

# KANAB AMBERSNAIL 2011 STATUS REPORT

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Technical Report 268  
Nongame and Endangered Wildlife Program  
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January 2012

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Sorensen, J.A. 2012. Kanab Ambersnail 2011 Status Report. Nongame and Endangered Wildlife Program Technical Report 268. Arizona Game and Fish Department, Phoenix, Arizona.

## ACKNOWLEDGMENTS

I thank the following individuals for their contributions in the field and to developing this report: Sara Baden, Chad and Shannon Baker, Jake Blackwell, Aaron Borling, Mark Capone, Bob and Kathy Casavant, Cat Crawford, Clay Crowder, Krista Dearing, Amy Draut, Ed Foss, Thetis Gamberg, Eric Gardner, Tim Grosch, Brian Healy, Jay Healy, Joy Hernbrode, Dave Loeffler, Owen Ludwig, Emily Omana, Susi MacVean, Brian Marshall, Pam Martin, Nic Medley, Anna and Mike Moscicki, Kent Mosher, Clay Nelson, Tom Newman, Jake Ring, Melissa Trammel, Dan Whiting, Krissy Wilson, and numerous volunteers, boatmen, and Department biologists that have helped with field work. Logistical and administrative support was provided by: Carol Fritzinger, Keith Kohl, Barbara Ralston, and Aaron Borling (Grand Canyon Monitoring and Research Center); Brian Healy, Dave Loeffler, Emma Omana, Ronda Newton, and RV Ward (National Park Service). A special thanks to the Grand Canyon Youth program, Maggie Sacher, and Moki Mac, for providing trip support and volunteers in conducting “citizen science” surveys of Kanab ambersnails in 2011.

## PROJECT FUNDING AND PERMITS

Funding for this project was provided by: voluntary contributions to Arizona’s Nongame Wildlife Check-off; the Arizona Heritage Fund; Game and Fish Fund; State Wildlife Grants, and U.S. Geological Survey contract. Logistical support provided by Grand Canyon Monitoring and Research Center, U.S. Geological Survey and National Park Service.

The project described in this publication (specifically, Vaseys Paradise population monitoring and management) was supported by Grant/Cooperative Agreement Number G11AC20194 from the U.S. Geological Survey.

All work described in this report was covered under NPS research permit GRCA-2011-SCI-0022, the Department’s Section 6 Cooperative Agreement and E5 Segment 22 work plan, and Federal Fish and Wildlife Permit TE821577-1 (amendment).

Filename: NGTR268 KAS 2011 Status Report.doc

## TABLE OF CONTENTS

Introduction.....	1
Methods.....	2
Results.....	5
Vaseys Paradise.....	5
Upper Elves Chasm.....	7
Indian Garden.....	8
Other Sites.....	8
Discussion.....	9
Literature Cited.....	10

### 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  
UTM = Universal Transverse Mercator

## ABSTRACT

Four monitoring surveys of the Kanab ambersnail population at Vaseys Paradise, Grand Canyon, were conducted in May, June, July, and September 2011. Surveys at the translocation site, Upper Elves Chasm, were made in May and June 2011. The Niobrara ambersnail population at Indian Garden, on the South Rim of Grand Canyon, was surveyed in September 2011. Department staff also participated in the April 2011 site visit of Minus Nine Mile Marsh, in the Lee's Ferry reach of Glen Canyon (the other Niobrara ambersnail population in Arizona), and the October 2011 site visit and survey of Kanab ambersnails at Three Lakes, Utah. In 2011, seasonal counts of live Kanab ambersnails and Catch Per Unit Effort estimates were greatly reduced at Vaseys Paradise compared to previous years. It is unclear if these reduced numbers are a true decline in the ambersnail population at that site or a result of high river flows and springflows, limits on our sampling efforts, or a combination of those factors. Overall, the ambersnail habitat at Vaseys Paradise appeared to be in good condition, even with inundation of the edges of lower elevation patches by the river. Patch 5, which typically holds the largest abundance of live Kanab ambersnails along its downslope edge did not appear to be directly affected by high river flows or high springflows in 2011. In contrast to Vaseys Paradise, the 2011 seasonal counts of live ambersnails and CPUE estimates were higher at Upper Elves Chasm and Indian Garden than in previous years. Neither of these sites appeared to experience higher springflows this year; neither site is affected by river flows due to their locations. Ambersnail habitat at both Upper Elves Chasm and Indian Garden appeared in good condition in 2011.

