Photo by Jeremiah Easter
Mojave fringe-toed lizard
(*Uma scoparia*)

BEFORE THE U.S. SECRETARY OF INTERIOR

PETITION TO LIST THE **AMARGOSA RIVER DISTINCT POPULATION SEGMENT OF THE MOJAVE FRINGE-TOED LIZARD (*Uma scoparia*)** AS THREATENED OR ENDANGERED UNDER THE U.S. ENDANGERED SPECIES ACT.

Submitted by:
Center for Biological Diversity – Deserts Program
Ms. Sylvia Papadakos-Morafka

April 10, 2006

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Dirk Kempthorne, US Secretary of the Interior
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Mr. Kempthorne,

The Center for Biological Diversity, and Ms. Sylvia Papadakos-Morafka hereby petition to list the Amargosa River Distinct Population Segment (DPS) of Mojave Fringe-toed Lizard (*Uma scoparia*) as threatened or endangered pursuant to the Endangered Species Act (hereafter referred to as ESA), 16 U.S.C. et seq. This petition is filed under 5 U.S.C. 553(e) and 50 CFR 424.14 (1990), which grants interested parties the right to petition for issuance of a rule from the Secretary of the Interior.

The Amargosa River Population qualifies as a DPS because it is discrete, significant, and threatened or endangered. The range of the Amargosa River DPS (Dumont Dunes, Ibex Dunes, and Coyote Holes) is highly restricted to fine sand environments, as are all fringe–toed lizards. A significant portion of the range of this Population has suffered severe habitat destruction and modification by extensive off-road vehicle (ORV) traffic.

Petitioners also request that Critical Habitat be designated for the Amargosa River DPS of Mojave Fringe-toed Lizard concurrent with listing, pursuant to 50 CFR 424.12, and pursuant to the Administrative Procedures Act (5 U.S.C. 553).

The Amargosa River DPS meets three criteria for consideration as a threatened or endangered species under the Endangered Species Act section 4(a)(1)(A,D,&E).

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;
(D) the inadequacy of existing regulatory mechanisms;
(E) other natural or manmade factors affecting its continued existence

The most significant threat to the Amargosa River DPS is intensive off-road (off-highway) vehicle traffic, which has killed many lizards directly and destroyed the lizards' habitat. Management of habitat by the Bureau of Land Management (hereafter referred to as BLM) allows intensive ORV use over a majority of the species' range.

Recent surveys at Ibex Dunes and Dumont Dunes (more than 98% of the DPS's range) found low densities of *U. scoparia* and massive habitat destruction by ORVs at Dumont. This petition action sets in motion a specific time table for the U.S. Fish and Wildlife Service to respond under the ESA, 16 U.S.C.1533(b).

The Center and Ms. Papadakos-Morafka submit this petition in the memory of Dr. David Morafka. Dr. Morafka was a leading scientist on *Uma scoparia*, and he supported ESA listing to ensure its survival and recovery in the wild.

We request a finding on this petition by July 12, 2006. We'd like to work with the Fish & Wildlife Service (FWS) out-of-court for reasonable dates on findings and rulemaking related to this petition.

Thank you,

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I. Executive Summary

Extensive ORV traffic at Dumont Dunes and to a lesser extent Coyote Holes and Ibex Dunes, poses a substantial threat to the continued existence of the Armagosa River DPS of the Mojave Fringe–toed Lizard. Since the 1970s, Dumont has experienced a more than 230% increase in off-road vehicle traffic (BLM 2004d). This increase has fueled illegal traffic to both Ibex Dune and Coyote Holes, presenting a population-wide threat. ORVs at Dumont Dunes results in the direct take of the lizard and destruction of its habitat. When disturbed, the lizard dives into loose sand only a few centimeters deep, where it is vulnerable to death or injury from ORV sand-digging tires. ORVs destroy habitat by trampling above-ground vegetation and destruction of shallow root systems common to many desert plants. This destruction of vegetation also results in a decline of insects, reducing the Mojave Fringe-toed Lizard's food sources.

At Death Valley National Park, *U. scoparia* could not be located at 2 of 3 potential historical sites. Ibex Dunes may represent the only remaining population within the Park.

Coyote Holes is a small sand blowout east of Dumont Dunes. This habitat is extremely small and could be significantly damaged by a single occurrence from illegal ORV use.

ORV use leading to extirpation of *U. scoparia* is a realistic threat. Recent surveys at BLM's El Mirage off-road "open area" showed that *U. scoparia* is likely extirpated at

this site likely because of habitat destruction and direct take by ORVs (Morafka, 2000 and 2002, BLM, 2004a) with Morafka (2000) concluding of El Mirage Dry Lake:

> "Local dunes appeared to be plowed by massive and repetitive ORV traffic, destroying perennial vegetation and altering dunes surfaces."

Other significant threats to the Amargosa River DPS are toxins in the environment from nearby military operations, residual pesticides, and blocking of sand sources, all of which have likely contributed to local extirpation of lizard populations (Morafka 2000 and 2002).

The Amargosa River DPS of *U. scoparia* is in need of protection as a threatened or endangered species with critical habitat. Listing for the Amargosa River DPS and critical habitat is essential due to massive habitat destruction and low densities of *U. scoparia* found by Morafka (2002) at Dumont Dunes and low densities of *U. scoparia* found by Emmerich (1998) at Ibex Dunes, comprising the vast majority of the population's range. The request for listing as a Distinct Population Segment is based in large part on genetic analyses by Murphy et al. (In review), showing the population to be isolated and genetically distinct.

II. Introduction

The Mojave fringe–toed lizard (*U. scoparia*) has a restricted range, found in the deserts of Southern California and a small area of Arizona. It is an extreme habitat specialist that is restricted to fine sand environments found in dune environments that have a patchy and limited distribution on the landscape (Hollingsworth et al. 1999). The Mojave Fringe-toed Lizard's narrow habitat requirements make it extremely vulnerable to habitat destruction.

The Mojave Fringe-toed Lizard is highly adapted to fine sand environments. The lizard has projecting scales that form a fringe on the sides of its toes that aid in traction and prevent sinking into the sand (Stebbins, 2004). Granular, velvet like scalation aids in rapid burial (Ibid.). The lizard's lower jaw is countersunk, which helps prevent sand getting in its mouth when burying (Ibid.). Overlapping eyelids and earflaps protect against sand, as does valvular nostrils and screen like nasal passages (Ibid.). Unfortunately, this unique lizard, along with many other desert dwelling plants and animals, are threatened by rampant ORV destruction of its habitat.

III. Natural History of *U. scoparia*

A. Description

The Mojave Fringe-toed Lizard (*U. scoparia*) is a medium-sized lizard with a dorsally compressed body and tail. It grows up to a length of 18 cm. Adult males tend to be longer than adult females and are distinguished by the presence of post-anal scales. This

is not universally indicative of males, because some females also have post-anal scales, however, no males are without them (Mayhew, 1966).

Figure 1. *Uma scoparia*, San Bernardino County, CA Photo: Brad Alexander

The Mojave Fringe-toed Lizard has smooth skin and a fine pattern of small black flecks and ocelli. Both sides of the belly have a conspicuous black spot, and the underside of the tail has black bars. Adults of the species have yellow-green wash on the venter and pink on the sides during breeding periods, but during non-breeding periods, the Mojave Fringe-toed Lizard's color mimics the sand dunes on which they dwell. The color matching ability of the genus is described as "extremely close," by Pough (1970) who states that "crouched motionless, flat on the sand [the genus] is extraordinarily difficult to see." Though this is not an uncommon trait in lizards in general, the color matching of the Mojave Fringe-toed Lizard is crucial for predation avoidance, since the habitat is uniformly hued.

The Mojave Fringe-toed Lizard is distinguished from its cogenitors by crescent shaped markings present on the throat, a posteriorly reduced lateral crest on the nasal process, and a frontonasal fontanelle present on the skull (Hollingsworth et al., 1999). The conspicuous dark black spot on the sides of the belly are also distinct in this species.

B. Taxonomy

The Mojave Fringe-toed Lizard is in the family *Phrynosomatidae*, the family of the North American Spiny Lizards, within the order *Squamata* of the class *Reptilia*, in the Kingdom *Animalia*.

Kingdom	*Animalia*
Phylum	*Crenate*
Class	*Reptilia*
Order	*Squamata* (lizards, serpents, snakes)
Suborder	*Iguania (*iguanas)
Family	*Phrynosomatidae* (North American spiny lizards and allies)
Genus	*Uma* (Fringe-toed Lizards)
Species	*U. scoparia* Cope 1894 (Mojave Fringe-toed Lizard)

The genus *Uma* contains three to seven species of Fringe-toed Lizards, two of which occur in the Chihuahuan Desert of Mexico. Edward Drinker Cope first described the species *U. scoparia* in 1894. There are no accepted synonyms for the taxa.
The taxonomy of the species was reexamined by Trépanier and Murphy (2001) using genetic analysis. Previous studies combined the species *U. scoparia*, *U. notata*, and *U. inornata* into a single species, *U. notata*. The more recent analysis supported either a two or five species classification, within the northern species complex, with *U. scoparia* maintained in either scenario (Ibid.).

C. Reproduction and Growth

The Mojave Fringe-toed Lizard generally reaches sexual maturity during the second summer following hatching. Reproductive activity in both sexes is annually variable, in accordance with seasonal rainfall patterns (Mayhew, 1966).

Breeding colors and testis size indicate the male breeding period, which occurs between April and late June. Testis enlarge considerably and change appearance. Testis size and volume were also correlated with the abundance of food and water in captive breeding experiments, therefore suggesting that rainfall and food availability in the wild may relate to reproductive capacity (Mayhew, 1966).

Female breeding colors are displayed between April and September, with maximized colors during May through July (Mayhew, 1966). Ovarian egg counts also fluctuate in response to rainfall and food availability; reduced egg counts and few juveniles were observed following dry winters (Ibid.). The number of eggs that reach the oviducts varies from two to five but most animals had two to three eggs per clutch (Ibid.). There is also evidence to suggest that female lizards may have more than one brood per year (Ibid.).

D. Movement

Mojave Fringe-toed Lizards spend their inactive periods and hibernation cycle (November-February) beneath the sand (Mayhew, 1966). It is believed that their flattened body form, skin surface scales, and wedge-shaped head with well-developed eye and ear flaps are all useful for the burrowing behavior exhibited by this genus (Pough, 1970).

Self-burial by the lizard is presumed to be defensive, as there is no evidence to suggest that it is thermoregulatory or used for sub-surface hunting as exhibited by other genera of sand lizards (Pough, 1970). When frightened, the Mojave Fringe-toed Lizard will dart away and either freeze under vegetation, enter a rodent burrow, or “dive” a few centimeters below the surface of the sand (Stebbins, 1966).

The enlarged, triangular shaped fringes on the third and fourth digit on the hind foot are associated with high speed and mobility on the sand (Hollingsworth et al., 1999). This species has been studied for its exceptional mobility and speed (Jayne and Irschick, 2000). When running rapidly, most of the body weight of the lizard is carried by its hind

limbs, with the front limbs used only for balance. Effectively, this accelerated locomotion is bipedal (Stebbins, 1944).

Dispersal of Mojave Fringe-toed Lizards between populations is poorly studied, but based on observed movements and limited ability of the species to cross unsuitable habitat, it is unlikely that isolated populations interact. The Mojave Fringe-toed Lizard is not found more than 45 m from its typical habitat (Norris 1958 as cited in Murphy et al. In review). This high degree of habitat restriction makes the conservation of existing habitat imperative, since the species can not relocate.

E. Feeding

The Mojave Fringe-toed Lizard is omnivorous throughout its lifecycle. It primarily feeds upon insects, but it also eats seeds and flowers (Stebbins, 1944). Annual plant species provide important forage during the springtime, though the reliance on vegetative plant species may diminish during the summer with increased arthropod availability (Ibid.). Examinations of the stomach contents of Mojave Fringe-toed Lizards suggest that the species eats insects that typically dwell close to the sand surface (Mayhew, 1966).

F. Habitat requirements

U. scoparia occurs in the Lower Sonoran life zones of the Mojave Desert and the northwestern reaches of the Sonoran Desert (Hollingsworth et al. 1999). They are restricted to small and large dunes of fine, aeolian sand, the margins of dry lakes, washes, and hillsides (Ibid.). These fine sand habitats range in elevation from sea-level to 600 meters (Ibid.).

Studies of the closely related *U. inornata* found that Fringe-toed Lizards preferentially burrow in fine or intermediate-grained sand, and avoided coarse-grained, silty or stabilized sand (Pough, 1970, Turner et al. 1984). Turner et al. (1984) found that *U. inornata* were absent from lee areas created by Tamarisk likely because of sand stabilization. *Uma sp.* likely select unstabilized areas with intermediate grain sand because it eases self-burying and facilitates respiration (Pough 1970). Pough (1970) found that Fringe-toed Lizards buried themselves 0.5-4 cm below the surface, which was typically not deep enough to avoid the hottest temperatures of summer, suggesting they bury themselves more for protection than thermo-regulation. Besides burying themselves to avoid predators, Fringe-toed Lizards dived into rodent burrows and under vegetation (Pough 1970, Turner et al. 1984, Jayne and Ellis 1998).

Fringe-toed Lizards are highly dependent on desert vegetation as a source of cover, for thermoregulation and as habitat for primary prey (Pough 1970, Turner et al. 1984, Jayne and Ellis 1998). Vegetation provides protective cover and concealment from predators. One technique to avoid capture for *U. scoparia* is to hide among surface vegetation (Brattstrom, 1979). In sister species *Uma notata*, 99% of individuals used vegetation as escape cover during surveys (Knauf, 2001). At night, Fringe-toed Lizards selected the windward end of small accretion dunes (dunes formed by vegetation) for self-burying,

presumably because leaves and branches protect them from predators and reduce sand pressure (Pough 1970). Shrubby-vegetation also provides habitat for the Fringe-toed Lizard's insect prey with more insect tracks observed in areas of greater vegetation density and cover than areas denuded of vegetation by ORVs (Luckenbach and Bury 1983). These observations indicate a strong relationship between plant and lizard densities (Luckenbach and Bury 1983, Knauf 2001).

The dependence of Fringe-toed Lizards on loose sand of a particular size, as well as their dependence on vegetation for cover and prey make it highly sensitive to habitat disturbance and destruction (Pough 1970, Turner et al. 1994).

G. Distribution

The Mojave Fringe-toed Lizard is endemic to the deserts of southern California and a small area of western Arizona. It is the northernmost species of the genus *Uma*, and, contrary to the common name, occurs in the Sonoran Desert as well as the Mojave Desert. Its distribution within the southern Mojave Desert is within the atypical ecosystems classified as the Lower Sonoran Lifezone, in the lowest and hottest valleys of the desert (Murphy et al. In review). The Amargosa River population occurs at Dumont and Ibex Dunes and Coyote Holes (Figure 2 and 3).

Dumont Dunes. The Dumont Dunes ORV Recreation Area (10,056 acres) is located in the northeast corner of San Bernardino County approximately 34 miles north of Baker, California off Highway 127 (BLM, 2003). This remote area is bordered by steep volcanic hills and the slow moving Amargosa River (Ibid.). The main dune area is approximately 4 miles long, one mile wide, and at its highest point over 450 feet above the desert floor.

Dumont Dunes began to form approximately 18,000 years ago when Lake Manley in Death Valley and Lake Dumont in the Silurian Valley began to dry (BLM, 2004b). Left behind was sand to be blown and deposited to form the dunes (Ibid.).

The Dumont Dunes ORV Recreation Area attracts over 100,000 off-roaders a year with increases in numbers expected (BLM, 2004a), presenting a substantial threat to the Mojave Fringe-Toed Lizard.

Ibex Dunes. Approximately two miles long, Ibex Dunes lie in the southern portion of Death Valley National Park on the west side of the Saddle Peak Mountains. This site is the northern most population of Mojave Fringe-toed Lizard. It is possibly the only population of *U. scoparia* within the Park (Morafka, 2000).

Illegal ORV use is occurring in Death Valley National Park (National Park Service 2001). Spill over of ORV traffic from Dumont Dunes occurs at Ibex, due to its relative closeness to Dumont.

Coyote Holes. Coyote Holes is a small sand blowout above the Kingston Wash. This Wash is designated as an authorized ORV route that "cherry stems" into a wilderness

area. The approximate location of this sandy blowout is 20 km east and 5 km south from the eastern end of Dumont Dunes. The habitat area at this location is less than 50 acres (Emmerich, personal communication).

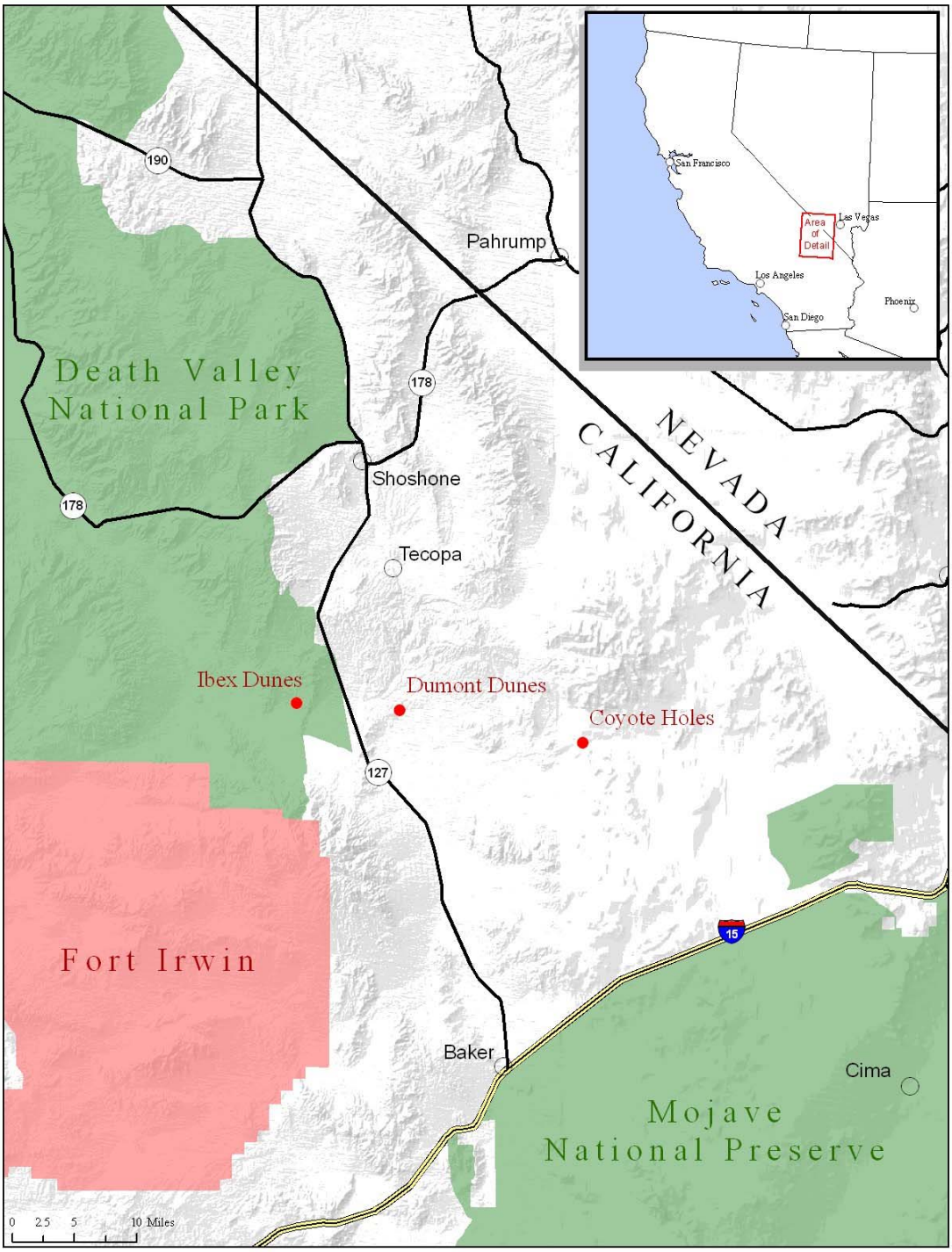

Figure 2. Location of Amargosa River populations of Mojave Fringe-toed Lizard in California.

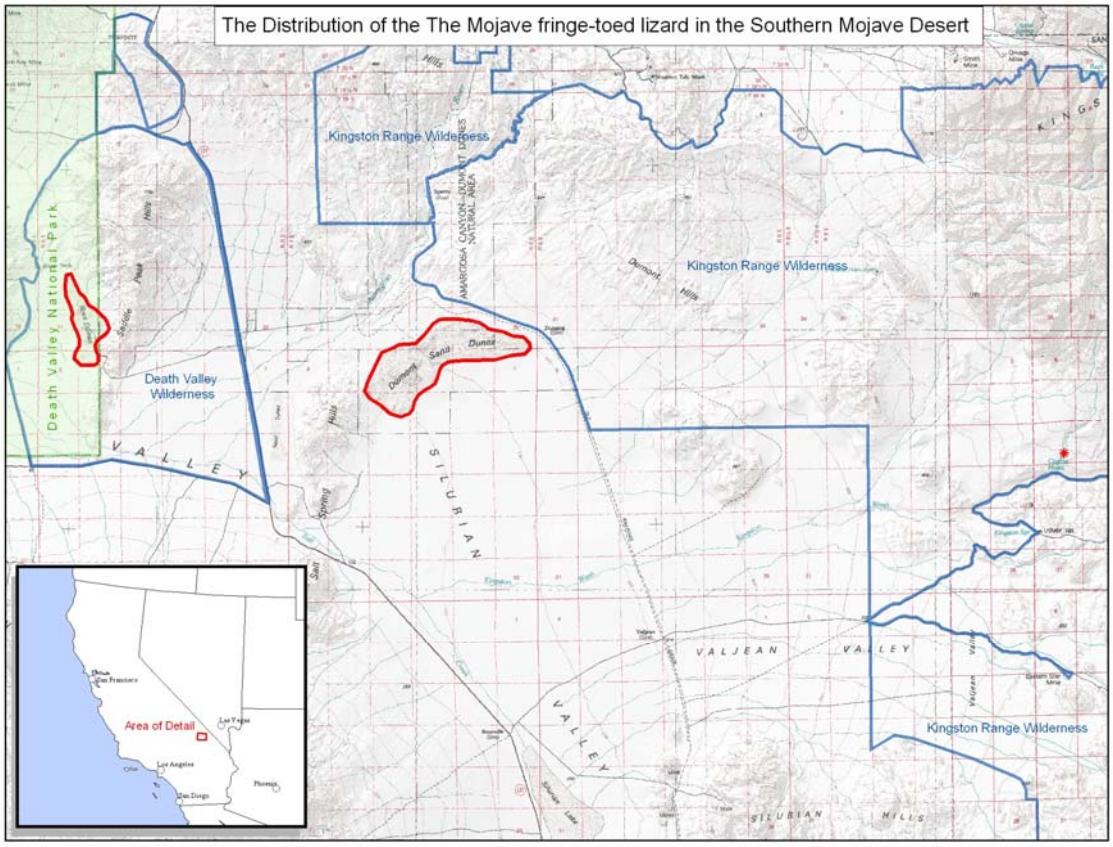

Figure 3. Detailed map of Dumont and Ibex Dunes in the Mojave Desert.

H. The Amargosa River population of the Mojave Fringe Toed Lizard qualifies as a Distinct Population Segment under the Endangered Species Act

To be considered for listing as an endangered species, the Amargosa River population of the Mojave Fringe-toed Lizard must qualify as a "distinct population segment" (DPS). The U.S. Fish and Wildlife Service (Fish and Wildlife) will consider a population a DPS if it is "discrete" in "relation to the remainder of the species to which it belongs" ***and*** it is "significant" to the species to which it belongs. According to Fish and Wildlife's current policy regarding recognition of distinct vertebrate populations (Federal Register V. 61, No. 26, February 7, 1996), a species is considered discrete if it is "markedly separated from other populations" because of "physical, physiological, ecological, or behavioral factors;" ***or*** it is "delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D)." The policy further clarifies that a population need not have "absolute reproductive isolation" to be recognized as discrete. A population is considered significant based on, but not

limited to, the following factors: 1) "persistence of the discrete population in an unusual or unique ecological setting;" 2) "loss of the discrete population would result in a significant gap in range;" 3) the population "represents the only surviving natural occurrence of an otherwise widespread population that was introduced;" or 4) the population "differs markedly in its genetic characteristics" (Federal Register V. 61, No. 26, February 7, 1996).

1. Discreteness

The Amargosa River population is clearly discrete. Mojave Fringe-toed Lizards only occur on dunes with fine, loose sand and are not known to disperse long-distances across unsuitable habitat. Indeed, *U. scoparia* has not been found more than 45 meters from its typical habitat (Norris 1958 as cited in Murphy et al. In review) and the lizard is believed to only disperse with movement of its dune habitats. Coyote Holes and Dumont and Ibex Dunes are thus isolated from other suitable habitat, making dispersal highly improbable. Discussing the discreteness of the Amargosa River population and also the Red Pass Dune population, Murphy et al. (In review) concluded:

> "Natural geographic barriers, including the absence of sand and presence of mountains, separate populations from one another. Each dune is a discrete entity and it is extremely unlikely that gene flow is occurring among the isolated dunes, and especially among dune systems not connected by a recent hydrogeologic system. Ecologically, dispersal is virtually impossible because of the absence of intervening sand dunes."

Moreover, genetic studies show that the Amargosa River population is reproductively isolated with Murphy et al. (In review) concluding:

> "the presence of a single "monophyletic" maternal lineage provides evidence that dispersal has not occurred; if dispersal was common we would expect to see haplotypes from different lineages scattered among the dune systems, as observed on Red Pass Dune. The Amargosa River lineage is genetically distinct."

2. Significance

The Amargosa River population shows marked genetic differences from other populations of Mojave Fringe-toed Lizards, reflecting long isolation of the population and likely adaptation to local conditions (Murphy et al. In review). Using mtDNA, Murphy et al. (In review) identified two distinct maternal lineages that have been isolated since likely the mid-Pleistocene (500 ka), when orogenic events changed the course of rivers. These lineages are associated with past and present river drainages that created the necessary conditions (e.g. sand dunes) for the lizard to survive, including the Amargosa River in the north and the Bristol-Lanfair Basin, Pleistocene Colorado River, Lucerne Trough and the Mojave River Sink in the south. The present petition concerns the Amargosa River lineage. The Amargosa River population was found to have the "greatest amount of DNA sequence divergence" (Murphy et al. In review). This lineage

includes animals from Coyote Holes and Ibex and Dumont Dunes, which are closely related and likely had recent contact during more mesic periods of the late Pleistocene and Holocene (Murphy et al. In review). In regards to the significance of genetic differences observed in the Amargosa River population, Murphy et al. (In review) concluded:

> "The Amargosa River lineage is genetically distinct. The presence of unique haplotypes gives credence to the possibility of regional adaptations and incipient speciation. The Amargosa River lineage represents a significant historical component and it deserves recognition as a DPS."

Loss of the Amargosa River populations will also create a significant gap in the range of the species and result in loss of the species from a unique ecological setting. Populations at Coyote Holes and Ibex and Dumont Dunes represent the northernmost extension of the species range and the only populations in the Amargosa River drainage. They harbor unique haplotypes that very likely represent adaptation to unique regional characteristics, such as differences in climate, vegetation and substrate. These differences need further exploration.

G. Population status

The Amargosa River DPS of Mojave Fringe-toed Lizard has a highly restricted distribution limited to Dumont and Ibex Dunes and Coyote Holes (Murphy et al. In review) and is an extreme habitat specialist that is only found on areas with loose intermediate grained sand and desert vegetation (Pough 1970, Turner et al. 1984). Although overall population numbers are unknown, this limited distribution and habitat specialization makes the Amargosa River DPS a rare species that is highly vulnerable to habitat destruction resulting in local extirpation. Local extirpations of other Mojave Fringe-toed Lizard populations outside of the Amargosa River DPS have already occurred (Morafka 2000 and 2002, Murphy et al. In review). Morafka (2000) surveyed several locations where Mojave Fringe-toed Lizards were known to occur and failed to find the species. For example, Morafka (2000) could not locate the species at El Mirage Dry Lakes and concluded:

> "Stebbins 1954 field guide document[s] the occurrence of this species at Mirage Dry Lake. Local dunes appeared to be 'plowed' by massive and repetitive ORV traffic, destroying perennial vegetation and altering dunes surfaces. Nearby agricultural endeavors may have also generated laterally displaced exposures to aerial pesticides (crop 'dusting'). No individuals were located even after three full morning searches by 3-5 member survey teams."

Mojave Fringe-toed Lizards were also absent from Harper Dry Lake, Saddle-back Butte State Park/Wilsonia Gardens, Rogers Dry Lake, Piute Butte, the entirety of El Mirage Dry Lake, and Lovejoy Butte (Morafka 2000 and 2002, Murphy et al. In review). These findings highlight the vulnerability of individual populations of Mojave Fringe-toed

Lizard like those found at Dumont and Ibex Dunes and Coyote Holes and indeed, each one of these populations is vulnerable to extinction:

Dumont Dunes. Dumont Dunes contains the largest area of habitat for the Amargosa River DPS of the Mojave Fringe-toed Lizard. Unfortunately, the BLM allows open travel over the entire dunes by ORVs, causing severe habitat destruction (Figure 4). As discussed below, ORV use at Dumont Dunes is leading to severe habitat destruction, resulting in reduced densities of Fringe-toed Lizards (Morafka 2002) and threatening the survival of the population.

Figure 4. Dumont Dunes, California. The ORV cross country travel allowed in this area has destroyed most of the vegetation of the dunes and has drastically endangered the Mojave fringe –toed lizard at these dunes. Photo: Robert L. DeMaagd

Ibex Dunes. Ibex Dunes is in the southern area of Death Valley National Park. Although occurrence in the National Park provides a modicum of protection for this population, recent surveys determined that Mojave Fringe-toed lizards may occur at extremely low densities at Ibex Dunes, placing them at risk of extinction. Emmerich (1998) found only five *U. scoparia* at Ibex Dunes during 8.5 hours of surveys. The cause of this observed low density is unknown, but illegal ORV traffic may be a factor. Other factors may be isolation of the population or marginal habitat at the northern edge of the species range.

According to Morafka (2000), there are several references in the popular and grey literature to other populations of Fringe-toed Lizard in Death Valley National Park, including Panamint Dunes and near Stovepipe Wells. Extensive surveys by Morafka (2000) failed to substantiate presence of the species at these sites, indicating they are either extirpated or were misidentified. If they were extirpated, this is cause for further concern for the population at Ibex Dunes.

Coyote Holes. The population at Coyote Holes is isolated from either Dumont or Ibex Dunes and is found on only 50 acres of habitat (Emmerich personal communication). The small area of habitat means that even occasional use by ORVs could extirpate the population, which is a distinct threat because Coyote Holes is near the East Mojave Heritage ORV trail. The isolation of the population is of concern because should the population decline to small numbers, there is little hope of rescue from a nearby population.

In sum, the Amargosa River DPS of the Mojave Fringe-toed Lizard is limited to three isolated populations, each of which is at risk of extinction primarily because of habitat destruction from ORVs. Indeed, Murphy et al. (In review) concluded:

> "Habitat destruction, habitat loss and disruption of aeolian sand transport pathways threaten the survival of *U. scoparia*."

