to Collier Seminole State Park, Collier County. The lowest population levels apparently occurred sometime during the 1960s or 1970s, when Ogden (1978) estimated the Florida population of the American crocodile to be between 100 and 400 non-hatchlings. P. Moler [Florida Game and Fish Commission, personal communication 1996, as referenced in the South Florida Multi-Species Recovery Plan (Service 1999)] believes between 500 and 1,000 individuals (including hatchlings) persist in South Florida. Habitat loss and fragmentation due to increased urbanization and agricultural land uses are threats to this species. In Florida, changes in the distribution, timing, and quantity of water flows also have affected the American crocodile, although the specifics of these effects are not clear. The crocodile population in Florida, although small, appears to be stable. The status throughout the remainder of its range is less certain. Future threats in Florida include stochastic natural disasters such as hurricanes and cold weather, road mortality, and continued habitat degradation. The American crocodile is a valuable indicator species of the health of South Florida's estuarine environments. (Service 1999).

Although the refuge seems to be at the northern extent of the range of the American crocodile, the refuge continues to be consistently used by one female American crocodile. To ensure ongoing protection for this individual and for any crocodiles on Sanibel Island, the refuge would continue to work with the partners to educate residents to proactively address crocodile-human interactions. Further, the refuge would work with the partners, including the City of Sanibel, FWC, South Florida Ecological Services Office (SFESO), and the University of Florida, to evaluate the feasibility and benefits of translocating male and female American crocodiles to the refuge. This action could potentially support recovery of the species, as well as the city of Sanibel's Resolution 98-89, which welcomes efforts of the Service and State to "introduce additional crocodiles to Sanibel, whether by relocating wild American crocodiles that are at risk in their present locations, or by relocating egg clutches that are vulnerable to mortality or failure". The refuge would continue to send staff or volunteers to observe any crocodile when it is in public use areas to minimize crocodile-human interactions. Proposed habitat management and restoration activities would also benefit crocodiles. The refuge will work with the partners and the public to evaluate the potential recovery benefits, success, and feasibility of translocating additional individuals to establish a breeding population of American crocodiles on the refuge.

Eastern Indigo Snake

The eastern indigo snake is listed by the Service and the State (FWC 2009b) as a threatened species. Although it historically occurred on the refuge, no eastern indigo snakes have been sighted on the refuge in recent years. However, the species is known to be difficult to observe and capture, even in areas where they are known to regularly occur.

Due to its relatively large home range, the eastern indigo snake is especially vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977, Moler 1985). In the southern part of its range, including the refuge, the eastern indigo snake may occupy areas of low density residential housing, but this represents additional threats with the increased likelihood of mortality due to the acts of homeowners and pets. Additional threats to these snakes in and around the refuge also include highway mortality, pesticides, and herbicides. The expectation is that over time, some populations of eastern indigo snakes have experienced declines and some have likely been extirpated (Service 2008).

Proposed gopher tortoise management activities and proposed upland habitat management activities would also benefit indigo snakes. Throughout the life of the CCP, the refuge would work with the partners to enhance upland habitat for indigo snakes and other species. The refuge would continue to work with SCCF and the City of Sanibel to remove invasive exotic vegetation, conduct prescribed burning to maintain and improve habitat, and thin understory where needed.

The Refuge will continue working with the partners to monitor presence/absence and study the movements of the eastern indigo snake on Sanibel Island. Within 10 years of CCP approval, work with the Service's SFESO and the partners to evaluate the translocation of eastern indigo snakes from donor sites to the refuge.

Smalltooth Sawfish

The smalltooth sawfish is listed by the Service as an endangered species. Records indicate that this species was once common throughout its historical range and that the smalltooth sawfish has declined dramatically in U.S. waters over the last century with a population decline of 95 percent or more. (National Marine Fisheries Service 2009a). The primary factor in this decline has been bycatch in commercial and recreational fisheries (National Marine Fisheries Service 2009a). Other threats include entanglement in marine debris, injury from saw removal, pollution of coastal waters, loss of

wetland and estuarine habitats, and disturbance of natural behavior by divers and other marine activities (National Marine Fisheries Service 2009a; National Marine Fisheries Service 2009b). Keys to recovery include rebuilding and monitoring the population, while managing and eliminating the threats (National Marine Fisheries Service 2009a).

Today, the largest numbers of smalltooth sawfish in the United States are found from Charlotte Harbor through the Dry Tortugas (National Marine Fisheries Service 2009a). The smalltooth sawfish is known to occur in the Sanibel area and may be present on the refuge. The recovery plan states that protecting nursery areas within Southwest Florida is important to the recovery of the species (National Marine Fisheries Service 2009a). Juvenile sawfish use mangrove shorelines as nursery habitat. Red mangroves and adjacent shallow euryhaline habitats are key elements of smalltooth sawfish conservation. The Charlotte Harbor Estuary nursery area contains the features important to the conservation of smalltooth sawfish because they facilitate recruitment into the adult population. In September of 2009 National Marine Fisheries Service designated the Charlotte Harbor Estuary (totaling 89,621 hectares [ha]), along with Ten Thousand Islands/Everglades Estuary (totaling 250,506 ha) as two critical habitat ‘‘units’’ for the smalltooth sawfish. The refuge will work with the partners to determine presence/absence of smalltooth sawfish on the refuge, adapting management as necessary to protect this species.

To enhance management for this and other species, the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows. Proposed management activities would also benefit the smalltooth sawfish.

