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Gambusia affinis - (Baird and Girard, 1853)
Western Mosquitofish
Unique Identifier: AFCNC02010
Informal Taxonomy: Animals, Vertebrates - Fishes - Bony Fishes - Other Bony Fishes

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Kingdom	Phylum	Class	Order	Family	Genus
Animalia	Craniata	Actinopterygii	Cyprinodontiformes	Poeciliidae	Gambusia

Genus Size: D - Medium to large genus (21+ species)
Concept Reference: Robins, C. R., et al. 1991. Common and scientific names of fishes from the United States and Canada. American Fisheries Society, Special Publishing 20. 183 pp.
Concept Reference Code: B91ROB01NAUS
Name Used in Concept Reference: *Gambusia affinis*
Taxonomic Comments: GAMBUSIA HOLBROOKI from east of the Mobile River formerly was regarded as a subspecies of G. AFFINIS; HOLBROOKI was elevated to full species status by Wooten et al. (1988); this change was adopted in the 1991 AFS checklist (Robins et al. 1991). Page and Burr (1991) retained HOLBROOKI as a subspecies of AFFINIS, noting intergradation in the Mobile Bay basin. GAMBUSIA AFFINIS apparently hybridizes/intergrades with G. HOLBROOKI in some sites in the Chattahoochee and Savannah river drainages (Lydeard et al. 1991).

Member of subgenus ARTHROPHALLUS, AFFINIS species group (Rauchenberger 1989). See Rauchenberger (1989) for a study of the interrelationships of the subgenera and species groups within the genus GAMBUSIA. Some southwestern populations of G. AFFINIS were regarded as a distinct species, G. SPECIOSA, by Rauchenberger (1989); Robins et al. (1991) viewed them as, at most, a subspecies of AFFINIS.

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Conservation Status

NatureServe Status

Global Status: G5
Global Status Last Reviewed: 20Sep1996
Global Status Last Changed: 20Sep1996
Rounded Global Status: G5

Nation: United States
National Status: N5

Nation: Canada
National Status: NNR

U.S. & Canada State/Province Status

United States	Alabama (S5), Arizona (SNA), Arkansas (S4), California (SNA), Colorado (SNA), Florida (SNR), Idaho (SNA), Illinois (S4S5), Indiana (SNA), Iowa (SNA), Kansas (SNA), Kentucky (S4S5), Louisiana (S5), Michigan (SNA), Mississippi (S5), Missouri (SNR), Montana (SNA), Navajo Nation (SNA), Nebraska (SNA), Nevada (SNA), New Jersey (SNA), New Mexico (SNA), North Carolina (SNA), Oklahoma (S5), Oregon (SNA), Tennessee (S5), Texas (S5), Utah (SNA), Washington (SNA), Wyoming (SNA)
Canada	Alberta (SNA), Ontario (SNA)

Other Statuses

NatureServe Conservation Status Factors

Global Abundance: FH
Global Abundance Comments: "Possibly the single most abundant freshwater fish in the world" (Minckley et al. 1991).

