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U.S. Fish and Wildlife Service
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Dear Officers,

I have now reviewed the document titled "Species Status Assessment for the Hermes copper butterfly (*Lycaena* [*Hermelycaena*] *hermes*) Version 1.0", prepared by the Region 8 U.S. Fish and Wildlife Service, Carlsbad CA, and I hope that my assessment of the report will help better interpret the scientific information relevant to conservation of this species.

The distribution, biology, landscape use, and behavior of the Hermes Copper Butterfly (*Lycaena hermes*) in its San Diego county range has been studied extensively over the last couple of decades. This report summarizes these findings and synthesizes species viability considering numerous factors that affect their species distribution. Broadly, findings indicate (a) low levels of genetic differentiation across its distribution, mostly concentrated along the peripheral populations, (b) predominantly wildfire mediated extirpations and species fragmentation, (c) low levels of long distance dispersal, and (d) numerous uncertain biotic and abiotic factors that could potentially contribute to furthering species decline.

While I largely agree with the ecological assessments of species range, distribution, extirpation, and restoration, I have some concerns about the interpretation of the limited population genetic analyses performed on this species across its range. The study of Deutschman et al. 2010 suggests potential for sex-biased dispersal in the species. This study does not quantify migration rates across subpopulation. The same observation holds for the study of Strahm et al. 2012, which reports little differentiation among populations, indicative of potential homogenization by gene flow. However, whether this potential gene flow occurred due to historical or contemporary processes is yet to be addressed. Considering the fact that ecological studies indicate very little natural vagility, this requires confirmation with additional population genetic analyses that directly estimate levels of historical and recent gene flow.

A second concern has to do with the landscape genetic study of Strahm et al. 2012. On pg. 12, the report suggests that this study suggests that landscape features impede movement within the species range. While this could be true based on mark-recapture based studies, this is not quite clear at all from the landscape genetics study. This study utilizes GIS data as a proxy for landscape variables, and clearly, the isolation by distance analyses indicate that there is little to no indication of genetic differentiation increasing with geographical distance. How this indicates the potential for impeding gene flow (especially since this study doesn't use landscape variables that are more representative of impeding gene flow, such as topography, or forest cover) is unclear to me.

A third concern that I have is that being a conservation report, there is little mention of either the effective population size, or the minimum viable population size. Neither are estimated as part of this study, or other studies that the report refers to. These can very well be accomplished using mark-recapture and/or genetic data. Additional features that are yet to be addressed in this species include local adaptation (ecological and genetic), quantifying inbreeding (and depression), landscape connectivity (specifically via unsampled populations/corridors), and temporal genetic variability (or loss thereof). These are important factors that are decisive to the three R's (redundancy, resiliency and representation) that are mentioned in the beginning of the report.

The last suggestion I have is that the species viability model suggested does not account for the traditional "error" variables, that are essentially other factors (including genetic, and other stochastic factors that are unaccounted for). For future work, I'd recommend utilizing a more robust probabilistic model that incorporates persistence likelihood (perhaps as suggested by the work of Schultz and Hammond 2003, "Using Population Viability Analysis to Develop Recovery Criteria for Endangered Insects: Case Study of the Fender's Blue Butterfly", Conservation Biology, http://www.jstor.org/stable/3588961).

I hope that the preparers of this report will find my comments/suggestions useful for future iterations. This report encompasses a wealth of information on the Hermes Copper Butterfly, and will hopefully serve as a guide for revising the species' conservation status. Importantly, I applaud the effort in suggesting future directions, which are key to bridge the gap between observational studies and policy.

Please feel free to contact me for any further clarifications on my assessment. I have also attached some comments on the document for your reference. I am also attaching my CV, and CoI form with this email.

Sincerely,

Arun Sethuraman