Gulf Sturgeon

The Gulf sturgeon is listed by the Service as threatened and by the State of Florida as a Species of Special Concern due to its significant vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a threatened species unless appropriate protective or management techniques are initiated or maintained (FWC 2009b). The Gulf sturgeon is known to occur in the area and is suspected to occur on the refuge.

To enhance management for this and other species, the refuge would coordinate with the partners to address concerns related to water quality, quantity, and timing of flows. Proposed management activities would also benefit the Gulf sturgeon.

VII. Determination of Effects:

A. Explanation of effects:

The impacts to all the listed species occurring on the refuge (listed in Table V.B) are anticipated to be beneficial over the long-term. The Draft CCP/EA for J.N. "Ding" Darling NWR includes a table that summarizes the environmental consequences of plan implementation (see Table 18 in the EA).

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Wood Stork	Positive. Increased habitat quantity and quality. Potential for stable to increased numbers of wood storks using the refuge. Increased information to enhance decision making. Decreased disturbance. Increased coordination to minimize impacts from water quality, quantity, and timing of flows.
Piping Plover	Neutral to positive. Potential for stable to increased numbers of piping plovers using the refuge. Increased coordination and information to enhance decision making. Decreased impacts and disturbances. Increased habitat quality.
Roseate Tern	Positive. Stable to increased numbers of roseate terns using the refuge. Increased habitat quality and quantity. Increased information to enhance decision making. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Decreased disturbances. Managed beach habitats.
West Indian Manatee	Neutral to positive. No change from current management. Stable numbers of manatees using the refuge. Increased protection of manatees.
Sea Turtles (Loggerhead, Hawksbill, Green, Leatherback, and Kemp's Ridley)	Neutral to positive. Stable numbers of sea turtles using the area. Increased information to enhance decision making. Minimized impacts from lighting.
Eastern Indigo Snake	Neutral to positive. Increased information to enhance decision making.
American Alligator and American Crocodile	Neutral to positive. Increased coordination to minimize impacts from water quality, quantity, and timing of flows. Potential for increased numbers.
Smalltooth Sawfish	Neutral to positive. Increased coordination to minimize impacts . Enhanced decision making from increased information.
Gulf Sturgeon	Neutral to positive. Increased coordination to minimize impacts . Enhanced decision making from increased information.

B. Explanation of actions to be implemented to reduce adverse effects:
The implementation of all goals, objectives, and strategies outlined in the CCP will follow the refuge's best management practices and will pursue avoidance and minimization of impacts to federally threatened and endangered species, to the extent possible and practicable. Whenever and wherever prudent, the avoidance and minimization measures outlined in Table VII.B will be incorporated into the implementation of the CCP to minimize the effect to federally threatened or endangered species.

SPECIES/ CRITICAL HABITAT	ACTIONS TO MINIMIZE IMPACTS
All federally threatened and endangered species on the refuge	**Fire Management Activities** Fire management is a tool employed for the benefit of wildlife, including improving habitat, controlling wildfires, and controlling or removing exotic plants. The refuge will make all efforts possible and practicable to limit long-term wildlife impacts of management activities. Measures employed to limit wildlife impacts related to fire management activities include scheduling fire preparation and burns around nesting seasons and other periods of increased wildlife activity. Fire management activities are implemented according to the refuge's Fire Management Plan which had a section 7 review prior to its implementation. Future plan revisions will also receive a section 7 review.
	Exotic Plant Control and Removal Activities The refuge provides orientation information regarding federally threatened and endangered species found on the refuge to all new employees, volunteers, and contractors involved in controlling and removing exotic plants. All pesticides and herbicides are approved through the Service's Pesticide Use Proposal process and applied in accordance with label directions. The refuge will make all efforts possible and practicable to limit long-term wildlife impacts from management activities. Measures to limit wildlife impacts during the control and removal of exotic plants include preliminary assessments by qualified individuals to avoid burrows, nests, and other obvious signs of wildlife activity. Exotic plant control and removal activities are guided by an exotic control plan which had a section 7 review prior to implementation. Future plan revisions will also receive a section 7 review.

SPECIES/ CRITICAL HABITAT	ACTIONS TO MINIMIZE IMPACTS
	Research Activities All researchers on the refuge must obtain all applicable permits, including a refuge special use permit before the commencement of research activities on the refuge. During the application for permits, conditions may be imposed to eliminate or minimize any impacts that may be anticipated from a research proposal. The refuge provides orientation information regarding federally threatened and endangered species found on the refuge to all researchers.
	Construction Projects A section 7 review will be completed for all construction projects prior to commencement.
	Restoration Other Than Fire Management and Exotic Plant Control and Removal These activities will have a section 7 review prior to commencement.

VIII. Effect Determination and Response Requested:

SPECIES / CRITICAL HABITAT	DETERMINATION[1]			RESPONSE[1] REQUESTED
	NE	NA	AA	
West Indian manatee (*Trichechus manatus*)		X		Concurrence
Atlantic green sea turtle (*Chelonia mydas*)		X		Concurrence
Hawksbill sea turtle (*Eretmochelys imbricata*)		X		Concurrence
Kemp's ridley sea turtle (*Lepidochelys kempii*)		X		Concurrence
Leatherback sea turtle (*Dermochelys coriacea*)		X		Concurrence
Loggerhead sea turtle (*Caretta caretta*)		X		Concurrence
Eastern indigo snake (*Drymarchon corais copueri*)		X		Concurrence
American crocodile (*Crocodylus acutus*)		X		Concurrence
Piping plover		X		Concurrence

SPECIES / CRITICAL HABITAT	DETERMINATION[1]			RESPONSE[1] REQUESTED
	NE	NA	AA	
(*Charadrius melodus*)				
Wood stork (*Mycteria americana*)		X		Concurrence
Roseate tern *(Sterna dougallii dougallii)*		X		Concurrence
Smalltooth sawfish (*Pristis pectinata*)				Consulted with NOAA NMFS
Gulf sturgeon (*Acipenser oxyrinchus oxyrinchus*)		X		Concurrence

[1]DETERMINATION/ RESPONSE REQUESTED:

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional, but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence."