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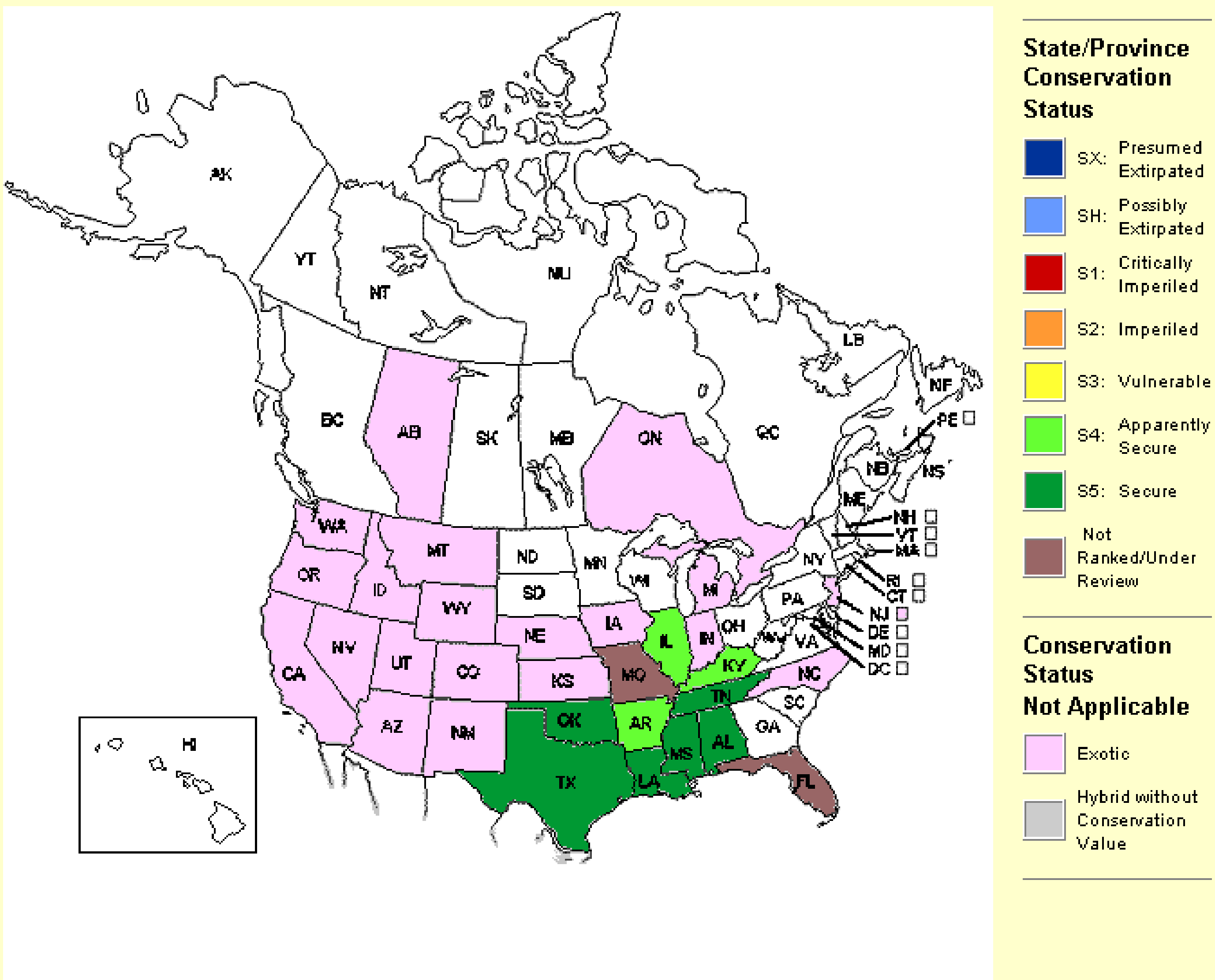
Distribution

