Peer Review of the Scientific Findings in the Proposed Rule to Delist the Valley Elderberry Longhorn Beetle

January 2013

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FORWARD

Atkins, North America, hereafter referred to as Atkins, was retained by the U.S. Fish and Wildlife Service (USFWS) to facilitate an independent scientific review of the proposed delisting rule for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB). The four reviewers on this panel read the proposed rule carefully and have produced thoughtful, informed and well-argued evaluations. Atkins finds the main thrust of the reviews, which are substantially critical, to be well-founded. Not all relevant information is referenced, and not all of the most recent information seems to have been used in the proposed delisting rule. The analysis, as it stands, cannot be said to represent "best available science". Nevertheless, the reviewers have, on several occasions, pointed out additional issues that *could* be addressed or new data that *could* be collected. These suggestions should be carefully considered by the USFWS, to determine whether these data are currently available (as in "best available"). If the information is unavailable, then Atkins believes (the comments of reviewers not withstanding) the USFWS has performed adequately on those issues. For other large, over-arching issues, such as climate change, the USFWS may wish to consider the comment, and provide clear justification as to why the comment warrants re-analysis or not.

Atkins recommends the USFWS take all of the reviewers' comments seriously, and create a clear written justification for whatever decision is made; Atkins does not recommend the USFWS accept all such comments without qualification.

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1.0 INTRODUCTION

1.1 Background

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) is found within the Central Valley (San Joaquin and Sacramento Valleys) of California. This species was listed as a threatened species pursuant to the Endangered Species Act (ESA) on August 8, 1980 (45 Federal Register [FR] 52803); at that time it was identified in ten occurrence records in three locations: Merced County, Sacramento County, and Yolo County. This species is a wood borer that is dependent on its host plant, the elderberry (*Sambucus* species), which is a common shrub component of riparian forests and adjacent upland vegetation along river corridors of the Central Valley. Local beetle populations tend to be sporadic, small, and clustered, independent of the availability of larger areas of mature elderberry. Current habitat conditions are the result of present and historical land use practices. Land ownership includes private and public lands, including federal, state, and local government lands.

In 2006, at the conclusion of the 5-year review of the status of VELB, the U.S. Fish and Wildlife Service (USFWS or Service) recommended removing VELB from the List of Threatened and Endangered Species (i.e., delisting).

Under the ESA, the USFWS may be petitioned to list, delist, or reclassify a species. In 2010, the USFWS received a petition from the Pacific Legal Foundation requesting that VELB be delisted. In 2011, the USFWS published its 90-day finding on the petition, which concluded that the petition contained substantial information that delisting the beetle may be warranted. Therefore, the USFWS also announced that it was initiating a status review for this species as required under the ESA.

On October 2, 2012, the USFWS published a proposed delisting rule for VELB. The proposed rule also serves as a 12-month finding in response to the 2010 petition to delist the species. In accordance with the USFWS's July 1, 1994 peer review policy (59 FR 34270) and the Office of Management and Budget's December 16, 2004 Final Information Quality Bulletin for Peer Review, the USFWS subjected this proposal to peer review.

1.2 Purpose and Scope of Peer Review

Given the long-term conservation implications of the proposed delisting rule for VELB and its influential information, the proposed rule required a formal, external, independent scientific peer review before a determination can be made whether to prepare a final delisting rule. If the proposed delisting rule does not provide the best science-based information and analyses, any decisions or conservation actions based on this report may be less effective in the long-term conservation of VELB.

The USFWS asked that the reviewers address the scientific merit of the report's primary analysis components (i.e., population and habitat parameters, threats) which provide the basis for the recommended action. Furthermore, the reviewers were requested to comment on the extent to which any scientific uncertainties are clearly identified and characterized, as well as the potential

implications of the uncertainties for the technical conclusions. Additionally, the reviewers were asked to evaluate whether the best scientific and commercial information available is used in the proposed rule. The reviewers were instructed not to provide a review of the USFWS's decision to propose VELB for delisting.

Specifically, the USFWS requested that reviewers consider and respond to the questions listed below, at a minimum, in their reviews.

1. Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical and supported by the data and information in the proposed rule, especially in regards to the beetle's biology, current habitat (including habitat connectivity and the availability of beetle habitat within riparian vegetation), range (including lost historical range), distribution, population size, and population trends?

2. Are there instances in the proposed rule where a different but equally reasonable and scientifically sound scientific conclusion might be drawn that differs from the conclusion drawn by the Service? If any instances are found where that is the case, please provide the specifics of that situation.

3. Does the proposed rule provide accurate and balanced reviews and analyses of the factors relating to the threats of the beetle (at the time of listing, currently, and in the future), including potential impacts from climate change and the future anticipated level of threat for habitat loss and potential sources of habitat loss? Are the Service's findings regarding threats to the species biologically sound and supportable based on the information and data in the proposed rule?

4. Does the proposed rule provide a logical and accurate review of the VELB recovery plan objectives, implementation, and evaluation?

5. Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the USFWS use the best available science to support its assumptions, arguments, and biological conclusions? If any instances are found where the best available science was not used, please provide the specifics of each situation.

6. Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document? Please identify any such papers.

7. Did the Service accurately assess the efficacy of past and on-going beetle management activities in conserving the VELB?

8. Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous or that could be condensed?

9. Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened, and if so, how?

10. Are scientific uncertainties clearly identified and characterized, and are the potential implications of the uncertainties for the technical conclusions clear?

2.0 PEER REVIEW PROCESS

Atkins, North America, hereafter referred to as Atkins, was retained by the USFWS to facilitate the peer review process. The terms of the contract include the following:

- organize, structure, lead and manage the scientific review;
- summarize the individual peer reviews and prepare a summary report for the USFWS;
- facilitate specific follow-up questions/answers between the USFWS and the reviewers, without attribution; and
- prepare and submit a final report and official record to the USFWS.

Rebecca Burns and Tom St. Clair facilitated this review on behalf of Atkins. Steven Courtney (RESOLVE) reviewed the draft report for quality assurance.

2.1 Selection of Reviewers

As part of its proposal, Atkins was required to submit the names and resumes of three to five well-qualified, independent reviewers whose expertise includes the following:

1. A Ph.D. in population ecology, or related field
2. Demonstrated experience working with endangered species issues
3. Expert knowledge of the life history and biology of the VELB, and riparian ecosystems of the Central Valley of California
4. Experience as a peer reviewer for scientific publications

In addition, Atkins was instructed to ensure reviewers had no financial or other conflicts of interest with the outcome or implications of the proposed rule.

Atkins confirmed four potential reviewers who met the criteria listed above and were willing and available to participate in the review. Their names and resumes were submitted as part of the proposal and were confirmed by the USFWS with acceptance of the proposal. The final panel composition was:

- Dr. Richard A. Arnold, Entomological Consulting Services, Ltd.
- Dr. Michael S. Caterino, Santa Barbara Museum of Natural History
- Dr. Marcel Holyoak, University of California, Davis
- Dr. Gary R. Huxel, University of Arkansas

The qualifications of each reviewer are included in Appendix A. A lead reviewer was selected to compile the individual reviews and ensure there was no attribution prior to sending to Atkins.

2.2 Document Review and Report Development

Upon selection, reviewers were provided with the proposed rule (published in the FR on October 2, 2012), a link to a secure file-sharing site with copies of all of the references cited in the proposed rule and instructions for conducting the review. Atkins held a brief teleconference with the reviewers on October 10, 2012 to describe the review process and schedule and ensure that the reviewers did not release any information regarding this peer review or respond to any outside inquiries for information.

Reviewers conducted their independent desk reviews of the proposed rule to delist the VELB between October 5, 2012 and October 23, 2012. All comments were submitted to the lead reviewer as individual memoranda; the lead reviewer compiled all of the reviews in the order in which they were received and labeled them as "Reviewer 1, Reviewer 2, etc." to comply with the USFWS's direction to provide unattributed reviews. The compiled individual reviews are included in this document as Appendix B. In the Results section, Atkins summarized the responses to the ten questions posed to the reviewers. The draft peer review report was submitted to the USFWS for review on November 1, 2012.

Originally, the USFWS was to provide comments and questions on the draft peer review report by November 16, 2012; however, upon receiving the report, the USFWS requested additional time to prepare comments and questions. The USFWS input was received on December 21, 2012 and distributed to the panel on January 2, 2013. Atkins held a brief teleconference with the panel and Steven Courtney on January 4, 2013 to discuss the comments and questions. Each reviewer prepared responses to those comments/questions that pertained to his individual review, and added any clarifying text to his review comments (Appendix B). Atkins added the responses to the USFWS comments and questions document, which is part of the Administrative Record. Atkins also inserted any additions/revisions to the reviewers' comments (in Appendix B) into this final peer review report.

3.0 RESULTS

The four reviewers provided detailed comments and insights on a wide array of topics relative to the questions they were posed. Positive aspects of the proposed rule included the review and assessment of threats to the VELB; the description of efforts to improve or create VELB habitat; the use of available scientific and technical literature; the accuracy with which analyses, studies and literature are reported; the review of the VELB's recovery plan; and the assessment of on-going beetle management activities.

For the most part, however, the reviewers raised strong concerns about the scientific foundation of the proposed rule. Though the topics raised in their individual reviews varied, the reviewers' greatest concerns were consistent. The primary issue identified regarded uncertainties with the proposed rule's conclusion that 26 locations currently host the beetle. The reviewers noted that the California Natural Diversity Data Base (CNDDB) records are old and rely heavily on exit holes, which are often misidentified, leading to erroneous conclusions. Furthermore, the reviewers indicated the proposed rule does not include the findings of Chemsak (2005), which are in disagreement with the CNDDB records in the southern end of the range. The reviewers

concluded there is a high likelihood that significantly fewer than 26 locations currently host VELB populations. The reviewers consistently commented on the proposed rule's dismissal, minimization or omission of potential threats to the beetle, particularly those from the invasive Argentine ant and European earwig. As a result of these and other factors, the reviewers concluded that the scientific foundation of the proposed rule is not fundamentally sound and additional effort is needed to strengthen the proposed rule.

Below are brief summaries of the individual reviewers' responses to the ten questions posed by the USFWS. For the reviewers' full comments see Appendix B.

Question 1: Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical and supported by the data and information in the proposed rule, especially in regards to the beetle's biology, current habitat (including habitat connectivity and the availability of beetle habitat within riparian vegetation), range (including lost historical range), distribution, population size, and population trends?

The reviewers had substantial and varied comments in response to this question, which are summarized below. The reviewers identified several instances where the analyses, findings and conclusions presented in the proposed rule are not supported by the available data, or further explanation is needed on the limitations of the data, assumptions and/or rationale for dismissing certain topics.

Reviewer 1 raised strong concerns about the conclusions in the proposed rule, specifically regarding the beetle's range. Significant uncertainties regarding the 26 locations thought to host VELB were noted and the use of exit holes to measure beetle occurrence was questioned. Specifically, Reviewer 1 stated that eight of the 26 locations had no evidence of beetle activity since before 2000 and 11 of the 26 locations had only documented exit holes, which other studies have suggested were those of the non-threatened subspecies *Desmocerus californicus californicus* (California Elderberry Longhorn Beetle; CELB), not VELB. Thus, Reviewer 1 contended that there is no scientific justification for the proposed rule's finding that VELB currently occupy and persist in 26 locations and noted "…the beetle appears to remain in decline."

Similarly, Reviewer 2 found the reliance on CNDDB reports of VELB exit holes to be problematic due to frequent misidentifications, potentially leading to erroneous conclusions. The reviewer recommended that this limitation be strongly emphasized in the proposed rule. Reviewer 2 also pointed out that the CNDDB records were dated and the results disagreed with updated distribution information from Chemsak (2005), which was not included in the proposed rule. Additionally, Reviewer 2 noted the absence of estimates of other habitat types where VELB occur (e.g., foothills, elderberry savanna). Several terms that are confusing and potentially misleading were identified, as well as a few areas where clarifications could be made (i.e., basis for dispersal information, reason for lack of VELB population data).

Reviewer 3 found much of the information summarized in the proposed rule to be correct, and the conclusions to be logical and supported by data; however, six specific exceptions were identified. First, the paucity of recent records in the southern end of the beetle's range is not

adequately summarized or considered to be a problem in assessing population trends. Second, discussion of the extent of beetle populations does not consider turnover due to extinction or colonization and evidence for declines in the northern end of the range are dismissed without logical rationale. Third, the proposed rule does not consider the effects of habitat alteration and floodplain successional processes due to damming, and the evidence of reduced elderberry recruitment on dammed rivers was omitted. Fourth, the accuracy of the estimates of locations with extant beetle populations may be influenced by the second and third items listed above, but this is not captured in the proposed rule, and the description of what constitutes a location with an occurrence may have narrowed over time. Consequently some of the increase in the number of locations is likely because of a changed definition of what constitutes a locality. Fifth, the effects of invasive Argentine ants are dismissed without a logical explanation and the spread of invasive Argentine ants from the south is omitted. And finally, the ability to consider climate change effects is also dismissed.

Reviewer 4 also noted data used in the proposed rule are old (i.e., censuses completed prior to 1995) and there are little to no data available on the newer mitigation and restoration sites. The reviewer noted the proposed rule assumes the beetle will persist as long as none of the available data show a negative trend in populations at viable sites. Similar to Reviewers 1 and 2, Reviewer 4 also commented on the lack of population size and trend estimates, as well as the possibility that CELB may have been misidentified as VELB in the CNDDB records.

Question 2: Are there instances in the proposed rule where a different but equally reasonable and scientifically sound scientific conclusion might be drawn that differs from the conclusion drawn by the Service? If any instances are found where that is the case, please provide the specifics of that situation.

All reviewers stated different conclusions than those presented in the proposed rule could be drawn due to limitations in the available data, over-simplification and over-estimation.

Reviewer 1 commented that the USFWS overlooked important and well-documented uncertainties in the available data and its conclusions regarding the current distribution of VELB appear to be overly simplified. Additionally, these conclusions conflict with other authoritative primary sources that identified most or all of the southern populations as CELB.

Reviewer 2 noted that different conclusions regarding VELB distribution could be drawn, given the limitations in the data used by the proposed rule (i.e., paucity of recent and reliable data) as well as other sources that were not included (i.e., Chemsak 2005). Specifically, the conclusion could be drawn that there are fewer than 26 recognized VELB locations (as noted by Reviewer 1 in Question 1), which could affect other conclusions in the document, such as those regarding threat levels.

Reviewer 3 questioned the conclusions in the proposed rule, noting that it overestimates the health of beetle populations, as described in the response to Question 1. The reviewer concluded that VELB populations are actually at substantial risk of extinction.

Reviewer 4 identified ten habitats that were characterized as "fair" in Table 2 where VELB persistence is questionable (i.e., populations are declining, status is uncertain, habitat is limited, habitat condition is poor and/or presence is uncertain). Overall the reviewer noted that many of the locations should be disregarded due to the lack of current data.

Question 3: Does the proposed rule provide accurate and balanced reviews and analyses of the factors relating to the threats of the beetle (at the time of listing, currently, and in the future), including potential impacts from climate change and the future anticipated level of threat for habitat loss and potential sources of habitat loss? Are the Service's findings regarding threats to the species biologically sound and supportable based on the information and data in the proposed rule?

Reviewers' responses to this question varied. Reviewers 1 and 3 indicated that the review of threats was "extensive," "fair" and "balanced" with some notable exceptions, whereas Reviewer 4 concluded the review was neither accurate nor balanced. Reviewer 2 was somewhere in between.

Reviewer 1 noted that the proposed rule's assessment of threats facing VELB is extensive, fair and representative of available data and predictions, with a few exceptions. Notably, the proposed rule does not provide accurate balance on the available information concerning threats from Argentine ants. Reviewer 1 added that the proposed rule minimizes threats based on small population size, which directly contradicts some of the cited literature, and it does not discuss the potential threats posed by invasive plants.

Reviewer 2 commented that a few threats are minimized in the proposed rule, while other threats are omitted but deserve consideration. Threats from Argentine and other invasive ants, as well as the European earwig, are dismissed as insignificant; however, further study is needed to determine their potential impact on VELB. Reviewer 2 pointed out that the threat from invasive plants is not mentioned in the proposed rule, and natural and human factors that alter riparian habitat ecology are not adequately discussed. Finally, the reviewer stated the potential effects of pesticides on VELB, as well as the discussion regarding potential genetic issues, are incomplete and potentially misleading.

Reviewer 3 stated that the review of threat factors represented a balanced attempt; however, the omissions described in response to Question 1 were reiterated, along with the recommendation to broaden the proposed rule's coverage of climate change effects.

Reviewer 4 concluded that the proposed rule does not provide accurate and balanced reviews and analyses, and instead describes a "glass half full scenario." The reviewer stated that threats are discounted and there are no analyses of combined threats at each location; each threat is considered independently.

Question 4: Does the proposed rule provide a logical and accurate review of the valley elderberry longhorn beetle recovery plan objectives, implementation, and evaluation?

The reviewers acknowledged that the VELB recovery plan is limited and that it was intended to be temporary, so it is difficult to assess how well its objectives have been met. The reviewers concluded most of the interim objectives have been met, to varying degrees; however, delisting criteria (i.e., number of sites and populations necessary to delist the species) were never established and the proposed rule does not assess quantitative data to address this objective.

Reviewer 1 noted that the VELB recovery plan was limited, comprising only interim objectives. The proposed rule thoroughly covers the progress that has been made protecting and documenting known populations and protecting new populations; however, specific delisting criteria were never formulated and the most important objective (i.e., what will it take to consider the species recovered) was never fulfilled.

Reviewer 2 wrote that, in general, the proposed rule provides a good review of the VELB's recovery plan objectives, implementation and evaluation; however, the plan is outdated and has not been updated since its publication 30 years ago. The reviewer also noted that the lack of bona fide occurrence data complicates evaluation of the recovery plan and whether its objectives have been met. Finally, Reviewer 2 disagreed that protection of "the three known locations" has been successful, citing personal experience that indicates otherwise.

Reviewer 3 assessed the completeness of the four interim objectives and is in general agreement with Reviewer 1. Objectives 1 and 2 (protecting known locations and conducting surveys) have been completed; however, the reporting of information is misleading because it does not consider the inadequacy of many CNDDB records or adequately consider population extinctions, declines and habitat loss due to succession. Objective 3 (protecting remaining habitat) has been "conducted to a reasonable and practicable extent" in the reviewer's opinion. But Objective 4 (determining the number of sites and populations necessary to delist the species) is inadequately handled. The proposed rule is misleading on this point and includes no assessment of the numbers of populations or sites required for VELB to survive.

Reviewer 4 noted the recovery goals were not specific, other than surveying for new populations, and there were no specific criteria for delisting. The proposed rule states that 25 or 30 sites were found to show evidence of VELB presence, compared to only three sites at the time of listing; however, evidence of occupancy is questionable given possible misidentification of exit holes, as previous noted. Site evaluation should include recent (within the past two years) censuses and habitat evaluations.

Question 5: Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the USFWS use the best available science to support its assumptions, arguments, and biological conclusions? If any instances are found where the best available science was not used, please provide the specifics of each situation.

All reviewers noted examples where conclusions in the proposed rule are not supported by the best available science, either because that science is not included or it is inappropriately disregarded or dismissed.

Reviewer 1 reiterated that the proposed rule's conclusions on two critical elements are not fully consistent with the studies cited. Specifically, no published studies unambiguously support the continued existence of VELB at more than 12 locations, thus the USFWS's conclusion that the beetle's distribution includes 26 locations is inaccurate. Secondly, the threats posed by Argentine ants are concluded to be minimal, contrary to the conclusions of Huxel (2000) and other published studies on the effects of the ant on other invertebrates, including cerambycid beetles.

Reviewer 2 noted that the conclusions in the proposed rule do not agree with Chemsak (2005), which was omitted from consideration. Halstead and Oldham (2000), which is cited in the proposed rule, provided additional evidence that concurs with Chemsak's findings. Reviewer 2 also reiterated the need to include information on the roles of invasive insects and plants, which are dismissed or omitted from the proposed rule.

Reviewer 3 answered positively, but noted the proposed rule omits additional, more recent studies and dismisses Huxel (2000) and Collinge et al. (2001) too strongly. The reviewer added that the general concept of habitat dynamics and its effects on a healthy metapopulation are overlooked.

Reviewer 4 stated that the proposed rule reports analyses, studies and literature accurately, but disregards negative data or conclusions, especially when they are limited to a few sites (e.g., Argentine ant and European earwig).

Question 6: Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document? Please identify any such papers.

The reviewers listed a total of 11 additional papers that would enhance the scientific quality of the proposed rule. Most noteworthy is Chemsak (2005), which is mentioned several times in comments by Reviewers 1 and 2 because of its updated distributional information for both VELB and CELB. The references are:

Chemsak, J.A. (2005). Illustrated revision of the Cerambycidae of North America (Vol II. Lepturinae). Wolfsgarden Books, Chino. 446pp + plates.

Fremier, A. and T. Talley. 2009. Scaling riparian conservation with river hydrology: lessons from blue elderberry along four California rivers. Wetlands 29: 150-162.

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Holyoak, M. and M. Koch-Munz. 2008. The effects of site conditions and mitigation practices on success of establishing the valley elderberry longhorn beetle and its host plant, blue elderberry. Environmental Management 42: 444-457.

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Vaghti, M.G., Holyoak, M., Williams, A. Talley, T., Fremier, A., and S. Greco.2009. Understanding the ecology of blue elderberry to inform landscape restoration in semiarid river corridors. Environmental Management 43:28-37.

Wilcox, C., B. J. Cairns, and H. P. Possingham. 2006. The role of habitat disturbance and recovery in metapopulation persistence. *Ecology* 87:855-863.

Question 7: Did the Service accurately assess the efficacy of past and on-going beetle management activities in conserving the valley elderberry longhorn beetle?

Reviewers' responses to this question varied. Reviewer 1 concluded that management activities, including efforts to protect, enhance, create and restore VELB habitat are described in great detail in the proposed rule, but estimates of success are based entirely on amount of habitat acquired, protected and/or restored, not on monitoring results. Reviewer 1 also noted that at some of the best known sites, beetle populations have appeared to decline. Similarly, Reviewer 2 highlighted two studies that indicated approximately 25 percent of apparently suitable habitat sites are actually inhabited by VELB. Furthermore, the reviewer noted the reliance on exit holes instead of adult observations could have led to some incorrect interpretations, affecting the proposed rule's analyses and conclusions. Reviewer 3 answered that this aspect of the proposed rule is handled well. Reviewer 4 commented the USFWS has not adequately monitored and managed VELB, thus the reviewer's answer to this question was no.

