CANDIDATE ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC AND COMMON NAME:

Pseudanophthalmus caecus Krekeler, Clifton Cave beetle
Pseudanophthalmus cataryctos Krekeler, Lesser Adams Cave beetle
Pseudanophthalmus frigidus Barr, Icebox Cave beetle
Pseudanophthalmus inquistor Barr, Inquirer cave beetle
Pseudanophthalmus major Krekeler, Beaver Cave beetle
Pseudanophthalmus pholeter Krekeler, Greater Adams Cave beetle
Pseudanophthalmus parvus Krekeler, Tatum Cave beetle
Pseudanophthalmus troglodytes Krekeler, Louisville cave beetle

LEAD REGION: 4

INFORMATION CURRENT AS OF: February 26, 2003

STATUS/ACTION (Check all that apply):
___ New candidates
_X_ Continuing candidate
    _X_ Non-petitioned
    ___ Petitioned - Date petition received: ___
        __ 90-day positive - FR date: ___
        __ 12-month warranted but precluded - FR date: ___
        __ Is the petition requesting a reclassification of a listed species?
    ___ Listing priority change
        Former LP: ___
        New LP: ___
Latest date species first became a Candidate: _____
___ Candidate removal: Former LP: ___ (Check only one reason)
    ___ A - Taxon more abundant or widespread than previously believed or not subject to a degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
    ___ F - Range is no longer a U.S. territory.
    ___ M - Taxon mistakenly included in past notice of review.
    ___ N - Taxon may not meet the Act=s definition of Aspecies.@
    ___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Insects - Carabidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:

Pseudanophthalmus caecus, Clifton Cave beetle - Kentucky
Pseudanophthalmus cataryctos, Lesser Adams Cave beetle - Kentucky

Pseudanophthalmus frigidus, Icebox Cave beetle - Kentucky
Pseudanophthalmus inquistor, Inquirer cave beetle - Tennessee
Pseudanophthalmus major, Beaver Cave beetle - Kentucky
Pseudanophthalmus parvus, Tatum Cave beetle - Kentucky
Pseudanophthalmus pholeter, Greater Adams Cave beetle - Kentucky
Pseudanophthalmus troglodytes, Louisville cave beetle - Kentucky

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Pseudanophthalmus major, Beaver Cave beetle - Kentucky
Pseudanophthalmus parvus, Tatum Cave beetle - Kentucky
Pseudanophthalmus pholeter, Greater Adams Cave beetle - Kentucky
Pseudanophthalmus troglodytes, Louisville cave beetle - Kentucky

LEAD REGION CONTACT (Name, phone number): Richard Gooch, 404/679-7124

LEAD FIELD OFFICE CONTACT (Office, name, phone number): Asheville, North Carolina Field Office, Robert R. Currie, 828/258-3939, extension 224

SUPPORT FIELD OFFICE(S): Cookeville, Tennessee Field Office; Frankfort, Kentucky Field Office

BIOLOGICAL INFORMATION (Describe habitat, historic vs. current range, historic vs. current population estimates (# populations, #individuals/population), etc.):

Species Description

Cave beetles in the genus Pseudanophthalmus are fairly small, eyeless, reddish-brown insects. Like most other insects, they have six legs and a body that consists of a head, thorax, and abdomen. Body length is generally from 3.0 to 8.0 millimeters (mm) (0.12 to 0.32 inches), depending upon the species. The different species within the genus are differentiated by differences in the shape and size of the various body parts, especially the shape of the male appendages used during reproduction. Barr (1996) states that there are approximately 255 species in the genus Pseudanophthalmus. The insect genus Pseudanophthalmus is in the predatory ground beetle family Carabidae. Most members of this genus are cave dependent (troglobites) and are not found outside the cave environment. All are predatory and feed upon small cave invertebrates such as spiders, mites, millipedes, and diplurans, while the larger Pseudanophthalmus species also feed on cave cricket eggs (Barr 1996). Members of this genus vary in rarity from fairly common, widespread species that are found in many caves to species that are extremely rare and restricted to only one cave or, at most, two caves.

