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MEMORANDUM August 25, 2006

To: Desert Tortoise Management Oversight Group

From: Desert Tortoise Recovery Coordinator, Nevada Fish and Wildlife Office, Reno

Subject: August 15, 2006, Meeting Summary

The Desert Tortoise Management Oversight Group met on August 15, 2006, at the Suncoast Casino in Las Vegas, Nevada. The meeting focused on updates and discussion of 1) the range-wide monitoring program; 2) conceptual recovery criteria developed by the Desert Tortoise Science Advisory Committee (SAC); and 3) the Situation Assessment regarding collaborative recovery planning, which was conducted by the U.S. Institute for Environmental Conflict Resolution (Institute) and Center for Collaborative Policy (Center). Meeting schedules and summaries can be found at: http://www.fws.gov/nevada/desert_tortoise/dtro_meet_events.html.

Range-wide Monitoring Program

Linda Allison and Roy Averill-Murray (Desert Tortoise Recovery Office [DTRO]) gave a brief update on the range-wide monitoring program. The Desert Tortoise Monitoring Committee (DTMC) has been using the data from the 2001-05 survey efforts to evaluate the objectives, direction, and implementation of the program. Sampling is planned for 2007 at levels similar to 2005, so a similar funding commitment will be necessary. Modifications to the sampling design will be made based on lessons learned from the results to date. Exploration of ways to monitor habitat or threats will continue and build upon data that were collected in 2005, but the emphasis of 2007 surveys will remain on tortoise populations. The DTMC will develop a study plan outline prior to the 2007 field season, and this outline will be fully developed into a formal study plan by 2008.

The draft 2001-05 summary report was distributed for comment in March and comments were received through the beginning of August. The DTMC has been addressing those comments and completing additional analyses (particularly 2005 density estimates). Roy committed to work with the DTMC to complete the final report as close to the end of August as possible.

Recovery Criteria Concepts

Roy presented conceptual recovery objectives and criteria that the SAC has developed over the course of several meetings for consideration for the revised recovery plan. The objective of the presentation was to present the concepts and receive feedback from the MOG and stakeholders. The SAC is meeting on September 16-17 and will refine the criteria. **Formal, written comments may also be sent to Roy Averill-Murray prior to this meeting.** Four concepts have been the focus of discussion: 1) desert tortoise demography, 2) distribution, 3) habitat, and 4) threats. Attachment 1 outlines these concepts.

Issues that were raised following the presentation included:

- Recovery criteria must be objective, measureable, and do-able
- What is the relationship of the habitat criteria and critical habitat? What is the baseline against which recovery will be measured, especially related to critical habitat?
- Do the criteria define how much is enough habitat?
- Can the 2001-05 population monitoring data be used to set a new baseline?
- Are self-sustaining populations at low levels sufficient? Should a minimum population number be identified?
- The concept of tortoise population stability should be reconsidered and modeled for long-term sustainability given population response to dramatic environmental fluctuations
- How do the demographic criteria fit within the range-wide monitoring program?
- When does the clock start for evaluating recovery?
- Clarify interim evaluation (i.e., before 25 years) and application of adaptive management
- Need recommendations for the size and number of demographic study areas
- Need to consider cause of death of different age classes
- Permanent study plot histories can help provide an assessment of the baseline and may reflect changes in management
- Criteria need to factor in human population growth

After the SAC refines the criteria, a meeting between the SAC and MOG will be scheduled to discuss the details further.

Stakeholder Assessment

Mike Eng (Institute) and Austin McInerny (Center) presented preliminary results and recommendations from the situation assessment conducted between March and August 2005. Attachment 2 includes their presentation, as well as a summary of the subsequent questions, comments, and responses. A formal, draft report is planned to be distributed by September 15. Comments should be provided to the Institute by October 27, and a final report with responses to comments will be provided by November 10.

