Nevada Springsnail Survey Protocol

This protocol has been adapted from the Arizona Springsnail Survey Protocol developed by Arizona Game and Fish. This level 1 survey combines information required by the Nevada Division of Natural Heritage with other survey methods to create a streamlined, point-in-time survey which will provide relevant data regarding springsnail presence, population density, and habitat condition. It can be used on single source and multi-source springs to answer the question: Are springsnails present in the spring system? For single source spring systems see Protocol 1-3, for complex spring systems see Protocol 1-3 and the section titled "Complex Spring Systems." Results from using this survey method can provide information to determine if a more extensive survey should be completed in the future.

Springsnail survey goals using this protocol:

1. Conduct a timed search to detect springsnails
2. If springsnails are present, determine capture-per-unit-effort (CPUE) by conducting a timed count
3. Record information on spring habitat and condition
4. Collect springsnails for species level identification

Equipment

Hand lens	Ruler
Muck boots (NO FELT BOTTOMS)	Transect tape (m)
Fine mesh kitchen strainer	GPS
Shallow Tupperware	Combo water meter (pH, temp, conductivity)
Tally counter	Plant guides for aquatic and riparian plants
Camera	Datasheets
White board	Pencils
Dry erase marker	Flashlight
Soft tipped forceps	Coin envelopes OR vials with 95% ethyl alcohol
Stopwatch	Super HDQ or Green Solutions Neutral Disinfect
2+ gallons H2O	Spray bottle or 5-gallon bucket

Protocol 1 Springsnail Detection: Observed or Not Observed

A. Two Independent Observers: Record time when search for springsnails begins, start stopwatch. Starting from the springhead each surveyor will move down the spring run on opposite sides of the wetted run. Each surveyor will investigate multiple substrates within the wetted run including boulder, stone, cobble, gravel, sand, silt, live and dead vegetation, roots, macrophytes, detritus, under hangs, etc. in search of springsnails. Alternately, if the area of the habitat is small (less than 10m in length or in total area), the second observer should repeat the search of the same habitat once the first searcher has finished—this effort provides a double blind observation, which is preferred. A flashlight and hand-held magnifier may be used to aid in the visual search of the habitat and substrates within the spring and spring run. A mesh kitchen strainer may be used to scoop sediment from the bottom of the spring to sift out snails. The survey continues until the

first live snail is detected (presence). Once snails are observed, stop the timer on the stopwatch and record the time to first springsnail in minutes and seconds (mm:ss). When search time reaches 10 minutes per searcher, stop the timer and conclude the survey (not observed).

Once springsnails are observed and time to first springsnail is determined, continue searching down the wetted run for springsnails. Using a GPS or meter tape, determine the length of the wetted run occupied by springsnails. This number will be recorded as the 'Total Occupied Length' for a single source system (see Complex Spring Systems for more than one spring source). Any rocks, vegetation or sediment handled during the survey will be replaced back into the habitat where they were found. This will help reduce any impacts from population monitoring and collections as recommended by Martinez and Sorensen (2007).

Helocrene Sampling: Sample a cross section of the wetted area following the instructions above. If helocrene is small, search the entire area. There may be no occupied length for a helocrene.

B. One Independent Observer: Conduct the survey as described, but increase the total search time to 20 minutes.

IF SPRINGSNAILS ARE NOT OBSERVED: Follow decontamination protocol listed on page 6 under Decontamination header before moving to next spring.

Protocol 2 Timed Observation Count Protocol: Relative Abundance via Catch-Per-Unit-Effort (CPUE)

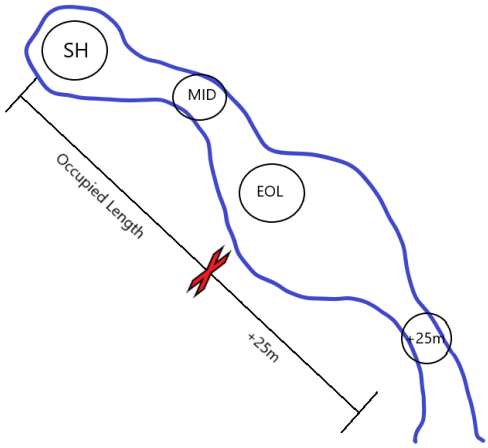
Protocol 2 begins once springsnails are first observed at a site. Conduct another "timed" search for 10 minutes. Each observer should use a counter and tally springsnails utilizing equipment that may help locate snails (sieve, hand lens, flashlight, Tupperware, etc.). Count live snails moving downstream from first encountered springsnail, without covering the same area twice. When removing rocks or vegetation from the spring to count snails, replace them where found when finished. At the end of the 10 minute search, record the total number of live snails found (including the first one) for each observer. Record the distance from spring source (in meters) where springsnails were first encountered and last observed. Identify the substrates searched for snails, and the types of substrate where springsnails were observed (circle on datasheet). Note presence/absence ("yes" or "no") of other aquatic animal species observed in the habitat: other snails, fish, amphipods, crayfish, amphibians, caddisfly/mayfly/stonefly larvae, odonatan larvae, other mollusks, or other macroinvertebrates. If any of the other organisms observed in the spring and spring run are abundant, they can be reported as "common" or "abundant".