Little detailed life history information is available for the rarest of the cave beetles that are considered here, but the generalized summary that follows is accurate for the more common and more easily studied species and is believed to also apply to the rarer species (Barr 1998). Cave

beetles copulate in the fall, and the eggs are deposited in the cave soil during late fall. The eggs hatch and larvae appear in late fall through early winter. Pupation occurs in late winter to early summer with the adult beetles emerging in early summer (Barr 1996).

Habitat

The limestone caves in which these cave beetles are found provide a unique and fragile environment that supports a variety of species that have evolved to survive and reproduce under the demanding conditions found in cave ecosystems. No photosynthesis takes place within the dark zone of a cave. Therefore, all organisms that are adapted to life within a cave are dependent upon energy from the surface. This energy can be in the form of leaf litter, woody debris or small bits of organic matter that is washed or falls into the cave, or guano deposited by cave-dependent bats that feed on the surface and return to the cave to roost (Barr 1996).

Status

Pseudanophthalmus caecus, the Clifton Cave beetle, was described by Krekeler (1973) based upon material collected by T.C. Barr in 1963. The cave supporting this species is near Versailles, Woodford County, Kentucky. Soon after the species was first collected, the entrance to the cave was enclosed due to road construction. Other caves in the vicinity of Clifton Cave were surveyed for the species during a 1995-1996 survey for the species. Most contained other species of Pseudanophthalmus, but only one additional site was found for the Clifton Cave beetle. Four specimens were found in a very small, 30 foot (9 meters) long cave about 1 mile (1.61 kilometers) from Clifton Cave. It can not be determined at this time if the species still occurs in Clifton Cave or if the species has been extirpated from its type locality by the closure of the cave entrance.

Pseudanophthalmus cataryctos, the Lesser Adams Cave beetle, was described by Krekeler (1973) based upon material collected by T.C. Barr and S.B. Peck in 1964 from Adams Cave in Madison County, Kentucky. This cave also supports P. pholeter, the Greater Adams Cave beetle, which was also described by Krekeler (1973) from additional collections made by T.C. Barr and S.B. Beck in 1964 (Barr 1996). During a 1995 visit to the cave, Barr (1996) observed one specimen of the Lesser Adams Cave beetle, but the Greater Adams Cave beetle was not observed. Although the Greater Adams Cave beetle was not observed during the 1995 visit to the cave, Barr speculated that the species may still exist at the site. In 2002, one lesser Adams Cave beetle and two greater Adams Cave beetles were found during a biological survey conducted by the Service and the Kentucky State Nature Preserves Commission. There are no other caves in the vicinity of Adams Cave and this species has not been found at any other locations. A gate to control access to the cave was constructed in 2002.

Pseudanophthalmus frigidus, the Icebox Cave beetle, was described by Barr (1981) based upon two specimens he collected from Icebox Cave, Bell County, Kentucky. Despite searches of caves in the vicinity of this cave and several later visits to Icebox Cave, no additional specimens of Icebox Cave beetle have been found.

Pseudanophthalmus inquistor, the inquirer cave beetle, was described by Barr (1980) from specimens collected in Sheals=s Cave, Clay County, Tennessee. The species is not known from

any other caves. During a 1997 survey of the cave, Barr (1998) observed 3 specimens of inquirer cave beetle.

Pseudanophthalmus major, the Beaver Cave beetle, was described by Krekeler (1973) from 3 specimens collected by T.C. Barr and J.R. Holsinger in 1966, from Beaver Cave, Harrison County, Kentucky. No additional caves that could provide habitat for the Beaver Cave beetle were found during a 1996 survey of Beaver Cave and the surrounding area. One specimen of the species was observed in Beaver Cave during this survey (Barr 1996).

Pseudanophthalmus parvus, the Tatum Cave beetle, was described by Krekeler (1973) from material collected from Tatum Cave, Marion County, Kentucky. Despite searches in 1980 and in 1996, the species has not been observed in Tatum Cave since 1965. There are no other known caves in the vicinity of Tatum Cave that could support the species.

Pseudanophthalmus troglodytes, the Louisville cave beetle, was described by Krekeler (1973) from specimens collected from Oxmoor Cave, Jefferson County, Kentucky. During 1994, surveys of other caves that could potentially support the species were conducted by J. Lewis (Barr 1996). Ten caves were surveyed and the species was found in only one additional cave (Eleven Jones Cave).

