U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Kinosternon sonoriense longifemorale

Common Name:

Sonoyta Mud turtle

Lead region:

Region 2 (Southwest Region)

Information current as of:

03/15/2013

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

> ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
>
> ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
>
> ___ Range is no longer a U.S. territory
>
> ___ Insufficient information exists on biological vulnerability and threats to support listing
>
> ___ Taxon mistakenly included in past notice of review
>
> ___ Taxon does not meet the definition of "species"
>
> ___ Taxon believed to be extinct
>
> ___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Arizona
- **US Counties**:County information not available
- **Countries**: Mexico, United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Arizona
- **US Counties**: Pima, AZ
- **Countries**: Mexico, United States

Land Ownership:

In the United States, 100% of the Sonoyta mud turtles habitat is owned by the National Park Service (NPS) within the Organ Pipe Cactus National Monument (OPCNM). The pond and springs at Quitobaquito are approximately 0.2 hectares (ha) (0.5 acres (ac)) in size. Habitat size in Mexico is variable and ownership information is limited; the lower end of the subspecies range is in Pinacate Biosphere Reserve.

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Biological Information

Species Description:

The Sonoyta mud turtle (*Kinosternon sonoriense longifemorale*, Iverson 1981) is a dark, medium-sized (carapace length to 14.5 centimeters (cm) (5.7 inches (in.))), aquatic turtle with a mottled pattern on the head, neck, and limbs. The upper shell (carapace) is olive brown to dark brown with dark seams; the lower shell (plastron) is hinged, front and rear, and yellow to brown. Long barbels (whisker-like organs) are typically present on the chin, and all four feet are webbed.

Taxonomy:

The Sonoyta mud turtle is an isolated endemic subspecies of the Sonoran mud turtle (*Kinosternon sonoriense*) recognized by the Society for the Study of Amphibians and Reptiles as a valid taxon (Crother 2008, p. 71). This is based upon Iversons (1981, p. 18) description of the subspecies established on a set of 19 shell measurements. It appeared to be distinctive from the nominate race based on a long femoral scute, short anal scute, wide first vertebral scute, and narrow gular scutes (Iverson 1981, pp. 43-44). Results from a population genetics study indicate that the Quitobaquito-Rio Sonoyta populations are distinct from all other Arizona-New Mexico populations of Sonoran mud turtles, which is consistent with the taxonomy developed by Iverson (1981, p. 27; Rosen 2003, p. 13). Based upon a careful review of the available taxonomic information and its recognition as a valid taxon by Study of Amphibians and Reptiles (Crother 2008, p. 71), we consider the Sonoyta mud turtle to be a valid taxon.

Habitat/Life History:

Sonoyta mud turtles are found both in natural and artificial spring-fed ponds and stream channels. Adults are typically captured in the deeper sections of the pond near dense stands of tules and other vegetation. Juveniles and sub-adults are found along the stream channel under overhangs and dense clumps of grass (Rosen and Lowe 1996a, p. 11). In addition to the aquatic environments, Sonoyta mud turtle habitat also includes basking sites for thermal regulation, vegetated areas for cover, and vegetation free shoreline for nesting substrates. In addition, shorelines must be accessible from aquatic environments to provide easy access to terrestrial habitat features essential for the life-history processes of the Sonoyta mud turtle. The subspecies feeds primarily on aquatic invertebrates and plants, although fish and other vertebrates are also eaten (Hulse 1974, p. 197). Male Sonoyta mud turtles become mature at 3 to 4 years in age, females at 5 to 6 years, and they can live as long as 25 years. Females deposit an average of 1.5 clutches per year with an average of four eggs per clutch from July to September and are buried in the soil on land (Rosen and Lowe 1996a, p. 21).

Historical Range/Distribution:

The Sonoyta mud turtle historically occurred throughout the Rio Sonoyta watershed where surface water was present. The Rio Sonoyta drainage originates in the Sierra del Pozo Verde in Mexico, and crosses into the United States where it turns west on the Tohono Oodham Nation, north of the international border (Figure 1). Vamori and San Simon washes on the Tohono Oodham Nation drain into the Rio Sonoyta before it crosses back into Mexico 48 kilometers (km) (30 miles (mi)) east of Sonoyta, Sonora, and continues approximately 23 km (14 mi) west, paralleling the United States and Mexico border. The river channel then turns south

along the east side of the Pinacate volcanic shield, passing through the eastern fringe of a sand field (the Gran Desierto) before reaching the Sea of Cortez east of Puerto Peñasco, Sonora, Mexico. Rio Sonoyta is a disjunct stream of the Colorado River system that was likely isolated in the Pinacate region during a volcanic activity period in the Pleistocene (Ives 1936, p. 349). Before 19th and 20th century degradation by groundwater pumping, livestock grazing, and subsequent downcutting, perennial waters flowed through portions of the river channel, and fed springs and cienegas in the area (wet, marshy areas) (Miller and Fuiman 1987, p. 602; Shoenherr 1988, p. 110; Hendrickson and Varela-Romero 1989, p. 481).

The Quitobaquito-Rio Sonoyta region of southwestern Arizona and northwestern Sonora, Mexico, is characterized by extremely arid climate and isolation from other river systems (i.e., Colorado and Gila Rivers and Rio Concepcion). Isolation of the Rio Sonoyta drainage probably occurred sometime in the last 100,000 to 1,000,000 years when eruptions from the Pinacate Volcanic Field diverted flow of the Rio Sonoyta southward to the Gulf of California resulting in several endemic animal taxa from this aquatic system including the Sonoyta mud turtle (Ives 1936, p. 349-350; Turner 1983, p. 691).

Current Range Distribution:

The Sonoyta mud turtle is extant in the United States at Quitobaquito Spring in OPCNM, Arizona, and in Mexico along the Rio Sonoyta and Quitovac Spring in Sonora (Figure 1; Rosen 2003, pp. 2-5). Quitobaquito Spring is a unique desert oasis in the Rio Sonoyta watershed located on the international border and 23 km (14 mi) west of Lukeville, Arizona. A series of natural springs rises in fractured granites and gneiss along the southwestern facing slopes of the Quitobaquito Hills. The two largest springs are captured and conducted into a manmade (gunnite) stream channel, which flows south approximately 244 meters (m) (800 feet (ft)) to a manmade pond that is up to 1 m (3 ft) deep and 0.2 ha (0.5 ac) in area. Other springs in the immediate area result in small natural seeps with no significant pooled water.

