U.S. Fish & Wildlife Service

Sturgeon, gulf

Acipenser oxyrinchus desotoi
Family: Acipenseridae
Group: Fishes

Current Status: Threatened (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Gulf sturgeon.
- Habitat Conservation Plans (HCP) in which Gulf sturgeon occurrence has been recorded.
- Petitions received on the Gulf sturgeon.
- USFWS Refuges on which the Gulf sturgeon is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://endangered.fws.gov/i/E2W.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach)*

Threatened

As of September 30, 1991, the Gulf sturgeon is designated as **Threatened** in the Entire Range. Within the area covered by this listing, this species is known to occur in: **Alabama, Florida, Louisiana, Mississippi.** The U.S. Fish & Wildlife Service **Southeast Region** (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 9685 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)
- Critical Habitat is designated for this entity.
- Go to details for Special Rule 17.44(v).

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
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Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

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Family: Acipenseridae
Group: Fishes

Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Threatened

Date	Citation Page	Type	Title
19-MAR-03	68 FR 13369 13495	Final Critical Habitat, Critical habitat--fishes	Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon; Final Rule(See PDF file)
08-AUG-02	67 FR 51530 51532	Notice Doc. Availability Notice Public Hearing	ETWP; Designation of Critical Habitat for the Gulf Sturgeon: Proposed rule; notice of availability (NOA) of draft conomic analysis, and correction on public hearing location.(See PDF file)
06-JUN-02	67 FR 39105 39199	Proposed Critical Habitat, Critical habitat--fishes	Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon(See PDF file)
27-FEB-98	63 FR 9967 9974	Notice Prudency Determination - Critical Habitat, Critical habitat--fishes	ETWP; Decision on Designation of Critical Habitat for the Gulf Sturgeon(See PDF file)
23-AUG-95	60 FR 43721 43723	Notice Prudency Determination - Critical Habitat	ETWP; Decision on Designation of Critical Habitat for the Gulf Sturgeon(See PDF file)
30-SEP-91	56 FR 49653 49658	Final Listing, Threatened Final Special Rule, 17.44(v)	ETWP; Threatened Status for the Gulf Sturgeon; 56 FR 49653 49658(See PDF file)
02-MAY-90	55 FR 18357 18360	Proposed Listing, Threatened	ETWP; Proposed Threatened Status for the Gulf Sturgeon; 55 FR 18357 18360(See PDF file)
06-JAN-89	54 FR 554 579	Notice CNOR	ETWP; Animal Notice of Review; 54 FR 554 579
30-DEC-82	47 FR 58454 58460	Notice CNOR	Review of Vertebrate Wildlife for Listing as End. or Thr. Species(See PDF file)

U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ENDANGERED SPECIES

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Sturgeon, Gulf *

(*Acipenser oxyrhynchus desotoi*)

..* Other Links -- Sturgeon, Gulf ^

- A lead Region Recovery Plan Summary (with image) has been prepared for this species.
- A National Marine Fisheries Service species account has been prepared for this species.

(Last addition to this file January 7, 1997.)
(Other links for this species will be added as they become available online.)

[Return to the U.S. Vertebrate Animal Species Index.]

Keywords =Gulf sturgeon, Acipenser oxyrhynchus desotoi, other links

U.S. Fish & Wildlife Service

Georgia Ecological Services
Athens, Brunswick & Columbus REGION 4

T & E Species
Georgia Birds
Georgia Fish
Reptiles & Amphibians
Invertebrates
Georgia Mammals
Georgia Plants
Species By County
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Listed Endangered Species in Georgia

Counties

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click on your county of interest to see the endangered species

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Listed Species in Baker County (updated May 2004)

Species	Federal Status	State Status	Habitat	Threats
Birds				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. Active eagle nests were located in Baker County 1989, 1991, 1993-1994,1996-1998 and 2000-2002	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptiles				
Alligator snapping turtle *Macroclemys temminckii*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Barbour's map turtle *Graptemys barbouri*	No Federal Status	T	Restricted to the Apalachicola River and larger tributaries including the Chipola, Chattahoochee, and Flint Rivers in eastern Alabama, western Georgia, and western Florida.	
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibians				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Active breeding sites found in Baker County since 1990.	Habitat destruction as a result of agricultural an silvicultural practices (e.g., clearclutting, mechanical site preparation), fire suppresion and residential and commercial development.
Georgia blind salamander *Haideotriton*	No Federal Status	T	Subterranean waters of upland limestone karst system; restricted to Dougherty Plain region of Georgia	

wallacei				
Invertebrates				
Fat three-ridge mussel *Amblema neislerii*	E	E	Main channels of small to large rivers with slow to moderate currents, in substrates ranging from gravel to a rocky rubble mixture of sand and sandy mud to a mixture of sand, sandy/clay substrates	Habitat modification, sedimentation, and water quality degradation
Gulf moccasinshell mussel *Medionidus pencillatus*	E	E	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots	Habitat modification, sedimentation, and water quality degradation
Oval pigtoe mussel *Pleurobema pyriforme*	E	E	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates	Habitat modification, sedimentation, and water quality degradation
Purple bankclimber mussel *Elliptoideus sloatianus*	T	T	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates	Habitat modification, sedimentation, and water quality degradation
Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Fish				
Bluestripe shiner *Cyprinella callitaenia*	No Federal Status	T	Brownwater streams	
Highscale shiner *Notropis hypsilepis*	No Federal Status	T	Blackwater and brownwater streams	
Plants				
American chaffseed *Schwalbea americana*	E	E	Fire-maintained wet savannahs in the Coastal Plain (with grass pinks, colic root, huckleberry and gallberry); grassy openings and swales of relict longleaf pine woods in the Piedmont	Fire suppression, habitat conversion, and incompatible agriculture and forestry practices
Buckthorn *Sideroxylon thornei*	No Federal Status	E	Oak flatwoods where soil normally is saturated for long periods after floods/heavy rain (i.e., calcareous swamps; woods bordering cypress ponds)	
Harper Fimbry *Fimbristylis perpusilla*	No Federal Status	E	Muddy bottoms and silty margins of drying pine barren ponds and farm ponds	
Pondberry *Lindera melissifolia*	E	E	Shallow depression ponds of sandhills, margins of cypress ponds, and in seasonally wet low areas among bottomland hardwoods	Drainage ditching and subsequent conversion of habitat to other uses; domestic hogs, cattle grazing, and timber harvesting; and apparent lack of seedling production

Variable-leaf Indian-plantain *Cacalia diversifolia*	No Federal Status	T	Swamps and muddy stream and river banks
Wagner spleenwort *Asplenium heteroresiliens*	No Federal Status	T	Marl outcrops, damp limestone ledges, and tabby masonry

Listed Species in Coffee County (updated May 2004)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. An active eagle nest was located in Coffee County in 1999 and 2000-2002.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Plant				
Creeping Morning-glory *Evolvulus sericeus var sericeus*	No Federal Status	E	Sparsely vegetated, partially shaded outcrops of Altamaha Grit (a course, gritty, sandstone-like hardened clay)	
Georgia plume *Elliottia racemosa*	No Federal Status	T	Sand ridges, dry oak ridges, evergreen hammocks, and sandstone outcrops in a variety of sandy soil conditions ranging from moist to very dry	
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods.	
Pondspice *Litsea aestivalis*	No Federal Status	T	Margins of swamps, cypress ponds, and sandhill depression ponds and in hardwood swamps	

Listed Species in Decatur County (updated May 2004)

Species	Federal Status	State Status	Habitat	Threats
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. Active eagle nests were located in Decatur County in 1988 and 1990-1999 and 2000-2002.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Alligator snapping turtle *Macroclemys temminckii*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Barbour's map turtle *Graptemys barbouri*	No Federal Status	T	Restricted to the Apalachicola River and larger tributaries including the Chipola, Chattahoochee, and Flint Rivers in eastern Alabama, western Georgia, and western Florida.	
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Georgia blind salamander *Haideotriton wallacei*	No Federal Status	T	Subterranean waters of upland limestone karst system; restricted to Dougherty Plain region of Georgia	
Invertebrate				
Fat three-ridge mussel *Amblema neislerii*	E	E	Main channels of small to large rivers with slow to moderate currents, in substrates ranging from gravel to a rocky rubble mixture of sand and sandy mud to a mixture of sand, sandy/clay substrates	Habitat modification, sedimentation, and water quality degradation

Gulf moccasinshell mussel *Medionidus penicillatus*	E	E	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots	Habitat modification, sedimentation, and water quality degradation
Oval pigtoe mussel *Pleurobema pyriforme*	E	E	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates	Habitat modification, sedimentation, and water quality degradation
Purple bankclimber mussel *Elliptoideus sloatianus*	T	T	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates	Habitat modification, sedimentation, and water quality degradation
Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Fish				
Alabama Shad *Alosa Alabamae*			Candidate	Candidate
Bluestripe shiner *Cyprinella callitaenia*	No Federal Status	T	Brownwater streams	
Plant				
Bay star-vine *Schisandra glabra*	No Federal Status	T	Twining on subcanopy and understory trees/shrubs in rich alluvial woods	
Buckthorn *Sideroxylon thornei*	No Federal Status	E	Oak flatwoods where soil normally is saturated for long periods after floods/heavy rain (i.e., calcareous swamps; woods bordering cypress ponds)	
Climbing buckthorn *Sageretia minutiflora*	No Federal Status	T	Calcareous rocky bluffs, forested shell middens on barrier islands, and evergreen hammocks along streambanks and coastal marshes	
Croomia *Croomia pauciflora*	No Federal Status	T	Rich moist deciduous woodlands, ravines, and river bluffs, often with ginseng	
Curtiss loosestrife *Lythrum curtissii*	No Federal Status	T	Swamps over limestone, boggy open areas in pinelands, shallow water of wet thickets and floodplains, and occasionally in openings along right-of-ways	
Florida anise-tree *Illicium floridanum*	No Federal Status	E	Moist wooded ravines and seepages along small streams	

Florida torreya *Torreya taxifolia*	E	E	Beech-magnolia forests and mixed hardwoods on middle slopes of steep ravines with nearly permanent seepage (steepheads)	A disease (first observed in late 1950's that killed all mature trees) that kills needles and stems, causing defoliation and tree death
Fringed campion *Silene polypetala*	E	E	Mature hardwood or hardwood-pine forests on river bluffs, small stream terraces, moist slopes and well-shaded ridge crests; two Decatur County populations last observed in 1993 and 1994	Residential development, logging, and spread of Japanese honeysuckle
Lax Water-milfoil *Myriophyllum laxum*	No Federal Status	T	Sinkholes and other shallow freshwater pools; also sandy clear streams draining spring-fed swamps	
Narrowleaf obedient plant *Physostegia leptophylla*	No Federal Status	T	Wet muck or peat in shallow water of river swamp openings and in the margins of both fresh and brackish (tidal) marshes	
Pondspice *Litsea aestivalis*	No Federal Status	T	Margins of swamps, cypress ponds, and sandhill depression ponds and in hardwood swamps	

Listed Species in Early County (updated May 2004)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. Active eagle nest were located in Early County 1997-1999 and 2000-2002.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Alligator snapping turtle *Macroclemys temminckii*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	
Amphibian				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Last breeding record for Early County was in the 1940's.	
Invertebrate				
Gulf moccasinshell mussel *Medionidus pencillatus*	E	E	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots	Habitat modification, sedimentation, and water quality degradation
Oval pigtoe mussel *Pleurobema pyriforme*	E	E	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates	Habitat modification, sedimentation, and water quality degradation

Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Fish				
Bluestripe shiner *Cyprinella callitaenia*	No Federal Status	T	Brownwater streams	
Plant				
Alabama milkvine *Matelea alabamensis*	No Federal Status	T	Upper areas of slopes and bluffs and in oak-hickory-mixed hardwood forests	
American chaffseed *Schwalbea americana*	E	E	Fire-maintained wet savannahs in the Coastal Plain (with grass pinks, colic root, huckleberry and gallberry); grassy openings and swales of relict longleaf pine woods in the Piedmont	Fire suppression, habitat conversion, and incompatible agriculture and forestry practices
Baltzell sedge *Carex baltzellii*	No Federal Status	E	Rich hardwood forests with a beech-southern magnolia canopy and an abundance of wildflowers	
Buckthorn *Sideroxylon thornei*	No Federal Status	E	Oak flatwoods where soil normally is saturated for long periods after floods/heavy rain (i.e., calcareous swamps; woods bordering cypress ponds)	
Clearwater butterwort *Pinguicula primuliflora*	No Federal Status	T	Shallow running water of sandy, clear streams and spring-fed rivulets (spring runs); also along moist streambanks in mats of peat moss	
Curtiss loosestrife *Lythrum curtissii*	No Federal Status	T	Swamps over limestone, boggy open areas in pinelands, shallow water of wet thickets and floodplains, and occasionally in openings along right-of-ways	
Florida willow *Salix floridana*	No Federal Status	E	In low woods, rocky and gravelly shores, and along stream beds	
Lax Water-milfoil *Myriophyllum laxum*	No Federal Status	T	Sinkholes and other shallow freshwater pools; also sandy clear streams draining spring-fed swamps	
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods	
Plumleaf azalea *Rhododendron prunifolium*	No Federal Status	T	Moist soils of rich hardwood ravines	
Relict trillium *Trillium reliquum*	E	E	Hardwood forests; in the Piedmont, found in either in rich ravines or adjacent alluvial terraces with other spring-flowering herbs	Logging, road construction, agricultural conversion, mining, residential/industrial development, and encroachment by Japanese

				honeysuckle and kudzu
Sweet pitcher-plant *Sarracenia rubra*	No Federal Status	E	Acid soils of open bogs, savannahs, and low areas in pine flatwoods	
Variable-leaf Indian-plantain Arnoglossum diversifolium	No Federal Status	T	Swamps and muddy stream and river banks	
White trumpet *Sarracenia leucophylla*	No Federal Status	E	Acid soils of open bogs and on sphagnum mats in light gaps along streams and in red maple-blackgum swamps	

Listed Species in Miller County (updated May 2004)

Species	Federal Status	State Status	Habitat	Threats
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Alligator snapping turtle *Macroclemys temminckii*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Found in Miller County on Mayhaw WMA in 1998	Habitat destruction as a result of agricultural an silvicultural practices (e.g., clearclutting, mechanical site preparation), fire suppresion and residential and commercial development.
Georgia blind salamander *Haideotriton wallacei*	No Federal Status	T	Subterranean waters of upland limestone karst system; restricted to Dougherty Plain region of Georgia	
Invertebrate				

Oval pigtoe mussel *Pleurobema pyriforme*	E	E	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates	Habitat modification, sedimentation, and water quality degradation
Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Plant				
American chaffseed *Schwalbea americana*	E	E	Fire-maintained wet savannahs in the Coastal Plain (with grass pinks, colic root, huckleberry and gallberry); grassy openings and swales of relict longleaf pine woods in the Piedmont; the known population of this species in Miller County has been extirpated	Fire suppression, habitat conversion, and incompatible agriculture and forestry practices
Buckthorn *Sideroxylon thornei*	No Federal Status	E	Oak flatwoods where soil normally is saturated for long periods after floods/heavy rain (i.e., calcareous swamps; woods bordering cypress ponds)	
Curtiss loosestrife *Lythrum curtissii*	No Federal Status	T	Swamps over limestone, boggy open areas in pinelands, shallow water of wet thickets and floodplains, and occasionally in openings along right-of-ways	
Pondspice *Litsea aestivalis*	No Federal Status	T	Margins of swamps, cypress ponds, and sandhill depression ponds and in hardwood swamps	
Variable-leaf indian-plantain *Cacalia diversifolia*	No Federal Status	T	Swamps and muddy stream and river banks	

Listed Species in Mitchell County (updated May 2004)

Species	Federal Status	State Status	Habitat	Threats
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Alligator snapping turtle *Macroclemys temminckii*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Barbour's map turtle *Graptemys barbouri*	No Federal Status	T	Restricted to the Apalachicola River and larger tributaries including the Chipola, Chattahoochee, and Flint Rivers in eastern Alabama, western Georgia, and western Florida.	
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Georgia blind salamander *Haideotriton wallacei*	No Federal Status	T	Subterranean waters of upland limestone karst system; restricted to Dougherty Plain region of Georgia	
Invertebrate				
Gulf moccasinshell mussel *Medionidus pencillatus*	E	E	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots	Habitat modification, sedimentation, and water quality degradation

Purple bankclimber mussel *Elliptoideus sloatianus*	T	T	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates	Habitat modification, sedimentation, and water quality degradation
Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Fish				
Bluestripe shiner *Cyprinella callitaenia*	No Federal Status	T	Brownwater streams	
Plant				
Creeping Morning-glory *Evolvulus sericeus var sericeus*	No Federal Status	E	Sparsely vegetated, partially shaded outcrops of Altamaha Grit.	
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods	

Listed Species in Seminole County (updated May 2004)

Species	Federal Status	State Status	Habitat	Threats
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. Active eagle nest were located in Seminole county in 2000	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Alligator snapping turtle *Macroclemys temminckii*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Barbour's map turtle *Graptemys barbouri*	No Federal Status	T	Restricted to the Apalachicola River and larger tributaries including the Chipola, Chattahoochee, and Flint Rivers in eastern Alabama, western Georgia, and western Florida.	
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Invertebrate				
Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Fish				
Bluestripe shiner *Cyprinella callitaenia*	No Federal Status	T	Brownwater streams	
Plant				

Buckthorn *Sideroxylon thornei*	No Federal Status	E	Oak flatwoods where soil normally is saturated for long periods after floods/heavy rain (i.e., calcareous swamps; woods bordering cypress ponds)
Harper Fimbry *Fimbristylis perpusilla*	No Federal Status	E	Muddy bottoms and silty margins of drying pine barren ponds and farm ponds
Lax Water-milfoil *Myriophyllum laxum*	No Federal Status	T	Sinkholes and other shallow freshwater pools; also sandy clear streams draining spring-fed swamps
White trumpet *Sarracenia leucophylla*	No Federal Status	E	Acid soils of open bogs and on sphagnum mats in light gaps along streams and in red maple-blackgum swamps

Listed Species in Tift County (updated May 2004)

Species	Federal Status	State Status	Habitat	Threats
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Plant				
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods.	

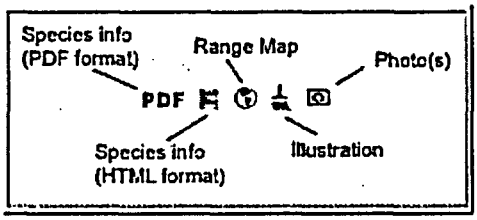
Listed Species in Worth County (updated May 2004)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps. Active rookeries were located in Worth County in 1996 - 1999.	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Alligator snapping turtle *Macroclemys temminckil*	No Federal Status	T	Rivers, lakes, and large ponds near stream swamps.	Destruction and modification of habitat and overharvesting.
Barbour's map turtle *Graptemys barbouri*	No Federal Status	T	Restricted to the Apalachicola River and larger tributaries including the Chipola, Chattahoochee, and Flint Rivers in eastern Alabama, western Georgia, and western Florida.	
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Last breeding record for Worth County was in 1962.	Habitat destruction as a result of agricultural an silvicultural practices (e.g., clearclutting, mechanical site preparation), fire suppresion and residential and commercial development.
Invertebrate				

Purple bankclimber mussel *Elliptoideus sloatianus*	T	T	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates	Habitat modification, sedimentation, and water quality degradation
Shiny-rayed pocketbook mussel *Lampsilis subangulata*	E	E	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay	Habitat modification, sedimentation, and water quality degradation
Gulf moccasinshell mussel *Medionidus penicillatus*	E	E	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots	Habitat modification, sedimentation, and water quality degradation
Oval pigtoe mussel *Pleurobema pyriforme*	E	E	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates	Habitat modification, sedimentation, and water quality degradation
Fish				
Bluestripe shiner *Cyprinella callitaenia*	No Federal Status	T	Brownwater streams	
Plant				
American chaffseed *Schwalbea americana*	E	E	Fire-maintained wet savannahs in the Coastal Plain (with grass pinks, colic root, huckleberry and gallberry); grassy openings and swales of relict longleaf pine woods in the Piedmont ; the known population of this species in Worth County has been extirpated	Fire suppression, habitat conversion, and incompatible agriculture and forestry practices
Buckthorn *Sideroxylon thornei*	No Federal Status	E	Oak flatwoods where soil normally is saturated for long periods after floods/heavy rain (i.e., calcareous swamps; woods bordering cypress ponds)	
Cooley meadowrue *Thalictrum cooleyi*	E	E	On fine sandy loam in open, seasonally wet mixed pine-hardwoods and in adjacent wet savannahs; in Georgia, may be restricted to roadsides and powerline right-of-ways	Most extirpated populations were eliminated by fire suppression and/or silvicultural or agricultural development.
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods	
Pondberry *Lindera melissifolia*	E	E	Shallow depression ponds of sandhills, margins of cypress ponds, and in seasonally wet low areas among bottomland hardwoods	Drainage ditching and subsequent conversion of habitat to other uses; domestic hogs, cattle grazing, and timber harvesting; and apparent lack of seedling production

amphibian, salamanders, caudata, caudate, amphiumidae, amphiuma, means, pholeter, tridactylum, two toed, three toed, one toed

Amphiumidae (Cope, 1866): Amphiuma/Congo Eels - Amphiuma are large, aquatic, eel-like salamanders. Amphiuma are capable of enclosing their bodies in a water-proof mucus, which will retain enough moisture to survive the driest seasons.

Amphiuma inhabit swamps, marshes, drainage ditches, and streams in southeastern areas of the United States. Although mostly aquatic, adult Amphiuma do not possess gills, but respire through the use of lungs. The front and hind limbs are extremely reduced. All three species differ by the number of digits on each limb, one, two, and three...more about Amphiumidae.



Genus Amphiuma (Garden, 1821) Amphiuma / Congo Eels

	Amphiuma means	Two-Toed Amphiuma
	Amphiuma pholeter	One-Toed Amphiuma
	Amphiuma tridactylum	Three-Toed Amphiuma

New caudate species are still occasionally discovered in the wild today, and recognized species re-classed based on genetic information frequently. Because of this, the databases and taxonomic models are updated often, when new information is discovered or handed down, and an effort is made to keep it as up to date as possible. Taxonomy is increasingly based on molecular findings, rather than morphological similarities, which has cleared up many "gray areas" in the caudate order, and enabled scientists to classify similar species definitively. However, like all amphibians, the caudate taxonomic model is still subject to change as new information is discovered. The year 2003 alone has produced at least 5 new species, most of which have been reclassifications of existing species based on genetic information. Please feel free to email us at info@livingunderworld.org with any comments, suggestions, or questions about this database or the taxonomic model.

For more information about each caudate family, and the taxonomic model, see the **Caudate Families, and the Taxonomic Model.** For information about Taxonomy, the Linnaean System of Classification, and Cladistics, see article 0012 - Introduction to Systematics & Taxonomy.

Database updated August 2003, info@livingunderworld.org

Macrochelys temminckii
(alligator snapping turtle)

2004/10/30 01:23:56.496 GMT-4

By Paul DiLaura

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Testudines
Family: Chelydridae
Genus: Macrochelys
Species: **Macrochelys temminckii**

Geographic Range

Alligator snapping turtles are native to the southeastern region of the United States. They are confined to the river systems that drain into the Gulf of Mexico (Levine 1994 and Ernst et al 1994).

Biogeographic Regions: nearctic (native).

Habitat

Alligator snapping turtles live in freshwater areas in the southeastern United States. They generally live in the deep water of large rivers, canals, lakes, swamps, and rivers. Hatchlings and juveniles usually live in small streams (Ernst et al 1994 and http://vygotsky.sfasu.edu:80/zoo/gator.snap.turtle.html).

Aquatic Biomes: lakes and ponds; rivers and streams.

Physical Description

Mass
70 to 80 kg
(154 to 176 lbs)

The alligator snapping turtle is the largest freshwater turtle in the world. It is characterized by three large, pronounced ridges that run from the front to the back of the carapace. It has powerful jaws and a large head, and it is unique among snapping turtles for having eyes on the side of its head. The alligator snapping turtle looks very primitive and has been called the dinosaur of the turtle world (Levine 1994).

Some key physical features: ectothermic; bilateral symmetry.

Reproduction

During reproduction, the male alligator snapping turtle mounts the back of the female. He grasps her shell with all four of his feet and inseminates her. It is unlikely that females reproduce more than once a year, and some females lay eggs on an alternate-year basis. The turtles mate in early spring in Florida and late spring in the Mississippi Valley. They nest about two months later in a nest approximately 50 meters from the shore. All nests are dug in the sand and clutch success is highly variable. A clutch may contain 8 to 52 eggs and incubation takes 100 to 140 days. Hatchlings, therefore, emerge in the fall. The sex of the hatchling is determined by the incubation temperature and the hatchlings look very much like adults. Sexual maturity occurs in 11 to 13 years (Levine 1994, Pritchard 1979, Ernst et al 1994, and http://vygotsky.sfasu.edu:80/zoo/gator.snap.turtle.html).

Key reproductive features: gonochoric/gonochoristic/dioecious (sexes separate).

Behavior

Alligator snapping turtles spend most of their time in the water, and generally only nesting females venture on land. They are solitary, and there is very little social structure or parental care. The turtles stay submerged for 40 to 50 minutes at a time, and only go to the surface for air. They are so motionless under water that algae can cover their backs and make the turtles almost invisible to fish (Ernst et al 1994 and http://vygotsky.sfasu.edu:80/zoo/gator.snap.turtle.html).

Key behaviors: motile.

Food Habits

The alligator snapping turtle is both a scavenger and an active hunter. It most actively forages for food during the night. During the day, it

usually lies quietly in the bottom of a dark body of water and opens its jaw to reveal a small pink worm-like lure in the back of its gray mouth. The lure attracts fish, and when the fish enter the jaws, they are either swallowed whole, sliced in two by the sharp jaws, or impaled on the sharp tips of the upper and lower jaws. The alligator snapping turtle eats any kind of fish and also eats frogs, snakes, snails, worms, clams, crayfish, aquatic plants, and other turtles. The turtles feed year round by taking advantage of warm winter days to search for food (Levine 1994, Pritchard 1979, and Ernst et al 1994).

Economic Importance for Humans: Positive

Alligator snapping turtles play a role in freshwater ecosystems. Adults are not a source of food for any animals other than humans, but eggs and hatchlings are a source of food for large fish, racoons, and birds. The adults, however, are important predators. Humans find them valuable for their unique appearance and their meat (Levine 1994, Ernst et al 1994, and http://vygotsky.sfasu.edu:80/zoo/gator.snap.turtle).

Conservation Status

The main threat to the alligator snapping turle is humans, who these reptiles for their meat. (http://vygotsky.sfasu.edu:80/zoo/gator.snap.turtle.html).

Other Comments

There is an unverified legend that a 403 lb alligator snapping turtle was found in the Neosho River in Kansas in 1937 (Ernst et al 1994).

Contributors

Paul DiLaura (author), University of Michigan: June, 1999.

References

Ernst, C.H., Barbour, R.W., Lovich, J.E. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington.

Levine, Diane. 1994. http://www.inetjungle.com:80/CTTC/MACROCL.html

Pritchard, P. 1979. Encyclopedia of Turtles. T.F.H Publications, Inc., Neptune, New Jersey

http://vygotsky.sfasu.edu:80/zoo/gator.snap.turtle.html
2004/10/30 01:23:59.153 GMT-4

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U.S. Fish & Wildlife Service

Three-ridge, fat (mussel)

Amblema neislerii
Family: Unionidae
Group: Clams

Current Status: Endangered (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Fat three-ridge (mussel).
- Habitat Conservation Plans (HCP) in which Fat three-ridge (mussel) occurrence has been recorded.
- Petitions received on the Fat three-ridge (mussel).
- USFWS Refuges on which the Fat three-ridge (mussel) is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://ecos.fws.gov/docs/life_histories/F032.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach*

Endangered

As of March 16, 1998, the Fat three-ridge (mussel) is designated as **Endangered** in the Entire Range. Within the area covered by this listing, this species is known to occur in: Florida. The U.S. Fish & Wildlife Service Southeast Region (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 1076 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
Go to the U.S. Fish & Wildlife Service Home Page

Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

Three-ridge, fat (mussel)

Amblema neislerii
Family: Unionidae
Group: Clams

Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Endangered

Date	Citation Page	Type	Title
01-OCT-03	68 FR 56647 56648	Notice Final Recovery Plan Availability	Availability of the Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), Oval Pigtoe (Pleurobema pyriforme) and the Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus)(See PDF file)
17-JUL-03	68 FR 42419 42420	Notice Draft Recovery Plan Availability	Notice of Availability of an Agency Draft Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme), and the Threatened Chipola Slabshell (Elliptio chipolaensis) and Purple Bankclimber (Elliptoideus sloatianus), for Review and Comment(See PDF file)
16-MAR-98	63 FR 12664 12687	Final Listing, Endangered	ETWP; Determination of Endangered Status for Five Freshwater Mussels and Threatened status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
19-SEP-97	62 FR 49397	Notice CNOR	Review of Plant and Animal Taxa(See PDF file)
28-FEB-96	61 FR 7595 7613	Notice CNOR	ETWP; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species(See PDF file)
15-NOV-94	59 FR 58982 59028	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species.(See PDF file)
03-AUG-94	59 FR 39524 39532	Proposed Listing, Endangered	ETWP; Proposed Endangered Status for Five Freshwater Mussels and Proposed Threatened Status for Two Freshwater Mussels From Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
21-NOV-91	56 FR 58804 58836	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species; 56 FR 58804 58836(See PDF file)
06-JAN-89	54 FR 554 579	Notice CNOR	ETWP; Animal Notice of Review; 54 FR 554 579

FAT THREERIDGE
Amblema neislerii

SPECIES CODE: F032 I01

STATUS: On March 16, 1998, the fat threeridge was designated as Endangered throughout its entire range (USFWS 1998). A recovery plan addressing the fat threeridge was finalized on October 1, 2003 (USFWS 2003).

SPECIES DESCRIPTION: The fat threeridge is a medium-sized to large, subquadrate, inflated, solid, and heavy-shelled mussel that reaches a length of 10.2 centimeters (4.0 inches). Large specimens are so inflated that their width approximates their height. The umbos (bulge or beak that protrudes near the hinge of the mussel) are in the anterior quarter of the shell. The dark brown to black shell is strongly sculptured with seven to eight prominent horizontal parallel plications (ridges). As is typical of the genus, no sexual dimorphism is displayed in the shell characters. Internally, there are two subequal pseudocardinal teeth in the left valve and typically one large and one small tooth in the right valve (shell half). The lateral teeth are heavy, long, and slightly accurate (curved like a bow), with two in the left valve and one in the right valve. The inside surface of the shell (nacre) is bluish white to light purplish and very iridescent. Brim Box and Williams (2000) outlined various aspects of the species soft anatomy and provided the only published color photographs of the species. This taxon was originally described as *Unio neislerii* (Lea, 1858), and has been assigned to the genera *Quadrula* and *Crenodonta* by Simpson (1914) and Clench and Turner (1956), respectively. Subsequent investigators (e.g., Mulvey et al. 1997, Turgeon et al. 1998) have placed the fat threeridge in the genus *Amblema*.

Like other freshwater mussels, adults are filter-feeders, orienting themselves in the substrate to facilitate siphoning of the water column for oxygen and food (Kraemer 1979). Mussels have been reported to consume detritus, diatoms, phytoplankton, zooplankton, and other microorganisms (Coker et al. 1921, Churchill and Lewis 1924, Fuller 1974). Juvenile mussels employ foot (pedal) feeding, and are thus suspension feeders (Yeager et al. 1994). Foods of juvenile freshwater mussels up to two weeks old include bacteria, algae, and diatoms with amounts of detrital and inorganic colloidal particles (Yeager et al. 1994). Specific food habits of the fat threeridge are unknown, but are likely similar to those of other freshwater mussels.

REPRODUCTION AND DEVELOPMENT: O'Brien and Williams (2002) studied various aspects of the life history of the fat threeridge. A tachytictic species, it appears to be gravid in Florida when water temperatures reach 75.2°F, in late May or June. This release period would suggest that this species is a summer releaser. Fat threeridge glochidia are released in a white, sticky, web-like mass, which expands and wraps around a fish, thus facilitating attachment. Viability is maintained for two days after release (O'Brien and Williams 2002). The glochidia were described and figured by O'Brien and Williams (2002). Five potential host fishes have been identified: weed shiner (*Notropis texanus*), bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), largemouth bass (*Micropterus salmonides*), and blackbanded darter (*Percina nigrofaciata*). Transformation of the glochidia on host fishes required 10 to 14 days at approximately 73.4 $\pm$ 2.7°F (O'Brien and Williams 2002).

RANGE AND POPULATION LEVEL: The type locality of the fat threeridge is the Flint River, Macon County, Georgia. Records for this species are limited to the Apalachicola-Chattahoochee-Flint (ACF) River system main stems of the Flint, Apalachicola, and Chipola rivers in southwest Georgia and north Florida (Clench and Turner 1956, Williams and Butler 1994), all below the Fall Line (Brim Box and Williams 2000). This species has never been recorded from the Chattahoochee River, and thus is absent from Alabama. Two historical records from the Escambia River (van der Schalie 1940, Heard 1979) are considered erroneous (Williams and Butler 1994).

Apparently, the fat threeridge has been extirpated from the main stem of the Flint River (and thus from Georgia), and from Dead lake in the Chipola River. It is documented in recent collections from 15 main stem sites on the Apalachicola River and lowermost portion of the Chipola River in Florida (Table 1, USFWS, 2003).

The status survey (USFWS 1998) produced an average of 6.4 live specimens of the fat threeridge from six sites of occurrence in the ACF Basin. Brim Box and Williams (2000) reported a subpopulation of approximately 100 specimens located on the Chipola River below Dead Lake in 1988. Relatively large subpopulations are currently known in the lower Apalachicola River, where scores of specimens could be found in the mid-1990s (J. Brim Box, USGS, pers. comm., 1994); and a distributary (a side channel whose origin is the river main stem), Swift Slough. The latter site apparently serves as a nursery; 17 specimens, 2.5 to 5.0 cm (1.0 to 2.0 inches) long, were discovered in 2000 (J.D. Williams, USGS, pers. comm., 2000). Limited quadrat sampling at one main stem site (six 2.7 square feet samples) conducted by Richardson and Yokley (1996) determined the fat threeridge to be the second most abundant of four species encountered (25 percent relative abundance). Although their data are unclear, it would appear that this species occurred at a density of less than 0.4 specimens per square foot in this bed (Richardson and Yokley 1996), in what may represent the largest known subpopulation.

The Corps has completed mussel surveys at potential dredged material disposal sites, slough locations, and other main channel areas within the Apalachicola and Chipola rivers (Miller 1998, Miller 2000, Miller, US Army Engineer Research and Development Center [ERDC], pers. comm. 2003). During these surveys, approximately 100 sites were examined over 30 river miles. The fat threeridge was detected at 22 locations and recruitment was documented at several of these locations. At the Chipola River cutoff (nautical mile 41.6) a "dense band" of mussels was located, which more than 60 percent were fat threeridge. At the same location, 10 percent of the fat threeridge were less than 30 mm in total shell length, representing recent recruitment (Miller, ERDC, pers. comm. 2003).

HABITAT: The fat threeridge inhabits that main channel of small to large rivers in slow to moderate current. Substrate used by this mussel varies from gravel to cobble to a mixture of sand and sandy mud (Williams and Butler 1994). Brim Box and Williams (2000) found 60 percent of the specimens were located in a sandy silt substrate.

PAST THREATS: The abundance and distribution of the fat threeridge decreased historically from habitat loss from habitat loss and degradation (Williams et al. 1993, Neves 1993), caused by impoundments, sedimentation and turbidity, dredging and channelization, and contaminants contained in numerous point and nonpoint sources. A comprehensive review of these past threats is provided elsewhere (USFWS 2003, Brim Box and Williams 2000, Butler 1993, Howard 1997, Frick et al. 1998, Buell and Couch 1995, Richter 1997, Watters 1997, Neves et al. 1997). These habitat changes have resulted in significant extirpations (localized loss of populations), restricted and fragmented distributions, and poor recruitment of young.

CURRENT THREATS: Habitat loss and degradation (Williams et al. 1993, Neves 1993) primarily caused by contaminants contained in point and nonpoint source discharges, sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments, and alien species are primary threats to the fat threeridge (USFWS 2003).

Sediment samples from various ACF Basin streams tested for heavy metals that are known to be deleterious to mussels had concentrations markedly above background levels (Frick et al. 1998), among those were copper (throughout the Piedmont), and cadmium (large Coastal Plain tributaries of the Flint River). Past episodes of significant heavy metal contamination of ACF Basin streams may continue to impact mussel faunas. An estimated 950 million gallons of chemical-laden rinse, stripping, cleaning, and plating solutions were discharged indirectly into the Flint River (P. Laumeyer, USFWS, pers. comm., 1994) over a several year period. Concentrations of heavy metals (e.g., chromium and cadmium) in Asian clam, *Corbicula fluminea* (Muller 1774), and sediment samples were elevated downstream from two abandoned battery salvage operations on the Chipola River (Winger et al. 1985). Chromium concentrations found in sediments from Dead Lake downstream in the Chipola River (Winger et al. 1985) are known to be toxic to mussels (Havlik and Marking 1987).

Agricultural sources of contaminants in the ACF and Suwannee basins include nutrient enrichment from poultry farms and livestock feedlots, and pesticides and fertilizers from row crop agriculture (Couch et al. 1996, Frick et al. 1998, Berndt et al. 1998). Nitrate concentrations are particularly high in surface waters downstream of agricultural areas (Mueller et al. 1995; Berndt et al. 1998). A study by the U.S. Soil Conservation Service (USSCS; now the Natural Resources Conservation Service [NRCS]) in the Flint River system determined that between 72 and 75 percent of the nutrients entering Lake Blackshear were derived from agricultural sources (USSCS 1993). Stream ecosystems are impacted when nutrients are added at concentrations that cannot be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996, Fleming et al. 1995). Organochlorine pesticides were found at levels in ACF Basin streams that often exceeded chronic exposure criteria for the protection of aquatic life (Buell and Couch 1995, Frick et al. 1998). Once widely used in the ACF Basin (Buell and Couch 1995), these highly toxic compounds are persistent in the environment, and are found in both sediments and the lipid reservoir of organisms (Day 1990, Burton 1992). Commonly used pesticides have been directly implicated in a North Carolina mussel dieoff (Fleming et al. 1995). Cotton is raised extensively in much of the Apalachicolan Region inhabited by these mussels. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of a mussel to respire and obtain food. This chemical may pose a continuing threat to some populations of

these mussels.

Many pollutants in the ACF Basin originate from urban stormwater runoff, development activities, and municipal waste water facilities, primarily in the Piedmont (Frick et al. 1998). Urban catchments in Piedmont drainages have higher concentrations of nutrients, heavy metals, pesticides, and organic compounds than do agricultural or forested ones (Lenat and Crawford 1994, Frick et al. 1998), and at levels sufficient to significantly affect fish health (Ostrander et al. 1995). Within the Suwannee River basin, nutrient concentrations were greater in agricultural areas and nitrates were found to exceed U.S. Environmental Protection Agency (EPA) drinking water standards in 20 percent of the surficial aquifer groundwater samples (Berndt et al. 1998). Pesticide concentrations were found to exceed criteria for protection of aquatic life mostly in urban areas. Currently, there are discharges from 137 municipal waste water treatment facilities in the ACF River basin alone (Couch et al. 1996). Although effluent quality has improved with modern treatment technologies and a phosphate detergent ban, hundreds of miles of streams in the ACF and Ochlockonee basins in Alabama, Florida, and Georgia, as identified in reports prepared by the water quality agencies of these states under Section 305(b) of the Clean Water Act, do not meet water use classifications.

Since approximately 29 percent of the ACF Basin is in agriculture (Frick et al. 1998), sedimentation from agricultural sources is probably significant. According to USSCS (1993), 89 percent of the sediments entering Lake Blackshear on the Flint River are derived from agricultural sources. The lower Flint River system serves as the heart of numerous mussel species' range and is a major agricultural center. This area has experienced "severe losses of topsoil and nutrient additions to local streams due to agriculture" (Neves et al. 1997), and has profoundly affected the biota of surface and ground waters there (Patrick 1992). Despite the implications, only a few studies (e.g., Cooper 1987, Stewart and Swinford 1995) have specifically attributed changes in mussel populations to sediments derived from agricultural practices.

Many southern streams have increased turbidity levels due to siltation (van der Schalie 1938). The fat threeridge attracts host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. Such a reproductive strategy depends on clear water during the critical time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Turbidity is a limiting factor impeding sight-feeding fishes (Burkhead and Jenkins 1991). In addition, mussels may be indirectly affected when turbidity levels significantly reduce light available for photosynthesis and the production of unionid food items (Kanehl and Lyons 1992).

Water quantity is becoming more of a concern in maintaining mussel habitat in the Apalachicolan Region. The potential impacts to mussels, their host fishes, and their respective habitats from ground water withdrawal may be profound. Within the Flint River basin, decreases in flow velocity and dissolved oxygen were highly correlated to mussel mortality (Johnson et al. 2001). Low DO conditions in stagnating stream pools due to drought conditions are having a disastrous effect on these mussels. Mussel mortality increases dramatically as DO decreases below 5 mg/L (Johnson et al. 2001).

Nonnative aquatic species invasions may also impact the fat threeridge. For example, the nonindigenous Asian clam (*Corbicula fluminea*) has been implicated as a competitor with native mussels for resources such as food, nutrients, and space (Heard 1977, Kraemer 1979, Clarke 1986), particularly as juveniles (Neves and Widlak 1987). Densities of Asian clams are sometimes high in Apalachicolan Region streams (Stringfellow and Stanton 1998), with estimates from approximately 9 per square foot (Flint River, Sickel 1973) to over 195 per square foot (Santa Fe River, Bass and Hitt 1974).

