



Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park

Data Quality Standards

Natural Resource Report NPS/GULN/NRR—2018/1817



ON THE COVER

Photograph of Texas tortoise at Palo Alto Battlefield National Historical Park
Photograph courtesy of the National Park Service

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Natural Resource Report NPS/GULN/NRR—2018/1817

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Abstract

As part of the nationwide Inventory and Monitoring Program of the National Park Service, the Gulf Coast Network monitors the Texas tortoise population at Palo Alto Battlefield National Historical Park in Brownsville, Texas. The network's monitoring objectives are to document the status of Texas tortoises across the park's major lomas, using mark-recapture data, and to track changes in population parameters over time. Monitoring this population not only provides crucial information on the tortoises themselves, but can also be indicative of habitat changes in the park and surrounding region.

The purpose of this report is to document the data quality standards used in the Gulf Coast Network Texas Tortoise Monitoring Protocol. This report and the associated quality assurance plan (QAP; forthcoming) are meant to serve as a single source, independent of the protocol, for understanding how data are collected, processed, reviewed, subjected to quality control, stored and presented—and to what standards of accuracy—so that any associated data sets can be analyzed and reported on correctly.

Introduction

The purpose of this report is to document the data quality standards used in the Gulf Coast Network for activities related to the collection, processing, storage, analysis and publication of monitoring data as described in *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a). The policies and procedures detailed in this data quality standards document complement the data quality standards and quality-assurance plans for other monitoring activities conducted by the Gulf Coast Network and supplement the National Inventory & Monitoring Division Quality Management Plan (in development). The plan also serves as a guide for all GULN personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

The Texas tortoise (*Gopherus berlandieri*) is one of the Gulf Coast Network's high priority vital signs at Palo Alto Battlefield National Historical Park. It was selected for long-term monitoring because of its state-level designation as threatened and its importance to the park and its visitors. The park's tortoise population, which mainly occurs on low-rising ridges called lomas, is at risk due to geographic isolation, road mortality, predation and habitat conversion within the park. Long-term monitoring data will inform the park on how to best protect their tortoise population. These data will also contribute to broader regional assessments across the Texas tortoise's limited geographic range.

Monitoring objectives addressed by this protocol include:

1. To provide a detailed depiction of the status of Texas tortoises across the park's major lomas, including catch per unit effort, within-park tortoise movements, body condition, and the distribution of sizes and sexes captured. Catch per unit effort and tortoise body condition are also analyzed for change over time.
2. To assess tortoise population parameters across the park's major lomas and track how these parameters change over time, including estimated abundance and survivorship from mark-recapture data.

To meet these objectives, the Gulf Coast network collects data on Texas tortoises during one fall trip per year, using time-and-area constrained survey events at seven permanent sampling units at Palo Alto Battlefield NHP. There is one sampling unit on each of the park's major lomas, which across the seven units covers much of the tortoise's preferred habitat in the park: high elevation shrublands and the sloping ecotone to salt prairie. Each of seven sampling units are surveyed twice over a three or more day period, with repeat samples 24 to 72 hours later, at the same time of day, and typically by a different sampling crew. The two crews per trip each have between four and eight members, and each have a designated crew leader and data recorder/timekeeper. During each sampling event, the leader, recorder, and all other members work independently to search for tortoises within the four hectare (9.8 acre [ac]) sampling unit. The boundaries of the sampling unit are viewed on a hand-held

GPS that shows user movements in real-time. Each observer walks through the designated search area, with instructions to cover as much of the sampling unit as possible and avoid following other observers. While walking, observers carefully scan the ground surface and bases of vegetation for resting or active tortoises. Full descriptions of the protocol's searching methods are provided in SOP TORT03 *Performing Visual Ground Search—Version 3.0* (Carlson et al. 2018b).

