



Mojave Desert Network Selected Large Springs

Blue Point Spring Benthic Macroinvertebrate and Springsnail Data 2012 to 2015

Natural Resource Data Series NPS/MOJN/NRDS—2017/1124



ON THE COVER

Blue Point Spring.

Photograph courtesy of the Mojave Desert Network.

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Blue Point Spring Benthic Macroinvertebrate and Springsnail Data 2012 to 2015

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Abstract

As part of the Selected Large Springs protocol, the Mojave Desert Network Inventory and Monitoring Program (MOJN I&M) collects samples of benthic macroinvertebrates and measures water quality and discharge in several springs. The purpose of these actions is twofold:

- to provide data regarding the overall health of the aquatic ecosystems in the springs, and
- to monitor the endemic species present in the springs.

These data will be useful in determining the effects of any observed changes in hydrology or vegetation and will provide baseline information that can be used to evaluate management actions at the springs.

In 2012, 2013, and 2015, MOJN I&M visited Blue Point Spring in Lake Mead National Recreation Area to test and implement the methods proposed for benthic macroinvertebrate sampling and springsnail counting. This report presents the results of these monitoring efforts.

Acknowledgments

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Overview

The National Park Service (NPS) Mojave Desert Network Inventory and Monitoring Program (MOJN I&M) has developed a protocol to monitor the hydrology and ecology of large springs in the network parks. The MOJN I&M Selected Large Springs (SLS) protocol covers springs in Death Valley National Park (DEVA), Joshua Tree National Park (JOTR), Lake Mead National Recreation Area (LAKE), Mojave National Preserve (MOJA), and Grand Canyon-Parashant National Monument (PARA). The springs have been selected for their high discharges, stability, and biological importance, and were chosen in cooperation with park staff to address the resource management priorities of each park.

As part of the SLS protocol, MOJN I&M collects samples of benthic macroinvertebrates (BMI) and measures water quality and discharge in several springs. The purpose of these actions is twofold:

- to provide data regarding the overall health of the aquatic ecosystems in the springs, and
- to monitor the endemic species present in the springs.

These data will be useful in determining the effects of any observed changes in hydrology or vegetation and will provide baseline information that can be used to evaluate management actions at the springs.

On February 24, 2012, and March 26, 2015, MOJN I&M collected BMI samples from Blue Point Spring in LAKE and submitted them to the Utah State University National Aquatic Monitoring Center for taxonomic identification and enumeration. On March 2, 2012, March 8, 2013, and March 26, 2015, MOJN I&M tested in-situ springsnail counting methods at Blue Point Spring. This report presents the results of these monitoring efforts.

Blue Point Spring

Blue Point Spring is located near North Shore Road in Lake Mead National Recreation Area (Figure 1). Water flows from carbonate bedrock into a 10 m-long source pool created by a weir (Figure 2). The weir was gaged by the USGS from 1999 to 2012 (station #09419547). During this time, typical flow through the weir was about 0.55 cfs (935 L/min; USGS 2016). The USGS ceased gaging the station at the end of water year 2012 due to funding constraints. MOJN I&M has been monitoring the weir since early 2013.

Below the weir, the springbrook flows in a well-defined channel for approximately 100 m before reaching a historical earthen dam. The dam creates small marsh-like areas and pools, but most of the water bypasses the dam to flow along a narrow channel for another 300 m, where it reaches North Shore Road, and another small marsh-like area is formed. The spring flows beneath the road in a culvert, and supports a corridor of riparian vegetation approximately 1000 m long on the other side.