U.S. States and Canadian Provinces



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

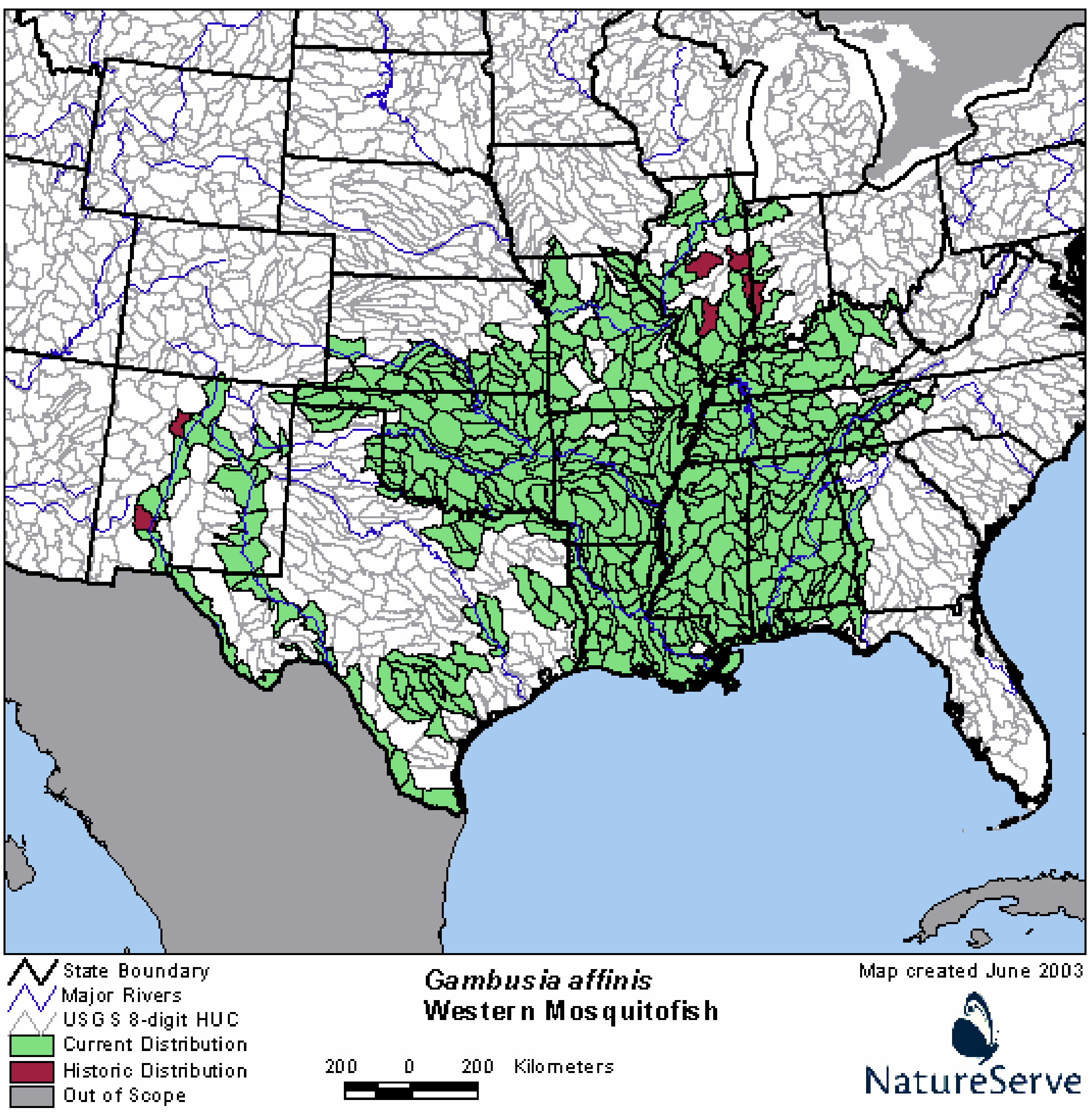
U.S. & Canada State/Province Distribution	
United States	AL, AR, AZ, CA, CO, FL, IA, ID, IL, IN, KS, KY, LA, MI, MO, MS, MT, NC, NE, NJ, NM, NN, NV, OK, OR, TN, TX, UT, WA, WY
Canada	AB, ON

Range Map
No map available.

Global Range Comments: Native to most of south-central U.S., north to Indiana and Illinois, west to Texas, south to southern Mexico, east to Mobile River system. Occurs also in the drainages of the Chattahoochee and Savannah rivers (Lydeard and Wooten 1991). See Walters and Freeman (2000) for information on the distribution of *G. affinis* and *G. holbrooki* in the Conasauga River system, where *G. affinis*is widespread and native and *G. holbrooki* is apparently introduced and expanding its range. Widely introduced in the western United States and throughout the world.

Lynch (1992) reported that five or six populations from Georgia, Illinois, Tennessee and Texas were used for most introductions nationwide and worldwide. Within the United States, sources from Illinois, Tennessee and Texas were used to establish mosquitofish in the western half of the country. Therefore, most if not all populations in the western United States are *G. affinis*.