Each tortoise encountered during the visual ground search is given or already has a permanent mark that represents its unique ID number. The ID number is applied as a pattern of holes drilled into the marginal scutes of the carapace. There is a carapace diagram on each observer datasheet that aids in interpreting the ID number code. Once the tortoise's ID number is determined, five activities must be completed: (1) the GPS location is recorded; (2) the calipers are used for measuring tortoise size; (3) the scale and rope sling are used for measuring tortoise weight; (4) the sex is visually assessed, and; (5) nine standardized photographs are taken. The photographs are used to verify the tortoise ID and document the encounter location. For examples of required photographs and a full description of all measurement steps, see SOP TORT04 *Tortoise Handling, Photography, Measurement, and Marking—Version 3.0* (Carlson et al. 2018c).

After all data are recorded, the tortoise is returned to its initial encounter location, a chalk mark is added to the carapace to prevent resampling during that event, and the search continues. The crew member informs the timekeeper of this encounter so the time spent on data collection is added onto the clock and is not counted as search time. At the end of the search event, all datasheets are collected and stored until the end of the field trip, when they are delivered to the data manager (see also SOP TORT 05 *Post sampling activities—Version 2.0*; Carlson et al. 2018d).

After each field trip, the subsequent steps of data entry, data management, quality assurance and quality control are completed in the Gulf Coast Network offices. These steps are described in SOP TORT06 *Entering data into the database—Version 3.0* (Granger et al. 2018a) and SOP TORT07 *Data management—Version 3.0* (Granger et al. 2018b). Data analysis and reporting are described separately in SOP TORT08 *Data Analysis and Reporting—Version 3.0* (Carlson et al. 2018e).

Protocol Activities

Data are collected or derived as a part of the Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park protocol (Carlson et. al 2018a) in five different activities or modules (Table 1).

Table 1. Protocol activity matrix for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Activity Category	Activity number	Activity detail	Description
Field Observations	1	General Sampling Event Documentation	Date, time, start- and end-times of sampling events, and environmental conditions, including % humidity and temperature measurements taken at the beginning and end of the sampling event for each plot.
	2	Visual Ground Search	Identification (of the individual) based on drilled hole pattern on the marginal scutes, sex, weight (grams [g]), carapace height (millimeters [mm]), carapace width (mm), carapace length (mm), total length (mm). Includes time of specific observations.
	3	New Tortoise Marking	Recording of drill pattern and any other notes documenting the new observation. The only tortoises that are left unmarked are those too small to drill, typically less than 150 g.
Sensor Data	4	Photo-documentation	A specific sequence of photographs is used to document a new tortoise or to confirm a known tortoise.
	5	GPS	GPS locations of search tracks and specific coordinates where tortoises are found.
Derived data	6	Catch per unit effort	The number of tortoises encountered during a survey event within a single unit, where the search effort is standardized to 2 person-hours per hectare (see also Carlson et al. 2018e).
	7	Tortoise body condition	The tortoise body mass is divided by the approximate tortoise volume (carapace height × width × length). Then this number is multiplied by 1000 (Nagy et al. 2002).
	8	Distribution of sizes captured	A frequency histogram of tortoise carapace lengths, presented separately for males, female and juveniles (any tortoise less than 120 mm in carapace length)
	9	Sex ratio	For a given park visit, the number of females encountered divided by the number of males encountered
	10	Population parameters of abundance and apparent survivorship	Calculated at least once every three years through analysis of mark-recapture data. Population parameters can be estimated using Pollock's robust design models, closed population models (Lincoln-Petersen), or open population models including Jolly-Seber and C-J-S in the program MARK (White and Burnham 1999; Cooch and White 2017) or a different free-ware program with similar functions. See Data Analysis SOP TORT08 for more details (Carlson et al. 2018e)

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Activity-level sample design matrix for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a). Activity numbers match those in Table 1.