Question 8: Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous or that could be condensed?

Reviewers generally found the proposed rule to be sufficient in terms of the level of detail provided; however, a few exceptions were noted. Reviewer 1 stated too much detail is provided on habitat protection and restoration at sites where no beetles have ever been reported. Reviewer 2 noted further analysis on the potential threat of climate change on VELB should be added to substantiate the conclusion it is a non-significant factor. Also, gaps and limitations in the data may have resulted in erroneous conclusions and as a result, reevaluation of existing data and/or additional data collection is necessary for proper analysis. Reviewer 3 did not find the level of detail to be a concern. Similar to Reviewer 2, Reviewer 4 wrote that the level of detail is sufficient; however, a reevaluation of the information and data (and lack thereof) is needed.

Question 9: Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened, and if so, how?

The reviewers found the scientific foundation to be fundamentally unsound, due to important omissions, old and missing data and potentially erroneous conclusions. The reviewers offer several suggestions for strengthening the scientific foundation of the proposed rule.

Reviewer 1 concluded that the scientific foundation of most relevance (i.e., where VELB populations currently exist) is weak and in some ways misleading. To strengthen the scientific basis, a greater population survey effort is needed. The reviewer proposed the use of pheromone attractants at sites where exit holes are known, but the identity or persistence of beetle populations is uncertain.

Reviewer 2 noted that the scientific foundation could be strengthened by the inclusion of specimen records from museum collections or other bona fide observations, given that the CNDDB records are based on exit holes which are often misidentified. The reviewer has personally conducted protocol surveys to review and field-check elderberry inventories and has detected numerous errors, so the proposed rule's reliance on CNDDB records is a major concern. The reviewer listed several collection and observation techniques that could be utilized to increase the number of adult VELB observations.

Reviewer 3 summarized the omissions previously discussed in response to Question 1 that compromise the soundness of the scientific foundation.

Reviewer 4 wrote that the scientific foundation is not firm due to its basis on old and missing data and information. To strengthen it, a better understanding of metapopulation or spatial ecology is needed to verify that the population is becoming more and more fragmented over time, in addition to more data.

Question 10: Are scientific uncertainties clearly identified and characterized, and are the potential implications of the uncertainties for the technical conclusions clear?

Reviewers 1 and 2 highlighted the uncertainties with the data upon which the proposed rule is based, as mentioned in the responses above. Reviewer 3, however, indicated the proposed rule goes "too far" in identifying uncertainties. Reviewer 4 stated that the proposed rule ignores uncertainties.

Reviewer 1 stated that the primary uncertainty is the current status of VELB, which is recognized by the detailed discussion of data gaps in the proposed rule; however, its conclusions are founded on optimistic (or erroneous) interpretations of available data, thus the entire basis for the delisting proposal rests on uncertainty.

Similarly, Reviewer 2 noted that the primary uncertainties are the current geographic range and status of VELB due to the reliance on exit hole data. The proposed rule recognizes some uncertainties in these data, but nevertheless they are the basis for its analyses. Reviewer 2 stated that it would be appropriate to identify and omit any questionable data from the analyses to better substantiate the proposed rule.

Reviewer 3 found that the proposed rule goes too far in outlining uncertainties, thereby dismissing sound and reliable scientific findings, which are described above. Reviewer 3 also noted that the effects of altered environmental regimes due to climate change and the projected distribution of riparian woodlands would benefit from further characterization.

Reviewer 4 commented that the uncertainties are largely ignored, stating that "uncertainty is taken as no negative indications of potential extinction." Similar to Reviewer 3, Reviewer 4 also noted uncertainties about the potential impacts of climate change on VELB, citing Ruhl (2008) for a number of ways in which the species could be impacted.

4.0 REFERENCES

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Ruhl, J.B. 2008. Climate change and the Endangered Species Act: Building bridges to the no-analog future. Boston University Law Review 88:1-25.

5.0 APPENDICES

Appendix A: Reviewer Curricula Vitae
Appendix B: Individual Reviewer Comments

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APPENDIX A: REVIEWER CURRICULA VITAE

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EMPLOYMENT HISTORY:

Self-Employed Entomological Consultant, 1977 to present. Founder and president of Entomological Consulting Services, Ltd., a firm that is contracted to conduct environmental and technical studies dealing with rare and endangered terrestrial and aquatic insects, arachnids, crustaceans, and other invertebrates for various federal, state, and local governmental agencies; law, environmental planning, architectural, and civil engineering firms; land developers; biotech firms; agribusiness; defense department contractors; energy, forestry, mining, utility, chemical, water, and oil companies; plus non-profit organizations.

SUMMARY OF PROFESSIONAL AND TECHNICAL SKILLS:

- Status survey and habitat assessment methods for rare and endangered terrestrial and aquatic insects, arachnids, crustaceans, gastropods, and other invertebrates
- Population sampling and census techniques
- Ecological and behavioral research methods
- Insect, arachnid, crustacean, and invertebrate identifications
- Environmental impact and constraints analysis
- Mitigation design, implementation, and monitoring
- Habitat management and enhancement to benefit endangered insects and plants
- Preparation of environmental documents to satisfy CEQA, the Endangered Species Act of 1973, NEPA, California Coastal Act, and SMARA
- Preparation of mitigation, resource management, and habitat restoration plans
- Aerial photo interpretation, plus vegetation sampling and classification techniques
- GPS and GIS map preparation and spatial analysis using ArcView and Arc GIS
- Agency consultation and permit acquisition
- Education awareness training and construction monitoring
- Expert witness testimony
- Supervision and direction of field and office personnel, plus subconsultants

PROFESSIONAL ACTIVITIES:

Secretary, The Lepidopterists' Society: 1986-1989.
Executive Council, The Lepidopterists' Society: 1976-1979, 1990-1992.
Research Associate, Department of Entomology, Los Angeles County Museum of Natural History: 1984-present.
Research Associate, Department of Entomological Sciences, University of California at Berkeley: 1980-1989.
Survival Service Commission (International Union for the Conservation of Nature/World Wildlife Fund), Lepidoptera Specialist's Group: 1979-1983.
Chief Counsellor, Xerces Society: 1981-1985.
Board of Trustees, Lepidoptera Research Foundation: 1980-1983.
Board of Directors, Xerces Society: 1978-1980.
Board of Directors, San Francisco Bay Chapter, California Native Plant Society: 1978-1980
Review Editor of ATALA, Journal of the Xerces Society: 1976-1979.
Assistant Editor of Insect World Digest: 1973-1977.
Editor-in-Chief, Teen International Entomology Group (TIEG): 1971-1973

MEMBERSHIP IN SCIENTIFIC AND PROFESSIONAL SOCIETIES:

California Native Plant Society (CNPS), Entomological Society of America, Lepidoptera Research Foundation, Lepidopterist's Society, Natural Areas Association, New York Entomological Society, Pacific Coast Entomological Society, Society for Conservation Biology, and Xerces Society.

ENTOMOLOGICAL PUBLICATIONS:

1) 1968. The effects of x-irradiation on *Papilio polyxenes asterius* (L.) (Lepidoptera: Papilionidae). *J. Lepid. Soc.* 22:173-177 (with A. Arnold).

2) 1969. The effects of x-irradiation on *Colias philodice* Godart (Lepidoptera: Pieridae). *J. Lepid. Soc.* 23:257-260.

3) 1970. Practical tips for improving your insect photography. *TIEG Newsletter* 4 (2):14-16.

4) 1971. Sex attraction: a new way to control insect pests. *TIEG Newsletter* 6 (4):26-28.

5) 1972. Butterflies in mailboxes. *Cornell Countryman* 49 (6):10-11.

6) 1974. The future of entomology: an interview with Dr. Gordon E. Guyer, President of the ESA. *Insect World Digest* 1 (2):24-26.

ENTOMOLOGICAL PUBLICATIONS: (cont'd)

7) 1977. Copulatory and ovipositional mechanisms in *Speyeria* (Lepidoptera: Nymphalidae). *Annals Ent. Soc. Amer*. 70:455-468 (with R. L. Fischer).

8) 1978. *Survey and status of six endangered butterflies in California.* California Department of Fish and Game, Inland Fisheries Branch report. 95 pp.

9) 1980. Great Basin Silverspot (*Speyeria nokomis nokomis*) butterfly study. Bureau of Land Management administrative report. 119 pp.

10) 1980. The Antioch Dunes--safe at last? *Fremontia* 8 (3):3-12+ (with A.Q. Howard).

11) 1980. *Ecological studies of six endangered butterflies: island biogeography, patch dynamics and the design of habitat preserves.* Ph.D. thesis, University of California, Berkeley. 365 pp.

12) 1981. *Status of proposed threatened or endangered California Lepidoptera*. California Department of Fish and Game, Inland Fisheries Branch report. 39 pp.

13) 1981. A review of endangered species legislation in the U.S.A. and preliminary research on 6 endangered California butterflies (Lepidoptera: Lycaenidae). IN, *Biotop- und Artenschutz bei Schmetterlingen*. Referate des II. Europaischen Kongresses fur Lepidopterologie. G. Schmid, ed. *Beih. Veroff.* Naturschutz Landschaftspflege Bad.-Wurtt. Karlsruhe. 21:79-96.

14) 1982. *Recovery plan for the endangered El Segundo Blue butterfly*. Office of Endangered Species, U.S. Fish & Wildlife Service. Portland, OR. 44 pp.

15) 1983. Ecological studies of six endangered butterflies (Lepidoptera: Lycaenidae); island biogeography, patch dynamics and the design of habitat preserves. *Univ. of Calif. Publ. in Entomol*. 99: 1-161.

16) 1983. *Speyeria callippe*: (Lepidoptera: Nymphalidae): Application of information-theoretical and graph-clustering techniques to analyses of geographic variation and evaluation of classifications. *Annals Entomol. Soc. Amer*. 76:929-941.

17) 1983. Conservation of the Endangered Smith's Blue Butterfly. *J. Research Lepid.* 22: 135-153.

18) 1984. *Recovery plan for the endangered Palos Verdes Blue butterfly*. Office of Endangered Species, U.S. Fish & Wildlife Service. Portland, OR. 46 pp.

19) 1984. *Recovery plan for the San Bruno Elfin and Mission Blue butterflies*. Office of Endangered Species, U.S. Fish & Wildlife Service. Portland, OR. 81 pp.

20) 1984. *Valley Elderberry Longhorn beetle recovery plan.* Office of Endangered Species, U.S. Fish & Wildlife Service. Portland, OR. 62 pp.

21) 1984. An introduction to computer-assisted cladistic methods. IN, *Cladistics: Perspectives on the Reconstruction of Evolutionary History*. Proceedings of a National Science Foundation workshop. T. Duncan and T.F. Stuessy, eds. ColumbiaUniv. Press. pp. 295-298. (with Thomas Duncan).

22) 1985. *Recovery plan for the endangered Lotis Blue butterfly.* Office of Endangered Species, U.S. Fish & Wildlife Service report. Portland, OR. 46 pp.

23) 1985. Geographic variation in natural populations of *Speyeria callippe* (Bdv.) (Lepidoptera: Nymphalidae). *Pan-Pacific Entomol.* 61:1-23.

24) 1985. *Delta Green Ground Beetle and Solano Grass Recovery Plan*. Office of Endangered Species, U.S. Fish & Wildlife Service report. Portland, OR. 82 pp. (with R. Holland).

25) 1985. Private and government-funded conservation programs for endangered insects in California. *Natural Areas Journal* 5 (2):28-39.

26) 1985. *Studies of the El Segundo Blue butterfly--1984*. Calif. Dept. of Fish & Game, Inland Fisheries Branch. Administrative Report. 35 pp.

27) 1986. Observation of an inter-subfamilial mating (Lycaenidae: Lycaeninae and Riodininae). *Jour. Lepid. Soc.* 40:238-239.

28) 1987. Habitat enhancement techniques for the El Segundo Blue butterfly, an urban endangered species. IN, *Integrating Man and Nature in the Metropolitan Environment*. Proc. Natl. Symp. on Urban Wildlife, Chevy Chase, MD, 4-7 Nov. 1986, L.W. Adams and D.L. Leedy, eds. Published by the National Institute for Urban Wildlife. pp. 173-181. (with Audrey E. Goins).

29) 1987. Mission Blue butterfly. IN, *Audubon Wildlife Report--1987*. R.L. Di Silvestro, ed. National Audubon Society. Academic Press, Inc., New York. pp. 370-379.

30) 1987. Decline of the endangered Palos Verdes Blue butterfly in California. *Biol. Conserv.* 40:203-217.

31) 1987. Book Review: The ecology and conservation of the Purple Emperor butterfly (*Apatura iris*), by K.J. Willmott. *Atala, The Journal of Invertebrate Conservation* 15 (1/2):21.

32) 1990. The ecology and conservation of two endangered Southern California butterflies. IN, *Endangered Wildlife and Habitats in Southern California*. P.J. Bryant and J. Remington, eds. Memoirs of the Natural History Foundation of Orange County. Vol. 3, pp. 36-47.

33) 1990. *Impacts of diseases and arthropods on California's rangeland oaks.* California Department of Forestry and Fire Protection, Forest and Rangeland Resources Assessment Program, Sacramento, CA. 94 pp. (with Tedmund J. Swiecki and Elizabeth A. Bernhardt).

34) 1991. Insect and disease impacts on blue oak acorns and seedlings. *Proc. of the Symposium on Oak Woodlands and Hardwood Rangeland Management, Oct. 31 - Nov. 2, 1990, Davis, CA*, R.B. Standiford, Tech. Coord. General Technical Report PSW-126. Pacific Southwest Research Station, Forest Service, U.S. Dept. of Agriculture. Berkeley, CA. pp. 149-155. (with Tedmund J. Swiecki and Elizabeth A. Bernhardt). 376 pp.

35) 1991. Monitoring insect and disease impacts on rangeland oaks in California. *Proc. of the Symposium on Oak Woodlands and Hardwood Rangeland Management, Oct. 31 - Nov. 2, 1990, Davis, CA*, R.B. Standiford, Tech. Coord. General Technical Report PSW-126. Pacific Southwest Research Station, Forest Service, U.S. Dept. of Agriculture. Berkeley, CA. pp. 208-213. (with Tedmund J. Swiecki and Elizabeth A. Bernhardt). 376 pp.

36) 1992. Biological diversity and seral stages: a case study of the Lotis Blue Butterfly (*Lycaeides idas* (= *argyrognomon*) *lotis*. *Proceedings of the Symposium on Biodiversity of Northwestern California, October 28-31, 1991, Santa Rosa, CA.* R.R. Harris, D.C. Erman, and H.M. Kerner, eds. Wildland Resources Center, University of California, Berkeley. Report #29. (with S. de Becker and M. Boland). pp. 119-121.

37) 1993. *Endangered Wildlife Species of the World, Vols. 1-11*. G. Lee, ed. Essays on numerous endangered insects and invertebrates. Marshall Cavendish Corp., North Bellmore, NY. 1,536 pp.

38) 1993. The Lotis Blue butterfly, *Lycaeides idas lotis*. IN, *Conservation biology of Lycaenidae (butterflies).* T.R. New, ed. Occasional Paper of the International Union for the Conservation of Nature and Natural Resources, Species Survival Commission, No. 8. Gland, Switzerland. pp. 143-144.

39) 1993. *CAPTABLE: an IBM PC-based program for analysis of capture-recapture data for open wildlife populations. User's manual*. Entomological Consulting Services, Ltd., Pleasant Hill, CA. 218 pp. (with Larry Arndt).

40) 1995. *Recovery plan for seven coastal dune plants and Myrtle's Silverspot butterfly.* Prepared for the U.S. Fish & Wildlife Service. 103 pp. (with The Habitat Restoration Group).

41) 1995. Design of captive environments for endangered invertebrates. IN, *Conservation of endangered species in captivity: an interdisciplinary approach.* E.F. Gibbons, B.S. Durrant, and J. Demarest, eds. State University of New York Press, Stonybrook. pp. 51-71. (with L. Saul and J. Mark Scriber).

42) 1997. The California oak disease and arthropod (CODA) database. IN, Proceedings of a symposium on oak woodlands: ecology, management, and urban interface issues. N.H. Pillsbury, J. Verner, and W.D. Tietje, eds. General Technical Report PSW-GTR-160, Pacific Southwest Research Station, U.S. Forest Service, U.S. Dept. of Agriculture. Pp. 543-552. (with T.J. Swiecki and E. Bernhardt).

SOFTWARE PRODUCTS:

1) *BUGGY Database*. Locality records for special-status insects and invertebrates that occur in California. Reports available from Entomological Consulting Services, Ltd.

2) *CAPTABLE*. A computer program for the analysis of capture-recapture data using open populations. (with Larry Arndt). Software and user's manual available from Entomological Consulting Services, Ltd.

3) *CODA - California Oak Disease and Arthropod host insect database and computer program.* (with Tedmund J. Swiecki, E.A. Bernhardt, and J. Kellogg). Available from Phytosphere Research, 1027 Davis St., Vacaville, CA 95687.

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EDUCATION

1992 – *Bachelor of Science*, Biological Sciences, University of Mississippi.
1998 – *Doctor of Philosophy*, Entomology, University of California, Berkeley.

PROFESSIONAL EXPERIENCE

2008-present – Head, Department of Invertebrate Zoology, Santa Barbara Museum of Natural History.
2003-present – Assistant Adjunct Professor, University of California Santa Barbara.
2001-present – Schlinger Foundation Chair of Entomology, Santa Barbara Museum of Natural History.
1999-2001 – Postdoctoral researcher with A. Vogler, NHM, London.
1998-1999 – Postdoctoral researcher with F. Sperling, UC Berkeley.
1992-1998 – Graduate research assistant to F. Sperling and J. Doyen, UC Berkeley.
1994-1999 – Research/curatorial assistant, Essig Museum of Entomology, UC Berkeley.
1991-1992 – Research assistant to P. Lago, Univ. of Mississippi.

TEACHING EXPERIENCE

1999-present – Guest lecturer, UC Santa Barbara, UC Berkeley. Dung beetle biology, Insect embryology and development; beetle diversity and evolution.
2006 – Lecturer, The Natural History of the Santa Barbara Region.
2001-2008 – Entomology instructor. SBMNH Quasar to Seastars teen program.
2001-2006 – Docent trainer, Santa Barbara Museum of Natural History, UC Sedgwick Reserve, Arroyo Hondo Preserve.
1993-1998 – Co-coordinator, graduate seminar in systematic entomology, UC Berkeley.
1993-1998 – Laboratory instructor, General Entomology, UC Berkeley.

PUBLICATIONS

Tishechkin, A.K. and **M.S. Caterino**. (in prep). A revision of the genus *Yarmister* Wenzel (Histeridae: Histerinae: Exosternini).

Caterino, M.S., M. Polihronakis and S. Chatzimanolis (in review) On the origins of the insect fauna of California's Channel Islands: A comparative phylogeographic study of island beetles. *JOURNAL OF BIOGEOGRAPHY*.

McCoshum, S.M, **M.S. Caterino** and A.R. Cline. (in press) Introduced Sap Beetles (Coleoptera: Nitidulidae) on Santa Catalina Island, California. COLEOPTERISTS BULLETIN.

59. **Caterino, M.S**, A.K. Tishechkin and Y. Gomy. 2012. *Lactholister tricinctus* Cooman, 1932: une double synonymie conséquence de l'isolement. L'Entomologiste 68: 151-153.

58. Degallier, N, Arriagada, G., Kanaar, P., Moura, D.P., Tishechkin, A.K., **Caterino, M.S**. & W.B. Warner (in press). Coleoptera Histeridae de Guyane. VII. Compléments au catalogue avec des données sur la faune du Surinam et une contribution à la connaissance des Saprininae. pp 33-52, in Coléoptères de Guyane. Tome VI. ACOREP-France. Paris.

57. **Caterino, M.S**, A.K. Tishechkin and N. Dégallier. 2012. A revision of the genus *Mecistostethus* Marseul (Coleoptera: Histeridae). Zookeys 213: 63-78.

56. Dégallier, N., S. Mazur, A.K. Tishechkin and **M.S. Caterino**. 2012. A revision of the genus *Kaszabister* Mazur. ZOOKEYS 199: 71-89.

55. Polihronakis, M. and **M.S. Caterino**. 2012. Asymmetric dispersal and ecological factors mediate geographic effects on phylogeographic structure of the western banded glowworm, *Zarhipis integripennis* (Coleoptera: Phengodidae) in California's Transverse Ranges. *ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA* 105(2): 241-252.

