



Monitoring Amphibians in Gulf Coast Network Parks

Data Quality Standards

Natural Resource Report NPS/GULN/NRR—2018/1745



ON THE COVER

Photograph of GULN field crew checking for amphibians under a coverboard in Jean Lafitte NHP&P.
Photograph courtesy of Chris Adams

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Jane E. Carlson and Whitney Granger

National Park Service
Gulf Coast Inventory and Monitoring Network
646 Cajundome Blvd, Ste 175
Lafayette, LA 70506

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Introduction and Summary

The purpose of this report is to document the standards used by the Gulf Coast Network (GULN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in *Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0* (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 Gulf Coast Network monitors the condition of biological resources in eight national parks and preserves in the southern United States, and one of its highest priority taxa for monitoring is amphibians. Key reasons for monitoring amphibians are (1) they are known to be highly sensitive to environmental conditions, making them valuable as ecological indicators; (2) in and around the Gulf Coast region, amphibian diversity is high and includes many geographically restricted species; and (3) amphibian populations are in decline across the globe, due to anthropogenic influences and environmental change. Thus, long-term data on amphibian presence and abundance provide informative reference points for resource condition in parks and can add breadth to regional, national and world-wide datasets.

The Gulf Coast Network uses two passive techniques for detecting amphibians in focal habitats: coverboards and PVC pipes. When placed on the ground or in trees, respectively, these objects create artificial cover for amphibian species, providing a favorable microclimate and allowing the animals to come and go unharmed. The PVC pipes are hung in pairs, with one pair-member 2.5 centimeters (1.0 inch [in]) in diameter and the other 5 centimeters (2.0 in) in diameter; both are 61 centimeters (24.0 in) long. The plywood coverboards are 0.9 × 1.2 meters (3.0 × 3.9 feet [ft]) in size and are placed on the ground in clusters of four, 1–2 meters (3.3–6.5 ft) apart in an approximate quartered-square design. Each pipe or board is checked during park visits that take place between sunrise and noon every other month. In addition to recording the amphibian species present and number of each, the crew records the on-site environmental conditions, including temperature in and around the pipe or board, relative humidity, and in some cases water level in the nearest water body. Nearby weather stations are used as sources for additional data on rainfall and temperature during the days and weeks leading up to a sampling event. The field methods for preparing, deploying and checking artificial cover objects, as well as recording environmental data on-site, are described in SOP AM03 *Field Methods for Amphibian Monitoring—Version 1.0* (Carlson et al. 2018b).

The Gulf Coast Network currently monitors amphibians in seven sites distributed across three parks. Jean Lafitte National Historical Park has two replicate sites that are located more than one kilometer (.6 miles [mi]) apart in similar bottomland hardwood forest habitats adjacent to the same fresh waterbody. Each site contains 32 coverboards and 32 pairs of PVC pipes. Within sites, pipes and

boards are arranged in eight clusters along a transect that is roughly 140 meters (460 ft) long, with an additional cluster of eight pairs of PVC pipes over the nearest waterbody. Gulf Islands National Seashore also has two replicate sites in oak forest/scrub habitats near a fresh waterbody, with the same numbers of pipes and boards in the same general arrangement as Jean Lafitte NHP&P. San Antonio Missions National Historical Park is the smallest of the three parks, and it only has coverboards that are divided among three, rather than two sites. Each site contains 20 coverboards in clusters of four along an 80 meter (262 ft) transect.

Following this sampling design and field methodology, the Gulf Coast Network protocol addresses two monitoring objectives:

1. Determine species composition of the amphibian communities that use the monitored cover objects (PVC pipes and coverboards) at each site, and determine species richness for native and exotic species separately.
2. Determine the frequency (yes/no detected) and relative abundance (counts per pipe or board) of the more commonly encountered amphibian species at each site, and determine trends over time.

Protocol Activities

Data are collected or derived as a part of the Gulf Coast Network Amphibian Monitoring Protocol (Carlson et al. 2018a) in 10 different activities or modules (Table 1).

