KANAB AMBERSNAIL HABITAT MITIGATION FOR THE 2008 HIGH FLOW EXPERIMENT

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EXECUTIVE SUMMARY

The Arizona Game and Fish Department and its Federal partners in ambersnail recovery helped mitigate habitat loss for the endangered Kanab ambersnail (Succineidae: *Oxyloma haydeni kanabensis* Pilsbry) for the March 2008 High Flow Experiment from Glen Canyon Dam.

This mitigation effort was conducted at Vaseys Paradise (River Mile 32, Grand Canyon National Park). Approximately 20 m^2 of monkeyflower rootmat was collected from Patch 5 and 10 (high quality, occupied ambersnail habitat) that was expected to be inundated or scoured away from the 41,500 cfs stage discharge flow, and was held above the flood zone during the high flow. Following the high flow, the segments of rootmat were returned to their respective locations, and researchers documented the habitat recovery during their September 2008 monitoring survey.

Affected habitat in the flood-inundation zone at Vaseys Paradise had fully recovered to its initial condition and extent in approximately 6 months (similar to the habitat mitigation effort for the November 2004 Beach/Habitat-Building Flow of 41,000 cfs stage discharge). Based on previous population surveys, the lower edge of Patch 5 historically contained high numbers of live ambersnails, and it was this area that was at risk of being scoured away or degraded with the 2008 High Flow Experiment. The numbers of live Kanab ambersnails observed in the September 2008 and April 2009 post-flood monitoring trips indicate that the habitat mitigation was both successful and worthwhile for maintaining the low-zone ambersnail population at Vaseys Paradise.

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Jeff A. Sorensen

INTRODUCTION

One of two wild populations of the endangered Kanab ambersnail (KAS; Succineidae: *Oxyloma haydeni kanabensis* [=*O. kanabense*] Pilsbry) (Fig. 1) occurs at a large, riverside spring in Grand Canyon National Park, known as Vaseys Paradise (VP; located at River Mile 32 along the Colorado River; Fig. 2 and 3). As part of an adaptive approach to managing the Colorado River resources within Grand Canyon, artificial floods known as a Beach/Habitat-Building Flows (BHBF) and High Flow Experiments (HFE) from Glen Canyon Dam are designed to redistribute sediments from the river channel bottom to the riverbanks, create or restore sand beaches and backwaters, and help rejuvenate native fish habitat. However, it was determined that the increased hydrograph from these flows would inundate and scour away ambersnails and habitat from the VP site (Stevens and others 1997).