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation." Response requested for proposed and candidate species is "Conference."

Signature (originating station) _____ **Date** _____

Title _____

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X. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Non-concurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

_____ _____

Signature **Date**

_____ _____

Title **Office**

Appendix H. Wilderness Review

The Wilderness Act of 1964 defines a wilderness area as an area of federal land that retains its primeval character and influence, without permanent improvements or human inhabitation, and is managed so as to preserve its natural conditions and which:

1. generally appears to have been influenced primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
2. has outstanding opportunities for solitude or primitive and unconfined types of recreation;
3. has at least 5,000 contiguous roadless acres or is of sufficient size to make practicable its preservation and use in an unimpeded condition; or is a roadless island, regardless of size;
4. does not substantially exhibit the effects of logging, farming, grazing, or other extensive development or alteration of the landscape, or its wilderness character could be restored through appropriate management at the time of review; and
5. may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

The lands within J.N. "Ding" Darling National Wildlife Refuge were reviewed for their suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964.

In review of the federally owned lands and waters within the boundary of J.N. "Ding" Darling NWR Complex, no additional areas were found suitable for designation as Wilderness. The lands and waters of the refuge:

- do not meet the Wilderness minimum size requirement of 5,000 contiguous roadless acres;
- do not contain any units of sufficient size for preservation as Wilderness;
- have been altered by historic and ongoing human activities;
- do not include outstanding opportunities for solitude or for primitive recreation; and
- are fragmented by roadways and human development.

Therefore, no units of J.N. "Ding" Darling National Wildlife Refuge are suitable for designation as Wilderness at this time and the designation of Wilderness is not further analyzed in the CCP.

Appendix I. Refuge Biota

Birds of the J.N. "Ding" Darling National Wildlife Refuge

LOONS
Common Loon *Gavia immer*

GREBES
Pied-billed Grebe *Podilymbus podiceps*
Horned Grebe *Podiceps auritus*

PELICANS AND ALLIES
American White Pelican *Pelecanus erythrorhynchos*
Brown Pelican *Pelecanus occidentalis*
Double-crested Cormorant *Phalacrocorax auritus*
Anhinga *Anhinga anhinga*
Magnificent Frigatebird *Fregata magnificens*

HERONS, EGRETS AND ALLIES
American Bittern *Botaurus lentiginosus*
Least Bittern *Ixobrychus exilis*
Great Blue Heron *Ardea Herodias*
Great Egret *Ardea alba*
Snowy Egret *Egretta thula*
Little Blue Heron *Egretta caerulea*
Tricolored Heron *Egretta tricolor*
Reddish Egret *Egretta rufescens*
Cattle Egret *Bubulcus ibis*
Green Heron *Butorides virescens*
Black-crowned Night-Heron *Nycticorax nycticorax*
Yellow-crowned Night-Heron *Nyctanassa violacea*

IBISES, SPOONBILL AND STORKS
Glossy Ibis *Plegadis falcinellus*
White Ibis *Eudocimus albus*
Roseate Spoonbill *Platalea ajaja*
Wood Stork *Mycteria americana*

WATERFOWL
Green-winged Teal *Anas crecca*
Mottled Duck *Anas fulvigula*
Northern Pintail *anas acuta*
Blue-winged Teal *Anas discors*
Northern Shoveler *Anas clypeata*
American Wigeon *Anas americana*
Lesser Scaup *Aythya affinis*
Hooded Merganser *Lophodytes cucullatus*
Red-breasted Merganser *Mergus serrator*

VULTURES, HAWKS AND ALLIES
Black Vulture *Coragyps atratus*
Turkey Vulture *Cathartes aura*
Osprey *Pandion haliaetus*
American Swallow-tailed Kite *Elanoides forficatus*
Bald Eagle *Haliaeetus leucocephalus*
Northern Harrier *Circus cyaneus*
Sharp-shinned Hawk *Accipiter striatus*
Cooper's Hawk *Accipiter cooperii*
Red-shouldered Hawk *Buteo lineatus*
Broad-winged Hawk *Buteo platypterus*
Red-tailed Hawk *Buteo jamaicensis*
American Kestrel *Falco sparverius*
Merlin *Falco columbarius*
Peregrine Falcon *Falco peregrinus*
Short-tailed Hawk *Buteo brachyurus*

RAILS, GALLINULES AND COOTS
Clapper Rail *Rallus longirostris*
King Rail *Rallus elegans*
Virginia Rail *Rallus limicola*
Sora *Porzana carolina*
Common Moorhen *Gallinula chloropus*
American Coot *Fulica americana*