ATTACHMENT 1

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CONCEPTUAL RECOVERY OBJECTIVES AND CRITERIA
August 15, 2006

The Desert Tortoise Science Advisory Committee (SAC) developed the following conceptual recovery objectives and criteria for the revision of the desert tortoise recovery plan. The SAC reviewed the 1994 delisting criteria (attached below) in light of current tortoise status and management efforts, experience in developing and striving to achieve recovery criteria for the desert tortoise and other listed species, and new information relevant to recovery and monitoring efforts. This document includes four conceptual recovery objectives and associated recovery criteria for consideration in replacing the 1994 delisting criteria. These concepts address desert tortoise demography, distribution, habitat, and threats, respectively, and are followed by a rationale section that describes how they relate to and are intended to improve upon the 1994 delisting criteria.

Discussion continues among the SAC on defining the objectives and criteria more specifically, so input from managers and stakeholders at this stage will inform the SAC on practical implications of the concepts described. A future meeting is planned specifically between the SAC, managers, and stakeholders to discuss draft recovery objectives and criteria in a more detailed form.

**Recovery Objective 1 (Demography):** Maintain well distributed, self-sustaining populations of desert tortoises into the future.

Recovery Criterion 1: Demographic criteria would be evaluated over a tortoise generation (25 years) AND within demographic study areas (see the Rationale for ideas behind demographic study areas).

Recovery Criterion 1a: Desert tortoise population growth rates are stable or increasing.

Recovery Criterion 1b: Desert tortoise density is stable or increasing.

Recovery Criterion 1c: Desert tortoise survival rates are stable or increasing.

Recovery Criterion 1d: Desert tortoise recruitment is increasing.

**Recovery Objective 2 (Distribution):** Maintain a broad and stable-to-increasing distribution of desert tortoises within each recovery unit *(note that recovery units remain to be evaluated)*.

Recovery Criterion 2: Distribution criteria would be evaluated over a tortoise generation (25 years).

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Recovery Criterion 2a: Desert tortoise distribution, across public lands and private conservation lands within each recovery unit, is stable or increasing.

Recovery Criterion 2b: Desert tortoise distribution within geographic subunits of each recovery unit is stable or increasing.

**Recovery Objective 3 (Habitat):** Ensure that habitat within each recovery unit is protected to allow long-term viability of desert tortoise populations.

Recovery Criterion 3a: A GIS model has been developed to identify desert tortoise habitat and non-habitat.

Recovery Criterion 3b: A habitat-tracking system, based on the habitat model above, is in place and implemented to monitor the status of desert tortoise habitat across the tortoise's range.

Recovery Criterion 3c: The quantity and quality of desert tortoise habitat across public lands and private conservation lands is stable or improving.

**Recovery Objective 4 (Threats):** Threats to desert tortoise population persistence are sufficiently mitigated to ensure the continued existence of the species.

Recovery Criterion 4: Management plans or cooperative agreements have been implemented within each recovery unit to ensure the maintenance of Recovery Criteria 1-3. Each plan or agreement must contain:

a) explicit management actions that reflect the risks facing desert tortoise population persistence within that recovery unit,

b) management strategies that ensure that the plan is evaluated and revised regularly,

c) a system to track the implementation of management actions, and

d) assurances that the plan will be implemented.

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## RATIONALE

The 1994 Desert Tortoise Recovery Plan[1] identified the following recovery objective and five delisting criteria.

> Recovery objective: … recovery and delisting of the Mojave population of the desert tortoise.
>
> Delisting Criterion 1: As determined by a scientifically credible monitoring plan, the population within a recovery unit must exhibit a statistically significant upward trend or remain stationary for at least 25 years (one desert tortoise generation).
>
> Delisting Criterion 2: Enough habitat must be protected within a recovery unit, **or** the habitat and the desert tortoise populations must be managed intensively enough, to ensure long-term population viability.
>
> Delisting Criterion 3: Provisions must be made for population management in each DWMA so that population lambdas are maintained at or above 1.0 into the future.
>
> Delisting Criterion 4: Regulatory mechanisms or land management commitments have been implemented that provide for adequate long-term protection of desert tortoises and their habitat.
>
> Delisting Criterion 5: The population in the recovery unit is unlikely to need protection under the Endangered Species Act in the foreseeable future. Detailed analyses of the likelihood that a population will remain stable or increase must be carried out before determining whether it is recovered. These analyses should include observed and anticipated effects of: (a) fluctuations in abundance, fecundity, and survivorship; (b) movements of desert tortoises within the area and to or from surrounding areas; (c) changes in habitat, including catastrophic events; (d) loss of genetic diversity; and (e) any other threats to the population all might be significant and should be important elements that should be considered in such an analysis.