Protocol 3 Habitat and Stressor Descriptions

At the completion of the aforementioned protocols, collect the following data regardless of springsnail presence:

1) **Measure total wetted length:** Total wetted length of the spring run (or where it empties into a pond, wetland, or confluence with a creek or river; recorded in meters. Use GPS, GIS or Google Earth for extensive distances. This can be completed in the field when possible with time constraints or in the office upon return from the field.

2) **Record Habitat Information at each Search Area:** Water quality, vegetation and substrate composition is collected at "SH" being the springhead, "Mid" approximately half way along the occupied length, "EOL" the end of occupied length, and "+25m" which is 25m past the EOL or the end of the wetted reach. SH, Mid, EOL, and +25m are referred to as 'search areas'. Measurements will be recorded at the end of the wetted reach when springsnails are observed in the system, end of occupied length has been measured, and surface water does not continue up to or past 25m from the EOL. See illustration below for more details.



If springsnails are not observed record habitat, water quality, vegetation and substrate cover information for SH only. Also, complete evidence of habitat disturbance, sketch of spring and record any other pertinent notes.

Measure the width and depth of each search area using a ruler with metric units. The width is the wetted width of the spring in meters, widths can be rounded up or down to the closest meter mark. Depth can be measured from the substrate bottom of the spring to the top of the water surface with the ruler perpendicular to the ground. Round the depth to the nearest centimeter. A measurement at the center of the wetted width is appropriate for smaller systems. Larger systems can be measured multiple times across the wetted width and averaged.

Water quality should be determined using a combo water meter, which records temperature in degrees C, pH, and conductivity. If you have equipment to determine the amount of water produced by the spring (often a small portable weir and a measured bucket will suffice), please record in the flow category. If you do not have the time or resources to determine flow quantitatively, use the qualitative parameters: L= little or no flow; mostly stagnant; M=moderate flow; moves fine particles; H= high flow with turbulence; strong riffles. The qualitative parameters for measuring flow can be found in the definitions portion of the datasheet for quick reference.

Vegetation and substrate percent cover can be collected using an ocular estimate at each position (SH, MID, EOL, +25m), the Daubenmire method can be used to streamline ocular estimates with assigned cover classes. If more detailed information is necessary vegetation and substrate can be collected using a quantitative method such as line-point intercept or line intercept. Daubenmire method (see appendix??).

3) **Record Evidence of Habitat Disturbance:** After observing the entire spring (or complex of springs) circle yes, no, or N/A for each listed potential cause of habitat disturbance to the spring. If you circle yes, use the note section to the right to describe observed stressors and estimate level of impact to the spring. If there are anticipated future impacts on the spring, circle no and comment in the notes section with details about those future impacts. If history and activities are unknown, circle N/A and consult additional resources for more information upon returning from the field. After assessing all habitat disturbance categories, circle the disturbance category listed which is causing the most immediate threat to the functionality of the spring system.

4) **Record Spring Run Aspect:** Record the approximate compass direction of the spring flow. This can be completed with a compass or GPS in the field or using GIS or Google Earth in the office.

5) **Complete Spring Sketch:** Sketch the general features of the spring with "SH" denoting springhead, an arrow showing the direction and path of the spring run, any modifications like a spring box or piped flow, pooled water, photo locations, or where it goes subsurface or connects with another water or wetland, and include a north arrow on your diagram for reference.

10) **Take Site Photos:** Using a white board (or laminated piece of white paper) and a dry erase marker, record the spring name or number, UTMs and any other relevant information for your project. Take a digital photograph of the springhead and spring-run with the photo board visible and readable in the bottom right-hand corner of the photo. Photos should contain about 2/3 immediate surroundings and 1/3 background and sky. Background is essential for identifying where the photo was taken for repeat photo points in the future. Reference photos should include an image of the springhead (if it could be identified) looking downstream at the spring run, and if possible, an image taken from the end of the wetted length or +25m, looking back at the springhead.

Blank examples of the springsnail survey datasheets are provided in Appendix A. Completed examples of the springsnail datasheets are provided in Appendix B.

Upon completing desired protocols, gear must be decontaminated to avoid the spread of aquatic organisms. Reference the Decontamination header on page 6 for specific instructions.