Birds of the J.N. "Ding" Darling National Wildlife Refuge

PLOVERS, SANDPIPERS AND ALLIES

Black-bellied Plover *Pluvialis squatarola*
Wilson's Plover *Charadrius wilsonia*
Piping Plover *Charadrius melodus*
American Oystercatcher *Haematopus palliates*
Greater Yellowlegs *Tringa melanoleuca*
Solitary Sandpiper *Tringa solitaria*
Spotted Sandpiper *Actitis macularius*
Ruddy Turnstone *Arenaria interpres*
Sanderling *Calidris alba*
Western Sandpiper *Calidris mauri*
Dunlin *Caldris alpine*
Short-billed Dowitcher *Limnodromus griseus*
Snowy Plover *Charadrius alexandrinus*
Semipalmated Plover *Charadrius semipalmatus*
Killdeer *Charadrius vociferus*
Black-necked Stilt *Himantopus mexicanus*
Lesser Yellowlegs *Tringa flavipes*
Willet *Catoptrophorus semipalmatus*
Marbled Godwit *Limosa fedoa*
Red Knot *Calidris canutus*
Semipalmated Sandpiper
Least Sandpiper *Calidris minutilla*
Stilt Sandpiper *Calidris himantopus*
Common Snipe *Capella gallinago*

GULLS, TERNS AND SKIMMERS

Laughing Gull *Larus atricilla*
Ring-billed Gull *Larus delawarensis*
Caspian Tern *Sterna caspia*
Sandwich Tern *Sterna sandvicencis*
Least Tern *Sterna antillarum*
Black Skimmer *Rynchops niger*
Bonaparte's Gull *Larus philadelphia*
Herring Gull *Larus argentatus*
Royal Tern *Serna maxima*
Forster's Tern *Sterna fosteri*
Black Tern *Chlidonias niger*

PIGEONS AND DOVES

* Eurasian Collared-Dove *Streptopelia decaocto*
Mourning Dove *Zenaida macroura*
* Ringed Turtle-Dove *Streptopelia risoria*
Common Ground-Dove *Columbina passerina*

CUCKOOS

Yellow-billed Cuckoo *Coccyzus americanus*
Mangrove Cuckoo *Coccyzus minor*

OWLS

Barn Owl *Tyto alba*
Great Horned Owl *Bubu virginianus*
Eastern Screech-Owl *Megascops asio*

GOATSUCKERS

Common Nighthawk *Chordeiles minor*
Whip-poor-will *Caprimulgus vociferous*
Chuck-will's-widow *Caprimulgus carolinensis*

SWIFTS

Chimney Swift *Chaetura pelagica*

HUMMINGBIRDS

Ruby-throated Hummingbird *Archilochus colubris*

KINGFISHERS

Belted Kingfisher *Ceryle alcyon*

WOODPECKERS

Red-bellied Woodpecker *Melanerpes carolinus*
Downy Woodpecker *Picoides pubescens*
Pileated Woodpecker *Dryocopus pileatus*
Yellow-bellied Sapsucker *Sphyrapicus varius*
Northern Flicker *Colaptes auratus*

Birds of the J.N. "Ding" Darling National Wildlife Refuge

FLYCATCHERS
Eastern Phoebe *Syornis phoebe*
Western Kingbird *Tyrannus verticalis*
Gray Kingbird *Tyrannus dominicensis*
Great Crested Flycatcher *Myiarchus crinitus*
Eastern Kingbird *Tyrannus tyrannus*
Scissor-tailed Flycatcher *Tyrannus forficatus*

MARTINS AND SWALLOWS
Purple Martin *Progne subis*
Bank Swallow *Riparia ripaira*
Northern Rough-winged Swallow *Stelgidopteryx serripennis*
Tree Swallow *Tachycineta bicolor*
Barn Swallow *Hirundo rustica*

JAYS AND CROWS
Blue Jay *Cyanocitta cristata*
Fish Crow *Corvus ossifragus*
American Crow Corvus brachyrhynchos

WRENS
Carolina Wren *Thryothorus ludovicianus*
House Wren *Troglodytes aedon*

GNATCATCHERS
Blue-gray Gnatcatcher *Polioptila caerulea*

THRUSHES
American Robin *Turdus migratorius*
Gray-cheeked Thrush *Catharus minimus*
Wood Thrush *Hylocichla mustelina*
Swainson's Thrush *Catharus ustulatus*
Veery *Catharus fuscescens*

MOCKINGBIRDS, THRASHERS AND ALLIES
Gray Catbird *Dumetella carolinensis*
Brown Thrasher *Toxostoma rufum*
Northern Mockingbird *Mimus polyglottos*

WAXWINGS
Cedar Waxwing *Bombycilla cedrorum*

STARLINGS
* European Starling *Sturnus vulgaris*

VIREOS
White-eyed Vireo *Vireo griseus*
Red-eyed Vireo *Vireo olivaceus*
Blue-headed Vireo *Vireo solitarius*
Black-whiskered Vireo *Vireo altiloquus*

