



EXTINCTION

AND THE

ENDANGERED SPECIES ACT

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SUMMARY

One hundred eight U.S. species are known to have become extinct in the first 21 years following the creation of the Endangered Species Act. We analyzed the conservation histories of these species and found that 23 species became extinct after they were placed on the endangered species list, but the majority of extinctions (85) involved species that were not on the endangered species list.

There were lengthy delays in the listing process for 83 (77%) of the species that became extinct: 29 of these species became extinct before a listing process was initiated, 42 became extinct during a delay in the listing process, and eleven listed species became extinct after a delay in the listing decision.

The use of the candidate list as a tool to defer listings for many years was particularly dangerous: 24 species became extinct after being placed on the candidate or warrant-review list. Listing petitions were routinely ignored to the detriment of the species: 17 species became extinct while their listing petition was under a long-delayed review.

If extinction is the ultimate criteria by which to judge agency implementation of the ESA, the failure has been spectacular. In many cases it has been purposeful. The agency has knowingly delayed listings to avoid political controversy even when it knew the likely result would be the extinction of the species. Full support and implementation of the endangered species listing program is necessary to avoid unnecessary future extinctions.

METHODS

We surveyed published literature, government reports, conservation databases, and field researchers to identify all species that became extinct or missing after the creation of the Endangered Species Act in December 1973 and before January 1, 1995. We defined “extinct or missing” as not having been recorded in ten years despite survey efforts. For convenience, we use the term “extinct” to mean “extinct or missing” throughout the text and we do not distinguish “extinct” species from “missing” species. We use the terms to acknowledge the difficulty of determining absolute extinction. We did not classify any species as extinct if it was observed after 1994. Ten years is the minimum time required to make a reasonably certain assertion about whether a species may be extinct or missing.

Each species was assigned a year indicating when it was last observed. In most cases, we confirmed literature and database reports with field researchers. Imprecise dates were normalized: “1980s” would be classed as 1985, “late 1980s” would be classed as “1988,” and “early 1980s” would be classed as 1982. In most instances, however, precise dates were available.

¹ This paper would not have been possible without the contributions of dozens of scientists who made their field notes available to augment published records. Dr. Johnathan Price of the Smithsonian Institution provided a very helpful review of the first version of the paper.

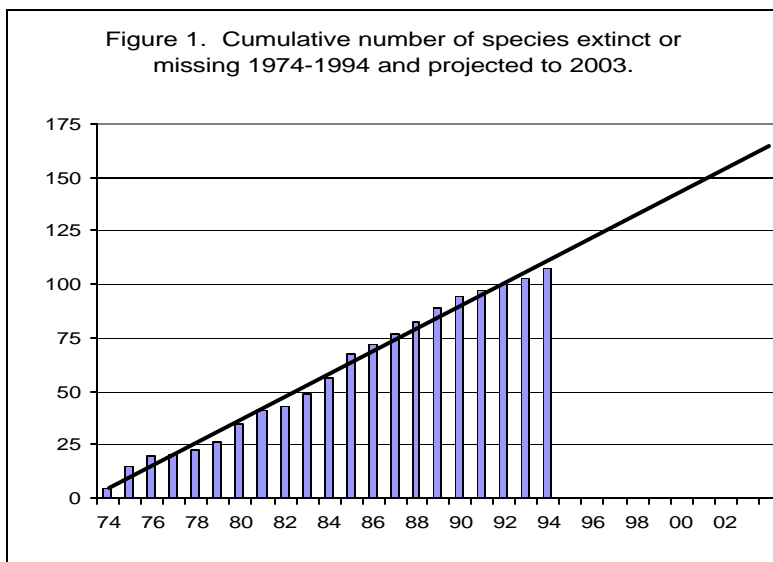
We reviewed the conservation history of each species, identifying when and if each was 1) discovered, 2) listed as an endangered species, 3) formally proposed for listing, 4) petitioned for listing, 5) placed on the federal candidate list, 6) placed on the C.I.T.E.S. list, 7) known to be endangered, and 8) appeared on list of imperiled species. The federal endangered species list has precursors dating back to 1966, but the modern Endangered Species Act and all of its significant protection mechanisms came into existence on December 28, 1973. We therefore consider 1974 as the first possible year of ESA listing. While conservation reports and lists prior to 1974 are noted, all potential listing delays are measured from 1974 forward.

RESULTS AND DISCUSSION

There are approximately 200,000 known species in the United States (Stein *et al.* 2000). A natural background rate of one extinction per million species per year (Wilson 1992) would predict four known extinctions between December 1973 and December 1994. We identified 107. This very high extinction rate is of particular concern since it occurred in the first twenty years after the creation of the Endangered Species Act. The ESA was supposed to stop or at least decrease the number of extinctions. Do the data indicate that the ESA is not working? Or that it is not being implemented? To answer these questions, we examined the conservation history of all 107 species to determine what role, if any, the ESA played in efforts to stop their decline and extinction. We also reviewed the geographic distribution of extinct species.

NUMBER OF EXTINCTIONS

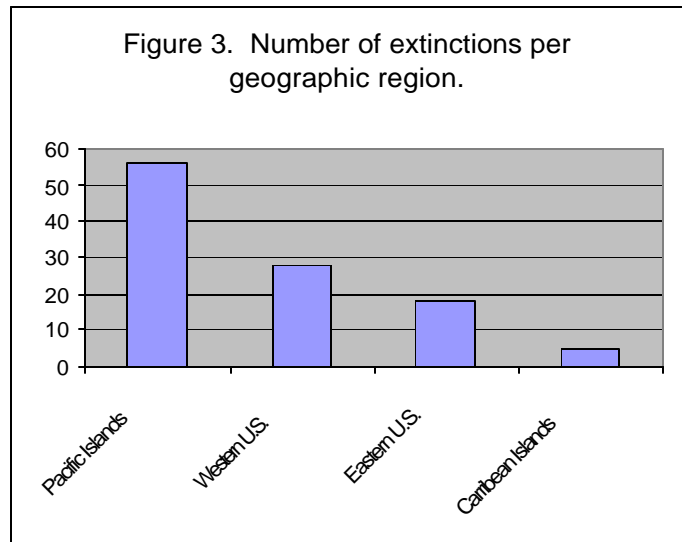
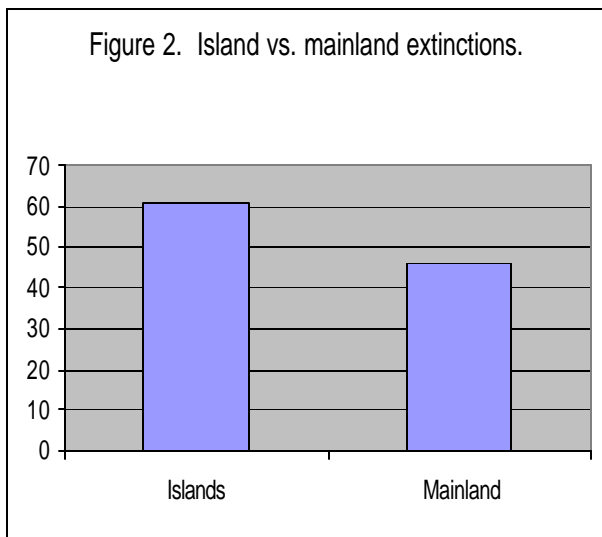
We identified 108 species that are known to have become extinct or missing between 1974-1994 (see **Appendix A**). The number of species which actually became extinct during this time is unknown but is certainly much greater. Annual rates were highly variable and did not appear to follow any temporal trends. If the same rate of species disappearance occurred during 1994-2003, approximately 165 species will eventually be known to have disappeared since the Endangered Species Act was created in December, 1973 (figure one). Again, the actual number of extinctions is certainly greater than this.



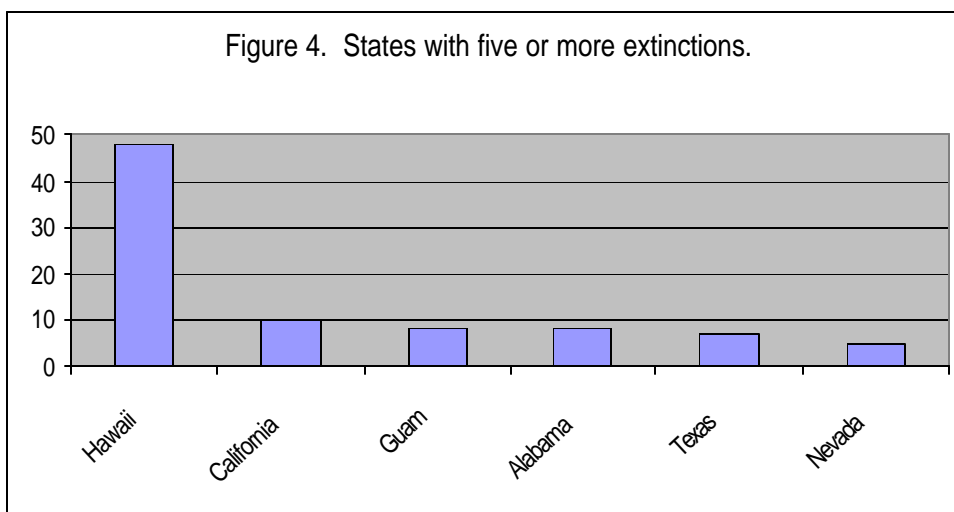
GEOGRAPHIC DISTRIBUTION

As island biogeography theory would predict, more extinctions occurred on islands than on the mainland (figure two). The trend is even more significant if one considers that the islands have a vastly smaller combined land mass and far fewer total species than the mainland. Thus a far greater percentage of island species are going extinct, and there are far more extinctions per landmass on islands than on the mainland.

At the broad regional level, Pacific islands suffered almost half of all extinctions and the western U.S. suffered a little over a quarter (figure three).

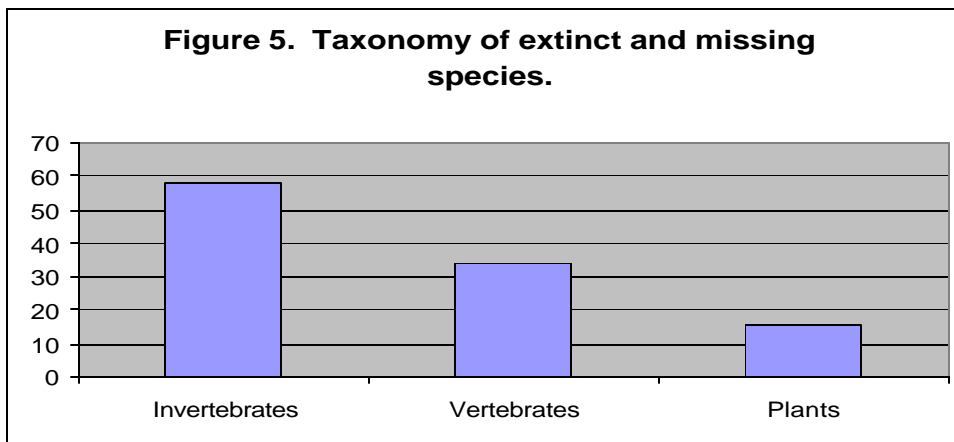


At the state level, Hawaii had the greatest number of extinctions with other Pacific island and southern states forming a second tier (figure four).

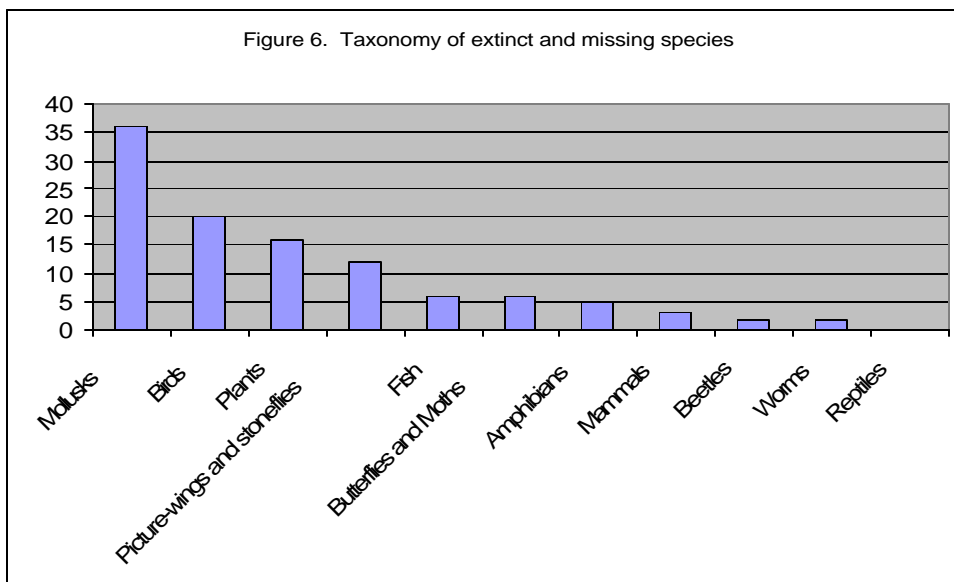


TAXONOMY

As invertebrates are more numerous than vertebrates or plants, and have received relatively little conservation attention, we hypothesized that they would suffer a greater number of extinctions. This was the case (figure five). For similar reasons, we expected plant extinctions to outnumber vertebrate extinctions. This was not the case. We suggest three explanatory hypotheses. 1) Plant disappearances may be underreported due to a lack of conservation attention or a longer lag-time between disappearance and reporting. Plants can survive as unnoticed seed material, thus their absence for short periods of time is less alarming, and less likely to be reported, than the absence of vertebrates. 2) The vertebrate disappearance rate appears to have been biased by intensive survey efforts for rare birds on Hawaii, Guam, and to a lesser extent, the mainland (figure six). If similar survey efforts had been conducted for plants, invertebrates, and non-avian vertebrates, it is likely that all would show greater extinction levels. 3) Vertebrates may actually have disappeared at a faster rate between 1974-1994.



Mollusks, especially Southeastern mussels and Hawaiian snails, suffered the greatest number of extinctions (see figure six). Birds, plants, and picture-wings and stoneflies formed a second tier.



EXTINCTION OF UNPROTECTED SPECIES

Seventy-nine percent (85 species) of the extinctions happened to plants and animals that were not on the endangered species list. Thus in the vast majority of cases, the agencies managing the ESA—the U.S. Fish and Wildlife Service and NOAA Fisheries (formerly National Marine Fisheries Service)—failed to implement its most basic function. These species were not listed and thus were not protected by the ESA’s prohibition on take and extinction. They did not have critical habitat or recovery plans. They did not receive federal recovery funds. Indeed, it was legal to drive them extinct.

It should be noted, however, that it is not possible for the agencies to know about and put every imperiled species on the endangered list. There is little they can do for species that go extinct immediately after being discovered, and even less for species that are “discovered” after they go extinct. Five species were not seen after their first discovery and nine became extinct within two years of the ESA being created. We don’t believe the agencies had sufficient time to recognize and act upon the imperilment of these species.

Eighteen species were placed on the endangered list after they became extinct (Table 1). All 18 suffered lengthy listing delays and clearly should have been listed prior to becoming extinct.

- Two birds from the U.S. Territory of Guam—the Guam broadbill and Guam bridled white-eye—were known to be approaching extinction before the ESA was created. When over five years passed with no federal effort to list them, the governor of Guam petitioned the U.S. Fish and Wildlife Service to do so in 1979. Instead of listing them, however, the agency placed them on the federal candidate list. The candidate program is essentially a waiting room for imperiled species that have not yet been placed on the endangered list. It confers no legal protection to the species. The species were finally listed in 1984, almost eleven years after the creation of the ESA, but they were both extinct by then. The white-eye was last seen in 1983 and the broadbill in 1984. See *Case Study One* for more detailed information on these and other extinct Guam birds.
- At the request of Congress, the Smithsonian Institution petitioned the U.S. Fish and Wildlife Service to list the four-angled pelea as an endangered species in 1975. In 1976 the agency formally proposed to protect the Hawaiian plant. Then two years passed without further action, prompting the Smithsonian to submit a second petition in 1978. Instead of listing the pelea, however, the agency placed it on the federal candidate list in 1980. After 14 years of candidacy, the pelea was finally listed as an endangered species in 1994. Unfortunately, it was last seen in 1991.
- Other species suffered lengthy delays to even get on the candidate list. The Ochlockonee moccasinshell, a freshwater mussel from Georgia, was first acknowledged as an imperiled species in 1968 and appeared as such in a 1971 Department of Interior publication. Yet it was not placed on the candidate list until 1994, 21 years after the ESA was created. It was already extinct by then, having last been seen in 1993. It was placed on the endangered list in 1998 in the vain hope that it would be rediscovered.