Table 1. Protocol activities (aka Protocol activity matrix) for *Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0* (Carlson et al. 2018a). Field methods are described fully in SOP AM03 (Carlson et al. 2018b). See SOP AM07: *Data Analysis and Reporting* (Carlson et al. 2018c) for additional details on how derived data are calculated and used.

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 relative humidity and temperature measurements taken at the beginning and end of the sampling event for each site.
	2	Pipe- or board-level data	Identification of each species seen in the cover object and a count of the number of individuals of that species. If no amphibians are found in a pipe or board, a zero is recorded. Data recorder also notes if the cover object is damaged, missing, or >50% in the sun. For coverboards, they note if the board is >50% submerged in water. For PVC pipes, they note if another occupant is present that could deter treefrogs.
Sensor Data	3	Photo-documentation	A specific sequence of photographs is used to verify species identity in association with the pipe or board. These photos are used in quality control measures and when crew members are uncertain of the identity of a given species. A photopoint photo is also recorded at each cluster.
	4	Infrared surface temperature	The ground surface temperature at the center of the ground area below the newly-lifted coverboard, or the inside surface temperature of a newly-checked PVC pipe, measured at a point roughly 4-6 cm down from the upper edge.
	5	Continuous data loggers	Loggers at each site record hourly data throughout the year on relative humidity, air temperature and barometric pressure. Water level of the nearest water body is also recorded hourly, but for two parks only. For descriptions of placement and use of these loggers, see Carlson et al. (2018b).
External data	6	Weather data	Data on rainfall and temperature are acquired from nearby weather stations and summarized for use as covariates in data analyses.
Derived data	7	Species richness and species composition	All species that were recorded over a year within each site are listed and counted, with separate counts for native versus invasive species.
	8	Frequency of common species	For each site, the proportion of PVC pipes or coverboards that contained at least one individual of a given species. Once every two years, these data are calculated for each visit and graphed as a time series. Once every six years, these data are calculated on an annual basis and analyzed for trends over time.
	9	Relative abundance of common species	For each site, the number of individuals of a given species found in PVC pipes or coverboards, divided by the total number checked over the period of interest. Once every two years, these data are calculated for each visit and graphed as a time series. Once every six years, these data are calculated on an annual basis and analyzed for trends over time.
QA/QC data	10	Quality Control on Species ID	At one randomly-selected cluster per park visit, all amphibians seen in the cluster's monitored cover objects are photographed for ID verification by another person not in the field: either a qualified network staff person or an outside expert. The other person's ID determinations are compared to those of the field crew leader to assess the error rate in species ID.

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Sampling design and revisit design for *Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0* (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 at each of two or three sites per park; sites are near water bodies and chosen using professional judgment.	Measured at the start and end of each sampling event for a site (2-3 sites per park), during visits to the park that occur between sunrise and noon on a single day, once every other month.
	2	Pipe- or board-level data	Targeted: 5 (SAAN) or 8 (GUIS/JELA) clusters of 4 coverboards along a transect at each site. 3 pairs of PVC pipes per coverboard cluster and one separate cluster of 8 pairs of PVC pipes placed over water (GUIS/JELA). Sites are as described for Activity 1.	Every pipe and board is checked, in the same order, during the sampling event that takes place once every other month.
Sensor Data	3	Photo-documentation	Targeted: Every amphibian that cannot be identified with certainty is photographed from standardized views. Also, every amphibian in the randomly-selected QC cluster is similarly photographed. A photopoint photograph is also taken at each cluster.	For amphibians, the targeted individuals are photographed when encountered during sampling events. For photo points, every cluster is photographed, in the same order, during the sampling event that takes place once every other month.
	4	Infrared surface temperature	Targeted: As described for Activity 2.	As described for Activity 2.
	5	Continuous data loggers	Targeted: One continuous logger for air temperature and relative humidity is hung on a tree in the shade at the centerpoint of each transect. For two of three parks (SAAN excluded), a water level logger is deployed in the nearest water body to the transect.	Data loggers (e.g., HOBO models by Onset) are set to record data every hour. Data downloads coincide with the sampling event schedule, once every other month.

