

KANAB AMBERSNAIL 2012 STATUS REPORT

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Note:

In this report, Arizona and Utah ambersnail populations identified as “Kanab ambersnail” and “Niobrara ambersnail” are based primarily on morphological distinctions described by Pilsbry and S.K. Wu. Recent genetic analysis and morphological evaluation on ambersnail specimens from localities in Alberta, Canada, and in the United States (Southwest, Northwest, and Midwest) suggests that the Arizona and Utah populations, including Vaseys Paradise, are genetically and morphologically similar to other *Oxyloma* populations in the recent study, and their taxonomic identity may be revised in the future. However, until the recent genetic and morphological study results are published in a peer-reviewed science journal, we will continue to use the “Kanab ambersnail” and “Niobrara ambersnail” designations for their respective historical populations.

Key to acronyms used in this report:

AGFD = Arizona Game and Fish Department
GCMRC = Grand Canyon Monitoring and Research Center
NPS = National Park Service
USBR = U.S. Bureau of Reclamation
USGS = U.S. Geological Survey
USFWS = U.S. Fish and Wildlife Service
KAS = Kanab ambersnail
NAS = Niobrara ambersnail
VP = Vaseys Paradise
UEC = Upper Elves Chasm
IG = Indian Garden
CPUE = Catch Per Unit Effort
UTM = Universal Transverse Mercator

ABSTRACT

Three monitoring surveys of the Kanab ambersnail population at Vaseys Paradise, Grand Canyon, were conducted in May, June, and September 2012. Overall, the snail counts and Catch Per Unit Effort estimates of abundance were down from previous years. The September 2012 survey had the lowest counts of live ambersnails (n=11) and lowest CPUE estimate (0.41 snails/10 min search) at Vaseys Paradise than in all past surveys (both by season and by year) since timed presence-absence sampling was started in 2006. The snail habitat at Vaseys Paradise generally was in good condition throughout the year, with the exception of the upstream half of Patch 6, all of Patch 7U and 7L, and most of Patch 8L which was predominately dry, dead vegetation during the June and September surveys. That area is typically kept wet with springflow from the upper waterfalls, but in 2012 most of the springflow drained along the base of the waterfall to the upper pool and lower waterfall on the downstream end of the site.

The translocation site, Upper Elves Chasm, was surveyed in May 2012. Like at Vaseys Paradise, counts of live ambersnails (n=7) and CPUE estimate (0.85 snails/10 min search) at Upper Elves Chasm were the lowest compared to past surveys (since 2009, when this sampling method was first used at this site). In contrast, the Niobrara ambersnail population at Indian Garden, on the South Rim of Grand Canyon, had relatively higher counts of live ambersnails (n=13) and a high CPUE estimate (6.50 snails/10 min search) when this site was surveyed in September 2012, but these counts and CPUE estimate were still lower than the previous year.

Based on the lower snail counts and CPUE estimates from our September survey at VP, the Department did not advocate conducting any snail habitat mitigation for the planned November 2012 High Flow Experiment. If future high flows occur more regularly rather than once every 4-5 years, it is expected that the lower edge of high quality ambersnail habitat will remain at a higher elevation at VP—and should result in less incidental take of KAS during high flows in the long term. The most current biological opinion on the operation of Glen Canyon Dam does not require ambersnail habitat mitigation at VP due to high flow experiments planned under programmatic sediment trigger events.

KANAB AMBERSNAIL 2012 STATUS REPORT

Jeff A. Sorensen

INTRODUCTION

Since being listed as endangered in 1992, the Kanab ambersnail (KAS; Succineidae: *Oxyloma haydeni kanabensis* Pilsbry 1948) in Arizona has been the focal point of an extensive cooperative effort to facilitate its recovery through research, survey, monitoring, and management actions. Coordination and funding of much of this work was provided by the following agencies: Arizona Game and Fish Department (AGFD or Department), Central Utah Project Completion Act Office of the U.S. Department of Interior, National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Reclamation (USBR), U.S. Geological Survey (USGS) and its Grand Canyon Monitoring and Research Center (GCMRC), and Western Area Power Administration.

Since 2000, USGS-GCMRC has contracted AGFD to lead the monitoring and management of the KAS population at Vaseys Paradise, as part of the Glen Canyon Dam Adaptive Management Work Group's annual science plans. The Department continues to monitor the translocated KAS population at Upper Elves Chasm and the Niobrara ambersnail (NAS; *Oxyloma haydeni*) population at Indian Garden using funding from State Wildlife Grants, Arizona Heritage Fund, and state Game and Fish Fund. The following report documents the Department's 2012 monitoring efforts for both ambersnail species.