Sixty-seven species never made it onto the endangered species list (Table 2):

- The Smithsonian Institution petitioned the U.S. Fish and Wildlife Service in 1975 to list Hoffman’s jewelflower. The agency proposed listing in 1976 but did not complete the action,

spurring a second petition by the Smithsonian in 1978. Instead of listing, the agency placed it on the candidate list in 1980. The jewelflower has not been seen since 1984. It never made it onto the endangered list.

- The cardinal honey-eater is bird from the U.S. territory of Guam. The Governor of Guam petitioned the U.S. Fish and Wildlife Service to list the honey-eater in 1979. It was placed in the candidate program instead of being listed in 1982. It went extinct in 1984—15 years after the ESA was created—without ever having received the Act's protection.

EXTINCTION OF PROTECTED SPECIES

Twenty-one percent of the extinctions (23 species) involved species already on the endangered species list (Table 3). Listing delays contributed to the extinction of these species as well.

Eleven appeared on the predecessor lists to the ESA, and thus by law were automatically listed as endangered species in 1974. There was no opportunity to delay listing, and thus there was no delay. Nonetheless, they had declined to such low levels prior to being protected that it was not possible to save them. For these species, it was not listing, but the creation of the ESA that came too late. The longjaw cisco, for example, was virtually extinct in 1974 and was not seen after 1975. The ESA was created decades too late to stop its decline in Lakes Michigan, Huron, and Erie. Similarly, the Kauai 'O'o (a Hawaiian bird) was rarely seen after 1974, and was never observed nesting after 1973.

Twelve species were listed after 1974 at the discretion of the U.S. Fish and Wildlife Service (Table 4). Listing delays for these species were thus possible. They occurred in every instance. The ESA requires that a final listing decision be made within two years of a petition being filed; we thus use two years as the standard for determining whether listing was delayed. None of the species were listed within two years of being petitioned, put on the candidate list, or known by the agency to be imperiled.

- Curtus's pearlymussel, a freshwater mussel from the Tombigbee River in Alabama and Mississippi, was identified as an imperiled species in a 1971 Department of Interior publication, yet it was not listed as an endangered species until 1987. It was virtually gone by then. It was only seen twice after listing, and both times it was dead. After 1990 it was never seen again. The listing process for this species and two other mussels shows that the Fish and Wildlife Service purposefully delayed the listing in order to avoid a political conflict with a major dam construction project even though the dam had been identified as the greatest threat to the species' existence. After the dam was complete and out of reach of the ESA, the species were listed. Two were already extinct. Curtus's pearlymussel went extinct immediately afterward. See *Case Study Two* for more information on this and the extinction of other southeastern mussels.
- The Golden coqui, a Puerto Rican frog, was known by the early 1970s to have severely decreased populations, but endangered listing was delayed until 1977. By then it was too late to save it, it was not seen again after 1981.

LISTING DELAYS

Lengthy listing delays were the rule, not the exception. Eighty-three (77%) of the 108 extinctions involved a delay of more than two years between the time the species was identified as imperiled and the time it was listed or became extinct.

83 Extinct species experienced significant delays in gaining protections
42 became extinct during a long delayed listing process
29 became extinct with no listing process initiated
12 were listed after a long delay and were too depleted to survive

Forty-two species became extinct while in a delayed listing process (Table 5):

- A petition was filed in 1980 to list the Amak Island song sparrow, an Alaskan bird, as an endangered species. Instead of processing the petition, the Fish and Wildlife Service placed the species on the candidate list in 1982. It languished there without protection until 1988, when it went extinct.
- The U.S. Fish and Wildlife declared in 1977 that the Valdina farms salamander, a species unique to one cave in Texas, likely required ESA protection. Five years passed without further action and it was placed on the candidate list in 1982. There it sat until a local water agency diverted a river into the salamander's cave, driving it extinct in 1987. Had the species been listed shortly after being identified as imperiled in 1977, the water diversion would not have been permitted.

Twenty-nine species became extinct without the benefit of any listing process being initiated even though they were known to be imperiled at least two years prior to their extinction (Table 6):

- The High Rock Spring tui chub was a unique fish living in three interconnected high desert springs on the northern California-Nevada border. It was known to be imperiled by the early 1970s, but was not put on the candidate list until 1991. It was already extinct by then. It disappeared in 1989 after the California Department of Fish and Game allowed exotic predatory fish to be introduced into the spring system. The springs on the Nevada side of the border were pumped dry. Neither action would have been permitted had the chub been listed as an endangered species.
- The San Gabriel Mountains blue butterfly lived in a single wet meadow in the Angeles National Forest in southern California. It had been known to be imperiled since the early 1970s, but was not put on the candidate list until 1989. By 1985 it had already disappeared due to the diversion of water from the meadow.

Twelve species were listed after long delays in the listing process (Table 4). Most became so depleted during the delay that there was no hope of saving them by the time they were listed. This group is discussed above.

NO LISTING DELAYS

25 species experienced no listing delays
11 were automatically listed when the ESA was created in 1974
9 became extinct in 1974-1975 before the agencies had time to act
5 became extinct immediately after being discovered

Only 25 of the 108 extinctions involved no delay in the listing process (Table 7). However, the peculiar circumstance of these species made delay impossible. In all cases where discretion existed, delays occurred.

Eleven species were listed as endangered species in precursors to the ESA. They were automatically placed on the ESA list in 1974. This group is discussed above.

Nine species went extinct in 1974-1975. The agencies did not have sufficient time to develop proposed and final listing rules for them. The standard timeline for this process is two years.

Five species were only seen once and never again. They became extinct so fast that the agencies did not have time to study and prepare a listing rule for them.

CONCLUSIONS

One-hundred-eight species became extinct in the first twenty one years of the Endangered Species Act. This is far in excess of the four species that would have been expected to go extinct from natural causes. If extinction is the ultimate criteria by which to judge ESA implementation, the failure has been severe.

The primary failure was not that endangered species went extinct. Only 21% of the extinctions involved species that were on the endangered list. Protection for all of these species was delayed either by the Endangered Species Act being created too late, or there being too long a lag-time between the creation of the Act and the protection of the species. All were at extremely low population levels when listed and thus were virtually unsavable.

The vast majority of extinctions (79%) involved species that were not on the endangered list. While a small number went extinct so fast, it was not possible to put them on the list, most could have been protected had the U.S. Fish and Wildlife acted more swiftly. Placement of species on the endangered species list is the first line of defense against extinction. There was a systematic and in several cases purposeful failure to invoke this defense. Long delays—often for more than a decade, sometimes for more than twenty years—contributed to the extinction of both unlisted and listed species. Seventy-seven percent of extinctions involved significant delays in the listing process. In every instance where agency discretion permitted delay, delay occurred.

The use of the candidate list as a tool to defer listing for many years was particularly dangerous: 24 species became extinct after being placed on the candidate or warrant-review list. Listing petitions were also routinely ignored: 17 species became extinct while their listing petition was under review.

Reviewers of the ESA listing program, including the U.S. General Accounting Office, the Department of Interior Inspector General, the Congressional Research Service, the U.S. Congress, and scientists both inside and outside the agency have repeatedly pointed out that the program has been hampered by chronic underfunding, political intervention, and lack of leadership. The situation, however, has gotten worse, not better. Under the current Bush Administration the annual rate of listing has reached its lowest point in the history of the ESA. Budget requests and allocations continue to fall far short of the funds identified by the U.S. Fish and Wildlife Service. Political pressure continues to slow protection for imperiled species. And just as importantly, the program lacks leadership and drive. The agency is almost entirely lacking a sense of urgency and a desire to reform, revamp and accelerate the process.

We recommend the following:

- Fully fund the U.S. Fish and Wildlife Service to list all species currently on the candidate list and designate critical habitat for all species that require it. This can be done in five years with an annual budget of \$31 million per year.
- A proposal to list all current candidates should be immediately issued as a matter of policy. The Fish and Wildlife Service has already declared that these species warrant listing proposals. There is no need to engage in a lengthy, expensive listing process that will certainly result in another decade of delay for many of the current candidates. Once the listing proposal is issued, the agency can develop a schedule to complete individual listing rules.
- The agencies should return to the multi-species listing rules of the 1990s. They resulted in the highest annual listing rate in the history of the ESA. The shift back to single species rules has slowed, complicated, and driven up the cost of the program.
- The candidate list has become an extinction waiting room. Species regularly spend 15 or 20 years on the list, and twenty-seven species have become extinct on the candidate list. Regulations should be adopted to require that all candidates receive a final listing decision within five years of being put on the list.
- Listing petitions have been routinely ignored, contributing to the extinction of 17 species. Previously, conservationists could sue to enforce the listing requirements of the ESA. This caused a dramatic increase in the annual listing rate between 1990 and 1996. However, the Clinton administration established regulations in 1996 that effectively prevented conservationists from enforcing this aspect of the ESA. The annual rate of listing immediately began to drop, and under the Bush administration descended to the lowest level in the history of the ESA. Citizen enforcement worked well; policies eliminating it should be rescinded.

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CASE STUDY ONE:

GUAM BROADBILL (Myiagra freycineti)



The Guam broadbill formerly occurred throughout the forests and mangrove swamps of Guam. It was driven to extinction by habitat destruction and predation by introduced brown tree snakes. It was removed from the endangered species list on February 23, 2004.

The songbird had already been extirpated from two-thirds of Guam when the Endangered Species Act (ESA) was created 1973, but a significant population still existed and could have been saved through captive breeding and local brown tree snake control. Instead, the broadbill’s listing was delayed for nearly eleven years

and did not happen until *after* it was extinct.

No action was taken to protect the broadbill under the ESA until the Governor of Guam petitioned the U.S. Fish and Wildlife Service to list it in 1979.

The territory also requested that the northern coast line be designated as critical habitat. In 1982 the Fish and Wildlife Service declared that ESA listing was warranted, but that actual listing was precluded by higher priorities. The broadbill was placed on the agency’s “candidate list” where it received no protection. But there were no higher listing priorities. In fact, the assertion was made during the slowest listing period in the history of the ESA: between February 1981 and January 1982, not a single species was listed; in all of 1982, only 12 species were listed; and in the 12 months following the decision to delay protection for the broadbill, just seven species were listed. None of the 17 species listed during this three-year period were as endangered as the broadbill. All still exist today.

By the time the Fish and Wildlife Service issued a listing proposal in 1983, the broadbill had declined to about 100 birds occupying just 150 acres of forest in the Pajon Basin. A male broadbill was captured for emergency breeding purposes, but a mate for it could not be found. It died alone in captivity in February 1984.

In March, 1984 a single bird was seen on Andersen Air Force Base. In August the last Guam broadbill ever seen was reported near the Navy golf course. And on August 27, 1984, the broadbill was listed as an endangered species. The listing came almost eleven years after the ESA was created, six years after the governor of Guam petitioned for listing, two years after the species was put on the candidate list, and just days after it went extinct.

The Guam broadbill was not an exception: seven species went extinct after the Guam Governor petitioned to list them as endangered species.			
	Petitioned	Extinct	Listed
Guam broadbill	1979	1984	1984
Guam bridled white-eye	1981	1983	1984
Little Mariana fruit bat	1978	1979	1984
Guam rufous fantail	1981	1984	
Guam cardinal honey-eater	1979	1984	
Guam white-throated ground dove	1979	1986	
Guam Mariana fruit bat	1978	1985	
The Governor of Guam petitioned to list the Pacific sheath-tailed bat as an endangered species in 1981. The U.S. Fish and Wildlife put it on the candidate list in 1982. It is still on the list, unprotected and declining in 2004.			

CASE STUDY TWO:

**CURTUS’S PEARLY MUSSEL (*PLEUROBEMA CURTUM*),
MARSHALL’S PEARLY MUSSEL (*PLEUROBEMA MARSHALLI*)
STIRRUP SHELL (*QUADRULA STAPES*)**



Curtus’s pearly mussel, Marshall’s pearly mussel, and the stirrup shell inhabited the Tombigbee River and its larger tributaries in Alabama and Mississippi. All three were categorized as imperiled species in 1968, but they were not put on the endangered species list until 1987. Marshall’s pearly mussel and stirrupshell were already extinct by then; Curtus’s pearly mussel was virtually extinct and disappeared several years later.

Why did the U.S. Fish and Wildlife Service wait 13.5 years to protect these mussels? The major threat to their existence was the three-billion-dollar Tennessee-Tombigbee Waterway project. The project was under construction, thus if the mussels were listed, the dam builders would have to redesign it to save the species. The political battle would be fierce. Instead, the Fish and Wildlife Service chose to delay listing until after the project was complete and thus beyond the reach of the Endangered Species Act. The choice resulted in the extinction of at least three species.

The waterway was authorized by Congress in 1946. Construction was to commence in 1971, but a federal judge temporarily stopped the construction because the waterway’s impacts—including the likely extinction of five mussels—was not fully analyzed. Evidence supporting the injunction included letters from the Department of Interior warning of the mussels’ pending extinction. The injunction was lifted in 1972 when the court ruled that there was no law against driving species extinct. That loophole was remedied when the Endangered Species Act was signed into law in 1973. From that day forward, the Army Corps of Engineers was prohibited from causing the extinction of animals on the endangered species list. Had the U.S. Fish and Wildlife Service’s immediately placed the mussels on the endangered list, it could have ensured the waterway was redesigned to save them. It did not do so.

Two years passed without action and in 1976 the chief of the Office of Endangered Species issued a memo warning of the dire consequences of the waterway. In 1978 agency biologists stated that the listing was being delayed in order to avoid conflicts with the waterway and its powerful allies. In 1979 the U.S. General Accounting Office exposed the politicization of the listing process, prompting the Fish and Wildlife Service to announce in 1980 that the mussels were being considered for listing. But it was too late for Marshall’s pearly mussel which became extinct that year.

Six additional eastern mussels have become extinct since 1974. All were known to be endangered in 1968. Three went extinct before being listed. One was never listed. Two went extinct after listing		
	Extinct	Listed
Ochlockonee moccasinshell	1993	1998
Southern acornshell	1974	1993
Upland combshell	1988	1993
Green blossom	1984	1976
White catspaw	1993	1976
Lined pocketbook	1976	
Nine mussels are on the 2004 USFWS candidate list. Eight of them are known to have been endangered since 1968. The nine mussels have spent an average of 20 years in the ESA listing process and have not yet been protected.		

The Army Corps Engineers, the governors of AL and MS, and several Congressmen lobbied against listing. The mussels were put on the candidate list instead of being protected. Four years later, the stirrup shell became extinct. In 1985 construction of Tennessee-Tombigbee Waterway was complete and thus no longer vulnerable to being stopped. The listing process was suddenly fast-tracked: a proposal was issued in 1986 and a final rule in 1987. Both repeatedly emphasized that listing would have no impact on the waterway because the species and their habitats had already been destroyed. All conservation actions would have to occur outside the boundaries of the waterway.

Three freshly dead Curtus's pearly mussels were found in 1989. Two more dead shells were found in 1990. The species was never seen again.

Table 1. 20 species were listed as endangered under the Endangered Species Act after becoming extinct.