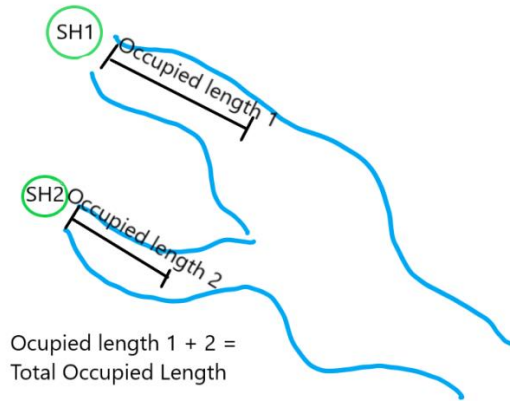
Complex Spring Systems: Springs with Multiple Spring Sources

Consult project partners before entering the field and determine project goals and the extent of surveys to be completed at complex systems. The methodology below is written for initial visits to complex spring systems for springsnail detection. Depending on project goals for complex systems, after completing this method another site visit with more intensive survey (level 2 survey) may be required. This method will answer the question: Are springsnails observed in the spring system? Once springsnails are observed in the system, a quick assessment will be completed at each spring source to aid in determining how many collections need to be made and from where, extent of springsnail population, and overall habitat condition of the system.

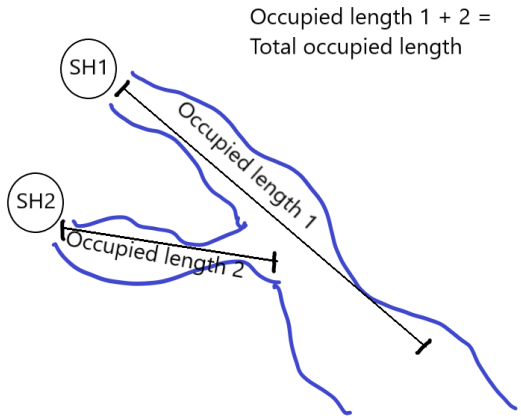
1) Walk around spring complex to assess the full extent of the spring, or use aerial imagery before entering the field
2) Draw a sketch of the spring complex, labeling each springhead as you go. Determine a spring source to begin the survey, this will be SH01 (springhead 1). The remaining springheads will be

labeled numerically (SH02, SH03, SH04, etc.) for survey purposes. Use the "Additional Sketch Page" for more drawing space.

3) Complete Protocol 1 at SH01.
   - **A. If springsnails are observed**, complete Protocol 2 and 3 at this springhead. Continue to each springhead in the system and collect the data required on the Spring Complex Additional Springhead Information datasheet. For each springhead determine if springsnails are observed and the occupied length. Total occupied length of springsnail habitat in the system can be recorded on the Springsnail Survey datasheet (Appendix A), by adding the occupied length for each springhead (example 2). If the occupied length is extensive, do not count the same length twice (see example 3).
   - **B. If springsnails are not observed** at SH01, continue visiting each springhead consecutively and complete Protocol 1 until springsnails are observed, once observed see section 3 A above. Use the "Spring Complex Additional Springhead Information" datasheet to record pertinent information for each additional spring source (Appendix C). If no springsnails are observed in the spring complex, complete protocols 2 and 3 at the last springhead or a springhead which represents the majority of the springheads in the system. Ex. If the complex spring system includes 1 helocrene and 7 limnocrenes, complete protocols 2 and 3 at a limnocrene to represent the system as a whole.



Example 2: Springsnails occupy lengths that do not intersect within a complex system.



Example 3: Springsnails occupy lengths that intersect within a complex system.

This additional survey information will help determine if further extensive surveys should be completed at the site. Certain springsnail species are often specific to temperature ranges or other water quality parameters. A wide range of temperatures in the spring sources would indicate a need for more extensive surveys and additional collections of springsnails if observed. Protocols 1-3 can be completed at each spring source where multiple sources exist to provide a more extensive survey.

Upon completing desired protocols at each complex, gear must be decontaminated to avoid the spread of aquatic organisms. Reference the Decontamination header on page 6 for specific instructions.

Collection of Voucher Specimens

Please only make collections at springs supporting adequate populations of springsnails. Do not collect the only springsnails observed at the site.

If you have a permit to collect springsnails for your project, fill out the collection section of the datasheet. Method of collection of voucher specimens will depend on where you plan to send them. Please check with your chosen lab to determine the preferred method for preservation. Collection methods may require the use of soft tipped forceps, hard tipped forceps, coin envelopes, and vials with non-denatured 95% ethyl alcohol or other tools for preservation of genetic material. Location of collections in complex systems will also vary by project, please consult project leads for further direction.

In large systems collections for ID will often be limited by funding. Suggestions for collecting with limited funding in complex systems include making collections at the spring sources with:

1. The greatest distance between them (ex. SH01 and SH20 are .25miles apart)
2. A significant difference in temperature or water quality
3. More than one species previously ID'd using morphology
4. Springsnails that look significantly different in size, color, or shell shape

Determine an appropriate naming convention for all of your collections beforehand. Record pertinent information about your collection on the sample and the datasheet. An example naming convention for collections is found below.

Collection ID: Site name abbreviation-collection number at this site-year
Example: Robinson Mountain, collection #4, 12 MAY 2018
Final Collection ID: RM-04-18

Record information for each collection in a separate file for sending specimens to the lab including: collection ID, spring name or number, UTMs, elevation, collector, number of specimens, notes, and any other information the lab prefers.

Decontamination

Before moving from one spring to the next, be sure to complete the following decontamination protocol (NWCG 2017) to avoid spreading aquatic invaders or springsnails between springs.

