STEWARDSHIP OF AQUATIC RESOURCES

for the

Gulf Coastal Plain Ecosystem Partnership:

an Aquatic Management Plan

for the Watersheds of the Western Panhandle of Florida and Southern Alabama

The Nature Conservancy

SAVING THE LAST GREAT PLACES ON EARTH

GCPEP

Gulf Coastal Plain Ecosystem Partnership

Winter 2006

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Ecoregion: East Gulf Coastal Plain (EGCP)

States/Counties: **Florida**: Bay, Escambia, Holmes, Jackson, Okaloosa, Santa Rosa, Walton, and Washington counties
Alabama: Baldwin, Barbour, Bullock, Butler, Conecuh, Crenshaw, Coffee, Covington, Dale, Escambia, Geneva, Henry, Houston, Monroe, and Pike counties

Acreage: **1,052,321 ac.**

GCPEP Landholdings (approx. acreage)**:**

Department of Defense (481,241)
Florida Division of Forestry (211,752)
Northwest Florida Water Management District (112,963)
National Forests in Alabama (83,790)
Florida Department of Environmental Protection (57,270)
Nokuse Plantation (50,000)
National Park Service (24,795)
International Paper (24,263)
The Nature Conservancy (5,081)
Florida Fish & Wildlife Conservation Commission (1,166)

GCPEP Aquatic Subcommittee

Shelley Alexander – Coastal and Aquatic Managed Areas
Jennifer (JJ) Bachant-Brown – Gulf Coastal Plain Ecosystem Partnership
Steve Brown – Northwest Florida Water Management District
Vernon Compton – Gulf Coastal Plain Ecosystem Partnership
Paul Freeman – The Nature Conservancy - Alabama
Riley Hoggard – Gulf Islands National Seashore
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John Knight – Florida Fish and Wildlife Conservation Commission
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Donald Ray – Florida Department of Environmental Protection
Doug Shaw – The Nature Conservancy - Florida
Bill Tate – US Fish and Wildlife Service
Dagmar Thurmond – Conecuh National Forest, Alabama
Chris Verlinde – Florida Sea Grant Extension Program
Nicole Vickey – The Nature Conservancy - Alabama

OVERVIEW OF THE GULF COASTAL PLAIN ECOSYSTEM PARTNERSHIP

The Gulf Coastal Plain Ecosystem Partnership (GCPEP) is a collaboration among the Department of Defense, Florida Division Of Forestry, Northwest Florida Water Management District, National Forests In Alabama, Florida Department Of Environmental Protection, Nokuse Plantation, National Park Service, International Paper, The Nature Conservancy, and the Florida Fish & Wildlife Conservation Commission that together operate under a 1996 multi-party Memorandum of Understanding (MOU) encompassing 1,052,321 acres in northwest Florida and south Alabama (Figure 1) (Hardesty et al. 1999). This area is known for its extensive longleaf pine forests, as well as being one of the most critical freshwater and marine sites in the United States, including numerous outstanding examples of wetland, riverine, and estuarine systems.

The Partnership is guided by a Steering Committee which is composed of two representatives from each of the partner organizations, one primary and one alternate. The GCPEP Steering Committee, operating under the MOU, has agreed upon operating guidelines to ensure efficient operation of the Partnership. In reaching agreements, consensus is the method of decision making. If there is a dissent, the majority is charged with finding an alternative solution. The GCPEP staff is present to provide information and assistance to the Steering Committee, and does not vote on issues. The GCPEP Staff is guided by partner needs.

GCPEP AQUATIC MANAGEMENT PLAN OBJECTIVES

The primary objective of this GCPEP Aquatic Management Plan is to preserve the aquatic plants and animals and natural aquatic communities that represent the diversity of life within the GCPEP landscape by protecting the waters and upland terrestrial areas they need to survive.

Specifically, we will identify threats to each conservation target (e.g., watersheds) and the components of that watershed (e.g. headwaters, bays, and estuaries), develop strategies to abate the threats, and establish specific “on the ground” conservation strategies and measures (e.g., monitoring) of success.

This is a living document, which will augment the terrestrial management plan, and will continue to grow through the completion of action items, periodic evaluation, gathering information, and closing data gaps.

Figure 1. Gulf Coastal Plain Ecosystem Partnership Lands and Surrounding Landscape in the western Florida Panhandle and southern Alabama.

N

10 5 0 10 Miles

Scale 1 : 750,000

Gulf Coastal Plain Ecosystem Partnership
Partnership Lands

Northwestern Florida and Southern Alabama

Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

II. CONSERVATION BY DESIGN AND CONSERVATION PLANNING

GCPEP's mission is to conserve a set of places that will ensure the long-term survival of all native life and natural communities—not just those that are threatened. We call these places conservation areas. Our plan is to protect networks of conservation areas across the GCPEP landscape using The Nature Conservancy's Conservation Area Planning Process (Low 2000, TNC 2000b, 1998). Using TNC's collaborative, science-based approach to conservation, GCPEP first created a conservation area plan (CAP) for the GCPEP landscape. We have now created a GCPEP Aquatic Management Plan which we will further strengthen by developing a CAP for each GCPEP watershed (headwaters to gulf), including important target elements, communities, and species. These plans form a conservation blueprint that guides the GCPEP Partner actions.

There are five steps in The Nature Conservancy's Conservation Area Planning Process (TNC 1998):

- **Identifying Conservation Elements.** Ecoregional planning teams made up of Conservancy staff and partners identify the species, natural communities and ecosystems in a given ecoregion and select as conservation elements those that best capture its biodiversity.

- **Gathering Information.** The teams gather data about the conservation elements, such as location and species viability.

- **Setting Goals.** The team sets goals for each conservation element. Setting goals involves determining how much of a particular element is needed to ensure its long-term survival and how elements need to be distributed across the landscape.

- **Assessing Viability.** The team assesses the viability of each conservation element and identifies the healthiest examples of each element.

- **Assembling Portfolios.** All this information is analyzed and used to design a network of conservation areas that, if protected, will ensure the preservation of biodiversity in the ecoregion.

The Conservancy uses conservation area plans to develop site-specific conservation strategies and prepare for taking action and measuring success. These plans follow what is known as the 5-S Framework (TNC 2000b):

- **Systems.** The conservation area planning team identifies the species and natural communities that will be the conservation elements for the area. This is done using element lists developed during ecoregional planning and modifying the lists to include site-specific conservation elements.

- **Stresses.** The team determines how conservation elements are compromised, such as by habitat reduction or fragmentation, or changes in the number of species in a forest or grassland.

- **Sources.** The team then identifies and ranks the causes, or sources, of stress for each element. The analysis of stresses and sources together make up the threat assessment.

- **Strategies.** An important step in the process is finding practical cooperative ways to mitigate or eliminate the identified threats and enhance biodiversity.

- **Success.** Each plan outlines methods for assessing effectiveness in reducing threats and improving biodiversity--usually by monitoring progress toward established biological and programmatic goals.

- An understanding of the cultural, political and economic situation behind the threats is essential for developing sound strategies. This human context is often referred to as the sixth "S".

III. CONSERVATION AREA OVERVIEW

WHAT IS A CONSERVATION AREA?

A conservation area is an area, large or small, that is, or has the potential to be, an ecologically functional system. Ecologically functional means that it supports all the plant and animal species native to the area and that sustaining ecological processes (e.g., hydrologic cycles, energy flow, and fire regimes) are occurring. Conservation areas are thus defined primarily as biological units. The boundary defines the ecological system that GCPEP and its partners used in selecting conservation targets and in assessing conservation needs. The actual scope of on-the-ground work in the GCPEP area is partly delineated by this boundary but has and will continue to be based also on biological requirements, feasibility, and a respect for the needs and desires of local communities.

GCPEP BOUNDARY JUSTIFICATION

The GCPEP aquatic management area is situated within the East Gulf Coastal Plains ecoregion, along Florida's northern gulf coast and southern Alabama. The boundary of the GCPEP aquatic management area is based on the conservation area as delineated in (1) East Gulf Coastal Plain ecoregion plan, which addresses terrestrial and shoreline areas (East Gulf Coastal Plain Core Team, 1999), and (2) the Northern Gulf of Mexico ecoregional plan, which focuses on near shore marine environments (TNC 2000a). The GCPEP Aquatic Subcommittee has defined the conservation areas as all major rivers and bays in the western Florida Panhandle and continuing northward up into Alabama. The major rivers and bays are the Perdido, Escambia/Conecuh, Blackwater, Yellow/Shoal, and Choctawhatchee rivers and their tributaries and Perdido, Pensacola, (Escambia and East bay), and Choctawhatchee bays.

GCPEP BIOLOGICAL OVERVIEW

The climate across the GCPEP landscape is sub-tropical. The average July temperature is 32.6º C (90.7º F) and January averages 16.2º C (61.2º F), with an overall yearly average of 21º C (70º F). There are typically over 200 days of sunshine annually. Average annual rainfall is 163 cm. (64.28 in.) (National Weather Service - NOAA 2005). Hurricanes are an infrequent but important natural process. Since 1900 there have been 30 hurricanes to make landfall in northwest Florida, 12 of which have been category 3 or higher (National Hurricane Center - NOAA 2005).

The East Gulf Coastal Plain ecoregion stretches from the southern portion of Georgia across the Florida Panhandle and west to the southern portion of Louisiana, and encompasses portions of Georgia, Florida, Alabama, Mississippi, and Louisiana. Because of its meager topographic and soil diversity, the East Gulf Coastal Plain would suggest an area of low biodiversity and endemism; however, it is one of the richest ecoregions in North America in species richness, species endemism, and community diversity — terrestrial, freshwater, barrier islands, and estuarine systems (East Gulf Coastal Plain Core Team 1999). Embedded within the biologically diverse fire-dependant longleaf pine sandhill matrix and pine flatwoods matrix are specialized natural communities such as seepage slopes and seasonally flooded depression wetlands. These specialized aquatic communities provide excellent habitat for plants, amphibians, and invertebrates. The freshwater and marine systems are among the most significant and at-risk

aquatic biodiversity resources in North America, particularly for fish, reptiles and amphibians, aquatic macroinvertebrates, and mussel species. The estuarine systems, along with the barrier island systems, are highly productive.

Currently, the East Gulf Coastal Plain's longleaf pine system, with its embedded aquatic communities, covers less than five percent of its former range, making it one of the most endangered landscapes in North America (Noss et al. 1995). The aquatic systems of this ecoregion have been severely affected by hydrologic alterations, pollution, damming, and the introduction of invasive non-native species (East Gulf Coastal Plain Core Team 1999). Conservation actions are imperative to stymie the degradation and to prevent further loss.

The GCPEP landscape (Figure 1) is considered by The Nature Conservancy to be one of the two most important landscapes in the East Gulf Coastal Plain Ecoregion and a critical link in conserving the biodiversity of the Southeastern United States. Despite being only a small portion of the land and water area within the 42 million acre ecoregion, GCPEP lands and waters contain nearly half of the ecoregion's target species and natural communities. The GCPEP area's longleaf pine sandhill matrix encompasses a quarter of the world's remaining large tracts of longleaf pine, including more than half of the remaining old growth stands (East Gulf Coastal Plain Core Team 1999). In addition, the GCPEP landscape has some of the best examples of shifting sand-bottomed blackwater rivers, steephead stream/slope systems, and Gulf Coast barrier island and key complexes.

GCPEP includes significant portions of the watersheds of the Perdido, Escambia/Conecuh, Blackwater, Yellow/Shoal, and Choctawhatchee rivers, the Perdido, Pensacola, and Choctawhatchee bays, and the many streams originating on Eglin Air Force Base that flow directly into Choctawhatchee Bay. A number of these rivers have been identified as Outstanding Florida Waterways, and the Yellow River has been designated as an Aquatic Preserve by the Florida Department of Environmental Protection. Together, these wetlands, rivers, and bays support more than 120 species that are considered globally rare or imperiled (East Gulf Coastal Plain Core Team 1999; also see Appendix A). A recent assessment of North American freshwater systems identified these watersheds as important hotspots for protecting at-risk fish and mussel species (Master et al. 1998). The Florida Fish and Wildlife Conservation Commission rates the GCPEP region as having the greatest concentration of rare and imperiled fish species in Florida, with two federally listed species, the Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and the Okaloosa darter (*Etheostoma okaloosae*) (Hoehn 1998).

Of the more than 300 species of plants, animals, and lichens that are considered East Gulf Coastal Plain Ecoregion target species by The Nature Conservancy, more than 100 have been recorded as occurring on GCPEP lands and waters. Eleven are listed as federally Endangered or Threatened, with many more that may be considered for future listing unless immediate conservation action is taken. Sixty-one of the target species occurring on GCPEP lands have Natural Heritage ranks of G1, G2, T1, or T2, meaning that they have extremely limited distributions from a global perspective (East Gulf Coastal Plain Core Team 1999; see Appendix B).

Fifty or more of these species do not occur outside of the East Gulf Coastal Plain Ecoregion. Of these, 16+ are endemic to the GCPEP area, meaning they occur only within the GCPEP managed areas, and nowhere else. Global conservation of these species depends on conservation of their habitat on GCPEP managed areas. For example, a small area overlapping Eglin Air Force Base and International Paper properties contains the entire known range of the Florida bog frog (*Rana okaloosae*), one of the rarest vertebrates in North America. Eglin is also home to another endemic vertebrate, the Okaloosa darter (*Etheostoma okaloosae*). Eglin Air Force Base, Blackwater River State Forest, and the Northwest Florida Water Management District's Choctawhatchee River Water Management Area all host endemic invertebrates. For example, six of the 12 freshwater mollusk species found in GCPEP rivers are endemic to the watersheds of the GCPEP landscape, and nine are G1 or G2 target species (East Gulf Coastal Plain Core Team 1999).

The Gulf Coastal Plain Ecosystem Partnership also has a number of non-endemic targets that are of great conservation concern. Some of the more imperiled non-endemics include the federally Threatened Gulf sturgeon (*Acipenser oxyrhinchus desotoi*), and the federally Threatened flatwoods salamander (*Ambystoma cingulatum*). The presence of these species on multiple partner landholdings, including in some cases the movement of individuals among them (e.g., Gulf sturgeon, flatwoods salamander), suggests that many opportunities for cooperative conservation exists among GCPEP land managers, and in some cases, may be essential for the long-term persistence of a number of ecologically important species.

IV. CONSERVATION TARGETS

INTRODUCTION AND DESCRIPTION OF GCPEP CONSERVATION TARGETS

As the first step in its conservation planning process, GCPEP has adopted The Nature Conservancy's approach to conservation planning. The Conservancy evaluates conservation needs at an ecoregional scale (The Nature Conservancy 2000a, 2000c; East Gulf Coastal Plain Core Team 1999). Scientists and land managers develop portfolios of conservation areas for each ecoregion. These portfolios represent the full distribution and diversity of conservation targets—native species, natural communities, and ecological systems—within each ecoregion (see Chapter I and Glossary). Because conservation targets are usually at or below optimum numbers, part of the ecoregional planning process involves establishing goals for their number and distribution across the ecoregion (The Nature Conservancy 2000c). Planning that the Conservancy does at the local (i.e., conservation area) level must serve two main purposes: (1) help us reach the biological goals set out in the ecoregional plan, and (2) address any biological, socio-cultural, economic, or political issues unique to the conservation area.

The Nature Conservancy's methodology for local-level planning allows selection of conservation targets at various scales (e.g., species, guild, community) but encourages limiting their number to eight. Because the conservation area contains far more than eight targets of interest, the aquatic subcommittee took care to choose conservation targets at a coarse enough scale to encompass the diverse guilds and species of conservation concern. This effort produced a list of five watersheds with their common landscape targets (e.g., headwaters, saltmarshes, etc.) and natural communities (below). These five watersheds (Figure 2) together cover about 12,446 square miles of the conservation area. Approximate sizes of each system are given in the viability analysis (next section).

- **Perdido Watershed**
- **Escambia/Conecuh Watershed**
- **Blackwater Watershed**
- **Yellow/Shoal Watershed**
- **Choctawhatchee Watershed**

To address key species within these systems, landscape elements, plant and animal species, and vegetation communities were nested under the broader conservation targets, the watersheds (Tables 1 and 2). Nested targets are imperiled, ecologically linked to a conservation target, and – perhaps most importantly – can be conserved via strategies designed for that conservation target (The Nature Conservancy 2000b).

Table 1. GCPEP Nested Landscape Elements (see Appendix E for descriptions).

Nested Conservation Element	Nested Landscape Elements
Headwaters	*Landscape Elements* Spring-run streams (G2/S2) Seepage Streams (G3/S2) Seepage Bogs (G2/S1)
Riverine/Floodplain	*Landscape Elements* Blackwater & Alluvial Streams (G4/S3 – G4/S2) Bottomland & Floodplain Forests (G4S3) River Floodplains & Swamp Lakes (G4/S2 – G4/S3)
Estuary/Bay	*Landscape Elements* Estuarine Mollusk Reefs (G3S3) Seagrass Beds (G2/S2) Tidal Marshes (G4/S4)
Island/Key	*Landscape Elements* Coastal Interdunal Swales (G3/S2) Coastal Dune Lakes (G2/S1) Swash Zone
Isolated Wetlands and Terrestrial Ecotones	*Landscape Elements* Wet Prairies & Flatwoods (G4/S3 – G3/S2) Depression Wetlands (G4/S3) Seepage Slopes (G3/S2) Swamps (Dome/Basin/Strand) (G?/S3? – G4?/S4?) Bogs (G?/S3)

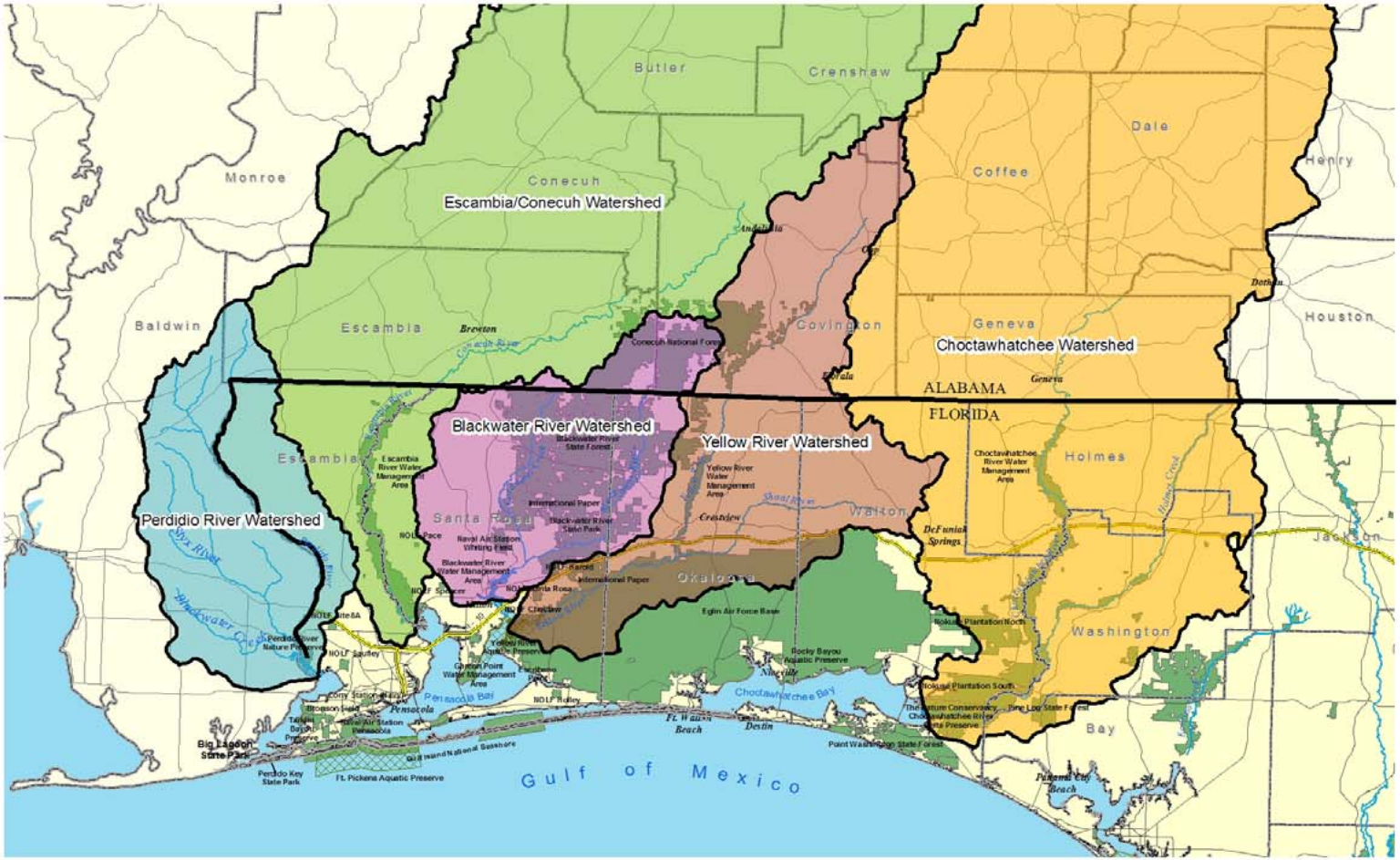
Table 2. GCPEP Nested Indicator Species and Groups (see Appendix E for descriptions).

Nested Conservation Element	**Nested Indicators Species and Groups**
Headwaters	*Vertebrate Indicators* Southern Dusky Salamander (*Desmognathus auriculatus* G5/S3) Seal Salamander (*Desmognathus monticola* G5/S1) Okaloosa Darter (*Etheostoma okaloosae* G1/S1) Florida Bog Frog (*Rana Okaloosae* G2/S2) *Macroinvertebrate Indicators* TOE Complex (Imperiled Trichoptera, Odanata, Ephemeroptera) *Plant/Lichen Indicators* Red/Whitetop Pitcherplants (*Sarracenia rubra* G3/S2, *Sarracenia leucophylla* G3/S3) Hummingbird Flower (*Macranthera flammea* G3/S2) Bog Button (*Lachnocaulon minus* G3G4)
Riverine/Floodplain	*Vertebrate Indicators* Alligator Snapping Turtle (*Macroclemmys temmincki* G3G4/S3) Gulf Sturgeon (*Acipenser oxyrinchus desotoi* G3T2/S2/SC) River Otter (*Lontra canadensis* G5/SNR) *Macroinvertebrate Indicators* Mollusk/TOE Complex (Imperiled mollusks & TOE Complex) *Plant/Lichen Indicators* Ashe's Magnolia (*Magnolia ashei* G2/S2) Panhandle Lily (*Lilium iridollae* G2/S2)
Estuary/Bay	*Vertebrate Indicators* Saltmarsh Topminnow (*Fundulus jenkinsi* G2/S2/SC) Gulf Saltmarsh Snake (*Nerodia clarkii clarkii* G4T3/S3) Diamondback Terrapin (*Malaclemys terrapin* G4/S4) Inshore Game Fish (RSF) Complex (Red Drum/Speckled Trout/Flounder) *Macroinvertebrate Indicators* Fiddler Crabs (*Uca* spp.) *Plant/Lichen Indicators* Seagrasses: Manatee-grass (*Cymodocea filiformis* G4/SNR); Shoal-grass (*Halodule beaudettei* G5/SNR); Turtle-grass (*Thalassia testudina* G4G5/SNR) Spartina/Juncus Complex: Smooth Cordgrass (*Spartina alterniflora*) & Black Needlerush (*Juncus roemerianus*)

Table 2 (cont.). GCPEP Nested Indicator Species and Groups (see Appendix E for descriptions).

Nested Conservation Element	**Nested Indicators**
Island/Key	*Vertebrate Indicators* Sea Turtles: Kemp's Ridley (*Lepidochelys kempi* G1/S1); Loggerhead (*Caretta caretta* G3/S3); Green Turtle (*Chelonia mydas* G3/S2); Leatherback (*Dermochelys coriacea* G3/S2) Plover/Tern Group: Snowy Plover (*Charadrius alexandrinus* G4/S1); Piping Plover (*Charadrius melodus* G3/S2); Wilson's Plover (*Charadrius wilsonia* G5/S2); Sandwich Tern (*Sterna sandvicensis* G5/S2); Royal Tern (*Sterna maxima* G5/S3); Least Tern (*Sterna antillarum* G4/S3) *Macroinvertebrate Indicators* Horseshoe Crab (*Limulus polyphemus*) *Plant/Lichen Indicators* Large-leaved Jointweed (*Polygonella macrophylla* G3/S3) Perforated Reindeer Lichen (*Cladonia perforate* G1/S1/E)
IsolatedWetlands and Terrestrial Ecotones	*Vertebrate Indicators* Flatwoods Salamander (*Ambystoma cingulatum* G2G3/S2S3) Pine Barrens Treefrog (*Hyla andersonii* G4/S3) Gopher Frog (*Rana capito* G3/S3) Florida Bog Frog (*Rana okaloosae* G2/S2) *Macroinvertebrate Indicators* Odonate Group (Imperiled Dragon & Damsel Flies G4/G2/S1 – G4S3) *Plant/Lichen Indicators* Red/Whitetop Pitcherplants (*Sarracenia rubra* G3/S2, *Sarracenia leucophylla* G3/S3) Hummingbird Flower (*Macranthera flammea* G3/S2) Panhandle Lily (*Lilium iridollae* G2/S2) Bog Button (*Lachnocaulon minus* G3G4)

Figure 2. Gulf Coastal Plain Ecosystem Partnership Aquatic Landscape.



