Database on the Status, Distribution, and Biology of Florida's Rare Invertebrates

A Florida's Wildlife Legacy Initiative Project

Final Report

TRACKING INFORMATION

Project Number	05034
Project Title	Database on the Status, Distribution, and Biology of Florida's Rare Invertebrates
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Dates Covered	1 July 2005– 30 May 2008
Date Submitted	30 May 2008

ABSTRACT

The goal of this multi-year project was to expand and enhance informational databases that the Florida Natural Areas Inventory (FNAI) maintains to describe and track invertebrates of conservation concern in the state. Data contained in these databases are directly available to state agencies, with summary data available to the public via the Internet (both through FNAI's web site and NatureServe Explorer).

Since project inception, FNAI instigated tracking of more than 200 taxa, nearly doubling its prior list of tracked taxa developed during more than 2 decades of previous work. Newly tracked taxa represented the following groups (and numbers): snails (12), spiders (2), amphipods (1), crayfish (2), springtails (2), mayflies (1), dragonflies and damselflies (5), grasshoppers (14), stoneflies (11), beetles (56), scorpionflies (1), caddisflies (24), butterflies and moths (71), bees (1), and velvet ants (3). Most of these taxa are endemic to Florida or the Southeast. We collated and entered information pertaining to rarity and endangerment for all of the new taxa as well as most of the 279 previously tracked taxa. This allowed us to rank the taxa as far as rarity or endangerment using natural heritage system methodology.

The project also allowed us to enhance our databases by the addition of nearly 1300 new element occurrence records for over 200 taxa, more than1500 new county-of-occurrence records (maps available on-line at www.fnai.org), and over documented references. To gather this information, we collaborated with numerous experts and land managers from 30 private, state, and federal agencies, organizations, and academic institutions. Besides extracting data from pre-existing sources, we documented many new occurrences via field work. Highlights included numerous new county records and 2 new state records; re-documentation of the Torreya Pygmy Grasshopper, last recorded in the 1940's; identification of the only known protected population of the Pygmy Anomala Scarab beetle; and acquisition of much-needed recent and specific distributional and biological information for a large diversity of other tracked taxa.

The ability to apply meaningful conservation ranks to invertebrates has long been hindered by lack of knowledge. Recent and specific data are not available for most rare invertebrates. The extensive data produced and consolidated by this project can now be viewed in conjunction with other FNAI data layers for habitats, other rare species, and conservation lands. This is already proving to be invaluable in assessing invertebrate conservation needs. We recommend continued collation of all available information into a centralized database, and we strongly encourage the gathering of new data through statewide field surveys. Resulting data should be disseminated to land managers, so that known populations can be considered within their management frameworks, as well as to agencies and organizations that may be able to secure protection for suitable habitats for taxa that do not currently occur on Florida's conservation lands.

ACKNOWLEDGEMENTS

Principal support for the project was provided by the Florida Fish and Wildlife Conservation Commission's (FWC) Florida's Wildlife Legacy Initiative program, and the U.S. Fish and Wildlife Service's State Wildlife Grants program (grant 05034). Matching support was provided by Florida State University and the Florida Natural Areas Inventory. David Cook (FWC) provided additional support in terms of both equipment and personnel. Brian Branciforte and Kate Haley assisted greatly with grant processing and coordination.

We are indebted to many dozens of researchers and field biologist who provided data and consultation. These include John Capinera (University of Florida, UF), Nicole Capuano (NatureServe), Paul Choate (UF), Jay Cordeiro (NatureServe), Jerrell Daigle (Dragonfly Society of the Americas), Lloyd Davis, Mark Deyrup (Archbold Biological Station), James Dunford (UF), G.B. Edwards (Florida State Collection of Arthropods, FSCA), John Epler, Michael Floyd (U.S. Fish and Wildlife Service, USFWS), Dick Franz (Florida Museum of Natural History), Jason Froeba (UF), Phillip Harpootlian (Clemson University), Karen Herrington (USFWS), Joshua King (Florida State University, FSU), C. Barry Knisley (Randolph-Macon College), Hugo Kons (American Entomological Institute), Samuel Marshall (Northwestern State University), D. Bruce Means (Coastal Plains Institute and Land Conservancy), Marc Minno (St. Johns River Water Management District), Paul Moler (Florida Fish and Wildlife Conservation Commission), Tom Morris (Karst Environmental Services, Inc.), Stewart Peck (Carleton University, Canada), Andrew Rasmussen (Florida A&M University), Dale Schweitzer (NatureServe),

Paul Skelley (FSCA), Jeffrey Slotten, Warren Steiner (Smithsonian Institution), Michael Thomas (FSCA), Walter Tschinkel (FSU), David Wagner (University of Connecticut), and Thomas Walker (UF).

The following persons kindly granted permission to collect invertebrates from lands under their supervision or otherwise greatly facilitated our field survey work: Rebecca Brown (Chinsegut Wildlife and Environmental Area, CWEA), Suzie Buzzo (Tallahassee Museum of History and Natural Science, TM), Jim Cox (Tall Timbers Research Station, TTRS), Kelli Flournoy (formerly with The Nature Conservancy, TNC), Kaye Gainey (TTRS), Dennis Hardin (Division of Forestry), Mike Jones (Tallahassee Museum), Michael Keys (Saint Mark's National Wildlife Refuge), Bryan Kreiter (Apalachicola Bluffs and Ravines Preserve, ABRP), Mark Ludlow (Torreya State Park), Tyler Macmillan (Northwest Florida Water Management District), Vincent Morris (Withlacoochee State Forest, WSF), Steve Morrison (Tiger Creek Preserve, TCP), Steve Oswalt (Lake Talquin State Forest), Beatriz Pace-Aldana (TCP), David Printiss (ABRP), Kevin Robertson (TTRS), Colleen Werner (WSF), and Kristin Wood (CWEA).

This project benefited immeasurably from the input of all FNAI staff, past and present, as their collective knowledge, expertise and advice were crucial to various aspects of our work. Help from Takesha Henderson, FWC assistant invertebrate zoologist, contributed a great deal to the success of the project also, especially in the realm of spiders.

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INTRODUCTION

Invertebrate species far outnumber the combined total of plant and vertebrate species in Florida, with insects alone accounting for an estimated 12,500 species (Frank and McCoy 1995), yet they have received very little conservation attention from natural resource agencies. In many cases, they live in habitats that are otherwise poorly represented by rare species (e.g., caves and spring-run streams) and which therefore may receive inadequate conservation attention. Because of degradation to their habitats and their localized distributions, hundreds of Florida's invertebrates may be imperiled (Deyrup and Franz 1994, Stein et. al. 2000). Further, many aquatic groups (e.g., mussels, crayfish, mayflies, caddisflies) serve as potential indicators of environmental degradation (Richter et al. 1997). Invertebrates also provide other vital services—including pollination, dung burial, pest control, and contributions to recreation such as fishing and hunting via their roles in food webs—and for insects alone the annual economic value of these services for the U.S. has been estimated at $57 billion (Losey and Vaughan 2006).

Efforts to protect and manage Florida's wildlife, including its rare invertebrate fauna, require comprehensive, current information about the taxonomy, status, distribution, and biology of all target taxa. Currently, such data for the state's rare invertebrates are widely scattered and not readily accessible. The major goal of the present project is to incorporate such data into a single, readily accessible, and spatially retrievable database that will greatly facilitate all programs that evaluate and implement wildlife conservation activities in the state. In conjunction, we gathered recent and specific data, which are

unavailable anywhere for some taxa, using *de novo* field surveys. This information is crucial in evaluating the conservation status of potentially rare species and to facilitate the identification of additional sites in which they may occur.

Our work builds upon that of countless researchers who have collected rare invertebrate information and begun evaluating conservation threats and needs, although we are not aware of any researchers who have gone about collating Florida invertebrate information in the same way that we have. A major impetus to our work was two volumes published in the late 20th century (Franz, 1982; Deyrup and Franz, 1994), drafted by biologists who comprised the Special Committee on Invertebrates of the Florida Committee on Rare and Endangered Plants and Animals (FCREPA). Extensive data have accumulated since their publication, and advances in technology now allow such data to be stored, accessed, and manipulated in ways that no paper volumes can match.

METHODS

The project followed the highly successful approach to data management developed and refined over three decades by the State Natural Heritage Program system (which includes the Florida Natural Areas Inventory [FNAI] and is now overseen by NatureServe, an umbrella organization for Natural Heritage Programs and Conservation Data Centers). Data were obtained from knowledgeable experts, published and gray literature, museum specimens, and field surveys, then entered into Biotics Tracker (Windows-based textual information system) and Biotics Mapper (ArcView-based GIS mapping system) databases. FNAI's Geographic Information System, which also

contains the state's most comprehensive coverage for managed areas (conservation lands) and land protection proposals, allows the user to view and manipulate rare taxa occurrence data for a multitude of evaluation and production purposes to assist conservation and management efforts.

Integral to such work is the development and continued enhancement of a list of "tracked" species that are potentially of conservation concern. This list is comprised of taxa that appear to be declining or rare, although some taxa may be more common than presently available information suggests. Some species on the tracking list are not in any immediate danger of extinction but may be on the list because they require upland habitats that are being rapidly developed, aquatic habitats that are especially sensitive to pollution or other aspects of their biology may make them vulnerable in the future.

Data pertaining to the rarity or endangerment of tracked taxa were entered into Global and State Element Tracking and Element Ranking forms (an Element is a biological entity such as a species or subspecies). Evaluation of data entered into these forms allowed assignment of Global (G#) and State (S#) Element Ranks that reflect an element's perceived degree of rarity or endangerment (e.g., G3/S1, a species very rare or threatened in Florida but of only moderate range-wide conservation concern; ranks range from 1 = rarest or most endangered, to 5 = common and secure). Taxa which appeared to be rare, but for which distributional and biological information may be far from complete, were given range ranks to reflect lack of knowledge. For example, a taxon that has not been the subject of intensive field surveys and which is known only from two sites in widely separated counties might be assigned a State Element Rank of S1S2. This

reflects the possibility that the taxon only occurs at the two known sites, but that it is equally possible that it occurs in intervening areas.

Site-specific data about the occurrences of tracked species were incorporated into FNAI's Element Occurrence Record database, which ties geographically specific information into the map-based GIS. The resulting database can be used to produce a variety of maps and other data products as needed for conservation or other purposes.

In conjunction with processing data in standard Natural Heritage Program network format, we also updated the FNAI web site (www.fnai.org) so that 1) almost all tracked invertebrates are represented by statewide maps showing counties of occurrence, and 2) searches for elements inhabiting specific counties will include all tracked invertebrates. Staff also compiled computerized and manual libraries of sources of information from which data were extracted. These references include communications from experts, published and gray literature, field report forms, GIS shapefiles, and other sources. To supplement existing data, we actively sought certain species during field surveys to gather recent and specific data, especially distribution and habitat needs.

Products include the computerized and GIS-mapped documentation of data (and its evaluation) about the statewide and/or global conservation status and needs, biology, habitat requirements, and site-specific occurrences of species on the greatly expanded tracking list. All data will soon be available in a variety of computerized and map-based formats via Geographic Information System (GIS) technology and much of it will be available online. FNAI's ArcView-based GIS includes many conservation data layers (e.g., public lands and proposed land protection projects) that can be viewed and

evaluated in conjunction with the resulting invertebrate occurrence database to help direct the state‘s invertebrate conservation programs.