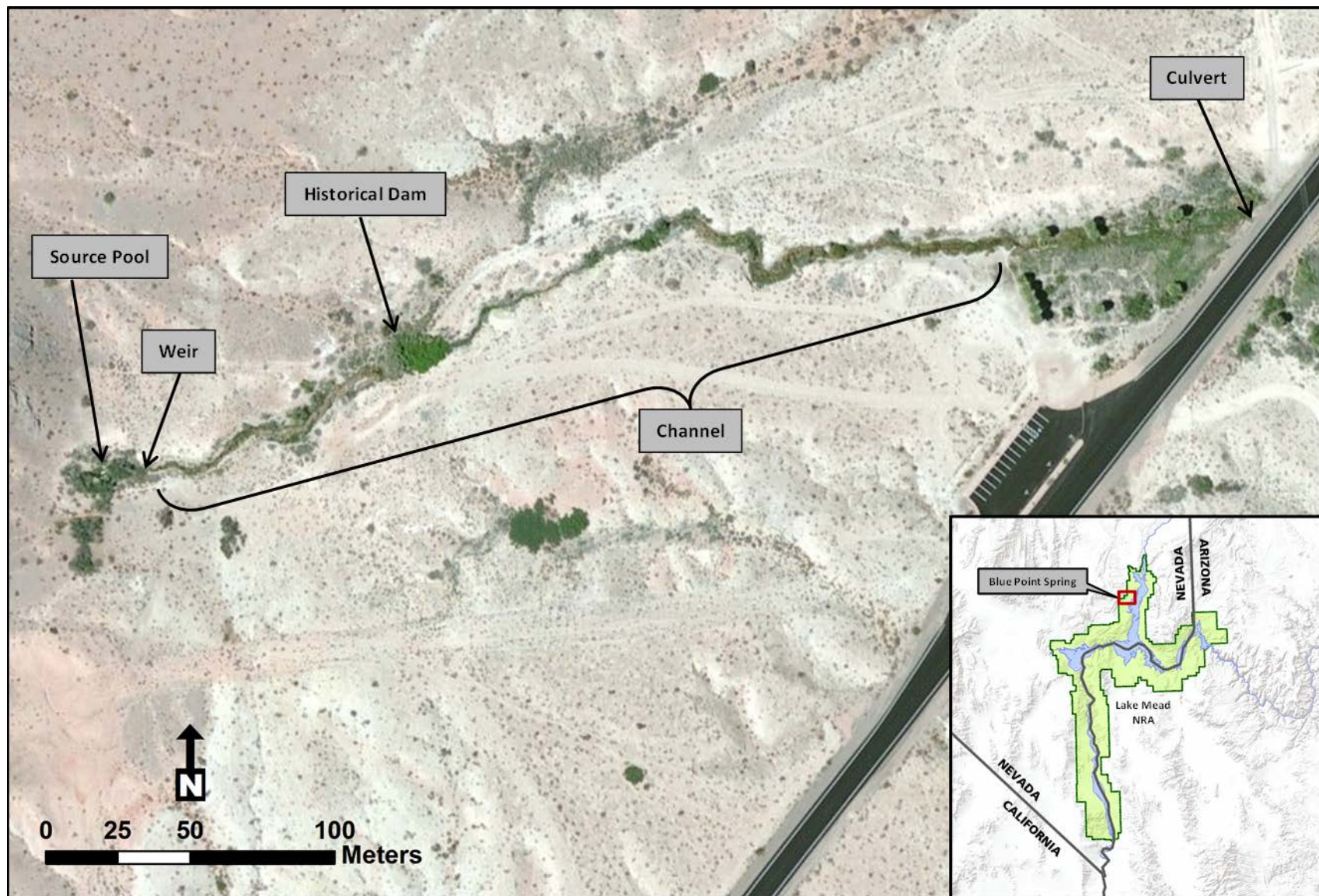


Figure 1. Aerial view of Blue Point Spring. Inset: Location of Blue Point Spring in LAKE.



Figure 2. Standing near the weir at Blue Point Spring, looking upstream toward the source pool.

Blue Point Spring supports three endemic species of snails in different habitat niches: the Blue Point pyrg (*Pyrgulopsis coloradensis*), Blue Point tryonia (*Tryonia infernalis*), and an unnamed assimineid species (*Assimineia* sp.; Hershler et al. 2015). The collection and identification of *T. infernalis* in 2014 was supported by MOJN I&M. The spring may also host an endemic amphipod (*Hyaella* sp.; Witt et al. 2006).

One of the few remaining natural populations of the relict leopard frog (*Rana onca*) is located at Blue Point Spring (Bradford, Jaeger, and Jennings 2004). Once thought to be extinct, this rare frog was recently a candidate for listing under the federal Endangered Species Act. However, the FWS found that existing regulations and conservation actions are adequate to protect the frog and determined that the species was not warranted for listing in 2016 (Federal Register 2016). In 2013 and 2014, UNLV, NDOW, and BLM personnel conducted vegetation management and habitat maintenance for the frog in the marshy area at the end of the channel (Jaeger and Rivera 2014).