54. Dégallier, N., Y. Gomy, F. Penati, M.S. Caterino, T. Théry, and A.K. Tishechkin. 2011. Troisième Congrès mondial d'Histéridologie à Paris, le 3 Septembre 2010. *LE COLEOPTERISTE* 14(3): 199-203.
53. Chandler, D.S. and **M.S. Caterino.** 2011. A taxonomic revision of the New World genus *Oropodes* Casey (Staphylinidae: Pselaphinae). A Festschrift in honor of Dr. Ross Bell. Zookeys 147: 425-477.
52. Polihronakis, M., **M.S. Caterino** and S. Chatzimanolis. 2010. Elucidating the phylogeographic structure among a mosaic of unisexual and bisexual populations of the weevil Geodercodes latipennis (Coleoptera: Curculionidae) in the Transverse Ranges of southern California. *BIOLOGICAL JOURNAL OF THE LINNAEAN SOCIETY* 101: 935-948.
51. **Caterino, M.S.** and D.S. Chandler. 2010. A new species of *Actium* Casey (Staphylinidae: Pselaphinae) endemic to Santa Catalina Island, California. *COLEOPTERISTS BULLETIN* 64(3): 187-191.
50. Chatzimanolis**,** S., L.A. Norris, and **M.S. Caterino.** 2010. Multi-island endemicity: the phylogeography and conservation of *Coelus pacificus* darkling beetles on the California Channel Islands. *ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA* 103: 785-795.
49. Polihronakis, M. and **M.S. Caterino**. 2010. Contrasting patterns of phylogeographic relationships in sympatric sister species of ironclad beetles (Zopheridae: *Phloeodes* spp.) in California's Transverse Ranges. *BMC EVOLUTIONARY BIOLOGY* 10(195): 1-11.
48. Pfeiler, E., J.E. Vergara-Quintanar, S. Castrezana, **M.S. Caterino** and T.A. Markow. 2010. Phylogenetic relationships of Sonoran Desert cactus beetles in the tribe Hololeptini (Coleoptera: Histeridae: Histerinae), with comments on the taxonomic status and population biology of *Iliotona beyeri*. *MOLECULAR PHYLOGENETICS AND EVOLUTION* 56: 474-479.
47. **Caterino, M.S.** 2010. A review of California *Margarinotus* Marseul (Coleoptera: Histeridae: Histerinae: Histerini), with descriptions of two new species. *COLEOPTERISTS BULLETIN* 64: 1-12.
46. Polihronakis, M. and **M.S. Caterino**. 2010. Multilocus phylogeography of the flightless darkling beetle *Nyctoporis carinata* (Coleoptera: Tenebrionidae) in the California Floristic Province: deciphering an evolutionary mosaic. *BIOLOGICAL JOURNAL OF THE LINNEAN SOCIETY* 99: 424-444.
45. Tishechkin, A.K. and **M.S. Caterino**. 2009. A new North American genus of the Hetaeriinae (Coleoptera: Histeridae), with descriptions of six new species from U.S.A. and Mexico. *ZOOTAXA* 2311: 1-18.
44. Hopp, K.J. and **M.S. Caterino**. 2009. Seven new species of *Cephennium* Müller and Kunze (Coleoptera: Staphylinidae: Scydmaeninae: Cephenniini) from California with a key to native North American species. *ZOOKEYS* 24: 31-54.
43. Paulsen, M.J. and **M.S. Caterino.** 2009. The *Platycerus* (Coleoptera: Lucanidae) of California, with the recognition of *Platycerus cribripennis* Van Dyke as a valid species. *ZOOKEYS* 8: 89-94.
42. Short, A.E.Z and **M.S. Caterino.** 2009. On the validity of habitat as a predictor of genetic structure in aquatic systems: a comparative study using California water beetles. *MOLECULAR ECOLOGY* 18:403-414.
41. **Caterino, M.S.** and S. Chatzimanolis. 2009. Conservation genetics of three flightless beetle species in Southern California. *CONSERVATION GENETICS* 10: 203-216. DOI: 10.1007/s10592-008-9548-7
40. **Caterino, M.S.**, R.A.B. Leschen and C. Johnson. 2008. A new genus of Caenoscelini (Cryptophagidae: Cryptophaginae) from California, with two new species. *COLEOPTERISTS BULLETIN* 62(4): 509-523.
39. Chatzimanolis**,** S. and **M.S. Caterino.** 2008. Phylogeography and conservation genetics of Californian coastal terrestrial communities: A comparative study using three beetles. *INSECT CONSERVATION AND DIVERSITY* 1: 222-232.
38. **Caterino, M.S.** and A.K. Tishechkin. 2008. A review of *Hippeutister* Reichensperger

(Histeridae: Hetaeriinae), with new species from California and Costa Rica. *ZOOTAXA* 1895: 39-52.

37. Chatzimanolis, S. and **M.S. Caterino**. 2008. Phylogeography of the darkling beetle *Coelus ciliatus* in California. *ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA* 101: 939-949.
36. Young, D.K. and **M.S. Caterino**. 2007. Discovery of the male of *Neopyrochroa californica* (Horn). *PAN-PACIFIC ENTOMOLOGIST* 83(4): 315-320.
35. Hunt, T., J. Bergsten, Z. Levkanicova, A. Papadopoulou, O. St John, R. Wild, P. M. Hammond, D. Ahrens, M. Balke, **M.S. Caterino**, J. Gómez-Zurita, I. Ribera, T. G. Barraclough, M. Bocakova, L. Bocak, and A. P. Vogler. 2007. A comprehensive phylogeny of beetles reveals the evolutionary origins of a super-radiation. *SCIENCE* 318:1913-1916.
34. **Caterino, M.S.** 2007. Species richness and complementarity of insect faunas in a mediterranean-type biodiversity hotspot. *BIODIVERSITY AND CONSERVATION* 16(14):3993-4007.
33. **Caterino, M.S.** and S. Chatzimanolis. 2007. Newly recorded and noteworthy California Staphylinidae. *COLEOPTERISTS BULLETIN* 61:398-407.
32. **Caterino, M.S.** 2007. Two new species of *Chlamydopsis*. *COLEOPTERISTS BULLETIN* 61:327-333.
31. Chatzimanolis, S. and **M.S. Caterino**. 2007. Toward a better understanding of the 'Transverse Range Break': Lineage diversification in southern California. *EVOLUTION* 61: 2127-2141.
30. Tishechkin, A.K. and **Caterino, M.S.** 2007. Description of the first Chlamydopsinae from the Philippines. *ZOOTAXA* 1527: 39-44.
29. Chatzimanolis, S. and **M.S. Caterino**. 2007. Limited phylogeographic structure in the flightless ground beetle, *Calathus ruficollis* Dejean, in southern California. *DIVERSITY AND DISTRIBUTIONS* 13: 498-509.
28. **Caterino, M.S.** and N. Degallier. 2007. A review of the biology and taxonomy of Chlamydopsinae (Coleoptera: Histeridae). *INVERTEBRATE SYSTEMATICS* 21: 1-28.
27. Chatzimanolis, S., **M.S. Caterino** and M.S. Engel. 2006. The first fossil of the subfamily Trypanaeinae: A new species of *Trypanaeus* in Dominican amber. *COLEOPTERISTS BULLETIN* 60(4): 333-340.
26. **Caterino, M.S.** 2006. Chlamydopsinae from New Caledonia. *MEMOIRS OF THE QUEENSLAND MUSEUM*. 52(1): 27-64.
25. **Caterino, M.S.** 2006. California beetle faunistics: 100 years after Fall. *COLEOPTERISTS BULLETIN* 60(2): 177-191.
24. **Caterino, M.S.** and A.K. Tishechkin. 2006. DNA identification and morphological description of the first confirmed larvae of Hetaeriinae (Coleoptera: Histeridae). *SYSTEMATIC ENTOMOLOGY* 31: 405-418.
23. Dégallier, N. and **M.S. Caterino**. 2005. Notes taxonomiques sur les Chlamydopsinae et descriptions d'espèces nouvelles. – I. Genres *Ceratohister* Reichensperger, *Eucurtiopsis* Silvestri et *Orectoscelis* Lewis. *BULLETIN DE LA SOCIETE ENTOMOLOGIQUE DE FRANCE* 110(3): 299-326.
22. Dégallier, N. and **M.S. Caterino**. 2005. Notes taxonomiques sur les Chlamydopsinae et descriptions d'espèces nouvelles. – II. Genres *Pheidoliphila* Lea. *BULLETIN DE LA SOCIETE ENTOMOLOGIQUE DE FRANCE* 110(4/5): 463-494.
21. Kovarik, P.W. and **M.S. Caterino**. 2005. Histeridae, pp. 190-222 in: Beutel, R.G. and R.A.B. Leschen, eds., Handbook of Zoology Part 38, Coleoptera, Vol. 1: Morphology and Systematics. Walter de Gruyter, Berlin.
20. **Caterino, M.S.**, T. Hunt, and A.P. Vogler. 2005. On the constitution and phylogeny of Staphyliniformia. *MOLECULAR PHYLOGENETICS AND EVOLUTION* 34: 655-672.
19. **Caterino, M.S.** 2004. Description of the first Old World *Peploglyptus* LeConte (Histeridae: Onthophilinae). Coleopterists Bulletin 58 (4): 603-609.

18. Navarrete-Heredia, J.L., G.A. Quiroz-Rocha, P.W. Kovarik, **M.S. Caterino**, A. Tishechkin, and M. Vásquez-Bolaños. 2004. Histeridae, pp. 649-658, in: *Biodiversidad, Taxonomía y Biogeographía de Artrópodos de México, Hacia una síntesis de su conocimiento, Vol IV*. (J.L Bousquets, J.J. Morrone, O.Y. Ordóñez, and I.V. Fernández, eds.) Facultad de Ciencias, UNAM, Mexico City.
17. **Caterino, M.S.** 2004. Taxonomy of the *Hister criticus* group, with description of a new species. *ZOOTAXA* 601: 1-16.
16. Zakharov, E.V., **M.S. Caterino**, and F.A.H. Sperling. 2004. Molecular phylogeny, historical biogeography and divergence time estimates for swallowtail butterflies of the genus *Papilio* sensu lato. *SYSTEMATIC BIOLOGY* 53: 193-215.
15. Vogler, A.P. and **M.S. Caterino**. 2003. The basal relationships of Coleoptera based on 18S rRNA sequences. Entomologische Abhandlungen 61: 159-160. [Abstract from Proceedings of 1st Dresden Meeting on Insect Phylogeny, Klass, K.D., ed.]
14. **Caterino, M.S.** 2003. New species of *Chlamydopsis*, with a review and phylogenetic analysis of all known species. *MEMOIRS OF THE QUEENSLAND MUSEUM* 49(1): 159-235.
13. **Caterino, M.S.** and G. Arriagada. 2003. Un nuevo *Hister* L. psamophilo de Chile. *REVISTA CHILENA DE ENTOMOLOGIA* 29: 67-69.
12. **Caterino, M.S.** and A.P. Vogler. 2002. The phylogeny of the Histeroidea (Staphyliniformia). *CLADISTICS* 18(4): 394-415.
11. **Caterino, M.S.** 2002. Revision of the *Hister militaris* group (Histeridae). *ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA* 95(3): 323-334.
10. **Caterino, M.S.**, V.L. Shull, P.M. Hammond and A.P. Vogler. 2002. The basal phylogeny of the Coleoptera based on 18S rDNA sequences. *ZOOLOGICA SCRIPTA* 31(1): 41-49.
9. **Caterino, M.S.**, R. Reed, M. Kuo and F.A.H. Sperling. 2001. A partioned likelihood analysis of swallowtail butterfly phylogeny. *SYSTEMATIC BIOLOGY* 50 (1): 106-127
8. **Caterino, M.S.** and P.W. Kovarik. 2001. A new species of *Spilodiscus* (Coleoptera: Histeridae) and a reevaluation of *Spilodiscus* phylogeny. *COLEOPTERISTS BULLETIN* 55(2): 134-143.
7. Kovarik, P.W. and **M.S. Caterino**. 2000. Histeridae. pp. 212-227 in: Arnett, R.H. and Thomas, M.C., eds., American Beetles, Volume 1. CRC Press.
6. **Caterino, M.S.** 2000. Descriptions of the first Chlamydopsinae (Coleoptera: Histeridae) from Wallacea. *TIDSCHRIFT VOOR ENTOMOLOGIE* 43(2): 267-278.
5. **Caterino, M.S.**, S. Cho, and F.A.H. Sperling. 2000. The current state of insect molecular systematics: A thriving Tower of Babel. *ANNUAL REVIEW OF ENTOMOLOGY* 45:1-54.
4. **Caterino, M.S.** 1999. Taxonomy and phylogenetics of the *coenosus* group of *Hister*. *UNIVERSITY OF CALIFORNIA PUBLICATIONS IN ENTOMOLOGY* 119: 1-93.
3. **Caterino, M.S.** and F.A.H. Sperling. 1999. *Papilio* phylogeny based on mitochondrial COI and COII genes. *MOLECULAR PHYLOGENETICS AND EVOLUTION* 11: 122-137
2. **Caterino, M.S.** 1999. Taxonomy and phylogeny of the *Hister servus* group: a Neotropical radiation. *SYSTEMATIC ENTOMOLOGY* 24: 351-376.
1. **Caterino, M.S.** 1998. A phylogenetic revision of *Spilodiscus* Lewis. *THE JOURNAL OF NATURAL HISTORY* 32(8): 1129-1168.

BOOK REVIEWS

Caterino, M.S. 2006. Review of: Coleoptera: Histeridae; The Insects and Arachnids of Canada, part 24, by Y. Bousquet and Serge Laplante. *ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA* 99(6): 1260-1261.

Caterino, M.S. 2004. Review of: An Introduction to California Beetles, by A.V. Evans, and J.N. Hogue. *COLEOPTERISTS BULLETIN* 58: 353-354.

GRANTS & AWARDS

2010-2012 – NSF SysBiol (DEB0949790): “RevSys: A systematic revision of the New World Exosternini (Coleoptera: Histeridae)”, $400,000.

2009 – Santa Monica Mts. National Recreation Area: “Toward an insect inventory of the Santa Monica Mountains National Recreation Area”, $17,043.
2009 – NSF SysBiol REU Supplement (to CAREERS award DEB0447694): “A comparative study of novel coding and non-coding nuclear markers for intraspecific phylogeny in beetles”, $7,500.
2008-2009 – National Geographic Society Committee for Research and Exploration: "Exploring the beetle biodiversity of the California Channel Islands", $19,000.
2005-2010 – NSF CAREERS (DEB-0447694): "A Faunistic and Phylogeographic Survey of Beetle Diversity in the California Floristic Province Hotspot", $503,000.
2004-2008 – NSF Major Research Instrumentation (DBI-0420726): "Acquisition of a Scanning Electron Microscope for the Santa Barbara Museum of Natural History", $245,970 (co-PIs H. Chaney and D. Geiger).
2004-2005 – UCSB Pearl Chase Fund: Insects of the Coal Oil Point Reserve, $5,453 (co-PI C. Sandoval).
2002 – SBMNH Museum League: Building a tissue collection for SBMNH, $8,000.
2000-2003 – BBSRC – “A multilocus phylogeny of Coleoptera”, £225,000 (co-PIs A. Vogler and P. Foster).
2000 – British Airways Assisting Conservation Programme: Myrmecophilous beetle diversity of Las Cuevas Resarch Station, Belize, complimentary airfare.
1997 – Harvey I. Magy Scholarship, $1000.
1996 – Achievement Rewards for College Scientists (ARCS) Scholarship, $5000.
1995 – U.C. Berkeley Vice Chancellor for Research Award: Training in electron microscopy, $1813.
1995 – CanaColl Foundation: Travel grant for research at Canadian National Collection, $200.
1995 – Margaret C. Walker Fund for Systematic Entomology: Field studies of *Spilodiscus*, $1000.
1995 – Sigma Xi, Berkeley chapter: Research Grant-in-Aid for research at European natural history collections, $500.
1994 – Thomas J. Dee Fund (Field Museum of Natural History): Visiting Scholar Fellowship, $480.
1994 – Margaret C. Walker Fund for Systematic Entomology: Training in molecular systematic techniques, $1000.

STUDENTS AND POSTDOCS ADVISED

Alexey K. Tishechkin. Postdoctoral researcher, SBMNH, March, 2010-present.
Denise Knapp. Ph.D. committee, UC Santa Barbara, September 2010-present.
Maxi Polihronakis. Postdoctoral researcher, SBMNH, 2008-2010.
Ainsley E. Seago. Ph.D. committee, University of California, Berkeley. Degree expected September, 2008.
Andrew E. Z. Short. Ph.D. committee, Cornell University. Degree granted 2007. Postdoctoral researcher, SBMNH, 2007-2008.
Stylianos Chatzimanolis. Postdoctoral researcher, SBMNH, 2005-2007.

INVITED TALKS

Departmental Seminar, UC Davis, February 18, 2009.
Friends of the Riverside Entomology Museum, UC Riverside, January 31, 2009.
Departmental Seminar, University of Arizona, October 16, 2008.
Departmental Seminar, Vanderbilt University, September 25, 2008.
Departmental Seminar, San Diego State University, April 14, 2008.
Departmental Seminar, Cornell University, April 23, 2007.
Departmental Seminar, Michigan State University, April 20, 2007.

OTHER PROFESSIONAL PRESENTATIONS

Polihronakis, M., **Caterino, M.S.** and S. Chatzimanolis. 2009. Where the boys aren’t: repeated evolution of parthenogenesis in the weevil *Geodercodes latipennis* (Coleoptera: Curculionidae) in the California Floristic Province. Entomological Society of

America Annual Meeting, Indianapolis, IN.

Ouzounov, I., Polihronakis, M. and **M.S. Caterino**. 2009. Exploring new nuclear markers for phylogeographic study in beetles. Entomological Society of America Annual Meeting, Indianapolis, IN.

Caterino, M.S. and M. Polihronakis. 2009. Multilocus phylogeography of the night walker (Coleoptera: Tenebrionidae: Nyctoporis carinata) in the California Floristic Province. Entomological Society of America Annual Meeting, Indianapolis, IN.

Hopp, K.J. and **M.S. Caterino**. 2009. On the edge: the beetles of the Santa Monica Mountains National Recreation Area. Entomological Society of America Annual Meeting, Indianapolis, IN.

Caterino, M.S. and S. Chatzimanolis. 2008. Investigating endemicity in beetles of California's Channel Islands. 7th Channel Islands Symposium, Ventura, CA.

Chatzimanolis, S. and **M.S. Caterino**. 2007. Comparative phylogeography of littoral beetles in southern California. Entomological Society of America Annual Meeting, San Diego, CA.

Caterino, M.S. 2007. Phylogeographic and faunistic diversity of California Tenebrionidae. Entomological Society of America Annual Meeting, San Diego, CA.

Caterino, M.S. and S. Chatzimanolis. 2007. Comparative phylogeoegraphy of beetles in southern California. Entomological Society of America, Pacific Branch Annual Meeting.

Caterino, M.S. 2006. The California Beetle Project: Data sharing and management. Entomological Collections Network Annual Meeting.

Caterino, M.S. 2006. Faunistics of a temperate biodiversity hotspot: The California beetle project. Entomological Society of America Annual Meeting.

Chatzimanolis, S. and **M.S. Caterino**. 2006. Phylogeography of rove beetles (Coleoptera: Staphylinidae) across Southern California. Entomological Society of America Annual Meeting.

Short, A.E.Z., J.K. Liebherr, and **M.S. Caterino**. 2006. Into the trees: Phylogeny and eco-morphological shifts of the hydrobiusine water scavenger beetles. Entomological Society of America Annual Meeting.

Caterino, M.S., and A. K. Tishechkin. 2005. DNA identification and morphological description of the first confirmed larvae of Hetaeriinae (Coleoptera: Histeridae). Entomological Society of America Annual Meeting.

Caterino, M.S., T. Hunt, and A.P. Vogler. 2004. Phylogenetic relationships of Staphyliniformia and Scarabaeiformia (Coleoptera: Polyphaga), as revealed by 18S rDNA. Entomological Society of America Annual Meeting.

Vandergast, A., D. Weissman, **M.S. Caterino**, T. Reeder, and R. Fisher. 2003. Phylogenetics of the mahogany jerusalem cricket in southern California. Society for the Study of Evolution Annual Meeting.

Caterino, M.S. 2002. Diversity and evolution of the chlamydopsine Histeridae. Entomological Society of America Annual Meeting.

Caterino, M.S. and A.P. Vogler. 2001. A combined data phylogeny of Histeridae. Entomological Society of America Annual Meeting.

Caterino, M.S. 2001. The evolution of Histerid beetles. Departmental seminar, The Natural History Museum, London. (talk)

Caterino, M.S. 2000. The evolution of Histeridae. Invited seminar, Zoological Museum of the University of Copenhagen, Denmark. (talk)

Sperling, F.A.H. and **M.S. Caterino**. 2000. Phylogeny of the Papilionidae. International Congress of Entomology, Iguassu Falls, Brazil. (talk)

Sperling, F.A.H. and **M.S. Caterino**. 2000. Papilionidae phylogeny: Molecules and morphology converge. Entomological Society of America Annual Meeting.

Caterino, M.S., R.D. Reed, M.M. Kuo, and F.A.H. Sperling. 1999. The phylogeny and evolution of the Papilionidae. Entomological Society of America Annual Meeting. (talk).

Caterino, M.S. and D.B. Weissman, 1998. Mitochondrial DNA variation in California

Jerusalem Crickets. Entomological Society of America Annual Meeting. (talk)

Caterino, M.S. 1998. The Neotropical *Hister servus* group: phylogenetics and biogeographical implications. Society of Systematic Biologists Annual Meeting. (talk)

Caterino, 1997. Preliminary molecular phylogenetics of histeromorph beetles: comparative utilities of four genes. Entomological Society of America Annual Meeting. (poster)

Caterino, M.S. and F.A.H. Sperling, 1997. Phylogeny of *Papilio*. Society of Systematic Biologists Annual Meeting. (talk)

Caterino, M.S. 1995. Phylogenetics and biogeography of *Spilodiscus* Lewis. Entomological Society of America Annual Meeting. (talk)

Caterino, M.S. 1995. A procedure for phylogenetic taxonomy. Society of Systematic Biologists Annual Meeting. (talk)

Caterino, M.S. 1995. Implementation of a phylogenetic taxonomy. Entomological Society of America, Pacific Branch Annual Meeting. (talk)

Caterino, M.S. 1995. The phylogenetic and biogeographic relationships of the new world Histerini. Presented at the annual dinner of the Berkeley Chapter of Sigma Xi. (talk)

Lago, P.K. and **M.S. Caterino**. 1992. Survey of the scarab beetles associated with white-tailed deer dung in Mississippi. Entomological Society of America Annual Meeting. (poster)

ELECTRONIC MEDIA

www.histeroidea.org. 2010. A website for the dissemination of information resulting from NSF RevSys project: A systematic revision of the New World Exosternini. *under construction.*

Lucid Key to the Genera of Chlamydopsinae. 2007. An interactive, illustrated key to the genera of the myrmecophilous histerid subfamily Chlamydopsinae. (with A. K. Tishechkin and C. E. Carlton). **http://entomology.lsu.edu/lsam/Chlamydopintro.htm *[currently offline]***

The California Beetle Project. 2001-2010. An illustrated guide and interactive database on California beetle diversity and distributions. **http://www.sbnature.org/calbeetles**

A Guide to the Insects of the Coal Oil Point Reserve. 2005. A field guide to over 500 species of insects occurring at this Santa Barbara area UC Reserve. **http://www.sbnature.org/collections/invert/entom/COP/COPbugshome.php**

An Online Field Guide to the Butterflies of Santa Barbara County. 2004. A pictorial guide to the 112 species of butterflies known or suspected to occur in Santa Barbara county. **http://www.sbnature.org/sbbutterflies *[currently offline]***

Histeroidea and Histeridae pages for the Tree of Life. **http://tolweb.org/Histeroidea/9075**

California's Endangered Insects. 1996. Information on California's threatened and endangered entomofauna. **http://www.mip.berkeley.edu/essig/endins/endins.htm**

The Essig Museum of Entomology. 1995. Internet site for the dissemination of collections information. ***[since superceded]***

OTHER RELEVANT EXPERIENCE

2008 – Volunteer scientist, San Diego Natural History Museum Bioblitz.