Currently, KAS exists at three locations within the southwestern United States. Two populations occur naturally, with one located at the privately-owned Three Lakes (UTM: 12S N4111342, E360828), just north of Kanab in southern Utah, and the other at Vaseys Paradise (VP; UTM: 12S N4039530, E423202) in Grand Canyon, Arizona. The third population of KAS was established at Upper Elves Chasm (UEC; UTM: 12S N4006364, E369311) in Grand Canyon, Arizona, through translocation efforts in 1998-99 (Sorensen and Nelson 2000; Nelson and Sorensen 2011). There are two natural populations of NAS in Arizona, one at Minus Nine Mile Marsh (UTM: 12S N4081308, E453936) in the Lee's Ferry reach of Glen Canyon and the other at Indian Garden (IG; UTM: 12S N3993218, E398462) along the South Rim of Grand Canyon (Sorensen and Nelson 2003). UTM coordinates are in NAD83 datum. Figure 1 shows the locations of each of these ambersnail populations described in this report.

KAS research needs and recovery goals are identified in the KAS Recovery Plan (USFWS 1995). With input from the Kanab Ambersnail Working Group, the Interim Conservation Plan for southwestern ambersnails (Sorensen and Nelson 2002) updated the research needs and management goals for KAS, as well as NAS, in Arizona and Utah. Much of the early research on the VP population of KAS was documented in various project reports and publications (Stevens et al. 1997a, 1997b, 2000; Sorensen and Kubly 1997a, 1997b; Meretsky 1999; Miller et al. 2000; Nelson and Sorensen 2000). The VP monitoring is identified as Goal 5 (BIO 5.R1.11, 12) under the Glen Canyon Dam Adaptive Management Program Science Plan.

