CANDIDATE ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Cochliopa texana*

COMMON NAME: Phantom Lake cave snail

LEAD REGION: Region 2

INFORMATION CURRENT AS OF: February 2003

STATUS/ACTION (Check all that apply):
___ New candidate
_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: Snails: *Hydrobiidae*

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

CURRENT STATES/COUNTIES (optional)/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

LEAD REGION CONTACT: Susan Jacobsen, 505/248-6641

LEAD FIELD OFFICE CONTACT: Austin, Texas Field Office, Nathan Allan, 512/490-0057

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

In the desert Southwest, aquatic snails are distributed in isolated geographically-separate wetland populations (Hershler et al. 1999). They likely evolved into distinct species during recent dry periods from parent species that once enjoyed a wide distribution during wetter, cooler climates of the Pleistocene. Such divergence has been well-documented for aquatic and terrestrial macroinvertebrate groups within arid ecosystems of western North America (e.g., Taylor 1987, Metcalf and Smartt 1997, Bowman 1981).

The Phantom Cave snail is an aquatic snail occurring only in three spring systems and associated outflows (Phantom Lake, San Solomon, and East Sandia springs) in the Toyah Basin of Jeff Davis County and Reeves County, Texas (Landye 1980). There is no available information that the species= historic distribution was larger than the present distribution. However, other area springs may have contained the same species, but because these springs have been dry for many decades, there is no opportunity to determine the potential historic occurrence of the snail fauna.

Another endemic hydrobiid aquatic snail, Brune=s tryonia (*Tryonia brunei*), may also have occurred historically in lateral canals at Phantom Lake Spring (Taylor 1987). A recent study (Hershler et al. 1999) of phylogenetic relationships among the 23 recognized species of the genus *Tryonia* in the southwestern United States was unable to relocate this species (*Tryonia brunei*). No confirmed occurrence of this species has been made since the original description by Taylor (1987). Brune=s tryonia may now be extinct. An additional endemic hydrobiid aquatic snail, Phantom springsnail (*Tryonia cheatumi*), has essentially the same current distribution as the Phantom Cave snail.

The Phantom cave snail was first described by Pilsbury (1935). It is a very small snail, measuring only 1 to 1.4 mm in length (Dundee and Dundee 1969). Habitat of the species is found mostly on firm substrates (rocks and vegetation) on the margins of spring outflows (Taylor 1987). These snails likely have life spans of 9-15 months and reproduce several times during the spring to fall breeding season (Taylor 1987, Pennak 1989, Brown 1991). Snails of the family Hydrobiidae are sexually dimorphic with females being characteristically larger and longer-lived than males. The snails are ovoviviparous, producing live young serially (as opposed to broods). They are presumably fine-particle feeders on detritus and periphyton associated with the substrates (mud and vegetation); Dundee and Dundee (1969) found diatoms to be the primary component in the digestive tract.

Dundee and Dundee (1969) described the conditions of Phantom springsnail at Phantom Lake Spring in 1968. Despite the fact that Phantom Lake Spring has been drastically altered from its original state, the native snails (Phantom springsnail and Phantom Cave snail) occurred in the irrigation canal in such tremendous numbers that the sides of the canal appeared black from the cover of snails. Today the snails are limited to low densities in the small pool at the mouth of Phantom Cave and can not be found in the irrigation canal downstream (J. Landye, *in litt*, 2000). A similar situation occurs at San Solomon Spring, which has been significantly altered. Taylor (1987) reported the snail was abundant and generally distributed in the canals from 1965 - 1981. No recent information is available on the status of the species at San Solomon Spring.

In the summer of 2000, East Sandia Spring was surveyed for aquatic macroinvertebrates for the first time. A healthy abundance and diversity of springsnails (including what appears to be Phantom Cave snail) were present in the small stream that makes up the spring outflow (J. Landye, USFWS, in litt. 2000). The entire habitat is less than 150 meters in length.