Activity Category	Activity number	Activity Detail	Sampling Design	Revisit Design
Field Observations	1	General Sampling Event Documentation	Targeted: Measured for each sampling event, of which there are two per permanent sampling unit on each trip	Measured at the start and end of each of 14 survey events (two per unit), during fall annual trips.
	2	Visual Ground Search	Targeted: Every tortoise encountered during a survey event is subjected to all weight and size measurements. All marked tortoises are identified individually. All tortoises are sexed except juveniles, i.e., smaller than 120 millimeter (mm) carapace length.	When encountered during fall annual trips.
	3	New Tortoise Marking	Targeted: Every unmarked tortoise encountered during a survey event that is large enough to mark (typically weighing 150 gram [g] or more) is given a uniquely identifying mark.	When encountered during fall annual trips.
Sensor Data	4	Photo-documentation	Targeted: Every tortoise encountered during a survey is photographed from nine standardized views	When encountered during fall annual trips.
	5	GPS	Targeted: Every tortoise encountered during a survey has its GPS location recorded. All crew members have their GPS tracklogs recorded	For tortoises, when encountered during fall annual trips. For crew members, for the duration of each survey event during fall annual trips.

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 through Table 6.

Table 3. Data Quality Values (DQVs) for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Data Quality	Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	All tortoises are properly identified and marked using a unique drill hole pattern. The correct identity of that tortoise is later verified using 8 or more photos at the network office. Tortoises are correctly sexed using externally visible features, which are illustrated in a 8-panel figure that can be carried in the field. The sex assignment is later verified from photos and against previous encounter data for that tortoise. Tortoise dimensions are measured with 3 mm repeatability and weighed within ± 15 grams (g). Measurement data are compared against previous measurements of that tortoise for realistic entries. All tortoise GPS locations are accurate to the standards of the GPS unit, which is required to be 3 meters or better. Saved locations are checked against tracklogs and confirmed for logicalness in the network offices.
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	The seven units selected for monitoring cover the majority of the park's major lomas and portions of the sloping ecotone to salt prairie. The loma shrublands and ecotones are considered preferred tortoise habitats in the area. Major lomas were identified using bare-earth LiDAR data, and they were confirmed to have shrub cover using first-surface LiDAR data. Sampling units were drawn as polygons in ArcGIS with the objective of covering most or all of the high elevation area on each of the park's seven major lomas. Encountered tortoises are representative of the adult tortoises on the park that use loma habitats during the sampling event. It is assumed that each adult tortoise in a unit has a small but fairly consistent probability of being found during a given event, using the searching techniques described in the associated SOP (Carlson et al. 2018b). Immature tortoises are presumed less likely to be found and are not the primary focus of the protocol.

Table 3 (continued). Data Quality Values (DQVs) for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Data Quality	Value	Definition	Protocol Considerations
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	For each park visit, each unit is always searched at the same time of day. Additionally, the same techniques are always used for searching, handling, marking and measuring tortoises (Carlson et al. 2018a). These techniques are described in depth in their associated SOPs (Carlson et al. 2018b and Carlson et al. 2018c). The sampling units within the park are comparable to each other because all represent broadly similar shrubland habitats and are at relatively high elevations. The units are at different spatial locations within the park, however, and their plant communities are not identical. An additional caveat is that two units are always searched in the first morning time-block (starting at 30 minutes post-sunrise), two units are searched in the second morning time-block (starting 2.5-3.5 hours post-sunrise) and three units are always searched in the afternoon (starting at 8 hours post-sunrise)
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Within one month after each park visit, the ID numbers of all encountered tortoises are verified with photographs, and an internal report is written to summarize the weather and capture statistics for the visit. Finalized data sets and full reports are broadly distributed to the park, collaborators and posted on IRMA within three months of each 6 th survey event.
	Completeness	All data and measures required to evaluate accuracy and representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	The park is always visited once per year, in late October or early November. All seven sampling units are surveyed twice on each trip, and all measurements are taken on every tortoise every time it is found. Before leaving a sampling unit, all datasheets are reviewed for completeness by the data recorder

Table 3 (continued). Data Quality Values (DQVs) for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Data Quality	Value	Definition	Protocol Considerations
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Data are fit for analysis after passing all QA/QC measures and becoming an accepted or certified dataset. The reporting products are always based on accepted or certified datasets, and they always use the same variables to represent tortoise body condition and population health, as described in the protocol narrative (Carlson et al. 2018a) and the data analysis and reporting SOP (Carlson et al. 2018d)
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	Specific GPS location data could be considered protected due to the Texas tortoise being state-listed as threatened. Procedures for masking these protected data from publicly available products are described in the data management SOP (Granger et al. 2018b). Protected location data may be released in limited cases only with park resource manager approval following park procedures. The park superintendent will make the final decision on whether data are protected, and the network is currently working with him on this process.