Common Name	Scientific Name	Taxon	Range	Listed	Extinct
Four-angled pelea	<i>Melicope quadrangularis</i>	Flowering Plants	HI	1994	1991
Guam bridled white-eye	<i>Zosterops conspicillatus conspicillatus</i>	Birds	Guam	1984	1983
Guam broadbill	<i>Myiagra freycineti</i>	Birds	Guam	1984	1984
Haha	<i>Cyanea truncata</i>	Flowering Plants	HI	1994	1983
Hedyotis degeneri var. coprosmifolia	<i>Hedyotis degeneri var. coprosmifolia</i>	Flowering Plants	HI	1991	1985
Little Aguja pondweed	<i>Potamogeton clystocarpus</i>	Flowering Plants	TX	1991	1989
Little Mariana fruit bat	<i>Pteropus tokudae</i>	Mammals	Guam	1984	1979
Marshall's pearly mussel	<i>Pleurobema marshalli</i>	Freshwater Mussels	AL, MS	1987	1980
Oahu tree snail bellula	<i>Achatinella bellula</i>	Terrestrial snails	HI	1981	1981
Oahu tree snail lorata	<i>Achatinella lorata</i>	Terrestrial snails	HI	1981	1974
Oahu tree snail phaeozona	<i>Achatinella phaeozona</i>	Terrestrial snails	HI	1981	1974
Oahu tree snail pupukanioe	<i>Achatinella pupukanioe</i>	Terrestrial snails	HI	1981	1980
Oahu tree snail swiftii	<i>Achatinella swiftii</i>	Terrestrial snails	HI	1981	1976
Oahu tree snail taeniolata	<i>Achatinella taeniolata</i>	Terrestrial snails	HI	1981	1978
Oahu tree snail turgida	<i>Achatinella turgida</i>	Terrestrial snails	HI	1981	1974
Oahu tree snail viridans	<i>Achatinella viridans</i>	Terrestrial snails	HI	1981	1979
Ochlockonee moccasinshell	<i>Medionidus simpsonianus</i>	Freshwater Mussels	FL, GA	1998	1993
Southern acornshell	<i>Epioblasma othcaloogensis</i>	Freshwater Mussels	AL, GA, TN	1993	1974
Stirrup shell	<i>Quadrula stapes</i>	Freshwater Mussels	AL, MS	1987	1984
Upland combshell	<i>Epioblasma metastriata</i>	Freshwater Mussels	AL, GA, TN	1993	1988

Table 2. 72 species became extinct and were never listed as threatened or endangered under the Endangered Species Act.

Common Name	Scientific Name	Taxon	Range	Listed	Extinct
Achatinellid land snail	<i>Partulina kaaeana</i>	Terrestrial Snails	HI	N/A	1981
Achatinellid land snail	<i>Newcombia plicata</i>	Terrestrial Snails	HI	N/A	1989
Achatinellid land snail	<i>Newcombia cinnamomea</i>	Terrestrial Snails	HI	N/A	1975
Amak Island song sparrow	<i>Melospiza melodia amaka</i>	Birds	AK	N/A	1988
Bishop's 'O 'o	<i>Moho bishopi</i>	Birds	HI	N/A	1986
Bland Oregonian	<i>Cryptomastix mullani blandi</i>	Terrestrial Snails	ID	N/A	1990
Blood tetramolopium	<i>Tetramolopium consanguineum var. kauense</i>	Flowering Plants	HI	N/A	1980
Blue point pyrg	<i>Pyrgulopsis coloradensis</i>	Freshwater Snails	NV	N/A	1992
Breckenridge Mountain slender salamander	<i>Batrachoseps "breckenridge"</i>	Amphibians	CA	N/A	1983
Cahaba pebblesnail	<i>Clappia cahabensis</i>	Freshwater Snails	AL	N/A	1976
Chiricahua mudwort	<i>Limosella pubiflora</i>	Flowering Plants	AZ, NM	N/A	1992
Cuyamaca raspberry	<i>Rubus glaucifolius var. ganderi</i>	Flowering Plants	CA	N/A	1988
Cyanea dolichopoda	<i>Cyanea dolichopoda</i>	Flowering Plants	HI	N/A	1992
Cyanea habenata	<i>Cyanea habenata</i>	Flowering Plants	HI	N/A	1978
Digressa picture-wing	<i>Drosophila digressa</i>	Insects	HI	N/A	1986
Emerald seaslug	<i>Phyllaplysia smaragda</i>	Marine Slugs	FL	N/A	1981
False spike	<i>Quincuncina mitchelli</i>	Freshwater Mussels	TX, NM	N/A	1975
Fish Lake pyrg	<i>Pyrgulopsis ruinosa</i>	Freshwater Snails	NV	N/A	1993
Georgia Depression Lewis's woodpecker	<i>Melanerpes lewis pop. 1</i>	Birds	WA	N/A	1975
Giant palouse earthworm	<i>Driloleirus americanus</i>	Worms	WA, ID	N/A	1978

Giffard's 'Ohe hedyleptan moth	<i>Omiodes giffardi</i>	Other Moths	HI	N/A	1982
Guam cardinal honey-eater	<i>Myzomela cardinalis saffordi</i>	Birds	Guam	N/A	1984
Guam rufous fantail	<i>Rhipidura rufifrons uraniae</i>	Birds	Guam	N/A	1984
Guam white-throated ground dove	<i>Gallicolumba xanthonura xanthonura</i>	Birds	Guam	N/A	1986
Haleakala stenogyne	<i>Stenogyne haliakalae</i>	Flowering Plants	HI	N/A	1984
Hawaiian picture wing	<i>Drosophila alsophila</i>	Other Insects	HI	N/A	1985
Hawaiian picture wing	<i>Drosophila toxochaeta</i>	Other Insects	HI	N/A	1985
Hawaiian picture wing	<i>Drosophila psilotarsalis</i>	Other Insects	HI	N/A	1985
Hibiscadelphus crucibracteatus	<i>Hibiscadelphus crucibracteatus</i>	Flowering Plants	HI	N/A	1985
High Rock Spring tui chub	<i>Gila bicolor ssp. 11</i>	Freshwater Fish	CA, NV	N/A	1989
Hoffman jewelflower	<i>Streptanthus glandulosus var. hoffmanii</i>	Flowering Plants	CA	N/A	1984
Keeled sideband	<i>Monadenia circumcarinata</i>	Terrestrial Snails	CA	N/A	1984
Koa nalo	<i>Drosophila musaphilia</i>	Insects	HI	N/A	1988
Lake Tahoe benthic stonefly	<i>Capnia lacustra</i>	Stoneflies	CA, NV	N/A	1994
Lanai phyllostegia	<i>Phyllostegia imminuta</i>	Flowering Plants	HI	N/A	1979
Lined pocketbook	<i>Lampsilis binominata</i>	Freshwater Mussels	AL, GA	N/A	1976
Longstreet springsnail	<i>Pyrgulopsis sp.</i>	Freshwater Snails	NV	N/A	1975
Lysimachia venosa	<i>Lysimachia venosa</i>	Flowering Plants	HI	N/A	1990
Marianas euploea butterfly	<i>Euploea eleutho</i>	Butterflies	Guam	N/A	1975
Mexican fawnsfoot	<i>Truncilla cognata</i>	Freshwater Mussels	TX	N/A	1975
Meyrick's banana hedyleptan moth	<i>Omiodes meyricki</i>	Other Moths	HI	N/A	1982
Mottled coqui (Eneida's coqui)	<i>Eleutherodactylus eneidae</i>	Amphibians	Puerto Rico	N/A	1990

Nalo hihiu	<i>Drosophila substenoptera</i>	Insects	HI	N/A	1991
Nalo huluhulu	<i>Drosophila tarphytrichia</i>	Insects	HI	N/A	1975
Nalo kihikihi	<i>Drosophila heteroneura</i>	Insects	HI	N/A	1993
Nalo makamae	<i>Drosophila ochrobasis</i>	Insects	HI	N/A	1986
Nalo maka'ula	<i>Drosophila differens</i>	Insects	HI	N/A	1986
Nalo mea hula	<i>Drosophila neoclavisetae</i>	Insects	HI	N/A	1975
Nalo miki	<i>Drosophila hemipeza</i>	Insects	HI	N/A	1983
Narrow-leaved hoary pea	<i>Tephrosia angustissima</i> var. <i>angustissima</i>	Flowering Plants	FL	N/A	1985
Neal's melicope	<i>Melicope nealiae</i>	Flowering Plants	HI	N/A	1979
Nerite rams -horn	<i>Vorticifex neritoides</i>	Freshwater Snails	OR, WA	N/A	1988
Oahu 'Akepa	<i>Loxops coccinea wolstenholmii</i>	Birds	HI	N/A	1976
O'ahu hesperomannia philodoria moth	<i>Philodoria</i> sp.	Other Moths	HI	N/A	1987
Oha, haha, `Ohawai	<i>Cyanea eleeleensis</i>	Flowering Plants	HI	N/A	1977
Opuhe nalo	<i>Drosophila aglaia</i>	Insects	HI	N/A	1980
Oregon giant earthworm	<i>Driloleirus macelfreshi</i>	Worms	OR	N/A	1985
Paria iris	<i>Iris pariensis</i>	Flowering Plants	UT	N/A	1976
Penasco least chipmunk	<i>Tamias minimus atristriatus</i>	Mammals	NM	N/A	1980
Phantom shiner	<i>Notropis orca</i>	Freshwater Fish	NM, TX	N/A	1975
Pupillid land snail	<i>Lyropupa perlonga</i>	Terrestrial Snails	HI	N/A	1980
Rich Mountain cave beetle	<i>Pseudanophthalmus krekeleri</i>	Other Beetles	WV	N/A	1985
Saline Valley phacelia	<i>Phacelia amabilis</i>	Flowering Plants	CA	N/A	1985
San Gabriel Mountains blue butterfly	<i>Plebejus saepiolus aureolus</i>	Butterflies	CA	N/A	1985

Sangre de Cristo peaclam	<i>Pisidium sanguinichristi</i>	Freshwater Snails	NM	N/A	1981
Scaevola hobdyi	<i>Scaevola hobdyi</i>	Flowering Plants	HI	N/A	1980
Shortnose cisco	<i>Coregonus reighardi</i>	Freshwater Fish	IL, IN, MI, NY, WI	N/A	1985
Sylvan hygrotus diving beetle	<i>Hygrotus sylvanus</i>	Other Beetles	MN, NY, MA?	N/A	1979
Texas Henslow's sparrow	<i>Ammodramus henslowii</i> <i>houstonensis</i>	Birds	TX	N/A	1983
Valdina farms sala mander	<i>Eurycea troglodytes ssp.</i>	Amphibians	TX	N/A	1987
Virgin Islands screech owl	<i>Otus nudipes newtoni</i>	Birds	Virgin Islands	N/A	1980
Web-footed coqui	<i>Eleutherodactylus</i> <i>karlschmidti</i>	Amphibians	Puerto Rico	N/A	1974

Table 3. 22 species became extinct after being listed as endangered under the Endangered Species Act.

Common Name	Scientific Name	Taxon	Range	Listed	Extinct
Curtus's pearly mussel	<i>Pleurobema curtum</i>	Freshwater Mussels	AL, MS	1987	1990
Dusky seaside sparrow	<i>Ammodramus maritimus nigrescens</i>	Birds	FL	1974	1987
Eskimo curlew	<i>Numenius borealis</i>	Birds	AK, AR, CO, CT, IA, IL, IN, KS, LA, MA, MD, ME, MI, MN, MO, MT, NB, NC, ND, NE, NJ, NY, OH, OK, PA, RI, SC, SD, TX, WI, WY	1974	1987
Fresno kangaroo rat	<i>Dipodomys nitratoides exilis</i>	Mammals	CA	1985	1992
Golden coqui	<i>Eleutherodactylus jasperii</i>	Amphibians	Puerto Rico	1977	1981
Green blossom	<i>Epioblasma torulosa gubernaculum</i>	Freshwater Mussels	TN, VA	1976	1984
Kauai 'O'o	<i>Moho braccatus</i>	Birds	HI	1974	1987
Large Kauai thrush	<i>Myadestes myadestinus</i>	Birds	HI	1974	1989
Longjaw cisco	<i>Coregonus alpenae</i>	Freshwater Fish	IL, IN, MI, NY, OH, PA, WI	1974	1975
Lotis blue butterfly	<i>Lycaeides argyrognomon lotis</i>	Butterflies	CA	1976	1983
Marianna mallard	<i>Anas oustaleti</i>	Birds	Guam	1977	1981
Maryland darter	<i>Etheostoma sellare</i>	Freshwater Fish	MD	1974	1988
Maui 'Akepa	<i>Loxops coccineus ochraceus</i>	Birds	HI	1974	1988
Moloka'i thrush	<i>Myadestes lanaiensis rutha</i>	Birds	HI	1974	1980
Morro Bay kangaroo rat	<i>Dipodomys heermanni morroensis</i>	Mammals	CA	1974	1991
'O 'u	<i>Psittirostra psittacea</i>	Birds	HI	1974	1989
Oahu alauahio	<i>Paroreomyza maculata</i>	Birds	HI	1974	1990
Oahu tree snail bulimoides	<i>Achatinella bulimoides</i>	Terrestrial Snails	HI	1981	1985
Oahu tree snail curta	<i>Achatinella curta</i>	Terrestrial Snails	HI	1981	1989
Oahu tree snail leucorraphe	<i>Achatinella leucorraphe</i>	Terrestrial Snails	HI	1981	1989
San Marcos gambusia	<i>Gambusia georgei</i>	Freshwater Fish	TX	1980	1983
White catpaw	<i>Epioblasma obliquata perobliqua</i>	Freshwater Mussels	IL, IN, KY, MI, OH	1976	1993

Table 4. 11 species were eventually listed as endangered, after delay in the endangered listing process.

Common Name	Scientific Name	Taxon	Range	Listing Initiated	Listed	Extinct	Length of Delay (years)
Fresno kangaroo rat	<i>Dipodomys nitratooides exilis</i>	Mammals	CA	1982	1985	1992	3
Oahu tree snail leucorraphe	<i>Achatinella leucorraphe</i>	Terrestrial Snails	HI	1970	1981	1989	11
Oahu tree snail curta	<i>Achatinella curta</i>	Terrestrial Snails	HI	1970	1981	1989	11
Oahu tree snail bulimoides	<i>Achatinella bulimoides</i>	Terrestrial Snails	HI	1970	1981	1985	11
Marianna mallard	<i>Anas oustaleti</i>	Birds	Guam	1974	1977	1981	3
White catspaw	<i>Epioblasma obliquata perobliqua</i>	Freshwater Mussels	IL, IN, KY, MI, OH	1971	1976	1993	5
Golden coqui	<i>Eleutherodactylus jasperii</i>	Amphibians	Puerto Rico	1974	1977	1981	3
San Marcos gambusia	<i>Gambusia georgei</i>	Freshwater Fish	TX	1974	1980	1983	6
Green blossom	<i>Epioblasma torulosa gubernaculum</i>	Freshwater Mussels	TN, VA	1971	1976	1984	5
Lotis blue butterfly	<i>Lycaeides idas lotis</i>	Butterflies	CA	1974	1976	1983	2
Curtus's pearly mussel	<i>Pleurobema curtum</i>	Freshwater Mussels	AL, MS	1968	1987	1990	19

Table 5. 42 species became extinct while the endangered listing process was delayed.

