Eldorado Valley Post Translocation Surveys
Clark County, Nevada

Final Project Report

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CONTRACT TITLE: Eldorado Valley Post Translocation Surveys
PROJECT NUMBER: 2017-GBI-1741A
REPORTING DATE: September 15 2024
PI: Scott Cambrin, Senior Biologist, Desert Conservation Program
DELIVERABLE: Final Project Report (D33)

EXECUTIVE SUMMARY

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Contract Title: Eldorado Valley Post Translocation Surveys

This report documents Eldorado Valley post-translocation surveys of the Mojave desert tortoise *(Gopherus agassizii*) by the Great Basin Institute (GBI) in spring 2024. The Clark County Desert Conservation Program (DCP) and the U.S. Fish and Wildlife Service (FWS) translocated tortoises from the Desert Tortoise Conservation Center (DTCC) and monitored the effectiveness of translocation efforts. GBI coordinated with the DCP to conduct transect surveys and telemetry (G0) for desert tortoises in Eldorado Valley prior to and after translocation.

In collaboration with FWS, GBI provided desert tortoise handling and field training, field data collection, logistical support, quality assurance/quality control (QA/QC) data checks, and GIS mapping. GBI hired a support staff consisting of a data specialist responsible for QA/QC-GIS, and a field crew consisting of three crew supervisors, seven survey technicians, and two telemetry technicians.

The study design included four survey plots (Release 1, Release 2, Control 1, and Control 2) of equal size. Each plot was 5 x 5 km and contained 100 5 km transects. Transect walkers surveyed two 5 km transects each day from 1 April through 21 May 2024. Tortoises found were equipped with paper tags with unique numbers, provided the tortoises were accessible and the ambient shaded temperature was below 35ºC. Telemetry surveys began 1 April 2023 and ran concurrently with transects to capture expected visibility.

Transects teams found 92 live tortoises and 140 carcasses during the field season. Of the live observations, 87 were recaptures and 5 were opportunistic. Of the carcasses, 129 were found on transect while 11 were opportunistic, and 22 had existing tags. Telemetry was conducted using 13 animals, for a total of 1409 observations.

INTRODUCTION

Project Background

The Mojave desert tortoise (*Gopherus agassizii*) is federally listed as threatened under the Endangered Species Act (USFWS 1990) and is a priority species for conservation under the Multiple Species Habitat Conservation Plan in Clark County, Nevada (Clark County 2000). The Clark County Desert Conservation Program (DCP) and the U.S. Fish and Wildlife Service (FWS) translocated tortoises from the Desert Tortoise Conservation Center (DTCC) to a population in Eldorado Valley, and conducted pre- and post-translocation monitoring to assess effectiveness of translocation efforts. Prior to translocation in 2014, data were collected for comprehensive health assessments and baseline information. Post-translocation surveys were first conducted in 2015 and 2016 to estimate abundance, density, and expected visibility of desert tortoises using line distance sampling methods. Monitoring continued in 2023 and 2024 using the same methods (USFWS 2022). This document provides information on methods and materials implemented during data collection and management, as well as results for the 2024 field season.

Project Description

Beginning 2014, the Great Basin Institute (GBI) coordinated with DCP to monitor the abundance and density of desert tortoises in Eldorado Valley at four study plots: two release plots, which served as translocation areas, and two control plots, which did not receive DTCC tortoises. Project study plots are located within a Bureau of

Land Management Area of Critical Environmental Concern at the north end of Eldorado Valley, which is southwest of Boulder City and bisected by Highway 95 (Figure 1). The two release plots (Plots 1 and 2) are between 1 and 8 km west of Highway 95, within 932 and 1,250 m elevation, with east to east-northeast aspects. The two control plots (Plots 3 and 4) are adjacent to the release sites, and between 758 and 1,250 m elevation, with a west and northeast aspect, respectively. An established telemetry site is located in Piute Valley, approximately 29 km south of the plots.