Blue Point Spring has been colonized by exotic species, such as the Malaysian trumpet snail (*Melanooides tuberculata*). The Malaysian trumpet snail has been observed to outcompete and replace several native aquatic snail species throughout the Mojave Desert (Williams et al. 1985) and may pose a threat to the native springsnails in Blue Point Spring.

The convict cichlid (*Amatitlania nigrofasciata*), a popular aquarium fish, is another exotic species that was introduced to Blue Point Spring during the 1990s. Its establishment in the channel below the weir coincided with the disappearance of native springsnails from that location, suggesting that the fish may also negatively affect the abundance and distribution of native springsnails (Sada and Jacobs 2008). The non-native western mosquitofish (*Gambusia affinis*) has been introduced to Blue Point Spring as well. Its effects on native springsnail populations have not been studied.

Methods

BMI Samples

For more detailed information on the BMI collection methods used at Blue Point Spring, refer to SOP 8: Water Sampling, Benthic Macroinvertebrate Sampling, and Springsnail Monitoring (Moret et al. 2016).

BMI samples collected at the spring were preserved in ethanol and shipped to the Utah State University National Aquatic Monitoring Center (NAMC) for processing. There, the samples were sorted, identified to the lowest resolute taxon, and enumerated. Identifications were made by taxonomists certified by the Society for Freshwater Science using the taxonomic keys recommended by the Southwest Association of Freshwater Invertebrate Taxonomists (Richards and Rogers 2011). In order to provide a more complete taxa list, the samples were visually searched for 10 minutes for additional big and/or rare taxa. The NAMC's full procedures can be reviewed on their website (<http://www.usu.edu/buglab/SampleProcessing/LaboratoryProcedures/>, accessed 26 July 2017). The specimens from the samples are archived by the NAMC under the terms of a long-term loan agreement with the NPS.

February 2012

BMI sampling occurred on February 24, 2012. Two composite samples were collected: one from the source pool and one from the downstream channel. The methods used to collect each sample are described below.

The source pool sample was collected along an 8 m transect from the source to the weir. Five samples were collected every 2 m from 0 m to 8 m downstream of the spring source. The springbrook was approximately 2 m wide in the vicinity of the source, so the left, center, or right of the springbrook was chosen for sampling based on the last digit displayed on a digital watch. At each location, a kicknet sample was collected from a 30 cm x 30 cm quadrat. The study plan called for disturbing the substrate in the area by kicking it for 30 seconds and allowing the current to carry the disturbed macroinvertebrates into the net. However, the water velocity in the pool was too slow to carry the macroinvertebrates into the net, so samples were collected by sweeping the net through the vegetation for 30 seconds while simultaneously disturbing the substrate. The submerged vegetation in the quadrat was then jabbed five times with the kicknet. The material collected at the five sample locations was combined into a single composite source pool sample with a total area of 0.45 m².

The downstream channel sample was collected along a 50 m transect below the historical dam. Eleven samples were collected every 5 m from 0 m to 50 m. The springbrook was generally the width of the kicknet (30 cm) or less along the sample reach, so no attempt was made to select locations at the left, center, or right of the channel. At each sample location, a kicknet sample was collected by disturbing a 30 cm x 30 cm quadrat of substrate upstream of the net for 30 seconds. No submerged vegetation was present. The material collected at the eleven sample locations was combined into a single composite downstream channel sample with a total area of 0.99 m².

March 2015

BMI sampling occurred again on March 26, 2015. Two composite samples were collected: one from the source pool and one from the downstream channel. The methods used to collect each sample differed slightly from the previous visit and are described below.

The source pool sample was collected along an 11 m transect from the source to the weir. Eleven samples were collected every meter from 0 m to 10 m downstream of the spring source. At each location, a kicknet sample was collected from a 10 cm x 10 cm quadrat. The material collected at the eleven sample locations was combined into a single composite source pool sample with a total area of 0.11 m².

The downstream channel sample was collected along a 390 m-transect downstream of the weir. Samples were collected approximately every 30 m from 20 m below the weir to 410 m where the channel reached Northshore Road. At each location, a kicknet sample was collected from a 10 cm x 10 cm quadrat. The material collected at the fourteen sample locations was combined into a single composite downstream channel sample with a total area of 0.14 m².