CONSERVATION MEASURES:

Exposure Scenario Summary Table for the Fat Threeridge

Species	Life Stage	Habitat Type	Exposure Route	Diet	Significant Interspecies Relationships
Fat Threeridge	glochidia	parasite	contact with water, diet	fish body fluids	weed shiner, bluegill, redear sunfish, largemouth bass, blackbanded darter
	juvenile/ adult	sediment dweller	contact & ingestion of water, diet, sediment	filter feeder (bacteria, algae, detritus, sediment)	

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U.S. Fish & Wildlife Service

Slabshell, Chipola

Elliptio chipolaensis
Family: Unionidae
Group: Clams

Current Status: Threatened (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Chipola slabshell.
- Habitat Conservation Plans (HCP) in which Chipola slabshell occurrence has been recorded.
- Petitions received on the Chipola slabshell.
- USFWS Refuges on which the Chipola slabshell is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://ecos.fws.gov/docs/life_histories/F03O.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach)*

Threatened

As of March 16, 1998, the Chipola slabshell is designated as **Threatened** in the Entire Range. Within the area covered by this listing, this species is known to occur in: **Alabama, Florida.** The U.S. Fish & Wildlife Service Southeast Region (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 1076 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
Go to the U.S. Fish & Wildlife Service Home Page

Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

Slabshell, Chipola

Elliptio chipolaensis
Family: Unionidae
Group: Clams

Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Threatened

Date	Citation Page	Type	Title
01-OCT-03	68 FR 56647 56648	Notice Final Recovery Plan Availability	Availability of the Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), Oval Pigtoe (Pleurobema pyriforme) and the Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus)(See PDF file)
17-JUL-03	68 FR 42419 42420	Notice Draft Recovery Plan Availability	Notice of Availability of an Agency Draft Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme), and the Threatened Chipola Slabshell (Elliptio chipolaensis) and Purple Bankclimber (Elliptoideus sloatianus), for Review and Comment(See PDF file)
16-MAR-98	63 FR 12664 12687	Final Listing, Threatened	ETWP; Determination of Endangered Status for Five Freshwater Mussels and Threatened status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
19-SEP-97	62 FR 49397	Notice CNOR	Review of Plant and Animal Taxa(See PDF file)
28-FEB-96	61 FR 7595 7613	Notice CNOR	ETWP; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species(See PDF file)
15-NOV-94	59 FR 58982 59028	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species.(See PDF file)
03-AUG-94	59 FR 39524 39532	Proposed Listing, Threatened	ETWP; Proposed Endangered Status for Five Freshwater Mussels and Proposed Threatened Status for Two Freshwater Mussels From Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)

CHIPOLA SLABSHELL
Elliptio chipolaensis

SPECIES CODE: F03O I01

STATUS: On March 16, 1998, the Chipola slabshell was designated as Threatened throughout its range (USFWS 1998). A recovery plan addressing the Chipola slabshell was finalized on October 1, 2003 (USFWS 2003).

SPECIES DESCRIPTION: The Chipola slabshell is a medium-sized species that reaches a length of about 8.4 cm (3.3 in). The shell is ovate to subelliptical, somewhat inflated, and with the posterior ridge starting out rounded, but flattening to form a prominent biangulate margin. The periostracum is smooth and chestnut colored. Dark brown coloration may appear in the umbonal region and the remaining surface may exhibit alternating light and dark bands. The umbos are prominent, well above the hingeline. As is typical of all *Elliptio* mussels, no sexual dimorphism is displayed in shell characters. Internally, the umbone cavity is rather deep. The lateral teeth are long, slender, and slightly curved, with two in the left and one in the right valve. The pseudocardinal teeth are compressed and crenulate, with two in the left and one in the right valve. Nacre color is salmon, becoming more intense dorsally and somewhat iridescent posteriorly. The Service currently recognizes *Unio chipolaensis* Walker, 1905, as a synonym of *Elliptio chipolaensis,* Frierson, 1927 (USFWS 2003).

Like other freshwater mussels, adults are filter-feeders, orienting themselves in the substrate to facilitate siphoning of the water column for oxygen and food (Kraemer 1979). Mussels have been reported to consume detritus, diatoms, phytoplankton, zooplankton, and other microorganisms (Coker et al. 1921, Churchill and Lewis 1924, Fuller 1974). Juvenile mussels employ foot (pedal) feeding, and are thus suspension feeders (Yeager et al. 1994). Foods of juvenile freshwater mussels up to two weeks old include bacteria, algae, and diatoms with amounts of detrital and inorganic colloidal particles (Yeager et al. 1994). Specific food habits of the Chipola slabshell are unknown, but are likely similar to those of other freshwater mussels.

REPRODUCTION AND DEVELOPMENT: Little is known about the life history of the Chipola slabshell. A unionine, it is suspected that this species expels conglutinates and is a tachytictic summer releaser. Southeastern congeners of the Chipola slabshell have been documented to use centrarchids (sunfishes) as host fish (Keller and Ruessler 1997), although a relationship between cyprinids and tachytictic brooders has been documented (Bruenderman and Neves 1993).

RANGE AND POPULATION LEVEL: The type locality is Chipola River, Marianna, Jackson County, Florida. The Chipola slabshell was thought to be endemic to the Chipola River system (van der Schalie 1940, Clench and Turner 1956, Burch 1975, Heard 1979, Williams and Butler 1994) until Brim Box and Williams (2000) located a museum lot (single specimen) from Howards Mill Creek, a Chattahoochee River tributary in southeastern Alabama. The historical range of this Apalachicola-Chattahoochee-Flint (ACF) Basin endemic is centered throughout much of the Chipola

River main stem and several of its headwater tributaries. The Chipola slabshell is one of the most narrowly distributed species in the Apalachicolan Region.

The Chipola slabshell is no longer known from Howards Mill Creek. Likewise, this species is probably extirpated from Dead Lake on the lower main stem of the Chipola and in two Chipola River tributaries, Cowarts and Spring Creeks, and thus is considered extirpated from Alabama (Lydeard et al. 1999). Currently, six populations of Chipola slabshell remain in Marshall and Dry Creeks, and from the upper two-thirds of the Chipola River main stem (Table 6, USFWS 2003). The largest remaining subpopulation appears to be on the Chipola River main stem in the vicinity of (but not in) Dead Lake, where the species remains relatively common (J.D. Williams, USGS, unpub. data). An average of 3.7 Chipola slabshell specimens per site of occurrence (3 sites) were found during the status survey (USFWS 1998).

HABITAT: The Chipola slabshell inhabits silty sand substrates of large creeks and the main channel of the Chipola River in slow to moderate current (Williams and Butler 1994). Specimens are generally found in sloping bank habitats. Nearly 70 percent of the specimens found during the status survey were associated with a sandy substrate (Brim Box and Williams 2000).

PAST THREATS: The abundance and distribution of the Chipola slabshell decreased historically from habitat loss and degradation (Williams et al. 1993, Neves 1993) caused by impoundments, sedimentation and turbidity, dredging and channelization, and contaminants contained in numerous point and nonpoint sources. A comprehensive review of these past threats is provided elsewhere (USFWS 2003, Brim Box and Williams 2000, Butler 1993, Howard 1997, Frick et al. 1998, Buell and Couch 1995, Richter 1997, Watters 1997, Neves et al. 1997). These habitat changes have resulted in significant extirpations (localized loss of populations), restricted and fragmented distributions, and poor recruitment of young.

CURRENT THREATS: Habitat loss and degradation (Williams et al. 1993, Neves 1993) primarily caused by contaminants contained in point and nonpoint source discharges, sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments, and alien species are primary threats to the Chipola slabshell (USFWS 2003).

Sediment samples from various ACF Basin streams tested for heavy metals that are known to be deleterious to mussels had concentrations markedly above background levels (Frick et al. 1998), among those were copper (throughout the Piedmont), and cadmium (large Coastal Plain tributaries of the Flint River). Past episodes of significant heavy metal contamination of ACF Basin streams may continue to impact mussel faunas. An estimated 950 million gallons of chemical-laden rinse, stripping, cleaning, and plating solutions were discharged indirectly into the Flint River (P. Laumeyer, USFWS, pers. comm., 1994) over a several year period. Concentrations of heavy metals (e.g., chromium and cadmium) in Asian clam, *Corbicula fluminea* (Muller 1774), and sediment samples were elevated downstream from two abandoned battery salvage operations on the Chipola River (Winger et al. 1985). Chromium concentrations found in sediments from Dead Lake downstream in the Chipola River (Winger et al. 1985) are known to be toxic to mussels (Havlik and Marking 1987).

Agricultural sources of contaminants in the ACF and Suwannee basins include nutrient enrichment from poultry farms and livestock feedlots, and pesticides and fertilizers from row crop agriculture (Couch et al. 1996, Frick et al. 1998, Berndt et al. 1998). Nitrate concentrations are particularly high in surface waters downstream of agricultural areas (Mueller et al. 1995; Berndt et al. 1998). A study by the U.S. Soil Conservation Service (USSCS; now the Natural Resources Conservation Service [NRCS]) in the Flint River system determined that between 72 and 75 percent of the nutrients entering Lake Blackshear were derived from agricultural sources (USSCS 1993). Stream ecosystems are impacted when nutrients are added at concentrations that cannot be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996, Fleming et al. 1995). Organochlorine pesticides were found at levels in ACF Basin streams that often exceeded chronic exposure criteria for the protection of aquatic life (Buell and Couch 1995, Frick et al. 1998). Once widely used in the ACF Basin (Buell and Couch 1995), these highly toxic compounds are persistent in the environment, and are found in both sediments and the lipid reservoir of organisms (Day 1990, Burton 1992). Commonly used pesticides have been directly implicated in a North Carolina mussel dieoff (Fleming et al. 1995). Cotton is raised extensively in much of the Apalachicolan Region inhabited by these mussels. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of a mussel to respire and obtain food. This chemical may pose a continuing threat to some populations of these mussels.

Many pollutants in the ACF Basin originate from urban stormwater runoff, development activities, and municipal waste water facilities, primarily in the Piedmont (Frick et al. 1998). Urban catchments in Piedmont drainages have higher concentrations of nutrients, heavy metals, pesticides, and organic compounds than do agricultural or forested ones (Lenat and Crawford 1994, Frick et al. 1998), and at levels sufficient to significantly affect fish health (Ostrander et al. 1995). Within the Suwannee River basin, nutrient concentrations were greater in agricultural areas and nitrates were found to exceed U.S. Environmental Protection Agency (EPA) drinking water standards in 20 percent of the surficial aquifer groundwater samples (Berndt et al. 1998). Pesticide concentrations were found to exceed criteria for protection of aquatic life mostly in urban areas. Currently, there are discharges from 137 municipal waste water treatment facilities in the ACF River basin alone (Couch et al. 1996). Although effluent quality has improved with modern treatment technologies and a phosphate detergent ban, hundreds of miles of streams in the ACF and Ochlockonee basins in Alabama, Florida, and Georgia, as identified in reports prepared by the water quality agencies of these states under Section 305(b) of the Clean Water Act, do not meet water use classifications.

Since approximately 29 percent of the ACF Basin is in agriculture (Frick et al. 1998), sedimentation from agricultural sources is probably significant. According to USSCS (1993), 89 percent of the sediments entering Lake Blackshear on the Flint River are derived from agricultural sources. The lower Flint River system serves as the heart of numerous mussel species' range and is a major agricultural center. This area has experienced "severe losses of topsoil and nutrient additions to local streams due to agriculture" (Neves et al. 1997), and has profoundly affected the biota of surface and ground waters there (Patrick 1992). Despite the implications, only a few studies (e.g., Cooper 1987, Stewart and

Swinford 1995) have specifically attributed changes in mussel populations to sediments derived from agricultural practices.

Many southern streams have increased turbidity levels due to siltation (van der Schalie 1938). The Chipola slabshell attracts host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. Such a reproductive strategy depends on clear water during the critical time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Turbidity is a limiting factor impeding sight-feeding fishes (Burkhead and Jenkins 1991). In addition, mussels may be indirectly affected when turbidity levels significantly reduce light available for photosynthesis and the production of unionid food items (Kanehl and Lyons 1992).

Water quantity is becoming more of a concern in maintaining mussel habitat in the Apalachicolan Region. The potential impacts to mussels, their host fishes, and their respective habitats from ground water withdrawal may be profound. Within the Flint River basin, decreases in flow velocity and dissolved oxygen were highly correlated to mussel mortality (Johnson et al. 2001). Low DO conditions in stagnating stream pools due to drought conditions are having a disastrous effect on these mussels. Mussel mortality increases dramatically as DO decreases below 5 mg/L (Johnson et al. 2001).

Maintaining vegetated riparian buffer zones adjacent to stream banks is a well-known method of reducing stream sedimentation and other runoff (Allan and Flecker 1993, Lenat and Crawford 1994). Buffers reduce impacts to fish and other aquatic faunas (Armour et al. 1991, Naiman et al. 1988, Osborne and Kovacic 1993, Belt and O'Laughlin 1994, Penczak 1995, Rabeni and Smale 1995), and are particularly crucial for mussels (Neves et al. 1997). Riparian forest removal in southeastern streams and subsequent sedimentation has been shown to be detrimental to fish communities (Burkhead et al. 1997, Jones et al. 1999). Particularly affected in the study by Jones et al. (1999) were benthic-dependent species (e.g., darters, benthic minnows, sculpins), which were found to decrease in abundance with longer deforested patches of riparian area. Benthic-dependent fishes, themselves disproportionately imperiled (Burkhead et al. 1997), commonly serve as hosts for numerous imperiled mussel species (Watters 1994), probably including the Chipola slabshell.

CONSERVATION MEASURES:

Exposure Scenario Summary Table for the Chipola Slabshell

Species	Life Stage	Habitat Type	Exposure Route	Diet	Significant Interspecies Relationships
Chipola Slabshell	glochidia	parasite	contact with water, diet	fish body fluids	unknown host fish(es), centrarchids or cyprinids??

	juvenile/ adult	sediment dweller	contact & ingestion of water, diet, sediment	filter feeder (bacteria, algae, detritus, sediment)	

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Society 13(2):217-222.

U.S. Fish & Wildlife Service

Bankclimber, purple (mussel)

Elliptoideus sloatianus
Family: Unionidae
Group: Clams

Current Status: Threatened (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Purple bankclimber (mussel).
- Habitat Conservation Plans (HCP) in which Purple bankclimber (mussel) occurrence has been recorded.
- Petitions received on the Purple bankclimber (mussel).
- USFWS Refuges on which the Purple bankclimber (mussel) is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://ecos.fws.gov/docs/life_histories/F02E.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach)*

Threatened

As of March 16, 1998, the Purple bankclimber (mussel) is designated as **Threatened** in the Entire Range. Within the area covered by this listing, this species is known to occur in: **Florida, Georgia**. The U.S. Fish & Wildlife Service Southeast Region (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 1076 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
Go to the U.S. Fish & Wildlife Service Home Page

Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

Bankclimber, purple (mussel)

Elliptoideus sloatianus
Family: Unionidae
Group: Clams

Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Threatened

Date	Citation Page	Type	Title
01-OCT-03	68 FR 56647 56648	Notice Final Recovery Plan Availability	Availability of the Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), Oval Pigtoe (Pleurobema pyriforme) and the Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus)(See PDF file)
17-JUL-03	68 FR 42419 42420	Notice Draft Recovery Plan Availability	Notice of Availability of an Agency Draft Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme), and the Threatened Chipola Slabshell (Elliptio chipolaensis) and Purple Bankclimber (Elliptoideus sloatianus), for Review and Comment(See PDF file)
16-MAR-98	63 FR 12664 12687	Final Listing, Threatened	ETWP; Determination of Endangered Status for Five Freshwater Mussels and Threatened status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
19-SEP-97	62 FR 49397	Notice CNOR	Review of Plant and Animal Taxa(See PDF file)
28-FEB-96	61 FR 7595 7613	Notice CNOR	ETWP; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species(See PDF file)
15-NOV-94	59 FR 58982 59028	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species.(See PDF file)
03-AUG-94	59 FR 39524 39532	Proposed Listing, Threatened	ETWP; Proposed Endangered Status for Five Freshwater Mussels and Proposed Threatened Status for Two Freshwater Mussels From Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
21-NOV-91	56 FR 58804 58836	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species; 56 FR 58804 58836(See PDF file)
06-JAN-89	54 FR 554 579	Notice CNOR	ETWP; Animal Notice of Review; 54 FR 554 579

PURPLE BANKCLIMBER
Elliptoideus sloatianus

SPECIES CODE: F02E I01

STATUS: On March 16, 1998, the purple bankclimber was designated as Threatened throughout its range (USFWS 1998). A recovery plan addressing the purple bankclimber was finalized on October 1, 2003 (USFWS 2003).

SPECIES DESCRIPTION: The purple bankclimber is a very large, heavy-shelled, strongly sculptured mussel reaching lengths of 20.5 cm (8.0 in). A well-developed posterior ridge extends from the umbo to the posterior ventral margin of the shell. The posterior slope and the disk just anterior to the posterior ridge are sculptured by several irregular plications that vary greatly in development. The umbos are low, extending just above the dorsal margin of the shell. No sexual dimorphism is displayed in purple bankclimber shell characters. Internally, there is one pseudocardinal tooth in the right valve and two in the left valve. The lateral teeth are very thick and slightly curved, with one in the right valve and two in the left valve. Nacre color is whitish near the center of the shell becoming deep purple towards the margin, and very iridescent posteriorly. Fuller and Bereza (1973) described aspects of its soft anatomy, and characterized *Elliptoideus* as being an "extremely primitive" genus. The Service currently follows Turgeon et al (1998) and recognizes the purple bankclimber as *Elliptoideus sloatianus* with the following names considered synonyms: *Unio atromarginatus* Lea, 1840, *Unio aratus* Conrad, 1849, and *Unio plectophorus* Conrad, 1850.

Like other freshwater mussels, adults are filter-feeders, orienting themselves in the substrate to facilitate siphoning of the water column for oxygen and food (Kraemer 1979). Mussels have been reported to consume detritus, diatoms, phytoplankton, zooplankton, and other microorganisms (Coker et al. 1921, Churchill and Lewis 1924, Fuller 1974). Juvenile mussels employ foot (pedal) feeding, and are thus suspension feeders (Yeager et al. 1994). Foods of juvenile freshwater mussels up to two weeks old include bacteria, algae, and diatoms with amounts of detrital and inorganic colloidal particles (Yeager et al. 1994). Specific food habits of the purple bankclimber are unknown, but are likely similar to those of other freshwater mussels.

REPRODUCTION AND DEVELOPMENT: Females of the purple bankclimber with viable glochidia were found in the Ochlockonee River from February through April when water temperatures ranged from 46.4 to 59.0 degrees Fahrenheit (O'Brien and Williams 2002). This indicates that it is a late winter-early spring releaser that may or may not be a parent overwintering species, dependent upon when fertilization takes place. Females expelled narrow lanceolate-shaped conglutinates (1.0 to 1.5 cm (0.4 to 0.6 in)long) that remain viable for three days after release. The white structures, which are two-glochidia thick, are generally released singly although some are paired, being attached at one end (O'Brien and Williams 2002). Rigid when aborted prematurely (containing only eggs), conglutinates with mature glochidia easily disintegrate presumably facilitating host infection. Glochidial morphology was described and figured by O'Brien and Williams (2002).

The eastern mosquitofish *(Gambusia holbrooki)*, blackbanded darter *(Percina nigrofasciata)*, guppy *(Poecilia reticulata)* and greater jumprock transformed glochidia of the purple bankclimber during laboratory infections (O'Brien and Williams 2002, P.D. Johnson, Tennessee Aquatic Research Institute [TNARI], pers. comm. 2003). Only the eastern mosquitofish was effective at transforming glochidia (100 percent transformation rate), with the percentages for the blackbanded darter and guppy being under 33 percent. Transformation on eastern mosquitofish occurred in 17 to 21 days at temperatures of 68.9 $\pm$ 5.4 degrees Fahrenheit (O'Brien and Williams 2002). Only one glochidium was successfully transformed on the greater jumprock during preliminary trials and occurred after 52 days (Johnson, TNARI, pers. comm. 2003). The eastern mosquitofish occupies stream margins in slower (or slack) currents (Lee et al. 1980), and is considered a secondary host fish since the purple bankclimber is more of a channel species (Williams and Butler 1994). The primary host species for this mussel remains unknown (O'Brien and Williams 2002).

RANGE AND POPULATION LEVEL: The type locality of the purple bankclimber was restricted to the Chattahoochee River, Columbus, Georgia, by Clench and Turner (1956). This large species is virtually restricted to Apalachicola-Chattahoochee-Flint (ACF) Basin main stems and the Ochlockonee River in Florida and Georgia (Clench and Turner 1956, Williams and Butler 1994, Brim Box and Williams 2000). Generally distributed in the Flint, Apalachicola, and Ochlockonee Rivers, it was also known from the lower halves of the Chattahoochee and Chipola Rivers, and from two tributaries in the Flint River system. Heard (1979) erroneously reported it from the Escambia River system (Williams and Butler 1994).

Subpopulations from the Chattahoochee River have apparently been extirpated save for a single live specimen found in 2000 (C. Stringfellow, Columbus State University, pers. comm., 2000). In addition, it is no longer known from the Line and Ichawaynochaway Creeks, and has not been seen live in the Chipola River since 1988. Within portions of the Flint and Ochlockonee Rivers, the purple bankclimber occurs more sporadically than it did historically. Most occurrences in the Ochlockonee River are above Talquin Reservoir. An anomalous small stream occurrence (a single specimen from an unnamed tributary of Mill Creek, Flint River system) was discovered during the status survey (USFWS 1998). Overall, 34 subpopulations of purple bankclimber currently persist (Table 7, USFWS 2003).

During the status survey, an average of 54 specimens of the purple bankclimber was recorded from 41 sites rangewide (USFWS 1998), 30 sites occurring in the ACF Basin (Brim Box and Williams 2000). The Corps completed mussel surveys at potential dredged material disposal sites, slough locations, and other main channel areas within the Apalachicola and Chipola rivers (Miller 1998, Miller 2000, Miller, ERDC pers. comm. 2003). The purple bankclimber was found at 10 sites. Limited quantitative sampling for the purple bankclimber has been conducted in the upper Apalachicola and Ochlockonee Rivers. Six 2.7 square feet quadrat samples taken below Jim Woodruff Dam on the former river revealed approximately one specimen per square foot of substrate when sieved (Richardson and Yokley 1996). Four 97-square foot quadrat hand-picked samples in the Ochlockonee River in 1993 recorded purple bankclimber densities averaging 0.34 per square foot (J. Brim Box, USGS, unpub.data).

HABITAT: The purple bankclimber inhabits small to large river channels in slow to moderate current over sand or sand mixed with mud or gravel substrates (Williams and Butler 1994). Over 80 percent of the specimens located during the ACF Basin portion of the status survey were found at sites with a substrate of sand/limestone (Brim Box and Williams 2000). ACF Basin collections were often in waters over 10 feet in depth.

PAST THREATS: The abundance and distribution of the purple bankclimber decreased historically from habitat loss and degradation (Williams et al. 1993, Neves 1993) caused by impoundments (Talquin Reservoir), sedimentation and turbidity, dredging and channelization, and contaminants contained in numerous point and nonpoint sources. A comprehensive review of these past threats is provided elsewhere (USFWS 2003, Brim Box and Williams 2000, Butler 1993, Richter et al. 1997, Watters 1997, Neves et al. 1997). However, the histories of anthropogenic impacts specifically to the Ochlockonee River drainage have not been summarized. These habitat changes have resulted in significant extirpations (localized loss of populations), restricted and fragmented distributions, and poor recruitment of young.

CURRENT THREATS: Habitat loss and degradation (Williams et al. 1993, Neves 1993) primarily caused by contaminants contained in point and nonpoint source discharges, sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments, and alien species are primary threats to the purple bankclimber (USFWS 2003).

Sediment samples from various ACF Basin streams tested for heavy metals that are known to be deleterious to mussels had concentrations markedly above background levels (Frick et al. 1998), among those were copper (throughout the Piedmont), and cadmium (large Coastal Plain tributaries of the Flint River). Past episodes of significant heavy metal contamination of ACF Basin streams may continue to impact mussel faunas. An estimated 950 million gallons of chemical-laden rinse, stripping, cleaning, and plating solutions were discharged indirectly into the Flint River (P. Laumeyer, USFWS, pers. comm., 1994) over a several year period. Concentrations of heavy metals (e.g., chromium and cadmium) in Asian clam, *Corbicula fluminea* (Muller 1774), and sediment samples were elevated downstream from two abandoned battery salvage operations on the Chipola River (Winger et al. 1985). Chromium concentrations found in sediments from Dead Lake downstream in the Chipola River (Winger et al. 1985) are known to be toxic to mussels (Havlik and Marking 1987).

Agricultural sources of contaminants in the ACF and Suwannee basins include nutrient enrichment from poultry farms and livestock feedlots, and pesticides and fertilizers from row crop agriculture (Couch et al. 1996, Frick et al. 1998, Berndt et al. 1998). Nitrate concentrations are particularly high in surface waters downstream of agricultural areas (Mueller et al. 1995; Berndt et al. 1998). A study by the U.S. Soil Conservation Service (USSCS; now the Natural Resources Conservation Service [NRCS]) in the Flint River system determined that between 72 and 75 percent of the nutrients entering Lake Blackshear were derived from agricultural sources (USSCS 1993). Stream ecosystems are impacted when nutrients are added at concentrations that cannot be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996, Fleming et al. 1995). Organochlorine pesticides were found at levels in ACF Basin streams that often

exceeded chronic exposure criteria for the protection of aquatic life (Buell and Couch 1995, Frick et al. 1998). Once widely used in the ACF Basin (Buell and Couch 1995), these highly toxic compounds are persistent in the environment, and are found in both sediments and the lipid reservoir of organisms (Day 1990, Burton 1992). Commonly used pesticides have been directly implicated in a North Carolina mussel dieoff (Fleming et al. 1995). Cotton is raised extensively in much of the Apalachicolan Region inhabited by these mussels. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of a mussel to respire and obtain food. This chemical may pose a continuing threat to some populations of these mussels.

Many pollutants in the ACF Basin originate from urban stormwater runoff, development activities, and municipal waste water facilities, primarily in the Piedmont (Frick et al. 1998). Urban catchments in Piedmont drainages have higher concentrations of nutrients, heavy metals, pesticides, and organic compounds than do agricultural or forested ones (Lenat and Crawford 1994, Frick et al. 1998), and at levels sufficient to significantly affect fish health (Ostrander et al. 1995). Within the Suwannee River basin, nutrient concentrations were greater in agricultural areas and nitrates were found to exceed U.S. Environmental Protection Agency (EPA) drinking water standards in 20 percent of the surficial aquifer groundwater samples (Berndt et al. 1998). Pesticide concentrations were found to exceed criteria for protection of aquatic life mostly in urban areas. Currently, there are discharges from 137 municipal waste water treatment facilities in the ACF River basin alone (Couch et al. 1996). Although effluent quality has improved with modern treatment technologies and a phosphate detergent ban, hundreds of miles of streams in the ACF and Ochlockonee basins in Alabama, Florida, and Georgia, as identified in reports prepared by the water quality agencies of these states under Section 305(b) of the Clean Water Act, do not meet water use classifications.

Since approximately 29 percent of the ACF Basin is in agriculture (Frick et al. 1998), sedimentation from agricultural sources is probably significant. According to USSCS (1993), 89 percent of the sediments entering Lake Blackshear on the Flint River are derived from agricultural sources. The lower Flint River system serves as the heart of numerous mussel species' range and is a major agricultural center. This area has experienced "severe losses of topsoil and nutrient additions to local streams due to agriculture" (Neves et al. 1997), and has profoundly affected the biota of surface and ground waters there (Patrick 1992). Despite the implications, only a few studies (e.g., Cooper 1987, Stewart and Swinford 1995) have specifically attributed changes in mussel populations to sediments derived from agricultural practices.

Many southern streams have increased turbidity levels due to siltation (van der Schalie 1938). The purple bankclimber attracts host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. Such a reproductive strategy depends on clear water during the critical time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Turbidity is a limiting factor impeding sight-feeding fishes (Burkhead and Jenkins 1991). In addition, mussels may be indirectly affected when turbidity levels significantly reduce light available for photosynthesis and the production of unionid food items (Kanehl and Lyons 1992).

Water quantity is becoming more of a concern in maintaining mussel habitat in the Apalachicolan Region. The potential impacts to mussels, their host fishes, and their respective habitats from ground water withdrawal may be profound. Within the Flint River basin, decreases in flow velocity and dissolved oxygen were highly correlated to mussel mortality (Johnson et al. 2001). Low DO conditions in stagnating stream pools due to drought conditions are having a disastrous effect on these mussels. Mussel mortality increases dramatically as DO decreases below 5 mg/L (Johnson et al. 2001).

Maintaining vegetated riparian buffer zones adjacent to stream banks is a well-known method of reducing stream sedimentation and other runoff (Allan and Flecker 1993, Lenat and Crawford 1994). Buffers reduce impacts to fish and other aquatic faunas (Armour et al. 1991, Naiman et al. 1988, Osborne and Kovacic 1993, Belt and O'Laughlin 1994, Penczak 1995, Rabeni and Smale 1995), and are particularly crucial for mussels (Neves et al. 1997). Riparian forest removal in southeastern streams and subsequent sedimentation has been shown to be detrimental to fish communities (Burkhead et al. 1997, Jones et al. 1999). Particularly affected in the study by Jones et al. (1999) were benthic-dependent species (e.g., darters, benthic minnows, sculpins), which were found to decrease in abundance with longer deforested patches of riparian area. Benthic-dependent fishes, themselves disproportionately imperiled (Burkhead et al. 1997), commonly serve as hosts for numerous imperiled mussel species (Watters 1994), probably including the purple bankclimber.

Exposure Scenario Summary Table for the Purple Bankclimber

Species	Life Stage	Habitat Type	Exposure Route	Diet	Significant Interspecies Relationships
Purple Bankclimber	glochidia	parasite	contact with water, diet	fish body fluids	host fish(es) unknown
	juvenile/ adult	sediment dweller	contact & ingestion of water, diet, sediment	filter feeder (bacteria, algae, detritus, sediment)	

CONSERVATION MEASURES:

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pyriforme); and Threatened Chipola Slabshell *(Elliptio chipolaensis)*, and Purple Bankclimber *(Elliptoideus sloatianus)*. Atlanta, Georgia. 142 pp.

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U.S. Fish & Wildlife Service

Pocketbook, shinyrayed

Lampsilis subangulata
Family: Unionidae
Group: Clams

Current Status: Endangered (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Shinyrayed pocketbook.
- Habitat Conservation Plans (HCP) in which Shinyrayed pocketbook occurrence has been recorded.
- Petitions received on the Shinyrayed pocketbook.
- USFWS Refuges on which the Shinyrayed pocketbook is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://ecos.fws.gov/docs/life_histories/F02Y.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach)*

Endangered

As of March 16, 1998, the Shinyrayed pocketbook is designated as Endangered in the Entire Range. Within the area covered by this listing, this species is known to occur in: Alabama, Florida, Georgia. The U.S. Fish & Wildlife Service Southeast Region (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 1076 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
Go to the U.S. Fish & Wildlife Service Home Page

Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

Pocketbook, shinyrayed

Lampsilis subangulata
Family: Unionidae
Group: Clams

Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Endangered

Date	Citation Page	Type	Title
01-OCT-03	68 FR 56647 56648	Notice Final Recovery Plan Availability	Availability of the Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), Oval Pigtoe (Pleurobema pyriforme) and the Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus)(See PDF file)
17-JUL-03	68 FR 42419 42420	Notice Draft Recovery Plan Availability	Notice of Availability of an Agency Draft Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme), and the Threatened Chipola Slabshell (Elliptio chipolaensis) and Purple Bankclimber (Elliptoideus sloatianus), for Review and Comment(See PDF file)
16-MAR-98	63 FR 12664 12687	Final Listing, Endangered	ETWP; Determination of Endangered Status for Five Freshwater Mussels and Threatened status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
19-SEP-97	62 FR 49397	Notice CNOR	Review of Plant and Animal Taxa(See PDF file)
28-FEB-96	61 FR 7595 7613	Notice CNOR	ETWP; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species(See PDF file)
15-NOV-94	59 FR 58982 59028	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species.(See PDF file)
03-AUG-94	59 FR 39524 39532	Proposed Listing, Endangered	ETWP; Proposed Endangered Status for Five Freshwater Mussels and Proposed Threatened Status for Two Freshwater Mussels From Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
21-NOV-91	56 FR 58804 58836	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species; 56 FR 58804 58836(See PDF file)
06-JAN-89	54 FR 554 579	Notice CNOR	ETWP; Animal Notice of Review; 54 FR 554 579

SHINYRAYED POCKETBOOK
Lampsilis subangulata

SPECIES CODE: F02Y I01

STATUS: On March 16, 1998, the shinyrayed pocketbook was designated as Endangered throughout its range (USFWS 1998). A recovery plan addressing the shinyrayed pocketbook was finalized on October 1, 2003 (USFWS 2003).

SPECIES DESCRIPTION: The shinyrayed pocketbook is a medium-sized mussel that reaches approximately 8.4 cm (3.3 in) in length. The shell is subelliptical, with broad, somewhat inflated umbos and a rounded posterior ridge. The shell is fairly thin but solid. The surface is smooth and shiny, light yellowish brown in color with fairly wide, bright emerald green rays over the entire length of the shell. Older specimens may appear much darker brown with obscure rays. Female specimens are more inflated postbasally, whereas males appear to be more pointed posteriorly. Internally, the pseudocardinal teeth are double and fairly large and erect in the left valve, with one large tooth and one spatulate tooth in the right valve. The lateral teeth are relatively short and straight, with two in the left valve and one in the right valve. The nacre is white, with some specimens exhibiting a salmon tint in the vicinity of the umbonal cavity. The U.S. Fish and Wildlife Service recognizes *Unio subangulatus* (Lea, 1840), and *Unio kirklandianus* (Wright, 1897), as synonyms of *Lampsilis subangulata.*

Like other freshwater mussels, adults are filter-feeders, orienting themselves in the substrate to facilitate siphoning of the water column for oxygen and food (Kraemer 1979). Mussels have been reported to consume detritus, diatoms, phytoplankton, zooplankton, and other microorganisms (Coker et al. 1921, Churchill and Lewis 1924, Fuller 1974). Juvenile mussels employ foot (pedal) feeding, and are thus suspension feeders (Yeager et al. 1994). Foods of juvenile freshwater mussels up to two weeks old include bacteria, algae, and diatoms with amounts of detrital and inorganic colloidal particles (Yeager et al. 1994). Specific food habits of the shinyrayed pocketbook are unknown, but are likely similar to those of other freshwater mussels.

REPRODUCTION AND DEVELOPMENT: O'Brien and Brim Box (1999) summarized the reproductive biology of the shinyrayed pocketbook. This species is one of four lampsiline species known to produce a superconglutinate to attract potential fish hosts. Gravid females are found from December through August and superconglutinates are released from late May to early July at water temperatures of 71.6 to 74.3 degrees Fahrenheit. Although apparently mature glochidia are present in the marsupia after the end of the superconglutinate "season", they could not get them to transform during a single test trial with largemouth bass (see below). They suggested that nearly an entire year is needed by the incubating glochidia to reach full maturity. This indicates that the shinyrayed pocketbook is a parent overwintering, summer releasing species. They also described and figured glochidial morphology. Primary host fishes for the shinyrayed pocketbook based on their laboratory infections appear to be largemouth bass (*Micropterus salmoides)* and spotted bass (*Micropterus punctulatus)* (100 percent transformation rates on fishes tested), although transformations also occurred in low percentages

on eastern mosquitofish (*Gambusia holbrooki)*, bluegill (*Lepomis macrochirus)*, and the nonindigenous guppy (*Poecilia reticulata)* that were tested. Glochidia metamorphosed in 11 to 16 days on the basses at a temperature of 72.5 ± 4.5 degrees Fahrenheit.

RANGE AND POPULATION LEVEL: The shinyrayed pocketbook was described from the Chattahoochee River, Columbus, Muscogee County, Georgia. Historically, this species was widely distributed in streams in the Apalachicola-Chattahoochee-Flint (ACF) River basin and Ochlockonee River systems in Alabama, Florida, and Georgia (Heard 1977, Williams and Butler 1994, Brim Box and Williams 2000). van der Schalie (1940), Clench and Turner (1956), and Burch (1975) erroneously reported it from the Choctawhatchee River system; their records were actually based on the closely related southern sandshell (Williams and Butler 1994).

This species has apparently been extirpated from the Chattahoochee River main stem (although relic specimens were found in 1999) and several of its tributaries, including Mill, Little Uchee, Cowikee, and Kirkland Creeks. Historically, 23 collections were known from this subsystem (Brim Box and Williams 2000). Several streams in the Flint River system have also presumably lost their shinyrayed pocketbook subpopulations, including Patsiliga, Gum, Fowlton, and Dry Creeks. The shinyrayed pocketbook has apparently been extirpated in Mosquito Creek, a tributary to the Apalachicola River. In the Chipola River system, subpopulations are no longer known from Cowarts, Spring (near Marianna), and Rocky Creeks. Although Brim Box and Williams (2000) reported no live specimens from the Chipola River main stem during the early 1990s status survey, USFWS personnel documented living shinyrayed pocketbooks at four Chipola River main stem sites in 2000 (J. Ziewitz, USFWS, pers. obs.). This species is extirpated from the Little River and from the lower Ochlockonee River system below Talquin Dam.

Uchee Creek is one of two remaining subpopulations known from Alabama, while Sawhatchee Creek is the only other shinyrayed pocketbook subpopulation known from the entire Chattahoochee River system. This mussel persists in the uppermost Flint River main stem, and in Line, Whitewater, Swift, Jones, Abrams, Mill, Muckalee, Lanahassee, Kinchafoonee, Ichawaynochaway, Chickasawhatchee, Aycocks, Coolewahee, and Spring Creeks. Small subpopulations are also known from the upper half of the Chipola River main stem and its tributaries, Big, Waddells Mill, Baker, and Dry Creeks. Ochlockonee River system subpopulations are known from the upper half of the main stem, the Little Ochlockonee River, Barnetts Creek, and West Branch Barnetts Creek. Overall, the shinyrayed pocketbook is thought to persist at 45 sites in seven different watersheds (Table 2, USFWS, 2003).

Relative subpopulation size for shinyrayed pocketbook is generally low (USFWS 2003). An average of 2.9 live specimens of the shinyrayed pocketbook was found at each of 23 sites during the status survey (USFWS 1998). O'Brien and Brim Box (1999) recorded adult densities of the largest known subpopulation of the shinyrayed pocketbook (Cooleewahee Creek) to be 0.02 specimens per square foot in a bed measuring 59 x 26 feet. Densities of shinyrayed pocketbooks at four other sites where quantitative work was conducted in the Flint and Chipola Rivers yielded no more than 0.01 specimens per square foot (J. Brim Box, USGS, unpub. data). At four sites within approximately a two-mile stretch of the Chipola River, 27 shinyrayed pocketbooks were documented in 2000 (J. Ziewitz,

USFWS, pers. obs.).

HABITAT: The shinyrayed pocketbook inhabits small to medium-sized creeks to rivers in clean or silty sand substrates in slow to moderate current (Williams and Butler 1994; Garner, pers. comm. 2003). Specimens are often found in the interface of stream channel and sloping bank habitats, where sediment particle size and current strength are transitional. Clench and Turner (1956) noted it preferred small creeks and spring-fed rivers. During the status survey in the ACF Basin, 45 percent of the specimens were found in a sand/rock substrate, while 38 percent were associated with a predominance of sand/clay or sandy substrates (Brim Box and Williams 2000).

PAST THREATS: The abundance and distribution of the shinyrayed pocketbook decreased historically from habitat loss and degradation (Williams et al. 1993, Neves 1993) caused by impoundments, sedimentation and turbidity, dredging and channelization, gravel mining, and contaminants contained in numerous point and nonpoint sources. A comprehensive review of these past threats is provided elsewhere (USFWS 2003, Brim Box and Williams 2000, Butler 1993, Howard 1997, Frick et al. 1998, Buell and Couch 1995, Richter 1997, Watters 1997, Neves et al. 1997). However, the histories of anthropogenic impacts specifically to the Ochlockonee river drainage have not been summarized. These habitat changes have resulted in significant extirpations (localized loss of populations), restricted and fragmented distributions, and poor recruitment of young.

CURRENT THREATS: Habitat loss and degradation (Williams et al. 1993; Neves 1993) primarily caused by contaminants contained in point and nonpoint source discharges, gravel mining, sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments and alien species are primary threats to the shinyrayed pocketbook.

Sediment samples from various ACF Basin streams tested for heavy metals that are known to be deleterious to mussels had concentrations markedly above background levels (Frick et al. 1998), among those were copper (throughout the Piedmont), and cadmium (large Coastal Plain tributaries of the Flint River). Past episodes of significant heavy metal contamination of ACF Basin streams may continue to impact mussel faunas. An estimated 950 million gallons of chemical-laden rinse, stripping, cleaning, and plating solutions were discharged indirectly into the Flint River (P. Laumeyer, USFWS, pers. comm., 1994) over a several year period. Concentrations of heavy metals (e.g., chromium and cadmium) in Asian clam, *Corbicula fluminea* (Muller 1774), and sediment samples were elevated downstream from two abandoned battery salvage operations on the Chipola River (Winger et al. 1985). Chromium concentrations found in sediments from Dead Lake downstream in the Chipola River (Winger et al. 1985) are known to be toxic to mussels (Havlik and Marking 1987).

Agricultural sources of contaminants in the ACF and Suwannee basins include nutrient enrichment from poultry farms and livestock feedlots, and pesticides and fertilizers from row crop agriculture (Couch et al. 1996, Frick et al. 1998, Berndt et al. 1998). Nitrate concentrations are particularly high in surface waters downstream of agricultural areas (Mueller et al. 1995; Berndt et al. 1998). A study by the U.S. Soil Conservation Service (USSCS; now the Natural Resources Conservation Service [NRCS]) in the Flint River system determined that between 72 and 75 percent of the nutrients entering Lake Blackshear

were derived from agricultural sources (USSCS 1993). Stream ecosystems are impacted when nutrients are added at concentrations that cannot be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996, Fleming et al. 1995). Organochlorine pesticides were found at levels in ACF Basin streams that often exceeded chronic exposure criteria for the protection of aquatic life (Buell and Couch 1995, Frick et al. 1998). Once widely used in the ACF Basin (Buell and Couch 1995), these highly toxic compounds are persistent in the environment, and are found in both sediments and the lipid reservoir of organisms (Day 1990, Burton 1992). Commonly used pesticides have been directly implicated in a North Carolina mussel dieoff (Fleming et al. 1995). Cotton is raised extensively in much of the Apalachicolan Region inhabited by these mussels. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of a mussel to respire and obtain food. This chemical may pose a continuing threat to some populations of these mussels. Nutrients from aquaculture ponds may also have an impact on stream water quality. A large catfish farm is located in the floodplain of lower Cooleewahee Creek. Discharges of enriched pond water could negatively affect the largest known population of the shinyrayed pocketbook, which occurs in that stream.