# KANAB AMBERSNAIL 2011 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 and Minus Nine Mile Marsh using funding from State Wildlife Grants, Arizona Heritage Fund, and state Game and Fish Fund. The following report documents the Department's 2011 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.

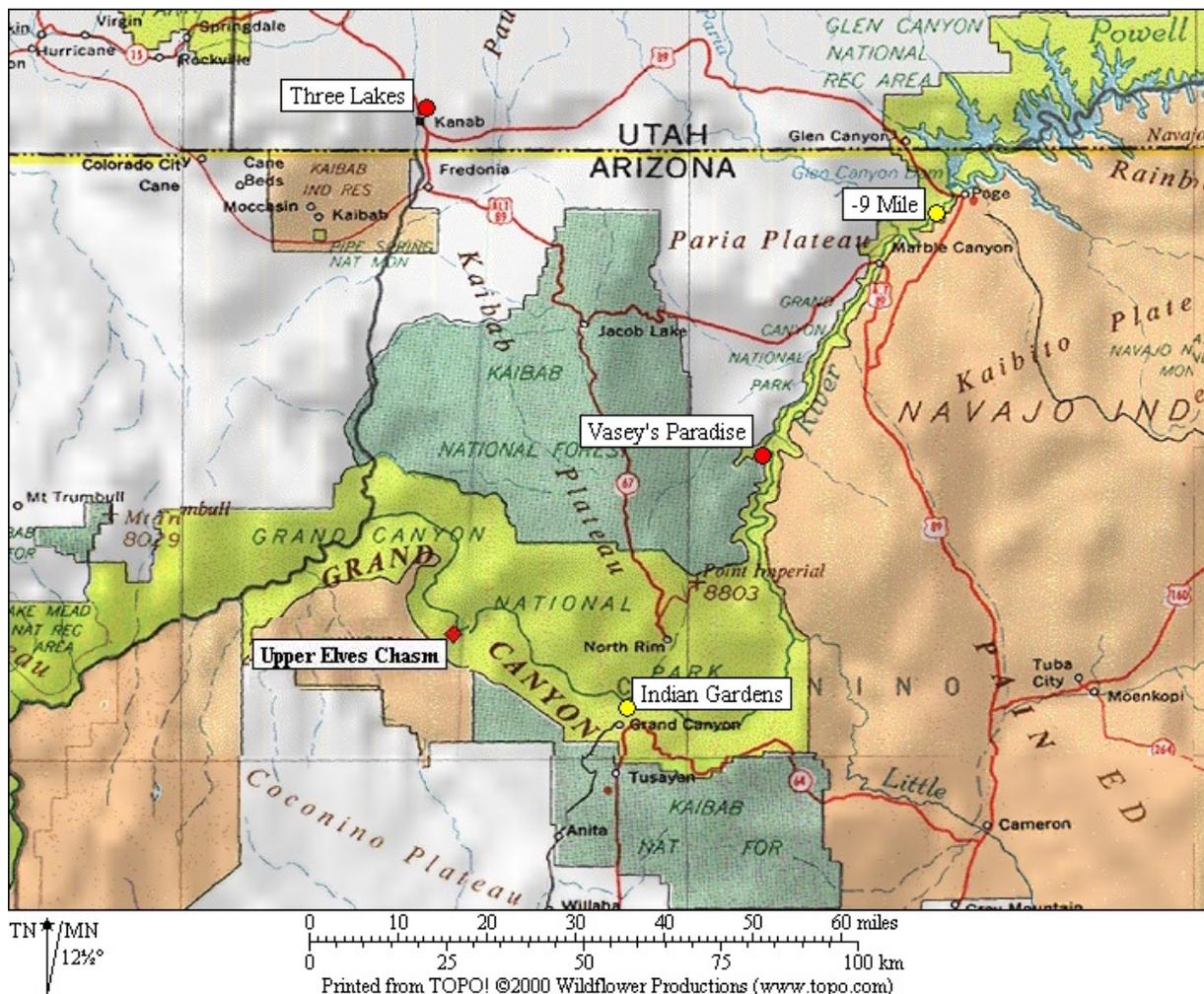


Figure 1. Location of Upper Elves Chasm, Indian Garden, and Vaseys Paradise in Grand Canyon National Park, Minus Nine Mile Marsh in Glen Canyon National Recreation Area, and Three Lakes in southern Utah. Red waypoints indicate KAS populations and yellow waypoints indicate NAS populations.