The subspecies inhabits the Rio Sonoyta in Sonora, Mexico, with the majority of the sites within or near the town of Sonoyta where pools are present for most of the year. The sites include an intermittent reach approximately 2 to 4 km (1 to 2 mi) upstream of the town of Sonoyta, an ephemeral dam pool near Presa Xochimilco, a sewage lagoon adjoining the river near the town of Sonoyta, and an intermittent reach that begins some 15 km (9 mi) downstream of the town of Sonoyta near Santo Domingo, continuing for several kilometers through the 2 to 3.4 km (1 to 2 mi) perennial Papalote Reach in the northwestern corner of the Reserva de la Biosfera el Pinacate y Gran Desierto de Altar (Pinacate) south of Quitobaquito (Rosen 2003, pp. 2-5). The Papolote Reach, formerly known as the Agua Dulce reach, is the only remaining perennial reach of the Rio Sonoyta.

Lastly, the Sonoyta mud turtle inhabits an approximate 2 ha (5 ac) spring complex at Quitovac approximately 40 km (25 mi) southeast of the town of Sonoyta. The population at Quitovac might represent an introduced population, as there are no aquatic migratory pathways between Rio Sonoyta and Quitovac, or it could be an isolated relict (Paredes-Aguilar and Rosen 2003, p. 10).

Figure 1. Current Sonoyta mud turtle distribution (Quitobaquito Springs in Arizona, Papalote Reach of Rio Sonoyta, and Quitovac Spring in Sonora).

Population Estimates/Status:

The Sonoyta mud turtle was once abundant at Quitobaquito Springs, but the population declined from approximately several hundred in the 1950s to less than 100 in the late 1980s. Biologists at OPCNM and their partners have conducted annual mark-recapture surveys at Quitobaquito since 2001, except from 2008 to

2010 when water levels were too low for a regular census. Census methods and previous results are described in National Park Service reports (NPS) (2008a, entire). The average population estimate, excluding young of the year (up to 40 millimeters (mm) (1.6 in) carapace length), is 100.2 turtles based on 17 years of data collected since 1984 (NPS 2012, p. 1). Population estimates were not generated between 2007 and 2009 (Holm 2011, p. 1). Since 2001, estimates have ranged from a low of 39 turtles in 2005 to a high of 156 in 2011 (NPS 2012, p. 1). The population estimate of 156 turtles for 2011 was the largest estimate since 1984, and excluded turtles released from captivity.

Size classes peaked at 81 to 90 mm (3 to 3.5 in) in 2011, compared to 101 to 110 mm (4 to 4.3 in) during 2001 to 2007, suggesting a wave of recruitment. The 2011 captures were also used as a second catch to generate an estimate for 2010, with the 29 captures in 2010 serving as the first catch. This results in an estimate of 123 turtles for 2010. In 2012, the most recent sampling effort, Sonoyta mud turtles were sampled at Quitobaquito Springs over two consecutive nights in both September and October. These captures included 43 females, 44 males, 4 turtles of undetermined sex, and 12 young of the year. Nine of the 24 turtles released from captivity in 2011 were recaptured in the 2012 sampling effort. The 2012 population estimate was 148 for turtles greater than 40 mm. Between 2001 and 2007, the number of hatchlings per trap night ranged from a low of 0.08 in 2003 to a high of 1.04 in 2007 and an average of 0.35. Young-of-the-year captured during surveys continued to increase in 2012, with number of hatchlings per trap night reaching a new high of 3.

Sonoyta mud turtles have been documented at seven sites in Mexico (Paredes-Aguilar and Rosen 2003, p. 5; Rosen 2003, pp. 2-5); however, sampling in Mexico has not been extensive enough to make accurate estimates of total population size. The population discovered in March 2002 at Quitovac, Mexico, was estimated at about 200 individuals (Rosen 2003, p. 5). Rosen (2003, pp. 5-6) also estimated the combined population size of all Sonoyta mud turtle populations to be 1,200 individuals (range 600-2,700).

Figure 2. Population estimates and standard error for yearling and older turtles (carapace length 41 mm or greater) at Quitobaquito, Organ Pipe Cactus National Monument. No data was collected or estimated for 2008 and 2009.

Threats

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

range:

Groundwater Depletion and Surface Water Diversion

Rio Sonoyta and Quitobaquito Spring have long been stopover points for travelers heading west across the Sonoran Desert. As the only water source in the region, both surface and subsurface water have been used heavily for agricultural and other purposes. As a perennial desert stream, any additional withdrawals from the water table, particularly during drought years, could have negative impacts on the stream and the Sonoyta mud turtle.

Quitobaquito pond is a dredged and impounded pond fed by springs and seeps in nearby granite outcrops. Flow from springs may have been connected to the Rio Sonoyta via surface flows in recent times, but is now separated by approximately 1.5 km (.9 mi) of Sonoran Desert and Mexico Highway 2. The effects of the original dredging and impoundment on the Sonoyta mud turtle are unknown. Prior to 1957, humans and livestock occupied the area and there was considerably less vegetation and more water in the springs. Discharge from the spring has diminished by nearly 50 percent over the past 30 years (NPS, unpubl. data). Since essentially no water withdrawal or livestock grazing occurs upslope or upstream of Quitobaquito, drought is suspected as the primary cause for this depletion. Lack of water in Quitobaquito pond is an ongoing threat to the species, and the pond continues to be highly managed by the NPS to maintain water levels as described below under conservation measures.

In Mexico, the Sonoyta mud turtles aquatic habitat along the Rio Sonoyta continues to shrink and degrade due to groundwater pumping and surface water diversion. Increases in the amount of groundwater withdrawal, changes in wastewater treatment, and the potential for complete desiccation of the only remaining perennial stretch of Rio Sonoyta are threats to the Sonoyta mud turtle in Mexico. Irrigated agriculture is widespread in the Rio Sonoyta Valley, and continued development in the towns of Sonoyta and Lukeville is placing increased demands on limited water supplies (Brown 1991, pp. 48-49). Paredes-Aguilar and Rosen (2003, p. 8) observed that groundwater pumping for agricultural purposes may have decreased. This decrease was likely temporary, because the town of Sonoyta continues to grow and is expected to create an increasing demand on the local water supply. At an Arizona-Mexico Commission Water Committee meeting in Tucson in June 2007, an official from the Comisión Estatal de Agua del Estado de Sonora presented results from a recent study of the Rio Sonoyta aquifer. Preliminary results from the study indicate current groundwater usage in the Rio Sonoyta watershed is greater than the estimated recharge rate, and the Comisión Estatal de Agua del Estado de Sonora recommended no further well drilling (Quitobaquito-Rio Sonoyta Working Group (QRSWG) in prep.). As a result, complete desiccation of the Papalote Reach of Rio Sonoyta is likely to occur in the future as a result of upstream aquifer depletion by agricultural pumping and drought exacerbated by climate change (QRSWG in prep.). Loss of the Papalote Reach would result in the loss of the Sonoyta mud turtle population found there. In 2010, the water level was greatly reduced at the Papalote Reach of the Rio Sonoyta likely due to increased groundwater pumping associated with improvements to Mexican Highway 2 (Aguirre-Pompa 2011, pers. comm.).

