LETTER

Processes affecting extinction risk in the laboratory and in nature

A fascinating laboratory experiment by Hufbauer et al. (1) manipulates genetic diversity and population size of flour beetles (*Tribolium castaneum*) in the face of a change in the resource base offered in experimental microcosms. The experiment finds that extinction risk is offset to a comparable degree by adding a few genetically diverse individuals or by more substantially elevating population size with individuals drawn from the same source pool as the experimental population, leading the authors to argue that conservation of at-risk populations is most efficiently achieved by enhancing genetic diversity. This conclusion is in stark contrast, however, to that of a previously published 12-generation field experiment with an intertidal kelp (*Postelsia palmeaformis*; the sea palm), which followed extinction risk in free-living populations after independently manipulating population size and genetic diversity, and found overwhelming effects of demographic processes relative to genetic diversity (2). In light of the divergent conclusions and the important implications of these experiments for biodiversity conservation, an essential question is why these differences may have arisen.

A key insight may be present in the field experiment (2), where detailed demographic analysis revealed that the interplay of environmental stochasticity and population size dominated extinction risk. Observing such an effect is only possible in a field setting, where inherent variability in the biotic and abiotic environment adds challenges to population viability that are not faced in a laboratory study, and cautions that extrapolating laboratory results to the management of species in nature should be done with care. Of course, details of the respective experimental designs might also influence the outcomes. For example, the laboratory experiment (1) explicitly introduces an abrupt environmental shift, whereas the field study (2) does not. Environmental changes are ongoing in the context of the field study, however, such as a documented sustained rise in ocean acidification (3, 4). Different results, particularly regarding evolutionary rescue, might be obtained under sustained vs. abrupt environmental challenge. The method of introducing genetic variation also differs among experiments, and differences in standing genetic variation derived from initial mixing of distinct genetic stocks vs. its introduction through low-level migration from different sources may have alternative outcomes; under some strategies, demographic effects may lead to extinction before genetic rescue via migration can occur (5). Finally, perhaps the dominant processes leading to extinction depend on the species in question. In any event, the results of these studies together underscore the need for more extensive experiments in populations in the wild that probe this underinvestigated but essential issue for biodiversity conservation.

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