Table 4. Measurement Quality Objectives for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Activity detail and number	Indicator	Quality objective
General Sampling Event Documentation (1)	Measurement accuracy for temperature and relative humidity	Hand-held meter meets accuracy standards of ± 0.5 °C for temperature and $\pm 3\%$ relative humidity
Visual Ground Search (2)	Taxonomic Resolution for tortoises	Taxonomic identifications are made to the species level: Texas tortoises (<i>Gopherus berlandieri</i>). Only one tortoise species occurs in southern Texas, so there is no potential for confusion with other species. The taxonomic authority used is Crother (2017)
	Individual-level identification accuracy	Identifications are 98% accurate for all encountered tortoises that are uniquely marked
	Individual-level identification completeness	Identifications are made for 100% of individuals that are uniquely marked. The size cut-off for marking is at least 150 grams (g).
	Tortoise measurement accuracy	± 3 mm for dimensions and ± 15 g for weight
	Sex determination	100% of tortoises that are over 120 mm in carapace length are classified to the correct sex.
New tortoise marking (3)	Individual –level marking completeness	Marks are applied to 95% of individuals that are above the size cut-off for marking, which is 150 g. Crew members may use their discretion to leave unmarked a heavier tortoise, if, for example, its carapace is damaged or scutes are unusually small.
Photo documentation (4)	Image resolution	10 megapixel
	Image format	jpg w/ embedded EXIF metadata
GPS (5)	Tortoise location accuracy	Point location accuracy is ± 3 m horizontal (estimated). This positional instrument accuracy is reported in real-time on the GPS unit. Waypoint averaging over three minutes at individual tortoise locations should improve this accuracy, but it is not required.
	Tortoise in/out of boundary	The total number of encountered tortoises is not affected by GPS error in the tortoise's location relative to the digital, fixed polygon boundary. In other words, an equal number of tortoises will be incorrectly recorded outside the boundary as the number of tortoises incorrectly recorded as inside the boundary, due to GPS error of ± 3 meter.

Table 4 (continued). Measurement Quality Objectives for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Activity detail and number	Indicator	Quality objective
GPS (5) (continued)	Coverage of unit by crew member track logs	Crew members search and remain within the established site polygon 100% of the survey time, with the exception of leaving the polygon to walk around obstructions. Crew member tracks (with 2 meter buffer) cover 60% or more of the polygon area. Percent coverage may be included as a covariate in analyses for trends over time in catch per unit effort.

Table 5. Taxonomic standards to be used in *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a).

Activity detail and number	Standard to be used	Reference/Authority
Visual ground search, collection of observational data	Scientific Publication	Crother (2017)
Visual ground search, reporting of observational data	Scientific Publication	Crother (2017)

Table 6. Data protection standards for *Gulf Coast Network Texas Tortoise Monitoring in Palo Alto Battlefield National Historical Park: Protocol Narrative* (Carlson et. al 2018a). With the exceptions noted, all data collected are to be made publicly available in a timely fashion.

Type of Data	Level of Protection	Rules for Dissemination
<u>Resource Data and Information</u> Texas Tortoise Locations	Operationally or Legally Protected	Depending on the decision of the park superintendent, the specific locations of Texas tortoises may be considered protected. If so, locations of tortoise observations are unreported or reported at the park centroid only
<u>Location Data and Information</u> Permanent Sampling Units	Operationally Protected	Exact boundaries provided upon request only. Approximate boundaries shown in reports and the protocol.
<u>Personally Identifiable Information</u> Non-NPS Staff Information	Legally Protected	All but first name and last initial redacted from public release.

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