

Summary of Comments from the TWG Kanab Ambersnail Ad Hoc Committee

July 19, 2001

The Kanab ambersnail (*Oxyloma haydeni kanabensis*) KAS is a small endangered land snail. The subspecies was originally described from a population found in Southern Utah, and in 1991 another population was discovered at Vaseys Paradise in Grand Canyon National Park. The snails at Vaseys Paradise live in vegetation that grows along the course of a perennial spring that emerges from the Redwall limestone and then flows some 200 meters to the Colorado River. After the closing of Glen Canyon Dam in 1963 the vegetation expanded down slope into areas closer to the river. Snails also moved into the new habitat and are now vulnerable to high releases from Glen Canyon Dam. The US Fish and Wildlife Service has issued a recovery plan and several biological opinions to help guide actions that could affect KAS or their habitat.

In 1998 Grand Canyon National Park completed National Environmental Policy Act and Endangered Species Act compliance to attempt the establishment of one or more new populations of KAS in the Park. Translocations of KAS were made from Vaseys Paradise to three other sites along the course of the Colorado River. These attempts were made to increase the future flexibility of Glen Canyon Dam operations, by providing a potential means for meeting current and future requirements of Fish and Wildlife Service biological opinions on controlled floods carried out as part of the Glen Canyon Dam Adaptive Management Program (AMP).

The AMP provides advice to the Secretary of the Interior about resources affected by Glen Canyon dam. In 1999 representatives of several participating organizations invited a panel of scientists to review information about the KAS and to prepare a report of their recommendations (Noss et al. 2000¹). This newly formed Kanab Ambersnail Ad Hoc Committee (KAS ad hoc) was charged by Technical Work Group (TWG) to evaluate the Panel's report. The TWG is a subgroup of the Glen Canyon Dam Adaptive Management Work Group (AMWG) and both groups are in the AMP. The KAS ad hoc was also charged to prepare a draft response from the TWG to the AMWG and to send a report to the TWG by July 20, 2001. This is the KAS ad hoc's report.

The members of the KAS ad hoc included Bob Winfree (Chair), Paul Barrett, Gary Burton, Bill Davis, Rick Johnson, Dennis Kubly, Bill Persons and Barb Ralston. Debra Bills and Della Snyder also joined the committee for discussions on specific issues. The independent Kanab Ambersnail Working Group (KAWG) has also reviewed the Panel's report (Karas 2001²). The KAS ad hoc review includes comments on the KAWG's response to the Panel's report and a summary of all three group's recommendations on five specific resource management questions

¹ Noss, R., M. Gordon, E. Hoagland, C. Lydeard, P. Mehlhop, and B. Roth. 2000. Report of Kanab Ambersnail Review Panel on Taxonomic, Ecological, and Translocation Issues Concerning the Conservation of *Oxyloma* Snails in Arizona and Utah. 12 pp.

² Karas, C. D. March 13, 2001. Kanab Ambersnail Working Group response to the expert panel review. 3 pp.

identified through discussion. This report is divided into four parts: A. Summary of KAS ad hoc recommendations, B. Resource Management Questions, C. Issues, and D. Panel Recommendations. Several topics are discussed under more than one section, but the main points are summarized in part A.

A. Summary of TWG KAS Ad Hoc Recommendations Regarding Kanab Ambersnails at Vaseys Paradise (VP *Oxyloma*)

Research and Monitoring

- Implement low-impact monitoring of VP *Oxyloma* and translocated populations
- Model habitat and population responses to environmental change
- Seek funding outside the AMP for expanded taxonomic studies
- Continue using captive populations for research when needed
- Continue searching for other present and past KAS populations

Moving Snails

- Do not routinely move snails and habitat up slope during floods
- Do not establish new populations before the new Recovery Plan is completed
- Conduct a risk/benefit analysis before augmenting populations*
- Do not stock a translocation site from multiple founder populations
- Avoid moving parasitized snails to new locations
- Do not release snails from captive populations
- Develop criteria for determining successful establishment*