Use either 1 Tbsp Super HDQ or 4 Tbsps Green Solutions Neutral Disinfectant PER 1-gallon water. Submerge equipment and soak for 10 minutes in 5-gallon bucket, or spray equipment and let stand for 10 minutes. Rinse gear thoroughly with clean water after cleaning period. IMPORTANT: Quaternary ammonia compounds (Quats) are highly toxic to aquatic organisms and therefore the decontamination process must be conducted at least 100ft from wetted areas. These compounds become immobile in soil. Quats are preferable to bleach concentrations because they are less corrosive to canvas and rubber gear, and are less likely to degrade waterproofing. However, bleach concentrations may also be used for decontamination, and the components break down quickly in the soil. Use $1^{1/8}$ cup of bleach per gallon of water and soak for 10min.

Factor to consider: If working in a large interconnected complex, decontamination may not be necessary between visits to each individual springhead. This is dependent on project requirements.

Data Analysis (adapted from Piorkowski and Diamond [2015] by AZGFD)

Using the protocols above, compare detection results from each one and a standardized index of catch-per-unit-effort (CPUE) for Protocol 2 to enumerate snail density. For Protocol 1, record a binary "1" or "0" for observed or not observed respectively. Although this protocol does not lend itself to a calculation of CPUE, we can assess the time needed to first detect springsnails in a system. Compare the average number of documented springsnails from each of the timed surveys (Protocol 2) to the time of first detection (Protocol 1). Then measure the relationship with simple linear regression and the coefficient of determination (R2) value to assess the goodness-of-fit between the two variables. For the Protocol 2, CPUE will be calculated independently.

Calculate each protocol's detection probability based on the combined efforts of all protocols for direct comparison. In addition, calculate individual searcher detection probability using PRESENCE 6.1 (Hines 2006), when double blind observations of spring surveys are conducted. These will be used to compare the use of imperfect springsnail detection (MacKenzie *et al*. 2002) with raw sample counts.

Contacts

Direct questions/comments and provide copies of completed datasheets, site photographs, and associated field notes to:

Eric Miskow
Biologist/Data Manager
Nevada Natural Heritage Program
Department of Conservation and Natural Resources
emiskow@heritage.nv.gov
(775) 684-2905

For information regarding springsnail surveys in Nevada and this protocol:

Almeta (Ali) Helmig
Biodiversity Program Coordinator
Great Basin Institute
In coordination with Elko, NV BLM
ahelmig@blm.gov OR ahelmig@thegreatbasininstitute.org
(775) 753-9236

For information regarding original protocol developed by AZGFD or springsnail sampling in Arizona:

Jeff Sorensen
Invertebrate Wildlife Program Manager
Arizona Game and Fish Department
(623) 236-7740 OR (480) 243-5496
jsorensen@azgfd.gov OR snails@azgfd.gov

Literature Cited

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Springsnail Survey

Start Time:_____

Survey Protocols Completed #1 #2 #3
Collection made? Y N

Site: **Date:** **Recorder:** **Observer:**

Landowner:	NPS	USFS	BLM	Tribal	Military	Private	Other	Spring Type *:	Limnocrene	Rheocrene	Helocrene

Spring Name or ID Code	Allotment	Field Office	UTMs (NAD83)	E:	Elevation:	Notes:
				N:	m ft	

Springsnails	Time to 1st Springsnail	Distance from Springhead to: 1st Encounter	Distance from Springhead to: Last Encounter	Observer	Substrate Searched (Circle where springpsnails found)	Count of Springsnails (10min searched)
		m	m	1		
				2		

Other Snails	Fish	Amphi-pods	Crayfish	Amphib-ians	EPT*	Aquatic Beetles	Odonata Larvae	Other Mollusks	Other

Collection ID:	Collector:	Lab Name for ID:	Notes:	# Collected	Return ID:

Springsnail Survey: Habitat Data

Habitat Description	Exclosure: Y N

Spring Run Physical Measurments				Water Quality Parameters				Dominant Vegetation *		Substrate Composition (as Percent Cover)*						
Total Wetted Length of Run	Search Area*	Width (m)	Depth (cm)	Flow*	Temp (C)	pH	Cond (uS)	Species or Type	Percent Cover	Clay	Silt	Sand	Gravel	Cobble	Stone	Boulder
m	SH															
Total Occupied Length	MID															
m	EOL															
	+25 m															

* = Refer to Definitions Section for further information

Appendix A. Springsnail Survey Datasheet

Evidence of Habitat Disturbance	Present*	Notes
Springhead Modification	Y - N - N/A	
Ungulate Use	Y - N - N/A	
Off-trail OHV Use	Y - N - N/A	
Wildfire	Y - N - N/A	
Human Disturbance	Y - N - N/A	
Oil, Gas, Mineral, Geothermal	Y - N - N/A	
Aquatic Invasive Spp.	Y - N - N/A	
Riparian Invasive Spp.	Y - N - N/A	
Drought	Y - N - N/A	
Other	Y - N - N/A	

