Analysis of Biological Assessment of Oakland Zoo Expansion Impacts on Alameda Whipsnake

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The East Bay Chapter of the California Native Plant Society and Friends of Knowland Park requested that I review the conclusions of the Oakland Zoo's environmental consultant, Swaim Biological, Inc.(SBI), regarding the impacts of the Zoo's planned expansion on Alameda whipsnake (*Masticophis lateralis euryxanthus*) aka Alameda Striped Racer. The Oakland Zoo wishes to expand onto 56 acres of the western highlands of the remaining 340-acre portion of upper Knowland Park. This expansion would convert >18% of the remaining area, which is known to support at least one Alameda whipsnake, and which is surrounded by residential areas on all sides except the eastern-most boundary with Chabot Regional Park. I am a wildlife research biologist with a Ph.D. in Ecology from the University of California at Davis in 1990. I have authored numerous publications on special-status species issues. My qualifications for preparing a review and my CV are summarized at the end of this report.

Site Visit and Document Review

I visited the project site on 27 February 2013. I walked over the western highlands of upper Knowland Park, and noted the condition of the maritime chaparral, annual and native grassland, and other types of vegetation.

I reviewed a Biological Assessment prepared by Swaim (2011), as well as a second version of the Biological Assessment (Swaim 2013). I also reviewed the several reports that were attached to that assessment. I reviewed letters of correspondence on the proposed project authored by Kim Squires (US Fish and Wildlife Service), Scott Wilson (California Department of Fish and Game), Dr. Joel Parrott (Oakland Zoo), as well as the Programmatic Biological Opinion for the East Alameda County Conservation Strategy, an Information Request for Section 7 Consultation from Eric Tattersall (US Fish and Wildlife Service), and the Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California (November 2002). I also reviewed a US Geological Survey study of the genetics of Alameda Whipsnake (Richmond et al. 2011).

Comments on Impact Conclusions

According to Swaim (2013:17), the Oakland Zoo plans on enhancing the habitat in Knowland Park. This enhancement would consist of "*control and eradication of target invasive species such as broom and fennel, and through revegetation with native grassland, riparian, and woodland species where the native cover types have been displaced by non-native species*." The Zoo further plans to involve community groups in controlling invasive plants and revegetating native species as habitat restoration within a 20-acre "Ecological Recovery Zone," just outside the California Exhibit. However, the terms *habitat restoration* and *habitat enhancement* are only meaningful when directed toward specific biological species that are intended to benefit from the restoration or enhancement. Habitat is the place in the environment where a particular species lives (Hall et al. 1997), so habitat restoration is the preparation of conditions necessary for a species to live where it had formerly lived but had at some point in time lost its ability to live there due to habitat loss or habitat degradation. Habitat enhancement is the improvement of habitat conditions, where the habitat has been degraded for some particular reason. Otherwise, what is termed habitat restoration or habitat enhancement is really just a gardening exercise (Morrison 2002).

Intending to perform habitat restoration implies that the species can be restored to a place where it was previously extirpated. However, upper Knowland Park is known to support Alameda whipsnake, so Alameda whipsnake is neither extirpated nor in need of restoration in Knowland Park. Efforts to "restore" habitat where the species exists could actually harm the local snakes.

Intending to perform habitat enhancement implies that the species' habitat can be improved, presumably to improve reproductive success and survival rates. However, upper Knowland Park is known to support Alameda whipsnake, and there has been no connection made between the species' condition and measured resource variables. It remains unclear what, if anything, could be done to enhance habitat of Alameda whipsnake in upper Knowland Park. Efforts to "enhance" habitat in the face of high uncertainty over limiting resources could actually harm the snakes.

Managing habitat for endangered species requires considerable care, most especially when doing so in a relatively small area vulnerable to the effects of habitat fragmentation. Habitats of endangered species are usually poorly understood. It is often unknown exactly which environmental resources most limit the species in its habitat. In the face of high uncertainty of the limiting factors, a scientifically defensible approach would be to manage the habitat in an experimental design so that the investigator can learn about the species' habitat before implementing more expansive management actions. The experimental treatments must be of sufficient spatial and temporal grain and extent for the species to notice the treatments and for the investigator to measure the species' response to the treatments. However, the goal of conserving the species also requires limited experimental treatment to prevent any large-scale adverse impacts on the species (US Fish and Wildlife Service 1989). In my experience, a balance must be found between the needs of experimentation and the immediate need to conserve the species. This balance can be achieved, for example, by replicating and interspersing treatments arbitrarily or systematically rather than randomly (Hurlbert 1984).