Development of and Changes to Urban Infrastructure

Current thought suggests that the turtles at the town of Sonoyta may be surviving primarily because of the consistent influx of sewage run-off from a wastewater treatment plant. Although sewage effluent may grow in overall volume, if treated using more modern methods, the actual volume of treated water returned to the Rio Sonoyta may decrease and ultimately lead to the demise of the turtles using it. Currently in Sonora, Mexico, surface water remains generally present in the Rio Sonoyta at Sonoyta. Here a dam retains seasonal run-off, forming an ephemeral reservoir, Presa Xochimilco, and produces a small spring in the bedrock. Within the town of Sonoyta, water can be found above and below the Presa Xochimilco. Approximately 0.5 km (0.3 mi) upstream, wastewater discharge from a military complex located above Presa Xochimilco was used to create large perennial pools within the Rio Sonoyta streambed at the upper end of Presa Xochimilco. In 2008, the effluent was piped to the wastewater treatment facility in the town of Sonoyta, bypassing Presa

Xochimilco. As a result, the Presa Xochimilco pools rely only on stormwater runoff and may no longer be perennial. Despite the potential detrimental effects of chemical pollutants and nutrient loading, these pools provided habitat for Sonoyta mud turtles during frequent periods when the stream was otherwise dry. This was the largest known population of the Sonoyta mud turtle in Mexico (Paredes-Aguilar and Rosen 2003, p. 9). No surveys have been completed for this population since the water source was diverted. Loss of these perennial pools has likely adversely impacted this population of Sonoyta mud turtles.

On the west side of the town of Sonoyta, Sonoyta mud turtles currently occupy a sewage lagoon greater than 5 ha (12 ac) that drains into the Rio Sonoyta. In 2008, the U.S. Environmental Protection Agency awarded a grant to the wastewater utility of Sonoyta for the construction of a new wastewater treatment facility east of the town of Sonoyta to improve water quality and human health conditions in the town. The current wastewater treatment system will be decommissioned once the new wastewater treatment facility is completed. This will result in elimination of wastewater flow into the sewage lagoon currently occupied by Sonoyta Mud turtles, and cause the lagoon to dry so that it is unsuitable habitat for the subspecies. The project will also result in the elimination of outflow from the current sewage lagoon into the Rio Sonoyta and could diminish recharge of the shallow aquifer that contributes to the perennial Papalote Reach of the Rio Sonoyta downstream of the town of Sonoyta. However, the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) issued a resolution with binding conditions for the project proponent to provide habitat for this population of Sonoyta mud turtles at the new facility, as described below under conservation measures.

Figure 3. Current (sewage lagoon) and proposed waste treatment plant sites along Rio Sonoyta in Sonora.

Contaminants

Between 1989 and 1993, environmental contaminants biologists employed by the U.S Fish and Wildlife Service (Service) investigated Sonoyta mud turtles found dead by Rosen and Lowe (1996a, p. 29), and also analyzed pond sediments from Quitobaquito Springs. They found that these turtles from Quitobaquito Springs had very low body fat reserves which indicated possible dietary deficiency and starvation. In 2007, the U.S. Geological Survey National Wildlife Health Centers initial necropsy resulted in the same findings (Holm 2007, p. 1). The Service biologists also found relatively high levels of boron, chromium, selenium, strontium, and zinc in Sonoyta mud turtle tissues. Chromium, selenium, and zinc are Environmental Protection Agency designated priority pollutants regulated by the Clean Water Act. High levels of these

elements combined with low availability of protein-rich foods may be limiting turtle survival (King et al. 1996, p. 5). Low lipid reserves may also result in reduced egg production. Other contaminants, including pesticides and herbicides used on agricultural lands along the Rio Sonoyta may enter turtle habitats via runoff. For example, low levels of dichlorodiphenyldichloroethylene (DDE), a metabolite of the insecticide dichlorodiphenyltrichloroethylene (DDT), and Dacthal, an active ingredient in herbicides, have been found in Sonoyta mud turtles from Quitobaquito since 1981 (King et al. 1996, p. 3; Rosen and Lowe 1996a, pp. 30-31). The effects of such pesticides on this species have not been studied. Sonoyta mud turtles that are still present in the sewage lagoon on the west side of the town of Sonoyta are subject to contaminants from sewage as well as potential contaminants in runoff from agricultural fields and livestock holdings (King et al. 1996, pp. 4-5).

Alteration of Native Plant Composition

Several invasive plant species have displaced native vegetation and present a fire hazard in Sonoyta mud turtle habitat. Salt cedar (*Tamarix ramosissima*) has become established along the Rio Sonoyta (Paredes-Aguilar and Rosen 2003, pp. 7-8). It also poses a threat at Quitobaquito but currently is being aggressively and successfully controlled by OPCNM (Tibbitts 2010, pers. comm.). It is a high water use plant, and may utilize valuable water resources during dry periods. Although the dense thickets of salt cedar at Rio Sonoyta may use more water than native vegetation that it has displaced, its roots stabilize the stream banks and provide hard shelter protecting turtles against predation and floods. Also, bufflegrass (*Pennisetum ciliare*) and Sahara mustard (*Brassica tournefortii*) have become established along the Rio Sonoyta. In addition to altering the native plant composition, the presence of nonnative plant species increases the potential for wildfire (both frequency and intensity). Staff at OPCNM are currently concerned about the build-up of dead wood in the bosque (an area of trees along streams or river banks) surrounding Quitobaquito that is currently a potential for severe fire (Holm 2012, pers. comm.). Large intense fires could result in increase siltation within the stream system and further degrade the watershed. The OPCNM is currently developing a fire management plan to address this issue.