THREATS (Describe threats in terms of the five factors in section 4 of the ESA providing specific, substantive information. If this is a removal of a species from candidate status or a change in listing priority, explain reasons for change):

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

All of these eight cave beetles (Clifton Cave beetle, Greater Adams Cave beetle, Icebox Cave beetle, Inquirer cave beetle, Beaver Cave beetle, Lesser Adams Cave beetle, Tatum Cave beetle, and Louisville Cave beetle) are currently known from only one cave.

Their limited distributions make these species vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction (Barr 1996). Caves and the species that are completely dependent upon them (troglobites) receive the energy that forms the basis of the cave food chain from outside the cave. This energy can be in the form of bat guano deposited by cave-dependent bats, large or small woody debris washed or blown into the cave, or tiny bits of organic matter that is carried into the cave by water through small cracks in the rocks overlaying the cave (Barr 1996). Activities such as industrial, residential, commercial, or highway construction can, if not planned in a manner to protect caves, directly destroy caves or result in severe modification of the natural processes that maintain the sensitive biological systems they support. Pollution and chemical contamination can, under certain circumstances, result in the complete destruction of the unique life found within a cave impacted by these factors. Vandalism and trash dumping have affected some of the sites and all of the caves are vulnerable to these activities. Loss or reduction of the supply of energy can result in the loss or severe reduction of cave beetle populations (Barr 1996).

Many of these fragile caves have been adversly impacted. The entrance to Clifton Cave was enclosed due to road construction. Barr reported that Adams Cave Ahas now become [one of] the most outrageously vandalized caves in the eastern United States@ He observed large amounts of trash, batteries, discarded clothing and other debris throughout the cave. Icebox Cave is within the city limits of Pineville and is frequently visited, heavily vandalized, and contains a lot of trash. Wood is the basis of the food chain in Whites Cave and the wood at this site is slowly decaying. Barr (1996) has observed a gradual decrease in the number of surprising cave beetles in White Cave as the quantity of wood available has decreased. Sheals=s Cave is in a rapidly expanding urban area and indirect impacts, such as chemicals or other pollution, could significantly impact both the cave and the species the cave supports. A sinkhole that drains into the cave system is located away from the protected entrance and is near a highway (Barr 1998). Chemical and other spills could easily enter the cave system through this sinkhole entrance. Alterations in the landscape associated with an expanding urban area are expected and could negatively affect the cave system that contains the inquirer cave beetle. Beaver Cave is well known in the local area and receives frequent visitation. Vandalism and the accumulation of trash in the cave has increased in recent years. Barr (1996) states that this has probably resulted in a decrease in the habitat available to the Beaver Cave beetle. Tatum Cave has three natural entrances and an additional entrance has been created in order to use the cave as a water supply (Barr 1996). This additional entrance has modified air flow within the cave and may have seriously impacted the Tatum Cave beetle population. Oxmoor and Eleven Jones Caves are both within the Louisville metropolitan area. Urban expansion has resulted in the loss of Oxmoor Cave. In about 1990, the entrance to the cave was bulldozed shut and a residential subdivision was built over the area. Eleven Jones Cave is a small cave that sometimes has high levels of carbon dioxide (Barr 1996). These elevated carbon dioxide levels may be related to high levels of pollution in the water entering the cave. Dependence upon the surface makes caves and the life that is found within them vulnerable to actions that take place well outside and away from the cave. Protection of caves and cave dependent species must include both the physical environment in which the species are found and the surface components that provide the energy and clean water needed for survival.

B. <u>Overutilization for commercial, recreational, scientific, or educational purposes</u>.

All of these cave beetles occur at only one location. Most populations are extremely small and careless collecting, whether for scientific or other purposes, could adversely affect them. These species have no known commercial value, however, the caves in which these species occur may be used for recreational purposes by spelunkers and by passive recreationists.

C. <u>Disease or predation</u>.

Disease or predation is not known to be a significant problem for any of these species. However, since each species appears to exist with low numbers of individuals, mortality via either of these two factors may have a significant, negative impact on recruitment and long-term survival.

D. <u>The inadequacy of existing regulatory mechanisms</u>.

These species are not protected under Kentucky or Tennessee state law.

E. Other natural or manmade factors affecting its continued existence.

None are known at this time.