The habitat enhancement plan proposed by the Oakland Zoo includes no experimental design, and no means for learning how Alameda whipsnake might respond to the Zoo's weed control and planting program. It is universal in its implementation, so that if anything about it is detrimental to the snake, then the adverse effect will apply to the entirety of the treated area. The plan includes no linkage between management actions (i.e., weed pulling and native plant cultivation) and the factors hypothesized by biologists to be limiting the snake.

Swaim's (2011) account of Alameda whipsnake use of the project site was confusing. According to Swaim (2011), "*Habitat modeling within the project area indicated a mosaic of core habitats spaced close enough that any one Alameda whipsnake on site would utilize* *several core habitats and if an Alameda whipsnake population were present, it would use most if not all of the area to varying degrees (Swaim 2011).*" In the 2013 Biological Assessment, Swaim (2013:23) wrote, "*…the surveys also documented the species is not thriving and that there is a potential that a breeding population does not currently occupy the site*." The 2011 passage established the premise that the site would be used in full by a single snake, if a population was present, and the second passage concludes a breeding population is likely absent due to the capture of only a single snake. The protocol surveys were designed for detection of the species, and not for quantifying numbers or for determining the presence or absence of populations, let alone breeding populations or whether a population is "thriving." I have performed many protocol surveys for special-status species, and I have detected the targeted species numerous times, but I never used these detections as a basis for concluding population status because doing so would be inappropriate. Conclusions about population status need to be made from much more extensive investigations.

The first quote noted in the preceding paragraph indicates that Swaim is conflating terminology from home range analysis to habitat characterizations, as there is no such operational term in wildlife biology as a "core habitat." In her cited report (Swain 2011), she cited a series of unpublished reports of her radio-telemetry work in the early 1990s on Alameda whipsnake, resulting in the delineation of core activity areas. This type of characterization is common in home range studies, but the vegetation occurring in core activity areas should not be interpreted as "core habitat." Core activity areas in home range studies apply to individuals, whereas habitat applies to species. The levels of demographic organization and spatial grain and extent are very different between home range studies and species' habitat descriptions. It must be remembered that individuals are members of larger demographic units (e.g., populations), which are the more reliable units for performing habitat analysis.

In her habitat modeling, Swaim (2011) inappropriately used vegetation cover types typical of the core activity areas within home ranges that she delineated for an unstated number of individual snakes in the early 1990s at other locations. Core activity areas are not necessarily where the species' most limiting resources occur, and they are not where meaningful habitat analysis is performed. In human terms, Swaim's approach is akin to delineating human habitat by the walls of living rooms, thereby omitting bathrooms, kitchens, bedrooms, neighborhoods, towns, and agricultural fields.

In both quotes noted in the earlier paragraph, Swaim (2011, 2013) did not define what she meant by "population" in the related discussions. How many individuals would comprise a population? And where would be the boundaries of the population? Certainly, no population studies were performed since these require an appropriate experimental design that would address these issues. More importantly, what does it matter whether the Alameda whipsnakes living in Knowland Park comprise a population? The answer is that it does not matter. The Alameda whipsnake captured by the consultant in Knowland Park, and the other Alameda whipsnakes that likely also reside in Knowland Park, most probably interact with other Alameda whipsnakes outside Knowland Park, likely to the east of the Park. It would be scientifically unreasonable to conclude that the captured snake was alone and isolated, and it would be scientifically imprudent to make this conclusion in the face of high uncertainty and when dealing with such a rare, important resource (National Research Council 1986, Shrader-

Frechette and McCoy 1992, O'Brien 2000).

According to Swaim (2013:27), the zoo animal "*enclosures will provide significant habitat value for the ARS and are considered a permanent affect [sic] but not a total loss of habitat*." This conclusion appears to have been based on hopeful speculation as there are no data presented that show that conditions within captive animal enclosures can support Alameda whipsnake. There is no reasonable, scientific basis for concluding that the enclosures will provide significant habitat value for Alameda whipsnakes since captive animals spend large amounts of time digging, pawing, trampling and otherwise degrading the vegetation upon which they're enclosed for most of the day. In fact, the zoo animal enclosures might serve as ecological sinks if Alameda whipsnakes venture into them because they will contain large predatory animals that could easily prey upon the snakes or very large grazing ungulates that could trample them. Swaim's conclusion is inconsistent with the precautionary principle in risk assessment.