2008 – Volunteer scientist, Santa Monica Mountains National Recreation Area Bioblitz.

2006-present – Collaborator (TWiG member, Staphyliniformia), Assembling the Beetle Tree of Life.

2007 – Invited external reviewer, Albert J. Cook Arthropod Research Collection, Michigan State University.

2007 – Coordinator, Santa Barbara Botanic Garden BioBlitz entomology team.

2006-2007 – Co-curator, 'Treasures' exhibit of exceptional collection objects, Santa Barbara Museum of Natural History.

2005-2006 – Co-curator, 'Extreme Close-up' exhibit of SEM imagery, Santa Barbara Museum of Natural History.

2001-2007 (semi-annual summers) – Co-curator, 'Butterflies Alive' living butterfly pavilion, Santa Barbara Museum of Natural History.

2000 – Presenter, 'Voyages of Discovery' exhibit. The Natural History Museum, London.
1994-present – Collaborator, Instituto Nacional de Biodiversidad de Costa Rica. Identifying Histeridae for National Biodiversity Survey.

PROFESSIONAL SERVICE

2010-present – President, Coleopterists Society (President-Elect, 2008-2009).
2009-present – Entomological Society of America student travel awards committee.
2009-present – Associate Editor, ZOOKEYS.
2004-2008 – Secretary, Vice Chair, Chair, Past-president, Entomological Society of America, Section A (now Systematics, Evolution and Biodiversity).
2004-2008 – Review Editor, COLEOPTERISTS BULLETIN.
2004-present – NSF panelist, Biological Research Collections, Systematic Biology.
2005-2006 – Associate Editor, ZOOLOGICAL JOURNAL OF THE LINNAEAN SOCIETY.
2001-2005 – Names Committee, North American Butterfly Association.
2001-2003 – Councilor, Coleopterists Society.
1995-1997 – Secretary, Entomology Students' Organization, U.C. Berkeley.
1993-1994 – President, Entomology Students' Organization, U.C. Berkeley.

MARCEL HOLYOAK: CURRICULUM VITAE

Last updated July 5, 2012

Professor, Department of Environmental Science and Policy, University of California, One Shields Ave., Davis CA 95616, USA.

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Education

1985-89	Imperial College, University of London, U.K. Bachelor of Science, with honors, in biology.
1990-92	Imperial College, University of London, U.K. Ph.D. in ecology. Dissertation title: 'The detection of density dependence in insect populations'.

Employment

1988	Research assistant, Imperial College at Silwood Park, U.K. (Integrated pest management).
1989	Graduate research assistant, Imperial College at Silwood Park, U.K. (Behavioral bioassays to investigate the effects of antifeedant compounds on aphid feeding).
1992-1994	Postdoctoral Researcher, NERC Centre for Population Biology, Imperial College at Silwood Park, U.K.
1994-1995	Postdoctoral Researcher, Center for Ecology, Evolution and Behavior, University of Kentucky.
1995-June 2000	Assistant Research Entomologist and Lecturer, Department of Entomology, University of California, Davis.
July 2000-June 2002	Assistant Professor in the Department of Environmental Science and Policy and College of Agricultural and Environmental Sciences at the University of California, Davis.
July 2002 June 2006	Associate Professor in the Department of Environmental Science and Policy and College of Agricultural and Environmental Sciences at the University of California, Davis.
Jan.-July 2007	Research Fellow at Institute for Advanced Studies at the Hebrew University in Jerusalem, Israel, January-July 2007.
July 2006 onwards	Professor in the Department of Environmental Science and Policy and College of Agricultural and Environmental Sciences at the University of California, Davis.
July 2011 onwards	Vice-Chair Department of Environmental Science and Policy, University of California, Davis.

Grants and Contracts

Holyoak, M. and S. P. Harrison. Multi-species metapopulation dynamics: experiments in a model systems. $150,000 over 3 years from 1 Oct. 1996 (NSF: DEB-9629876).

Holyoak, M. Development of an interim management plan for the threatened Valley Elderberry Longhorn Beetle in the American River Parkway. Contract from Sacramento Area Flood Control Authority (SAFCA). $8068, 9/1/2001 to 3/31/2003.

Holyoak, M. Valley Elderberry Longhorn Beetle Habitat Management Plan. Contract from Sacramento Area Flood Control Authority (SAFCA) for matching funds and a National Fish and Wildlife Foundation Challenge Grant. $193,581 in 3 separate contracts in period 5/1/2002 to 9/31/2008.

Holyoak, M. and A. Hastings. QEIB: Using phase dynamics and a model experimental system to understand the effects of extrinsic variability on predator and prey metapopulations. NSF–DEB 0213026 $274,708, 7/1/2002 to 6/30/2005.

Holyoak, M. QEIB: Island Biogeography and Metacommunity Dynamics of Food Webs—Theory and Experiments in a Model System. NSF–DEB 0414465. $400,978 8/1/2004 to 7/31/2008.

Holyoak, M. Monitoring Elderberry and VELB for the Arden Parallel Force Main Mitigation Site, The American River Parkway, Sacramento, CA. Contract with Sacramento County Regional Sanitation District. $134,904, 1/1/2005 to 12/31/2009.

Holyoak, M. Pruning and the Valley Elderberry Longhorn Beetle. Contract with CALTRANS. $15,000, 6/15/2005 to 3/30/2006.

Holyoak, M. Improving mitigation for the Valley Elderberry Longhorn Beetle. Contract with CALTRANS. $110,400, 6/15/2005 to 6/30/2007.

Holyoak, M. The effects of construction activities on Valley Elderberry Longhorn Beetle habitat. Contract with CALTRANS. $309,047, 12/31/2005 to 12/30/2008.

Karban, R. and Holyoak, M. LTREB - Understanding Food Web Complexity by Linking Long-Term Data, Multiple Causes and a Spatial Approach. NSF-DEB 0639885. $295,410, 01/30/2007 to 1/29/2012.

Holyoak, M. Monitoring for the Valley Elderberry Longhorn Beetle. US Fish and Wildlife Service. 11/15/2007-11/15/2008, $35,000.

Holyoak, M. and Kelsey, T.R. An online population database for tricolored blackbird monitoring. California Department of Fish and Game funds routed through the Center for Population Biology at UC-Davis. 3/1/2008 to 6/30/2012, $40,000.

In-press Publications

Karban, R; P. Grof-Tisza, J.L. Maron and **M. Holyoak**. 2012. The importance of host plant limitation for caterpillars of the Arctiid moth (*Platyprepia virginalis*) varies spatially. *Ecology.*

Karban, R; P. Grof-Tisza, and **M. Holyoak**. 2012. Facilitation of Tiger Moths by Outbreaking Tussock Moths That Share the Same Host Plants. *Journal of Animal Ecology.*

Holyoak, M., Kneitel, J.M. Metacommunities. In Hastings, A.M. and Gross, L. Sourcebook in Theoretical Ecology. University of California Press.

Peer-Reviewed Publications (in reverse chronological order)

See http://www.researcherid.com/rid/C-3475-2009 for a summary of publications and citations.

66. Mata, TM, NM Haddad, and **M Holyoak**. 2012. How invader traits interact with resident communities and resource availability to determine invasion success. *Oikos*.
65. Altermatt, F. and **M. Holyoak**. 2012. Spatial clustering of habitat structure effects patterns of community composition and diversity. *Ecology* **93(5)**:1125-1133.
64. Reeves, M. K., M. Perdue, G. D. Blakemore, D. J. Rinella, and **M. Holyoak**. 2011. Twice as easy to catch? A toxicant and a predator cue cause additive reductions in larval amphibian activity. Ecosphere **2**:art72.
63. Altermatt, F., A. Bieger, F. Carrara, A. Rinaldo, and **M. Holyoak**. 2011. Effects of Connectivity and Recurrent Local Disturbances on Community Structure and Population Density in Experimental Metacommunities. PLoS ONE **6**:e19525.
62. Altermatt, F., S. Schreiber, and **M. Holyoak**. 2011. Interactive effects of disturbance and dispersal directionality on species richness and composition in metacommunities. Ecology 92:859-870.
61. Reeves, M. K., P. Jensen, C. L. Dolph, **M. Holyoak**, and K. A. Trust. 2010. Multiple stressors and the cause of amphibian abnormalities. Ecological Monographs 80:423-440.
60. **Holyoak, M**., T. Talley, and S. Hogle. 2010. The effectiveness of US mitigation and monitoring practices for the threatened Valley elderberry longhorn beetle. Journal of Insect Conservation. DOI: 10.1007/s10841-009-9223-4.
59. Hornberger, M. I., S. N. Luoma, M. L. Johnson, and **M. Holyoak**. 2009. Influence of remediation in a mine-impacted river: metal trends over large spatial and temporal scales. Ecological Applications 19:1522-1535.
58. Davies, K. F., M. **Holyoak**, K. A. Preston, V. A. Offeman, and Q. Lum. 2009. Factors controlling community structure in heterogeneous metacommunities. Journal of Animal Ecology **78**:937-944.
57. Vaghti, M., **M. Holyoak**, A. Williams, T. Talley, A. Fremier, and S. Greco. 2009. Understanding the Ecology of Blue Elderberry to Inform Landscape Restoration in Semiarid River Corridors. Environmental Management **43**:28-37.
56. **Holyoak, M**., R. Casagrandi, R. Nathan, E. Revilla, and O. Spiegel. 2008. Trends and missing parts in the study of movement ecology. Proceedings of the National Academy of Sciences **105**:19060-19065.
55. Nathan, R., W. M. Getz, E. Revilla, **M. Holyoak**, R. Kadmon, D. Saltz, and P. E. Smouse. 2008. A movement ecology paradigm for unifying organismal movement research. Proceedings of the National Academy of Sciences **105**:19052-19059. Selected as a "must read" on Faculty of 1000: "This paper introduces an important Special Feature of articles on the movement of organisms across landscapes. The entire series is worth reading for all ecologists. This paper sets out the idea of movement ecology as a paradigm with the idea that parallels exist across a wide range of types of organism."
54. **Holyoak, M**. and T. M. Mata. 2008. Metacommunities. Pages 2313-2318 *in* J. Sven Erik and F. Brian, editors. Encyclopedia of Ecology. Academic Press, Oxford.
53. **Holyoak, M**. 2008. Ecological Indicators: Connectance and Connectivity. Pages 737-743 *in* J. Sven Erik and F. Brian, editors. Encyclopedia of Ecology. Academic Press, Oxford, UK.

Peer-Reviewed Publications (cont.)

52. Koch-Munz, M. and **M. Holyoak**. 2008. An evaluation of the effects of soil characteristics on mitigation and restoration involving blue elderberry, *Sambucus mexicana*. *Environmental Management*, 42: 49-65.

51. Schlesinger, M., P. Manly, and **M. Holyoak**. 2008. Distinguishing stressors acting on landbird communities in an urbanizing environment. *Ecology*, 89: 2302-2314.

50. **Holyoak, M.** and M. Koch-Munz. 2008. The effects of site conditions and mitigation practices on success of establishing the Valley elderberry longhorn beetle and its host plant blue elderberry. *Environmental Management*, 42: 444-457.

49. Haddad, N. M., M. Holyoak, T. M. Mata, K. F. Davies, B. A. Melbourne, and K. Preston. 2008. Species' traits predict the effects of disturbance and productivity on diversity. *Ecology Letters* 11:348-356.

48. Talley, T. S., E. Fleishman, **M. Holyoak**, D. D. Murphy, and A. Ballard 2007. Rethinking a rare-species conservation strategy in an urban landscape: The case of the valley elderberry longhorn beetle. Biological Conservation 135:21-32.

47. Melbourne, B. A., H. V. Cornell, K. F. Davies, C. J. Dugaw, S. Elmendorf, A. L. Freestone, R. J. Hall, S. Harrison, A. Hastings, M. Holland, **M. Holyoak**, J. Lambrinos, K. Moore, and H. Yokomizo 2007. Invasion in a heterogeneous world: resistance, coexistence or hostile takeover? Ecology Letters 10:77-94.

46. Talley, D. M., Huxel G.R., and **M. Holyoak** 2006. Connectivity at the land-water interface. Pages 97-129 in K. Crooks and M. Sanjayan, editors. Connectivity conservation. Cambridge University Press, Cambridge, U.K.

45. Ellis, A. M., L. P. Lounibos, and **M. Holyoak**. 2006. Evaluating the long-term metacommunity dynamics of tree hole mosquitoes. Ecology 87:2582-2590.

44. **Holyoak, M.**, M. Loreau, D. R. Strong. 2006. Neutral Community Ecology. Introduction to Special Feature and Special Feature edited by the same authors. Ecology 87: 1368-1369.

43. **Holyoak, M**. and M. Loreau. 2006. Reconciling empirical ecology with neutral community models. Ecology 87: 1370-1377.

42. Talley Theresa S., **M. Holyoak**, D. A. Piechnik**.** 2006. The effects of road dust on the federally threatened valley elderberry longhorn beetle. Environmental Management 37: 647-658.

41. **Holyoak, M**., and S. P. Lawler. 2005. The contribution of laboratory experiments on protists to understanding population and metapopulation dynamics. Advances in Ecological Research 37:245-271.

40. **Holyoak, M.**, M. A. Leibold, and R. D. Holt, editors. 2005. Metacommunities: Spatial Dynamics and Ecological Communities. University of Chicago Press, Chicago, IL. Includes five chapters with Holyoak as a lead or coauthor (listed separately below, numbers 35-39) and four introductory or summary sections. The book was independently peer reviewed by the press and separately by the subject editors.

39. **Holyoak, M.**, M. A. Leibold, N. M. Mouquet, R. D. Holt, and M. F. Hoopes. 2005. Metacommunities: A framework for large-scale community ecology. Pages 1-31 *in* M. Holyoak, M. A. Leibold, and R. D. Holt, editors. Metacommunities: spatial dynamics and ecological communities. University of Chicago Press, Chicago, IL.

Peer-Reviewed Publications (cont.)

38. Hoopes, M. F., R. D. Holt, and **M. Holyoak**. 2005. The effects of spatial processes on two species interactions. Pages 35-67 *in* M. Holyoak, M. A. Leibold, and R. D. Holt, editors. Metacommunities: spatial dynamics and ecological communities. University of Chicago Press, Chicago, IL.

37. Chase, J. M., P. Amarasekare, K. Cottenie, A. Gonzalez, R. D. Holt, **M. Holyoak**, M. F. Hoopes, M. A. Leibold, M. Loreau, N. Mouquet, J. B. Shurin, and D. Tilman. 2005. Competing theories for competitive metacommunities. Pages 335-354 *in* M. Holyoak, M. A. Leibold, and R. D. Holt, editors. Metacommunities: spatial dynamics and ecological communities. University of Chicago Press, Chicago, IL.

36. Leibold, M. A., R. D. Holt, and **M. Holyoak**. 2005. Adaptive and coadaptive dynamics in metacommunities: Tracking environmental change at different spatial scales. Pages 439-464 *in* M. Holyoak, M. A. Leibold, and R. D. Holt, editors. Metacommunities: spatial dynamics and ecological communities. University of Chicago Press, Chicago, IL.

35. Holt, R. D., **M. Holyoak**, and M. A. Leibold. 2005. Future directions in metacommunity ecology. Pages 465-490 *in* M. Holyoak, M. A. Leibold, and R. D. Holt, editors. Metacommunities: spatial dynamics and ecological communities. University of Chicago Press, Chicago, IL.

34. Amarasekare, P., M. F. Hoopes, N. Mouquet, and **M. Holyoak**. 2004. Mechanisms of coexistence in competitive metacommunities. The American Naturalist **164**: 310-326.

33. Leibold, M. A., **M. Holyoak**, N. Mouquet, P. Amarasekare, J. M. Chase, M. F. Hoopes, R. D. Holt, J. B. Shurin, R. Law, D. Tilman, M. Loreau, and A. Gonzalez. 2004. The metacommunity concept: a framework for multi-scale community ecology. Ecology Letters **7**: 601-613.

32. Huxel G.R., **M. Holyoak**, T.S. Talley, and S. Collinge. 2003 Perspectives on the recovery of the threatened Valley Elderberry Longhorn Beetle. In: *California Riparian Systems: Habitat and Floodplain Processes, Management, and Restoration.* (ed. Faber, P.M.), pp. 457-462. Riparian Habitat Joint Venture, Picklewood Press, Mill Valley, CA.

31. Bolker, B., **M. Holyoak**, V. Krivan, L. Rowe, and O. Schmitz. 2003. Connecting theoretical and empirical studies of trait-mediated interactions. Ecology 84:1101-1114.

30. Donahue, M. J., **M. Holyoak**, and C. Feng. 2003. Patterns of dispersal and dynamics among habitat patches varying in quality. The American Naturalist 162:302-317.

29. Kreuder, C., J.A.K. Mazet, G.D. Bossart, T.E. Carpenter, **M. Holyoak**, M.S. Elie and S. Wright. 2002. Clinicopathologic features of suspected brevecotoxicosis in double-crested cormorants (*Phalacrocorax auritus*) along the Florida Gulf coast. *Journal of Zoo and Wildlife Medicine*, 33, 8-15.

28. Dingle, H., and **M. Holyoak**. 2001. The evolutionary ecology of animal movement. *In*: Evolutionary ecology: Concepts and case studies *eds.* C.W. Fox, D.A. Roff and D.J. Fairbairn. Oxford University Press, Oxford, U.K.

27. Collinge, S.K., **M. Holyoak**, C.B. Barr, and J.T. Marty. 2001. Riparian habitat fragmentation and population persistence of the threatened valley elderberry longhorn beetle in central California. *Biological Conservation*, 100, 103-113.

26. **Holyoak, M.** 2000. Effects of nutrient enrichment on predator-prey metapopulation dynamics. *Journal of Animal Ecology*, 69, 985-997.

Peer-Reviewed Publications (cont.)

25. **Holyoak, M.** 2000. Habitat subdivision causes changes in food web structure. *Ecology Letters*, 3 (6), 509-515.

24. **Holyoak, M.**, S.P. Lawler, and P.H. Crowley. 2000. Predicting extinction: Progress with an individual-based model of protozoan predators and prey. *Ecology* 81, 3312–3329.

23. Amezcua, A.B., and **M. Holyoak.** 2000. Empirical evidence for predator-prey source-sink dynamics. *Ecology*, 81(11), 3087-3098.

22. **Holyoak, M.** 2000. Habitat patch arrangement and metapopulation persistence of predators and prey. *The American Naturalist*, 156 (4), 378-389.

21. **Holyoak, M.** 2000. Comparing parasitoid-dominated food webs with other food webs: problems and future promises. Pages 184-197 *in*: Parasitoid Population Biology *eds*. M.E. Hochberg and A.R. Ives. Princeton University Press, Princeton, N.J.

20. **Holyoak, M.**, and C. Ray. 1999. A roadmap for metapopulation research. *Ecology Letters*, 2, 273-275.

19. Lawler, S.P., D. Dritz, T. Strange, and **M. Holyoak.** 1999. Effects of introduced mosquitofish and bullfrogs on a threatened frog. *Conservation Biology*, 13, 613-622.

18. **Holyoak, M.**, and S. Sachdev. 1998. Omnivory and the stability of simple food webs. *Oecologia*, 117, 413-419.

17. Hawkins, B.A., and **M. Holyoak.** 1998. Transcontinental crashes of insect populations? *The American Naturalist* 152, 480-484.

16. Yela, J.L., and **M. Holyoak.** 1997. Effects of moonlight and environmental factors on light and bait trap catches of noctuid moths (Lepidoptera: Noctuidae). *Environmental Entomology* 26, 1283-1290.

15. **Holyoak, M.**, V. Jarosik, and I. Novak. 1997. Weather-induced changes in moth activity bias measurement of long-term population dynamics from light trap samples. *Entomol. Exp. Appl*. 83, 329-335.

14. **Holyoak, M.**, and S.P. Lawler. 1996. Persistence of an extinction-prone predator-prey interaction through metapopulation dynamics. *Ecology* 77, 1867-1879.

13. **Holyoak, M.**, and S.P. Lawler. 1996. The role of dispersal in predator-prey metapopulation dynamics. *Journal of Animal Ecology* 65, 640-652.

12. **Holyoak, M.**, and S.R. Baillie. 1996. Factors influencing detection of density dependence in British birds: I. Population trends. *Oecologia* 108, 47-53.

11. **Holyoak, M.**, and S.R. Baillie. 1996. Factors influencing detection of density dependence in British birds: II. Longevity and population variability. *Oecologia* 108, 54-63.

10. **Holyoak, M.** 1994. Comment: appropriate time-scales for identifying lags in density dependent processes. *Journal of Animal Ecology* 63, 479-483.

9. **Holyoak, M.** 1994. Identifying delayed density dependence in time series data. *Oikos* 70, 296-304.

8. Seddon, M.B., and **M. Holyoak.** 1994. *Pupoides coenopictus* (Hutton, 1834) new to Tunisia. *Journal of Conchology* 35, 89.

Peer-Reviewed Publications (cont.)

Peer-Reviewed Publications (cont.)

7. **Holyoak, M.**, and J.H. Lawton. 1993. Comment arising from a paper by Wolda and Dennis: using and interpreting the results of tests for density dependence. *Oecologia* 95, 592-594.

6. **Holyoak, M.** 1993. The frequency of detection of density dependence in insect orders. *Ecological Entomology* 18, 339-347.

5. **Holyoak, M**. 1993. New insights into testing for density dependence. *Oecologia* 93, 435-444.

4. **Holyoak, M.**, and P.H. Crowley. 1993. Avoiding erroneously high levels of detection in combinations of semi-independent tests. *Oecologia* 95, 103-114.

3. **Holyoak, M.**, and J.H. Lawton. 1992. Detection of density dependence from annual censuses of bracken-feeding insects. *Oecologia* 91, 425-430.

2. Hardie, J., **M. Holyoak**, N.J. Taylor, and D.C. Griffiths. 1992. The combination of electronic monitoring and video-assisted observations of plant penetration by aphids and behavioural effects of polygodial. *Entomol. Exp. Appl*. 62, 223-239.

1. Hardie, J., **M. Holyoak**, J. Nicholas, S.F. Nottingham, J.A. Picket, J.A., L.J. Wadhams, and C.M. Woodcock. 1990. Aphid sex pheromone components: age-dependent release by females and species-specific male response. *Chemoecology* 1, 63-68.