U.S. Distribution by Watershed (based on multiple information sources)



Economic Attributes

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Management Summary

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Stewardship Overview: The spread of mosquitofish outside its native range should be monitored and necessary steps taken to: (1) understand the competitive edge it has over native species, (2) limit its introduction or invasion into new locations, and (3) evaluate the possible benefit of eradication efforts in locations that can be rehabilitated for native fishes.
Species Impacts: Outside their native range, mosquitofish play a role in decreasing populations of native fishes (Miller 1961, Myers 1965, Minckley and Deacon 1968). Due to the number of introductions and corresponding decreases in native fish populations, there can be no doubt of the destructive nature of such introductions. Myers (1965) wrote that almost everywhere introductions have been made, mosquitofish have gradually eliminated or reduced populations of small native fishes. For example, mosquitofish have been instrumental in eliminating native populations of *Poeciliopsis occidentalis* in the southwestern U.S. (Sublette et al. 1990); *P. occidentalis* may be effectively eliminated in 1-3 years (Meffe 1984). Evermann and Clark (1931) reported that mosquitofish in the Salton Sea, California, drove out *Cyprinodon macularius* less than 10 years after introduction to the state. The mechanism for many of these reductions is believed to be predation (Meffe 1985, Courtenay and Meffe 1989). Myers (1965) reported that mosquitofish have even reduced largemouth bass (*Micropterus salmoides*) and carp (*Cyprinus carpio*) populations due to predation on larvae. Another problem is caused when mosquitofish hybridize with other *Gambusia* species (Yardley and Hubbs 1976, Rutherford 1980). Intergradation then corrupts the genome of the native species.

Introduced mosquitofish also prey heavily on amphibian larvae (Goodsell and Kats 1999) and potentially negatively impact salamander and frog populations (Lawler et al. 1999).
Restoration Potential: Not applicable.
Preserve Selection & Design Considerations: Lands do not need to be protected to provide adequate habitat within the native range.
Management Requirements: It is unclear whether management activities can control this fish. Eradication efforts have often been temporarily successful, but either not all individuals were killed or reintroductions were made. Certainly, eradication efforts must be followed with intensive monitoring. Preventative measures, such as barrier construction to obstruct the paths into uncolonized tributaries, should be taken when feasible. Transport and introduction of non-native fishes should be curtailed. Natural flooding regimes in western streams could aid in keeping populations in check. Meffe (1984, 1985) showed that flooding removes proportionally more mosquitofish than native topminnows.

Regulations should be drafted and/or enforced that discourage transport and stocking of non-native fishes into uncolonized habitats. An education program targeted at fishers relating the damage non-native fishes do to the environment should be implemented. An education program targeted at state and federal agencies should be implemented explaining the detrimental impact of stocking mosquitofish for mosquito larvae control. Natural barriers can be enhanced, or new barriers built to prevent the invasion of non-native fishes. Barrier design should not significantly alter stream flow and the potential impact on natural upstream and downstream movements of native fishes should be assessed. Barrier design must be approved by appropriate agencies and the appropriate Desert Fishes Recovery Teams.
Monitoring Requirements: Populations should be monitored at the periphery of their native and introduced ranges. This data will provide information on their spread. It is possible that in certain situations, eradication efforts can be made in newly colonized habitats outside of the native range.

When populations are discovered in a new location outside the native range, a monitoring program should be initiated. Due to the rapid rate of increase and colonization potential, monitoring stations should be set-up in the affected stream and adjacent tributaries. Distances between stations will depend on variation in habitat and permanency of flow. Mosquitofish are usually easily seined and dip-netted, although small mesh sizes should be used to sample juveniles. Due to their habit of swimming just under the water surface, they can be spotted before a collecting effort is made.
Monitoring Programs: Information on mosquitofish is usually gathered incidental to other monitoring programs.
Management Research Needs: Because this is a wide ranging eastern species, much of the biology is known in the native habitat. The following specific topics are research areas that should be addressed relative to locations where introductions have been made: (1) rate of colonization in stream reaches after flooding events or after new introductions, (2) competition for food with native species, comparing diets of all life stages, (3) reproductive potential in introduced locations, emphasizing comparisons with native species, (4) aggression and predation directed towards native species in field studies, and (5) an evaluation of past eradication efforts, and (6) an analysis of sites where mosquitofish and native species have coexisted for several years (e.g. Black Draw, San Bernardino National Wildlife Refuge), and comparison to sites where mosquitofish and native species do not coexist.

