
Critiques of PVA Ask the Wrong Questions: Throwing the Heuristic Baby Out with the Numerical Bath Water

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The analyses of Ellner et al. (2002 [this issue]), like those of Ludwig (1999) and Fieberg and Ellner (2000), suggest that although the predictions of population viability analyses (PVA) may be unbiased, the estimates of extinction risk are usually too imprecise to be worthwhile. Ellner et al. correctly reconcile the superficial discrepancies between Ludwig (1999) and Brook et al. (2000). But they then allude to the recent review by Coulson et al. (2001) that restates the widely held view (see also Harcourt 1995; Beissinger & Westphal 1998) that in circumstances where data are sparse or of low quality (commonly the case for threatened species), PVAs have little useful predictive value and should be dispensed with in favor of "alternative methods." The trouble is that none of these authors have specified why these alternatives would be superior to PVA. It is our view that even when PVAs perform poorly against some vaguely defined absolute standard, they still perform better than alternatives that are even more vague, are less able to deal with uncertainty, are considerably less transparent in their reliability, and do not use all the available information.

Conservation biologists are aware that ours is a crisis discipline (Soulé 1985) and that decisions must be made quickly and in the face of incomplete data. In such cases, any method of assessment will be uncertain. Although critiques such as those of Ellner et al. are entirely appropriate, there is a growing body of opinion (e.g., Coulson et al. 2001) that recommends dropping PVAs, without suggesting an alternative. At the moment, PVAs are the best tool available in many circumstances, and although the current debate serves to emphasize the point that they work better for some problems than for others,

the results of Brook et al. (2000) demonstrate that PVAs have value even when uncertainty exists. The options in decision-making are to use the best scientific information and tools available (e.g., PVA). The alternatives are subjective decisions made by humans, which are notoriously inaccurate (Zeckhauser & Viscusi 1990), or decisions made by bureaucrats and politicians with little or no scientific input.

We agree with Ellner et al. that in any single application PVA predictions may be unreliable, even over short time frames (see Chapman et al. 2001). This reiterates a point made earlier by Taylor (1995) that there is a statistical distribution associated with any prediction and that the confidence intervals may be broad. But PVA provides substantial information content that makes it a useful tool in applications to single species. The question of how much information is sufficient to provide a basis for reliable or useful predictions depends largely on the question being asked. For individual cases, the only objective way to assess whether data quality is high enough is to systematically incorporate uncertainties and evaluate whether the results are too uncertain to address the question at hand (Akçakaya & Raphael 1998; Caswell 2001). Even with uncertain data, or with data from related species (Gaillard et al. 2000), one might be able to conclude that extinction risk is very high (or negligible), which can be a useful result for management. In fact, the Red List system of the World Conservation Union operates on this basis (Mace & Hudson 1999).

Ellner et al. describe PVA as one of a variety of possible tools. But the three alternatives Ellner et al. mention—historical and predicted future habitat loss, recent population trends, and genetic considerations—are actually only types of information that may be used in a PVA. Akçakaya and Sjögren-Gulve (2000) describe the limitations of other decision-support tools. Reserve-selection

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algorithms have a narrow scope (reserve design) and use only occurrence data (in space). Habitat models and gap analysis ignore demographic data on population structure, dynamics, and trends. Rule-based and score-based methods have limited scope (species ranking or prioritization) but can use PVA results (e.g., Red List). Estimating extinction probability from sighting data is retrospective, running the risk that the species is already extinct), and uses only occurrence data (in time). Landscape indices such as fractal dimension ignore demographic data and have questionable relevance to viability of species. “Ecosystem-based” methods are vague, not well-developed, and not transparent.

Although each of these methods is useful for particular objectives, none can be considered a “replacement” for PVA because none uses all available information, most cannot assess management or impact scenarios, and many do not incorporate uncertainties. Although we agree that we should use whatever works, it is the responsibility of the users of other tools or methodologies to subject them to at least the level of scrutiny PVA has been subject to before they are recommended as alternatives.

Although it is often true that “even the best available science may be unable to provide the level of predictability and accuracy we might wish” (Ellner et al. 2002), it is better to use whatever guidance scientific evidence has to offer than to dispense with it simply because it is not as precise as we might wish. The latter alternative throws away knowledge. A final decision on how and when to act to protect or conserve a species always depends on human judgment. But we believe that PVA should not be ignored when it helps to set priorities, ensures the internal consistency of arguments, and eliminates semantic ambiguities that plague subjective and intuitive interpretations of evidence. Population viability analyses are applied in a wide variety of contexts, and numerical precision in forecasts is important in just some cases (Burgman & Possingham 2000). In many cases the value of a PVA is determined by the clarity it brings to a problem, and predictive reliability is relatively unimportant. Blanket advice that PVAs should be dropped will risk throwing the heuristic baby out with the numerical bath water.

The results of a PVA are just one factor in any social and political decision-making context and should be a necessary precursor to good judgment. We advocate cau-

tious interpretation of predictions, conditioned on their reliability, and contend that in the absence of any better alternative, the heuristic advantages of PVA, together with its (admittedly limited) predictive reliability, make it by far the best conservation management tool we have.

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