Border Activities

Although Quitobaquito Spring lies mostly within designated wilderness, Mexico Highway 2 also lies approximately 100 m (328 ft) to the south and is the primary land transportation link between mainland Mexico and the Baja California peninsula. Threats to Quitobaquito pond and springs include high levels of cross-border violator and U.S. Border Patrol activities in the immediate area. To date this has not been documented, although cross-border violators could damage the pond or springs and surrounding area or contaminate the pond or springs. U.S. Border Patrol or other vehicles have driven several times recently on the berm that impounds Quitobaquito pond. Evidence of driving on the berm was noted in an OPCNM database on May 13, 2008; November 20, 2008; March 4, 2009. June 11, 2009; September 4, 2009; and October 7, 2009; however, staff have also informally observed tracks about 10-15 times in the last two years. The tracks often show tread types characteristic of U.S. Border Patrol vehicles, although other unauthorized vehicles have likely driven on the berm as well (Tibbitts 2009, pers. comm.). The OPCNM has recently constructed wooden fence at the western and eastern ends of the berm to discourage vehicle traffic. Vehicle activity on the berm could cause its partial collapse or deterioration. If the integrity of the berm is compromised and the berm collapses, much or all of the pond could be lost. Even if the berm does not collapse, driving on it could cause deterioration, resulting in materials spilling into the pond, decreasing its volume, reducing habitat for Sonoyta mud turtle. Additionally, vehicles could slide into the pond, either due to collapse of the berm or driving too close to the edge followed by accidental slippage off the berm and into the pond. Contaminants in the form of oil or other vehicle fluids could cause damage to Sonoyta mud turtle habitat.

As documented in October 2009, vehicles have been driven over the stream crossing that connects the springs to the pond. The stream flows through an artificial concrete channel designed by the Arizona-Sonora Desert Museum (ASDM) in 1989 to create habitat for Sonoyta mud turtles, while supplying a dependable flow of

water to the pond. Though no significant damage was sustained from this recent incident in which a U.S. Border Patrol agent drove over the channel several times in an all terrain vehicle, such events could alter the flow of water from the spring to the pond. If the concrete channel was broken or damaged, water could be diverted from the channel, resulting in dewatering of the spring channel and possible lowering or drying of the pond.

The future of Quitobaquito pond and springs depends heavily on OPCNMs ability to manage the site, which is currently affected by the threat posed by high levels of cross-border violator activities along the border at OPCNM (i.e., OPCNM biologists and staff cannot freely visit the site to conduct management, maintenance, and monitoring, as they must be accompanied by law enforcement on all visits).

Summary of Factor A

In summary, we find the Sonoyta mud turtle is threatened by habitat destruction, modification, or curtailment resulting from groundwater depletion and surface water diversion, and potentially threatened by contaminants, invasive plants, and border activities. We believe these activities are substantial enough to threaten the subspecies throughout its entire range in the foreseeable future.

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

Illegal collection of Sonoyta mud turtles is occurring, but the extent of this activity is unknown (Pate 2007, pers. comm.). Rosen and Lowe (1996b, p. 9) documented illegal collection of the Sonoyta mud turtle at Quitobaquito. In the town of Sonoyta, the subspecies has been collected from Xochimilco by residents and sold to a local veterinarian (Paredes-Aguilar and Rosen 2003, p. 7). Because of low population sizes and reproductive potential, any collecting, particularly of adult female turtles, could be critical to local population viability. However, we do not currently have information indicating overutilization is a significant threat to the Sonoyta mud turtle.

C. Disease or predation:

Nonnative predators capable of consuming Sonoyta mud turtles or their eggs are known from Quitobaquito or the Rio Sonoyta, such as feral and domestic cats and dogs in and near the town of Sonoyta. However, the level of predation of turtles by cats and dogs near Sonoyta is unknown. Introduction of nonnative crayfish (e.g., northern crayfish (*Orconectes virilis*), or red [Louisiana] swamp crayfish (*Procambarus clarkii*)), bullfrogs (*Rana catesbeiana*), and large predaceous fish to Quitobaquito or the Rio Sonoyta could result in extirpation of the Sonoyta mud turtle from these aquatic ecosystems. Bullfrogs are known to prey on turtles and may be capable of impacting populations of mud turtles. Likewise, nonnative crayfish are known to prey on the Sonoran mud turtle (Schwendiman 2001, p. 39) and their introduction was closely correlated with marked population reductions at the one Arizona locality that has been evaluated (Fernandez and Rosen 1996, pp. 40-41). Concern has also been expressed over possible nonnative fish introduction into Quitobaquito. Some nonnative species, such as largemouth bass (*Micropterus salmoides*), are likely capable of preying on mud turtles (Stone 2009, pers. comm.); however, largemouth bass are not known from any of the habitats currently supporting the Sonoyta mud turtle. Individuals of several species of nonnative turtles also have been documented in Quitobaquito. Smith and Hensley (1957, pp. 201-202) collected a mating pair of yellow mud turtles (*K. flavescens arizonense*) in 1955. This nonnative mud turtle species can compete for limited resources, introduce disease and parasites currently not known in the Sonoyta mud turtles, and potentially prey on hatchlings. This species may have been native on the Rio Sonoyta floodplain, but thrives in ephemeral, rather than perennial water; thus, although it is not a likely threat under current conditions, it will likely replace the Sonoyta mud turtle as waters become increasingly intermittent. The Arizona mud turtle has recently been documented photographically at Presa Xochimilco, Sonoyta (Pate 2007, pers. comm.) and from just north or OPCNM (Holm 2009, pers. comm.). No nonnative turtle species have been documented in

the Rio Sonoyta, but released pet turtles and potential competition for resources will be an on-going issue within the Rio Sonoyta basin. Based on current information, disease and predation is not a significant threat to the subspecies at this time.

D. The inadequacy of existing regulatory mechanisms:

Arizonas State Wildlife Action Plan, formerly known as the Comprehensive Wildlife Conservation Strategy, considers the Sonoyta mud turtle to be 1 of 57 species in Arizona in immediate need of conservation actions (Arizona Game and Fish Department (AGFD) 2006a, pp. 13, 32, and 490). Arizona State law allows collection of Sonora mud turtles with an annual bag limit of four, live or dead, under the species level taxon. However, the NPS requires special permitting for any collections of the Sonoyta mud turtle subspecies on OPCNM where it solely occurs in the United States.