FOR RECYCLED PETITIONS:

a. Is listing still warranted? NA

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? NA

c. Is a proposal to list the species as threatened or endangered in preparation? NA

d. If the answer to c. above is no, provide an explanation of why the action is still precluded.

LAND OWNERSHIP (Estimate proportion Federal/state/local government/private, identify non-private owners):

All but four of the caves supporting these species are privately owned. The entrance to the cave supporting Greater Adams Cave beetles is within a State-owned highway right of way (Kentucky Department of Transportation).

PRELISTING (Describe status of conservation agreements or other conservation activities):

The Kentucky Department of Fish and Wildlife Resources (KDFWR) in cooperation with the Service funded a status survey for the rarer cave beetles that occur in Kentucky. A part of this survey included identification of owners of the caves supporting these species. In gathering the land ownership information needed for the final report on this cooperatively funded project (Barr 1996), the landowners were made aware of the presence of the rare cave beetles within caves on their land. In general, these land owners were supportive of protecting these rare species. The Tennessee Wildlife Resources Agency (TWRA) and the Service entered into a similar agreement for the rare cave beetles of Tennessee. An interim progress report for this effort (Barr 1998) states that the owner of Sheals=s Cave in Tennessee (site for Inquirer cave beetle) was contacted and seemed to be interested in providing protection for the cave.

Most of the owners of the sites on which these cave beetle caves occur were contacted by Barr or those assisting him with survey activities to determine the status of these species. Most owners were pleased to learn of the presence of a rare species within their caves and are expected to be willing to assist with any protection activities needed to protect and recover these cave beetles. The KDFWR and TWRA both actively participated in gathering the information presented in Barr (1996, 1998) on the status of these species. It is anticipated that they will continue to support and participate in the rare cave beetle protection.

During the summer of 2002, the Service working with the landowner and several partners, constructed a gate at the entrance of Adams Cave. Adams Cave supports Greater Adams Cave beetle and Lesser Adams Cave beetle. This gate was constructed to control access to the cave and reduce the threats to the Adams Cave beetles and other cave dependent species that occur there. The Service is continuing negotiations with the landowner and Eastern Kentucky University (Richmond, Kentucky) to develop a long-term management agreement for this site. The gate provides for the short-term protection of Adams Cave and when implemented, the management with provide long-term protection for the cave and the two rare cave beetles it supports.

REFERENCES (Identify primary sources of information (e.g., status reports, petitions, journal publications, unpublished data from species experts) using formal citation format):

Barr, Thomas C. 1959. New cave beetles (Carabidae, Trechini) from Tennessee and Kentucky. Journal Tennessee Academy of Science 34:5-30.

Barr, Thomas C. 1995. Kentucky Cave Beetles: Progress Report II. Unpublished Report to Kentucky Department of Fish and Wildlife Resources. Frankfort, Kentucky. 20 pp.

Barr, Thomas C., 1996. Cave Beetle Status Survey and Prelisting Recovery Project. Unpublished Report to Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, and the U.S. Fish and Wildlife Service, Asheville, North Carolina. 63 pp.

Barr, Thomas C. 1998. Study of Potentially Threatened or Endangered Species of Cave Beetles in Tennessee, Alabama and Georgia. Interim Progress Report to the Tennessee Wildlife Resources Commission. 11 pp.

Krekeler, C. H. 1973. Cave Beetles of the Genus Pseudanophthalmus (Coleoptera, Carabidae) from the Kentucky Bluegrass and Vicinity. Feildiana 62(4):35-83.

LISTING PRIORITY (place * after number)

THREAT

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5 *
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: All of these eight cave beetles are currently known from only one cave. Their limited distributions make these species vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction.

Imminence: The treats faced by these species are significant, however, it is not anticipated that they will be subject to these threats in the immediate future (next 1-2 years).

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all additions of species to the candidate list, annual retentions of candidates, removal of candidates, and listing priority changes.

Approve: Linda Kelsey March 14, 2003

Acting Regional Director, Fish and Wildlife Service Date

Concur: _____ _____

Director, Fish and Wildlife Service Date

Do not concur: _____ _____

Director, Fish and Wildlife Service Date

Director's Remarks:

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Date of annual review: February 2003

Conducted by: Robert Currie - Asheville, North Carolina FO

Comments:

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