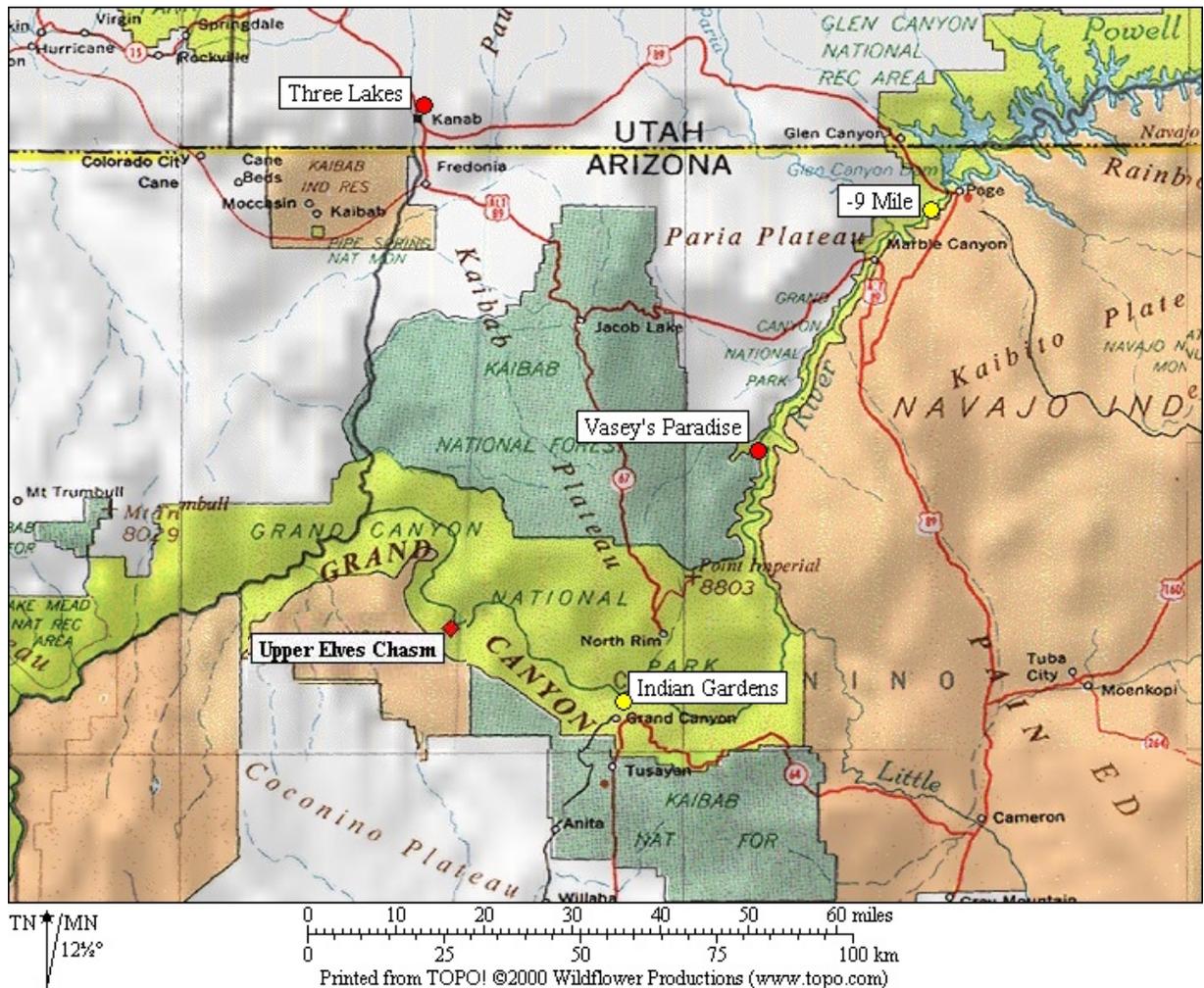


Figure 1. Location of Upper Elves Chasm, Indian Garden, and Vaseys Paradise in Grand Canyon National Park, Minus Nine Mile Marsh in Glen Canyon National Recreation Area, and Three Lakes in southern Utah. Red waypoints indicate KAS populations and yellow waypoints indicate NAS populations.

METHODS

Timed presence/absence surveys were first used as a monitoring technique for the VP KAS population in September 2006, the UEC KAS population in April 2009, and the IG NAS population in June 2009. The following is the protocol used for these surveys:

- Use a 2-person search team (1 searcher and 1 data recorder).
- Data recorder uses a stopwatch to record the amount of time it takes the searcher to find the first live snail (target species)—mm:ss:ss = minutes : seconds : 1/100 of a second (note: times will be rounded off to nearest half minute by the project biologist during data entry).
- Reset the stopwatch and start again for 10 minutes only—the searcher counts as many live snails (target species) in nearby habitat, without covering the same area twice.

- At the end of the 10 minutes, report the total number of live snails found (including the first one) and the total time from the initial search plus the 10 minutes. Searcher should keep track of numbers per age class (juveniles are <5 mm in size and mature snails are >5 mm in size) to report out.
- If the searcher doesn't find a live snail (target species) within 20 minutes, then end the search and report "0" time for the initial search, 20 minutes total, and "0" live snails.
- If the searcher covers all of the available or accessible habitat before finding a live snail OR before the end of the 10 minute search, then report the total time spent searching and note "all habitat searched" or "all accessible habitat searched" as appropriate.
- The recorder must note the dominant vegetation of the habitat patch (or "mixed" if no clear dominant species is apparent)—use a 4-letter genus-species vegetation code (refer to the code list on the datasheet).
- Patch ID number or name (if mapped or provided by project biologist), site name, survey date, and names of the searcher and recorder must be recorded.
- Note any other relevant comments for the survey (such as snail egg masses, estivating or mating snails), condition of the vegetation patch, or other non-target mollusks observed.
- At the bottom of the datasheet, draw a sketch of the vegetation patch with search area shaded (also indicate North direction and nearby landscape features such as a stream, river, trail, or large trees)—or use a site map with vegetation patches identified, and shade the area searched.

The timed presence/absence sampling protocol is used while surveying other ambersnail sites. To collect more detailed habitat association data with those surveys, a limited number of traditional sampling plots (that is, 20-cm diameter haphazard-selected plots described in Stevens et al. 1997a) are used following the timed presence/absence surveys in habitat occupied by ambersnails. Other live mollusks (such as *Catinella*, *Fossaria*, *Physa*, zonitid landsnails, and marsh slugs) are also noted while surveying.

Repeat digital photographs of each habitat patch were taken from fixed photo points during each survey. Figure 2 represents the approximate locations of each habitat patch in the low-zone habitat (below 100,000 cfs stage discharge elevation) at VP.