The subspecies may be afforded some regulatory protection because it co-occurs with the federally endangered desert (Quitobaquito) pupfish (Cyprinodon [macularis] eremus). The range of the Sonoyta mud turtle completely overlaps that of desert (Quitobaquito) pupfish. Designated critical habitat for the desert pupfish (Cyprinodon macularius) includes Quitobaquito Springand a 100-foot riparian buffer zone around the spring (Service 1986, p. 10848). We interpret this to mean Quitobaquito pond and a 30 m (100 ft) buffer around the pond. Federal actions affecting the desert pupfish or its critical habitat would require consultation under section 7 of the Endangered Species Act and potentially provide benefits to the Sonoyta mud turtle. Such activities have included the General Management Plan for OPCNM (Service File# 22410-F-1989-0078) and issuance of a special use permit by OPCNM to CBP (Service File# 22410-F-2009-0089). The extent of these benefits is limited to the aquatic habitat and critical habitat overlap; effects to turtles using terrestrial habitat are not addressed. In Mexico, the Sonoyta mud turtle does not have protected status, nor is the habitat protected. We conclude that the inadequacy of existing regulatory mechanisms in the United States is not a significant threat to the subspecies. However, the existing regulatory mechanisms in Mexico do not ameliorate the threats to the subspecies in Mexico.

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

A reduction in annual precipitation at OPCNM and a reduction in water levels in Quitobaquito Springs have been contributing factors to the drop in the population estimates from 2002 to 2005, based upon earlier work by Rosen and Lowe (1996a, p. 24), which directly correlated precipitation with recruitment (Rosen et al. 2006, p. 4). This relationship may be related to impacts of drought on terrestrial vegetation, spring output, and evaporation rate as these impacts can decrease turtle food supply and egg survival during drought (Rosen et al. 2006, p. 4). In addition, this population of Sonoyta mud turtles has likely experienced some nutritional stress based upon a lack of stored fat reserves found in dead individuals (Rosen and Lowe 1996a, pp. 31-32; Rosen *et al.* 2006, p. 6; Holm 2007, p. 1). Five adult individuals were found dead at Quitobaquito in late 2007 when water levels were extremely low. A necropsy was performed by the U.S. Geological Survey National Wildlife Health Center on one of the dead male Sonoyta mud turtles. Initial results found two principle abnormalities in this male Sonoyta mud turtle, such as fluids in the body cavity and severe depletion of fat reserves (Holm 2007, p. 1). Both abnormalities are non-specific changes that could have multiple causes. No evidence of infectious disease was found in the Sonoyta mud turtle. The finding of low fat reserves is consistent with previous autopsies of dead Sonoyta mud turtles at Quitobaquito (Rosen and Lowe 1996a, pp. 31-32). Rosen and Lowe (1996a, pp. 31-41) suggested that stressors associated with poor nutrition are important contributors to observations of unexplained mortality of the subspecies, and that competition for limited food resources with desert pupfish likely accounts for nutrient deficiency in Sonoran mud turtles at Quitobaquito.

In Mexico, aquatic habitat in the Rio Sonoyta is extremely dynamic due to climatic extremes (Ives 1936, pp. 352-354; Hendrickson and Varela-Romero 1989, p. 482), which may also contribute to Sonoyta mud turtle population fluctuations. Because turtle populations have a low intrinsic population growth rate, they are incapable of expanding rapidly to take advantage of temporary habitats created by periods of high

precipitation, but populations can decline rapidly during drought years. Also, populations of Sonoyta mud turtles are relatively small. Small populations may be vulnerable to environmental and demographic random events, such as drought, which increase the probability of extinction (Lande 1993, p. 923).

Periods of drought in the Sonoyta mud turtles range are not uncommon; however, the frequency and duration of dry periods may become more frequent. Global climate change and associated effects on regional climatic regimes, is not well understood, but the predictions for the Southwest indicate less overall precipitation and longer periods of drought. Seager *et al.* (2007, p. 1181) predict, based on broad consensus among 19 climate models, that the Southwest will become drier in the 21st century and that the transition to this drier state is already underway. The increased aridity associated with the current ongoing drought will become the norm for the Southwest within a timeframe of years to decades, if the models are correct. This aquatic subspecies, along with its habitat, will likely be affected in some manner by climate change, but the magnitude and extent of possible change cannot be verified or quantified at this time.

We conclude that the other natural or manmade factors are a significant threat to the subspecies, primarily from stressors that limit water availability. We believe effects of drought are substantial enough to threaten the subspecies throughout its entire range in the foreseeable future.

Conservation Measures Planned or Implemented :

Conservation Agreement

The Service awarded a section 6 grant to the AGFD to develop a conservation agreement for the Sonoyta mud turtle. Through this section 6 grant, AGFD provided funding to the University of Arizona, and Centro de Estudios de Estado y Sociedad (CEDES) (formerly Instituto del Medio Ambiente y el Desarrollo Sustentable del Estado de Sonora or IMADES), Hermosillo, Sonora, to define the status and distribution of the Sonoyta mud turtle in Sonora, Mexico. Results of this work are reported in Paredes-Aguilar and Rosen (2003) and Rosen et al. (2006).

The QRSWG was formed in 2001 with the agencies and interested parties in the United States and Mexico to assist in development of a conservation strategy and agreement for the subspecies. The QRSWG is working together to improve the status of the Sonoyta mud turtle and has developed potential conservation measures for this subspecies (QRSWG in prep.). The ASDM currently supports a refugia population of Sonoyta mud turtles, and though most will be repatriated to Quitobaquito, some will likely be retained at the ASDM. The Phoenix Zoo has also expressed interest in propagating Sonoyta mud turtles and perhaps establishing a captive population on the zoo grounds.

NPS Maintenance of Quitobaquito Pond

The imperiled status of the Sonoyta mud turtle was unknown to NPS personnel for many years. The pond at Quitobaquito Spring was drained twice to eliminate nonnative fish and enhance habitat for the endangered desert pupfish. During these drying episodes many Sonoyta mud turtles were collected and apparently distributed to individuals (Rosen 1986, p. 17). The NPS has since recognized the unique nature of the Sonoyta mud turtle population and managed for its conservation. The NPS identified habitat features such as basking sites, banks free of vegetation, access to terrestrial habitats, and pools in the inlet channel, that are becoming less available to the subspecies. The NPS is working to maintain these habitat features and improve habitat heterogeneity.