WARBLERS
Orange-crowned Warbler *Vermivora celata*
Tennessee Warbler *Vermivora peregrine*
Blue-winged Warbler *Vermivora pinus*
Yellow Warbler *Dendroica petechia*
Black-throated Green Warbler *Dendroica virens*
Black-throated Blue Warbler *Dendroica caerulescens*
Blackburnian Warbler *Dendroica fusca*
Prairie Warbler *Drendroica discolor*
Blackpoll Warbler *Dendroica striata*
American Redstart *Setophaga ruticilla*
Bay-breasted Warbler *Dendroica castanea*
Ovenbird *Seiurus aurocapilla*
Louisiana Waterthrush *Seiurus motacilla*
Hooded Warbler *Wilsonia citrina*
Nashville Warbler *Vermivora ruficapilla*
Golden-winged Warbler *Vermivora chrysoptera*
Northern Parula *Parula americana*
Magnolia Warbler *Dendroica magnolia*
Cape May Warbler *Dendroica tigrina*
Yellow-rumped Warbler *Dendroica coronata*
Yellow-throated Warbler *Dendroica dominica*
Palm Warbler *Dendroica palmarum*
Black-and-white Warbler *Mniotilta varia*
Prothonotary Warbler *Protonotaria citrea*
Worm-eating Warbler *Helmitheros vermivorum*
Northern Waterthrush *Seiurus noveboracensis*
Common Yellowthroat *Geothlypis trichas*

Birds of the J.N. "Ding" Darling National Wildlife Refuge

TANAGERS
Summer Tanager *Piranga rubra*
Scarlet Tanager *Piranga olivacea*

NEW WORLD FINCHES
Northern Cardinal *Cardinalis cardinalis*
Indigo Bunting *Passerina cyanea*
Rose-breasted Grosbeak *Pheucticus ludovicianus*
Blue Grosbeak *Passerina caerulea*
Painted Bunting *Passerina ciris*
Eastern Towhee *Pipilo erythrophthalmus*

SPARROWS
Rufous-sided Towhee *Pipilo erythrophthalmus*
Swamp Sparrow *Melospiza georgiana*

BLACKBIRDS, GRACKLES, COWBIRDS AND ORIOLES
Bobolink *Dolichonyx oryzivorus*
Boat-tailed Grackle *Quiscalus major*
Shiny Cowbird *Molothrus bonariensis*
Orchard Oriole *Icterus spurious*
Red-winged Blackbird *Agelaius phoeniceus*
Common Grackle *Quiscalus quiscula*
Brown-headed Cowbird *Molothrus ater*
Baltimore Oriole *Icterus galbula*

NORTHERN FINCHES
American Goldfinch *Carduelis tristis*

OLD WORLD SPARROWS
* House Sparrow *Passer domesticus*

ACCIDENTALS
(Birds seen only once or twice during the past eight years)
Northern Gannet *Morus bassanus*
Greater Flamingo *Phoenicopterus ruber*
Fulvous Whistling-Duck *Dendrocygna bicolor*
Wood Duck *Aix sponsa*
Mallard *Anas platyrhynchos*
Savannah Sparrow *Passerculus sandwichensis*
White-crowned Pigeon *Columba leucocephala*
Canvasback *Aythya valisineria*
Hairy Woodpecker *Picoides villosus*
Ring-necked Duck *Aythya collaris*
Bufflehead *Bucephala albeola*
Ruddy Duck *Oxyura jamaicensis*
Swainson's Hawk *Buteo swainsoni*
Black Rail *Laterallus jamaicenis*
Purple Gallinule *Porphyrio martinica*
Roseate Tern *Sterna dougallii*
Common Tern *Sterna hirundo*
American Avocet *Recurvirostra americana*
Whimbrel *Numenius phaeopus*
Chestnut-sided Warbler *Dendroica pensylvanica*
White-rumped Sandpiper *Calidris fuscicollis*
Parasitic Jaeger *Stercorarius parasiticus*
Pectoral Sandpiper *Calidris melanotos*
Black-billed Cuckoo *Coccyzus erythropthalmus*
Red-headed Woodpecker *Melanerpes erythrocephalus*
Great Black-backed Gull *Larus marinus*
Common Black-headed Gull *Larus ridubundis*
Sandhill Crane *Grus canadensis*
Smooth-billed Ani *Crotophaga ani*
Barred Owl *Strix varia*
Short-eared Owl *Asio flammeus*
Redhead *Aythya americana*
Eastern Meadowlark *Sturnella magna*
Vermilion Flycatcher *Pyrocephalus rubinus*
Sedge Wren *Cistothorus platensis*
Marsh Wren *Cistothorus palustris*
Ruby-crowned Kinglet *Regulus calendula*
Eastern Bluebird *Sialia sialis*
* White-winged Dove *Zenaida asiatica*
Loggerhead Shrike *Lanius ludovicianus*
Yellow-throated Vireo *Vireo flavifrons*
Philadelphia Vireo *Vireo philadelphicus*
Snow Goose *Chen caerulescens*
Gadwall *Anas strepera*
Pine Warbler *Dendroica pinus*
Kentucky Warbler *Oporornis formosus*
Wilson's Warbler *Wilsonia pusilla*
Yellow-breasted Chat *Icteria virens*
Gull-billed Tern *Sterna nilotica*
Limpkin *Aramus guarauna*
* Rock Dove *Columbo columbo*
* Monk Parakeet *Myiopsitta monachus*
* Green Parakeet *Aratinga holochlora*
* Rose-ringed Parakeet *Psittacula krameri*

