UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
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December 26, 1990

Mr. Gary W. Frey
Director
Division of Environmental Affairs
Department of Energy
Western Area Power Administration
P. O. Box 3402
Golden, Colorado 80401

Re: Biological Opinion and Conference Report on Mead to Phoenix Transmission Line Project

Dear Mr. Frey:

This Biological Opinion responds to your letter dated October 18, 1990, which requested formal consultation and conference with the Fish and Wildlife Service (FWS) pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act). The FWS received your request on October 22, 1990. The action under consultation involves construction of a 500-kilovolt (kV) transmission line project and its impacts on the following threatened and endangered species: desert tortoise (Gopherus agassizii), a Federally listed threatened species; and bald eagle (Haliaeetus leucocephalus), American peregrine falcon (Falco peregrinus anatum), California brown pelican (Pelecanus occidentalis), Yuma clapper rail (Rallus longirostris yumanensis), bonytail chub (Gila elegans), Colorado squawfish (Ptychocheilus lucius), woundfin (Plagopterus argentissimus), desert pupfish (Cyprinodon macularius), Hualapai vole (Microtus mexicanus hualapaiensis), and Arizona cliffrose (Purshia subintegra), all Federally listed endangered species. Additionally, this consultation involves impacts to the razorback sucker (Xyrauchen texanus), a species proposed for Federal listing on May 22, 1990.

This Biological Opinion was prepared using the best project description and on-site biological information available at the time of consultation, including: Mead-Phoenix 500kV DC Transmission Line Project (November 1983), Mead-Phoenix Transmission Project Preliminary Draft Biological Assessment (June 1990), Environmental Analysis of the Changes to the Proposed Mead-Phoenix Transmission Project (February 1990), discussions with your staff, and information contained in our files.

BIOLOGICAL OPINION

It is my Biological Opinion that the proposed action for the Mead-Phoenix Transmission Project is not likely to jeopardize the continued existence of the desert tortoise, bald eagle, American peregrine falcon, California brown pelican, Yuma clapper rail, bonytail chub, Colorado squawfish, woundfin, desert pupfish, Hualapai vole, Arizona cliffrose, or razorback sucker.

BACKGROUND INFORMATION

Project Description

The Western Area Power Administration (WAPA), the Salt River Project (SRP), Southern California Public Power Authority, and Modesto-Santa Clara-Redding Public Power Agency propose to construct, operate, and maintain 260 miles of 500 kilovolt (kV) alternating current (AC) transmission line with the capability to be upgraded later to 500 kV direct current (DC). This transmission line will connect the Westwing Substation, located north of Phoenix, Arizona with a new McCullough II Substation, located approximately 14 miles west of Boulder City, Nevada. (Figure 1). The Mead-Phoenix Transmission Line project is referred to as the "Project" throughout this document. The Project sponsors will apply for a right-of-way grant for the Project from the Bureau of Land Management (BLM).

The transmission line towers will be the free-standing lattice type using either a horizontal or delta tower geometry. Land areas would be required for tower construction, conductor-pulling stations, splicing sites, lay-down areas, and equipment storage areas. New access roads will not be required for the Nevada portion of the Project although some new access road construction will be required in Arizona. New spur roads to transmission line towers will need to be graded in most locations.

There are three types of access roads for the proposed action based on the occurrence of nearby existing access: 1) new access roads would be built where no roads currently exist, 2) existing access roads of poor quality in the proposed right-of-way would be upgraded and used wherever possible, and 3) existing sufficient access roads would be used wherever possible without need for improvement. Land area permanently committed to the proposed action is primarily in the form of new access roads to transmission line towers.

The McCullough II Substation will be constructed in the immediate vicinity of the existing McCullough and El Dorado Substations. The McCullough II to Westwing 500kV transmission line will also be interconnected into Mead Substation, located approximately three miles south of Boulder City, Nevada. The McCullough II substation will be constructed in conjunction with the Mead to Adelanto Transmission Project. The 500kV transmission line will pass immediately north of Mead Substation and only a few new structures will be required to interconnect into Mead Substation. A new 500 kV yard will need to be constructed at Mead, which may be constructed in the existing substation (inside the fence) or adjacent to the existing substation.

The Technical Report (Volume 2) of the Environmental Impact Statement (USDOE 1983) and the updated "Environmental Analysis (USDOE 1990) prepared for the proposed action included WAPA's Standard Mitigation measures designed to minimize environmental impacts. Mitigation measures from these documents applicable to portions of the proposed transmission corridor are (Dames and Moore 1990):

1. No widening or upgrading of existing access roads will be undertaken in the area.

2. All access roads not required for maintenance will be permanently closed using the most effective and least environmentally damaging methods appropriate to the area and with the concurrence of the landowner. This would limit new or improved accessibility into the area.

3. In designated areas, structures will be placed as to avoid sensitive features and/or to allow conductors to clearly span the features, within limits of standard tower design. This would minimize the amount of sensitive features disturbed and/or reduce visual contrast.

4. In designated areas, construction activities will be modified during the breeding season (critical use period in the case of desert bighorn sheep) of sensitive, listed, or proposed threatened or endangered species. This would limit disturbance to such species during critical life history periods.

5. Prior to construction, an ecological field review of tower and access road design will be conducted by a qualified professional to identify site-specific impacts to threatened, endangered, or sensitive vegetation and wildlife and to determine the most effective means to mitigate those impacts.

6. Native waters will not be used for dust suppression, cement mixing, or other construction activities.

7. Construction staging areas and lay-down areas will avoid sensitive species habitat and will [be located in] previously disturbed areas to the extent possible.

The following mitigation measures are designed specifically to reduce adverse impacts to desert tortoises and their habitat. These measures are recommended for any activity in the Nevada portion of the Project (Dames and Moore 1990).

1. The project sponsors will designate a field contact representative (FCR). The FCR will be responsible for overseeing compliance with protective stipulations for the desert tortoise and for coordination on compliance with the FWS. The FCR will have the authority to halt construction activities.

2. Construction and maintenance workers will participate in a tortoise education program. The program will include a brief natural history of desert tortoise, sensitivity of the species to disturbance, legal protection for desert tortoises, penalties for violations of Federal and State laws, general tortoise activity patterns, reporting requirements, and personal measures employees can take to promote the conservation of the desert tortoise.

3. A biologist will be assigned to the pre-construction survey team stipulated in measure 13 of the EIS. The biologist will be responsible for ensuring that placement of spur roads and tower sites affect as few tortoise burrows as possible. These areas will be designated by flagging. The placement of spur routes will be as direct as possible to minimize habitat disturbance while minimizing destruction of tortoise burrows. Other work areas (e.g. splicing and tensioning areas) will also be reviewed by a biologist as construction proceeds. To the extent possible, work areas will be located in disturbed areas. Potential work areas will be flagged several days prior to construction for review by a biologist.

4. Overnight parking and storage of equipment and material will be in disturbed area (i.e. lacking vegetation). These areas could be batch sites, pulling sites, and towers sites.

5. A tortoise relocation plan will be prepared for tortoises that may need to be excavated from burrows as a result of construction. The relocation plan will be developed in cooperation with the FWS and will be approved by the FWS prior to construction. It is hoped that all occupied burrows can be avoided through pre-construction surveys.

6. The FWS will be notified within three days of finding any tortoises killed or injured as a result of project activities. Injured animals will be transported to a veterinarian. The FWS will furnish direction on the final disposition of injured tortoises.

7. Trash and food items will be removed daily by the construction workers and placed in raven-proof containers.

8. Firearms and dogs will be prohibited on all construction and maintenance sites except for designated security purposes.

9. Construction and maintenance vehicles will not exceed a speed of 25 mph in tortoise habitat.

10. Within 90 days after completion of construction within tortoise habitat, a report will be prepared for the FWS. The report will document the effectiveness of the tortoise mitigation measures, the number of tortoises excavated from burrows (if any), and the number of tortoises moved from construction sites (if any). The report will make recommendations for modifying or refining the stipulations to enhance benefits to the tortoise or to reduce needless hardship on the project proponent.

Species Description:

Desert tortoise. The Beaver Dam Slope population of the desert tortoise, located in southwestern Washington County, Utah, was Federally listed as a threatened species with 39 square miles of critical habitat on August 20, 1980. Subsequently, the Mojave population of the desert tortoise was listed by emergency rule as endangered on August 4, 1989, and by final rule as threatened on April 2, 1990. The Mojave population includes all desert tortoises north and west of the Colorado River in California, southern Nevada, northwestern Arizona, and southwestern Utah, including the Beaver Dam Slope.

The burrowing habits of tortoises, which vary greatly with their geographic locality (Burge 1978, Luckenbach 1982), represent unique adaptations to the extreme environs they occupy. Burrows function primarily as thermo-regulatory aids and may also serve to aid in water conservation and protection from predators. Sheltersites may be located under bushes, in the banks or beds of washes, in rock outcrops, or in caliche caves.

Peak tortoise activity usually coincides with the abbreviated period of annual bloom in the spring. Average home ranges of tortoises can vary from 11 to 53 hectares (ha), (Berry 1986). Berry also reported extreme long distance movements of 7.2 kilometers (km) over a 15-month period. Additional information on the biology of the desert tortoise can be found in Grant (1936), Berry (1984), and Woodbury and Hardy (1948).

Data on desert tortoise distribution and abundance were obtained from the BLM's Las Vegas District Office and field surveys. The BLM data were derived from a map dated August 8, 1989 showing the interim desert tortoise Habitat Areas for Nevada. The BLM also provided 1:250,000 scale maps showing the location and results of previous surveys for desert tortoises in the Project area.