Common Name	Scientific Name	Taxon	Range	Listing Initiated	Last Seen	Delay (Years)	Listing History
(none)	<i>Carex wahuensis ssp. herbstii</i>	Flowering Plants	HI	1990	1994	4	1990 candidate
Achatinellid land snail	<i>Newcombia cinnamomea</i>	Terrestrial Snails	HI	1970	1975	2	1970 report
Amak Island song sparrow	<i>Melospiza melodia amaka</i>	Birds	AK	1980	1988	8	1980 petition
Bishop's 'O 'o	<i>Moho bishopi</i>	Birds	HI	1982	1986	4	1982 candidate
Blood tetramolopium	<i>Tetramolopium consanguineum</i> <i>var. kauense</i>	Flowering Plants	HI	1975	1980	5	1975 petition
Cahaba pebblesnail	<i>Clappia cahabensis</i>	Freshwater Snails	AL	1971	1976	5	1971 report, 1989 candidate
Four-angled pelea	<i>Melicope quadrangularis</i>	Flowering Plants	HI	1975	1991	16	1975 petition
Guam bridled white-eye	<i>Zosterops conspicillatus</i> <i>conspicillatus</i>	Birds	Guam	1979	1983	4	1979 petition
Guam broadbill	<i>Myiagra freycineti</i>	Birds	Guam	1979	1984	5	1979 petition
Guam cardinal honey-eater	<i>Myzomela cardinalis saffordi</i>	Birds	Guam	1979	1984	5	1979 petition
Guam rufous fantail	<i>Rhipidura rufifrons uraniae</i>	Birds	Guam	1981	1984	3	1981 petition
Guam white-throated ground dove	<i>Gallicolumba xanthonura</i> <i>xanthonura</i>	Birds	Guam	1979	1986	7	1979 petition
Haha	<i>Cyanea truncata</i>	Flowering Plants	HI	1990	1994	4	1994
Haleakala stenogyne	<i>Stenogyne haliakalae</i>	Flowering Plants	HI	1975	1984	9	1975 petition
Hoffman jewelflower	<i>Streptanthus glandulosus var.</i> <i>hoffmanii</i>	Flowering Plants	CA	1975	1984	9	1975 petition
Keeled sideband	<i>Monadenia circumcarinata</i>	Terrestrial Snails	CA	1968	1984	11	1968 report, 1984 candidate
Lake Tahoe benthic stonefly	<i>Capnia lacustra</i>	Stoneflies	CA, NV	1984	1994	10	1984 candidate
Lined pocketbook	<i>Lampsilis binominata</i>	Freshwater Mussels	AL, GA	1968	1976	3	1968 report, 1971 report, 1989 candidate
Little Mariana fruit bat	<i>Pteropus tokudae</i>	Mammals	Guam	1978	1979	1	1978 petition
Marshall's pearly mussel	<i>Pleurobema marshalli</i>	Freshwater Mussels	AL, MS	1971	1980	9	1971 report, 1980 warrant review
Mottled coqui	<i>Eleutherodactylus eneidae</i>	Amphibians	Puerto Rico	1989	1990	1	1989 candidate
Narrow-leaved hoary pea	<i>Tephrosia angustissima var.</i> <i>angustissima</i>	Flowering Plants	FL	1975	1985	10	1975 petition

Neal's melicope	<i>Melicope nealiae</i>	Flowering Plants	HI	1975	1979	4	1975 petition
Oahu 'Akepa	<i>Loxops coccinea wolstenholmii</i>	Birds	HI	1970	1976	6	1970 report
Oahu tree snail bellula	<i>Achatinella bellula</i>	Terrestrial Snails	HI	1970	1981	8	1970 report, 1976 petition
Oahu tree snail lorata	<i>Achatinella lorata</i>	Terrestrial Snails	HI	1970	1974	1	1970 report, 1976 petition
Oahu tree snail phaeozona	<i>Achatinella phaeozona</i>	Terrestrial Snails	HI	1970	1974	1	1970 report, 1976 petition
Oahu tree snail pupukanioe	<i>Achatinella pupukanioe</i>	Terrestrial Snails	HI	1970	1980	7	1970 report, 1976 petition
Oahu tree snail swiftii	<i>Achatinella swiftii</i>	Terrestrial Snails	HI	1970	1976	3	1970 report, 1976 petition
Oahu tree snail taeniolata	<i>Achatinella taeniolata</i>	Terrestrial Snails	HI	1970	1978	5	1970 report, 1976 petition
Oahu tree snail turgida	<i>Achatinella turgida</i>	Terrestrial Snails	HI	1970	1974	1	1970 report, 1976 petition
Oahu tree snail viridans	<i>Achatinella viridans</i>	Terrestrial Snails	HI	1970	1979	6	1970 report, 1976 petition
Ochlockonee moccasinshell	<i>Medionidus simpsonianus</i>	Freshwater Mussels	FL, GA	1971	1993	20	1971 report, 1994 candidate
Pupillid land snail	<i>Lyropupa perlonga</i>	Terrestrial Snails	HI	1970	1980	7	1970 report
Saline Valley phacelia	<i>Phacelia amabilis</i>	Flowering Plants	CA	1975	1985	10	1975 petition
Shortnose cisco	<i>Coregonus reighardi</i>	Freshwater Fish	IL, IN, MI, NY, WI	1982	1985	3	1982 candidate
Southern acornshell	<i>Epioblasma othcaloogensis</i>	Freshwater Mussels	AL, GA, TN	1971	1974	1	1971 report, 1989 candidate
Stirrup shell	<i>Quadrula stapes</i>	Freshwater Mussels	AL, MS	1971	1984	11	1971 report, 1980 warrant review
Texas Henslow's sparrow	<i>Ammodramus henslowii houstonensis</i>	Birds	TX	1982	1983	1	1982 candidate
Upland combshell	<i>Epioblasma metastriata</i>	Freshwater Mussels	AL, GA, TN	1971	1988	15	1971 report, 1989 candidate
Valdina farms salamander	<i>Eurycea troglodytes ssp.</i>	Amphibians	TX	1977	1987	10	1977 warrant review
Virgin Islands screech owl	<i>Otus nudipes newtoni</i>	Birds	Virgin Islands	1975	1980	5	1975 CITES, 1980 petition

Table 6. 32 species became extinct with no endangered listing process initiated under the Endangered Species Act to provide protections.

Common Name	Scientific Name	Taxon	Range	Extinct
Achatinellid land snail	<i>Newcombia plicata</i>	Terrestrial Snails	HI	1989
Bland Oregonian	<i>Cryptomastix mullani blandi</i>	Terrestrial Snails	ID	1990
Blue point pyrg	<i>Pyrgulopsis coloradensis</i>	Freshwater Snails	NV	1992
Breckenridge Mountain slender salamander	<i>Batrachoseps "Breckenridge"</i>	Amphibians	CA	1983
Cyanea dolichopoda	<i>Cyanea dolichopoda</i>	Flowering Plants	HI	1992
Digressa picture-wing	<i>Drosophila digressa</i>	Insects	HI	1986
Emerald seaslug	<i>Phyllaplysia smaragda</i>	Marine Slug	FL	1981
Fish Lake pyrg	<i>Pyrgulopsis ruinosa</i>	Freshwater Snails	NV	1993
Giant palouse earthworm	<i>Driloleirus americanus</i>	Worms	WA, ID	1978
Giffard's 'Ohe hedyleptan moth	<i>Omiodes giffardi</i>	Moths	HI	1982
Haha	<i>Cyanea truncata</i>	Flowering Plants	HI	1983
Hawaiian picture wing	<i>Drosophila alsophila</i>	Insects	HI	1985
Hawaiian picture wing	<i>Drosophila toxochaeta</i>	Insects	HI	1985
Hawaiian picture wing	<i>Drosophila psilotarsalis</i>	Insects	HI	1985
Hibiscadelphus crucibracteatus	<i>Hibiscadelphus crucibracteatus</i>	Flowering Plants	HI	1985
High Rock Spring tui chub	<i>Gila bicolor ssp. 11</i>	Freshwater Fish	CA, NV	1989
Koa nalo	<i>Drosophila musaphilia</i>	Insects	HI	1988
Lysimachia venosa	<i>Lysimachia venosa</i>	Flowering Plants	HI	1990
Meyrick's banana hedyleptan moth	<i>Omiodes meyricki</i>	Moths	HI	1982
Nalo hihiu	<i>Drosophila substenoptera</i>	Insects	HI	1991
Nalo kihikihi	<i>Drosophila heteroneura</i>	Insects	HI	1993
Nalo makamae	<i>Drosophila ochrobasis</i>	Insects	HI	1986
Nalo maka'ula	<i>Drosophila differens</i>	Insects	HI	1986
Nalo miki	<i>Drosophila hemipeza</i>	Insects	HI	1983
Nerite rams -horn	<i>Vorticifex neritoides</i>	Freshwater Snails	OR, WA	1988
O'ahu hesperomannia philodoria moth	<i>Philodoria sp.</i>	Moths	HI	1987
Opuhe nalo	<i>Drosophila aglaia</i>	Insects	HI	1980
Oregon giant earthworm	<i>Driloleirus macelfreshi</i>	Worms	OR	1985
Penasco least chipmunk	<i>Tamias minimus atristriatus</i>	Mammals	NM	1980
Rich Mountain cave beetle	<i>Pseudanophthalmus krekeleri</i>	Beetles	WV	1985
San Gabriel Mountains blue butterfly	<i>Plebejus saepiolus aureolus</i>	Butterflies	CA	1985

| Sylvan hygrotus diving beetle

Hygrotus sylvanus

Beetles

MN, NY, MA

1979

|

Table 7. 26 extinct species did not suffer delays in the endangered listing process.

Common Name	Scientific Name	Taxon	Range	Listing Initiated	Listed	Extinct
Achatinellid land snail	<i>Partulina kaaeana</i>	Terrestrial Snails	HI	1994		1981
Cyanea habenata	<i>Cyanea habenata</i>	Flowering Plants	HI			1978
Dusky seaside sparrow	<i>Ammodramus maritimus nigrescens</i>	Birds	FL	1967	1974	1987
Eskimo curlew	<i>Numenius borealis</i>	Birds	USA	1967	1974	1987
False spike	<i>Quincuncina mitchelli</i>	Freshwater Mussels	TX, NM	1989		1975
Georgia Depression Lewis's woodpecker	<i>Melanerpes lewis pop. 1</i>	Birds	WA			1975
Kauai 'O'o	<i>Moho braccatus</i>	Birds	HI	1967	1974	1987
Large Kauai thrush	<i>Myadestes myadestinus</i>	Birds	HI	1970	1974	1989
Longjaw cisco	<i>Coregonus alpenae</i>	Freshwater Fish	IL, IN, MI, NY, OH, PA, WI	1967	1974	1975
Longstreet springsnail	<i>Pyrgulopsis sp.</i>	Freshwater Snails	NV			1975
Marianas euploea butterfly	<i>Euploea eleutho</i>	Butterflies	Guam	1996		1975
Maryland darter	<i>Etheostoma sellare</i>	Freshwater Fish	MD	1967	1974	1988
Maui 'Akepa	<i>Loxops coccineus ochraceus</i>	Birds	HI	1970	1974	1988
Mexican fawnsfoot	<i>Truncilla cognata</i>	Freshwater Mussels	TX	1989		1975
Moloka'i thrush	<i>Myadestes lanaiensis rutha</i>	Birds	HI	1970	1974	1980
Morro Bay kangaroo rat	<i>Dipodomys heermanni morroensis</i>	Mammals	CA	1970	1974	1991
Nalo huluhulu	<i>Drosophila tarphytrichia</i>	Insects	HI	1995		1975
Nalo mea hula	<i>Drosophila neoclavisetae</i>	Insects	HI	1995		1975
'O'u	<i>Psittirostra psittacea</i>	Birds	HI	1967	1974	1989
Oahu alauahio	<i>Paroreomyza maculata</i>	Birds	HI	1970	1974	1990
Oha, haha, `Ohawai	<i>Cyanea eleeleensis</i>	Flowering Plants	HI	1977		1977
Paria iris	<i>Iris pariensis</i>	Flowering Plants	UT	1976		1976
Phantom shiner	<i>Notropis orca</i>	Freshwater Fish	NM, TX	1982		1975

Sangre de Cristo peaclam	<i>Pisidium sanguinichristi</i>	Freshwater Snails	NM	1981	1981
Scaevola hobdyi	<i>Scaevola hobdyi</i>	Flowering Plants	HI		1980
Web-footed coqui	<i>Eleutherodactylus karlshmidti</i>	Amphibians	Puerto Rico	1982	1974

Table 8. 114 species that have become extinct since 1973, organized by state.

Common Name	Scientific Name	Taxon	Range	Extinct
Amak Island song sparrow	<i>Melospiza melodia amaka</i>	Birds	AK	1988
Eskimo curlew	<i>Numenius borealis</i>	Birds	AK, AR, CO, CT, IA, IL, IN, KS, LA, MA, MD, ME, MI, MN, MO, MT, NB, NC, ND, NE, NJ, NY, OH, OK, PA, RI, SC, SD, TX, WI, WY	1987
Cahaba pebblesnail	<i>Clappia cahabensis</i>	Snails	AL	1976
Lined pocketbook	<i>Lampsilis binominata</i>	Freshwater Mussels	AL, GA	1976
Southern acornshell	<i>Epioblasma othcaloogensis</i>	Freshwater Mussels	AL, GA, TN	1974
Upland combshell	<i>Epioblasma metastrinata</i>	Freshwater Mussels	AL, GA, TN	1988
Curtus's pearly mussel	<i>Pleurobema curtum</i>	Freshwater Mussels	AL, MS	1990
Marshall's pearly mussel	<i>Pleurobema marshalli</i>	Freshwater Mussels	AL, MS	1980
Stirrup shell	<i>Quadrula stapes</i>	Freshwater Mussels	AL, MS	1984
Chiricahua mudwort	<i>Limosella pubiflora</i>	Flowering Plants	AZ, NM	1992
Breckenridge Mountain slender salamander	<i>Batrachoseps "breckenridge"</i>	Amphibians	CA	1983
Cuyamaca raspberry	<i>Rubus glaucifolius var. ganderi</i>	Flowering Plants	CA	1988
Fresno kangaroo rat	<i>Dipodomys nitratooides exilis</i>	Mammals	CA	1992
Hoffman jewelflower	<i>Streptanthus glandulosus var. hoffmanii</i>	Flowering Plants	CA	1984
Keeled sideband	<i>Monadenia circumcarinata</i>	Snails	CA	1984
Lotis blue butterfly	<i>Lycaeides idas lotis</i>	Butterflies	CA	1983
Morro Bay kangaroo rat	<i>Dipodomys heermanni morroensis</i>	Mammals	CA	1991
Saline Valley phacelia	<i>Phacelia amabilis</i>	Flowering Plants	CA	1985
San Gabriel Mountains blue butterfly	<i>Plebejus saepiolus aureolus</i>	Butterflies	CA	1985
High Rock Spring tui chub	<i>Gila bicolor ssp. 11</i>	Freshwater fish	CA, NV	1989
Lake Tahoe benthic stonefly	<i>Capnia lacustra</i>	Insects	CA, NV	1994
Dusky seaside sparrow	<i>Ammodramus maritimus nigrescens</i>	Birds	FL	1987
Emerald seaslug	<i>Phyllaplysia smaragda</i>	Marine Slugs	FL	1981
Narrow-leaved hoary pea	<i>Tephrosia angustissima var. angustissima</i>	Flowering Plants	FL	1985
Ochlockonee moccasinshell	<i>Medionidus simpsonianus</i>	Freshwater Mussels	FL, GA	1993