Birds of the J.N. "Ding" Darling National Wildlife Refuge

ADDITIONAL Birds of Sanibel Island

Hermit Thrush *Catharus guttatus*
Cerulean Warbler *Dendroica cerulean*
Connecticut Warbler *Oporornis agilis*
Dickcissel *Spiza Americana*
Grasshopper Sparrow *Ammodramus savannarum*
Le Conte's Sparrow *Ammodramus leconteii*
Seaside Sparrow *Ammodramus maritimus*
White-throated Sparrow *Zonotrichia albicollis*
Purple Finch *Carpodacus purpureus*
Black Scoter *Melanitta nigra*
Bridled Tern *Sterna anaethetus*
Acadian Flycatcher *Empidonax virescens*
Bay-breasted Warbler *Dendroica castanea*
Swainson's Warbler *Limnothlypis swainsonii*
Mourning Warbler *Oporornis Philadelphia*
Field Sparrow *Chondestes grammacus*
Henslow's Sparrow *Ammodramus henslowii*
Sharp-tailed Sparrow *Ammodramus caudacutus*
Song Sparrow *Melospiza melodia*
White-crowned Sparrow *Zonotrichia leucophrys*
Cinnamon Teal *Anas cyanoptera*
Wilson's Snipe *Gallinago delicate*
Eastern Wood-Pewee *Contopus virens*
* Canary-winged Parakeet *Brotogeris versicolurus*

Yellow-headed Blackbird *Xanthocephalus xanthocephalus*
Long-billed Curlew *Numenius americanus*
Least Flycatcher *Empidonax minimus*
American Pipit *Anthus rubescens*
Lesser Black-backed Gull *Larus fuscus*
Tufted Titmouse *Baeolophus bicolor*
Chipping Sparrow *Spizella passerina*

* Invasive exotic species

Sources: "Birds of Sanibel", Sanibel-Captiva Conservation Foundation, http://www.sccf.org/files/downloads/WildLProjSanibelBirds.pdf

"Bird Checklists of the United States, J.N. "Ding" Darling National Wildlife Refuge", Northern Prairie Wildlife Research Center, USGS, http://www.npwrc.usgs.gov/resource/birds/chekbird/r4/dingdarl.htm

"Birds of the J.N. "Ding" Darling National Wildlife Refuge, Sanibel and Captiva Islands and Surrounding Waters" Checklist, U.S. Fish and Wildlife Service, 2007

Amphibians and Reptiles of J.N. "Ding" Darling National Wildlife Refuge

Amphibians

Frogs

Southern Toad *Bufo terrestris*
** Oak Toad *Bufo quercicus*
Eastern Narrowmouth Toad *Gastrophryne c. carolinensis*
Pig Frog *Rana grylio*
Southern Leopard Frog *Rana sphenocephala*
Green Tree Frog *Hyla cinerea*
Squirrel Tree Frog *Hyla squirella*
* Cuban Tree Frog *Osteopilus septentrionalis*
* Greenhouse Frog *Eleutherodactylus planirostris planirostris*
** Florida Cricket Frog *Acris gryllus*
** Florida Chorus Frog *Pseudacris nigrita*
** Little Grass Frog *Pseudacris ocularis*

Reptiles

Crocodilians

American Alligator *Alligator mississippiensis*
American Crocodile *Crocodylus acutus*

Snakes

Yellow Rat Snake *Elaphe obsoleta quadrivittata*,{ *E. alleganiensis*}
Corn Snake *Elaphe guttata guttata*
Southern Black Racer *Coluber constrictor priapus*
Eastern Coachwhip Snake *Masticophis flagellum flagellum*
Southern Ringneck Snake *Diadophis punctatus punctatus*
Florida Brown Snake *Storeria victa*
Peninsula Ribbon Snake *Thamnophis sauritus sackenii*
Florida Water Snake *Nerodia fasciata pictiventris*
Mangrove Water Snake *Nerodia clarki compressicauda*
Eastern Indigo Snake *Drymarchon corais couperi*
* Brahminy Blind Snake *Rhamphotyphlops braminus*
* Burmese python
Eastern Coral Snake *Micrurus fulvius fulvius*
Eastern Diamondback Rattlesnake *Crotalus adamanteus*
** Brown Water Snake *Nerodia taxispilota*
** Green Water Snake *Nerodia floridana*
** Eastern Garter Snake *Thamnophis sirtalis sirtalis*
** Florida Cottonmouth *Agkistrodon piscivorus conanti*
** Dusky Pigmy Rattlesnake *Crotalus miliarius barbouri*

Amphibians and Reptiles of J.N. "Ding" Darling National Wildlife Refuge

Lizards
Green Anole *Anolis carolinensis*
* Brown Anole *Anolis sagrei*
Six-lined Racerunner *Cnemidophorus sexlineatus*
Southeastern Five-lined Skink *Eumeces inexpectatus*
Ground Skink *Scincella lateralis*
** Eastern Glass Lizard *Ophisaurus ventralis*
* Indo-pacific Gecko *Hemidactylus garnotii*
* Tropical House Gecko *Hemidactylus mabouia*
* Tokay Gecko *Gekko gecko*
* Green Iguana *Iguana iguana*
* Nile Monitor Lizard *Varanus niloticus*
* Red-headed Agama *Agama agama Africana*

Turtles
Peninsula Cooter Turtle *Pseudemys peninsularis*
Florida Redbelly Turtle *Pseudemys nelsoni*
Yellowbelly Slider *Trachemys scripta scripta*
Florida Chicken Turtle *Deirochelys reticularia chrysea*
Ornate Diamondback Terrapin *Malaclemys terrapin macrospilota*
** Florida Mud Turtle *Kinosternon subrubrum steindachneri*
Striped Mud Turtle *Kinosternon bauri*
Florida Box Turtle *Terrapene carolina bauri*
Gopher Tortoise *Gopherus polyphemus*
Loggerhead Sea Turtle *Caretta carretta*
Green Sea Turtle *Chelonia mydas*
Hawksbill Sea Turtle *Eretmochelys imbricata*
Kemp's Ridley Sea Turtle *Lepidochelys kempii*
Florida Snapping Turtle *Chelydra serpentina osceola*
Florida Softshell Turtle *Apalone ferox*
Red-eared Slider *Trachemys scripta elegans*
Leatherback Sea Turtle *Dermochelys coriacea*