In 2024, GBI hired a staff of 12 personnel to conduct spring monitoring: 4 crew supervisors, 5 transect technicians, 2 telemetry technicians, and one data manager. Terry Christopher reprised his role as program coordinator, a position he has filled since 2007 on similar projects in collaboration with DCP and USFWS. James Cash returned to the project as project manager taking responsibility over all project logistics. At the beginning of the season, GBI collaborated with FWS and DCP to conduct training from 4 March to 29 March. Training covered survey protocols, tortoise handling, desert safety, and GBI protocols. Field staff were assessed by GBI and FWS project management personnel for proper transect and data collection protocol, as well as by DCP staff and a wildlife veterinarian for safe tortoise handling protocol.

Surveys took place between 1 April through 21 May, and consisted of 100 transect surveys per plot, for a total of 400 transect surveys to monitor the success of the translocated tortoises (Figure 1).

Focal telemetry surveys corresponded with transect surveys in both location and time to serve as a correction factor for tortoises visible on the landscape during transect surveys (referred to as G_0 monitoring). Two telemetry monitors recorded multiple observations per day for a set of tortoises equipped with radio transmitters in Piute-Mid. Telemetry surveys began each day before transect start times, and continued until transects were concluded or about 4 PM (adjusted +/- 60 min depending on start time), whichever came first.

Data were collected by the data manager at the end of each week and were examined for errors and inconsistencies. Written assessments of the data were produced by USFWS Desert Tortoise Monitoring Coordinator, Corey Mitchell, in order to give feedback to field crews on the data they were collecting. Data were submitted to Clark County DCP on a regular basis, with a QAQC l final database submitted at the end of the field season.

Project Goals and Objectives

The overarching objectives of Eldorado Valley post-translocation surveys are to:

1. Conduct post-translocation monitoring at two release sites and two control sites using line distance sampling methods
2. Conduct monitoring at the telemetry site in Piute Valley to calibrate the results of transect surveys in the release and control sites in the Eldorado Valley

The specific goals of desert tortoise transect surveys and G0 are to:

1. Record data on live tortoises and carcasses found to determine abundance and density
2. Assess the visibility of tortoises in order to calibrate the results of transect surveys

METHODS AND MATERIALS

Training

Technicians were trained on proper tortoise handling, LDS protocols, GBI protocols, and desert safety, which included a two-day wilderness first aid course.

Technicians recorded practice data from live captive tortoises as they would in the field, with emphasis placed on tortoise safety, biosecurity, and data accuracy. Technicians were evaluated by staff from GBI, DCP, FWS, and a wildlife veterinarian on their ability to follow handling protocols.

The LDS protocols training covered how to use GPS and compasses for navigation, calculate transect start points, reflect transects for human-made obstacles, interrupt transects for landscape obstacles, record data in paper and electronic formats, and develop a search image for tortoises.

A training course was set up to determine technicians' rate of detection. The course consisted of 288 tortoise models made from painted Styrofoam and concrete, placed at known locations along 12 two-kilometer long transect lines marked by colored poles. Each team was asked to record observations on an 8-kilometer trial and a 16-kilometer trial (over two days) so that project managers could provide feedback about each team's search pattern and ultimately build a detection curve for each team based on the observations that were recorded. The detection curve will be used in the post-season analysis.

Once detection curves were built, teams completed practice transects at the Large-Scale Translocation Site near Jean, NV. Data were assessed by GBI staff for accuracy, completeness, and consistency.

Transects

The study design included four survey plots (Release 1, Release 2, Control 1, and Control 2) of equal size. Each plot was 5 x 5 km and contained 100 5 km transects (500 km/site) walked at cardinal bearings of 90° or 270°. Transects were created 50 m apart in each plot and assigned a random walkorder, then were grouped to allow adjacent transects to be surveyed together when possible (to improve logistical efficiency, provide safety in case of emergency, and allow for two-person processing of live animals). . Transect surveys began at 9:00 AM, 1 April 2024, with progressively earlier start times as needed, but never before 30 minutes after sunrise, and continued through 16 May 2024. Biologists used a Garmin Global Positioning System (GPS), set to Universal Transverse Mercator (UTM), World Geodetic System 1984 (WGS84), Zone 11 North to locate transect start points and record spatial data. All data were collected in both hardcopy and electronic format. Electronic data were recorded on an iPad mini using the application, Survey123, with an integrated GPS set to UTM, WGS84, Zone 11 North.