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 the *Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0* (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.	To achieve high data accuracy, the protocol includes specific instructions to maximize the likelihood that during sampling (1) all amphibians using coverboards or pipes are detected by the field crew, (2) all detected amphibians are properly identified to species, and (3) correlative data on environmental conditions are measured correctly and accurately. To ensure that all amphibians are detected, two crew members are actively looking for amphibians as the cover objects are checked. Also, a photograph is taken of the ground beneath a coverboard as soon as it is lifted, and that photograph is later scrutinized for amphibians that may have escaped before being seen in the field. To ensure that IDs are correct, a specific sequence of photographs is taken for a subset of individuals, and these photos are used to verify species ID after fieldwork is complete. The photographed individuals are those that could not be identified with certainty in the field, or all amphibians in each visit's QC cluster. For the correlative data on environmental conditions, crew members are instructed to measure surface temperature at a specific location under boards and within pipes. The crew is also required to use high-quality, accurate field instruments that are not placed or read in direct sun. Some equipment items are for use during a sampling event (air temperature, relative humidity, and ground or pipe surface temperature) and some are always present at the site for continuous data logging (air temperature, relative humidity, barometric pressure and water level of the nearest water body). For PVC pipes, the initial tree diameter at breast height (DBH) is recorded along with the tree species.

Table 3 (continued). Data Quality Values (DQVs) for the Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0 (Carlson et al. 2018a).

Data Quality	Value	Definition	Protocol Considerations
Intrinsic Data Quality (cont.)	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Monitoring activities take place from sunrise to noon on sampling visits to parks once every-other-month. During these park visits, two or three permanent sites are sampled, and sites within parks have similar habitat characteristics. Sites were selected from within a targeted habitat type that was expected to have viable and diverse amphibian populations. Specifically, the sites had appropriate habitats for both ground- and tree-dwelling amphibians, and pipes and boards could be successfully deployed (i.e., relatively flat ground area that was near a fresh waterbody but not itself inundated, sufficient numbers of trees large enough to support PVC pipes for treefrogs). These sites also were relatively easy to access and traverse on foot, were in places that were not immediately visible to the public and were of particular interest from a management perspective. Since the study locations were not chosen as a random draw, they are not to be extrapolated to all similar habitats in the park. However, the within-park replicates are included to determine if detected patterns are site-specific or occurring at a broader scale. More details on site-selection and cover object locations are in Appendix A of the protocol appendices packet (Carlson et al. 2018d).
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	Data can be compared for each site over time, because for each park visit, the same sites and cover objects are always searched in the same order within the same 1-2 hour period, and the same techniques are always used for field sampling. The crew leader is often the same person across years, and even when not, crew leaders must be skilled in amphibian detection and identification. The field techniques and crew responsibilities are described in depth in the field sampling SOP (Carlson et al. 2018b). Also, the 2-3 sampling sites within a park are comparable to each other because they are in similar types of vegetated habitats. For JELA and GUIB, they are also in the same relatively narrow elevation band and distance to a water body. It must be noted, however, that because sites are sampled in the same order each time, the time of sampling (early AM vs. later AM) is confounded with the site itself. The network can also compare data collected under this protocol in different parks, with the caveat that the sampled habitats differ among parks. Finally, the data from this protocol on amphibian presence and abundance in PVC pipes and coverboards are broadly comparable with other projects using these types of cover objects, with the caveat that in the other projects the coverboard and PVC pipe sizes may differ, and the habitats likely differ as well.
	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 several weeks of each park visit, the data are entered into the database. Data are verified and validated within three months of a full 6-visit cycle (1 year) to all three parks, and they are also posted to IRMA at that time. Finalized datasets and 2-year reports are broadly distributed to the park, collaborators and posted on IRMA within three months after the end of every 2 nd year. Status and Trends reports are completed within six months after the end of the 6 th year.

Table 3 (continued). Data Quality Values (DQVs) for the Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0 (Carlson et al. 2018a).