Further, the addition of thousands of feet of permanent fencing, seven gondola towers, and hundreds of feet of gondola line (Swaim 2013: Figure 10) would offer increased perching opportunities for raptors to hunt Alameda whipsnakes and other local wildlife. This is an impact of the project to Alameda whipsnake that is neither analyzed nor mitigated.

To manage fuels around constructed buildings, and I would assume around the fence as well, Swaim (2013:27) explains that "*Stumps will not be removed and all thinning will reduce shrub cover to no less than 25% cover to maintain high quality ASR habitat*." Again, the terminology is vague, and the conclusion is apparently based on optimistic speculation. It is unclear what Swaim means by high quality habitat -- whether quality is measured as the number of resident individuals, the production of young, or the number of young surviving to breeding age. Furthermore, Swaim cannot know whether fuels management resulting in ≥25% cover will maintain, improve, or destroy the habitat, which is the very reason that the prudent approach to managing endangered species habitat is to do it in phases and using a conservation-moderated experimental design (discussed above).

Swaim (2013:28) claims that "…*thinning of shrubs is beneficial to the ASR in many situations where lack of natural disturbance results in dense closed canopy communities*." This may be true, but Swaim presented no evidence in support of this claim. It would be reassuring to know where thinning of shrubs has proven to be beneficial to Alameda whipsnake, where the proof was in measurement of the response of the snake, and the results peer-reviewed and published. Without the proof, it would be misguided to universally thin shrubs (i.e., not experimentally and not in a phased manner) in an area known to support Alameda whipsnakes.

According to the Programmatic Biological Opinion for the East Alameda County Conservation Strategy (page 40), the Primary Constituent Element was characterized as "*scrub/shrub communities with a mosaic of open and closed canopy*" and went on to include details that appeared to me to be consistent with the conditions I observed in upper Knowland Park. In other words, the Alameda whipsnake does not appear to be in urgent need of habitat restoration or enhancement in upper Knowland Park. That said, I suggest that it might be helpful to reduce the grazing pressure on the grassland portion of the Park, and it would be prudent to do so in an experimental design tailored to measuring a response by Alameda whipsnake (e.g., see Smallwood et al. 2009 on an experimental grazing regime designed to measure raptor foraging responses to shifts in grass height and small mammal abundance).

The next most important Primary Constituent Element in the Programmatic Biological Opinion for the East Alameda County Conservation Strategy was characterized as "*woodland or annual grassland plant communities contiguous to lands containing PCE 1*," i.e., the conditions summarized in the previous paragraph. Upper Knowland Park includes these conditions, as well. In fact, upper Knowland Park also includes Primary Constituent Element 3, which listed rock outcrops and mammal burrows. Upper Knowland Park appears to include all the Primary Constituent Elements described in the Programmatic Biological Opinion for the East Alameda County Conservation Strategy. The proposed Zoo expansion would reduce the availability of these Primary Constituent Elements in Knowland Park.

According to Richmond et al. (2011), who performed what will likely turn out to be a landmark study of the genetic history and status of Alameda whipsnake, the Priority 1 conservation strategy for conserving Alameda whipsnake would be to conserve the whipsnakes in western Alameda County. Western Alameda County appears to be where whipsnakes "*…more closely resemble the common ancestral haplotype for the Central CA clade. By targeting the ancestral 'type' for conservation, our presumption is that we would be preserving the original variation that ultimately gave rise to the diversity that exists today*"(Richmond et al. 2011:44). Furthermore, Richmond et al. (2011:40) advocated for further genetic study of the whipsnake in the areas yet to be sampled between the major clusters identified in their study. No samples were available from Unit 2, including from the whipsnakes in Knowland Park. Studies in these locations are important because genetic clines reveal the distance at which whipsnakes move between habitat areas, "*and where the most important areas of gene exchange exist. In turn, managers may want to focus their efforts on conserving the habitat in these particular places*."Eliminating the Alameda whipsnake from Knowland Park through habitat destruction would also eliminate the possibility of learning whether and how the individuals in the Park contribute to a cline within the very area of the ancestral type for this species.