Many pollutants in the ACF Basin originate from urban stormwater runoff, development activities, and municipal waste water facilities, primarily in the Piedmont (Frick et al. 1998). Urban catchments in Piedmont drainages have higher concentrations of nutrients, heavy metals, pesticides, and organic compounds than do agricultural or forested ones (Lenat and Crawford 1994, Frick et al. 1998), and at levels sufficient to significantly affect fish health (Ostrander et al. 1995). Within the Suwannee River basin, nutrient concentrations were greater in agricultural areas and nitrates were found to exceed U.S. Environmental Protection Agency (EPA) drinking water standards in 20 percent of the surficial aquifer groundwater samples (Berndt et al. 1998). Pesticide concentrations were found to exceed criteria for protection of aquatic life mostly in urban areas. Currently, there are discharges from 137 municipal waste water treatment facilities in the ACF River basin alone (Couch et al. 1996). Although effluent quality has improved with modern treatment technologies and a phosphate detergent ban, hundreds of miles of streams in the ACF and Ochlockonee basins in Alabama, Florida, and Georgia, as identified in reports prepared by the water quality agencies of these states under Section 305(b) of the Clean Water Act, do not meet water use classifications.

Since approximately 29 percent of the ACF Basin is in agriculture (Frick et al. 1998), sedimentation from agricultural sources is probably significant. According to USSCS (1993), 89 percent of the sediments entering Lake Blackshear on the Flint River are derived from agricultural sources. The lower Flint River system serves as the heart of numerous mussel species' range (including the shinyrayed pocketbook) and is a major agricultural center. This area has experienced "severe losses of topsoil and nutrient additions to local streams due to agriculture" (Neves et al. 1997), and has profoundly affected the biota of surface and ground waters there (Patrick 1992). Despite the implications, only a few studies (e.g., Cooper 1987, Stewart and Swinford 1995) have specifically attributed changes in mussel populations to sediments derived from agricultural practices.

Within the Suwannee basin, predominant sources of nutrient enrichment were inorganic fertilizers and animal wastes (Crandall 1996). A herd of cattle several score in size was observed to have direct access

to a large spring and spring run adjacent the Chipola River just upstream of Florida Caverns State Park during the summer of 2000 (R.S. Butler, USFWS, pers. obs.). Although anecdotal, the shinyrayed pocketbook was found live during mussel sampling in the Chipola River upstream of the mouth of this spring run, but not downstream.

Gravel mining activities continue to threaten the shinyrayed pocketbook subpopulation from the Uchee Creek system (Howard 1997). These activities probably played a significant role in eliminating the Gulf moccasinshell and oval pigtoe from the same creek system.

Many southern streams have increased turbidity levels due to siltation (van der Schalie 1938). The shinyrayed pocketbook attracts host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. Such a reproductive strategy depends on clear water during the critical time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Turbidity is a limiting factor impeding sight-feeding fishes (Burkhead and Jenkins 1991). In addition, mussels may be indirectly affected when turbidity levels significantly reduce light available for photosynthesis and the production of unionid food items (Kanehl and Lyons 1992).

Water quantity is becoming more of a concern in maintaining mussel habitat in the Apalachicolan Region. The potential impacts to mussels, their host fishes, and their respective habitats from ground water withdrawal may be profound. Within the Flint River basin, decreases in flow velocity and dissolved oxygen were highly correlated to mussel mortality (Johnson et al. 2001). Maintaining adequate water levels in streams is particularly important during the reproductive season for mussels. Drought-related responses could affect the long-term viability of mussel populations in the lower Flint River basin by decreasing the effectiveness of lures and interrupting the life cycle by hindering the process of glochidial release and attachment. For instance, superconglutinates of the shinyrayed pocketbook have been observed lying on the river bottom due to low flow rates (Johnson et al. 2001). Superconglutinates need to be suspended in current for their erratic "swimming" motions to attract the proper host fish. Approximately 150 specimens of the shinyrayed pocketbook were salvaged live from drought-ravaged segments of Spring Creek, Miller County, Georgia, during the summer 2000 drought (L. Andrews, and R.S. Butler, USFWS, pers. obs.). Large numbers were also found fresh dead in the dried stream bed, in mud holes, and in shrinking pools of water. Low DO conditions in stagnating stream pools due to drought conditions are having a disastrous effect on these mussels. Mussel mortality increases dramatically as DO decreases below 5 mg/L (Johnson et al. 2001). Rare species (e.g., shinyrayed pocketbook, oval pigtoe, and Gulf moccasinshell) were more susceptible to drought-related morality within the Flint River basin and had the highest mortality rates from hypoxic conditions (Johnson et al. 2001).

CONSERVATION MEASURES:

Exposure Scenario Summary Table for the Shinyrayed Pocketbook

Species	Life Stage	Habitat Type	Exposure Route	Diet	Significant Interspecies

					Relationships
Shinyrayed Pocketbook	glochidia	parasite	contact with water, diet	fish body fluids	largemouth bass, spotted bass
	juvenile/ adult	sediment dweller	contact & ingestion of water, diet, sediment	filter feeder (bacteria, algae, detritus, sediment)	

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U.S. Fish & Wildlife Service

Moccasinshell, Gulf

Medionidus penicillatus
Family: Unionidae
Group: Clams

Current Status: Endangered (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Gulf moccasinshell.
- Habitat Conservation Plans (HCP) in which Gulf moccasinshell occurrence has been recorded.
- Petitions received on the Gulf moccasinshell.
- USFWS Refuges on which the Gulf moccasinshell is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://ecos.fws.gov/docs/life_histories/F03M.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach)*

Endangered

As of March 16, 1998, the Gulf moccasinshell is designated as Endangered in the Entire Range. Within the area covered by this listing, this species is known to occur in: Florida, Georgia. The U.S. Fish & Wildlife Service Southeast Region (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 1076 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
Go to the U.S. Fish & Wildlife Service Home Page

Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

Moccasinshell, Gulf

Medionidus penicillatus
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Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Endangered

Date	Citation Page	Type	Title
01-OCT-03	68 FR 56647 56648	Notice Final Recovery Plan Availability	Availability of the Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), Oval Pigtoe (Pleurobema pyriforme) and the Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus)(See PDF file)
17-JUL-03	68 FR 42419 42420	Notice Draft Recovery Plan Availability	Notice of Availability of an Agency Draft Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme), and the Threatened Chipola Slabshell (Elliptio chipolaensis) and Purple Bankclimber (Elliptoideus sloatianus), for Review and Comment(See PDF file)
16-MAR-98	63 FR 12664 12687	Final Listing, Endangered	ETWP; Determination of Endangered Status for Five Freshwater Mussels and Threatened status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
19-SEP-97	62 FR 49397	Notice CNOR	Review of Plant and Animal Taxa(See PDF file)
28-FEB-96	61 FR 7595 7613	Notice CNOR	ETWP; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species(See PDF file)
15-NOV-94	59 FR 58982 59028	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species.(See PDF file)
03-AUG-94	59 FR 39524 39532	Proposed Listing, Endangered	ETWP; Proposed Endangered Status for Five Freshwater Mussels and Proposed Threatened Status for Two Freshwater Mussels From Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)

GULF MOCCASINSHELL
Medionidus penicillatus

SPECIES CODE: F03M I01

STATUS: On March 16, 1998, the Gulf moccasinshell was designated as Endangered throughout its range (USFWS 1998). A recovery plan addressing the Gulf moccasinshell was finalized on October 1, 2003 (USFWS 2003).

SPECIES DESCRIPTION: The Gulf moccasinshell is a small mussel that reaches a length of about 5.6 cm (2.2 in), is elongate-elliptical or rhomboidal in outline, fairly inflated, and has relatively thin valves. The ventral margin is nearly straight or slightly rounded. The posterior ridge is rounded to slightly angled and intersects the end of the shell at the base line. Females tend to have the posterior point above the ventral margin and are somewhat more inflated. Sculpturing (ridges/bumps on a shell caused by natural processes) consists of a series of thin, radially-oriented plications along the length of the posterior slope. The remainder of the surface is smooth and yellowish to greenish brown with fine, typically interrupted green rays. The left valve has two stubby pseudocardinal and two arcuate lateral teeth. The right valve has one pseudocardinal tooth and one lateral tooth. Nacre color is smoky purple or greenish and slightly iridescent at the posterior end. Much confusion has clouded the taxonomy of *Medionidus* species in the Apalachicolan Region (Brim Box and Williams 2000, USFWS 2003). The Service recognizes *Unio kingii* Wright, 1900, as a synonym of *Medionidus penicillatus* (USFWS 2003).

Like other freshwater mussels, adults are filter-feeders, orienting themselves in the substrate to facilitate siphoning of the water column for oxygen and food (Kraemer 1979). Mussels have been reported to consume detritus, phytoplankton, zooplankton, and other microorganisms (Coker et al. 1921, Churchill and Lewis 1924, Fuller 1974). Juvenile mussels employ foot (pedal) feeding, and are thus suspension feeders (Yeager et al. 1994). Foods of juvenile freshwater mussels up to two weeks old include bacteria, algae, and diatoms with amounts of detrital and inorganic colloidal particles (Yeager et al. 1994). Specific food habits of the Gulf moccasinshell are unknown, but are likely similar to those of other freshwater mussels.

REPRODUCTION AND DEVELOPMENT: Gulf moccasinshell glochidia are released in early to late spring, while gravid females were found in March, April, September, and November (O'Brien and Williams 2002). The presence of gravid specimens of this lampsiline species in the late summer and fall months suggests that the Gulf moccasinshell is a parent overwintering, summer releasing species. Gravid specimens were observed lying upside down (i.e., umbos down) on top of gravel and sand substrates in mid-March and flapping their mantle margins (Brim Box and Williams 2000). This host-attractant behavior has been noted in the Alabama moccasinshell (*M. acutissimus* Lea, 1831) during the spring in northern Alabama (W.R. Haag, U.S. Forest Service [USFS], pers. comm., 1995). Glochidial morphology was described and figured first by Lea (1858), and then by O'Brien and Williams (2002).

Primary fish hosts for the Gulf moccasinshell in the Apalachicola-Chattahoochee-Flint (ACF) Basin appear to include the blackbanded darter *(Percina nigrofasciata)* and the brown darter (*Etheostoma edwini)*(O'Brien and Williams 2002). Laboratory tests reveal that 100 percent of the fish of these two species transformed the glochidia that were exposed to them. Glochidia metamorphosed in 29 to 33 days for the blackbanded darter and 30 to 37 days for the brown darter. Two other fishes, the eastern mosquitofish and guppy, also transformed glochidia, but at lower percentage rates. All tests were conducted at 70.7 $\pm$ 2.7 degrees Fahrenheit (O'Brien and Williams 2002).

RANGE AND POPULATION LEVEL: The type locality for the Gulf moccasinshell was originally recorded as three sites in the ACF Basin in Georgia - the Chattahoochee River near Columbus and near Atlanta, and the Flint River near Albany (Table, 3, USFWS, 2003). Historically, the Gulf moccasinshell was known in Alabama, Georgia, and Florida from the main stems and tributaries throughout the ACF Basin and Econfina Creek (Johnson 1977, Butler 1989, Williams and Butler 1994, Brim Box and Williams 2000). The Service adheres to the position of Brim Box and Williams (2000) concerning the present taxonomy and distribution of the Gulf moccasinshell (USFWS 2003).

Subpopulation losses have been substantial for the Gulf moccasinshell. The species is no longer found in the Chattahoochee River main stem (Brim Box and Williams 2000). ACF Basin streams where the Gulf moccasinshell has apparently been extirpated include Mulberry, Uchee, and Little Uchee Creeks in the Chattahoochee River system; Line, Patsiliga, Turkey, Sandy Mount, Gum, Cedar, Jones, Abrams, Mill, Ichawaynochaway, and Spring Creeks, all tributaries to the Flint River; the Apalachicola River main stem; and Marshall, Cowarts, Dry, Rocky, and both Spring Creeks in the Chipola River system. This species has also been eliminated from most of the Flint and Chipola River main stems.

Generally small subpopulations of the Gulf moccasinshell persist in ACF Basin streams. These include Sawhatchee and Kirkland Creeks (Chattahoochee River system); Whitewater, Little Pennahatchee, Swift, Muckalee, Kinchafoonee, and Chickasawhatchee Creeks (Flint River system); single main stem localities in the Flint and Chipola Rivers; and Big, Baker and Waddells Mill Creeks in the latter system. The Gulf moccasinshell also persists in Econfina Creek. This mussel, overall, is found in 24 subpopulations in 6 different watersheds.

During the status surveys, an average of 1.4 Gulf moccasinshell specimens was found per site of occurrence (eight sites), although new and larger subpopulations were subsequently discovered (USFWS 1998). The subpopulation in Waddells Mill Creek, where dozens of specimens can be found, is thought to be the largest remaining (D.N. Shelton, Alabama Malacological Research Center, pers. comm., 1998). Recent quantitative sampling using sieves from 50 quadrat samples (2.7 square feet each) in Chickasawhatchee Creek recorded a density of 0.044 specimens per square foot of substrate (R.S. Butler, USFWS, unpub. data).

HABITAT: The Gulf moccasinshell inhabits the channels of small to medium-sized creeks to large rivers with sand and gravel or silty sand substrates in slow to moderate currents (Williams and Butler 1994; Garner, pers. comm., 2003). Approximately 46 percent of the ACF basin specimens located during the Basin's status survey were in a substrate of sand/rock (Brim Box and Williams 2000).

PAST THREATS: The abundance and distribution of the Gulf moccasinshell decreased historically from habitat loss and degradation (Williams et al. 1993, Neves 1993) caused by impoundments, gravel mining (e.g., Uchee Creek system, a tributary of the Chattahoochee River in Alabama), sedimentation and turbidity, dredging and channelization, and contaminants contained in numerous point and nonpoint sources. A comprehensive review of these past threats is provided elsewhere (USFWS 2003, Brim Box and Williams 2000, Butler 1993, Howard 1997, Frick et al. 1998, Buell and Couch 1995, Richter 1997, Watters 1997, Neves et al. 1997). These habitat changes have resulted in significant extirpations (localized loss of populations), restricted and fragmented distributions, and poor recruitment of young.

CURRENT THREATS: Habitat loss and degradation (Williams et al. 1993, Neves 1993) primarily caused by contaminants contained in point and nonpoint source discharges, sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments, and alien species are primary threats to the Gulf moccasinshell (USFWS 2003). Low population levels and restricted ranges now render these mussels extremely vulnerable to toxic chemical spills and other catastrophic events, and the deleterious effects of genetic isolation.

Sediment samples from various ACF Basin streams tested for heavy metals that are known to be deleterious to mussels had concentrations markedly above background levels (Frick et al. 1998), among those were copper (throughout the Piedmont), and cadmium (large Coastal Plain tributaries of the Flint River). Past episodes of significant heavy metal contamination of ACF Basin streams may continue to impact mussel faunas. An estimated 950 million gallons of chemical-laden rinse, stripping, cleaning, and plating solutions were discharged indirectly into the Flint River (P. Laumeyer, USFWS, pers. comm., 1994) over a several year period. Concentrations of heavy metals (e.g., chromium and cadmium) in Asian clam, *Corbicula fluminea* (Muller 1774), and sediment samples were elevated downstream from two abandoned battery salvage operations on the Chipola River (Winger et al. 1985). Chromium concentrations found in sediments from Dead Lake downstream in the Chipola River (Winger et al. 1985) are known to be toxic to mussels (Havlik and Marking 1987).

Agricultural sources of contaminants in the ACF and Suwannee basins include nutrient enrichment from poultry farms and livestock feedlots, and pesticides and fertilizers from row crop agriculture (Couch et al. 1996, Frick et al. 1998, Berndt et al. 1998). Nitrate concentrations are particularly high in surface waters downstream of agricultural areas (Mueller et al. 1995; Berndt et al. 1998). A study by the U.S. Soil Conservation Service (USSCS; now the Natural Resources Conservation Service [NRCS]) in the Flint River system determined that between 72 and 75 percent of the nutrients entering Lake Blackshear were derived from agricultural sources (USSCS 1993). Stream ecosystems are impacted when nutrients are added at concentrations that cannot be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996, Fleming et al. 1995). Organochlorine pesticides were found at levels in ACF Basin streams that often exceeded chronic exposure criteria for the protection of aquatic life (Buell and Couch 1995, Frick et al. 1998). Once widely used in the ACF Basin (Buell and Couch 1995), these highly toxic compounds are persistent in the environment, and are found in both sediments and the lipid reservoir of organisms (Day 1990, Burton 1992). Commonly used pesticides have been directly implicated in a North Carolina mussel dieoff (Fleming et al. 1995). Cotton is raised extensively in much of the Apalachicolan Region

inhabited by these mussels. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of a mussel to respire and obtain food. This chemical may pose a continuing threat to some populations of these mussels.

Many pollutants in the ACF Basin originate from urban stormwater runoff, development activities, and municipal waste water facilities, primarily in the Piedmont (Frick et al. 1998). Urban catchments in Piedmont drainages have higher concentrations of nutrients, heavy metals, pesticides, and organic compounds than do agricultural or forested ones (Lenat and Crawford 1994, Frick et al. 1998), and at levels sufficient to significantly affect fish health (Ostrander et al. 1995). Within the Suwannee River basin, nutrient concentrations were greater in agricultural areas and nitrates were found to exceed U.S. Environmental Protection Agency (EPA) drinking water standards in 20 percent of the surficial aquifer groundwater samples (Berndt et al. 1998). Pesticide concentrations were found to exceed criteria for protection of aquatic life mostly in urban areas. Currently, there are discharges from 137 municipal waste water treatment facilities in the ACF River basin alone (Couch et al. 1996). Although effluent quality has improved with modern treatment technologies and a phosphate detergent ban, hundreds of miles of streams in the ACF and Ochlockonee basins in Alabama, Florida, and Georgia, as identified in reports prepared by the water quality agencies of these states under Section 305(b) of the Clean Water Act, do not meet water use classifications.

Since approximately 29 percent of the ACF Basin is in agriculture (Frick et al. 1998), sedimentation from agricultural sources is probably significant. According to USSCS (1993), 89 percent of the sediments entering Lake Blackshear on the Flint River are derived from agricultural sources. The lower Flint River system serves as the heart of numerous mussel species' range (including the Gulf moccasinshell) and is a major agricultural center. This area has experienced "severe losses of topsoil and nutrient additions to local streams due to agriculture" (Neves et al. 1997), and has profoundly affected the biota of surface and ground waters there (Patrick 1992). Despite the implications, only a few studies (e.g., Cooper 1987, Stewart and Swinford 1995) have specifically attributed changes in mussel populations to sediments derived from agricultural practices.

Many southern streams have increased turbidity levels due to siltation (van der Schalie 1938). The Gulf moccasinshell attracts host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. Such a reproductive strategy depends on clear water during the critical time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Turbidity is a limiting factor impeding sight-feeding fishes (Burkhead and Jenkins 1991). In addition, mussels may be indirectly affected when turbidity levels significantly reduce light available for photosynthesis and the production of unionid food items (Kanehl and Lyons 1992).

Water quantity is becoming more of a concern in maintaining mussel habitat in the Apalachicolan Region. The potential impacts to mussels, their host fishes, and their respective habitats from ground water withdrawal may be profound. Within the Flint River basin, decreases in flow velocity and dissolved oxygen were highly correlated to mussel mortality (Johnson et al. 2001). Low DO conditions in stagnating stream pools due to drought conditions are having a disastrous effect on these mussels.

Mussel mortality increases dramatically as DO decreases below 5 mg/L (Johnson et al. 2001). Rare species (e.g., oval pigtoe, shinyrayed pocketbook, and Gulf moccasinshell) were more susceptible to drought-related morality within the Flint River basin and had the highest mortality rates from hypoxic conditions (Johnson et al. 2001).

Maintaining vegetated riparian buffer zones adjacent to stream banks is a well-known method of reducing stream sedimentation and other runoff (Allan and Flecker 1993, Lenat and Crawford 1994). Buffers reduce impacts to fish and other aquatic faunas (Armour et al. 1991, Naiman et al. 1988, Osborne and Kovacic 1993, Belt and O'Laughlin 1994, Penczak 1995, Rabeni and Smale 1995), and are particularly crucial for mussels (Neves et al. 1997). Riparian forest removal in southeastern streams and subsequent sedimentation has been shown to be detrimental to fish communities (Burkhead et al. 1997, Jones et al. 1999). Particularly affected in the study by Jones et al. (1999) were benthic-dependent species (e.g., darters, benthic minnows, sculpins), which were found to decrease in abundance with longer deforested patches of riparian area. Benthic-dependent fishes, themselves disproportionately imperiled (Burkhead et al. 1997), commonly serve as hosts for numerous imperiled mussel species (Watters 1994), including Gulf moccasinshell.

CONSERVATION MEASURES:

Exposure Scenario Summary Table for the Gulf Moccasinshell

Species	Life Stage	Habitat Type	Exposure Route	Diet	Significant Interspecies Relationships
Gulf Moccasinshell	glochidia	parasite	contact with water, diet	fish body fluids	blackbanded darter, brown darter
	juvenile/ adult	sediment dweller	contact & ingestion of water, diet, sediment	filter feeder (bacteria, algae, detritus, sediment)	

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U.S. Fish & Wildlife Service

Pigtoe, oval

Pleurobema pyriforme
Family: Unionidae
Group: Clams

Current Status: Endangered (see below)

- Status Details regarding information on Recovery Plans, Special Rules and Critical Habitat for specific designations.
- Federal Register documents that apply to the Oval pigtoe.
- Habitat Conservation Plans (HCP) in which Oval pigtoe occurrence has been recorded.
- Petitions received on the Oval pigtoe.
- USFWS Refuges on which the Oval pigtoe is reported.
- Virtual Newsroom
- Current News Releases
- NatureServe Explorer Species Reports.
- Life History
  - http://ecos.fws.gov/docs/life_histories/F02S.html

Status Details *(Email data-related questions or comments to USFWS Endangered Species Outreach*

Endangered

As of March 16, 1998, the Oval pigtoe is designated as Endangered in the Entire Range. Within the area covered by this listing, this species is known to occur in: Florida, Georgia. The U.S. Fish & Wildlife Service Southeast Region (Region 4) is the lead region for this entity.

- Go to Federal Register documents.
- A recovery plan details specific tasks needed to recover this species. (This file is in PDF format with a file size of 1076 kb. To view PDF documents, you may need to download and install the Adobe Acrobat Reader, free from Adobe, Inc.)

Go to the U.S. Fish & Wildlife Service Endangered Species Home Page
Go to the U.S. Fish & Wildlife Service Home Page

Email data-related questions or comments to: USFWS Endangered Species Outreach

This information current as of NOVEMBER 01, 2004

U.S. Fish & Wildlife Service

Pigtoe, oval

Pleurobema pyriforme
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Federal Register Documents

(Please note: To view PDF documents, you may need to download and install Adobe Acrobat Reader, free from Adobe, Inc.)
The Federal Register is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

Listed below are federal register documents such as, proposed and final listing decisions, critical habitat designations, recovery plans, policies and other announcements issued by the Division of Endangered Species, U.S. Fish and Wildlife Service.

Status:Endangered

Date	Citation Page	Type	Title
01-OCT-03	68 FR 56647 56648	Notice Final Recovery Plan Availability	Availability of the Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), Oval Pigtoe (Pleurobema pyriforme) and the Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus)(See PDF file)
17-JUL-03	68 FR 42419 42420	Notice Draft Recovery Plan Availability	Notice of Availability of an Agency Draft Recovery Plan for the Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook Lampsilis subangulata), Gulf Moccasinshell (Medionidus penicillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme), and the Threatened Chipola Slabshell (Elliptio chipolaensis) and Purple Bankclimber (Elliptoideus sloatianus), for Review and Comment(See PDF file)
16-MAR-98	63 FR 12664 12687	Final Listing, Endangered	ETWP; Determination of Endangered Status for Five Freshwater Mussels and Threatened status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
19-SEP-97	62 FR 49397	Notice CNOR	Review of Plant and Animal Taxa(See PDF file)
28-FEB-96	61 FR 7595 7613	Notice CNOR	ETWP; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species(See PDF file)
15-NOV-94	59 FR 58982 59028	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species.(See PDF file)
03-AUG-94	59 FR 39524 39532	Proposed Listing, Endangered	ETWP; Proposed Endangered Status for Five Freshwater Mussels and Proposed Threatened Status for Two Freshwater Mussels From Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia(See PDF file)
21-NOV-91	56 FR 58804 58836	Notice CNOR	ETWP; Animal Candidate Review for Listing as Endangered or Threatened Species; 56 FR 58804 58836(See PDF file)
06-JAN-89	54 FR 554 579	Notice CNOR	ETWP; Animal Notice of Review; 54 FR 554 579

OVAL PIGTOE
Pleurobema pyriforme

SPECIES CODE: F02S I01

STATUS: On March 16, 1998, the oval pigtoe was designated as Endangered throughout its range (USFWS 1998). A recovery plan addressing the oval pigtoe was finalized on October 1, 2003 (USFWS 2003).

SPECIES DESCRIPTION: The oval pigtoe is a small to medium-sized mussel that attains a length of about 6.1 cm (2.4 in). The shell is suboviform and compressed. The periostracum is shiny smooth; yellowish, chestnut, or dark brown; rayless; and with distinct growth lines. The posterior slope is biangulate and forms a blunt point on the posterior margin. The umbos are slightly elevated above the hingeline. No sexual dimorphism is displayed in *Pleurobema* shell characters. Internally, the pseudocardinal teeth are fairly large, crenulate (bumpy/notched), and double in each valve. The lateral teeth are somewhat shortened, arcuate, and also double in each valve. Nacre color varies from salmon to bluish white and is iridescent posteriorly. The Service currently recognizes *Unio modicus* Lea, 1857, *Unio bulbosus* Lea 1857, *Unio amabilis* Lea, 1865, *Unio harperi* Wright, 1899, *Unio reclusus* Wright, 1898, and *Pleurobema simpsoni* Vanatta, 1915, as synonyms of *Pleurobema pyriforme* (USFWS 2003).

Like other freshwater mussels, adults are filter-feeders, orienting themselves in the substrate to facilitate siphoning of the water column for oxygen and food (Kraemer 1979). Mussels have been reported to consume detritus, diatoms, phytoplankton, zooplankton, and other microorganisms (Coker et al. 1921, Churchill and Lewis 1924, Fuller 1974). Juvenile mussels employ foot (pedal) feeding, and are thus suspension feeders (Yeager et al. 1994). Foods of juvenile freshwater mussels up to two weeks old include bacteria, algae, and diatoms with amounts of detrital and inorganic colloidal particles (Yeager et al. 1994). Specific food habits of the oval pigtoe are unknown, but are likely similar to those of other freshwater mussels.

REPRODUCTION AND DEVELOPMENT: Ortmann (1909) considered *Pleurobema* species to have a short, summer breeding season (tachytictic). Gravid oval pigtoe were collected from the Apalachicola-Chattahoochee-Flint (ACF) Basin from March through July at water temperatures of 55.4 to 77.0 degrees Fahrenheit (O'Brien and Williams 2002). This indicates that this unionine is a summer releasing, but not necessarily a parent overwintering species, as fertilization may take place in late winter or early spring. Females readily aborted their conglutinates in the laboratory, which contained both ova and glochidia in several stages of development. The structures are elongate, white to pinkish, approximately 0.5 cm (0.2 in) long, and one layer thick (O'Brien and Williams 2002). Once released, the glochidia remained viable for three days. The morphology of the glochidia was described and figured by O'Brien and Williams (2002). Based on laboratory infections, juvenile specimens transformed on the gills of the sailfin shiner *(Pteronotrophis hypselopterus)*, eastern mosquitofish (*Gambusia holbrooki)*, and guppy *(Poecilia reticulata)* (O'Brien and Williams 2002). Only the sailfin

shiner was considered to be a primary host as it was the only species upon which the glochidial transformation rate exceeded 50 percent. Glochidia metamorphosed in 20 to 25 days at a temperature of 70.7 $\pm$ 2.7 degrees Fahrenheit (O'Brien and Williams 2002).

RANGE AND POPULATION LEVEL: The oval pigtoe was described from the Chattahoochee River, near Columbus, Muscogee County, Georgia. This species historically occurred in four major stream systems in Alabama, Georgia, and Florida: Econfina, ACF, Ochlockonee and Suwannee (Brim Box and Williams 2000). All four stream systems still harbor the oval pigtoe, but numerous subpopulations have been lost. Stream extirpations in the ACF Basin are thought to include the Chattahoochee River main stem and three tributaries, Randall, Uchee, and Little Uchee Creeks; most of the Flint River main stem and its tributaries Patsiliga, Little Patsiliga, Sandy Mount, Gum, Cedar, Chokee, Abrams, Mill, Little Pachitla, Dry, and Spring Creeks; the Apalachicola River main stem; and several Chipola River tributaries including both Spring, Rocky (Houston County, Alabama), Marshall, and Cowarts Creeks. The oval pigtoe was recently found extant at only three sites within Suwannee River drainage, two in the New River, and one in the Santa Fe River (Blalock-Herod and Williams 2001). This species is no longer known from the Suwannee River main stem and the Sampson River and its range is greatly reduced in the Santa Fe River (Blalock-Herod and Williams 2001).

The oval pigtoe is currently known from Econfina Creek; Sawhatchee Creek (the only Chattahoochee River system locality remaining); Flint River, Decatur County, Georgia; the upper-most main stem of the Flint River and its tributaries Line, Red Oak, tributary to Walnut Creek, Hogcraw, Little Pennahatchee, Turkey, Swift, Jones, Muckalee, Lanahassee, Kinchafoonee, Cooleewahee, Chickasawhatchee, and Spring Creeks; the upper Chipola River main stem, and Big, Baker, Waddells Mill, Dry, and Rocky (Jackson County, Florida) Creeks; the upper Ochlockonee River main stem, Little Ochlockonee River, and Barnetts Creek; and the New and Santa Fe Rivers in the Suwannee River system. This relatively wide ranging mussel presently persists in 43 subpopulations, overall (see Table 5, USFWS 2003).

Nearly all known subpopulations are presently comprised of relatively small numbers of oval pigtoes, with the exceptions of sites on the Chipola River and Chickasawhatchee Creek (Brim Box and Williams 2000). Rangewide, an average of 5.2 specimens per site of occurrence (24 sites) were recorded during the status survey (USFWS 1998). More recent quantitative sampling using sieves at two sites (Chickasawhatchee Creek, 50 samples 2.7-square feet each; and New River, 75 samples 2.7-square feet each) found 8 specimens in Chickasawhatchee Creek and 3 in new River for densities of 0.059 and 0.015 per square feet of substrate, respectively (R.S. Butler, USFWS, unpub. data). Blalock-Herod (2000) reported an overall density of 0.003 per square foot (15 specimens in 2,000 samples 2.7-square feet each) in sieved samples and found no recruitment at a study site on the New River (Suwannee River drainage). Only one specimen was detected after searching for two hours at another site on the New River (Blalock-Herod and Williams 2001).

HABITAT: The oval pigtoe occurs in small to medium-sized creeks to small rivers where it inhabits silty sand to sand and gravel substrates, usually in slow to moderate current (Willliams and Butler 1994; Garner, pers. comm., 2003). Stream channels appear to offer the best habitat for this species. The ACF

Basin status survey located 85 percent of the specimens in sandy substrates associated with either detritus, clay, silt, or cobble (Brim Box and Williams 2000). In the Suwannee River drainage, specimens of the oval pigtoe were associated with sandy mud and coarse sand sediments with little or no detritus (Blalock-Herod 2000).

PAST THREATS: The abundance and distribution of the oval pigtoe decreased historically from habitat loss and degradation (Williams et al. 1993, Neves 1993) caused by impoundments, sedimentation and turbidity, dredging and channelization, gravel mining, and contaminants contained in numerous point and nonpoint sources. A comprehensive review of these past threats is provided elsewhere (USFWS 2003, Brim Box and Williams 2000, Butler 1993, Howard 1997, Frick et al. 1998, Buell and Couch 1995, Richter 1997, Watters 1997, Neves et al. 1997). These habitat changes have resulted in significant extirpations (localized loss of populations), restricted and fragmented distributions, and poor recruitment of young.

CURRENT THREATS: Habitat loss and degradation (Williams et al. 1993, Neves 1993) primarily caused by contaminants contained in point and nonpoint source discharges, sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments and alien species are primary threats to the oval pigtoe (USFWS 2003).

Sediment samples from various ACF Basin streams tested for heavy metals that are known to be deleterious to mussels had concentrations markedly above background levels (Frick et al. 1998), among those were copper (throughout the Piedmont), and cadmium (large Coastal Plain tributaries of the Flint River). Past episodes of significant heavy metal contamination of ACF Basin streams may continue to impact mussel faunas. An estimated 950 million gallons of chemical-laden rinse, stripping, cleaning, and plating solutions were discharged indirectly into the Flint River (P. Laumeyer, USFWS, pers. comm., 1994) over a several year period. Concentrations of heavy metals (e.g., chromium and cadmium) in Asian clam, *Corbicula fluminea* (Muller 1774), and sediment samples were elevated downstream from two abandoned battery salvage operations on the Chipola River (Winger et al. 1985). Chromium concentrations found in sediments from Dead Lake downstream in the Chipola River (Winger et al. 1985) are known to be toxic to mussels (Havlik and Marking 1987).

Agricultural sources of contaminants in the ACF and Suwannee basins include nutrient enrichment from poultry farms and livestock feedlots, and pesticides and fertilizers from row crop agriculture (Couch et al. 1996, Frick et al. 1998, Berndt et al. 1998). Nitrate concentrations are particularly high in surface waters downstream of agricultural areas (Mueller et al. 1995; Berndt et al. 1998). A study by the U.S. Soil Conservation Service (USSCS; now the Natural Resources Conservation Service [NRCS]) in the Flint River system determined that between 72 and 75 percent of the nutrients entering Lake Blackshear were derived from agricultural sources (USSCS 1993). Stream ecosystems are impacted when nutrients are added at concentrations that cannot be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996, Fleming et al. 1995). Organochlorine pesticides were found at levels in ACF Basin streams that often exceeded chronic exposure criteria for the protection of aquatic life (Buell and Couch 1995, Frick et al. 1998). Once widely used in the ACF Basin (Buell and Couch 1995), these highly toxic compounds are

persistent in the environment, and are found in both sediments and the lipid reservoir of organisms (Day 1990, Burton 1992). Commonly used pesticides have been directly implicated in a North Carolina mussel dieoff (Fleming et al. 1995). Cotton is raised extensively in much of the Apalachicolan Region inhabited by these mussels. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of a mussel to respire and obtain food. This chemical may pose a continuing threat to some populations of these mussels. Nutrients from aquaculture ponds may also have an impact on stream water quality. A large catfish farm is located in the floodplain of lower Cooleewahee Creek. Discharges of enriched pond water could negatively affect an oval pigtoe population which occurs in that stream.

Many pollutants in the ACF Basin originate from urban stormwater runoff, development activities, and municipal waste water facilities, primarily in the Piedmont (Frick et al. 1998). Urban catchments in Piedmont drainages have higher concentrations of nutrients, heavy metals, pesticides, and organic compounds than do agricultural or forested ones (Lenat and Crawford 1994, Frick et al. 1998), and at levels sufficient to significantly affect fish health (Ostrander et al. 1995). Within the Suwannee River basin, nutrient concentrations were greater in agricultural areas and nitrates were found to exceed U.S. Environmental Protection Agency (EPA) drinking water standards in 20 percent of the surficial aquifer groundwater samples (Berndt et al. 1998). Pesticide concentrations were found to exceed criteria for protection of aquatic life mostly in urban areas. Currently, there are discharges from 137 municipal waste water treatment facilities in the ACF River basin alone (Couch et al. 1996). Although effluent quality has improved with modern treatment technologies and a phosphate detergent ban, hundreds of miles of streams in the ACF and Ochlockonee basins in Alabama, Florida, and Georgia, as identified in reports prepared by the water quality agencies of these states under Section 305(b) of the Clean Water Act, do not meet water use classifications.

Since approximately 29 percent of the ACF Basin is in agriculture (Frick et al. 1998), sedimentation from agricultural sources is probably significant. According to USSCS (1993), 89 percent of the sediments entering Lake Blackshear on the Flint River are derived from agricultural sources. The lower Flint River system serves as the heart of numerous mussel species' range (including the oval pigtoe) and is a major agricultural center. This area has experienced "severe losses of topsoil and nutrient additions to local streams due to agriculture" (Neves et al. 1997), and has profoundly affected the biota of surface and ground waters there (Patrick 1992). Despite the implications, only a few studies (e.g., Cooper 1987, Stewart and Swinford 1995) have specifically attributed changes in mussel populations to sediments derived from agricultural practices.

Within the Suwannee basin, predominant sources of nutrient enrichment were inorganic fertilizers and animal wastes (Crandall 1996). A herd of cattle several score in size was observed to have direct access to a large spring and spring run adjacent the Chipola River just upstream of Florida Caverns State Park during the summer of 2000 (R.S. Butler, USFWS, pers. obs.). Although anecdotal, the oval pigtoe was found live during mussel sampling in the Chipola River upstream of the mouth of this spring run, but not downstream.

Many southern streams have increased turbidity levels due to siltation (van der Schalie 1938). The oval

pigtoe attracts host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. Such a reproductive strategy depends on clear water during the critical time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Turbidity is a limiting factor impeding sight-feeding fishes (Burkhead and Jenkins 1991). In addition, mussels may be indirectly affected when turbidity levels significantly reduce light available for photosynthesis and the production of unionid food items (Kanehl and Lyons 1992).

Water quantity is becoming more of a concern in maintaining mussel habitat in the Apalachicolan Region. The potential impacts to mussels, their host fishes, and their respective habitats from ground water withdrawal may be profound. Within the Flint River basin, decreases in flow velocity and dissolved oxygen were highly correlated to mussel mortality (Johnson et al. 2001). Approximately 90 specimens of the oval pigtoe were salvaged live from drought-ravaged segments of Spring Creek, Miller County, Georgia, during the summer 2000 drought (L. Andrews, and R.S. Butler, USFWS, pers. obs.). Large numbers were also found dead in the dried stream bed, in mud holes, and in shrinking pools of water. Low DO conditions in stagnating stream pools due to drought conditions are having a disastrous effect on these mussels. Mussel mortality increases dramatically as DO decreases below 5 mg/L (Johnson et al. 2001). Rare species (e.g., oval pigtoe, shinyrayed pocketbook, and Gulf moccasinshell) were more susceptible to drought-related morality within the Flint River basin and had the highest mortality rates from hypoxic conditions (Johnson et al. 2001).

Nonnative aquatic species invasions may also impact the oval pigtoe. For example, the nonindigenous Asian clam (*Corbicula fluminea*) has invaded all of the rivers where the oval pigtoe occurs. This species has been implicated as a competitor with native mussels for resources such as food, nutrients, and space (Heard 1977, Kraemer 1979, Clarke 1986), particularly as juveniles (Neves and Widlak 1987). Densities of Asian clams are sometimes high in Apalachicolan Region streams (Stringfellow and Stanton 1998), with estimates from approximately 9 per square foot (Flint River, Sickel 1973) to over 195 per square foot (Santa Fe River, Bass and Hitt 1974). In the New River (Suwannee River drainage), Blalock and Herod (1999) found an overall density of 8 Asian clams per square foot in the same study area where oval pigtoe density was 0.003 per square foot (Blalock-Herod 2000).

CONSERVATION MEASURES:

Exposure Scenario Summary Table for the Oval Pigtoe

Species	Life Stage	Habitat Type	Exposure Route	Diet	Significant Interspecies Relationships
Oval Pigtoe	glochidia	parasite	contact with water, diet	fish body fluids	sailfin shiner
	juvenile/	sediment	contact &	filter feeder	

	adult	dweller	ingestion of water, diet, sediment	(bacteria, algae, detritus, sediment)	

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neislerii), Shinyrayed Pocketbook *(Lampsilis subangulata)*, Gulf Moccasinshell *(Medionidus penicillatus)*, Ochlockonee Moccasinshell *(Medionidus simpsonianus)*, and Oval Pigtoe *(Pleurobema pyriforme)*; and Threatened Chipola Slabshell *(Elliptio chipolaensis)*, and Purple Bankclimber *(Elliptoideus sloatianus)*. Atlanta, Georgia. 142 pp.

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Regulations and Enforcement

- Regulations for 03-04 Game, Fish and Fur
- Nongame Species Protected by Alabama Regulations
- Endangered and Threatened Species
- Endangered or Threatened Species by County

Licenses

Nongame Books

Alabama Birding Trails

- Alabama Birding Trails Map
- Tennessee Valley Talon Trail
- Highland Flyers Trail
- Riverbend Gliders Trail
- Winged Plains Trail
- North Alabama Birding Trail
- Alabama Coastal Birding Trail
- Alabama Birding Information
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What to Watch

- Bald Eagles
- Brown Pelicans
- Shorebirds
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Where

- Indian Shell Mound Park

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watchable wildlife

Regulations for 03-04 Game, Fish and Fur | Nongame Species Protected by Alabama Regulations | Endangered and Threatened Species | **Endangered or Threatened Species by County**

County by County Listing of Alabama Species on the Federal List for Threatened and Endangered Species or Whose Status is a Concern

For the latest information, go to the US Fish and Wildlife Service's list of endangered and threatened species in Alabama.

Other nongame species may be protected by Alabama regulation.

Last Updated - June 6, 2003

The US Fish and Wildlife Serice is continually updating this list and, therefore, it may be incomplete and is provided strictly for informational purposes. This list does not constitute any form of Section 7 consultation. We recommend that the USFWS Daphne, Alabama, Field Office be contacted for more current, site specific information prior to project activities. To be certain of occurrence, surveys should be conducted by qualified biologists to determine if a Federally protected species occurs within a project area.

Key to codes on list:

E - Endangered
T - Threatened
CH - Critical Habitat has been designated
PE - Proposed to be listed as Endangered
PT - Proposed to be listed as Threatened
PCH - Proposed Critical Habitat
C - Candidate Species
(P) - Possible Occurrence

Notes:
- Bald eagles *Haliaeetus leucocephalus*, red-cockaded woodpeckers *Picoides borealis* and American peregrine falcons *Falco peregrinus anatum* may occur in any county, if suitable habitat exists.