In reviewing the 1994 delisting criteria, we should distinguish between the recovery objective and criteria listed in the 1994 recovery plan and current guidance. Current guidance[2] defines recovery goals, objectives, and criteria. In particular, the term "objective" has been modified to be more consistent with general planning terminology. Therefore, the 1994 Recovery *Objective* ("Delisting through recovery") now corresponds to the overall Recovery *Goal*. Recovery objectives should provide parameters for the recovery goal of delisting the tortoise, and each recovery objective should include "objective, measurable criteria which, when met, would result in a determination … that the species be removed from the list (of threatened and endangered species)."[3] Several of the 1994 delisting criteria better fit the current concept of recovery objectives.

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[1] Fish and Wildlife Service. 1994. Desert tortoise (Mojave population) recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 73pp plus appendices.
[2] National Marine Fisheries Service. 2004. Interim Endangered and Threatened Species Recovery Planning Guidance (developed in conjunction with the Fish and Wildlife Service).
[3] ESA, Section 4(f)(1)(B)(ii).

Recovery *Criteria*:

- can be viewed as the targets, or values, by which progress toward achievement of recovery objectives can be measured;
- should address representation (conserving the breadth of the genetic makeup of the species to conserve its adaptive capabilities), resiliency (ensuring that each population is sufficiently large to withstand stochastic events), and redundancy (ensuring a sufficient number of populations to provide a margin of safety for the species to withstand catastrophic events);
- must include the management or elimination of threats, addressing the five statutory (de-) listing factors; and
- must be measurable and objective (but they need not all be quantitative).[4]

The following narrative describes the basis for the revised recovery objectives and criteria.

Recovery Objective/Criteria 1

This objective and associated criteria expand upon the 1994 plan's first and third delisting criteria by focusing on trends in demographic parameters necessary for recovery. The identified set of parameters encompasses characteristics of populations recovering to the point that ensures their viability. Specific target numbers (e.g., 100 tortoises/sq. mi.) would be avoided, however. Instead, the targets would be stable-to-increasing trends over 25 years (a tortoise generation). Basing the criteria on trends has an important advantage over arbitrarily setting specific target numbers. Measuring trends in demographic parameters provides for ecologically based differences in those parameters between geographic areas and accounts for potentially different baselines in those areas. For example, natural densities may differ between populations in the Upper Virgin River and Colorado Desert,[5] so a single target density would not apply to both areas. Age structure is included in Criterion 1d rather than fecundity (egg-laying rates or hatchling production) due to the difficulty of measuring fecundity and the low and highly variable survival of eggs and hatchlings. The actual size class of juveniles to be measured under Criterion 1d (e.g., all tortoises <180mm carapace length, 100-180mm, etc.) would be determined by the available data and any potential new techniques for detecting small tortoises.

The concept of "demographic study areas" is introduced to focus sampling efforts at a scale at which statistically defensible trends of the desired population parameters can be measured. The number and size of demographic study areas remain to be defined, but 1) they should be small relative to the size of each recovery unit, 2) they should form a representative sample of each recovery unit, and 3) they may be based on outcomes of the habitat model identified below. Measuring population parameters within demographic study areas within each recovery unit addresses the recovery concepts of representation and resiliency.