Observations

Teams recorded information for live tortoises and carcasses found on and off the transect paths. When either was observed, the team collected location information and made a series of measurements from the transect path to the tortoise that were used later in density estimation analysis.

For live tortoise observations, teams recorded the visibility and behavior upon initial observation, measured the mid-line carapace length (MCL), determined the sex, and assigned a body condition score (BCS). When possible, all live tortoises were marked using a paper tag with a unique FWS number. Tortoises were handled with minimal contact by one individual wearing single-use gloves. All equipment that came into contact with an animal was disinfected with a chlorhexidine and water solution (one ounce concentrated chlorhexidine per one gallon of water). Tortoises were not handled if the ambient shaded temperature was over 35º Celsius, if they were too deep in a burrow to safely access, or if they were engaged in social interaction, among other reasons. Technicians documented any reason that prevented them from collecting the full suite of required data.

Carcass observations were only recorded when more than half the shell was present. If enough of the carapace was attached to properly measure MCL then the carcass was considered intact. If the carcass was not sufficiently intact to measure the MCL, it was considered to be disarticulated and the team estimated the MCL to be greater or less than 180 millimeters. When possible, teams recorded sex and searched the carcasses for evidence of ID tags.

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Live tortoises were recorded as transect tortoises if they were found while the observer walked a transect line.Tortoises observed while walking to or from a start point, driving to a transect, or at camp were recorded as opportunistic. Data from opportunistic observations are useful, but ultimately not included in the teams' final detection curve.

Telemetry
The primary goal of conducting G_0 telemetry surveys was to gather information to estimate the proportion of the tortoises in the local area that were visible, which can serve as a correction factor for the transect surveys. Telemetry surveys were conducted in conjunction with LDS surveys. Telemetry surveys were conducted at Piute-Mid, where a group of 13 tortoises was equipped with radio transmitters. Telemetry surveys began each day before transect start times, and continued until transects were concluded or about 4 PM (adjusted +/- 60 min depending on start time), whichever came first. For each observation, the monitor recorded the location, visibility, and behavior of the tortoise.

Data Processing
Data were recorded in the field on paper datasheets and in an electronic data collection application on iPad Mini tablets (Survey123, an ESRI produced app). At the end of each field day, biologists exchanged and reviewed each other's paper and electronic data to verify consistency of data collection. At the end of each week, paper datasheets were collected, and the electronic data was uploaded into an ArcGIS Online database. Data were then downloaded from the ArcGIS Online database into a Microsoft Access database where they were verified, examined for errors, and corrected using automated QA/QC scripts and visual checks on both spatial and tabular data. Written assessments were produced weekly at minimum to provide feedback to field teams on the data that they recorded.

RESULTS
Objectives Completed

1. *All transect surveys completed within all plots (Plots 1 through 4):*
    - Surveys conducted 1 April through 21 May 2024
    - Four plots completed
    - 400 transect lines walked
2. *Data collected on live tortoises and carcasses found during transect surveys:*
    - 92 total live tortoise observations
    - 140 total carcass observations