Data Quality	Value	Definition	Protocol Considerations
Contextual Data Quality (continued)	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.	Each site is always visited six times per year, once every other month. Cover objects within sites are always sampled every time in the same order, and all required data are collected at every pipe or board. Before leaving a sampling site, all datasheets are reviewed for completeness by the data recorder. Correlative environmental data are also always collected as prescribed and continuous data loggers are downloaded upon every site visit. Occasionally, data for specific pipe or board may be omitted, for example if a coverboard deteriorates or is replaced. Our data summarization and analysis approaches can accommodate occasional missing data.
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 amphibian presence and abundance, as described in the protocol narrative (Carlson et al. 2018a) and the data analysis and reporting SOP (Carlson et al. 2018c).
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	Specific GPS location data of the coverboards and PVC pipes are protected due to the possibility that species of concern may come to use them. This includes species that are state-listed, federally listed, or otherwise deemed by the park to be rare or commercially valuable. Procedures for masking these protected data from publicly available products are described in the data management SOP (Granger et al. 2018). Protected location data may be released in limited cases only with park resource manager approval following park procedures.

Table 4. Measurement Quality Objectives for *Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0* (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 +/- 3% relative humidity
Pipe- or board-level data (2)	Taxonomic Resolution	Taxonomic identifications are made to the species level using taxonomic authority Crother (2017)
	Individual-level identification accuracy	Identifications to species are 95% accurate for all amphibians that receive a good visual inspection for ID confirmation resulting in accepted data.
	Individual-level identification completeness	Crew members detect and identify at least 95% of all individual amphibians that are present under coverboards or inside PVC pipes at the time of sampling.
Photo documentation (3)	Image resolution	10 megapixel
	Image format	jpg w/ embedded EXIF metadata
Infrared surface temperature (4)	Measurement accuracy	A required specification of the thermometer is that at 1-meter (3.2-ft) distance, the unit can measure a target (pin-pointed with the unit's laser) of 5 centimeters (1.9 in) diameter. When the unit is held within approximately 14 centimeters (5.5 in) of the pipe, the target can be as small as 13 millimeters (0.5 in). Accuracy must be within +/- 1°C.
Continuous Data Loggers (5)	Measurement accuracy	Temperature accuracy: ± 0.21°C from 0° to 50°C. Humidity accuracy: ± 2.5% from 10% to 90% RH typical to a maximum of ± 3.5% including hysteresis at 25°C (77°F), below 10% and above 90% ±5%. Water level accuracy: typical error is ± 1.0 cm (0.03 ft) water, maximum error is ± 2.0 cm (0.06 ft) water. Pressure accuracy ±0.43 kPa (0.063 psi) maximum error. For water level, the data of interest are relative depths, rather than true elevations. Accuracy of measurement is improved by ensuring that all gauges are mounted to fixed, permanent stations and are returned to the same location after data download. For the temperature/humidity loggers, the unit is hung from the same nail every time. For water level loggers, the unit is returned to the same location in the water column using markings on the stilling well and a fixed length of cord, plus the expectation that the fixed mount has not shifted. To check for shifting, a marking on the fixed mount is compared to markings on two nearby independent structures (i.e., a tree or dock), and the angle is compared over time using a rangefinder. If the change in inclination is greater than 0.5 degrees, the logger is adjusted to maintain the original inclinations.

Table 5. Taxonomic standards to be used in *Monitoring Amphibians in Gulf Coast Network Parks Protocol Narrative—Version 2.0* (Carlson et al. 2018a).

Activity detail and number	Standard to be used	Reference/Authority
Pipe- or board-level data (2), collection of observational data	Scientific Publication	Crother (2017)
Pipe- or board-level data (2), reporting of observational data	Scientific Publication	Crother (2017)

Table 6. Data protection standards for Gulf Coast Network Amphibian Monitoring protocol (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> State/federal threatened/endangered species locations	Legally protected	Locations of species observations are unreported or reported at the park centroid only
<u>Location Data and Information</u> Permanent Sampling sites and cover object locations	Operationally Protected	Exact coordinates provided upon request only. Approximate locations 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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1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525