The San Solomon Spring System is located in the Toyah Basin at the foothills of the Davis Mountains near Balmorhea, Texas. The system includes Phantom Lake, San Solomon, Giffin, Saragosa and Sandia Springs and several other minor springs at higher elevations to the south and southwest. In addition to rare snails, the springs are also important aquatic habitat for two federally endangered fish species, the Comanche Springs pupfish (*Cyprinodon elegans*) and the Pecos gambusia (*Gambusia nobilis*) and endemic amphipods of the *Gammarus pecos* complex (Cole 1985). These springs are also an important source of irrigation water for the communities in the Toyah Basin. Phantom Lake Spring is in Jeff Davis County, while the other major springs in this system are in Reeves County. The Reeves County Water Improvement District #1 (District) diverts water from the springs using a system of canals to irrigate fields in the area.

The general physiographic setting of the San Solomon Spring System is that of a largely alluviated, arid, karst terrain. The aridity of the region restricts the available habitat for spring-dependent species, and limits the available recharge to replenish and maintain spring flow. Pumping of the regional aquifer has significantly affected other springs in the area, including Comanche Springs and Leon Springs near Fort Stockton, which were once important habitat for rare desert aquatic species, but have ceased flowing.

Historically, Phantom Lake Spring, located at the base of the Davis Mountains, about 5 miles west of Balmorhea, was a large desert cienega with a pond of water more than several acres in size. The pristine condition of the spring outflow is at about 3200 feet elevation and would have provided ideal habitat for the endemic native aquatic fauna. During the 1940's the spring outflow was modified into a concrete-lined irrigation ditch so that the total outflow from the spring could be captured and used for irrigation of agriculture lands. The native aquatic snails persisted, though probably in reduced numbers, in the small pool of water at the mouth of the spring (Phantom Cave) and in the irrigation canals downstream.

The U.S. Bureau of Reclamation, Albuquerque Area Office, Reclamation) owns and manages Phantom Lake Spring and a surrounding area of about 17 acres. A refugia was built by Reclamation in 1993 (Young et al. 1993) to increase the available aquatic habitat at Phantom Lake Spring. Although still an artificial habitat, Winemiller and Anderson (1997) showed that the refuge channel is used by endangered fish species when water is available. Unfortunately, the refuge channel was constructed for a design flow down to 0.5 cubic feet per second (cfs), which at the time of construction was the lowest flow ever recorded out of Phantom Lake Spring. Recent declines in spring flow have diminished the usefulness of the refugia because it is has been completely dry for the past two years (Allan 2000). Habitat for the snails is limited to a small pool at the mouth of Phantom Cave that is being supported by a pumping system. Hubbs (2001) documented changes in water quality and fish community structure at Phantom Lake Spring since natural flows have ceased.

San Solomon Spring is located within Balmorhea State Park encompassing about 45.9 acres southwest of Balmorhea in Reeves County and owned and managed by the Texas Parks and Wildlife Department. The Park was built by the Civilian Conservation Corps (CCC) in the early

1930s and was opened as a State Park in 1968. The entire spring head was converted into a concrete-lined swimming pool. The outflow from the pool is completely contained in concrete irrigation channels. Recently TPWD created the San Solomon Cienega which uses some spring flow to recreate more natural aquatic habitats for the benefit of the endangered fishes in the Park.

East Sandia Spring is located on the Sandia Springs Preserve recently (1997) purchased by The Nature Conservancy of Texas (TNC). There are two disjunct tracts (East and West Sandia Springs) that together make up 240 acres of preserved land. East Sandia Spring is located just east of the town of Balmorhea in Reeves County, Texas. West Sandia Spring has ceased flowing in recent times. East Sandia Spring discharges at an elevation of 977 m (3,205 ft) from alluvial sand and gravel, but the water is probably derived from Comanchean limestone underlying the alluvium (Brune 1981). The small flow from the springs is used by the local farming community for agricultural irrigation. The primary threat is the loss of surface flows due to declining groundwater levels from drought and pumping. TNC provides protection of the land around the spring, but can not prevent declining spring flows due to groundwater pumping in other areas.