Sketch of Spring (Identify "SH", path of spring run flowing downslope, "EOW", end of water, other features like pooled water, spring box, etc)

Spring Run Aspect (Direction of Flow)

N
NW NE
W E
SW SE
S

(circle one direction)

DEFINITIONS

Substrate Composition Approximate Size Comparison	
Boulder = 600mm (beach ball)	
Stone = 250mm (volleyball)	
Cobble = 64mm (tennis ball)	
Gravel = 2mm (match head)	
Sand = 1.5-0.1mm	
Silt = < .1mm	
Present	Unk site history=N/A

Spring Flow Qualitative Estimate (if unable to measure flow velocity)
L = little/no flow; mostly stagnant
M = moderate flow; moves fine particles
H = high flow w/ turbulance; strong riff.
Search Area
"SH" =springhead, "MID" =mid-point of run, "EOL"=end of occupied length, "+25m"= 25m downstream of EOL or end of wetted run

Common Vegetation Species Codes (first two letters of genus and first two letters of species; unless otherwise noted)			
NAOF=watercress	MIGL=Monkeyflwr	SC*sp* =reeds	PHAU=phragmytes
LEMI=duckweed	SA*sp* =willow	DISP=saltgrass	CAPU=white top
JU*sp* =rush	PR*sp* =mesquite	ROWO=wild rose	FIAL=filamentous algae
CA*sp* =sedge	TY*sp* =cattails	POFR=cottonwood	DETR=detritus
POGR=pondweed	EL*sp* =spikerush	VI*sp* =grapevine	MOSS=moss
Spr. Type	Limnocrene: Pool --> Channel, Rheocrene: Channel, Helocrene: Pool		
EPT	Ephemeroptera, Trichoptera, and/or Plecoptera		

Springsnail Survey

Start Time: 8:30am

Survey Protocols Completed (#1) (#2) (#3)
Collection made? (Y) N

Site: Beaver Creek **Date:** 10/5/18 **Recorder:** John Doe **Observer:** John Doe (1) Jane Doe (2)

Landowner:	NPS	USFS	(BLM)	Tribal	Military	Private	Other	Spring Type *:	Limnocrene	(Rheocrene)	Helocrene

Spring Name or ID Code	Allotment	Field Office	UTMs	E: 123456	Elevation:	Notes:
ABC-##-B###	Beaver Creek	Tuscarora	(NAD83)	N: 1234567	5604 (m) ft	Spring also named Snail Spring

Springsnails	Time to 1st Springsnail	Distance from Springhead to: 1st Encounter	Distance from Springhead to: Last Encounter	Observer	Substrate Searched (Circle where springpsnails found)	Count of Springsnails (10min searched)
Yes	7sec	1 m	8 m	1	sand, (gravel), roots, (live veg), (underhang)	267
				2	sand, gravel, (stone), (live veg), roots	308

Other Snails	Fish	Amphi-pods	Crayfish	Amphib-ians	EPT*	Aquatic Beetles	Odonata Larvae	Other Mollusks	Other
Physa snails, land snails	No	Yes	No	No	Yes	Yes	No	Fingernail Clams	Bullfrog observed at site, mayfly larvae

Collection ID:	Collector:	Lab Name for ID:	Notes:	Return ID:
AB01-18	Jane Doe	National Snail Indetification Center	Snails bright green in color, likley algae # Collected: 12	

Springsnail Survey: Habitat Data

Habitat Description Spring emerges from hillshide and flows downslope, crossing a dirt road and channeling down it's side as the road continues across the hillside. Duckweed and watercress common in pooled water, though several pools are punctured by hoof prints likely belonging to cows. Cow patties present near spring, as well as elk droppings. An old spring pipe is present but no water seems to be passing through it.

Exclosure: Y (N)

Spring Run Physical Measurments				Water Quality Parameters				Dominant Vegetation *		Substrate Composition (as Percent Cover)*						
Total Wetted Length of Run	Search Area*	Width (m)	Depth (cm)	Flow*	Temp (C)	pH	Cond (uS)	Species or Type	Percent Cover	Clay	Silt	Sand	Gravel	Cobble	Stone	Boulder
50 m	SH	1	3	Low	15	7.3	356	NAOF	40	0	40	25	25	5	5	0
Total Occupied Length	MID	2	1	Low	16	7.6	327	CASP	26	0	10	10	40	40	0	0
7 m	EOL	1	4	Low	21	7.7	362	LEMI	35	0	10	50	30	10	0	0
	+25 m	2	1	Low	23	7.8	368	CASP	50	0	15	5	5	75	0	0