Non Peer-Reviewed Publications

11. **Holyoak, M.** 2011. Virtual Issue of *Ecology Letters* for "The ecology, conservation and management of forests." This consists of a new introduction and a compilation of already-published articles to commemorate the UN International Year of Forests. http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291461-0248/homepage/virtual_issue.htm

10. Holyoak, M., 2011. Editorial: The growth of Ecology Letters, and scope of the journal. Ecology Letters 14: 81.

9. **Holyoak, M.** and N. Espuno, N. 2010. Virtual Issue of *Ecology Letters* for "Year of Biodiversity, September 2010." This consists of a new introduction and a compilation of already-published articles. http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291461-0248/homepage/virtual_issue.htm

8. Aubrey, D. P. and **M. Holyoak**. 2010. Targeting journals and covering letters. *Frontiers in Ecology and the Environment* 8:161-162.

7. McPeek, M. A., D. L. DeAngelis, R. G. Shaw, A. J. Moore, M. D. Rausher, D. R. Strong, A. M. Ellison, L. Barrett, L. Rieseberg, M. D. Breed, J. Sullivan, C. W. Osenberg, **M. Holyoak**, and M. A. Elgar. 2009. The golden rule of reviewing. *The American Naturalist* 173:E155-E158

6. **Holyoak, M.** 2009. Editorial. *Ecology Letters* 12:1.

5. **Holyoak, M.** 2008. Book Review: Diverse perspectives on how to unite quantitative scaling patterns and mechanisms for biodiversity. Scaling biodiversity editedy D. Storch, P. A. Marquet, and J.H. Brown (2007). *Ecology* 89:2364-2365.

***Non Peer-Reviewed Publications* (cont.)**

4. Talley, T. S., D. Wright, and **M. Holyoak**. 2006. Assistance with the 5-Year Review of the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). United States Fish and Wildlife Service, Sacramento. http://www.fws.gov/sacramento/es/documents/VELB_5yr_review_Talley_etal.pdf

3. **Holyoak, M.** 2003. Book Review: Turchin P. 2003. Complex Population Dynamics: A Theoretical/Empirical Synthesis. *Integrative and Comparative Biology* 43:479-479.

2. **Holyoak, M.** 2002. Book Review. Gardner, Robert H., W. Michael Kemp, Victor S. Kennedy, and John E. Petersen, editors. 2001. Scaling relations in experimental ecology. Columbia University Press, New York, New York. *Ecology*, 83(5), 1471-1472.

1. **Holyoak, M.** 1998. Book Review. Population Dynamics in Ecological Space and Time. Olin E. Rhodes, Jr., Ronald K. Chesser, and Michael H. Smith (eds). The University of Chicago Press, 1996. *American Scientist* 86, 88.

Reviews of Holyoak et al. 2005. Metacommunities: spatial dynamics and ecological communities. University of Chicago Press, Chicago, IL.

Bruun, H. H. 2006. Holyoak, M., M. A. Leibold & R. D. Holt (Eds.), 2005. Metacommunities: Spatial Dynamics and Ecological Communities. University of Chicago Press, xi + 513 p., 15 x 23 cm, softcover, US$38.00, ISBN 0-22635064-9. *Ecoscience* **13**:563-564.

Driscoll, D. A. 2006. Metacommunities: Spatial Dynamics and Ecological Communities. *Austral Ecology* **31**:910-911.

Fuller, M. M. 2006. In a World of Diversity, a Search for Unity. *Ecology* **87**:2681-2682.

Gaston, K. J. 2006. Book Reviews. Metacommunities: Spatial Dynamics and Ecological Communities Edited by Marcel Holyoak, Matthew A. Leibold and Robert D. Holt xi + 513 pp., 23 × 15 × 3 cm, ISBN 0 226 35064 paperback, US$ 38.00/GB£ 24.00, Chicago, IL, USA: The University of Chicago Press, 2005. *Environmental Conservation* **33**:175-176.

Gross, M. 2006. Book Review: Metacommunities: Spatial dynamics and ecological communities by Marcel Holyoak, Mathew A. Lebiold and Robert D. Holt. *History and Philosophy of the Life Sciences* **28**:111-112.

Paine, R. T. 2006. Metacommunities. Spatial Dynamics and Ecological Communities. Marcel Holyoak, Mathew A. Leibold, and Robert D. Holt, editors. *Integrative and Comparative Biology*. **46**:347.

Pergl, J. 2007. M. Holyoak, M.A. Leibold, and R.D. Holt: Metacommunities: Spatial Dynamics and Ecological Communities. Book Review. *Folia Geobotanica* **42**:222.

Urban, M. C. 2006. Conservation beyond Community. *Conservation Biology* **20**:1330-1332.

Graduate Students and Postdocs Trained

Michele Buckhorn. PhD The effects of marine protected areas and fisheries on leopard grouper (a large fish species) in Baja, Mexico. Coadvised by Peter Moyle.Oct 2002 to January 2009. Postdoctoral researcher at UC-Davis.

K. Jun Bando, PhD about the population ecology and genetics of sea grasses and *Spartina*. Coadvised by Don Strong. Oct. 2000 to Sept. 2005. Works for US State Dept. in Washington DC.

Kendi F. Davies. Postdoctoral Researcher (Project Scientist). Jan 2005 December 2006. Faculty at University of Colorado, Boulder, CO.

***Graduate Students and Postdocs Trained* (cont.)**

Melanie Gogol-Prokurat. PhD. Effects of disturbance on the metapopulation dynamics and responses to fragmentation of rare plant species. Oct. 2003 to June 2009. Works for California Dept. of Fish and Game.

Kim Preston. MSc by examination. Oct. 2003 to Sept. 2010.

Mari Reeves. PhD. Causes of amphibian deformities in Alaska. January 2009 to December 2011.

Matthew Schlesinger. PhD. Effects of urbanization and fragmentation on bird communities in urban forest plots in Lake Tahoe, California. Oct. 2001 to February 2007. Works for The Nature Conservancy in New York State.

Jennifer (Jenna) Shinen. PhD. Community effects of an invasive intertidal mussel species. Oct 2002 to September 2007. Coadvised by Stephen Morgan. Postdoc in Chile.

Drew Talley. Postdoctoral Researcher and affiliated professional researcher. Jan 2002 to 2005. Faculty, University of San Diego, San Diego, CA.

Theresa S. Talley. PhD about the population and landscape ecology of the threatened Valley Elderberry Longhorn Beetle. Oct. 2000 to Sept. 2005. Instructor, University of San Diego.

Quenby Lum. PhD candidate. Studying the effects of soil and ecosystem processes on responses of serpentine plant communities to burning. Oct. 2000, degree expected 2011, coadvised by William Horwath.

Tawny Mata. PhD candidate. Invasive species and metacommunity dynamics. Oct 2005, degree expected 2011.

Emil Aalto. PhD candidate. Project to be decided. Oct 2007, degree expected 2012.

Julia Blum. PhD candidate. Project to be decided. January 2009, degree expected 2014.

Cory Overton. PhD candidate. Conservation and ecology Clapper Rails. September 2009, degree expected 2014. Co-advised by Don Strong.

Patrick Grof-Tisza. PhD candidate. Spatial population ecology and movement of a moth, *Platyprepia virginalis*. Oct 2008, degree expected 2013. Coadvised by Rick Karban.

Sacha Heath, PhD candidate. October 2011, degree expected 2016.

Professional Activities and Awards

- Editor-in-chief for *Ecology Letters* December 2008 onwards.
- Member of the Executive Committee for an international group promoting data archiving: DRYAD http://datadryad.org/ January 2010-
- Member of the editorial board for *Ecology* February 2004 to July 2008
- Member of the editorial board of *The American Naturalist* July 2005 to August 2008.
- Member of the editorial board of *Ecology Letters*, July 2002 to April 2007, and Acting Editor-in-chief and Associate editor at various times between August and December 2008.
- Sub-editor for *Antenna*, the magazine of the Royal Entomological Society of London, 1991-1994.

Professional Activities and Awards (cont.)

- Member of "Faculty of 1000" (http://www.f1000biology.com/), January 2006 to August 2008. Published by BioMed Central, Faculty of 1000 Biology is an online research tool that highlights the most interesting papers in biology, based on the recommendations of over 1000 leading scientists worldwide.
- Research Fellow and member of a working group on "Movement Ecology" at the Institute for Advanced Studies at the Hebrew University in Jerusalem, Israel, January-July 2007.
- Member of two working groups at the National Center for Ecological Analysis and Synthesis at Santa Barbara, CA:
    - NCEAS Working Group Member "The Meta-Community Concept: A Framework for Large Scale Community Ecology?" Led by Mathew Leibold (U. of Chicago). 2002-2005
    - NCEAS Working Group Member "The Role of Individual-Scale Processes in Community-Level Dynamics: What are the Dynamically Relevant Organizational Scales for Predicting Community Dynamics?" Led by Oswald Schmitz of Yale University. 2000-2001
- Recipient of "Ecology Professor of the Year", May 2001, June 2002, and June 2006, a prize awarded annually "In honor of an outstanding professor that donated extra time, energy and enthusiasm to the Graduate Group in Ecology and its students at the University of California at Davis". This Graduate Group in Ecology includes approximately 130 professors and 250 graduate students.
- University of California at Davis, major committees and administrative duties:
    - Chair of campus (Academic Senate's) Committee on Courses of Instruction 2008-2011. This committee oversees the review of all courses at UC-Davis.
    - Master Advisor for Environmental Biology and Management Major 2002-2010, and for Environmental Science and Management Major 2007 onwards.
    - Vice-Chair, Department of Environmental Science and Policy, Fall 2011 onwards.
- Awarded The Murray Prize for Insect Physiology for the best undergraduate research project in entomology, Imperial College, University of London (1989).
- External examiner for a Ph.D. candidate in Ecology, University of Helsinki, Finland (Feb. 1996), University of Miami, FL. (January 2003), Dartmouth College, NH (April 2004), and Linkoping University, Sweden (Dec. 2009). Thesis committee member of MSc student at California State University, Chico (September 2009).
- Reviewer of manuscripts for *The American Naturalist*, *The Auk, Behavioral Ecology*, *Biological Conservation*, *Biology Letters*, *Bulletin of Entomological Research, Conservation Biology*, *Conservation Ecology, Ecological Entomology*, *Ecological Modelling*, *Ecology*, *Ecology Letters, Entomologia Experimentalis et Applicata, Environmental Entomology, European Journal of Entomology, Experimental and Applied Acarology*, *Journal of Animal Ecology*, *Nature, Oecologia, Oikos*, *Proceedings of the U.S. National Academy of Sciences, Proceedings of the Royal Society of London* (*Biological Sciences*), Quarterly Review of Biology, *Science*, and *Theoretical Population Biology. Ad-hoc editor for Ecology 2001-2004.*
- Reviewer of undergraduate ecology texts for Blackwell, Oxford University Press, Elsevier and Sinauer.

Professional Activities and Awards (cont.)

- Member of the British Ecological Society, Ecological Society of America, and Union of Concerned Scientists.
- Member of NSF Panel in Evolutionary and Population Ecology during Fall 2004, and Spring 2006 and 2007, and Doctoral Dissertation Improvement Grant panel during Spring 2003. Reviewer of grant applications for The National Science Foundation, The National Geographical Society, The Natural Environment Research Council, U.K., the Czech Academy of Sciences, The Royal Society of London, Faculty of Science at Göteborg University, Sweden, and The Royal Society of New Zealand.
- Member of NSF Division of Environmental Biology's (DEB) Committee of Visitors advisory meeting 21-23 June 2006. The COV is a panel of 12 that gives feedback to NSF about how best to direct research resources. The program involves a comprehensive review of the success of DEB in funding research in ecology, evolution and systematics, and the business practices used by the programs. A public report came from this evaluation.
- Invited participant in "Forum" on NPR station KQED in San Francisco discussing the Endangered Species Act, its effectiveness, and some of the amendments proposed. February 15th 2006.
- Undertook a five-year review of the listing status of the federally threatened Valley Elderberry Longhorn Beetle for US Fish and Wildlife Service, led by Theresa Talley, a postdoctoral researcher in my lab and David Wright. http://www.fws.gov/sacramento/es/documents/VELB_5yr_review_Talley_etal.pdf

Gary R. Huxel
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E-mail: ornate.ornata@gmail.com

Summary of Qualifications:

- Over twenty years in ecological and environmental research and analyses
- Excellent analytical skills, methodological skills, communication skills
- Broad knowledge of environmental policy issues and environmental law
- Experience in development of strategy and planning and assessment of projects and their impacts
- Experience managing scientific personnel (undergraduate and graduate students, and lab technicians and postdoctoral fellows)

Professional Experience:

2005-present Assistant Professor, Department of Biological Sciences – University of Arkansas

- Teaching graduate and undergraduate courses
- Direct graduate student research
- Research on endangered species, stream communities, and landscape processes
- Skills in statistical analyses, spatial dynamics using GIS, and mathematical modeling

2001-2005 Assistant Professor, Department of Biology – University of South Florida

- Teaching graduate and undergraduate courses
- Direct graduate student research
- Research on endangered species, stream communities, and landscape processes
- Skills in statistical analyses, spatial dynamics using GIS, and mathematical modeling

1996-2001 Postdoctoral Research Associate, Department of Environmental Science and Policy - University of California – Davis

- Population and community ecology
- Mathematical ans statistical modeling
- Ecosystem dynamics
- Endangered species and habitat loss and fragmentation

1990-1995 Graduate Research Assistant, Program in Ecology - University of Tennessee

- Stream and lake ecology
- Mathematical modeling
- Dynamics of genetically engineered bacterium in hazardous waste decontamination

1990 Chemical/Environmental Analyst II, Formula Group Limited - Scottsdale, AZ.

- Chemical analyses of hazardous waste
- Remediation of toxic waste sites
- Development of technology and microbes for cleanup of toxic substances

Education:

2012: MS Environmental Law and Policy
Vermont Law School (graduation Spring 2013)
2011: Coursework in Microeconomics, Macroeconomics, and Accounting I, II
1995: Ph. D. Ecology
University of Tennessee
Knoxville, TN
1989: B. S. Biology with Honors
Arizona State University
Tempe, AZ

Awards and Grants:

Faculty of 1000 nominated and selected paper: Antagonistic and synergistic interactions among predators. **Bulletin of Mathematical Biology** 69:2093-2104 (2007)
Academic Keys Who's Who In Science (2004)
USF Outstanding Faculty Research Achievement Awards (2002 – 2003)
National Science Foundation – DEB-0079426 – The effects of spatial subsidies and food web structure on the stability and long-term dynamics of island ecosystems, $400,000, (2000-2004), PI
National Science Foundation – CHE-0221834 – BE/CBC: Ecosystem Response to Elevated Arsenic Concentrations, $1,490,000 (2002-2006), Co-PI
UCMEXUS - Trophic structure of the food web supporting birds nesting on Isla Montague, Delta of the Río Colorado, 1 year, $20,000, Collaborator
National Science Foundation Fellowship - Honorable Mention (1991)
Science Alliance/Center for Excellence Graduate Assistance Fellowship (1990-1994)
Science Alliance Award for Outstanding Scholarly Achievement (1992, 1994)
Sigma Xi Grant-in-Aid of Research (1992)

Recent and Key Publications:

Books and Book Chapters:

Talley, D.M. G.R. Huxel, and M. A. Holyoak. 2006. Habitat connectivity at the land-water interface. Pages 97-129 *in:* Sanjayan M. and Crooks K. (Eds.), Conservation Connectivity. Cambridge University Press.
Polis, G. A., M. E. Power, and G. R. Huxel, editors. 2004. **Food webs at the landscape level.** University of Chicago Press.
Vanni, M. J., D. L. DeAngelis, D. E. Schindler, and G. R. Huxel. 2004. Fluxes of nutrients and detritus across habitats. Pages 3-11 *in* **Food webs at the landscape level** (G. A. Polis, M. E. Power, and G. R. Huxel, editors). University of Chicago Press.
Huxel G. R., G. A. Polis and R. H. Holt. 2004. Spatial population and community dynamics: a synthesis. Pages 434-451 *in* **Food webs at the landscape level** (G. A. Polis, M. E. Power, and G. R. Huxel, editors). University of Chicago Press.
Huxel, G. R., M. A. Holyoak, T. S. Talley, and S. Collinge. 2003. Perspectives on the recovery of the threatened Valley Elderberry Longhorn Beetle. Pages 457-462 *in* Faber, P.M. (editor) California Riparian Systems: Processes and Floodplain Management, Ecology, and

Restoration. University of California Press, Berkeley, CA.
Sayler, G.S., C. Steward, U. Matrubutham, G. Huxel, J. Thonnard, and J. Drake. 1997. A Species Invasion Paradigm for Managing Biodegradative Microbial Communities. Pages 577-585 *in* Progress in Microbial Ecology: Proceedings for the 7th International Symposium on Microbial Ecology (ISME-7), Brazil.

Journal Articles:

Rojas, C., S.L. Stephenson, G.R. Huxel. 2010. Macroecology of high-elevation myxomycete assemblages in the northern Neotropics. **Mycological Progress**. Online Oct 16, 2010. DOI: 10.1007/s11557-010-0713-2.
Dekar, M. P., D. D. Magoulick, and G. R. Huxel. 2009. Shifts in the trophic base of intermittent stream food webs. **Hydrobiologia** 635:263-277.
Holt, R.D. and G.R. Huxel. 2007. Alternative prey and the dynamics of intraguild predation: Theoretical perspectives. **Ecology** 88:2706-2712.
Huxel, G.R. 2007. Antagonistic and synergistic interactions among predators. **Bulletin of Mathematical Biology** 69:2093-2104. ** Faculty of 1000 nominated and selected manuscript ***
Hewitt, C. L. and G. R. Huxel. 2002. Invasion success and community resistance in single and multiple species invasion models: do the models support the conclusions? **Biological Invasions 3**:263-271.
Huxel, G. R., K. McCann and G. A. Polis. 2002. The effect of partitioning of allochthonous and autochthonous resources on food web stability. **Ecological Research** 17:419-435.
Lee, C. T., M. Hoopes, E. Clark, J. Diehl, W. Gilliland, G. R. Huxel, K. McCann, J. Umbanhowar and A. Mogliner. 2001. Nonlocal concepts and models in biology. **Journal of Theoretical Biology** 210: 201-219.
Huxel, G. R. 2000. The effect of the invasive Argentine ant on the threatened valley elderberry longhorn beetle. **Biological Invasions** 2:81-85.
Polis, G. A., A. L. W. Sears, G. R. Huxel, D. R. Strong and J. Maron. 2000. When is a trophic cascade a trophic cascade? **Trends in Ecology and Evolution** 15:473-475.
Harrison, S. P., J. Maron and G. R. Huxel. 2000. Local extinction, colonization and regional patterns in five plants confined to serpentine seeps. **Conservation Biology** 14: 769-779.
Huxel, G. R. and A. Hastings. 1999. Habitat loss, fragmentation, and restoration. **Restoration Ecology** 7:1-7.
Huxel, G. R. 1999. Rapid displacement of native species by invasive species: effects of hybridization. **Biological Conservation** 89:143-152.
Huxel, G. R. and K. McCann. 1998. Food web stability: the influence of trophic flows across habitats. **American Naturalist** 152:460-469.
Huxel, G. R. and A. Hastings. 1998. Population size dependence, competitive coexistence and habitat destruction. **Journal of Animal Ecology** 67:446-453.
McCann, K., A. Hastings and G. R. Huxel. 1998. Weak trophic interactions and the balance of nature. **Nature** 395:794-798.

Recent Presentations:

A. Grimsley and G. R Huxel. Correlation of habitat factors and presence or absence of eastern collared lizards. Ecological Society of America. 2011.

F. Sanchez Pinero, G. R. Huxel, and D. M. Talley. Spatial subsidies and the paradox of enrichment: Seabird inputs decreases diversity in an insular ecosystem. Ecological Society of America. 2010.

G.R. Huxel. Box turtles in Arkansas. Ecological Society of America. 2008.

D.D. Magoulick, G.R. Huxel, C.M. Bare, M.P. Dekar, S.W. Hodges. Stream drying and fish refugia: forecasting effects of global climate change. American Fisheries Society Annual Meeting August 17-21, Ottawa, CANADA. 2008.

M.P. Dekar, D.D. Magoulick, and G.R. Huxel. Spatial and temporal variation of intermittent stream food webs derived from stable isotopes. American Fisheries Society Annual Meeting August 17-21, Ottawa, CANADA. 2008.

Holt, R.D., G.R. Huxel, and M. Barfield. Alternative prey and the dynamics of intraguild predation: Theoretical perspectives. Ecological Society of America, 2007.

Huxel, G.R. Importance of predator-predator interactions in ecosystem-based management models. American Society of Ichthyologists and Herpetologists, 2006.

Huxel, G.R., D. Magoulick, J. Ludlam, and M. Dekar. Trophic structure in pools subject to drying. Ecological Society of America, 2006.

Krementz, D. and G.R. Huxel. Population dynamics of American Woodcock in the Central Region. Tenth American Woodcock Symposium, 2006.

Huxel, G.R. Spatial complexity and habitat use by breeding birds in the Colorado River Delta. Sigma Xi – University of Arkansas Chapter, 2005.

Huxel, G.R., D.M. Talley, and F. Sanchez-Pinero. The role of multiple predators in food webs. Ecological Society of America, 2005.

Harwood, V.J., G.R. Huxel, and F.I.M. Thomas. Population dynamics of indictors and pathogens in Tampa Bay, Florida. US Geological Survey – Gulf of Mexico Integrated Science, 2005.

Bellanceau, C. and G.R. Huxel. Diversity of arthropods in the University of South Florida Ecological Research Area, Tampa, Florida. Association of Southeastern Biologists, 2005.

Courses Taught

Community and Ecosystem Ecology
Population Ecology
Mathematical Biology
General Ecology
Biometry
Ordination Methods
Spatial Complexity
Quantitative Methods in Ecology
Conservation Biology
Epidemiology

Membership in Professional and Other Societies:

American Association for the Advancement of Science
American Society of Ichthyologists and Herpetologists
American Society of Naturalists
Ecological Society of America
International Society for Ecological Economics
National Resource Defense Council

Journals Referee or Associate Editor For:

American Naturalist
Aquatic Living Resources
Biological Conservation
BioScience
Conservation Biology
Diversity and Distributions
Ecology/Ecological Monographs
Ecological Applications
Ecological Modelling
European Journal of Entomology
Heredity
Journal of Animal Ecology
Journal of Ecology
Journal of Mathematical Biology
Journal of Theoretical Biology
Nature
Oecologia
Oikos
Science
Theoretical Population Biology

Postdoctoral Fellows Mentored:

Drew Talley, 2001-2004, currently Assistant Professor at the University of San Diego

Graduate Students Mentored:

Pablo Andres Bacon, PhD at University of Arkansas, 2007-present
Ashley Grimsley, MS student University of Arkansas, 2009-present
Doug Leasure, PhD at University of Arkansas, 2010-present
Matthew Holden, MS student University of Arkansas, 2011-present
Timothy Chorley, MS student University of Arkansas, 2011-present
Celina Bellanceau, MS student at University of South Florida, 2002-2006
Teresa Piacenza, MS student at University of South Florida, 2004-2007

Patent

Reclamation system for contaminated material. US Patent No: 5,114,568. Awarded 1990.