Four and one-half miles of proposed transmission line corridor immediately east of the Mead Substation were surveyed using 6 belt transects 10 meters wide for 100 percent coverage (Figure 2). The transects were centered on the proposed transmission centerline. All tortoise sign was recorded and mapped. Tortoise sign includes live tortoises, burrows, pallets, scats, egg shell fragments, body parts, tracks etc. The survey was conducted on May 24 and 25, 1990.

The survey method used for the Mead to McCullough portion of the proposed route followed that described by Berry and Nicholson (1984). Biologists walked four 1.5 mile transects, approximately 10 meters in width, each of which consisted of an equilateral triangle, approximately 0.5 mile on each side. These transects were conducted on May 25 and 26, 1990. In addition, eleven transects were walked by the BLM within this portion of the proposed line.

The first 4.5 miles of proposed corridor east of the Mead Substation is occupied by a relatively low density tortoise population based on survey data collected during May 1990. During these surveys, 45 corrected sign were located over 190 acres of survey for an average of 0.41 corrected sign per acre. This converts to an estimated 10 to 45 tortoises per square mile based on the use of a regression equation developed by Berry and Nicholson (1984) and modified by density estimates developed by the BLM's Las Vegas District. Tortoise habitat ends abruptly at the start of the Colorado River gorge.

These estimates of tortoise distribution and abundance are consistent with surveys conducted in the areas by the BLM and by Dames & Moore for the Clark County Regional Flood Control (1990).

The 13.5 miles of proposed corridor between the Mead and McCullough Substations (the Eldorado Valley) is not suitable desert tortoise habitat (Dames and Moore 1990). No tortoise sign was identified on four 1.5 mile transects walked during May 1990. The May 1990 survey covered approximately 27 acres. The sandy/silty soils surrounding the Eldorado dry lakebed, in which the proposed corridor is located, does not allow for the construction of tortoise burrows. Further, no cut bank washes occur in the basin bottom which could provide sheltersites such as caliche caves (Dames and Moore 1990).

The BLM has recently categorized the Mead to McCullough portion of the Eldorado valley as non-tortoise habitat. Tortoise habitat in the Eldorado Valley starts at approximately the 2,000 foot contour; just upslope from either substation. Since 1987, the BLM has conducted 11 transects within one mile of the proposed line. No sign was located on 9 transects, and 1 to 3 corrected sign were located on the remaining 2 transects indicating a low density population of tortoises starting approximately one mile upslope of the proposed route.

The distribution of other sensitive wildlife and plant species within the corridor was determined through a review of the existing literature, including technical reports for the Project that were prepared in 1983. Literature-based information was updated by contacts with the FWS, the BLM, the Arizona Game and Fish Department (AGFD), and the Nevada Department of Wildlife (NDOW) in March 1989 and reported in September 1989 and February 1990 (USDOE 1989 and 1990).

Bald eagle. Bald eagles are large raptors with white head and tail in the adult; immatures are dark or mottled. Bald eagles winter along rivers and major reservoirs in the southwestern United States and other areas where prey species such as fish, waterfowl, rabbits and carrion are available (USFWS 1987). Nest sites are usually located in large trees or cliffs near water, where fish are abundant. Nesting in Arizona is known to occur along the Salt, Verde, and Bill Williams rivers (USFWS 1987, AGFD 1988). In the project area, wintering bald

eagles may occur on the Big Sandy River near Wickieup, on Burro Creek, and along the Colorado River. In 1975 and 1976, a pair of bald eagles attempted to nest near Topock, Arizona (Monson and Phillips 1981). Another pair of bald eagles attempted to nest on Burro Creek in 1988, but have not been seen since (R. Mesta, pers. comm. 1990).

Factors contributing to the bald eagle's decline include degradation and loss of riparian habitat, pesticide-induced reproductive failure, ingestion of lead-poisoned waterfowl, illegal hunting, and human disturbance (USFWS 1987, AGFD 1988).

Peregrine falcon. The peregrine falcon is a reclusive, crow-size falcon; slatey blue-gray above, whitish below. The head is black with a vertical pattern over the eyes. The peregrine falcon inhabits areas characterized by steep, rocky cliffs preferably near water where prey are abundant. In Arizona, this bird is most often found in the transition zone from 6500 to 8500 feet elevation, but may occur from 3500 to 9000 feet (USFWS 1987). It winters occasionally along the lower Colorado and in central Arizona (Monson and Phillips 1981). Peregrine falcons have been observed nesting along the Colorado River in the project area and are known to nest at the Grand Wash Cliffs and in the Cerbat Mountains in Arizona (Dames and Moore 1990).

The primary reason for the peregrine falcon's decline is reproductive failure due to pesticide contamination (USFWS 1987). Nationwide population declines in the 1950's and 1960's appear to have been reversed in recent years (AGFD 1988).

California Brown pelican. The California brown pelican is a large, dark gray-brown water bird with a pouch underneath a long bill and with webbed feet. Adults have a white head and neck, brownish black on breast and belly, silver grayish on most of the upper parts. Although primarily an inhabitant of coastal areas where it nests on islands, the brown pelican occurs in Arizona as a transient along the lower Colorado River and is occasionally found in central Arizona where it is blown inland by storms. The decline in numbers of brown pelicans is primarily a result of pesticide-induced reproductive failure (USFWS 1987).

Yuma clapper rail. The Yuma clapper rail is a small, hen-sized water bird with long legs and a long, slender, decurved bill. It is tawny-gray in color with barred feathers and a short tail. The Yuma clapper rail occurs in Arizona along the Colorado River in marsh habitats which have formed behind dams, and occasionally occurs in the Salt River marshes north of Phoenix and Picacho Reservoir. It presently breeds as far north as Topock Marsh on the Havasu National Wildlife Refuge (USFWS 1987). A portion of the breeding population over-winters in Arizona (Monson and Phillips 1981). The primary reasons for the decline of the Yuma clapper rail are floods and destruction of habitat (USFWS 1987).

Bonytail chub. The bonytail chub is a large (up to 24 inches) minnow characterized by a small head, large fins, humped back, and extremely thin caudal peduncle. The bonytail chub was once found throughout the mainstream Colorado River but is now close to extinction. Although a few old specimens (40+ years) have been taken in recent years, there is no known reproduction in the wild. This fish inhabits warm, swift, turbid rivers and is usually found in eddies and pools (USFWS 1987). The only remaining natural population is located in Lake Mohave (AGFD 1988).

Colorado Squawfish. The Colorado squawfish is the largest American minnow (up to 6 feet long). It is dusky-greenish, with a slender body with gold flecks on the dorsal surface. The head is long and slender and the mouth is large. The Colorado squawfish was once present throughout the Colorado River and its tributaries in Arizona but has been extirpated from the lower river basin. It is endemic to the Colorado River and inhabits warm, swift, turbid waters. Adults are found in pools and eddies, and young in backwater areas. Alteration of river systems due to dam construction, introduction of exotic species, and over harvesting are the reasons suggested for the decline of the Colorado squawfish (USFWS 1987, AGFD 1988).

Woundfin. The woundfin is a small (4 inches), silver minnow with fairly large fins and a sharp dorsal fin spine. Historically, the woundfin was found in the lower Colorado Basin, below the Grand Canyon, the lower Gila River drainage, and the lower Colorado River in Arizona. This fish is currently present in the Virgin River between La Verkin Springs, Utah and Lake Mead, Nevada (USFWS 1987).

Desert pupfish. The desert pupfish is a small fish (2 inches long) with a smoothly rounded body shape and with narrow, vertical, dark bars on the sides. Three natural populations of this fish remain in the United states: two in the tributaries of the Salton Sea in California and the other at Quitobaquito Springs in Pima County, Arizona. The desert pupfish was once common in desert springs, marshes, and tributaries of the lower Gila and Colorado River drainages in Arizona, California, and Mexico and also in some slower reaches of the Colorado, Gila, San Pedro, and Santa Cruz rivers (USFWS 1987).

Hualapai vole. The Hualapai vole is a small rodent known only from ponderosa pine stands from 1770 to 2760 meters elevation in the Hualapai Mountains, Mohave County, Arizona. Its preferred habitat has been seriously damaged by livestock grazing. There is a possibility this species occurs in the Music Mountains, as well (USFWS 1987).

Arizona cliffrose. This member of the rose family is an evergreen shrub that reaches 30 inches in height. Bark is pale gray and shreddy. Leaves, twigs, and flowers are covered with dense, soft, white hairs. Leaves are simple or 3-lobed and have entire (smooth) margins. Flowers have 5 white or yellow petals about 0.4 inch long.

The Arizona cliffrose is presently known from Mohave, Graham, Yavapai and Maricopa Counties, below the Mogollon Rim in Arizona. Habitat consists of creosotebush-crucifixion thorn series of the Arizona Upland Subdivision of Sonoran Desert Scrub. It is found on gravelly clay loam soils over limestone on low rolling hills between 2050 and 3660 feet elevation (USFWS 1987).

The Arizona cliffrose is threatened by habitat destruction due to overgrazing; road construction, widening and maintenance; mining; and off-road vehicle damage (USFWS 1987). It is known to occur within 1.5 miles of the project area in the vicinity of Burro Creek. There is no known habitat on the preferred route, however, surveys have not been conducted within the preferred route.