* Invasive exotic species
** Species that have not been confirmed since at least the 1980s

Sources: "J.N. "Ding" Darling National Wildlife Refuge Amphibian and Reptile List", U.S. Fish and Wildlife Service, http://library.fws.gov/Refuges/j.n.ding_darling_amphib_reptiles98.pdf

"J.N. "Ding" Darling National Wildlife Refuge Amphibian and Reptile List", U.S. Fish and Wildlife Service, Charles LeBuff, 1982

"Amphibians & Reptiles of Sanibel Island 2007", Sanibel-Captiva Conservation Foundation, http://www.sccf.org/files/downloads/WildLProgReptilesList.pdf

Skip Snow, personal communication, 2009

Mammals in the vicinity of J.N. "Ding" Darling National Wildlife Refuge

Florida Bonneted Bat *Eumops floridanus*
** False Killer Whale *Pseudorca crassidens*
Atlantic Bottle-nosed Dolphin *Tursiops truncatus*
West Indian Manatee *Trichechus manatus*
Virginia Opossum *Dilelphis virginiana*
** Sherman's Short-tailed Shrew *Blarina carolinensis shermani*
** Least Shrew *Cryptotis parva floridana*
** Eastern Mole *Scalopus aquaticus*
Eastern Yellow Bat *Lasiurus intermedius*
Evening Bat *Nycticeius humeralis*
Brazilian Free-tailed Bat *Tadarida brasiliensis*
** Eastern Big-eared Bat *Plecotus refinesquei*
Nine-banded Armadillos *Dasypus novemcinctus*
** Eastern Cottontail Rabbit *Sylvilagus floridanus floridanus*
Marsh Rabbit *Sylvilagus palustris*
Gray Squirrel *Sciurus carolinensis*
Sanibel Island Rice Rat *Oryzomys palustris sanibeli*
Florida Cotton Mouse *Peromyscus gossypinus palmarinus*
Florida Mouse *Podomys floridanus*
Florida Hispid Cotton Rat *Sigmodon hispidus floridanus*
Insular Hispid Cotton Rat *Sigmodon hispidus insulicola*
Round-tailed Muskrat *Neofiber alleni*
*Black Rat *Rattus rattus*
* Norway Rat *Rattus norvegicus*
*House Mouse *Mus musculus*
Gray Fox *Urocyon cinereoargenteus floridanus*
Florida Raccoon *Procyon lotor elucus*
Long-tailed Weasel *Mustela frenata peninsulae*
Everglades Mink *Mustela vison mink*
Spotted Skunk *Spilogale putorius ambarvalus*
Striped Skunk *Mephitis mephitis elongata*
River Otter *Lutra canadensis*
Bobcat *Lynx rufus*

* Invasive exotic species
** Species have not been documented since at least the 1980s

Sources:
J.N. "Ding" Darling NWR Species Lists (Kendra Willet, 2006; Charles LeBuff, 1982);
Sanibel Terrestrial Mammal List (Chris Lechowicz, Sanibel-Captiva Conservation Foundation, 2007);
The Nature of Things on Sanibel (George Campbell, 1988);
Mammal Master Database (Florida Museum of Natural History, 2009);
Rare and Endangered Biota of Florida, Vol. I Mammals (FCREPA, 1992a);
"Mammal Checklists of the United States, Pine Island, Matlacha Pass, Island Bay, Caloosahatchee National Wildlife Refuges", Northern Prairie Wildlife Research Center, USGS,
http://www.npwrc.usgs.gov/resource/birds/chekbird/r4/pinemam.htm

Fish in the vicinity of J.N. "Ding" Darling National Wildlife Refuge

Florida Gar *Lepisosteus platyrhincus*
Nurse Shark *Ginglymostoma cirratum*
Bull Shark *Carcharhinus leucas*
Blacktip Shark *Carcharhinus limbatus*
Spinner Shark *Carcharhinus maculipinnis*
Sandbar Shark *Carcharhinus plumbeus*
Dusky Shark *Carcharhinus obscurus*
Tiger Shark *Galeocerdo cuvieri*
Lemon Shark *Negaprion brevirostis*
Atlantic Sharpnose Shark *Rhizoprionodon terraenovae*
Great Hammerhead *Sphyrna mokarran*
Bonnethead Shark *Sphyrna tiburo*
Atlantic Guitarfish *Rhinobatos lentiginosus*
Lesser Electric Ray *Narcine brasiliensis*
Clearnose Skate *Raja eglanteria*
Southern Stingray *Dasyatis americana*
Atlantic Stingray *Dasyatis sabina*
Smooth Butterfly Ray *Gymnura micura*
Spotted Eagle Ray *Aetobatus narinari*
Southern Eagle Ray *Myliobatis goodei*
Cownose Ray *Rhinoptera bonasus*
Ladyfish *Elops saurus*
Tarpon *Megalops atlantica*
American Eel *Anguilla rostrata*
Gulf Menhaden *Brevoortia patronus*
Atlantic Thread Herring*Opisthonema oglinum*
Scaled Sardine *Harengula jaguana*
Bay Anchovy *Anchoa mitchilla*
Inshore Lizardfish *Synodus foetens*
Gafftopsail Catfish *Bagre marinus*
Hardhead Catfish *Arius felis*
Gulf Toadfish *Opsanus beta*
Skilletfish *Goiesox strumosus*
Polka-dot Batfish *Ogcocephalus radiatus*
Houndfish *Tylosurus crocodilus*
Sheepshead minnow *Cyprinodon variegatus*
Gulf Killifish *Fundulus confluentus*
Longnose Killifish *Fundulus similis*
Rainwater Killifish *Lucania parva*
Mosquitofish *Gambusia affinis*
Sailfin Molly *Poecilia latipinna*
Dwarf Seahorse *Hippocampus zosterae*
Gulf Pipefish *Syngnathus hildebrandi*
Common Snook *Centropomus undecimalis*
Spotted Jewfish *Epinephelus itajara*
Marsh Killifish *Fundulus confluentus*
Bluefin Killifish *Lucania goodei*
Flagfish *Joranella floridae*
Least Killifish *Heterandria Formosa*

Fish in the vicinity of J.N. "Ding" Darling National Wildlife Refuge

Warmouth *Lepomis gulosus)*
Bluegill *Lepomis macrochirus*
Red-eared Sunfish *Lepomis microlophus*
Largemouth Bass *Micropterus salmoides*
Red Grouper *Epinephelus morio*
Gag Grouper *Mycteroperca microlepis*
Black Seabass *Centropristis striata*
Bluefish *Pomatomus saltatrix*
Cobia *Rachycentron canadum*
Remora *Remora remora*
Yellow Jack *Caranx bartholomaei*
Crevalle Jack *Caranx hippos*
Atlantic bumper *Chloroscombrus chrysurus*
Leatherjacket *Oligoplites saurus*
Greater Amberjack *Seriola setapinnis*
Florida pompano *Trachinotus carolinus*
Lane Snapper *Lutjanus synagris*
Mangrove Snapper *Lutjanus griseus*
Tripletail *Lobotes surinamensis*
Striped Mojorra *Diapterus plumieri*
Silver Jenny *Eucinostomus gula*
Mottled Mojarra *Ulaema lefroyi*
Pigfish *Orthopristis chrysoptera*
White Grunt *Haemulon plumieri*
Sheepshead *Archosargus probatocephalus*
Pinfish *Lagodon rhomboides*
Grass Porgy *Calamus arctifrons*
Cubbyu *Equetus umbrosus*
Southern Kingfish *Menticirrus americanus*
Gulf Kingfish *Menticirrhus littoralis*
Black Drum *Pogonias cromis*
Red Drum *Sciaenops ocellata*
Silver *Cynoscion nothus*
Spotted Seatrout *Cynoscion nebulosus*
Atlantic Spadefish *Chaetodipterus faber*
Striped Mullet *Mugil cephalus*
White Mullet *Mugil curema*
Great Barracuda *Sphyraena barracuda*
Highfin Blenny *Lupinoblennius nicholsi*
Spanish Mackerel *Scomberomorus maculatus*
Bighead Searobin *Prionotus tribulus*
Barbfish *Scorpaena brasiliensis*
Gulf Flounder *Paralichthys albigutta*
Southern Flounder *Paralichthys lethostigma*
Hogchoker *Trinectes maculatus*
Tonguefish *Symphurus sp.*
Plainhead Filefish *Monachnthus hispidus*
Queen Triggerfish *Balistes vetula*
Southern Puffer *Sphoeroides nephelus*

Fish in the vicinity of J.N. "Ding" Darling National Wildlife Refuge

Striped Burrfish *Chilumycterus schoepfi*
*Mayan cichlid *Cichlasoma urophthalmus* *Mozambique tilapia *Oreochromis mossambicus*
* Walking Catfish *Clarias batrachus*

Sources: "Miscellaneous Checklists of the United States, Pine Island, Matlacha Pass, Island Bay, Caloosahatchee National Wildlife Refuges", http://www.npwrc.usgs.gov/resource/birds/chekbird/r4/pinefish.htm

"Freshwater Fishes of the Sanibel River Basin" by Chris Lechowicz, Sanibel-Captiva Conservation Foundation, 2007
USGS, Nonindigenous Aquatic Species. 2008. <http://nas.er.usgs.gov/>

Appendix J. List of Preparers

A variety of local, state, and federal agencies; non-governmental organizations; area residents and landowners; and local businesses, as well as the general public played a role in the development of this CCP (see Chapter V in the EA for an overview of consultation and coordination). The actual preparers of the documents are listed.

U.S. Fish and Wildlife Service

- Paul Tritaik, Project Leader, J.N. “Ding” Darling NWR Complex
- Cheri M. Ehrhardt, AICP, Natural Resource Planner
- Patrick Martin, Deputy Project Leader, J.N. “Ding” Darling NWR Complex
- Kevin Godsea, Refuge Ranger-Environmental Education, J.N. “Ding” Darling NWR Complex
- Joyce Mazourek, Biologist, J.N. “Ding” Darling NWR Complex
- Spencer Simon, Ecological Services

Contractor to the U.S. Fish and Wildlife Service

- Charles McEntyre, Tennessee Valley Authority
- Pat Hamlett, Tennessee Valley Authority
- Dennis Meinert, Tennessee Valley Authority