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Ecology & Life History

Diagnostic Characteristics: *G. holbrooki* usually has seven dorsal rays and a gonopodium with prominent teeth on ray three. *G. affinis* usually has six dorsal rays and lacks prominent teeth on gonopodial ray three. Both subspecies have a chromosome number of 2n = 48 but female *G. affinis* possess a large heteromorphic sex chromosome which is lacking in *G. holbrooki* (Black and Howell 1979).

In Arizona, *G. affinis* may be confused with *Poeciliopsis occidentalis*, the Sonoran topminnow. In topminnows the gonopodium is asymmetrical to the left, large hooks and serrae absent on gonopodial tip, and the gonopodium reaches beyond the snout when directed forward. The pelvic fins of males are unmodified and somewhat reduced. Many breeding males will be blackened. In *G. affinis* the gonopodium is symmetrical with large hooks and serrae on the tip. The pelvic fins of males are modified with a fleshy appendage on the distal third of the first, short, unbranched ray. Males are rarely blackened.

Reproduction Comments: Fish born early in the spring may reproduce later in the summer and fall. Those born late in the reproductive season overwinter before reproducing (Krumholz 1948). In southcentral Texas, young may be collected from March to October with a peak in abundance in April (Davis 1978). In some constant temperature springs, these fish cease reproduction in winter (Brown and Fox 1966, Davis 1978). However, some populations from thermal habitats (such as cooling ponds and lakes) reproduce year-round (Ferens and Murphy 1974, Bennett and Goodyear 1978). At the Savannah River Power Plant site, South Carolina, fish reproduce throughout the winter although at much reduced brood sizes (Meffe, pers. comm., cited in Constantz 1989). These same workers found that the percentage of reproductively active females increased with increasing water temperature.

Mosquitofish have internal fertilization and are ovoviviparous (Sublette et al. 1990). Females can store sperm from one copulation and fertilize several broods sequentially (Krumholz 1948). After a gestational period of 21 to 28 days, the young are born alive at a size of approximately eight to nine mm total length (Krumholz 1948). Larger females produce more offspring (Krumholz 1948). Brood sizes of one to 315 young have been reported (Barney and Anson 1921, Moyle 1976). Females annually have four to five broods (Krumholz 1948). Sex ratios are 1:1 at birth, but in older cohorts, the number of males declines relative to the number of females (Krumholz 1948). Under optimal conditions females can become gravid at 6 weeks of age, produce 2-3 broods in first summer. Few individuals live more than 15 months (Moyle 1976).

Life history is flexible, varies with environmental conditions (Stearns 1983).

Ecology Comments
May experience severe winter mortality in some areas, but may quickly reestablish population.

Predators include water snakes (NERODIA) (Mushinsky and Hebrard 1977, Kofron 1978), water birds (Kushlan 1973), spiders (Suhr and Davis 1974), and fishes such as black basses and gars (Hunt 1953).

Habitat Type: Freshwater

Non-Migrant: Y

Locally Migrant: N

Long Distance Migrant: N

Estuarine Habitat(s): Bay/sound, Herbaceous wetland, Lagoon, River mouth/tidal river, Tidal flat/shore

Riverine Habitat(s): BIG RIVER, CREEK, Low gradient, MEDIUM RIVER, Pool, SPRING/SPRING BROOK

Lacustrine Habitat(s): Shallow water

Palustrine Habitat(s): FORESTED WETLAND, HERBACEOUS WETLAND

Habitat Comments: River channels, margins, backwaters; springs, marshes, and artificial habitats of all kinds (Minckley et al. 1991). Often in shallow, often stagnant, ponds and the shallow edges of lakes and streams where predatory fishes are largely absent and temperatures are high. Most abundant in shallow water with thick vegetation (Hubbs 1971). Also in brackish sloughs and coastal saltwater habitats (Tabb and Manning 1961, Odum 1971). More tolerant of pollution than most other fishes (Lewis 1970, Kushlan 1974). Tolerates dissolved oxygen levels as low as 0.18 mg/L (Ahuja 1964). Cannot tolerate extreme cold; temperature apparently limits range northward (Hubbs 1971). However, some populations are known to overwinter under ice in Indiana and Illinois (Krumholz 1944).

Adult Food Habits: Herbivore, Invertivore

Immature Food Habits: Herbivore, Invertivore

Food Comments: Opportunistic omnivore; eats mainly small invertebrates, often taken near water surface. Also eats small fishes and, in the absence of abundant animal food, algae and diatoms (Moyle 1976).

Mosquitofish are principally carnivorous, and have strong, conical teeth and short guts (Meffe et al. 1983, Turner and Snelson 1984). They are reported to feed on rotifers, snails, spiders, insect larvae, crustaceans, algae, and fish fry, including their own progeny (Barnickol 1941, Minckley 1973, Meffe and Crump 1987). Cannibalism has been documented by several authors (Seale 1917, Krumholz 1948, Walters and Legner 1980, Harrington and Harrington 1982). Plant material is taken occasionally (Barnickol 1941) and may make up a significant portion of the diet during periods of scarcity of animal prey (Harrington and Harrington 1982). Grubb (1972) showed that anuran eggs from temporary ponds were preferentially selected over those breeding in permanent systems. Several workers have documented changes in the prey community after mosquitofish introduction (Hurlbert et al. 1972, Farley and Younce 1977, Hurlbert and Mulla 1981, Walters and Legner 1980).

Due to their name, these fishes are popularly believed to be "super" mosquito-larvae predators. Reddy and Shakuntala (1979), however, found that adult females grew poorly on a diet of mosquito larvae, but they grew quickly on tubifex worms. These results matched the outcome of preference tests, i.e. worms were chosen over mosquito larvae. Cech et al. (1980) found that juveniles grew more quickly when they were raised on brine shrimp nauplii than tubifex worms. Many biologists have concluded these fishes are no more effective in mosquito-larval control than various native fishes (Cross 1967). The effectiveness of predation on mosquito larvae decreases as water volume decreases (Reddy and Pandian 1973).

Length: 6 centimeters

Population/Occurrence Delineation

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Group Name: LIVEBEARERS (POECILIIDS)

Use Class: Not applicable
Minimum Criteria for an Occurrence: Occurrences are based on evidence of historical presence, or current and likely recurring presence, at a given location. Such evidence minimally includes collection or reliable observation and documentation of one or more individuals in appropriate habitat.
Separation Barriers: Dam lacking a suitable fishway; high waterfall; upland habitat.
Alternate Separation Procedure: Each spring system that is undivided by a barrier constitutes a single distinct occurrence. Otherwise, use a separation distance of 10 km for any type of aquatic habitat.
Separation Justification: Separation distance is arbitrary. Because of the difficulty in defining suitable versus unsuitable habitat, especially with respect to dispersal, and to simplify the delineation of occurrences, a single separation distance is used regardless of habitat quality.
Date: 21Sep2004
Author: Hammerson, G.

Population/Occurrence Viability

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Authors/Contributors

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NatureServe Conservation Status Factors Edition Date: 21Feb2003
Management Information Edition Date: 21Feb2003

Management Information Edition Author: Vives, Stephen P.
Element Ecology & Life History Edition Date: 21Feb2003
Element Ecology & Life History Author(s): Vives, S. P., and G. Hammerson

Zoological data developed by NatureServe and its network of natural heritage programs (see Local Programs) and other contributors and cooperators (see Sources).

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