* = Refer to Definitions Section for further information

Appendix B: Examples of completed springsnail survey datasheets

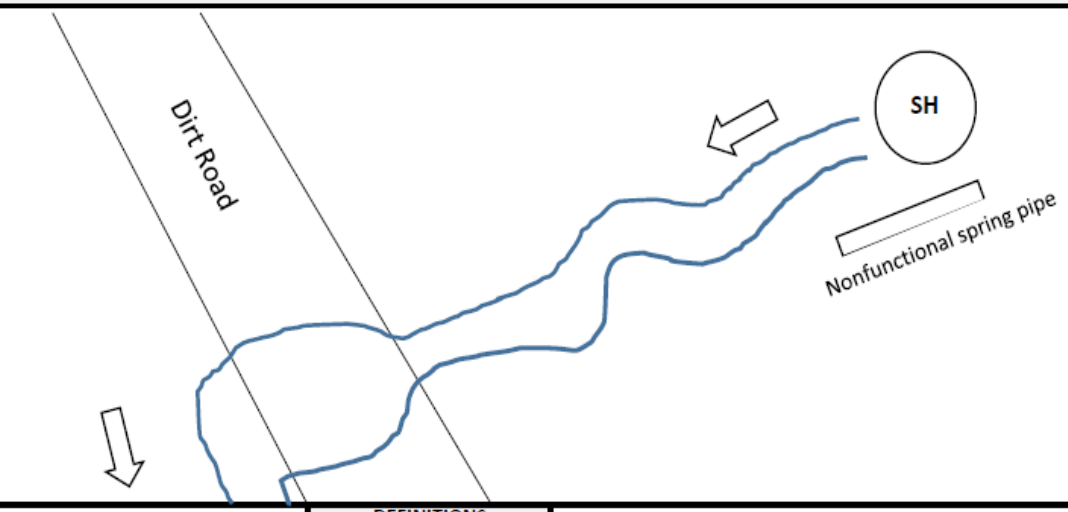
Evidence of Habitat Disturbance	Present*	Notes
Springhead Modification	Y - N - N/A	Nonfuctional pipe present at spring
Ungulate Use	Y - N - N/A	Cattle and elk droppings observed, numerous deep pools punched into spring by hooves
Off-trail OHV Use	Y - N - N/A	Spring flow crosses road and diverts down it's side
Wildfire	Y - N - N/A	
Human Disturbance	Y - N - N/A	
Oil, Gas, Mineral, Geothermal	Y - N - N/A	
Aquatic Invasive Spp.	Y - N - N/A	Invasive bullfrog observed
Riparian Invasive Spp.	Y - N - N/A	
Drought	Y - N - N/A	
Other	Y - N - N/A	

Sketch of Spring (Identify "SH", path of spring run flowing downslope, "EOW", end of water, other features like pooled water, spring box, etc)

Spring Run Aspect (Direction of Flow)

N
NW NE
W E
SW SE
S

(circle one direction)



DEFINITIONS

Substrate Composition Approximate Size Comparison	
Boulder = 600mm (beach ball)	
Stone = 250mm (volleyball)	
Cobble = 64mm (tennis ball)	
Gravel = 2mm (match head)	
Sand = 1.5-0.1mm	
Silt = < .1mm	
Present	Unk site history=N/A

Spring Flow Qualitative Estimate (if unable to measure flow velocity)
L = little/no flow; mostly stagnant
M = moderate flow; moves fine particles
H = high flow w/ turbulance; strong riff.
Search Area
"SH" =springhead, "MID" =mid-point of run, "EOL"=end of occupied length, "+25m"= 25m downstream of EOL or end of wetted run

Common Vegetation Species Codes (first two letters of genus and first two letters of species; unless otherwise noted)			
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LEMI=duckweed	SA*sp* =willow	DISP=saltgrass	CAPU=white top
JU*sp* =rush	PR*sp* =mesquite	ROWO=wild rose	FIAL=filamentous algae
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POGR=pondweed	EL*sp* =spikerush	VI*sp* =grapevine	MOSS=moss
Spr. Type	Limnocrene: Pool --> Channel, Rheocrene: Channel, Helocrene: Pool		
EPT	Ephemeroptera, Trichoptera, and/or Plecoptera		

Spring Complex- Additional Springhead Information

Spring ID:________________________

Spring Run Physical Measurments			Water Quality Parameters				Dominant Vegetation *		Substrate Composition (as Percent Cover)*							UTMs (NAD83)	E:
																	N:
SH #*	Width (m)	Depth (cm)	Flow*	Temp (C)	pH	Cond (uS)	Species or Type	Percent Cover	Clay	Silt	Sand	Gravel	Cobble	Stone	Boulder	Notes:	

Springsnails Observed	Occupied Length	Collection ID	Number Collected	Collector	Return ID

Spring Run Physical Measurments			Water Quality Parameters				Dominant Vegetation *		Substrate Composition (as Percent Cover)*							UTMs (NAD83)	E:
																	N:
SH #*	Width (m)	Depth (cm)	Flow*	Temp (C)	pH	Cond (uS)	Species or Type	Percent Cover	Clay	Silt	Sand	Gravel	Cobble	Stone	Boulder	Notes:	

Springsnails Observed	Occupied Length	Collection ID	Number Collected	Collector	Return ID

Spring Run Physical Measurments			Water Quality Parameters				Dominant Vegetation *		Substrate Composition (as Percent Cover)*							UTMs (NAD83)	E:
																	N:
SH #*	Width (m)	Depth (cm)	Flow*	Temp (C)	pH	Cond (uS)	Species or Type	Percent Cover	Clay	Silt	Sand	Gravel	Cobble	Stone	Boulder	Notes:	