Autauga
E - Wood stork *Mycteria americana*
E - Alabama sturgeon *Scaphirhynchus suttkusi*
E - Alabama canebrake pitcher plant *Sarracenia rubra ssp.alabamensis*
T - Price's potato bean *Apios priceana*

Baldwin
ECH - Alabama beach mouse *Peromyscus polionotus ammobates*
ECH - Perdido Key beach mouse *Peromyscus polionotus trissylepsis*
E - Red-cockaded woodpecker *Picoides borealis*
E - Least tern *Sterna antillarum*
TPCH - Piping plover *Charadrius melodus*
T - Bald eagle *Haliaeetus leucocephalus*
E - Wood stork *Mycteria americana*
E - Alabama red-bellied turtle *Pseudemys alabamensis*
T - Loggerhead sea turtle *Caretta caretta*
E - Kemp's ridley sea turtle *Lepidochelys kempii*
T - Green sea turtle *Chelonia mydas* (P)
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
E - Alabama sturgeon *Scaphirhynchus suttkusi*
E - Heavy pigtoe mussel *Pleurobema taitianum*
T - Inflated heelsplitter mussel *Potamilus inflatus*
E - American chaffseed *Schwalbea americana*
T - Eastern indigo snake *Drymarchon corais couperi*
T - Flatwoods salamander *Ambystoma cingulatum* (P)
C - Bachman's sparrow *Aimophila aestivalis*

Barbour
E - Wood stork *Mycteria americana*

Bibb
E - Red-cockaded woodpecker *Picoides borealis*
E - Cahaba shiner *Notropis cahabae*
T - Goldline darter *Percina aurolineata*

T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Cylindrical lioplax snail *Lioplax cyclostomaformis*
E - Flat pebblesnail *Lepyrium showalteri*
T - Round rocksnail *Leptoxis ampla*
T - Mohr's Barbara's buttons *Marshallia mohrii*
E - Tennessee yellow-eyed grass *Xyris tennesseensis*
C - Georgia rockcress *Arabis georgiana*

Blount
T - Flattened musk turtle *Sternotherus depressus*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Plicate rocksnail *Leptoxis plicata*
T - Eggert's sunflower *Helianthus eggertii*
E - Cahaba shiner *Notropis cahabae*
C - Black Warrior waterdog *Necturus alabamensis*

Bullock
E - Relict trillium *Trillium reliquum*

Butler
T - Red hills salamander *Phaeognathus hubrichti*

Calhoun
E - Gray bat *Myotis grisescens*
E - Red-cockaded woodpecker *Picoides borealis*
T - Pygmy sculpin *Cottus paulus*
T - Blue shiner *Cyprinella caerulea*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Tulotoma snail *Tulotoma magnifica*
T - Painted rocksnail *Leptoxis taeniata*
E - Southern pigtoe mussel *Pleurobema georgianum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
E - Southern clubshell mussel *Pleurobema decisum*
E - Tennessee yellow-eyed grass *Xyris tennesseensis*
T - Mohr's Barbara's buttons *Marshallia mohrii*
C - White fringeless orchid *Platanthera integrilabia*

Chambers
T - Little amphianthus *Amphianthus pusillus*

Cherokee
T - Bald eagle *Haliaeetus leucocephalus*
T - Blue shiner *Cyprinella caerulea*
E - Coosa moccasinshell mussel *Medionidus parvulus*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Southern clubshell mussel *Pleurobema decisum*
E - Green pitcher plant *Sarracenia oreophila*
E - Harperella *Ptilimnium nodosum*
T - Mohr's Barbara's buttons *Marshallia mohrii*
E - Alabama leather flower *Clematis socialis*
T - Kral's water-plantain *Sagittaria secundifolia*

Chilton
T - Bald eagle *Haliaeetus leucocephalus*
E - Red-cockaded woodpecker *Picoides borealis*
E - Wood stork *Mycteria americana*
E - Alabama canebrake pitcher plant *Sarracenia rubra ssp.alabamensis*
T - Painted rocksnail *Leptoxis taeniata*

Choctaw
T - Bald eagle *Haliaeetus leucocephalus*
E - Wood stork *Mycteria americana*
T - Gopher tortoise *Gopherus polyphemus*
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
T - Inflated heelsplitter mussel *Potamilus inflatus*

Clarke
E - Wood stork *Mycteria americana*
T - Bald eagle *Haliaeetus leucocephalus*
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
E - Alabama sturgeon *Scaphirhynchus suttkusi*
T - Inflated heelsplitter mussel *Potamilus inflatus*
E - Heavy pigtoe mussel *Pleurobema taitianum* (P)
C - Black pine snake *Pituophis melanoleucus lodingi*

Clay
E - Southern pigtoe mussel *Pleurobema georgianum*
T - Blue shiner *Cyprinella caerulea*
E - Tulotoma snail *Tulotoma magnifica*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
C - White fringeless orchid *Platanthera integrilabia*

Cleburne
E - Red-cockaded woodpecker *Picoides borealis*
E - Southern pigtoe mussel *Pleurobema georgianum*
E - Southern clubshell mussel *Pleurobema decisum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Fine-lined pocketbook *Lampsilis altilis*
C - White fringeless orchid *Platanthera integrilabia*

Coffee
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
T - Eastern indigo snake *Drymarchon corais couperi*

Colbert
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis* (P)
E - Pink mucket pearly mussel *Lampsilis abrupta*
E - White warty-back pearly mussel *Plethobasus cicatricosus*
E - Rough pigtoe pearly mussel *Pleurobema plenum*
E - Cumberlandian combshell mussel *Epioblasma brevidens*
E - Ring pink mussel *Obovaria retusa*
E - Turgid blossom pearlymussel *Epioblasma turgidula*
E - Cracking pearlymussel *Hemistena lata*
E - Fanshell *Cyprogenia stegaria*
T - Lyrate bladder-pod *Lesquerella lyrata*
E - Alabama cave shrimp *Palaemonias alabamae*
E - Spotfin chub *Cyprinella (=Hybopsis) monacha*
C - Slabside pearlymussel *Lexingtonia dolabelloides*
T - Eggert's sunflower *Helianthus eggertii* (P)

Conecuh
E - Gray bat *Myotis grisescens*
T - Red hills salamander *Phaeognathus hubrichti*
E - Red-cockaded woodpecker *Picoides borealis*
T - Eastern indigo snake *Drymarchon corais couperi (P)*
C - Alabama pearlshell *Margaritifera marrianae*

Coosa
E - Red-cockaded woodpecker *Picoides borealis*
T - Bald eagle *Haliaeetus leucocephalus*
T - Blue shiner *Cyprinella caerulea*
E - Tulotoma snail *Tulotoma magnifica*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
T - Kral's water-plantain *Sagittaria secundifolia*

Covington
E - Red-cockaded woodpecker *Picoides borealis*
T - Eastern indigo snake *Drymarchon corais couperi*
T - Red hills salamander *Phaeognathus hubrichti*
T - Flatwoods salamander *Ambystoma cingulatum* (P)
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*

Crenshaw
T - Red hills salamander *Phaeognathus hubrichti*
E - Wood stork *Mycteria americana*

Cullman
T - Flattened musk turtle *Sternotherus depressus*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Fine-lined pocketbook mussel *Lampsilis altilis*

Dale
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
T - Eastern indigo snake *Drymarchon corais couperi* (P)

Dallas
T - Bald eagle *Haliaeetus leucocephalus*
E - Wood stork *Mycteria americana*
E - Red-cockaded woodpecker *Picoides borealis*
E - Alabama sturgeon *Scaphirhynchus suttkusi*
E - Southern clubshell mussel *Leurobema decisum*
E - Heavy pigtoe mussel *Pleurobema taitianum*

T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Fine-lined pocketbook mussel *Lampsilis altilis*

DeKalb
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis* (P)
T - Blue shiner *Cyprinella caerulea*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
T - Kral's water-plantain *Sagittaria secundifolia*
E - Green pitcher plant *Sarracenia oreophila*
E - Harperella *Ptilimnium nodosum*
T - Eggert's sunflower *Helianthus eggertii* (P)

Elmore
E - Tulotoma snail *Tulotoma magnifica*
E - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Alabama canebrake pitcher plant *Sarracenia rubra ssp.alabamensis*
C - Georgia rockcress *Arabis georgiana*

Escambia
E - Wood stork *Mycteria americana*
E - Red-cockaded woodpecker *Picoides borealis*
T - Bald eagle *Haliaeetus leucocephalus*
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
T - Eastern indigo snake *Drymarchon corais couperi*

Etowah
T - Flattened musk turtle *Sternotherus depressus*
T - Mohr's Barbara's buttons *Marshallia mohrii*
E - Green pitcher plant *Sarracenia oreophila*
E - Alabama leather flower *Clematis socialis*
E - Southern clubshell mussel *Pleurobema decisum*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
E - Southern pigtoe mussel *Pleurobema georgianum*
E - Ovate clubshell mussel *Pleurobema perovatum*

Fayette
T - Orange-nacre mucket mussel *Lampsilis perovalis*
E - Dark pigtoe mussel *Pleurobema furvum*
T - Fine-lined pocketbook mussel *Lampsilis altilis*

Franklin
T - Bald eagle *Haliaeetus leucocephalus*
E - Gray bat *Myotis grisescens*
E - Cumberlandian combshell mussel *Epioblasma brevidens*
T - Lyrate bladder-pod *Lesquerella lyrata*
E - Leafy prairie clover *Dalea foliosa*
E - Tennessee yellow-eyed grass *Xyris tennesseensis*
T - Eggert's sunflower *Helianthus eggertii*
C - Slabside pearlymussel *Lexingtonia dolabelloides*

Geneva

T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
E - Red-cockaded woodpecker *Picoides borealis*
T - Eastern indigo snake *Drymarchon corais couperi* (P)

Greene
T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Alabama moccasinshell mussel *Medionidus acutissimus*
E - Southern clubshell mussel *Pleurobema decisum*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Heavy pigtoe mussel *Pleurobema taitianum*
T - Inflated heelsplitter mussel *Potamilus inflatus*
E - Stirrup shell mussel *Quadrula stapes*

Hale
E - Red-cockaded woodpecker *Picoides borealis*
T - Bald eagle *Haliaeetus leucocephalus*
E - Wood stork *Mycteria americana*
T - Inflated heelsplitter mussel *Potamilus inflatus*

Henry
T - Bald eagle *Haliaeetus leucocephalus*
E - Relict trillium *Trillium reliquum*
T - Eastern indigo snake *Drymarchon corais couperi* (P)

Houston
T - Flatwoods salamander *Ambystoma cingulatum* (P)

T - Eastern Indigo snake *Drymarchon corais couperi* (P)

Jackson
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis*
T - Bald eagle *Haliaeetus leucocephalus*
E - Palezone shiner *Notropis albizonatus*
E - Anthony's riversnail *Athearnia anthonyi*
E - Shiny pigtoe pearly mussel *Fusconaia cor (edgariana)*
E - Pink mucket pearly mussel *Lampsilis abrupta*
E - Alabama lamp pearly mussel *Lampsilis virescens*
E - Pale lilliput pearly mussel *Toxolasma cylindrellus*
E - Fine-rayed pigtoe mussel *Fusconaia cuneolus*
E - Green pitcher plant *Sarracenia oreophila*
T - American hart's-tongue fern *Phyllitis scolopendrium var.americana*
T - Eggert's sunflower *Helianthus eggertii* (P)
C - Slabside pearlymussel *Lexingtonia dolabelloides*
C - White fringeless orchid *Platanthera integrilabia*

Jefferson
T - Flattened musk turtle *Sternotherus depressus*
E - Watercress darter *Etheostoma nuchale*
E - Cahaba shiner *Notropis cahabae*
PE - Vermilion darter *Etheostoma chermocki*
E - Upland combshell mussel *Epioblasma metastriata*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
E - Plicate rocksnail *Leptoxis plicata*
E - Leafy prairie clover *Dalea foliosa*

Lamar
E - Southern combshell mussel *Epioblasma penita*
E - Southern clubshell mussel *Pleurobema decisum*
E - Ovate clubshell mussel *Pleurobema perovatum*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Alabama moccasinshell mussel *Medionidus acutissimus*

Lauderdale
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis* (P)
T - Bald eagle *Haliaeetus leucocephalus*
TCH - Slackwater darter *Etheostoma boschungi*
ECH - Alabama cavefish *Speoplatyrhinus poulsoni*
E - Spotfin chub *Cyprinella (=Hybopsis) monacha*
E - Ring pink mussel *Obovaria retusa*
E - Turgid blossom pearlymussel *Epioblasma turgidula*
E - Cracking pearlymussel *Hemistena lata*
E - Pink mucket pearly mussel *Lampsilis abrupta*
E - White warty-back pearly mussel *Plethobasus cicatricosus*
E - Rough pigtoe pearly mussel *Pleurobema plenum*
E - Fanshell *Cyprogenia stegaria*
T - Eggert's sunflower *Helianthus eggertii* (P)

Lawrence
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis*
E - Red-cockaded woodpecker *Picoides borealis*
E - Pink mucket pearly mussel *Lampsilis abrupta*
T - Alabama moccasinshell mussel *Medionidus acutissimus*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
E - Dark pigtoe mussel *Pleurobema furvum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
E - Rough pigtoe mussel *Pleurobema plenum*
E - Leafy prairie clover *Dalea foliosa*
T - Lyrate bladder-pod *Lesquerella lyrata*
T - Eggert's sunflower *Helianthus eggertii* (P)

Lee
E - Relict trillium *Trillium reliquum*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Southern clubshell mussel *Pleurobema decisum*
T - Fine-lined pocketbook mussel *Lampsilis altilis*

Limestone
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis* (P)
T - Slackwater darter *Etheostoma boschungi*
E - Boulder darter *Etheostoma wapiti*

E - Pink mucket pearly mussel *Lampsilis abrupta*
E - Rough pigtoe mussel *Pleurobema plenum*
E - Cumberland monkeyface mussel *Quadrula intermedia*
E - Cracking pearlymussel *Hemistena lata*
E - Ring pink mussel *Obovaria retusa*
E - Anthony's riversnail *Athearnia anthonyi*
E - Slender campeloma snail *Campeloma decampi*
E - Armored snail *Pyrgulopsis pachyta*
T - Eggert's sunflower *Helianthus eggertii* (P)

Lowndes
E - Wood stork *Mycteria americana*
E - Alabama sturgeon *Scaphirhynchus suttkusi*

Macon
E - Red-cockaded woodpecker *Picoides borealis*
E - Wood stork *Mycteria americana*
E - Southern clubshell mussel *Pleurobema decisum*
E - Ovate clubshell mussel *Pleurobema perovatum*
T - Fine-lined pocketbook mussel *Lampsilis altilis*

Madison
E - Gray bat *Myotis grisescens*
T - Bald eagle *Haliaeetus leucocephalus*
T - Slackwater darter *Etheostoma boschungi*
E - Snail darter *Percina tanasi*
E - Alabama cave shrimp *Palaemonias alabamae*
E - Pink mucket pearly mussel *Lampsilis abrupta*
E - Shiny pigtoe pearly mussel *Fusconaia cor (edgariana)*
E - Fine-rayed pigtoe mussel *Fusconaia cuneolus*
E - Rough pigtoe mussel *Pleurobema plenum*
C - Slabside pearlymussel *Lexingtonia dolabelloides*
E - Slender campeloma snail *Campeloma decampi*
T - Price's potato bean *Apios priceana*
E - Morefield's leather flower *Clematis morefieldii*
T - Eggert's sunflower *Helianthus eggertii* (P)

Marengo
T - Bald eagle *Haliaeetus leucocephalus*
T - Inflated heelsplitter mussel *Potamilus inflatus*

Marion
E - Southern combshell mussel *Epioblasma penita*
C - White fringeless orchid *Platanthera integrilabia*

Marshall
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis*
E - Red-cockaded woodpecker *Picoides borealis*
T - Bald eagle *Haliaeetus leucocephalus*
T - Flattened musk turtle *Sternotherus depressus*
E - Snail darter *Percina tanasi*
E - Pink mucket pearly mussel *Lampsilis abrupta*
E - Shiny pigtoe pearly mussel *Fusconaia cor (edgariana)*
E - Fine-rayed pigtoe mussel *Fusconaia cuneolus*
E - Orange-footed pimpleback mussel *Plethobasus cooperianus*
E - Rough pigtoe mussel *Pleurobema plenum*
T - Price's potato bean *Apios priceana*
E - Green pitcher plant *Sarracenia oreophila*
T - Eggert's sunflower *Helianthus eggertii* (P)
C - Slabside pearlymussel *Lexingtonia dolabelloides*

Mobile
T - Piping plover *Charadrius melodus*
E - Red-cockaded woodpecker *Picoides borealis*
E - Least tern *Sterna antillarum*
T - Eastern indigo snake *Drymarchon corais couperi*
T - Gopher tortoise *Gopherus polyphemus*
E - Alabama red-bellied turtle *Pseudemys alabamensis*
T - Loggerhead sea turtle *Caretta caretta*
E - Kemp's ridley sea turtle *Lepidochelys kempii* (P)
T - Green sea turtle *Chelonia mydas* (P)
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
T - Flatwoods salamander *Ambystoma cingulatum* (P)
E - Louisiana quillwort *Isoetes louisianensis* (P)
C - Black pine snake *Pituophis melanoleucus lodingi*

Monroe
E - Gray bat *Myotis grisescens*
T - Bald eagle *Haliaeetus leucocephalus*

T - Red hills salamander *Phaeognathus hubrichti*
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
E - Alabama sturgeon *Scaphirhynchus suttkusi*
E - Heavy pigtoe mussel *Pleurobema taitianum*
C - Alabama pearlshell *Margaritifera marrianae*
T - Eastern indigo snake *Drymarchon corais couperi* (P)

Montgomery
E - Wood stork *Mycteria americana*

Morgan
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis*
E - Pink mucket pearly mussel *Lampsilis abrupta*
E - Ring pink mussel *Obovaria retusa*
E - Rough pigtoe mussel *Pleurobema plenum*
E - Leafy prairie clover *Dalea foliosa*
T - American hart's-tongue fern *Asplenium scolopendrium var.americana*
T - Eggert's sunflower *Helianthus eggertii* (P)

Perry
T - Bald eagle *Haliaeetus leucocephalus*
E - Red-cockaded woodpecker *Picoides borealis*
E - Cahaba shiner *Notropis cahabae*

Pickens
E - Red-cockaded woodpecker *Picoides borealis*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Alabama moccasinshell mussel *Medionidus acutissimus*
E - Southern clubshell mussel *Pleurobema decisum*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Heavy pigtoe mussel *Pleurobema taitianum*
E - Stirrup shell mussel *Quadrula stapes*

Pike

Randolph
T - Little amphianthus *Amphianthus pusillus*

Russell
E - Shiny-rayed pocketbook mussel *Lampsilis subangulata*
E - Red-cockaded woodpecker *Picoides borealis*
C - Georgia rockcress *Arabis georgiana*

Shelby
E - Gray bat *Myotis grisescens*
E - Indiana bat *Myotis sodalis*
E - Cahaba shiner *Notropis cahabae*
T - Goldline darter *Percina aurolineata*
T - Painted rocksnail *Leptoxis taeniata*
E - Tulotoma snail *Tulotoma magnifica*
E - Southern clubshell mussel *Pleurobema decisum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
E - Southern acornshell mussel *Epioblasma othcaloogensis* (P)
T - Fine-lined pocketbook mussel *Lampsilis altilis*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Alabama moccasinshell mussel *Medionidus acutissimus*
E - Cylindrical lioplax (snail) *Lioplax cyclostomaformis*
E - Flat pebblesnail *Lepyrium showalteri*
T - Round rocksnail *Leptoxis ampla*

St. Clair
E - Tulotoma snail *Tulotoma magnifica*
E - Southern acornshell mussel *Epioblasma othcaloogensis*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
E - Southern pigtoe mussel *Pleurobema georgianum*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Upland combshell mussel *Epioblasma metastriata*
E - Southern clubshell mussel *Pleurobema decisum*
E - Alabama leather flower *Clematis socialis*

Sumter
E - Wood stork *Mycteria americana*
E - Ovate clubshell mussel *Pleurobema perovatum*
T - Inflated heelsplitter mussel *Potamilus inflatus*
E - Stirrup shell mussel *Quadrula stapes*
E - Heavy pigtoe mussel *Pleurobema taitianum*
T - Gopher tortoise *Gopherus polyphemus*

Talladega

E - Red-cockaded woodpecker *Picoides borealis*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Coosa moccasinshell mussel *Medionidus parvulus*
E - Southern pigtoe mussel *Pleurobema georgianum*
E - Tulotoma snail *Tulotoma magnifica*
T - Painted rocksnail *Leptoxis taeniata*
T - Lacy elimia (snail) *Elimia crenatella*

Tallapoosa
E - Red-cockaded woodpecker *Picoides borealis*
T - Fine-lined pocketbook mussel *Lampsilis altilis*

Tuscaloosa
E - Red-cockaded woodpecker *Picoides borealis*
T - Flattened musk turtle *Sternotherus depressus*
E - Southern clubshell mussel *Pleurobema decisum*
E - Dark pigtoe mussel *Pleurobema furvum*
E - Ovate clubshell mussel *Pleurobema perovatum*
T - Alabama moccasinshell mussel *Medionidus acutissimus*
T - Inflated heelsplitter mussel *Potamilus inflatus*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
C - Black Warrior waterdog *Necturus alabamensis*
C - White fringeless orchid *Platanthera integrilabia*

Walker
T - Flattened musk turtle *Sternotherus depressus*
E - Ovate clubshell mussel *Pleurobema perovatum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
C - Black Warrior waterdog *Necturus alabamensis*

Washington
E - Wood stork *Mycteria americana*
T - Eastern indigo snake *Drymarchon corais couperi*
T - Gopher tortoise *Gopherus polyphemus*
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
T - Inflated heelsplitter mussel *Potamilus inflatus*
E - Louisiana quillwort *Isoetes louisianensis* (P)
C - Black pine snake *Pituophis melanoleucus lodingi*

Wilcox
T - Bald eagle *Haliaeetus leucocephalus*
E - Wood stork *Mycteria americana* (P)
T - Gulf sturgeon *Acipenser oxyrinchus desotoi*
E - Alabama sturgeon *Scaphirhynchus suttkusi*
C - Alabama pearlshell *Margaritifera marrianae*
E - Heavy pigtoe mussel *Pleurobema taitianum* (P)
C - Georgia rockcress *Arabis georgiana*

Winston
T - Flattened musk turtle *Sternotherus depressus*
E - Red-cockaded woodpecker *Picoides borealis*
T - Orange-nacre mucket mussel *Lampsilis perovalis*
T - Alabama moccasinshell mussel *Medionidus acutissimus*
E - Coosa moccasinshell mussel *Medionidus parvulus*
E - Dark pigtoe mussel *Pleurobema furvum*
E - Triangular kidneyshell mussel *Ptychobranchus greenii*
T - Fine-lined pocketbook mussel *Lampsilis altilis*
E - Ovate clubshell mussel *Pleurobema perovatum*
T - Kral's water-plantain *Sagittaria secundifolia*
T - Alabama streak-sorus fern *Thelypteris pilosa var. alabamensis*
C - Black Warrior waterdog *Necturus alabamensis*
C - White fringeless orchid *Platanthera integrilabia*

Please send comments, questions, or corrections to Mark Sasser.

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ARMI National Atlas for Amphibian Distributions

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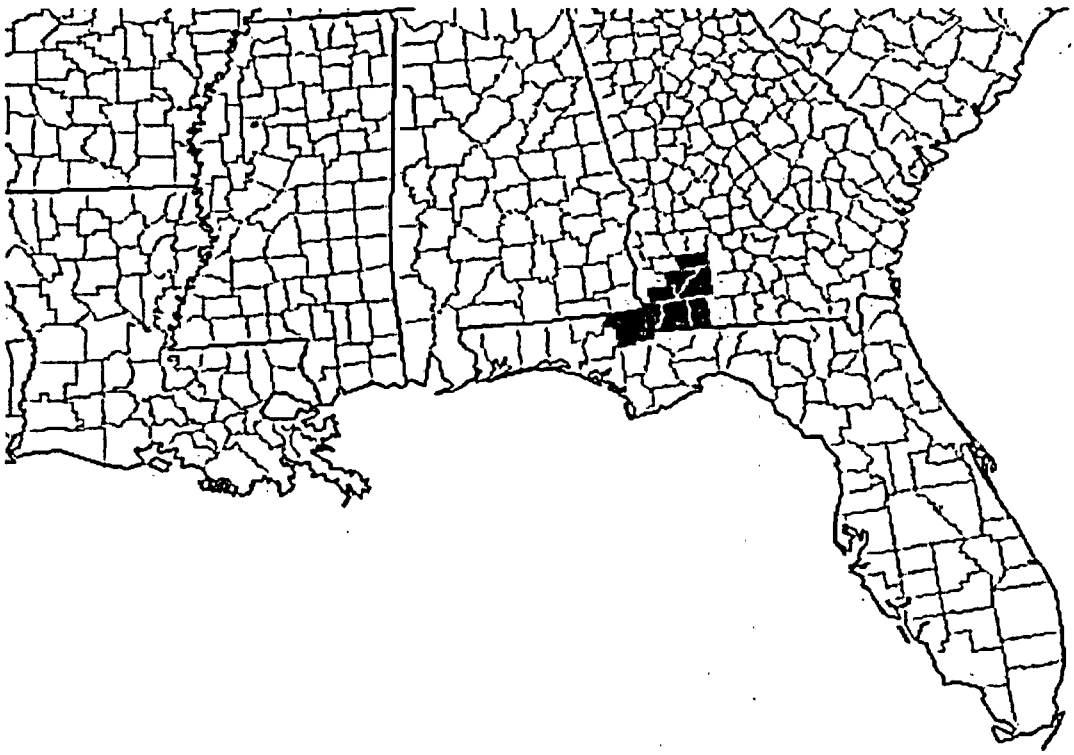
Georgia blind salamander
Caudata > Plethodontidae > Haideotriton > *Haideotriton wallacei*



These maps have been adapted from the "United States Amphibian Atlas Database" assembled at Ball State University by Laura Blackburn, M.S., Priya Nanjappa, M.S., and Michael J. Lannoo, Ph.D. (2002). Development of this database was supported in part by grants and/or matching funds from the National Fish and Wildlife Foundation, United States Fish and Wildlife Service, and Disney Wildlife Conservation Fund.

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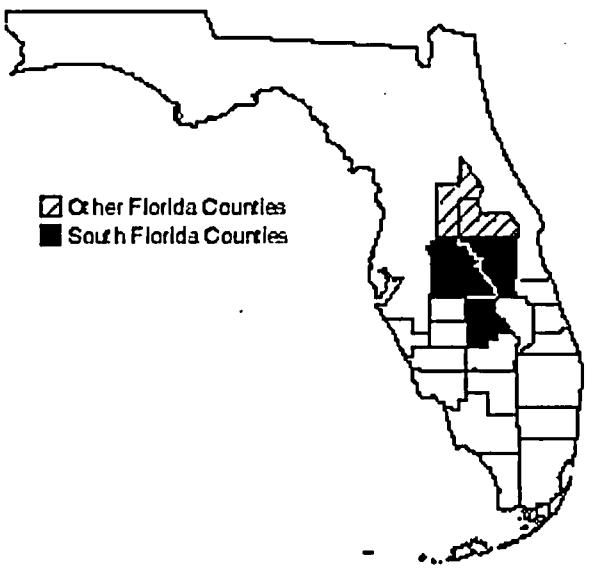
12/8/03

Papery Whitlow-wort

Paronychia chartacea Fern

Federal Status:	**Threatened (January 21, 1987)**
Critical Habitat:	**None Designated**
Florida Status:	**Endangered**
Recovery Plan Status:	**Revision (May 18, 1999)**
Geographic Coverage:	**Rangewide**

Figure 1. County distribution of the papery



Paronychia chartacea (=*Nyachia pulvinata*) is a member of the pink family, Caryophyllaceae. *Paronychia chartacea* is a short-lived dioecious herb, forming small mats. There are two geographically isolated subspecies of this small herb: *P. chartacea* ssp. *chartacea* in central Florida and the recently described *P. chartacea* ssp. *minima* in northwestern Florida. Both subspecies are federally listed as threatened. Like many of the other Lake Wales Ridge endemic scrub plants, this species was listed because of habitat loss to agricultural, commercial, residential, and recreational purposes.

This account represents a revision of the existing recovery plan for the papery whitlow-wort (FWS 1996).

Description

The papery whitlow-wort is mat-forming with many bright yellowish-green branches radiating flatly from a strong taproot (Kral 1983, Small 1933). The stems are 5 to 20 cm long and are wiry. The leaf blades are sessile, 1.5 to 3.0 mm long, ovate to triangular-ovate in shape, and strongly revolute. It has numerous small cream-colored to greenish flowers (Small 1933, FWS 1996) that produce a very thin-walled utricle (Kral 1983).

There are two geographically isolated subspecies of this small herb: *P. chartacea* ssp. *chartacea* in central Florida and *P. chartacea ssp. minima* L. Anderson in the Florida panhandle. Much of the distinction between the two subspecies is a matter of degree (Anderson 1991). The *P. chartacea* ssp. *minima* is somewhat less pubescent than ssp. *chartacea*. There are also differences in their base stems, leaf width, and flower cluster (Anderson 1991).

Taxonomy

The papery whitlow-wort was first named by Small (1925) as *Nychia pulvinata*. In 1936 Fernald transferred the species to the genus *Paronychia* as *P. chartacea* because the name *P.*

pulvinata was pre-empted (Anderson 1991). In 1991 Anderson formally described two geographically distinct subspecies, *P. chartacea* ssp. *chartacea* and *P. chartacea* ssp. *minima*. The subspecies P. *chartacea* ssp. *minima* was formally described by Anderson (1991), several years after *P. chartacea* had been listed as a threatened species. Because the entire species was listed as threatened, the newly described subspecies is also protected.

Distribution

P. chartacea ssp. *chartacea* is endemic to the scrub community on the Lake Wales Ridge (Kral 1983), in Highlands, Polk, Osceola, Orange, and Lake counties (Anderson 1991) (Figure 1). The subspecies *P. chartacea* ssp. *minima* occurs in the karst region of the Florida panhandle, Washington and Bay counties.

Habitat

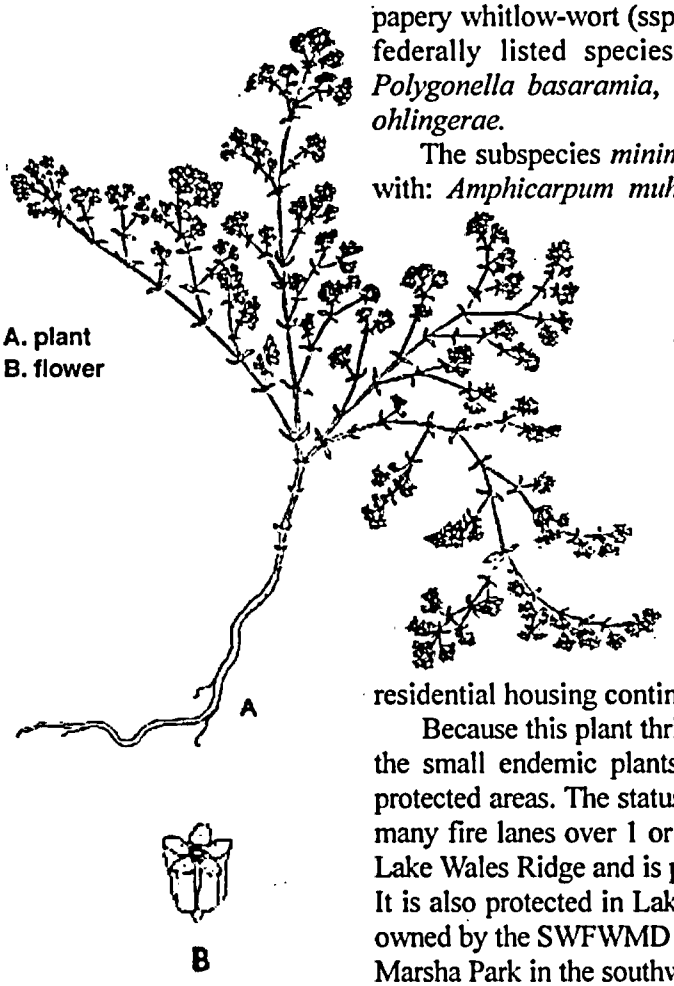
The natural habitat for the papery whitlow-wort on the Lake Wales Ridge (that is for *P. chartacea* ssp. *chartacea*) is rosemary scrub, which is also known as the rosemary phase of sand pine scrub (Abrahamson *et al.* 1984, Christman 1988, Menges and Kohfeldt 1995). At Archbold Biological Station, rosemary scrubs are found only on the higher ridges and knolls in the intra-ridge valley at 40 to 50 m in elevation, and are largely restricted to St. Lucie and Archbold soil types (Abrahamson *et al.* 1984), both well-drained white sands (Carter *et al.* 1989). The fire cycle in rosemary scrub can range from 10 to as long as 100 years (Johnson 1982, Myers 1990). Rosemary scrub is dominated by Florida rosemary (*Ceratiola ericoides*) and oak species (*Quercus chapmannii, Q. geminata, Q. inopina*) with occasional sand pine *(Pinus clausa)*. Abrahamson *et al.* (1984) provides a full description of the rosemary scrub habitat. The shrub matrix is interspersed with open sandy areas that contain a cover of herbs and lichens (Abrahamson *et al.* 1984, Hawkes and Menges 1996). These gaps are more persistent in rosemary scrubs than in scrubby flatwoods (Hawkes and Menges 1996).

Within these scrub communities, papery whitlow-wort is more abundant in disturbed, sandy habitats such as road rights-of-way and recently cleared high pine (Abrahamson *et al.* 1984, Christman 1988, FWS 1996). In rosemary scrub paper whitlow-wort can become very abundant after a fire or on disturbed sites such as along fire lanes or trails (FWS 1996, Johnson and Abrahamson 1990).

The subspecies *P. chartacea* ssp. *minima* occurs in the Florida panhandle in coarse white sand along margins of karst lakes (Anderson 1991). It is apparently favored by mild disturbance. It often occurs in nearly pure stands (Anderson 1991).

Reproduction

Anderson (1991) notes that *P. chartacea* ssp. *chartacea* has repeatedly been described as an annual, but states that it is often a short-lived perennial. Observations at Bok Tower Gardens indicate that *P. chartacea* ssp. *chartacea* behaves, both in the garden and in the wild, as a short-lived perennial. The



Papery whitlow-wort. *Image adapted from an original drawing by Anna-Lisa King.*

subspecies *P. chartacea* ssp. *minima* is strictly an annual (Anderson 1991). Flowering and fruiting occur in late summer or fall (Anderson 1991) and the seeds mature in September or October (T. Race, Bok Tower Gardens, personal communication 1996).

Relationship to Other Species

In rosemary scrub, the papery whitlow-wort is found in association with 37 vascular plants and seven species of reindeer lichens (Johnson and Abrahamson 1990). In a study of the responses of species to fire in rosemary scrub, Johnson and Abrahamson (1990) identified two groups of this species: seeders and sprouters, and a third group that they were uncertain about. The papery whitlow-wort was considered a seeder along with 11 other species (Johnson and Abrahamson 1990, Ostertag and Menges 1994). Johnson and Abrahamson (1990) have also found that the papery whitlow-wort appeared in post burn plots of rosemary scrub when it was rare or absent prior to the burn. The papery whitlow-wort was displaced by rosemary and reindeer lichens within about 9 to 12 years post fire (Johnson and Abrahamson 1990). The papery whitlow-wort (ssp. *chartacea*) occurs in association with several other federally listed species: *Bonamia grandiflora, Hypericum cumulicola, Polygonella basaramia, Cladonia perforata, Eryngium cuneifolium, Liatris ohlingerae.*

The subspecies *minima* can occur in nearly pure stands or in association with: *Amphicarpum muhlenbergianum, Bulbostylis barbata, B. ciliatifolia, Chrysopsis lanuginosa, Eriocaulon lineare, Hypericum lissophloeus, H. reductum, Lachnanthes carolinianam, Lachnocaulon anceps, Paronychia patula, Polypremum procumbens, Rhexia salicifolia, Rhynchospora globularis, Sagittaria isoetiformis,* and *Xyris longisepala.*

Status and Trends

The loss of scrub habitat is the primary reason the papery whitlow-wort is listed as a threatened species (52 CFR 2234). More than two-thirds of the historic scrub habitat of this plant was destroyed by 1980 (Christman 1988). Land conversion for citrus and residential housing continues to diminish scrub habitats.

Because this plant thrives in fire lanes and along sand roads, it is the last of the small endemic plants of the Lake Wales Ridge to disappear from fire-protected areas. The status of this species could be assessed by examining it in many fire lanes over 1 or 2 years (FWS 1996). It is ubiquitous in scrub on the Lake Wales Ridge and is protected in all of the biological preserves in this area. It is also protected in Lake County at the Crooked Lake site near Lake Louisa owned by the SWFWMD (FWS 1996) and in Orange County at Lakes Cain and Marsha Park in the southwest Orlando area.

Management

The density of *P. chartacea* ssp. *chartacea* increases in relation to available open space (Hawkes and Menges 1996, Menges and Kohfeldt 1995). Open spaces are commonly found in rosemary scrub after fire and in fire lanes and trails. The rosemary scrub has developed with periodic disturbances and the available open space and frequencies of disturbances are likely to influence the species composition (Hawkes and Menges 1996). Densities of *P. chartacea* ssp. *chartacea* decrease with time after fire, and it is displaced from rosemary scrub within 9 to 12 years post fire (Johnson and Abrahamson 1990, Hawkes and Menges 1996). Because it thrives in fire lanes, along sand roads, and trails, it is the least likely of the rare scrub plants to go extinct.

Management for *P. c.* ssp. *chartacea* will require the development of long-term burning regimes that mimic the natural fire cycles of rosemary scrub. There are complex relationships among fire, open space, and plant distributions within a xeric scrub that are essential for fire management and need to be studied further (Hawkes and Menges 1996). Management practices for rosemary scrub should include the fire requirements for all scrub flora and fauna (Hawkes and Menges 1996).

The species' tendency to colonize disturbed areas along easily accessible State road cuts and rights of way can result in over-estimation of the species abundance and health. On publicly managed lands, we caution against using species presence or abundance in altered habitats as the benchmark with which management decisions are made. Instead, management decisions should be made that maintain or enhance the dynamic diversity of Florida's scrub vegetation.

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Recovery for the Papery Whitlow-wort

Paronychia chartacea Fern

Recovery Objective: DELIST the species once recovery criteria are met.

Recovery Criteria

Paronychia chartacea may be delisted when: enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to assure 95 percent probability of persistence for 100 years; when these sites, within the historic range of *P. chartacea*, are adequately protected from habitat loss, degradation, and fragmentation; when these sites are managed to maintain the rosemary phase of xeric oak scrub communities to support *P. chartacea*; and when monitoring programs demonstrate that these sites support the appropriate numbers of self-sustaining populations, and those populations are stable throughout the historic range of the species.

Species-level Recovery Actions

S1. Determine current distribution of *P. chartacea*. Some portions of *P. chartacea*'s range have been well surveyed yet a total distribution has not been ascertained for this species. A thorough survey is needed to determine the distribution for this species.

S1.1. Conduct surveys for additional populations of *P. chartacea*.

S1.1.1. Continue surveys in Polk, Osceola, and Highlands counties. The Lake Wales Ridge has probably been adequately surveyed, though new sites for *P. chartacea* may still be found.

S1.1.2. Continue surveys on protected lands. New sites for listed species are still being found on protected lands. This survey work should be continued to catalog all existing protected sites and new sites as they are purchased.

S1.2. Maintain distribution of known populations and suitable habitat in GIS database. Use GIS to map existing populations and to assess the species' status and trends over time. The database should contain information on locations, population sizes, and status. This information should also be used for project review, in land acquisition activities, and to coordinate updates with the Florida Natural Areas Inventory database. Currently, the Lake Wales Ridge Ecosystem Working Group and Archbold Biological Station are proposing to map the entire central ridge. This information would show potential habitat for scrub endemics based on their habitat needs.

S2. **Protect and enhance existing populations.** Much of the native xeric uplands on the Lake Wales Ridge and surrounding counties have been converted to agriculture or urban development. The remaining habitat is fragmented into small parcels and in many cases, has been isolated. For this reason, existing populations are in need of protection from a variety of threats.

S2.1. **Protect privately-owned habitat through acquisition, conservation easements, or agreements with landowners.**

S2.2. **Protect populations on public lands.** Develop management guidelines that allow for a fire regime that includes a mosaic of successional stages.

S2.3. **Use local or regional planning to protect habitat.** Utilize available regional and county planning processes to encourage protection of suitable habitat both unoccupied and occupied of *P. chartacea.*

S2.4. **Continue *ex situ* conservation.** *Ex situ* collections are important for preserving genetic diversity, preventing extirpation, and determining ecological characteristics and habitat management needs of species. These collections will be instrumental in the recovery of *P. chartacea.*

S2.4.1. **Conserve germ plasm.** The seed for this species is not presently in long term storage.

S2.4.2. **Maintain *ex situ* collection.** Currently, the Center for Plant Conservation coordinates conservation activities and maintains a database for the National Collection. Bok Tower Gardens, as a participating institution, maintains and propagates *P. chartacea* as part of the National Collection.

S2.5. **Enforce available protective measures.** Use local, State and Federal regulations to protect this species from overcollecting and damage from off-road vehicle use. Regulations should also be used to protect xeric vegetative communities where *P. chartacea* lives.

S2.5.1. **Initiate section 7 consultation when applicable.** Initiate section 7 consultations when Federal activities may affect this species.

S2.5.2. **Enforce take and trade prohibitions.** This species is protected by take provisions of the ESA (including its prohibition against removing and reducing to possession any endangered plant from areas under Federal jurisdiction; maliciously damaging or destroying any such species on any such area; or removing, cutting, or digging up any such species), by the Preservation of Native Flora of Florida Act, and by the Florida rules regarding removal of plants from State lands.

S3. **Conduct research on life history characteristics of *P. chartacea.*** Much of the basic biology and ecology of this species remains poorly understood. To effectively recover this species, more specific biological information is needed.