Guam bridled white-eye	<i>Zosterops conspicillatus</i>	Birds	Guam	1983
	<i>conspicillatus</i>			
Guam broadbill	<i>Myiagra freycineti</i>	Birds	Guam	1984
Guam cardinal honey-eater	<i>Myzomela cardinalis saffordi</i>	Birds	Guam	1984
Guam rufous fantail	<i>Rhipidura rufifrons uraniae</i>	Birds	Guam	1984
Guam white-throated ground dove	<i>Gallicolumba xanthonura</i>	Birds	Guam	1986
	<i>xanthonura</i>			
Little Mariana fruit bat	<i>Pteropus tokudae</i>	Mammals	Guam	1979
Marianas euploea butterfly	<i>Euploea eleutho</i>	Butterflies	Guam	1975
Marianna mallard	<i>Anas oustaleti</i>	Birds	Guam	1981
Achatinellid land snail	<i>Partulina kaaeana</i>	Terrestrial Snails	HI	1981
Achatinellid land snail	<i>Newcombia plicata</i>	Terrestrial Snails	HI	1989
Achatinellid land snail	<i>Newcombia cinnamomea</i>	Terrestrial Snails	HI	1975
Bishop's 'O 'o	<i>Moho bishopi</i>	Birds	HI	1986
Blood tetramolopium	<i>Tetramolopium consanguineum</i> var.	Flowering Plants	HI	1980
	<i>kauense</i>			
Cyanea dolichopoda	<i>Cyanea dolichopoda</i>	Flowering Plants	HI	1992
Cyanea habenata	<i>Cyanea habenata</i>	Flowering Plants	HI	1978
Digressa picture-wing	<i>Drosophila digressa</i>	Insects	HI	1986
Four-angled pelea	<i>Melicope quadrangularis</i>	Flowering Plants	HI	1991
Giffard's 'Ohe hedylectan moth	<i>Omiodes giffardi</i>	Moths	HI	1982
Haha	<i>Cyanea truncate</i>	Flowering Plants	HI	1983
Haleakala stenogyne	<i>Stenogyne haliakalae</i>	Flowering Plants	HI	1984
Hawaiian picture wing	<i>Drosophila alsophila</i>	Insects	HI	1985
Hawaiian picture wing	<i>Drosophila toxochaeta</i>	Insects	HI	1985
Hawaiian picture wing	<i>Drosophila psilotarsalis</i>	Insects	HI	1985
Hedyotis degeneri var. coprosmifolia	<i>Hedyotis degeneri</i> var. <i>coprosmifolia</i>	Flowering Plants	HI	1985
Hibiscadelphus crucibracteatus	<i>Hibiscadelphus crucibracteatus</i>	Flowering Plants	HI	1985
Kauai 'O'o	<i>Moho braccatus</i>	Birds	HI	1987
Koa nalo	<i>Drosophila musaphilia</i>	Insects	HI	1988
Lanai phyllostegia	<i>Phyllostegia imminuta</i>	Flowering Plants	HI	1979
Large Kauai thrush	<i>Myadestes myadestinus</i>	Birds	HI	1989
Lysimachia venosa	<i>Lysimachia venosa</i>	Flowering Plants	HI	1990

Maui 'Akepa	<i>Loxops coccineus ochraceus</i>	Birds	HI	1988
Meyrick's banana hedyleptan moth	<i>Omiodes meyricki</i>	Moths	HI	1982
Moloka'i thrush	<i>Myadestes lanaiensis rutha</i>	Birds	HI	1980
Nalo hiihiu	<i>Drosophila substenoptera</i>	Insects	HI	1991
Nalo huluhulu	<i>Drosophila tarphytrichia</i>	Insects	HI	1975
Nalo kihikihi	<i>Drosophila heteroneura</i>	Insects	HI	1993
Nalo makamae	<i>Drosophila ochrobasis</i>	Insects	HI	1986
Nalo maka'ula	<i>Drosophila differens</i>	Insects	HI	1986
Nalo mea hula	<i>Drosophila neoclavisetae</i>	Insects	HI	1975
Nalo miki	<i>Drosophila hemipeza</i>	Insects	HI	1983
Neal's melicope	<i>Melicope nealiae</i>	Flowering Plants	HI	1979
'O 'u	<i>Psittirostra psittacea</i>	Birds	HI	1989
Oahu 'Akepa	<i>Loxops coccinea wolstenholmii</i>	Birds	HI	1976
Oahu alauahio	<i>Paroreomyza maculata</i>	Birds	HI	1990
O'ahu hesperomannia philodoria moth	<i>Philodoria sp.</i>	Moths	HI	1987
Oahu tree snail bellula	<i>Achatinella bellula</i>	Terrestrial Snails	HI	1981
Oahu tree snail bulimoides	<i>Achatinella bulimoides</i>	Terrestrial Snails	HI	1985
Oahu tree snail curta	<i>Achatinella curta</i>	Terrestrial Snails	HI	1989
Oahu tree snail leucorraphe	<i>Achatinella leucorraphe</i>	Terrestrial Snails	HI	1989
Oahu tree snail lorata	<i>Achatinella lorata</i>	Terrestrial Snails	HI	1974
Oahu tree snail phaeozona	<i>Achatinella phaeozona</i>	Terrestrial Snails	HI	1974
Oahu tree snail pupukanioe	<i>Achatinella pupukanioe</i>	Terrestrial Snails	HI	1980
Oahu tree snail swiftii	<i>Achatinella swiftii</i>	Terrestrial Snails	HI	1976
Oahu tree snail taeniolata	<i>Achatinella taeniolata</i>	Terrestrial Snails	HI	1978
Oahu tree snail turgida	<i>Achatinella turgida</i>	Terrestrial Snails	HI	1974
Oahu tree snail viridans	<i>Achatinella viridans</i>	Terrestrial Snails	HI	1979
Oha, haha, `Ohawai	<i>Cyanea eleeleensis</i>	Flowering Plants	HI	1977
Opuhe nalo	<i>Drosophila aglaia</i>	Insects	HI	1980
Pupillid land snail (Mirapupa)	<i>Lyropupa perlonga</i>	Terrestrial Snails	HI	1980
Scaevola hobbyi	<i>Scaevola hobbyi</i>	Flowering Plants	HI	1980
Bland Oregonian	<i>Cryptomastix mullani blandi</i>	Snails	ID	1990
White catspaw	<i>Epioblasma obliquata perobliqua</i>	Freshwater Mussels	IL, IN, KY, MI,	1993

Longjaw cisco	<i>Coregonus alpenae</i>	Fish	OH IL, IN, MI, NY, OH, PA, WI	1975
Shortnose cisco	<i>Coregonus reighardi</i>	Fish	IL, IN, MI, NY, WI	1985
Maryland darter	<i>Etheostoma sellare</i>	Fish	MD	1988
Sylvan hygrotus diving beetle	<i>Hygrotus sylvanus</i>	Beetles	MN, NY, MA	1979
Penasco least chipmunk	<i>Tamias minimus atristriatus</i>	Mammals	NM	1980
Sangre de Cristo peaclam	<i>Pisidium sanguinichristi</i>	Snails	NM	1981
Phantom shiner	<i>Notropis orca</i>	Fish	NM, TX	1975
Blue point pyrg	<i>Pyrgulopsis coloradensis</i>	Freshwater Snails	NV	1992
Fish Lake pyrg	<i>Pyrgulopsis ruinosa</i>	Freshwater Snails	NV	1993
Longstreet springsnail	<i>Pyrgulopsis sp.</i>	Freshwater Snails	NV	1975
Oregon giant earthworm	<i>Driloleirus macelfreshi</i>	Worms	OR	1985
Nerite rams -horn	<i>Vorticifex neritoides</i>	Freshwater Snail	OR, WA	1988
Golden coqui	<i>Eleutherodactylus jasperi</i>	Amphibians	Puerto Rico	1981
Mottled coqui (Eneida's coqui)	<i>Eleutherodactylus eneidae</i>	Amphibians	Puerto Rico	1990
Web-footed coqui	<i>Eleutherodactylus karlschmidti</i>	Amphibians	Puerto Rico	1974
Green blossom	<i>Epioblasma torulosa gubernaculum</i>	Freshwater Mussels	TN, VA	1984
Little Aguja pondweed	<i>Potamogeton clystocarpus</i>	Flowering Plants	TX	1989
Mexican fawnsfoot	<i>Truncilla cognata</i>	Freshwater Mussels	TX	1975
San Marcos gambusia	<i>Gambusia georgei</i>	Fish	TX	1983
Texas Henslow's sparrow	<i>Ammodramus henslowii houstonensis</i>	Birds	TX	1983
Valdina farms salamander	<i>Eurycea troglodytes ssp.</i>	Amphibians	TX	1987
False spike	<i>Quincuncina mitchelli</i>	Freshwater Mussels	TX, NM	1975
Paria iris	<i>Iris pariensis</i>	Flowering Plants	UT	1976
Virgin Islands screech owl	<i>Otus nudipes newtoni</i>	Birds	Virgin Islands	1980
Georgia Depression Lewis's woodpecker	<i>Melanerpes lewis pop. 1</i>	Birds	WA	1975
Giant palouse earthworm	<i>Driloleirus americanus</i>	Worms	WA, ID	1978
Rich Mountain cave beetle	<i>Pseudanopthalmus krekeleri</i>	Beetles	WV	1985

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Appendix A. 108 species that have become extinct since 1973, organized by state.					
Common Name	Scientific Name	Taxon	Range	Last Seen	Conservation History
Amak Island song sparrow	<i>Melospiza melodia amaka</i>	Bird	AK	1988	Approximately 25 individual Amak Island song sparrows (<i>Melospiza melodia amaka</i>) were seen in July 1987; only four or five were observed in July 1988.
Eskimo curlew	<i>Numenius borealis</i>	Bird	AK and continental	1987	The Eskimo curlew (<i>Numenius borealis</i>) was formerly across much of the eastern U.S. and Canada. It was driven to extinction by hunting, conversion of winter and migratory stopover grassland habitat to agriculture, and commercial development. One of its key prey species, the Rocky Mountain grasshopper, was also driven extinct by habitat loss. The last reliable sighting was in 1987, though unconfirmed and questionable sightings occur to this day.
Cahaba pebblesnail	<i>Clappia cahabensis</i>	Snail	AL	1976	The Cahaba pebblesnail (<i>Clappia cahabensis</i>) was collected only once in the Cahaba River, Bibb County, Alabama in 1976.
Lined pocketbook	<i>Lampsilis binominata</i>	Mussel	AL, GA	1976	The lined pocketbook (<i>Lampsilis binominata</i>) was last seen alive (four individuals) in 1967 in the Flint River, Pike and Meriwether counties. The last shell, appearing to be three years old, was collected in 1976 in the Flint River at Warm Spring, Georgia [312]
Southern acornshell	<i>Epioblasma othcaloogensis</i>	Mussel	AL, GA, TN	1974	The southern acornshell (<i>Epioblasma othcaloogensis</i>) was last seen in the Cahaba River in the 1930s and the Coosa River in 1974.
Upland combshell	<i>Epioblasma metastrata</i>	Mussel	AL, GA, TN	1988	The upland combshell (<i>Epioblasma metastrata</i>) was last seen in the Cahaba River, AL in the early 1970s, and the Conasauga River, GA in 1988.
Curtus's pearly mussel	<i>Pleurobema curtum</i>	Mussel	AL, MS	1990	Curtus's pearly mussel (<i>Pleurobema curtum</i>) was historically found in the Tombigbee River near Pickensville, Alabama and the East Fork of the Tombigbee River downstream of its confluence with Bull Mountain Creek, Mississippi. A single record from the Big Black River, Mississippi is considered erroneous [310]. Mussel populations in the East Fork have been surveyed regularly since the 1980s. The Mississippi Museum of Natural Science surveyed the most promising pearly mussel habitat in 1990, 1991, 1992, 1993, 1997, 1999, and 2001 [28]. The most recent records are three freshly dead shells killed by a raccoon in 1989 in the East Fork, and two more in 1990 [28].
Marshall's pearly mussel	<i>Pleurobema marshalli</i>	Mussel	AL, MS	1980	Marshall's pearly mussel (<i>Pleurobema marshalli</i>) was historically known from the mainstem of the Tombigbee River in Mississippi and Alabama. It was last seen in 1980 in the Tombigbee River near Columbus, Mississippi [28].
Stirrup shell	<i>Quadrula stapes</i>	Mussel	AL, MS	1984	The stirrup shell (<i>Quadrula stapes</i>) formerly occurred in the Tombigbee River from Columbus, Mississippi to Epes, Alabama, the Black Warrior River, Alabama and in the Alabama River. It was last seen in 1984 [310]
Curtis pearlymussel	<i>Epioblasma florentina curtisi</i>	Mussel	AR, MO	1994	The Curtis pearlymussel (<i>Epioblasma florentina curtisi</i>) historically occurred in the White and St. Francis watersheds of southern Missouri and northeastern Arkansas [1]. In Arkansas, it occurred in the Spring River system, a tributary to the Black River; in Missouri it occurred

					in the White, Black, and Castor river systems [1]. It was last seen in the Little Black River, MO in 1994. Surveys in 1995, 1996, and 1998 did not locate any individuals [50, 103].
Virgin Islands screech owl	<i>Otus nudipes newtoni</i>	Bird	AVI	1980	The Virgin Islands screech owl (<i>Otus nudipes newtoni</i>) historically occurred on several small islands immediately east of Puerto Rico in the Caribbean. It was last seen in 1980 despite a three-week survey of St. John, St. Croix, and St. Thomas in 1995 [211]. These islands contain the largest remaining patches of suitable habitat.
Breckenridge Mountain slender salamander	<i>Batrachoseps "breckenridge"</i>	Amphibian	CA	1983	The Breckenridge Mountain slender salamander (<i>Batrachoseps "breckenridge"</i>) was known only from a single seepage on the southeastern flank of Breckenridge Mountain, Tulare County, California at 6,300 ft [193]. It was discovered in 1979 and seen again in 1983. In the intervening years, black oaks around the seepage had been logged and a logging road had been constructed across the seep [1, 190, 193]. It has not been found since[31]. In 2001, collections of a similar butterfly were made in the Lucas Creek drainage on the northern side of Breckenridge Mountain and deposited in the Museum of Vertebrate Zoology which also houses the original collection [190]. David Wake at UC Berkeley is examining the 2000 and 2001 populations
Fresno kangaroo rat	<i>Dipodomys nitratoides exilis</i>	Mammal	CA	1992	The Fresno kangaroo rat (<i>Dipodomys nitratoides exilis</i>) formerly occurred on about 888,500 acres in an area of grassland and chenopod scrub communities on the San Joaquin Valley floor, from about the Merced River, Merced County on the north, to the northern edge of the marshes surrounding Tulare Lake, Kings County on the south, and extending from the edge of the Valley floor near Livingston, Madera, Fresno, and Selma, westward to the wetlands of Fresno Slough and the San Joaquin River. Fresno kangaroo rats were captured on the Alkali Sink Ecological Reserve in 1981 and 1985, and on adjacent privately owned land in 1981. In spring of 1986 a levee on the south side of the San Joaquin River broke, flooding the Alkali Sink Ecological Reserve and other important habitat. Water nearly a meter deep covered most of the area for several days. The last sighting of the subspecies was the capture of a single male in autumn 1992 on the Reserve. Trapping at the Reserve in 1993, 1994, and 1995 did not yield additional captures. Trapping at other sites in Merced, Madera, and Fresno Counties between 1988 and 1996 were also unsuccessful.
Hoffman jewelflower	<i>Streptanthus glandulosus var. hoffmanii</i>	Plant	CA	1984	The Hoffman jewelflower (<i>Streptanthus glandulosus var. hoffmanii</i>) is endemic to Sonoma County, California. It was last observed in 1984 [1].
Keeled sideband	<i>Monadenia circumcarinata</i>	Snail	CA	1984	The keeled sideband (<i>Monadenia circumcarinata</i>) is a terrestrial snail endemic to the Tuolumne River canyon, where it was found in association with steep limestone outcrops and talus slopes (246). The California Academy of Sciences records eight specimens from Tuolumne and Stanislaus Counties including one on Paper Cabin Ridge about 18.5 miles west of the Yosemite National Park [246]. By 1968 it was nearing extinct [174]. It was last

					seen in 1984.
Lotis blue butterfly	<i>Lycaeides idas lotis</i>	Insect	CA	1983	The Lotis blue butterfly (<i>Lycaeides idas lotis</i>) formerly occurred in wet meadows and sphagnum-willow bogs in Mendocino, northern Sonoma, and possibly northern Marin Counties, California [96]. It was last observed in 1983 in a sphagnum bog in the Pygmy Forest, Mendocino County (a report of a 1994 citing is erroneous). Surveys from the mid 1980s through 2003 have not located the species [15]. Droughts in the late 1970s caused severe declines in populations of Coast Hosackia (<i>Lotus formosissimus</i>), the plant thought to have supported its development. Fire suppression, tree encroachment, development, and possibly climate change also reduced the species' habitat.
Morro Bay kangaroo rat	<i>Dipodomys heermanni morroensis</i>	Mammal	CA	1991	The Morro Bay kangaroo rat (<i>Dipodomys heermanni morroensis</i>) lived in stabilized sand dune areas south of Morro Bay, California. In 1918, approximately 35,000 animals occupied a contiguous block of habitat. By 1957 the population was estimated to be 8,000 animals. By 1977 a maximum of 2,000 animals were estimated. By 1986, only 50 individuals remained with available habitat having been reduced by 98% to 12.6 ha. Wild animals were last seen in 1987 and signs of an introduced population (tracks, tail drags, and scat) were last seen in 1991 on the Bay View Property [79, 91]. Survey efforts since then have not found the species.
Saline Valley phacelia	<i>Phacelia amabilis</i>	Plant	CA	1985	Saline Valley phacelia (<i>Phacelia amabilis</i>) was discovered in 1942, confirmed to exist in the 1980s, and has not since been seen [1].
San Gabriel Mountains blue butterfly	<i>Plebejus saepiolus aureolus</i>	Insect	CA	1985	The San Gabriel Mountains Blue butterfly (<i>Plebejus saepiolus aureolus</i>) was known only from a single wet meadow within the yellow pine forest near the Big Pines Ranger Station, San Gabriel Mountains, Angeles National Forest, California [14]. Its host plant was <i>Trifolium wormskioldii</i> . At a minimum it was seen in 1970, 1980, and 1985. It has not been seen since 1985 [14]. It was not found in a 1995 survey which was a very wet year that would have encouraged reproduction if the taxon still existed [97]. The meadow was still wet, but had been made smaller due to the diversion of some of the water from the natural spring feeding it. The diversion of the spring by the U.S. Forest Service has been suggested as the cause of the species extinction [189]. There is a chance the San Garbriel blue exists in the upper Fish Fork of the San Gabriel River on the north side of Mt. San Antonio though it has never been recorded there [97]. The area has permanent water and may contain suitable wet meadow habitats. Other sites that should be checked are the few remaining wet meadows just ESE of Mountain High Ski Area, WNW of Wrightwood [97]. Some of these are on private land, and willows have overgrown much of the acreage. Water has likely been drained away from the meadows.
High Rock Spring tui chub	<i>Gila bicolor ssp. 11</i>	Fish	CA, NV	1989	The High Rock Spring tui chub (<i>Gila bicolor ssp. 11</i>) was endemic to three connected springs on the border of northern California/Nevada. In California it occurred in High Rock Springs and its outflow in eastern Lassen County. In Nevada it occurred at Fish Springs and