Razorback sucker. The razorback sucker was proposed for listing as endangered on May 22, 1990. A final determination on the status of this species has not yet been made. The razorback sucker once occurred in all major rivers and larger streams of the Colorado River drainage. Natural populations have been reduced to a non-recruiting population in Lake Mohave and a few remnant populations in Lake Mead, Lake Havasu, the Central Arizona Project, and the lower Colorado River. Although massive reintroductions have been made in the Gila, Verde, and Salt rivers, long-term success of these efforts is uncertain (AGFD 1988). The razorback sucker is threatened by habitat alteration and predation by non-native fish (AGFD 1988).

EFFECTS OF THE ACTION

Direct impacts to sensitive species from construction activities consist of electrocution and/or in-flight collision with transmission lines and temporary and/or permanent disturbance, displacement, and/or removal of species or their habitat. Areas of disturbance include tower bases (38 ft^2), access and spur roads, parking areas, crane pad locations, conductor pulling stations, splicing sites, lay down areas, equipment storage areas, and parking areas. Activities associated with project construction and maintenance could have deleterious effects on some sensitive species. Heavy construction equipment and other motorized vehicles probably represent the most significant potential threat to sensitive plant and animal species. Sensitive fish populations could be affected if vehicle fuels or lubricants are allowed to enter streams supporting population of such species.

Acreage disturbed for both access roads and spur roads combined are calculated as follows. New access roads would require the permanent use of about 2.0 acres per mile of transmission line. Existing roads requiring upgrading would result in the permanent loss of 1.5 acres per mile. Sufficient existing roads would require the removal of 0.5 acre per mile for the construction of spur roads (USDOE 1986). The land area temporarily disturbed by construction of the project is estimated to be 4.78 acres per mile (USDOE 1986).

Bald eagle and peregrine falcon. Adverse impacts from construction and operation of the proposed Mead-Phoenix transmission project on American peregrine falcon and bald eagle may result from electrocution and/or in-flight collision with transmission lines. Raptor electrocutions are related to distribution, size, behavior, and other biological aspects of raptors (Olendorff et al. 1981). Raptors use powerlines and support structures for perching and nesting. Electrocution of birds on powerlines occurs when they can simultaneously contact two conductors or a conductor and a grounded portion of the line (Olendorff et al. 1981). For this to occur, the bird must be of such a size that it can make contact. The wingspan of the peregrine falcon is typically 3.25 to 3.75 feet while that of a bald eagle is 6 to 7 feet.

Because the transmission line will span the Colorado River, Big Sandy River, and Burro Creek, the potential also exists for bird collisions with the line. The visibility of overhead wires is a major factor in the extent to which there is conflict with local bird populations (USDOE 1983). Most collisions occur at night during periods of foul weather and/or at dusk or dawn (Thompson 1978). Extra high voltage (EHV) transmission lines may be less of a problem than smaller distribution lines or telephone/telegraph lines because of their greater size and, therefore, greater visibility (Thompson 1978; Scott et al. 1972). Thompson (1978) recommends clustering lines at river crossings to increase their overall visibility. Lee (1978) found that 89 percent of birds flew between them. Willard et al. (1977) noted that most migrants travel about 300 yards above the ground, while Gauthreaux (1969 and 1978) found that most migration occurred at about 500 feet above the ground. Gauthreaux also noted that there appears to be quite a lot of migratory activity within 328 feet of the ground, but his detection method (radar) was not sufficient to detect much activity below this level.

Olendorff et al (1981) reported that eagles constitute 70 to 90 percent of all raptor mortalities on electric distribution lines. They also reported that most golden eagle mortalities along power lines (up to 98 percent of identifiable carcasses) are immature or subadult birds, which are generally less adept at maneuvering than adults.

Raptors that actively pursue prey in flight, such as peregrine falcons, are probably more vulnerable to colliding with transmission lines than those that do not, but size of bird, wingspan, and maneuverability are also important factors (Anderson et al. 1978). Nonresident birds are more susceptible to collisions than locals, which are more likely to know the location of flight hazards in their area (Anderson et al. 1978).

Although Link 1 crosses the Colorado River, it does not cross in an area of heavy waterfowl, heron, egret, or other bird use (Dames and Moore 1990). The probability of conflicts between EHV lines and wintering bald eagles along the

Colorado River is small (Dames and Moore 1990). Based on conversations between FWS and WAPA, all transmission line towers and line conformations will be constructed to minimize bird collisions and electrocutions according to criteria set forth by the Raptor Research Foundation (J. Bridges pers. comm. 1990). High visibility balls will be placed on static lines from milepost 7 to 11 to minimize collisions (USDOE 1990).

Project construction activities could disturb peregrines nesting in the area, which could cause nest failure or abandonment of an established nest. A pre-construction survey will be conducted between mileposts 7 and 11 to determine whether active nests are present along the line route (USDOE 1990). If active nests are found within one mile of the line route, construction in these areas will be delayed until fledging has occurred (USDOE 1990).

Yuma clapper rail. The Yuma clapper rail presently breeds as far north as Topock Marsh on the Havasu National Wildlife Refuge. The proposed transmission line will span the Colorado River and associated wetlands habitats (Dames and Moore 1990). Therefore, the proposed action is expected to have no effect on this species or its habitat.

Bonytail chub, woundfin, Colorado squawfish, and desert pupfish. Impacts to bonytail chub, woundfin, Colorado squawfish, and desert pupfish may result from pollutants released into the river or from habitat disturbance during construction. The bonytail chub is known to occur only in Lake Mohave, which is located approximately 20 miles downstream of the proposed location where the transmission line would cross the Colorado River. The woundfin is currently known to occur only between La Verkin Springs, Utah and Lake Mead, Nevada. The Colorado squawfish now occurs only in the upper basin of the Colorado River. The three remaining populations of desert pupfish occur in tributaries of the Salton Sea and at Quitobaquito Springs in Pima County, Arizona. The transmission line will not traverse any habitats currently occupied by these species. None of the four species should therefore be affected by the proposed action.

Razorback sucker. The razorback sucker may occur in the project area, but construction of the transmission line and placement of the supporting structures will be conducted in such a way as to avoid impacts to the Colorado River and associated lakes (Dames and Moore 1990). The proposed actions should have no effect on the razorback sucker.

Hualapai vole. The Hualapai vole occurs only in the Hualapai Mountains in Mohave County, Arizona. The proposed transmission line corridor does not traverse the Hualapai Mountains, therefore, the proposed action will not affect the vole or its habitat.

Arizona cliffrose. Arizona cliffrose is known to occur within 1.5 miles of the project area in the vicinity of Burro Creek. Individuals or portions of rare plant populations could be crushed by vehicles during construction. Preconstruction surveys for Arizona cliffrose will be conducted if Soil Conservation maps show that the appropriate soil types occur on the Project route (Dames and Moore 1990).

Desert tortoise. Adverse effects of construction and operation of the proposed transmission line to desert tortoises may result from vehicle strikes due to increased construction-related traffic and through inadvertent entrapment in collapsed sheltersites during use of construction equipment. Individual animals also may be subject to harassment from increased levels of human activity and from ground vibrations caused by use of heavy equipment. Harassment also may occur during implementation of certain mitigation measures, such as excavation of sheltersites and capture and removal of individual animals from the construction right-of-way.

Desert tortoises may be indirectly affected by the proposed project through loss or degradation of their habitats. Such loss or degradation would result from ground compaction and crushing of vegetation and from actual denudation and disruption of the ground surface on spur roads, crane pad locations, and tower sites. Inadvertent or intentional destruction of dens and burrows could result in a net reduction of habitat used by these species for shelter, reproduction, and escape cover. Some animals may escape direct injury if dens and burrows are destroyed but become displaced into adjacent areas. Such individuals could be vulnerable to increased predation, exposure, or stress through disorientation and loss of shelter.

In Nevada, an estimated 24 acres of desert tortoise habitat will receive long-term impacts as a result of tower site disturbance, spur road construction, and crane pad locations (Dames and Moore 1990). These figures result from corridor specific surveys conducted between the Colorado River and McCullough Substation. Because arid ecosystems require such a long period of time to restore naturally, the FWS considers disturbance which removes vegetation to be a long-term impact.

Construction activity and the associated human presence could also result in an increase in the number of common ravens (Corvus corax) in the vicinity. Ravens are very efficient predators of young tortoises and are attracted to trash generated by human activity. Trash removal programs proposed as part of the project should minimize numbers of ravens due to construction activities. Individual desert tortoises could be collected as pets by pipeline construction and maintenance crews; however, the employee education program should preclude this possibility.

After construction, risk of injury or mortality to desert tortoise may continue because of activities associated with maintenance, repair, and responses to emergency situations.

These effects, when combined with past and current developments in the Mohave Desert, could contribute to a continuing pattern of habitat fragmentation that, ultimately, could have significant consequences for long-term management of the desert tortoise in this area.

Cumulative Effects

Cumulative effects are those effects of future non-Federal (State, local government, or private) activities that are reasonably certain to occur during the course of the Federal activity subject to consultation. Future Federal actions are subject to the consultation requirements established in Section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

The Mead/McCullough-Victorville/Adelanto Transmission Project will connect southern California to out-of-state energy resources in Arizona, Nevada, New Mexico, and west Texas. The new McCullough II Substation will be constructed in conjunction with the Mead to Adelanto Transmission Project.