APPENDIX B: INDIVIDUAL REVIEWER COMMENTS

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Combined Peer Review of the U.S. Fish & Wildlife Service's Proposed

Ruling (Federal Register 77:60238-60276) to Delist the Threatened

Valley Elderberry Longhorn Beetle (VELB), ***Desmocerus californicus dimorphus***

REVIEWER #1:

General Comments:

Thirty-two years after the designation of the Valley Elderberry Longhorn Beetle (VELB, *Desmocerus californicus dimorphus*) as Threatened under the Endangered Species Act, there is significantly more information on the range, abundance, and habitat requirements of this subspecies. Many questions remain, however, about the status of this elusive beetle, questions which I would want conclusively answered prior to removing protections for any threatened or endangered species. While many researchers have contributed to our growing knowledge of the species, the level of knowledge is still incredibly poor relative to that which one comes to expect in the case of listed vertebrate species. The argument made in the Proposed Rule essentially boils down to the idea that listing itself wouldn't have been warranted in the first place if they knew then what we know now. However, as my responses to the questions below detail, I don't think we know now nearly as much as the Proposed Rule purports. It may very well be that this species is healthy and with a good future prognosis, but this Proposed Rule lacks what I would consider to be sufficient data to make that case strongly.

Question 1. Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical and supported by the data and information in the proposed rule, especially in regards to the beetle's biology, current habitat (including habitat connectivity and the availability of beetle habitat within riparian vegetation), range (including lost historical range), distribution, population size, and population trends?

Question 1 gets right to the heart of my most significant comments – the documentation of the VELB's current range. If the primary basis of the delisting proposal is that the VELB is more widespread than originally reported, the foundation of this assertion needs to be solid. As to whether the pertinent conclusions presented within are based on the best available scientific information, I strongly think otherwise. Much of the primary literature cited in the proposal contains disclaimers and ambiguity that are not adequately reflected in the proposal. The Proposed Rule states: "survey efforts have expanded our knowledge of the beetle's range to include much of the San Joaquin and Sacramento Valleys, from Shasta County in the northern Sacramento Valley to Kern County in the southern San Joaquin Valley, California" (Federal Register 77: 60242), and goes on to cite and list 26 locations that are thought to host the beetle. There are significant uncertainties and doubt about many of these, which I will highlight here.

The majority of the new records come from the California Natural Diversity Database (CNDDB). Although the Proposed Rule highlights the importance and feasibility, given proper training, of distinguishing recent emergence holes from historical emergence holes, the records from the CNDDB are not annotated as such, and cannot be assumed to come from observers

trained to make this distinction. Yet USFWS accepts the presumption that all occurrences recorded in the CNDDB represent currently extant populations. Not only is no justification given for this assumption, much of the information that follows contradicts it.

Eight of the 26 locations (Thomas Creek, Stony Creek, Butte Creek, Yuba River, Tuolumne River, Kings River, Kaweah River, Caliente Creek) have not had any evidence of any kind of beetle activity, exit holes or adults, since before the year 2000. It cannot be assumed that the beetle persists at any of these.

Eleven of the 26 locations (Thomas Creek, Stony Creek, Big Chico Creek, Butte Creek, Yuba River, Upper American River, Ulatis-Green Valley Creeks, Tuolumne River, Kern River, Caliente Creek, San Joaquin River) have never had documented adult VELB beetles present, only exit holes. At several of the locations, particularly those in the San Joaquin Valley, there is considerable published data to suggest that these exit holes are those of the non-threatened subspecies *Desmocerus californicus californicus* (CELB). Halstead and Oldham (2000) state: "The new record males [the only identifiable sex] from the Merced River (only one of two) and one from the Mokelumne River resemble […] VELB. The other new record males (in the San Joaquin Valley, Coast Range, Sierra Nevada foothills, and remainder of the state) resemble the description of CELB." This statement covers the supposed records from Kings River, Kern County (Kern River and Caliente Creeks), Tulare County, (Tule River-Deer Creek), Madera County (San Joaquin River), and Stanislaus County, (Upper Stanislaus Hills). The finding of polymorphic males at the Merced River site also suggests that localities along and near the Merced River host intergrades between CELB and VELB populations (as many authors have suggested). This accords completely with the distributional map published by Chemsak (2005), in which CELB exclusively occurs in the central and southern San Joaquin Valley, while VELB occurs predominantly in the Sacramento Valley, extending into only to the extreme northern portion of the San Joaquin Valley. These studies were based primarily on specimens, and represent the only conclusive documentation of the actual distribution of VELB from these areas. Documentation of exit holes in the southernmost areas cannot be considered conclusive evidence of occurrence of VELB. Most in fact probably represent CELB populations.

Taking this information into account leaves only 5 locations where unquestioned VELB adults have been documented in the past 10 years (Sacramento River, Feather River, Bear River, Lower American River, and Cache Creek). Observations of recent exit holes (within the past 10 years) within the uncontroversial portion of the range add 7 locations to this (Big Chico Creek, Upper American River, Putah Creek, Ulatis-Green Valley Creeks, Consumnes-Laguna-Dry Creeks, Mokelumne-Bear Rivers, and Stanislaus River). So, to my interpretation, 12 locations can be reasonably considered to currently support populations of VELB, rather than 26. Its distribution certainly is broader than was known at the time of listing, but nowhere near as broad as the Proposed Rule suggests. The frequent citation of "the 26 locations" throughout the proposal is very misleading. For example, p. 60238 and p. 60272: "Records since listing show the beetle may currently occupy most of the 26 locations identified and continues to persist in these locations, as is expected for some period of time into the future." I see no scientific justification for this statement.

It is also worth highlighting that several of the localities on the list that are known to have supported VELB in fairly recent times no longer appear to – there is evidence that populations that have been known to be active recently have become extirpated in recent times (Thomas Creek, Stony Creek, Butte Creek). Even populations at some well-known sites appear to be in continual decline, as noted by Zisook (2007) resurveying Talley's (2005) sites, and Collinge et al. (2001) resurveying Barr's (1991) sites. So while new populations of VELB have inarguably been discovered (essentially all in the northern Sacramento Valley), overall the beetle appears to remain in decline.

On the positive side, a number of studies cited and reviewed in the proposed rule have helped establish a more precise understanding of VELB habitat preferences, which in turn will help secure and protect higher quality habitat, and provide a more effective target for restoration efforts.

Question 2. Are there instances in the proposed rule where a different but equally reasonable and scientifically sound scientific conclusion might be drawn that differs from the conclusion drawn by the Service? If any instances are found where that is the case, please provide the specifics of that situation.

As detailed above, it seems to me that USFWS has overlooked important and well-documented uncertainties in the available data, and made what appear to be overly optimistic conclusions regarding the current distribution of VELB. In my examination of the available published findings, I see much that conflicts with the purported broad, current distribution of VELB, including several authoritative, primary sources that assign most or all of the southern populations to the CELB subspecies (*D. californicus californicus*). In fact no publications prior to the recent Proposed Rule have ever suggested that exit holes discovered in the southern parts of the range are evidence for the presence of VELB. The identifications of exit holes as such in the California Natural Diversity Database are unjustified.

Question 3. Does the proposed rule provide accurate and balanced reviews and analyses of the factors relating to the threats of the beetle (at the time of listing, currently, and in the future), including potential impacts from climate change and the future anticipated level of threat for habitat loss and potential sources of habitat loss? Are the Service's findings regarding threats to the species biologically sound and supportable based on the information and data in the proposed rule?

The proposed rule provides an extensive assessment of the variety of threats that VELB may face, including continued habitat losses, utilization for commercial or recreational purposes, predation, and climate change. For the most part, this discussion appears fair and representative of data and predictions available, with a few exceptions.

The risk posed by Argentine ants (as predators on beetle eggs and larvae) was highlighted by Huxel (2000) in the peer-reviewed ecological literature. The Proposed Rule relies largely on an unpublished report (Klasson et al., 2005) to minimize this threat. Regardless the source of the information, the proposed rule takes one unsupported sentence from the Klasson report ("It is likely that there are threshold densities … under which predation does not significantly affect

VELB… *we are analyzing the data to answer this question"* [emphasis mine]) and uses that to diminish its own main conclusion that "given the opportunity, the ant will increase mortality of vulnerable beetle larvae". Given that the ant is present at essentially all restored and mitigation sites, I do not believe the USFWS proposed rule provides accurate balance to the available results with respect to threats from Argentine ant.

The Proposed Rule minimizes threats based on small population size, in direct contradiction to some of the cited literature. VELB is among the rarest of the rare, having limited geographic range, small local populations, and high habitat specificity, and multiple local extirpations have been documented (Collinge at al. 2001, Zisook 2007). Talley et al. (2006a) do indicate that some new colonization has been observed as well, but only at limited spatial scales. Previous work unanimously expresses doubt that large scale colonization occurs with any significant frequency, due both to low propensity to disperse in general, and to strong female philopatry. On balance, the literature suggests that local extinction is likely in small populations and the chances of recolonization, except from very nearby populations, are extremely low. The Proposed Rule embraces the metapopulation model to the extent that it predicts and allows small, ephemeral populations. But also inherent in this model is significant connectivity among patches of suitable habitat. Where suitable habitat is isolated (or dispersal capabilities are weak – two sides of the same coin), the probability of colonization is extremely low, and if no subpopulation is large enough to exist on its own, the metapopulation is doomed over time.

There is no discussion in the proposed rule of potential risks to critical habitat for VELB from invasive plants. Talley et al (2006) and Holyoak & Graves (2010) emphasize this potential threat, pointing out several invasive plant species that may or do displace native vegetation, including elderberry plants. Invasive plants in general are widely agreed as one of the primary threats to biodiversity, and habitats of limited extent, such as riparian corridors, are particularly vulnerable (Bossard et al. 2000. Invasive plants of California's Wildlands. UC Press).

Question 4. Does the proposed rule provide a logical and accurate review of the valley elderberry longhorn beetle recovery plan objectives, implementation, and evaluation?

The recovery plan for VELB was limited, comprising only interim objectives, which never cohered into a solid plan. Among them, progress was made protecting known populations, documenting new populations, and protecting new populations, and these advances are covered thoroughly. Specific delisting criteria were never formulated, so while the interim objectives are discussed, the most important one, what will it take to consider the species recovered, was never fulfilled.

Question 5. Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the Service use the best available science to support its assumptions, arguments, and biological conclusions? If any instances are found where the best available science was not used, please provide the specifics of each situation.

As discussed in detail above, the USFWS conclusions with regard to two critical elements of VELB's status are not fully consistent with those of the studies cited. In both cases the peer-reviewed, published literature conflicts with the conclusions: 1) the beetle's <u>current</u> distribution

is inaccurately concluded to include 26 locations. No published studies unambiguously support the continued existence of VELB at more than 12 locations. Several published studies assign southern populations to the non-threatened subspecies CELB. 2) The threats posed by invasive Argentine ants to the beetle are concluded to be minimal. While studies by Huxel (2000) could not show a definite link between beetle decline and Argentine ant presence, it was his strong conclusion that the Argentine ant would have negative effects on VELB populations. He showed that the two species co-occur at most sites, and subsequent work has shown that Argentine ants are abundant at most mitigation sites as well, where VELB populations, if present, would be especially vulnerable. Essentially all literature on the invasive Argentine ant has repeatedly emphasized its strong negative effects on other invertebrates in invaded areas (Holway and Suarez 2006), including specifically on cerambycid beetles (Way et al. 1992) and in riparian habitats in northern California (Holway 1998). To question the possibility that Argentine ants may severely impact VELB populations does not seem to be a fair interpretation of available data and knowledgeable predictions.

Question 6. Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document? Please identify any such papers.

Chemsak, J.A. (2005). Illustrated revision of the Cerambycidae of North America (Vol II. Lepturinae). Wolfsgarden Books, Chino. 446pp + plates. – This revision of the author's own 1972 work (Linsley & Chemsak, 1972) contains updated distributional information for VELB and CELB, in map figures and text. Although specific records are not listed, it is apparent that Chemsak (the leading Cerambycid specialist in North America prior to his death in 2007) considered all the southern San Joaquin Valley populations to represent CELB.

Question 7. Did the Service accurately assess the efficacy of past and on-going beetle management activities in conserving the valley elderberry longhorn beetle?

Management activities to conserve VELB have focused almost exclusively on protection, maintenance and expansion of suitable habitat. VELB shares important riparian shrub and woodland habitat with a number of other species of concern, including breeding and migratory birds. Healthy riparian zones are also considered beneficial for freshwater and anadromous fish. So in some areas VELB has probably indirectly benefitted from general conservation measures involving its habitat. USFWS itself oversees two large Natural Wildlife Refuge areas, in which riparian protection and enhancement is a primary goal. Several non-governmental conservation organizations also manage areas of riparian habitat in the Central Valley that are known to or could potentially support VELB populations. Outside of preserves and other protected areas, significant efforts have been made to plant elderberry specifically to create or restore VELB habitat, primarily as mitigation for permitted take on private lands. So it is clear that potentially suitable habitat for the beetle has increased.

Restoration and mitigation-related plantings have occasionally (accidentally) transplanted VELB larvae along with transplanted elderberries. So there is potential that new populations have been established at some restoration and mitigation sites. However, it is also highlighted that plants at many such sites have done relatively poorly because of site-related characteristics unfavorable to

long-term elderberry persistence (too low in floodplain, too hot, etc.), so the quality of a number of such sites is low. In addition, repeated surveys that have attempted to track population movement or expansion have concluded that long-distance dispersal of adult beetles to previously unoccupied sites is extremely unlikely (=extremely infrequent), and this likelihood falls off rapidly with distance (Collinge et al. 2001, Talley et al. 2006a). So equating protected and/or restored habitat to any kind of success for VELB is not really justified.

In general the efforts to protect and enhance existing, and to create new or restored VELB habitat are described in great detail. For the most part, estimates of success or efficacy are based entirely on amount of habitat acquired, protected and/or restored. Very little beetle monitoring has been carried out in such sites, and the Proposed Rule fairly admits that the specific objective of enhancing beetle populations cannot be clearly evaluated. It is discussed that at some of the best known sites beetle populations have appeared to decline (Collinge et al. 2001, Talley et al. 2006a).

Question 8. Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous or that could be condensed?

Overall the level of detail in the proposed rule is largely fine. As it is already published, I have to wonder whether this question is relevant? If I had to comment, though, I would say that sections detailing habitat protections and restoration at sites where no beetles have ever been reported are overly detailed. It's good to know that additional potential habitat exists, but for a variety of reasons (unless reintroductions were planned) it is not directly relevant.

Question 9. Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened, and if so, how?

Here I primarily refer back to my previous points. The scientific foundation of most relevance (where VELB populations currently exist) seems weak and in some ways positively misleading. The way to strengthen the scientific foundation would be through a much greater survey effort. Although a number of academics have become interested in VELB and have provided valuable data, it appears that very little effort has been made by USFWS to obtain more concrete data.

One possible avenue for improving the scientific foundation for any listing action, and a timely one, would be through the use of pheromone attractants in sites where exit holes are known, but the identity or persistence of beetle populations is uncertain. Recently, several chemical ecologists published the first known pheromone for *Desmocerus* (Ray AM, Swift IP, McElfresh JS, Alten RL, Millar JG. 2012). (R)-desmolactone, a female-produced sex pheromone component of the cerambycid beetle *Desmocerus californicus californicus* (subfamily Lepturinae). Journal of Chemical Ecology 38(2):157-67), which has been shown to be strongly attractive to male *D. californicus californicus* in areas with robust populations. A couple of years of serious field surveys aided by pheromones would greatly solidify the basis for this proposal.

Question 10. Are scientific uncertainties clearly identified and characterized, and are the potential implications of the uncertainties for the technical conclusions clear?

The current status of VELB is the chief uncertainty in this proposal, and while the Proposed Rule details the gaps in data that lead to this uncertainty, the very existence of a delisting proposal indicates that it is not considered significant. Within the Proposed Rule, most summary sections suggest that the beetle "currently is known from 26 locations", and many conclusions and predictions are based on this suggestion.

The entire basis for this delisting proposal rests uneasily on this uncertainty. Among the justifications for the conclusion that delisting is warranted are:

(1) the increase in number of beetle occurrence records

(2) increase in number of locations where the beetle is found, including over a larger range than what was known at the time of listing

While these statements are strictly true, a substantial number of the new records are old, dubious, or are generally agreed to pertain to the non-threatened CELB. I strongly recommend that if USFWS believes that delisting is justified, the proposal should be founded on conclusive data, not optimistic (or erroneous) interpretations of available data. The newly discovered populations in the northern Central Valley may well be robust enough to justify delisting, but the proposal does not attempt to make that case, relying on the much broader but much flimsier evidence pertaining to the Central Valley as a whole.

REVIEWER #2:

General Comments:

In general, the proposed VELB ruling is well-written, uses much of the available scientific and other technical literature (except as noted in this review), and reviews information regarding current and future threats to the VELB. A wide variety and amount of information on numerous subjects was reviewed, and some original analyses were prepared, especially the GIS-based estimates of former and current riparian habitat, as well as restored or protected riparian habitat areas. These review comments focus more on topics to clarify, data gaps, limitations of the existing data used in this proposed rule, and other possible interpretations and ways to improve the VELB rule and the USFWS findings for its final ruling. Where appropriate, specific page numbers from the proposed rule are noted in my responses.

Question 1. Are the Service's description, analyses, and biological findings and conclusions accurate, logical and supported by the data and information in the proposed rule, especially in regards to the beetle's biology, current habitat (including habitat connectivity and availability of beetle habitat within riparian vegetation), range (including lost historical range), distribution, population size, and population trends?

Based on my own experience with the VELB, it definitely occurs in a wider geographic area, but in a patchily distributed manner usually near water courses, than was documented at the time of its recognition as threatened in 1980. However, the finding of a larger geographic range after an insect is listed is also true for most insects that have been recognized as threatened or endangered species under the Endangered Species Act by USFWS. Nonetheless, the USFWS's reliance on occurrence records from the California Natural Diversity Data Base (CNDDB), which are primarily reports of VELB exit holes rather than confirmed adult observations, is problematic due to frequent misidentifications of various bark features as VELB exit holes (see more details in response to Question 9). Thus, this data set of occurrence records can lead to erroneous conclusions for any analyses upon which these data are the scientific foundation. Even though this situation is mentioned as a concern in the proposed rule, this limitation should probably be emphasized even more strongly, as the CNDDB occurrence data are heavily relied upon by USFWS to assess the VELB's status.

Also, updated distribution information from Chemsak's (2005) revision of the cerambycid subfamily Lepturinae (which includes the VELB) was not included in the USFWS review. Indeed, Chemsak restricted the distribution of the VELB primarily to the Sacramento Valley and northern San Joaquin Valley, which would exclude several populations from the central and southern San Joaquin Valley treated as the VELB by USFWS in the proposed rule. Likewise, much of the CNDDB occurrence data is dated and not as recent as would be desirable to properly demonstrate the VELB's current status at most sites.

The USFWS review and analyses of habitat loss focus on riparian habitat only. Estimates of historical and current riparian habitat seem reasonable in light of the stated assumptions. However, VELB and its elderberry food plant also occur in some surrounding foothills, elderberry savanna, and other plant communities, but no estimates of historical or current habitat

areas, or losses of such habitats, are provided. Similarly, estimates of take of the VELB or mitigation or restoration in these habitats are omitted.

Although some other data sources are mentioned, they are not always clearly identified. For example, it is not clear if USFWS used museum or private collection records outside of what is contained in the CNDDB. As noted earlier, CNDDB records are usually based on exit holes rather than adults and are often incorrectly attributed to the VELB. Also, occurrence records from nearby sites or multiple occurrences from the same site are often combined into a single occurrence record by the CNDDB, which can complicate identifying spatial and temporal trends.

Uses of the terms "site", "survey site", "locations", "occurrences", etc. are a little unconventional and potentially even confusing in the proposed rule. Since the USFWS's use of "locations" really refers to "water courses", it might be more appropriate to use "watersheds", "water courses", or "drainages" to refer to these geographic regions rather than the term "locations", which often implies a more site-specific geographic area. Also, CNDDB often combines separate observations from nearby sites into a single occurrence record, which further complicates what is defined as a "location" in the proposed USFWS rule.

No capture-recapture or other marking/tracking studies have been performed to substantiate VELB dispersal distances presented; instead, dispersal information is inferred based on occupancy patterns rather than actual observations of beetle dispersal. This point could be emphasized in the USFWS rule. Dispersal data from related cerambycid taxa, if available, might possibly be used as a surrogate for the lack of such information for the VELB.

The discussion on VELB population trends is based primarily on comparison of occupancy at common sites during two surveys rather than population censuses because no statistically-based census estimates for the VELB exist. Low densities of the beetle make it inherently difficult to perform such studies and to obtain reliable estimates since the statistical models usually require relatively high sample sizes and recapture/resighting rates to generate reliable estimates of population parameters. Although occupancy data through time are useful, in my experience surveying and monitoring of the VELB suggests that there is year-to-year variation in VELB numbers at a particular site as well as variation between sites in the same year, which can complicate the comparison of VELB occupancy data at different points in time and its use to assess population trends. USFWS blames the lack of VELB population data on infrequency of sampling, especially lack of recent sampling (P60243). Rather, this is probably due more to the low density of the beetle and the lack of statistical methods that are able to generate accurate estimates of population parameters in such situations.

Repeated use of the phrase "increased number of populations" is potentially misleading as it implies that the VELB has expanded its geographic range and colonized new drainages since it was listed, when in reality these are more likely populations that were just unknown at the time of the beetle's recognition as threatened. At the time of its listing, coleopterists were the primary folks that were even aware of the VELB. Because of its recognition as threatened, many more people became aware of the VELB and started to survey for it.