Figure 1. Kanab ambersnail

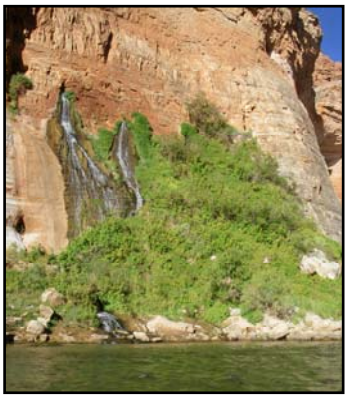

Figure 2. Vaseys Paradise

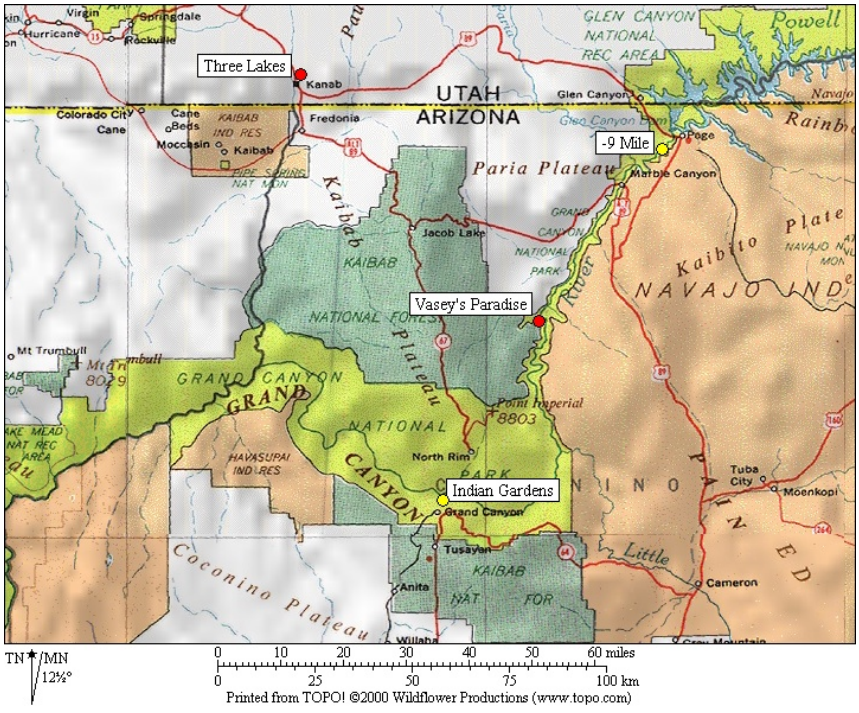

Figure 3. Location of Vaseys Paradise in Grand Canyon National Park.

Research and conservation objectives under the Adaptive Management Program for Glen Canyon Dam and U.S. Fish and Wildlife Service (USFWS) biological opinions on these experimental flows identify the need to monitor and manage the KAS population at Vaseys Paradise, including mitigating actions to benefit the species (USGS 2007). The Arizona Game and Fish Department (AGFD or Department) assists its Federal partners in these efforts, including the habitat mitigation for the March 2008 HFE (identified as Experimental Study #6 in

the Science Plan, USGS 2007). Logistic support for ambersnail monitoring and management efforts in Grand Canyon was provided by Grand Canyon Monitoring and Research Center (GCMRC). The National Park Service (NPS) and cooperators with the Kanab Ambersnail Working Group had recommended this type of habitat mitigation for the snail initially for the November 2004 BHBF, and were supportive of repeating this effort for the March 2008 HFE.

On March 5, 2008, the start of a 41,500 cfs stage height experimental flow was released from Glen Canyon Dam. This HFE was maintained at peak flow for 60 hours then gradually decreased to 8000 cfs by March 10 (Fig. 4). Department staff and Federal partners had previously determined that approximately 20 m^2 of high quality, occupied ambersnail habitat would be lost from scour and/or seriously degraded with this flow. Pre-experiment topographical survey of the VP low-zone affected habitat was conducted during the last monitoring trip in September 2007. The low-zone habitat at VP had not changed appreciably overwinter, so no additional total station measurements were required for the March 2008 mitigation.