Demographic study areas should not include elevated management above that in the surrounding areas, such as headstarting, provision of supplemental water during drought, etc. They should be representative of what is happening on the landscape with respect to regional management. Intensive manipulation, such as headstarting and supplemental watering, should be directed

[4] National Marine Fisheries Service. *op cit.*

[5] R.C. Averill-Murray, et al. 2006. Range-wide Monitoring of the Desert Tortoise: 2001-05 Summary Report. Draft report. U.S. Fish and Wildlife Service, Reno, NV. 75pp.

toward experimental areas established separately from demographic study areas. Demographic study areas may provide controls for such experiments.

Recovery Objective/Criteria 2

Recovery Objective 2 and Criteria 2a-b would supplement monitoring local demographic parameters by focusing on tortoise populations across the entire landscape. The 1994 recovery plan only indirectly addresses this issue in its second delisting criterion, which requires enough habitat to ensure viable tortoise populations. The 1994 plan ignores potential metapopulation processes acting across the vast spatial scale of each recovery unit by lumping all populations within each unit (particularly in the first and third delisting criteria).[6] The complete loss of some populations could temporarily be balanced by increased density within other populations, which would potentially place the entire stakes of recovery on fewer, more isolated populations.

Criterion 2a calls for a stable tortoise distribution, as measured by occupancy,[7] across the remaining range of the tortoise. Criterion 2b would divide the tortoise's current range into smaller "geographic areas" to ensure that populations are well distributed across the range (Fig. 1). How these geographic areas would be defined is relatively unimportant, but they may be based on vegetation classifications, ecosystem units, current population distribution information, genetic data, or other information. The intent is simply to ensure that the broad distribution of tortoises is not further reduced across a recovery unit; therefore, these recovery criteria would help provide for representative, resilient, and redundant populations. Each geographic area should include at least one demographic study area.

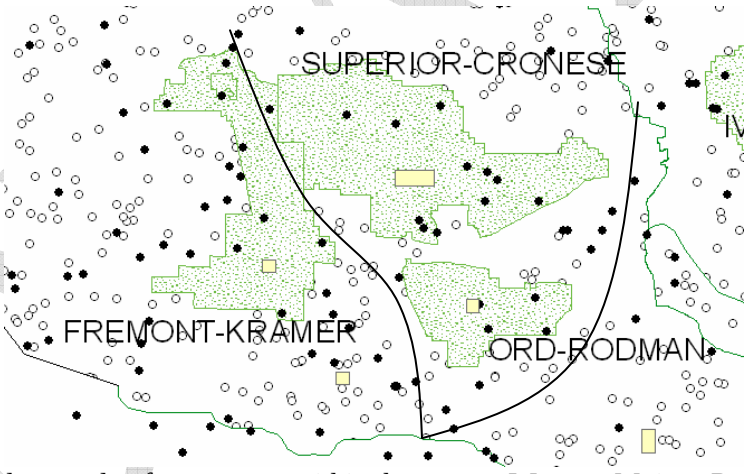


Figure 1. Hypothetical example of occupancy within the current Western Mojave Recovery Unit. Stippled green polygons = designated critical habitat; filled circles = samples with tortoises; open circles = samples without tortoises. Recovery Criterion 2a would evaluate trends in the level of tortoise occupancy across the entire recovery unit. Criterion 2b would further evaluate trends within each "geographic area," delineated by the dark lines, in order to better detect declines in occupancy within particular geographic areas of a recovery unit.

An important requirement of these criteria would be the establishment of a precise baseline of the area over which tortoise occupancy is measured, so occupancy over time will be measured

[6] C.R. Tracy, et al. 2004. Desert Tortoise Recovery Plan Assessment. Report to U.S. Fish and Wildlife Service. 217pp.