Planning and Compliance

- Continue planning and compliance for flows above 45,000 cfs
- Develop a Recovery Implementation Plan as soon as possible
- Develop a new Recovery Plan when taxonomic questions are resolved
- Ensure broad peer review of the draft new Recovery Plan
- Develop acceptable means to meet incidental take requirements
- Consult on the proposed new program of experimental flows
- Adopt and incorporate these recommendations into the AMP strategic plan

B. Resource Management Questions

The KAS ad hoc identified five questions that need to be considered by the TWG and AMWG. In this section of the report we raise the questions, provide the Panel's and KAWG's perspectives on the issues, and provide our recommendations regarding future resource management decisions.

* Tasks that need to be completed before writing a biological opinion for new experimental flows

1) Should TWG & AMWG support establishment of new populations of Kanab Ambersnail *Oxyloma haydeni kanabensis* through additional translocation of snails from Vaseys Paradise or other populations?

The "panel believes that translocations into sites where no previous records exist is not advisable except under emergency circumstances", while KAWG was divided on "the need for redundant populations". KAWG noted that "The Recovery Plan is still in effect and at least five members wanted to preserve the opportunity to continue implementing the plan as a means of reaching recovery and de-listing".

The KAS ad hoc does not recommend establishment of new *Oxyloma haydeni* populations within Grand Canyon National Park or Glen Canyon National Recreation Area unless there is evidence that other populations of *Oxyloma haydeni* have been, or are likely to be, extirpated by human actions within these National Park Service areas. If the historic habitat cannot be saved or restored, then translocation to unoccupied or constructed habitats should be considered with appropriate planning and environmental compliance. Any new populations should be founded from the population that is genetically most closely related to the population of concern, if possible. Any reintroduction sites should be above expected high water levels for regulated flows from Glen Canyon Dam.

2) Should TWG & AMWG support augmentation of the existing translocated VP *Oxyloma* populations at Keyhole Spring, Lower Deer Creek, or Upper Elves Chasm?

The Panel recommended against "further augmentation of the populations already established within Grand Canyon National Park." The KAWG indicated that they reached "consensus [on other points] assuming some snails could be used to augment translocated populations".

The KAS ad hoc recommends against further augmentation of the existing translocated VP *Oxyloma* populations until the benefits and risks of such augmentation have been reevaluated, and until the reasons for apparent lack of success of the Keyhole and Deer Creek introductions are better understood. Evaluation of benefits and risks needs to be accomplished prior to any discretionary Federal action that would result in incidental take of VP *Oxyloma*.

3) Should TWG & AMWG support using captive refugia populations as reservoirs of animals for research, public education, or for possible future reintroductions?

The Panel said, "We do not see a useful conservation-oriented purpose for the captive populations (refugia). These populations exist in an artificial selective regime and may harbor diseases that potentially could be disastrous if introduced to the wild.... On the other hand, they may be useful for controlled laboratory research". While KAWG agreed with the utility of captive populations for research and educational purposes, we are unclear about KAWG's current position regarding potential use of captive snails for reintroductions.

The KAS ad hoc recommends using experimental captive populations when needed for research. Maintaining captive populations of endangered species solely for educational or display purposes is not allowed under the Endangered Species Act, although public display of research populations may be permissible. Captive populations should not be used for reintroduction when other viable populations exist (see comments under Recommendation 3, below.)

4) Should the TWG & AMWG refrain from recommending test floods between 45,000 cfs and the pre-dam average annual maximum in order to protect the Vaseys Paradise snail population?

The panel said, "a strong case can be made that releases should be increased to more closely match the pre-dam natural hydrologic regime, including inter-annual variability...There is no reason to believe that the population cannot survive floods of these magnitudes in the future". KAWG noted that "larger flows are not precluded but would require additional compliance" and "Factors such as recent climatic conditions and physical habitat would need to be considered."