RESULTS

Major Database Goals

All project goals have been exceeded or are well on their way to being exceeded (see Table 1). Major accomplishments include the addition of more than 200 taxa to FNAI's pre-existing invertebrate tracking list (see Appendix B), nearly 1300 new element occurrence records for over 200 taxa, and in excess of 1500 new county records that now appear in the online county-of-distribution maps. Nearly all of the existing and new taxa were ranked or re-ranked concerning rarity or degree of rarity or endangerment within the state. We documented over 200 references; this underestimates our actual work, however, as some references are compilations of separate references that were entered as one record for efficiency, and some pre-existing references were acquired or their database records expanded or edited. Appendix A provides a list of all newly entered references except those for which the citation contains sensitive information. FNAI now possesses, or otherwise has access to, nearly all of the listed references. Table 1 summarizes progress for all of the project's major database goal categories.

Table 1. Progress toward meeting major database goals through 30 May 2008. (Totals include deletions and subsumations, so the new total may not be equal to the sum of the first two.)

Goal Category	Pre-project Total	Added	Present Total
Tracked Elements	280	206	479
Global Ranking Forms	244	123	367
State Ranking Forms	95	355	452
Element Occurrence Records	599	1276	1865
County-of-Occurrence Distribution Maps	100	338	438
County Records	264	1697	1961
References	747	206	953

Taxonomically Focused Work

Various taxa.—We visited the Florida State Collection of Arthropods to gather specimen label data and other information. Element occurrence and other information were collected for approximately 50 invertebrate taxa, including beetles, grasshoppers, and spiders. Important taxonomic and other information was also obtained by talking to experts and obtaining publications, some of which will make major changes in the ranking of certain species.

We also began collating habitat and phenological data for entry into fields in the database. We had entered some of this information into text fields, but had not made a major effort to collate all data of this type and systematically enter them. Once the

available information is all entered, we will be able to predict where species may occur to aid in future survey work and refining rarity rankings. We will also also be able to identify which species are most in need of research into these aspects of their biologies.

Corals (Cnidaria: Anthozoa).—Two Florida species tracked by FNAI were recently federally listed as Threatened by NOAA/NMFS; a third may be of hybrid origin. FNAI has updated its databases to reflect these changes.

Mussels (Mollusca: Bivalvia).—We initiated an effort to update and expand our database for this important group of freshwater invertebrates during spring of 2008. Initial work is focusing on improving representation of element occurrences as polygons encompassing inhabited portions of rivers. Several currently untracked species are under review for addition to the FNAI tracking list.

Snails and Allies (Mollusca: Gastropoda).—We obtained and processed element occurrence records for 14 species of snails from the Florida Museum of Natural History (FLMNH) database and others from other sources. We also added 12 snail species, both terrestrial and aquatic, to our tracking list.

Dr. Fred Thompson, Curator of Non-marine Malacology at the FLMNH, related that one species of snail, the squaremouth Amnicola snail (*Amnicola rhombostoma*), may have become extinct since the last known record of it in 1981. In 2003, Dr. Thompson intensively surveyed every locality at which he had previously collected this species, as well as other suitable areas, and did not find a single specimen. Dr. Marc Minno and Dean Dobberfuhl, with the St. Johns River Water Management District, confirmed that biologists in their organization had not documented this species in any mainstream or tributary sampling from 2002-2007. This species had been known from "…small sand-

bottomed streams and rivers draining into the west side of the St. Johns River in Clay and Putnam Counties…" (Thompson 1968). Dr. Thompson believes that it may be extinct, possibly due to water pollution (F. Thompson, pers. comm.).

Amphipods, Isopods and Decapods (Crustacea: Malacostraca).—A major focus was the entry of cavernicolous invertebrate data generated in 2003 by Tom Morris from a series of cave dives in the Choctawhatchee (Holmes Creek, Washington Co.) and Chipola (Jackson Co.) river drainages. This entailed the addition of a new (undescribed) species of amphipod (*Stygobromus* sp.) to the tracking list, as well as the transcription and revision of occurrences of several tracked species (crayfish and isopods but also the blind salamander) and natural communities (aquatic and terrestrial caves) (note: only the processing of invertebrate data was charged to this project). Additionally, we initiated tracking of two surface-dwelling species of crayfish from western Florida: the cypress crayfish (*Cambarellus blacki*) and the rusty gravedigger (*Cambarus miltus*).

Spiders (Arachnida: Araneae).—With help from an assistant invertebrate zoologist, Takesha Henderson, provided by David Cook (FWC Invertebrate Taxa Coordinator), we initiated FNAI's first major effort to secure and process data for spiders. This included processing a large backlog of data for two species of purse-web spiders (*Sphodros* spp.) as well as performing literature searches to obtain occurrence and other information about other species, including some untracked species under consideration for addition to our tracking list.

In conjunction with our work with other cavernicolous invertebrates, we added two cave-associated species of spiders, the Marianna Cave sheetweb weaver spider (*Islandiana* sp. 2) and a sheetweaver spider (*Centromerus latidens*). These species are

only known in Florida from caves in Jackson County. We also evaluated wolf spiders of the genera *Geolycosa* and *Arctosa* and will soon begin tracking of at least two species.

Springtails (Insecta: Collembola).—This project allowed us to address this poorly known group of small jumping insects for the first time. *Pseudosinella pecki* is a cave-inhabiting species first discovered in 1965 in Florida Caverns State Park. Although the habitat is still present, current data about the species' occurrence are non-existent. In January 2008, FNAI staff met with the original discoverer, Dr. Stewart Peck (Carleton University, Canada), to discuss the original discovery and potential to resurvey for the species.

We also began tracking the Florida Sminthurus springtail (*Sminthurus floridanus*), which in Florida is known only from Eglin Air Force Base and the Apalachicola National Forest, It has only been found in quality longleaf pine and wiregrass habitats.

Dragonflies and Damselflies (Insecta: Odonata).—As part of this project, FNAI convened a meeting with odonate expert Jerrell Daigle (Florida Department of Environmental Protection, retired) to evaluate the list of odonates tracked by FNAI. As a direct result, we initiated tracking of an additional 5 species. Daigle's input also led us to edit state ranking forms for all tracked odonates and to revise the state ranks of 15 previously tracked taxa.

In early 2007, Daigle provided FNAI with 13 field report forms documenting the known (or last known) locations for the 13 rarest Florida odonate species. We have also received an additional 9 field report forms from Ed Keppner documenting other tracked odonate locations in the Florida Panhandle. We have begun processing occurrences from these data sets and will complete the task in months ahead.

Stoneflies (Insecta: Plecoptera).—The project enabled us to research this generally stream-inhabiting order of insects, that are very important related to water quality. Based on Rasmussen *et al.* (2003) and advice from its primary author (Dr. Andrew Rasmussen, Florida A&M University), we added 11 species of stoneflies to the FNAI tracking list. All 11 species were assigned FNAI rarity rankings of S1 or S2. At least one of them, the southeastern roachfly (*Tallaperla cornelia*), appears to be declining in Florida in conjunction with changes in water quality. Rasmussen kindly shared his aquatic invertebrate database with us, which yielded 63 element occurrence records for this group.

Beetles (Insecta: Coleoptera).—The project led to the addition of 56 species of beetles to our tracking list, with many more species still under review. Provision of an assistant invertebrate zoologist by D. Cook (FWC) allowed us to process numerous beetle occurrences from Deyrup and Franz (1994).

Dr. Paul Choate, a University of Florida tiger beetle expert who described the highlands tiger beetle (*Cicindela highlandensis*), a candidate for federal listing, assisted our evaluation of the state's tiger beetle fauna. This resulted in the addition of 8 species to the FNAI tracking list. Choate (2003) stated that one of these species, the hairy-necked tiger beetle (*C. hirticollis*), "…appears to be almost extinct in Florida."

Since the time when FNAI initially processed occurrence data for the highlands tiger beetle, extensive new data have accrued. This project allowed us to collate and analyze this information, which includes a report from the U.S. Fish and Wildlife Service (USFWS 2007), in which the agency reaffirmed this endemic species as a candidate for federal listing in 2007; a recent report (Knisley 2005) by Barry Knisley (Randolph-

Macon College, Virginia); and personal communications from Knisley, his staff, and Paul Choate, who described the species in 1984.

Analyses of the collated information suggest some interesting conclusions. Although Knisley (2005) lists approximated 40 "sites" as having extant populations, many of the sites are in close proximity to each other, in several cases separated only by a road. Using our methodology for delineating element occurrences, there are 5 occurrences for this species. Some sites believed to be destined for development were found, by using FNAI's up-to-date managed areas database, to occur on protected lands. We will inform managers of these lands soon.

A crucial factor in the evaluation of what constitutes a population of a species is the amount of gene flow across a given distance or potential barriers; this can be inferred from knowledge of its dispersal capabilities. While there is some evidence that the highlands tiger beetle may be a weaker flier than some congeners and does not disperse very far in the short term (Knisley and Hill 1994), there has been no study of its long-term and long-range dispersal. Depending upon its dispersal abilities, and taking into consideration the known dispersal abilities of congenerics, there could be anywhere from 2 large metapopulations to approximately 10 smaller ones.

This species has been reported to have been extirpated from its type locality at least in part by intensive collecting pressure (Knisley and Hill 1992, USFWS 2007). It appears that this erroneous statement was the result of a misconception of the extent of the type locality (B. Knisley, pers. comm.), as well as a premature declaration of its extirpation after only a 2-hour late-season survey in 1991 (Knisley and Hill 1992), as the species has been documented in 1992, 1996, and 2004 at the type locality (Knisley 2005). It does

appear that the population may have declined in that area, but this is by no means certain. If so, our interpretation of aerial photographs from 1970 and 2004 suggests that habitat degradation and loss may be more likely factors than over-collection. Part of the type locality is within the Lake Wales Ridge Wildlife Management Area, and we have already alerted the land managers and provided information pertaining to the species' habitat requirements. Using our GIS software and statewide coverages of various types, we identified at least two likely sites for *C. highlandensis* that had apparently not previously been surveyed according to Knisley and other sites in which there appears to be much unsurveyed suitable habitat.

Skelley and Kovarik (2001) stated that the southeastern pocket gopher, *Geomys pinetis* Rafinesque, is declining throughout its range and has been forced into marginal habitats in many areas where it is still extant. Based on this and discussions with Dr. Skelley, we began tracking 10 beetle species that are commensals of the pocket gopher, as a decline in the host species would result in a decline of commensals (Woodruff and Deyrup 1994). We subsequently processed, from records generously supplied by Dr. Skelley, approximately 300 element occurrence records for these and 2 other pocket gopher commensal species that were previously on our tracking list.

We began tracking 5 species of *Geopsammodius* based on information in a recent revision of the genus (Skelley, 2006) and communications with its author. These beetles, which are flightless and presumed to be blind, inhabit coastal dunes or relictual dunes that are now sand ridges. Four of the 5 species are endemic to Florida, with 3 being known from only 1 or 2 very small areas within the state. We processed all available element occurrence records of these species. Skelley (pers. comm.), also recommended

that we begin tracking *G. hydropicus*. We also formulated plans to survey for one of the rarest species, the Withlacoochee tiny sand-loving scarab (*G. withlacoochee*). This species is presently known from only 2 unprotected localities in Citrus and Hernando counties, although it may occur nearby on nearby protected land. We did not find it at Withlacoochee State Forest in April, but we have pinpointed some likely sites for future survey work.

The project also entailed initiation of tracking and processing of occurrence data for 7 species of beetles in the genus *Selonodon*. (This genus used to be in its own family, Cebrionidae, but is now considered a subfamily of Elateridae.) Males of these species fly during summer rainstorms, but females are flightless. Little else is known of their biology. Five of the species are endemic to Florida, and 4 are known from fewer than 5 localities each. Some species appear to be very restricted geographically as well as by habitat. Most available records are at least 10 years old, and some species appear not to have been documented in the state for 30 years or more.