Water quality at VP was measured in June 2012, by NPS Hydrologist, Steve Rice, using a Hydrolab MS5 multiparameter sonde. Springflow volume was estimated with an AquaCalc flowmeter; these readings were taken at the base of the waterfalls where the springflow is channeled down the downstream edge of the site.

During most surveys, a qualitative assessment of habitat condition at VP was recorded—that is: percentage of monkeyflower and watercress in bloom, river flow inundation of lower elevation patches, observed impacts from bighorn grazing/trampling and recreational visitors. At UEC, any impacts to ambersnail habitat from flash flooding and recreational visitors were also noted during surveys.

While the Department is contracted to complete two seasonal surveys of VP each year, the author had the opportunity to conduct an additional survey of that site in May 2012 during a Moki Mac citizen science commercial river trip. That opportunity provided increased public

awareness and outreach on the Kanab ambersnail, and contributed to standardized data collection for the species at little cost to partner agencies.

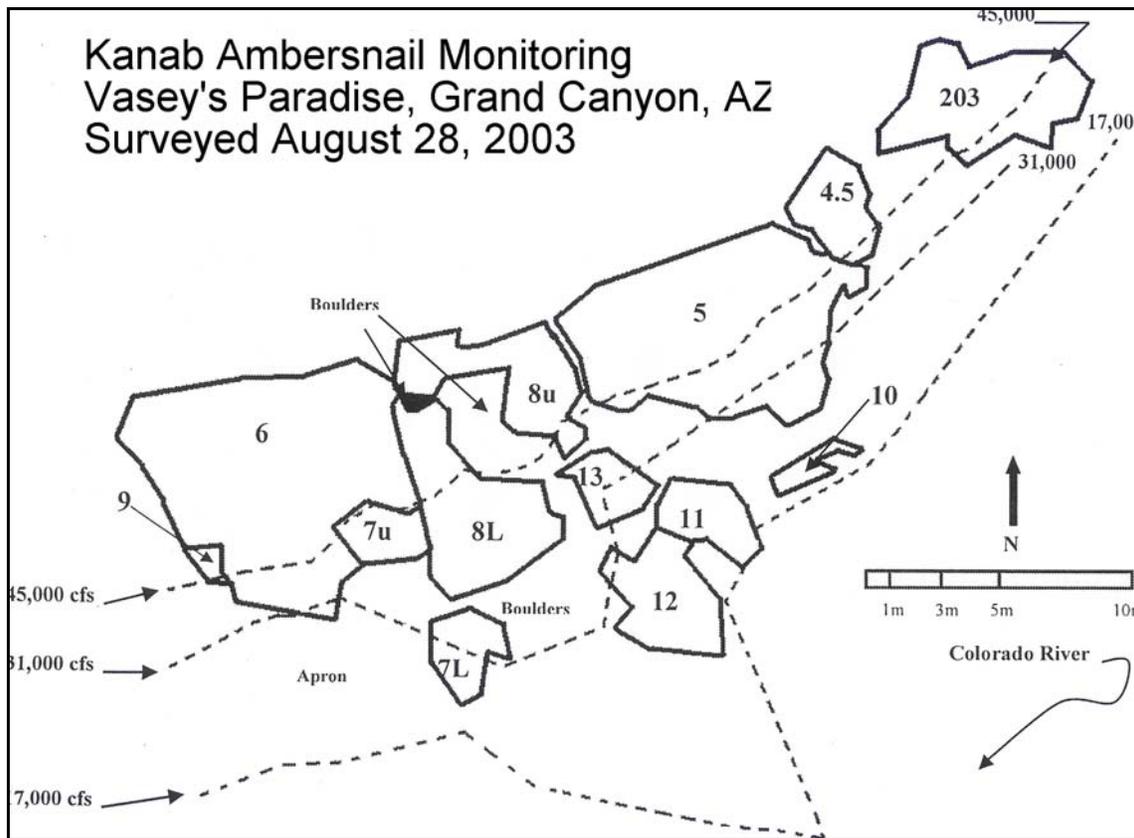


Figure 2. Ambersnail habitat patches at VP, below 100,000 cfs stage discharge elevation (map by Keith Kohl, GCMRC). Patch numbers reflect the most current naming convention for ambersnail habitat at VP.