## 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. A total station survey of VP low-zone habitat was conducted in July 2011 by Aaron Borling (with GCMRC) and the author; the map of 2011 patch boundaries and area estimates have not been finalized yet.

Water quality sampling of VP and UEC was conducted using a Hanna® waterproof combo tester to measure water temperature, pH, and conductivity. Rough estimates of springflow at VP were measured using a 2-gallon or 5-gallon bucket and stopwatch to time how quickly it takes to fill the bucket from the lower springflow. Five timed efforts were made to calculate an average time to fill the bucket, paired with a visual estimate of how much of the springflow was captured. In June 2011, NPS Hydrologist, Steve Rice, measured VP water quality with a Hydrolab MS5 multiparameter sonde and estimated springflow volume 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, carry-forward funds under the USGS cooperative agreement from 2010 were available to support two additional surveys of that site in 2011. The additional surveys were citizen science trips which 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.

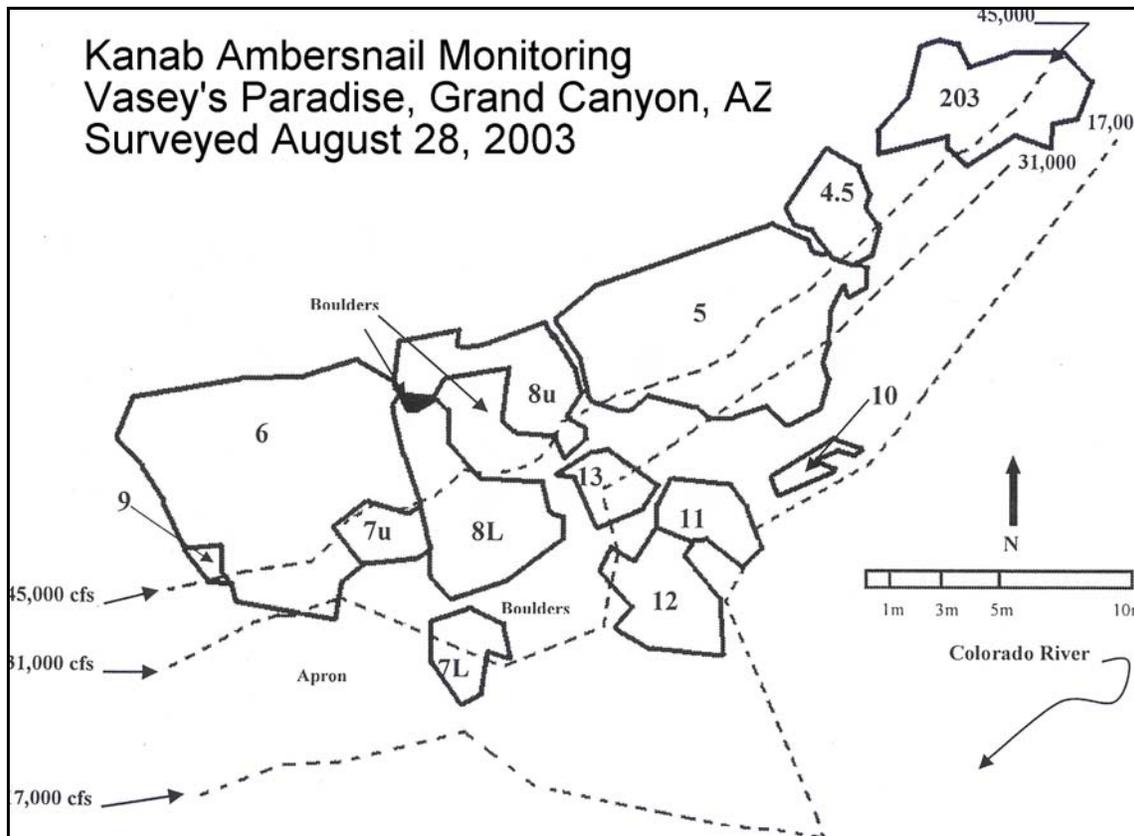


Figure 2. Ambersnail habitat patches at VP, below 100,000 cfs stage discharge elevation (map by Keith Kohl, GCMRC). Patch numbers reflect the most current naming convention for ambersnail habitat at VP.

In June and September 2011, Department staff and volunteers 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. Total hike time is ~3-4 hours roundtrip. The remote camera was built and installed by USGS-GCMRC over the winter of 2010-2011. The camera is a Canon EOS Digital Rebel XT<sub>i</sub> (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—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 September 2011, and the images from the first spring and summer seasons will be analyzed in 2012.

## RESULTS

### VASEYS PARADISE

Department and cooperating agency staff (NPS, USFWS, and USGS), along with volunteers, conducted four monitoring surveys of the KAS population at VP in 2011: May, June, July, and September. The May and July surveys were completed with citizen scientists (Moki Mac charter trip in May and Grand Canyon Youth service trip in July) supervised by the Department’s species lead (Jeff Sorensen). The results from the 2011 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, 2007-2011.			
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
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
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	307	4.53