Maintaining water levels at Quitobaquito pond continues to be a challenge. In 2006, the water level in the pond at Quitobaquito Spring reached an all time low in June prior to summer rains. In an effort to increase the discharge rate from Quitobaquito Spring, OPCNM staff reconstructed the leach field below the springhead through trenching and replacing the existing gravel and perforated pipe in April 2007 (Pate 2007,

p. 1). From September to October 2007, the pond reached its lowest recorded water level at 59 cm (23 in) below the overflow pipe (Tibbitts 2007, p. 1). This resulted in an estimated 70 percent reduction in surface area and an average depth of about 11 cm (4 in). The OPCNM staff removed the dead vegetation around the pond, and trimmed the aquatic vegetation and improved the pools along the stream channel to improve access to basking structures at Quitobaquito Springs (Tibbitts 2007, pers. comm.). In March 2008, water levels began to drop again, causing OPCNM staff to conclude that the pond may be leaking water through the retaining berm. A small turtle moat was created that captured the water coming from the spring channel. In April and May 2008, the NPS removed several decades of tree growth on the retaining berm and installed a diaphragm wall down the center of Quitobaquito ponds retaining berm in hopes of stopping any water leaking through the berm (NPS 2008a, p. 4). This diaphragm wall was constructed with a plastic liner and dry cement fill placed in a 0.3-m (1-ft) wide by 1.8 m (5.9 ft) deep trench down the center of the retention berm. After the completion of the diaphragm wall, the water remained at an all time low of minus 72 cm (29 in) (or 29in below the outflow pipe) (NPS 2008a, p. 5). More than 1,830,246 liters (l) (483,500 gallons (gal)) of water were hauled to Quitobaquito pond during July and August of 2008. When the monsoon rains came in late August and early September, the water level was raised in the pond by 8.8 cm (3.5 in) in late August and early September (NPS 2008a, p. 5). By the end of 2008, water levels increased through a combination of spring input, water hauling, and precipitation events to a minus 49.5 cm (19.5 in) below the outflow pipe (NPS 2008a, p. 5).

During the winter of 2008 to 2009, OPCNM staff removed extensive growths of bulrush, which had encroached toward the pond center since water levels had dropped. Following these efforts and to test whether a leak persisted, additional water was trucked to the pond during March 2009. This effort resulted in the highest water level in the pond since mid-September 2007. By April 2009, falling water levels confirmed a leak was present (the lowest level reached in 2009 was minus 69.9 cm (27.5 in). In the summer of 2009, approximately 1,371 m^2 (4,500 ft^2) of the southeastern corner of the pond was isolated by constructing a temporary coffer dam. All possible Sonoyta mud turtles were removed for temporary safekeeping offsite. The southeastern corner was then emptied of water, mud, and detritus. The retaining berm was widened inward approximately 4 ft, using compacted clean fill material. A bentonite wall was built into the center of this enlargement of the berm. Finally, the pond bottom was covered with about 15 cm (6 in) of compacted bentonite and fill mixture. In early December 2009, the total rise in water level since the southeastern corner renovation was approximately 25 cm (10 in) (the pond level was minus 36 cm (14 in) below the outflow pipe), with no rain, relatively low spring input, and above average temperatures much of that time, suggesting the renovation plugged a leak in the berm. Rain events in January 2010 increased the pond level to about minus 15 cm (6 in) below the outflow pipe; however, in February 2010, the level of Quitobaquito pond fell to minus 30 cm (12 in) (Tibbitts, 2010, pers. comm.). The pond level held steady at minus 30 cm (12 in), which indicated one remaining leak was controlling the pond at that level. The large leaning cottonwood tree was the leading candidate for the remaining leak and therefore, in October 2010, OPCNM sealed around this tree. The effort was successful and the pond leveled off at minus around 12 cm (5 in). This seal is temporary and partial, and was expected to be capable of holding for up to 5 years (through October 2015).

Regardless of these efforts, water levels in the pond dropped 46 cm (18 in) between December 2011 and July 2012. This is the largest single loss of water in recorded history of Quitobaquito pond. The cause of the loss was likely a combination of pressure-induced activation of one or more leaks in the liner, failure of the pond layer seal around the cottonwood tree, and large-scale evapotranspiration loss via increasing stands of bulrush. In May 2012, OPCNM staff initiated bulrush mowing and continued weekly mechanical removal of bulrush through July when monsoon rains were in full swing. The daily drop in pond level prior to mowing was 0.6 cm/day (0.24 in/day) with spring input into the pond about 3.7 l/min (14 gal/min). After bulrush mowing was implemented, the daily drop in pond level remained between 0.3 to 0.4 cm (0.1 to 0.15 in), even with spring input falling to 3.2 l/min (12 gal/min) and hotter temperatures than before mowing began. Lower water levels revealed new leaks in the liner around the cottonwood tree caused by woodrats (Neotoma sp.) taking up residence in the tree.

In light of these continuing challenges, the QRSWG discussed long-term plans for Quitobaquito pond at its

annual meeting on June 26, 2012. The group is in full support of reconstructing the dam, removing the leaning cottonwood before it falls and destroys the berm, and resetting the pond liner. Due to a decrease in flow from the spring heads, the group also supports creating a smaller pond.

Turtle Salvage and Repatriation

On October 30, 2007, 13 juveniles, subadults, and adults were salvaged from Quitobaquito Pond and taken to the ASDM in Tucson, Arizona, as a response to the unexpected drop in the water level. Unfortunately, raccoons (Procyon lotor) gained access to the ASDMs Sonoyta mud turtle pens and killed 12 of the 13 salvaged turtles. The remaining individual was placed in a more secure location. On April 22, 2008, 31 individuals were captured out of the pond and transported to The Phoenix Zoo for temporary holding while ASDM repaired its turtle pens (NPS 2008b, p. 3). One individual died in captivity at The Phoenix Zoo. The remaining 30 individuals were transported to the ASDMs newly secured Sonoyta mud turtle pens in February 2009 with the goal of establishing a captive population. In 2009, large volumes of water were lost from Quitobaquito Pond over a short period of time, providing evidence of one or more leaks in the pond. On August 20, 2009, 37 additional individuals were captured from Quitobaquito Pond and transported to the ASDMs secure Sonoyta mud turtle pens (NPS 2009, p. 18). Five more turtles have died in captivity at ASDM. In total, 81 turtles were removed from Quitobaquito Pond due to decreased pond water levels. Of these salvaged turtles, 18 individuals were lost from predation or died in captivity so that 63 turtles remained in the salvage population at ASDM. On July 13, 2011, 12 turtles from ASDM were repatriated to Quitobaquito Pond. An additional 12 turtles were repatriated on September 13, 2011. Another 12 turtles were due to be released to Quitobaquito Pond in 2012; however, the low water levels in June 2012 prompted a decision to delay the release until the pond could be stabilized. Three of the females at ASDM drowned in August 2012 when they were paired with males. This leaves a total of 33 individuals (7 males, 10 females, and 16 juveniles) remaining in the refuge population at ASDM (NPS 2012, p. 1). The long-term plan is for 12 turtles to remain at ASDM in an assurance population in a turtlarium that will be constructed in June 2013 with $7,500 in funding provided by AGFD. There are also two mud turtles currently in the COBACH pond. Other captive holding facilities suggested by the QRSWG include International Sonoran Desert Alliance, Ajo Wastewater Services in Ajo, Arizon; Tohono O'odham Nation; Mayan Pace in Puerto Pensaco, Sonora; Quitovac, Sonora; and a mine southeast of Quitovac, Sonora.