N

10 5 0 10

Miles

Gulf Coastal Plain Ecosystem Partnership
Major Watersheds

Northwestern Florida and Southern Alabama

Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

PERDIDO RIVER WATERSHED

The Perdido River Watershed flows through Escambia and Baldwin counties in Alabama and Escambia County Florida. The river forms the boundary between the states of Alabama and Florida. The watershed encompasses an area of 1,250 square miles. Before flowing into the Gulf of Mexico, the river flows about 44 miles before forming the Perdido Bay which covers an area of around fifty square miles (Figure 3).

The river is characterized as a blackwater stream with a sand bottom visible through the clear water, and large white sandbars occurring frequently along the numerous bends in the river. The river is excellent for canoeing and is recognized as one of Florida's official canoe trails. The Nature Conservancy's Betty and Crawford Rainwater Perdido River Nature Preserve is located on the banks of the Perdido River approximately 11 miles west of West Pensacola on US Highway 90. The preserve consists of 2,350 acres of protected wilderness, previously managed by International Paper.

Sub-watersheds, tributaries and other waterbodies within the Perdido Basin include the following: Big Lagoon, Tarkiln Bayou, Bridge Creek, Marcus Creek, Bullshead Branch, Turner Creek, Hurst Branch, Eightmile Creek, Tenmile Creek, Elevenmile Creek, McDavid Creek, Coffee Branch, Hollinger Creek, Brushy Creek, Rock Creek, Wolf Creek, Negro Creek, Styx River, and Blackwater River.

The Styx River and the Blackwater River are two of the Perdido watersheds' longest tributaries. The headwaters of the Styx begin just south of Bay Minette, AL and flows in a southeasterly direction until joining the Perdido River just south of Highway 90. The Blackwater River's headwaters begin just East of Loxley, AL and flows east by southeast, joining the Perdido River approximately 3 miles north of the mouth of the river.

Biologically, the Perdido Watershed is unique in that its banks are shared by two states and limited biological data is available. Much biodiversity work is needed in the watershed, though many of the same organisms found in coastal Alabama and the Florida panhandle are surely present. Initial surveys have revealed a variety of invertebrates, vertebrates, and plants, previously undocumented for the watershed. The Perdido Watershed and its plant and wildlife are in need of concentrated scientific investigation.

Overall water quality in the upper river basin is generally good according to a 1996 water quality report, with the worst water quality reported in Beaver Pond Creek and Dry Creek. Elevenmile Creek is considered the one of the more impaired waterbodies in the Perdido basin flowing directly into Perdido Bay and flowing entirely within the state of Florida. The creek has a long list of parameters of concern including: nutrients, turbidity, total suspended solids (TSS), biological oxygen demand (BOD), dissolved oxygen (DO), coliform bacteria, and ammonia. The creek's headwaters are in Cantonment and flow south draining the suburbs of Pensacola.

Land use in the Perdido Basin is mixed with the majority of the watershed used for silvicultural (timber harvesting) activities. Other land use in the basin includes forest, agriculture, and wetlands. Population density is fairly low and less than 10% of the basin's landmass is urban.

Timber is the major natural resource in the area, 75% of the basin in Baldwin County, 70% of the basin in Escambia County, AL, and 85% of the basin in Escambia County, FL are utilized for timber production. Major land owners are International Paper and Dupont.

Figure 3. Perdido River and Bay Watershed.


ALABAMA
Escambia
Perdido River Watershed
FLORIDA
Escambia River
Escambia
Escambia River Water Management Area
Baldwin
Styx River
Perdido River
NOLF Pace
NOLF S
NOLF Site 8A
Blackwater Creek
Perdido River Nature Preserve
NOLF Saufley
Big Lagoon State Park
Corry Station (Navy)
Bronson Field
N
0 2 4
Miles
Gulf Coastal Plain Ecosystem Partnership
Major Watershed
Northwestern Florida and Southern Alabama
Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

ESCAMBIA/CONECUH RIVER WATERSHED

(Adapted from Thorpe et al. 1997)

Originating in Alabama as the Conecuh River, the Escambia River travels south approximately 240 miles before discharging into Escambia Bay (Figure 4). The river basin drains a total of 4,223 square miles, 425 of which are within Florida. The Escambia River is the fourth largest in the state in terms of discharge, with an average annual discharge of 6,300 cubic feet per second (cfs). Seasonal fluctuations are large, with floods commonly occurring in winter and early spring and low flows generally occurring from late spring through autumn. Flows originate primarily from rainfall, with some groundwater contribution via scattered springs and seepage from surficial sands. Pine Barren Creek is the river's largest tributary within Florida, draining approximately 98 square miles. Tidal influence causes river level fluctuations at least ten miles upriver. During periods of low flow, a salt wedge extends upriver from Escambia Bay for about seven miles at high tide.

The Escambia River is described as a classic alluvial river. As such, it carries a heavy sediment load and has substantial variation in flows and a diversity of associated aquatic and wetland habitat types. The river is slightly acidic. The upper river (within Florida) is sand-bottomed, with sand bars and beaches forming along the inside arcs of river bends. According to a Florida Fish and Wildlife Conservation Commission (FWCC) Scientist, in-stream vegetation tends to be lacking, with habitat primarily provided by snags, exposed tree roots, and undercut banks. Bottomland hardwood forest and oxbow lakes border the main river, although pine forest also occupies much of the riparian zone. The lower river is influenced by tides, and is bordered by emergent marshes as well as patches of swamp. In 1980, primary land uses in the basin included forestry, which accounted for 71.6 % of the area, and agriculture, which accounted for another 14.5 percent.

Characteristic species of fish include warmouth, largemouth bass, and channel catfish. Threatened, endangered, or otherwise sensitive species supported by the Escambia River system include the crystal darter, Gulf sturgeon, harlequin darter, saltmarsh topminnow, bluenose shiner, and several freshwater mussels. The basin supports populations of the Florida black bear, southeastern American kestrel, bald eagle, gopher tortoise, osprey, and egrets, among other sensitive animal and plant species.

The Escambia is among the more impacted rivers in the region. It receives industrial and domestic waste discharges, as well as substantial nonpoint source (NPS) pollution. Additionally, the lower portion of the river has been dredged for navigation purposes, and two dams are upstream in Alabama. FWCC scientist describes fish populations and water quality in the river in general as being in a state of recovery.

Escambia Bay is situated between the City of Pensacola to the west, the Garcon Point peninsula to the east, and the Escambia River delta to the northwest. The primary source of water in the bay is the Escambia River. Other sources in upper Escambia Bay include the Pace Mill Creek and Mulatto Bayou drainage basins, among others. Sources of water in lower Escambia Bay include the river via upper bay and the Indian Bayou, Trout Bayou, and Bayou Texar basins.

Tidal flushing in Escambia Bay is considered poor, and sediments are highly organic. High tides, low river discharge, and strong surface winds tend to decrease stratification, while the reverse of these conditions increases it. Railroad and highway bridges may inhibit flushing and exchange between the upper and lower bay, and surface wind effects may also influence circulation in upper portions of the bay.

Escambia Bay is among the most anthropogenically stressed components of the Pensacola Bay system. It has historically received substantial industrial and domestic wastewater discharges, and is still affected by surface water discharges and reuse sources in the vicinity of the bay, as well as from the Escambia River basin. The bay also receives NPS pollution from the City of Pensacola, unincorporated areas, and the river basin. Bayous, such as Texar and Mulatto, are also impacted by NPS pollution, and Bayou Texar may also be threatened by contaminated plumes from two US EPA designated Superfund sites.

Figure 4. Escambia / Conecuh River and Escambia Bay Watershed.


ALABAMA
Butler
Monroe
Conecuh
Escambia/Conecuh Watershed
Escambia
Brewton
Conecuh River
Conecuh National Forest
Baldwin
Escambia River
Escambia
Escambia River Water Management Area
Blackwater River State Forest
Yellow River Water Management Area
Santa Rosa
International Paper
Blackwater River State Park
Crestview
NOLF Pace
Naval Air Station Whiting Field
Blackwater River Water Management Area
NOLF Harold
International Paper
Okaloosa
NOLF Spencer
NOLF Santa Rosa
Milton
NOLF Choctaw
Eglin Air Force B
Sipsx River
Blackwater Cr
NOLF Site 8A
Perdido River Nature Preserve
NOLF Saufley
Yellow River Aquatic Preserve
Garcon Point Water Management Area
Escribano Point
Corry Station (Navy)
Bronson Field
Pensacola
Pensacola Bay
NOLF Holley
I-10
N
10 5 0
Miles
Gulf Coastal Plain Ecosystem Partnership
Major Watershed
Northwestern Florida and Southern Alabama
Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

BLACKWATER RIVER WATERSHED

(Adapted from Thorpe et al. 1997)

Originating in Bradely, Alabama, the Blackwater River travels south approximately 62 miles prior to discharging into Escambia Bay (figure 5). The river drains approximately 860 square miles, approximately 700 of which are within Florida. Average depths are between two and 15 feet, and widths tend to vary between 110-300 feet. The major source of flow is groundwater discharge, with a smaller contribution from surface runoff. Lower portions of the river have a tidal range of approximately two feet, and saltwater intrusion has been identified six miles upstream. Principal tributaries of the river include Big Juniper Creek, Big Coldwater Creek, and Pond Creek. Primary land uses within the basin include forestry (76.6%) and agriculture (18.8%). The Blackwater River is designated as an Outstanding Florida Water (OFW), and is among the most popular waterbodies in the state for canoeing and other recreational activities.

The Blackwater River and its tributaries drain acidic flatwoods and other wetlands, as well as being influenced by discharge from the Sand and Gravel Aquifer. The river tends to exhibit a reddish color, due primarily to the presence of tannic and organic acids. The upper Blackwater River and its tributaries Big Juniper Creek, Sweetwater Creek, and Big Coldwater Creek have been described as swift, relatively shallow, and sand-bottomed.

Aquatic vegetation is sparse, and some habitat cover is provided by snags, fallen trees, and undercuts. In the 1970s, only the upper reaches of this system were assessed as having adequate cover for fish habitat. The lower Blackwater River is tidally influenced with moderate currents. Substrates are more fine and organic, and emergent and submergent species of vegetation are more common. Pond Creek is similar to the lower Blackwater River, with lower reaches tidally-influenced. Currents are moderate, substrates range from sand to mud, and emergent and submergent species of vegetation are common. FWCC scientist further describes a series of lake-like freshwater and brackish basins along the lower river. Aquatic vegetation is abundant in these basins, substrates tend to be rich and organic with sand along some shorelines, and currents are nonexistent except when associated with tidal fluctuation.

Characteristic fish species include spotted bass, sailfin shiner, chain pickerel, and largemouth bass. The Blackwater River system supports the endangered blackmouth shiner. Among the sensitive species living in the watershed are the red cockaded woodpecker, Florida pine snake, eastern indigo snake, osprey, Florida black bear, and the white-topped pitcher plant.

The lower Blackwater River system receives discharges from domestic wastewater treatment facilities, and portions of the system are subject to impacts from nonpoint source pollution. Water quality in general has been characterized as excellent and much of the river basin is protected by conservation lands.

Figure 5. Blackwater River and East Bay Watershed.


ALABAMA
Butler
Crenshaw
Monroe
Conecuh
Andalusia
Opp
Escambia
Brewton
Conecuh River
Conecuh National Forest
Covington
Florala
Blackwater River Watershed
Blackwater River State Forest
Escambia River Water Management Area
Escambia River
Escambia
Santa Rosa
International Paper
Blackwater River State Park
NOLF Pace
Naval Air Station Whiting Field
Blackwater River Water Management Area
NOLF Harold
NOLF Spencer
NOLF Santa Rosa
Milton
NOLF Choctaw
International Paper
Okaloosa
Eglin Air Force Base
Yellow River Water Management Area
Shoal River
Crestview
Perdido River
Styx River
Blackwater Creek
NOLF Site 8A
Perdido River Nature Preserve
NOLF Saufley
I-10
Yellow River Aquatic Preserve
Garcon Point Water Management Area
Escribano Point
Rocky Bayou Aquatic Preserve
Niceville
Corry Station (Navy)
Pensacola Bay
Pensacola
Bronson Field
NOLF Holley
Choctawhatchee Bay
Tarkiln Bayou Preserve
Naval Air Station Pensacola
Ft. Walton Beach
Destin
Big Lagoon State Park
Gulf Island National Seashore
Point Washington
Perdido Key State Park
Ft. Pickens Aquatic Preserve
Gulf of Mexico
N
10 5 0
Miles
Gulf Coastal Plain Ecosystem Partnership
Major Watershed
Northwestern Florida and Southern Alabama
Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

YELLOW/SHOAL RIVERS WATERSHED

(Adapted from Thorpe et al. 1997)

The Yellow River originates in Covington County, Alabama and travels 92 miles to Blackwater Bay in Florida (figure 6). The river travels through the Western Highlands in parts of Alabama and Okaloosa County, Florida, creating bluffs reaching 40 feet in some areas. The river drains generally from the east/northeast and has a drainage basin of 1,365 square miles, of which about 860 are within Florida. The river floodplain is generally about two miles wide and has an extensive floodplain forest. Fluctuations due to tidal effects are noticeable nearly 19 miles upstream. The Yellow River is described as a sand bottom river and is characterized by shallow clear-tan waters.

The principal tributary of the Yellow River is the Shoal River, which originates in northern Walton County and discharges into the Yellow River south of Crestview. Titi and Turkey creeks are tributaries of the Shoal River. In 1980, about 78 percent of the Yellow-Shoal River basin was reported as forested, with another 18 percent under agricultural use. The portion of the basin under residential, commercial, and other development, however, has increased since that time, notably in the vicinity of Crestview. The lower portion of the Yellow River, as well as portions of Blackwater and East bays, is managed as the Yellow River Marsh Aquatic Preserve. The Shoal River and waters within the aquatic preserve are designated as Outstanding Florida Waters (OFWs).

Common fish species supported by the Yellow River system are similar to those described for the Escambia and Blackwater rivers. Some of the species identified by Eglin AFB included speckled madtom, redbreast sunfish, and chain pickerel. Like other systems, the Yellow River system is subject to impacts from a variety of nonpoint sources of pollution, as well as potentially by drainage from domestic and industrial wastewater reuse facilities. Urban runoff from the vicinity of Crestview has also been described as problematic for the Shoal and Yellow rivers. Water quality in the Yellow River system, however, has been assessed as generally "excellent."

Figure 6. Yellow / Shoal Rivers and East Bay Watershed.


Butler
Crenshaw
ALABAMA
Conecuh
Coffee
Andalusia
Opp
Brewton
Conecuh River
Conecuh National Forest
Covington
Geneva
Florala
ALABAMA
FLORIDA
Yellow River Watershed
Blackwater River State Forest
Yellow River Water Management Area
Choctawhatchee River Water Management Area
Shoal River
Crestview
Walton
DeFuniak Springs
Santa Rosa
International Paper
Blackwater River State Park
NOLF Pace
Naval Air Station Whiting Field
Blackwater River Water Management Area
NOLF Harold
International Paper
Okaloosa
NOLF Spencer
NOLF Santa Rosa
Milton
NOLF Choctaw
Eglin Air Force Base
Nokuse Plantation North
Yellow River Aquatic Preserve
Rocky Bayou Aquatic Preserve
Garcon Point Water Management Area
Escribano Point
Niceville
Nokuse Plantation South
Pensacola Bay
NOLF Holley
Choctawhatchee Bay
The Nature Conservancy Choctawhatchee River Delta Preserve
Pine Log State
Ft. Walton Beach
Destin
Point Washington State Forest
Gulf Island National Seashore
Gulf of Mexico
N
10 5 0
Miles
Gulf Coastal Plain Ecosystem Partnership
Major Watershed
Northwestern Florida and Southern Alabama
Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

CHOCTAWHATCHEE RIVER WATERSHED

(Adapted from Thorpe et al. 2002)

The watershed of the Choctawhatchee River and Bay system (figure 7) covers approximately 4,748 square miles, roughly 66% (3400 mi.^{2}) lie in Alabama and approximately 34% (1348 mi.^{2}) lie in Florida. It is formed by the confluence of the east and west forks in Dale county near Newton, AL. The Choctawhatchee crosses the Alabama/Florida state line just south of Geneva, AL where the river's largest tributary, the Pea River converges. The river flows generally southward for 138 miles (50 mi. in AL and 88 mi. in FL) to empty into the Choctawhatchee Bay in Florida. The bay has one direct opening to the Gulf of Mexico at East Pass, adjacent to the city of Destin, and joins with Santa Rosa Sound to the west and the Intracoastal Waterway to the east. The Choctawhatchee Bay is 25 miles long running east to west with an average width of 3 miles. It has a surface area of 86,000 acres with an average depth of 10 feet in the eastern 1/3 and 30 feet in the remainder.

The main stem of the Choctawhatchee River is an alluvial river and carries a heavy sediment load and has substantial variation in flows and a diversity of associated aquatic and wetland habitat types. Major tributaries of the river include the Pea and Little Choctawhatchee rivers in Alabama, as well as Holmes, Wrights, Bruce, and Pine Log creeks in Florida. Direct tributaries of the bay include Alaqua, Rocky, Black, and Turkey creeks. The watershed also includes a portion of the Sand Hill Lakes in Washington County, including a recharge area for Floridan Aquifer springs discharging into Holmes Creek.

The Choctawhatchee River and Bay watershed supports a wide array of aquatic and wetland resources and provides numerous benefits for the human community. Among the environmental resources are diverse aquatic and wetland habitats, vast forests, Floridan Aquifer springs, steephead streams, and many species of flora and fauna. Human benefits provided include commercial and recreational fisheries, marine transportation, military uses, outdoor recreation, tourism, aesthetic qualities, and economic benefits associated with all of these.

The Nature Conservancy considers the Choctawhatchee to be a hot bed of biological diversity. There are over 2,000 small watersheds across the country, yet of these there are only 87 that stand out as hot spots, harboring 10 or more imperiled species. The Choctawhatchee represents two of these 87. The Pea River is 61st with 11 at-risk fish and mussel species and the Lower Choctawhatchee is 62nd also with 11 at-risk species. In both stream sections only 2 of these species are federally listed as threatened or endangered. The Upper Choctawhatchee Basin is also biologically significant with seven at-risk species. These statistics rank the Choctawhatchee as an exceptionally significant river basin for the conservation of aquatic biodiversity.

While the Choctawhatchee River and Bay watershed continues to support outstanding resources, it has also experienced many of the impacts that are common to Florida estuaries. These include urban stormwater runoff and other nonpoint sources of pollution, widespread sedimentation, domestic and industrial wastewater discharges, hydrologic modification, and habitat loss and degradation. Cumulatively, these impacts have degraded the productivity of the river and bay system and diminished the benefits it provides. Effective watershed management and planning can help to preserve and restore the natural resources and human benefits provided by the

Choctawhatchee River and Bay system and limit the need for more expensive and difficult solutions in the future. Almost one-half of the basin's Alabama residents depend upon septic systems for waste disposal (six of every ten families). In 1993 there were an estimated 36,000 septic systems in operation in the basin. One of every five septic systems has serious problems.

Land use for the Alabama portion of the basin is approximately 51.7% forestry, 30.6% cropland, 11.6% pasture, 3.2% urban development. The region is largely forested, but there are extensive open lands devoted to farming and pasture.

Figure 7. Choctawhatchee River and Bay Watershed.


Crenshaw
ALABAMA
Dale
Coffee
Henry
Andalusia
Opp
Dothan
Houston
Covington
Geneva
Choctawhatchee Watershed
Florala
Geneva
ALABAMA
FLORIDA
Holmes
Choctawhatchee River Water Management Area
Yellow River Water Management Area
Shoal River
Walton
Holmes Creek
DeFuniak Springs
I-10
Jackson
Okaloosa
Eglin Air Force Base
Nokuse Plantation North
Washington
Rocky Bayou Aquatic Preserve
Niceville
Choctawhatchee Bay
Nokuse Plantation South
The Nature Conservancy Choctawhatchee River Delta Preserve
Pine Log State Forest
Destin
Bay
Point Washington State Forest
Gulf of Mexico
Panama City Beach
N
10 5 0
Miles
Gulf Coastal Plain Ecosystem Partnership
Major Watershed
Northwestern Florida and Southern Alabama
Note: Because of map scale, map does not indicate all private property. GCPEP partners recognize the full rights of individual land managers & neighboring private property owners to pursue their own interests and objectives on their own land.

V. CONSERVATION THREATS

ASSESSING CHALLENGES: THREATS AND BIODIVERSITY HEALTH

Identifying conservation elements is a preliminary step in planning for conservation action. The next step is to examine the effect of any threats on the viability of conservation elements and the biodiversity health of the area as a whole. Threats are conditions or activities that negatively affect conservation elements, either directly or indirectly. Viability is the likelihood that an element will persist long-term. Biodiversity health is the aggregation of the viability of all conservation elements, the likelihood that the conservation area will remain an ecologically functional landscape over time (The Nature Conservancy 2000b). Threats and biodiversity health are examined within a five-year time frame, using current conditions and projected trends. Assessments should be completed during the initial planning process and every year thereafter, each time projecting five years ahead.

BIODIVERSITY HEALTH ASSESSMENT

To assess biodiversity health, the viability of each element is evaluated, ranked, and the ranks aggregated to provide a biodiversity health rank for the conservation area (for methodology and rank definitions, see Appendix C). The assessment of viability is based on three criteria: size, condition, and landscape context. Size is a measure of the area or abundance of an element's occurrence. Condition is an integrated measure of the composition, structure, and biotic interactions that characterize its occurrence. Landscape context is an integrated measure of the dominant environmental regimes and processes that establish and maintain the element, and habitat connectivity across the landscape.

The current biodiversity health rank for the GCPEP Aquatic Area is "fair – good" (Table 3). This suggests that the GCPEP's aquatic landscape is "at or above minimum restoration level" or "at or above minimum threshold for biological integrity." Four of the five conservation elements (watersheds) received "fair - good" viability ranks, meaning they are at or above minimum restorable levels. One conservation element, the Choctawhatchee River and Bay System, viability score is at or above the minimum threshold for biological integrity (Appendix C). However, many of the landscape elements, nested targets, and indicators (Appendix E) are extremely variable in their overall viability.

Table 3. GCPEP Target Viability and Biodiversity Health.

Conservation Element (River and Bay Systems)	**Size**	**Condition**	**Landscape Context**	**Overall Viability Rank**
Perdido	Good	Fair	Good	**Fair - Good**
Escambia/Conecuh	Very Good	Fair	Fair	**Fair - Good**
Blackwater	Good	Fair	Good	**Fair - Good**
Yellow/Shoal	Good	Fair	Good	**Fair - Good**
Choctawhatchee	Very Good	Fair	Good	**Good**
Biodiversity Health Rank for the Conservation Area				**Fair - Good**

THREATS ASSESSMENT

A threats assessment is the identification, evaluation, and ranking of threats that affect conservation elements (for further methodology and details of the analysis, see Appendix D). Threats are composed of stresses and sources. A stress is a process or event with direct negative consequences for the conservation element (e.g., cessation of freshwater flow into a marsh). The source of a stress is the action or entity that produces that stress (e.g., water impoundments). The GCPEP Aquatic Subcommittee identified and ranked stresses and sources for each GCPEP aquatic conservation element. Stress and source ranks help elucidate the factors influencing each element and subsequently, the necessary conservation strategies for the watershed. Table 4 provides insight into the relationship between "Major Stresses" and "Sources of Stress." A "Major Stress" may have few to many "Sources of Stress," for example, the *Altered biological structure and function* (a "Major Stress") may be influenced by ALL the listed "Sources of Stress," whereas, *Altered fire regime* may be affected by only a relatively few "Sources of Stress." A conservation element's stress and source ranks are analyzed together to provide an overall threat rank for each element and source (Tables 5 and 6a-d). One important part of the threats assessment is the determination of critical threats. Critical threats are highly ranked threats that jeopardize multiple conservation elements or threats that affect at least one element and are ranked "very high." Critical threats necessitate development of immediate conservation strategies. Several critical threats acting at a conservation area usually indicate that the site is highly or very highly threatened.

Across the GCPEP conservation area, there are 15 major (critical) stresses and at least 48 sources of stress:

GCPEP MAJOR STRESSES (in alphabetical order)

1. **Altered biological structure and function**
2. **Altered community structure and function**
3. **Altered energy regime**
4. **Altered fire regime**
5. **Altered habitat structure and function**
6. **Altered hydrologic regime**
7. **Altered salinity regime**
8. **Altered soil structure and chemistry**
9. **Altered thermal regime**
10. **Altered water quality**
11. **Erosion/sedimentation/sediment contamination**
12. **Habitat conversion**
13. **Habitat destruction**
14. **Habitat fragmentation**
15. **Invasive plants and animals**

GCPEP SOURCES OF STRESS (in alphabetical order)

1. Alteration of trophic structure
2. Aquatic vegetation clearing/snagging for water conveyance
3. Bridges and causeways
4. Channel modification/shipping lanes
5. Chemicals and toxins
6. Coastal development
7. Commercial and industrial development
8. Conversion to agriculture
9. Dams/incompatible water control structures
10. Deadhead logging
11. Disruption of longshore transport of sediments
12. Dredging
13. Groundwater withdrawal

14. Housing and urban development
15. Illegal trash dumping
16. Industrial effluent
17. Inadequate/Incompatible beach management
18. Inadequate/Incompatible farming practices
19. Inadequate/Incompatible fire management
20. Inadequate/Incompatible forestry practices
21. Inadequate/Incompatible grazing and ranching management
22. Inadequate/Incompatible solid waste management
23. Inadequate/Incompatible stormwater management
24. Inadequate/Incompatible wetlands management
25. Inadequate/Incompatible wildlife and fisheries management
26. Incompatible fishing pressure
27. Incompatible industrial operations
28. Incompatible recreation
29. Incompatible resource extraction – mining/drilling
30. Incompatible wastewater discharge
31. Industrial spills
32. Inlet relocation/creation
33. Light pollution
34. Military activities
35. Noise pollution
36. Nutrient loading – agriculture
37. Nutrient loading – industrial
38. Nutrient loading – recreational
39. Nutrient loading – residential
40. Nutrient loading – urban
41. Off-road vehicles
42. Placement of artificial structures
43. Removal of upland large woody debris
44. Road and utility corridors
45. Shoreline erosion
46. Shoreline hardening
47. Surface water withdrawal
48. Vessel/boat impacts

Table 4. GCPEP Aquatic Stresses and Sources of Stress Matrix (in alphabetical order).

SOURCES OF STRESS	MAJOR STRESSES														
	Altered biological structure and function	Altered community structure and function	Altered energy regime	Altered fire regime	Altered habitat structure and function	Altered hydrologic regime	Altered salinity regime	Altered soil structure and chemistry	Altered thermal regime	Altered water quality	Erosion/sedimentation/ sediment contamination	Habitat conversion	Habitat destruction	Habitat fragmentation	Invasive plants and animals
Alteration of trophic structure	X	X	X												X
Aquatic vegetation clearing/ snagging for water conveyance	X	X	X		X	X			X		X		X	X	
Bridges and causeways	X	X	X		X	X			X	X	X		X	X	X
Channel modification/ shipping lanes	X	X	X		X	X	X		X	X	X		X	X	
Chemicals and toxins	X	X			X			X		X			X		
Coastal development	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial development	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Conversion to agriculture	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dams/incompatible water control structures	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Deadhead logging	X	X	X		X	X			X	X	X		X	X	
Disruption of longshore transport of sediments	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Dredging	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Groundwater withdrawal	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Housing and urban development	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Illegal trash dumping	X	X		X	X	X	X	X		X		X		X	X
Industrial effluent	X	X	X		X	X	X	X	X	X	X				X

Table 4 (cont.). GCPEP Aquatic Stresses and Sources of Stress Matrix (in alphabetical order).

	MAJOR STRESSES														
SOURCES OF STRESS	Altered biological structure and function	Altered community structure and function	Altered energy regime	Altered fire regime	Altered habitat structure and function	Altered hydrologic regime	Altered salinity regime	Altered soil structure and chemistry	Altered thermal regime	Altered water quality	Erosion/sedimentation/ sediment contamination	Habitat conversion	Habitat destruction	Habitat fragmentation	Invasive plants and animals
Inadequate/Incompatible beach management	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Inadequate/Incompatible farming practices	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Inadequate/Incompatible fire management	X	X	X	X	X	X		X	X	X	X	X		X	X
Inadequate/Incompatible forestry practices	X	X	X	X	X	X		X	X	X	X	X		X	X
Inadequate/Incompatible grazing and ranching management	X	X	X	X	X	X		X	X	X	X	X		X	X
Inadequate/Incompatible solid waste	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Inadequate/Incompatible stormwater management	X	X	X		X	X	X	X	X	X	X	X	X		X
Inadequate/Incompatible wetlands management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Inadequate/Incompatible wildlife and fisheries management	X	X	X	X	X	X		X		X	X	X		X	X
Incompatible fishing pressure	X	X	X							X	X				X
Incompatible industrial operations	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Incompatible recreation	X	X		X	X	X		X		X	X	X		X	X
Incompatible resource extraction – mining/drilling	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Incompatible wastewater discharge	X	X	X		X	X	X	X	X	X	X	X	X	X	X

Table 4 (cont.). GCPEP Aquatic Stresses and Sources of Stress Matrix (in alphabetical order).

SOURCES OF STRESS	MAJOR STRESSES														
	Altered biological structure and function	Altered community structure and function	Altered energy regime	Altered fire regime	Altered habitat structure and function	Altered hydrologic regime	Altered salinity regime	Altered soil structure and chemistry	Altered thermal regime	Altered water quality	Erosion/sedimentation/ sediment contamination	Habitat conversion	Habitat destruction	Habitat fragmentation	Invasive plants and animals
Industrial spills	X	X	X		X			X	X	X			X		
Inlet relocation/creation	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Light pollution	X	X	X												
Military activities	X	X	X	X	X	X		X		X	X	X	X	X	X
Noise pollution	X	X	X												
Nutrient loading – agriculture	X	X	X		X	X	X	X	X	X	X	X		X	X
Nutrient loading – industrial	X	X	X		X	X	X	X	X	X	X	X		X	X
Nutrient loading - recreational	X	X	X		X	X	X	X	X	X	X	X		X	X
Nutrient loading – residential	X	X	X		X	X	X	X	X	X	X	X		X	X
Nutrient loading – urban	X	X	X		X	X	X	X	X	X	X	X		X	X
Off-road vehicles	X	X	X	X	X	X		X	X	X	X	X		X	X
Placement of artificial structures	X	X	X	X	X			X	X	X	X	X		X	X
Removal of upland large woody debris	X	X	X	X	X	X		X	X	X	X	X		X	X
Road and utility corridors	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shoreline erosion	X	X	X		X	X	X	X	X	X	X	X		X	X
Shoreline hardening	X	X	X		X	X	X	X	X	X	X	X		X	X
Surface water withdrawal	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Vessel/boat impacts	X	X	X		X				X	X	X	X		X	X

Table 5. GCPEP Watershed Stress Assessment.

STRESSES	WATERSHED					
	Perdido	**Escambia/Conecuh**	**Blackwater**	**Yellow/Shoal**	**Choctawhatchee**	**Overall Stress Rank**
Altered biological structure and function	M-H	M	M-H	M-H	M-H	**M-H**
Altered community structure and function	M-H	M	M-H	M-H	M-H	**M-H**
Altered energy regime	M-H	M	M-H	H	M-H	**M-H**
Altered fire regime	M-H	M-H	M-H	M-H	M-H	**M-H**
Altered habitat structure and function	M-H	M-H	M-H	M-H	M-H	**M-H**
Altered hydrologic regime	M	H	L	M-H	M-H	**M**
Altered salinity regime	L-M	L-M	L	L	M-H	**L-M**
Altered soil structure and chemistry	L-M	L-M	L	L	M-H	**L-M**
Altered thermal regime	L-M	L-M	L	L	L-M	**L-M**
Altered water quality	L-M	H	L-M	L-M	M-H	**M**
Erosion/sedimentation/sediment contamination	L-M	H	M-H	L-M	M-H	**M**
Habitat conversion	M	L-M	L-M	M-H	H	**M**
Habitat destruction	M-H	L-M	M	M-H	H	**M-H**
Habitat fragmentation	M	M	L-M	M-H	H	**M**
Invasive plants and animals	M-H	M	L-M	M	M-H	**M**
Stress Status for Watershed	**M**	**M**	**L-M**	**M**	**M-H**	

Table 6a. Perdido River and Bay Threats Assessment.

STRESSES	WATERSHED ELEMENTS					
	Headwaters	**Riverine/Floodplain**	**Estuary/Bay**	**Island/Key**	**Isolated Wetlands/ Terrestrial Ecotones**	**Overall Stress Rank**
Altered biological structure and function	M-H	M-H	M	M-H	H	**M-H**
Altered community structure and function	M-H	M-H	M	M-H	H	**M-H**
Altered energy regime	M	M	M-H	M-H	M	**M-H**
Altered fire regime	M-H	M-H	M-H	M-H	M-H	**M-H**
Altered habitat structure and function	M	L-M	L-M	M	L-M	**M-H**
Altered hydrologic regime	M	M	M	M	M	**M**
Altered salinity regime	n/a	L-M	L-M	L-M	n/a	**L-M**
Altered soil structure and chemistry	L-M	L-M	L-M	L-M	L-M	**L-M**
Altered thermal regime	L-M	L-M	L-M	L-M	L-M	**L-M**
Altered water quality	L-M	L-M	M	M	L-M	**L-M**
Erosion/sedimentation/sediment contamination	L-M	L-M	M	M	L-M	**L-M**
Habitat conversion	M-H	M	M	L-M	M-H	**M**
Habitat destruction	M	M	M-H	H	M-H	**M-H**
Habitat fragmentation	L-M	L-M	M	M-H	L-M	**M**
Invasive plants and animals	L-M	M-H	M-H	M-H	M	**M-H**
Stress Status for Watershed Element	**L-M**	**L-M**	**M**	**L-M**	**L-M**	

Table 6b. Escambia/Conecuh River and Escambia Bay Threats Assessment.

STRESSES	WATERSHED ELEMENTS					
	Headwaters	**Riverine/Floodplain**	**Estuary/Bay**	**Island/Key**	**Isolated Wetlands/ Terrestrial Ecotones**	**Overall Stress Rank**
Altered biological structure and function	M	M	M	M	M	**M**
Altered community structure and function	M	M	M	M	M	**M**
Altered energy regime	M	M	M	M	M	**M**
Altered fire regime	dg[1]	M	M-H	H	dg	**M-H**
Altered habitat structure and function	dg	M	M-H	H	dg	**M-H**
Altered hydrologic regime	M-H	H	M-H	M-H	H	**H**
Altered salinity regime	n/a	M	L	L	n/a	**L-M**
Altered soil structure and chemistry	L-M	L	L	L	L-M	**L-M**
Altered thermal regime	dg	M	L-M	L	dg	**L-M**
Altered water quality	dg	H	M-H	M-H	dg	**H**
Erosion/sedimentation/sediment contamination	dg	H	M-H	M-H	dg	**H**
Habitat conversion	dg	M	M	L-M	dg	**L-M**
Habitat destruction	dg	M	M-H	M-H	dg	**L-M**
Habitat fragmentation	dg	M	M	M-H	dg	**M**
Invasive plants and animals	dg	M	M	M-H	dg	**M**
Stress Status for Watershed Element	**dg**	**M**	**M**	**M**	**dg**	

[1] dg = Data Gap

Table 6c. Blackwater River and East Bay Threats Assessment.

STRESSES	WATERSHED ELEMENTS					
	Headwaters	**Riverine/Floodplain**	**Estuary/Bay**	**Island/Key**	**Isolated Wetlands/ Terrestrial Ecotones**	**Overall Stress Rank**
Altered biological structure and function	L-M	M-H	M	M	M-H	**M-H**
Altered community structure and function	M	M	M	M	M-H	**M-H**
Altered energy regime	M	M-H	M	M	M-H	**M-H**
Altered fire regime	M-H	M	M	M	M-H	**M-H**
Altered habitat structure and function	M	M-H	L-M	H	M	**M-H**
Altered hydrologic regime	L	L	L	L	L	**L**
Altered salinity regime	n/a	L	L	L	n/a	**L**
Altered soil structure and chemistry	L	L	L	L	L	**L**
Altered thermal regime	L	L	L	L	L	**L**
Altered water quality	L	L-M	L-M	L-M	L	**L-M**
Erosion/sedimentation/sediment contamination	M	M-H	M	M	M-H	**M-H**
Habitat conversion	M	L	L	L	L-M	**L-M**
Habitat destruction	L	L-M	M	H	L-M	**M**
Habitat fragmentation	L	L	L-M	H	L-M	**L-M**
Invasive plants and animals	L	M	L-M	M-H	L-M	**L-M**
Stress Status for Watershed Element	**L-M**	**L-M**	**L-M**	**L-M**	**L-M**	

Table 6d. Yellow/Shoal Rivers and East Bay Threats Assessment.

STRESSES	WATERSHED ELEMENTS					
	Headwaters	**Riverine/Floodplain**	**Estuary/Bay**	**Island/Key**	**Isolated Wetlands/ Terrestrial Ecotones**	**Overall Stress Rank**
Altered biological structure and function	M-H	M-H	M	M	M-H	**M-H**
Altered community structure and function	M-H	M-H	M	M	M-H	**M-H**
Altered energy regime	H	H	H	H	H	**H**
Altered fire regime	M-H	M	M	M	H	**M-H**
Altered habitat structure and function	M-H	H	M-H	M-H	H	**M-H**
Altered hydrologic regime	M-H	H	M-H	M-H	H	**M-H**
Altered salinity regime	n/a	L	L	L	n/a	**L**
Altered soil structure and chemistry	L	L	L	L	L	**L**
Altered thermal regime	L	L	L	L	L	**L**
Altered water quality	L	L	L-M	L-M	L	**L-M**
Erosion/sedimentation/sediment contamination	L	L	L-M	L-M	L	**L-M**
Habitat conversion	M-H	H	H	M-H	H	**M-H**
Habitat destruction	M-H	H	H	M	H	**M-H**
Habitat fragmentation	M-H	H	H	M	H	**M-H**
Invasive plants and animals	L-M	M	M	M-H	M	**M**
Stress Status for Watershed Element	**M**	**M**	**M**	**M**	**M-H**	

Table 6e. Choctawhatchee River and Bay Threats Assessment.

STRESSES	WATERSHED ELEMENTS					
	Headwaters	**Riverine/Floodplain**	**Estuary/Bay**	**Island/Key**	**Isolated Wetlands/ Terrestrial Ecotones**	**Overall Stress Rank**
Altered biological structure and function	H	M-H	M	M	H	**M-H**
Altered community structure and function	H	M-H	M	M	H	**M-H**
Altered energy regime	M-H	H	M	M	H	**M-H**
Altered fire regime	H	M-H	M	M-H	H	**M-H**
Altered habitat structure and function	H	M-H	M	M	M-H	**M-H**
Altered hydrologic regime	M-H	H	M	M	H	**M-H**
Altered salinity regime	n/a	M-H	M-H	M	n/a	**M-H**
Altered soil structure and chemistry	M	H	M	M	H	**M-H**
Altered thermal regime	M	M	L-M	L-M	M-H	**L-M**
Altered water quality	M-H	H	M-H	M	M-H	**M-H**
Erosion/sedimentation/sediment contamination	M-H	H	M	M	H	**M-H**
Habitat conversion	H	H	M-H	M-H	H	**H**
Habitat destruction	H	H	M-H	H	H	**H**
Habitat fragmentation	H	H	M-H	H	M-H	**H**
Invasive plants and animals	M	M-H	M-H	H	M-H	**M-H**
Stress Status for Watershed Element	**M-H**	**M-H**	**M**	**M**	**M-H**	

MAJOR THREATS TO THE GCPEP AQUATIC LANDSCAPE

Of the 15 major stresses and their sources, there are several threats that naturally cluster into ecological and conservational groups and others that need to be addressed individually. The first of these is the ecological cluster; altered biological, community, and habitat structure and altered energy regime, collectively termed "*Altered structure and function*." Habitat conversion, destruction, and fragmentation cluster for the second group or "*Habitat Issues*." The third and fourth threats are invasive aquatic plants and animals and erosion/sedimentation/sedimentation contamination. The following is a brief description of the clustered and individual threats, current conditions, justification for ranking, and proposed actions to lower the present ranking. It should be noted that in ecological systems these threats are not mutually exclusive and there is an example of the interconnectedness of the threats following the descriptions.

Habitat Issues: Habitat loss is the single greatest threat to most plants and animals. Altering the landscape through fragmentation, destruction, and conversion affects the systems natural capacity. Habitat fragmentation is simply the "dividing" of an area, whether by a road, dam, or other such man-made structure and is one of the simplest and easiest assaults to correct. In the continuum of habitat issues, habitat conversion is the transformation of a landscape or area to another "use," such as the removal of forest timber and the subsequent addition of row crop operations. While habitat conversion requires more restoration effort than habitat fragmentation, it is, with time, an assault that can be corrected. The complete destruction of habitat involves a permanent change in the landscape. Habitat destruction entails converting a natural landscape or area into an unnatural landscape or area, such as installing impervious surfaces (e.g., parking lots and buildings). Presently, the GCPEP landscape is experiencing unprecedented population growth and the accompanying habitat issues and is ranked Medium (M) to Medium-High (M-H) (Table 5). These rankings are the results of a variety of habitat issues (e.g., impervious surfaces, shoreline hardening, land conversion, low-order stream impoundment, etc.). Several actions are required to abate this group of threats, such as the placing of sensitive lands in conservation easements, removing earthen dams, and restoring fragmented and converted lands.

Altered Structure and Function: Biological, community, and habitat structure and function addresses the natural evolutionary "flow" of energy through the ecosystem. Any alteration to one may alter the other. The disruption of energy (e.g., food chains and webs) in the ecosystem may be "top-down" or "bottom-up." Top-down alterations involve the reduction or removal of primary or secondary (and occasionally tertiary) predator in an energy regime and the subsequent collapse or diminished capacity of the system at lower levels. On the other hand, bottom-up alterations are characterized by the removal or diminished capacity of lower levels (e.g., plants and/or soil nutrients) in the food chain or web. However, it should be noted that *any* alteration of the energy regime can have catastrophic results. Presently, the GCPEP landscape ranks a Medium-High (M-H) on the threats watershed threats assessment (Table 5). The sources of stress for these stresses are numerous and any combination of the 48 listed sources of stress can be involved. Actions required to abate this group of threats are as unique as the threats involved. Examples of specific actions are numerous and include: the management of the removal of instream and riparian vegetation and snags, strategically placing bridges, causeways, and roads to avoid wildlife conflicts, controlling the introduction of invasive aquatic species, and controlling the harvest of "keystone" species.

Invasive Aquatic Plants and Animals: Natural ecosystems and communities possess characteristic nature flora and fauna. Any alteration to these natural communities affords opportunistic non-native plant and animal species to invade. Invasive species can and do have consequences on the overall energy regime of the system. As in the above section, invasive species may invade the food chain/web at any level and disrupt the natural energy flow or out-compete native species. Table 5 ranks this threat at a Medium (M) because much of the distribution and status data of invasive aquatic plants and animals is unknown and in an effort to avoid the "South Florida Crisis" such data is required for the GCPEP landscape. To adequately address the issue of this threat, proactive efforts, such as mapping and monitoring existing and new invasive population and applying the appropriate control and eradication prescriptions is needed.

Erosion/Sedimentation/Sediment Contamination: Erosion of sediments is a simple physical process. Sediments are wash, blown, or otherwise transport away from the source. The transportation of sediments and any contained contaminants are the direct result of habitat alteration. Sediments are deposited downstream, altering new habitat in a never-ending downstream fashion. The overall ranking of the GCPEP landscape for this threat is a Medium (M), but ranges widely depending on the watershed, Low-Medium (L-M) in the Perdido and Yellow/Shoal watersheds to High (H) in the Escambia/Conecuh watershed (Table 5). Conservation actions needed to abate this threat are, again, unique to the given watershed, situation, and stream reach. Stabilization and restoration of impacted stream banks by the planting of native riparian vegetation, maintaining appropriate streamside management zones (SMZ), and controlling recreational access are a few actions needed to abate this threat.

Example of Interconnectedness of Systems and their Threats: Much of Coastal America is experiencing alarming declines in saltmarsh acreage. New scientific evidence suggests that, contrary to previous research, that commercial and recreational harvest of blue crabs is destroying this critical nursery ground. Commercial and recreational crab fishermen use crab pots or crab traps to harvest blue crab and subsequently catch Diamondback Terrapins as bycatch. Together, blue crabs and terrapins act as top predators in the saltmarsh ecosystem and harvest and subsequent drowning of terrapins is having a "top-down" indirect negative affect on the saltmarsh and two primary plant species of the saltmarsh, smooth cordgrass and black needlerush. As a result of the removal of the two predators, the Periwinkle, a small saltmarsh snail, population explodes in the absence of predatory controls. Periwinkles feed almost exclusively on saltmarsh grasses and with increased population numbers the small snail is having a devastating affect on the saltmarsh. The story does not end here. The removal of saltmarsh plants opens the "proverbial ecological door" to invasive aquatic and semi-aquatic species and sediment, including residual contaminates, erosion. The resulting deposition of sediments and the establishment of invasive species further alter the natural habitat and the natural energy regime of the saltmarsh.

VI. CONSERVATION GOALS AND STRATEGIES

INTRODUCTION

The conservation goals are the end toward which GCPEP will be working, the desired future state for each of the watersheds. Goals, developed from our assessment of current conditions, trends, and our organizational capacity, function as our benchmarks along the path to conservation success. The GCPEP Aquatic Subcommittee developed seven goals for GCPEP's work. Progress toward several goals may be made with a single project. For example, two of the major threats identified in the previous section (Conservation Threats) are "altered biological structure and function" and "altered community structure and function." Accomplishment of any combination of the below conservation goals would serve to abate these two threats simultaneously.

Conservation strategies and action items are the specific steps that will be taken to ensure we abate critical threats and reach the aforementioned goals. The GCPEP Aquatic Subcommittee felt it important to select a priority list of conservation strategies that (1) would be most effective in abating critical threats, (2) would make the most progress toward achievement of conservation goals, and (3) fall within the GCPEP's available or obtainable capacity over the next five years (Table 7a-g). The complete array of conservation strategies from the workplan that frames the GCPEP's day-to-day work on this project, will include partnership building, fundraising, and biological and programmatic monitoring. This aquatic management plan will undergo annual review to assess progress made on identified strategies. During these reviews, the planning team will assign additional strategies and action items as needed.

GCPEP AQUATIC CONSERVATION GOALS AND STRATEGIES

GCPEP Aquatic Conservation Goals:

- ✓ **Education:** Increase the amount of awareness on key aquatic issues.
- ✓ **Knowledge and Data gaps:** Decrease the amount of information not known about each conservation target, nested landscape elements, and nested indicator species and groups; threats; and existing and proposed management actions.
- ✓ **Water quality:** Maintain and improve current water quality conditions across the GCPEP landscape.
- ✓ **Hydrology:** Improve, if necessary, and maintain freshwater inputs required for key hydrological processes in landscape headwaters, wetlands, rivers, marshes, and open water estuaries and bays.
- ✓ **Aquatic and Ecotonal Land Protection:** Increases the lands and waters enrolled in some form of protection within the GCPEP area.
- ✓ **Invasive species:** Minimize new establishments and reduce existing populations of aquatic invasive species.
- ✓ **Funding:** Increase our financial stability and capacity to further improve aquatic management.

Table 7a. Education: Increase the amount of awareness on key aquatic issues.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP staff will attend and actively participate in key aquatic working groups: meetings/ symposia/counsels/committees/boards for the purpose of learning and conveying information.	
Action item 1: Determine the key aquatic working groups to be involved, potential working groups include: Bay Area Resource Council (BARC)-Technical Advisory Committee and Unpaved Roads Interagency Team.	**2006**
Action item 2: Inform partners of pertinent aquatic-related meetings.	**On going**
***Strategy 2*:** GCPEP staff will develop and host key aquatic working groups: meetings/symposia/counsels/ committees/boards for the purpose of learning and conveying information.	
Action item 3: Through the use of the GCPEP Aquatic Subcommittee, improve communications with partners regarding herpetological issues.	**2006, On going**
Action item 4: Through the use of the GCPEP Aquatic Subcommittee, improve communications with partners regarding invasive species issues.	**2006, On going**
Action item 5: Establish an aquatic working group to include: macroinvertebrate, fish, amphibian and reptile, mammal, bird, and plant experts.	**2006**
***Strategy 3*:** GCPEP staff will attend and actively participate and/or develop and host aquatic workshops/ seminars/training.	
Action item 6: Develop and host a workshop that will convey importance of improving dirt road maintenance for aquatic system health to the general public, partners, and county engineer/road maintenance departments using Unimproved Roads BMPs.	**2007**
***Strategy 4*:** GCPEP staff will compile and/or develop aquatic educational material for various audiences.	
Action item 7: Compile reports, articles, and data on the GCPEP targets and make them available to partners.	**2006**
Action item 8: Compile information on stream restoration techniques and pre- and post-restoration monitoring and provide to partners.	**2007**
Action item 9: Compile and distribute existing information on desired habitats of key aquatic species, the management of their habitats, and their population dynamics.	**2007**
Action item 10: Develop and distribute educational materials for the general public that discuss the importance of dirt road maintenance.	**2007**

Table 7a (cont.)**. Education :** Increase the amount of awareness on key aquatic issues.

Strategies and Action Items	Date
Action item 11: Work with local and state agencies to determine which aquatic public education campaign(s) are most critical (e.g., septic tanks, impervious surface, lawn and yard care, stormwater discharge, sea walls/docks, canals, groundwater withdrawals, dams, dredging, light pollution, and/or other issues).	**2007**
Action item 12: Work with local and state agencies to develop and/or fine-tune existing educational materials related to the most critical issues identified in the above Action item 5.	**2008**
***Strategy 4*:** Use demonstration projects and areas for increasing awareness of key aquatic audiences.	
Action item 13: Identify examples of appropriate and inappropriate dirt road, utility corridor, and clay pit restoration projects and demonstration areas.	**2007**
Action item 14: If not available, encourage and assist in the development of appropriate dirt road, utility corridor, and clay pit restoration projects and demonstration areas.	**2008**
Action item 15: Identify examples of appropriate and inappropriate stream restoration, streambank stabilization, and woody debris management projects and demonstration areas.	**2007**
Action item 16: If not available, encourage and assist in the development of appropriate stream restoration, streambank stabilization, and woody debris management projects and demonstration areas.	**2008**
Action item 17: Work with the Blackwater River Foundation, Inc. to help establish an Environmental Education and Research program.	**2006**
Action item 18: Explore a landowner/GCPEP/NRCS program to reduce and/or prevent negative water quality inputs.	**2009**
Action item 19: Educate waterfront property owners and developers on environmentally friendly shoreline development and restoration techniques.	**2009**

Table 7b. Knowledge and Data gaps: Decrease the amount of information not known about each conservation target, nested landscape elements, and nested indicator species and groups; threats; and existing and proposed management actions.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP will prioritize research needs and both encourage and conduct top research projects.	
Action item 20: Compile and distribute existing knowledge and data on conservation target, nested landscape elements, and nested indicator species and groups; threats; and existing and proposed management actions.	**2007**
Action item 21: Coordinate research with Universities as advanced undergraduate and graduate projects.	**2006, On going**
Action item 22: Research range and habitat requirements for GCPEP indicator species and groups. Starting with the currently proposed East Bay Saltmarsh Vertebrate Surveying and Monitoring Project.	**2006**
Action item 23: Research aquatic impacts from sprayfields.	**2008**
Action item24: Research pros and cons of fire ecology related to aquatic species and communities.	**2007**
Action item 25: As biological, chemical, and physical data are accumulated determine the viability and desired future condition for each watershed.	**2007, On going**
Action item 26: Work cooperatively with partners and other non-partners to assess the needs and technologies associated with wildlife passage, underpasses, and fish ladders.	**2007**
Action item 27: Identify indicator and sentinel species and/or habitats for each watershed.	**2006**
Action item 28: Work cooperatively with partners and other non-partners to assess the needs associated with raptor nesting platforms.	**2008**
***Strategy 2*:** GCPEP staff will prioritize survey and monitoring needs and both encourage and conduct top surveying and monitoring projects.	
Action item 29: Coordinate survey and monitoring with Universities as advanced undergraduate and graduate projects.	**2006, On going**
Action item 30: Using GIS/GPS technology, survey, map, and monitor GCPEP imperiled species and communities, paying particular attention to status and distribution and threats.	**2007**
Action item 31: Compile list from partners of stream reaches, wetlands, and other GCPEP targets that need restoration and those in relatively good condition, along with a map of their locations.	**2008**
Action item 32: Submit grant proposal for GCPEP Drift-fence Project.	**2006**
Action item 33: Work cooperatively with partners not monitoring reptiles and amphibians to establish herpetological surveying and monitoring.	**2006**

Table 7b (cont.)**. Knowledge and Data gaps:** Decrease the amount of information not known about each conservation target, nested landscape elements, and nested indicator species and groups; threats; and existing and proposed management actions.

Strategies and Action Items	Date
***Strategy 3*:** GCPEP staff will serve as the clearing-house and center of communication for aquatic information.	
Action item 34: Create and coordinate a GCPEP aquatic database, a web-based database.	**2007**
Action item 35: Compiling existing aquatic GIS layers for GCPEP conservation target, nested landscape elements, and nested indicator species and groups, and threats.	**2007**
Action item 36: Develop a GCPEP Herpetological Surveying and Monitoring Protocols and "tool-kits."	**2007**
Action item 37: Standardize data collection methods, data sheets, mapping techniques, databases, etc.	**2007**
Action item 38: Compile existing chemical and physical data into the GCPEP aquatic database for each of the watersheds.	**2007**
Action item 39: Coordinate and host annual aquatic symposium, including GCPEP Aquatic Experts, GCPEP Aquatic Subcommittee, and local and regional aquatic scientists.	**2007**
Action item 40: Utilize The Nature Conservancy's Conservation Area Plan (CAP) Excel Program to create a CAP workbook for each watershed.	**2007**
Action item 41: Include GCPEP Partners land ownership in the GCPEP aquatic database.	**2007**

Table 7c. Water quality: Maintain and improve current water quality conditions across the GCPEP landscape.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP staff will coordinate and conduct water quality monitoring across the GCPEP aquatic landscape.	
Action item 42: Create a volunteer water quality monitoring program to include groups in each watershed.	**2008**
Action item 43: Determine existing water quality monitoring activities in each watershed.	**2007**
Action item 44: Identify water quality threats for each watershed.	**2006**
Action item 45: Work with FL DEP on TMDL development and monitoring.	**2006**

Table 7d. Hydrology: Improve, if necessary, and maintain freshwater inputs required for key hydrological processes in landscape headwaters, wetlands, rivers, marshes, and open water estuaries and bays.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP stall will determine and create a usable database of existing threats altering the hydrologic regime in each watershed.	
Action item 46: Using GPS/GIS technology, map existing reaches affected by all hydrologic threats within each watershed.	**2007**
***Strategy 2*:** GCPEP will determine and create a usable database of proposed threats altering the hydrologic regime in each watershed.	
Action item 47: Using GPS/GIS technology, map proposed hydrologic threats within each watershed.	**2007**
***Strategy 3*:** GCPEP will prioritize hydrologic threats and develop specific strategies and action items per threat category to abate threats in each watershed.	
Action item 48: Create prioritized list of hydrologic threats, strategies, and actions.	**2008**

Table 7e. Invasive species: Minimize new establishments and reduce existing populations of aquatic invasive species.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP staff will encourage and conduct surveying and mapping of aquatic invasive species.	
Action item 49: Compile existing invasive species survey data and add to the GCPEP aquatic database.	**2007**
Action item 50: Surveying and map the GCPEP landscape for aquatic invasive species.	**2007**
***Strategy 2*:** GCPEP staff will encourage and conduct monitoring areas of aquatic invasive species.	
Action item 51: Develop GIS tracking maps to monitor spread and reduction of aquatic invasive species.	**2008**
***Strategy 3*:** GCPEP staff will encourage and conduct control and/or eradicate of aquatic invasive species.	
Action item 52: Physically and/or chemically remove or control all invasive species as necessary.	**2007, On going**
Action item 53: Work with other invasive species groups on eradication and control strategies.	**2007, Ongoing**

Table 7f. Aquatic and Ecotonal Land Protection: Increases the lands and waters enrolled in some form of protection within the GCPEP area.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP staff will utilize the Florida Forever Program to pursue land protection.	
Action item 54: Develop a prioritize protection map for GCPEP lands and waters to be protected.	**2007**
***Strategy 2*:** GCPEP staff will pursue mitigation bank opportunities.	
Action item 55: Investigate and/or work with TNC's land protection staff on waters and lands enrolled in existing mitigation programs.	**2006, On going**
***Strategy 3*:** GCPEP staff will increase the total acreage enrolled in conservation easements.	
Action item 56: Determine the existing lands and waters enrolled in conservation easements in the GCPEP area.	**2006**
***Strategy 4*:** GCPEP staff will pursue the use of other conservation designations within the GCPEP landscape.	
Action item 57: Encourage the GCPEP partners to enroll key parcels into their individual conservation programs.	**2007**
Action item 58: GCPEP staff will Work with NRCS/USFWS Partners for Wildlife/private landowners/local governments to protect critical aquatic habitat and ecotonal margins.	**2006, Ongoing**

Table 7g. Funding: Increase our financial stability and capacity to further improve aquatic management.

Strategies and Action Items	Date
***Strategy 1*:** GCPEP staff will increase donation dollars.	
Action item 59: Staff will research and expand list of potential financial donors.	**2006**
Action item 60: Work with The Nature Conservancy's philanthropy department to obtain donations.	**2006, On going**
***Strategy 2*:** GCPEP staff will increase grant funding.	
Action item 61: Create a list of grant funding agencies and organizations.	**2006**
Action item 62: Pursue more grants.	**2006, On going**
***Strategy 3*:** GCPEP staff will increase partner financial contributions.	
Action item 63: Discuss with partners opportunities for additional financial contributions.	**2006, On going**

VII. MEASURES OF SUCCESS

PROJECT CAPACITY

Determining the important biological elements at a site and the pressures affecting those elements is a vital part of organized conservation. However, to successfully address these conservation needs, we must have the necessary human and fiscal resources. Thus, the next step towards conservation action is an assessment of available resources, or project capacity. These factors are ranked from low to very high and used to estimate the likelihood of success for the project from a programmatic standpoint. This process shows where capacity is lacking and allows organizations engaged in the project to proactively address deficiencies. Just as we re-evaluate threats and biodiversity health, we will measure our success also by changes in project capacity. Under current conditions, the ability to address conservation concerns associated with the GCPEP aquatic resources is medium (Table 8). Following the table are explanations of the rankings given to each success indicator.

Table 8. Conservation capacity for GCPEP Aquatic Management

Key Success Indicator	**Indicator Rating**
Staff Leadership	High
Multidisciplinary Team	Low
Institutional Leadership	Medium
Funding	Low
Social/Legal Framework for Conservation	Medium – High
Community and Constituency Support	Medium
Overall Project Capacity	**Medium**

Staff Leadership: The GCPEP Project Director and current GCPEP Staff is dedicated to this project and partnership and will play a critical role in the projects' success. The GCPEP Program Manager's position is presently vacant and a candidate list has been created, the expected hire date is March 2006. The responsibilities of the GCPEP Program Manager are many and this individual may need assistance. The majority of aquatic management lies with the Aquatic Ecologist, with support from the Conservation Ecologist and the Ecosystem Support Team (EST). Gaps in coordination and management of the partnership will be handled by the Aquatic Ecologist and the Conservation Ecologist. Alternatively, if additional EST personnel were hired, the Aquatic Ecologist could coordinate with partners to implement aquatic strategies beyond GCPEP boundaries.

Multidisciplinary Team: GCPEP Staff: Vernon Compton, Program Manager (vacant), JJ Bachant Brown, Ken Kallies, Brett Williams, Nathan Price. The Nature Conservancy: Alabama –Nicole Vickey, Paul Freeman, Florida – Ad Platt, Mike McManus and Doug Shaw. Florida Department of Environmental Protection: Shelley Alexander and Donald Ray. US Fish and Wildlife Service: Bill Tate. Florida Fish and Wildlife Conservation Commission: John Knight. Florida Sea Grant Extension Program: Chris Verlinde. National Park Service: Riley Hoggard. US Forest Service: Dagmar Thurmond. This is a good, experienced team, but it is missing key

members. Ideally, to service the GCPEP aquatic landscape, we need additional staff to accomplish our goals. Currently, only one person is focused solely on the GCPEP aquatic landscape (over 1,000,000 acres of land and over 12,000 acres of aquatic habitat), which leaves coverage for implementation incomplete in many areas. Additional staffing should include: filling the GCPEP Program Manager's position and hiring an Office Manager, bringing on an EST Coordinator and 6 additional EST members, and hiring a Volunteer Coordinator/Public Relations Person. Also, the monitoring capacity within this team is strong, but diffuse and more assistance is needed.

Institutional Leadership: Multiple organizations and agencies are involved, but most lack sufficient resources for specific project goals. Collaboration has been initiated on some efforts, but a framework needs to be built for others. Individuals within the partnership do have a shared vision of success, but institutional recognition and support of collaborative efforts is needed.

Funding: Additional funding to implement key aquatic strategies has not yet been secured, though strategies and action items have been written and will be implemented. Additional funding for new projects is uncertain, but will be pursued. The largest of the funding needs is additional GCPEP staff. To ensure aquatic management success, funding for at least 9 additional GCPEP staff is needed (as outlined in the *Multidisciplinary Team* section above). Other new strategies outlined in this document will require outreach and solicitation of additional support, over the next three to five years. Funding will also be needed for a variety of "on-the-ground" projects, including but not limited to, riparian lands acquisition, wetland and streambank restoration, prescribed burning, research and monitoring projects, and building the GCPEP aquatic database.

Legal Framework: An appropriate combination of legally protected conservation areas is in place. Policy protections are less adequate; particularly with respect to water supplies and freshwater inflows for wetlands, marshes and estuaries (no definition of ecologically sustainable freshwater inflow, nor any meaningful mandate to retain water for the environment). Additionally, fisheries and by-catch regulations may be insufficient to protect bay biodiversity long-term.

Community and Constituency Support: The aquatic project and the GCPEP staff are largely favorably received and supported by the community and are strongly supported by the partnership.

CONCLUSIONS AND NEXT STEPS

The aquatic management plan is not a static document. Members of the GCPEP Aquatic Subcommittee will reassess the plan annually and the conservation vision, goals, and priority strategies after five years to ensure they are still appropriate and feasible (The Nature Conservancy 2000a). Also, in three years, the GCPEP Aquatic Subcommittee will reassess project capacity and the viability of conservation elements. When the plan is revised, we will incorporate additional short- and long-term strategies. Strategies will be based on accomplishments made during the first years of the project and upon the changing needs and conditions across the conservation area. These steps will help ensure that GCPEP uses its

resources most effectively, and that our actions are in concert with our goals in the aquatic landscape and the organization, as well as with the needs of the partners.

Using this planning process, the partners involved have made great strides in understanding the natural systems and biological, social, and economic needs at the GCPEP landscape and its aquatic resources. However, this is just the beginning of the conservation work needed here. Such strategies may include diversifying agricultural operations or securing funding for resource enhancement. Where desired by landowners, GCPEP will act to facilitate or provide technical support for organizations and landowners who wish to maintain or enhance native habitats and water resources. GCPEP will also collaborate on community outreach efforts that demonstrate the ecological, aesthetic and economical value of this coastal area and its aquatic resources. Working with partners on multiple fronts, GCPEP hopes to continue its role as a contributing member of the local community and to help sustain the ecological integrity of the aquatic resources within the western panhandle and south Alabama conservation area in perpetuity.

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GLOSSARY

anadromous: referring to a fish that spends a majority of its life in marine environments and migrates to freshwater spawning grounds.

biodiversity: the variety of life forms and ecological systems, the genetic variability they contain and the ecological processes that maintain them.

centimeter: metric unit of measurement, equivalent to .3937 inches.

community, ecological community, ecological system: an interdependent assemblage of plant and animal species.

compatible: (as in *wildlife compatible, habitat compatible, ecologically compatible*): having a benign influence on wildlife or habitat, or on conservation efforts.

consensus: to come to a general agreement.

conservation area plan (CAP): The Nature Conservancy's process for helping conservation practitioners develop strategies, take action, measure success, and adapt and learn over time.

conservation area: specific area important to maintaining conservation value. Conservation sites may be a few acres up to thousands of acres. Conservation sites should support or have the potential to support species or communities of conservation interest (alternative term: *site*).

conservation element/target: a species, guild, community, or assemblage of communities that has been selected as a priority for conservation planning or action.

conservation status: a federal or state legal designation usually indicating some degree of threat or imperilment.

conservation strategy: a specific action to abate the affects of conservation threats.

conservation threat: a stress and the source of the stress.

data gap (dg): any missing information or data pertaining to GCPEP watersheds, landscape elements, and/or indicator species.

ecology: the study of the natural environment and of the relations of organisms to one another and to their surroundings.

ecoregion: a relatively large area of land and water characterized by similar climate, vegetation and geology, and other ecological and environmental patterns.

ecoregional planning: planning for long-term conservation goals within ecoregions.

ecotonal: referring to the edge or boundary of one habitat with another.

element occurrence: a detailed description of the location and conditions in which a species population or ecological community occurs.

element: plant or animal species, community or other entity of biodiversity; may serve as a focus for conservation efforts (see *conservation element*).

emergent: referring to aquatic plants with "out-of-water" aerial parts.

endangered: legal term, meaning at immediate risk of extinction, and probably unable to survive without direct human intervention. Indicates the species has been listed on federal or state endangered species list.

endemic: found nowhere else, unique to a place.

epiphytic: living on the surface of plants or animals.

estuarine: of, relating to, or formed in an estuary.

extirpated: to destroy completely.

fire-dependent: an organism or natural community that depends on fire to maintain its biological and/or community structure and function.

functional conservation landscape/functional landscape: similar to a *functional site*, but supports a large number of species over a large area.

functional conservation network/functional network: a set of *functional sites* and *landscapes* that allow species survival and reproduction on a regional scale (e.g., golden-cheeked warbler habitat spans hundreds of thousands of acres and includes many separate sites among which birds can travel).

functional conservation site/functional site: a site that maintains species and their supporting ecological processes. A functional conservation site typically supports a small number of species.

headwaters: small streams that form rivers.

hectare: metric land unit, equal to 2.47 acres.

hotspot: an area or region of unusual or unusually high biodiversity.

hydrology: pertaining to water, particularly its movement above and below the land surface.

hydrophytic: referring to a plant growing in water or in soil too waterlogged for most plants to survive.

hyproperiod: referring to the length of time water is present, particularly in isolated wetlands and small temporary streams.

impervious: not allowing entrance or passage of water, particularly to the aquifer.

invertebrate: any animal lacking a "backbone," usually possessing a external, hardened "shell."

karst: an irregular limestone region with sinks, underground streams, and caverns.

keystone species: a species upon which a number of other species depend in one way or another.

landscape: a heterogeneous land area of interacting ecosystems that are repeated in similar form throughout.

marsh: tidal marsh with salinity between 5 and 30 parts per thousand (ppt.).

Memorandum of Understanding: a formalized, sometimes legal, document identifying agreement among individuals or groups.

meter: fundamental measure of length in the metric system; 1 meter equals 3.28 feet.

nested conservation element: similar to *conservation element/target*; any species, guild, community, or assemblage of communities that has been selected by The Nature Conservancy as a priority for conservation planning or action that is part of a larger element or target.

nonpoint source pollution: a source of pollution that lacks a fixed point of entry into the environment, such as runoff of rain water.

overstory: referring to the uppermost portion of a forest or plant community.

prescribed burn: the skilled application of fire to forest or grassland fuels under predetermined conditions, used in our case to reach specific conservation objectives.

remnant: a patch of native vegetation around which most or all of the original vegetation has been removed.

riparian: forested or wooded streamside or riverside.

riverine: relating to, formed by, or resembling a river or living or situated on the banks of a river.

sessile: permanently attached or established, not free to move about.

silviculture: a branch of forestry dealing with the development and care of forests.

site: see *conservation area*.

source of stress: the cause of a stress to a conservation target, nested target, and/or indicator species.

strategy: see *conservation strategy*.

stress: anything that negatively affects a conservation target, nested target, and/or indicator species.

submergent: referring to aquatic plants with only submerged plant parts.

sustainable: allowing the continued use and viability of natural resources.

system: a collection of interdependent living and non-living elements and the natural processes that maintain them.

tannic: of or resembling tan (tea-colored), derived from a tannin.

target: plant or animal species, community or other entity of biodiversity; may serve as a focus for conservation efforts (see *conservation element/target*).

threat: see *conservation threat*.

threatened: legal term, meaning species is 1) abundant in parts of its range but declining in overall numbers and at risk of extinction, or 2) present in low numbers across its range and at risk of extinction. Indicates the species has been listed on federal or state threatened species list.

topographic: of, relating to, or concerned with topography, or the lay of the land and water.

trophic: of or relating to nutrition, a level in the food chain/web.

understory: an underlying layer of vegetation; the vegetative layer and especially the trees and shrubs between the forest canopy (overstory) and the ground cover.

vertebrate: any animal possessing a "backbone."

viability: capable of living, particularly in an altered environment.

Appendix A: GCPEP Imperiled Species

Common Name	**Species**
BIVALVES (15)	
Roundlake	*Amblema perplicata*
Flat Floater	*Anodonta suborbiculata*
Narrow Pigtoe	*Fusconaia escambia*
Round Ebonyshell	*Fusconaia rotulata*
Purple Pigtoe	*Fusconaia succissa*
Round Pearlshell	*Glebula rotundata*
Southern Sandshell	*Lampsilis australis*
Southern Pocketbook	*Lampsilis ornata*
Gulf Moccasinshell	*Medionidus penicillatus*
Round Washboard	*Megalonaias boykiniana*
Fuzzy Pigtoe	*Pleurobema strodeanum*
Southern Kidneyshell	*Ptychobranchus jonesi*
Tapered Pigtoe	*Quincuncina burkei*
Southern Creekmussel	*Strophitus subvexus*
Choctaw Bean	*Villosa choctawensis*
GASTROPODS (1)	
Clench's Goniobasis	*Elimia clenchi*
MAYFLIES (3)	
Dolania Mayfly	*Dolania americana*
Blue Sand-River Mayfly	*Homoeoneuria dolani*
White Sand-River Mayfly	*Pseudiron centralis*
CADDISFLIES (12)	
Zigzag Blackwater River Caddisfly	*Agarodes ziczac*
Gordon's Little Sister Sedge	*Cheumatopsyche gordonae*
Peter's Little Sister Sedge	*Cheumatopsyche petersi*
Morse's Little Plain Brown Sedge	*Lepidostoma morsei*
Morse's Dinky Light Summer Sedge	*Nyctiophylax morsei*
Okaloosa Somber Microcaddisfly	*Ochrotrichia okaloosa*
Morse's Long-Horn Sedge	*Oecetis morsei*
Elerod's Cream & Brown Mottled Microcaddisfly	*Oxyethira elerodi*
Kelley's Cream & Brown Mottled Microcaddisfly	*Oxyethira kelleyi*

CADDISFLIES (cont.)

Setose Cream & Brown Mottled Microcaddisfly	*Oxyethira setosa*
Florida Brown Checkered Summer Sedge	*Polycentropus floridensis*
Marsh Triaenode Caddisfly	*Triaenodes helo*

DRAGONFLIES (13)

Say's Spiketail	*Cordulegaster sayi*
Southeastern Spineyleg	*Dromogomphus armatus*
Twin-Striped Clubtail	*Gomphus geminatus*
Hodge's Clubtail	*Gomphus hodgesi*
Gulf Coast Clubtail	*Gomphus modestus*
Diminutive Clubtail	*Gomphus westfalli*
Allegheny River Cruiser	*Macromia alleghaniensis*
Elfin Skimmer	*Nannothemis bella*
Smoky Shadowfly	*Neurocordulia molesta*
Belle's Sanddragon	*Progomphus bellei*
Yellow-Sided Clubtail	*Stylurus potulentus*
Towne's Clubtail	*Stylurus townesi*
Gray Petaltail	*Tachopteryx thoreyi*

Fishes (20)

Gulf Sturgeon	*Acipenser oxyrinchus desotoi*
Alligator Gar	*Atractosteus spatula*
Crystal Darter	*Crystallaria asprella*
Lake Eustis Minnow / Pupfish	*Cyprinodon variegatus hubbsi*
Harlequin Darter	*Etheostoma histrio*
Okaloosa Darter	*Etheostoma okaloosae*
Goldstripe Darter	*Etheostoma parvipinne*
Cypress Darter	*Etheostoma proeliare*
Florida Chub	*Extrarius* n. sp. Cf *aestivalis*
Southern Starhead Topminnow	*Fundulus dispar blairae*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Cypress Minnow	*Hybognathus hayi*
Southern Striped Shiner	*Luxilus chrysocephalus isolepis*
Blacktip Shiner	*Lythrurus atrapiculus*
River Redhorse	*Moxostoma carinatum*
Southern Bluehead Chub	*Nocomis leptocephalus bellicus*
Rough Shiner	*Notropis baileyi*
Blackmouth Shiner	*Notropis melanostomus*
Florida Logperch	*Percina caprodes*

Fishes (cont.)

Saddleback Darter	*Percina vigil*
Bluenose Shiner	*Pteronotropis welaka*

Amphibians (9)

Flatwoods Salamander	*Ambystoma cingulatum*
Eastern Tiger Salamander	*Ambystoma tigrinum*
One-toed Amphiuma	*Amphiuma pholeter*
Southern Dusky Salamander	*Desmognathus auriculatus*
Seal Salamander	*Desmognathus monticola*
Four-toed Salamander	*Hemidactylium scutatum*
Pine Barrens Treefrog	*Hyla andersonii*
Dusky Gopher Frog	*Rana capito sevosa*
Florida Bog Frog	*Rana okaloosae*

Reptiles (9)

Gulf Coast Smooth Softshell	*Apalone mutica calvata*
Eastern Indigo Snake	*Drymarchon corais couperi*
Escambia Map Turtle	*Graptemys ernsti*
Alabama Map Turtle	*Graptemys pulchra*
Southern Hognose Snake	*Heterodon simus*
Alligator Snapping Turtle	*Macroclemmys temmincki*
Diamondback Terrapin	*Malaclemys terrapin*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*
Alabama Redbelly Turtle	*Pseudemys alabamensis*

Birds (18)

Seaside Sparrow	*Ammodramus maritimus*
Limpkin	*Aramus guarauna*
Snowy Plover	*Charadrius alexandrinus*
Piping Plover	*Charadrius melodus*
Wilson's Plover	*Charadrius wilsonia*
Marsh Wren	*Cistothorus palustris*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Tricolored Heron	*Egretta tricolor*
Swallow-tailed Kite	*Elanoides forficatus*
White Ibis	*Eudocimus albus*
Bald Eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Brown Pelican	*Pelecanus occidentalis*

Birds (cont.)

Black Skimmer	*Rynchops niger*
Least Tern	*Sterna antillarum*
Royal Tern	*Sterna maxima*
Sandwich Tern	*Sterna sandvicensis*

Mammals (5)

Southeastern Big-Eared Bat	*Corynorhinus rafinesquii*
Southeastern Bat	*Myotis austroriparius*
Eastern Chipmunk	*Tamias striatus*
Florida (West Indian) Manatee	*Trichechus manatus*
Florida Black Bear	*Ursus americanus floridanus*

Plants (18)

Southern Milkweed	*Asclepias viridula*
Many-Flowered Grasspink	*Calopogon multiflorus*
Washington Hawthorn	*Crataegus phaenopyrum*
Dwarf Witch Alder	*Fothergilla gardenii*
Henry's Spiderlily	*Hymenocallis henryae*
Panhandle Lily	*Lilium iridollae*
West's Flax	*Limum westii*
Bog Spicebush	*Lindera subcoriacea*
Pondspice	*Litsea aestivalis*
Hummingbird Flower	*Macranthera flammea*
Ashe's Magnolia	*Magnolia ashei*
Florida Pondweed	*Potamogeton floridanus*
Small-Flowered Meadow-Beauty	*Rhexia parviflora*
Panhandle Meadow-Beauty	*Rhexia salicifolia*
Whitetop Pitcherplant	*Sarracenia leucophylla*
Red Pitcherplant	*Sarracenia rubra*
Thorne's Buckthorn	*Sideroxylon thornei*
Cooley's Meadowrue	*Thalictrum cooleyi*

Lichens (1)

Perforate Reindeer Lichen	*Cladonia perforate*

Appendix B: Heritage Ranking System and Federal/State Status Symbols

Deciphering Heritage Ranks

The conservation rank of an element within a given area is designated by a G (Global), N (National) or S (State) as appropriate and followed by a rank number, 1 to 5. Species of conservation concern usually are those with global (G-ranks) ranks of 1-3; however, some species with higher global ranks may be of conservation concern in a particular area due to national, state, or local conditions. The heritage rank numbers have the following meaning:

1 = critically imperiled, less than 6 known occurrences of the species.
2 = imperiled, 6-20 known occurrences.
3 = vulnerable to extirpation or extinction, 21-100 known occurrences; species very rare and local throughout its range or found locally (even abundantly) in a restricted range.
4 = apparently secure, though may be quite rare in parts of its range; over 100 known occurrences.
5 = demonstrably widespread, abundant, and secure, though may be quite rare in parts of its range.

Rank numbers may be combined when there is uncertainty over the status (e.g., an element may be given a G-rank of G2G3, indicating global status is somewhere between imperiled and vulnerable).

Other Rank Symbols
Q = Questionable taxonomy that may reduce conservation priority
? = Inexact numeric rank. May also be seen as a combination of numbers (G2G3).
G? = un-assessed global rank
R = reported, not yet ranked
X = presumed extirpated

Rank Criteria, Relationship to Other Status Designations

Ranking is a qualitative process, with multiple factors going into rank decisions. For species elements, the following factors are applied: 1) total number and condition of occurrences (sighting/records) of that species, 2) population size, 3) range extent and area of occupancy, 4) short and long-term trends in the first three factors, 5) threats to the element, and 6) fragility of the element.

Heritage Ranks are often, but not always, comparable to statuses assigned by government agencies. For instance, the Heritage sub-national ranking for an endangered species may not be S1. For this reason, Federal and State statuses are also given for species of conservation concern when possible.

Federal and State Listing

The system used to indicate the status of a species is as follows:
C = candidate species for federal imperiled status
PT = proposed for listing as federally threatened
PE = proposed for listing as federally endangered
LT = federally threatened
LE = federally endangered
ST = state threatened
SE = state endangered

For more information or to find heritage ranks for species and ecological communities, visit the NatureServe website: http://www.natureserve.org/

Appendix C: Biodiversity Health and Viability Ranking System

The viability of the selected conservation elements should be assigned a rank using a four-level scale. The **viability ranking system** uses simple categorical ranks, as follows:

Very Good = viability criteria at or above desired future status.
Good = viability criteria at or above minimum threshold for biological integrity.
Fair = viability criteria at or above minimum restorable level.
Poor = viability criteria below minimum restorable status (probably unrecoverable).

The assessment of viability is based on 3 viability criteria:

Size is a measure of the area or abundance of the conservation element's occurrence. For ecological systems and communities, size is simply a measure of the occurrence's geographic coverage. For species, size takes into account the area of occupancy and number of individuals. Minimum area needed to ensure survival or re-establishment of an element after natural disturbance is another aspect of size.

Condition is an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes factors such as reproduction, age structure, biological composition (e.g., presence of native versus exotic species; presence of characteristic patch types for ecological systems), structure (e.g., canopy, understory, and groundcover in a forested community), and biotic interactions (e.g., levels of competition, predation, and disease).

Landscape context is an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element occurrence, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbance. Connectivity includes such factors as species elements having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and system, and the ability of any element to respond to environmental change through dispersal, migration, or re-colonization.

Appendix D: Threat Ranking Guidelines

Threats are composed of stresses and sources of stress (or sources). A stress is defined as a process or event with direct negative consequences on the conservation element (e.g., alteration of water flow into a marsh). The source of stress is the action or entity that produces a stress (e.g., channel building). The planning team must identify and rank the stresses and sources for each of the conservation elements. Guidelines for selection and ranking of stresses and sources are below.

The stress ranks and source ranks for individual elements 1) help elucidate the factors influencing that element and subsequently, the necessary conservation strategies, and 2) contribute to the analysis of threats for the conservation area. A conservation element's stress and source rankings are analyzed together via computer to provide threat ranks for the element. Once element threat ranks have been generated, the threat ranks are further examined via computer to assess threat ranks across elements and for the conservation area as a whole.

Stress Ranking

Severity of Damage -- what level of damage can reasonably be expected within 10 years under current circumstances (given the continuation of the existing management/conservation situation)	
Very High	The stress is likely to *destroy or eliminate* the conservation element over some portion of the element's occurrence at the conservation area
High	The stress is likely to *seriously degrade* the conservation element over some portion of the element's occurrence at the conservation area
Medium	The stress is likely to *moderately degrade* the conservation element over some portion of the element's occurrence at the conservation area
Low	The stress is likely to *only slightly impair* the conservation element over some portion of the element's occurrence at the conservation area

Scope of Damage – what is the geographic scope of impact on the conservation element at the conservation area that can reasonably be expected within 10 years under current circumstances (given the continuation of the existing situation)	
Very High	The stress is likely to be *very widespread or pervasive in its scope*, and affect the conservation element *throughout the element's occurrences* at the conservation area
High	The stress is likely to be *widespread in its scope*, and affect the conservation element at *many of its locations* at the conservation area
Medium	The stress is likely to be *localized in its scope*, and affect the conservation element at *some of the element's locations* at the conservation area
Low	The stress is likely to be *very localized in its scope*, and affect the conservation element at a *limited portion of the element's location* at the conservation area

Stress Ranking Chart

Severity	Scope			
	Very High	**High**	**Medium**	**Low**
Very High	Very High	High	Medium	Low
High	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
Low	Low	Low	Low	Low

Source Ranking

Contribution -- Expected contribution of the source, acting alone, to the full expression of a stress (as determined in the stress assessment) under current circumstances (i.e., given the continuation of the existing management/conservation situation)	
Very High	The source is a *very large* contributor of the particular stress
High	The source is a *large* contributor of the particular stress
Medium	The source is a *moderate* contributor of the particular stress
Low	The source is a *low* contributor of the particular stress

Irreversibility – Difficulty of reversing the impact from the projected Source of Stress; also an inverse measure of the source's responsiveness to corrective action	
Very High	Impact of the projected stress from the source, for all intents and purposes, is not reversible (e.g., wetland converted to shopping center)
High	Impact of the projected stress from the source is reversible, but not practically affordable (e.g., wetland converted to agriculture)
Medium	Impact of the projected stress from the source is reversible with a reasonable commitment of additional resources (e.g., ditching and draining of wetland)
Low	Impact of the projected stress from the source is easily reversible at relatively low cost (e.g., ORVs trespassing in wetland)

Source Ranking Chart

Irreversibility	Contribution			
	Very High	**High**	**Medium**	**Low**
Very High	Very High	High	High	Medium
High	Very High	High	Medium	Medium
Medium	High	Medium	Medium	Low
Low	Medium	Medium	Low	Low

Appendix E: Description of Nested Habitat Elements and Indicator Species and Groups
*Source: Nature Serve 2005, FWCC 2005, and/or FNAI 2005.

Description of Nested Habitat Elements

HEADWATER HABITAT TYPES

Spring-Run Stream: Spring-run Streams are characterized as perennial water courses which derive most, if not all, of their water from artesian openings in the underground aquifer. Spring-run Streams are among the most productive aquatic habitats. Spring-run Streams generally have sand bottoms or exposed limestone along their central channel. Calcareous silts may form thick deposits in quiet shallow zones, while leaf drift and other debris collect around fallen trees and quiet basins. Human activities affect flow rates by withdrawing water from the aquifer through deep wells. When withdrawal is substantial within the recharge area, spring flow is reduced or, in some cases, ceases entirely. If polluted groundwater infiltrates the deep aquifer feeding a Spring-run Stream, recovery may not be possible. Other human-related impacts to Spring-run Streams include the destruction of aquatic vegetation by overuse or misuse, and the introduction and proliferation of exotic plants and animals.

Seepage Stream: Seepage Streams are characterized as perennial or intermittent seasonal water courses originating from shallow ground waters that have percolated through deep, sandy, upland soils. Although a stream may be classified as a Seepage Stream along its entire length, they also form the headwaters of many Alluvial and Blackwater Streams. Because they are generally sheltered by a dense overstory of broad-leaved hardwoods which block out most sunlight, Seepage Streams most often have depauperate aquatic floras; however, the faunal elements may be rich. Seepage Streams generally have sandy bottoms, although clays, gravel and limestone may be prevalent along stretches where formations composed of these sediments are exposed. Seepage Streams are generally confined to portions of the state where topographic relief is pronounced, especially in northern Florida. They are often associated with Seepage Slope and Slope Forest near their head waters, and Bottomland Forest, Floodplain Forest and Swamp Forest near their mouths. Seepage Streams may be threatened by various activities, such as the applications of fertilizers or biocides on the surrounding uplands, dumping of hazardous wastes and other refuse within the drainage basin that could pollute the shallow ground waters that feed the Seepage Streams, and deforestation could increase surface erosion and cause excessive sedimentation of the stream valley, as well as increase insulation levels and cause the stream to become overgrown with shrubs or emergent herbaceous species.

Seepage Bog: Bogs or seepage bogs are characterized as wetlands on deep peat substrate with moisture maintained by capillary action and soils usually saturated or inundated. The vegetation is characterized by sphagnum moss and dense evergreen forests or shrub thickets of hydrophytic species or by marshy prairie with or without woody species. Bogs occur on acidic peat soils that have accumulated in a depression. Fire frequency in Bogs is highly variable. In shrubby types fires will occur normally every 3-8 years while in woody types every 50-150 years. Bogs may grade into Baygall, Wet Flatwoods, Seepage Slopes, Basin Swamp, and Bottomland Forest. In managing Bogs, the hydrologic regime and water quality must be maintained. Some Bogs may require fire management, but catastrophic peat fires should be avoided.

RIVERINE/FLOODPLAIN HABITAT TYPES

Blackwater and Alluvial Streams: Typical Blackwater Streams originate from sandy flats containing broad wetlands which collect rainfall and slowly release water into the stream. This habitat category has water with low pH, low carbonate, and may be stained by tannins and humic acids filtered from the drainage of swamps and marshes. The flow rate is usually gentle in smaller streams to moderate in larger, but is altogether influenced by seasonal local rainfall. These streams typically have sand or silt bottoms with varying amounts of aquatic vegetation. Plants include golden club, smartweed, sedges, and grasses. Blackwater Streams differ from Alluvial Streams by having high, steep banks, and by lacking extensive floodplains and natural levees. Most of the streams in this category are small natural streams originating in pinelands or swamps or small natural segments of otherwise channelized streams in south central Florida. Smaller Blackwater Streams examples include Big Coldwater Creek, Pine Barren Creek, Big Escambia Creek, Big Sweetwater Creek. Large Blackwater Stream examples include the Blackwater, Yellow, and Perdido rivers.

Alluvial streams originate in high uplands that are composed of sand and silt based clays, thereby giving these streams a natural high turbidity. These streams only occur in the north region of Florida and are characterized as having meandering channels with a mix of sand bottom, sand and gravel, and areas of bedrock or shoals. Large Alluvial Streams have flow rates and sediment loads that range from low to high (flood) stages, consequently causing water depth and other water quality parameters to fluctuate substantially with seasonal rainfall patterns. Flood stages which overflow the banks and inundate the adjacent floodplain and Bottomland Hardwood Forest communities usually occur one or two times each year during winter or early spring. Due to the high natural turbidity of these streams there is minimal vegetation which is mostly confined to channel edges or backwaters. Typical plants include spatterdock, duckweed, American lotus, and water hyssop. Examples of this stream category include the Escambia and Choctawhatchee rivers.

Bottomland and Floodplain Forests: These wetland forests and swamp lakes are composed of a diverse assortment of hardwoods or occur as a mixture of hardwoods and cypress which occur on the rich alluvial soils of silt and clay deposited along the floodplain of several Panhandle rivers including the Choctawhatchee and Escambia. This association of wetland-adapted trees occurs throughout the Panhandle on organic soils and forms the forested floodplains of non-alluvial rivers, creeks, and broad lake basins. Tree species include a mixed overstory containing water hickory, overcup oak, swamp chestnut oak, river birch, American sycamore, red maple, Florida elm, bald cypress, blue beech, swamp ash, black gum, water tupelo, dahoon holly, cabbage palm, and sweetbay. The understory can range from open and park-like to dense and nearly impenetrable. Understory plants can include bluestem palmetto, hackberry, swamp azalea, pink azalea lanceleaf greenbrier, poison ivy, peppervine, rattanvine, indigo bush, white grass, plume grass, redtop panicum, caric sedges, silverbells, crossvine, American wisteria, and wood grass. The canopy is usually dense and closed, keeping air movement and light penetration relatively low and, thus, keeping the humidity high. Due to these damp conditions, this habitat infrequently burns. Bottomland and Floodplain forests occur on low-lying flatlands or scattered low spots in basins and depressions that will only flood in extreme conditions. In Bottomland and Floodplain Forests, soils and hydroperiods primarily determine the diverse

temporary and permanent species composition along with community structure. Additionally, the rich organic material that accumulates on the forest floor is carried off by flooding waters during the wet season, and therefore provides an essential source of minerals and nutrients for downstream ecosystems such as estuarine systems.

ESTUARY/BAY HABITAT TYPES

Estuarine Mollusk Reef: Estuarine Mollusk Reefs are typically characterized as expansive concentrations of sessile mollusks occurring in intertidal and subtidal zones to a depth of 40 feet. In Florida, the most developed mollusk reefs are generally restricted to estuarine areas and are dominated by the American Oyster. Numerous other sessile and benthic invertebrates live among, attached to, or within the collage of mollusk shells. Most common are burrowing sponge, oyster drill, lightning whelk, polychaetes, mud worms, barnacles, bluecrab, amphipods, and starfish. Several fish also frequently occur near or feed among mollusk reefs, including, menhaden, gafftopsail catfish, pinfish, sea trout, spot, black drum, flounders, and mullet. Mollusk reefs that are exposed during low tides (e.g., coon oysters) are frequented by a multitude of shorebirds, wading birds, raccoons, and other vertebrates. Reef-building mollusks require a hard (consolidated) substrate on which the planktonic larvae (i.e., spat) settle and complete development. The spat dies if it settles on soft (unconsolidated) substrates, such as mud, sand or grass. Hard substrates are often limited in estuarine communities because of the large amounts of silt, sands and muds that are deposited around river mouths. Once established, however, mollusk reefs can generally persist and often expand by building upon themselves. Mollusk reefs occupy a unique position among estuarine invertebrates and have been an important human food source since prehistoric times. They present a dynamic community of estuarine ecology, forming refugia, nursery grounds, and feeding areas for a myriad of other estuarine organisms. The major threats to mollusk reefs continue to be pollution and substrate degradation due, in large part, to upland development.

Seagrass Beds: Seagrass Beds are typically characterized as expansive stands of vascular plants. This community occurs in subtidal (rarely intertidal) zones, in clear, coastal waters where wave energy is moderate. Seagrasses are not true grasses. The three most common species of seagrasses in Florida are turtle grass, manatee grass, and shoal grass. Attached to the seagrass leaf blades are numerous species of epiphytic algae and invertebrates. Together, seagrasses and their epiphytes serve as important food sources for manatees, marine turtles, and many fish, including spotted sea trout, flounders, sheepshead, and redfish. Seagrass Beds occur most frequently on unconsolidated substrates of marl, muck or sand. Some factors affecting the establishment and growth of seagrass beds include water temperature, salinity, wave-energy, tidal activity, and available light. One of the more important factors influencing seagrass communities is the amount of solar radiation reaching the leaf blades. In general, the water must be fairly clear because turbidity blocks essential light necessary for photosynthesis. Seagrass Beds are extremely vulnerable to human impacts. Many have been destroyed through dredging and filling activities or have been damaged by sewage outfalls and industrial wastes, as well as outboard motor-prop scarring. In these instances, the seagrass beds are either physically destroyed, or succumb as a result of decreased solar radiation resulting from increased water turbidity.

Tidal Marsh: Estuarine Tidal Marshes are generally characterized as expanses of grasses, rushes and sedges along coastlines of low wave-energy and river mouths. Black needlerush and smooth cordgrass are indicator species which usually form dense, uniform stands. Typical zonation in this community includes smooth cordgrass in the deeper edges, grading to salt tolerant plants such as the black needlerush that withstand less inundation. The stands may be arranged in well-defined zones according to tide levels or may grade subtly over a broad area, with elevation as the primary determining factor. In the upper reaches of river mouths, where tidal marsh begins to blend with freshwater tidal swamp, sawgrass may occur in dense stands. Typical animals include marsh snail, periwinkle, mud snail, spiders, fiddler crabs, isopods, amphipods, diamondback terrapin, saltmarsh snake, wading birds, waterfowl, osprey, marsh wrens, seaside sparrows, muskrat and raccoon. Tidal marsh soils are generally very poorly drained muck or sandy clay loams with substantial organic components and often a high sulfur content. The elevation of tidal marshes range from just below sea level to slightly above sea level with vegetation occupying the intertidal and supratidal zones. Tidal fluctuation is the most important ecological factor in tidal marsh communities, cycling nutrients and allowing marine and estuarine fauna access to the marsh. This exchange helps to make tidal marsh one of the most biologically productive Natural Communities in the world.

ISLAND/KEY HABITAT TYPES

Coastal Interdunal Swales: Coastal Interdunal Swales are associated with the large barrier islands on the Florida coasts, most commonly in the Panhandle. They appear as a mix of grasslands, small ponds, and depression marshes. Dominant species are quite variable depending on local hydrology, substrate, and the age of the swales. Coastal Interdunal Swales are distinguished from The Inventory's Coastal Grassland natural community by long periods of standing water following rains. They are distinguished from depression marshes by their location on barrier islands and lack of concentric zones of vegetation. They are distinguished from tidal fresh water marshes by the lack of tidal fluctuations in water levels. Little in the way of active management is required other than to prevent disruption by vehicles or excessive foot traffic. Fires occasionally burn through the swales but the dominant factor in this community's development and maintenance is hydrology and storm history.

Coastal Dune Lakes: Coastal Dune Lakes are generally characterized as shallow irregularly shaped or elliptic depressions occurring in coastal communities. They are generally permanent water bodies, although water levels may fluctuate substantially. Vegetation may be largely restricted to a narrow band along the shore, composed of hydrophytic grasses and herbs or a dense shrub thicket, depending on fire frequency and/or water fluctuations. The substrate of Coastal Dune Lakes is primarily composed of sands with organic deposits increasing with water depth. Coastal Dune Lakes develop from various coastal processes. They most commonly begin as a tidally influenced basin or lagoon that becomes closed by sand filling its inlet. They are important breeding areas for many insects that form the base of numerous food chains. Coastal Dune Lakes are extremely vulnerable to hydrological manipulations. Excessive withdrawals of ground water could lower local water tables or increase salt water intrusion and, thus, induce successional responses in the lake basin.

Swash Zone: The Swash Zone is the long, often narrow strip of sand and shells between the tides. Daily flooding by salt water and moderate- to high-energy waves prohibit plant growth except for some inconspicuous algae. Low-energy beaches provide important spawning habitat for horseshoe crabs and feeding habitat for multiple species of shorebirds. Beach dunes are mounds of windblown sand that are periodically inundated by seawater during extreme high tides and storms. Vegetation on beach dunes varies regionally in Florida but is restricted to a few highly specialized terrestrial plants (e.g., Sea Oats, *Uniola paniculata*). Florida beaches are important nesting sites for several species of shorebirds and wintering grounds for others. Beaches are also vital nesting sites for many sea turtles and support numerous other mammals and invertebrates. The swash zone is an important nursery and feeding habitat for many species of fish including Florida Pompano.

ISOLATED WETLANDS/UPLANDS HABITAT TYPES

Wet Prairies and Flatwoods: Wet Prairies and Flatwoods both occur on low, relatively flat, poorly drained terrain. Wet prairies are characterized as treeless plains with a sparse to dense ground cover of grasses and herbs, whereas, wet flatwoods are characterized as relatively open forests of scattered pine trees, with either a thick shrubby understory or very sparse ground cover, or a sparse understory and a dense ground cover of hydrophytic herbs and shrubs. The most important physical factors of both are hydrology and fire. Wet prairie is seasonally inundated or saturated for 50 to 100 days each year and wet flatwoods are inundated for a month or more. Fire typically occurs every 2 to 4 years in the wet prairie and every 3 to 10 years in the wet flatwoods. Both the wet prairie and wet flatwoods are home to a number of species that are dependent upon the hydrological and fire regimes. Wet prairie and wet flatwoods are home to pitcherplants and many other imperiled plant species. Both habitat types are critical habitat for reptile and amphibian populations and lack the predatory fishes of other larger, more permanent wetlands. Most important of these is the Flatwoods Salamander, a threatened species across the landscape. Soils typically consist of sands, sometimes 1 – 3 feet deep with substantial clay and organic components. Wet prairies and flatwoods are vulnerable to alterations in fire and hydrological regimes, over grazing, and off-road vehicles. Recovery from disturbance is typically poor and slow.

Depression Wetlands: Depression Wetlands are characterized as a shallow, usually rounded depression in sand substrate with herbaceous vegetation often in concentric bands. Because of their isolation and small size, many depression wetlands support a very different assemblage of species than that found in larger, more permanent wetlands. Depression wetlands are considered extremely important in providing breeding or foraging habitat for such species as the flatwoods salamander, dwarf salamander, oak toad, cricket frog, pinewoods treefrog, barking treefrog, squirrel treefrog, southern and ornate chorus frogs, narrowmouth toad, eastern spadefoot toad, gopher frog, white ibis, wood stork and sandhill crane. Typical plants include St. John's wort, spikerush, yellow-eyed grass, chain fern, willows, maidencane, wax myrtle, swamp primrose, bloodroot, buttonbush, fire flag, pickerelweed, arrowheads, and bladderwort. The substrate is usually acid sand with deepening peat toward the center. Some depressions may have developed or be maintained by a subsurface hardpan. Hydrological conditions vary, with most depression wetlands drying in most years. Hydroperiods range widely from as few as 50 days or less to more than 200 days per year, important in removing most predators. Fire is important to maintaining this community type by restricting invasion of shrubs and trees and the formation of

peat. Fire frequency is often greatest around the periphery of the wetland and least toward the center. A severe peat fire can lower the ground surface and create a pond at the center of the wetland. Depression wetlands are threatened by drainage, agriculture, pollution, fire suppression, and invasion of exotic species. Depression wetlands may be filled and converted to other uses. A regional lowering of the water table as a result of overuse may eliminate many depression wetlands. Depression wetlands on some public lands have been deepened to allow for stocking with game fish. By preying upon the eggs and larvae of frogs and salamanders, these fish may eliminate the amphibians that depend on such seasonal wetlands for successful reproduction. Likewise, many species of invertebrates not adapted to predation by fishes may be eliminated.

Seepage Slopes: Seepage Slopes are wetlands characterized as shrub thickets or boggy meadows on or at the base of a slope where moisture is maintained by downslope seepage such that the ground is usually saturated but rarely inundated. They generally occur where water percolating down through the sand hits an impermeable layer, such as clay or rock. Seepage Slope soils are acidic, loamy sands with low nutrient availability that are constantly saturated by seepage except during droughts. Seepage slopes are extremely rich in plants and animals. Fire with a frequency of about 5 years or less limits shrub and tree encroachment and recycles nutrients in herb bogs. Shrub bogs typically burn no more often than once every 20 to 50 years. In the absence of fire, larger woody plants establish, the increased transpiration of which lowers soil moisture levels. Over a period of years without fire, the Bog becomes drier and a Baygall may develop. The pitcher plant and shrub types of this Natural Community occur mostly in two regions of Florida, the western panhandle and northeast Florida. Seepage Slopes may be limited in the US to the southern Gulf coastal plain. Recent estimates indicate that only about 1% of the original extent of this type of system remains.

Swamps (Dome, Basin, and Strand): Swamps are an integral and vital part of the Gulf Coastal Plain ecosystem. Dome, Basin, and Strand Swamps all tend to be isolated swamp systems that generally have similar hydroperiods, typically 200 – 300 days per year. Water levels in swamp systems are typically maintained by runoff and during drier periods may wick water from the water table. Swamps are distinguished by their characteristic shape, geology, and origin. Dome swamps are typically formed in areas of karst topography with sand-filling creating a somewhat circular depression. Basin swamps originated as oxbows of former river channels or swales and lagoons formed during periods of higher water and can be found in a variety of irregular shapes. Stand swamps form along troughs in limestone formations and tend to be elongated. The most common tree found in all swamps is the cypress, though tupelo, blackgum, and pine are also part of the landscape. Other common plants are red maple, swamp redbay, sweetbay magnolia, and loblolly bay, willow, sphagnum moss, and a variety of ferns. A variety of wetland-dependent species are found in swamp systems including flatwoods salamander, southern dusky salamander, pine barren treefrog, alligator snapping turtle, watersnakes and cottonmouth, Florida black bear, pileated woodpecker, turkey, and wood duck. Soils in swamp systems tend to include nutrient poor peat overlaying acidic sands and typically contained by impervious clays and limestone. Fire is essential and extremely important in swamp systems. Without periodic fires, hardwood encroachment and peat accumulation would convert the swamps to bottomland forest or bog. Fire frequency varies with swamp type ranging from 5 to 200 years. All swamps tend to burn about every 150 years, though more frequent fires are not uncommon. Normal

hydrological and fire regimes are vital for maintaining these landscape features. Extended hydroperiods will limit tree growth and prevent reproduction and shortened hydroperiods will permit the invasion of mesophytic species. Most swamp systems have been degraded by timber harvests, and many have been drained or polluted. Thus, very few pristine examples of swamp communities exist. Those that remain should be adequately protected and properly managed.

Bogs: Bogs are characterized as wetlands on deep peat substrate with moisture maintained by capillary action and soils usually saturated or inundated. The vegetation is characterized by sphagnum moss and dense evergreen forests or shrub thickets of hydrophytic species or by marshy prairie with or without woody species. Bogs occur on acidic peat soils that have accumulated in a depression. Fire frequency in Bogs is highly variable. In shrubby types they occur normally every 3-8 years while in woody types every 50-150 years. Bogs may grade into Baygall, Wet Flatwoods, Seepage Slopes, Basin Swamp, and Bottomland Forest. In managing Bogs, the hydrologic regime and water quality must be maintained. Some Bogs may require fire management, but catastrophic peat fires should be avoided.

Description of Nested Indicator Species and Groups

INDICATOR SPECIES

Macroinvertebrates

Trichoptera, Odonate, Ephemeroptera (TOE) Complex and Mollusk/TOE Complex

Description: This group is a collection of imperiled caddisflies, dragonflies and damselflies, mayflies, bivalves, and at least one snail. The Trichoptera, Odonate, and Ephemeroptera (TOE) Complex includes as many as 28 species and the Mollusk group includes more than 15 species (see Appendix A for a complete listing of species).

Habitat: Small to Medium-sized creeks to large rivers with sand, muddy sand, silt-bottom, and gravel substrates and slow to moderate currents; occasional in backwater areas with no current. Immature individuals of the TOE Complex are completely aquatic. Several species of the TOE Complex are endemic to blackwater systems. Mollusks are not known from blackwater systems.

Seasonal Occurrence: Present year-round.

Florida Distribution: Found throughout the Panhandle, some are endemic.

Conservation Status: All members of the TOE Complex and the Mollusk/TOE Complex are important in aquatic systems. The TOE Complex, particularly the aquatic phases, serve as both grazers and predators and structure the lower trophic levels of the aquatic food chain. Mollusks are filter feeders and may serve as sentinels of aquatic health.

Protection and Management: Protect waters from degradation, development, and pollution. Populations remain vulnerable and would benefit from expansion of sanctuaries in this region.

Fiddler Crabs (*Uca* spp.)

FNAI Ranks: n/a

Description: Sand fiddler (*Uca pugilator*) is usually yellowish white in color. The color of displaying males is fleeting purplish violet patch on cardiac region. The major chela is yellowish white with pale orange base. The carapace color of non-displaying phases variously marked in semi-reticular patterns of brown, or completely brown with small gold or light brown spots. **Mud fiddler** (*Uca pugnax*) is usually brown, sometimes whitening to pale gray at least on branchial regions, but display whitening poorly or not at all developed. Anterior parts of third maxillipeds are often blue to blue-green. Walking legs are dark and banded. **Red-jointed or brackish water fiddler** (*Uca minax*) is chestnut brown and become gray in front. Chelipeds have red spots at articulation. The legs are olive or grayish brown.

Habitat: Coastal brackish and saltwater marshes and tidal streams, particularly areas dominated by Spartina. Also, mud and sand flats and small beaches.

Seasonal Occurrence: Generally active year round with brief periods of slowed activity. Breeds biweekly throughout the summer. Juveniles are thought to inhabit the "reedy" portion of the saltmarsh and larvae (zoe and megalops) are completely aquatic.

Florida Distribution: One or more species can be found throughout Florida and the Panhandle.

Conservation Status: Fiddler crabs play important roles in many marsh processes. They are not only important regulators of cordgrass-derived production and decomposition (bacteria and fungi), but also important to the food web, eaten by many larger predators, such as the blue crab, rails, egrets, herons and raccoons. They are also a good environmental indicator and sensitive to environmental contaminates especially insecticides. Their population densities are an example of the high productivity of our vital wetlands. Coupled with the crab's role in marsh processes, gives good reason to conserve ecologically important species that are so critical to our own food web.

Protection and Management: Protect coastal waters and estuaries from degradation, development, and pollution. Populations farther west throughout the Panhandle remain vulnerable and would benefit from expansion of coastal sanctuaries in this region.

Horseshoe Crab (*Limulus polyphemus*)

FNAI Ranks: n/a
FL Status: n/a

Descriptions: The horseshoe crab, *Limulus polyphemus*, is more closely related to spiders than it is to true crabs and other crustaceans. The horseshoe crab has two-part body consisting of a head region and an abdominal region. The head region contains 6 pairs of legs and 2 types of eyes: 2 compound eyes and 2 simple eyes. The abdominal region has 6 pairs of appendages which aid in respiration, reproduction, and locomotion. The last 5 appendages are modified to function as gills, sometimes called book lungs. A long spine, called a telson, is located behind the abdominal region and gives this order its name: *Xiphos* being Greek for "sword", and *uros* meaning "tail." Horseshoe crabs are long-lived and slow to mature.

Habitat: Horseshoe crabs spend most of its life in the subtidal zone, except for annual spawning migrations. Horseshoe crabs require a sloping sandy beach upon which to make their nests. Horseshoe crabs in Florida nest in a narrow band in the upper middle quarter of the beach. Subtle alteration of sediment may affect the suitability of the habitat for horseshoe crab reproduction.

Seasonal Occurrence: Year round.

Florida Distribution: Statewide.

Conservation Status: A great deal of research has been done on the horseshoe crab, *Limulus polyphemus* in the northeast United States, but little is known about the populations on the coast of Florida. A widespread decline in the abundance of horseshoe crabs in the last 20 years may be particularly severe in some areas of Florida and potentially in the Panhandle. While the horseshoe crab is not currently listed as threatened, there is a rising concern that available nesting sites are declining due to habitat alteration associated with beach nourishment and renourishment.

Protection and Management: The horseshoe crab and its eggs are an important component of the beach ecosystem, providing food for threatened loggerhead sea turtles, wading birds, alligators and many species of fish. Beach nourishment and renourishment seem to be the primary threat to this species and efforts should be made to identify important nesting beaches and avoid altering beach sand structure.

VERTEBRATES

AMPHIBIANS

Flatwoods Salamander (*Ambystoma cingulatum*)

FNAI Ranks: G2G3/S2S3
FL Status: Species of Special Concern

Description: A small to medium-sized (to 4.5 in. = 11.5 cm) salamander with a delicate white to silvery-gray pattern that may resemble nets, lichens, or narrow lines and rings on a black background. Belly black with grayish specks; head relatively small, no groove between nostril and upper lip, tail thick. Aquatic larva to nearly 3 in. (7.5 cm) in length, with bushy reddish gills, a dorsal tail fin, and on each side a tan stripe sandwiched between a pair of dark stripes, including one that passes through the eye.

Habitat: Pine flatwoods (longleaf or slash) communities with wiregrass groundcover and scattered wetlands often dominated by cypress or gum. Usually breeds in ponds that lack predatory fish and which usually have some emergent herbaceous vegetation.

Seasonal Occurrence: Breeds October - December, with adults moving overland to and from ponds at that time. At other times, adults and juveniles remain underground, sometimes in crayfish burrows. Aquatic larvae remain in ponds for 2 - 3 months, usually January - March.

Florida Distribution: Locally distributed in the Florida Panhandle and northern peninsula, formerly south to Marion County.

Conservation Status: Though declining from habitat loss, populations exist on Apalachicola National Forest, Eglin Air Force Base, and St. Marks National Wildlife Refuge. Local populations can be severely threatened by massive deaths of migrating adults and juveniles attempting to cross roads.

Protection and Management: Protect native pine flatwoods habitats and associated wetlands from incompatible forestry that disrupts soil and groundcover vegetation; allow growing-season fires to burn through occupied sites, including dry wetland basins and adjacent uplands. Prevent drainage, deepening, pollution (from livestock, pesticides, or stormwater), and introduction of fish in isolated wetlands. Protect natural upland habitat, with no roads or firebreaks, for at least 1.5 mi. (2.5 km) around known or potential breeding ponds, and maintain broad natural connections among breeding sites. Eliminate or control feral hogs, which disrupt habitat and may even eat salamanders.

Florida Bog Frog (*Rana okaloosae*)

FNAI Ranks: G2/S2
FL Status: S2

Description: A relatively small, yellow-green to brown frog lacking conspicuous spots and with a light dorsolateral ridge on each side of back, starting behind eye but not reaching hind leg. Body length (excluding legs) roughly 1.5 - 2 in. (38 - 50 mm). Scattered light spots on lower jaw, lower sides, and outer abdomen; belly with dark, worm-like markings. Eardrum brown, upper lip greenish-yellow, throat yellowish, iris of eye coppery. Webbing of hind feet extremely reduced, with toes extending well beyond. Tadpole olive brown with numerous buff spots on tail and white spots on belly.

Similar Species: Most similar frogs within species' range are larger than 2 in. (50 mm) as adults. Bullfrog (*Rana catesbeiana*), pig frog (*R. grylio*), and river frog (*R. heckscheri*) lack dorsolateral ridges. Bronze frog (*R. clamitans*), common along Florida streams, has raised center on eardrum. All four have more extensively webbed hind feet, with toes extending little or not at all beyond webbing. Bronze frog tadpole lacks white belly spots.

Habitat: Clear, shallow, non-stagnant, acidic (pH 4.1 - 5.5) seeps and seepage streams arising from sandy uplands, plus associated boggy overflow areas, often with sphagnum moss and black titi or white cedar.

Seasonal Occurrence: Resident year-round but less active in cold weather. Breeding, as indicated by calling males, occurs mid-April - September. Tadpoles apparently over-winter and transform into tiny frogs < 1 in. (25 mm) the following spring or summer.

Florida Distribution: Known solely from the Yellow and East Bay river drainages in western Panhandle.

Conservation Status: All but a few inhabited streams are on Eglin Air Force Base.

Protection and Management: Protect streams from siltation, pollution, and excess surface runoff, all of which are threats to habitat where roads cross slopes above streams; move or close roads as needed. Avoid damming streams within range. Burn adjacent uplands to retard encroachment of hardwood forests along streams.

Gopher Frog (Rana *capito*)

FNAI Ranks: G3G4/S3
FL Status: Species of Special Concern

Description: A medium-sized, boldly spotted frog with a chunky appearance: body short and plump, head large with somewhat rounded snout, legs relatively short. Back with somewhat warty skin and prominent, often bronze-colored longitudinal ridge on each side behind eye. Dorsal pattern of irregularly shaped dark spots on background that may be cream, gray, or brown. Chin and throat spotted, belly usually unmarked posteriorly. Adults 2.5 - 4 in. (63 - 102 mm) (excluding legs). Call resembles a deep snore. Tadpole large, to 3.5 in. (89 mm), globose, olive green, with large black spots on sides of tail.

Habitat: Dry, sandy uplands, chiefly sandhill and scrub, that include isolated wetlands or large ponds within about 1 mi. (1.7 km). Occasional in dry pine flatwoods, xeric hammock, and disturbed examples of above. Breeds chiefly in seasonally flooded, temporary ponds, but also in some permanent waters. Nocturnal, normally spending daytime in stumpholes, tunnels, or burrows, especially those of gopher tortoise (*Gopherus polyphemus).*

Seasonal Occurrence: Migrates to ponds for breeding from October through April, though may also breed during summer in central and southern Florida.

Florida Distribution: Most of state excluding Everglades and Keys; potential but not documented for some counties indicated on map. Two subspecies: dusky gopher frog (*R. c. sevosa*) in western Panhandle, Florida gopher frog (*R. c. aesopus*) in peninsula and eastern Panhandle.

Conservation Status: Many protected conservation lands in Florida support gopher frogs, although attention to managing and protecting breeding habitat and migratory pathways is often insufficient.

Protection and Management: Maintain large tracts of native vegetation in sandy, upland habitats that include wetlands. Allow fires to burn through dry wetland basins in addition to uplands. Manage uplands for gopher tortoises.

Pine Barrens Treefrog (*Hyla andersonii*)

FNAI Ranks: G4/S3
FL Status: Species of Special Concern

Description: A small, lime-green frog with expanded disc-like toe pads and a yellow-edged, broad, maroon to chocolate-brown stripe on each side that extends forward from eye to nostril and onto hind leg. Belly white; many bright yellow spots on front and back of thighs and on side of body inside thighs and armpits. Adult body length (excluding legs) about 1.5 in. (38 mm). Call a nasal "quonk" repeated many times at intervals of about a half-second. Tadpoles to 1.5 in. (38 mm), dark olive with black spots on back, greenish yellow belly, and tail with black blotches.

Habitat: Acidic seepage bogs, both herbaceous and shrubby, draining sandy uplands. Water shallow and clear, sphagnum moss abundant. Common trees and shrubs include titi, sweet bay magnolia, fetterbush, red maple, tulip poplar, black gum, gallberry, pepperbush, and St. Johns wort. Extent of use of surrounding uplands is unknown.

Seasonal Occurrence: Calls March - September; tadpoles present May - August.

Florida Distribution: Western Panhandle, mostly in tributaries of the Blackwater and Yellow rivers and Choctawhatchee Bay.

Conservation Status: Most Florida populations are within Eglin Air Force Base and Blackwater River State Forest.

Protection and Management: Protect streams from siltation, pollution, and excess surface runoff, all of which are threats to habitat where roads cross slopes above streams; move or close roads as needed. Avoid damming streams within range. Burn adjacent uplands to retard development of hardwood forests along streams; allow fire to encroach into herbaceous bogs.

Seal Salamander (*Desmognathus monticola*)

FNAI Ranks: G5/S1
FL Status: S1

Description: A medium-sized (to 4.5 in. = 11.5 cm), stout-bodied, semi-aquatic salamander with a dark brown, faintly patterned back but a plain or lightly blotched, pale belly and lower sides, usually with fairly sharp demarcation between. Hind legs larger than front. Light diagonal line below each eye. Dorsal pattern ranges from variable black markings on a brown, gray, or buff background to nearly patternless in adults; often a row of light dots on sides between legs. Tail somewhat flattened from side to side, especially near tip, and about one half of total length. Eyes protruding, head often held high. Young brownish with four or more pairs of chestnut spots on back, more on tail. Larvae have small gills and flattened tail.

Habitat: Cool, well-shaded ravines with spring seepages that support small, permanent streams; substrate may contain sandstone and clay. Overstory consists of mixed-hardwood slope forest. Salamanders usually hide beneath cover objects or in burrows during day. Larvae aquatic, live along shallow stream edges and in seepages.

Seasonal Occurrence: Present year-round but may descend below ground during extended droughts and cold weather. Larvae hatch in early fall, probably metamorphose in spring.

Florida Distribution: Known only from a series of ravines along Canoe Creek, Escambia County. Population is disjunct from rest of range.

Conservation Status: Only known site is on private land.

Protection and Management: Landowner currently protects site, but eventual acquisition as a preserve is desirable. Maintain forest on ravine slopes and uplands above stream system. Prevent siltation and pollution.

Southern Dusky Salamander (*Desmognathus auriculatus*)

FNAI Ranks: G5/S3
FL Status: S3

Description: A medium-sized (to 5 in. = 127 mm), dark, robust, semi-aquatic salamander with a stout tail that is flattened posteriorly from side to side, hence blade-like. Body, including belly, coal-black but sometimes with a reddish wash and usually with a series of white to reddish spots on sides between legs and continuing onto tail; white specks on belly. Diagonal line below eye often obscured by dark pigment. Hind legs larger than front. Larva coal black with some light spots on sides, bushy black gills.

Habitat: Mucky areas around cypress heads, sphagnum bogs, gum swamps, swampy lake margins, and sluggish stream floodplains under forest canopy. Infrequent in steep ravines with small clear creeks at bottom. Aquatic larvae.

Seasonal Occurrence: Present year-round. Lays eggs in fall. Larvae present December - April.

Florida Distribution: Panhandle and northern peninsula. Probably extirpated from many localities, including several counties shown on map.

Conservation Status: Uncertain but may be in sharp decline. Some populations still occur on Apalachicola National Forest and possibly Osceola National Forest.

Protection and Management: Determine cause of disappearance of seemingly protected populations. Acquire remaining lands supporting unprotected populations. Maintain forest on slopes and uplands above stream systems, and prevent siltation and pollution. Avoid wetland drainage. Eliminate or control feral hogs, which disrupt habitat and may even eat salamanders.

REPTILES

Alligator Snapping Turtle (*Macroclemys temmincki*)

FNAI Ranks: G3G4/S3
FL Status: S3

Description: A freshwater turtle reaching immense proportions, adult males as large as 30 in. (760 mm) shell length and 200 lbs. (90 kg); females smaller (to 24 in. = 610 mm). Both common and alligator hatchling © Dale R. Jackson snappers have rough brown shells and very long tails, nearly as long as body. *Macroclemys* has three sharp ridges or keels that run length of upper shell (carapace), very large head that is roughly triangular from above, strongly hooked beak, mouth that is brownish-gray inside, eyes on sides rather than top of head, and an extra row of scales near edge of carapace between outer ring of marginal scales and large inner costal scales. Hooked beak and shell ridges may be weak or lost in old adults.

Habitat: Strictly a turtle of rivers, though utilizes backwater swamps, overflow lakes, and impoundments as well as main channels.

Seasonal Occurrence: Present year-round but rarely observed because of secretive, bottom-dwelling habits. Females nest in late April and May, with young emerging in August and September.

Florida Distribution: Only in rivers draining into the upper Gulf of Mexico, from the Suwannee River westward throughout the Panhandle. Populations are known from the Suwannee, Ochlockonee, Apalachicola, Econfina Creek, Choctawhatchee, Yellow, East Bay River, Blackwater, and Escambia drainages.

Conservation Status: Subject to some debate, though unquestionably reduced by long-term commercial trapping in much of its range. Still common in some Florida rivers. Much of the floodplains of inhabited rivers in Florida has been protected by state and federal land acquisition, but water quality of several rivers remains threatened by pollution. The Apalachicola River in particular is threatened by growing demand for water by the greater Atlanta metropolis.

Protection and Management: Publicly acquire remaining unprotected floodplains and uplands bordering all inhabited rivers. Protect water quality and flow of inhabited river systems, including tributaries. Increase enforcement of regulations prohibiting commercial collecting (i.e., poaching).

Diamondback Terrapin (*Malaclemys terrapin*)

FNAI Ranks: G4/S4
FL Status: S5

Description: A small to medium-sized turtle (females to 8.5 in. = 216 mm shell length, males to 5.5 in. = 140 mm) of tidal and salt marsh habitats but otherwise resembling freshwater turtles. Each large scale on back bears concentric grooves and rings or dark and light markings, often with center area slightly raised and of different color than background. Colors vary among regions of Florida, which includes ranges of five races. Head, neck and legs often light with many dark dots, but sometimes streaks. Upper shell (carapace) with low, central keel, sometimes knobbed. Horny covering of beak usually broad and light, giving appearance of a smile. Hatchlings typically with large bulbous knobs down center of back.

Habitat: Salt and brackish waters only, occurring in marshes, tidal creeks, bays, and lagoons. Often associated with mangroves in southern Florida. Sandy beaches and berms used for nesting; may bask on oyster bars at low tide.

Seasonal Occurrence: Active mostly in daytime March - December, potentially year-round in south. Large breeding aggregations have been observed in Brevard County in March and April. Nesting typically April - June, with hatchlings usually emerging in late summer and fall.

Florida Distribution: Entire coastline of Florida, including Keys. Florida comprises more than a third of species' range.

Conservation Status: Extensively harvested for food in the past; less so today. Major threats are habitat degradation (loss of salt marsh, pollution, sea walls) and incidental drowning in crab traps, which are dispersed by the millions throughout range. Several national wildlife refuges and state aquatic preserves presumably protect some Florida populations.

Protection and Management: Protect coastal waters and estuaries from degradation, development, and pollution. It is imperative to minimize incidental take of terrapins in crab traps, either by restricting use or by incorporating inexpensive devices that prevent terrapins from entering. Statewide population surveys and monitoring are sorely needed.

Gulf Saltmarsh Snake (*Nerodia clarkii clarkii*)

FNAI Ranks: G4T3
FL Status: S3

Description: The Gulf Salt Marsh Snake is a relatively slender, longitudinally-striped water snake with strongly-keeled scales. The dorsum is patterned with two dark-brown stripes along each side of the body, separated by lighter stripes of a yellowish to pale olive coloration. The belly is reddish-brown to black with a large central row of whitish or yellowish spots and often a smaller row along each side. Adults average approximately 2 ft. (61 cm) in total length, but females can be up to 3 ft. (91.4 cm) long.

Habitat: Coastal salt marshes supporting Cordgrass (*Spartina*), Black-rush (*Juncus roemerianus*) and other halophytes are the typical habitat of the Gulf Salt Marsh Snake. This snake is usually found along the grassy edges of brackish creeks and ponds, where salinity may fluctuate daily due to tidal influences.

Seasonal Occurrence: Primarily nocturnal, but will feed at periods of low tide. Mating probably occurs in early spring. Young (1 to 16, average 7), are born alive in July and August.

Florida Distribution: Gulf Salt Marsh Snakes may be found in marsh habitats across the entire Florida Panhandle, though there are no records of the snake being captured in Santa Rosa, Okaloosa, or Walton Counties in Florida.

Conservation Status: The habitat of the Gulf Salt Marsh Snake is limited to a very narrow and fragile strip of estuarine wetlands that is discontinuous along the upper Gulf Coast of Florida, especially in the western Panhandle. Throughout much of its Florida range, the Gulf Salt Marsh Snake occurs in disjunct, local populations that are vulnerable to extirpation from habitat disturbance. In addition, Salt Marsh Snakes are also susceptible to more subtle perturbations, wetlands alteration can promote hybridization and genetic swamping by other watersnakes in adjacent freshwater. Chemical pollution and industrial wastes may adversely affect Salt Marsh Snakes, especially if pollutants are concentrated in the tissues of their prey.

Protection and Management: Understanding the life history, ecology, and behavior of this species is essential to understanding and protection. Much of the eastern range is protected by a number of refuges, preserves, and sanctuaries along the Big Bend coast (Levy County through Wakulla County). Populations farther west throughout the Panhandle remain vulnerable and would benefit from expansion of coastal sanctuaries in this region.

Sea turtles

Kemp's Ridley (*Lepidochelys kempi)*

FNAI Ranks: G1/S1
FL Status: Endangered

Description: A small to medium-sized sea turtle with a nearly circular shell. Front limbs modified as flippers. Upper shell (carapace) olive-green to gray, with five large scales (costal scutes) on each side, the first one touching the nuchal scale (small scale over neck). Lower shell (plastron) yellow to white and usually with a single, small scale (the interanal) at its posterior tip. Bridge with four (rarely five) large scales, each with a pore near the rear edge. Adults reach 23 - 28 in. (58 - 71 cm) shell length and 70 - 100 lbs. (32 - 45 kg). Young are almost completely dark gray, a light gray streak along the rear edge of each flipper, three spined ridges (keels) on upper shell and four on lower. Hatchlings measure about 1.5 - 1.75 in. (38 - 44 mm) shell length.

Habitat: Marine coastal waters, usually with sand or mud bottoms; nests (rarely in Florida) on sandy beaches. Juveniles frequent bays, inlets, and lagoons.

Seasonal Occurrence: Present in Florida waters year-round.

Florida Distribution: Coastal waters statewide, though rare off southeastern coast. Waters along the entire Gulf coast are important for growth of young. Apparently did not historically nest in Florida, but eight nests have been recorded since 1989, possibly as a result of conservation efforts. Whether the Ridley will become a regular nester in Florida is unknown.

Conservation Status: State aquatic preserves partially protect some feeding and developmental habitat. The largely immature population segment using Florida waters is threatened by coastal habitat destruction and degradation, including pollution of estuaries and marine waters as well as coastal development. Direct mortality of older immature animals that drown in commercial shrimp nets is considered the principal threat.

Protection and Management: Continued use of Turtle Excluder Devices (TEDs), which have reduced incidental drownings in shrimp nets, is essential for species' recovery. Also must protect coastal waters from pollution, dredging, and synthetic debris, and limit coastal development. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

Green Turtle (*Chelonia mydas)*

FNAI Ranks: G3/S2
FL Status: Endangered

Description: A large sea turtle that is dark above, light below, and which bears only a single pair of elongate scales (prefrontals) between eyes; front limbs modified as flippers. Upper shell (carapace) of adult: olive with dark spots; juvenile: brown to olive with radiating lines. Carapace without central keel except in young, and with only four large, non-overlapping scales (costal scutes) on each side, the first one not in contact with nuchal scute (small scale over neck). Lower shell (plastron) cream to yellow. Adults reach 35 - 48 in. (88 - 122 cm) shell length and 220 - 450 lbs. (104 - 204 kg). Hatchlings 1.6 - 2.4 in. (41 - 61 mm) shell length, black to dark gray above, white ventrally and along rear margins of flippers, with a low keel on back and two keels on plastron.

Habitat: Estuarine and marine coastal and oceanic waters; nests on coastal sand beaches, often near dune line, sufficiently high to avoid tidal inundation. Large juveniles and adults feed on seagrasses and algae. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, lagoons, and offshore worm reefs.

Seasonal Occurrence: Present in Florida waters year-round, but more commonly observed during warmer months. Nests late May - September; hatchlings emerge and head toward sea August - November.

Florida Distribution: Coastal waters statewide. Nests mostly along Atlantic coast, especially from Volusia to Miami-Dade County, with a few nests in Keys and on southwestern and western Panhandle coasts. Areas known to be especially important to young green turtles include Gulf coast of Citrus and Levy counties, Indian River Lagoon, shallow hard bottom along southeastern coast, and Florida Bay.

Conservation Status: Some nesting beaches are on military, state, federal, and private conservation lands on both Atlantic and Gulf coasts. State designated aquatic preserves partially protect some feeding and developmental habitat.

Protection and Management: Protect beaches and adjacent uplands statewide from development and coastal armoring. Protect estuaries and coastal waters from pollution, dumping of entangling debris, dredging, over-use by boats and ships, and other disturbance. Focus extreme attention on Brevard and Indian River counties. While Turtle Excluder Devices (TEDs) have reduced mortality in shrimp nets, greater regulation of long-line and gill-net fisheries is needed to prevent hooking mortality and incidental drowning. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

Leatherback (*Dermochelys coriacea)*

FNAI Ranks: G3/S2
FL Status: Endangered

Description: A huge sea turtle with a dark gray to black body covered by leathery skin and bearing seven prominent longitudinal ridges; five similar ridges occur on the mostly white lower shell (plastron). Front limbs modified as flippers. Adults typically reach 53 - 70 in. (135 - 178 cm) shell length and 650 - 1300 lbs. (295 - 590 kg). Young are black dorsally with white ridges and are covered by small beady scales; hatchlings measure 2.4 - 3 in. (61 - 76 mm).

Habitat: Oceanic waters; nests on coastal sand beaches. Leatherbacks are rarely seen in coastal waters except as hatchlings dispersing from nesting beaches and as adult females approaching the beach to nest.

Seasonal Occurrence: Present in Florida waters year-round, though concentrations of adults are known to occur from Nassau through Brevard counties from fall through early spring. Nests from early spring through early summer, with hatchlings emerging and heading toward sea in late spring and summer.

Florida Distribution: Entire coast of Florida, with nesting known from every Atlantic coastal county and in Panhandle. Approximately half of Florida nests are in Palm Beach County.

Conservation Status: Believed to be in severe decline worldwide. Some Florida nesting beaches are on state, federal (including military), and private conservation lands on both coasts.

Protection and Management: Protect beaches and adjacent uplands statewide from development and coastal armoring. Protect coastal and oceanic waters from pollution, dumping of plastic debris which leatherbacks mistake for their jellyfish prey, dredging, overuse by boats and ships, and other disturbance. While Turtle Excluder Devices (TEDs) have reduced general sea turtle mortality in shrimp nets, their openings must be enlarged to allow leatherbacks to escape as well. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

Loggerhead (*Caretta caretta)*

FNAI Ranks: G3/S3
FL Status: Threatened

Description: A large sea turtle with a reddish brown carapace (upper shell) and large, blunt head with yellow cheeks; front limbs reddish brown and modified as flippers. Carapace with five or more large scales (costal scutes) on each side, the first one touching the nuchal scute (small scale over neck). Lower shell (plastron) yellow and usually without a single small scale at its posterior tip. Bridge usually with three large scales, occasionally four, and these lack pores. Two pairs of scales (prefrontals) between eyes. Adults 28 - 49 in. (70 - 125 cm) carapace length, 170 – 350 lbs. (77 - 159 kg). Hatchlings 1.6-1.9 in. (41 - 48 mm) shell length, with three lengthwise ridges (keels) on upper shell, and two on lower; brown, tan, or light to dark gray above and often lighter below.

Habitat: Marine coastal and oceanic waters; nest on coastal sand beaches, often near the dune line, sufficiently high to avoid tidal inundation. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, and lagoons.

Seasonal Occurrence: Present in Florida waters year-round, but more commonly observed during warmer months when turtles are more active. Nesting occurs late April - early September; hatchlings emerge from nests and head toward the sea July - November.

Florida Distribution: Coastal waters statewide. Nesting occurs along the entire Atlantic coast, in the Keys, and along the Gulf coast from Pinellas County south and Franklin County west, with the greatest numbers from Brevard to Broward counties.

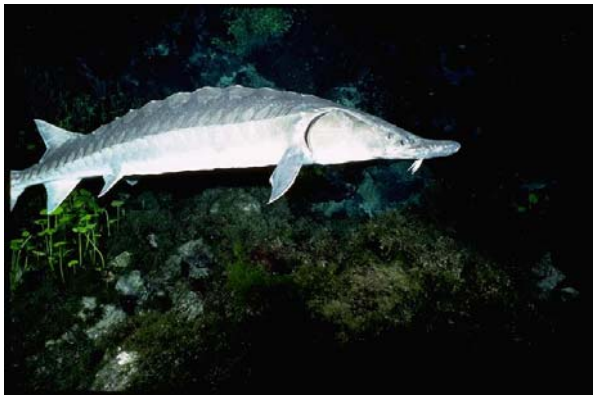
Conservation Status: Some nesting beaches are on military lands and state, federal, and private conservation lands on both Atlantic and Gulf coasts. State-designated aquatic preserves partially protect some feeding and developmental habitat.

Protection and Management: Protect beaches and adjacent uplands statewide from development and coastal armoring. Protect estuaries and coastal waters from pollution, dumping of entangling debris, dredging, over-use by boats and ships, and other disturbance. Focus extreme attention on Brevard and Indian River counties. While Turtle Excluder Devices (TEDs) have reduced mortality in shrimp nets, greater regulation of longline and gill-net fisheries is needed to prevent hooking mortality and incidental drowning. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

FISHES

Gulf Sturgeon (*Acipenser oxyrinchus desotoi)*

FNAI Ranks: G3T2/S2
FL Status: Species of Special Concern



Description: A large sturgeon, generally reaching 5 - 7.5 ft. (1.5 - 2.2 m), with historical records of specimens reaching 9.5 ft. (2.8 m); vertical mouth, lightly colored viscera, long, sharply V-shaped snout (upturned at the tip in young), and prominent bony scutes (enlarged scales); general body color is blue-black dorsally, fading on sides, and eventually white ventrally.

Habitat: Forages in Gulf of Mexico and associated estuaries; spawns in most major coastal rivers in areas with limestone outcrops.

Seasonal Occurrence: Gulf sturgeon is anadromous; adults and subadults spend the coldest three to four months in the Gulf and the remainder of the year in rivers where spawning occurs. Spawning typically takes place February - April.

Florida Distribution: Reproducing populations in Gulf of Mexico and major Panhandle rivers eastward to the Suwannee River. Non-breeding animals observed in Tampa Bay and Charlotte Harbor. During cold years, individuals have been documented as far south as Florida Bay.

Conservation Status: Due to the damming of many of north Florida's tributaries to the Gulf of Mexico, the Suwannee, Choctawhatchee, Yellow, and Escambia rivers appear to be the last high-quality spawning areas for the Gulf sturgeon. Banning of commercial harvest of this species has undoubtedly resulted in increased stocks.

Protection and Management: Due to the limited breeding habitat that has resulted from the damming of most of the large rivers within the Gulf sturgeon's range, the recovery of this and other anadromous species will likely require some means for these species to pass dams that are currently blocking their migrations. Protection of existing spawning areas is critical; any main channel or tributary construction or maintenance should be avoided during spawning periods.

Okaloosa Darter (*Etheostoma okaloosae*)

FNAI Ranks: G1/S1
FL Status: S1/Endangered

Description: Small, up to 2 in. (51 mm), darter with well-developed spot above the base of the pectoral fin and five to eight rows of brownish spots along the lateral surface of the body. General coloration ranges from red-brown to green-yellow; ventral surface is lighter. Breeding males have a bright orange band on the edge of first dorsal fin.

Habitat: Edges of clear, flowing streams among vegetation, root mats, and decaying material.

Seasonal Occurrence: Present in all seasons.

Florida Distribution: Known only from six tributaries of Rocky and Boggy bayous.

Conservation Status: Sedimentation of streams from erosion of clay borrow pits and roads is the chief threat. Land managers at Eglin Air Force Base, which includes approximately 90 percent of the watershed area inhabited by the Okaloosa darter, are taking tremendous management steps to remedy this problem. Permanent impoundment of streams by dams or by culverts clogged with debris reduces or eliminates darters; beavers frequently use culverts and other midstream structures to increase the durability of their dams. USFWS reports that from 1995 - 1998 most Okaloosa darter populations were stable or increasing. If this trend continues, the species' legal status may be changed to threatened in 2006.

Protection and Management: Monitor groundwater withdrawals, surface water runoff, and water quality contamination via sewage treatment spray fields and landfills to assess degradation of Okaloosa darter habitat.

Saltmarsh Topminnow (*Fundulus jenkinsi*)

FNAI Ranks: G2/S2
FL Status: S2/SC

Description: Small topminnow, averaging approximately 1.75 in. (44 mm). The most diagnostic feature is a series of small, round, black spots on the mid-side of the body that often form two rows. General coloration is a very light yellowish brown.

Habitat: Saltmarsh ranging from small tidal meanders to areas just outside the mouth. Prefers cord grass (*Spartina*) marsh with a salinity below 20 parts per thousand and is most abundant at 1-4 parts per thousand. Characterized as a small, schooling fish that can occur in large numbers in quiet fresh waters, bays, saltwater marshes, tidal creeks, estuaries, and lagoons. Not found on reefs or far away from shore. Exact habitat requirements are poorly known.

Seasonal Occurrence: Present in all seasons

Florida Distribution: Perdido, Escambia, and East bays.

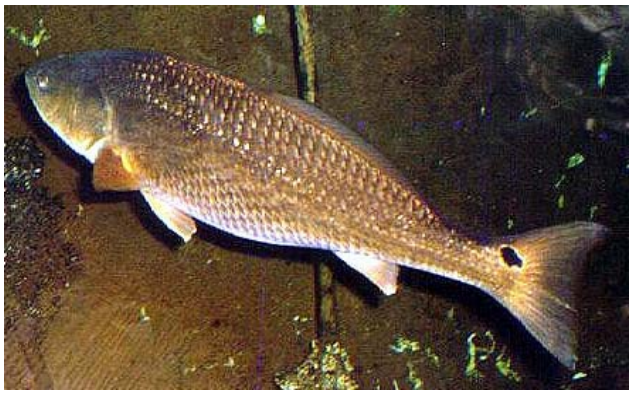
Conservation Status: The majority of the shoreline of Perdido, Escambia and East bays is privately owned. Areas that have not yet been developed will likely encounter developmental pressure in the near future.

Protection and Management: Conserve saltmarsh habitat within the species range. Protect water quality by prohibiting water contamination via septic systems and surface runoff from nearby developments.

Inshore Game Fish (RSF) Complex:

Red Drum/Redfish (*Sciaenops ocellatus*)

FNAI Ranks: n/a
FL Status: n/a



Descriptions: The most distinguishing mark on the red drum is one large black spot on the upper part of the tail base. Having multiple spots is not uncommon for this fish but having no spots is extremely rare. The color of red drum ranges from a deep blackish, coppery color to nearly silver. The most common color is reddish-bronze. Red drum is a fast growing fish reaching approximately 11 inches and one pound in its first year, 17-22 inches and 3 1/2 pounds in two years, and 22-24 inches and 6-8 pounds in three years.

Habitat: Estuaries, bays, marshes, inlets, oysterbeds and weedbeds in inshore and nearshore salt and brackish waters to 200 feet deep. Prefers water in the 70's and lower 80's F. Water in the low 50's for extended periods can be fatal if the fish cannot seek deeper water. Spawns fall in shallow open water to 200 feet. Groups of fish gather in large schools and drop the fertilized eggs which drift until hatching. The young swim into bays and estuaries to grow. Females are larger and take up to 5 years for first spawning (like many drums).

Seasonal Occurrence: Year round.

Florida Distribution: Statewide.

Conservation Status: The red drum, or more commonly called redfish, is one of Florida's most favored inshore game fish. This species experienced severe declines during the mid part of the 1900's because of its excellent table fare. Creel limits set by FWCC appear to be in line with the conservation of this species. However, much of the required habitat, grassbeds and oyster beds, are being lost at an alarming rate in the Panhandle.

Protection and Management: The most critical need for this species and the other species of the Inshore Game Fish Complex is habitat protection, restoration, and maintenance. Conservation of vital spawning areas and other required habitats must be at the top of the conservation "to do list." Efforts should be made to work with groups that are responsible for the protection, restoration, and maintenance of this group's critical habitat and working with state agencies to ensure appropriate creels.

Spotted Seatrout/Speckled Trout (*Cynoscion nebulosus*)

FNAI Ranks: n/a
FL Status: n/a

Descriptions: Distinguishing characteristics include a dark gray or green back and silvery-white below, with distinct round spots on back, fins and tail; black margin along the edge of tail; soft dorsal (back) fin with no scales; and one or two prominent canine teeth usually present at the tip of the upper jaw. Spotted seatrout males average 19 inches (48 cm) in length. Females are 25 inches (63 cm) long on average. Males and females weigh 2 to 3 pounds (1 to 1.3 kg).

Habitat: Estuaries, bays, marshes, inlets, oysterbeds and weedbeds in inshore and nearshore salt and brakish waters to 60 feet deep. Prefers water in the 70's and lower 80's F. Water in the low 50's for extended periods can be fatal if the fish cannot seek deeper water. Spawns spring to fall inshore over shallow grassbeds, especially in bays. Groups of fish gather and drop the fertilized eggs over vegetation. The young grow and remain inshore.

Seasonal Occurrence: Year round.

Florida Distribution: Statewide.

Conservation Status: The spotted seatrout, or more commonly called speckled trout, is one of Florida's most favored inshore game fish. This species is known for its excellent table fare. Creel limits set by FWCC appear to be in line with the conservation of this species. However, much of the required habitat, grassbeds and oyster beds, are being lost at an alarming rate in the Panhandle.

Protection and Management: The most critical need for this species and the other species of the Inshore Game Fish Complex is habitat protection, restoration, and maintenance. Conservation of vital spawning areas and other required habitats must be at the top of the conservation "to do list." Efforts should be made to work with groups that are responsible for the protection, restoration, and maintenance of this group's critical habitat and working with state agencies to ensure appropriate creels.

Flounder (*Paralichthys* spp.)

FNAI Ranks: n/a
FL Status: n/a

Descriptions: All flatfishes, including the southern flounder, are compressed laterally and spend most of their life lying and swimming along the bottom on their side. Young swim much like other fishes until they metamorph. In the case of southern flounder, the left side is always the "up" side; in other species, the opposite is true. Small flounders grow rapidly and may reach 12 inches in length by the end of their first year. Males seldom exceed 12 inches, but females grow larger than males and often reach a length of 25 inches.

Habitat: The southern flounder generally prefers muddy bottoms throughout most of the estuary, but it can occur in channel and bay mouths and also frequents areas around piers, pilings, and rock jetties. Migrations to offshore spawning grounds begin in late fall at the onset of cold weather, and spawning is completed during winter months. This species is the prefect predator, lying in total camouflage on the bottom until unsuspecting prey wander within reach and are capture with lightning quick movements. Foods of this species include shrimp and fishes.

Seasonal Occurrence: Year round.

Florida Distribution: Statewide.

Conservation Status: The flounder, which is actually a collection of two common species, the Gulf and Southern Flounder, are two of Florida's most favored inshore game fish. These species are perennial favorites among inshore and nearshore fisherman largely because of their angling-ease and because of its excellent table fare. Creel limits set by FWCC appear to be in line with the conservation of this species. However, much of the required habitat, grassbeds and oyster beds, are being lost at an alarming rate in the Panhandle.

Protection and Management: The most critical need for this species and the other species of the Inshore Game Fish Complex is habitat protection, restoration, and maintenance. Conservation of vital spawning areas and other required habitats must be at the top of the conservation "to do list." Efforts should be made to work with groups that are responsible for the protection, restoration, and maintenance of this group's critical habitat and working with state agencies to ensure appropriate creels.

BIRDS

Plover/Tern Group

SNOWY PLOVER (*Charadrius alexandrinus)*

FNAI Ranks: G4/S1
FL Status: Threatened

Descriptions: Small plover with a slim, dark bill, dark ear patch, and dark legs. Extremely pale gray or brownish above with dark collar patches on each side of breast and a black band across forehead. Dark collar or neckring, head, and ear markings are less prominent in females and become indistinct in winter birds and juveniles.

Habitat: Restricted to dry, sandy beaches, where they nest in shallow depressions, usually near some vegetation or debris. Also forage in tidal flats along inlets and creeks.

Seasonal Occurrence: Present year-round. There appears to be some migration out of state as well as movement to other sites within state.

Florida Distribution: Most abundant as a breeder in the Panhandle from Escambia County east to Franklin County, and less so in the more developed stretch from Pinellas County south to Marco Island in Collier County. Highest counts in winter are found at Anclote Key Preserve State Park (Pasco and Pinellas counties). No longer breeds in Keys but occurs occasionally there and along Atlantic coast as a fall - winter visitor.

Conservation Status: Surveys conducted in 1989 suggest 170 – 200 breeding pairs, with 82 - 85 percent occurring in northwest Florida. Populations have been greatly reduced and fragmented by coastal development and increased human recreational activity. Much suitable habitat has already been destroyed or is in public ownership. Predation is also a threat, as is reduced productivity caused by increased harassment by humans and pets.

Protection and Management: Continue protection measures at breeding locations, including posting and fencing, public education, and predator control. Expand measures to wintering sites where necessary. Restore beach dune habitat and acquire undeveloped beaches, especially in southwest Florida.

PIPING PLOVER (*Charadrius melodus*)

FNAI Ranks: G3/S2
FL Status: Threatened

Descriptions: Small plover with a short, stout, black bill, yellow to greenish-olive legs, and very pale upperparts. In Florida, usually encountered in winter plumage. Black band across forehead and dark ring partly around neck, present in breeding birds, fade in winter birds and are not present in juveniles.

Habitat: Found on open, sandy beaches and on tidal mudflats and sandflats along both coasts.

Seasonal Occurrence: Very rare to uncommon winter resident, although may appear locally early July - May.

Florida Distribution: Winters on both Gulf and Atlantic coasts, although much more common on Gulf coast. Of 582 plovers sighted in Florida during the 1991 International Winter Census, 88 percent were recorded on the Gulf coast. Found along beaches from Perdido Key (Escambia County) to Dog Island and Lanark Reef (Franklin County), and from Anclote Key (Pasco County) to Marco Island and vicinity (Collier County). Small numbers overwinter in the Keys. Atlantic coast birds number much fewer (20 - 30 birds) and are scattered from Duval County south to Brevard, St. Lucie, and Miami-Dade counties. No longer believed to overwinter in Broward, Indian River, Nassau, or Palm Beach counties.

Conservation Status: Surveys conducted during the 1991 winter census resulted in 582 plovers sighted, of which 511 were on the Gulf coast and 71 on the Atlantic coast (including the Keys). Destruction and degradation of summer and winter habitat, shoreline erosion, human disturbance, and predators (including domestic animals) all contribute to low reproductive success and declines in numbers over much of the plover's range. Although Florida's conservation lands provide considerable suitable habitat, increasing recreational demands result in increased harassment of foraging and roosting birds. US Fish and Wildlife Service is currently reviewing wintering areas to be designated as Critical Habitat.

Protection and Management: Protect high-use wintering areas on public lands from disturbance by educating the public and, if necessary, by posting. Protection of known habitat outside current conservation lands is warranted in light of the rarity of the species and fragile nature of its required habitat.

WILSON'S PLOVER (*Charadrius wilsonia*)

FNAI Ranks: G5/S2
FL Status: None

Descriptions: Small to medium-sized plover with long, heavy, black bill, single broad breast band, and pinkish-gray legs. Upperparts gray-brown. In breeding adults, breast band is black in males and brownish in females. Sexes similar in non-breeding adults. Juvenile plumage similar to that of non-breeding adults, but upperparts have more scaly appearance.

Habitat: Almost entirely coastal, inhabiting sandy beaches, tidal flats, and spoil islands. Nests on dry sand or bare soil, abandoned road surfaces, and (rarely) roof tops. Usually locates nests near vegetation or debris (as does snowy plover), although more tolerant of vegetated areas.

Seasonal Occurrence: Local breeder on parts of both coasts. Population shifts southward in fall, primarily in August and September. Spring movements back north begin late February - mid-March.

Florida Distribution: In breeding season, plovers are most abundant along Gulf coast from Escambia County east to Franklin County, and Anclote Key (Pasco County) south through Keys; less so on Florida Atlantic coast (see also Conservation Status). Highest concentrations during winter are found from Tampa Bay south to Cape Sable area.

Conservation Status: Although there has been no systematic survey for breeding Wilson's plovers, the Breeding Bird Atlas project (1986 - 1992) confirmed breeding in 64 (27 percent) of approximately 237 coastal 7.5-minute quadrangles surveyed. Only 13 (5 percent) were on the east coast from Nassau County to Miami-Dade County. A statewide survey of winter shorebirds in 1993 - 1994 found an average of 282 birds at 29 of 60 sites surveyed (excluding Keys). Many breeding and wintering sites are on public lands, but recreational activity by humans and their pets, environmental pollutants, and predators are potential threats to nesting and foraging success. Coastal development and engineering activities (e.g., dredging, sediment diversion) also contribute to loss and degradation of habitat.

Protection and Management: As with other beach-dwellers, protect breeding sites through posting and fencing, public education, and predator control. Educate public to minimize disturbance by humans and pets at wintering sites.

SANDWICH TERN (*Sterna sandvicensis*)

FNAI Ranks: G5/S2
FL Status: None

Descriptions: Medium-sized, slim, crested tern with a slender black bill tipped with yellow (often lacking in juveniles). A black cap is present during breeding season; nonbreeding adults and juveniles have a white forehead and a less prominent black crest. Breeding adult has pale gray upperparts and a white rump and tail; legs and feet are black. Long, narrow wings are darker on outer primaries. White underparts with dark trailing edge to primaries.

Habitat: Coastal areas throughout Florida, including beaches, bays, estuaries, mudflats, inlets, lagoons, and dredge spoil islands. Nests are small depressions or scrapes in unvegetated sand or sand-shell substrates on barrier beaches, sandflats, and spoil islands. Commonly seen with other terns (especially royal), gulls, and skimmers.

Seasonal Occurrence: Resident along coasts, although becomes less frequent in the north during winter. Transients and overwintering migrants augment numbers, especially along Gulf coast of the central peninsula and Keys. Nests April - July.

Florida Distribution: Currently nests at only four or five sites on the Gulf coast in Franklin, Citrus, Hillsborough, and Manatee counties, with the large majority of pairs occurring at Passage Key National Wildlife Refuge. In the 1970s, nested on an island in Nassau Sound (Duval County) on the Atlantic coast. Nonbreeding and wintering sandwich terns are found along both coasts and the Keys, but are scarce in north Florida in winter. Also found at inland sites, often following storms or during migration.

Conservation Status: Recent increases in estimates of breeding population, from roughly 200 pairs in the early 1990s to approximately 500 pairs based on 2000 data. Most nesting sites are in public ownership and/or are designated as Critical Wildlife Areas. Like other coastal species, habitat destruction, pollutants, and disturbance and harassment by humans are current and potential problems at colony sites and at roosting and foraging sites. Natural threats include predators and extreme high tides during the nesting season.

Protection and Management: Colony sites are posted and monitored by Florida Fish and Wildlife Conservation Commission and Audubon of Florida. Manage for people and pets (e.g., posting and law enforcement) at some colony sites and probably at many loafing and foraging sites. Keep dredge spoil islands and causeway rights-of-way free of thick vegetation to extend use of these sites by terns.

ROYAL TERN (*Sterna maxima*)

FNAI Ranks: G5/S3
FL Status: None

Descriptions: A large tern with a long, moderately thick, orange-red bill, grayish flight feathers, white underparts, and a deeply forked tail. Adults have a black, crested cap for a short time during the breeding season. Immatures and nonbreeding adults have a white forehead and black streaked or black crest (black does not usually encompass eye).

Habitat: Coastal areas throughout Florida, including beaches, lagoons, bays, estuaries, and inlets. Occasional to common on some large inland lakes and phosphate pits in central Florida. Loafs and sleeps on sandbars, mudflats, beaches. Nests are shallow depressions scraped out in dry sand, well above high-tide levels, usually on small islands. Nests also on dredge spoil islands. Usually seen (including nesting) in association with gulls, skimmers, and other terns, especially sandwich terns.

Seasonal Occurrence: Permanent resident around coast; population augmented by northern migrants in winter. Large concentrations at breeding colonies, May – July.

Florida Distribution: Nonbreeding and wintering royal terns found along both coasts, the Keys, and inland around large lakes and rivers, and phosphate pits. At least 10 breeding colonies have been identified (1987 -1996) from Franklin, Citrus, Pinellas, Hillsborough, Manatee, and Charlotte counties on the Gulf coast and Nassau, Volusia, Brevard, and Indian River counties on the Atlantic coast.

Conservation Status: Historically more widespread than now. Possibly extirpated as a breeding species in early 1900s, until 1950s. Rough estimate of breeding population, based on reports of various colonies between 1987 and 1993, was about 5,600 pairs, and appears to be about the same in 2000. This is a possible decrease of 3,800 birds since the early 1980s. However, large fluctuations in colony size are commonly observed from year to year. Most nesting sites are in public ownership and/or are designated as Critical Wildlife Areas. Human disturbance and harassment, habitat destruction, and pollutants are current and potential problems at colony sites and roosting and foraging sites. Natural threats include predators and extreme high tides during nesting season. The large concentrations of terns at colony sites leave them vulnerable to single disasters, whether natural or manmade, which may significantly affect the total population.

Protection and Management: Most colony sites are posted and monitored by Florida Fish and Wildlife Conservation Commission and Audubon of Florida. Increased management needed for people and pets (e.g., posting and law enforcement) at some colony sites and probably at many loafing and foraging sites. Keep dredge spoil islands and causeway right-of-ways free of thick vegetation to extend use of these sites by terns.

LEAST TERN (*Sterna antillarum*)

FNAI Ranks: G4/S3
FL Status: Threatened

Descriptions: Smallest North American tern. Breeding adults light gray above, black cap and nape, white forehead, and black line running from crown through eye to base of bill. Bill yellowish-orange, often with a dark tip (black in non-breeding adults). Underparts white or grayish; tail short and deeply forked; legs and feet yellowish-orange. Outer primaries have dark edges conspicuous in flight. Immature has dark bill and black eyeline and is mottled above with more dark on upper wing.

Habitat: Coastal areas throughout Florida, including beaches, lagoons, bays, and estuaries. Increasingly use artificial nesting sites, including gravel rooftops, dredge spoil islands or other dredged material deposits, construction sites, causeways, and mining lands. Nesting areas have a substrate of well-drained sand or gravel and usually have little vegetation.

Seasonal Occurrence: Migratory. Generally begins nesting in mid-April in central and southern Florida and in May in northern Florida. Terns are gone from state November - February.

Florida Distribution: Found throughout almost all coastal Florida, including the Keys. Adoption of artificial nesting sites, particularly rooftops, has led to increased use of inland locations, mainly in Orange, Seminole, Polk, and Leon counties. Does not nest in Big Bend region of Gulf coast, which mostly consists of salt marsh. Also absent from mangrove-dominated shorelines of Monroe County.

Conservation Status: Strong indication that populations in Florida have increased since the 1970s, although unclear by how much because of varying levels of census effort. Difficult to estimate because habitat is ephemeral and nesting sites may change from year to year. More recent work in Panhandle found greater numbers of terns than in previous reports. A conservative estimate in 1996 was 10,000 birds. Many nesting sites in public ownership; some designated as Critical Wildlife Areas. Successful nesting on gravel rooftops is increasing. Nesting sites subject to human use and development, destructive storm events, and predation by birds and mammals. Rooftop nesters risk exposure to high temperatures, flooding, and high winds. Trend toward rolled plastic roofs in place of gravel could have a serious impact on availability of suitable nesting areas.

Protection and Management: Continue population monitoring to refine population estimates and trends and to track colony locations. Continue to educate building managers, emphasizing importance of gravel roofs and of not disturbing nesting birds. Keep dredge spoil islands and causeway rights-of-way free of thick vegetation to extend use of these sites by terns. Listed status prohibits disturbing or destroying birds, eggs, or nests.

MAMMAL

River Otter (*Lontra canadensis*)

FNAI Ranks: Not ranked
FL Status: Not ranked

Description: North American river otters are semi-aquatic mammals, with long, streamlined bodies, thick tapered tails, and short legs. They have wide, rounded heads, small ears, and nostrils that can be closed underwater. The vibrissae are long and thick, reflecting their importance in sensory perception. The fur is dark brown to almost black above and a lighter color ventrally. The throat and cheeks are usually a golden brown. The fur is dense and soft, effectively insulating these animals in water. The feet have claws and are completely webbed. Body length ranges from 889 to 1300 mm and tail length from 300 to 507 mm. Weight ranges from 5 to 14 kg. Males average larger than females in all measurements. Males and females do not associate except during the mating season. Males often breed with several females, probably those whose home ranges overlap with their own.

Habitat: North American river otters are found anywhere there is a permanent food supply and easy access to water. They can live in freshwater and coastal marine habitats, including rivers, lakes, marshes, swamps, and estuaries. River otters can tolerate a variety of environments, including cold and warmer latitudes and high elevations. North American river otters seem to be sensitive to pollution and disappear from areas with polluted waters. North American river otters build dens in the burrows of other mammals, in natural hollows, such as under a log, or in river banks. Dens have underwater entrances and a tunnel leading to a nest chamber that is lined with leaves, grass, moss, bark, and hair.

Seasonal Occurrence: Active year-round, with periods of low activity during colder months.

Florida Distribution: Statewide.

Conservation Status: The River Otter has been virtually eliminated through many parts of their range, especially around heavily populated areas in the midwestern and eastern United States.

Protection and Management: The southeastern populations of the River Otter appear, in the absence of real data, to be stable. However, many of the other populations outside the southeast have fallen victim to pollutant accumulation and magnification in the aquatic food chain. Conservation efforts should focus on: 1) assessing the local population status and distribution, 2) water quality and toxicity monitoring of known otter river reaches, 3) protecting, restoring, and maintaining know habitats of the River Otter, and 4) educate managers and the general public about the need for large woody debris.

PLANTS AND LICHENS

Ashe's Magnolia (*Magnolia ashei*)

FNAI Ranks: G2/S2
FL Status: S2/Endangered

Description: Small tree or large shrub, 15 - 30 feet tall, usually with several leaning, gray-barked trunks. Twigs stout with conspicuous stipule scars encircling stem and large, shield-shaped leaf scars. Leaves 1 - 2 feet long (largest simple leaves of any FL tree), alternate, deciduous, broadly oval, wider above the middle, with "eared" base; upper surface green, lower surface shaggy on young leaves and chalky-white on mature leaves. Flowers 1 foot across, fragrant, petals white with large, purple splotch. Fruit cone-like, 2 inches long, red maturing to brown, with red seeds held in small, open pockets.

Habitat: Rich upland hardwood forests of slopes, bluffs, and floodplains.

Seasonal Occurrence: Flowers in April. Multiple trunks, stout twigs, and large fallen leaves, which look like old paper bags on the ground, are distinctive in the winter.

Florida Distribution: Ashe's magnolia is endemic to the FL Panhandle.

Conservation Status: About half of the 90 occurrences of Ashe's magnolia are protected on five conservation areas.

Protection and Management: Avoid logging, clearing, or burning slope forests and floodplains.

Bog Button (*Lachnocaulon digynum*)

FNAI Ranks: G3S3
FL Status: Threatened

Description: Perennial, dense tufts of rosettes resemble moss; leaves linear, to 1 cm long and to 2.5 mm wide, yellow-green; flower stalk to 10 cm long, glabrous; inflorescence ball-like, pale brown; flower with 2 stigmas.

Habitat: Wet acid sands, peat or seepage bogs, pond margins.

Seasonal Occurrence: Flowers in spring and summer.

Florida Distribution: Known from the Big Bend area west throughout the Panhandle.

Conservation Status: Unknown or not published.

Protection and Management: Apply prescribed fire every 2 - 3 years. Avoid altering hydrology of streams and wetlands. Avoid soil disturbances such as conversion to pine plantation. Eradicate feral hogs.

Hummingbird Flower (*Macranthera flammea*)

FNAI Ranks: G3/S2
FL Status: Endangered

Description: Large, coarse, biennial herb with erect, 4-angled stems, 5 - 10 feet tall. Leaves 3 - 4 inches long, opposite, deeply lobed and toothed. Flower clusters to 2 feet long; flowers bright orange, fleshy, with a tube to 1 inch long and 5 short lobes, on curving flower stalks. Thread-like style and 4 stamens extend well beyond flower tube. Calyx with 5 narrow lobes. Fruit an oval capsule with long, persistent style. Seeds have 3 fluted wings. Plants are semi-parasitic and turn black when dried. Flowers are very attractive to hummingbirds.

Habitat: Seepage slopes, wet streamside thickets, edges of baygalls and cypress–gum ponds. Semi-parasitic on the roots of swamp black gum, bayberry, blackberry, tulip poplar, and other wetland shrubs and trees.

Seasonal Occurrence: Flowers July–September. Fruits and leaves are diagnostic throughout growing season.

Florida Distribution: Statewide.

Conservation Status: Fewer than 30 populations are known in FL, only 10 on managed areas, most in Blackwater River State Forest, Eglin Air Force Base, and Apalachicola National Forest.

Protection and Management: Apply prescribed fire every 2 - 3 years. Avoid altering hydrology of streams and wetlands. Avoid soil disturbances such as conversion to pine plantation. Eradicate feral hogs.

Large-leaved Jointweed (*Polygonella macrophylla*)

FNAI Ranks: N/A
FL Status: S2

Description: Large-leaved jointweed is a small slender shrub, has alternate, simple, obovate leaves that are 2-6 cm long and somewhat fleshy or rubbery to the touch. Its flowers are small and pinkish to bright red, and because they are borne on racemes their added effect makes them very showy during the fall.

Habitat: Found in the scrub communities of Florida's xeric uplands. This species favors open areas of sand in the sand pine/oak scrub of ridges and the low sand dunes near the coast.

Seasonal Occurrence: Blooming season - October to November.

Florida Distribution: Populations of Large-leaved Jointweed can be found in many places along the coast of the western Florida Panhandle and Alabama.

Conservation Status: Threats include habitat loss from coastal development and clearing for tree plantations.

Protection and Management: Protect dunal and interdunal areas, particularly to development and insensitive foot traffic.

Panhandle Lily (*Lilium iridollae*)

FNAI Ranks: G2/S2
FL Status: Endangered

Description: Perennial herb with stems 4 – 6 feet tall. Leaves lance-shaped, 2 - 3.5 inches long and 1 inch wide at widest point; whorled at mid-stem, alternate above and below. Flowers nodding at top of stems; petals yellowish-orange with brown spots, curved sharply backwards; stamens long and dangling, with brownish-red anthers. Flowers not fragrant. Fruit an erect, oval capsule, 1 - 1.5 inches long.

Habitat: Panhandle lily: floodplain forests, baygalls, swamps and bogs along small streams, and seepage slopes.

Seasonal Occurrence: Panhandle lily flowers late July to mid-August.

Florida Distribution: Panhandle lily is endemic to the western FL Panhandle and 2 adjacent counties in AL.

Conservation Status: Panhandle lily is known from 70 sites in FL; over half are protected on Blackwater River State Forest and Eglin Air Force Base.

Protection and Management: Protect streams from siltation during road construction and logging. Avoid logging on slope forests, and filling and draining wetlands. Avoid placing firebreaks in ecotones. Allow fire to burn into edges of streamside forests. Eradicate feral hogs.

Red Pitcherplants (*Sarracenia rubra*) **Whitetop Pitcherplants** (*Sarracenia leucophylla*)

FNAI Ranks: G3/S2 and G3/S3
FL Status: S3/Threatened

Description: Pitcherplants (*Sarracenia* spp.) are perennial herb with hollow, tubular leaves (pitchers) 1 - 2 feet tall and 1 - 2 inches across at the mouth. Pitchers clumped, erect, red or pale green with a dark red network of veins; a narrow wing runs the length of the pitcher and a small, pointed hood curves over the mouth. Flowers solitary, nodding at top of a leafless stalk 2.5 feet tall; petals 5, maroon, drooping; sepals 5, green to maroon, horizontal or turned upwards, persisting long after petals drop. Green, five-pointed style disk in the center of the flower lasts all summer.

Habitat: Openings in thickets along spring-fed streams, wet prairies, bogs.

Seasonal Occurrence: Flowers April–May. Pitchers identifiable until fall.

Florida Distribution: Known only from the western Panhandle; Escambia, Santa Rosa, Okaloosa, Holmes, and Bay Counties.

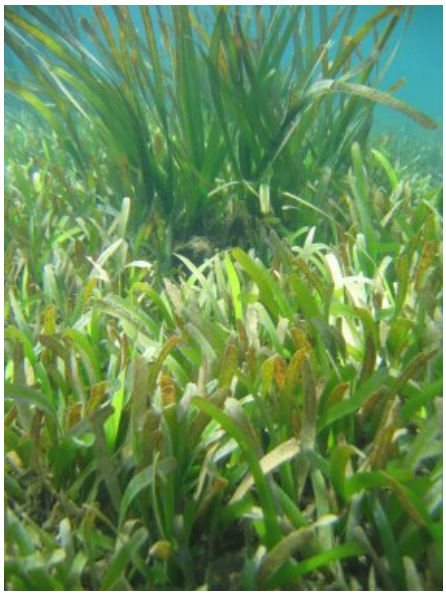
Conservation Status: Many populations are protected on Eglin AFB and Blackwater River State Forest, but inadequate/incompatible silviculture and wetland draining and filling have eliminated most habitat elsewhere.

Protection & Management: Burn wet prairies every 2 - 3 years. Allow upland fires to burn into stream thickets. Avoid soil disturbance in wetland ecotones. Prevent siltation into streams from roads and logging.

Seagrasses

Turtle-grass (*Thalassia testudinum*), **Manatee Grass** (*Syringodium filiforme*), and **Shoal Grass** (*Halodule wrightii*)

FNAI Ranks: N/A
FL Status: S1/SNR



Description: Turtle grass (*Thalassia testudinum*) is our largest seagrass species, with long strap-shaped leaves and robust rhizomes. In the marine environment extensive meadows are usually dominated by this species, in combination with manatee grass (*Syringodium filiforme*). Manatee grass can be distinguished by its cylindrical leaves which, because they are brittle and buoyant, are frequently broken off from the parent plant and dispersed widely by winds and currents. Shoal grass (*Halodule wrightii*) has flat, narrow leaves and a shallow root system. It is thought to be an early successional species in the development of seagrass beds in the Gulf and Caribbean, and is a dominant species in many estuarine environments. *Halodule* is able to survive more frequent and prolonged exposure during periods of low tide, and is often the predominant species at the shallow-water fringe of large meadows. In some areas *Halodule* also dominates the deep-water edge of many meadows and in some cases may exhibit different growth forms in the two depth zones.

Habitat: Seagrass beds.

Seasonal Occurrence: Year round, though some winter dieback may occur.

Florida Distribution: Distributed statewide. Local densities vary substantially.

Conservation Status: Seagrass beds are extremely vulnerable to human impacts. Many have been destroyed through dredging and filling activities or have been damaged by sewage outfalls and industrial wastes, as well as outboard motor-prop scarring. In these instances, the seagrass beds are either physically destroyed, or succumb as a result of decreased solar radiation resulting from increased water turbidity.

Protection and Management: Continue to post and protect existing natural areas, as well as areas that are replanted. Manage areas to preclude vessel impacts.

Spartina/Juncus Complex

Saltwater Cordgrass (*Spartina alterniflora*) and **Black Needlerush** (*Phragmites roemerianus*)

FNAI Status: N/A
Florida Status: SNR

Description: Saltwater Cordgrass (*Spartina alterniflora*) is a rhizomatous perennial grass, to four feet tall. The stems are hollow and hairless. The leaf blades are 1/4 to 3/5 inches wide. The leaves lack auricles and have ligules that consist of a fringe of hairs. The flowers are inconspicuous and are borne in greatly congested spikes, two to three inches long. Black Needlerush (*Juncus roemerianus*) is the most common plant in saltmarshes after smooth cordgrass. It has rounded, sharply pointed leaf blades all of which have their leaf-sheath attachments at the sediment surface; there is no aerial stem except for the few flowering shoots. It is a clonal plant like smooth cordgrass.

Habitat: Salt Marsh.

Seasonal Occurrence: Year round.

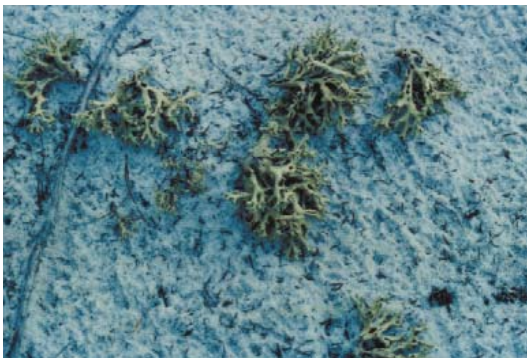
Florida Distribution: Statewide.

Conservation Status: Poor and declining. According to the best available information, approximately 442,577 acres of Spartina/Juncus habitat remains in Florida. Most of the habitat for this group is in existing conservation or managed areas and a small portion in private lands.

Protection and Management: Habitat destruction and habitat fragmentation are the greatest threat to this group. Protection of this group and its habitat is critical. Prevent all sources of pollution and altering the water regime.

Perforated Reindeer Lichen (*Cladonia perforate*)

FNAI Ranks: G1/S1
FL Status: S1



Description: Terrestrial lichen in tufts 0.8 - 2.5 inches tall, consisting of densely forking branches. Branches up to 0.24 inch wide, hollow, smooth, glossy, pale yellowish-gray, and intricately forked with large, conspicuous holes below each branching point.

Habitat: Rosemary scrub on FL Panhandle coasts, Lake Wales Ridge, and Atlantic Coastal Ridge.

Seasonal Occurrence: All year.

Florida Distribution: Endemic to Florida.

Conservation Status: Fewer than 30 populations are known, about half on conservation lands. Perforate reindeer lichen populations in the Panhandle were severely impacted by recent hurricanes. Privately owned sites are subject to clearing and conversion.

Protection and Management: Purchase and protect privately owned populations. Avoid frequent or catastrophic fires; manage scrub fires to create a mosaic of microhabitats. Monitor re-colonization after fire. Limit foot and vehicle traffic in scrub.