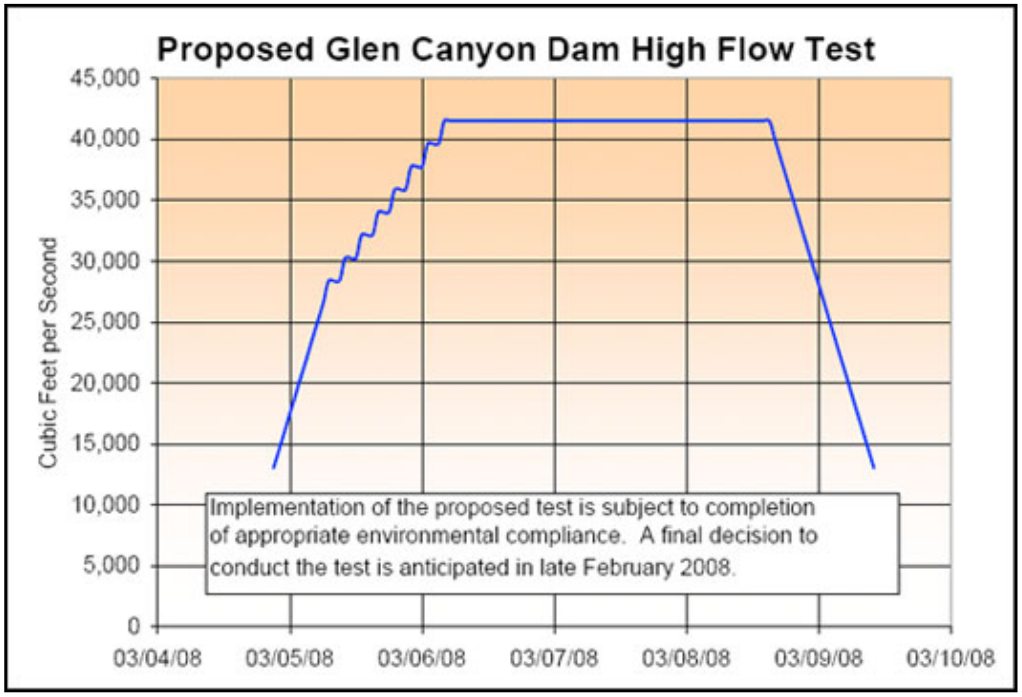

Figure 4. The hydrograph of the March 2008 High Flow Experiment (graph by USBR).

Based on observations from the March 1996 and November 2004 BHBFs and recent total station survey estimates, the lower portions of monkeyflower habitat from Patch 4.5, 5, 10, and 203 (Fig. 5) were expected to be scoured away with the 41,500 cfs flow. From previous high flows in 1996 and 2004, we expected that sand would mostly bury Patch 7L and woody debris and sand would be deposited on Patch 11, 12, and to a lesser extent on Patch13. Patch 8L, 7U, and the lower edge of 6 were expected to be inundated, but not scoured.

Very few KASs have historically been found in Patch 11 and 12 over the years. Patch 11 contains a fairly resilient stand of common reed (*Phragmites australis*), and Patch 12 is a boulder

pile with scattered tufts of horsetail (*Equisetum* spp.) and grasses. In recent years, we have not detected many live KASs in Patches 7L, 7U, 8L, 4.5, and 203. On the other hand, Patch 5 continues to harbor the highest number of live ambersnails in the habitat below the 45,000 cfs stage elevation.