In August 2012, USGS-GCMRC staff hiked up from the river along Fence Fault and the Supai-Redwall plateau river trail to visit the remote camera setup that overlooks VP from the northside of the river. The remote camera was built and installed by USGS-GCMRC; first images recorded on February 19, 2010. The camera is a Canon EOS Digital Rebel XTi (using an 8GB or 16GB CompactFlash memory card) mated to a processor/timer, 12V battery and external solar panel (to recharge and maintain the battery). The camera, processor/timer, and battery are housed in a desert camouflaged, electrical utility box with a camera lens port facing VP. The camera is programmed to take repeat photographs of the VP site five times every day—approximately 7:50 am, 9:50 am, 11:50 am, 1:50 pm, and 3:50 pm. Images from this camera should be able to document river flow levels and inundation of lower elevation ambersnail habitat at VP, springflow discharge from VP, and frequency of river trip or hiker visitation of the site. The memory card was replaced in August 2012, and the ~4500 images from the first 30 months of operation are being analyzed by the author and Department technician, Shay Richardson.

RESULTS

VASEYS PARADISE

Department and NPS staff, along with volunteers, conducted three monitoring surveys of the KAS population at VP in 2012: May, June, and September. The May ambersnail survey was supervised by the author. The June survey was led by Clay Nelson, and the September survey was supervised by Christina Akins and Kent Mosher. The results from the 2012 timed presence/absence count surveys at VP compared to past years are summarized in Table 1 (note: from low zone [below 100,000 cfs stage discharge elevation] habitat surveys only).

Table 1. Kanab ambersnail counts, search effort, and catch-per-unit-effort (CPUE) from timed presence/absence sampling at Vaseys Paradise, 2007-2012.			
Survey Date	# Live KAS Observed	Minutes of Search Effort	CPUE (# snails per 10 min search)
May 2007	186	526	3.54
April 2009*	52	214	2.43
April 2010*	51	164.5	3.10
May 2011*	28	358	0.78
May 2012*	38	303.5	0.80
July 2009*	106	169.5	6.25
June 2010	141	314.5	4.48
June 2011	82	277	2.96
July 2011*	34	223	1.52
June 2012	34	239.5	1.42
Sept 2006	16	219	0.73
Sept 2007	35	217.5	1.61
Sept 2008	22	225.5	0.97
Sept 2009	66	215.5	3.06
Sept 2010**	139	292	4.75
Sept 2011	51	308.5	1.65
Sept 2012	11	268	0.41

Note: AGFD supervised several citizen science surveys denoted by“*”. The May 2007 survey was a 2.5 day survey with small AGFD and USFWS crew to refine the timed P/A sampling method. Sept 2008 was 6-months post-high flow survey. Recalculated total search time and CPUE estimate on data error-check, denoted by “**”.

Water quality and springflow measurements for the VP surveys in June 2012 are summarized in Table 2. Colorado River flows were between 7000-14,000 cfs in May, between 9000-15,000 cfs in June, and at a steady 8000 cfs in September.

Table 2. Water quality parameters and springflow measurements at Vaseys Paradise, 2012.					
Survey Date	Temp (°C)	pH	Cond (µS)	Springflow (ave seconds)	Comments
June	16.2	8.04	346	1.64 cfs	Measured ~75% of springflow using a flowmeter; dissolved oxygen = 11.62 mg/L

During the May 2012 survey of VP, the survey teams only made note of physid snails and KAS observed, not other mollusks or macroinvertebrates present. Patches 203 and 9 were not sampled; the areas around both patches were too slick for crews to safely work. Approximately 10-15% of the monkeyflower and 80-90% of the watercress was in bloom during this survey. The poison ivy was leafed out and green. Patch 10 had regrown after last year's high river flows—the downstream half of that patch was thick with rushes and sedges, while the upstream half had a sparse cover of watercress and monkeyflower. The common reeds in Patch 11 continued to encroach into neighboring patches 12 and 13. Patch 12 was drier this survey than last year. Patch 7U was thick with watercress and some sedges. Patch 9 was overgrown with a wide mix of vegetation—none dominant. The normally wet slope of Patch 100K and Patch GHIJ (both above the 100,000 cfs stage elevation, upslope of Patch 6 and 8U) was drying out; the area was damp, but recently stopped getting overland springflow from the waterfalls above. The large Goodings willow was heavily damaged by recent beaver activity again and the stump was not leafed out much. There were no obvious signs of habitat disturbance from recreational use or bighorn grazing, other than a lightly used pathway between Patch 8L and 7L, and Patch 11 and 13.