Springsnails Observed	Occupied Length	Collection ID	Number Collected	Collector	Return ID

Spring Run Physical Measurments			Water Quality Parameters				Dominant Vegetation *		Substrate Composition (as Percent Cover)*							UTMs (NAD83)	E:
																	N:
SH #*	Width (m)	Depth (cm)	Flow*	Temp (C)	pH	Cond (uS)	Species or Type	Percent Cover	Clay	Silt	Sand	Gravel	Cobble	Stone	Boulder	Notes:	

Springsnails Observed	Occupied Length	Collection ID	Number Collected	Collector	Return ID

*SH# is the springhead number, assigned by the recorder

Appendix C: Additional datasheet for complex systems with multiple spring sources

Springsnail Survey Metadata

This information is a quick reference to aid in filling out the springsnail survey datasheet. Reference the Nevada Springsnail Survey Protocol for more detailed questions.

General Survey Information

Site: Name of area in which the current spring is located ex: project name or area, a mountain range, the name of large spring complex, etc.
Date: Date of datasheet completion
Recorder: Name of individual completing the datasheet
Observer: Name of individual searching and collecting the data being relayed to the recorder. If more than one observer is participating number each observer, Ex: 1. Jane Doe 2. John Doe

General Site Information

Landowner: The individual or entity responsible for the land on which the spring resides

- NPS- National Park Service
- USFS- United States Forest Service
- BLM- Bureau of Land Management
- Tribal- Native American Tribal Land
- Military- Military base or Institution
- Private- Private Landowner, ex. Ranch
- Other- Other (state owned land, US Fish and Wildlife Service, etc.)

Spring Type: The type of spring present

- Limnocrene- Spring emerges, pools, and then flows down a channel
- Rheocrene- Spring emerges and immediately flows into a defined channel
- Helocrene- Spring emerges diffusely, pools with no defined channel

Spring Name or ID Code: Listed or known spring name, water inventory number, or other known name/number used to identify the spring. If spring name or number is unknown during visit, use GPS coordinates and available records to determine if a name or number exists. Using a known name or number is important to determine spring history and potential impacts. Use an arbitrary naming mechanism for undocumented springs, Ex. (Site)01, etc. If multiple spring names are known for a single spring, please record other names in the notes section.
Allotment: Allotments are most often used with USFS and BLM. This is an administrative boundary used for grazing purposes.
Field Office: The field office associated with the entity conducting the springsnail survey
UTMs, E, N: All spring locations will be recorded in using UTM, NAD 83 (Easting and Northing) at the springhead
Elevation: Elevation of the springhead, circle m for meters or ft for feet
Notes: Any notes relating to the Spring Name, Allotment, Field Office, UTMs, Easting/Northing, or Elevation

Springsnail Survey

Springsnails: Are springsnails observed, Yes or No, please note if not found at spring head
Observer: Data associated with the first or second observer (previously numbered at top of page if more than one). If only one observer is available, search for 20 minutes instead of 10 minutes for presence/absence (protocol 1).
Time to 1st Springsnail Encounter: The amount of time that passes between the activation of the stopwatch and the discovery of the first springsnail by an observer.
Distance from Springhead to: 1st Encounter/Last Encounter: The distance, in meters, from the springhead to the location where the first springsnail is found. The distance, in meters, from the springhead to the location where the last springsnail is found.
Substrate Searched: List the kind of substrate searched for springsnails, including: boulder, stone, cobble, gravel, sand, silt, live and dead vegetation, roots, under- hangs, etc. Circle any substrate where springsnails are found.
Count of Springsnails: The number of springsnails counted in 10min by each observer (see protocol 2 for further details). When completing the timed counts, each observer will conduct the timed count for 10 minutes (protocol 2). If only one observer is present, they will still only count for 10 minute

Other Snails: Record other snails observed within the spring; Ramshorn snails, physa snails, pond snails
Fish: Fish observed in the spring, yes or no
Amphipods: Amphipods observed in the spring, yes or no
Crayfish: Crayfish observed in the spring, yes or no
Amphibs: Amphibians observed in the spring, yes or no; record species if known in this box or in the notes section
EPT: Ephemeroptera (mayfly), Trichoptera (caddisfly), and/or Plecoptera (stone fly) observed in the spring, yes or no
Aquatic Beetles: Aquatic beetles observed in the spring, yes or no
Odonata Larvae: Odonata (dragonfly/damselfly) larvae observed in the spring, yes or no
Other Mollusks: Other mollusks such as fingernail clams observed in the spring, yes or no
Other: Document any other species observed within the spring

Springsnail Collection Information

Collection ID: Code used to identify snails collected at current spring (use a consistent naming convention for your project)
Collector: Name of individual who made the collection
Lab Name for ID: Name of the lab where the collections will be sent for genetic identification
Notes: Any notes on the collected snails including the number of specimens collected at the site or any notes about historical observations of springsnails
Return ID: Upon genetic testing by the designated lab, the confirmed ID of the collected snails

Habitat Survey

Habitat Description: A basic description of the spring and the habitat it provides, as well as the surrounding habitat. Include if the spring is in an exclosure and if the exclosure is in need of repair. Plant species present can be circled on backside of data sheet in definitions section; if there are additional plants record them in the habitat description.