The majority of the land along the right-of-way is Federal land managed by the BLM. Any future activities on these lands will be subject to Section 7 consultation. Certain actions on public lands, such as unauthorized livestock use, off-road vehicle use, and dumping are difficult to control and may contribute to continued habitat loss and degradation. On-going actions on private lands, such as mining, oil and gas leases, sand and gravel operations, grazing, off-road vehicle use, and urbanization may also contribute to continued habitat loss and degradation.

Extensive development on private lands is occurring west of Phoenix where the Westwing substation is located.

The FWS does not believe the impacts described above, considered together with other non-Federal actions, would appreciably reduce the likelihood of survival and recovery of these species for the following reasons:

1. The project will not disturb a significant amount of desert tortoise habitat. Additionally, impacts to desert tortoise habitat will be compensated through acquisition of additional habitat as facilitated by the WAPA's contribution to the Desert Tortoise Habitat Conservation Fund.

2. The WAPA will implement measures to reduce the incidence of in-flight collisions and electrocutions of birds with the transmission line.

3. Prior to construction, an ecological field review of tower and access road design will be conducted by a qualified professional to identify site-specific impacts to threatened, endangered, or sensitive plant and wildlife species.

INCIDENTAL TAKE

Section 9 of the Endangered Species Act, as amended, prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Under the terms of Section 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered taking within the bounds of the Act, provided that such taking is in compliance with this incidental take statement. The measures described below are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit issued to the applicant, as appropriate.

Based on the analysis of impacts provided above, the FWS anticipates that the following take could occur as a result of the activities associated with construction of the proposed county road:

1. Three tortoises may be taken during construction of the transmission line in the form of harassment through excavation of three tortoise burrows in the construction area.

2. A total of 24 acres of desert tortoise habitat in Nevada may be taken as a result of tower site disturbance, spur road construction, and crane pad locations.

No take should occur in conjunction with operation and maintenance of the transmission line if the proper mitigation measures are implemented.

The FWS is assuming that the stipulations contained in this Opinion, as Reasonable and Prudent Measures and Terms and Conditions to reduce take, will reduce the potential for take of both individual tortoises and tortoise habitat as a result of the proposed action. These stipulations include measures developed by the WAPA, where terms and conditions are not more restrictive. This Opinion does not authorized take in the form of collection of tortoises for pets. Any person found engaging in such an activity will be liable for prosecution.

Reasonable and Prudent Measures

The FWS believes that the following Reasonable and Prudent Measures are necessary and appropriate to minimize the incidental taking authorized by this Biological Opinion:

1. The potential for harm or mortality to all desert tortoises resulting from project related activities shall be minimized.

2. Loss, degradation, and fragmentation of desert tortoise habitat resulting from project related activities shall be minimized.

3. Potential for violations of Terms and Conditions shall be minimized.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the WAPA is responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. The FWS hereby incorporates by reference into this biological opinion as part of these terms and conditions all project mitigation measures proposed by WAPA in USDOE (1990) and Dames and Moore (1990), except where terms and conditions are more restrictive. The following terms and conditions either specify additional measures considered necessary by the FWS or modify measures proposed by WAPA. Where these terms and conditions vary from or contradict mitigation measures as proposed by WAPA, specifications in these terms and conditions shall apply.

1a. A biologist will be assigned to the pre-construction survey team. The biologist will be responsible for ensuring that placement of spur roads and tower sites minimize impacts to tortoise burrows. These areas will be designated by flagging. The placement of spur routes will be as direct as possible to minimize habitat disturbance while minimizing destruction of tortoise burrows. Other work areas (e.g. splicing and tensioning areas) will also be surveyed by a biologist as construction proceeds. Work areas shall be located in disturbed areas in desert tortoise habitat and shall be approved by the biologist prior to additional disturbance.

1b. Within 48 hours prior to onset of surface-disturbing activities, construction rights-of-way within desert tortoise habitat that are subject to immediate disturbance shall be inspected by qualified biologists for tortoises and their burrows. The survey shall provide 100 percent coverage of the construction areas. All tortoises found on the ground surface within construction corridors shall be moved a minimum of 150 feet from the outside edge of the corridor and placed in a shaded location. Tortoise burrows that are unavoidable during construction activities shall be excavated, backfilled, and occupying tortoises moved to a safe location. Tortoise burrows within the construction right-of-way that are avoidable shall be protected by installation of snow fencing placed at a maximum distance from the burrow allowable by construction activities. If a minimum fence distance from such burrows of 15 feet cannot be accommodated, the burrow shall be excavated. Tortoises removed from excavated burrows during inactivity periods shall be relocated to unoccupied natural burrows or artificially constructed burrows. Burrows to which desert tortoise are relocated during tortoise inactivity periods shall be of similar size, shape, orientation, and depth as original burrows.

1c. Tortoises that wander onto construction corridors during construction periods shall be removed to a safe location as necessary. Tortoises shall be handled only by qualified tortoise biologists, and shall be moved solely for the purpose of preventing death or injury. If a tortoise is endangered by any construction activity, that activity shall cease until a biologist is able to remove the tortoise to safety.

Disposable latex gloves shall be used to handle all tortoises. Cardboard boxes used to transport and hold tortoises shall be purchased new, used once, and discarded. All materials which come into contact with tortoises shall be used only once and then properly discarded to minimize contact with the causative factor(s) for Upper Respiratory Disease Syndrome (URDS). Tortoises shall be kept upright at all times and handled in a secure but gentle manner to minimize stress, including possible voiding of the bladder. All desert tortoises handled shall be checked for signs of URDS and the presence or absence of URDS signs shall be noted on desert tortoise data sheets. These measures shall be implemented in accordance with specific tortoise handling and moving protocols outlined in the attached appendix.

1d. A tortoise relocation plan will be prepared for tortoises that may need to be excavated from burrows as a result of construction. The relocation plan will be developed in cooperation with the FWS and will be approved by the FWS prior to construction.

1e. Biological consultants authorized to handle and move tortoises shall be approved by the FWS prior to the onset of construction activities. The FWS's approval is based on the demonstrated experience of these individuals in working with desert tortoises. Information shall be submitted to the FWS at least 30 days prior to the onset of construction.

1f. A litter control program shall be implemented during construction to avoid attracting ravens. This program shall include daily trash collection (especially that which is food-related), disposal in covered receptacles, and prompt and regular removal from project sites.

1g. During the operation phase of the transmission line, pest control compounds and herbicides shall not be used along permanent transmission line rights-of-way within desert tortoise habitat unless

written approval from the FWS and appropriate state agencies is obtained prior to any such use. Pesticide use may be approved on a case-by-case basis if found to be necessary or, alternately, the WAPA may submit a comprehensive pest control plan to the agencies for review and approval. In general, use of such compounds and devices shall be minimized.

1h. To prevent mortality, injury,and harassment of desert tortoises and damage to their sheltersites, no pets or discharge of firearms will be allowed on construction and maintenance sites except for designated security purposes.

1i. Except on state and county highways and roads, speed limits shall not exceed 25 mph in desert tortoise habitat.

1j. The ground beneath any vehicle parked in areas occupied by the desert tortoise shall be carefully searched for tortoises before the vehicle is moved. If a tortoise is found beneath a vehicle and has not moved out of harm's way of its own volition within 15 minutes, then the biologist shall move it according to the appropriate protocol.

2a. The WAPA shall provide $7,776.00 as mitigation for the loss of 24 acres of desert tortoise habitat prior to initiation of any construction activity. The amount shall be based on $324.00 per acre of permanently lost habitat, and $130.00 per acre of temporarily disturbed habitat. Permanently lost habitat shall include any habitat destroyed not only for structure placement, but also habitat cleared of vegetation in a manner that significantly alters the ground surface, resulting in breaking of caliche soils or actual movement of soils to a depth that may preclude or significantly slow the reestablishment of a natural cover of native vegetation. The mitigation amount shall be indexed annually for inflation based on the Bureau of Labor Statistics Consumer Price Index beginning January 1, 1992. The funds shall be deposited in the Desert Tortoise Habitat Conservation Fund Number 236-8290, administered by Clark County, for the purpose of securing tortoise management areas, habitat enhancement, and tortoise research. None of these funds shall be used to develop the Habitat Conservation Plan. These funds are independent of any other fees collected by the County for desert tortoise conservation planning. These funds shall be held in an interest bearing account, and the accrued interest also shall be expended on desert tortoise conservation measures. Proposed expenditures shall be approved by the FWS. Should the funds not be expended on desert tortoise conservation measures approved by the FWS within two (2) years of their placement in the County fund, then these funds shall be transferred to the Nature Conservancy for such purposes.

Payment must be made prior to initiation of project construction in order for the project proponent to be in compliance with the provisions of the Act. Payment shall be made by certified check or money order payable to Clark County, and delivered to:

Clark County
Department of Administrative Services
225 Bridger Avenue, 6th floor
Las Vegas, Nevada 89155
(702) 455-3530

The payment shall be accompanied by a cover letter from the payee that identifies the project and biological opinion that is requiring the payment, the amount of payment enclosed, and the check or money order number. The cover letter shall also identify the name and address of the payee, the name and address of the Federal agency responsible for authorizing the project, and the address of the FWS office issuing the Biological Opinion. This information will be used to notify the payee, the authorizing Federal agency, and the FWS that the payment has been received.

2b. All construction and maintenance vehicles shall stay within the designated construction areas and routes of travel. Parking, staging, and storage areas shall be located in previously disturbed areas within desert tortoise habitat.

2c. All access roads not required for maintenance shall be permanently closed using the most effective and least environmentally damaging methods appropriate to the area and with the concurrence of the landowner. This would limit new or improved accessibility into the area.

3a. No later than 90 days after the completion of construction within tortoise habitat, the designated biologist (or other appropriate person) shall submit a post-construction biological report to the FWS. This report shall document the following information: 1) dates that construction activities occurred; 2) the effectiveness of the tortoise mitigation measures, 3) known occurrences of incidental take of federally listed wildlife species, if any, 4) known project effects on endangered and threatened species habitat, including specific number of habitat acres temporarily or permanently disturbed, and specific number of dens and burrows damaged or destroyed, 5) and other pertinent information.

3b. If requested, upon completion of the proposed transmission line, WAPA personnel shall accompany FWS personnel on on-site inspections of suitable portions of the rights-of-way. The purpose of such inspection would be to determine impacts to desert tortoises and their habitats and compliance with certain mitigation measures.

3c. WAPA shall develop and implement a worker education program that addresses 1) the occurrence and distribution of federally listed species within the right-of-way and other construction areas; 2) measures being implemented to protect these species and their habitats; 3) specific protocols to observe should endangered or threatened wildlife be encountered in the field; 4) reporting requirements should incidental take of listed species occur; and 5) applicable definitions and prohibitions under the ESA and penalties for violations. All contractors, construction workers, supervisory personnel, and other persons with access to construction rights-of-way shall attend this program within 60 days prior to construction. Appropriate handouts summarizing this information shall be prepared and provided to all workers. Each worker shall sign a statement declaring that he/she has completed this program, understands all responsibilities with regard to endangered species protection measures, including the terms and conditions contained in the opinion, and will comply with all such measures during transmission line construction.

3d. The WAPA shall designate a Field Contact Representative (FCR) who will be responsible for overseeing general project compliance and providing coordination with the FWS. The FCR will have the authority to halt construction activities.

3e. The FCR shall provide the construction company with names, addresses, and telephone numbers of local veterinarians who can be contacted should any federally listed animal(s) be injured during construction and require medical treatment.

Reporting Requirements

Upon locating dead, injured, or sick animals that are listed as threatened or endangered, initial notification must be made to the FWS' Division of Law Enforcement. In Arizona, notification must be made to: Special Agent Frank Schumacher, Federal Building, Room 8, 26 North McDonald, Mesa, Arizona, (Telephone: 602/261-6443). In Nevada, initial notification must be made to Special Agent Edward Dominguez, Las Vegas, Nevada (Telephone: 702/388-6380). Instructions for proper handling and disposition of such specimens will be issued by the Division of Law Enforcement. Care must be taken in handling sick or injured animals to ensure proper treatment and care, and in handling dead specimens to preserve biological material in the best possible state. All tortoise remains shall be frozen immediately and provided to one of the following institutions holding appropriate Federal and State permits per their instructions:

Museum of Vertebrate Zoology, University of California, Berkeley, California
Los Angeles County Museum of Natural History, Los angeles, California
San Bernardino County Museum, San Bernardino, California
University of Nevada, Department of Biology, Las vegas, Nevada
University of New Mexico, Albuquerque, New Mexico

Arrangements shall be made with the institution by the WAPA through a biologist prior to construction regarding proper disposition of potential museum specimens. Should none of the above institutions want the tortoise specimens, the remains may be disposed of in any appropriate manner. In conjunction with the care of sick or injured tortoises, or the preservation of biological materials from a dead tortoise, the WAPA has the responsibility to ensure that photographs and information relative to the date, time, and location of the tortoise when found, and possible cause of injury or death of each tortoise be recorded and provided to the FWS. Should injured animals be treated by a veterinarian and survive, the FWS should be contacted regarding final disposition of these tortoises.

The WAPA will notify the FWS of all tortoises killed, injured, or removed from within the right-of-way within three days of the completion of the construction. The WAPA shall submit to the FWS a report on all tortoise-related activities undertaken due to the road construction, including tortoise biologist activities and number of tortoises killed or injured, within 30 days after completion of construction.

If, during the course of the action, the amount or extent of the incidental take limit is reached, the WAPA must immediately reinitiate consultation with the FWS to avoid violation of Section 9 of the Act. Operations must be stopped in the interim period between the initiation and completion of the new consultation if the FWS determines that the impact of additional taking will cause an irreversible and adverse impact on the species, as required by CFR 402.14(i). The WAPA should provide an explanation of the causes of the taking.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by implementing conservation programs for the benefit of endangered and threatened species. Conservation recommendations have been defined as FWS suggestions regarding discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or regarding development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's Section 7(a)(1) responsibility for these species.

1. WAPA should carefully survey construction sites prior to clearing of vegetation during the avian breeding season to avoid destruction of nests. Harm of eggs and/or nestlings in occupied nests would constitute a violation of the Federal Migratory Bird Treaty act.

2. WAPA should implement studies in Nevada to determine the extent to which ravens use transmission lines for nesting and perching and the degree to which transmission lines have increased the raven population in Nevada.

3. WAPA should use native seed mixes when revegetating areas disturbed by construction activities.

In order for the FWS to be kept informed of actions that either minimize or avoid adverse effects, or that benefit listed species or their habitat, the FWS requests notification of the implementation of any conservation recommendations.

CONCLUSION

This concludes formal consultation for the Mead-Phoenix Transmission Line Project. As required by 50 CFR 402.16, reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is reached, 2) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion, 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion, and 4) a new species is listed or critical habitat designated that may be affected by the action.

The FWS appreciates the assistance and cooperation of your staff throughout this consultation process. If we may be of further assistance, please contact Sherry Barrett or Sam F. Spiller, Field Supervisor (Telephone: 602/379-4720 or FTS 261-4720).

Sincerely,

Sally E. Stefferud
Acting Field Supervisor

Attachment

cc: Field Supervisor, Fish and Wildlife Service, Reno, Nevada
Field Supervisor, Fish and Wildlife Service, Salt Lake City, Utah
Field Supervisor, Fish and Wildlife Service, Ventura, California
Office Supervisor, Fish and Wildlife Service, Laguna Niguel, California
State Director, Bureau of Land Management, Phoenix, Arizona
Director, Arizona Game and Fish Department, Phoenix, Arizona
Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico (FWS/HC)
Regional Director, Fish and Wildlife Service, Portland Oregon
Director, Fish and Wildlife Service, Washington, DC (EHC)
Salt River Project (Attn: Kate Maracas), P. O. Box 52025, Phoenix, Arizona

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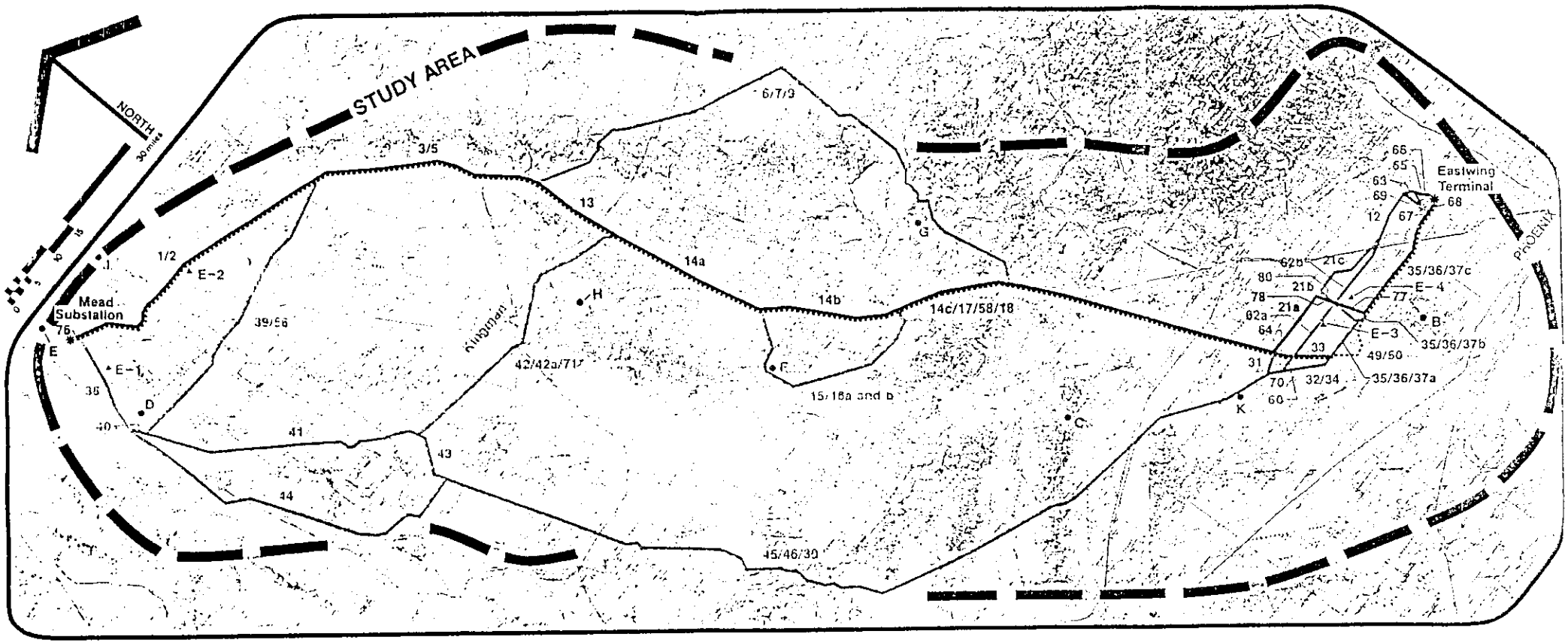

MEAD-PHOENIX

±500kV DC Transmission Line Project

Preferred Alternatives

····· Environmentally Preferred Route

— Project Sponsors Preferred Route

* Terminal

▲ Ground Electrode Site

• Communication Site

— Other Alternatives

Figure 1.

APPENDIX Protocols for Handling Live Tortoises

INTERIM TECHNIQUES HANDBOOK FOR COLLECTING AND ANALYZING DATA ON DESERT TORTOISE POPULATIONS AND HABITATS

JUNE 1990

ARIZONA GAME AND FISH DEPARTMENT

CALIFORNIA STATE RESOURCE AGENCIES

NEVADA DEPARTMENT OF WILDLIFE

UTAH DIVISION OF WILDLIFE RESOURCES

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

FISH AND WILDLIFE SERVICE

III. PROTOCOLS FOR HANDLING LIVE TORTOISES

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III. PROTOCOLS FOR HANDLING LIVE TORTOISES

Field workers should always utilize the least stressful methods when handling tortoises for weighing, measuring or taking tissue and other samples.

Disease Precautions

1. Because of the threat of Upper Respiratory Disease Syndrome (URDS), all tortoises will be handled so as to minimize the chances of spreading disease, even if URDS has not been documented in a given locality. All personnel handling tortoises should wear disposable gloves (latex or plastic are preferred) to prevent transmission of diseases among tortoises. No more than one tortoise should be handled with each pair of gloves. Dispose properly of possibly contaminated gloves, newspapers, cardboard boxes, etc.

2. If more than one tortoise is being held at the same time for measuring or sampling, provide a separate, disposable container for each tortoise. New cardboard boxes are recommended. Bundles of new boxes do not take up much space and the boxes can be broken down easily for disposal.

3. Equipment that comes in contact with a tortoise should be sterilized before it is used on another tortoise. Triangular files used for marking marginal scutes, the tips of calipers used to measure tortoises, rules and other similar equipment should be sterilized by soaking in 95% isopropyl or ethyl alcohol for at least 20 minutes before using on another tortoise. (A 25% solution of chlorine bleach may also be used. Be warned that the bleach is extremely corrosive and may damage many types of equipment). Wooden rules should not be used; they are more difficult to sterilize than metal or plastic ones because of the porosity of the wood and they tend to warp under the prescribed sterilization.

4. To avoid having to sterilize spring scales or weighing straps prior to weighing each tortoise, use individual "T-shirt bags", the plastic bags with the two straps that are used to bag groceries, to suspend the tortoise while weighing. A new bag should be used for each tortoise. These bags may be purchased from grocery supply or cooperative discount houses in quantity for only a few cents apiece.

5. Clothes should be changed completely, including shoes, before visiting other tortoise sites. (As a general rule, a single valley or desert mountain range would be considered one site, unless there were special circumstances, such as URDS confirmed in one part of a valley, but not thought to occur in other parts of that valley. In such an instance, a change of clothes would be

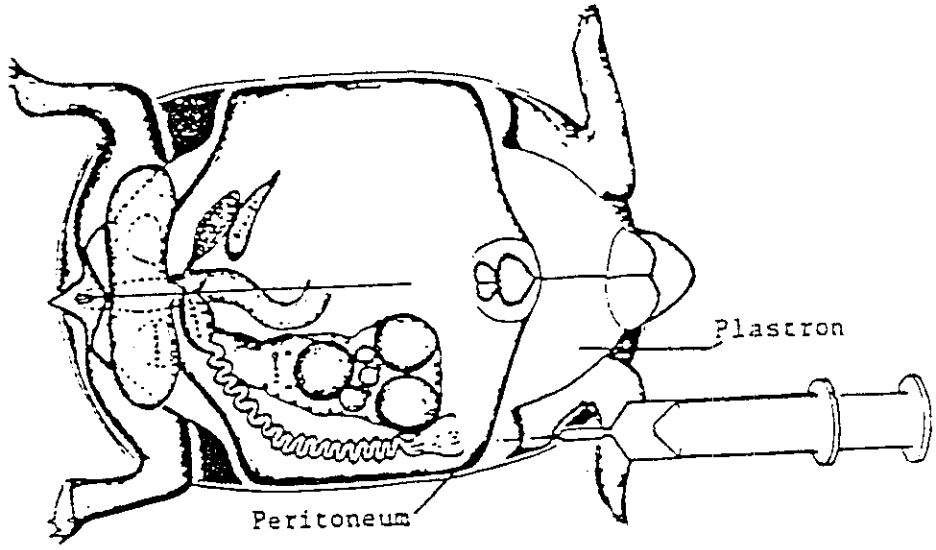

Figure III-1. Ventral view of desert tortoise showing proper placement of needle for rehydration. The distal portion of the plastron has been cut away to show the relationship of internal structures. THE TORTOISE SHOULD REMAIN IN AN UPRIGHT POSITION FOR THIS PROCEDURE. THE VENTRAL VIEW PRESENTED IS ONLY TO ILLUSTRATE PROPER NEEDLE PLACEMENT. Modified from Woodbury and Hardy (1948).

complexed-iodine scrub solution (Betadine or Medadine, for example). The re-hydrating solution (Normosol and dextrose/saline mixture) should be injected using a 1 inch, 22 gauge needle. Insert the needle asshown in Fig. III-1. THE TORTOISE SHOULD REMAIN UPRIGHT. FIG. III-1 IS SHOWN IN VENTRAL VIEW ONLY TO SHOW THE PLACEMENT OF THE NEEDLE FOR REHYDRATION.

Before injecting any fluid, pull the plunger of the syringe slightly backwards to create a vacuum. If blood or bile (a dark, greenish fluid) appears in the syringe, stop aspirating, withdraw the needle slightly and aspirate again to assure that the needle is not in a blood vessel or lobe of the liver.

If more than one syringe of fluid is to be injected, do not remove the needle between injections. Simply remove the empty syringe while holding the needle in place and attach the full syringe, ensuring that no air bubbles are introduced. Discard the needle safely. Do not use a needle on more than one tortoise or use a non-sterile needle to draw fluids.

The needle should enter the skin below and behind the left shoulder joint at its most lateral extent. The needle should parallel the plastron, with the fluid injected just behind the attachment of the pectoral musculature to the plastron and between the plastron and the peritoneum (Fig. III-1).

6/30/90

Normosol-R is produced by Abbott Laboratories (800-222-6883) and can be purchased from veterinary or medical supply houses in most larger cities. The 2.5% dextrose in half-strength saline can also usually be purchased from local veterinary or medical supply houses. (Sometimes laboratories will dilute 5% dextrose in normal saline with distilled water to achieve the desired concentrations). Syringes, needles and other supplies can be purchased from any scientific, medical or veterinary supply house. See suggested lists of suppliers later in this chapter.

The 1:1 mixture will assure a slightly hypotonic replacement, and should maintain normal ionic balance. This is especially important during periods of drouth, such as experienced in many desert tortoise localities the past few years. For 1991, consideration is being given to hydrating apparently desiccated tortoises or those from areas of severe drouth, whether they void or not.

3. To prevent hyperthermia, on warm days a tortoise must be kept in the shade (of the fieldworker, a pack, other equipment etc.) except during photography. Tortoises should not be processed (weighed, measured, etc.) when air temperatures exceed 90 degrees F (32 C) at 1.5 m (4.9 ft) above ground, unless measures are taken to insure the animal does not overheat. If tortoises are collected early in the day when it is cooler and held for processing during midday, take care to provide sufficient shade and cooling for the tortoises while holding and processing them. Insure that the animals always have sufficient shade, especially as the sun moves across the sky during the day. CAUTION! TEMPERATURES ARE MUCH HIGHER NEARER THE GROUND! Take extreme caution to avoid overheating of tortoises whenever <u>surface</u> temperatures exceed 86 F (30 C). Shield the bulb of the thermometer from direct solar radiation when measuring temperatures.

4. Carelessly turning a tortoise on its back or spinning it can cause serious problems such as pulmonary edema, internal egg breakage, psychogenic shock and possibly intestinal torsion. If a tortoise must be turned over on its back, it should not be spun around or repeatedly turned over. The fieldworker should return the tortoise to the upright position by carefully rolling it back over in the same direction. The tortoise should not be rolled end over end, side over side, or spun.

5. Tortoises, especially females, may be fatally damaged by blows, butting, or overturning, which results in egg yolk peritonitis brought on by seepage of egg yolk or breakage of shelled eggs into the peritoneal cavity (Rosskopf and Woerpel 1982, Yanoff and Rosskopf 1983). Egg yolk can cause a serious inflammatory reaction. Handling of potentially gravid females should be done very carefully. An aggressive, courting male can easily kill an egg-carrying female. Such instances may occur mostly in captivity, where females cannot easily escape the advances of the male. A careless fieldworker could also cause breakage of eggs,

especially if they are thin-shelled. Rosskopf and Woerpel (1982) state:

> Clients should be advised to carefully observe all female tortoises of egg-laying age and to avoid trauma to them, especially any activity that may lead to the tortoise turning over on its back. Tortoises with uric acid cystic calculi are especially prone to this condition, due to the trauma-inducing nature of these foreign bodies on the neighboring ovarian tissue.

6. Remove a tortoise from its cover site only if the cover site will not be damaged in the process. Pallets and burrows can be damaged or destroyed in attempts to capture tortoises. Pallets and burrows of juvenile tortoises are particularly vulnerable. If the tortoise is out of reach in the cover site, do not break away the opening or otherwise damage the burrow to reach the tortoise. Instead, flag the site and return later in the day or early the next day in hopes of capturing the individual when it emerges from the cover site or is closer to the entrance.

Often tortoises within reach in the burrow are difficult to remove, because they will firmly press the shell against the roof and tense the limbs against the burrow floor. In tugging and pulling to remove the tortoise, parts of the burrow can break away. One way of avoiding damage is to gently remove soil from the floor of the burrow and from beneath the tortoise with the hand, thereby increasing the height of the burrow. The tortoise is then more easily pulled out and the soil can be replaced.

Tim Shields, Karen Bohuski, and other fieldworkers have expressed concern about removing juveniles from their cover sites. They suggest that juveniles are particularly sensitive to handling, and once pulled from a cover site may leave the site and not return in the short term, if ever. Instead, these fieldworkers recommend that juveniles be captured when outside the cover site. They use flagging and frequent visits to the site to capture the juvenile and are often successful. Juveniles captured outside the cover sites apparently show no reluctance to return to the cover site.

7. When transporting a tortoise, insure that the tortoise is as secure as possible so that it will not slide around in its transport box while being driven from or back to the field. Minimize the stress of transport as much as possible by minimizing temperature differentials between its environment and the holding box or container.

8. The tortoise should be returned to the place where it was found (preferably it would not be moved at all) and should not be taken some distance away for release. Cases have arisen where

fieldworkers have conducted personal, unauthorized experiments, and have moved resident tortoises from one place to another to "see what would happen." Such practices are not authorized and could result in the revocation of one's Federal collecting permit.

The above are general rules. If the shells of the tortoises are abnormally thin, soft, or lack proper ossification, such as some of the tortoises from the Beaver Dam Slope of Utah and Arizona, then special measures should be instituted during handling to prevent damage to the tortoises.

Health of Live Tortoises

Fieldworkers should continue to record information on anomalies, injuries, signs of disease and parasites. What is the condition of eyes and nose? Is there dried mucous on the face or front limbs? Is the tortoise wheezing? What is the condition of the shell, including chew and bite marks (old and recent) on the shell and limbs? Note the presence and location of replacement bone; presence and location of sunken scutes; and shell wear class. If problems or symptoms of disease exist with the animal, slides should be taken to document the problem, in addition to extensive notes on the data sheet.

Blood Collecting Procedures

There is a need to standardize blood sampling procedures so that results from different physiological studies can be compared. In this section we are referring to blood samples $\geq$ 0.5 ml. The three principal methods of taking blood that are currently being used or are proposed for use are brachial and jugular venipuncture and cardiac puncture. Jugular venipuncture is the recommended method. However, because some studies are in progress using brachial venipuncture, that technique may also be used in those studies until results of tests comparing the techniques have been analyzed.

Cardiac puncture is not recommended for sampling wild desert tortoise populations at this time. Cardiac puncture may be appropriate for certain laboratory experiments and should be evaluated on a case-by-case basis.

Jugular venipuncture

Three individuals are needed per tortoise for jugular venipuncture: one for manual restraint/neck extension and venipuncture, one to draw the blood into the syringe, and one to handle the sample tubes, determine packed cell volumes, and prepare coverslip films or smears.

1. Extend the neck of the tortoise and visualize the jugular vein. (If a blood sample cannot be obtained from the jugular vein, a sample should be obtained from the brachial vein). Clean the area of skin over the vein with 70% ethanol. Insert a 23-gauge butterfly infusion catheter into the vein. Collect 6cc (for a tortoise >1000 grams) of blood in a 10cc syringe. Hand the syringe quickly to the third person who should be waiting with appropriate tubes. After the catheter needle is withdrawn, the person restraining the tortoise should apply gentle pressure to the puncture site to prevent bleeding and hematoma.

The likelihood of blood clotting during analysis may be decreased by coating the inside of the butterfly catheter with lithium heparin prior to the blood collection. Add 4cc of saline to a 5cc lithium heparin tube. Draw up a small amount of the saline and lithium heparin solution and flush it through the catheter so that only a small film remains on the catheter.

2. Place approximately 0.6cc of blood into a lithium microtainer tube for complete blood count (CBC) and hemoglobin determination. Place the remainder of the blood into a 5cc lithium heparin tube. Cap the tubes quickly and invert several times to ensure that the anticoagulant is properly mixed with the blood. Place the tube on the hematology mixer as soon as possible. The hematology mixer is recommended if many blood samples are to be taken. If only a few samples are being taken for other studies, take care to gently mix the samples. After mixing for a few minutes, place the microtainer tube in a box on wet ice or in a cooler with ice packs. DO NOT FREEZE THIS SAMPLE. Ship the samples by Federal Express or similar carrier the same day.

3. Draw a small quantity of blood from a lithium heparin tube up into a microhematocrit tube for packed cell volume (PCV) determinations. Seal the end of the tube properly before centrifugation. Use a small drop of blood for preparing blood films. Identify microscopic slides using a Fisher brand Histoprep Film Secure-Line Marker. Fix the microscopic slide blood films in absolute methanol, store them in a slide box, and ship along with the blood.

4. Centrifuge the remaining 5cc lithium heparin tube within 45 minutes and transfer the plasma to "O-ring" Sarstedt tubes. Place the Sarstedt tubes in liquid nitrogen. Try to standardize the period the blood samples are held before centrifuging. Remove the plasma as soon as possible or hold on ice while waiting to spin it down. At room (or field) temperature, the blood parameters can change while waiting to be centrifuged (potassium leaks out of the red blood cells, for instance). The receptacles in the centrifuge that hold the tubes should be kept on ice until the sample is centrifuged so as not to warm the blood.

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Make sure that the tubes are properly marked with a Sharpie brand, permanent marking pen. Use P as a prefix indicating plasma.

Check the liquid nitrogen container daily and refill as needed (probably every 4 to 6 weeks). The plasma samples in the "O-ring" Sarstedt tubes may be sent to the processing laboratory on dry ice in a well-insulated container once all samples have been collected for a particular sampling period.

Suggested Products for Blood Collection and Processing

The following list of products are suggested to facilitate the work of personnel unfamiliar with medical and veterinarian supplies. Of course, other suppliers may be used, especially if smaller quantities of materials are needed. Quantities needed will vary with the project.

Item	Company	Catalog No.	Quantity
1. TRIAC combination centrifuge	Fisher	05-100-80	1 each
2. Syringes			
3cc	Fisher	14-823-39	1 case
10cc	Fisher	14-823-140	1 case
3. Needles			
23 gauge 1"	Fisher	14-826A	5 pkg
22 gauge 1"	Fisher	14-826B	5 pkg
4. Capillary tubes	Fisher	02-668-66	2 pkg
5. Hemat-O-Seal	Fisher	02-678	1 pkg
6. Lithium heparin microtainer tubes	Fisher	02-668-75	1 case
7. Lithium heparin tubes -- 5cc	Fisher	02-687-81	1 case
8. Coverslips 22mm squares	Fisher	12-540-100	1 pkg

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Item	Company	Catalog No.	Quantity
9. Histoprep Film Secure Line Marker II	Fisher	14-905-30	1 pkg
10. Hematology/chemistry mixer	Fisher	14-059-346	1 each
11. Pediatric tube adapters (for 10 above)	Fisher	14-059-345	1 each
12. Plastic transfer pipettes	Fisher	13-771-7	1 pkg
13. Microscope slides	Fisher	12-550-13	1 gross
14. Slide storage box	Fisher	03-450-5	10 each
15. Coplin staining jar-polyethylene	Fisher	08-815-10	6 each
16. Liquid nitrogen tank (LNT) SC 20/20	Specialty Gases S.E.		1 each
17. Canes (for LNT)	Specialty Gases S.E.		30 each
18. Sarstedt tubes 2cc O-ring serum storage tubes	Sarstedt	72.694.006	1000 each
19. Polycarbonate special screw-cap micro-tube racks	Sarstedt	93.1428	1 each
20. Styrofoam storage boxes	Sarstedt	95.064.249	20 each
21. Absolute methanol	Purchase locally		
22. 70% ethanol	Purchase locally		

Telephone Numbers:

Abbott	- 800-222-6883
Fisher	- 714-669-4600
Sarstedt	- 800-321-5680
Specialty Gases S.E.	- 800-344-1872

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Protocol for Mycoplasma and Aerobe Culture

In general, at least two persons are required to obtain culture specimens, one to stabilize the tortoise in the proper orientation and the other to obtain the specimens. Since the tortoise often finds these procedures annoying, it is important that the tortoise be well-controlled so that procedures do not become unnecessarily lengthy and specimen quality is maintained.

1. Cleansing the external nares.

While the tortoise is stabilized, thoroughly moisten a sterile polyester swab with one tube of sterile saline. Use this saline-soaked swab to gently superficially cleanse the area around both external nares. Discard the swab. Repeat the procedure with a fresh saline-soaked swab.