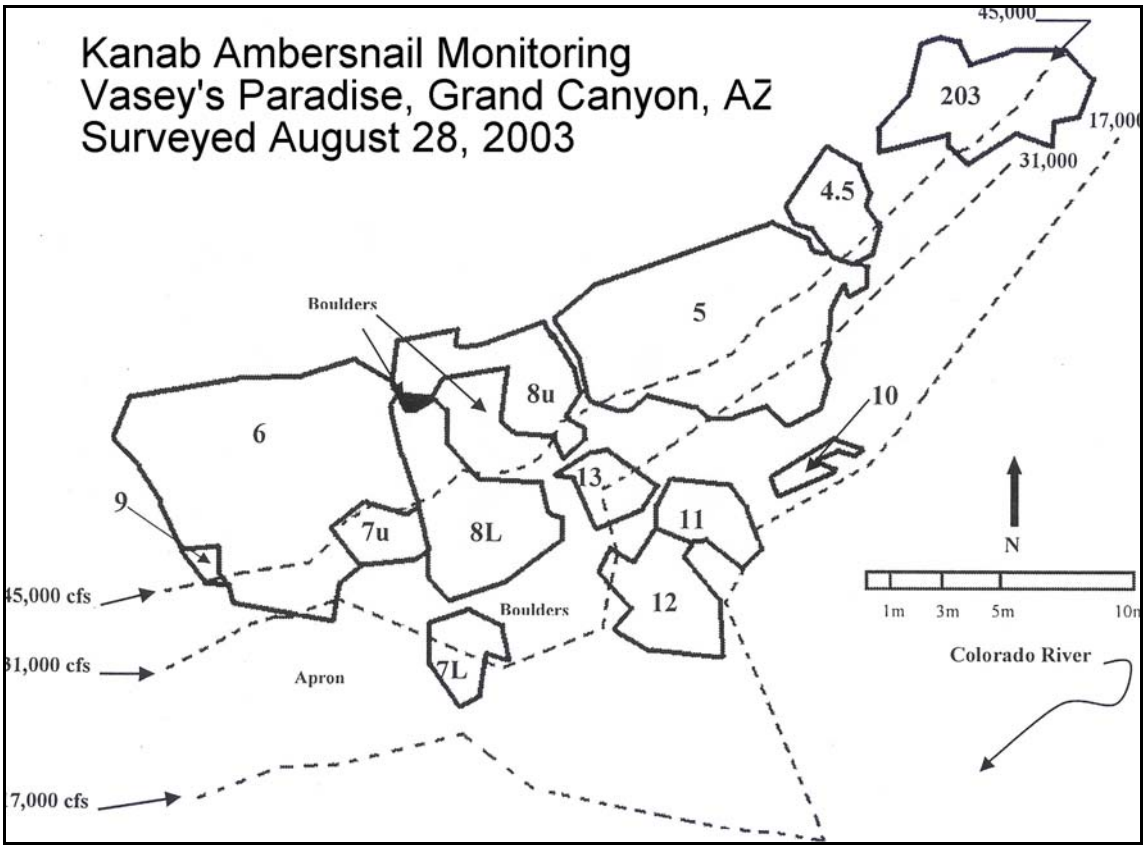

Figure 5. Ambersnail habitat patches at VP, below 100,000 cfs stage discharge elevation (map by Keith Kohl, GCMRC).

METHODS

Prior to the high flow, Department and Reclamation biologists were on site at VP to search for KASs in the anticipated flow-impacted zone and remove affected high quality, occupied ambersnail habitat to help mitigate impacts of the high flow. This mitigation effort was nearly identical to the November 2004 BHBF mitigation at VP (Sorensen 2005), as requested by the USFWS, Reclamation, and GCMRC. The primary goals of this effort were: 1) to collect and move ambersnail habitat from the flood-scour zone, then return that habitat following a high flow; and 2) document recovery of ambersnail habitat post-flood during the next scheduled monitoring survey in September 2008.

The following supplies were used for the March 2008 habitat mitigation effort at VP:

- 22 plastic bread pallets (each measuring 0.6 m x 0.75 m [2 ft x 2.5 ft])
- 4 rolls of 0.9 m x 7.2 m (3 ft x 24 ft) burlap
- 2 flat-bladed shovels

- 2 gardening snips/pruners
- Flagging tape and black Sharpie® markers
- Field notebook
- Digital camera
- 15 m (50 ft) soaker hose
- 30 m (100 ft) garden hose
- An 18.9 L (5 gal) bucket

Based on our experience from the November 2004 effort, we estimated a 3-person crew would only take a few hours to complete this habitat collection and move, prior to the high flow.

Early on March 5, 2008, Department and Reclamation biologists searched the lower edge of Patch 5 and 10 for live KASs. Very few live KASs were observed in that area, which was not surprising considering KASs typically overwinter in drier habitat than they normally are found when active and foraging. The few KASs found were still estivating on dry leaf litter and branches—these were left in place, since detaching estivating snails would likely result in their demise, by breaking the adhesive operculum seal they use for substrate attachment and which they respire through while in this resting state.

Researchers took digital photographs of the habitat patches prior to collecting and moving segments of rootmat. These photos would be used later to compare habitat recovery over time. Field notes included a sketch of Patch 5 and 10, with numbered segments of rootmat to assist in replacing those segments in their original location after the high flow receded.

In the next step of the mitigation effort, the researchers cut approximately 1 m^2 segments of monkeyflower (*Mimulus cardinalis*) rootmat from Patch 5 and 10. The monkeyflower habitat in Patch 4.5 and 203 were left in place as experimental controls. The thick rootmass of monkeyflower allowed researchers to cut out segments, similar to sod grass, and place those segments onto burlap-covered plastic bread pallets (Fig 6). Gardening snips/pruners and flat-bladed shovels were used to cut out and move each segment of rootmat. Each of these segments was labeled with marked flagging tape so they could be placed back where they were found after the high river flow (Fig 7).


Figure 6. Sod-cut monkeyflower rootmat.


Figure 7. Rootmat covered and labeled for transport.

The sod-cut segments of habitat were temporarily placed in an open area on site and above the peak flow elevation during the HFE. Transplanted habitat was watered twice daily, and continually kept wet with a spring-fed soaker hose, as well as covered with wet burlap to help maintain moisture during the 60-hour high flow. Weather during this effort was cool and sunny.