					<p>Flanigan, Washoe County. It was extirpated from the Nevada sites by dessication due to water pumping. In 1982, the California Department of Fish and Game issued an aquaculture permit to the owner of High Rock Springs rear Mozambique tilapia (<i>Oreochromis mossambica</i>) 100 yards downstream of the spring. Tilapia penetrated the protective screening, entered the spring, and competed with/preyed upon the tui chub. The latter was not seen was after 1989 [342, 160]. Introduced channel catfish and freshwater prawns may also have contributed to the species extinction [1].</p>
Lake Tahoe benthic stonefly	<i>Capnia lacustra</i>	Insect	CA, NV	1994	<p><i>Capnia lacustra</i> is a unique, flightless stonefly endemic to deep waters in Lake Tahoe, Nevada and California. It appears to have been abundant (38-80 stoneflies per square meter) in 1962 and 1963 when first discovered. (Some report erroneously state that the species was only located in 1962). <i>Capnia lacustra</i> was not located during surveys in the mid 1980s, and the last collection was of two individual in October 1993 and two more in March 1994 [181, 98]. (Some reports erroneously state that specimens were collected in 1992 or none in 1994). An intensive 1999 survey using a variety of techniques failed to locate the species [181]. The surveyors concluded that the species was either extinct, greatly reduced in number, or reduced in distribution.</p> <p>Algae production has increased in Lake Tahoe due to anthropogenic causes, causing a 33% clarity reduction in the past three decades [181]. The reduction in available light would likely affect <i>Capnia lacustra</i> by reducing the density and distribution of its vegetative habitat. <i>Chara delicatula</i> populations appear to have declined dramatically from historic levels, especially in deeper waters, and may already have been in decline in 1963. Compounding this problem was the introduction of opossum shrimp (<i>Mysis relicta</i>) to the lake (probably by California Game and Fish) to feed introduced fish [430]. It caused a decline in zooplankton which in turn caused an increase in algal growth.</p> <p>Unlike other stoneflies which mate during their flight stage and thus have a high degree of population interaction, <i>Capnia lacustra</i>'s flightlessness limits dispersal ability and may make the species more vulnerable to extinction. The introduction of exotic, predatory kokanee salmon and large mouthbass may also threaten the species.</p>
Dusky seaside sparrow	<i>Ammodramus maritimus nigrescens</i>	Bird	FL	1987	<p>The dusky seaside sparrow (<i>Ammodramus maritimus nigrescens</i>) was endemic to Merritt Island and the upper St. Johns River marshes of Brevard County, Florida. It declined as its salt marsh habitat was drained or converted to freshwater mosquito-control impounds [175]. The use of DDT to control mosquitoes was also suspected as a contributing factor. The last remaining wild birds-- all male --were taken into captivity in 1979 and 1980 and mated with the closely related <i>A. m. peninsulae</i>. It was hoped that backcrossing would produce a subspecies nearly identical to <i>A. m. nigrescens</i>, but the program was terminated by the Reagan administration and the last pure sparrow died on June 16, 1987. The hybrid offspring had died by the summer of 1989.</p>

Emerald seaslug	<i>Phyllaplysia smaragda</i>	Marine Slug	FL	1981	The emerald seaslug (<i>Phyllaplysia smaragda</i>) was discovered in the early 1970s where it was relatively common in the Indian River lagoon system on Florida's Atlantic coast [158, 159]. It may have specialized on the epiphytic algae growing on the basal stems of the seagrass <i>Syringodium</i> . This habitat was extirpated from the species type locality, but remains widespread elsewhere in Florida and the Caribbean. It was last seen in 1981.
Narrow-leaved hoary pea	<i>Tephrosia angustissima</i> var. <i>angustissima</i>	Plant	FL	1985	The narrow-leaved hoary pea (<i>Tephrosia angustissima</i> var. <i>angustissima</i>) was first collected in 1846 in pine rockland habitat near the Miami River. This habitat has been largely destroyed in south Florida, and virtually none exists within the taxa's former range. The last collection was from a natural site was in 1947. A collection was made from a disturbed lot outside of the taxon's natural range in 1985. This plant is thought to have been brought in on roadfill. A survey in 2000 found that the population had been destroyed. [212, 318].
Ochlockonee moccasinshell	<i>Medionidus simpsonianus</i>	Mussel	FL, GA	1993	The Ochlockonee moccasinshell (<i>Medionidus simpsonianus</i>) formerly inhabited the Ochlockonee River system, occurring in the main stem in Georgia and Florida, and the Little River. Only three live specimens have been collected since 1974 despite concerted efforts by numerous investigators. Single live specimens were found in 1974, 1990, and 1993 [99].
Guam bridled white-eye	<i>Zosterops conspicillatus conspicillatus</i>	Bird	GU	1983	The Guam bridled white-eye (<i>Zosterops conspicillatus conspicillatus</i>) was endemic to, and occurred throughout the island of Guam. Its disappearance from the island occurred from the south to the north. By 1945 the southern portion of the island supported just a few birds. The central portion was last known to support a bird in 1961. A 1981 U.S. Fish and Wildlife Service survey documented the extirpation of the species from the southern, central, and 98% of the northern portions of the island. It estimated that 2,220 birds remained, but this was likely a vast overestimation. In 1982 white-eyes were restricted to the Pajon Basin at Ritidian Point in extreme northern Guam. A 1983 survey suggested that fewer than 50 remained there. The last family group was observed with a fledgling in the fall of 1982 at Pajon Basin. The last observation was of an individual was in June 1983 in Pajon Basin.
Guam broadbill	<i>Myiagra freycineti</i>	Bird	Guam	1984	The Guam broadbill (<i>Myiagra freycineti</i>) was once found in mangrove swamps and all forests on Guam. Prior to 1950, it occupied 310 square miles. By 1950, its range had been reduced to 193 square miles. By the early 1970s, it was entirely absent from the southern two-thirds of the island but remained widespread and common in northern Guam into the mid-1970s. By 1979 it was restricted to the mature limestone forest of the relatively undisturbed northern cliffline and was rare in the mixed woodlands and second growth of the extreme northwestern portion of the northern plateau. A 1981 U.S. Fish and Wildlife survey estimated a total population of 460 Guam broadbills, with birds occurring at low densities, and encountered regularly only in extreme northwestern Guam. In 1983 survey estimated 100 birds, primarily restricted to the Pajon Basin, a small area on the north coast. That same year, a male broadbill was collected for captive propagation. This captive breeding attempt failed because no other individuals could be located and the captive male died of unknown causes

					<p>in February 1984. The last sightings of this species took place in 1984, one in March in the Northwest Field on Andersen Air Force Base, and one in August adjacent to the Navy golf course in Barrigada.</p> <p>The extinction of the Guam broadbill was caused by habitat loss, pesticide use, avian diseases, and most importantly, predation by introduced animals, including rats, monitor lizards, and brown tree snakes. The latter was the primarily culprit in the broadbill's extinction.</p>
Guam cardinal honey-eater	<i>Myzomela cardinalis saffordi</i>	Bird	Guam	1984	The cardinal honey-eater (<i>Myzomela cardinalis saffordi</i>) has not been observed since 1984 [1]. It formerly occurred on Guam where it was devastated by the introduction of brown tree snakes from New Guinea during World War II.
Guam rufous fantail	<i>Rhipidura rufifrons uraniae</i>	Bird	Guam	1984	The Guam rufous fantail (<i>Rhipidura rufifrons uraniae</i>) was formerly widely dispersed on Guam, using most habitats except savannah. It was last seen in 1984 [26].
Guam white-throated ground dove	<i>Gallicolumba xanthonura xanthonura</i>	Bird	Guam	1986	The Guam white-throated ground dove (<i>Gallicolumba xanthonura xanthonura</i>) was endemic to Guam [26].
Little Mariana fruit bat	<i>Pteropus tokudae</i>	Mammal	Guam	1979	The Little Mariana fruit bat (<i>Pteropus tokudae</i>) was endemic to Guam. Only three specimens have been collected: two by W.F. Coultas for the Whitney South Sea Expedition in 1931, and one skull by G.S.A. Perez between 1966-1968 [424]. The last confirmed sighting was a female which was shot by hunters in a mature limestone forest at Tarague Point in Northern Guam. There was a possible sighting in June 1979 at Ritidian Point
Marianas euploea butterfly	<i>Euploea eleutho</i>	Insect	Guam	1975	The Marianas euploea butterfly (<i>Euploea eleutho</i>) was endemic to the Mariana Islands and historically recorded from Guam, Rota, Saipan, and the northern islands of Alamagan and Anatahan. It was common on Guam in 1936, but has not been collected from Guam, Rota, or Saipan since 1946. Surveys in 1995 confirmed that it is extinct on these southern islands. In the 1970s, the species was recorded on Alamagan and Anatahan. Members of a recent Japanese entomological expedition initially believed that they had rediscovered it on some of the small, remote northern Mariana Islands, but their collections proved to be a different species [342].
Marianna mallard	<i>Anas oustaleti</i>	Bird	Guam	1981	The Mariana mallard (<i>Anas oustaleti</i>) was endemic to freshwater marshes, lakes, rivers, and mangrove lagoons on the islands of Guam, Tinian, and Saipan. It may have also inhabited Rota and Pagan, but the evidence is not conclusive.
					The historic population size is unknown, but the the mallard was likely never abundant because freshwater habitats are limited on the Mariana Archipelago. Two flocks of 50-60 birds observed in 1936 were the largest ever recorded. By the 1940s, flocks of more than a dozen birds were rarely seen. The mallard was last seen on Guam in 1967, on Tinian in 1974, and on Saipan in 1979. A pair of the Saipan birds were captured in 1979 and sent to Sea World (San Diego, CA). The breeding program failed and the last known mallard died in

					<p>captivity in 1981. Repeated surveys of all mallard habitat on Guam, Rota, Tinian, and Saipan since 1979 found no birds.</p> <p>The Mariana mallard's extinction was caused by habitat loss and hunting, especially during and immediately after World War II. During the Japanese occupation of Saipan and Tinian (1914-1945), most wetlands were channelized and converted to rice paddies. Sugar mill wastes were discharged into Lake Susupe on Saipan, the last known location of the Mariana mallard in the wild. After the occupation, wetlands continued to be drained or filled for development on Guam, Tinian, and Saipan. Gun ownership was banned during the occupation but hunting pressure was significant after as the mallard was not wary of humans, and thus was easily caught.</p>
[none given]	<i>Cyperus neokunthianus</i>	Plant	HI	1980	<p><i>Cyperus neokunthianus</i> was endemic to the West Maui Mountains, Maui, Hawaii. It is listed as extinct by Wagner et al. 1999 [3] and as missing by NatureServe [1]. The latter states that it was last seen in the early 1900s, but Price et al. 2004 state that was last seen in 1980 [438]. A USFWS database suggests it was last seen in 1997 [43], but there is no supporting documentation. We judge 1980 to be the last reasonably certain observation date.</p>
`Oha, haha, `Ohawai	<i>Cyanea eleeeensis</i>	Plant	HI	1977	<p>The `Oha, haha, or `Ohawai (<i>Cyanea eleeeensis</i>) is known only from the type specimen collected in 1977 on private land in the Wainiha Valley on Kauai, where it had less than ten individuals when discovered. It was considered to be a population of an existing species of <i>Cyanea</i> until 1992, when it was described as a new species [274]. It has not been since originally discovered in 1977 [1].</p>
[none given]	<i>Carex wahuensis ssp. herbstii</i>	Plant	HI	1994	<p><i>Carex wahuensis ssp. herbstii</i> is known only from a small cliff face leeward of the main spine of the Koolau Range, Oahu, Hawaii. It is listed as possibly extinct by Wagner et al. 1999 [3]. It was collected by Perlman and Obata in 1992 and Perlman in 1994 [444]. A 2003 USFWS database suggests that it was last seen in 1995 [43], but provides no further information. We have been unable to verify the sighting thus regard 1994 as the last reliable observation.</p>
Achatinellid land snail	<i>Partulina kaaeana</i>	Snail	HI	1981	<p>The Achatinellid land snail <i>Partulina kaaeana</i> has been observed twice, both times in 1981 at the same location [1].</p>
Achatinellid land snail	<i>Newcombia plicata</i>	Snail	HI	1989	<p>The Achatinellid land snail <i>Newcombia plicata</i> was found in the State of Hawaii's 1,620-acre Olokui Natural Area Reserve on Molokai during a 1989 survey [261], but apparently has not been seen since. The U.S. Fish and Wildlife Service considers all <i>Newcombia</i> species extinct, though it did not expressly mention this species [USFWS 2002].</p>
Achatinellid land snail	<i>Newcombia cinnamomea</i>	Snail	HI	1975	<p>The Achatinellid land snail <i>Newcombia cinnamomea</i> was last recorded in 1975 on the eastern coastal ridge of the Olokui Natural Area Reserve [209].</p>
Bishop's 'O 'o	<i>Moho bishopi</i>	Bird	HI	1986	<p>On the island of Molokai, Bishop's 'O 'o (<i>Moho bishopi</i>) was last collected at Kaluaaha in 1892, last seen in 1904, and last reported in 1915 at Wailau Trail [1, 11]. An unnamed <i>Moho</i> species, perhaps <i>Moho bishopi</i>, is present in the Maui fossil record [141]. Unconfirmed sightings of <i>Moho bishopi</i> occurred on west Maui in the early 1800s and near</p>