Springsnail Field Counts

While springsnails were identified and quantified in the lab as discussed in the BMI results, MOJN I&M also monitored the spatial extent and density of springsnails in the field. The methods were modified from those outlined by Sada (2009). The advantages of this method are that it is inexpensive and no springsnails are removed from the spring. However, in our experience, snail counts from samples submitted to a laboratory can be significantly greater than hand counts. Springsnails were counted during visits on March 2, 2012 and March 8, 2013. The presence or absence of springsnails in each quadrat was noted for the March 26, 2015 visit.

In 2012 and 2013, the extent of the springsnail population was determined by observing the presence or absence of springsnails at accessible locations. At each location, a sample of substrate was brushed into a sieve. The portion of the substrate retained in the sieve was then spread across a white plastic tray and visually inspected for springsnails. Hand lenses were used for additional identification.

Monitoring points were selected at accessible locations across the extent of the springbrook where springsnails were present. A measuring tape was used to select monitoring points approximately 1 m apart. In both 2012 and 2013, the farthest monitoring point was 9 m downstream of the spring source, so there were ten monitoring points including the source.

At each monitoring point, a 10 cm by 10 cm quadrat was placed on the bottom of the springbrook, and the surface material and loose substrate were brushed into a sieve. The material retained from the sieve was transferred to a sorting tray, and approximately 1 cm of water was added. During the 2012 visit, the number of springsnails in each tray was determined by photographing the tray in bright sunlight using the macro setting on the digital camera and then counting the springsnails in those photographs on a computer monitor. During the 2013 visit, the number of springsnails was counted directly on the tray. All springsnails were returned to the spring.

Results

Water Quality

Several water quality parameters were measured in the source pool just above the weir in 2015. The values of these measurements are provided in Table 1.

Table 1. Water quality measured just above the weir at Blue Point Spring in March 2015.

Parameter	Value
Temp (°C)	29.52
pH	6.98
SpCond (µS/cm)	3761
DO (%)	24.3
DO (mg/L)	1.83

BMI Samples

The results of the BMI sample processing and taxonomic analysis conducted by the NAMC are shown in Table 2 for 2012 and Table 3 for 2015. Selected population metrics reported by the NAMC are shown in Table 4 for both visits.

Table 2. Abundance of BMI identified in samples collected in February 2012 at Blue Point Spring, reported per square meter.

Phylum	Class	Order	Family	SubFamily	Genus	Species	Source Pool	Downstream Channel
Annelida	Clitellata	–	–	–	–	–	11	20
Arthropoda	Arachnida	Trombidiformes	–	–	–	–	0	1
Arthropoda	Insecta	Coleoptera	Elmidae	–	<i>Microcylloepus</i>	–	96	129
Arthropoda	Insecta	Diptera	Ceratopogonidae	–	–	–	4	1
Arthropoda	Insecta	Diptera	Ceratopogonidae	Ceratopogoninae	<i>Probezzia</i>	–	0	11
Arthropoda	Insecta	Diptera	Ceratopogonidae	Dasyheleinae	<i>Dasyhelea</i>	–	11	0
Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	<i>Endotribelos</i>	–	7	0
Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	<i>Polypedilum</i>	–	11	15
Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	<i>Procladius</i>	–	43	4
Arthropoda	Insecta	Diptera	Dolichopodidae	–	–	–	0	1
Arthropoda	Insecta	Diptera	Psychodidae	–	<i>Pericoma</i>	–	4	1
Arthropoda	Insecta	Diptera	Stratiomyidae	–	–	–	0	2
Arthropoda	Insecta	Odonata	Coenagrionidae	–	–	–	18	0
Arthropoda	Insecta	Odonata	Coenagrionidae	–	<i>Argia</i>	–	4	21
Arthropoda	Insecta	Odonata	Libellulidae	–	–	–	2	0
Arthropoda	Insecta	Trichoptera	Helicopsychidae	–	<i>Helicopsyche</i>	–	0	1
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Smicrideinae	<i>Smicridea</i>	–	0	2
Arthropoda	Malacostraca	Amphipoda	Hyalellidae	–	<i>Hyalella</i>	–	472	19
Mollusca	Gastropoda	Neotaenioglossa	Hydrobiidae	–	–	–	1369	0
Mollusca	Gastropoda	Neotaenioglossa	Hydrobiidae	–	<i>Tryonia</i>	<i>infernalis*</i>	36	0
Mollusca	Gastropoda	Neotaenioglossa	Thiaridae	–	<i>Melanooides</i>	<i>tuberculata</i>	85	0

* Identified to species level as *Tryonia infernalis* by Hershler, Liu, and Simpson (2015).