S3.1. **Continue research to determine demographic information, such as numbers of sites and populations, numbers of individuals in a population, recruitment, dispersal, growth, survival, and mortality.**

S3.2. **Once demographic data are known, conduct population viability and risk assessment analysis to determine the numbers of plants, sites, subpopulations/populations, and spatial distribution needed to ensure persistence of the species.**

S3.3. **Conduct research to assess management requirements of *P. chartacea*.** Determine which natural populations can be stabilized or increased by habitat management. Surveys, research, and monitoring information will provide factors contributing to any declines at each site. Monitoring of populations should be in reference to various habitat management practices. Site-specific management guidelines should be provided to land managers and close coordination among land managers is essential to develop adaptive management techniques. This species experiences a dramatic increase in flowering the first year after a burn, yet can bloom up to 30 years without fire. More information is needed on the response to management activities for this species.

S4. **Monitor populations of *P. chartacea*.**

S4.1. **Develop monitoring protocol to assess population trends for *P. chartacea*.**

S4.1.1. **Monitor to detect changes in demographic characteristics, such as reproduction, recruitment, growth, dispersal, survival, and mortality.** Also monitor for pollinators, herbivory, disease, and injury.

S4.1.2. **Monitor the effects of various land management actions on *P. chartacea*.** Assess any changes in demographic characteristics of *P. chartacea* in response to land management activities, such as prescribed fire, exotic plant control, *etc.*

S4.2. **Develop a quantitative description of the population structure of *P. chartacea*.** This description will provide a baseline for monitoring population dynamics in response to natural environmental changes and management treatments. Data recorded should include morphology, survivorship, mortality, and reproduction for individual plants. Collect data about each plant's microsite (vegetation cover, litter depth, substrate, and closest neighbors).

S5. **Provide public information about *P. chartacea*.** It is important for the recovery of this species that governmental agencies, conservation organizations such as the Florida Native Plant Society, and private landowners be appropriately informed about this species. Care is needed, though, to avoid revealing specific locality information about *P. chartacea*.

Public outreach efforts must also continue to address the increasing concern that horticultural demand for this and other rare species may not benefit conservation of threatened and endangered species. Public education should identify that commercial production and horticultural uses of endangered species provide little benefit to species, since the recovery of *P. chartacea* and other rare species requires a self-sustaining, secure, number of natural populations.

Habitat-level Recovery Actions

H1. **Prevent degradation of existing habitat.** Extensive habitat loss, degradation, and fragmentation have already occurred throughout the range of this species. Both urbanization and fire suppression have decreased the available habitat. This species is ubiquitous in the scrub preserves in Polk and Highlands counties.

H1.1. **Secure habitat through acquisition, landowner agreements, and conservation easements.** With so little xeric scrub habitat left, any method of securing protected populations should be sought.

H1.2. **Manage and enhance habitat.** Manage habitat to maintain *P. chartacea* populations by preventing damage from off-road vehicle use, over collection, and provide proper management of habitat including prescribed fire.

H1.2.1. **Perform prescribed fires.** Fire is a necessary and integral characteristic of the scrub community. A variable interval in fire return and in season is important to mimic the natural fire regime. In addition, spatial variation in fire intensity and unburned patches are necessary to construct a natural fire landscape. The scrub is naturally made up of islands of suitable and unsuitable habitat. To repeat this landscape pattern, sites should be burned as a mosaic when possible to allow for variation.

H1.2.2. **Control and eliminate exotic and invasive plants and animals.** Exotic plant and animal species are not yet a major threat in Florida scrub as compared to other communities in South Florida. However, in isolated areas, exotic species are becoming established. Without control, exotic/invasive plants may become a threat to the survival and recovery of *P. chartacea.*

H1.2.3. **Control access to areas where listed plants are growing.** Collection, trampling, and off road vehicles can severely threaten individual populations.

H2. **Restore areas to suitable habitat.** Native habitats that have been disturbed or that have experienced a long history of fire suppression may be good candidates for future reserves.

H2.1. **Restore natural fire regime.** Long periods without fire can change the species composition and the ability of the site to carry fire. Rehabilitation of a site may be a lengthy process, but with fewer and fewer sites remaining, these sites may become more valuable for future recovery. On these sites a seed bank may exist that could include rare endemic species.

H2.2. **Enhance sites with native plant species.** Because of logging or long periods without fire, certain native plant species that were present historically may now be absent from the natural composition of the community. These species can be reintroduced if natural colonization is not possible.

H3. **Conduct habitat-level research projects.** Study the response of *P. chartacea* to various land management practices, such as prescribed fire regimes, vegetative thinning, and control of exotic/invasive vegetation..

H4. **Monitor habitat/ecological processes.** Monitor the effects of land management actions, such as prescribed fire, exotic plant control, etc., on the habitats where *P. chartacea* occurs.

H5. **Provide public information about scrub and its unique biota.** Educational efforts, especially those conducted by Archbold Biological Station, have been successful. Without these successful efforts, the Lake Wales Ridge NWR would not have been created. Florida's system of biological preserves depends on a broad base of public understanding and support for its funding and future success. In addition to past and ongoing educational efforts by The Nature Conservancy, Bok Tower Gardens, and Archbold Biological Station, future efforts by these organizations, and the Florida Park Service, the Florida Division of Forestry, the South Florida Water Management District, the Florida Native Plant Society, and local garden clubs are crucial in increasing public appreciation of scrub and high pine communities, and their associated plant species. The Arbuckle Appreciation Day sponsored by the Florida Division of Forestry has been successful in disseminating knowledge about these unique communities.

Source: *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 2/91

GOPHER TORTOISE

(*Gopherus polyphemus*)

FAMILY: Testudinidae

STATUS: Threatened in Louisiana, Mississippi, and west of the Tombigbee and Mobile Rivers in Alabama (*Federal Register*, July 7, 1987).

DESCRIPTION: The gopher tortoise is a large, (shell 15 to 37 centimeters or 5.9 to 14.6 inches long) dark-brown to grayish-black terrestrial turtle with elephantine hind feet, shovel-like forefeet, and a gular projection beneath the head on the yellowish, hingeless plastron or undershell (Ernst and Barbour 1972). The sex of individual turtles can usually be determined by shell dimensions. A male turtle has a greater degree of lower shell concavity, and a longer gular projection. However, the sex of tortoises at maturity size is difficult to determine (U.S. Fish and Wildlife Service 1990).

This turtle feeds primarily on grasses, grass-like plants, and legumes. Its diet may also include mushrooms, fleshy fruits, and possibly some animal matter.

REPRODUCTION AND DEVELOPMENT: Sometime between late April and mid-July, the female digs out a 6-inch deep nest in sandy soil, lays a clutch of 4 to 12 eggs, and after refilling the hole leaves the eggs for incubation by the sun's heat. Hatching occurs in August and September. The juvenile tortoises suffer a heavy natural predation loss of almost 97 percent through the first 2 years of life. Those that survive grow to sexual maturity slowly over a period of 13 to 21 years, depending on the portion of the range and the sex of the turtles. Males usually reach sexual maturity at a younger age and a smaller size than females. Females usually reach reproductive maturity at 19 to 21 years old. The low reproductive rate is accentuated by the fact that there is some evidence to indicate that not all females nest every year (Lohoefener and Lohmeier 1984; Wright 1982.) The juveniles that are born and survive may live an average of 40 to 60 years, sometimes 80 to 100.

Most of the gopher tortoise's life is spent in and around the burrow. The gopher tortoise establishes a well-defined home range which increases in size as the tortoise grows older and larger. Gourley (1969) recorded a home range of 31,400 square meters (7.7 acres) for a 20.3-centimeter (8-inch) specimen. For refuge the tortoises dig burrows which average around 5 to 10 feet in depth and may be 10 to 20 feet (or more) in length. The burrow becomes a more or less permanent home although there may be alternate burrows in the area. Several other species may also share gopher tortoise burrows. Some commonly known burrow sssociates include the eastern indigo snake, the eastern diamondback rattlesnake, and the gopher frog (U.S. Fish and Wildlife Service 1990).

RANGE AND POPULATION LEVEL: The species occurs in sandy coastal plain areas from extreme southern South Carolina to the southeastern corner of Louisiana, and throughout most of Florida. The population segment from the Tombigbee and Mobile Rivers in Alabama, westward, is classified as

threatened, and for convenience is termed the western population. This entire western population is within the the original range of the longleaf pine. Using statistics of the U.S. Department of Agriculture (USDA) (1978a) the Fish and Wildlife Service estimates that present ownership distribution of gopher tortoise habitat is approximately two-tenths in National Forest, one-tenth in other public ownership, three-tenths in forest industry, and four tenths in other private ownership. No estimate is available for the gopher tortoise's total population size. Auffenberg and Franz (1982) estimated a population density of O.713 tortoises per hectare in Mississippi and O.97 tortoises per hectare in Alabama in 1975, whereas Lohoefener and Lohmeier (1984) estimated a density of O.1O7 and O.32 per hectare in those states, respectively, in the early 198O's. Lohoefener and Lohmeier (1984) were also able to document only 11 active burrows in Louisiana in 1981, and only one remaining in 1984. Although these estimates may not be strictly comparable because of different methodologies, there is an indicated decline in population densities ranging from 67 percent in Alabama to 91 percent in Louisiana.

HABITAT: The gopher tortoise most often lives on well-drained, sandy soils in transitional (forest and grassy) areas (Ernst and Barbour 1972). It is commonly associated with a pine overstory and an open understory with a grass and forb groundcover and sunny areas for nesting (Landers 1980).

REASONS FOR CURRENT STATUS: Conversion of gopher tortoise habitat to urban areas, croplands, and pasturelands along with adverse forest management practices has reduced the western portion of the historic range of the gopher tortoise by more than 80 percent. Fragmentation of the western range accentuates those impacts. Taking gopher tortoises for sale or use as food or pets has also had a serious effect on some populations. The seriousness of the loss of adult tortoises is magnified by the length of time required for tortoises to reach maturity and their low reproductive rate. Current estimates of human predation and road mortality alone are at levels that could offset any annual addition to the population. Sightings of gopher tortoises have become rare in many areas and the ones sighted are much smaller than in the past (Diemer 1984). A number of other species also prey upon gopher tortoises including the raccoon, who is the primary egg and hatchling predator; gray foxes; striped skunks; armadillos; dogs; snakes; and raptors. Imported fire ants also have been known to prey on hatchlings. Reported clutch and hatchling losses often approach 9O percent (Landers *et al.*, 198O).

Forestry management practices which allow development of thick underbrush, closing of forest canopies, or clearcutting, destroy food plants, inhibit nesting, and cause tortoises to relocate to the edge of roadsides and ditch banks, increasing their susceptibility to human predation and vehicle mortality.

MANAGEMENT AND PROTECTION: Less than 2O percent of the historically available habitat remains for the western population of the gopher tortoise. Protection of this habitat, along with proper management, deserves high priority. Since the gopher tortoise requires an open forest floor with grasses and forbs for food, and sunny areas, regular burning or thinning of trees is required to maintain this type of habitat. However, clearcutting and site preparation can be very damaging, with the adverse effects apparently persisting for many years (Wright 1982). Taking gopher tortoises for sale or use as food or pets has also had a serious effect on some populations, and will require control through public education and effective enforcement of taking prohibitions under Section 9 of the Endangered Species Act.

Artifiicial planting of longleaf has proven successful in the DeSoto National Forest and other areas. The U.S. Forest Service is continuing its practice of regenerating longleaf pine on longleaf pine sites in the Desoto Forest. However, most tortoise habitat is on private land and most timberland owners still have problems with the growth, economic value, and availability of seed stock of longleaf. Proper longleaf forest management for on-site species, such as the gopher tortoise, should be encouraged on private and state lands.

About 136,OOO acres of gopher tortoise habitat in the DeSoto Forest has been used for military operations

(Camp Shelby). A Section 7 consultation has resulted in the establishment of a 2,2OO feet gopher tortoise refuge where military use is restricted and forest management benefits the tortoise.

Besides the activities discussed above, the recovery plan for the gopher tortoise, approved in December 199O, also suggests rangewide surveys at 5-year intervals on public and private lands; research on tortoise population viability and genetics; and rewards for conservation efforts on private land.

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For more information please contact:

U.S. Fish and Wildlife Service
6578 Dogwood View Parkway, Suite A
Jackson, Mississippi 39213

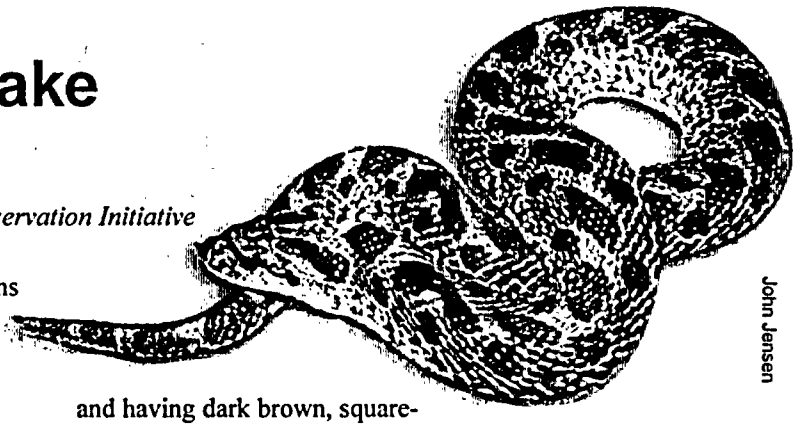
Telephone: 6O1/965-49OO

Upland Snake Species Profile:

Southern Hognose Snake

Heterodon simus

TRACEY TUBERVILLE *Co-chair, GTC Upland Snake Conservation Initiative*



John Jensen

Range: Southeastern Coastal Plain and (historically) portions of the Ridge and Valley physiographic province, from North Carolina to Mississippi.

Conservation Status: Listed by U.S. Fish and Wildlife Service (USFWS) as a Category 2 (C2) species in 1991, meaning insufficient information was available to determine if listing as endangered or threatened was warranted. The species currently receives no federal protection due to the elimination of the C2 category in 1996. However, USFWS still considers the southern hognose snake a "species of concern."

The Natural Heritage Program global rank was G3G4 ("globally secure") prior to 1999, when it was revised to G2 ("globally imperiled"). The state ranks for each state in which the species occurs are listed below.

State	State rank		State Legal Protection
NC	S3	*vulnerable*	None
SC	S?	*status unknown*	None
GA	S2	*imperiled*	None
FL	S2	*imperiled*	None
AL	SH	*historical*	Protected
MS	SH	*historical*	Endangered

The southern hognose snake has apparently declined throughout large portions of its range, and may be extirpated from Mississippi and Alabama. The maps below indicate counties from which the species has been documented and counties from which it has been documented within the last 20 years (based on data presented in Tuberville et al. 2000).

Description: The southern hognose snake is a small, stout-bodied snake, reaching a maximum size of 61cm (24 inches) and having dark brown, square-shaped blotches on the back and sides, a beige to light gray background color, and a cream colored belly. The southern hognose snake's most distinctive physical feature is its sharply upturned snout. This species is often confused with eastern hognose snakes and pigmy rattlesnakes, both of which can occur with the southern hognose snake.

Natural History: Very little is known about this secretive, infrequently encountered animal. This strictly diurnal snake is extremely fossorial, spending most of its time in underground burrows. Most captures have been reported during May-June (adults) and September-October (primarily hatchlings). Southern hognose snakes feed almost exclusively on toads. Natural nests have never been found, but in captivity, females have laid clutches of 6-14 eggs.

The southern hognose snake, like its more common relative the eastern hognose snake, is sometimes called the "puff adder", because it will flare its throat and hiss at its "attackers" when feeling threatened. Another defensive behavior this species may display is rolling over on its back, with its tongue hanging out-playing "possum."

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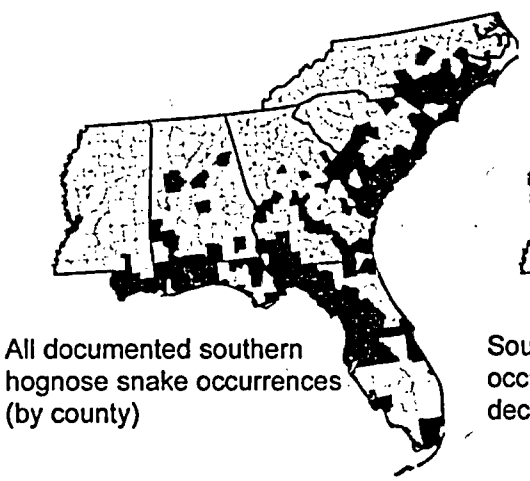
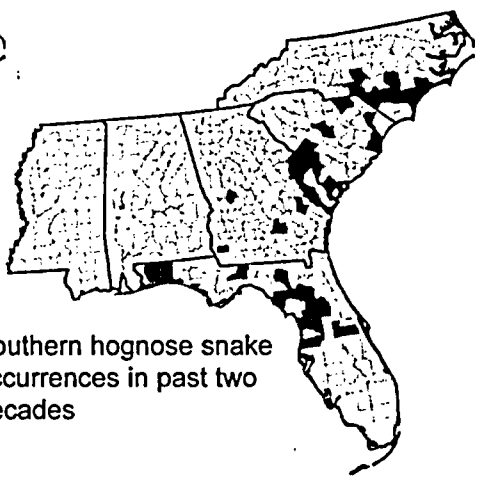


All documented southern hognose snake occurrences (by county)



Southern hognose snake occurrences in past two decades

For more information, contact:

GOPHER TORTOISE COUNCIL
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Gainesville, FL 32611-7800
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southern nuclear

Plant Farley

The Joseph M. Farley Nuclear Plant, located near Dothan in southeast Alabama, is owned by Alabama Power and operated by Southern Nuclear Operating Company. It is one of three nuclear facilities in the Southern electric system.

Construction of the plant began in 1970. Unit 1 achieved commercial operation in December 1977. Unit 2 began commercial operation in July 1981. The total cost of the plant was about $1.57 billion.

Each unit is capable of generating 888 megawatts (mw) for a total capacity of 1,776 mw. The plant is powered by Westinghouse pressurized water reactors.

The containment building, which houses the reactor, the reactor coolant system and other nuclear-related components, is constructed of reinforced concrete and carbon steel.

Since commercial operation began in 1977, Plant Farley has generated more than 200 billion kilowatts of electricity. That's enough generation to supply every Alabama residential customer with electricity for 14 years.

Plant Farley replaced Unit 1's steam generators during its Spring 2000 outage and Unit 2's steam generators during its Spring 2001 outage.

News about the plant

- When Farley Unit 1 came offline to begin its outage in October 2001, it set a new plant record of 495 days of continuous operation. At the time, this was the fifth longest run by a Westinghouse domestic 3-loop reactor.
- Plant Farley's Unit 2 established a new net generation record in 2000 as it generated 7,362,998 megawatt-hours (Mwh) of electricity, a unit and plant record. The previous record was 7,281,390 Mwh, set by Unit 2 in 1997.
- In October 2000, Plant Farley was awarded the inaugural Industry Partnership Award from the Alabama Science Teachers Association. The Association honored Plant Farley for its Teacher in Residence Program, Certified Nuclear Science Educator workshops, and for its overall support of science.
- In March 2000, Plant Farley employees reached a new safety milestone of 7 million work hours without a lost-time injury or illness, a feat never before accomplished by an Alabama Power-owned generating site.
- In 1999, Plant Farley set plant records for lowest radiation exposure in a single year and single outage. Man-rem for 1999 was 190.463 rem, beating the previous record of 231.6 rem set in 1996. Unit 2's fall outage achieved the plant's lowest refueling outage man-rem record with 159.9

man-rem, beating the previous best of 167 man-rem set in 1982.

- In Oct. 1999, the Wildlife Habitat Enhancement Council again recognized Plant Farley for its wildlife and land management efforts. The award recognizes Farley for enhancing 1,300 acres of land for wildlife habitat on its 1,850-acre site. Plant Farley was originally certified through the program in 1992.
- In 2000 Plant Farley supplied 20 percent of Alabama Power's electricity, generating more than 12.5 million mwh.
- In 1998, Unit 2 set a Farley plant on-line record of 464 days.
- In 1998, Units 1 and 2 broke a record for a dual-unit continuous run. When Unit 2 shut down temporarily in March for its re-fueling, the dual-run record stopped at 297 consecutive days for both units to be on-line together.
- In August 1997 Plant Farley Unit 2 joined the elite group of plants that have generated 100 billion kilowatt-hours of electricity.
- In May 1995 Plant Farley Unit 1 joined the elite group of plants that have generated 100 billion kilowatt-hours of electricity.
- The plant was named for Joseph M. Farley, Alabama Power Company president from 1969-1989. Farley also served as president and CEO of Southern Nuclear Operating Company.

Mustela frenata - Lichtenstein, 1831
LONG-TAILED WEASEL
Heritage Identifier: AMAJF02030
Informal Taxonomy: Animals, Vertebrates - Mammals - Carnivores

Kingdom	Phylum	Class	Order	Family	Genus
ANIMALIA	CRANIATA	MAMMALIA	CARNIVORA	MUSTELIDAE	MUSTELA

Genus Size: 6-20 species

---Jump to Section---

Conservation Status

Heritage Status

Global Heritage Status Rank: G5 (18Nov1996)
Rounded Global Heritage Status Rank: G5

Nation: United States
National Heritage Status Rank: N5 (05Sep1996)

Nation: Canada
National Heritage Status Rank: N5 (01Feb2000)

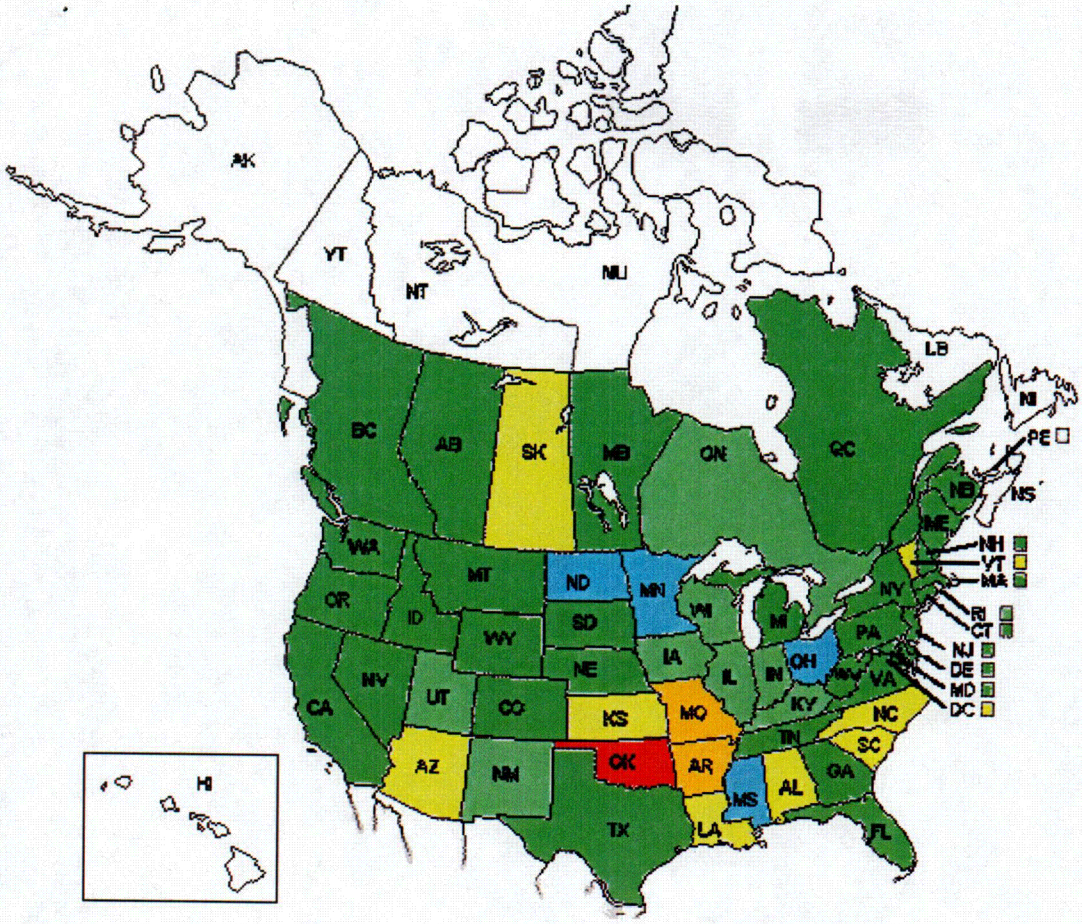
U.S. & Canada State/Province Heritage Status Ranks	
United States	Alabama (S3), Arizona (S3), Arkansas (S2?), California (S5), Colorado (S5), Connecticut (S5), Delaware (S5), District of Columbia (S3), Florida (S5), Georgia (S5), Idaho (S5), Illinois (S4), Indiana (S4), Iowa (S4), Kansas (S3), Kentucky (S4), Louisiana (S2S4), Maine (S5), Maryland (S5), Massachusetts (S5), Michigan (S5), Minnesota (S?), Mississippi (S?), Missouri (S2), Montana (S5), Navajo Nation (S5), Nebraska (S5), Nevada (S5), New Hampshire (S5), New Jersey (S5), New Mexico (S4), New York (S5), North Carolina (S3S4), North Dakota (S?), Ohio (S?), Oklahoma (S1), Oregon (S5), Pennsylvania (S5), Rhode Island (S4), South Carolina (S3S4), South Dakota (S5), Tennessee (S5), Texas (S5), Utah (S4S5), Vermont (S3S4), Virginia (S5), Washington (S5), West Virginia (S5), Wisconsin (S4), Wyoming (S5)
Canada	Alberta (S5), British Columbia (S5), Manitoba (S5), New Brunswick (S5), Ontario (S4), Quebec (S5), Saskatchewan (S3S4)

Other Statuses

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): (PS:NAR)

---Jump to Section---

Distribution



State/Province Conservation Status Rank

- ☐ SX: Presumed Extirpated
- ☐ SH: Possibly Extirpated
- ☐ S1: Critically Imperiled
- ☐ S2: Imperiled
- ☐ S3: Vulnerable
- ☐ S4: Apparently Secure
- ☐ S5: Secure

- ☐ SR: Reported
- ☐ SZ: Migratory Transient
- ☐ SE: Exotic
- ☐ S?: Unranked
- ☐ Under Review
- ☐ SU: Unrankable

Endemism: occurs (regularly, as a native taxon) in multiple nations

U.S. & Canada State/Province Distribution	
United States	AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NN, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY
Canada	AB, BC, MB, NB, ON, QC, SK

Global Range Comments: Southern Canada, most all of the contiguous U.S., and south to Venezuela and Bolivia, excluding the southwestern deserts of the U.S. (Wozencraft, in Wilson and Reeder 1993; Sheffield and Thomas 1997).

---Jump to Section---

Rank Factors

Threats: Threats include monoculture and "clean" farming and drainage of wetlands. Perhaps affected directly and indirectly by pesticide use (effects on reproduction, habitat, and/or food supply). Prairie subspecies LONGICAUDA declined significantly in the northern Great Plains in the mid-1900s due to intense agricultural activity, use of pesticides, and habitat degradation, but the subspecies still is widespread and stable in its Canadian range (Johnson et al. 1993).

---Jump to Section---

Economic Attributes

---Jump to Section---

Management Summary

---Jump to Section---

Ecology & Life History

Reproduction Comments: Breeds July-August. Gestation lasts 205-337 days (average 279); implantation delayed. Litter size is 1-12 (average 4-7). In north, one litter is born in April-May; nests with young have been found in November in southeastern U.S. Weaning begins at about 5 weeks. Young begin to disperse at about 11-12 weeks (see Johnson et al. 1993). Females are sexually mature in 3-4 months (in captivity) or usually 2 years in southern Canada (see Johnson et al. 1993), males in about 1 year.

Ecology Comments
Male home range is 10-160 ha, varying with location and prey availability; female range averages smaller than male range (Jackson 1961, Caire et al. 1989, Johnson et al. 1993). Basically solitary, though more social where prey is abundant and habitat optimal. Population density averages 1 per 7-40 acres (Jackson 1961), depending upon habitat and environmental conditions (Baker 1983).

Non-Migrant: Y

Palustrine Habitat(s): BOG/FEN, FORESTED WETLAND, HERBACEOUS WETLAND, RIPARIAN

Terrestrial Habitat(s): CROPLAND/HEDGEROW, DESERT, FOREST - CONIFER, FOREST - HARDWOOD, FOREST - MIXED, GRASSLAND/HERBACEOUS, OLD FIELD, SHRUBLAND/CHAPARRAL, WOODLAND - CONIFER, WOODLAND - HARDWOOD, WOODLAND - MIXED

Special Habitat Factors: BURROWING IN OR USING SOIL, FALLEN LOG/DEBRIS, STANDING SNAG/HOLLOW TREE

Habitat Comments: Found in a wide variety of habitats, usually near water. Favored habitats include brushland and open woodlands, field edges, riparian grasslands, swamps, and marshes (Sheffield, in Wilson and Ruff 1999). Dens are in abandoned burrow made by other mammal, rock crevice, brushpile, stump hollow, or space among tree roots; one individual may use multiple dens. Tolerant of close proximity to humans.

Food Habits: CARNIVORE

Food Comments: Feeds primarily on small mammals, occasionally birds, other small vertebrates, and insects.

Phenology: CREPUSCULAR, NOCTURNAL

Phenology Comments: Primarily nocturnal, but frequently can be seen during daytime.

Length: 55

Weight: 267

---Jump to Section---

Authors/Contributors

Element Ecology & Life History Edition Date: 22Nov1993
Element Ecology & Life History Author(s): Hammerson, G.

Zoological data developed by NatureServe's Central Zoology group, in cooperation with U.S. Natural Heritage Programs and Canadian Conservation Data Centers and other contributors and cooperators(see About the Data, Data Sources and Data Management).

---Jump to Section---

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Citation:
NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 29, 2004).

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Falco sparverius paulus - (Howe and King, 1902)
SOUTHEASTERN AMERICAN KESTREL

Heritage Identifier: ABNKD06022
Informal Taxonomy: Animals, Vertebrates - Birds - Raptors

Kingdom	Phylum	Class	Order	Family	Genus
ANIMALIA	CRANIATA	AVES	FALCONIFORMES	FALCONIDAE	FALCO

Genus Size: 21+ species
Taxonomic Comments: This nonmigratory subspecies is smaller and less spotted ventrally (males) than more northern races, which are migratory and may coexist with F. S. PAULUS outside of the breeding season.

---Jump to Section---

Conservation Status

Heritage Status

Global Heritage Status Rank: G5T4 (22Nov1996)
Rounded Global Heritage Status Rank: T4
Global Heritage Status Rank Reasons:

F. S. PAULUS is endemic to the lower southeast Coastal Plain; it appears to have undergone a population decline as a result of destruction of habitat, principally the longleaf pine/sandhill ecosystem. However, it does tolerate some disturbance if certain limiting factors (e.g., dead trees for nesting) are maintained.

Nation: United States
National Heritage Status Rank: N3N4 (05Jan1997)

U.S. & Canada State/Province Heritage Status Ranks	
United States	Alabama (SU), Florida (S3), Georgia (S3), Louisiana (S?), Mississippi (S4?B,SZN), South Carolina (S?)

Other Statuses

Convention on International Trade in Endangered Species Protection Status (CITES): Appendix II

---Jump to Section---

Distribution

Map unavailable!:

Distribution data for U.S. states and Canadian provinces is known to be incomplete or has not been reviewed for this taxon.

Endemism: occurs (regularly, as a native taxon) in multiple nations, but breeds in a single nation

U.S. & Canada State/Province Distribution	
United States	AL, FL, GA, LA, MS, SC

Global Range Comments: RESIDENT: eastern Texas, Louisiana, central and southern parts of Mississippi, Alabama, Georgia, South Carolina. Florida except the southernmost counties and the keys (AOU 1957, Johnsgard 1990, Lane and Fisher 1997).

---Jump to Section---

Rank Factors

Global Abundance Comments: F. S. SPARVERIUS estimated at over 2 million individuals (Lane and Fisher 1997). Estimate for F. S. PAULUS not available but likely over 10,000 given relatively wide range. Considered rare over most of Georgia and the Piedmont of the Carolinas (Hamel et. al 1982). A small population occurs along the Mississippi Gulf Coast (Collopy 1996). Relative abundance on Florida North American Breeding Bird Survey routes for 1966-1996 is 0.21 birds per route. All other states and provinces in North America for which data was provided have higher American kestrel relative abundance except for Nova Scotia (Sauer et al. 1997).

Estimated Number of Element Occurrences Comments: Exact number of occurrences unknown. Occurs patchily throughout much of range.

Global Trend Comments: Extirpated from much of its former range including southern Florida (Dade County since about 1935 to 1950). Has undergone a decrease in last two centuries, but populations likely have fluctuated with changing land use patterns. Decreased by estimated 82 percent from early 1940s to 1981-1983 in north-central Florida and decreased substantially in south-central Florida (Hoffman 1983, Hoffman and Collopy 1988). Also believed to have decreased in South Carolina and Alabama (Smallwood 1990, cited in Lane and Fisher 1997). Long term data from North American Breeding Bird Suervey (1966-1996) show non-significant -6.9 percent annual decline ($P = 0.17$; $n = 17$; Sauer et al. 1997). Christmas Bird Count shows significant (P less than 0.05) decline for 1957-1988 (-1.2 percent annual change; $n = 65$) in Florida but the counts likely include northern migrants making interpretation for the subspecies not possible.

Threats: HABITAT: Reasons for decline include habitat destruction, especially of nest trees. In north-central Florida, population decline associated with removal of isolated longleaf pines from agricultural fields, residential development, and timber production. In south-central Florida habitat loss attributed to conversion of longleaf pine-turkey oak to citrus groves. Extirpation from southern Florida due to cutting of virgin slash pine forest and modification of the understory by clearing and fire suppression (Hoffman and Collopy 1988). PESTICIDES: Insecticides likely play deleterious role. PREDATION: Nestling mortality has been reported due to snakes and fire ants in north-central Florida (Stys 1993, cited in Lane and Fisher 1997). Also likely affected by mammalian and avian predators. DISTURBANCE: Hunting is a threat. Most banded recoveries came from shot birds (Terres 1991). Fifty-two percent of birds found killed, injured, or incapacitated due to collisions with motor vehicles (Stys 1993, cited in Lane and Fisher 1997).

Other Considerations: Relatively large tracts of appropriate habitat are necessary to assure population viability. Optimal habitat is fire-maintained. Formerly listed by USFWS as Category 2 candidate species; official listing no longer used but unofficially considered a species of concern (Lane and Fisher 1997).

---Jump to Section---

Economic Attributes

---Jump to Section---

Management Summary

Biological Research Needs: Life history study to determine ecological needs and limiting factors; effect of insecticides; migratory patterns (if any).

---Jump to Section---

Ecology & Life History

Basic Description: Southeastern American kestrel, Falconidae.
General Description: Pointed wings, reddish back and tail, two black stripes on each side of white sides of head; male has blue-gray wings (NGS 1983).

Diagnostic Characteristics: Adult males are smaller and less spotted ventrally (center of belly and breast immaculate or nearly so) than are more northern races; adult females usually have a shorter tail than do those of the nominate subspecies (Friedmann 1950).

Reproduction Comments: See Palmer (1988) for egg dates. Clutch size is 3-7 (usually 4-5). Incubation is mainly by female, usually lasts 29-31 days. Young are tended by both parents, leave nest in about 29-31 days, may stay with parents for 2-4 weeks or more (no later than late summer). Readily lays replacement clutch if first clutch is lost. Most first breed at one year. Monogamy through successive breeding seasons seems to prevail (Palmer 1988).

Non-Migrant: Y

Locally Migrant: Y

Migration Comments: Evidently mostly nonmigratory; this subspecies may coexist in Florida with other (migratory) subspecies outside of the breeding season.

Palustrine Habitat(s): RIPARIAN

Terrestrial Habitat(s): CLIFF, CROPLAND/HEDGEROW, GRASSLAND/HERBACEOUS, OLD FIELD, SAVANNA, SUBURBAN/ORCHARD, WOODLAND - CONIFER, WOODLAND - HARDWOOD, WOODLAND - MIXED

Special Habitat Factors: STANDING SNAG/HOLLOW TREE

Habitat Comments: Open or partly open habitat: optimal habitat is sandhill, although can adapt to clearings with dead trees; also prairies, coasts, wooded streams, burned forest, cultivated lands and farmland with scattered trees, open woodland, roadsides, suburbs, and some urban areas. In winter in Florida, males use less open habitats than do females (Smallwood 1987, Palmer 1988).

Nests in natural holes in trees, abandoned woodpecker holes, holes in buildings or cliffs, and similar sites. Readily uses nest-boxes, which may dramatically increase density of nesting pairs in some areas (may use boxes put up for wood duck). Rarely returns to breed in vicinity where reared, but breeders tend to return to their previous territories (Palmer 1988).

Food Habits: CARNIVORE, INVERTIVORE

Food Comments: In summer feeds on insects (e.g., grasshoppers and crickets) and small vertebrates (e.g., snakes, lizards, birds, mice, sometimes bats). In winter, feeds mainly on arthropods in Florida (Smallwood 1987). Forages from perch or while in flight (e.g., hovering). See Palmer (1988) for extensive account of food and feeding.

Phenology: DIURNAL

Phenology Comments: Hunts most actively in the morning and late afternoon; rests during the middle of the day.

---Jump to Section---

Authors/Contributors

Global Ranking Factors Edition Date: 14Nov1999
Global Ranking Factors Author: JACKSON, D. R.; REVISIONS BY M. KOENEN AND D.W. MEHLMAN.
Element Ecology & Life History Edition Date: 06Apr1995
Element Ecology & Life History Author(s): HAMMERSON, G.

Zoological data developed by NatureServe's Central Zoology group, in cooperation with U.S. Natural Heritage Programs and Canadian Conservation Data Centers and other contributors and cooperators(see About the Data, Data Sources and Data Management).

---Jump to Section---

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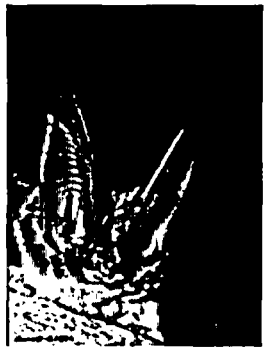
Bats



Rafinesque's Big-eared Bat, *Plecotus rafinesquii*

Scientific name: The genus name *Plecotus* is from two Greek words, *plekos* (to twist) and *otus* (ear), referring to this bat's habit of twisting its long ears almost in a spiral as it folds them down over its back when roosting. The species is the Latinized name of the eccentric French naturalist Constantine Rafinesque (1783 - 1840), who collected and described many species of flora and fauna of eastern North America. This species is also sometimes called the Eastern Big-eared Bat.

Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Mammalia
Order: chiroptera
Family: Vespertilionidae

Species Description

Size: This medium-sized bat ranges from 9.5 - 10.5 cm (3.7 - 4.1 in) in total length.
Color: Individual hairs of the fur are bicolored with black bases, the tips of the hairs being grayish brown on the dorsum and nearly white on the venter.
Other things to look for: The very long ears, over 2.54 cm (1 in) in length and joined in the middle, are the most distinctive characteristic of this species. Two large, conspicuous glands are present on either side of the snout, and form prominent lumps on the top of the nose.

Life Cycle

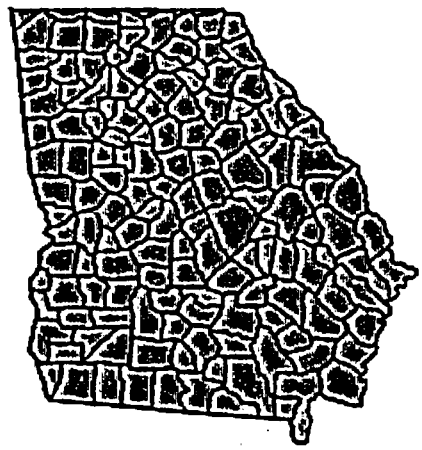
Breeding occurs in the fall. The female joins with others in a "nursery colony," and her single offspring is born the following May or June. Young are able to fly within three weeks after birth and reach adult size in about one month.

Natural History

In terms of its natural history, this is one of the least known bats of the southeastern United States. It is colonial, and roosts can contain from several individuals to over 100. Females maintain separate roosts in the spring and summer when rearing young, but males and females roost together in the fall and winter months. The Rafinesque's Big-eared Bat roosts in buildings, old mine shafts, wells, caves, hollow trees, areas behind loose bark, and crevices in rock ledges. This species is not crepuscular like most other bat species. Instead, it becomes active only in complete darkness. It feeds on flying insects. Several species of snakes prey upon it. This species hibernates in the winter months, but may be active during warm spells in the southern portions of its range.

Range

Rafinesque's Big-eared Bat ranges over the southeastern United States, and may occur throughout Georgia.



Conservation Status

The Georgia Department of Natural Resources considers this species to be Rare in the state.

Similar Species

No other bat species in Georgia has such large ears.

Mammals: Classification, Species list, References

Georgia Wildlife Web

Information provided by: The Georgia Museum of Natural History and Georgia Department of Natural Resources
1 June 2000

Gopher

Southeastern Pocket Gopher, *Geomys pinetis*

Scientific name: The genus name *Geomys* is from the Greek words *geo* (earth) and *mys* (mouse). Together they mean "earth mouse," a reference to the Pocket Gopher's life underground. The species name is the Latin word *pinetis* (piney woods). Together, the quite appropriate scientific name means "earth mouse of the piney woods." The Pocket Gopher gets its common name from its cheek pouches, which are used like pockets or shopping bags. In the southeastern United States, another common name for Pocket Gopher is "Salamander," which may have been derived from the term "sandy mounder." The common name "Gopher" is also applied to the Gopher Tortoise, a type of turtle which digs tunnels.

Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Mammalia
Order: rodentia
Family: Geomyidae

Species Description

Size: Total length is from 25.4 - 30.5 cm (10 - 12 in).
Color: The body is covered in short hair, which is medium to dark brown on the upper parts and brownish gray on the belly.
Other things to look for: The Southeastern Pocket Gopher has a thickset body, stout front legs with large claws, external fur-lined cheek pouches, and a hairless tail. The small eyes and ears are adaptations for a fossorial existence.