Scorpionflies (Insecta: Mecoptera).—We added the first member of this order added to the FNAI tracking list. The earwig scorpionfly (*Merope tuber*) was officially reported for the first time from Florida in 2007 (Dunford et al. 2007). In Florida it is known only from a beech-magnolia forest at Tall Timbers Research Station in Leon County, and a ravine at the Apalachicola Bluffs and Ravines Preserve in Liberty County. While the species is somewhat more common north of Florida, it is still very rarely encountered, and its diet, life cycle, and larval stages are all unknown.

Butterflies and Moths (Insecta: Lepidoptera).—The pre-project list of only 11 FNAI-tracked butterfly taxa was clearly incomplete. Project staff developed a

preliminary list of 38 butterfly taxa for possible addition to the FNAI tracking list. This list was circulated among the following Florida butterfly experts: Drs. Jaret Daniels and Akers Pence, McGuire Center for Lepidoptera and Biodiversity; John Calhoun, Conservation Committee of the Lepidopterists' Society; Dr. Marc Minno, author of several books on Florida butterflies and caterpillars; and several prominent and active North American Butterfly Association (NABA) members in Florida (Linda and Buck Cooper, Marc Salvato, Lyn and Brooks Atherton, and Mary Ann Friedman). Their input and recommendations were synthesized into the list of FNAI-tracked butterfly species, which as a result now includes 75 taxa. We spent considerable time populating various aspects of the FNAI database with information about the newly tracked taxa, and this effort continues.

We also received records of the field observations of Linda and Buck Cooper for 27 FNAI-tracked butterflies. Because FNAI has only just begun to process their data, it is premature to estimate the number of element occurrence records that this valuable data set will generate. However, many of the 26 butterfly element occurrence records that were begun during this period stem from the Cooper's data.

FNAI has also received, from the U.S. Fish and Wildlife Service's Vero Beach office, a CD-ROM containing the results of the North American Butterfly Association's project to survey for rare southeastern Florida butterflies. We will evaluate these data and incorporate them into the database over the next few months. The data are only provided at the quadrangle level of locational precision, so FNAI may, in some cases, already have more precise data.

FNAI staff also reviewed NatureServe global rankings of several species of butterflies in addition to revising the state ranks of 3 (*Electrostrymon angelia* from S1? to S4, *Kricogonia lyside* from S1 to SA, and *Phocides pigmalion* from S2S4 to S3S4).

Caddisflies (Insecta: Trichoptera).—Based on and information from Dr. Andrew Rasmussen (FAMU) and other sources, FNAI began tracking an additional 24 species of caddisflies. Some of these species are known only from Eglin Air Force Base. Rasmussen generously provided a dataset of more than 500 caddisfly locality records for 43 species; these yielded approximately 240 new element occurrence records. We will use these data in a future reevaluation of FNAI rarity ranks for the group.

Field Work

We identified some sites for survey work to search for tracked or apparently rare invertebrates by using FNAI's comprehensive and statewide conservation lands coverage in conjunction with occurrence data for habitats and species. We surveyed, or obtained permission to survey, at The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve, Avalon Plantation, Chinsegut Nature Center and Wildlife and Environmental Area, Eleanor Klapp-Phipps Park, Lake Talquin State Forest, St. Marks National Wildlife Refuge, The Nature Conservancy's Tiger Creek Preserve, Tall Timbers Research Station, and Withlacoochee State Forest. The invertebrate team made brief trips to other sites, and other FNAI staff documented interesting species from still other areas by collecting specimens for identification. Two new state records, many new county records, and other

valuable data were obtained from the *de novo* fieldwork. Highlights follow, and appendix C summarizes the most important findings from this fieldwork.

The Torreya pygmy grasshopper (*Tettigidea empedonepia*) is a G1S1 species that is known from only one ravine in Florida and two localities in Alabama, and we could find no Florida specimens or records for this species more recent than the 1940s. There was some confusion as to the precise location of the type locality, "Camp Torreya Ravine," but by collaborating with Wilson Baker, Leigh Brooks (The Nature Conservancy's Northwest Florida Program) and D. Bruce Means (Coastal Plains Institute and Land Conservancy) and using our GIS software, we definitively determined the site to be Long Branch ravine in Liberty County. Fieldwork by DA successfully obtained one specimen at this site, which is protected within the ABRP.

During another survey at the ABRP, DA discovered a predaceous diving beetle, *Dytiscus carolinus*, while surveying with a blacklight. This large and distinctive species had been recorded from southern Georgia, but this constitutes a n**ew state record** for the species. John Epler, author of the 1996 Identification Manual for the Water Beetles of Florida, confirmed the identity. It is now on our list of species to evaluate further.

Several interesting finds were also made at Tiger Creek Preserve, which was targeted as a likely site for the pygmy Anomala scarab beetle (*Anomala exigua*) based on proximity and similar habitat type to previous occurrences of this species. During a collaborative field survey with Dr. Paul Skelley (Florida State Collection of Arthropods, we documented this species on the only protected property that it is known from. Dr. Skelley had co-authored a paper with Roy Morris on the rediscovery of this beetle (2001) at privately-owned sites that were subsequently either developed or in the process of

being developed. Two other beetle species that were known only from Archbold Biological Station in Highlands County, a comb-clawed beetle (*Onychomira floridensis*) and the Archbold cebrionid beetle (*Selonodon archboldi*), were found and have been added to the FNAI tracking list. A viable population of the Highlands tiger beetle (*Cicindela highlandensis*), which has been proposed for protection under the U.S. Endangered Species Act, was also documented.

Gopher tortoise commensals (beetles) were collected by DA and DRJ in Gadsden, Jefferson, Lafayette, Polk, and Wakulla counties. Most of these records proved to be new county records. Besides coordinating with tortoise relocation efforts and looking for beetles in the burrows, we tested a trap designed to capture most of the commensal beetles without disturbing the tortoises or their burrows; preliminary results were good.

We discovered or re-documented, as well as obtained new biological information for, populations of all three species of M*ycotrupes* beetles tracked by FNAI. The larvae of two species are undescribed, and little is known of their biologies. Kyle Beucke, a Ph.D. student who is researching these species at University of Florida, is attempting to rear the species, and we have been collaborating with him to gather information.

Aubrey Davis collected beetle specimens found during a herpetological survey of Andrews Wildlife Management Area (Levy County); DA confirmed their identity as the north peninsular Mycotrupes beetle (*M. gaigei*), a G2G3 species. Although this species was known to occur in Levy County, this was a new site and a new habitat. Previously the species had been known only from scrub and sandhill habitats (Woodruff and Deyrup 1994), whereas these specimens were found in a closed-canopy xeric hammock.

The southwest Florida Mycotrupes beetle (*M. pedester*) is known from very few localities on deep sand ridges in Charlotte, De Soto, and Lee counties. No populations of this species have been documented on protected lands; in fact, we knew of only one recently documented population, and that is on land that is likely to be developed. However, in early December 2007, an FNAI field biologist, Jim Surdick, collected a specimen, identified by DA, in a pitfall trap set at Babcock Ranch in Lee County.

We also obtained new records as well as habitat and other biological data for three populations of Cartwright's Mycotrupes beetle (*M. cartwrighti*), which has only definitely been recorded from a few sites in the Red Hills region. These populations were found partly by using soils coverage, habitat information, and GIS software to extrapolate probable sites and by conferring with Ann Johnson, FNAI community ecologist, and Wilson Baker. This species was usually found associated with red oak woods, aka pine oak hickory forest, which at least partly accounts for its rarity. The food of this species had been a mystery, but based on two collections by DA, deer dung may constitute a significant part of its diet. The population at TTRS, which had been known about for many years, appears to be the largest and best population.

Although the floodplain Phanaeus scarab beetle (*Phanaeus triangularis*) is not particularly rare outside of Florida, within the state it is only known from ravines along the Apalachicola River south to Bristol, where its range and habitat overlap those of the endangered Florida Torreya tree. Although this species was apparently very common in the ravines in 1977, when Lloyd Davis, Jr. first found it in Florida (Davis 1980), DA did not find a single specimen during repeated surveys in 2007 at ABRP and TSP. Whether

the species has been extirpated from the ravines or was not found for some other reason is uncertain.

Paul Skelley alerted DA to the rarity of some dung beetles, primarily *Aphodius* species, which specialize on deer dung in winter. One of them, *A. windsori*, is known only from 2 localities: one in South Carolina, and the other at Tall Timbers Research Station (TTRS), in Leon County, Florida; further, the males were unknown. Two other species on the FNAI tracking list also utilize deer dung. During a survey at TTRS, Skelley and DA, along with M. J. Paulsen, re-documented *A. windsori*, collected the undescribed males for the first time, and documented a **new state record** for *A. lodingi*. The latter species was only known from one locality each in South Carolina, Alabama, and Georgia. Whether these species merit conservation attention is uncertain at this time, as it is possible that use of appropriate survey techniques will reveal them to be more common than is currently known. Until we can ascertain this, we will retain them on our list of species to evaluate further.

New occurrences of several taxa of butterflies were documented by DKJ in various parts of the state. Highlights include new county records for the frosted elfin (*Callophrys irus*) in Liberty County and Franklin County, previously known only from Clay County and Nassau County, a new county record for Sweadner's juniper hairstreak (*Callophrys gryneus sweadneri*) in Jefferson County and the second documented Florida record of the coral hairstreak (*Satyrium titus*) since 2002 in Wakulla County.

DISCUSSION

FNAI's network of resources, including staff experts as well as a variety of technological tools that provide easy access to statewide information about soils, habitats, conservation lands, and species, proved to be invaluable to the success of this project. Our geographically precise database of site-specific element occurrence records allows land managers statewide to gain access to information about rare and endangered invertebrates that might occur on their lands but which heretofore was nearly inaccessible to them. This available dataset continues to expand every day that the project continues. Further, the ability to examine multiple spatially oriented data layers such as habitat, vegetation, soil type, and tracked species occurrences greatly facilitated the identification of additional sites that proved fruitful to survey for tracked and apparently rare taxa. We were able to identify potential locations to survey based on a taxon's habitat, host plant, or preferred soil types. Conversely, we could examine known sites of occurrence for these attributes when a taxon's requirements were unknown, then utilize this information to search for similar sites.

One of the major obstacles to evaluating taxa for conservation attention was lack of information. Although we overcame this for some species by conducting in-depth literature searches often supplemented by direct correspondence with experts, for many species there is insufficient, and sometimes no, recent and specific distributional and biological information available to evaluate taxa confidently. This underscores the critical need to continue exactly the sorts of field surveys and research described earlier in this report. For some species, we will be unable to process any definitive element occurrence records until such research is done.

As an example, the *Selonodon* species that we added to our tracking list appear to be uncommon at best to extremely rare based on available information. Unfortunately, all records are at least 10 years old, and some species have not been documented in the state for at least 30 years. The case is the same for many other taxonomic groups, for which there are no available distributional and biological data post-dating 1994, and often the latest records are far more than 15 years old. In such a rapidly changing state as Florida, drastic declines can happen during such periods, as evidenced by the squaremouth Amnicola snail apparently becoming extinct during the last 20 years.

Beetles provide a further dramatic example. Approximately 550 beetle taxa are endemic to Florida and many beetle species have been recorded from three or less counties (Peck and Thomas 1998). While "endemic" does not necessarily equate to "rare," and it is likely that the ranges of many of these species are incompletely known, surely some of them merit conservation attention. However, it is presently impossible to evaluate their conservation statuses and needs with any confidence.

Surveys by FNAI staff and collaborators turned out to be a surprisingly important part of the project, as evidenced by the results highlighted above. Originally this was to comprise a very small facet of the project but, although surveys were relatively limited and sporadic, they became the most effective method of obtaining recent and specific distributional and biological data for many of our tracked elements. Such surveys must continue and expand.

Although a wealth of data were obtained and processed during this project, there is much more to be done. There remains a vast storehouse of knowledge to be discovered and collated, both for species currently tracked by FNAI and for the many potential

candidates for tracking. The ability to evaluate the statuses and needs of all species rests upon having a solid, comprehensive, and readily accessible database of information. It is the development of such a database that this project has facilitated, and for which continued support in the future is so vital.