Table 3. Abundance of BMI identified in samples collected in March 2015 at Blue Point Spring, reported per square meter.

Phylum	Class	Order	Family	Genus	Species	Source Pool	Downstream Channel
Annelida	Clitellata	—	—	—	—	85	107
Arthropoda	Insecta	Coleoptera	Elmidae	<i>Microcylloepus</i>	—	267	193
Arthropoda	Insecta	Coleoptera	Elmidae	<i>Zaitzevia</i>	<i>parvula</i>	12	0
Arthropoda	Insecta	Coleoptera	Elmidae	<i>Microcylloepus</i>	<i>formicoideus</i> *	0	14
Arthropoda	Insecta	Diptera	Ceratopogonidae	<i>Ceratopogon</i>	—	12	0
Arthropoda	Insecta	Diptera	Ceratopogonidae	<i>Probezzia</i>	—	12	0
Arthropoda	Insecta	Diptera	Chironomidae	<i>Chironomus</i>	—	0	7
Arthropoda	Insecta	Diptera	Chironomidae	<i>Endotribelos</i>	—	0	7
Arthropoda	Insecta	Diptera	Chironomidae	<i>Paratendipes</i>	—	0	21
Arthropoda	Insecta	Diptera	Chironomidae	<i>Polypedilum</i>	—	242	171
Arthropoda	Insecta	Diptera	Chironomidae	<i>Cricotopus</i>	—	0	7
Arthropoda	Insecta	Diptera	Chironomidae	<i>Cricotopus</i>	—	0	57
Arthropoda	Insecta	Diptera	Chironomidae	<i>Djalmabatista</i>	<i>pulcher</i>	48	136
Arthropoda	Insecta	Diptera	Chironomidae	<i>Labrundinia</i>	—	0	7
Arthropoda	Insecta	Diptera	Chironomidae	<i>Larsia</i>	—	24	29
Arthropoda	Insecta	Diptera	Chironomidae	<i>Zavrelimyia</i>	—	0	7
Arthropoda	Insecta	Diptera	Simuliidae	<i>Simulium</i>	—	61	0
Arthropoda	Insecta	Ephemeroptera	Baetidae	—	—	0	7
Arthropoda	Insecta	Odonata	Coenagrionidae	—	—	12	0
Arthropoda	Insecta	Odonata	Coenagrionidae	<i>Argia</i>	—	0	7
Arthropoda	Malacostraca	Amphipoda	Hyalellidae	<i>Hyalella</i>	—	1091	107
Mollusca	Gastropoda	Neotaenioglossa	Hydrobiidae	—	—	5891	0
Mollusca	Gastropoda	Neotaenioglossa	Thiaridae	<i>Melanoides</i>	<i>tuberculata</i>	94	0

* *Microcylloepus formicoideus* is endemic to DEVA. These specimens were likely a different species of the same genus.

Table 4. Selected population metrics for February 2012 and March 2015 BMI samples from Blue Point Spring.

Population Metric	February 2012		March 2015	
	Source Pool	Downstream Channel	Source Pool	Downstream Channel
# of Taxa*	7	12	10	7
Abundance	2171	229	7852	886
Dominant Family	Hydrobiidae	Elmidae	Hydrobiidae	Chironomidae
% Dominant Family	64.7	56.4	75.0	50.8
# of EPT Taxa*	0	2	0	0
EPT Abundance	0	3	0	7
# of Shredder Taxa*	0	0	0	0
Shredder Abundance	11	15	242	171
# of Scraper Taxa*	1	0	1	0
Scraper Abundance	1369	1	5891	0
# of Collector-Filterer Taxa*	0	1	1	0
Collector-Filterer Abundance	0	2	61	0
# of Collector-Gatherer Taxa*	3	4	3	4
Collector-Gather Abundance	604	172	1442	514
# of Predator Taxa*	2	5	3	3
Predator Abundance	71	39	109	186
# of Long-Lived Taxa*	1	2	2	2

Values for richness-based metrics are standardized to operational taxonomic units and a fixed count of 300. Standardized metrics are indicated with an asterisk. Abundance-based metrics are presented as the estimated number of individuals per square meter. EPT stands for the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies).