Life Cycle

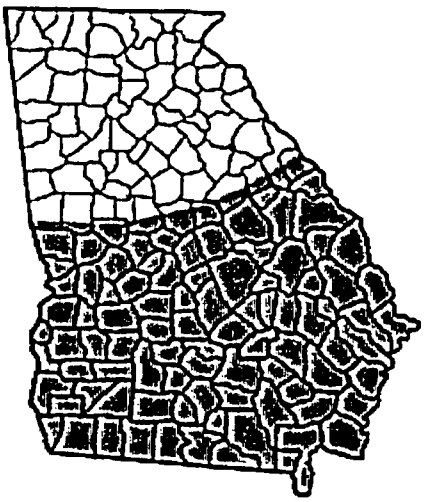
Breeding occurs all year, with peaks in February and March and June through August, when adult males and females share the same burrow system. Otherwise the Pocket Gopher leads a solitary existence. Older females may produce 2 litters per year. After a gestation period of from 40 - 50 days, 1 - 3 young are born. At one month of age, the young are weaned and disperse to begin life on their own.

Natural History

The Southeastern Pocket Gopher searches for food by digging shallow burrows. Roots, tubers, stems, and other plant materials that are encountered are stored temporarily in cheek pouches. Once the pouches are full, the gopher empties their contents into chambers excavated especially for food storage. A gopher burrow system also contains chambers which are used as latrines and in the deepest part of the burrow, a grass-lined nest chamber. The Pocket Gopher is easily detected by the presence of numerous mounds of soil which have been excavated from the burrow system. The Southeastern Pocket Gopher is found in upland areas of dry, sandy soil or well drained, fine-grained gravely soils, where burrows can be easily dug. Predators of the Pocket Gopher include snakes, weasels, the Bobcat, the Coyote, hawks, and owls.

Range

The Southeastern Pocket Gopher has a very limited distribution. It is found only on the Coastal Plains of Georgia, Alabama, and the northern half of Florida.



Conservation Status

This species can be common in some areas. It is considered to be a pest when it is found tunneling under golf courses, cemeteries, garden, and residential lawns.

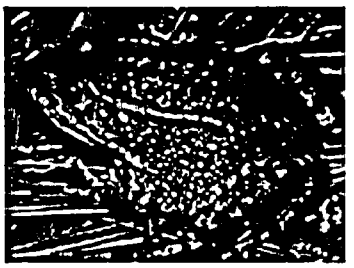
Similar Species

No other member of the Pocket Gopher Family occurs in Georgia. Moles are also burrowers, but they can be distinguished from Pocket Gophers by their smaller size, tiny eyes, and the lack of large obvious gnawing teeth.

Mammals: Classification, Species list, References

Information provided by: The Georgia Museum of Natural History and Georgia Department of Natural Resources
1 June 2000

Frogs



Gopher Frog, *Rana capito*

Scientific name: The name of the genus comes from the Latin *rana* (frog). The species name is from the Latin *capito* (one who has a large head).

Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Amphibia
Order: Anura
Family: ranidae

Species Description

Size: A large, plump frog, 5.1 - 11.4 cm (2-4.5 in) in length.
Color: Its back is gray to brownish, with dark spots and gold dorsolateral folds.
Other things to look for: Its head seems thicker compared to its body than that of other frogs. It has prominent wart-like bumps on its body. There are three recognized subspecies: the Carolina Gopher Frog *Rana capito capito*, the Florida Gopher Frog *Rana capito aesopus*, and the Dusky Gopher Frog *Rana capito servosa.*

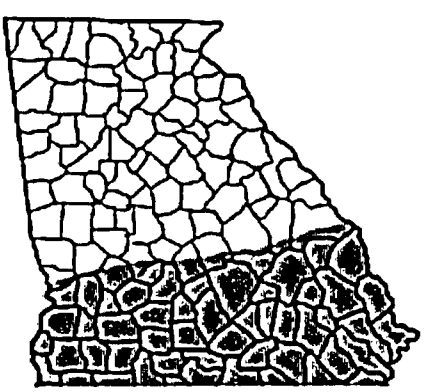
Life Cycle & Natural History

The Gopher Frog is an explosive breeder. Heavy rains from late fall through early winter trigger congregation and breeding. Fertilization is external. The female lays large clumps of eggs, which she attaches to submerged or emergent vegetation. Eggs hatch in four to five days and transform from tadpoles into frogs 2 1/2 to 3 1/2 months later.

The Gopher Frog is found in pine scrub and sandhills, near ponds. It is very secretive, and spends a great deal of time on land away from the water. It is active at night and hides during the day. It often hides in burrows made by other animals, particularly Crayfish and Gopher Tortoises. It is an opportunistic feeder, as are most of the larger frog species.

Range

The Gopher Frog is found throughout the Coastal Plain of Georgia.



Conservation Status

This frog is listed in Georgia as being Of Special Concern and is being considered for Federal listing. It is hard to obtain accurate numbers on this frog because it is so difficult to find. The main threat to this frog is loss of habitat. The sandhills it prefers are being developed for agriculture, tree farming, and housing. Practices that maintain the open scrub nature of the pine forests on the

Coastal Plain can help preserve this species.

Similar Species

The River Frog has similar coloration and size, but the River Frog has white spots on its lips and would not be found in drier pine scrub forests.

Amphibians: Classification, Species list, References

Georgia Wildlife Web

Information provided by: The Georgia Museum of Natural History and Georgia Department of Natural Resources
1 June 2000

Ospreys

Ospreys

Osprey, *Pandion haliaetus*

Scientific Name: The genus name arises from the Greek myth about Pandion, whose two daughters were turned into birds. In the myth, a man turned into a hawk is forever chasing both of them - his wife (now a swallow) and her sister (a nightingale). The species name is from the combination of two Greek words *halos* (the sea) and *aetos* (eagle).

Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Aves
Order: Falconiformes
Family: Accipitridae

Species Description

Size: 56-64 cm (22-25 in) length; 147-183 cm (58-72 in) wingspan. Color: Body, dark brown above and white below. Head, white except for a brown stripe from the eye to the back of the head. The tail has medium-sized, alternating, dark brown and white bands. The female Osprey had a ring of brown spots around her neck. Other things to look for: While in flight, large dark patches at the birds' "wrist" and crooked wings help distinguish this bird from others.

Life Cycle

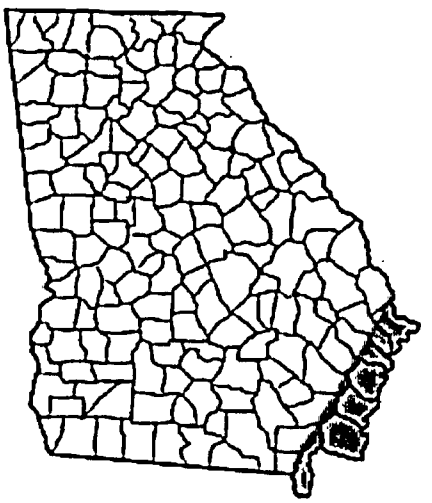
The breeding season begins in November and extends through early July. Ospreys sometimes nest in close proximity to one another if food is plentiful. The large bulky nest is built by both the male and female, and is approximately 3-18 m (10-60 feet) above the ground. Branches, sticks, twigs, and many unlikely materials such as rope, bones, conch shells, nylon webbing, and other debris, are used in the nest. The nest is built in large snags, conifers, cliffs, rocky outcrops, and on artificial nesting platforms. The female lays 3 eggs. With some help from the male, she incubates these for approximately 33 days. The male feeds the female while she is on the nest. The young are semi-altricial. For about 40 days, the female remains near the nest, tending to the young and feeding them. The male brings food to the female during this time as well, which she feeds to the young. The adults care for the young for 48-59 days.

Natural History

The Osprey is rarely seen far from water, except during migration. It eats primarily fish, with occasional snakes, amphibians, and some smaller vertebrates. It usually flies over the water searching for prey. When the prey is located, it dives and strikes it with its talons. If hunting habitat is available, an Osprey can be somewhat adaptable in choosing a nesting site. It traditionally nests on coastal islands, but can now be seen nesting inland on natural or man-made structures such as telephone poles, duck blinds, and marker buoys.

Range

In the United States during the breeding season, the Osprey occurs in the southeastern and western coastal areas, the northern states, and the Northwest. Some Ospreys migrate to winter in Central and South America, while others spend their winters in Florida and southern California. The Osprey stays all year in southern Florida.



Conservation Status

The Osprey is listed as Endangered in Kentucky, Missouri, Tennessee, and Alabama. Osprey populations were declining rapidly in the mid-1900's, most likely due to the use of DDT and other pesticides. The accumulation of pesticides caused reproductive failures. With the banning of DDT and conservation programs (particularly, creating nesting platforms) for this species, Osprey populations are starting to increase.

Similar Species

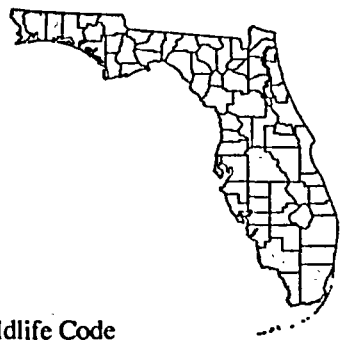
While in flight the Osprey could be mistaken for a gull. The Osprey's wings are broader, and the wing tips are not as pointed as a gull's. When lighting is poor and the bird is at a distance, the Osprey may be mistaken for a Bald Eagle. The Bald Eagle has broad wings that are held on a horizontal plane while the bird is soaring, and it is much larger than the Osprey.

Birds: Classification, Species list, References

Information provided by: The Georgia Museum of Natural History and Georgia Department of Natural Resources
1 June 2000

SOUTHEASTERN AMERICAN KESTREL

Falco sparverius paulus



Order: Falconiformes
Family: Falconidae
FNAI Ranks: G5T4/S3
U.S. Status: None
FL Status: Threatened
U.S. Migratory Bird Treaty Act and state Wildlife Code prohibit take of birds, nests, or eggs.

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Description: Smallest falcon in U.S. and similar in size to the familiar mourning dove (*Zenaida macroura*). Sexes distinctive: male has blue-gray wings, while female is larger and has more uniformly rufous back and wings. Both sexes have a mustached black-and-white facial pattern with strong perpendicular lines extending below eye and near ear, and a black band at base of rufous tail. Falcons in general have long, pointed wings and long tails, similar to doves. The alarm call, given frequently in flight, is *[illegible]*.

Similar Species: The merlin (*Falco columbarius*), another falcon found in Florida, is larger and lacks the rufous back and tail found on kestrels. The sharp-shinned hawk (*Accipiter striatus*) has rounded wings and also lacks the rufous tail and back. Both the merlin and sharp-shinned hawk also are generally not found in Florida in summer (May - early September).

SOUTHEASTERN AMERICAN KESTREL *Falco sparverius paulus*

Habitat: Found in open pine habitats, woodland edges, prairies, and pastures throughout much of Florida. Availability of suitable nesting sites is key during breeding season. Nest sites are tall dead trees or utility poles generally with an unobstructed view of surroundings. Sandhill habitats seem to be preferred, but may also occur in flatwoods settings. Open patches of grass or bare ground are needed in flatwoods settings, since thick palmettos prevent detection of prey.

Seasonal Occurrence: Found throughout Florida year-round, but seasonal occurrence is complicated by arrival of northern migrants in winter. The subspecies that breeds in Florida is listed, but northern migrants are not listed. Northern migrants generally arrive in September and depart by March, but there are records outside these dates. All birds found in the breeding season (April through early September) should be treated as the listed subspecies.

Florida Distribution: Wintering birds found throughout Florida (including the Keys), but the breeding subspecies is non-migratory and most common in peninsular Florida, rare in the panhandle. Breeding subspecies appears to be extirpated from former nesting areas in south Florida (Miami-Dade County).

Range-wide Distribution: Found throughout most of North and South America, but the listed subspecies is restricted to the southeastern U.S., occurring from Louisiana east to South Carolina and south through the Florida peninsula.

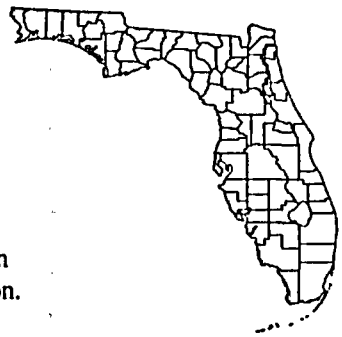
Conservation Status: Population trends cannot be determined from available survey programs. Natural nesting and foraging habitats have certainly declined, as sandhill and open flatwoods habitats are converted to intensive agricultural lands and residential development. Pasture lands may be used by the breeding species but often lack snags used for nesting sites.

Protection and Management: A key habitat feature necessary for breeding is a suitable cavity tree. Cavity trees are usually excavated in large pines and, less frequently, oaks by various woodpeckers. Manage for dead tree snags on public lands. Nest-box programs have been used to augment populations in many areas. Protect large blocks of natural habitats; open fields and pastures also are needed to provide adequate foraging habitat.

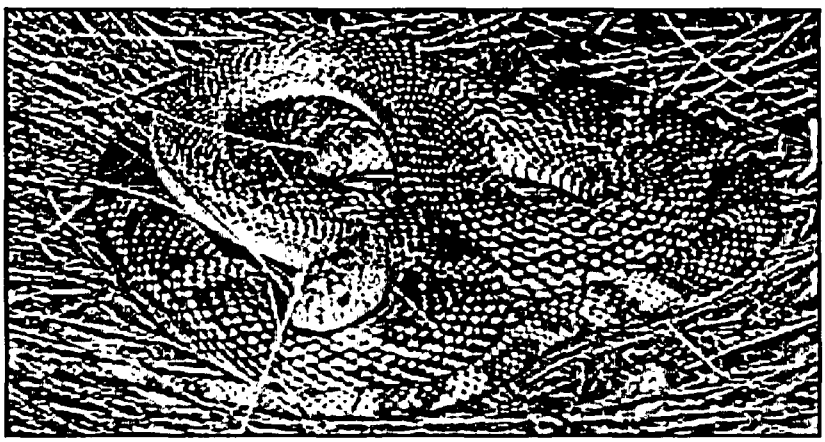
Selected References: Loftin 1992, Robertson and Woolfenden 1992, Rodgers et al. (eds.) 1996, Stevenson and Anderson 1994, Stys 1993, Wood et al. 1988.

FLORIDA PINE SNAKE

Pituophis melanoleucus mugitus



Order: Squamata
Family: Colubridae
FNAI Ranks: G4T3?/S3
U.S. Status: None
FL Status: Species of Special Concern
State possession limit of one snake per person.



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Description: A large, stocky, tan or rusty colored snake with an indistinct pattern of large blotches on a lighter background; blotches more distinct posteriorly; venter white. May be dark brown in far western panhandle, where it intergrades with another subspecies. Body muscular, with keeled scales and undivided anal scale. Head relatively small, snout somewhat

FLORIDA PINE SNAKE *Pituophis melanoleucus mugitus*

pointed, four prefrontal scales, rostral scale extending upward between internasal scales. Adults 4 - 7 ft. (122 - 213 cm) or longer; young 15 - 24 in. (380 - 610 mm) at hatching. May hiss loudly and vibrate tail when encountered.

Similar Species: Most Florida snakes have only two prefrontal scales, and the rostral scale does not split the two internasals. Blotches of red rat snakes (*Elaphe guttata*) are smaller, more numerous (nearly 40), and more distinct. Eastern coachwhip (*Masticophis flagellum*) is more slender, usually darker anteriorly, lacks blotches, and has smooth scales and divided anal scale.

Habitat: Habitats with relatively open canopies and dry sandy soils, in which it burrows. Especially sandhill and former sandhill, including oldfields and pastures, but also sand pine scrub and scrubby flatwoods. Often coexists with pocket gophers and gopher tortoises.

Seasonal Occurrence: Spends most of time below ground; occasional surface activity from spring through fall, especially May - October. Eggs laid June - August; hatch in September and October.

Florida Distribution: Most of panhandle and peninsula south to Lake Okeechobee, extending southward along eastern ridge to Dade County, but absent from Keys. Possibly extirpated from some of more heavily developed counties such as Pinellas.

Range-wide Distribution: Southern South Carolina, southern Georgia, and most of Florida.

Conservation Status: Occurs on many state and federal lands in Florida. Threats include collection for pets (now restricted); highway mortality; and habitat loss and fragmentation from development, intensive agriculture, and mining.

Protection and Management: Maintain large, unfragmented blocks of xeric natural communities; can tolerate some habitat degradation. Manage habitats with fire to prevent succession to closed canopy forests.

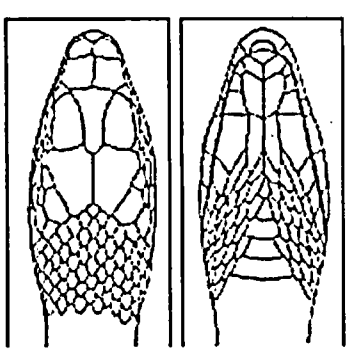
Selected References: Ashton and Ashton 1988b, Conant and Collins 1991, Ernst and Barbour 1989, Franz 1986, Moler (ed.) 1992, Mount 1975, Tenant 1997.

Eastern Coachwhip Snake

Kenneth L. Krysko photos.

Scientific name: *Masticophis flagellum flagellum*

Description: The Eastern Coachwhip is one of the largest snakes in North America. Average adult size is 50-72 inches (127-182.8 cm), record is 102 inches (259 cm). Adults are long and slender, and typically have a black head and neck, which gradually fades to tan posteriorly. The belly color matches that of the back. Some individuals may be uniformly tan or cream colored, lacking the dark pigmentation on the head. The head is large and angular, with large eyes shielded by projecting supraocular scales. The scales are smooth, and there are 17 dorsal scale rows at midbody. The pupil is round. Juveniles are brown or tan with indistinct dark dorsal crossbands.



Eastern coachwhip snake: Left to right: Top of the head; underside of the head (chin and throat).

Eastern coachwhip snake: Left to right: Side of the head; front (face view) of the head.

Range: It is found throughout Florida, excluding the keys. Outside of Florida, it is found from Texas, Oklahoma, and Kansas, east to North Carolina. However, it is absent from most of the Mississippi River delta.

Habitat: It is locally abundant, and occurs primarily in pine and palmetto flatwoods, longleaf pine-turkey oak sandhills, scrub, and along the beaches interspersed with sand dunes, sea oats, and grape vines.

Comments: **HARMLESS (non-venomous).** Coachwhips are active during the day, are extremely fast on the ground, and are great climbers. Its diet consists of lizards, small mammals, and birds.

Breeding takes place in the spring, and a clutch of 12-16 eggs is laid in late spring and early summer. Little is know about longevity in the wild, but captive coachwhips have lived more than 16 years.

Florida crackers (native Floridians) believe that coachwhips will attack and beat humans with their whip-like tail. This belief has no basis in fact. Violently lashing its body around like a whip would immediately break the snake's back and spinal cord — lashing its body like a whip would be committing suicide. It is called a 'coachwhip' because the large scales on its long, slowly tapering tail, give it the appearance of a braided bullwhip.

They appear to be high-strung, in part because when first encountered, they nervously vibrate the tail and strike in an attempt to scare off the threat. However, given the chance, it will flee. One of the most remarkable traits of this species is the speed with which it moves, racing away on the ground or through vegetation. It can escape in the blink of an eye.

Comparison with other species: The racers (*Coluber constrictor*) have solid black or bluish-black backs and 15 dorsal scale rows at midbody.

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Checklist of Florida Amphibians and Reptiles — Florida Herpetology

12/12/03

Source: *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 2/92

GENTIAN PINKROOT

(*Spigelia gentianoides*)

FAMILY: Loganiaceae

STATUS: Endangered, *Federal Register*, November 26, 1990

DESCRIPTION AND REPRODUCTION: A perennial herb with a single, erect, sharply ridged stem 10 to 30 centimeters (4-12 inches) tall. The leaves are opposite and sessile, largest at the top of the stem, 3 to 5 centimeters (1 to 2 inches) long. Flowers are borne at the top of the stem in a few-flowered, spikelike raceme. The flowers, mounted on very short stalks, point upward. Sepals are 4 to 6 millimeters long. The corolla is 2.5 to 3 centimeters long, consisting of a narrow tube about 1 centimeter long, broadening to a wider tube with five lobes, each 5 to 6 millimeters long. The corolla is pale pink, slightly darker at the margins of the lobes. The stamens stay inserted within the flower (Kral 1983). The corolla lobes tend to stay nearly closed, with five slits opening between the lobes, but the flowers do open completely (George Rogers, Missouri Botanical Garden, pers. comm. 1989). The flower resembles those of gentians, which is the reason for the plant's name. Flowering is in May and June.

The closest relative of *Spigelia gentianoides* is pinkroot, *Spigella marilandica*, a widespread species that grows in clumps rather than as single stems and has brilliant red flowers (Kral 1983).

RANGE AND POPULATION LEVEL: This species was first collected by A.W. Chapman before the Civil War, from the west side of the Apalachicola River, probably in Jackson County and Mariana, Jackson County. One specimen is labelled "Quincy. 1836, not seen since.", but the date is incorrect, so the locality is unreliable. Ferdinand Rugel collected the plant near Mount Vernon (now Chattahoochee, Gadsden County) in 1843 (K. Wurdack, *in litt.* 1988).

The University of Florida herbarium has specimens (verified by Rogers [pers. comm. 1989]) from Chipley, Washington County (1940 and 1941), and from 8 miles north of Wewahitchka, Calhoun County (1954). Harry Ahles and David Boufford found one locality in Jackson County in 1973 (Wunderlin et al. 1980). A specimen from Gulf Hammock (Levy County), labelled by its collectors as *Spigelia gentianoides*, has been determined to be *S. loganioides* (R. Wunderlin, University of South Florida, pers. comm. 1988). Godfrey (1979) included Liberty County, Florida in the distribution of this plant.

Recently, Gary Knight, Robert Kral, Angus Gholson, Jr., Wilson Baker, and Kenneth Wurdack relocated one population and found two more (Rogers 1988a, 1988b; Gholson, pers. comm. 1989). Rogers, Robert Bowden (Director of Horticulture, Missouri Botanical Garden) and others revisited the populations in 1989. One population, in Jackson County, had about 30 plants in 1988, one fifth as many as it had 12 years earlier. The second, near the Jackson-Bay County line, has no more than 10 plants (Rogers, pers. comm. 1988). The third population is somewhat larger than the others.

HABITAT: Gentian pinkroot occurs in mixed pine-hardwood forest, but the largest known population is in a longleaf-wiregrass woods, drier than flatwoods but apparently not a longleaf-turkey oak site. At this site, logging and replanting of pines resulted in full sunlight, at least until the young pines provide shade. Pinkroot plants at the site had sturdy stems and flowered, while plants at a shaded site appeared spindly, indicating that this species may actually prefer sun (Rogers, pers. comm. 1989; Bowden, *in litt.* 1990). Prescribed fire in a mixed hardwood-pine forest may have benefitted the pinkroots.

REASONS FOR CURRENT STATUS: This may have been a locally common species in the early nineteenth century. It may not have been difficult to find as late as 1941 label information on herbarium specimens is skimpy. The plant seems not to have been collected between 1954 and 1973, and Robert Kral, an expert and persistent field worker, had located the plant only once. The plant is definitely extremely rare now. In the absence of information on its habitat requirements, it is premature to give an explanation for the decline of gentian pinkroot. The species may be native to the wiregrass understory of longleaf pinelands, in which case the destruction of such vegetation for cotton fields, along with twentieth century forestry practices on sites that weren't cleared may have severely affected the species.

MANAGEMENT AND PROTECTION: One small population is on State-managed land, where managers will have to adopt a cautious experimental approach to habitat management. Prescribed fire, already tried, may be beneficial. It is not known at present what might be done to protect or manage the largest known population, on private land planted to pines.

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12/12/03

Source: *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 2/92

FRINGED CAMPION

(*Silene polypetala*)

FAMILY: Caryophyllaceae

STATUS: Endangered, *Federal Register*, January 18, 1991

DESCRIPTION AND REPRODUCTION: Fringed campion is a perennial herb that spreads vegetatively by long, slender, stolon-like rhizomes and leafy offshoots, both terminating in overwintering rosettes. Rosette and lower stem leaves are opposite, obovate, 3-9 centimeters (1 to 4 inches) long. Each rosette produces one to several flowering shoots, each of which is unbranched or sparingly branched, erect or ascending, up to 40 centimeters (16 inches) tall. The flowers are arranged in groups of three to five in a terminal cyme with leafy bracts. The calyx is tubular, 2 to 3 centimeters long, five-lobed, and covered with long, slender hairs. The five separate petals are each divided into a lower part about as long as the calyx and a triangular upper part that extends 3 to 4 centimeters from the calyx. The wide apex of each petal is divided into slender segments, giving the flower a fringed appearance. The petals are pink or white. Flowering is from late March to May (Kral 1983, Hitchcock and Maguire 1947, Faust 1980). This wildflower is very easy to propagate from cuttings (F.C. Galle *in litt.* 1977).

RANGE AND POPULATION LEVEL: Fringed campion occurs in two distinct geographic areas. The northern portion of its range is in central Georgia in the Piedmont very near the Coastal Plain sandhills, from Macon in Bibb County west through Crawford, Taylor, and Talbot Counties. The southern part of fringed campion's range is primarily along the east side of the Flint and Apalachicola Rivers at the boundary between Decatur County, Georgia and Gadsden County, Florida, with two sites in Georgia (Faust 1980, Allison 1988), and two in Florida, in and south of the town of Chattahoochee.

In the Georgia Piedmont, Allison (1988) counted at least 610 fringed campion rosette clusters at nine sites, with at least 225 rosette clusters at the largest site. Because the plant spreads vegetatively, the number of rosette clusters probably far exceeds the number of genotypes in any population. In central Georgia, fringed campion occurs "in various situations within hardwood forest. Often on fairly steep slopes of deep ravines or north-facing hillsides. Sometimes on nearly level ground, particularly in `flatwoods' developed on Iredell soils" (Allison 1988). Piedmont flatwoods are bottomland hardwood forests on level sites, with basic or circumneutral soils on mafic or ultramafic volcanic rock. Three sites are on flatwoods, six sites are on gentle to strongly north-facing slopes, and one site is on a gentle east-facing slope. All of the sites with fringed campion appear to be consistently moist, either from downslope seepage or from location in a bottomland.

In the southern portion of this plant's range, Allison (1988) counted at least 250 rosette clusters of fringed campion at the two southwest Georgia sites, where Faust (1980) had found about 625 plants; the difference in numbers may be due to a severe drought in 1988. In Florida, fringed campion occurs west of the Apalachicola River in Jackson County (Angus Gholson *in litt.* 1990; also a specimen collected in 1937 cited by Faust 1980 and Kent Perkins, Herbarium, Univ. of Florida, *in litt.* 1990). A distribution map (Hitchcock

and Maguire 1947) that places the Florida distribution of fringed campion near the Suwannee River rather than the Apalachicola River is evidently incorrect. No herbarium specimens are known to support such a distribution (the New York Botanical Garden herbarium was checked by W. Thomas, *in litt.* 1990). One Florida population of fringed campion had about 250 plants in 1980, and was normally about this size (Faust 1980, reporting data from A. Gholson, Jr.). The sizes of the two other Florida populations are not available.

HABITAT: The Georgia Piedmont deciduous hardwood forests where fringed campion occurs have northern red and white oaks, mockernuts and pignut hickories, tulip trees, beeches, maples, and loblolly and shortleaf pines. Understory species include oak-leaf hydrangea, blue palmetto (*Sabal minor*), and *Rhododendron minus* (Faust 1980). At one site in Talbot County, Georgia, fringed campion occurs with the endangered relict trillium (*Trillium reliquum*) (Allison 1988). At another site, fringed campion occurs with *Scutellaria ocmulgee*, a candidate for listing.

Near the Georgia-Florida border, fringed campion occurs in rich wooded ravines with southern magnolias, tulip trees, maples, beeches, spruce pines (*Pinus glabra*), and sugarberries (*Celtis laevigata*). Understory trees include oakleaf hydrangea and redbud. Herbs include giant chickweed (*Stellaria pubera*) and bloodroot (*Sanguinaria canadensis*), both northern species. The endangered Florida torreya (*Torreya taxifolia*) occurs in these ravines.

REASONS FOR CURRENT STATUS: Residential development and logging are the main problems. The spread of Japanese honeysuckle may also pose a threat. This species apparently always was rare, so the loss of even a few populations threatens the species.

MANAGEMENT AND PROTECTION: Major needs are:

(1) Search for more populations, in hopes that a few more sites may be found.

(2) Protect sites from logging. Those sites that have been protected from recent logging need little further attention until the new stand of pines matures.

(3) Cooperate with private and public landowners. The fringed campion's range in central Georgia is entirely on private land. Local efforts have already saved several sites from logging, and only a relatively small total acreage needs to be protected. The southwestern Georgia part of this plant's range is on Corps of Engineers land, which is also inhabited by the endangered Florida torreya tree. At least two of the three Florida sites are on private land. One of the sites probably should be acquired for conservation purposes.

(4) Monitor sites for the well-being of the populations, after determining what information should be gathered. Watching for Japanese honeysuckle incursions (below) will probably be an important task.

(5) Investigate the effects of Japanese honeysuckle and possibly other exotics, such as the fern *Lygodium japonicum*, on fringed campion. Honeysuckle may be a sufficiently serious threat to native forest herbs to justify research on biological control.

(6) The Georgia Department of Natural Resources has established two new populations of this plant; establishment of more such populations may be feasible and desirable.

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Source: *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 2/91

FLORIDA TORREYA

(*Torreya taxifolia*)

FAMILY: Taxaceae

STATUS: Endangered, *Federal Register*, January 23, 1984

DESCRIPTION AND REPRODUCTION: Florida Torreya is a relatively small, conical, evergreen, needle-bearing tree (up to 18 meters tall but usually less than half that height). Its needles are attached singly and spirally but their short petioles twist so as to spread the needles in one plane on either side of the twigs. The needles are stiff, sharp pointed, and piercing to the touch. They have a strongly pungent or resinous odor when crushed. The female cone develops into a single, fleshy-covered, dark green, oval seed 2.5 to 3.O centimeters long which is coated with a whitish bloom. About 2O years are needed for the trees to mature. Staminate and ovulate cones shed and receive pollen in spring (March and April), and ovulate cones mature in mid-summer to fall in the second year after their first appearance.

RANGE AND POPULATION LEVEL: This tree is endemic to the Apalachicola River area in Gadsden, Liberty and Jackson Counties, Florida, and in a closely adjacent part of Decatur County, Georgia. Scattered immature trees occur within the general range. Census data are available, and further censuses will be conducted. Mature trees have been killed by fungus and other infections, leaving only root sprouts which mostly grow to less than 3 meters in height before becoming infected by the fungus. Cultivated, uninfected specimens exist in various botanical gardens. The present range does not appear to be significantly smaller than the historic range.

HABITAT: Florida Torreya grows on bluffs and ravine slopes in the moist shade of associated pine-hardwoods.

REASONS FOR CURRENT STATUS: The most significant threat to the species has come from a decline which apparently began in the late 195O's and eventually killed all mature trees. The decline culminates in death of needles and stems causing defoliation and death of the tree. New trees resprout from the old roots and stumps, but they also become infected and die long before reaching maturity. Unless the disease can be controlled, the wild population may become extinct.

MANAGEMENT AND PROTECTION: The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve, the Corps of Engineers' Lake Seminole lands, and a city park in Chattahoochee provide habitat protection; but, the majority of the Florida habitat is in private ownership. The Georgia population occurs entirely on land administered by the U.S. Army Corps of Engineers on the margins of Lake Seminole. No effective method is available to control the decline. The Center for Plant Conservation, with assistance from the National Fish and Wildlife Foundation, is sponsoring establishment of a cultivated population of this species (by the Arnold Arboretum, Jamaica Plain [Boston], Mass.), coupled with research into management of the decline in wild populations (lead researcher: Mark Schwartz, Davis, California).

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Source: *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 1/91

EASTERN INDIGO SNAKE

(*Drymarchon corais couperi*)

FAMILY: Colubridae

STATUS: Threatened, *Federal Register*, January 31, 1979

DESCRIPTION: The eastern indigo snake is a large, docile, non-poisonous snake growing to a maximum length of about 8 feet. The color in both young and adults is shiny bluish-black, including the belly, with some red or cream coloring about the chin and sides of the head.

The indigo subdues its prey (including venomous snakes) through the use of its powerful jaws, swallowing the prey usually still alive. Food items include snakes, frogs, salamanders, toads, small mammals, birds, and occasionally young turtles.

REPRODUCTION AND DEVELOPMENT: Indigo snakes probably reach sexual maturity at 3 to 4 years of age. Based on observations of captive indigos at Auburn University, mating begins in November, peaks in December, and continues into March. Clutches averaging eight to nine eggs laid in late spring hatch approximately 3 months later. The snakes remain active to some degree throughout the winter, often emerging from their dens whenever air temperatures exceed 5O degrees Fahrenheit.

RANGE: This species is currently known to occur throughout Florida and in the coastal plain of Georgia. Historically, the range also included southern Alabama, southern Mississippi, and the extreme southeastern portion of South Carolina.

HABITAT: The indigo snake seems to be strongly associated with high, dry, well-drained sandy soils, closely paralleling the sandhill habitat preferred by the gopher tortoise. During warmer months, indigos also frequent streams and swamps, and individuals are occasionally found in flat woods. Gopher tortoise burrows and other subterranean cavities are commonly used as dens and for egg laying.

The home range of indigos varies considerably according to season. Based on a study conducted in southwest Georgia, Speake et al., (1978) reported an average seasonal range of 4.8 hectares during the winter (December through April), 42.9 hectares during late spring or early summer (May through July), and 97.4 hectares during late summer and fall (August through November). The most extensive monthly movements occurred during August. Of a total of 1O8 den sites located, 77 percent were in gopher tortoise burrows, 18 percent were in or under decayed stumps and logs, and 5 percent were under plant debris. The study area included windrows of debris piled up in the 196O's during site preparation for a slash pine plantation. The snakes showed some tendency to prowl and locate their dens near these windrows.

REASONS FOR CURRENT STATUS: The decline is attributed to a loss of habitat due to such uses as farming, construction, forestry, pasture, etc., and to over-collecting for the pet trade. The snake's large size

and docile nature have made it much sought after as a pet. The effect of Rattlesnake Roundups on the indigo snake are speculative. Both indigos and rattlers utilize the burrows of gopher tortoises at certain times. Rattlesnake hunters often pour gasoline down these burrows to drive out the snakes. While some indigos may be killed by this practice, the actual degree of impact on the population is unknown.

MANAGEMENT AND PROTECTION: The ultimate recovery plan objective is to delist the species by insuring that numerous indigo snake populations exist and are reproducing and protected where suitable habitat still exists in the historical range of the species. Before these objectives can be accomplished, research is necessary to: (1) develop population monitoring methods; (2) determine habitat requirements of juveniles; and (3) determine captive breeding and restocking potential of the species. Establishment of protected areas of good habitat as reintroduction sites and sanctuaries is thought to be important, as is the improvement of public attitude and behavior towards the indigo snake.

Recovery tasks currently being implemented include habitat management through controlled burning, testing experimental miniature radio transmitters for tracking of juvenile indigo snakes, maintenance of a captive breeding colony at Auburn University, recapture of formerly released snakes to confirm survival in the wild, presentation of education lectures and field trips, and efforts to obtain landowner cooperation in indigo snake conservation efforts.

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12/12/03

Source: *Endangered and Threatened Species of the Southeastern United States (The Red Book)* FWS Region 4 -- As of 2/91

INDIANA BAT

Myotis sodalis

FAMILY: Vespertilionidae

STATUS: Endangered throughout its range, *Federal Register*, March 11, 1967

DESCRIPTION: The Indiana bat is a medium-sized myotis, closely resembling the little brown bay (*Myotis lucifugus*) but differing in coloration. Its fur is a dull grayfish chestnut rather than bronze, with the basal portion of the hairs of the back dull lead colored. This bat's underparts are pinkish to cinnamon, and its hind feet smaller and more delicate than in *M. lucifugus*. The calcar (heel of the foot) is strongly keeled.

Little is known of the this bat's diet beyond the fact that it consists of insects. Females and juveniles forage in the airspace near the foliage of riparian and floodplain trees. Males forage the densely wooded area at tree top height (LaVal et al., 1976, 1977).

RANGE AND POPULATION LEVEL: The Indiana bat occurs in the Midwest and eastern United States from the western edge of the Ozark region in Oklahoma, to southern Wisconsin, east to Vermont, and as far south as northern Florida. In summer it is apparently absent south of Tennessee; in winter it is apparently absent from Michigan, Ohio, and northern Indiana where suitable caves and mines are unknown. About 500,000 individuals of this species still exist.

REPRODUCTION AND DEVELOPMENT: This bat has a definite breeding period that usually occurs during the first 10 days of October. Mating takes place at night on the ceilings of large rooms near cave entrances. Limited mating may also occur in the spring before the hibernating colonies disperse.

Hibernating colonies disperse in late March and most of the bats migrate to more northern habitat for the summer. However, some males remain in the hibernating area during this period and form active bands which wander from cave to cave.

Limited observations indicate that birth and development occur in very small, widely scattered colonies consisting of 25 or so females and their young. Birth usually takes place during June with each female bearing a single offspring. About 25 to 37 days are required for development to the flying stage and the beginning of independent feeding.

Migration to the wintering caves usually begins in August. Fat reserves depleted during migration are replenished largely during the month of September. Feeding continues at a diminishing rate until by late November the population has entered a definite state of hibernation.

The hibernating bats characteristically form large, tight, compact clusters. Each individual hangs by its feet from the ceiling. Every 8 to 10 days hibernating individuals awaken to spend an hour or more flying about

or to join a small cluster of active bats elsewhere in the cave before returning to hibernation.

HABITAT: Limestone caves are used for winter hibernation. The preferred caves have a temperature averaging 37 degrees to 43 degrees Fahrenheit in midwinter, and a relative humidity averaging 87 percent. Summer records are rather scarce. A few individuals have been found under bridges and in old buildings, and several maternity colonies have been found under loose bark and in the hollows of trees. Summer foraging by females and juveniles is limited to riparian and floodplain areas. Creeks are apparently not used if riparian trees have been removed. Males forage over floodplain ridges and hillside forests and usually roost in caves. Foraging areas average 11.2 acres per animal in midsummer.

CRITICAL HABITAT: The following caves have been designated as Critical Habitat within the Southeast Region:

Tennessee:	White Oak Blowhole Cave, Blount County
Kentucky:	Bat Cave, Carter County
	Coach Cave, Edmonson County

REASONS FOR CURRENT STATUS: The decline is attributed to commercialization of roosting caves, wanton destruction by vandals, disturbances caused by increased numbers of spelunkers and bat banding programs, use of bats as laboratory experimental animals, and possibly insecticide poisoning. Some winter hibernacula have been rendered unsuitable as a result of blocking or impeding air flow into the caves and thereby changing the cave's climate. The Indiana bat is nearly extinct over most of its former range in the northeastern states, and since 195O, the major winter colonies in caves of West Virginia, Indiana, and Illinois have disappeared. A high degree of aggregation during winter makes the species vulnerable. During this period approximately 87 percent of the entire population hibernates in only seven caves.

MANAGEMENT AND PROTECTION: The original Indiana bat recovery plan was approved in 1976, and a revised plan was approved on October 14, 1983, Some of the major recovery goals include: (1) Preserving critical winter habitat by securing primary caves and mines and restricting entry; (2) Initiating an information and education program; and, (3) Monitoring population levels and habitat (to include an evaluation of pesticide effects).

To date, the primary conservation efforts have been to control access of people by the installation of properly designed gates across cave entrances. Some gating has already been accomplished on Federal and State lands. Gating of all seven of the major wintering hibernacula would provide protection for about 87 percent of the population. Some privately-owned caves in Missouri and West Virginia are being negotiated for public acquisition. The National Speological Society and the American Society of Mammologists are taking measures within their respective organizations to promote conservation of the Indiana bat.

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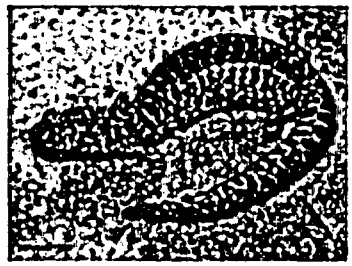
**U.S. Fish and Wildlife Service in Cooperation with the Indiana Bat Recovery Team. 1983. Recovery Plan for the Indiana Bat. U.S. Fish and Wildlife Service, Twin Cities, Minnesota. 82 pp.

For more information please contact:

U.S. Fish and Wildlife Service
330 Ridgefield Court
Asheville, North Carolina 28806

Telephone: 704/665-1195

Salamanders



Flatwoods Salamander, *Ambystoma cingulatum*

Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Amphibia
Order: Caudata
Family: ambystomatidae

Species Description

Size: 9 - 13 cm (3.5 - 5 in).
Color: Dark, almost black with gray markings on its back. The markings may look like fine lines, a net, or circles. Its belly is black with gray specks.
Other things to look for: This is a small Mole Salamander, not as robust as other members of this genus. The head is not quite as blunt as in other *Ambystoma* species. It has 15 costal grooves.

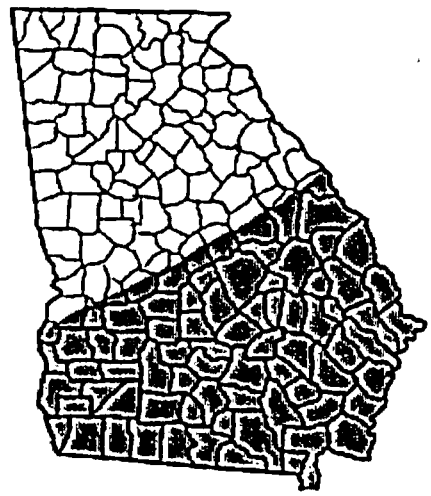
Life Cycle & Natural History

Breeding occurs in the late fall. Fertilization is internal. The female lays small clumps of eggs on damp ground near water. Hatching occurs when winter rains flood the area where the eggs have been laid, usually 20 to 40 days later. Transformation to adult form occurs in the spring, three to four months later.

Members of the Mole Salamander Family (ambystomatidae) are aptly named because they spend most of their time underground. This salamander burrows near water or moves about under debris on the forest floor. It is nocturnal and most likely to be seen during the fall courtship and breeding period. The Flatwoods Salamander is found in flatwoods dominated by longleaf or slash pines, and is very closely associated with the pine/wiregrass habitat. It is carnivorous, and is an opportunistic feeder, primarily eating earthworms and arthropods. It needs shallow winter ponds to breed and does not do well in ponds that contain fish.