Population Viability Analysis

In 2008, OPCNM funded J. Daren Riedle and Richard Kazmaier of West Texas A&M University, to construct an individual-based population viability analysis model based on the available population monitoring data from 1982-1995 and 2001-2006 monitoring efforts at OPCNM to determine the number of Sonoyta mud turtles that should be held in an assurance colony. The population viability analysis was calculated using four 3-stage models based on female survivorship (Riedle et al. 2012, p. 185). The three stages were divided among 3 age classes (0-1 yr, 2-6 yrs, and 7-12 yrs). All simulations were set to run 1000 replications for 50 time steps (50 yr). Model 1 simulated conditions based on 2001 to 2006 data to determine current population status within Quitobaquito. The population was set at 65 and divided between 3 age classes. Models 2 4 were recovery-based models testing minimum number of animals needed to recover the OPCNM population while reducing extinction risk and population-halving events. Model 2 was based on the initial 13 females being held within offsite assurance colonies. In Model 3, they simulated the effects of doubling the number of adult females. Model 4 simulated the effects of adding 10 individuals from younger age classes to animals already held within the assurance colony.

Based on current population estimates, Model 1 predicts that the OPCNM population of Sonoyta mud turtles is increasing significantly (Riedle et al. 2012, p. 186). Models 2 and 3, which calculate the likelihood of recovery by using only adult turtles, predict that the total estimated population size remains low. Of more concern is the probability of a population-halving event occurring when Models 2 and 3 were compiled. With

the addition of just five prereproductive turtles in both prereproductive age classes in Model 4, estimated population sizes doubled and the probability of the population halving was reduced to zero. Based on iterations within Model 4, the smallest viable population to return a zero extinction risk was 24 individuals.

Reidle et al. (2012, p. 186) conclude that maintaining reproduction and juvenile survivorship is important to the persistence of this population. Their PVA models also support the importance of prereproductive females to this population, particularly when dealing with assurance colonies and reintroductions (Riedle et al. 2012, p. 187).

Water Protection in Mexico

In 2008 the SEMARNAT issued a resolution with binding conditions for the proposed Environmental Protection Agency funded wastewater treatment facility project to the water and wastewater utility for the municipality of Sonoyta, Mexico. These conditions include a requirement for the utility to negotiate an agreement with the Pinacate Biosphere Reserve to: 1) ensure all treated water from the new facility is returned to the Rio Sonoyta, 2) build a pond for Sonoyta mud turtles near the new facility, and 3) hire a biologist to oversee management of these measures. Construction of the new facility began in Spring 2011 and was planned for completion in 2012. The Pinacate Biosphere Reserve is working with the utility to provide technical assistance with implementation of conditions of the Resolutivo as appropriate. Although construction is currently underway, completion of the new wastewater treatment facility has been delayed. One of the ponds at the new treatment facility failed in early 2012, resulting in effluent running directly into the Rio Sonoyta. No liner was installed in the pond, nor was soil compacted during construction. Sonoyta mud turtles will eventually be moved from the decommissioned lagoon to the new lagoons once they are filled and operating, which could be several years (Aguirre-Pompa 2012, pers. comm.).

Summary of Threats :

The most significant threats to the Sonoyta mud turtle include future destruction, modification, or curtailment of its habitat or range from ground water withdrawal and surface water diversion for urban and agricultural development that is exacerbated by drought throughout its entire range. Other factors that could potentially threaten the subspecies throughout its range include water contamination; the establishment of nonnative invasive upland plants that increases the potential for wildfire; border activities; the introduction of nonnative predators including bullfrogs, crayfish, and predatory fish; and illegal collection of turtles. Aquatic habitat in the Rio Sonoyta watershed is extremely dynamic due to climatic extremes (Ives 1936, pp. 352-354; Hendrickson and Varela-Romero 1989, p. 482) and Sonoyta mud turtle populations are likely reduced due to this dynamic nature. Drought coupled with a corresponding reduction in water levels in Quitobaquito Springs pond were contributing factors to the drop in the population estimates from 2001 to 2005 (Rosen et al. 2006, p. 4). In addition, this population of Sonoyta mud turtles has been shown to be under some nutritional stress, based upon a lack of stored lipids (Rosen and Lowe 1996a, pp. 31-32; Holm 2007, p. 1). In Mexico, increases in the amount of groundwater withdrawal, changes in wastewater treatment, and the potential for complete desiccation of the only remaining perennial stretch of Rio Sonoyta are threats to the Sonoyta mud turtle. Recent changes in wastewater treatment and effluent release have reduced the amount of perennial water available to support Sonoyta mud turtle habitat in the Rio Sonoyta drainage near the town of Sonoyta. Because Sonoyta mud turtle populations have a low population growth rate, they are not capable of expanding rapidly to take advantage of temporary habitats created by periods of high precipitation, but populations can decline rapidly during drought years. Also, populations of Sonoyta mud turtles are relatively small and are vulnerable to environmental and stochastic events, which increase the probability of extinction (Lande 1993, p. 923). Conservation efforts for the subspecies by the Quitobaquito/Rio Sonoyta Working Group in both Arizona and Sonora have contributed to reducing some of the immediate threats to the species, including maintenance of Quitobaquito Pond; salvage and repatriation of turtles in Quitobaquito pond; as well as the planned creation of habitat, salvage, and repatriation of turtles at the new Sonoyta wastewater treatment plant. However, the species will continue to be affected by threats throughout all of its range in the

foreseeable future. Thus, we find that this subspecies is warranted for listing throughout all its range, and therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

- Secure and maintain all Sonoyta mud turtle habitat occurring within OPCNM.
- Improve habitat occurring along the Rio Sonoyta.
- Reduce and remove threats as much as possible within Quitobaquito Spring and Sonora, including the protection of the aquifers that supply Quitobaquito Spring and tje Papalote reach of the Rio Sonoyta.
- Collaborate with and assist Mexican and Environmental Protection Agency efforts to reconcile conservation of the Sonoyta mud turtle with modernization of the public health infrastructure and riparian parkland in and adjoining Sonoyta. Monitor the status of these efforts underway with town of Sonoyta, Pinacate, SEMARNAT, CEDES, Environmental Protection Agency, and OPCNM.
- Establish and maintain refuge and assurance populations.
- Monitor all populations of Sonoyta mud turtles and implement adaptive management practices as needed to maintain or increase existing population numbers.
- Conduct research that investigates the ecology of and threats to Sonoyta mud turtles.
- Increase local awareness of the unique resources of the Rio Sonoyta and increase community involvement in the conservation of these resources.
- Continue to work towards develoment and implementation of a Candidate Conservation Agreement.