This risk is magnified by population isolation, which eliminates any possibility of rescue following habitat disturbance. Probability of persistence for the Amargosa River Distinct Population Segment is thus highly dependent on habitat protection. Such protection is best served by listing the DPS as a threatened or endangered species under the Endangered Species Act.

IV. The Amargosa River DPS of the Mojave Fringe-toed Lizard warrants listing as a threatened or endangered species

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

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The primary threat to the habitat of the Amargosa River DPS of *U. scoparia* is rampant and uncontrolled use of ORVs at Dumont Dunes and trespass use of ORVs at Ibex Dune. Use of ORVs at Dumont Dunes and elsewhere in the range of the Amargosa River DPS results in the direct destruction of habitat by eliminating vegetation critical to the Mojave Fringe-toed Lizard's survival and compacting soils, and results in direct harm and take to Mojave Fringe-toed Lizards (Busack and Bury 1974, Hosier and Eaton 1980, Luckenbach and Bury 1983).

1. Destruction of habitat of the Amargosa River DPS of the Mojave Fringe-toed Lizard.

ORV use results in the direct destruction of Fringe-toed Lizard habitat, as documented in a number of studies (Busack and Bury 1974, Brattstrom 1979, Luckenbach and Bury 1983, Morafka 2000). In a comprehensive study on the impacts of ORVs on lizards and their habitat and prey in the nearby Algodones Dunes, Luckenbach and Bury (1983) found severe impacts from ORV use. Areas excluded from ORVs had greater vegetation density and diversity with the authors concluding:

> "The high levels of vegetative destruction in the Algodones Dunes are attributable to ORV usage. Most commonly, plants were destroyed by direct destruction or damage to the root systems of psammophytic shrubs."

Overall, control areas had 2.4 times more plant species, 10 times greater plant density, and 9.4 times greater cover than ORV areas. Given the similar vegetation and ORV use between the Algodones Dunes and Dumont Dunes, similar impacts can be expected. As stated previously, *U. scoparia* are dependent on vegetation, which provides cover and forage for Fringe-toed Lizards, allowing thermo-regulation and predator avoidance, as well as providing cover and forage for their arthropod prey (Pough 1970, Turner et al. 1984). Severe loss of vegetation cover can thus be expected to greatly impact populations of the Mojave Fringe-toed Lizard.

Figure 4. Tracks demonstrate no effort to avoid vegetation by ORVs. Photo: Robert L. DeMaagd

Indeed, Luckenbach and Bury (1983) found greater lizard density and diversity, and more arthropods in control areas compared to ORV-use areas. Significantly, they found that the closely related *U. notata* showed the "greatest differences in number of individuals" with control areas having nearly five times more lizards than ORV areas. Insect tracks were 24 more times abundant in control areas verses ORV impacted areas (Luckenbach

and Bury 1983). Reduced numbers of insects for prey likely has direct impact on *U. scoparia*. Mayhew (1966) reported testes (and presumably ovaries) of *U. scoparia* are not as reproductively active if they do not obtain adequate food.

The sum-total of these results led Luckenbach and Bury (1983) to conclude:

> "The findings of this study clearly demonstrate that ORV activities in the Algodones Dunes are highly detrimental to dune biota. Both herbaceous and shrubby perennial vegetation are greatly reduced in habitats where ORVs operate. The sand adapted desert kangaroo rat (*D. deserti*) and fringe-toed lizard (*U. notata*) are severely reduced in areas frequently used for ORV recreation. Judging from information obtained on tracks, there also is a marked decline in the number of arthropods in ORV-used areas."

Supporting these results, Knauf (2001) found 2.3 times the number of lizards (99% *Uma notata*) in closed areas verses open ORV areas at Algodones Dunes.

Likewise, Morafka (2002) found reduced densities of Mojave Fringe-toed Lizard in areas of ORV traffic. Although the results can only be considered preliminary because surveys were conducted in a drought year and sample design was not sufficiently robust to control for habitat differences or to allow statistical testing, Morafka (2002) stratified sampling for Mojave Fringe-toed Lizards into low, moderate and high ORV use-areas at two sites, including Razor Road and Dumont Dunes. At Razor Road, Mojave Fringe-toed Lizards had a mean frequency of 1.917 (SD 1.730), 0 and 0 at areas of low, moderate and high ORV use, respectively. At Dumont Dunes trends were less clear with mean frequencies of 0.583 (SD 0.900), 0.250 (SD 0.463), 0.500 (SD 0.674) at low, moderate and high ORV use areas, respectively. Sampling was also conducted at two other sites with low human impact, Bitter Springs on Fort Irwin and Red Pass in the Soda Mountains. Mean frequencies of Fringe-toed Lizards were 6.714 (SD 2.059) at Bitter Springs and 6.156 (SD 2.825) at Red Pass. These results further suggest that ORV disturbance depresses populations of Mojave Fringe-toed Lizard.

Finally, Murphy et al. (In review) recognized the overall sensitivity of the Mojave Fringe-toed Lizard to habitat destruction and alteration stating:

> "Disruption of dune ecosystems by off-road vehicles poses a major threat. Pollution, alterations of wind patterns required for sand deposition, and habitat loss due to commercial development (condominiums, homes, golf courses and commercial developments) contribute to loss of habitat. In addition, windbreaks comprised of exotic species of trees and the conversions of land for agriculture are ongoing threats to sand dune habitats (U.S. Fish and Wildlife Service, 1984; Jennings and Hayes, 1994). Fringe-toed lizard densities are negatively affected by sand depletion and surface stabilization (Turner et al., 1984). Sand compaction and sand patch size adversely affect the abundance of fringe-toed lizards (Barrows, 1997). Off-road vehicles can severely compact sands and destroy vegetation at dune sites (Davidson and Fox, 1974; Adams et al., 1982;

Luckenbach and Bury, 1983). This loss of vegetation results in the elimination of cover, which is used for thermoregulation and predator avoidance (Pough, 1969). Vegetation is also required for food sources for fringe-toed lizards (Luckenbach and Bury, 1983)."

2. Direct take and harm to Mojave Fringe-toed Lizards

ORV induced hearing loss

Brattstrom (1979) found *U. scoparia* suffered hearing loss when exposed to dune buggy sounds of 95 dBa (100dBl) for a moderate duration of 500 seconds. This is level of exposure is not atypical, as dune buggies have been observed traversing the same area repetitively and in packs (Brattstrom 1979). Brattstrom also noted that dune buggies have been observed stationary with engines revving at high rpms for longer than 5 minutes. The sound levels of 95 dBa were lower intensities than maximum reported field values for a single dune buggy (Brattstrom, 1978, cited in Brattstrom, 1979).

Figure 5. ORVs travel in packs, and even under new stricter noise emission standards for California, this will likely cause hearing loss for *U. scoparia*. Photo: americansandassociation.org

ORVs caused tail loss and fatal compression

Luckenbach and Bury (1983) found tail loss in sister species *Uma notata* to be greater in ORV-impacted areas. In lizards "tails are often used for fat storage organs" (Pianka and Vitt, 2003). The loss of fat stores in *U. scoparia* may negatively effect reproduction. As previously stated, *U. scoparia* testes (and presumably ovaries) are not as reproductively active if they do not obtain adequate food (Mayhew, 1966).

One of the fringe-toed lizard's escape mechanisms is burial in sand only a few centimeters in depth (Pough, 1970). The shallow buried fringe-toed lizard can be fatally harmed if in the path of an ORV's tires (see figure 6). Luckenbach and Bury (1983) found eleven dead Fringe-toed Lizards in an ORV impacted area. This is an unusually

high rate of dead Fringe-toed Lizards, the authors stated, considering the abundance of scavengers in the area. Most were discovered partially buried indicating they had been killed in that position. The authors also relate that fringed-toed lizards often retire on east facing slopes at night where they are in a position to receive direct heat from the early morning sun; these lizards are particularly vulnerable because of the popularity of these slip faces by dune buggy drivers. Luckenbach and Bury (1983) additionally stated there is no doubt ORVs contribute to the maiming and crushing to death of shallow-buried Mojave Fringe-toed Lizards.

Figure 6. Specialized sand tires dig in deep and cause death for the shallow buried *Uma* lizards. In addition shallow root systems in desert plants are destroyed.
Photo: americansandassociation.org

3. The growing threat

In California the threat to public lands is ever growing due to increasing ORV use (BLM 2000). In California there has been a 30% increase in the number of dirt bike registrations, a 96% increase in the number of all-terrain vehicle registrations, and a 96% increase in dune buggies and sand rail registrations through 1983 to 2000 (California State Parks, Taking the High Road, 2002, cited in BLM, 2002). “The U.S. Census Bureau estimates that California’s population will increase 39% between 2000 and 2020” (BLM, 2003).

Specifically, Dumont Dunes has seen an increase in ORV use (BLM, 2004 d).
For fiscal year 1999 ORV traffic was 45,188 for Dumont Dunes (Ibid.). The fiscal year 2003 data shows ORV use has increased more than 230% to 114,541 since 1999 (Ibid.). Fiscal year 2004 showed a few thousand less visitors in comparison to 2003 (Ibid.). The BLM believes that the visitor use in 2003 and 2004 were approximately the same, but they are still working out the bugs with a new traffic counter (Ahrens, personal

communication). The growing populations of California and Nevada are contributing to this increase in ORV traffic at Dumont Dunes. Las Vegas and Pahrump, Nevada are two of the fasting growing communities in the west, one factor contributing to the increase of ORVs at Dumont Dunes (BLM, 2004a).

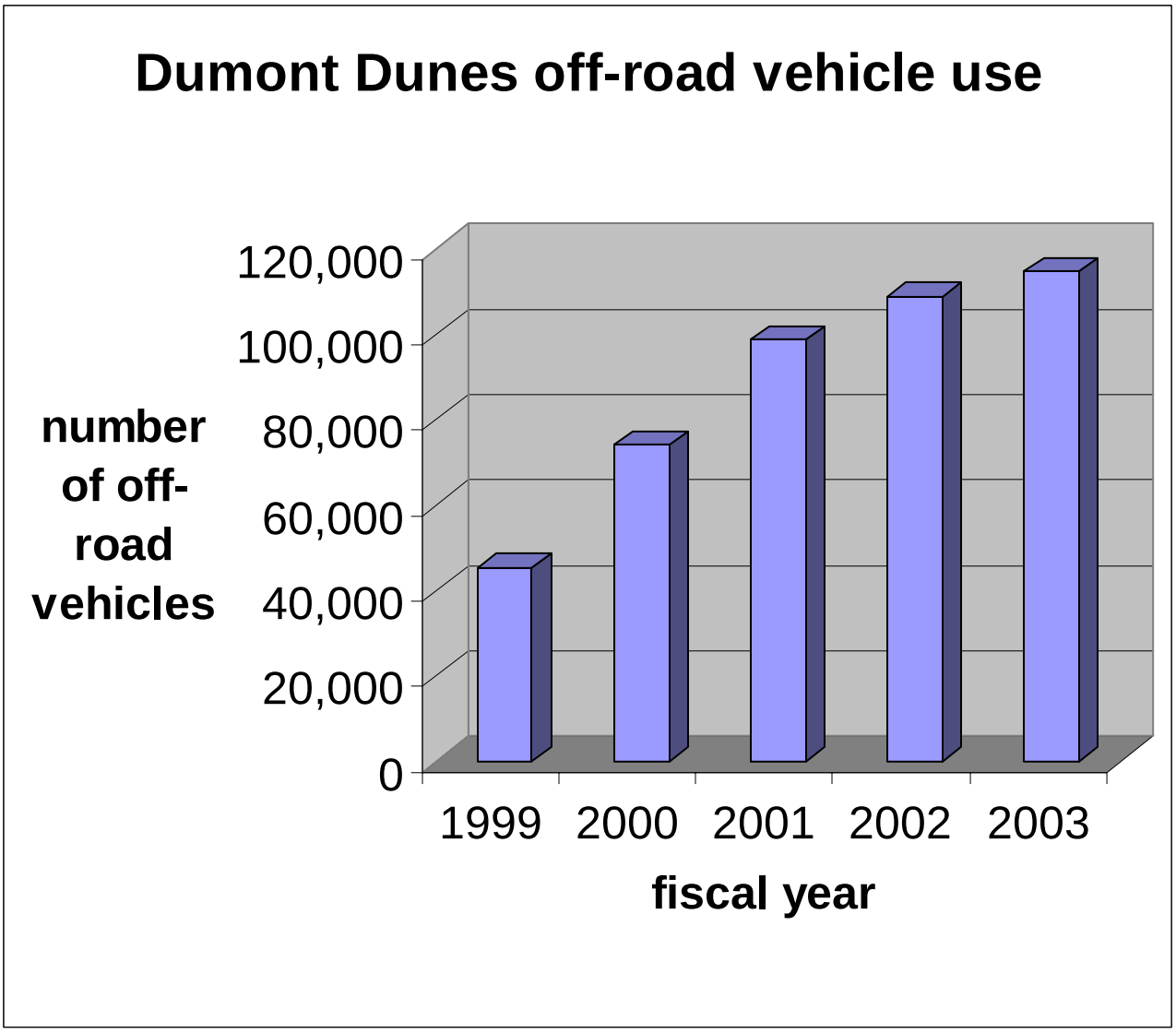

Figure 7: ORV use at Dumont Dunes has increased greatly in a short period of time (BLM, 2004d).

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

We have no information on collection of the Fringe-toed Lizard, but it could pose a potential threat that listing of the species will address.

C. The inadequacy of existing regulatory mechanisms and management failures

BLM. Both Dumont Dunes and Coyote Holes are managed by the BLM. Currently, the BLM lists *U. scoparia* as a sensitive species. The BLM manual 6840.06E states: "The protection provided by the policy for candidate species shall be used as the minimum level of protection for BLM sensitive species," and at Section 6840.06C pertaining to candidate species states: "Consistent with existing laws, the BLM shall implement management plans that conserves candidate species and their habitats and shall ensure that actions authorized, funded, or carried out by the BLM do not contribute to the need for the species to become listed."

Although theoretically this guidance could provide some protection for the Mojave Fringe-toed Lizard, in reality the BLM has implemented few protections for the Lizard. To date, there is no management plan for the Lizard and no areas have been closed to ORV traffic or other uses to protect the Lizard's habitat. Even if the BLM did have existing regulations to protect the Lizard, current law enforcement personnel at Dumont Dunes are not sufficient to prevent malicious destruction of habitat (see Figure 4). Lack of regulatory protections at Dumont Dunes is occurring despite greatly expanded use of the area by ORVs that is leading to direct take of the Lizard and destruction of its habitat.

The National Environmental Policy Act (NEPA) governs management of BLM lands, including those occupied by the Mojave Fringe-toed Lizard. NEPA, however, only requires the BLM to analyze their impacts on the environment, not choose an alternative that would protect species like the Mojave Fringe-toed Lizard and thus provides little regulatory protection.

National Park Service. The National Park Service manages Ibex Dunes and prohibits ORV use, which provides some protection to the Amargosa DPS of the Mojave Fringe-toed Lizard. Despite this protection, however, ORV use still occurs at Ibex, potentially leading to take of Lizards and destruction of habitat. For example, in a recent environmental assessment on the environmental impacts of installing a "bat-gate" on a nearby mine to restrict human access, the National Park Service concluded:

> "Of particular concern for the management of the Rainbow Talc Mine is the increasing amount of visitation to the mine. A popular off-road vehicle use destination lies due east of the Rainbow. Visitation at the Bureau of Land Management's 8,150-acre Dumont Dunes Open Area has between 14,000 and 16,000 recreating people on holiday weekends. The National Park Service is aware that some of that ORV visitation occasionally spills over from Dumont Dunes into Death Valley's Ibex Dunes, increasing unauthorized ORV vehicular visitation to the mines in the area. The point at which the former access road (now closed by wilderness designation) to the mine departs California State Highway 127 is located on the flat sparsely vegetated valley floor. Simply driving around any type of road barrier in such terrain easily defeats them. Miles of inappropriate and obtrusive fencing would need to be constructed to effectively establish a vehicular barrier" (NPS 2004).

Thus, the Park Service admits that ORVs trespass on Ibex Dunes and that it would not be possible to stop this trespass through physical barriers. This problem is compounded by the fact that law enforcement at Ibex Dunes does not exist, which would be the only other means to stop trespass. The Park Service law enforcement officer stationed closest to Ibex is no longer there and has not been replaced. Although ORV use is "occasional" at Ibex Dunes, it may still impact the Mojave Fringe-toed Lizard population, particularly because the population may be very small. Emmerich (1998) found only five *U. scoparia* at Ibex Dunes during over eight hours of survey, suggesting that small amounts of mortality may be sufficient to decimate the population.

Figure 8. ORV tracks at Ibex Dunes. Photo: Daniel R. Patterson, December, 2004.

Finally, the National Park Service is not monitoring Mojave Fringe-toed Lizard populations. A request to National Park Service for *U. scoparia* documents only yielded surveys from 1998. These surveys were not required by the Park Service, but were done by the personal initiative of a Park Service Ecologist who is no longer there (Emmerich, personal communication).

State of California. In 2002 the state of California passed AB 2274, which amended section 3870 of the California Vehicle Code, relating to off-road vehicles. The new noise emission standards are as follows.

(1) Any vehicle manufactured prior to January 1, 1973 may not exceed 92 dBa at a distance of 50 feet.
(2) Any vehicle manufactured on or after January 1, 1973, and before January 1, 1975 may not exceed 88dBa at a distance of 50 feet.
(3) Any vehicle manufactured on or after January 1, 1975, and before January 1, 1986 may not exceed 86 dBa at 50 feet.
(4) Any vehicle manufactured on or after January 1, 1986 may not exceed 82 dBa at 50 feet.

The new legislation is a step in the right direction, but is not sufficient to protect the lizard because most if not all vehicles will likely still exceed noise levels found to harm the Lizard and because ORVs travel in packs compounding the total noise. Hearing loss for *U. scoparia* may result in a decreased ability to locate prey and escape predators.

E. Other natural or manmade factors affecting its existence

Small population size and population isolation. The Amargosa River DPS of the Mojave Fringe-toed Lizard occurs as three disjunct populations and in the case of Coyote Holes and Ibex Dunes, small populations. Coyote Holes is less than 50 acres in size and thus supports what is very likely a small, vulnerable population (Emmerich, personal communication). A single occurrence from a pack of off-roaders or other disturbance could significantly harm the population. Similarly, limited survey data indicates the population at Ibex Dunes has a low density and thus potentially a small overall size. This potentially makes the population vulnerable to environmental or demographic stochasticity.

Air Pollution. Although the impacts of pollution on the Mojave Fringe-toed Lizard have not been studied, there are several sources of pollution in the range of the Amargosa River DPS that may be impacting the species. ORVs are a substantial source of air pollution, producing 118 times more smog-forming pollutants as modern automobiles on a per-mile basis (Cal/EPA Air Resource Board, 2003). In addition, smog from Los Angeles and the San Fernando Valley may reach the range of the Amargosa River DPS (Thompson, 1995). Air pollution from both sources may harm the Lizard.

Other sources of toxins that are cause for concern are agricultural pesticides, mining waste and others. The Lizard occurs on dunes which are formed by wind-borne particles. Any pollutants carried in these particles have the potential to enter Lizards food-chain and impact its health. Residual pesticides may be responsible for extirpations at historical sites. Local extirpation of *U. scoparia* at pristine sites, along with the absence or rarity of another usually abundant lizard in the area that also feeds on surface dwelling insects indicates extirpation caused possibly by residual pesticides (Morafka, 2002).

Global Climate Change. Another cause of concern for the Amargosa River DPS is climate change. As stated previously, Dumont and Ibex Dunes are associated with the lowest elevations and driest and hottest areas for the species (Murphy et al. In review). Projections for global climate change estimate that over the next 50 years there will be a 1.5-6.0°C rise in temperature (IPCC, 2001). Temperatures in western North America are expected to increase at a rate greater than the global average, and there is uncertainty about whether this will be accompanied by greater or lesser precipitation (Ibid.). This climate change may reduce the amount of vegetation that *U. scoparia* is dependent upon for thermoregulation and as a food source. This may also decrease the insects associated with these plants which *U. scoparia* also feeds on. Additionally, the temperature increase may shorten the breeding season and time for foraging. Being that this area is one of the hottest places in the world, one questions if the temperature increase may directly kill the lizard.

Invasive plants. A number of non-native plants occur in the range of the Amargosa River DPS of the Mojave Fringe-toed Lizard. Non native plants may reduce water available for native species. Additionally, non native species may thrive during the spring, but die off during the brutal desert summer, and thus provide less food and shade than native plants otherwise would.

V. Actions Needed for Recovery

A. Designation of critical habitat.

Petitioners request the designation of critical habitat for the Amargosa River DPS of the Mojave Fringe-toed Lizard concurrent with listing. Protection and recovery of Critical Habitat is vital to ensure the survival the Amargosa River Distinct Population Segment. In particular, the Mojave Fringe-toed Lizard needs immediate protection from the ravages of ORV recreation. Given the limited range of the Lizard, we recommend inclusion of all occupied habitat in critical habitat.

B. Immediate revegetation and invasive weed control projects at Dumont

As shown in Figure 2, Dumont Dunes is in need of immediate replanting of vegetation. This is required to provide shade, food, and cover for the Lizard. This restoration of habitat is essential to recovery efforts. Additionally, removal of non native plants is needed to ensure healthy habitat for the entire DPS.

C. Barriers

Construction of barriers in prime Mojave Fringe-toed Lizard habitat is feasible. These barriers would greatly decrease the possibility of entry into critical habitat from ORVs. The Coachella Valley Preserve System Draft Management Plan prepared for the BLM (2000a), for example, states that fencing and signing of Mojave Fringe-toed Lizard habitat would reduce the mortality of the lizard and habitat.

D. Law enforcement protection

Additional law enforcement protection is needed to ensure survival of the Amargosa River DPS. If certain areas are off limits a sign alone will not provide protection, evident in Figure 9 below. The BLM has recognized an increase in less compliant off-roaders at Dumont Dunes (BLM, 2004a), further evidence of a need for law enforcement protection. Additionally, illegal off-road activity is occurring at Ibex Dunes in Death Valley National Park (NPS, 2004, and Figure 8).

Figure 9. A sign alone is not enough to keep renegade off-roaders out in the California Desert. Law enforcement in addition to fencing is needed to protect species and habitat. Photo: Jim Rose, California Wilderness Coalition

VI. Conclusion

The Amargosa River population of the Mojave Fringe-toed Lizard qualifies as a Distinct Population Segment under the Endangered Species Act. It is discrete from other populations, far more genetically distinct from other lineages of *U. scoparia* than endangered *Uma inornata* is from its sister species *Uma notata* (Trépanier and Murphy 2001, cited in Murphy et al. In review), occurs in a unique ecological setting and its loss would result in a significant gap in the range of the species.

The Amargosa River DPS is severely threatened by ORVs in a significant portion of its range. As stated previously, Morafka (2002) found lower *U. scoparia* densities at Dumont Dunes in comparison to ORV closed areas at Red Pass and Bitter Springs. The federal government has already recognized the adverse affects of ORVs on Fringe-toed Lizard' habitat and prohibits ORVs in the endangered and threatened sister species *Uma inornata*'s habitat at Windy Point (FR 65: 81881, 2000). ORV use has increased more than 230% at Dumont Dunes in recent years (BLM 2004d), threatening this significant

population, as well as those found on nearby Coyote Holes and Ibex Dunes due to spillover ORV use.

Local extirpation of *U. scoparia* is a realistic concern. Morafka (2000) found no *U. scoparia* at Harper Lake, El Mirage, and Saddle-back Butte State Park/Wilsonia Gardens, all locations where the Los Angeles County Museum of Natural History records confirm historical presence. Recently the BLM has recognized extirpation at El Mirage (BLM, 2004b) most likely caused by intense ORV activity. The Amargosa River DPS of Mojave Fringed-toed Lizard needs immediate protection.

LITERATURE CITED

Ahrens, Michael. Personal communication. 2004. BLM, Barstow office, ORV coordinator.

BLM.2000a. Environmental Assessment for the Five Year Update of the Draft Management Plan for the Coachella Valley Preserve System. BLM EA# CA-660-01-06.Prepared by the Center for Natural Lands Management for the USDI, BLM.

BLM.2000b. News release: Q's and A's on Development of an ORV Management Strategy. Downloaded from BLM website http://www.blm.gov/nhp/news/releases/pages/2000/pr000110_ORV_qa.html (accessed 12/02/2004).

BLM. 2002. Environmental Assessment and Draft Plan Amendment for Western Colorado Desert Routes of Travel Designation. E.A. number CA-670-EA2002-2.

BLM. 2003. Barstow Field Office Business Plan. Barstow, California.

BLM. 2004a. Barstow Office, grant application to the State of California OHMVR Division, law enforcement grant, Barstow for 2005.

BLM. 2004b. Barstow Office, grant application to the State of California OHMVR Division, operation and maintenance grant, El Mirage for 2005.

BLM. 2004c. Dumont Dunes visitor information sign posted by BLM at "little" Dumont Dunes.

BLM. 2004d. Visits and Visitor Days for FY 1999-2004 by RMA. BLM Recreation Management Information Systems.

Brattstrom, B.H. 1979. The Effects of Dune Buggy Sounds on the Telenchephalic Auditory Evoked Response in the Mojave Fringe–Toed Lizard *U. scoparia*. U.S. Bureau of Land Management.CA-060-CT7-2737.

Busack S.D. and R.B. Bury. 1974. Some Effects of ORVs and Sheep Grazing on Lizard Populations in the Mojave Desert. Biological Conservation, 6:179-183.

Emmerich, Kevin. 1998. *U. scoparia* surveys, Ibex Dunes, Death Valley National Park. (NPS documents, 3 surveys).

Emmerich, Kevin. Personal communication. 2004. Former Death Valley Park Service Ecologist.

EPA. 1998a. Damage and Environmental Releases from Mines and Mineral Processing Sites. EPA Office of Solid Waste.

EPA. 1998b. Toxic Release Inventory.

DOI, BLM. 2002. Notice of availability and comment period for public review of the draft, BLM National off-road vehicle Management Strategy.

Hollingsworth, Bradford D. and Kent R. Beaman.1999. Mojave Fringe-toed Lizard. Downloaded from BLM PDF file http://www.ca.blm.gov/pdfs/cdd_pdfs/fringe1.PDF (Accessed 6/14/2004)

Hosier, P.E. and T.E. Eaton.1980. The Impact of Vehicles on Dune Grassland Vegetation on a South-Eastern North Carolina Barrier Beach. Journal of Applied Ecology 17:173-182.

Integrated Taxonomic Information System. On-line database http://www.itis.usda.gov. (Accessed 7/16/ 2004)

IPCC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T.,Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, USA, 881pp.

Jayne, Bruce C. and Duncan J. Irschick. 2000. A field study of incline use and preferred speeds for the locomotion of lizards. Ecology; Vol. 81 Issue 11, p29-69.

Knauf, Chris. 2001. Annual Monitoring Report 2001 (Draft). A draft comparative analysis of Colorado Fringe-toed lizard (*Uma notata*) populations in ORV open and closed areas of the Algodones Dunes, Imperial County, CA. Contained within BLM.2003. Imperial Sand Dunes Recreation Area, Grant Application (CA State OHMVR).

Lathrop, E.W. 1983. Recovery of Perennial Vegetation in Military Maneuver Areas. p. 265-277 in R.H. Webb and H.G. Wilshire, Editors. Environmental Effects of ORVs. Springer-Verlag, New York, NY.

Luckenbach, R.A. and R.B. Bury. 1983. Effects of ORVs on the Biota of Algodones Dunes, Imperial County, California. Journal of Applied Ecology, 20:265-286.

Mayhew, Wilbur W. 1996. Reproduction in the psammophilous lizard *U. scoparia*. Copeia, 1: 114-122.

Morafka, David J. 2000(revised final 1998-1999 Report). Biogeography, Demographics, and Potential Management of the Mojave Fringe-toed Lizard (*U. scoparia)* : A Species of Special Concern at the NTC, Ft. Irwin, CA and in proposed Acquisition Areas. U.S. Dept. of the Army, Corps of Engineers, Sacramento. Contract No. DAC05-98-p-0667.

Morafka, David J. 2002. 1000 meter transect analyses of frequencies of Mojave fringed-toed lizards at ORV BLM sites at El Mirage Dry Lake, Rasor Road, and Dumont Dunes, San Bernardino County, California, Summary Report for 2002 and recommendations for 2003. Prepared for Anteon Corporation.

Murphy, Robert W., Tanya L. Trépanier, and David J. Morafka. In Review. Conservation genetics, evolution, biogeography and distinct population segments of the Mojave Fringe-toed Lizard, *U. scoparia*.

NPS. 2000. Death Valley Revised Draft, Environmental Impact Study and General Management Plan July 2000. Chapter: Affected Environment, pp.117-118. Downloaded from http://www.nps.gov/moja/planning/devarevisedplan/ (accessed 10/01/2004).

NPS. 2001. Annual Performance Plan for Death Valley National Park, FY2002, VII Annual Goals, la 1A, Disturbed Lands.

NPS. 2004. Environmental Assessment: Rainbow Talc Mine Bat Gate Installation. Death Valley National Park, June 15, 2004. U.S. Department of Interior, National Park Service.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer (Accessed: July 16, 2004).

Pianka, Eric R. and Laurie J. Vitt. 2003. Lizards, Windows to the Evolution of Diversity. University of California Press.

Pough, F. Harvey. 1970. Burrowing of sand lizards. Copeia, no.1. pp. 145-157.

SDEIS. 2004. Public Draft, Supplemental Draft Environmental Impact Statement, Proposed Addition of Maneuver Training Land at Ft. Irwin, CA. Prepared for U.S. Army National Training Center, CA. Prepared by Charis Corporation, Temecula, California.

Stebbins, Robert C. 1944. Some aspects of the ecology of the iguanid genus, *Uma*. Ecological Monographs, vol. 14, no 3, p 311-332.

Stebbins, Robert C. 1966. Field guide to western reptiles and amphibians. Houghton Mifflin Publishers.

Stebbins, Robert C. 2004. Peterson's Field Guides, Western Reptiles and Amphibians. Houghton, Mifflin Publishers.

Thompson, C. Ray. 1995. Air pollution effects on desert plants. pp.481 in J. Lattings and P.G. Rowlands, editors. The California Desert: An Introduction to Natural Resources and Man's Impact.

Trépanier, Tanya L. and Robert W. Murphy. 2001. The Coachella Valley fringe-toed lizard *Uma inornata*: Genetic diversity and phylogenetic relationships of an endangered species. Molecular Phylogenetics and Evolutions, 18: 327-334.

Turner, F.B., D.C. Weaver, and J.C. Rorabaugh. 1984. Effects of reduction in windblown sand on the abundance of the Fringe-toed Lizard (*Uma inornata*) in the Coachella Valley, California. Copeia No. 2: 370-378.

USDA Forest Service, 2004. Off Highway Vehicles on Arizona Forests. Downloaded from http://www.fs.fed.us/r3/ORV/faq/ click on question 19. (Accessed 9/16/2004).

USGS 2001. Flooding in the Amargosa River Drainage Basin, February 23-24, 1998, Southern Nevada and Eastern California, including the Nevada Test Site. Fact Sheet 036-01. Prepared by Tanko, Daron J. and Patrick A. Glancy. Downloaded from http://water.usgs.gov/pubs/fs/fs-036-01/text/fs03601.htm (Accessed 12/28/2004).

ACKNOWLEDGEMENTS: Robert L. DeMaggd, Noah Greenwald.