					Olinda on East Maui in 1901. The species was not again reported until two auditory detections in 1973 and unconfirmed sightings in 1980, 1981, 1983, and 1986 [70, 115, 134, 136].
Blood tetramolopium	<i>Tetramolopium consanguineum</i> ssp. <i>leptophyllum</i> var. <i>kauense</i>	Plant	HI	1980	Tetramolopium consanguineum ssp. leptophyllum var. kauense is endemic to the Ka'u district on the island of Hawaii. It has not been seen since its discovery in 1980 [1, 444]. The taxon to which it belongs, however, was the subject of Smithsonian Institution Endangered Species Act listing petitions in 1975 and 1978. Taxonomic note: NatureServe identifies this taxon as Tetramolopium consanguineum var. kauense but states that it is a subtaxon of Tetramolopium consanguineum ssp. leptophyllum [1]. It is listed as Tetramolopium consanguineum ssp. kauense by the Bishop Museum [157] and the Hawaiian Ecosystems at Risk Project [442]. The correct name is Tetramolopium consanguineum ssp. leptophyllum var. kauense [444].
Cyanea dolichopoda	<i>Cyanea dolichopoda</i>	Plant	HI	1992	Cyanea dolichopoda is known only from the type specimen collected in 1990 at the headwaters of the Wailua River, Kauai [1]. Surveys following the strike of Hurricane Iniki in 1992 failed to locate the species [150]. The species may survive undetected, and virtually undetectable, on the vertical cliffs surrounding the Blue Hole [150].
Digressa picture-wing	<i>Drosophila digressa</i>	Insect	HI	1986	The digressa picture-wing (<i>Drosophila digressa</i>) was endemic to the island of Hawaii where it was last seen in 1986 [1].
Four-angled pelea	<i>Melicope quadrangularis</i>	Plant	HI	1991	The four-angled pelea (<i>Melicope quadrangularis</i>) was endemic to Kauai. The last published account was of a 1991 collection [441]. It is listed as extinct in the USFWS 2000 Biennial Report to Congress [2] and in the agency's decision to not designate critical habitat in 2003 [13]. The latter states that it was last seen in 1991. A 2003 USFWS database states that it was last seen in 1998 but no further information is provided [43]. We judge 1991 to be the last reliable sighting.
Giffard's 'Ohe hedyleptan moth	<i>Omiodes giffardi</i>	Insect	HI	1982	Giffard's 'Ohe hedyleptan moth (<i>Omiodes giffardi</i>) was last seen in 1982 [207].
Haha	<i>Cyanea truncate</i>	Plant	HI	1994	<i>Cyanea truncate</i> was discovered in 1911 and is known from a few scattered locations along the windward side of the Koolau Mountains on Oahu. It is listed as extinct by Wagner et al. 1999 [3], possibly extinct by the Hawaiian Biological Survey [19], extirpated from the wild by the IUCN [11], and as missing by NatureServe [1]. The latter states that the last remaining population of two plants was destroyed by feral pigs in 1983. However, citing a personal communication with Joel Q.C. Lau, Hawai'i Natural Heritage Program, Price et al. 2004 state that species was last seen in 1994 [438]. The USFWS 2003 database states that no plants remain, but that the species was last seen in 2002 [43]. We have not been able to document the 2002 sighting thus believe 1994 is the most last credible observation.
Haleakala stenogyne	<i>Stenogyne haliakalae</i>	Plant	HI	1984	The Haleakala stenogyne (<i>Stenogyne haliakalae</i>) formerly occurred on the south and west sides of Haleakala on the Island of Maui [1]. It has not been observed since 1984 [1, 207].

Hibiscadelphus crucibracteatus	<i>Hibiscadelphus crucibracteatus</i>	Plant	HI	1985	Hibiscadelphus crucibracteatus is one of seven Hibiscadelphus trees native to Hawaii. All are endangered, extinct in the wild, or extinct. <i>H. crucibracteatus</i> is known only from the type specimen, a single tree discovered in 1981 on a windward, dry slope of Puhielelu Ridge, Lanai. Seeds were harvested on several occasions, but none germinated [1, 3].
Kauai 'O'o	<i>Moho braccatus</i>	Bird	HI	1987	The Kauai 'O'o (<i>Moho braccatus</i>) was formerly common throughout Kauai. By 1920 it was rare. The 1968-1973 population was estimated to be 36 birds +/- 29 [121]. It was last observed nesting in 1973. A single pair was observed in 1975 [123] and 1981 [121]. The female was likely killed during or in the aftermath of Hurricane Iwa in 1982 or 1983. The male was last seen in 1985, and last heard in 1987 [124, 128].
Koa nalo	<i>Drosophila musaphilia</i>	Insect	HI	1988	Koa nalo (<i>Drosophila musaphilia</i>) was endemic to Kaua'i where it was known only from State of Hawai'i-owned land at Alexander Reservoir, Koke'e State Park, and Halemanu [273]. It has only been seen five times in the past 28 years, the last time being in 1988 [435].
Large Kauai thrush	<i>Myadestes myadestinus</i>	Bird	HI	1989	The largest native Hawaiian thrush, Large Kauai thrush (<i>Myadestes myadestinus</i>) was once the most common bird on Kauai [125]. It disappeared from the outer forests by 1928, but the 1968-1973 population was estimated at 337 birds [121], and in 1975 it "was not uncommon" at Alaka'I Swamp in [123]. By 1981 the population was estimated at 24 birds [121] and was likely further depressed in 1982 by Hurricanes Iwa which drove birds down into ravine shelters which by then were infested with exotic disease-carrying mosquitoes. In 1992 Hurricane Iniki again ravaged the island. Confirmed sightings of two birds occurred in 1985 [124,126]. Two "probable" but unconfirmed sightings with no auditory contact occurred in 1989 [126]. "Brief but inadequate" sightings of two birds were reported in 1993 [127]. The last potential record is an unconfirmed sighting of a single bird in 1995 [124]. We judge the 1989 sighting to be last sufficiently certain record.
Lysimachia venosa	<i>Lysimachia venosa</i>	Plant	HI	1990	Lysimachia venosa is known from one current and two historical collections from the area of Waialeale, Kuai. None were found in 1999 (NatureServe 4-26-03).
Maui 'Akepa	<i>Loxops coccineus ochraceus</i>	Bird	HI	1988	The Maui 'Akepa (<i>Loxops coccineus ochraceus</i>) was locally abundant on East Maui in the 1890s. Its known range is a small patch of undisturbed native forest, but in former times it was likely widespread in wet and mesic forests down to sea level. There were either three [137] or eight [124] detections in 1980, two confirmed sightings in 1988 [124, 137], and unconfirmed audio detections in 1994 and 1995 [124].
Meyrick's banana hedyleptan moth	<i>Omiodes meyricki</i>	Insect	HI	1982	Meyrick's banana hedyleptan moth (<i>Omiodes meyricki</i>) was last seen in 1982 [207].
Moloka'i thrush	<i>Myadestes lanaiensis rutha</i>	Bird	HI	1980	The Moloka'I thrush (<i>Myadestes lanaiensis rutha</i>) was endemic to, and very common on, Moloka'I into the early 1900s, but was in serious decline before 1930 [121]. It was known from higher elevation forests including Mt. Olokui, the Kamakou Preserve, and the Ohialele Plateau [121, 70]. The last sightings occurred in 1974 (three birds at Kamakou Preserve and

					adjacent areas) [121], 1975 (2-3 birds) [124], 1979 (three birds on Olokui Plateau) [121], 1980 (three confirmed, three unconfirmed sightings) [124], and one reported, unconfirmed sighting in 1988 [124, 144]. It is likely, however, that last record is actually of a 1980 sighting [135].
Nalo hihii	<i>Drosophila substenoptera</i>	Insect	HI	1991	Nalo hihii (<i>Drosophila substenoptera</i>) was endemic to O'ahu where it was known from private lands (Wiliwili Nui Ridge, Castle Trail, Halawa Ridge Trail, and Palikea Ridge), state lands (Mt. Ka'ala and the DuPont trail) and those belonging to the City and County of Honolulu (Ka'au Crater) [273]. It was last seen in 1991 on the summit of Mt. Ka'ala [273, 435].
Nalo huluhulu	<i>Drosophila tarphytrichia</i>	Insect	HI	1975	Nalo huluhulu (<i>Drosophila tarphytrichia</i>) was endemic to the Ko'olau and Wai'anae mountain ranges on O'ahu [273]. It disappeared first from the Ko'olau range, was reduced to four sites in the Wai'anae range, and was last seen in 1975 [273, 435].
Nalo kama'a'ole	<i>Drosophila psilotarsalis</i>	Insect	HI	1985	Nalo kama'a'ole (<i>Drosophila psilotarsalis</i>) was last seen in 1972, but according to the U.S. Fish and Wildlife Service it was believed to be extant in the 1980s based on historical collection records, habitat assessments, and surveys by <i>Drosophila</i> researchers [342]. It was not found in more recent surveys, leading the agency to delare the species extinct.
Nalo kikokiko	<i>Drosophila alsophila</i>	Insect	HI	1985	Nalo kikokiko (<i>Drosophila alsophila</i>) was last seen in 1977, but according to the U.S. Fish and Wildlife Service it was believed to be extant in the 1980s based on historical collection records, habitat assessments, and surveys by <i>Drosophila</i> researchers [342]. It was not found in more recent surveys, leading the agency to delare the species extinct.
Nalo makamae	<i>Drosophila ochrobasis</i>	Insect	HI	1986	Nalo makamae (<i>Drosophila ochrobasis</i>) was endemic to the island of Hawai'i where it was regularly collected-- sometimes in large numbers-- between 1967-1975 on State of Hawaii land at Kí puka and Alakahi Stream [273]. It was also seen on private lands at Kí puka Pahipa and Hualalai. It was last seen in 1986 [273, 435].
Nalo malila	<i>Drosophila toxochaeta</i>	Insect	HI	1985	Nalo malila (<i>Drosophila toxochaeta</i>) was last seen in 1973, but according to the U.S. Fish and Wildlife Service it was believed to be extant in the 1980s based on historical collection records, habitat assessments, and surveys by <i>Drosophila</i> researchers [342]. It was not found in more recent surveys, leading the agency to delare the species extinct.
Nalo mea hula	<i>Drosophila neoclavisetae</i>	Insect	HI	1975	Nalo mea hula (<i>Drosophila neoclavisetae</i>) was endemic to Mau'i where it was known only from State of Hawai'i land at Pu'u Kukui [273]. It was last seen in [435].
Nalo miki	<i>Drosophila hemipeza</i>	Insect	HI	1983	Nalo miki (<i>Drosophila hemipeza</i>) was endemic to O'ahu where it is known from only six localities [273]. It was last seen in 1983 [435].
Neal's melicope	<i>Melicope nealiae</i>	Plant	HI	1979	Neal's melicope (<i>Melicope nealiae</i>) is known only from three collections on the west side of Kauai. The first was collected in 1909 at Kaholuamano, the second in 1960 at Kumuwela Ridge, and the third in 1979 on the Honopu Trail [1].
'O'u	<i>Psittirostra psittacea</i>	Bird	HI	1989	The 'O'u (<i>Psittirostra psittacea</i>) formerly occurred on the six largest islands. It was extirpated from Oahu by 1899, from Maui by 1901, from Molokai by 1907, and from Lanai

					<p>by 1931 [129]. By the late 20th century it inhabited only Kauai and Hawaii. The 'O 'u remained one of the most common endemic forest birds on Kauai into the 1960s and had a population estimated in the low hundreds during the late 1970s [123]. It was devastated by Hurricane Iwa in 1982. The last confirmed observations were of one bird in 1987 and two birds in 1989 [124, 126]. There were unconfirmed auditory detections between 1995 and 1997 along Koai'e Stream [124].</p> <p>On Hawaii, the species was most recently found in the wet ohī'a forests of the Hamakua region in Volcanoes National Park. The population estimate was 400 birds +/- 300 in 1976-1978, but a significant portion of its habitat was inundated by the 1984 Mauna Loa lava flow, destroying thousands of acres of forest, creating a treeless corridor over a kilometer [7]. There was an unconfirmed audio detection in 1994 [124]. The last confirmed sighting was in 1987 in the 'Ola'a Forest, Volcanoes National Park [124].</p>
Oahu 'Akepa	<i>Loxops coccinea wolstenholmii</i> (= <i>Loxops coccineus rufa</i>)	Bird	HI	1976	The Oahu 'Akepa (<i>Loxops coccineus wolstenholmii</i>) was endemic to Oahu. It was common in the early 19th century, but apparently rare by the end of the century. Specimens were collected in 1825 and 1893 [125]. There have only been two confirmed sightings in the 20th century: one in about 1900 and one in the late 1930s [139]. A probable sighting of a female in the Koolau range near the headwaters of Kaukonahua Stream occurred in 1976 [138]. Surveys since then have found no birds [121].
Oahu alauahio	<i>Paroreomyza maculate</i>	Bird	HI	1990	The Oahu alauahio (<i>Paroreomyza maculata</i>) was endemic to Oahu. Fossil evidence suggests it once occurred in the lowlands, though historic sightings are all from less degraded higher elevation sites. Sightings since 1977 have been restricted to the Ko'olau and Waianae mountain ranges [70]. There have been no confirmed sightings since February 12, 1985 on the Poamoho Trail [44]. The last probable sighting was in 1990 [69].
O'ahu hesperomannia philodoria moth	<i>Philodoria</i> sp.	Insect	HI	1987	The O'ahu hesperomannia philodoria moth (<i>Philodoria</i> sp.) is only known from Oahu, Hawaii where it was last seen in 1987.
Oahu tree snail bellula	<i>Achatinella bellula</i>	Snail	HI	1981	The Oahu tree snail <i>Achatinella bellula</i> historically ranged from Manoa to Kalihi, a distance of four miles, on the island of Oahu. Some were transplanted to Makaweli on Kauai (none were recovered after 1945). 169 were collected in one location in 1960, but no more than five have been seen at one time since 1979. The species was last seen in 1981 on the trail to Puu Konahuanui.
Oahu tree snail bulimoides	<i>Achatinella bulimoides</i>	Snail	HI	1985	Endemic to the Koolau Mountains, the Oahu tree snail <i>Achatinella bulimoides</i> formerly ranged 12 miles from Waialeale to Kaaawa. There have been four occurrences after 1945: one current (1985) and three historical (1946-1977). [1]. Sightings after 1945 include a 20-square-mile area near Kahana Gulch, on the Poamoho Ridge Trail, and on the ridge between Kaipapau and Maakua Gulches.
Oahu tree snail	<i>Achatinella curta</i>	Snail	HI	1989	The Oahu tree snail <i>Achatinella curta</i> historically occurred in Waialua, Ahonui to Kawaihoa,