RECOMMENDATIONS

Successful conservation of Florida's wildlife, including its unique and diverse invertebrate fauna, requires that biologists address the many gaps in knowledge that continue to exist. With invertebrates specifically in mind, we recommend the following actions.

1. Continue to collate all available distributional and biological data on declining, definitely rare, and apparently rare invertebrates, including from sources such as published and gray literature, experts, and museum labels.

2. Encourage and support invertebrate surveys, both general and specific, throughout the state to gain recent and specific distributional and biological data. This should include surveys by as many entities and biologists, both amateur and professional, as possible, as it is not feasible for any one entity to comprehensively survey the state for rare invertebrates. The collection of voucher specimens should be encouraged, as sight records are not generally reliable for most invertebrates, except for some Lepidoptera, and taxonomic changes may make even reliable records useless in the future without voucher specimens.

3. Monitor known populations of invertebrates of conservation concern on a regular basis so that declines or extirpations can be documented in a timely manner, and hopefully reversed or prevented, respectively.

4. Inform land managers about populations of rare invertebrates on their lands so that they are included in their management plans and monitored in the future.

5. Evaluate all invertebrate species considered to be rare or of conservation concern to assure that one or more viable populations are adequately protected (not only by securing the lands but also by managing them appropriately). For species that appear to be inadequately protected by conservation lands, identify specific tracts that support populations and call them to the attention of agencies that may be able to secure their protection.

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Appendix B: FNAI tracking list of rare invertebrates as of 30 May 2008. Species and subspecies in bold were added since 30 June 2005.

TAXON OR TAXONOMIC GROUP	COMMON NAME OR GROUP	G RANK	S RANK	FEDERAL	STATE	ENDEMIC
PORIFERA	**SPONGES**					
Dosilia palmeri	Oklawaha sponge	G1G3	S1S3	N	N	N
Ephydatia subtilis	Kissimmee sponge	GH	SH	N	N	Y
ANTHOZOA	**CORALS**					
Acropora cervicornis	staghorn coral	G3	S1	LT	N	N
Acropora palmata	elkhorn coral	G3	S1	LT	N	N
Acropora prolifera	fused staghorn coral	G3	S1	N	N	N
Agaricia agaricites	lettuce coral	G4	S2	N	N	N
Colpophyllia natans	large grooved brain coral	G3G4	S2	N	N	N
Dendrogyra cylindrus	pillar coral	G3	S1	N	LE	N
Diploria clivosa	knobby brain coral	G4G5	S2	N	N	N
Diploria labyrinthiformis	grooved brain coral	G4	S2	N	N	N
Diploria strigosa	symmetrical brain coral	G4	S2	N	N	N
Eusmilia fastigiata	flower coral	G3G4	S1	N	N	N
Meandrina meandrites	butterprint brain coral	G4	S2	N	N	N
Montastraea annularis	boulder star coral	G5	S2	N	N	N
Montastraea cavernosa	great star coral	G5	S2	N	N	N
Mussa angulosa	large flower coral	G3G4	S1	N	N	N
Siderastrea siderea	massive starlet coral	G4	S2	N	N	N
BIVALVIA	**CLAMS AND MUSSELS**					

Alasmidonta undulata	triangle floater	G4	S1	N	N	N
Alasmidonta wrightiana	Ochlockonee arc-mussel	GH	SH	N	N	Y
Amblema neislerii	fat threeridge	G1	S1	LE	N	N
Amblema plicata	threeridge	G5	SH	N	N	N
Anodonta heardi	Apalachicola floater	G1G2	S1	N	N	N
Anodonta suborbiculata	flat floater	G5	S1S2	N	N	N
Anodontoides radiatus	rayed creekshell	G3	SH	N	N	N
Elliptio arctata	delicate spike	G2G3Q	S2	N	N	N
Elliptio buckleyi	Florida shiny spike	G5	SNR	N	N	Y
Elliptio chipolaensis	Chipola slabshell	G1	S1	LT	N	N
Elliptio mcmichaeli	fluted elephant-ear	G3	S1S2	N	N	N
Elliptoideus sloatianus	purple bankclimber	G2	S1S2	LT	N	N
Fusconaia apalachicola	Apalachicola ebonyshell	GX	SX	N	N	N
Fusconaia escambia	narrow pigtoe	G2	S1S2	C	N	N
Fusconaia rotulata	round ebonyshell	G1	S1	C	N	N
Glebula rotundata	round pearlshell	G4G5	S3	N	N	N
Hamiota australis	southern sandshell	G2G3	SNR	C	N	N
Hamiota subangulata	shiny-rayed pocketbook	G2	S1S2	LE	N	N
Lampsilis haddletoni	Haddleton's lampsilid clam	GXQ	SX	N	N	N
Lampsilis ornata	southern pocketbook	G5	S1	N	N	N
Medionidus penicillatus	Gulf moccasinshell	G2	S1	LE	N	N
Medionidus simpsonianus	Ochlockonee moccasinshell	G1	S1	LE	N	N
Medionidus walkeri	Suwannee moccasinshell	G1	S1	N	N	Y
Megalonaias nervosa	washboard	G5	S3	N	N	N
Panopea bitruncata	Atlantic geoduck	G3?	S3?	N	N	?
Plectomerus dombeyanus	bankclimber	G5	SH	N	N	N
Pleurobema pyriforme	oval pigtoe	G2	S1S2	LE	N	N
Pleurobema strodeanum	fuzzy pigtoe	G2G3	S2	C	N	N

Ptychobranchus jonesi	southern kidneyshell	G1	SH	C	N	N
Quincuncina burkei	tapered pigtoe	G2G3	S2	C	N	N
Strophitus subvexus	southern creekmussel	G3	S1S2	N	N	N
Uniomerus declivis	tapered pondhorn	G5Q	SU	N	N	N
Utterbackia peggyae	Florida floater	G3	S3	N	N	N
Utterbackia peninsularis	peninsular floater	G3	S2	N	N	Y
Villosa amygdala	Florida rainbow	G3	S3	N	N	Y
Villosa choctawensis	Choctaw bean	G2G3	S1	C	N	N
GASTROPODA	**SNAILS AND ALLIES**					
Amnicola rhombostoma	**squaremouth Amnicola snail**	**GH**	**SH**	**N**	**N**	**Y**
Aphaostracon asthenes	Blue Spring hydrobe snail	G1	S1	N	N	Y
Aphaostracon chalarogyrus	freemouth hydrobe snail	G1	S1	N	N	Y
Aphaostracon monas	Wekiwa hydrobe snail	G1	S1	N	N	Y
Aphaostracon pycnum	dense hydrobe snail	G1	S1	N	N	Y
Aphaostracon theiocrenetum	Clifton Springs hydrobe snail	G1	S1	N	N	Y
Aphaostracon xynoelictum	Fenney Springs hydrobe snail	G1	S1	N	N	Y
Bothriopupa variolosa	**pitted birddrop**	**G1**	**S1**	**N**	**N**	**?**
Chondropoma dentatum	**crenulate horn**	**G2G3**	**S2?**	**N**	**N**	**N**
Cochlodinella poeyana	**truncate urocoptid**	**G1G2**	**S1S2**	**N**	**N**	**N**
Dasyscias franzi	shaggy ghostsnail	G1	S1	N	N	Y
Dryachloa dauca	**carrot glass snail**	**G2**	**S2**	**N**	**N**	**N**
Drymaeus multilineatus latizonatus	wide-banded forest snail	G5T1	SU	N	N	Y
Elimia albanyensis	black-crested Elimia snail	G3	S1	N	N	N
Elimia clenchi	Clench's goniobasis	G3	S1	N	N	N
Floridobia alexander	**Alexander siltsnail**	**G1**	**S1**	**N**	**N**	**Y**
Floridobia fraterna	**creek siltsnail**	**G2**	**S2**	**N**	**N**	**Y**
Floridobia helicogyra	crystal siltsnail	G1	S1	N	N	Y
Floridobia leptospira	**flatwood siltsnail**	**G1G2**	**S1S2**	**N**	**N**	**Y**

Floridobia mica	Ichetucknee siltsnail	G1	S1	N	N	Y
Floridobia monroensis	Enterprise siltsnail	G1	S1	N	N	Y
Floridobia parva	pygmy siltsnail	G1	S1	N	N	Y
Floridobia petrifons	**Rock Springs siltsnail**	**G1**	**S1**	**N**	**N**	**Y**
Floridobia ponderosa	Ponderous Spring siltsnail	G1	S1	N	N	Y
Floridobia porterae	**Green Cove springsnail**	**G1**	**S1**	**N**	**N**	**Y**
Floridobia vanhyningi	Seminole Spring siltsnail	G1	S1	N	N	Y
Floridobia wekiwae	Wekiwa siltsnail	G1	S1	N	N	Y
Hojeda inaguensis	**Keys mudcloak**	**G1**	**S1?**	**N**	**N**	**N**
Liguus fasciatus matecumbensis	Florida tree snail	G3T2	S2	N	LS	?
Liguus fasciatus septentrionalis	Florida tree snail	G3T2	S1	N	LS	?
Liguus fasciatus solidus	Florida tree snail	G3TX	SX	N	LS	?
Orthalicus floridensis	banded tree snail	G3	S3	N	N	Y
Orthalicus reses nesodryas	Florida Keys tree snail	G2T2	S2	N	N	Y
Orthalicus reses reses	Stock Island tree snail	G2T1	S1	LT	LE	Y
Praticolella bakeri	ridge scrubsnail	G2G3	S2S3	N	N	Y
Sterkia eryiesii	**Caribbean birddrop**	**G1**	**S1**	**N**	**N**	**?**
Vertigo hebardi	Keys Vertigo	G1	SNR	N	N	Y
ARACHNIDA	**SPIDERS AND ALLIES**					
Centromerus latidens	**a sheetweaver spider**	**G5**	**S1S3**	**N**	**N**	**?**
Cesonia irvingi	Key gnaphosid spider	GNR	S1	N	N	N
Cyclocosmia torreya	Torreya trap-door spider	GNR	S2	N	N	N
Eustala eleuthera	Eleuthera orb weaver	GNR	S1	N	N	N
Geolycosa xera	McCrone's burrowing wolf spider	G2	S2	N	N	Y
Habrocestum parvulum	little mountain jumping spider	GNR	S1	N	N	N
Islandiana sp. 2	**Marianna cave sheetweb weaver spider**	**G1**	**S1**	**N**	**N**	**Y**
Latrodectus bishopi	red widow spider	G3G4	S3S4	N	N	Y
Lycosa ericeticola	rosemary wolf spider	G1	S1	N	N	Y