Comments on Mitigation

Conserving land onsite as a mitigation measure, as described in Swaim (2013:37-40) is redundant because the land in Knowland Park is already supposed to be conserved. Preserving property that is already supposed to be preserved provides the Alameda whipsnake with no added conservation value, and no offset to the project's impacts. In fact, the project, once constructed, would likely degrade the remaining Alameda whipsnake habitat in Knowland Park, as the invasive species spreading from the current facilities would have even more disturbed areas from which they can spread. Furthermore, the fuels management that will be required by fire departments around roads and fencing will likely open up additional disturbance for invasive species to establish footholds. Fuels management might also cause additional habitat loss due to rill and gully erosion.

According to Swaim (2013:42), "*Continual reduction of the distribution of several not native shrubs and trees that negatively impact the quality of vegetative cover for the ASR will be the* *primary criteria for success of the mitigation*." As I explained above, this success criterion (note that I used the singular and not the plural) qualifies the mitigation effort as a gardening exercise with no measured bearing on Alameda whipsnake. Swaim only assumes that the removal of non-native shrub species will benefit the snake, when in reality it might have the opposite effect. Furthermore, this measure includes no thresholds of success directly relevant to the snake--there are no criteria for measuring the different effects of reducing all vegetation density as opposed to removing non-native shrubs-- and no consequences for failure.

Comments on Determination

Swaim (2013:42) concluded, "*Golf Links Road and Skyline Boulevard separate these two areas, which are considered a significant deterrent to movement to Alameda whipsnakes potentially moving into the project area (Swaim 2011)*." The basis of this conclusion appears to be the characterization of the snake as wary of roads. It is thought that the snake is so wary that it will not attempt to cross roads. However, an Alameda whipsnake was discovered as road-kill in Contra Costa County in May 2007 (http://www. wildlifecrossing.net/california/roadkill/7772), indicating that the snake does at least attempt to cross roads. The reader is also led to believe that the basis of this conclusion can be found in the cited report (Swaim 2011), but what I found in this cited report (page 5) was the following: "*To the east, a major road (Golf Links Road) bisects Knowland Park into two areas. This road does not function as a complete barrier to movement, but likely is a significant deterrent. The potential for whipsnakes moving into the site from the closest known occupied habitat to the east is limited by the need to cross both Golf Links Road and Skyline Boulevard further to the east. The potential for AWS to come to the site via other routes has not been specifically analyzed*." This source material is speculative, and not based on evidence. The genetic evidence is less convincing, as Richmond et al. (2011) were unable to support the hypothesis that highways affect population pairwise genetic differentiation after controlling for geographic distance. This result does not mean that highways do not cause habitat fragmentation, but so far the evidence fails to support the hypothesis.

Conclusions

The proposed project has more potential to harm than to conserve Alameda whipsnake. Upper Knowland Park includes the Primary Constituent Elements of the snake as described in the Programmatic Biological Opinion for the East Alameda County Conservation Strategy. At least one Alameda whipsnake was found in upper Knowland Park, and it would be biologically and scientifically unreasonable to conclude that this snake was alone and isolated from others of its species without appropriately designed population studies. After all, the species is rare--which is why it is listed in both the state and federal ESA. Swaim's habitat analysis was based on a flawed characterization of habitat (i.e. the conflation of core activity areas to "core habitat"), and her conclusions were too dismissive of the species' habitat potential in the face of high uncertainty related to such a rare and valuable resource. The case for habitat restoration was ineffective, especially given that the snake is known to occur on the site, so habitat is known to be available. The case for habitat enhancement was equally weak, as no connection was made between measured resources and the welfare of Alameda whipsnake. The proposed mitigation measures would more likely cause harm to Alameda whipsnake than it would to help the species. If anything is to be done to the vegetation in upper Knowland Park, it should be done very carefully and in a conservation-focused experimental manner.

The Biological Assessment concludes that the conservation and compensation measures will offset the net effects to the Alameda whipsnake and ensure that the project will not appreciably diminish the species' chances of survival or recovery (Swaim 2013:43). For the reasons explained in this report, the Biological Assessment does not support this conclusion. Given the extremely limited distribution of Alameda whipsnake and the permanent constraints imposed on the whipsnake's capacity to expand (i.e., recover) via habitat restoration or habitat enhancement due to human encroachment, the loss of any additional habitat could appreciably diminish the whipsnake's chance of survival and recovery.