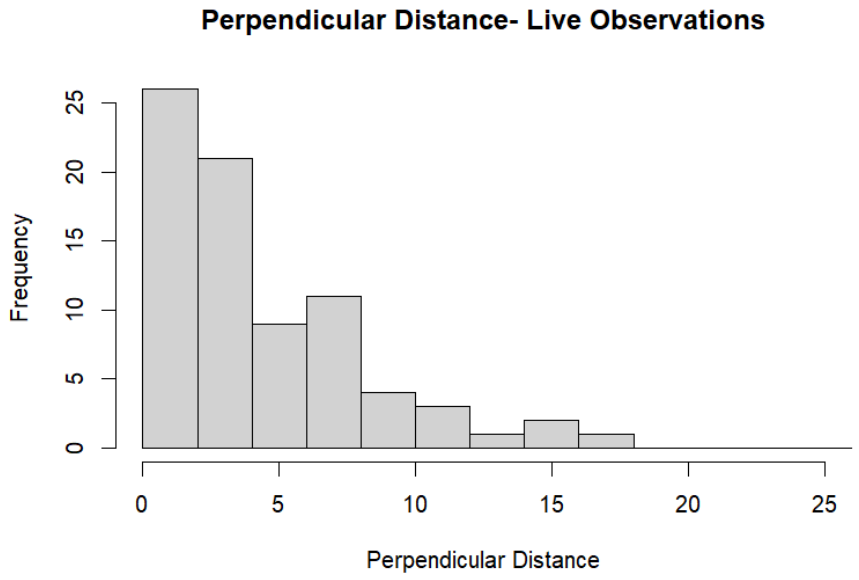

Figure 1: Histogram of live observations of tortoise > 180mm MCL

3. *Visibility of resident tortoises in Piute-Mid conducted during transect surveys to calibrate results:*

- Monitoring conducted 1 April through 21 May 2024
- 13 telemetered tortoises tracked
- 1,409 total observations

Transects

A total of 400 transects were assigned and surveyed within the four plots in Eldorado Valley (100 transects/plot). Transects were completed between 1 April through 21 May 2024. Roughly a third of the transects were accessed via a road that bisected the transect, requiring technicians to survey the transect in 2 distinct sections. These "split" transects were considered to be planned modifications . Transects interrupted for difficult terrain, injury, walking off the assigned bearing or incomplete due lack of time is denoted as an unplanned modification. A total of 41 transects had to be revisited for better plot coverage due to a prior interruption for terrain and/or time. 33 of the 41 revisited transects were completed in a one week extension to the project.

Table 1 Summary of transects assigned and walked during the 2024 field season

Plot	Transects Assigned	Transects Walked	Transects with Planned Modifications*	Transects with Unplanned Modifications
1	100	100	34	23
2	100	100	35	50
3	100	100	24	9
4	100	100	34	2
Total	400	400	127	84