Sept 2011	51	308.5	1.65

Note: citizen science surveys in April 2009-10, May 2011, July 2009 and July 2011. 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.

Water quality and springflow measurements for the VP surveys in 2011 are summarized in Table 2. The springflow at VP in May 2011 was a higher volume than observed in recent years. Colorado River flows were at a steady 16,000 cfs in May, at 23,000 cfs in June, between 24,000 and 25,000 cfs in July, and at a steady 16,500 cfs in September. Above 25,000 cfs flows, the “pathway” between Skull Cove and VP is impassable. At the end of the July survey, the agency

staff had to walk carefully along that pathway with their feet submerged to their ankles in order to return to South Canyon for the hike out.

Table 2. Water quality parameters and springflow measurements at Vaseys Paradise, 2011.

Survey Date	Temp (°C)	pH	Cond (µS)	Springflow (ave seconds)	Comments
May	14.3	8.06	244	1.49	Fill a 2-gallon bucket; captured ~2% of lower springflow
June	15.9	-	344	3.06 cfs	Measured ~75% of springflow using a flowmeter; dissolved oxygen = 11.37 mg/L
July	17.2	8.36	354	2.30	Fill a 5-gallon bucket; captured ~40% of lower springflow
Sept	16.8	8.4	345	1.92	Fill a 5-gallon bucket; captured ~75% of lower springflow

During the May 2011 survey of VP, the survey team found four live *Catinella*, numerous physid snails, marsh slugs, aphids, and lady bug beetles. Patches 6 and 9 were not sampled due to the high volume of springflow moving through that habitat during this site visit. In May 2011, approximately 40% of the monkeyflower and 33% of the watercress was in bloom. The poison ivy was leafed out. In May, most of the ambersnail habitat appeared in good condition, except some of Patch 5 looked to be flood damaged by high springflows earlier in the year. The Goodings willow was heavily damaged by recent beaver activity and the stump was not leafed out much. Traditional 20-cm diameter plot sampling was not conducted in May 2011, due to limited time on site for this row-supported river trip.

During the June 2011 survey of VP, no details on habitat condition were reported by the survey leader (Clay Nelson) other than the following: most of Patch 12 was inundated by high river flows and patches 6, 9, 10, 12, 13, and 203 were not sampled due to high river flows, high springflows from VP, and for crew safety. Numerous aquatic physid snails were found in Patch 11, and eight zonitid landsnails were found in Patch 7U. Traditional 20-cm diameter plot sampling was done: seven plots in Patch 5, five plots in Patch 7U, and two plots each in patches 4.5, 7L, 8U, and 11.