February 2012

In the source pool sample, hydrobiid snails (including *Tryonia infernalis*) were the dominant taxon with 1,405 individuals per m². There were also 472 amphipods (*Hyaella* sp.) per m². Riffle beetles (*Microcylloepus* sp.) were the most abundant insect taxon with 96 individuals per m². The invasive Malaysian trumpet snail (*Melanoides tuberculata*) was also present with 85 individuals per m² (Figure 3).

In the downstream channel sample, riffle beetles were the dominant taxon with 129 individuals per m². There were no Malaysian trumpet snails collected in this sample.



Figure 3. Malaysian trumpet snail (*Melanoides tuberculata*) observed in the source pool during springsnail monitoring.

March 2015

BMI sampling protocols changed in 2015, so the higher BMI densities reported for this year may reflect changes in methodology as opposed to actual changes in the BMI community.

In the source pool sample, hydrobiid snails were again the dominant taxon with 5,891 individuals per m². Amphipods (*Hyaella* sp.) were also abundant with 1,091 individuals per m². The dominant insect taxa were non-biting midges (family Chironomidae) and riffle beetles (*Microcylloepus* sp.), with 314 and 279 individuals per m², respectively. The Malaysian trumpet snail (*Melanoides tuberculata*) was present at a density of 94 individuals per m².

In the downstream channel sample, non-biting midges were the dominant taxon with 449 individuals per m². Also abundant were riffle beetles with 207 individuals per m². Amphipods and annelid (segmented) worms both had 107 individuals per m². There were no Malaysian trumpet snails collected in this sample. One relict leopard frog (*Rana onca*) was observed during BMI sampling about 100 m downstream of the weir.

Springsnail Field Counts

Table 5 shows the springsnail abundances counted in the office and estimated in the field during the 2012 visit. Table 6 shows the springsnail abundances counted in the field during the 2013 visit. On the day of the 2013 visit, it rained in the morning and again about half-way through springsnail monitoring in the afternoon, but no effect was observed on the springsnail counts. Table 7 shows the presence of springsnails observed in the field during the 2015 visit after quantitative field counts had been discontinued.

Table 5. Springsnail population abundances observed at Blue Point Spring in March 2012.

Location on Transect 0 m = Source	Substrate	Abundance Counted in the Office from Photos: 10 x 10 cm (0.01 m²) Quadrat	Abundance Estimated in the Field: 10 x 10 cm (0.01 m²) Quadrat
0 m	Fines	0	0
1 m	Silt	0	0
2 m	Cobble	1	3
3 m	Organics	1	1
4 m	Organics, fines	3	5
5 m	Gravel, fines	13	10-15
6 m	Gravel, fines	18	25-30
7 m	Gravel, sand	13	10-15
8 m	Gravel	15	15-20
9 m	Gravel, concrete	66	45-50
Composite Source Pool	Abundance per square meter	1300	1265 (1140–1390)

Table 6. Springsnail population abundances observed at Blue Point Spring in March 2013.

Location on Transect 0 m = Source	Substrate	Abundance Counted in the Field 10 x 10 cm (0.01 m²) Quadrat
0 m	Silt, sand	4
1 m	Silt, organics, large rocks	2
2 m	Silt, fallen reed	1
3 m	Silt, gravel	1
4 m	Silt, organic	6
5 m	Silt, gravel	8
6 m	Gravel, rock	67
7 m	Silt	3
8 m	Gravel, silt	35
9 m	Concrete	24
Composite Source Pool	Abundance per square meter	1510

Table 7. Springsnail presence observed in Blue Point Spring in March 2015.

Source Pool Location on Transect 0 m = Source	Substrate	Presence Observed in the Field
0	Gravel	Yes
1	Fines	Yes
2	Fines	No
3	Fines, gravel	Yes
4	Fines	Yes
5	Vegetative mat, fines	No
6	Vegetative mat	Yes
7	Vegetative mat	Yes
8	Vegetative mat	Yes
9	Algae on concrete	Yes
10	Algae	Yes

In both 2012 and 2013, native springsnails were present at or near the source and down the springbrook to the weir. There were no native springsnails observed or collected downstream of the weir. Invasive Malaysian trumpet snails were observed within the springbrook upstream and downstream of the weir. Convict cichlids and other introduced non-native fish species seemed to be thriving downstream of the weir.