The KAS ad hoc recognizes that the Colorado River watershed evolved with frequent flooding above 45,000 cfs, and believes that the potential for ecological benefits warrants continued planning for high flows and other experimental flows. However, such planning should include consideration of Endangered Species Act compliance requirements and potential impacts to VP *Oxyloma* and their habitat. Continued monitoring and a reasonably predictive model of habitat and population responses to environmental change are needed to make informed decisions about potential impacts and appropriate mitigation measures for future high flows.

5) Should TWG & AMWG recommend consultation on Biological Opinion issues and/or development of a new Recovery Plan? (Note: These are not AMWG responsibilities, but they would affect the Adaptive Management Program.)

The panel concluded "that the recovery plan and biological opinions regarding the Vasey's Paradise and other *Oxyloma* populations should be revised as soon as the major taxonomic and distributional issues are resolved by further morphological, anatomical, and molecular genetic studies and new field surveys". The KAWG agreed that the Kanab Ambersnail Recovery Plan "should be re-written as soon as the major taxonomic issues are resolved" and KAWG concurred with the need for "reconsideration of current management direction for these snails and their ecosystems". KAWG also recommended that "an interim strategy for obtaining the recommended data and moving toward recovery should be developed."

The KAS ad hoc recommends consultation and development of a new Recovery Plan. Consultation should proceed as soon as a new program of experimental flows has been designed. A new Recovery Plan should be developed as soon as taxonomic, genetic, and distribution questions have been resolved. A Recovery Implementation Plan should be developed to bridge this gap.

C. Discussion of Individual Issues Addressed By the Kanab Ambersnail Review Panel

This section follows the numbering system used in the Panel's original report. Comments that relate to specific subtopics in the Panel's report (1A, 1B, 1C, etc.) are included in the general response to the issue. The Kanab Ambersnail Working Group response (Karas 2001) did not specifically refer to the issues listed below.

Issue 1. This issue involves the molecular genetics, shell morphology, internal anatomy, and taxonomy of *Oxyloma* snails in the Colorado River drainage.

The KAS ad hoc concurs with the Panel's recommendations for more genetic and taxonomic research. Despite new information that has been produced since the panel met (Miller et al. 2000³, Stevens et al. 2000⁴), additional taxonomic and genetic work are still needed to better understand the VP *Oxyloma*. We recommend that the Grand Canyon Monitoring and Research Center (GCMRC) work with subject matter experts and with the TWG to identify information needs priorities, and appropriate technologies for resolving these questions. Supplemental funding should be sought from sources outside the AMP for work with *Oxyloma* and with related succineid species in the event that AMP funds are insufficient.

Issue 2. This issue concerns the observed wide seasonal and annual fluctuations of the Vaseys Paradise population in relation to the 1994 Biological Opinion.

The KAS ad hoc does not fully concur with the Panel on the question of whether "There is no reason to believe that the population cannot survive floods of these magnitudes [around 125,000 cfs] in the future". While we can assume that the VP *Oxyloma* have weathered numerous high flow events at Vaseys Paradise, we have little information about other changes that may have occurred since the population was established. Where were the founding population(s) and do they still exist? No one knows when the VP *Oxyloma* first reached Vaseys Paradise and we have no way of knowing whether other populations were destroyed by construction of Glen Canyon or Hoover dams. Nor do we know how often, if ever, the Vaseys population was augmented through rafting or other natural processes. Has the elimination of high, warm, debris laden pre-dam flows reduced any opportunities for accidental introductions from upriver populations, and to down river habitats? Is the population as resilient as ever, or have new diseases, parasites, or other factors limited its ability to recover from major environmental changes? The question is how to proceed given the uncertainty of questions that may never be answered. As the Panel noted, several methods for risk analysis and population modeling are available to help guide decision-making (e.g., James et al.

