

Monitoring Seeps, Springs, and Tinajas in the Sonoran Desert and Chihuahuan Desert Networks

Importance

Seeps, springs, and tinajas are critical surface water sources in the arid and semi-arid Sonoran and Chihuahuan deserts. They are a primary interface between groundwater and surface water and serve as biodiversity hotspots, supporting obligate (and generally rare) aquatic species and providing access to water for wide-ranging terrestrial animals.

Seeps are small, seasonally dry springs that support plants and animals adapted to drier conditions. Springs dry less often (or are even perennially wet) and support more aquatic and riparian habitat, including species that depend on moist soils or open water. Tinajas, or “small jars” in Spanish, are surface waters found in naturally occurring bedrock catchments. They are fed by springs and/or precipitation, and comprise the majority of available surface water in many large network parks, such as Organ Pipe Cactus NM and Saguaro NP.

In addition, Chihuahuan Desert and Sonoran Desert Network parks contain a number of regionally important water bodies linked with key natural or cultural resources. These include Rattlesnake Springs at Carlsbad Caverns NP, used by the Mesquero Apache since the 1400s and by U.S. Cavalry patrols in the 1880s, and Quitobaquito Spring, which feeds Quitobaquito Pond at Organ Pipe Cactus NM. The Chihuahuan Desert and Sonoran Desert networks have selected seeps, springs, and tinajas as a high priority for ecological monitoring.

Monitoring Objectives

Proposed specific, measurable objectives for springs, seeps, and tinajas (hereafter, “springs”) are based on a two-tier hierarchy. Level I springs are monitored qualitatively on a less-frequent basis, whereas high-priority, Level II springs are monitored annually using primarily quantitative methods. Specific monitoring objectives are to determine status and long-term trends in:

Channel morphology

- Spring orifice and basin morphometrics, and sediment-size distribution

PROTOCOL SUMMARY



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American avocets at Quitobaquito Pond, Organ Pipe Cactus NM.

- Spring brook cross-sectional area, sinuosity, channel slope, and sediment-size distribution

Riparian and wetland vegetation

- Spring and spring-brook cover of common (>10%) perennial species
- Spring and spring-brook frequency of uncommon perennial species and selected non-native invasive annual and perennial species

Water quality

- Daily, seasonal, and/or annual core water quality parameters (temperature, specific conductivity, pH, dissolved oxygen, turbidity)
- Seasonal and/or annual total nitrogen, total phosphorus, selected metals, and *E. coli* (when possible)

Water quantity

- Spring discharge
- Seasonal and annual base flow conditions on spring brooks
- Wetted distance of spring brooks

Aquatic macroinvertebrates

- Abundance of selected taxa and community structure
- Selected multimetric indicators of biotic integrity (when applicable)

Fish

- Presence or absence of key species
- Fish communities on local and regional scale



Tinaja, Saguaro National Park.

Methods

Channel morphology—Level I: Visual surveys assign categorical visual estimates of spring and spring-brook disturbance, and particle-size distribution as appropriate. Length, width, and depth measurements are conducted on springs and spring brooks. **Level II:** Survey-grade equipment is used to measure length, width, and depth of springs. A longitudinal profile and three evenly distributed, permanent channel cross-sections are located on each selected spring brook. Particle-size surveys are conducted in springs and across each spring brook.

Riparian and wetland vegetation—Level I: Visual surveys assign categorical visual estimates of spring and spring-brook cover and species composition. **Level II:** Small quadrats are employed to identify community composition and quantify abundance of plant species. At spring brooks, vegetation sampling is conducted on 20-m transects along each of the three permanent channel cross-sections. Vegetation data are recorded within three structural categories using the point-intercept method, with points spaced every meter. Soil cover is recorded to substrate class (e.g., sand, gravel). In the two meters surrounding the transect, frequency data are collected on plant taxa not encountered during point-intercept sampling. Data on tree and shrub recruitment are collected in a 20-m-wide band transect surrounding the thalweg. Extremely large trees are mapped and vigor metrics are collected (e.g., basal area, height). In extensive wetlands, a combination of cross-sections and plots are used to assess vegetation composition.

Water quality—Level I: A handheld, multiparameter water-quality instrument is employed to collect discrete data on core water quality parameters. **Level II:** At selected springs, a multiparameter datalogger (sonde) collecting continuous (15–30 min) core water quality measurements is employed for two-week deployments seasonally at each spring, or as appropriate. Nutrients, inorganics, metals, contaminants, and *E. coli* samples are collected quarterly or as appropriate.

Water quantity—Level I: Spring discharge measurements are collected or estimated using simple volumetric methods.

Level II: At selected springs, logging discharge meters and/or pressure transducers are employed to collect continuous discharge or stage data. Discrete discharge measurements are used in combination with staff gages, crest gages, and logging pressure transducers to collect data at springs and spring brooks, as appropriate.

Aquatic macroinvertebrates—Level I: Visual surveys assign categorical visual estimates of spring and spring-brook macroinvertebrate communities and abundance. **Level II:** Quantitative macroinvertebrate samples are collected with equipment that allows for sampling fixed areas. Semi-quantitative samples are collected according to timed sampling with appropriate-sized nets. In spring brooks, where appropriate, samples are collected in riffles for determining trend and for comparison with state indices of biotic integrity (IBIs). Methods are designed to be directly comparable to state and federal (EPA, NAWQA) methodologies.

Fish—The networks are working with adjacent land management agencies and state departments of fish and game to monitor fish communities in and around the parks, enabling the data to be analyzed in a regional context. Methods will include passive trapping, electrofishing, and seining.

Products, Scope, and Schedule

An annual summary report documenting effort and initial findings is produced in February of each year. Attempts should be made to coordinate effort across and between networks to ensure that sampling is conducted in an ecologically and statistically meaningful way for interpretation of regional trends. Information on springs is also communicated through live presentations, resource briefs and other written summaries, and podcasts and other media produced and distributed through the network websites and the Learning Center of the American Southwest (www.southwestlearning.org).

Protocol Status

The protocol and standard operating procedures are currently being written and tested. A draft of the springs protocol will be completed in Fall 2010. An initial inventory of springs for Sonoran Desert Network and selected Chihuahuan Desert Network parks has been completed. A draft Sonoran Desert Network springs inventory database has been completed and populated.

Project Contact

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