Traditional 20-cm diameter plot sampling was not conducted in May 2012, due to limited time on site and the river trip's travel schedule (eight days to Pearce Ferry). Survey crews counted a total of 17 live KAS (in 70.5 minutes of search effort) in Patch 5; that represented 45% of all the live KAS counted (n=38) during this survey of the low zone habitat. At the end of the survey (11:30am), a thermohygrometer was set at ground level in the shade of Patch 7U's and 8L's common border (in what appeared to be good snail habitat to the author) and the following readings were taken: air temperature = 31.4°C and relative humidity = 31%.

During the June 2012 survey of VP, the following details on habitat condition were reported by the survey leader (Clay Nelson): Patch 6 has dried out significantly, most of the monkeyflower in the area upslope of Patch 7U is dead; also Patch 13 had dead monkeyflower with some live watercress understory. Much of the downstream portion of Patch 5 has changed from monkeyflower to grasses and goldenrod (*Solidago* sp.)—this conversion has been gradually ongoing for several years. Nelson also reported that Patch 12 was inundated by 20,000 cfs river flows most of winter 2011-2012. From the habitat repeat photos taken during this survey, it appeared that none of the monkeyflower throughout the site was in bloom.

In the June 2012 survey, one live *Catinella* ambersnail was observed in Patch 8U. Survey crews counted a total of 21 live KAS (in 26.5 minutes of search effort) in Patch 5; that represented 62% of all the live KAS counted (n=34) during this survey of the low zone habitat.

During the September 2012 survey of VP, the upstream half of Patch 6 (upslope of Patch 7U) still contained lots of dead vegetation and dry habitat, extending up through Patch 100K. Survey crews noted ~100 KAS shells were found in drainage channels throughout Patch 6, and 163 KAS shells were counted in Patch 5. No live KAS were found in Patch 6 (40 minutes of search effort), and only two live KAS in Patch 5 (62 minutes of search effort). Those two KAS only represented 18% of all the live KAS counted (n=11) during this survey of the low zone habitat. The neighboring upstream patches contained the rest of the live KAS observed (n=4 for Patch 4.5 and n=5 for Patch 203) during this survey. Two live *Catinella* ambersnails were observed in

September 2012, one in Patch 6 and the other at the downstream edge of Patch 5, near Patch 8U. In the upper zone habitat, another two live KAS were observed in monkeyflower and watercress habitat near the base of the upper waterfalls (Patch GHII) in 13.5 minutes of search effort. At least 10 *Physa* pond snails were also observed in the upper pool at the base of the waterfalls. Other wildlife notes: a rattlesnake skin shed was found in Patch 13, and fox and bighorn scat were identified in Patch 12. From the habitat repeat photos taken during this survey, it appears that 40-50% of the monkeyflower throughout the site was in bloom. Three traditional 20-cm diameter plot samples were conducted in Patch 5.

The citizen science trip in May 2012 contributed approximately 57 hours of volunteer labor to the project—a cost savings to agency partners valued at over \$970 (combination of novice and professional-level crews). For the VP surveys, Department staff primarily used the USGS contract to fund their participation and travel expenses; Arizona Heritage Fund and Game and Fish Fund were also used.

UPPER ELVES CHASM

The author supervised a small team of citizen science volunteers in conducting a monitoring survey of the translocated KAS population at UEC in May 2012. The results from this timed presence/absence count survey compared to past years are summarized in Table 3.

Table 3. Kanab ambersnail counts, search effort, and catch-per-unit-effort (CPUE) from timed presence/absence sampling at Upper Elves Chasm, 2009-2012.			
Survey Date	# Live KAS Observed	Minutes of Search Effort	CPUE (# snails per 10 min search)
April 2009*	13	113.5	1.14
April 2010*	8	69	1.16
May 2011*	20	97.5	2.05
May 2012*	7	82	0.85
June 2009	30	184.5	1.62
June 2010	27	154	1.75
June 2011	27	65	4.15

Note: AZGFD supervised several citizen science surveys denoted by“*“.

The ambersnail habitat at UEC appeared to be good condition in 2012; the KAS release area (Patch P1M) was maintaining wet ambersnail habitat, but no live KAS were found there during the survey. Most of the live KAS at UEC were found in small clusters among moist monkeyflower and maidenhair fern habitat of Patches ML and Mid-ML during the surveys. Lots of live physid aquatic snails were found in and around the areas searched. No obvious signs of habitat trampling or recreational use disturbance were noted during the site survey. Also, there were no observable impacts of flash flooding to the occupied hanging garden habitat and release area vegetation at UEC at the time of the survey. Additional citizen science volunteers helped search the lower habitat of Elves Chasm—the lower waterfalls and plunge pool, where most of the recreational use occurs. No live KAS or shells were found in the lower habitats at Elves Chasm during this site visit. Department participation in this survey was funded by Arizona Heritage Fund and Game and Fish Fund.