curta					and across to Laie. There have been 19 post-1945 occurrences: five current (1979-1989) and 14 historical (1946-1976) [1]. Locations since 1979 include Peahinaia Trail, Helemano Trail, and Kawailoa Trail.
Oahu tree snail leucorraphe	<i>Achatinella leucorraphe</i>	Snail	HI	1989	The Oahu tree snail <i>Achatinella leucorraphe</i> was formerly found along the three-mile distance from Wahiawa (Schofield-Waikane Trail) to Kipapa. There have been five post-1945 occurrences, one current (1989) and four historical (1946-1960).
Oahu tree snail lorata	<i>Achatinella lorata</i>	Snail	HI	1974	The Oahu tree snail <i>Achatinella lorata</i> was historically found from Manoa to Waiawa on the leeward side of Oahu, a distance of 12 miles, and also on the windward side in Maunawili. The species has been sighted 16 times since 1945, the last being in 1974.
Oahu tree snail phaeozona	<i>Achatinella phaeozona</i>	Snail	HI	1974	The Oahu tree snail <i>Achatinella phaeozona</i> was endemic to the Koolau Mountains of Oahu and was historically found in Kaalakei, Kailua, Olomana and Waimanalo. It was last seen in 1965 or 1974. Sightings after 1945 occurred in Kuliouou.
Oahu tree snail pupukanioe	<i>Achatinella pupukanioe</i>	Snail	HI	1980	The Oahu tree snail <i>Achatinella pupukanioe</i> was endemic to the Koolau Mountains of Oahu. It has been sighted seven times after 1945, the last being in 1980 on the Aiea Ridge Trail.
Oahu tree snail swiftii	<i>Achatinella swiftii</i>	Snail	HI	1976	The Oahu tree snail <i>Achatinella swiftii</i> ranged historically from the western ridge of Waiawa to the ridges of Kaukonahua and has been sighted twice since 1945, between 1972 and 1978. It was last seen in 1976 or 1978.
Oahu tree snail taeniolata	<i>Achatinella taeniolata</i>	Snail	HI	1978	The Oahu tree snail <i>Achatinella taeniolata</i> was endemic to the Koolau Mountains of Oahu and existed historically from Kaalakei to Palolo, and Maunawili. Other locations include the Koolau Summit Ridge, Puu Lanipo, and the summit of Wiliwilinui Ridge. There were eleven sightings after 1945 and prior to 1979. It was last seen in 1978. Post-1945 records are from Maunalani Ridge, Hawaiiiloa Ridge, Kuliouou 1 and 2 Valleys, and Aniani Nui area.
Oahu tree snail turgida	<i>Achatinella turgida</i>	Snail	HI	1974	The Oahu tree snail <i>Achatinella turgida</i> has had two post-1945 sightings: 1953 and 1974. It was only known from Aiea Ridge Trail and Manana Trail.
Oahu tree snail viridans	<i>Achatinella viridans</i>	Snail	HI	1979	The Oahu tree snail <i>Achatinella viridans</i> was last seen in 1979 on the Summit Trail in the Koolau Mountains.
Opuhe nalo	<i>Drosophila aglaia</i>	Insect	HI	1980	Opuhe nalo (<i>Drosophila aglaia</i>) was endemic to O'ahu where it was known from only six locations in the Wai'anae Mountains [273]. It was last seen in 1980 [435].
Pupillid land snail	<i>Lyropupa perlonga</i>	Snail	HI	1980	The Pupillid land snail (<i>Lyropupa perlonga</i>) was last seen at Barber's Point deep draft harbor on Oahu in 1980 [1].
Scaevola hobdyi	<i>Scaevola hobdyi</i>	Plant	HI	1980	<i>Scaevola hobdyi</i> is known only from the type specimen, a single plant found on West Maui in 1980 [1].
Bland Oregonian	<i>Cryptomastix mullani blandi</i>	Snail	ID	1990	The bland oregonian (<i>Cryptomastix mullani blandi</i>) was once found in a limited areas in the Coeur d'Alene River Valley near Post Falls and Coeur d'Alene, Idaho. It was last collected in 1990 near Coeur d'Alene [182]. Recent surveys found no live specimens [182]. Much of the species' potential habitat has been logged, grazed by domestic livestock, mined, or urbanized

					[182].
White catspaw	<i>Epioblasma obliquata perobliqua</i>	Mussel	IL, IN, KY, MI, OH	1993	<p>The white catspaw (<i>Epioblasma obliquata perobliqua</i>) has been reported from New York to Indiana, but many are misidentifications. The species was likely limited to the Wabash River, White River, Tippecanoe River, Maume River, St. Joseph River, Fish Creek, and possibly the Ohio River [201]. It has only been collected four times since 1970, all in Fish Creek, northwestern Ohio: one living and one freshly dead female in 1975, a living male and a freshly dead female in 1985, one living and one freshly dead female in 1987, and one live animal in October 1993 [10, 200, 201]. The 1987 sighting is apparently mistakenly reported as 1988 by the USFWS Recovery Plan [201].</p> <p>The October 1993 survey was part of an effort to mitigate and monitor the effects of a September 1993 diesel pipeline rupture in a soybean field in DeKalb County, Indiana. The diesel fuel filtered through field tiles into a small drainage ditch and into Fish Creek above the last known and very small catspaw population [202]. By the spring of 1994, a tree had fallen on the last known mussel, scouring out the entire riffle habitat [200]. <i>E. o. perobliqua</i> was not found in 1994 or in 2002 [200].</p>
Longjaw cisco	<i>Coregonus alpenae</i>	Fish	IL, IN, MI, NY, OH, PA, WI	1975	Listed as the longjaw cisco (<i>Coregonus alpenae</i>), this taxa is now considered a population of shortjaw cisco (<i>Coregonus zenithicus</i>). It was known to occur in Lakes Michigan, Huron, and Erie. Extensive over-fishing and increased lake pollution led to a population crash in the first half of the 20th century. The cisco was further decimated by sea lamprey predation and habitat degradation, and has not been seen in Lakes Huron and Erie since the 1950s. It was seriously depleted in Lake Michigan by 1961 and last seen in 1975.
Shortnose cisco	<i>Coregonus reighardi</i>	Fish	IL, IN, MI, NY, WI	1985	The shortnose cisco (<i>Coregonus reighardi</i>) was formerly found in Lakes Huron, Michigan, and Ontario. It has not been seen since 1985 despite intensive survey efforts [191].
Maryland darter	<i>Etheostoma sellare</i>	Fish	MD	1988	The Maryland darter (<i>Etheostoma sellare</i>) was known only from tributaries of the lower Susquehanna River, Harford County, Maryland. It has rarely been seen since it was discovered in 1912. Most recent sightings were in a single riffle in Deer Creek, and it was last seen in 1988.
Sylvan hygrotus diving beetle	<i>Hygrotus sylvanus</i>	Insect	MN, NY, MA?	1979	The sylvan hygrotus diving beetle (<i>Hygrotus sylvanus</i>) was believed extinct until it was rediscovered in 1979 in Cedar Creek, Anoka and Isanti counties, Minnesota [170]. Prior to that it was known only from 1890 collections in Peekskill, New York and Lexington, Massachusetts, though the latter may be erroneous [171].
Sangre de Cristo peaclam	<i>Pisidium sanguinichristi</i>	Mussel	NM	1981	The Sangre de Cristo peaclam (<i>Pisidium sanguinichristi</i>) is one of only two Sphaeriacean clams endemic to North America and is perhaps the most endemic pisidia in the world. It was discovered in 1981 by Dwight Taylor in the muddy shallows and narrow outflow of Middle Fork Lake, a glacial 15 acre cirque at the base of Wheeler Peak (10,485 feet) on the Questa Ranger District, Carson National Forest, Taos County, New Mexico [244]. It has not definitively been located in post-1981 surveys by the New Mexico Game and Fish

					Department, though six specimens were possibly assignable to <i>P. sanguinichrist</i> [183, 243]. The Sangre de Cristo peaclam is considered a valid taxon, but its endemnicity (unusual for pisidia because they are easy transported by birds) and small number of collections, combined with the fact that pisidia are known to display significant morphological variation, has raised taxonomic questions. An mtDNA comparison with sympatric <i>P. milium</i> was inconclusive because there was virtually no remnant soft tissue from the sanguinichristi specimens. Shell mtDNA had to be used even though little DNA exists in the conchiolin of pidisia. Live or freshly dead specimens are needed for a definitive analysis [183, 243]
Blue point pyrg	<i>Pyrgulopsis coloradensis</i>	Snail	NV	1992	The Blue Point pyrg (<i>Pyrgulopsis coloradensis</i>) was collected in the 1970s, 1980s, and early 1990s at Blue Point Spring, Lake Mead Recreation Area, Clark County, Nevada [153]. Similar looking dead shells were found at Rogers Spring (1.25 miles to the southwest), but the species which occurred there has been extirpated and its taxonomy can not be determined [197]. <i>Pyrgulopsis coloradensis</i> was formally described in 1998 by Hershler, who reported that it had "become increasingly scarce in the past decade" [242]. It has not been seen since 1992 despite surveys throughout the 1990s and early 2000s [197]. The cause of the extinction is not definitively known, but coincided with the post-1993 introduction of the red-rimmed thiara (<i>Melanoides tuberculata</i>) a predatory snail native to Africa, Asia, and India commonly distributed through the aquarium trade [197]. Wild burros have caused vegetative damage, but the habitat conditions appear adequate and not to have degraded between 1993 and 2002 [197]. Rogers Spring was impounded for recreational swimming long prior to the 1990s destroying it ability to sustain <i>Pyrgulopsis coloradensis</i> if species ever occurred there. Rogers Spring has also contained various predatory cichlid species over the past 40 years.
Fish Lake pyrg	<i>Pyrgulopsis ruinosa</i>	Snail	NV	1993	The Fish Lake pyrg (<i>Pyrgulopsis ruinosa</i>) is endemic to a single spring on McNett Ranch in Fish Lake Valley and is known only from the type specimen collected on July 16, 1988 [242, 153]. The spring was impounded in the late 1980s or more likely the early 1990s [153]. Sada and Vinyard report an extinction date of 1990 [196], but it is not clear if this is the date last seen or the presumed date of extinction. The species has not been found in subsequent surveys, and the landowner has not allowed recent surveys [153]. The pyrg's species designation is from the latin ruinosa "going to ruin; referring to the current status of the species" [242].
Longstreet springsnail	<i>Pyrgulopsis sp.</i>	Snail	NV	1975	The Longstreet springsnail (<i>Pyrgulopsis sp.</i>) was collected by Dwight Taylor in the 1940s or 50s in Longstreet Spring. Groundwater pumping dried the spring in the 1970s driving the species extinct [196,
Oregon giant earthworm	<i>Driloleirus macelfreshi</i>	Worm	OR	1985	The Oregon giant earthworm (<i>Driloleirus macelfreshi</i>) grew up to three feet in length. It was endemic to the Willamette Valley of northwestern Oregon, where it was collected in 1903, 1929, and 1930 [173]. No sightings have been confirmed since 1985.

Nerite rams-horn	<i>Vorticifex neritoides</i>	Snail	OR, WA	1988	Nerite rams-horn (<i>Vorticifex neritoides</i>) was historically collected from the lower Columbia River below the Dalles (i.e. from Portland to the river's mouth), though it may also have occurred on the lowermost Willamette River between Oregon City and its confluence with the Columbia River [1]. The last certain collections were by Hempill in the 1930s, though several specimens from 1988 may be assignable to the species [260]. Surveys in 1994, 1996, and 2001 did not find the species [260].
Golden coqui	<i>Eleutherodactylus jasperi</i>	Amphibian	Puerto Rico	1981	The Golden coqui (<i>Eleutherodactylus jasperi</i>) is one of 16 <i>Eleutherodactylus</i> (i.e. "free fingered") frogs endemic to Puerto Rico and the only ovoviviparous anuran in the New World. It occurred in bromeliads on Cerra Avispa, Monte El Gato, and Sierra de Cayey summits in Puerto Rico. It was discovered in 1973 and described in 1976 [54]. The population in the early 1970s was estimated to be less than 10 on Cerro Avispa, 500 to 1,000 on Monte el Gata, and 1,000 to 2,000 on Sierra de Cayey [68]. It was last seen in 1981 [68]. There is a great demand for high elevation land within the coqui's range because of the moderate rainfall and temperatures to be found there. The summits have experienced large scale modification for residential development and has been slashed and burned for agricultural and pastoral purposes [177]. With the exception of a highway right-of-way, most of the known habitat of the golden coqui is privately owned. No golden coquis have been found in the extensive bromeliad growth at the summit of Cerro Planada and the adjacent peak to the west which have long been planted in coffee and citrus. Rafael Joglar believes the most probably cause of extinct was chitridiomycosis fungus combined with climate changes (raising of temperature and long periods of draught) [306].
Mottled coqui	<i>Eleutherodactylus eneidae</i>	Amphibian	Puerto Rico	1990	The mottled coqui (<i>Eleutherodactylus eneidae</i>) was endemic to the interior forested uplands of Puerto Rico. It was last seen in 1984 and last heard in 1990. Rafael Joglar believes the most probably cause of extinct was chitridiomycosis fungus combined with climate changes (raising of temperature and long periods of draught) [306].
Web-footed coqui	<i>Eleutherodactylus karlschmidti</i>	Amphibian	Puerto Rico	1974	The web-footed coqui (<i>Eleutherodactylus karlschmidti</i>) was last seen in 1974 [53, 54]. Rafael Joglar believes the most probably cause of extinct was chitridiomycosis fungus combined with climate changes (raising of temperature and long periods of draught) [306].
Green blossom	<i>Epioblasma torulosa gubernaculum</i>	Mussel	TN, VA	1984	The Green blossom (<i>Epioblasma torulosa gubernaculum</i>) was last seen in 1984 in the Clinch River. Repeat surveys after that time have been unsuccessful.
Mexican fawnsfoot	<i>Truncilla cognate</i>	Mussel	TX	1975	The Mexican fawnsfoot (<i>Truncilla cognate</i>) inhabited several hundred miles of the Rio Grande River in Texas and northern Mexico. The last sightings of the species were a number of observations in 1972 and a single weathered shell in 1975 [205].
San Marcos gambusia	<i>Gambusia georgei</i>	Fish	TX	1983	The San Marcos gambusia (<i>Gambusia georgei</i>) was endemic to San Marcos Spring and a 1.25 mile section of the San Marcos River between Rio Vista Dam and 0.3 miles below the I-35 bridge.

					It was discovered 1884 and was described in 1969, by which time less than 1,000 individuals remained. Captive populations were established in Austin, TX (1979) and Dexter, NM (1980), but both were contaminated by the closely related <i>G. affinis</i> in the early 1980s. The last genetically pure individuals were a few fish collected in the wild in 1983 less than three years after it was added to the endangered species list [204].
Texas Henslow's sparrow	<i>Ammodramus henslowii houstonensis</i>	Bird	TX	1983	Texas Henslow's sparrow (<i>Ammodramus henslowii houstonensis</i>) was endemic to a 105 acre brush field near Houston, Texas, where it was last seen in 1983.
Valdina farms salamander	<i>Eurycea troglodytes ssp.</i>	Amphibian	TX	1987	The Valdina Farms salamander (<i>Eurycea troglodytes</i>) was endemic to Valdina Farms Sinkhole, Texas. In 1987 the Edwards Underground Water District redirected a stream into the sinkhole for recharge purposes, driving the species extinct [206].
False spike	<i>Quincuncina mitchelli</i>	Mussel	TX, NM	1975	The false spike (<i>Quincuncina mitchelli</i>) inhabited the Rio Grande basin and the central Texas systems of the Gundelope, Colorado and Leon Rivers. It has not been seen in Texas since the mid 1970s and is known from New Mexico only as a fossil [1].
Phantom shiner	<i>Notropis orca</i>	Fish	TX, NM	1975	The Phantom shiner (<i>Notropis orca</i>) formerly occupied the Rio Grande River from Espanola, New Mexico to Brownsville, Texas, and adjacent Tamaulipas, Mexico. It was last collected in New Mexico in 1939 and in Tamaulipas in 1975 [208].
Paria iris	<i>Iris pariensis</i>	Plant	UT	1976	Paria iris (<i>Iris pariensis</i>) is a narrow endemic known only from the holotype collected in May of 1976 [1]. It has not been found in subsequent searches. It was included in the widespread <i>Iris missouriensis</i> by Kartesz [180], but is considered distinct by others [1].
Georgia Depression Lewis's woodpecker	<i>Melanerpes lewis pop. 1</i>	Bird	WA	1975	The Georgia Depression Lewis's woodpecker (<i>Melanerpes lewis pop</i>) formerly occurred from southeastern Vancouver Island and the lower Fraser Valley of southwestern British Columbia through the Gulf and San Juan Islands to the Puget Trough of western Washington. It was last seen in the mid 1970s.
Giant palouse earthworm	<i>Driloleirus americanus</i>	Worm	WA, ID	1978	The Giant palouse earthworm (<i>Driloleirus americanus</i>) was discovered while "very abundant" near Pullman, Washington in 1897 [210]. Since then its favored habitat -- the rich soils of the Palouse prairies in eastern Washington and northern Idaho -- have been almost completely destroyed by farmers. It was last seen in 1978 in Palouse County, Washington. The introduction of the European earthworm also likely contributed to its extinction.
Rich Mountain cave beetle	<i>Pseudanophthalmus krekeleri</i>	Insect	WV	1985	The Rich Mountain cave beetle (<i>Pseudanophthalmus krekeleri</i>) was endemic to Rich Mountain Cave in West Virginia. It was described by Barr in 1965 and the cave was destroyed by a limestone quarry in the 1980s [206].

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