Range

The Flatwoods Salamander is found in the pine woodlands and cypress swamps of the Coastal Plain.



Conservation Status

This species is listed as Threatened in Georgia, South Carolina, Alabama, and Florida both by the individual states and by the federal goverment. Its population has declined dramatically over the last fifteen years. The main threat is habitat destruction caused by clear-cutting, burning, and soil disturbance by heavy machinery. Protection of pine/wiregrass habitat is essential for the survival of this species. Pine wetlands should be protected

and not dredged or drained.

Similar Species

There are no other Mole Salamanders that can be confused with this species in Georgia. Some Slimy Salamanders have a similar appearance, but they also have noticeably sticky mucous secretions.

Amphibians: Classification, Species list, References

Information provided by: The Georgia Museum of Natural History and Georgia Department of Natural Resources
1 June 2000

Alligator

American Alligator, ***Alligator mississippiensis***

Scientific name: The genus name, like the common name, comes from the Spanish *el lagarto* (the lizard). The species is named for Mississippi, the state and river system where it is common.

Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: crocodilia
Family: Alligatoridae

Species Description

Size: This is the largest reptile in North America. Adults range from 1.8 - 4.9 m (6 - 16 ft). The record is 5.8 m (19 ft 2 in). Males grow larger than females.
Color: The young are dark grey to black, striped with bright yellow which fades with age. Adult alligators are dark grey to black.
Other things to look for: The snout is broad. The large fourth tooth is not visible when the mouth is closed.

Life Cycle

Courting and mating occur in the spring. Both sexes may be territorial. In the swamps and sloughs of southern Georgia, the male's bellow is a common spring sound as he courts the female or threatens other males. Fertilization is internal. Thirty to sixty leathery eggs are laid one to three weeks after mating. The nest of debris may reach 7 feet in diameter and 3 feet in height. The eggs are laid in the center, and the rotting of the vegetation helps to warm the eggs during development. Sex of the young is determined by the average temperature of the nest. High temperatures yield males; low temperatures result in females. This temperature-dependent sexual development of the young is found in all members of this family. The female guards the nest during incubation. Hatching is in nine weeks. The young may stay with the female for up to one year. Mother alligators are very protective. It is unwise to disturb nests or young. Maturity is reached in 4 - 8 years. The American Alligator may live for several decades.

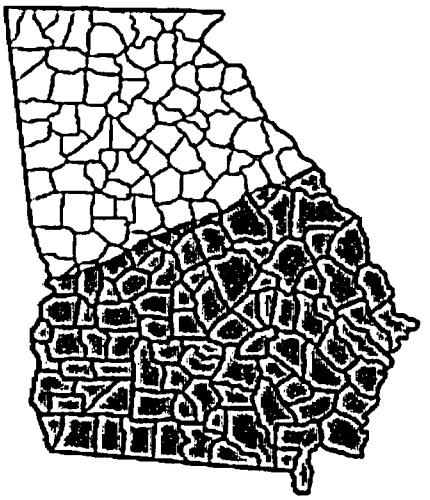
Natural History

The American Alligator is carnivorous and will eat anything it can catch and swallow. This includes fish, amphibians, smaller alligators, snakes, waterfowl, raccoons, and wild pigs. This species occurs in a variety of habitats, from large rivers to swamps and marshes. It [illegible] shallow fresh water with shoreline vegetation and mud or sand banks. It often basks

water is low.

Range

The American Alligator is found in appropriate habitats throughout the Gulf and Lower Atlantic Coastal Plain and in Florida. This species is found throughout southern Georgia up to the Fall Line and occasionally past it. It has also sometimes been released outside its known native range.



Conservation Status

The American Alligator was hunted to very low numbers in the 1940s to 1960s. It was placed on the Endangered list, hunting was prohibited, and today populations have rebounded. It is now listed as a Threatened species, but populations have recovered in some states to the point that there is a limited harvest. It is felt that the populations are not yet large enough to permit a regular harvest in Georgia. The prime threats to its survival are habitat reduction and over-hunting.

Similar Species

No other close relative is found in Georgia. The American Crocodile occurs chiefly in salty or brackish waters from southern Florida to South America; it has a tapering snout and (except in small individuals) the fourth lower jaw tooth protrudes consipcuously upward near its snout. The Spectacled Caiman is not native to the United States, but is locally thriving in extreme southern Florida; it has a curved, bony, crosswise ridge in front of its eyes.

Reptiles: Classification, Species list, References

Information provided by: The Georgia Museum of Natural History and Georgia Department of Natural Resources
1 June 2000

FLORIDA Natural Areas INVENTORY

Species and Natural Community Summary for Jackson County

Fish Amphibians Reptiles Birds Mammals Invertebrates Plants Natural Communities Other

Explanations and Definitions: Global/State Rank, Federal/State Status Occurrence Status

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Occurrence Status
FISH						
Acipenser oxyrinchus desotoi	Gulf sturgeon	G3T2	S2	LT	LS	C
Agonostomus monticola	mountain mullet	G5	S3	N	N	C
Ameiurus brunneus	snail bullhead	G4	S3	N	N	C
Ameiurus serracanthus	spotted bullhead	G3	S3	N	N	C
Atractosteus spatula	alligator gar	G5	S3	N	N	C
Cyprinella callitaenia	bluestripe shiner	G2	S1	N	N	C
Luxilus zonistius	bandfin shiner	G3	S1S2	N	N	C
Micropterus sp 1	shoal bass	G2	S1	N	LS	C
Moxostoma sp 1	grayfin redhorse	G2	S2	N	N	C
Notropis cummingsae	dusky shiner	G5	S4	N	N	C

Pteronotropis welaka	bluenose shiner	G4	S4	N	LS	P
AMPHIBIANS						
Ambystoma cingulatum	flatwoods salamander	G2G3	S2S3	PT	N	C
Ambystoma tigrinum	tiger salamander	G5	S3	N	N	P
Amphiuma pholeter	one-toed amphiuma	G3	S3	N	N	C
Haideotriton wallacei	Georgia blind salamander	G2	S2	N	LS	C
Rana capito	gopher frog	G4	S3	N	LS	P
REPTILES						
Agkistrodon contortrix	copperhead	G5	S2	N	N	C
Alligator mississippiensis	American alligator	G5	S4	T(S/A)	LS	C
Crotalus adamanteus	eastern diamondback rattlesnake	G5	S3	N	N	C
Drymarchon corais couperi	eastern indigo snake	G4T3	S3	LT	LT	C
Eumeces anthracinus	coal skink	G5	S3	N	N	P
Gopherus polyphemus	gopher tortoise	G3	S3	N	LS	C
Graptemys barbouri	Barbour's map turtle	G2	S2	N	LS	C
Macroclemys temminckii	alligator snapping turtle	G3G4	S3	N	LS	C
Pituophis melanoleucus mugitus	Florida pine snake	G5T3?	S3	N	LS	P
Pseudemys concinna suwanniensis	Suwannee cooter	G5T3	S3	N	LS	C
BIRDS						
Accipiter cooperii	Cooper's hawk	G4	S3?	N	N	P

Aimophila aestivalis	Bachman's sparrow	G3	S3	N	N	P
Aramus guarauna	limpkin	G5	S3	N	LS	P
Ardea alba	great egret	G5	S4	N	N	C
Buteo brachyurus	short-tailed hawk	G4?	S3	N	N	P
Egretta caerulea	little blue heron	G5	S4	N	LS	C
Egretta thula	snowy egret	G5	S4	N	LS	C
Egretta tricolor	tricolored heron	G5	S4	N	LS	P
Elanoides forficatus	swallow-tailed kite	G4	S2S3	N	N	P
Eudocimus albus	white ibis	G5	S4	N	LS	C
Falco columbarius	merlin	G5	SU	N	N	P
Falco peregrinus	peregrine falcon	G4	S2	LE	LE	P
Falco sparverius paulus	southeastern American kestrel	G5T3T4	S3?	N	LT	P
Ixobrychus exilis	least bittern	G5	S4	N	N	P
Mycteria americana	wood stork	G4	S2	LE	LE	C
Nyctanassa violacea	yellow-crowned night-heron	G5	S3?	N	N	P
Nycticorax nycticorax	black-crowned night-heron	G5	S3?	N	N	P
Pandion haliaetus	osprey	G5	S3S4	N	LS**	C
Picoides villosus	hairy woodpecker	G5	S3?	N	N	P
Plegadis falcinellus	glossy ibis	G5	S2	N	N	P
Seiurus motacilla	Louisiana waterthrush	G5	S3	N	N	P
MAMMALS						
Corynorhinus rafinesquii	Rafinesque's big-eared bat	G3	S3?	N	N	P

Eptesicus fuscus	big brown bat	G5	S3	N	N	P
Mustela frenata olivacea	southeastern weasel	G5T4	S3?	N	N	P
Myotis austroriparius	southeastern bat	G3	S3	N	N	C
Myotis grisescens	gray bat	G2G3	S1	LE	LE	C
Myotis septentrionalis	northern long-eared myotis	G4	SH	N	N	C
Myotis sodalis	Indiana bat	G2	SA	LE	LE	C
Sciurus niger shermani	Sherman's fox squirrel	G5T2	S2	N	LS	C
INVERTEBRATES						
Anodonta heardi	Apalachicola floater	G1	S1	N	N	C
Caecidotea hobbsi	Florida cave isopod	G2	S2	N	N	C
Cambarus cryptodytes	Dougherty Plain cave crayfish	G2	S2	N	N	C
Elliptio chipolaensis	Chipola slabshell	G2Q	S1	LT	N	C
Elliptoideus sloatianus	purple bankclimber	G2	S?	LT	N	C
Medionidus penicillatus	Gulf moccasinshell	G2	S?	LE	N	C
Megalonaias boykiniana	round washboard	G3	S?	N	N	C
Pleurobema pyriforme	oval pigtoe	G2	S?	LE	N	C
Strophitus subvexus	southern creekmussel	G2	S1S2	N	N	C
Villosa subangulata	shiny-rayed pocketbook	G2	S?	LE	N	C
VASCULAR PLANTS						
Agrimonia incisa	incised groove-bur	G3	S2	N	N	C
Andropogon arctatus	pine-woods bluestem	G3	S3	N	N	C

Aquilegia canadensis var *australis*	Marianna columbine	G5T1	S1	N	N	C
Arabis canadensis	sicklepod	G5	S1	N	LE	C
Aristida simpliciflora	southern three-awned grass	G2	S2	N	N	C
Arnoglossum diversifolium	variable-leaved Indian-plantain	G2	S2	N	LT	C
Asplenium x heteroresiliens	Wagner's spleenwort	HYB	S1S2	N	N	C
Aster fragilis var *brachypholis*	Apalachicola River aster	G4T2	S1	N	N	C
Baptisia megacarpa	Apalachicola wild indigo	G3	S2	N	LE	C
Botrychium lunarioides	winter grape-fern	G4?	S1	N	N	C
Brickellia cordifolia	Flyr's brickell-bush	G2G3	S2	N	LE	C
Calamintha dentata	toothed savory	G3	S3	N	N	C
Callirhoe papaver	poppy mallow	G5	S2	N	LE	C
Calycanthus floridus	sweet shrub	G5T4	S2	N	LE	C
Calystegia catesbiana	trailing bindweed	G3	S1	N	LE	C
Coreopsis integrifolia	Chipola dye-flower	G1G2	S1	N	N	C
Croton elliottii	Elliott's croton	G2G3	S2S3	N	N	C
Cryptotaenia canadensis	Canada honewort	G5	S2S3	N	LE	C
Cynoglossum virginianum	wild comphrey	G5	S2	N	N	C
Dirca palustris	eastern leatherwood	G4	S2	N	N	C
Euphorbia commutata	wood spurge	G5	S2?	N	N	C
Forestiera godfreyi	Godfrey's privet	G3	S2S3	N	LE	C
Hepatica nobilis	liverleaf	G5	S2	N	LE	C
Ilex amelanchier	serviceberry holly	G4	S2	N	N	C

Illicium floridanum	Florida anise	G5	S3	N	LT	C
Isopyrum biternatum	false rue-anemone	G5	S1	N	N	C
Kalmia latifolia	mountain laurel	G5	S3	N	LT	R
Lilium michauxii	Carolina lily	G4G5	S1S2	N	N	C
Lilium superbum	turk's cap lily	G5	S1	N	N	C
Linum westii	West's flax	G2	S2	N	LE	C
Macranthera flammea	hummingbird flower	G3	S2	N	LE	C
Magnolia ashei	Ashe's magnolia	G2	S2	N	LE	C
Magnolia pyramidata	pyramid magnolia	G4	S2	N	LE	C
Malaxis unifolia	green adder's-mouth	G5	S3	N	LE	C
Marshallia obovata	Barbara's buttons	G4G5	S1	N	LE	C
Matelea baldwyniana	Baldwyn's spiny-pod	G2G3	S1	N	LE	C
Matelea floridana	Florida spiny-pod	G2	S2	N	LE	R
Myriophyllum laxum	piedmont water-milfoil	G3	S2S3	N	N	C
Nuphar lutea ssp *ulvacea*	west Florida cowlily	G5T2	S2	N	N	C
Pachysandra procumbens	Allegheny spurge	G4G5	S1	N	LE	C
Physostegia leptophylla	slender-leaved dragon-head	G4?	S3S4	N	N	C
Pinguicula planifolia	Chapman's butterwort	G3?	S2	N	LT	C
Platanthera integra	yellow fringeless orchid	G4	S3S4	N	LE	C
Podophyllum peltatum	may apple	G5	S1	N	N	C
Polymnia laevigata	Tennessee leafcup	G3	S1?	N	N	C
Rhododendron austrinum	orange azalea	G3G4	S3	N	LE	C

Rudbeckia triloba var *pinnatiloba*	pinnate-lobed coneflower	G4T2?	S1	N	N	C
Ruellia noctiflora	white-flowered wild petunia	G2G3	S2	N	LE	C
Salix eriocephala	heart-leaved willow	G5	S1	N	LE	C
Salix floridana	Florida willow	G2	S2	N	LE	C
Salvia urticifolia	nettle-leaved sage	G5	S1	N	LE	C
Schisandra coccinea	schisandra	G4	S2	N	LE	C
Sideroxylon lycioides	gopherwood buckthorn	G5	S2	N	LE	C
Sideroxylon thornei	Thorne's buckthorn	G2	S1	N	LE	C
Silene polypetala	fringed campion	G2	S1	LE	LE	C
Sium floridanum	Florida water-parsnip	G1Q	S1	N	N	C
Spigelia gentianoides	gentian pinkroot	G2	S1	LE	LE	C
Torreya taxifolia	Florida torreya	G1	S1	LE	LE	C
Trillium lancifolium	narrow-leaved trillium	G3	S2	N	LE	C
Uvularia floridana	Florida merrybells	G3?	S1	N	N	C
Xyris scabrifolia	Harper's yellow-eyed grass	G3	S1	N	LT	C
NATURAL COMMUNITIES						
Alluvial Stream		G4	S2	N	N	C
Aquatic Cave		G3	S2	N	N	C
Basin Swamp		G4?	S3	N	N	C
Bottomland Forest		G4	S4?	N	N	C
Floodplain Forest		G?	S3	N	N	C
Floodplain Swamp		G?	S4?	N	N	C

Sandhill		G2G3	S2	N	N	C
Sinkhole Lake		G3	S3	N	N	C
Slope Forest		G3	S2	N	N	C
Spring-run Stream		G2	S2	N	N	C
Terrestrial Cave		G3	S1	N	N	C
Upland Glade		G1	S1	N	N	C
Upland Hardwood Forest		G?	S3	N	N	C
Upland Mixed Forest		G?	S4	N	N	C
OTHER						
Bird rookery				N	N	C
Geological feature				N	N	C

** See Rank and Status Explanations and Definitions, Special Animal Listings - Federal and State Status

County Occurrence Status

Vertebrates and Invertebrates:

C = (Confirmed) Occurrence status derived from a documented record in the FNAI data base.

P = (Potential) Occurrence status derived from a reported occurrence for the county or the occurrence lies within the published range of the taxon.

N = (Nesting) For sea turtles only; occurrence status derived from documented nesting occurrences.

Plants, Natural Communities, and Other:

C = (Confirmed) Occurrence status derived from a documented record in the FNAI data base or from a herbarium specimen.

R = (Reported) Occurrence status derived from published reports.

http://www.fs.fed.us/database/feis/plants/tree/tortax/all.htm

accessed 12/12/03

Introductory

SPECIES: Torreya taxifolia

ABBREVIATION :
TORTAX

SYNONYMS :
Tumion taxifolium (Arn.) Greene

SCS PLANT CODE :
TOTA

COMMON NAMES :
Florida torreya
stinking cedar
Savin
gopherwood
polecat wood

TAXONOMY :
The currently accepted scientific name of Florida torreya is Torreya taxifolia Arn.; it is a member of the yew family (Taxaceae) [11,17]. There are no recognized subspecies, varieties, or forms [2].

LIFE FORM :
Tree

FEDERAL LEGAL STATUS :
Endangered

OTHER STATUS :
Florida torreya is state-listed as threatened [24].

COMPILED BY AND DATE :
Lora L. Esser, August 1993

LAST REVISED BY AND DATE :
NO-ENTRY

AUTHORSHIP AND CITATION :
Esser, Lora L. 1993. Torreya taxifolia. In: Remainder of Citation

Species Index
FEIS Home

DISTRIBUTION AND OCCURRENCE

SPECIES: Torreya taxifolia

GENERAL DISTRIBUTION :
Florida torreya is endemic to three counties in northern Florida (Liberty, Gadsden, and Jackson) and extends 1 mile into Decatur County, Georgia [2,11]. The natural range of this species extends along the limestone bluffs on the eastern bank of the Apalachicola River and its tributaries for a 40-mile (64-km) stretch [14]. There is a small colony of 60 trees approximately 6 miles west of the river at a site known as Dog Pond in Jackson County [2,11]. Florida torreya is not an abundant species, and local occurrence is widely scattered along the Apalachicola River [9,11]. There is a small, introduced population of trees located in Asheville, North Carolina, on the Biltmore Estate [14].

ECOSYSTEMS :
FRES12 Longleaf - slash pine
FRES13 Loblolly - shortleaf pine
FRES14 Oak - pine
FRES15 Oak - hickory
FRES16 Oak - gum - cypress

STATES :
FL GA NC

ADMINISTRATIVE UNITS :
NO-ENTRY

BLM PHYSIOGRAPHIC REGIONS :
NO-ENTRY

KUCHLER PLANT ASSOCIATIONS :
K079 Palmetto prairie
K111 Oak - hickory - pine forest
K112 Southern mixed forest
K113 Southern floodplain forest

SAF COVER TYPES :
70 Longleaf pine
71 Longleaf pine - scrub oak
73 Southern redcedar
74 Cabbage palmetto
80 Loblolly pine - shortleaf pine
81 Loblolly pine
82 Loblolly pine - hardwood
83 Longleaf pine - slash pine
84 Slash pine
85 Slash pine - hardwood
87 Sweet gum - yellow-poplar
98 Pond pine
111 South Florida slash pine

SRM (RANGELAND) COVER TYPES :
NO-ENTRY

HABITAT TYPES AND PLANT COMMUNITIES :
Florida torreya is associated with oak-tupelo-cypress (Quercus-Nyssa-Cupressus) and oak-pine (Quercus-Pinus) forests on the eastern bank of the Apalachicola River [14]. The longleaf pine/wiregrass (P. palustris/Aristida stricta) sandhill community is upslope from these forests [1,21].

MANAGEMENT CONSIDERATIONS

SPECIES: Torreya taxifolia

WOOD PRODUCTS VALUE :
Commercial harvesting of Florida torreya is nonexistant due to scant availablility [11]. The fine-grained yellow wood is, however, highly attractive and of good quality [2]. It is lightweight, hard, strong, and highly durable [14]. The wood was historically used for making cabinets and fenceposts [15]. Fences made of Florida torreya 60 years ago are still sound [2]. Florida torreya was also used for Christmas trees [14].

IMPORTANCE TO LIVESTOCK AND WILDLIFE :
Various animals eat Florida torreya seeds [14].

PALATABILITY :
NO-ENTRY

NUTRITIONAL VALUE :
NO-ENTRY

COVER VALUE :
NO-ENTRY

VALUE FOR REHABILITATION OF DISTURBED SITES :
NO-ENTRY

OTHER USES AND VALUES :
Florida torreya was planted as an ornamental on the Biltmore Estate, Asheville, North Carolina [14].

OTHER MANAGEMENT CONSIDERATIONS :
Florida torreya is almost extinct in its natural range [9]. In 1988 the Center for Plant Conservation stated that Florida torreya faces such a serious and immediate threat of extinction that it will be gone in 10 years unless concerted conservation steps are taken [4]. An intricate array of circumstances threatens Florida torreya. The population is reduced because of habitat destruction by inundation and logging and fungal pathogens that kill young trees before they reach sexual maturity [4,21].

Disease: Florida torreya populations are drastically reduced by stem and needle blights [2]. The fungi responsible for these blights have been identified as members of the genera Physalospora and Macrophoma. As many as 11 species of fungi attack Florida torreya [9,13]. How the infection begins is unknown. It may begin with fungi attacking the tree while the fungi are in their sexual reproductive cycle [14].

Sudden exposure to full sunlight following logging of other tree species may stress Florida torreya, leading to susceptibility to fungal invasion [12].

Fungicide: Infected Florida torreya trees treated with the commercial fungicide Maneb recovered markedly and produced new growth with little or no infection [12,14].

Pests: Feral pigs uproot and destroy Florida torreya seedlings [20]. Deer preferrentially select Florida torreya saplings as antler rubbing posts, and sometimes kill saplings while rubbing their antlers [21].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Torreya taxifolia

GENERAL BOTANICAL CHARACTERISTICS :
Florida torreya is a dioecious native evergreen tree, typically from 30 to 40 feet (9-12 m) tall and 12 to 20 inches (30-50 cm) in diameter [11,14]. The largest living specimen is in North Carolina, and measures about 45 feet (14 m) in height and 35 inches (89 cm) d.b.h. Florida torreya bark is only about 0.5 inches (1.3 cm) thick on mature trees, and is irregularly divided by shallow fissures. The ovules or arils are 1.2 to 1.6 inches (3-4 cm) long. They are fleshy, turning leathery at maturity. The seeds have a woody seed coat [20].

RAUNKIAER LIFE FORM :
Phanerophyte

REGENERATION PROCESSES :
Male Florida torreya bear their microsporophylls within strobili. In contrast, the ovules of female trees are not contained within strobili but are solitary [14]. Male strobili begin growth the year prior to flowering, while female trees develop ovules in one growing season [11,14]. Florida torreya produces male and female cones at the age of 20 [14]. Torreya species are wind pollinated. Seeds mature in 2 years [15]. At Maclay State Gardens, some germination occurred when seeds were placed in rich, damp topsoil. Of 35 seeds planted in wet spaghnum moss, 80 percent germinated. Germination is hypogeal, and seeds require afterripening [14]. Viable seeds are rock hard when ripe. Seeds collected from diseased trees are soft and crumble easily [15]. Because of fungal infection, sexual reproduction has virtually stopped in this species. Infected trees seldom bear reproductive structures. Consequently, few trees can be identified as either male or female [21]. Few seedlings have been found in the wild since the late 1950's [14], and current reproduction is almost solely vegetative [21,22].

Florida torreya sprouts from the roots, bole, and root crown following damage to aboveground portions of the tree [14,15,20,21,22]. Numerous sprouts are produced at the base of the parent tree, although only one sprout usually survives after several years [14]. Basal sprouts grow several feet before succumbing to infection [15].

Florida torreya is propagated with stem cuttings [21].

SITE CHARACTERISTICS :
Florida torreya occurs mainly on steep, deeply shaded limestone slopes, bluffs, and wooded ravines, but is not confined to them [8,9,14]. It also occurs in forest hammocks and on slopes of ravines cutting through sandhills. The population in Jackson County, Florida, occurs on gently rolling hills [8]. Soils are well drained [21], with a pH range from 4.0 to 8.0 [8]. The climate is subtropical, with wet summers and dry winters. The average annual precipitation is 56 inches (1,420 mm), and the average growing season is 270 days [14]. Florida torreya transplants grow on southern aspects of the Appalachian Mountains, suggesting the species is more cold tolerant than its present range indicates [21].

Common overstory associates not listed under Distribution and Occurrence include spruce pine (P. glabra), southern red oak (Quercus falcata), American beech (Fagus grandifolia), magnolia (Magnolia grandiflora), American holly (Ilex opaca), Florida maple (Acer barbatum), basswood (Tilia americana var. heterophylla), Florida yew (Taxus floridana), and

eastern hophornbeam (Ostrya virginiana). Understory associates include poison-ivy (Toxicodendron radicans), greenbriar (Smilax spp.), crossvine (Bignonia capreolata), oak-leaf hydrangea (Hydrangea quercifolia), grape (Vitis rotundifolia), climbing hydrangea (Decumaria barbara), French mulberry (Callicarpa americana), woodbine (Parthenocissus), yaupon (Ilex vomitoria), blackberry (Rubus spp.), sedges (Carex spp.), panicgrass (Panicum spp.), partridgeberry (Mitchella repens), little sweet Betsy (Trillium cuneatum), cane (Arundinaria gigantea), and American climbing fern (Lygodium palmatum) [8,12,14].

SUCCESSIONAL STATUS :
Facultative Seral Species

Florida torreya is shade tolerant and is found in late seral and climax communities [8]. It grows better in full sunlight at Maclay State Gardens than in the dense shade of its natural habitat [14]. Seedlings, however, tolerate the deep shade of pines and hardwoods [14], and are probably more successful competitors on shady sites in their natural habitat [21].

SEASONAL DEVELOPMENT :
Reproductive structures emerge in March and April [11]. Seeds ripen from August to October and are released from September to November [11,14]. Midsummer aril ripening has been reported for Florida torreya, but is not typical [11]. Needles persist for 3 to 4 years [20].

FIRE ECOLOGY

SPECIES: Torreya taxifolia

FIRE ECOLOGY OR ADAPTATIONS :
Published research on fire adaptations of Florida torreya is lacking. A related species, California torreya (Torreya californica), sprouts from the roots, root crown, and bole following fire (see FEIS literature summary for Torreya californica). Florida torreya probably also sprouts from the roots, root crown, and bole after fire.

POSTFIRE REGENERATION STRATEGY :
Tree with adventitious-bud root crown/soboliferous species root sucker
Geophyte, growing points deep in soil

FIRE EFFECTS

SPECIES: Torreya taxifolia

IMMEDIATE FIRE EFFECT ON PLANT :
NO-ENTRY

DISCUSSION AND QUALIFICATION OF FIRE EFFECT :
NO-ENTRY

PLANT RESPONSE TO FIRE :
Because sprouting from the roots, bole, and root crown are natural methods of regeneration in this species [14,15,20,21,22], Florida torreya probably sprouts from those organs after fire.

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :
NO-ENTRY

FIRE MANAGEMENT CONSIDERATIONS :
Schwartz, a biologist with the Florida Nature Conservancy, suggested that in the past, smoke may have acted as a natural fungicide, suppressing the fungi now infecting Forida torreya. Ground fires resulting from lightning strikes were a constant feature of the region's longleaf pine forests until recently. Smoke drifting from these upland fires settled in the ravines where Florida torreya grew. This may have kept the fungal spore load low. After fire suppression, the spore load may have reached a critical mass, resulting in the present outbreak [21]. In August and October of 1987, 2,670 acres (1,080 ha) of a longleaf pine-slash pine (P. elliottii) forest were burned. Two of the eleven fungal pathogens identified in stricken Florida torreya were suppressed by smoke [13]. The Tall Timbers Research Station in Tallahassee, Florida, is currently researching the effects of smoke on the fungi that infect Florida torreya. The research is as yet unpublished [23].

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SPECIES: Torreya taxifolia

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Index
FEIS Home Page

Currently Designated Nonattainment Areas for All Criteria Pollutants

As of January 06, 2004

Classification Notes

Mouse over the red O,C,P,S,L to see the area name; click on them to see the associated counties.

A blank simple name indicates another area within the name listed above the blank.

		OZONE			CARBON MONOXIDE			PARTICULATE MATTER			SUFUR DIOXIDE			LEAD	
State(s)	Simple Name	2000 Pop (1000s)	No. Ctys	Class	2000 Pop (1000s)	No. Ctys	Class	2000 Pop (1000s)	No. Ctys	Class	2000 Pop (1000s)	No. Ctys	Class	2000 Pop (1000s)	No. Ctys
AK	Anchorage				255	1	Ser C	195	1	Mod P					
AK	Fairbanks				39	1	Ser C								
AK	Juneau							14	1	Mod P					
AL	Birmingham	805	2	Mar O											
AZ	Ajo							8	1	Mod P					
AZ	Douglas (Cochise County)							16	1	Mod P	16	1	P S		
AZ	Hayden/Miami							4	2	Mod P	2	1	P S		
AZ											2	1	P S		
AZ	Morenci										9	1	P S		
AZ	Nogales							25	1	Mod P					
AZ	Paul Spur (Cochise County)							1	1	Mod P					
AZ	Phoenix	3029	1	Ser O	3029	1	Ser C	3112	2	Ser P					

AZ	Rillito (Pima County)							1	1	Mod P					
AZ	San Manuel										8	1	P S		
AZ	Yuma							82	1	Mod P					
CA	Chico	203	1	S185 O											
CA	Imperial County	142	1	S185 O				120	1	Mod P					
CA	Los Angeles-South Coast Air Basin	14594	4	Ext O	14594	4	Ser C	14594	4	Ser P					
CA	Mono County							0	1	Mod P					
CA	Owens Valley							7	1	Ser P					
CA	Sacramento Metro	1978	6	Sev5 O				1223	1	Mod P					
CA	San Francisco-Bay Area	6542	9	Othe O											
CA	San Joaquin Valley	111	1	Ser O				3080	7	Ser P					
CA		3191	8	Sev5 O											
CA	Searles Valley							7	1	Mod P					
CA								4	1	Mod P					
CA	Southeast Desert Modified AQMA	981	3	Sev7 O				182	1	Ser P					
CA								199	1	Mod P					
CA	Ventura County	753	1	Sev5 O											
CA	Yuba City	114	2	S185 O											
CO	Lamar							9	1	Mod P					
CO	Steamboat Springs							10	1	Mod P					
CT	Greater Connecticut	2532	8	Ser O				124	1	Mod P					
DC-MD-VA	Washington	4545	16	Sev5 O											
DE	Sussex County	157	1	Mar O											
GA	Atlanta	3699	13	Sev5 O											
GU	Piti Power Plant										1	1	P S		
GU	Tanguisson Power Plant										1	1	P S		
ID	Bonner County (Sandpoint)							37	1	Mod P					
ID	Pocatello							66	2	Mod P					
ID								1	2	Mod P					
ID	Shoshone County							10	1	Mod P					

ID								2	1	Mod P					
IL-IN	Chicago-Gary-Lake County	8758	10	Sev7 O				109	1	Mod P	485	1	P S		
IL-IN								3	1	Mod P					
LA	Baton Rouge	636	5	Sev5 O											
MA	Springfield (W. Mass)	815	4	Ser O											
MA-NH	Boston-Lawrence-Worcester (E. Mass)	5883	12	Ser O											
MD	Baltimore	2512	6	Sev5 O											
MD	Kent County and Queen Anne's County	60	2	Mar O											
ME	Knox County and Lincoln County	73	2	Mod O											
ME	Lewiston-Auburn	221	2	Mod O											
ME	Portland	488	3	Mod O											
MO	Liberty and Arcadia (Iron County)													6	1 L
MO-IL	St. Louis													2	1 L
MT	Billings/Laurel										6	1	P S		
MT	Butte							35	1	Mod P					
MT	Columbia Falls (Flathead County)							4	1	Mod P					
MT	East Helena										2	1	P,S S	2	1 L
MT	Kalispell (Flathead County)							15	1	Mod P					
MT	Lame Deer							1	1	Mod P					
MT	Libby							3	1	Mod P					
MT	Missoula				52	1	M<12.7 C	52	1	Mod P					
MT	Polson (Lake County)							4	1	Mod P					
MT	Ronan (Lake County)							3	1	Mod P					
MT	Thompson Falls							1	1	Mod P					
MT	Whitefish (Flathead County)							5	1	Mod P					
NH	Cheshire County	74	1	Inc O											
NH	Manchester	365	3	Mar O											

NH	Portsmouth-Dover-Rochester	192	2	Ser O											
NJ	Atlantic City	355	2	Mod O											
NM	Anthony							3	1	Mod P					
NM	Sunland Park	10	1	Mar O											
NV	Lake Tahoe Nevada				29	3	NC C								
NV	Las Vegas				479	1	Ser C	1376	1	Ser P					
NV	Reno	339	1	Mar O	179	1	M<12.7 C	339	1	Ser P					
NY	Albany-Schenectady-Troy	892	6	Mar O											
NY	Buffalo-Niagara Falls	1170	2	Mar O											
NY	Essex County; Whiteface Mountain	0	1	Mar O											
NY	Jefferson County	112	1	Mar O											
NY	Poughkeepsie	600	3	Mod O											
NY-NJ-CT	New York-N. New Jersey-Long Island	19171	24	Sev7 O				1537	1	Mod P					
OH	Cleveland-Akron-Lorain										1095	1	P S		
OH	Toledo										455	1	P S		
OH-KY	Cincinnati-Hamilton	1514	4	Mod O											
OH-PA	Youngstown-Warren-Sharon	120	1	Mar O											
OR	Eugene-Springfield							179	1	Mod P					
OR	LaGrande							12	1	Mod P					
OR	Lakeview							3	1	Mod P					
OR	Medford							78	1	Mod P					
OR	Oakridge							3	1	Mod P					
OR	Salem	345	2	Inc O	135	2	NC C								
PA	Altoona	129	1	Mar O											
PA	Crawford County	90	1	Inc O											
PA	Erie	281	1	Mar O											
PA	Franklin County	129	1	Inc O											
PA	Greene County	41	1	Inc O											
PA	Harrisburg-Lebanon-	629	4	Mar O											

	Carlisle														
PA	Johnstown	233	2	Mar o											
PA	Juniata County	23	1	Inc o											
PA	Lancaster	471	1	Mar o											
PA	Lawrence County	95	1	Inc o											
PA	Northumberland County	95	1	Inc o											
PA	Pike County	46	1	Inc o											
PA	Pittsburgh-Beaver Valley										406	1	P S		
PA											5	1	P S		
PA	Schuylkill County	150	1	Inc o											
PA	Scranton-Wilkes-Barre	763	5	Mar o											
PA	Snyder County	38	1	Inc o											
PA	Susquehanna County	42	1	Inc o											
PA	Warren County	44	1	Inc o							17	1	P,S S		
PA											4	1	P S		
PA	Wayne County	48	1	Inc o											
PA	York	473	2	Mar o											
PA-DE-NJ-MD	Philadelphia-Wilmington-Trenton	6311	14	Sev5 o											
PA-NJ	Allentown-Bethlehem-Easton	740	4	Mar o							102	1	P,S S		
PR	Guaynabo County							92	1	Mod P					
RI	Providence (all of RI)	1048	5	Ser o											
TX	Beaumont-Port Arthur	385	3	Mod o											
TX	Dallas-Fort Worth	4590	4	Ser o											
TX	El Paso	680	1	Ser o	62	1	M<12.7 C	564	1	Mod P					
TX	Houston-Galveston-Brazoria	4670	8	Sev7 o											
UT	Ogden							77	1	Mod P					
UT	Provo				119	1	M>12.7 C	369	1	Mod P					
UT	Salt Lake City							898	1	Mod P	898	1	P,S S		
UT	Tooele County										41	1	P,S S		
VA	Smyth County; White Top	0	1	Mar o											

	Mountain														
WA	Spokane				323	1	Ser C	205	1	Mod P					
WA	Wallula							0	1	Ser P					
WA	Yakima							64	1	Mod P					
WI	Milwaukee-Racine	1839	6	Sev7 O											
WV	New Manchester-Grant Mag. Dis (Hanc										9	1	P S		
WV	Weirton							15	2	Mod P	17	1	P,S S		
WV-KY	Huntington-Ashland										50	1	P S		
WY	Sheridan							16	1	Mod P					

See Criteria Pollutant Area Detail Report

Note: The attainment status of Ada County (Boise, Idaho area for PM-10 is on hold pending the approval of a concent decree.

A blank line after an area name indicates the information is for the last listed area name.

Those areas designated nonattainment were also classified as follows:

Ozone Classifications

Ext = Extreme
Area has a design value of 0.280 ppm and above.
Sev7 = Severe 17
Area has a design value of 0.190 up to 0.280 ppm and has 17 years to attain.
Sev5 = Sever 15
Area has a design value of 0.180 up to 0.190 ppm and has 15 years to attain.
Ser = Serious
Area has a design value of 0/160 up to 0.180 ppm.
Mod = Moderate
Area has a design value of 0.138 up to 0.160 ppm.
Mar = Marginal
Area has a design value of 0.121 up to 0.138 ppm.

Some area's classification have been adjusted.

Other

On July 10, 1998 (63 FR 37258), EPA published the final rule redesignating the San Francisco Bay Area to nonattainment with the federal 1-hour ozone NAAQS. EPA did not assign the Bay Area a classification. Then on July 22, 1999 (64 CF 39416) EPA published a final rule assigning the area a nonattainment classification on moderate for purposes of funding appropriation under the Transportation Equity Act for the 21st Century (TEA 21), Congestion Mitigation and Air Quality Improvement Program (CMAQ) only.

Kansas City was the only area classified submarginal (listed under other), but it has been redesignated attainment. This category includes areas that violate the ozone standard and have a design value of less than 0.121 parts per million. This occurs when there is higher than the ozone standard exceedance rate of 1.0 per year even though the estimated design value is less than the level of the standard.

S185 = Section 185A of the Clean Air Act (Previously called Transitional)
An area designated as an ozone nonattainment area as of the date of enactment of the Clean Air Act Amendments of 1990 and has not violated the national primary ambient air quality standard for ozone for the 36-month period commencing on January 1, 1987 and ending on December 31, 1989. Twelve areas were classified transitional in 1991. Section 185A of the Clean Air Act. "Transitional Area" lists the requirements for these areas.

Inc = Incomplete (or No) Data
An area designated as an ozone nonattainment area as of the date of enactment of the Clean Air Act Amendments of 1990 and did not have sufficient data to determine if it is or is not meeting the ozone standard.

Carbon Monoxide Classifications

Ser = Serious
Area has a design value of 16.5 ppm and above.

Moderate
Area has a design value of 9.1 up to 16.4 ppm.

M>12.7
Moderate Greater than 12.7 ppm

M<12.7

Moderate Less than or equal to 12.7 ppm.

NC = Not Classified
An area designated as a carbon monoxide nonattainment area as of the date of enactment of the Clean Air Act Amendments of 1990 and did not have sufficient data to determine if it is meeting or is not meeting the carbon monoxide standard.

Partiulate Matter Classifications

Ser = Serious
Mod = Moderate

Sulfur Dioxide Classifications

P = Primary Standard
S = Secondard Standard

All areas of the nation are attainment for nitrogen dioxide.

Wind- Maximum Speed- (MPH)

See Table Notes for explanation.