*Planned modifications refer to transects interrupted due to road access

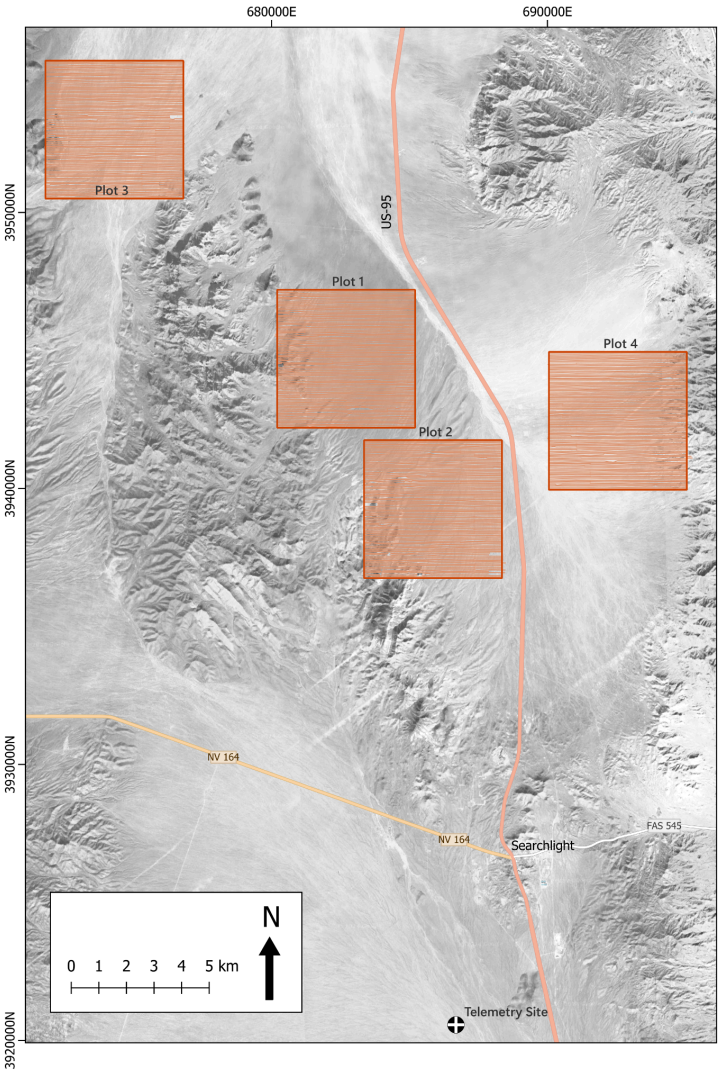

Figure 2. Map of walked transect paths in Eldorado Valley plots with telemetry site locality.

Tortoises

In 2024, 87 live tortoises were observed on transects, and 5 additional tortoises were observed opportunistically for a total of 92 tortoises observed (Table 3). Of the total observed, 47 did not have the full suite of data (attached tag, MCL, BCS, nare discharge/appearance, sex) collected due to various reasons, such as being too deep in a burrow. 10 had a measured or estimated MCL less than 180 millimeters (3 unknown), and 10 had an existing tag (10 unknown). Of the total live tortoises, 32 were females and 36 were males (24 unknown).

Table 2 Tortoises observed on transects and opportunistically during the 2024 field season

Plot	Transect Live Tortoises	Opportunistic Live Tortoises	Total Live Tortoises
1	15	0	15
2	27	1	28
3	16	1	17
4	29	3	32
Total	87	5	92

Carcasses

In 2024, 129 carcasses were observed on transects and 11 carcasses were observed opportunistically (Table 2). Of the total carcasses observed, 22 had an existing tag (22 unknown), 79 were intact (Table 3), and 16 were estimated or measured to have a MCL of less than 180 millimeters (6 unknown). Of the total carcasses, 27 were females and 49 were males (64 unknown).

Plots 1 and 2, which are Release sites, had higher numbers of total tortoise carcass observations (27 and 75, respectively) than Plots 3 and 4, which are Control sites (21 and 17 total carcass observations, respectively).

Table 4 Tortoise carcasses observed on transects and opportunistically during the 2024 field season

Plot	Transect Carcasses	Opportunistic Carcasses	Carcasses with Existing Tag
1	26	1	2
2	69	6	20
3	18	3	0
4	16	1	0
Total	129	11	22

Table 3 Intact and disarticulated carcasses observed on transects during the 2024 field season

Plot	Intact	Disarticulated
1	23	14
2	35	34
3	10	8
4	11	5
Total	79	61

Telemetry

Technicians made 1,409 G_0 observations of tortoises equipped with radio transmitters over 29 days for an average of 48.6 observations per day (Table 4).

Table 4 G_0 Observations of tortoises by telemetry monitors during the 2024 field season

Stratum	Transmitter Equipped Tortoises	Days Surveyed	Observations	Average Observations per Day
Piute-Mid	13	29	1,409	48.6

DISCUSSION

Several unforeseen circumstances during the field season necessitated a one week extension, from 13 May to 16 May 2024. A total of 113 transects/transect segments were walked during this extension week (some transects had not been walked at all previously, others had been partially surveyed and needed to be completed). Of the 12 recruited biologists for the extension week, 8 were new to the Eldorado Valley project, but had completed training and the field season on teams for concurrent desert tortoise monitoring projects. Two transects were walked on May 21 2024 to rectify incorrectly walked transects on the extension week.

Overall, crews were successful in properly implementing protocols and finding tortoises and carcasses on the transects. Telemetry observations corresponded well with transect surveys and were helpful in determining transect start times. Telemetry monitors were able to track tortoises repeatedly throughout the day and had an adequate number of daily observations. Data errors were corrected within the correction database and submitted to the DCP on a regular basis.

CONCLUSION

All transects were effectively surveyed during the spring field season. Telemetry monitoring corresponded well with transect walk times and dates and was an effective tool in determining transect start-times and tortoise visibility.

RECOMMENDATIONS

Additional monitoring of the release and control sites will better help biologists and land managers determine the suitability of relocation as a conservation strategy.

LITERATURE CITED

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