[7] D.I. MacKenzie, et al. 2006. Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence. Elsevier, Amsterdam. 324pp.

and compared against the same standard established at the time of the recovery plan revision. Importantly, this objective and its associated criteria would apply to the tortoise's entire distribution, not only to populations within designated critical habitat. Combined with habitat modeling under Objective 3, sampling both inside and outside designated critical habitat could provide a test of the existing "critical habitat model," provide a comparison of tortoise populations subject to different management inside and outside critical habitat, as well as recognize potentially important genetic lineages not included within critical habitat. Note that the criterion would not require tortoises to occupy *all* public lands, but the *level* of occupancy across these lands should remain stable or increase.

Recovery Objective/Criteria 3

Declining populations require intensive habitat management to stabilize and reverse trends. Much is known about what constitutes desert tortoise habitat, but we currently lack a method of monitoring changes in the quantity and quality of habitat, especially in the face of rapid urbanization, invasion by exotic plants, and increasing frequency and magnitude of fires. This recovery objective directly parallels the second delisting criterion in the 1994 recovery plan, but it also includes criteria that call for a mechanism to track the status of different habitat categories (e.g., critically important/biological core, moderate, degraded, non-habitat). Management agencies would report habitat status within their lands based on the GIS habitat model.

In order to manage desert tortoise habitat well enough to ensure sustainable trends in tortoise density and distribution, we must be able to link habitat data to tortoise demographic data. The habitat model should be designed to help us learn as much as possible about minimum conditions for potential tortoise occupancy and, therefore, allow us to analyze occupancy as a function of habitat characteristics. Maintaining stable-to-increasing trends in both tortoise distribution and habitat quantity, as well as maintaining quality habitat, provides opportunities to balance habitat degradation or loss in some areas with restoration of degraded habitat in other areas. The habitat model should identify thresholds below which habitat degradation fails to provide the minimum conditions for potential occupancy. The monitoring system needs a baseline delineation of habitat that includes the historic distribution of the tortoise (i.e., areas potentially containing tortoises at present, as well as in the future), less those areas already lost completely or degraded below suitability for tortoise occupancy. This system would provide an accountable "ledger" of habitat status so that restored areas could be added to the positive side and degraded or lost areas added to the negative side. We would then be able to quantitatively measure the amount of occupied habitat, the amount of newly available (restored) habitat for tortoises to expand into, the rate that restored habitat is occupied, and effectiveness of the restoration.

Recovery Objective/Criteria 4

This recovery objective parallels the fourth and fifth delisting criteria in the 1994 recovery plan. It incorporates the concept of conservation-reliant species and the need for ongoing management for these species.[8] However, very little still is known about the demographic impacts on tortoise populations of any of the various identified threats or the relative contributions each threat makes to tortoise mortality.[9,10]

[8] J.M. Scott, et al. 2005. Recovery of imperiled species under the Endangered Species Act: the need for a new approach. Front. Ecol. Environ. 3:383-389.
[9] Boarman, W.I. 2002. Threats to desert tortoise populations: a critical review of the literature. Report to West Mojave Planning Team, Bureau of Land Management. U.S. Geological Survey, Sacramento.
[10] C.R. Tracy, et al. *op cit.*

This criterion assumes that threat mitigation will have been successful if Recovery Objectives 1-3 have been met. While it is important to understand as much as possible about the direct links between threats and tortoise population response (i.e., cause and effect), the number of potential threats affecting desert tortoises and the nature of the species' life history (especially long generation time) may make it impractical to reach this level of understanding completely. Specific recovery actions, including research, must be implemented to identify sets of threats that contribute to a greater number of mortality mechanisms or affect size structure or fecundity. Experimental (or, in some cases, observational) studies should be applied to specific areas to better understand the relationship of threats, management actions, and tortoise populations.

The relative strengths of hypothesized connections between threats and mortality must also be assessed (some individual linkages may be more important than multiple linkages from other threats). This assessment should be based on data from research designed specifically to elucidate relationships between threats and mortality. As quantitative information on threats and tortoise mortality is obtained, more effective management actions can be identified, prioritized, and implemented through management plans or cooperative agreements. In addition, new information may contribute to the development of more specific threats-based recovery criteria during future recovery plan review or revision.

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