Question 2. Are there instances in the proposed rule where a different but equally reasonable and scientifically sound scientific conclusion might be drawn that differs from the conclusion drawn by the Service? If any instances are found where that is the case, please provide the specifics of that situation.

As noted in my response to Question 1, limitations in the data utilized during the USFWS review could lead to a different conclusion regarding the distribution of the VELB. The omission of Chemsak's updated revision would substantially reduce the historical and current geographic ranges of the VELB, compared to the ranges portrayed by the USFWS. The number of currently recognized VELB locations would be less than the 26 detailed in the proposed rule. Because of the smaller geographic range and fewer populations, this situation would also elevate the level of various threats discussed in the proposed rule, as well as others which were dismissed or omitted. These latter factors should assume an even greater relevance to the protection, conservation, and recovery of the beetle, as well as any delisting evaluation, if there are fewer populations and they occur in a smaller geographic region.

On P60243, USFWS laments "but there is rarely documentation of these temporal changes to an occurrence." CNDDB often combines old and newer records for the same site into a single record, as well as other records from nearby sites. For this reason, it can be difficult to detect any temporal trends at sites/locations with occurrence information for multiple years using CNDDB data, even if they actually exist. Perhaps a better source of such temporal information is from mitigation monitoring reports in which mitigation sites were studied for 10 or 15-year periods for sites where the USFWS has a complete set of monitoring reports and the monitoring was performed by folks truly knowledgeable about the VELB (see response to Question 9). Observations of adult VELBs and exit holes are supposed to be documented as part of the annual monitoring surveys. Although the proposed rule and Holyoak et al. (2010) both noted that monitoring reports for many restoration/mitigation sites are absent from the USFWS files, it may be worth tracking these down to more accurately assess temporal trends of the VELB at site-specific locations.

Given the paucity of recent and reliable data on the occurrence of the VELB at the 26 "locations" itemized in the USFWS analyses, it is difficult to agree with the conclusions about the VELB's current status and likelihood for its long-term persistence. A few of these sites are probably inhabited by the non-threatened subspecies, *Desmocerus californicus californicus*, rather than the VELB. At other sites, reliable surveyors found evidence of declines in elderberries and VELB, which is cited but dismissed in the proposed rule. At most other sites the data is not as recent as would be desirable to accurately assess the beetle's current status.

Question 3. Does the proposed rule provide accurate and balanced reviews and analyses of the factors relating to the threats of the beetle (at the time of listing, currently, and in the future), including potential impacts from climate change and the future anticipated level of threat for habitat loss and potential sources of habitat loss? Are the Service's findings regarding threats to the species biologically sound and supportable based on the information and data in the proposed rule?

A number of threats are identified and analyzed. As discussed in the remainder of this response, a few threats are minimized or deemed insignificant by USFWS. Unfortunately, hard data to substantiate some of these threats is minimal or lacking. Also, there are a few threats which are omitted from the proposed rule that deserve consideration.

USFWS (P60249) only considered near-term human population growth through 2020, yet the proposed rule to delist the VELB would likely stay in effect well beyond 2020. Lacking protection under the Endangered Species Act, I would anticipate that loss and alteration of the VELB's riparian and other habitats might accelerate as the other state and federal laws mentioned have done little to protect habitat used by the VELB, especially in non-riparian habitats. Even though these other state and federal laws may provide some protection for special-status species, such as the threatened VELB, if VELB is delisted then these other regulations are not as likely to afford the beetle or its habitat any significant protection since it would no longer be considered a special-status species.

Although discussed (P60259-60260), predation by the invasive Argentine ant, other invasive ant species, and European earwig deserve more study to elucidate the degree of any negative effects on VELB. Potential threats from these invasive insects are essentially dismissed as insignificant, which is incorrect based on existing evidence in cited publications for this topic in the proposed rule. Co-occurrence of invasive ants and VELB does ***not*** necessarily mean that they are living in harmony.

One very important threat factor that is not mentioned in the proposed rule is invasive plants, such as *Arundo*, *Tamarix*, *Robinia*, *Ailanthus*, Himalayan blackberry (*Rubus* sp.), etc. which displace native riparian plants, including elderberry. Outside of riparian habitat, these and other invasive plants are probably having similar adverse effects in other habitats where elderberry grows and the VELB occurs. These and still other invasive plants also cause problems at restoration/mitigation sites for the VELB.

Another threat factor that is not adequately discussed is the natural and human factors that alter the riparian habitat ecology. Blue elderberry is somewhat of an edge-inhabiting species that naturally grows in mid-successional stages of riparian woodland habitat. Thus natural succession and ecological disturbance factors such as floods and fire, plus human factors such as alteration of natural hydrology (due to damming of waterways and other flood control activities), and fire suppression, could directly or indirectly affect the life stages of beetle, regeneration and survival of its food plant, habitat patch dynamics, and habitat connectivity. These factors are also relevant for guiding habitat management actions to benefit the VELB at both natural and restored sites.

The discussion (P60262) about potential effects of pesticides on the VELB is incomplete and potentially very misleading. Insecticide trials would not normally be done on VELB by manufacturers, nor would herbicide trials normally be conducted on elderberry by manufacturers, as these are not considered economically important species. So unless such trials are performed on life stages of VELB or a surrogate species (as was recently done with a surrogate of the endangered Lange's Metalmark butterfly) and blue elderberry (or a related surrogate), there is unlikely to be any hard data on sensitivity of the VELB and its food plant to

pesticides. I have observed blue elderberry mortality due to the use of Round Up, Garlon, and Transline (which is supposedly specific to thistles) at VELB mitigation sites. Thus, the statement that their sensitivities are uncertain seems potentially misleading. It would be better to state that both the beetle and its food plant are probably sensitive to pesticides when there is direct exposure, but that, to date, no formal testing has been done to document their respective sensitivities to these products.

Similarly, the discussion about potential genetic issues (P60263) is incomplete and potentially misleading. It would be better to state that no genetic studies have been performed to provide insights as to potential genetic problems associated with small population sizes. Stating that there is "no evidence" implies that some genetic studies have been undertaken but the findings indicated no genetic issues were detected.

Question 4. Does the proposed rule provide a logical and accurate review of the valley elderberry longhorn beetle's recovery plan objectives, implementation, and evaluation?

In general, the proposed rule provides a good review of the VELB's recovery plan objectives, implementation, and evaluation. However, it should be noted that this recovery plan is nearly 30 years old and unlike some other recovery plans of similar age, has not been updated in the interim. The objectives of the VELB's recovery plan were primarily interim, with the anticipation that these objectives, especially for delisting and the ultimate recovery of the VELB would be updated as new information on the beetle became available. However, the lack of bona fide occurrence data for the VELB complicates any evaluation of the recovery plan and whether objectives have truly been met.

Based on my personal familiarity with the three known VELB localities at the time of its listing, I disagree with the conclusion that the recovery plan's Primary Interim Objective 1 to protect these three localities of VELB (P60246) has been achieved. Designated Critical habitat for VELB in the City of Sacramento has not been adequately protected as homeless folks have caused considerable damage to elderberry plants and the beetle's riparian habitat there. Frequent fires, pruning and removal of plants, dumping of trash, etc. have degraded habitat. Also, homeless folks cause similar problems at several other VELB locations, including at parks or lands that are otherwise considered "protected". As such, the threat of such human uses to VELB is probably greater than is stated in the proposed rule. Also, the homeless issue can complicate obtaining accurate information about the beetle's status at these locations.

Question 5. Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the Service use the best available science to support its assumptions, arguments, and biological conclusions? If any instances are found where the best available science was not used, please provide the specifics of each situation.

Omission of Chemsak's (2005) revision led USFWS to include populations in the central and southern San Joaquin Valley as part of the VELB's historic and current geographic ranges, even though this monograph indicates that populations in this region should no longer be treated as the threatened VELB. Since Dr. Chemsak was the world's leading specialist on cerambycid beetles prior to his death, his taxonomic and geographic range findings should be a fundamental basis

for any review of the VELB. One of the publications cited in the proposed rule, Halstead and Oldham (2000) provide additional evidence that concurs with Chemsak's findings.

In the threat assessment, the roles of invasive insects and plants are dismissed as insignificant or not even mentioned. Given that there is some evidence of negative impacts of the Argentine ant on VELB, and invasive plants can outcompete elderberry and otherwise degrade the quality of riparian habitats, these factors deserve greater consideration in the proposed rule. Similarly, the metapopulation studies by Collinge et al. (2001) were largely discounted. There is no discussion about riparian habitat ecology and its role in maintaining blue elderberry and the VELB.

The Post-Delisting Monitoring (PCM) study cited (P60248) in the proposed rule focuses on monitoring of elderberry and VELB occupancy. It is not clear how the PDM will help with deficiencies in understanding of VELB population dynamics and dispersal as is stated by USFWS in the proposed rule. This should be clarified.

Question 6. Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document? Please identify any such papers.

A few other peer-reviewed, scientific publications are relevant to the proposed rule and could be cited to better substantiate or re-evaluate statements in the rule. These include:

Chemsak, J.A. 2005. Illustrated revision of the Cerambycidae of North America. Vol. II, Lepturinae. Wolfsgarden Books.

Fremier, A. & Talley, T. 2009. Scaling riparian conservation with river hydrology: lessons from blue elderberry along four California rivers. Wetlands 29: 150-162.

Holyoak, M. & Koch-Munz, M. 2008. The effects of site conditions and mitigation practices on success of establishing the valley elderberry longhorn beetle and its host plant, blue elderberry. Environmental Management 42: 444-457.

Koch-Munz, M & Holyoak, M. 2008. An evaluation of the effects of soil characteristics on mitigation and restoration involving blue elderberry, *Sambucus mexicana*. Environmental Management 42:49-65.

Talley, T.S., et al. 2007. Rethinking a rare-species conservation strategy in an urban landscape: the case of the valley elderberry longhorn beetle. Biological Conservation 135:21-32.

Vaghti, M.G., et al. 2009. Understanding the ecology of blue elderberry to inform landscape restoration in semiarid river corridors. Environmental Management 43:28-37.

Question 7. Did the Service accurately assess the efficacy of past and on-going beetle management activities in conserving the valley elderberry longhorn beetle?

Without reviewing all the specific data in the GIS analyses prepared by the USFWS, reports and other information referred to by USFWS in its proposed rule, it is difficult to definitely say whether the USFWS's assessment is entirely accurate. USFWS discusses all of the protected and restored riparian acreage as one factor for delisting the VELB, yet studies by Barr (1991) and Collinge et al. (2001) indicate that only about 25% of apparently suitable habitat sites are actually inhabited by VELB. Acreages of restored and protected riparian habitat cited by USFWS should probably be adjusted to account for this factor. Also, the proposed rule notes that many monitoring reports for permitted projects are missing, so this lack of information limits any evaluation of the success of habitat restoration activities to benefit the VELB. Reliance on exit holes as evidence of VELB occurrence, which are often incorrectly identified, rather than adult observations of the VELB, could have led to some incorrect interpretations for some of the analyses and other findings presented in the proposed rule.

Question 8. Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous or that could be condensed?

Some topics treated in the proposed rule are adequately discussed; however, data gaps or limitations in the data used for several aforementioned topics may have resulted in erroneous conclusions that merit re-evaluation of existing data that was used and even collection of additional data to properly analyze. Although the potential effects of climatic change can be difficult to properly and fully evaluate, the rationale (P60262) for dismissing a more detailed climate change analysis seems inappropriate. Studies of other species and their food plants/habitats have been done to show how changes in climatic conditions might alter the geographic distribution of the plants/habitats and the species with which they are associated. Since climatic change is raised as a potential threat factor, some further analyses for the VELB would be warranted to substantiate the proposed rule's conclusion that it is a non-significant factor.

In the case of the VELB, climate change could alter average temperatures and precipitation, plus the frequency of drought, floods, fire, and other factors that could alter habitat conditions in ways that would affect site occupancy and geographic range of the beetle and its food plant. The issues of taxonomic uncertainty about the elderberry and lack of genetic information on the beetle are not good reasons to ignore this issue. Assumptions to deal with these concerns can be built into any analyses that are undertaken to more thoroughly evaluate the effects of climatic change.

Question 9. Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened, and if so, how?

The scientific foundation of the proposed rule could benefit from inclusion of specimen records from museum collections or other bona fide observations of adult beetles since most of the CNDDB records are based on exit holes, which are frequently misidentified. Also, information

from Chemsak (2005) should be included since it is relevant to the VELB's current and historical geographic ranges, and the discussions about habitat loss, protected and restored habitat.

Since the initial release of the USFWS's VELB Conservation Guidelines, I have independently reviewed and field checked 56 elderberry inventories (often referred to as "protocol surveys") that were conducted using these guidelines at specific sites scattered throughout the geographic range of the VELB. Numerous errors were detected, ranging from minor to egregious. Only 7 of the reviewed inventories were found to be error free. The following errors were identified in the remaining 49 (87.5%) inventories;

a) plants, such as Tree of Heaven (*Ailanthus*), Walnut (*Juglans*), Coffee Berry (*Rhamnus*), and Willow (*Salix* sp.), were mistakenly identified as elderberry;
b) purported VELB exit holes were identified from the aforementioned incorrect food plants;
c) other insects, such as Western Box Elder bugs (*Leptocoris rubrolineatus*) or Dimorphic Flower Longhorn beetle (*Anastrangalia laetifica*) were misidentified as VELB adults;
d) bud and branch scars, bark cracks, and holes made by carpenter bees, sphecid wasps, other insects, and insectivorous birds, were incorrectly identified as exit or emergence holes of the VELB;
e) bona fide exit holes of the VELB were overlooked, especially those near ground level; and
f) elderberry stem counts were often incorrect, particularly on plants with multiple stems.

Many of these protocol surveys exhibited multiple examples of these error types. So the assumed accuracy and reliance on CNDDB records in preparing this proposed rule is a definite concern. While the proposed rule and the 5-year review acknowledge the possibility of such data errors, it is not apparent that any similar verification of data used was done, or if it was, to what extent it was undertaken. For these and aforementioned reasons, it would be more reassuring to see the analyses and conclusions in the proposed rule based on actual life stages of the VELB. Various collecting/observing techniques could be used to increase the numbers of adult observations throughout the VELB's geographic range, such as stressing elderberries to attract adults, pheromone traps, tethered females to attract males, and other trap types or methods known to attract cerambycid beetles. A 2012 publication by Ray et al (J. Chemical Ecology 38:157-167) describes the pheromone used by females of *Desmocerus californicus californicus* to attract males.

Question 10. Are scientific uncertainties clearly identified and characterized, and are the potential implications of the uncertainties for the technical conclusions clear?

For reasons previously noted, primary issues of uncertainty in the proposed rule are the current geographic range and present-day status of the VELB at riparian sites due to the reliance on exit hole data that may not be as accurate as implied by the proposed rule. While the USFWS's proposed rule acknowledges some uncertainties in the data it utilized, it treated these data as though they are bona fide and used them as the basis for its own analyses. Furthermore, a fair proportion of the relied upon occurrence records in the CNDDB are not current. Based on an independent review of numerous elderberry inventories (i.e., "protocol surveys"), a significant portion of these records may be inaccurate, which could result in erroneous conclusions based on

these data. Some of this uncertainty may be reduced by finding missing monitoring reports. It would be appropriate to attempt to identify any questionable data and omit them from the analyses performed to better substantiate the proposed rule. In the absence of bona fide and up-to-date occurrence data, based preferably on adult specimens and observations from trusted observers (especially if exit hole data continue to be used), the current status of the VELB is probably not as certain as portrayed in the proposed rule and the conclusion for delisting of the beetle seems premature at this time.

A secondary issue of uncertainty is the omission of Chemsak's (2005) revision, as this affects the assessment of the VELB's historical and current geographic ranges. The findings of Chemsak's revision are also important for any analysis of the VELB's recovery and rationale for delisting.

Potential impacts of invasive insects are discounted, even in light of studies cited in the proposed rule indicating they have negative effects on the VELB. Negative impacts of invasive plants on the riparian habitat, blue elderberry, and the VELB are not mentioned in the proposed rule. These factors deserve more consideration.

REVIEWER #3:

General Comments
[None]

Question 1. Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical and supported by the data and information in the proposed rule, especially in regards to the beetle's biology, current habitat (including habitat connectivity and the availability of beetle habitat within riparian vegetation), range (including lost historical range), distribution, population size, and population trends?

The majority of the information summarized in 77 FR 60238 (the entire document) is correct and the conclusions are logical and supported by data and information with respect to the beetle's biology, current habitat, range, distribution, population size and population trends. There are, however, some instances where the information is not interpreted in ways that are supported based on the scientific method or factors outside of those considered. These include the following:

(1) A paucity of recent records in the south of the beetle's range is not adequately summarized or considered as a problem in considering population trends.
(2) Turnover of beetle populations due to extinction and colonization is not included in consideration of the extent of beetle populations; furthermore, the evidence for declines in occupancy in the northern part of the species' range is dismissed without a logical reason for doing so.
(3) The effects of dynamics of habitat due to destruction, restoration and especially successional processes are not included in consideration of population trends; the loss of floodplain processes that reset habitat to an earlier successional stage due to damming is not considered and recent published and peer-reviewed works showing an apparent lack of recruitment of elderberry on dammed rivers are omitted.
(4) Some of the perceived increase in number of sites with the beetle occurring may be in part due to (2) and (3) above, and due to broader definitions of what constitutes a location historically than in work conducted since listing.
(5) The effects of invasive Argentine ants are dismissed without good and logical evidence or reasons for doing so. The spread northwards of Argentine ants is also not considered in considering the beetle's biology and population trends.
(6) The ability to consider climate change effects is dismissed and consequently other studies have likely not been sought out.

These six points are summarized below.

(1) The paucity of records in the southern part of the beetle's range.

Taking records that are recent, there are few within recent years. For instance if we take records of occurrence that are less than 10 years old at the time of the Talley et al. (2006) five-year review document (i.e. 1996 onwards), records from Table 1 of the 77 FR 60242-3 defined as occurring in the southern region (south of the line of the south edge of

Sacramento and Amador counties) we get the following, which is locations 13-26 in Table 1:

Locations (north to south)	Years of occurrences
13. Ulatis-Green Valley Creeks	02, 04, (08)
14. Cosumnes-Laguna-Dry Creeks	(02, 03, 04)
15. Mokelumne-Bear Rivers	06
16. Stanislaus River	(10)
17. Upper Stanislaus hills.	99, 00, 02A, 07A
18. Calaveras River-Stockton Diverting Canal	00
19. Tuolumne River	99
20. Merced River	(10)
21. Kings River	98A, absent 10
22. Kaweah River	no records
23. Tule River-Deer Creek	(10)
24. Kern River (excluding Caliente Creek)	(08, 10)
25. Caliente Creek (foothill location >1,000 ft elevation)	no records
26. San Joaquin River	04

Therefore, there are only 20 records from 1996 onwards in the south part of the VELB range. This compares to 31 records in the equivalent period from the north part of the range. The footnote to the table notes: "Additionally, there could be existing known locations, or new locations … where valley elderberry longhorn beetles occur today, but it is uncertain because we know of no recent surveys that have been conducted." Overall the evidence of records from the southern portion of the range since (and including) 1996 is sparse. This is of concern in relation to factors (2) to (5) below. The year 1996 is arbitrarily chosen here to represent recent records, however while the numbers would change if another year was chosen, the data clearly show fewer records in more recent years.

(2) Turnover of beetle populations due to extinction and colonization.

The low number of records of occurrence in the entire range from 1996 onwards may also indicate that the assumption from the CNDDB that all occurrences are extant is questionable. For instance Collinge et al. (2001) found that 29% of sites experienced short-term extinctions during the 1991-1997 period (based on recent exit holes) and 19% experienced short-term colonizations. Hence population turnover through time may be substantial and treating all occurrences as supporting extant populations at a point in time is incorrect. Occurrence at a point in time would represent the vulnerability to extinction whereas cumulative long-term records are more indicative of the extent of habitat used over the long-term. For a species undergoing extinction and colonization on a continuing basis, this dynamic nature of populations within a metapopulation may give a very different perspective on long term regional viability of metapopulations compared to over-recording occurrence from cumulative records over a long time period. While 77 FR 60238 correctly states that because population densities are low it is hard to prove extinction, it is also likely that populations with such low densities would have a high risk of extinction, so that it remains likely that population turnover is substantial. Collinge et

al. (2001) also report loss of beetle populations from entire watersheds in the northern part of the beetle's range. This report is not given credence.

The interpretation of 77 FR 60264, about Loss of Populations Resulting from Habitat Fragmentation, is questionable. It states the following: "Although a downward trend was noted (Talley *et al.* 2006a), this conclusion is specific to the areas researched by Barr (1991) and Collinge *et al.* (2001). This observed trend should not necessarily be extrapolated to the long-term, range-wide status of the beetle due to the uncertainties involved in obtaining the results (e.g., all beetle habitat surveyed by Barr [1991] was not surveyed by Collinge *et al.* [2001], as further described in 'Population Status and Trends' above)." The surveys conducted by Barr (1991) and a rigorous effort to revisit as many sites as possible in the north part of the VELB range by Collinge et al. (2001) in 1997 represent the most thorough surveys of the beetle yet conducted. While the exact shrubs visited in the two surveys may be slightly different, there is no reason to presuppose that this would be a source of bias and should lead us to negate declines in occupancy. In more detailed work (Zisook 2007) found turnover of occupancy in individual shrubs and shrub clumps, and these were accurately identified using GPS so there is little doubt that they represent exactly the same habitat. While any population (or metapopulation) survey can be questioned unless extensive work is done to calculate sampling error, there is no particular reason to dismiss the findings of Collinge et al. (2001) with respect to reduced occupancy of sites between 2001 and 2007 and beetle extinction from entire watersheds. This conclusion in 77 FR 60264 also is opposite to Talley et al. (2006) as noted in 77 FR 60264.

(3) Habitat is dynamic and elderberry is an intermediate successional species, and floodplain processes have been effectively halted by damming.

A general omission from 77 FR 60238 is a consideration of the idea that habitat is dynamic. There are several elements to this. First and foremost, the long-term cumulative summary of habitat used by the beetle is likely misleading because it would include past and current habitat. Second is the problem that elderberry occurs most frequently at intermediate levels of canopy cover within riparian woodlands, and is an intermediate successionary-stage species (summarized below). This means that current habitats may not be habitat in the future because elderberry may not be present and applies to natural sites and especially to restoration sites. Third, is a consideration of disturbance processes such as flooding (and river channel meander processes) and fire that reset habitat to an earlier successional stage, and that without such processes continued active management of both natural and restored sites may be needed. Fire may increase through human activities (or decrease through fire suppression efforts) (e.g., examples mentioned in 77 FR 60263 and Barr 1991), whereas damming and flood control may eliminate or severely reduce flooding and river vegetation regeneration processes (discussed below). Habitat that is dynamic within metapopulations is expected to have several effects: average rates of patch occupancy will be lower than static-habitat metapopulations and metapopulation persistence time will be reduced (e.g., Wilcox et al. 2006). The connectivity of habitat and dispersal ability of species is expected to be more important to maintaining viable metapopulations with dynamic habitats than when habitats are static (Johst et al. 2002).