During the July 2011 survey of VP, the survey team found one live *Catinella*, numerous physid snails, marsh slugs, sow bugs, and various insects. Patches 203 and 4.5 were not sampled due to the high river flows and crew safety during this site visit. Patch 10 was mostly inundated, as well as the lower edges of Patch 11 and 12. None of the monkeyflower was in bloom. Most of the watercress was senescent, but with some young growth along wet spring runs. The overall habitat at VP appeared to be in good condition—no recreational or natural disturbances were apparent, with the exception of the infrequently used “walkway” between Patch 7L and 8L, which no live KAS were found along. Springflow from the VP waterfalls was reduced from the previous two months. Three live KAS were found in residence in Patch 12—this was surprising since this patch was previously too dry to support ambersnails. Traditional 20-cm diameter plot sampling was conducted in patches 5, 7L, 8U, 8L, and 12 (three plots in Patch 5 and one each in the others).

During the September 2011 survey of VP, the survey team continued to find numerous sow bugs and marsh slugs; physid snails and live *Catinella* were not reported on the datasheets, but live specimens of each were found for the team orientation on identifying mollusks while at the site. Springflow was reduced, so all traditionally sampled low zone habitat patches were surveyed,

along with a search of Patch 100K and Patch G (both high zone patches, predominately monkeyflower habitat). Five live KAS were found in Patch 100K in 13 total minutes of searching, while no live KAS were found in the higher elevation Patch G after 18 minutes of searching. The search of Patch G ended early due to an encounter with a mature Grand Canyon pink rattlesnake resting in the monkeyflower, near the base of the site’s downstream waterfall. In September 2011, approximately 50-70% of the monkeyflower was in bloom. There were several mature watercress patches—most in Patch 6, Patch 7U, and a small portion of Patch 7L near the “walkway”. The poison ivy on site was still leafed out, but starting to turn yellow. The lower half of Patch 10 and 12 was scoured away due to high river flows this past summer. There were no obvious signs of disturbance from bighorn grazing or trampling by visiting recreationists (other than the “walkway”, which no live KAS were found along). Two traditional 20-cm diameter plot samples were conducted in Patch 5.

The author provided interpretative talks on KAS and the work at VP to both citizen science groups in May and July 2011, and a visiting commercial river trip in September, while on site.

The two citizen science trips in 2011 contributed approximately 137 hours of volunteer labor to the project—a cost savings to agency partners valued at over \$3000 (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, Nongame Wildlife Check-off, and Game and Fish Fund were also used.

#### UPPER ELVES CHASM

Department and NPS staff, along with volunteers, conducted two monitoring surveys of the translocated KAS population at UEC in 2011: May and June. The May 2011 survey was completed with citizen scientists supervised by the Department’s species lead. The results from the 2011 timed presence/absence count surveys at UEC 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, 2009-2011.			
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
June 2009	30	184.5	1.62
June 2010	27	154	1.75
June 2011	27	65	4.15

Note: citizen science surveys in April 2009, April 2010, and May 2011.

The ambersnail habitat at UEC appeared to be good condition in 2011, and continues to recover from drought effects—the KAS release area (Patch P1M) is wet again and the survey teams in both May and June found a live KAS in residence there. 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 both surveys; those areas had lots of moist and saturated leaf litter. Lots of live physid aquatic snails, some marsh slugs, and a few zonitid shells were found in and around the areas searched. A couple orb-weaver spiders (genus *Tetragnatha*) and a small desert centipede were observed among monkeyflower and maidenhair ferns at UEC in May 2011. No obvious signs of habitat trampling or recreational use disturbance were noted during each visit. Also, there were no observable impacts of flash flooding to the occupied hanging garden habitat and release area vegetation at UEC during those two surveys. Additional volunteers and NPS staff 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 these site visits. Department participation in this survey was funded by State Wildlife Grant, Arizona Heritage Fund, and Game and Fish Fund.

#### INDIAN GARDEN

Department staff (Tim Grosch, Susi MacVean, Eric Gardner, and the author), along with a volunteer (Brian Marshall), conducted a monitoring survey of the NAS population at IG, on the South Rim of Grand Canyon in September 2011. The results from the 2011 timed presence/absence count survey at IG compared to past years are summarized in Table 4.