My Qualifications

I earned a Ph.D. degree in Ecology from the University of California at Davis in 1990. Subsequently I worked at U.C. Davis for four years as a post-graduate researcher in the Department of Agronomy and Range Sciences. My research has been on animal density and distribution, habitat selection, habitat restoration, interactions between wildlife and human infrastructure and activities, conservation of rare and endangered species, and the ecology of invading species. I have authored numerous papers on special-status species issues, including "Using The Best Scientific Data For Endangered Species Conservation," published in Environmental Management (Smallwood et al. 1998), and "Suggested Standards For Science Applied To Conservation Issues" published in the Transactions of the Western Section of The Wildlife Society (Smallwood et al. 2001). I served as Chair of the Conservation Affairs Committee for The Wildlife Society – Western Section. I am a member of The Wildlife Society and the Raptor Research Foundation, and I was a part-time lecturer at California State University, Sacramento. I was also Associate Editor of wildlife biology's premier scientific journal, The Journal of Wildlife Management, as well as of Biological Conservation, and I was on the Editorial Board of Environmental Management. I have performed numerous surveys for special-status species, including for California red-legged frog, California tiger salamander, Fresno kangaroo rat, salt marsh harvest mouse, California clapper rail, burrowing owl, Swainson's hawk, and many others. My CV is attached.

References Cited

CDFG (California Department of Fish and Game). 1997. Guidelines for assessing the effects of proposed developments on rare, threatened, and endangered plants and plant communities. California Department of Fish and Game, Sacramento.

CNPS (California Native Plant Society). 1998. Mitigation guidelines regarding impacts to rare, threatened, and endangered plants. California Native Plant Society. http://www.cnps.org/archives/mitigation2.htm.

Hall, L. S., P. R. Krausman, and M. L. Morrison. 1997. The habitat concept and a plea for standard terminology. Wildlife Society Bulletin 25:173-182.

Hurlbert, S. H. 1984.   Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54:187-211.

Morrison, M. L. 2002. Wildlife restoration: Techniques for habitat analysis and animal

monitoring. Island Press, Covelo, California.
National Research Council. 1986. Ecological knowledge and environmental problem-solving: concepts and case studies. National Academy Press, Washington, D.C.
O'Brien, M. 2000. Making better environmental decisions: an alternative to risk management. The MIT Press, Cambridge, Massachusetts. 283 pp.
Richmond, J. Q., D. A. Wood, C. Hoang, and A. G. Vandergast. 2011. Quantitative assessment of population genetic structure and historical phylogeography of the Alameda Whipsnake *Masticophis lateralis euryxanthus*. US Geological Survey, San Diego, California.
Shrader-Frechette, K. S., and E. D. McCoy. 1992. Statistics, Costs and Rationality in Ecological Inference. *Tree* 7: 96-99.
Smallwood, K.S., J. Beyea and M. Morrison. 1999. Using the best scientific data for endangered species conservation. Environmental Management 24:421-435.
Smallwood, K.S., A. Gonzales, T. Smith, E. West, C. Hawkins, E. Stitt, C. Keckler, C. Bailey, and K. Brown. 2001. Suggested standards for science applied to conservation issues. Transactions of the Western Section of the Wildlife Society 36:40-49.
Smallwood, K. S., L. Neher, D. Bell, J. DiDonato, B. Karas, S. Snyder, and S. Lopez. 2009. Range Management Practices to Reduce Wind Turbine Impacts on Burrowing Owls and Other Raptors in the Altamont Pass Wind Resource Area, California. Final Report to the California Energy Commission, Public Interest Energy Research – Environmental Area, Contract No. CEC-500-2008-080. Sacramento, California. 183 pp. http://www.energy.ca.gov/ 2008publications/CEC-500-2008-080/ CEC-500-2008-080.PDF
Swaim, K. (Swaim Biological, Inc.). 2011. Oakland Zoo California Project Biological Assessment. Report to EastBay Zoological Society, Oakland, California.
Swaim, K. (Swaim Biological, Inc.). 2013. Oakland Zoo California Project Revised Biological Assessment. Report to EastBay Zoological Society, Oakland, California.
USFWS. 1989. Sandplain gerardia (*Agalinis acuta*) recovery plan. U.S. Fish and Wildlife Service, Region 5, Newton Corner, Massachuesetts.