THREATS:

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range.</u>

The most significant threat to the continued existence of this snail is the degradation and eventual loss of spring habitat (flowing water) due to the decline of groundwater levels of the supporting aquifer. Over pumping of the regional aquifer system for agricultural production of crops have resulted in the drying of most other springs in this region (Brune 1981). Other springs that have already failed include Comanche Springs, which was once a large surface spring in Fort Stockton, Texas. This spring flowed at more than 1200 liters per second (lps) (Brune 1981) and undoubtably provided habitat for rare species of fishes and invertebrates, including springsnails. The spring ceased flowing by 1962 (Brune 1981). Leon Springs, located about 40 miles east of Balmorhea, was measured at 500 lps in the 1930s and was also known to contain rare fish, but ceased flowing in the 1950's following significant irrigation pumping (Brune 1981).

Phantom Lake Spring has experienced a long term, consistent decline in spring flows. Discharge data have been recorded from the spring six to eight times per year since the 1940's by the U.S. Geological Survey (Schuster 1997). The record shows a steady decline of flows, from greater than 10 cfs in the 1940's to 0 cfs in 2000. The data also show that the spring can have short term flow peaks resulting from local rainfall events in the Davis Mountains (Sharp et al. 1999). These peaks are from fast recharge and discharge, not surface runoff because the spring is not within a drainage basin. However, after each increase, the Abase flow@has returned to the same declining trend within a few months.

There have been extremely low flows from Phantom Lake Spring since the summer of 1998. Rainfall in the late summer of 1999 provided temporary increase in flow, but by the fall flow had returned to near zero. A small amount of water has, until recently, continued to flow from the cave to keep the refugia functional with shallow water and provide limited habitat for the endangered fish. Currently, water surface elevation from the cave has declined further and the

refuge channel is now dry. Only the small pool at the cave mouth continues to provide some aquatic habitat, supported by an artificial pumping system (Allan 2000). This last remaining habitat will be gone as the water surface elevation declines.

The exact causes for the decline in flow from Phantom Lake Spring are unknown. Some of the obvious reasons are groundwater pumping of the supporting aquifer and decreased recharge of the aquifer from drought. Unfortunately the supporting aquifer for the springs is not well defined. Recent studies (LaFave and Sharp 1987, Schuster 1997, Sharp et al. 1999) support that, although the spring is locally recharged by runoff from the Davis Mountains (resulting in the flow spikes), the Abase flow@comes from a regional groundwater system. The source to the springs is likely from the aquifer of the Capitan Reef associated with the Apache Mountains, with recharge areas in the Wildhorse Flat Basin to the northwest of the Toyah Basin. Sharp et al. (1999) further proposed that the decline in flows are most likely the result of groundwater pumping in this region.

Ashworth et al. (1997) provided a cursory study to examine the cause of declining spring flows in the Toyah Basin. The conclusion from this study suggested that Arecent declines in spring flows are more likely to be the result of diminished recharge due to the extended dry period rather than from groundwater pumpage@(Ashworth et al. 1997). Although certainly a factor, drought alone is unlikely the only reason for declines because the drought of record in the 1950s had no effect on the overall flow trend.

Exploration of Phantom Cave by cave divers has led to additional information about the nature of the spring and its supporting aquifer (pers. comm., Bill Tucker, Tucker=s Dive Shop, 1999). Beyond the entrance, the cave is a substantial conduit that transports a large volume of water generally from the northwest to the southeast, consistent with regional flow pattern hypothesis. Over 8,000 feet of the cave conduit have been mapped so far. In addition, flows have been measured and are in the 25 cfs range. The relatively small flow at Phantom Lake Spring is essentially an overflow of a larger flow system underground.

Although long term data are scarce, San Solomon Spring flows have declined somewhat over the history of record, but not as much as Phantom Lake Spring (Schuster 1997, Sharp et al. 1999). Some recent declines in overall flow have likely occurred due to drought conditions and declining aquifer levels. San Solomon Spring is a much larger volume spring and discharges are usually in the 25 to 30 cfs range (Ashworth et al. 1997, Schuster 1997) and are consistent with the theory that the water bypassing under Phantom Lake are later discharged at the San Solomon Spring. Giffin Spring (located within a mile to the northwest of San Solomon Spring) maintains a near constant 3 to 4 cfs outflow (Ashworth et al. 1997). Giffin Spring is on private land and the status of the snails there is uncertain. Similar water chemistry, and near constant temperatures of about 26°C, among these three springs (Phantom, San Solomon, and Giffin) also supports that their waters originate from the same source (Schuster 1997).