Priority Table

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	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

N/A

Magnitude:

The primary threat to the Sonoyta mud turtle is water development and its limited distribution. One small population occurs in the United States, in a pond less than 0.4 ha (1 ac) in size at Quitobaquito Springs on the OPCNM. The pond at Quitobaquito Springs is being managed to maintain the existing habitat, as the pond is showing a community successional trend towards a vegetation choked wetland. Populations in Mexico are similar in scale: a population in the Rio Sonoyta inhabits short perennial reaches totaling only a few kilometers in length, and a similarly sized population exists in a spring pool complex at Quitovac. The surface waters that this subspecies depends upon, both in the United States and Mexico, are highly dependent on land use and wastewater return flows. Irrigated agriculture in the region continues to place demands on groundwater, and surface water amounts are very limited and likely to continue to decrease. The pond at Quitobaquito could be affected by hydrologic changes in the Rio Sonoyta (Carruth 1996, p. 22). Changes in the current management of water resources of the Rio Sonoyta drainage could potentially result in extinction of the subspecies. Accordingly, we find that threats are of high magnitude.

Imminence :

The Sonoyta mud turtle is highly aquatic (Hulse 1974, p. 195; Rosen and Lowe 1996, p. 5). Irrigated agriculture is widespread in the Rio Sonoyta Valley, and the towns of Sonoyta and Lukeville are placing high demands on limited water supplies (Brown 1991, pp. 48-49). Combined with the current drought cycle in this region, high water demands have resulted in decreased surface water in the Rio Sonoyta and Quitobaquito Spring Pond. In addition, Quitobaquito Spring discharge has decreased since the mid-1990s, and it is currently just over half of what it was in the 1970s. In Mexico, the current groundwater usage in the Rio Sonoyta watershed is thought to be greater than the estimated recharge rate, so that complete desiccation of the Papalote Reach of Rio Sonoyta is likely to occur at some time. The subspecies was formerly under imminent threat from ongoing water loss at Quitobaquito pond. However, renovation efforts have improved the capability of Quitobaquito pond to hold water. In addition, a refuge population of Sonoyta mud turtles now exists at ASDM, and salvaged turtles continue to be repatriated to the pond. Perennial water for the Sonoyta mud turtle populations in the town of Sonoyta depend on the availability of wastewater effluent, and it is likely that the population at Presa Xochimiclo has been adversely affected by removal of this perennial water source. However, wastewater effluent along with new habitat for the other population in Sonoyta is currently assured by the new treatment plant. Nevertheless, the small remnant populations of Sonoyta mud turtles could be rapidly eliminated by surface and ground water withdrawal and changes in the discharge of wastewater effluent in the foreseeable future. Accordingly, we find that these threats are non-imminent.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

Population estimates of the United States population of Sonoyta mud turtles indicate that it is down from historical population levels and a drought related decline was documented in 2001. However, population estimates in 2007, indicate a low, but stable population. Though standard monitoring has not occurred since 2007, limited monitoring efforts in 2010 indicate that reproduction has been occurring despite issues with low water levels at Quitobaquito. Additionally, most of the 61 animals in the ASDM refuge population will likely be repatriated to Quitobaquito this year. Recent pond repairs and rainfall events have improved habitat conditions for the Sonoyta mud turtle at Quitobaquito, however a population estimate survey will only be carried out if conditions allow (i.e., if pond levels rise further). Until estimates are conducted, we will not be able to determine if improved habitat conditions at Quitobaquito have resulted in an increased Sonoyta mud turtle population.

While monitoring of the Mexico population in 2001-2004 indicated a stable population, the potential loss of habitat due to the loss of the effluent inflows from the military complex is likely to result in a corresponding loss of individuals similar to those experienced during drought. The populations at Quitovac, the Sonoyta wastewater treatment plant, and the Papalote reach of the Rio Sonoyta are currently presumed relatively stable. This said, proposed changes to the Sonoyta wastewater treatment plant could adversely affect the populations at the Sonoyta wastewater treatment plant and the Papalote reach of the Rio Sonoyta. However, binding conditions for project required by SEMARNAT should help minimize these impacts. Drought has severely affected the Papalote Reach, and for the first time in 2007 sampling recorded no evidence of reproduction. Although the species is considerably threatened by drought, water diversions, and groundwater pumping, as well as their small size and limited distribution, current information does not suggest that emergency listing is warranted.

Description of Monitoring:

Monitoring of the Sonoyta mud turtle is usually conducted annually, and in some cases biannually, in both countries by The University of Arizona, Service, AGFD, CEDES, OPCNM, and Pinacate Reserve. Biologists at OPCNM and their partners have conducted an annual mark-recapture survey at Quitobaquito since 2001, excep for 2008 to 2010 when water levels were too low to survey. Surveying methods consist of trapping Sonoyta mud turtles, measuring, aging, sexing, and marking. Monitoring data is used to determine population estimates.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Arizona

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

Arizona Game and Fish Department
Coordination occurs through the informal Quitobaquito-Rio Sonoyta Working Group, which meets annually. Membership includes:

Arizona Game and Fish Department
University of Arizona
Comision de Ecologia y Desarrollo Sustentable del Estado de Sonora (CEDES)
Reserva de la Biosfera el Pinacate y Gran Desierto de Altar (Pinacate)
National Park Service Organ Pipe Cactus National Monument
U.S. Fish and Wildlife Service Arizona Ecological Services Field Office

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: Jay E. Nicholopoulos 09/06/2013
Date

Concur: 10/28/2013
Date

Did not concur: _____ _____
Date

Director's Remarks: