

surveyed numerous times with the wolf spider observed on only a few occasions. This indicates that, despite careful searches by trained observers, the organisms are able to move into areas of suitable habitat that are too small for humans to enter. We note that the "type locality" from where the initial specimens of the cave amphipod were collected for scientific description (the "sand chamber" of the Mahaulepu Sinkhole cave) appears to have a drier environmental regime than during initial biological surveys there in the 1970s. No amphipods have been seen in that chamber in recent years, likely due to this alteration of conditions. The Service agrees with the scientific reviewer that maintenance (and possibly enhancement) of suitable environmental conditions of caves and voids is an important consideration in conservation of the caves species.

(3) *Comment:* Two scientific reviewers recommended that the size of the critical habitat areas should be sufficient to protect adequate population numbers such that, in the event of local extirpations of the species due to natural disaster or disease, recolonization of these areas can occur.

*Our Response:* We agree, and we consider the issue of population dynamics central to the concept of conservation of the species. The cave species have characteristics that make estimates of population sizes and dispersal capabilities difficult. In addition, the species have naturally low reproductive potential. These characteristics highlight the importance of ensuring that the populations do not slip towards extinction due to demographic stochasticity (natural disaster, disease, invasive species interactions) or suffer from the effects of loss of genetic variability (inbreeding, genetic drift). We feel that our revised critical habitat boundaries, based upon the incorporation of new information regarding the number and locations of known occupied sites and sites highly likely to be occupied, encompass a wide distribution across the Koloa Basin, which will provide adequate refugia despite the possibility that unforeseen events may eliminate the entire population of a single cave or cave complex. These modified critical habitat boundaries are described in detail in the section "Summary of Changes from the Proposed Rule."

(4) *Comment:* The proposed critical habitat designation is based upon little specific data regarding the distribution of the cave invertebrates and the caves they inhabit; this has resulted in an overly broad "blanket" approach to the proposed critical habitat boundaries. A

more reasonable approach would be to designate critical habitat around known population centers and known likely habitat.

*Our Response:* The proposed critical habitat designation was developed using the best technical information available to the Service at the time of preparation of the proposed rule. The majority of the lands where these species are found is privately owned, which severely limits and may prohibit the ability of the Service to survey caves and analyze landforms exhibiting potential habitat in short timeframes. Through ongoing outreach efforts and development of a series of cooperative conservation programs with certain landowners, a reasonable amount of scientific information had accumulated over time, and it was this available information that was used in the development of the proposed critical habitat designation. In response to Service requests for additional relevant information, several parties, including landowners and land managers, undertook surveys of their lands to obtain and share new information with the Service. This information has increased the level of specific knowledge about the species in terms of distribution of occupied and unoccupied caves, locations of additional areas with geologic features likely to contain habitat, and areas that, because of natural processes or human-caused changes, do not contain the primary constituent elements adequate for support of the species. In particular, the number of individual caves where one or both of the species are found has increased from six to nine. This has greatly influenced the technical analysis leading to the ultimate conclusion of which areas are necessary for the conservation of the species. As described elsewhere, the identification of additional known occupied habitat has resulted in refocusing critical habitat boundaries in consideration of our better understanding of the cave species populations, their distribution, the effects of habitat fragmentation, protection of isolated populations, and potential for retaining areas of habitat connectivity.

(5) *Comment:* A sand mining operation is located in Unit 2. Significant portions of this unit have been disturbed and should be excluded from designation.

*Our Response:* The sand mining operation is not included in the designation of critical habitat. As described above, new information regarding the geology and modification of potential habitat due to human activities such as the sand-pit operation, agriculture, and past and current land

use patterns, have resulted in modification of the boundaries of the proposed critical habitat. These modified critical habitat boundaries are described in detail in the section "Summary of Changes from the Proposed Rule."

(6) *Comment:* One scientific reviewer noted that the concern regarding diseases and alien species invasions is warranted, but the reference to *Bacillus thuringiensis* (Bt) toxin as a potential threat is weak.

*Our Response:* The threat of profound ecological disturbance, including species extinctions, due directly or indirectly to alien species introduction is a common theme in the conservation of virtually every native Hawaiian ecosystem. In addition to calling attention to this immediate threat, our use of the Bt example was to demonstrate: (1) That some disease and alien species threats are intentional "biocontrol" introductions that could have unintended effects upon native ecosystems (this has occurred and continues to occur in Hawaii and elsewhere); and (2) the rationale behind protecting multiple, isolated portions of suitable occupied and unoccupied habitat in the event of a catastrophic event, such as a pesticide spill or other surface disturbance.

(7) *Comment:* Based upon existing and new information, there appear to be four distinct populations of the cave invertebrates. They occur at: Kukuiula, Kiahuna, Bypass Road/Civil Defense caves, and the sinkhole area. Based upon other cave conservation efforts (including a proposed critical habitat designation for cave organisms in Texas by the Service), recovery goals can be achieved by protecting in perpetuity three discrete populations of organisms. Considering the cooperative conservation efforts of landowners at Kukuiula, Kiahuna (for caves), and at the sinkhole (presently for archeological preservation), the requisite three faunal areas for each species has been identified, which is sufficient for species protection.

*Our Response:* While the cave animals in Hawaii share some similarities with cave animals in Texas, it is inappropriate to assume recovery standards would be the same just because both occur in caves. Caves in Texas and caves in Hawaii are formed through different processes, have different food resources, and face different specific threats. Recovery standards need to be determined by evaluating individual species and their threats. Although there is no final recovery plan for either the Kauai cave amphipod or the Kauai cave wolf