³ Miller, M. P., L.E. Stevens, J.D. Busch J. A. Sorenson and P. Keim. 2000. Amplified fragment length polymorphism and mitochondrial sequence data detect genetic differentiation and relationships in endangered southwestern U.S.A. ambersnails (*Oxyloma* spp). Can. J. Zool. 78:1845-1854.

⁴ Stevens, L.E., P. Keim, M.P. Miller and S. Wu. 2000. Morphological and genetic relatedness among succineid landsnails in the United States and Canada, with emphasis on the endangered Kanab ambersnail (*Oxyloma haydeni kanabensis*). Draft Final report for GCMRC, Flagstaff, AZ.

1997⁵). Low-impact monitoring can provide data needed for modeling, and can provide advance notice of changes to population or habitat.

Issue 3. This issue is focused on the Vaseys Paradise site and raises questions about the vegetative habitat of the snail population there.

The KAS ad hoc differs with the panel, believing that the Panel misunderstood the Kanab Ambersnail Interagency Workgroup's use of the words "primary" and "secondary" habitat. These terms originally referred to areas of high or low snail density and were associated with specific vegetation types and other factors unrelated to stage. The Panel's response suggests that secondary VP *Oxyloma* habitat is restricted to repeatedly inundated and scoured areas below 45,000 cfs that were historically of less importance to the population's long-term survival than were habitats located further above the river. This interpretation was incorrect, and there is other information that must be taken into account when evaluating the effects of flows on VP *Oxyloma* and its habitat. The monitoring record above 60,000 cfs at Vaseys Paradise is incomplete, and the relationship between snail density and habitat type is less well documented. Other factors, such as vegetation type, soil moisture, slope, etc., also affect habitat suitability. Historic stage data also indicate that there were periods when maximum flows remained near 25,000 cfs for several years at a time, even in the pre-dam era. Vegetation may have expanded rapidly if floods laden with sediment and floating debris were followed by several seasons of low flows. While we agree that habitats above the historic high water line have probably always been critical to the species, the importance of lower elevation habitats to the VP *Oxyloma* during low water or drought years, and for accidental transport of snails to down river habitats during the pre-dam era remains unknown.

Issue 4. This issue deals with the proportion of the Vaseys Paradise snail population that could be lost in a given year without adverse long-term consequences.

The KAS ad hoc differs with the Panel. While the historic high water line certainly provides information about historic flooding at Vaseys Paradise, more information is needed to answer questions of how much loss the VP *Oxyloma* population can tolerate, how frequently, and under what other conditions. We are not confident that we have sufficient historical information about Vaseys Paradise or other *Oxyloma haydeni kanabensis* populations (past or present) to conclude, "initial take of 40% would almost certainly not threaten the persistence of the snail population." The USFWS Biological Opinions on incidental take of habitat (10%) have been revised (up to 17%) (Harlow, 2000⁶) since the panel met to reflect new information. We recommend that current information about the status of all populations within the CRE (habitat condition, snail numbers, snail distribution, etc.) be included in consultation when planning future flows above 45,000 cfs.

⁵ James, F. C., C. A. Hess, and D. Kufrin. 1997. Species-centered environmental analysis: indirect effects of fire history on red-cockaded woodpeckers. *Ecological Applications* 7:118-129.

⁶ Harlow, D. L. Biological opinion amendment for Kanab ambersnail in Arizona. (2000). Memorandum to the Regional Director, Bureau of Reclamation, Salt Lake City, Utah. Dated June 23, 2000. 3 pp.

Issue 5. This issue again deals with managed flood regimes; approaches for predicting population responses to environmental change, and appropriate mitigation activities.