Total Wetted Length of Run: The length of the spring and its outflow in meters. Estimate, or for great distances use GIS.

Length Occ. By Springsnails: The portion of the Wetted Run with springsnails observed. Use Distance from Springhead to 1st Encounter/Last Encounter for easy calculation.

Search Area: Area where habitat assessments will occur

SH: Springhead; the location where the spring begins, for water quality record as close to water emergence as possible

MID: Midsection; half the distance between the springhead and end of length occupied by spring snails

EOL: End of Occupied Length; position at last encounter of a spring snail

+25m: For a large system this will be 25m from the end of occupied length OR at the end of the wetted length for a small system if 25m past EOL is no longer part of the spring

For each of the search areas, you will collect the following data:

Spring run width (m): Wetted width of the spring

Spring run depth (cm): Average depth of the wetted width

Water Flow/Velocity: Qualitative or Quantitative measure of flow

Water Temperature (C): Temperature in degrees Celsius

Water pH: Measure of potential hydrogen

Water Conductivity: Measure of electrical current flow in microSiemens (uS/cm)

Dominant Vegetation: The dominant vegetation species or type *within* the wetted run, NOT including canopy cover.

% Cover: Estimated percent cover of the dominant vegetation within the wetted run

Substrate Composition as percent cover by silt, sand, gravel, and/or cobble: qualitative or quantitative percent cover of vegetation and substrate of spring bottom

Habitat Disturbance Survey

Evidence of Habitat Disturbance: For each of the categories beneath this header, you will record if evidence is present (Y) absent (N) or unknown (N/A). Then in the proceeding notes section you may record your observations concerning the associated habitat disturbance. Circle the disturbance causing the most immediate threat to the functionality of the spring system.

Springhead Modification- spring box, piped flow, dug out

Ungulate Use- grazing, trampling, or wallowing by cattle, elk, horses, sheep. Include suspected species with evidence (scat, tracks, visual observation of animal) in the notes sections.

Off-trail OHV Use- tire tracks, trampling

Wildfire- sedimentation or ash, chemical contaminants, fire history information, recently burned stumps of plants nearby, note if the surrounding uplands burned, but the spring did not

Human Disturbance- check damn, roads, diversions, fence, litter

Oil, Gas, Geothermal, Mineral- If area history and current oil, gas, geothermal and mineral activities are known answer with Y or N if they are impacting the spring system, if unknown or unsure answer with NA and consult additional resources for more information.

Aquatic Invasive Species- crayfish, mosquitofish, New Zealand mudsnails, mollusks, etc.

Riparian Invasive Species- wild rose, palm trees, thistles, etc.

Drought- reduced wetted reach, dry springhead, must have additional historical records supporting drought determination

Other- describe as needed, ex. head-cuts, groundwater pumping, disturbance from weasels/raccoons, pesticide use, etc.

Sketch of Spring

Draw a sketch of the current spring, including relevant information like the path of the spring, the springhead(s), bisecting roads or trails, modifications like spring boxes or damn, head-cuts, exclosure fences, photo locations, SH, MID, EOL, +25m, etc.

Spring Run Aspect: Circle the direction in which the spring flows.

Definitions

This section provides at-a-glance explanations of categories within the datasheet that may cause confusion in the field. These boxes are marked with an * for easy reference. The Aquatic Vegetation Species Codes can be circled or highlighted for easy documentation of vegetation present at the current spring. Substrate composition size classes are those classified by the Natural Resources Conservation Service in the Field Book for Describing and Sampling Soils.

Spring Complex- Additional Springhead Information

SH #: An identifier; the arbitrary number assigned to the springhead

Spring run width (m): Wetted width of the spring

Spring run depth (cm): Average depth of the wetted width

Water Flow/Velocity: Qualitative or Quantitative measure of flow

Water Temperature (C): Temperature in degrees Celsius

Water pH: Measure of potential hydrogen

Water Conductivity: Measure of electrical current flow in uS/cm.

Substrate Composition as percent cover by silt, sand, gravel, and/or cobble: qualitative or quantitative percent cover of vegetation and substrate of spring bottom

Springsnails Observed: Were springsnails observed at the springhead, yes or no

Occupied Length: The length of the spring occupied by springsnails. When there are multiple springheads, occupied length is measured until the wetted run in intersected by a different wetted run with an existing occupied length.

Collection ID: Code used to identify snails collected at current spring (use a consistent naming convention for your project)

Number Collected: The number of springsnails collected

Collector: Name of individual who made the collection

Return ID: Upon genetic testing by the designated lab, the confirmed ID of the collected snails

Notes: Any notes on the associated springhead