During the 2012 visit, the average springsnail density counted in the office was 1,300 specimens per m². The average springsnail density estimated in the field was 1,265 specimens per m². These densities are similar, but are both slightly lower than the 1,405 springsnails per m² reported by the lab. During the 2013 visit, the average springsnail density counted in the field was 1,510 specimens per m², higher than the previous year. There was no BMI sample collected during that visit for comparison.

During the 2012 visit, photographing the trays worked fairly well when organic matter was not present but poorly at locations where detritus composed the majority of the substrate (Figure 4). Organic matter obscured the springsnails and made precise enumeration difficult on the computer monitor. Counting was only found to be possible in the field as long as exact numbers were not required. Field counts of springsnails ended in 2014 because MOJN I&M found that they tended to significantly underestimate springsnail populations at Blue Point Spring and at other springs visited for the Selected Large Springs protocol. Springsnails, particularly juveniles, were often too small and inconspicuous to identify, especially when they were embedded within a matrix of dark sand and organic matter in the tray. Laboratory counts from BMI samples will be used in the future to monitor springsnail populations at Blue Point Spring.

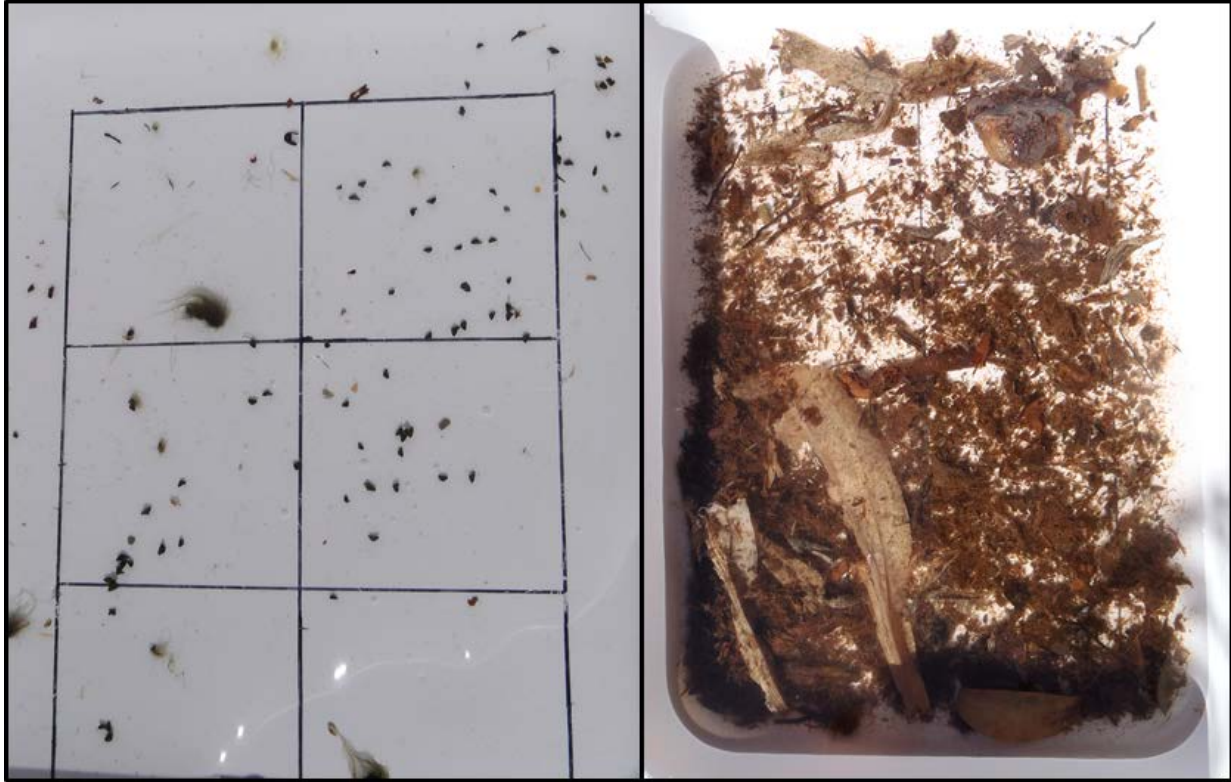


Figure 4. Example sorting tray photographs from springsnail monitoring in 2012. Left: Sorting tray at monitoring point 9 m from spring source. Most of the black specks are springsnails. Right: Sorting tray at monitoring point 3 m from spring source. Organic matter made counting springsnails difficult in this tray.

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