INDIAN GARDEN

Department staff (Christina Akins, Kent Mosher, Audrey Owens, and Linda Pollack) conducted a monitoring survey of the NAS population at IG, on the South Rim of Grand Canyon in September 2012. The results from the 2012 timed presence/absence count survey at IG compared to past years are summarized in Table 4.

Table 4. Niobrara ambersnail counts, search effort, and catch-per-unit-effort (CPUE) from timed presence/absence sampling at Indian Garden, 2009-2012.			
Survey Date	# Live NAS Observed	Minutes of Search Effort	CPUE (# snails per 10 min search)
June 2009	8	34.5	2.32
June 2010	10	30	3.33
Sept 2010	8	48	1.67
Sept 2011	28	31	9.03
Sept 2012	13	20	6.50

Live NAS and marsh slugs were found among the spring run on common reed and cattails (in the area we have historically searched, just downstream of the spring rill, by the trail crossing and gabion rock wall). The survey team also found several live NAS and a marsh slug on cattails near the drinking fountain northeast of the visitor's kiosk (former Search and Rescue cache cabin). Weather during this survey was partly cloudy, warm and dry. Department participation in this survey was funded by State Wildlife Grant and Arizona Heritage Fund.

DISCUSSION

This was the second year in a row that seasonal counts of live KAS and CPUE estimates were greatly reduced at VP compared to previous years. The September 2012 survey had the lowest counts of live ambersnails (n=11) and lowest CPUE estimate (0.41 snails/10 min search) at Vaseys Paradise than in all past surveys (both by season and by year) since timed presence-absence sampling was started in 2006. To put the 2012 surveys in context with past years, the September 2010 survey had the highest autumn count of live ambersnails (n=139) and highest CPUE estimate (4.75 snails/10 min search), but the September 2006 survey also had a low count of live KAS (n=16) and low CPUE estimate (0.73 snails/10 min search).

The snail habitat at Vaseys Paradise in 2012 generally was in good condition throughout the year, with the exception of the upstream half of Patch 6, all of Patch 7U and 7L, and most of Patch 8L which was predominately dry, dead vegetation during the June and September surveys. That large area is typically kept wet with springflow from the upper waterfalls, but in 2012 most of the springflow drained along the base of the waterfall to the upper pool and lower waterfall on the downstream end of the site.

Among all the low zone elevation patches, Patch 5 typically holds the largest abundance of live KAS along its downslope edge, and the live snail counts for that patch in May 2012 (n=17) and June 2012 (n=21) support that observation. However, in September 2012, only 2 of the 11 total live KAS observed were found in Patch 5, and the survey team documented over 160 dead shells in that area. It should be noted that Patch 5 has typically had very high numbers of dead shells in the past, so that is not surprising. I believe that observer error is a more likely reason for the low number of live KAS counts for Patch 5 in September—the novice search team working that patch may have not developed a proper search image for live KAS, and instead found shells easier to count.

The translocation site, Upper Elves Chasm, was surveyed in May 2012. Like at Vaseys Paradise, counts of live ambersnails (n=7) and CPUE estimate (0.85 snails/10 min search) at Upper Elves Chasm were the lowest compared to past surveys (since 2009, when this sampling method was first used at this site). In contrast, the Niobrara ambersnail population at Indian Garden, on the South Rim of Grand Canyon, had relatively higher counts of live ambersnails (n=13) and a high CPUE estimate (6.50 snails/10 min search) when this site was surveyed in September 2012, but these counts and CPUE estimate were still lower than the previous year.

Based on the lower snail counts and CPUE estimates from our September survey at VP, the Department did not advocate conducting any snail habitat mitigation for the planned November 2012 High Flow Experiment. If future high flows occur more regularly rather than once every 4-5 years, it is expected that the lower edge of high quality ambersnail habitat will remain at a higher elevation at VP—and should result in less incidental take of KAS during high flows in the long term. The most current biological opinion on the operation of Glen Canyon Dam does not require ambersnail habitat mitigation at VP due to high flow experiments planned under programmatic sediment trigger events.

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