The KAS ad hoc differs with the panel, because this issue cannot be addressed only from a biological perspective. There are also legal and philosophical issues to consider. We agree that natural flooding has probably scoured soils and vegetation and reduced snail numbers frequently during the VP population's history. However, the Kanab Ambersnail is a designated endangered species, the VP population is currently regarded as a population of endangered Kanab ambersnail, and present day dam releases are under human control. The Endangered Species Act requires that Federal agencies minimize the impact of their actions on endangered species, as do agency policies and our own philosophical considerations. The KAS ad hoc recognizes that several alternatives for reducing incidental take have been considered and tested in the past. We recommend that a wide range of alternatives also be considered during future planning, and that the selection of appropriate Reasonable and Prudent Measures be determined through consultation among subject matter experts, resource managers, and responsible agencies. We agree that modeling of habitat and population responses to environmental change can and should guide planning and consultation.

Issue 6. This issue involves management actions to avoid jeopardy, including moving snails to higher ground, establishing redundant wild populations, and establishing captive populations.

The KAS ad hoc shares the Panels concerns, but differ in several significant details. We recommend against translocation of Kanab ambersnails to any new location within the Colorado River Watershed before the Kanab Ambersnail Recovery Plan has been revised.

We recognize that there are risks associated with any translocation. Translocated organisms may not survive or prosper, translocation may introduce disease, parasites, or weeds to the new habitat, or the translocated species may interfere with organisms already present at the new site. These risks were considered before the VP *Oxyloma* was moved in 1996. Although there are differences of opinion about the potential risks and benefits, neither the Panel, KAWG, nor this group is recommending for their removal at this time. The existence of a redundant population at Elves may reduce the risk of losing the VP *Oxyloma* population from unforeseen circumstances at Vaseys Paradise, and its existence will also be considered in future consultation. The translocated populations also have full protection under the Endangered Species Act and cannot be removed without additional consultation between the National Park Service and the US Fish and Wildlife Service, neither of which has proposed taking such action.

We do not recommend routinely adding more snails to translocated populations at Keyhole Spring, Lower Deer Creek, and Upper Elves Chasm without well documented evaluation of the risks and benefits. Among these three sites, only the population at Elves appears to be expanding at this time. Two potential benefits were identified for augmentation of the Elves population. 1) Augmentation could reduce the potential for inbreeding due to the small founder population size (about 150 snails). 2) Augmentation may be an appropriate mitigation action for losses that would otherwise occur with future

high flow experiments. However, some risks associated with the original translocation would be repeated with each additional stocking (i.e., disease introductions). Other appropriate mitigation actions that do not involve translocation may also be identified. We recommend against moving additional snails to the Elves, Keyhole or Deer sites until the benefits and risks are evaluated, and status of the original introductions and the species habitat needs are better understood.

We are encouraged by the discoveries of additional populations of *Oxyloma* in Utah and recommend for additional research to find and characterize other sites where *Oxyloma haydeni* previously existed (fossil evidence) and where they may still exist in tributaries and side canyons in the Colorado River watershed.

Issue 7. This issue deals with the significance of the *Leucochloridium* parasite found in VP *Oxyloma*.

The KAS ad hoc does not fully agree with the Panel on this issue. The translocation procedures chosen in 1996 to safely move snails without moving their parasites (by moving snails less than 5 mm in length) appear to have accomplished their purposes. Recent scientific evidence suggests that the parasite has co-evolved with VP *Oxyloma* and does not significantly reduce the survival or reproduction of these or other known species. However, some of us remain reluctant to knowingly transport a disease organism into a location where it does not currently exist. This difference of opinion is based on principles, policies (DOI 2000⁷), past experience, and uncertainty about long-term effects. We recommend that the risks and benefits of moving snails larger than 5 mm be reevaluated in light of the best available information before any additional translocations or augmentation are undertaken in the future.

Issue 8. This issue deals with the questions of how to differentiate between distinct populations and how to measure the success of a reintroduction effort.