Collinge et al. (2001) noted a decline in the number of elderberry bushes at locations between 1991 and 1997. Additionally, Fremier and Talley (2009) noted a dependence on specific hydrological conditions that have been changed by damming on most rivers, and Vaghti et al. (2009) noted that elderberry seedlings (<5cm stem diameter) were rare and less common on dammed than undammed rivers. Vaghti et al. (2009) suggested that competition with nonnative invasive plant species might be a factor of physical conditions, though they stopped short of invoking damming as a cause directly and suggested further studies are needed, for instance of seedling survival. Vaghti et al. (2009) conclude (in their abstract) that: "Such lack of recruitment places increased importance on horticultural restoration for the survival of an imperiled species. These findings further indicate a need to ascertain whether intervention is necessary to maintain functional and diverse riparian because of a lack of recruitment of elderberry along the Sacramento River woodlands…"

Restoration sites are planted with a mix of species, and the long-term state of the vegetation is expected to be a lower abundance of elderberry than was planted as sites establish a tree canopy. These problems of succession are not unique to restoration sites, however, they are well illustrated by restoration plantings. Elderberry is a mid-successional species, as indicated by its peak occurrence on intermediate age floodplains (my interpretation of Figure 2 in Vaghti et al. 2009). Also Crane (1989) states (with his citations omitted): "Blue elderberry is a short lived seral species that is shade intolerant or slightly shade tolerant". Golet et al. (2008) note that VELB is increasing along the Sacramento River restoration sites. Nonetheless, as Golet et al. (2008) note, riparian forests need to remain functional by being connected to an active floodplain with habitat formation processes. Golet et al. (2008) also question "Although VELB are responding favorably to planted elderberry under current conditions, what will happen when forests mature around the planted bushes? Can conditions for natural recruitment of elderberry, and other important plants, be met in this highly regulated system?" (Golet et al. 2008, page 21). Fremier and Talley (2009) also indicate that recruitment of elderberry shrubs may be limited on dammed rivers.

We would expect that, unless there is continued intervention in restored habitats and/or a restoration of floodplain processes (e.g., levy breaches), restoration sites will reach a climax community dominated by oak and cottonwood with low frequencies of elderberry in the understory of such habitats--which comes from directly extrapolating effects reported in Vaghti et al. (2009; Figure 3). Similar concerns would be expected to apply to the American River Parkway and Putah Creek critical habitat areas. Hence these areas may be protected but their future ability to support VELB and elderberry populations is highly uncertain and could compromise Primary Interim Objectives 1 and 3.

(4) Accuracy of estimates of numbers of locations with extant beetle populations.
Any turnover of habitat (rather than populations) would mean that accumulating estimates of occurrence over time would over-record the amount of habitat available at any one time. CNDDB considers all records to represent extant populations. Hence the number of records of populations in CNDDB would be an overestimate because some populations have gone extinct by the time the others are recorded.

In various places 77 FR 60238 suggests that the number of locations or sites with beetles has increased. Some of this is inevitable, in that more details of any species are likely to reveal further sites/locations. However, there is also a tendency for what constitutes a site or locality to be poorly defined and seems questionable that the locations given at the time of listing are equivalent in extent to the locations used in CNDDB for current records. The advent of GPS (and GIS) technology has allowed more specific recording and the survey methods of Barr (1991) and Collinge et al. (2001) are quite localized in their definitions of sites and localities. There is a risk that more detailed reporting inflates our estimate of how much of a real increase in habitat there is for the beetle. This is also obscured by use of areas instead of elderberry shrub numbers or densities.

77 FR 60246 refers to just three historical localities, which are very broad geographic areas, whereas the more recent evaluation of CNDBB records in Table 1 of 77 FR 60242-3 uses records that are much more specifically and locally defined. This gives a false impression of discovery of new populations and misrepresents how many occurrences were known at the time of listing.

(5) Effects of predatory invasive Argentine ants on beetle populations.
The information on the effects of Argentine ants on 77 FR 60259 is misleading. The only sound scientific study of the effects of Argentine ants on the beetle is Huxel (2000). Klasson et al. (2005) is a progress report and does not contain rigorous reporting of results, nor statistics, and sample sizes are not stated. An important problematic part is the interpretation of positive ant-beetle correlations in Klasson et al. (2005) that is reported on 77 FR 60259. A positive association between prey and predators at a point in time in no way indicates a lack of feeding on the prey by the predator. An aggregative response by a predator species to prey individuals/accumulations may cause a positive association in the short term (e.g., point measurements in time) whereas there may be an underlying deleterious effect of predators on prey over a longer time period. This is problematic given that Argentine ants are only recently colonists in northern California. Argentine ants are very capable of recruiting to areas with prey because of their use of pheromone trails and this could create the positive correlation found by Klasson et al. (2005). Huxel (2000) deliberately surveyed 30 sites for ant and VELB presence, and it is unlikely that randomly selected sites resulted in a negative effect through correlation with habitat factors since the described small-scale habitat preferences of Argentine ants (e.g., David Hollway's work) and VELB (Talley et al. 2007, etc.) are similar. Both species occur in higher densities close to water and around tree canopy cover that is not complete. The proposed threshold density effect reported in Klasson et al. (2005) and mentioned in 77 FR 60259 lacks evidence for it and is hypothesized based on a predation experiment using meal worms that were exposed rather than VELB larvae: in general, based on many published works on predators and prey and even basic ecology texts, we expect more harmful effects of predators on prey densities at higher densities rather than a threshold to exist. The insubstantial evidence used to dismiss the effects in the Huxel (2000) work is in my opinion misleading and incorrect. In my view the only reliable evidence available points to a negative effect of Argentine ants on VELB. Holyoak and Graves (2010) suggest this might also be seen in VELB densities but sample sizes were too small to say anything more solidly, and so 77 FR 60259 correctly dismisses this

result. The net effect of negating Huxel's findings (2000) is that since Argentine ants have spread northwards to reach California there is the expectation that they are likely more widespread (and potentially more abundant) in the southern part of the beetle's range and the effects on the beetle there are unknown. As the data in Table 1 (above and 77 FR 60242-3) indicate there is a lack of adequate surveying of the southern part of the beetle's range to determine this. This is acknowledged in 77 FR 60269-70 but the consideration of Argentine ants is not explicitly considered in this regional summary and no difference in potential threat to ants between north and south parts of the beetle's range are reported.

(6) Climate change effects and what can be calculated.
On 77 FR 60262 the conclusions drawn about taxonomic identity of elderberry and beetle subspecies and that these preclude further work on the effects of climate change are incorrect. It is known that the beetle uses a variety of taxonomic forms of elderberry and there is no evidence that the beetle avoids certain elderberry species/subspecies. Additionally the range of VELB is reasonably well known and so it should be possible to use climate envelope methods to project future potential distributions of the beetle and to see if this would overlap with existing forms of the California elderberry longhorn beetle (for instance). A wide range of other forms of climate change studies can be done such as studies of the future distribution of vegetation types, and these could be combined with known vegetation types where elderberry occurs (e.g., Barr 1991, Collinge et al. 2001, Talley et al. 2007, Vaghti et al. 2009) to establish future distributions and whether these overlap with current VELB range. Additionally, changes to flooding and disturbance regimes for VELB habitats could be considered. Such studies could also indicate whether geographical translocations might be necessary to consider in the future. 77 FR 60259 does correctly surmise that no definite effects of climate change on VELB are currently known. The delisting document would benefit from a broader literature survey of the effects of climate change on future habitat conditions and distribution, flooding, fire, drought and other disturbances within the range of the beetle.

Question 2. Are there instances in the proposed rule where a different but equally reasonable and scientifically sound scientific conclusion might be drawn that differs from the conclusion drawn by the Service? If any instances are found where that is the case, please provide the specifics of that situation.

Points (2) to (5) in answer to the previous question detail these cases. Overestimation of the amount of habitat available, beetle populations, and failure to account for populations and habitat being dynamic and dependent on riverine processes all lead to an overestimation of the health of populations. I would conclude that all beetle populations are at substantial risk of extinction because of these factors as well as the spread of invasive Argentine ants, for which the conclusions reached (see (4) above) also seem questionable based on having dismissed the results of the most thorough study in favor of data that are misinterpreted in their meaning from Klasson et al. (2005).

Question 3. Does the proposed rule provide accurate and balanced reviews and analyses of the factors relating to the threats of the beetle (at the time of listing, currently, and in the

future), including potential impacts from climate change and the future anticipated level of threat for habitat loss and potential sources of habitat loss? Are the Service's findings regarding threats to the species biologically sound and supportable based on the information and data in the proposed rule?

There has been a clear attempt to thoroughly review all factors in a balanced way. Nonetheless the omissions listed above (and references given in answer to question 6 below) point towards a different conclusion on population trends. The coverage of climate change effects also bears consideration at a broader level than just elderberry and the beetle to understand what climate change might do to riparian woodlands and climatically-driven environmental regimes.

Question 4. Does the proposed rule provide a logical and accurate review of the valley elderberry longhorn beetle recovery plan objectives, implementation, and evaluation?

The VELB recovery plan lists four interim objectives, and was intended as a temporary measure until a fuller recovery plan could be drawn up with better information. The first objective was protection of "the three known locations", and this has largely been achieved. Second was to survey Central Valley rivers for the presence of the beetle and its habitat. This was largely done by Barr (1991) with USFWS funding, and voluntarily pursued by Collinge et al. (2001) for the northern part of the VELB range, and then a portion of sites were re-surveyed by Talley et al. (2007) and Holyoak and Graves (2010). Since the objective was only to survey the beetle and its habitat and no extent is listed, then yes it has been done. However, the reporting of the information is misleading because of problems of not considering inadequacy of many CNDDB records (public-supplied information of questionable quality), failure to adequately consider population extinctions, declines and habitat loss due succession. The third interim objective was to protect remaining habitat in the VELB's historic range. The historical range is largely unknown but presumed to be the Central Valley, and a good deal of habitat protection has been conducted to a reasonable and practicable extent in my opinion. The fourth objective, to determine the number of sites and populations necessary to delist the species is inadequately handled. There are substantial problems with misrepresenting locations in historical versus modern records, not considering the paucity of modern records, failure to consider metapopulation and habitat dynamics, and dismissal of climate change effects. These points are detailed in answer to question (1) above with specific information about the VELB. There has never been a determination of the number of populations or sites needed for the beetle to survive. The closest answer is from Collinge et al. (2001). FR 77 60248 is entirely misleading on this point and does not answer the question of numbers of sites or records. It states that discovery of new locations has "altered our understanding of the subspecies' range and distribution. This improved understanding, together with restoration, habitat management, and protection implemented at various locations to date, have led us to determine that the beetle can persist without the protections of the Act." This includes no assessment of numbers of populations or sites required for the VELB to survive. Collinge et al. (2001) conclude that entire metapopulations of the beetle are needed for it to survive and that it is currently declining with resultant loss of beetles from two watersheds (equivalent to metapopulations) between 1991 and 1997. Hence it is known that the number of populations required is large and the current number did not buffer against declines in at least some parts of the species range. A thorough analysis of interim question 4 based on metapopulation models is needed and such an analysis needs to

adequately consider all threats including climate change and invasive predators (see the answer to Question 1 "***Are the Service's descriptions, analyses, and biological findings and conclusions accurate…*".**

Question 5. Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the USFWS use the best available science to support its assumptions, arguments, and biological conclusions? If any instances are found where the best available science was not used, please provide the specifics of each situation.

In general yes, except some more recent studies were omitted (see answer to next question), and the study of Huxel (2000) was dismissed too strongly, as were the findings of Collinge et al. (2001). This is despite these being the most important and strongest scientific studies of Argentine ants (Huxel 2000) and metapopulation dynamics of the beetle (Collinge et al. 2001) available. The general concept of habitat dynamics and the consequence for what represents a healthy (viable) metapopulation was overlooked.

Question 6. Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document? Please identify any such papers.

Fremier, A., Talley, T., 2009. Scaling riparian conservation with river hydrology: Lessons from blue elderberry along four California rivers. *Wetlands* 29, 150-162.

Golet, G.H., Gardali, T., Howell, C.A., Hunt, J., Luster, R.A., Rainey, W., Roberts, M.D., Silveira, J., Swagerty, H., Williams, N., 2008. Wildlife Response to Riparian Restoration on the Sacramento River. *San Francisco Estuary and Watershed Science* 6 (2).

Johst, K., R. Brandl, and S. Eber. 2002. Metapopulation persistence in dynamic landscapes: the role of dispersal distance. *Oikos* 98:263-270.

Vaghti, M., Holyoak, M., Williams, A., Talley, T., Fremier, A., Greco, S., 2009. Understanding the Ecology of Blue Elderberry to Inform Landscape Restoration in Semiarid River Corridors. *Environmental Management* 43, 28-37.

Wilcox, C., B. J. Cairns, and H. P. Possingham. 2006. The role of habitat disturbance and recovery in metapopulation persistence. *Ecology* 87:855-863.

Question 7. Did the Service accurately assess the efficacy of past and on-going beetle management activities in conserving the valley elderberry longhorn beetle?

Yes, this aspect is well handled in my opinion.

Question 8. Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous or that could be condensed?

This is not a concern.

Question 9. Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened, and if so, how?

The lack of consideration of habitat dynamics and population turnover through time mean that the basis for considering the (meta)populations likely to persist is incorrect. We are given a misleading impression of number of extant populations and sites with habitat for the beetle by the summary of information presented. The Argentine ant as an invasive predator also needs to be given more full consideration in the likelihood of future populations of beetles being present at particular sites. Results for the lack of recruitment of elderberry on dammed rivers are important and need to be considered. The future distribution of riparian woodland habitats and expected future frequency of drought, fire and flooding should also be considered. Hence there are a wide range of omissions and these compromise the soundness of the science used.

Question 10. Are scientific uncertainties clearly identified and characterized, and are the potential implications of the uncertainties for the technical conclusions clear?

77 FR 60238 actually goes too far in outlining uncertainties because it dismisses what are (in my opinion as a scientist) sound and reliable scientific findings. I have outlined these above. The effects of altered environmental regimes due to climate change and likely future distribution of riparian woodlands would benefit from further characterization.

REVIEWER #4:

General Comments

Overall I believe that the Service's actions are premature and new studies (censuses of both host plants and the VELB as well as general conditions of the sites) need to be done at all sites. This may actually require two years of censuses to examine turnover rates. Also, the study should probably include mitigation and restoration sites to examine the efficacy of these actions.

Question 1. Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical and supported by the data and information in the proposed rule, especially in regards to the beetle's biology, current habitat (including habitat connectivity and the availability of beetle habitat within riparian vegetation), range (including lost historical range), distribution, population size, and population trends?

Superficially the Service findings are accurate that at the time of listing there were 3 known locations and currently there are 25 (or 30 if one counts the five sub-locations within location 1). However, the data are old; mostly the Service is relying on censuses done prior to 1995. There is little or no data available for most of the newer mitigation and restoration sites, and it is not even known by the Service whether the plantings are still viable. The range and distribution appears to be larger than at listing again due to limited available data at the time of listing. The Service seems to rely upon the statement "best available information or data" when data are not available to show whether a trend of increasing or decreasing viable sites are occupied. It seems that as long as no data show a negative trend, then it is assumed that the valley elderberry longhorn beetle will persist. No estimates are available for population size or trend in population numbers. In some cases, it is not even known whether the listed species is the one being counted or it is the California elderberry longhorn beetle.

Under the proposed delisting mechanism the VELB will be monitored for 10 years, but since the beetle is not monitored consistently nor are the mitigation and restoration sites monitored when the VELB is listed, I would not expect this to suddenly change when delisting occurs. I would rather like to see evidence that the Service is currently monitoring the VELB and mitigation/restoration sites across the range of the subspecies.

Question 2. Are there instances in the proposed rule where a different but equally reasonable and scientifically sound scientific conclusion might be drawn that differs from the conclusion drawn by the Service? If any instances are found where that is the case, please provide the specifics of that situation.

Yes, the Service is also relying on its rating system of poor, fair, average, good and best levels to suggest that at most sites the VELB is doing at least fair. However, if one looks closely at Table 2 where the rankings are listed, at many of the fair sites the listed beetle is declining, status is uncertain, habitat is limited, condition is poor and presence is questionable or uncertain. This does not sound as if the VELB is likely to persist in these 10 habitats. Four sites are listed as uncertain or unknown. At the one average site the population is suggested to be probable, but it may actually be the CELB and not the listed subspecies. Even at many of the good sites

persistence is only probable due to lack of data, habitat problems, outdated censuses, lack of evaluation of threats, and again proper ID of the species present. Thus many of the 25 or 30 locations should be disregarded due to the lack of current data.

Question 3. Does the proposed rule provide accurate and balanced reviews and analyses of the factors relating to the threats of the beetle (at the time of listing, currently, and in the future), including potential impacts from climate change and the future anticipated level of threat for habitat loss and potential sources of habitat loss? Are the Service's findings regarding threats to the species biologically sound and supportable based on the information and data in the proposed rule?

No, the proposed rule does not provide accurate and balanced reviews and analyses. It is very much a glass half full scenario. When problems are mentioned, they are largely discounted and we see the phrase, best available information or data, especially when no data is available. Threats are discounted out of hand and there are no analyses of combined threats at each location. Each type of threat is considered independently. In many cases, the threats to particular sites are unknown. Overall, I think that the Service relied too heavily on old data and should conduct censuses before the delisting rule takes effect or is approved.

Question 4. Does the proposed rule provide a logical and accurate review of the valley elderberry longhorn beetle recovery plan objectives, implementation, and evaluation?

There were not specific recovery goals other than finding more sites with the VELB present across a broader geographic range. There were no specific criteria listed for recovery conditions for delisting. The proposed rule did state that while only three records existed at the time of listing, 25 or 30 "sites" were found to show evidence of VELB presence. However, the evidence for occupancy is not clear cut with potential misidentification due to relying mainly on exit holes and most of the evidence is old or missing. Evaluation of these sites should include recent (less than two years) censuses and habitat evaluation.

Question 5. Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the Service use the best available science to support its assumptions, arguments, and biological conclusions? If any instances are found where the best available science was not used, please provide the specifics of each situation.

The proposed rule does report the analyses, studies, and literature accurately, but disregards any negative data or conclusions, especially when data are limited to a few sites. Consider the Argentine ant, no censuses on it or the earwig (another predator) are available, so the Service says according to best data available there is no problem with either, but it should be examined, but the delisting should still move forward.

Question 6. Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document? Please identify any such papers.

Ruhl, J.B. 2008. Climate change and the Endangered Species Act: Building bridges to the no-analog future. Boston University Law Review 88:1-25.

Question 7. Did the USFWS accurately assess the efficacy of past and on-going beetle management activities in conserving the valley elderberry longhorn beetle?

No, the Service has not done adequate monitoring and management of the listed species. According to Holyoak (2010), the Service does not keep up on monitoring of mitigation and restoration sites nor does it initiate or perform widespread censuses. My own experience from getting mitigation reports from the Service to look at success of those sites is that the Service had not evaluated any of the reports in terms of VELB migration into these sites.

Question 8. Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous or that could be condensed?

The proposed rule does not need additional detail or explanation; it needs a careful re-evaluation of the information and data, especially the lack of such, when considering moving forward with delisting. One key question is whether the Service expects the VELB to persist over the entirety of its range or within a smaller area and if so, what key areas need to be better protected.

Question 9. Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened, and if so, how?

No, the decision is not on a firm scientific foundation, the foundation is missing (old and missing data and information). A better understanding of metapopulation or spatial ecology is needed to see that the population is becoming more and more fragmented over time (but again lack of data for a better analysis is greatly needed). I think that the decision to delist is premature and the Service should follow through with the activities of the delisting program BEFORE delisting occurs.

Question 10. Are scientific uncertainties clearly identified and characterized, and are the potential implications of the uncertainties for the technical conclusions clear?

The uncertainties are largely ignored. The ESA strongly suggests that the precautionary principle should be followed and that is not the case here. Uncertainty is taken as no negative indications of potential extinction. Also the finding that the delisting proposed rule was found not to have a "significant impact" under Executive Orders 12866 and 13563 does not agree with the reality of the situation. The management and monitoring of the VELB significantly impacts the economy and land management within the Central Valley of California. It affects local, state and federal government actions as well as those of private citizens with elderberry bushes on their property. It has affected bridge retrofitting for earthquakes, management of bike trails, and levee and river management.

Uncertainties include the potential impact of climate change. Ruhl (2008) suggested a number of ways in which climate change could impact endangered species including: geographic isolation (relic populations left behind), life-stage habitat loss, altered biological events (including

phenological changes), increased stress (droughts and thermal stress), adaptive migration (including migration of competitors and predators into greater overlap with the target species), opportunistic invasions (as suitable range expands or contracts), direct habitat conversion (potential loss of elderberry scrub habitat with warming), degraded ecological conditions (due to spread of human activity), and induced invasions (range expansion due to human activity such as with the Argentine ant). One potential impact for riparian habitat in the Central Valley which includes much of the VELB habitat is reduced stream flow and snow pack in the Sierra Nevada decreases with regional warming.

Overall, I think that better understanding of the basic biology of the VELB needs to be examined even if it is necessary to use the CELB in experimental trials. One key factor is how far can the VELB disperse between sites. This influences the genetics, population dynamics, and spread of the species to mitigation and restoration sites. I think that a spatially explicit model needs to be developed to examine the long-term, large spatial scale of the VELB population dynamics. The model also would need to consider climate change effects. For example, the hypothesized reduction of Sierra Nevada snowpack will influence stream run-off in the Central Valley affecting riparian vegetation communities and the animal communities and species such as the VELB that rely upon this vegetation and ultimately upon the run-off (California Department of Water Resources, Climate Change, http://www.water.ca.gov/climatechange/). Coupled with increasing temperatures, riparian ecosystems may be greatly stressed over the coming years. Including these potential changes into any model would be critical to better understand the challenges of conservation of the VELB.

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