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

Live NAS were found among the spring run on decaying sedge leaf litter (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 many live NAS, along with lots of marsh slugs and sow bugs, near the drinking fountain northeast of the visitor's kiosk (former Search and Rescue cache cabin). Three pairs of live NAS were observed mating; at least two of those NAS measured between 18 and 22 mm in shell length. The ambersnail habitat at IG was in great condition and no recreational use impacts were noticed. Weather during this survey was hot and dry. Department participation in this survey was funded by State Wildlife Grant, Arizona Heritage Fund, Nongame Wildlife Check-off, and Game and Fish Fund.

#### OTHER SITES

Department staff (Clay Nelson and Susi MacVean) were invited by cooperating agency staff (USFWS and NPS), along with Grand Canyon Wildlands Council volunteers, to conduct a site visit at Minus Nine Mile Marsh, in the Lee's Ferry reach of Glen Canyon in April 2011. Dozens of live ambersnails were seen during the site visit. No specimens were collected, nor was a

monitoring survey conducted. Weather during this site visit was sunny and cool. Department participation in this survey was funded by State Wildlife Grant and Arizona Heritage Fund.

The author was also invited by cooperating agency staff (Mark Capone, USFWS, and Krissy Wilson and Pam Martin, Utah Division of Wildlife Resources) to conduct a monitoring survey of KAS at Three Lakes, north of Kanab, Utah, on October 5, 2011. Permission from the private landowner (Lon Childs) was secured by USFWS. A total of 146 live ambersnails were found in 139.5 minutes of search effort; CPUE was 10.47 snails per 10 minutes searched. No specimens were collected. Department participation in this survey was funded by state Game and Fish Fund and Arizona Heritage Fund.

The Three Lakes ambersnail habitat appeared to be in good condition—abundant KAS were found among thickets of cattails and rushes in the area the survey team called the “upper wet meadow” north of the northern-most pond. The team used a Garmin GPS (NAD83 datum) to waypoint the area where KAS were found—between UTM coordinates: 12S N4111342, E360828 and N4111309, E360855. Lots of marsh slugs and at least three live zonitid snails were also found in habitat occupied by KAS. A live gartersnake (species not confirmed) was seen in the area. Nearly all the KAS observed were new hatchlings and juveniles, but were still active. The survey team also searched the horse pasture (lower meadow, at the southern end of the property, south of the lower pond), and found only a few live KAS among watercress adjacent to a small pumphouse (UTM coordinates: 12S N4110471, E360913) and a few more live KAS in the marshy habitat at the southern end of the pasture (UTM coordinates: 12S N4110371, E360959). Mark Capone and the author also did a few quick spot checks among the cattails and bulrushes between the upper and middle ponds and found several live KAS there as well. Weather during this site visit was overcast, cool, with occasional rain sprinkles.

#### DISCUSSION

In 2011, seasonal counts of live KAS and CPUE estimates were greatly reduced at VP compared to previous years. It is unclear if these reduced numbers are a true decline in the KAS population at VP or a result of high river flows and springflows, limits on our sampling efforts (with several traditionally sampled patches not surveyed because of those high river and spring flows), or a combination of those factors. Overall, the ambersnail habitat at VP appeared to be in good condition, even with inundation of the edges of lower elevation patches by the river. Patch 5, which typically holds the largest abundance of live KAS along its downslope edge did not appear to be directly affected by high river flows or high springflows in 2011. Between site visits, there were no obvious signs of disturbed habitat due to previous KAS sampling or from recreational use. Monkeyflower and watercress habitat responded quickly to any physical disturbance with renewed growth, as documented by the series of repeat habitat photographs taken at the beginning of each survey.

In contrast to VP, the 2011 seasonal counts of live ambersnails and CPUE estimates were higher at UEC and IG than in previous years. Neither of these sites appeared to experience higher springflows this year; neither site is affected by river flows due to their locations. Ambersnail habitat at both UEC and IG appeared in good condition in 2011. This was the first year that

researchers were able to visit and survey the privately-owned Three Lakes site using the timed presence-absence count method of sampling. The CPUE estimate for the Three Lakes KAS population could only be considered a baseline estimate at best, especially given the late time of year that survey was conducted.

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