The KAS ad hoc concurs with the Panel's responses to the questions posed in 8A-8D. We also agree that species conservation areas should not be constrained by state/political boundaries. However, we do not agree with the panel's assumptions regarding the origin of the VP *Oxyloma*. Without information about pre-dam populations, we feel it is important to evaluate proposed management actions in light of the hypothesis favored by the Panel and also for the alternative hypotheses. The panel inferred that the VP *Oxyloma* evolved at its present site, or nearby, and has always been approximately as rare as it is now. One alternative hypothesis is that the VP *Oxyloma* evolved elsewhere and reached Vaseys Paradise more recently than the first hypothesis suggests. Another alternative view is that the VP *Oxyloma* may have been, or may still be, more widespread than we now know (i.e., Pleistocene relict theory). Accepting all three hypotheses as equally likely is a more conservative approach to resource management, as it involves consideration of a broader range of alternatives. We feel a conservative approach is appropriate when dealing with a designated endangered species. We recommend that the

⁷ DOI. Department of the Interior and Department of Commerce. 2000. Policy regarding controlled propagation of species listed under the Endangered Species Act. Federal Register. Vol. 65, No. 183. pp. 56916-56922.

National Park Service coordinate with Arizona Game and Fish Commission, GCMRC, the Bureau of Reclamation, the US Fish and Wildlife Service, and other appropriate entities to develop criteria for determining when the attempts to reintroduce VP *Oxyloma* at the Keyhole, Deer, and Elves sites should be abandoned or declared a success (USFWS 1998⁸). The Panel's report, this document, and the draft KAWG criteria for defining "establishment" include draft criteria for consideration.

Conclusion

The Panel's conclusion restates several of their assumptions, comments on current management approaches, and proposes alternative uses of limited funds. While we concur with many of the Panel's specific recommendations (listed above), we do not agree with all of their conclusions. We are not confident that natural flow processes and patterns (e.g., timing, duration, stage, sediment content, temperature, floating debris, existence of upriver and down river habitats) can be restored in the near future, given current legal and operational constraints for Colorado River dams. Consequently, we feel that other management actions on behalf of the VP *Oxyloma* are warranted for a variety of biological, legal, and philosophical reasons already discussed. Development of an interim Recovery Implementation Plan, a new Recovery Plan, and new biological assessments and biological opinions associated with future actions, are appropriate means of selecting those actions. The Panel's report has contributed much useful information to this effort, and will undoubtedly be referenced frequently in future planning documents.

D. Discussion of Individual Recommendations Made by the Kanab Ambersnail Review Panel and also Addressed by the Kanab Ambersnail Work Group

The following paragraphs follow the numbering system used by Karas (2001) to address recommendations listed on pages 1-2 of the Panel's report.

Recommendation 1. Additional analyses of shell morphology, anatomy, and molecular genetics (e.g., mitochondrial DNA), using state-of-the-art methods, are urgently needed to resolve taxonomic, phylogenetic, and, in part, distributional questions.

The KAS ad hoc concurs with the Panel and KAWG. (Also see comments under Issue 1, above.)

Recommendation 2. Also urgently needed are additional field surveys of potential succineid habitats both upstream of Glen Canyon dam and downstream within the Colorado River drainage, as well as in regions outside the Colorado River basin that provide potential habitat.

The KAS ad hoc concurs with the Panel and KAWG.

⁸ USFWS. U.S. Fish and Wildlife Service. 1998. Section 7 consultation for the establishment of the endangered Kanab ambersnail into Grand Canyon National Park.

Recommendation 3. In contrast, additional efforts at translocation and establishment of captive populations are not warranted.

The KAS ad hoc does not fully agree with the Panel's recommendation or with KAWG's recommendations.

We recommend against establishment of new populations in the Colorado River watershed before a new Recovery plan has been approved.

We have not categorically ruled out augmentation to sustain and maintain existing populations at the translocation sites and meet the original objectives of the current Recovery Plan and Biological Opinion. However, we recommend against stocking a translocation site from more than one founder population (issue 1 E) if sufficient numbers from one founder population can be obtained to prevent inbreeding.

We recommend for a thorough reevaluation of risks and benefits of augmenting the three translocated populations before moving more snails to any of those sites. This evaluation needs to be completed before writing a biological opinion associated with future experimental flows.

We recommend for establishment and maintenance of experimental populations in captivity when they are needed for research that is in the species best interests.

We recommend against using captive populations for reintroduction unless appropriate protocols have been rigorously applied to prevent disease introductions or unintended genetic selection to artificial environments (e.g., DOI 2000)⁹, and then only when sufficient numbers of animals cannot be obtained from closely related wild populations.

Recommendation 4. Population viability analysis of the Vasey's Paradise population, and probably other *Oxyloma* populations, is not likely to be informative or helpful for conservation of these populations; preferable alternatives to population viability analysis exist.

The KAS ad hoc concurs with the Panel and KAWG that there are potentially useful alternatives to PVA (e.g., James et al. 1997.) and we think that GCMRC should evaluate the full range of assessments in addressing this issue.

Recommendation 5. Flooding from dam releases within the historic (pre-dam) seasons and levels is justified ecologically and is unlikely to pose a significant threat to the Vasey's Paradise snail populations, which appears to have evolved under an intense flooding regime.

The KAWG did not reach consensus about this recommendation. The KAS ad hoc does not feel that there is sufficient information available to concur with the Panel (also see comments under Issue 2, above). However, we feel that the risks of higher flows can be evaluated and managed under the following circumstances:

⁹ Department of the Interior and Department of Commerce. 2000. Policy regarding controlled propagation of species listed under the Endangered Species Act. Federal Register. Vol. 65, No. 183. pp. 56916-56922.

Resource monitoring should continue at an appropriate level (details to be determined by the GCMRC in consultation with TWG).

A reasonably predictive model of habitat and population responses to environmental change needs to be developed.

Acceptable means must be determined to meet incidental take requirements.

Recommendation 6. No scientific basis exists for heroic efforts to maintain or create artificially large or multiple populations of the Vasey's Paradise snail; instead, available information on historical ecology supports a minimally invasive approach to management of Vasey's Paradise and other populations of *Oxyloma*.

The KAWG did not reach consensus on the first part of this recommendation, and they did not agree with the Panel on the second part. The KAS ad hoc agrees that a minimally invasive approach to management of the VP *Oxyloma* population is appropriate. Like the KAWG, we do not agree among ourselves about the benefits and risks of establishing redundant populations of endemic species. However, we are in agreement that that no new populations of *Oxyloma haydeni kanabensis* should be established in the Colorado River watershed before the Recovery Plan has been revised. We are not recommending, as a routine flood mitigation measure, that snails or vegetation be moved to higher elevations.

Recommendation 7. The Recovery Plan for the *Oxyloma* populations in this region should be rewritten as soon as the major taxonomic issues are resolved. The Vasey's Paradise population may warrant listing and conservation as a distinct, imperiled taxon, perhaps as a single-site endemic.

The KAS ad hoc agrees with the Panel and the KAWG that the Kanab Ambersnail Recovery Plan should be rewritten as soon as major taxonomic issues are resolved. We agree with KAWG that the Panel's second statement about listing the Vaseys Paradise population as a "distinct, imperiled taxon" was somewhat speculative, pending additional research on genetics, morphology, taxonomy and population dynamics, and that an interim strategy is needed for obtaining the recommended data.

Recommendation 8. The administrative and management implications of new taxonomic findings should be discussed and disseminated widely and promptly to all parties. Any subsequent management or recovery plan should be subjected to a review process similar to that of this panel prior to implementation.

The KAS ad hoc concurs with the Panel and with KAWG. The Recovery Team, Federal Register Notice, and external peer reviews can accomplish this.

Recommendation 9. Our conclusions suggest a reconsideration of current management direction for these snails and their ecosystems.

The KAS ad hoc concurs with the Panel and with KAWG. We think that the series of reviews on management practices for the VP *Oxyloma*, including ours, have been very beneficial in setting management direction and objectives for this taxon and other inhabitants of spring habitats in the Colorado River ecosystem.