After the high flow receded on March 10, we assessed the HFE impact to ambersnail habitat (Fig. 8). The sod-cut habitat segments were then moved back to their respective locations (Fig. 8 and 9) using photos and field notes as a guide. Replaced habitat looked distressed, and had numerous broken leaves and stems. From past experience, we knew that it was the clumps of monkeyflower rootmat that were essential in reestablishing this habitat. The broken stems and leaves would quickly decay into leaf litter to be used by ambersnails as food and shelter.

Figure 8. Patch 5 area scoured from the HFE.

Figure 9. Rootmat replaced in its original location.

Repeat photographs were taken at the end of this task and again 6 months later during our regularly scheduled monitoring trip in September 2008. All collection and maintenance materials were removed from the site on March 10.

RESULTS

We focused our effort on Patch 5 and 10, and moved approximately 20 m^2 of high quality, occupied ambersnail habitat out of the anticipated flood zone, then returned that habitat back to its original location after the high flow receded. Within 6 months post-flood, the mitigated habitat had fully recovered to its initial condition and extent, and live KASs were abundant in that area during our September survey.

The lower edge of Patch 203 (one of the control patches) had been scoured and had not re-grown back to its former extent below 41,500 cfs stage elevation prior to the 2008 HFE. We were able to determine this by the amount of white limestone bedrock exposed at the base of Patch 203—the surrounding bedrock (in the open) is normally covered in a layer of algae and is greenish-gray in color.

Figures 10 and 11 show the VP low-zone habitat during the March 2008 HFE at peak flow, and at 8000 cfs flow post-flood. Figures 12 and 13 show Patch 5 habitat pre-flood (September 2007), and 6 months post-flood (September 2008).

Figure 10. VP at peak 41,500 cfs flow (March 8).

Figure 11. VP at 8000 cfs post-flood (March 11).

Figure 12. Patch 5 and 10 pre-flood (Sept 2007).

Figure 13. Patch 5 post-flood (Sept 2008).

Note: the photo perspective in Fig. 13 is different (approximately 4 m upslope from the perspective for Fig. 12's photo).

During our post-flood monitoring survey of VP in September 2008, we observed 15 live KASs (from timed presence-absence sampling) living within the mitigated habitat of Patch 5. That number represents 68% of the live KASs that we detected across all the low-zone habitat patches surveyed in September 2008 (total count = 22 KASs in 225.5 minutes of search effort). In comparison, we found 19 live KASs in Patch 5 (or 54% of the total observed across all sampled patches) during the September 2007 survey (total count = 35 KASs in 191.5 minutes of search effort).

In April 2009, we found 31 live KASs in the lower edge of Patch 5 (or 60% of the live KASs detected across all the low-zone habitat patches surveyed; timed presence-absence sampling total count = 52 KASs in 214 minutes of search effort). This survey was conducted with "citizen science" volunteers on a chartered commercial river trip, supervised by the author. Previous surveys were conducted with Department, USFWS, and GCMRC staff and volunteers.

DISCUSSION

The ambersnail habitat mitigation that we conducted in March 2008 was successful in recovering KAS habitat within 6 months post-flood. Like the November 2004 effort, we were able to reduce the habitat recovery time substantially, which benefitted the KAS population during that growing season and thereafter. In 1996, we did not collect or move any ambersnail habitat, and the lower edges of Patches 5, 4.5, and 203 were scoured away in that 45,000 cfs BHBF. Department staff and cooperators documented that habitat recovery at VP from that flood took approximately 2.5 years for it to re-grow in both extent and condition (Stevens and others 1997; Meretsky and Wegner 2000; Sorensen 2005).

Based on previous population surveys, the lower edge of Patch 5 historically contained high numbers of live KASs, and it was this area that was at risk of being scoured away or degraded with the 2008 HFE. The numbers of live KASs observed in the September 2008 and April 2009 post-flood monitoring trips indicate that the habitat mitigation was both successful and worthwhile for maintaining the low-zone ambersnail population at VP.

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