The water discharging from East Sandia Spring is likely from a shallow groundwater source and water chemistry differences indicate it is not connected with the other Toyah Basin springs being considered (Schuster 1997). However, it may be even more susceptible to over pumping in the area of the local aquifer that supports the spring. Brune (1981) noted that flows were declining

from Sandia Springs. Measured discharges in 1995 and 1996 ranged from 0.45 to 4.07 cfs (Schuster 1997).

Another threat to the habitat of the snail is the potential degradation of water quality from point and nonpoint pollutant sources. This can occur either directly into surface water or indirectly through contamination of groundwater that eventually discharges into spring run habitats used by the snail. The primary threat for contamination comes from herbicide and pesticide use in nearby agricultural areas.

Two of the three known occurrences of the species are in degraded habitats (exception is East Sandia Spring) because the natural conditions of the springs have been substantially modified for human use. Any additional modification to the spring flow habitats at Phantom Lake Spring, San Solomon Spring or East Sandia Spring further threaten the remaining populations of the species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

None known. However, the presence of introduced species increases the potential for foreign diseases to be introduced to the species.

D. The inadequacy of existing regulatory mechanisms.

Texas State law provides no protection for these invertebrate species. There are no existing Federal, State or local regulatory mechanisms providing protection for these species. The snails are afforded some protection indirectly due to the presence of two fishes (Comanche Springs pupfish and Pecos gambusia) listed as endangered by State and Federal governments that occupy similar habitats. However, the snail may be more sensitive to changes in water quality than the fish and are likely more directly threatened by the presence of the exotic *Melanoides* snail, than the endangered fish.

Some protection for the habitat of this species is provided with the ownership of the springs by Federal (Phantom Lake) and State (San Solomon) agencies, and by TNC (East Sandia). However, this land ownership provides no protection for maintaining necessary groundwater levels to ensure adequate spring flows.

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

Within the last 10 years, an exotic snail, *Melanoides* sp., has become established in Phantom Lake Spring (B. Fullington, *in litt*., 1993; McDermott 2000). The species has been at San Solomon Spring for some time longer, but is not found in East Sandia Spring. In many locations at San Solomon Spring, this exotic snail essentially is the substrate in the small stream channel. The effects of this introduction are not known. However, this exotic snail is likely competing with the native snails for space and resources. Other changes to the ecosystem from the

dominance of this species are likely to occur and could have detrimental effects to the native invertebrate community.

BRIEF SUMMARY OF REASONS FOR REMOVAL OR LISTING PRIORITY CHANGE:
N/A

FOR RECYCLED PETITIONS: N/A

a. Is listing still warranted? ___
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? ___
c. Is a proposal to list the species as threatened or endangered in preparation? ___
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):

The land on which the snail occurs is owned and managed by U.S. Bureau of Reclamation, Texas Parks and Wildlife Department, and The Nature Conservancy of Texas. The surrounding watershed and surface area over contributing aquifers is all privately owned.

PRELISTING (Describe status of conservation agreements or other conservation activities):
None

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

Allan, N.L. 2000. Deterioration of Phantom Lake Spring, Jeff Davis County, Texas. Proceedings of the Desert Fishes Council, Vol. 32. pp. 50-51.

Ashworth, J.B., D.B. Coker, and W. Tschirhart. 1997. Evaluation of diminished spring flows in the Toyah Creek Valley, Texas. Open File Report 97-03. Texas Water Development Board, Austin, Texas. 12pp.

Boghici, R. 1997. Hydrogeological investigations at Diamond Y Springs and surrounding area, Pecos County, Texas. Unpublished Master=s Thesis, University of Texas at Austin. 120 pp.