2. Collecting the broth/flush specimen.

Use sterile technique to draw up about 2 cc of a tube of trypticase soy broth (TSB) into a sterile 3cc syringe to which a tomcat catheter has been affixed. Judge the size of the tortoise's nares by visual inspection and, with a flame-sterilized scissors (cooled), cut the catheter so that it will fit in a naris. The catheter will now be 2 to 3 cm long (1 to 1.5 inches) and will have an elliptical opening which will fit into the naris. Eject excess air from the syringe. Insert the tip of the catheter into one naris about 5mm, depending on the size of the tortoise. It is important that the catheter not be inadvertently contaminated by touching any part of the tortoise except the naris being sampled. If such contamination does occur, immediately discard the contaminated catheter and attach a fresh sterile catheter to the syringe. Inject about 1cc of TSB into the naris and pull back immediately on the plunger to aspirate broth and other material back into the syringe. This injection-withdrawal motion may be repeated. Place approximately 1cc of the aspirated broth into a 2cc Sarstedt tube. A separate syringe should be close at hand in order to perform the same procedure on the opposite naris; the same tomcat catheter can be used. Perform the same procedure on the opposite naris and add 1cc of the aspirate to the Sarstedt tube containing the aspirate from the first naris.

3. Handling the samples.

Label all Sarstedt tubes properly, utilizing the prefix M for microbial. Immediately place all tubes into liquid nitrogen.

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List of Materials for Microbial Culture

Item	Company	Catalog Number	Quantity/ Unit
1. Saline, 5cc tube	Remel	08-756	72/cs
2. Dacron-tipped swab	Remel	55-025	100/pg
3. 3.5 Fr. Tom Cat Catheter	Sherwood Medical	HRI 8890-703021	50/cs
4. Trypticase Soy Broth	Fisher	BB21404	100/cs

Telephone Numbers: Fisher - 714-669-4600

Remel - 800-255-6730

Sherwood Medical - 805-526-9071

Marking and Identifying Live Tortoises

Tortoises and turtles have been identified using one or more of several semi-permanent techniques, such as branding (Woodbury and Hardy 1948), drilling of holes in anterior and posterior marginals, and notching with a three-cornered file or saw. Desert tortoises on BLM study plots have been marked with two notching systems, one of which has been used on the majority of the plots (Fig. III-2). If a particular numbering system has been used on a plot, it should not be changed to another without compelling reasons.

Make notches with triangular files of various sizes on all sizes of tortoises, from juveniles of about 36 mm in length to large adults of 380 mm carapace length. Larger tortoises require larger files. Finger or toenail clippers or small scissors can be used on hatchlings and small juveniles to cut through the shell.

Notch depths will vary with the size of the tortoise and location on the carapace. Depth may range from 2 to 3 mm on a hatchling to 10 to 12 mm on a tortoise with flared marginals. If the tortoise is very small, select an identification number (out of sequence, if necessary) that allows notching of anterior and posterior marginals only, not the bridge. Notches should be deeper on anterior and posterior marginals than on the bridge, because these scutes are more vulnerable to wear and chewing by predators and because the bone is farther from the marginal edge, especially in young animals.

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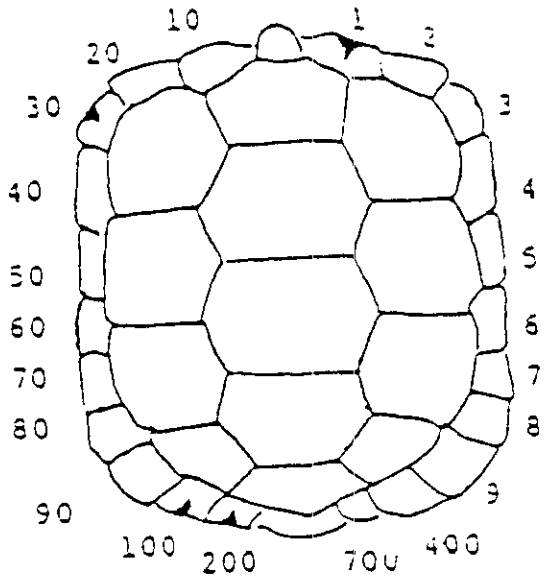
Tortoise number = 331



Tortoise number = 331

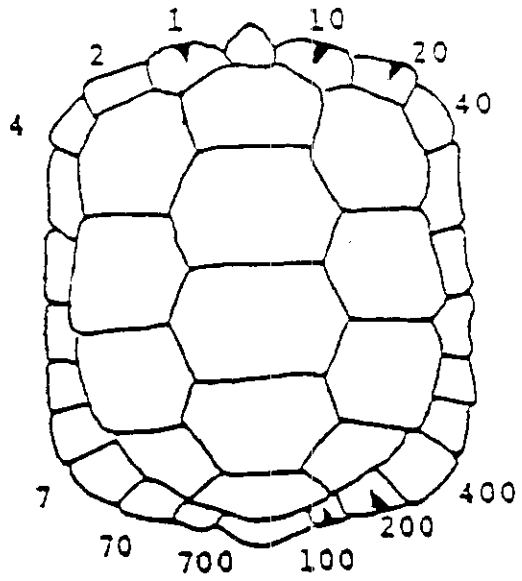


Figure III-2. Coding system (notching) for desert tortoises. Top: System used on most BLM plots in California, Nevada and Arizona. (Some workers do not use the bridge scutes [marginals four through seven] when marking turtles or tortoises). Bottom: System used on BLM plots in Utah and on the Arizona Strip.

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Several researchers do not mark the bridge scutes (marginals four through seven) on turtles because of the difficulty in identifying the shallow notches years later (J. Congdon, W. Gibbons and P. Rosen fide C. Schwalbe). This may be particularly troublesome in more complex tortoise habitats in the Sonoran Desert, where a given tortoise may not be recaptured for several years. Arizona is considering this issue and may require that bridge scutes not be used there in the future.

Take care to avoid deep cuts that could cause bleeding. Generally bleeding does not occur unless notches pass through bony tissue. If notches are too deep and bone is damaged, regeneration may occur and the area of damage will be sloughed. For example, bone and scute replacement is now occurring on several tortoises at the Ward Valley plot. Several tortoises first notched in 1980 and recaptured in 1987 have barely recognizable notches. The only evidence of the old notches is a thin fragment of lifting bone distal to scute material.

To avoid notching too deeply on anterior and posterior marginals, tilt the file at an angle to create a groove on the dorsal surface of the scute (Burge fide K. Berry). The groove may be 3 to 5 mm long. On the bridge, angle the file either anteriorly or posteriorly to create a diagonal groove 12 to 20 mm in length. The notch will be less likely to be mistaken for a natural groove, injury or anomaly.

With a wire (strip the paper from a commercial twist-tie), line the notches carefully with yellow ochre acrylic paint, making them slightly more visible to the observer and less likely to be overlooked, if the tortoise is not recaptured and renotched frequently. When a tortoise is recaptured for the first time after a year or more, the notches should be carefully examined and deepened where necessary. The yellow ochre was chosen to match the color of lichens frequently found in the Southwest on rocks.

When identifying a tortoise and when first marking it, the fieldworker should carefully count the marginal scutes from anterior to posterior. This is very important. Many tortoises have 10 or 12, instead of the normal 11 marginal scutes on each side. Other anomalies are common. If the tortoise only has other than 10 marginal scutes, then it should be assigned a number suitable to its scute configuration. When recapturing a tortoise, fieldworkers often see notches on the scutes adjacent to the pygal and assume that the tortoise is in the 200 or 700 series of numbers, when it is not. Always count the marginals from the anterior before identifying the tortoise.

Consideration should be given to techniques for marking juveniles. Clipping with fingernail scissors may be less traumatic than notching. Identification might also be assured with tiny,

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epoxy-covered numbers on the costal scutes. If epoxy is to be used, it should not touch the seams of the scutes.

In addition to notching, three other methods should be used concurrently:

- placing a tiny number on the right 4th costal and covering it with quick-drying epoxy, and

- taking a 35 mm photograph (slide) of the carapace, the plastron, and the 4th left costal scute.

- drawing any anomalies, injuries (old and recent), or abnormalities on the Live Tortoise Data Sheet.

In 1977 Betty Burge began testing a new identification system with wild tortoises on the permanent plots in Ivanpah Valley and at Goffs. She placed a tiny piece of paper with the number of the tortoise on the 4th costal scute and covered the number and paper with a drop of quick-drying epoxy. Those numbers have persisted for 10 years, and the system or a modification of it has been adopted on all California plots. It is a valuable supplementary form of identification. The revised system now involves placing a small dot of white paint on the 4th left costal, writing the tortoise number in permanent black ink on the white paint after it is dry, and then covering the number with epoxy. The epoxy will become scratched and the number obscured with time, but when a drop of water is rubbed on the dulled epoxy, the observer can read the number. If properly done, the dot of paint and epoxy will not be obvious to most observers. Dust will cover it. Do not let the epoxy touch the seam.

The 35-mm slides are another essential part of the identification system and have permitted identification of tortoises which have been misidentified, have lost notches, have been chewed extensively by predators, and have died. Even when only a few scutes or pieces of bone remain, the tortoise can sometimes be identified with the slides. If slides are carefully taken, they can show anomalies, injuries, shell wear, and the notches. Slides are preferable to prints, because they are more easily labelled and stored, and can be projected on a screen to compare year-to-year differences.

Before taking the photographs, dust off the tortoise with a small brush (tooth brush), which should be sterilized between tortoises as described above. Many tortoises are caked in mud, and it is difficult, if not impossible, to see seams, shell wear class, anomalies, and growth rings if the shell is not clean. A small piece of paper with the study site number, site name, date, and tortoise number should be affixed to the shell edge (not the center of the carapace or plastron). Plain white stickers 16 mm x 90 mm, used for identifying file folders, are particularly easy to use and

store. The tortoise, carapace, plastron or individual scute being photographed should fill the entire slide frame.

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