Paraphrynus raptator	dusky-handed tailless whip scorpion	GNR	S1	N	N	N
Phidippus workmani	Workman's jumping spider	G2	S2	N	N	N
Sosippus placidus	Lake Placid funnel wolf spider	G1	S1	N	N	Y
Sphodros abboti	blue purse-web spider	GNR	S4	N	N	?
Sphodros rufipes	red-legged purse-web spider	G4	S3	N	N	?
Ummidia sp. 1	Florida trap-door spider	GNR	SU	N	N	?
AMPHIPODA	**AMPHIPODS**					
Crangonyx grandimanus	Florida cave amphipod	G2G3	S2S3	N	N	Y
Crangonyx hobbsi	Hobbs' cave amphipod	G2G3	S2S3	N	N	Y
Stygobromus sp. 25	**an aquatic cave amphipod**	**G1**	**S1**	**N**	**N**	**?**
ISOPODA	**ISOPODS**					
Caecidotea hobbsi	Florida cave isopod	G2G3	S2	N	N	N
Caecidotea sp. 1	Rock Springs cave isopod	G1	S1	N	N	Y
Caecidotea sp. 8	Econfina Springs cave isopod	G1	S1	N	N	Y
Remasellus parvus	swimming little Florida cave isopod	G1G2	S1S2	N	N	Y
DECAPODA	**CRABS, CRAYFISHES, SHRIMP**					
Cambarellus blacki	**cypress crayfish**	**G1**	**S1**	**N**	**N**	**Y**
Cambarus cryptodytes	Dougherty Plain cave crayfish	G2G3	S2	N	N	N
Cambarus miltus	**rusty grave digger**	**G1G2**	**S1**	**N**	**N**	**N**
Cambarus pyronotus	fire-back crayfish	G2	S2	N	N	Y
Goniopsis cruentata	mangrove crab	G5	S3S4	N	N	N
Palaemonetes cummingi	Squirrel Chimney Cave shrimp	G1	S1	LT	N	Y
Procambarus acherontis	Orlando cave crayfish	G1	S1	N	N	Y
Procambarus attiguus	Silver Glen Springs crayfish	G1	S1	N	N	Y
Procambarus delicatus	big-cheeked cave crayfish	G1	S1	N	N	Y
Procambarus econfinae	Panama City crayfish	G1	S1	N	LS/PT	Y
Procambarus erythrops	Santa Fe cave crayfish	G1	S1	N	LS	Y
Procambarus franzi	Orange Lake cave crayfish	G1	S1	N	N	Y

Procambarus horsti	Big Blue Spring cave crayfish	G1	S1	N	N	Y
Procambarus leitheuseri	coastal lowland cave crayfish	G1G2	S1S2	N	N	Y
Procambarus lucifugus	light-fleeing cave crayfish	G2G3	S2S3	N	N	Y
Procambarus milleri	Miami cave crayfish	G1	S1	N	N	Y
Procambarus morrisi	Putnam County cave crayfish	G1	S1	N	N	Y
Procambarus orcinus	Woodville karst cave crayfish	G1	S1	N	N	Y
Procambarus pallidus	pallid cave crayfish	G2G3	S2S3	N	N	Y
Procambarus pictus	Black Creek crayfish	G2	S2	N	LS	Y
Procambarus youngi	Florida longbeak crayfish	G2	S2	N	N	Y
Sesarma benedicti	Benedict's wharf crab	G4?	SH	N	N	?
Troglocambarus maclanei	north Florida spider cave crayfish	G2	S2	N	N	Y
Troglocambarus sp. 1	Orlando Spider Cave Crayfish	G1	S1	N	N	Y
COLLEMBOLA	**SPRINGTAILS**					
Pseudosinella pecki	**Peck's cave springtail**	**G2G3**	**S1**	**N**	**N**	**N**
Sminthurus floridanus	**Florida Sminthurus springtail**	**G1**	**S1**	**N**	**N**	**N**
EPHEMEROPTERA	**MAYFLIES**					
Asioplax dolani	a mayfly	G4	S1	N	N	N
Attenella attenuata	hirsute mayfly	G5	S1S2	N	N	N
Baetisca becki	a mayfly	G2G3	S2	N	N	N
Baetisca laurentina	a mayfly	G5	S1	N	N	N
Baetisca rogersi	a mayfly	G4	S3	N	N	N
Brachycercus nasutus	a mayfly	G3G4	S1	N	N	N
Caenis eglinensis	**Eglin Caenis mayfly**	**G1**	**S1**	**N**	**N**	**Y**
Dannella simplex	a mayfly	G5	S1	N	N	N
Dolania americana	American sand-burrowing mayfly	G4	S1S2	N	N	N
Hexagenia bilineata	a mayfly	G5	S2	N	N	N
Homoeoneuria dolani	blue sand-river mayfly	G3G4	S1S2	N	N	N
Isonychia berneri	a mayfly	G2G3	S1	N	N	N

Isonychia sicca	a mayfly	G5	S1	N	N	N
Maccaffertium modestum	a mayfly	G5	S1?	N	N	N
Macdunnoa brunnea	a mayfly	G3G4	S1S2	N	N	N
Pseudiron centralis	white sand-river mayfly	G5	S2	N	N	N
Siphloplecton brunneum	a mayfly	G2	S1	N	N	Y
Siphloplecton fuscum	a mayfly	G1Q	S1	N	N	Y
Siphloplecton simile	a mayfly	G1G2Q	S1S2	N	N	N
Stenacron floridense	a mayfly	G3G4	S3S4	N	N	Y
ODONATA	**DRAGONFLIES AND DAMSELFLIES**					
Chrysobasis lucifer	**tail-light damsel**	**G4G5**	**S1**	**N**	**N**	**N**
Cordulegaster fasciata	**banded spiketail**	**G3Q**	**S3**	**N**	**N**	**N**
Cordulegaster sayi	Say's spiketail	G2	S2	N	N	N
Didymops floridensis	maidencane cruiser	G4	S4	N	N	Y
Dromogomphus armatus	southeastern spinyleg	G4	S3	N	N	N
Enallagma traviatum	slender bluet	G5	SNR	N	N	N
Epitheca spinosa	robust tongtail	G4	S2	N	N	N
Erpetogomphus designatus	eastern ringtail	G5	S1	N	N	N
Gomphaeschna antilope	taper-tailed darner	G4	S4	N	N	N
Gomphus cavillaris	sandhill clubtail	G4	S4	N	N	N
Gomphus geminatus	twin-striped clubtail	G3	S3	N	N	N
Gomphus hodgesi	Hodges' clubtail	G3	S3	N	N	N
Gomphus hybridus	cocoa clubtail	G4	SX	N	N	N
Gomphus modestus	Gulf Coast clubtail	G3	SX	N	N	N
Gomphus vastus	Cobra clubtail	G5	S1	N	N	N
Gomphus westfalli	diminutive clubtail	G1G2	S1S2	N	N	Y
Helocordulia selysii	Selys' sunfly	G4	S4	N	N	N
Hetaerina americana	American rubyspot	G5	S2	N	N	N
Lestes inaequalis	elegant spreadwing	G5	S2	N	N	N

Lestes spumarius	**Antillean spreadwing**	**G4**	**S1**	**N**	**N**	**N**
Lestes tenuatus	**blue-striped spreadwing**	**G5**	**S1**	**N**	**N**	**N**
Libellula jesseana	purple skimmer	G1	S1	N	N	Y
Macromia alleghaniensis	Allegheny river cruiser	G4	S1	N	N	N
Nannothemis bella	elfin skimmer	G4	S3	N	N	N
Nehalennia minuta	tropical sprite	G3	S1	N	N	N
Nehalennia pallidula	Everglades sprite	G3	S3	N	N	N
Neurocordulia clara	Apalachicola shadowfly	G1G3Q	S1	N	N	N
Neurocordulia molesta	smoky shadowfly	G4	S1	N	N	N
Neurocordulia obsoleta	umber shadowfly	G5	S1	N	N	N
Progomphus alachuensis	tawny sanddragon	G3	S3	N	N	Y
Progomphus bellei	Belle's sanddragon	G3	S3	N	N	N
Somatochlora calverti	Calvert's emerald	G3	S3	N	N	N
Somatochlora georgiana	coppery emerald	G3G4	S2	N	N	N
Somatochlora provocans	**treetop emerald**	**G4**	**S3**	**N**	**N**	**N**
Stylurus laurae	Laura's clubtail	G4	S3	N	N	N
Stylurus potulentus	yellow-sided clubtail	G2	S2	N	N	N
Stylurus townesi	bronze clubtail	G3	S1	N	N	N
Tachopteryx thoreyi	gray petaltail	G4	S4	N	N	N
ORTHOPTERA	**GRASSHOPPERS AND ALLIES**					
Belocephalus micanopy	Big Pine Key conehead katydid	G1	S1	N	N	Y
Belocephalus sleighti	Keys short-winged conehead katydid	G1G2	S1S2	N	N	Y
Cycloptilum irregularis	Keys scaly cricket	G1G2	S1S2	N	N	Y
Gymnoscirtetes morsei	**Morse's wingless grasshopper**	**G2G3**	**S1S2**	**N**	**N**	**N**
Melanoplus adelogyrus	**Volusia grasshopper**	**G1G2**	**S1S2**	**N**	**N**	**Y**
Melanoplus apalachicolae	**Apalachicola grasshopper**	**G1**	**S1**	**N**	**N**	**Y**
Melanoplus forcipatus	**broad cercus scrub grasshopper**	**G1G3**	**S1S3**	**N**	**N**	**Y**
Melanoplus gurneyi	**Gurney's spurthroat grasshopper**	**G1G2**	**S1S2**	**N**	**N**	**Y**

Melanoplus indicifer	**east coast scrub grasshopper**	**G1G2**	**S1S2**	**N**	**N**	**Y**
Melanoplus nanciae	**Ocala claw-cercus grasshopper**	**G1?**	**S1?**	**N**	**N**	**Y**
Melanoplus ordwayae	**Ordway Melanoplus grasshopper**	**G1G2**	**S1S2**	**N**	**N**	**Y**
Melanoplus pygmaeus	**pygmy sandhill grasshopper**	**G1G3**	**S1S3**	**N**	**N**	**Y**
Melanoplus querneus	**larger sandhill grasshopper**	**G1G2**	**S1S2**	**N**	**N**	**N**
Melanoplus scapularis	**lesser fork-tailed grasshopper**	**G2G4**	**S2S4**	**N**	**N**	**N**
Melanoplus tequestae	**Tequesta grasshopper**	**G2G3**	**S2S3**	**N**	**N**	**Y**
Melanoplus withlacoocheensis	**Withlacoochee Melanoplus grasshopper**	**G1G3**	**S1S3**	**N**	**N**	**Y**
Schistocerca ceratiola	**rosemary grasshopper**	**G2G3**	**S2S3**	**N**	**N**	**Y**
Tettigidea empedonepia	Torreya pygmy grasshopper	G1	S1	N	N	N
PLECOPTERA	**STONEFLIES**					
Acroneuria evoluta	**a stonefly**	**G5**	**S1S2**	**N**	**N**	**N**
Amphinemura nigritta	**a stonefly**	**G5**	**S2**	**N**	**N**	**N**
Eccoptura xanthenes	**a stonefly**	**G5**	**S2**	**N**	**N**	**N**
Helopicus subvarians	**a stonefly**	**G5**	**S1S2**	**N**	**N**	**N**
Hydroperla phormidia	**a stonefly**	**G3**	**S2**	**N**	**N**	**N**
Leuctra cottaquilla	**a stonefly**	**G2**	**S2**	**N**	**N**	**N**
Leuctra ferruginea	**a stonefly**	**G5**	**S1S2**	**N**	**N**	**N**
Leuctra triloba	**a stonefly**	**G5**	**S1**	**N**	**N**	**N**
Perlinella zwicki	**a stonefly**	**G4**	**S1S2**	**N**	**N**	**N**
Taeniopteryx burksi	**eastern willowfly**	**G5**	**S1S2**	**N**	**N**	**N**
Tallaperla cornelia	**southeastern roachfly**	**G4**	**S1**	**N**	**N**	**N**
COLEOPTERA	**BEETLES**					
Aethecerinus hornii	**Horn's Aethecerinus long-horned beetle**	**G2G4**	**S2S4**	**N**	**N**	**Y**
Aneflomorpha delongi	**Delong's Aneflomorpha long-horned beetle**	**G1G3**	**S1S3**	**N**	**N**	**Y**
Anomala exigua	pygmy Anomala scarab beetle	G1	S1	N	N	Y
Anomala eximia	Archbold Anomala scarab beetle	G1	S1	N	N	Y

Anomala flavipennis okaloosensis	Panhandle dune Anomala scarab beetle	G2?T1	S1	N	N	Y
Anomala robinsoni	Robinson's Anomala scarab beetle	G1?	S1?	N	N	Y
Aphodius aegrotus	small pocket gopher Aphodius beetle	GNR	S3?	N	N	N
Aphodius baileyi	**Bailey's pocket gopher Aphodius beetle**	**GNR**	**S2**	**N**	**N**	**N**
Aphodius bakeri	**Baker's pocket gopher Aphodius beetle**	**GNR**	**S2**	**N**	**N**	**N**
Aphodius dyspistus	**surprising pocket gopher Aphodius beetle**	**GNR**	**S3?**	**N**	**N**	**N**
Aphodius gambrinus	**amber pocket gopher Aphodius beetle**	**GNR**	**S1S2**	**N**	**N**	**N**
Aphodius hubbelli	Hubbell's pocket gopher Aphodius beetle	GNR	S3?	N	N	N
Aphodius laevigatus	large pocket gopher Aphodius beetle	G3?	S3?	N	N	Y
Aphodius pholetus	**rare pocket gopher Aphodius beetle**	**GNR**	**S1**	**N**	**N**	**N**
Aphodius platypleurus	**broad-sided pocket gopher Aphodius beetle**	**GNR**	**S2**	**N**	**N**	**N**
Aphodius tanytarsus	**long-clawed pocket gopher Aphodius beetle**	**GNR**	**S3?**	**N**	**N**	**N**
Aphodius troglodytes	gopher tortoise Aphodius beetle	GNR	S2S3	N	N	N
Aphotaenius carolinus	Carolina forest scarab	GNR	S1?	N	N	N
Ataenius brevicollis	island woodrat Ataenius beetle	GNR	S1	N	N	Y
Ataenius havanensis	Havana Ataenius beetle	GNR	S1	N	N	N
Ataenius rudellus	Florida coast Ataenius beetle	G2G3	S2S3	N	N	Y
Ataenius saramari	sand pine scrub Ataenius beetle	G3	S3	N	N	Y
Ataenius sciurus	fox squirrel scarab	G3G5	S3S5	N	N	N
Ataenius stroheckeri	Strohecker's Ataenius beetle	G1?	S1?	N	N	Y
Ataenius superficialis	Big Pine Key Ataenius dung beetle	G1?	S1?	N	N	Y
Ataenius woodruffi	**Woodruff's Ataenius dung beetle**	**GU**	**SU**	**N**	**N**	**Y**
Bolbocerosoma hamatum	bicolored burrowing scarab beetle	GNR	S3S4	N	N	N
Ceratocanthus aeneus	shining ball scarab beetle	G2	S2	N	N	N
Chelyoxenus xerobatis	**gopher tortoise hister beetle**	**GNR**	**S1S3**	**N**	**N**	**N**
Cicindela blanda	**sandbar tiger beetle**	**G4**	**S2S3**	**N**	**N**	**N**
Cicindela highlandensis	Highlands Tiger Beetle	G1G2	S1S2	C	N	Y

Cicindela hirticollis	**hairy-necked tiger beetle**	**G5**	**S1**	**N**	**N**	**N**
Cicindela nigrior	**autumn tiger beetle**	**G5**	**S1S2**	**N**	**N**	**N**
Cicindela olivacea	olive tiger beetle	G3	S1	N	N	N
Cicindela rufiventris rufiventris	**eastern red-bellied tiger beetle**	**G5T5**	**S1S2**	**N**	**N**	**N**
Cicindela scabrosa	scrub tiger beetle	G3	S3	N	N	Y
Cicindela sexguttata	**six-spotted tiger beetle**	**G5**	**S2S3**	**N**	**N**	**N**
Cicindela striga	a tiger beetle	G3G4	S3	N	N	N
Cicindela togata togata	**white-cloaked tiger beetle**	**G5T5**	**S1S2**	**N**	**N**	**N**
Cicindela wapleri	**a tiger beetle**	**G5**	**S2**	**N**	**N**	**N**
Copris gopheri	gopher tortoise Copris beetle	G2	S2	N	N	Y
Copris howdeni	Howden's Copris beetle	GNR	S1S2	N	N	N
Cotinis sp. 1	Keys green June beetle	G1	S1	N	N	Y
Cremastocheilus squamulosus	scaly anteater scarab beetle	GNR	S2S3	N	N	N
Cyclocephala miamiensis	Miami chafer beetle	G1?	S1?	N	N	Y
Desmopachria cenchramis	fig seed diving beetle	G1	S1	N	N	Y
Diplotaxis rufa	red Diplotaxis beetle	G2	S2	N	N	Y
Eburia stroheckeri	**Strohecker's ivory-spotted long-horned beetle**	**G1G3**	**S1S3**	**N**	**N**	**Y**
Eucanthus alutaceus	mat red globe scarab beetle	GNR	S1S3	N	N	N
Euphoria discicollis	**pocket gopher flower beetle**	**GNR**	**S2**	**N**	**N**	**N**
Geopsammodius fuscus	**dark tiny sand-loving scarab**	**G1**	**S1**	**N**	**N**	**Y**
Geopsammodius morrisi	**Morris' tiny sand-loving scarab**	**G1**	**S1**	**N**	**N**	**Y**
Geopsammodius relictillus	**relictual tiny sand-loving scarab**	**G2G3**	**S2S3**	**N**	**N**	**Y**
Geopsammodius subpedalis	**underfoot tiny sand-loving scarab**	**G2G3**	**S2**	**N**	**N**	**N**
Geopsammodius withlacoochee	**Withlacoochee tiny sand-loving scarab**	**G1**	**S1**	**N**	**N**	**Y**
Gronocarus autumnalis	**lobed spiny burrowing beetle**	**G2G3**	**S2**	**N**	**N**	**N**
Gronocarus inornatus	**lobeless spiny burrowing beetle**	**G1G2**	**S1S2**	**N**	**N**	**Y**
Heterachthes sablensis	**mangrove long-horned beetle**	**G1G2**	**S1S2**	**N**	**N**	**Y**

Hypotrichia spissipes	Florida Hypotrichia scarab beetle	G3G4	S3S4	N	N	Y
Ischyrus dunedinensis	**three spotted pleasing fungus beetle**	**GNR**	**S2S4**	**N**	**N**	**N**
Linsleyonides albomaculatum	**tropical white-spotted long-horned beetle**	**GNR**	**S1S3**	**N**	**N**	**N**
Micronaspis floridana	Florida intertidal firefly	G1G3	S1S3	N	N	Y
Mycotrupes cartwrighti	Cartwright's Mycotrupes beetle	GNR	S2?	N	N	N
Mycotrupes gaigei	north peninsular Mycotrupes beetle	G2G3	S2S3	N	N	Y
Mycotrupes pedester	Southwest Florida Mycotrupes beetle	G1G2	S1S2	N	N	Y
Nesostizocera floridana	**Florida privet long-horned beetle**	**GNR**	**S1**	**N**	**N**	**Y**
Nicrophorus americanus	American burying beetle	G2G3	SH	LE	N	N
Odontotaenius floridanus	**Archbold bess beetle**	**G1G2**	**S1S2**	**N**	**N**	**Y**
Onthophagus aciculatulus	sandyland Onthophagus beetle	G1G2	S1S2	N	N	Y
Onthophagus polyphemi polyphemi	punctate gopher tortoise Onthophagus beetle	GNR TNR	S2S3	N	N	N
Onthophagus polyphemi sparsisetosus	smooth gopher tortoise Onthophagus beetle	GNR TNR	S1S2	N	N	N
Onychomira floridensis	**a comb-clawed beetle**	**G1**	**S1**	**N**	**N**	**Y**
Peltotrupes profundus	Florida deepdigger scarab beetle	G3	S3	N	N	Y
Peltotrupes youngi	Ocala deepdigger scarab beetle	G1G2	S1S2	N	N	Y
Phanaeus triangularis	**floodplain Phanaeus scarab beetle**	**G5**	**S1S2**	**N**	**N**	**N**
Photuris brunnipennis floridana	Everglades brownwing firefly	GNR T1T3	SNR	N	N	Y
Photuris sp. 1	Turtle Mound firefly	G1G3	SNR	N	N	?
Phyllophaga clemens	**Clemens' June beetle**	**G2**	**S1**	**N**	**N**	**N**
Phyllophaga elizoria	elizoria June beetle	G2G3	S2S3	N	N	Y
Phyllophaga elongata	elongate June beetle	G2G4	S2S4	N	N	Y
Phyllophaga okeechobea	diurnal scrub June beetle	G2	S2	N	N	Y
Phyllophaga ovalis	Oval June beetle	G1G2	S1S2	N	N	Y
Phyllophaga panorpa	Southern Lake Wales Ridge june beetle	G1G2	S1S2	N	N	Y
Phyllophaga skelleyi	**Skelley's June beetle**	**G2**	**S2**	**N**	**N**	**Y**

Phyllophaga yemasseei	**Yemassee June beetle**	**G1G2**	**S1**	**N**	**N**	**N**
Phyllophaga youngi	Young's June beetle	GNR	S1	N	N	N
Polylamina pubescens	Eglin uplands scarab beetle	G1G2	S1S2	N	N	Y
Polyphylla gracilis	**slender polyphyllan scarab beetle**	**G2G4**	**S2**	**N**	**N**	**N**
Polyphylla woodruffi	**Woodruff's polyphyllan scarab beetle**	**G1**	**S1**	**N**	**N**	**Y**
Pseudataenius waltherhorni	Pseudataenius beetle	GNR	S1?	N	N	N
Ptomaphagus geomysi	**elongate pocket gopher Ptomaphagus beetle**	**GNR**	**S2**	**N**	**N**	**N**
Ptomaphagus schwarzi	**Schwarz' pocket gopher Ptomaphagus beetle**	**GNR**	**S3**	**N**	**N**	**N**
Romulus globosus	**round-necked Romulus long-horned beetle**	**G1G3**	**S1S3**	**N**	**N**	**Y**
Rutela formosa	handsome flower scarab beetle	GNR	S1S3	N	N	N
Selonodon archboldi	**Archbold cebrionid beetle**	**G1**	**S1**	**N**	**N**	**Y**
Selonodon ferrugineus	**rusty cebrionid beetle**	**G1G2**	**S1S2**	**N**	**N**	**N**
Selonodon floridensis	**Florida cebrionid beetle**	**G2G3**	**S2S3**	**N**	**N**	**Y**
Selonodon mandibularis	**large-jawed cebrionid beetle**	**G2G3**	**S2S3**	**N**	**N**	**Y**
Selonodon santarosae	**Santa Rosa cebrionid beetle**	**G1**	**S1**	**N**	**N**	**Y**
Selonodon similis	**similar cebrionid beetle**	**G1**	**S1**	**N**	**N**	**Y**
Selonodon simplex	**simple cebrionid beetle**	**G1**	**S1**	**N**	**N**	**N**
Serica delicata	delicate silky June beetle	G1G3	S1S3	N	N	Y
Serica frosti	Frost's silky June beetle	G1G2	S1S2	N	N	Y
Serica pusilla	pygmy silky June beetle	G2G3	S2S3	N	N	Y
Serica rhypha	crooked silky June beetle	G1G2	S1S2	N	N	Y
Serica tantula	little silky June beetle	G1?	S1?	N	N	Y
Spanglerogyrus albiventris	**Red Hills unique whirligig beetle**	**G1G3**	**SH**	**N**	**N**	**N**
Stenodontes chevrolati	**Chevrolat's tropical long-horned beetle**	**GNR**	**S1S3**	**N**	**N**	**N**
Tetracha carolina floridana	**a tiger beetle**	**G5T4**	**S2S3**	**N**	**N**	**Y**
Trigonopeltastes floridana	scrub palmetto flower scarab beetle	G2G3	S2S3	N	N	Y
Triplax alachuae	**Alachua pleasing fungus beetle**	**G2G4**	**S2S4**	**N**	**N**	**Y**

Triplax frontalis	**black-headed pleasing fungus beetle**	**GNR**	**S2S3**	**N**	**N**	**N**
Tritoma sanguinipennis	**red-winged pleasing fungus beetle**	**GNR**	**S2S3**	**N**	**N**	**N**
Trox howelli	caracara commensal scarab beetle	GNR	S1S2	N	N	N
Typocerus fulvocinctus	**yellow-banded Typocerus long-horned beetle**	**G1G2**	**S1S2**	**N**	**N**	**Y**
MECOPTERA	**SCORPIONFLIES**					
Merope tuber	**earwig scorpionfly**	**G3G5**	**S1S2**	**N**	**N**	**N**
TRICHOPTERA	**CADDISFLIES**					
Agarodes libalis	spring-loving psiloneuran caddisfly	G3	S2S3	N	N	N
Agarodes logani	**Logan's Agarodes caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Agarodes ziczac	zigzag Blackwater River caddisfly	G2	S2	N	N	Y
Agrypnia vestita	**unbanded Agrypnia caddisfly**	**G5**	**S1**	**N**	**N**	**N**
Ceraclea floridana	Florida ceraclean caddisfly	GH	SH	N	N	Y
Cernotina truncona	Florida cernotinan caddisfly	G4	S2	N	N	N
Cheumatopsyche gordonae	**Gordon's little sister sedge caddisfly**	**G2**	**S2**	**N**	**N**	**Y**
Cheumatopsyche petersi	Peters' Cheumatopsyche caddisfly	G3	S2	N	N	N
Chimarra florida	Floridian finger-net caddisfly	G4	S3	N	N	N
Hydroptila apalachicola	**Apalachicola Hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila berneri	Berner's microcaddisfly	G4G5	S2S3	N	N	N
Hydroptila bribriae	**Kriebel's Hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila eglinensis	**saberlike hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila hamiltoni	**Hamilton's hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila molsonae	Molson's microcaddisfly	G2G3	S1S2	N	N	N
Hydroptila okaloosa	**Rogue Creek Hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila sarahae	**Sarah's Hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila sykorai	**Sykora's Hydroptila caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Hydroptila wakulla	**Wakulla Springs vari-colored microcaddisfly**	**G1G2**	**S1S2**	**N**	**N**	**Y**
Lepidostoma morsei	**Morse's little plain brown sedge**	**G2G3**	**S1**	**N**	**N**	**N**

Nectopsyche tavara	**Tavares white miller caddisfly**	**G2**	**S2**	**N**	**N**	**Y**
Neotrichia rasmusseni	**Rasmussen's Neotrichia caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Nyctiophylax morsei	**Morse's dinky light summer sedge**	**G2**	**S2**	**N**	**N**	**N**
Ochrotrichia okaloosa	**Okaloosa somber microcaddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Ochrotrichia provosti	Provost's somber caddisfly	GH	SH	N	N	Y
Oecetis daytona	Daytona long-horned caddisfly	G3	S2?	N	N	N
Oecetis morsei	**Morse's long-horn sedge**	**G3**	**S1**	**N**	**N**	**N**
Oecetis parva	little Oecetis longhorned caddisfly	G1	S1	N	N	N
Oecetis porteri	Porter's long-horn caddisfly	G3G4	S2S3	N	N	N
Oecetis pratelia	little meadow long-horned caddisfly	GH	SH	N	N	Y
Orthotrichia curta	short orthotrichian microcaddisfly	G4	S1S2	N	N	N
Orthotrichia dentata	dentate orthotrichian microcaddisfly	G2G3	SH	N	N	N
Orthotrichia instabilis	changeable orthotrichian microcaddisfly	G3	S1	N	N	N
Oxyethira chrysocara	**Gold Head Branch caddisfly**	**G1**	**S1**	**N**	**N**	**Y**
Oxyethira elerobi	Elerob's microcaddisfly	G3G4	S2	N	N	N
Oxyethira florida	florida cream and brown microcaddisfly	G1G2	S1S2	N	N	Y
Oxyethira janella	little-entrance oxyethiran microcaddisfly	G5	S3S4	N	N	N
Oxyethira kelleyi	**Kelly's cream and brown mottled microcaddisfly**	**G2**	**S2**	**N**	**N**	**Y**
Oxyethira kingi	**King's cream and brown mottled microcaddisfly**	**GH**	**SH**	**N**	**N**	**Y**
Oxyethira novasota	Novasota oxyethiran microcaddisfly	G4G5	S2	N	N	N
Oxyethira pescadori	**Pescador's bottle-cased caddisfly**	**G1G3**	**S2**	**N**	**N**	**N**
Oxyethira setosa	**setose cream and brown mottled microcaddisfly**	**G2G3**	**S1**	**N**	**N**	**N**
Phylocentropus harrisi	**a caddisfly**	**G1G2**	**S1S2**	**N**	**N**	**N**
Polycentropus floridensis	**Florida brown checkered summer sedge**	**G2**	**S1**	**N**	**N**	**N**
Triaenodes florida	Floridian triaenode caddisfly	G2	S2	N	N	N
Triaenodes furcella	little-fork triaenode caddisfly	G2G3	S2S3	N	N	Y

Triaenodes tridontus	three-tooth Triaenodes caddisfly	G1G3	SH?	N	N	N
LEPIDOPTERA	**BUTTERFLIES AND MOTHS**					
Achalarus lyciades	**hoary edge**	**G5**	**S2S4**	**N**	**N**	**N**
Acrolophus pholeter	**gopher tortoise Acrolophus moth**	**G1**	**S1**	**N**	**N**	**Y**
Amblyscirtes aesculapius	**lace-winged roadside skipper**	**G4**	**S3**	**N**	**N**	**N**
Amblyscirtes alternata	**dusky roadside-skipper**	**G2G4**	**S1**	**N**	**N**	**N**
Amblyscirtes hegon	**pepper and salt skipper**	**G5**	**S1**	**N**	**N**	**N**
Amblyscirtes reversa	**reversed roadside-skipper**	**G3G4**	**S1**	**N**	**N**	**N**
Amblyscirtes vialis	**common roadside-skipper**	**G5**	**S1S2**	**N**	**N**	**N**
Anaea troglodyta floridalis	Florida leafwing	G5T1	S1	C	N	Y
Anthanassa frisia	**Cuban crescent**	**G5**	**S2**	**N**	**N**	**N**
Anthanassa texana seminole	**Seminole crescent**	**G5 T3T4**	**S2S3**	**N**	**N**	**N**
Anthocharis midea	**falcate orangetip**	**G4G5**	**SX**	**N**	**N**	**N**
Aphrissa statira	**statira**	**G5**	**S2S3**	**N**	**N**	**N**
Appias drusilla	**Florida white**	**G5**	**S2S3**	**N**	**N**	**N**
Atrytone arogos	arogos skipper	G3	S2	N	N	N
Atrytone arogos arogos	**arogos skipper**	**G3 T1T2**	**S1S2**	**N**	**N**	**N**
Atrytonopsis loammi	**loammi skipper**	**G1**	**S1**	**N**	**N**	**N**
Autochton cellus	**golden-banded skipper**	**G4**	**S2S3**	**N**	**N**	**N**
Callophrys gryneus sweadneri	**Florida olive hairstreak**	**G5T2**	**S2**	**N**	**N**	**Y**
Callophrys henrici	**Henry's elfin**	**G5**	**S3S4**	**N**	**N**	**N**
Callophrys hesseli	Hessel's hairstreak	G3G4	S1	N	N	N
Callophrys irus	**frosted elfin**	**G3**	**S1**	**N**	**N**	**N**
Callophrys niphon	**eastern pine elfin**	**G5**	**S3S4**	**N**	**N**	**N**
Catocala grisatra	**grisatra underwing**	**G1G3**	**S1**	**N**	**N**	**N**
Celastrina ladon	**spring azure**	**G5**	**S3**	**N**	**N**	**N**
Chlorostrymon maesites	**amethyst hairstreak**	**G4**	**S1**	**N**	**N**	**N**
Chlorostrymon simaethis	**silver-banded hairstreak**	**G5**	**S1S2**	**N**	**N**	**N**

Chlosyne nycteis	**silvery checkerspot**	**G5**	**S1**	**N**	**N**	**N**
Cupido (Everes) comyntas	**eastern tailed blue**	**G5**	**S2**	**N**	**N**	**N**
Cyclargus ammon	**nickerbean blue**	**G4G5**	**S1**	**N**	**N**	**N**
Cyclargus thomasi bethunebakeri	Miami blue	G3G4TU	S1	C	LE	Y
Enodia creola	**Creole pearly eye**	**G3G4**	**S3S4**	**N**	**N**	**N**
Enodia portlandia floralae	**Florida pearly eye**	**G4TU**	**S2S3**	**N**	**N**	**?**
Epargyreus zestos	**zestos skipper**	**G5**	**SX**	**N**	**N**	**N**
Ephyriades brunnea floridensis	**Florida duskywing**	**G5T2**	**S2**	**N**	**N**	**Y**
Erynnis baptisiae	**wild indigo duskywing**	**G5**	**S1**	**N**	**N**	**N**
Erynnis brizo sommnus	**dark dusky wing**	**G5T3T4**	**S3S4**	**N**	**N**	**?**
Erynnis martialis	**mottled duskywing**	**G3G4**	**S1**	**N**	**N**	**N**
Eumaeus atala	atala	G4	S3	N	N	N
Eunica monima	**dingy purplewing**	**G5**	**S1**	**N**	**N**	**N**
Eunica tatila tatilista	Florida purplewing	G5T4T5	S1	N	N	Y
Euphyes berryi	**Berry's skipper**	**G2G3**	**S1**	**N**	**N**	**N**
Euphyes dion	**Dion skipper**	**G4**	**S2**	**N**	**N**	**N**
Euphyes dukesi calhouni	**Calhoun's skipper**	**G3 T2T3**	**S1**	**N**	**N**	**Y**
Euphyes pilatka	**Palatka skipper**	**G3G4**	**S3S4**	**N**	**N**	**N**
Euphyes pilatka klotsi	**Klots' skipper**	**G3G4T1**	**S1**	**N**	**N**	**Y**
Feniseca tarquinius	**harvester**	**G4**	**S3**	**N**	**N**	**N**
Hesperia attalus slossonae	**Seminole skipper**	**G2G4T2T3**	**S2S3**	**N**	**N**	**N**
Hesperia meskei pinocayo	**rockland grass skipper- Keys race**	**G3G4T1**	**S1**	**N**	**N**	**Y**
Hesperia meskei straton	**eastern Meske's skipper**	**G3G4T3T4**	**S2S3**	**N**	**N**	**N**
Idia gopheri	**gopher moth**	**G2G3**	**S2S3**	**N**	**N**	**N**
Junonia genoveva	**tropical buckeye**	**G5**	**S1**	**N**	**N**	**N**
Kricogonia lyside	**Lyside sulphur**	**G5**	**SNA**	**N**	**N**	**N**
Megathymus cofaqui	**Cofaqui skipper**	**G3G4**	**S2S4**	**N**	**N**	**N**

Megathymus yuccae	**Yucca skipper**	**G5**	**S3S4**	**N**	**N**	**N**
Ministrymon azia	**gray ministreak**	**G5**	**S2S3**	**N**	**N**	**N**
Neonympha areolatus	**Georgia satyr**	**G3G4**	**S3S4**	**N**	**N**	**N**
Neonympha helicta dadeensis	**Helicta Satyr (Miami-Dade subspecies)**	**G3G4T1T3Q**	**S1S3**	**N**	**N**	**Y**
Nymphalis antiopa	**mourning cloak**	**G5**	**S2**	**N**	**N**	**N**
Papilio andraemon bonhotei	Bahamian swallowtail	G4G5T3	S1	N	N	N
Papilio aristodemus ponceanus	Schaus' swallowtail	G3G4T1	S1	LE	LE	Y
Pholisora catullus	**common sootywing**	**G5**	**S2**	**N**	**N**	**N**
Poanes viator zizaniae	**broad-winged skipper**	**G5T5**	**S2S3**	**N**	**N**	**N**
Poanes yehl	**Yehl skipper**	**G4**	**S2S3**	**N**	**N**	**N**
Poanes zabulon	**Zabulon skipper**	**G5**	**S3S4**	**N**	**N**	**N**
Polites baracoa	**Baracoa skipper**	**G4**	**S3**	**N**	**N**	**N**
Polygonia comma	**eastern comma**	**G5**	**S2S3**	**N**	**N**	**N**
Pompeius verna	**little glassywing**	**G5**	**S3S4**	**N**	**N**	**N**
Proserpinus gaurae	proud sphinx	G2G4	S1S2	N	N	N
Pseudocharis minima	**lesser wasp moth**	**G3G4**	**S2S3**	**N**	**N**	**N**
Pyreferra ceromatica	ceromatic noctuid moth	GU	S1S2	N	N	?
Pyrgus communis	**checkered skipper**	**G5**	**S1**	**N**	**N**	**N**
Pyrisitia dina	**Dina yellow**	**G5**	**S1**	**N**	**N**	**N**
Pyrisitia nise	**Mimosa yellow**	**G5**	**S1**	**N**	**N**	**N**
Satyrium calanus calanus	**banded hairstreak**	**G5 T3T4**	**S3S4**	**N**	**N**	**?**
Satyrium kingi	**King's hairstreak**	**G3G4**	**S2S3**	**N**	**N**	**N**
Satyrium liparops floridensis	Sparkleberry Hairstreak	G5 T1T2	S1S2	N	N	Y
Satyrium titus	**coral hairstreak**	**G5**	**S1**	**N**	**N**	**N**
Siproeta stelenes	**malachite**	**G5**	**S2S3**	**N**	**N**	**N**
Strymon acis bartrami	Bartram's scrub-hairstreak	G4 T1T2	S1	C	N	Y
Strymon limenia	**disguised hairstreak**	**G4**	**SNA**	**N**	**N**	**N**

Strymon martialis	**martial scrub-hairstreak**	**G4G5**	**S2S3**	**N**	**N**	**N**
Zale perculta	**Okefenokee Zale moth**	**G2**	**S1**	**N**	**N**	**N**
DIPTERA	**FLIES**					
Asaphomyia floridensis	Florida asaphomyian tabanid fly	G1G3	S1S2	N	N	Y
Merycomyia brunnea	brown merycomyian tabanid fly	G1G3	SNR	N	N	?
Mixogaster delongi	Delong's Mixogaster flower fly	G1G3	SNR	N	N	?
Nemopalpus nearcticus	sugarfoot moth fly	G1G2	S1S2	N	N	Y
HYMENOPTERA	**ANTS, BEES & WASPS**					
Dasymutilla archboldi	**Lake Wales Ridge velvet ant**	**G2**	**S2**	**N**	**N**	**Y**
Dasymutilla mickeli	**pygmy Florida Dasymutilla velvet ant**	**G1**	**S1**	**N**	**N**	**Y**
Hesperapis oraria	**barrier island Hesperapis bee**	**G1G2**	**S1S2**	**N**	**N**	**N**
Photomorphus archboldi	**nocturnal scrub velvet ant**	**G1G2**	**S1S2**	**N**	**N**	**Y**

Appendix C: Rare invertebrates documented from FNAI fieldwork. (ABRP=Apalachicola Bluffs and Ravines Preserve, AWMA=Andrew's Wildlife Management Area, BR=Babcock Ranch, ENP=Everglades National Park, LTSF=Lake Talquin State Forest, PP=Eleanor Klapp Phipps Park, TCP=Tiger Creek Preserve, TTRS=Tall Timbers Research Station, WSF=Withlacoochee State Forest.)

Taxon	Common Name	County	Site	State Rank	Notes
Orthoptera					
Tettigidea empedonepia	Torreya pygmy grasshopper	Liberty	ABRP	S1	First FL record in more than 50 years.
Coleoptera					
Anomala exigua	pygmy Anomala scarab beetle	Polk	TCP	S1	Was thought to be extinct, then rediscovered in 1998, but on land that is now either developed or in the process of being developed.
Anomala mendica	a scarab beetle	Liberty	ABRP	n/a	New county record. New habitat information. This species was only known from Marion County.
Aphodius lodingi	an Aphodius dung beetle	Leon	TTRS	n/a	**New state record.** Only known from three other localities in the southeast.
Aphodius windsori	an Aphodius dung beetle	Leon	TTRS	n/a	Only known from TTRS and one locality in South Carolina. Males were undescribed.
Aphodius troglodytes	gopher tortoise Aphodius teetle	Jefferson	n/a	S2S3	New county record. This species is a commensal of gopher tortoises.
Aphodius troglodytes	gopher tortoise Aphodius teetle	Hernando	WSF	S2S3	New county record. This species is a commensal of gopher tortoises.
Aphodius troglodytes	gopher tortoise Aphodius teetle	Polk	TCP	S2S3	New county record. This species is a commensal of gopher tortoises.
Aphodius troglodytes	gopher tortoise Aphodius teetle	Liberty	ABRP	S2S3	This species is a commensal of gopher tortoises.

Bolbocerosoma hamatum	bicolored burrowing scarab beetle	Lee	BR	S3S4	New county record.
Carabus sp.	a ground beetle	Leon	TTRS	n/a	The two Florida species in this genus are not on our list at present, but one is only known in Florida from Leon County and the other from Volusia County.
Chelyoxenus xerobatis	gopher tortoise hister beetle	Polk	TCP	S1S3	New county record. This species is a commensal of gopher tortoises.
Chelyoxenus xerobatis	gopher tortoise hister beetle	Jefferson	n/a	S1S3	New county record. This species is a commensal of gopher tortoises.
Cicindela highlandensis	Highlands tiger beetle	Polk	TCP	S1S2	This species has been proposed for ESA protection.
Cicindela sexguttata	six-spotted tiger beetle	Leon	TTRS	S2S3	New county record. In Florida, this species had only been recorded from Jackson and Liberty counties.
Copris inemarginatus	a scarab beetle	Gadsden	LTSF	n/a	New county record. This is a widespread, but uncommonly collected species.
Diplotaxis rufa	red Diplotaxis beetle	Polk	TCP	S2	New county record. New habitat information.
Dytiscus carolinus	a predaceous diving beetle	Liberty	ABRP	n/a	**New state record.**
Eucanthus alutaceus	mat red globe scarab beetle	Lee	BR	S1S3	New county record. Not recorded south of Levy County
Geomysaprinus floridae	a hister beetle	Lafayette	n/a	n/a	New county record. This species is probably the rarest commensal of gopher tortoises and will be added to the tracking list ranked as S1.

Goes tumifrons	a longhorned beetle	Wakulla	n/a	n/a	New county record. This species had only been recorded from four counties.
Gronocarus inornatus	lobed spiny burrowing beetle	Wakulla	n/a	S1S2	Last documented in this area more than a decade ago.
Hypotrichia spissipes	Florida Hypotrichia scarab beetle	Polk	TCP	S3S4	New county record.
Mycotrupes gaigei	north peninsular Mycotrupes beetle	Levy	AWMA	S2S3	New occurrence and new habitat information.
Mycotrupes cartwrighti	Cartwright's Mycotrupes beetle	Leon	TTRS	S2?	Last documented at Tall Timbers before 1973.
Mycotrupes cartwrighti	Cartwright's Mycotrupes beetle	Leon	PP	S2?	Known from Leon County, but not from this managed area.
Mycotrupes pedester	southwest Florida Mycotrupes beetle	Lee	BR	S1S2	New occurrence and new habitat information.
Odonteus alabamensis	an earth boring beetle	Leon	TTRS	n/a	New county record. New habitat information. This species had only been recorded from Calhoun County.
Odonteus thoracicornis	an earth boring beetle	Leon	TTRS	n/a	New county record. New habitat information. This species had only been recorded from Alachua County.
Odonteus thoracicornis	an earth boring beetle	Wakulla	n/a	n/a	New county record. New habitat information. This species had only been recorded from Alachua County.
Onthophagus polyphemi	gopher tortoise Onthophagus beetle	Gadsden	LTSF	S2S3	New county record. This species is a commensal of gopher tortoises.
Onthophagus polyphemi	gopher tortoise Onthophagus beetle	Polk	TCP	S2S3	New county record. This species is a commensal of gopher tortoises.

Onychomira floridensis	a comb-clawed beetle	Polk	TCP	S1	This species is not on our list but will be added because the only known prior record was from Archbold Biological Station in Highlands County. New county record.
Peltotrupes profundus	Florida deepdigger scarab beetle	Hernando	WSF	S3	New FNAI element occurrence.
Phyllophaga tristis	a June beetle	Gadsden	LTSF	n/a	New county record. This species is restricted to the panhandle and there are few collection records.
Polyphylla gracilis	slender polyphyllan scarab beetle	Gadsden	LTSF	S2	New county record. This species appears to have a very spotty distribution and was only known from three counties.
Polyphylla gracilis	slender polyphyllan scarab beetle	Liberty	ABRP	S2	New county record. This species appears to have a very spotty distribution and was only known from three counties.
Selonodon archboldi	Archbold cebrionid beetle	Polk	TCP	S1	New county record. New habitat information. This species was only known from Highlands County in and near Archbold Biological Station and only from sand pine scrub.
Serica frosti	Frost's silky June beetle	Polk	TCP	S1S2	New county record. New habitat information. This species was only known from Highlands County in and around Archbold Biological Station and only from sand pine scrub.
Serica pusilla	pygmy silky June beetle	Hernando	WSF	S2S3	New county record. This endemic species is known from very few specimens.

Serica rhypha	crooked silky June beetle	Gadsden	LTSF	S1S2	New county record. New habitat information. This species was only known from Okaloosa and Santa Rosa counties.
Serica rhypha	crooked silky June beetle	Wakulla	n/a	S1S2	New county record. New habitat information. This species was only known from Okaloosa and Santa Rosa counties.
Serica vespertina	a silky June beetle	Leon	TTRS	n/a	New county record. In Florida, this species had only been recorded from Okaloosa County.
Serica vespertina	a silky June beetle	Wakulla	n/a	n/a	New county record. In Florida, this species had only been recorded from Okaloosa County.
Lepidoptera					
Anthanassa frisia	Cuban crescent	Miami-Dade	n/a	S2	New FNAI element occurrence record
Atrytonopsis loammi	Loammi skipper	Liberty	n/a	S1	New FNAI element occurrence record
Autochton cellus	golden-banded skipper	Leon	n/a	S2S3	New FNAI element occurrence
Callophrys gryneus sweadneri	Florida olive hairstreak	Jefferson	n /a	S2	New county record and FNAI element occurrence record for species
Callophrys irus	frosted elfin	Nassau	n/a	S1	New FNAI element occurrence record
Chlosyne nycteis	silvery checkerspot	Jackson	n /a	S1	New FNAI element occurrence
Pseudocharis minima	lesser wasp moth	Miami-Dade	ENP	S2S3	New FNAI element occurrence. This species is only known from three of the southernmost counties of Florida.
Satyrodes appalachia	Appalachian brown	Wakulla	n/a	S3S4	New FNAI element occurrence

Pyrisitia dina	Dina yellow	Miami-Dade	n /a	S1	New FNAI element occurrence record. Recorded from Castellow - Hammock Park
Satyrium titus	coral hairstreak	Wakulla	n /a	S1	New FNAI element occurrence record. Second documented record of this species in Florida since 2002