DATA THROUGH 2002		YRS	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC		ANN	
			DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP	DR	SP
..BIRMINGHAM AP,AL		39	W	49	SE	59	SW	65	SW	56	NW	65	SW	56	SW	57	NW	50	SE	50	W	43	N	52	SE	41	SW	65
HUNTSVILLE, AL		35	26	44	08	43	12	46	18	44	24	46	24	56	10	52	02	63	23	43	01	43	27	40	30	40	02	63
MOBILE, AL		44	18	44	23	46	10	40	01	44	32	51	16	45	21	60	14	63	09	63	36	46	17	38	22	43	14	63
MONTGOMERY, AL		17	30	32	26	38	28	46	32	39	36	35	29	44	26	35	10	44	70	35	08	52	30	39	30	35	08	52
ANCHORAGE, AK	(G)	23	E	64	NE	61	NE	75	SE	43	S	43	SE	46	SE	40	N	44	S	48	S	55	NE	55	SE	55	NE	75
ANNETTE, AK		50	16	58	16	50	14	48	14	60	14	44	16	44	16	35	16	40	11	51	16	55	13	51	16	58	14	60
BARROW, AK	(G)	22	E	58	SW	74	E	56	26	51	NE	41	W	43	W	55	27	55	SW	66	W	54	E	53	SW	61	SW	74
BARTER IS.,AK	(G)	9	W	75	W	69	W	66	E	49	W	56	E	53	W	48	NW	58	E	58	W	69	E	61	W	70	W	75
BETHEL, AK	(G)	23	S	61	NE	59	S	56	S	51	S	53	S	59	S	46	NW	56	SE	69	S	77	W	66	S	67	S	77
BETTLES,AK		10	11	30	08	25	08	29	23	28	11	31	01	28	24	30	25	32	24	25	24	25	26	38	24	40	24	40
BIG DELTA,AK		29	29	74	18	67	20	63	18	60	20	55	16	51	18	63	16	47	18	66	18	58	11	56	11	63	29	74
COLD BAY,AK		47	17	71	16	73	15	71	15	61	14	60	11	63	17	54	16	64	17	75	21	60	14	66	11	64	17	75
FAIRBANKS, AK		51	25	31	26	36	22	40	24	32	23	32	25	40	27	32	27	34	08	33	25	40	25	35	24	37	22	40
GULKANA,AK		9	04	52	16	44	15	35	18	46	19	35	15	38	15	40	16	30	16	36	19	46	19	33	16	49	04	52
HOMER, AK		30	28	39	07	39	20	35	90	38	11	44	90	35	16	29	28	32	36	49	80	41	08	44	40	69	40	69
JUNEAU, AK		32	12	45	12	46	11	40	11	40	12	40	12	35	12	32	12	38	12	48	12	49	11	58	11	55	11	58
KING SALMON, AK	(G)	23	E	69	E	69	E	62	S	59	S	63	E	58	E	47	SW	56	E	71	E	67	E	67	E	66	E	71
KODIAK, AK	(G)	23	NW	75	NW	67	NW	82	E	67	W	59	NE	52	NW	52	NW	67	NW	78	NW	70	W	82	NW	83	NW	83
KOTZEBUE, AK	(G)	23	E	72	E	63	E	66	80	56	NE	49	SE	46	SE	45	S	53	NE	54	SE	60	SE	63	E	68	E	72
MCGRATH, AK	(G)	23	S	59	SW	47	SE	46	S	46	S	45	NW	62	S	46	S	49	S	49	E	40	S	53	SW	52	NW	62
NOME, AK		45	09	54	04	51	02	44	05	45	09	44	04	35	24	35	15	41	18	44	20	52	24	55	05	54	24	55
ST. PAUL ISLAND, AK	(G)	23		63	N	72	N	67	SE	67	SW	74	S	53	SE	47	N	58	N	61	W	70	SW	84	E	79	SW	84
TALKEETNA, AK		35	04	38	03	35	03	39	34	29	18	32	19	29	17	22	40	28	30	35	20	32	02	31	36	35	03	39
UNALAKLEET, AK	(G)	6	E	63	E	71	E	60	E	43	E	46	E	37	SW	39	S	44	S	45	SE	53	E	62	E	61	E	71

VALDEZ, AK	(G)	23	N	94	NE	83	NE	82	N	55	N	44	W	38	N	41	N	56	SW	69	NE	66	N	77	N	75	N	94
YAKUTAT, AK	(G)	23	SE	81	SE	62	SE	64	SE	64	SE	48	SE	45	SE	44	SE	60	SE	63	SE	60	SE	70	SE	63	SE	81
FLAGSTAFF, AZ		18	SW	38	SW	34	21	38	SW	40	SW	46	SW	35	NW	39	SW	30	W	33	40	38	SW	39	NE	38	SW	46
PHOENIX, AZ		17	25	36	26	30	24	43	30	51	11	35	40	33	13	43	14	37	15	39	24	36	25	30	29	39	30	51
TUCSON, AZ		54	E	40	E	59	SE	41	SW	46	SE	43	SE	50	SE	71	NE	54	SE	54	SE	47	E	55	W	44	SE	71
WINSLOW, AZ		37	23	56	22	63	22	61	25	56	25	53	20	52	16	59	21	45	31	45	22	49	22	46	22	52	22	63
YUMA, AZ		40	NW	41	W	50	N	43	NW	47	NW	38	SW	42	NE	61	SE	60	E	57	S	47	N	47	W	47	NE	61
FORT SMITH, AR		20	30	43	30	39	34	45	26	45	30	49	28	57	09	51	09	46	31	45	29	51	26	40	22	44	28	57
LITTLE ROCK, AR		41	S	44	SW	57	SE	56	NW	65	NW	61	NE	60	NW	56	NW	54	NW	50	SSW	58	SW	49	SW	48	NW	65
NORTH LITTLE ROCK, AR		3	NW	25	SW	25	S	28	NE	30	SW	30	NE	21	W	30	W	28	NE	24	SE	24	SW	27	SW	25	NE	30
BAKERSFIELD, CA		53	19	36	13	49	17	40	29	40	32	40	15	41	29	25	14	33	14	35	08	38	30	35	13	46	13	49
BISHOP, CA	(G)	17		60	W	63		58		62		62		54		60		70		47		52		66		68		70
BLUE CANYON, CA		33	20	67	17	76	07	67	20	50	23	37	07	49	09	32	07	30	09	49	05	70	19	54	07	51	17	76
EUREKA, CA.		83	S	54	SW	48	SW	48	N	49	NW	40	NW	39	N	35	N	34	N	44	SW	56	S	55	S	56	SW	56
FRESNO, CA		24	14	39	13	36	29	30	29	36	32	32	29	28	32	23	31	28	31	29	31	26	28	30	14	29	14	39
LONG BEACH, CA		33	17	37	18	40	11	39	29	44	27	30	29	24	18	23	16	23	10	26	30	37	25	44	32	39	29	44
LOS ANGELES AP, CA	(G)	52	NE	51	N	57	W	62	N	59	W	49	W	40	SW	31	SE	33	E	39	W	46	W	60	NW	49	W	62
LOS ANGELES C.O., CA		40	N	49	NW	40	NW	47	NW	40	NW	39	N	32	W	21	E	24	NW	27	N	48	N	42	SE	44	N	49
MOUNT SHASTA, CA		6	34	23	36	22	35	21	34	24	32	21	31	18	36	20	34	15	35	20	30	17	34	20	32	21	34	24
REDDING, CA	(G)	16	S	70	S	64	S	74	S	47	S	54	N	60	N	36	S	46		44	S	66	S	58	S	85	S	85
SACRAMENTO, CA		53	SE	60	SE	51	S	66	SW	45	SW	74	SW	47	SW	36	SW	38	NW	42	SE	68	SE	70	SE	70	SW	74
SAN DIEGO, CA		58	SE	56	S	45	SW	46	S	37	S	30	S	26	NW	23	NW	23	S	31	N	31	SE	51	NW	39	SE	56
SAN FRANCISCO AP, CA		53	16	58	22	55	26	46	18	47	26	46	28	44	28	40	26	37	28	38	25	44	18	51	22	54	16	58
SAN FRANCISCO C.O., CA		36	SE	47	SW	47	S	44	W	38	W	38	W	40	W	38	W	34	W	32	SE	43	S	41	SE	45	SE	47
SANTA MARIA, CA		13	13	36	13	46	16	35	30	44	30	35	29	36	29	32	29	30	29	32	17	37	26	31	16	36	13	46
STOCKTON, CA		39	14	46	16	41	33	39	35	37	35	41	29	35	27	31	26	30	34	33	33	37	15	47	15	44	15	47
ALAMOSA, CO	(G)	19	SW	58	23	62	23	60	24	71	22	63	20	69	30	66	34	51	SW	54	W	62	21	63	26	54	24	71
COLORADO SPRINGS, CO		52	29	55	28	61	29	60	28	61	27	52	20	55	22	49	34	45	30	44	27	59	34	52	27	60	28	61
DENVER, CO		14	32	44	30	36	30	41	33	46	36	43	21	38	29	46	33	33	29	36	01	36	36	36	32	38	33	46
GRAND JUNCTION, CO		23	25	36	20	41	34	53	27	49	20	46	30	57	35	45	24	45	28	49	21	44	31	39	26	35	30	57
PUEBLO, CO		18	29	51	29	46	36	52	35	52	35	60	29	48	30	58	22	48	01	46	30	47	04	48	27	47	35	60
BRIDGEPORT, CT		42	34	67	34	65	08	58	32	55	34	50	35	39	29	40	04	58	18	74	09	58	14	58	25	53	18	74
HARTFORD, CT		17	24	46	30	46	30	43	05	41	28	39	36	45	27	39	18	40	17	43	29	38	17	44	26	41	24	46
WILMINGTON, DE		54	15	51	29	46	28	45	33	46	24	48	34	43	27	48	35	46	07	40	20	58	16	46	32	46	20	58
WASHINGTON DULLES AP, D.C.		39	20	39	30	37	28	44	32	46	35	40	31	55	30	48	34	43	25	35	29	38	29	35	30	40	31	55
WASHINGTON NAT'L AP, D.C.		17	29	41	33	39	33	44	31	39	32	46	31	49	50	47	34	37	32	39	23	39	32	37	34	38	31	49
APALACHICOLA, FL		48	E	48	E	42	E	54	SE	51	SE	47	E	55	N	63	NE	59	E	67	NW	56	SE	47	SE	42	E	67
DAYTONA BEACH, FL		54	26	43	20	44	24	58	18	46	28	46	33	40	25	40	11	50	11	58	05	53	50	39	34	40	24	58
FORT MYERS, FL		51	25	40	25	39	35	46	20	39	32	44	31	48	18	45	25	44	05	92	23	45	30	32	33	35	05	92
JACKSONVILLE, FL		22	30	38	30	39	22	44	32	46	29	34	28	39	26	57	11	38	25	36	21	31	33	38	31	40	26	57
KEY WEST, FL		26	27	41	12	57	22	54	01	58	13	46	18	40	12	33	19	41	12	43	35	46	12	47	26	39	01	58
MIAMI, FL		45	24	46	19	55	04	46	24	35	32	52	13	37	25	43	12	86	06	69	90	59	07	38	32	38	12	86

ORLANDO, FL		53	25	42	25	46	24	46	02	50	35	51	32	64	14	46	32	50	24	46	05	48	26	46	20	35	32	64
PENSACOLA, FL		30	31	40	13	40	16	39	32	35	12	39	29	46	20	37	20	40	16	54	22	39	21	35	20	36	16	54
TALLAHASSEE, FL		43	23	46	09	40	27	48	19	35	29	40	03	44	22	39	02	58	08	46	20	32	16	40	28	37	02	58
TAMPA, FL		50	32	44	32	50	29	43	28	44	36	46	31	67	32	58	11	38	34	56	21	40	25	40	36	45	31	67
WEST PALM BEACH, FL		53	29	48	11	48	27	51	32	55	27	45	09	71	34	46	13	86	36	58	16	74	10	39	36	38	13	86
ATHENS, GA		47	25	52	20	52	24	50	23	47	31	35	18	43	13	35	35	47	15	37	05	35	24	41	10	48	25	52
ATLANTA, GA		26	23	46	29	52	31	49	30	44	27	54	24	51	30	60	32	41	27	37	09	35	29	39	30	33	30	60
AUGUSTA,GA		51	25	40	30	40	23	52	32	39	28	48	08	62	33	48	18	45	04	36	18	40	27	40	28	35	08	62
COLUMBUS, GA		44	29	46	20	52	27	44	28	40	23	39	29	55	36	52	18	47	36	38	12	40	31	37	33	35	29	55
MACON, GA		20	32	37	27	46	70	35	33	45	31	47	27	44	30	44	12	38	36	37	18	33	30	40	30	35	31	47
SAVANNAH, GA		22	31	30	09	31	32	46	23	35	22	44	05	43	04	45	34	37	10	40	31	35	23	40	30	29	32	46
HILO, HI		23	36	35	34	39	10	29	34	26	35	29	11	25	05	25	36	25	04	25	34	29	02	28	36	29	34	39
HONOLULU,HI		22	70	36	07	35	06	32	50	35	13	30	70	30	05	30	70	31	13	38	60	29	20	46	70	35	20	46
KAHULUI, HI		28	SW	44	NE	40	N	43	E	36	E	34	40	38	60	38	NE	35	E	33	E	36	SW	41	21	40	SW	44
LIHUE, HI		23	40	38	23	41	06	39	05	36	06	33	90	35	70	31	05	31	15	84	04	33	18	65	40	41	15	84
BOISE, ID		61	SE	50	W	56	W	52	W	50	W	50	SW	50	W	61	SE	56	SE	50	SE	56	NW	57	NW	56	W	61
LEWISTON, ID	(G)	31		72		64		60		58		54		54	29	59		51		59		59		59		63		72
POCATELLO, ID		51	SE	61	W	57	W	72	S	61	W	61	W	50	W	57	SW	54	W	57	SW	54	W	67	NW	57	W	72
CAIRO,IL		45	SW	50	SW	68	NW	60	SW	59	SW	63	SW	60	NW	49	S	45	SW	47	SW	40	SW	53	SW	63	SW	68
CHICAGO,IL		44	28	47	25	45	01	54	24	54	34	52	24	41	36	55	32	46	23	58	20	48	23	51	26	46	23	58
MOLINE, IL		13	29	40	26	40	23	46	26	49	30	40	24	49	27	37	20	57	26	36	26	40	26	49	22	45	20	57
PEORIA, IL		17	23	38	27	39	23	54	24	45	20	36	30	44	26	40	30	37	29	35	27	44	20	48	06	46	23	54
ROCKFORD, IL		52	27	40	22	49	25	46	11	54	27	52	20	47	30	53	29	57	20	52	21	40	20	46	06	46	29	57
SPRINGFIELD, IL		23	25	39	29	51	24	56	30	61	28	46	16	43	40	52	33	44	18	39	20	40	24	46	25	36	30	61
EVANSVILLE, IN		17	26	34	26	43	25	40	28	44	33	46	28	46	32	35	27	37	28	36	23	36	31	41	24	41	28	46
FORT WAYNE, IN		53	SW	59	W	61	S	65	W	63	S	57	SE	65	NW	61	N	55	W	52	SW	46	SW	57	SW	52	S	65
INDIANAPOLIS, IN		23	19	45	23	46	21	54	25	47	30	40	29	46	28	49	29	45	26	46	27	44	23	44	26	41	28	49
SOUTH BEND, IN		53	22	52	20	47	20	51	27	55	27	68	27	50	34	45	32	63	25	36	25	56	22	58	23	43	27	68
DES MOINES, IA		47	NW	66	W	56	S	66	W	76	W	70	NW	76	W	73	SSE	60	NW	55	W	56	W	72	SW	61	W	76
DUBUQUE,IA	(G)	19		58		52		62		68		74		55	NW	74	32	66	NW	58		54		55	E	56		74
SIOUX CITY, IA		58	NW	56	NW	54	N	61	W	68	W	80	W	91	NW	66	NW	56	S	66	W	70	NW	59	NW	53	W	91
WATERLOO, IA		42	29	46	28	44	23	46	25	52	18	52	33	60	35	58	21	46	28	38	29	43	22	53	32	39	33	60
CONCORDIA, KS		21	32	46	21	41	35	46	24	55	30	41	24	54	25	58	06	44	17	44	26	46	34	46	35	40	25	58
DODGE CITY, KS		16	34	56	34	47	35	63	21	53	30	52	29	60	36	56	32	63	14	51	34	49	20	44	32	46	32	63
GOODLAND, KS		53	34	53	36	51	33	62	29	62	27	61	33	66	30	64	23	60	34	51	27	61	33	52	34	52	33	66
TOPEKA, KS		17	31	39	31	36	18	55	08	51	34	47	34	48	34	44	27	38	32	43	23	39	31	45	30	37	18	55
WICHITA, KS		21	35	48	20	44	24	49	23	56	18	61	30	51	34	70	04	52	19	44	31	49	33	48	32	44	34	70
GREATER CINCINNATI AP		39	28	46	29	40	27	45	25	46	31	37	27	41	32	45	29	41	31	36	29	48	28	43	21	40	29	48
JACKSON, KY		21	23	37	19	39	31	33	27	43	28	39	29	31	33	32	28	37	29	26	25	28	19	30	30	30	27	43
LEXINGTON, KY		41	18	47	32	46	27	36	32	46	22	35	30	44	29	37	22	39	29	41	17	40	27	45	22	39	18	47
LOUISVILLE, KY		17	16	38	23	44	19	43	22	56	23	40	04	54	32	46	21	47	29	39	29	40	23	44	27	40	22	56
PADUCAH KY		18	30	41	25	40	19	37	24	38	24	51	29	45	34	51	10	33	18	35	24	43	21	44	22	35	34	51

BATON ROUGE, LA	40	24	39	17	39	27	38	23	39	17	48	03	40	03	41	14	46	06	58	33	40	22	33	29	60	29	60
LAKE CHARLES, LA	41	32	58	25	40	18	40	06	44	31	43	19	53	33	36	11	46	36	40	33	38	21	46	33	36	32	58
NEW ORLEANS, LA	43	27	48	26	43	16	38	10	40	36	55	25	49	13	44	33	42	09	69	17	40	22	38	28	46	09	69
SHREVEPORT, LA	40	30	41	30	43	29	54	28	52	32	63	36	46	29	46	11	40	19	44	25	37	31	46	32	43	32	63
CARIBOU, ME	13	31	36	25	41	33	37	31	33	33	37	34	35	32	32	33	28	30	26	30	40	32	41	31	39	32	41
PORTLAND, ME	17	16	38	08	45	11	41	29	40	28	37	28	35	29	37	28	57	29	33	14	37	10	41	30	44	28	57
BALTIMORE, MD	50	NE	63	W	68	SE	80	W	70	SW	65	SW	80	NW	57	NE	54	W	56	SE	73	E	58	W	57	SE	80
BLUE HILL, MA	39	S	76	S	77	ENE	72	NW	66	S	65	NW	61	NW	78	SSW	67	SSE	92	S	62	S	67	SSE	68	SSE	92
BOSTON, MA	17	17	46	08	43	06	54	28	43	24	43	28	45	26	46	08	47	23	47	04	47	11	48	05	51	06	54
WORCESTER, MA	46	25	60	32	76	29	76	05	54	31	51	25	39	31	46	36	44	32	41	25	43	20	54	23	51	32	76
ALPENA, MI	22	80	30	35	37	20	35	16	38	21	35	21	35	14	37	31	35	19	38	33	31	20	38	26	33	19	38
DETROIT, MI	23	22	48	22	51	21	46	22	47	23	43	23	37	28	53	29	35	28	35	24	47	24	45	29	49	28	53
FLINT, MI	47	26	45	28	40	27	58	24	44	32	81	29	52	29	41	27	37	27	46	25	39	23	46	27	40	32	81
GRAND RAPIDS, MI	23	24	45	24	55	25	47	24	52	26	47	24	39	26	51	31	41	18	40	24	47	23	49	24	39	19	52
HOUGHTON LAKE, MI	25	26	40	24	37	28	36	24	37	26	40	19	51	13	37	25	29	23	32	16	35	27	40	32	33	19	51
LANSING, MI	41	SW	54	SW	56	W	59	W	61	W	46	SE	63	NE	56	SW	47	N	57	SW	48	W	56	SW	56	SE	63
MARQUETTE, MI	6	NW	44	NW	31	NW	40	NW	44	N	34	NW	38	NW	35	NW	37	W	35	SE	38	NW	31	SW	35	NW	44
MUSKEGON, MI	43	31	44	34	41	25	41	22	48	27	44	24	44	33	40	26	43	20	40	22	40	23	52	23	40	23	52
SAULT STE. MARIE, MI	31	NW	47	W	47	SE	42	SE	42	E	49	S	37	SE	44	NW	35	W	43	NW	42	NW	60	NW	45	NW	60
DULUTH, MN	17	30	45	29	44	E	57	20	43	28	44	27	46	31	41	26	48	26	33	32	46	08	44	32	41	E	57
INTERNATIONAL FALLS, MN	47	30	35	26	36	29	42	23	52	20	52	18	46	29	46	30	43	34	38	30	47	27	35	31	36	23	52
MINNEAPOLIS-ST.PAUL, MN	23	32	51	34	37	32	37	18	45	22	49	33	48	35	43	20	44	29	39	31	43	25	41	32	38	32	51
ROCHESTER, MN	40	30	48	28	45	23	58	30	53	25	69	13	53	17	51	34	46	24	44	30	47	29	47	32	47	25	69
SAINT CLOUD, MN	13	1	36	30	46	30	43	30	44	27	41	32	62	22	49	22	45	32	34	31	43	30	39	31	39	32	62
JACKSON, MS	26	35	46	13	43	16	44	14	44	22	35	35	40	33	44	17	37	06	55	31	30	14	41	15	41	06	55
MERIDIAN, MS	43	33	41	02	35	34	39	19	48	17	35	22	46	40	51	34	38	02	45	02	35	19	41	80	37	40	51
TUPELO, MS	19	24	39	25	35	24	39	10	33	31	41	20	41	35	48	01	41	30	32	25	38	23	37	11	38	35	48
COLUMBIA, MO	14	NW	49	24	41	26	46	23	54	36	39	26	49	31	46	19	52	35	38	25	47	19	45	06	37	23	54
KANSAS CITY, MO	18	32	39	20	40	23	46	20	48	24	46	10	51	20	58	31	40	14	41	21	40	22	37	20	39	20	58
ST. LOUIS, MO	23	29	40	30	45	27	48	27	49	34	46	27	48	36	46	31	40	25	41	28	52	11	41	29	39	28	52
SPRINGFIELD, MO	17	NW	39	15	39	25	39	34	41	10	43	36	47	28	46	36	48	10	40	22	35	10	43	13	37	36	48
BILLINGS, MT	59	W	66	W	72	NW	61	NW	72	NN	68	NW	79	N	73	NW	69	NW	61	NW	68	NW	63	NW	66	NW	79
GLASGOW, MT	34	33	41	29	46	10	41	30	54	32	44	30	54	30	69	23	66	30	46	29	54	27	48	29	54	30	69
GREAT FALLS, MT	54	SW	65	W	72	W	73	W	70	SW	65	NW	70	W	73	SW	71	NW	73	W	73	SW	73	SW	82	SW	82
HAVRE, MT	3	29	46	24	46	27	46	28	58	10	51	27	47	28	55	25	46	33	45	26	69	33	46	29	45	26	69
HELENA, MT	62	SW	73	W	73	SW	61	W	52	SW	56	W	56	SW	65	S	65	NW	54	W	62	SW	56	NW	59	SW	73
KALISPELL, MT	36	04	52	01	40	03	41	23	43	23	40	03	38	31	38	15	43	22	36	32	38	03	35	03	52	04	52
MISSOULA, MT	57	S	52	NW	47	SW	50	NW	51	SW	57	S	51	SE	72	SW	58	16	48	SW	51	SW	42	W	56	SE	72
GRAND ISLAND, NE	40	34	54	33	53	34	55	21	52	29	59	30	68	29	59	22	52	25	40	33	51	34	51	31	52	30	68
LINCOLN, NE	30	33	48	NW	48	N	54	NW	52	W	51	NE	67	SW	52	NW	65	32	44	30	47	NW	48	34	46	NE	67
NORFOLK, NE	21	33	46	32	44	30	44	32	51	07	44	28	46	21	58	32	60	30	55	18	46	31	51	35	46	32	60
NORTH PLATTE, NE	23	31	45	36	52	02	47	28	49	31	48	32	52	24	55	31	56	30	46	31	53	29	46	02	52	31	56

OMAHA EPPLEY AP, NE		14	33	45	33	39	33	40	20	51	16	57	24	40	28	58	30	46	19	36	11	48	28	45	34	39	28	58
OMAHA (NORTH), NE		15	NW	41	NW	38	NW	38	NW	46	N	34	SW	39	SW	50	NW	39	NW	35	NW	34	NW	38	NW	37	SW	50
SCOTTSBLUFF, NE		52	34	53	29	60	29	62	31	55	32	80	29	80	05	52	35	52	32	46	31	48	29	56	32	47	32	80
VALENTINE, NE		20	32	43	30	52	33	43	30	49	33	49	29	53	26	51	20	53	31	40	29	51	30	45	31	41	20	53
ELKO, NV		39	23	40	27	39	29	41	25	48	34	55	27	61	23	45	16	35	27	58	29	35	20	40	27	50	27	61
ELY, NV		57	SE	66	S	56	SW	65	S	59	S	74	SW	63	S	50	E	57	S	57	S	65	S	51	SE	61	S	74
LAS VEGAS, NV		17	23	45	23	50	23	51	22	49	22	56	34	48	30	45	32	43	16	41	31	47	21	43	34	48	22	56
RENO, NV		13	16	45	15	44	21	49	SW	50	17	46	23	37	18	41	19	40	23	43	15	41	19	52	19	67	19	67
WINNEMUCCA, NV		51	W	56	W	59	W	66	W	52	N	61	W	57	W	56	W	51	W	57	NE	54	22	48	SW	61	W	66
CONCORD, NH		57	NW	44	N	42	NE	71	NW	52	NW	48	SW	44	SW	45	E	56	E	42	NW	39	NE	72	NW	52	NE	72
MT. WASHINGTON, NH	(G)	63	NW	173	E	166	W	180	SE	231	W	164	NW	136	NW	110	ENE	142	SE	174	W	161	NW	163	NW	178	SE	231
ATLANTIC CITY AP, NJ		43	29	47	27	43	24	46	07	46	70	40	30	41	31	41	12	35	32	60	29	41	28	47	36	55	32	60
ATLANTIC CITY C.O.,NJ		11	4	43	04	43	07	63	19	37	01	37	05	30	19	44	35	30	07	32	04	44	04	36	11	45	07	63
NEWARK, NJ		54	30	52	23	46	30	45	29	55	32	50	26	58	35	52	09	46	05	51	11	48	09	82	32	55	09	82
ALBUQUERQUE, NM		18	09	52	27	47	19	49	11	47	25	48	27	48	36	52	80	51	34	43	26	48	27	48	06	51	09	52
ROSWELL, NM		16	NW	47	NW	56	NW	52	25	49	NW	60	NW	73	19	49	NW	44	35	43	22	44	NE	65	SW	58	NW	73
ALBANY, NY		19	30	40	29	44	30	46	17	35	32	55	23	43	29	41	30	47	32	35	28	39	28	41	29	43	32	55
BINGHAMTON, NY		17	27	40	25	41	24	39	24	32	28	33	26	40	30	35	32	43	34	33	26	33	27	41	24	43	24	43
BUFFALO, NY		54	SW	91	SW	70	W	68	W	67	SW	63	NW	56	NW	59	SW	56	SW	59	SW	63	SW	66	S	60	SW	91
NEW YORK C.PARK, NY		19	7	40	08	34	8	37	80	35	30	29	08	28	35	29	30	33	90	29	33	28	32	30	05	39	7	40
NEW YORK (JFK AP), NY		39	26	52	25	46	06	46	31	46	16	44	28	43	29	51	30	46	28	47	26	44	30	44	26	49	26	52
NEW YORK (LAGUARDIA AP), NY		23	5	40	01	43	06	52	29	55	17	41	29	38	35	53	28	46	33	51	10	52	30	55	05	52	29	55
ROCHESTER, NY		17	24	45	25	59	25	55	25	41	18	45	36	39	20	52	27	40	27	68	25	43	25	46	24	45	27	68
SYRACUSE, NY		53	W	60	W	62	SE	56	NW	52	30	52	NW	49	28	54	NW	43	32	59	SE	63	E	59	W	52	SE	63
ASHEVILLE, NC		38	34	45	34	60	33	48	22	44	34	40	36	40	35	43	30	41	36	45	33	35	32	40	34	44	34	60
CAPE HATTERAS, NC		32	24	44	16	44	19	52	21	40	18	35	29	37	15	52	33	60	11	60	22	47	15	58	16	46	33	60
CHARLOTTE, NC		23	31	30	32	33	30	32	19	32	35	34	20	32	20	38	28	46	12	46	21	37	24	30	16	38	28	46
GREENSBORO-WNSTN-SALM-HGHPT,NC		22	19	41	07	38	30	49	26	37	27	62	27	43	35	50	19	30	26	46	30	46	20	38	24	34	27	62
RALEIGH, NC		49	27	41	23	45	24	46	25	40	20	54	33	39	23	69	33	46	04	53	29	73	32	35	22	40	29	73
WILMINGTON, NC		22	26	38	25	44	29	58	28	47	27	44	23	46	4	53	06	56	07	67	01	35	24	38	26	43	07	67
BISMARCK, ND		23	29	44	30	52	36	43	31	55	27	54	34	52	22	64	30	54	15	46	32	44	31	47	33	45	22	64
FARGO, ND		17	34	49	33	51	34	49	32	49	24	45	14	43	33	74	34	51	31	45	33	49	31	47	30	45	33	74
GRAND FORKS, ND		5	17	39	27	47	35	48	31	49	15	53	31	51	12	40	30	62	29	43	31	46	31	54	34	45	30	62
WILLISTON, ND		23	32	44	30	46	29	46	30	55	27	46	30	56	26	63	29	53	27	40	28	55	29	52	30	48	26	63
AKRON, OH		41	22	44	25	51	26	49	30	40	32	46	31	67	23	44	17	51	36	40	24	43	25	41	24	48	31	67
CLEVELAND, OH		25	22	53	24	45	27	46	23	44	20	42	28	41	23	43	24	39	29	35	24	46	18	40	25	46	22	53
COLUMBUS, OH		21	24	40	27	43	26	47	26	47	25	52	31	40	33	47	29	43	23	44	24	40	27	45	26	47	25	52
DAYTON, OH		17	25	43	28	45	27	49	25	49	24	54	24	43	29	61	26	33	22	43	26	43	22	44	25	46	29	61
MANSFIELD, OH		36	24	46	24	44	26	44	33	46	25	37	23	40	26	39	17	41	33	34	32	40	23	39	18	46	24	46
TOLEDO, OH		45	W	47	SW	56	W	56	SW	72	25	46	W	50	NW	54	W	47	NW	47	24	45	SW	65	30	48	SW	72
YOUNGSTOWN, OH		53	25	48	27	58	25	55	33	51	24	46	23	45	27	58	27	44	36	40	23	44	25	52	25	46	27	58
OKLAHOMA CITY, OK		21	34	45	32	45	24	52	32	67	23	53	35	48	31	74	05	46	21	52	30	43	19	46	33	44	31	74

TULSA, OK	25	18	37	20	41	18	46	34	55	30	41	04	49	19	51	29	38	27	39	25	40	29	44	33	36	34	55
ASTORIA, OR	49	17	55	19	47	18	47	20	52	22	37	18	30	19	29	20	30	17	36	20	44	20	46	25	52	17	55
EUGENE, OR	46	20	58	19	60	18	48	18	44	25	46	27	29	32	37	11	32	20	32	18	63	23	46	18	40	18	63
MEDFORD, OR	53	23	50	25	46	16	55	14	35	12	38	17	37	07	44	16	48	14	47	20	40	19	40	14	44	16	55
PENDLETON, OR	47	24	52	25	54	29	63	27	77	27	48	29	62	31	49	23	43	27	47	25	49	27	62	29	63	27	77
PORTLAND, OR	48	S	54	SW	61	S	57	S	60	SW	42	SW	40	SW	33	SW	29	S	61	S	88	SW	56	S	57	S	88
SALEM, OR	53	18	43	18	46	19	40	18	44	20	31	23	28	24	26	18	25	19	34	18	58	17	49	17	46	18	58
SEXTON SUMMIT, OR	15	16	60	19	53	21	60	20	50	20	44	18	42	35	39	20	45	12	45	14	51	19	59	20	63	20	63
GUAM, PC	38	W	64	NE	36	70	35	SW	64	NE	76	E	32	22	74	SE	43	E	35	W	44	NE	80	27	106	27	106
JOHNSTON ISLAND, PC	5	33	31	09	38	08	35	09	35	07	32	08	31	06	33	08	32	07	35	08	32	03	33	06	43	06	43
KOROR, PC	13	20	35	06	23	36	26	10	25	15	46	30	33	26	33	08	28	27	37	29	31	25	52	09	31	25	52
KWAJALEIN, MARSHALL IS., PC	42	22	55	18	35	90	39	08	37	11	44	12	41	09	41	70	44	07	44	20	40	12	60	09	45	12	60
MAJURO, MARSHALL IS, PC	13	06	36	70	35	07	25	07	26	07	25	09	29	23	30	32	29	22	29	06	33	22	31	09	35	06	36
PAGO PAGO, AMER SAMOA, PC	23	34	46	36	63	32	37	35	35	08	35	08	43	09	32	17	33	06	38	18	35	09	39	21	81	21	81
POHNPEI, CAROLINE IS., PC	14	29	28	10	21	23	20	29	26	10	23	90	18	30	18	25	32	23	21	22	23	24	35	27	23	24	35
CHUUK, E. CAROLINE IS., PC	13	34	30	50	28	33	33	8	29	09	29	40	29	24	33	23	39	21	32	22	35	24	35	24	46	24	46
WAKE ISLAND, PC	8	08	39	02	36	06	37	06	38	09	30	08	28	10	41	19	51	16	30	08	33	07	40	03	39	19	51
YAP, W CAROLINE IS., PC	13	05	23	04	23	12	39	13	23	08	20	23	23	28	28	22	25	09	23	16	26	09	36	26	41	26	41
ALLENTOWN, PA	54	29	55	25	58	29	58	29	60	30	58	27	81	27	55	23	58	25	46	14	49	30	58	29	52	27	81
ERIE, PA.	45	20	53	29	52	14	55	21	46	25	37	36	37	32	46	25	36	17	45	24	43	31	41	24	40	14	55
HARRISBURG, PA	10	27	44	30	35	28	37	28	35	29	47	33	58	29	35	35	46	28	31	25	30	31	40	31	46	33	58
MIDDLETOWN/HARRISBURG INTL APT	20	34	46	29	51	29	46	33	46	29	47	33	58	16	52	29	49	28	40	32	37	33	40	31	46	33	58
PHILADELPHIA, PA	60	NE	61	NW	59	NW	56	SW	59	SW	56	NW	73	SW	49	E	67	NE	49	SW	66	SW	60	NW	48	NW	73
PITTSBURGH, PA	50	23	52	26	58	25	48	30	51	30	48	34	53	25	51	29	46	20	38	31	39	29	45	25	48	26	58
AVOCA, PA	45	SW	52	W	60	S	49	NW	47	SW	46	W	43	NW	43	NE	50	SW	47	E	40	NW	49	SW	47	W	60
WILLIAMSPORT, PA	49	27	66	14	60	11	58	18	62	18	55	29	62	20	78	29	60	16	59	11	75	09	77	16	58	20	78
BLOCK IS.,RI	12	27	36	36	46	05	45	04	29	15	29	18	28	30	28	04	29	16	53	08	37	28	38	25	40	16	53
PROVIDENCE, RI	49	20	46	16	46	18	60	20	51	20	42	20	40	14	39	11	90	18	58	14	41	18	52	14	48	11	90
CHARLESTON AP,SC	27	20	40	30	38	21	46	20	38	24	33	17	44	28	40	27	38	21	52	21	39	15	37	24	39	21	52
COLUMBIA, SC	49	28	46	20	40	27	60	33	44	28	47	27	47	32	40	30	48	30	48	27	29	35	35	26	41	27	60
GREENVILLE-SPARTANBURG AP, SC	12	25	36	22	37	25	39	29	39	36	43	30	43	17	49	24	36	23	30	12	31	25	32	35	29	17	49
ABERDEEN, SD	33	34	58	06	52	35	52	31	55	16	46	10	47	31	63	33	46	32	41	33	49	34	46	33	43	31	63
HURON, SD	60	NW	57	NW	56	NW	68	SE	73	NW	70	SE	65	NW	77	NW	72	NW	64	W	72	NW	73	NW	59	NW	77
RAPID CITY, SD	19	32	59	33	59	33	54	32	61	32	57	25	54	21	69	32	54	32	52	32	55	33	57	33	52	21	69
SIOUX FALLS, SD	54	32	47	31	45	02	60	31	51	11	46	23	70	36	69	31	58	16	50	27	60	36	52	36	46	23	70
BRISTOL-JHNSN CTY-KNGSPRT,TN	47	25	40	25	46	25	40	25	41	32	50	27	39	23	40	34	46	31	29	27	36	26	37	24	40	32	50
CHATTANOOGA, TN	27	31	30	25	37	32	44	18	32	18	35	24	37	30	44	06	43	29	33	29	35	30	38	22	29	30	44
KNOXVILLE, TN	28	27	43	25	39	24	43	28	64	20	40	07	35	24	43	30	38	24	29	26	43	25	49	20	39	28	64
MEMPHIS, TN	23	34	35	24	38	16	40	24	46	34	40	29	51	34	37	30	37	36	39	28	40	23	40	30	36	29	51
NASHVILLE, TN	27	26	38	20	36	13	41	25	40	36	41	10	38	36	38	02	40	34	33	17	35	15	39	23	41	13	41
ABILENE, TX	22	19	38	31	45	27	41	27	55	31	54	21	49	30	48	19	55	35	43	31	46	33	39	32	40	27	55
AMARILLO, TX	28	25	45	25	48	34	58	25	53	13	47	35	60	30	48	02	46	80	41	31	58	31	46	32	51	35	60

AUSTIN/CITY, TX		23	35	37	34	39	33	36	27	46	20	52	34	41	28	40	03	35	02	52	35	33	30	36	31	44	20	52
AUSTIN/BERGSTROM, TX		61	29	73	23	59	20	73	25	60	32	78	29	80	11	62	36	66	02	63	36	51	32	62	34	76	29	80
BROWNSVILLE, TX		23	18	40	23	36	28	44	17	41	17	38	30	41	12	36	19	48	30	51	36	35	17	39	17	38	30	51
CORPUS CHRISTI, TX		26	30	43	06	45	17	45	30	45	10	56	01	41	02	46	11	55	30	49	28	49	90	41	18	38	10	56
DALLAS-FORT WORTH, TX		49	36	55	36	51	29	55	32	55	14	55	32	52	36	65	36	73	11	53	23	46	34	50	32	53	36	73
DALLAS-LOVE FIELD, TX		3	30	41	17	40	29	47	35	43	28	47	16	40	02	35	33	35	10	35	14	43	03	38	33	45	29	47
DEL RIO, TX		23	31	45	31	39	33	52	15	41	32	48	28	51	16	39	14	60	32	45	33	46	32	36	29	43	14	60
EL PASO, TX		27	26	64	24	51	28	52	26	56	25	45	32	51	30	45	26	54	35	41	23	41	23	52	26	44	26	64
GALVESTON, TX		124	S	53	N	60	SE	50	NW	68	W	66	SE	62	NW	68	E	91	NE	100	SE	66	NW	72	NW	50	NE	100
HOUSTON, TX		33	33	32	26	46	25	35	14	45	23	46	30	45	10	46	08	51	05	37	27	41	33	37	14	46	08	51
LUBBOCK, TX		54	28	59	25	58	34	69	25	58	36	70	05	63	25	64	30	46	36	45	25	65	25	59	25	58	36	70
MIDLAND-ODESSA, TX		49	28	44	25	67	27	53	30	53	20	52	24	58	05	58	16	55	23	53	14	46	25	48	26	47	25	67
PORT ARTHUR, TX		23	06	39	16	39	10	43	30	46	29	52	14	55	05	44	01	44	06	38	33	36	34	38	25	41	14	55
SAN ANGELO, TX		54	26	45	29	48	27	58	28	75	02	60	02	57	17	46	02	44	34	52	29	60	29	66	30	43	28	75
SAN ANTONIO, TX		26	29	39	31	42	33	46	35	39	28	46	90	38	09	48	11	39	25	43	31	35	33	37	33	33	09	48
VICTORIA, TX	(G)	19	N	49	N	54	N	54	N	62	N	68	N	60	E	54	N	54	S	44	NW	75	N	55	N	45	NW	75
WACO, TX		54	32	49	36	58	27	65	36	62	36	60	09	69	36	60	05	60	32	60	34	52	29	62	32	52	09	69
WICHITA FALLS, TX		54	32	49	29	57	27	59	14	52	20	59	36	69	33	60	34	55	01	53	29	60	32	56	29	55	36	69
MILFORD, UT		18	SW	44	W	56	SW	52	SW	52	SW	57	SW	57	NW	45	SW	52	SW	47	NW	45	SW	56	SW	53	SW	57
SALT LAKE CITY, UT		66	NW	59	SE	56	NW	71	NW	57	NW	57	W	63	NW	51	SW	58	W	61	NW	67	NW	63	S	54	NW	71
BURLINGTON, VT		19	16	38	17	39	16	33	33	36	29	35	29	39	30	37	36	35	19	36	13	32	18	35	27	35	29	39
LYNCHBURG, VA		58	W	45	S	50	S	43	NE	43	N	56	SW	56	NW	43	W	48	NE	40	N	41	NW	43	SE	45	N	56
NORFOLK, VA		30	20	43	36	44	22	46	02	41	70	40	30	46	34	46	35	46	30	46	04	48	21	40	01	39	04	48
RICHMOND, VA		17	22	38	23	39	27	41	33	46	23	46	26	45	23	40	36	44	10	40	10	37	23	36	15	40	33	46
ROANOKE, VA		41	30	53	31	40	32	52	32	58	36	46	28	46	34	46	30	44	10	38	30	36	34	52	30	40	32	58
WALLOPS ISLAND, VA		16	NNE	70	SSW	66	W	68	NE	69	S	52	W	69	WNW	67	WNW	75	WNW	70	W	60	WNW	60	E	73	WNW	75
OLYMPIA, WA		54	18	55	18	45	23	40	23	46	29	39	25	32	18	29	27	26	18	35	23	58	18	60	16	45	18	60
QUILLAYUTE, WA		34	21	35	SE	46	23	38	SW	32	W	28	SE	23	NE	23	SE	27	SE	33	SE	42	SE	37	SW	39	SE	46
SEATTLE C.O., WA	(G)	11	SSE	51	SSW	40	WSW	54	SW	44	WSW	46	SW	37	SW	39	S	33	S	33	SSW	41	SSW	63	SW	46	SSW	63
SEATTLE SEA-TAC AP, WA		34	S	47	S	51	SW	44	SW	38	SW	32	SW	29	SW	26	SW	29	20	36	SW	38	S	66	S	49	S	66
SPOKANE, WA		53	SW	59	SW	54	SW	54	SW	52	W	49	SW	44	SW	43	SW	50	SW	38	SW	56	SW	54	SW	51	SW	59
YAKIMA, WA		48	25	44	28	48	23	48	29	46	18	46	20	47	24	43	20	37	30	38	31	41	29	45	23	48	28	48
SAN JUAN, PR		17	50	28	06	29	07	32	60	31	60	28	12	35	32	49	04	34	05	79	40	37	36	33	70	30	05	79
BECKLEY, WV		39	24	46	26	40	27	58	27	44	24	41	27	40	36	46	32	40	30	46	26	32	16	44	28	41	27	58
CHARLESTON, WV		53	25	45	19	40	32	46	27	45	25	55	32	50	29	46	29	50	20	35	25	45	29	40	25	55	25	55
ELKINS, WV		19	27	46	25	55	32	46	27	50	30	46	27	40	30	37	32	40	26	35	29	46	30	33	27	40	25	55
HUNTINGTON, WV		40	26	43	26	41	25	37	18	44	29	47	24	35	34	35	24	35	34	29	30	38	23	35	26	36	29	47
GREEN BAY, WI		17	40	39	27	37	29	44	22	41	29	46	16	41	24	36	28	35	32	37	28	36	20	45	26	38	29	46
LA CROSSE, WI		21	32	45	34	37	34	40	25	53	09	58	34	63	27	52	32	63	27	40	34	39	18	46	34	43	34	63
MADISON, WI		53	E	68	W	57	SW	70	SW	73	SW	77	W	59	NW	72	W	47	W	52	SW	73	SE	56	SW	65	SW	77
MILWAUKEE, WI		20	80	44	27	52	26	41	24	48	30	46	31	47	30	54	02	47	70	41	24	43	23	52	04	40	30	54
CASPER, WY		49	20	58	23	58	25	81	25	54	32	58	26	54	25	52	25	50	32	53	25	55	25	51	20	63	25	81

CHEYENNE, WY	21	25	55	27	59	28	52	30	58	26	48	29	71	25	46	25	56	28	48	26	53	27	59	27	63	29	71
LANDER, WY	13	26	44	20	46	23	68	25	62	17	52	19	53	22	47	18	39	20	52	26	55	27	44	24	55	23	68
SHERIDAN, WY	17	30	53	24	45	31	49	30	61	31	60	31	47	20	52	32	58	31	46	29	46	32	55	31	48	31	60

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