Bowman, T.E. 1981. *Thermosphaeroma milleri* and *T. smithi*, new sphaeromatid isopod crustaceans from hot springs in Chihuahua, Mexico, with a review of the genus. Journal of Crustacean Biology. 1:105-122.

Brown, K. M. 1991. Mollusca: gastropoda. Pages 285-314 in J.H. Thorp and A.P. Covich, Eds. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc. San Diego, California. 940pp.

Brune, G. 1981. Springs of Texas. Branch-Smith, Inc. Fort Worth, Texas.

Cole, G. A. 1985. Analysis of the Gammarus-pecos complex (Crustacea: Amphipoda) in Texas and New Mexico, USA. Journal of the Arizona-Nevada Academy of Science 20:93-103.

Dundee, D. and H. Dundee. 1969. Notes concerning two Texas molluscs, *Cochliopa texana* Pilsbry and *Lyrodes cheatumi* Pilsbry (Mollusca: Hydrobiidae). Transactions of the American Microscipical Society 88(2):205-210.

Hershler, R., Hsiu-Ping Liu, and M. Mulvey. 1999. Phylogenetic relationships within the aquatic snail genus Tryonia: implications for biogeography of the North American Southwest. Molecular Phylogenetics and Evolution 13:377-391.

Hubbs, C. 2001. Environmental correlates to the abundance of spring-adapted versus stream-adapted fishes. Texas Journal of Science 53(4):299-326.

Landye, J. 1980. Status of rare, endangered and/or threatened molluscan species of Texas and Oklahoma. Report submitted to U.S. Fish and Wildlife Service, Albuquerque, New Mexico, Contract #14-16-0002-79-202. 12 pp.

LaFave, J.I. and J.M. Sharp. 1987. Origins of groundwater discharging at the Springs of Balmorhea. West Texas Geological Society Bulletin 26:5-14.

Metcalf, A.L. and R.A. Smartt. 1997. Land snails of New Mexico. New Mexico Museum of Natural History and Science. Bulletin No. 10. 145 pp.

McDermott, K. 2000. Distribution and infection relationships of an undescribed digenetic Trematode, its exotic intermediate host, and endangered fishes in springs of west Texas. Unpublished Master=s Thesis, Southwest Texas State University, San Marcos, Texas. 26+ pp.

Pennak, R. W. 1989. Fresh-water invertebrates of the United States: Protozoa to Mollusca. John Wiley & Sons, Inc.

Pilsbry, H.A. 1935. Western and southwestern Amnicolidae and a new *Humboldtiana*. Nautilus 48:91-94.

Schuster, S.K. 1997. Hydrogeology and local recharge analysis in the Toyah Basin Aquifer. Masters Thesis, Geological Sciences, University of Texas at Austin. 130 pp.

Sharp, J.M., Uliana, M.M., and R. Boghici. 1999. Fracture controls on regional groundwater flow in a semiarid environment and implications for long-term maintenance of spring flows. Water 99 Joint Congress, Inst. of Engineers. Australia, Brisbane. v. 2, p.1212-1217.

Taylor, D. W. 1987. Fresh-water molluscs from New Mexico and vicinity. New Mexico Bureau of Mines and Mineral Resources Bulletin 116:1-50.

Winemiller, K.O. and A.A. Anderson. 1997. Response of endangered desert fish populations to a constructed refuge. Restoration Ecology 5:204-213.

Young, D.A., K.J. Fritz, G.P. Garrett, and C. Hubbs. 1993. Status review of construction, native species introductions, and operation of an endangered species refugium channel, Phantom Lake Spring, Texas. Proceedings of the Desert Fishes Council 25:22-25.

LISTING PRIORITY

| 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:* Threats of spring flow loss will result in complete habitat loss and elimination of entire populations of the species.

*Imminence:* Drying of Phantom Lake Spring is happening now and will likely extirpate this population in the near future.

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, removal of candidates, and listing priority changes.

Approve: Tom Bauer 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: _____
_____
_____

Date of annual review: Feb 2003

Conducted by: Nathan Allan, Austin FWS office

Comments: _____
_____

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(rev. 7/02)