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Report

The Influence of the Academic Conservation Biology Literature on Endangered Species Recovery Planning

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ABSTRACT. Despite the volume of the academic conservation biology literature, there is little evidence as to what effect this work is having on endangered species recovery efforts. Using data collected from a national review of 136 endangered and threatened species recovery plans, we evaluated whether recovery plans were changing in response to publication trends in four areas of the academic conservation biology literature: metapopulation dynamics, population viability analysis, conservation corridors, and conservation genetics. We detected several changes in recovery plans in apparent response to publication trends in these areas (e.g., the number of tasks designed to promote the recovery of an endangered species shifted, although these tasks were rarely assigned a high priority). Our results indicate that, although the content of endangered species recovery plans changes in response to the literature, results are not uniform across all topics. We suggest that academic conservation biologists need to address the relative importance of each topic for conservation practice in different settings.

To address whether academic conservation biology literature is influencing endangered species recovery efforts.

> "Is it [conservation biology] merely another scientific discipline, safely nestled within the confines of academia? ... At times we seem to be documenting paths to extinction, telling ourselves that we need to do more research, developing theoretical models with insufficient consideration of their practical application, and giving each other advice on what others should be doing. If that is the limit of our expectations, then conservation biology is succeeding as a field. But if we are intent on holding back the forces driving extinction, then we are failing in a major way." (Whitten et al. 2001)
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> "Whitten et al. (2001) are confusing the academic discipline of conservation biology and the practice of conservation. ... Academics developing the principles of conservation biology do have much to contribute—such as reserve design, population theory, species recovery, and landscape management. ... Science in and of itself will not lead inexorably toward conservation, being much like an architect who cannot realize a design without a builder." (Kinnaird and O'Brien (2001) in response to Whitten et al. (2001).)

INTRODUCTION

A pervasive stereotype places academic conservation biologists in "ivory towers" in which debates about conservation practice may rage, unheeded by the individuals actually charged with managing rare and endangered species. This perception may in part underlie the Society for Conservation Biology's recent decision to create a new journal, *Conservation Biology in Practice,* with the goal of "putting conservation science into practice, and conservation practice into science." Indeed, Whitten et al. (2001) have suggested that the entire field of conservation biology might be displacement behavior for concerned biologists unable to create change on larger conservation issues and that many of the activities of academic conservation

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biologists have little effect on conservation practice or preventing biological extinctions.

However, others, including Kinnaird and O'Brien (2001) and Primack (2001), maintain that conservation biology has made and can continue to make strong contributions to stemming the tide of extinction, for example by protecting individual species, setting aside reserves, and providing the basic science necessary for sound policy. Despite the dogma that academic conservation biology is either ignored by or not practical enough for conservation practitioners, and despite the recent debate over whether this dogma is valid, few attempts have been made to quantify the degree to which ideas debated in the academic literature have an influence on conservation practice. Determining this influence, or lack thereof, is a crucial first step for assessing how readily biological theory, methods, and research can be applied in a policy context.

In this paper, we ask whether academic conservation biology has had a detectable effect on one important aspect of conservation practice, the development of recovery plans for threatened and endangered species as mandated by the United States Endangered Species Act of 1973 (amended 1988). In the United States, once a species is listed as "threatened" or "endangered", the first step in the recovery process is gathering information about the species, developing recovery goals, and devising management options (USFWS 1992). These data, in turn, are used to develop a recovery plan, "which serves as the blueprint for private, Federal, and State cooperation" on recovery activities (USFWS 1992).

We looked for an influence of the academic literature on recovery plans by asking whether conservation practices proposed in the plans corresponded to trends in the academic literature. Our goal was not to verify whether the "ivory tower" stereotype is correct, but to identify which (if any) of a set of major themes in the academic literature have been perceived to be of greater or lesser utility to conservation planners and managers. Rather than assume a disconnect between the literature and recovery plans, we let the data and evidence guide our assessments. Where evidence exists of a dissociation between academic and practical conservation biology, we attempt to identify possible causes in the hope of fostering more productive dialogue between conservation biologists of the two stripes.

Our analysis makes use of a database on recovery plans compiled in conjunction with the National Center for Ecological Analysis and Synthesis (NCEAS), the Society for Conservation Biology (SCB), and the U.S. Fish and Wildlife Service (USFWS), as described by Boersma et al. (2001) and Hoekstra et al. (2002). The data were gathered using a survey developed jointly by SCB and USFWS; the database contains information on 181 endangered species compiled from 136 recovery plans approved by the USFWS or the National Marine Fisheries Service (NMFS). For a description of the type of questions asked in the survey, see Hoekstra et al. (2002). We focus on four major themes of the academic literature: metapopulation dynamics, population viability analysis (PVA), conservation corridors, and conservation genetics. We chose these themes because all of them have been the subjects of considerable attention or debate in the literature, because sufficient data on these topics existed in the recovery plan database, and because we could only examine a finite number of themes. Moreover, these themes achieved prominence in the academic literature during the years spanned by the recovery plan database, allowing an assessment of whether plans changed in response to them. Although all of our four topics might not be relevant to any individual species, we hypothesized that our analyses could detect general trends across the wide diversity of recovery plans, taxonomic groups, and species included in the database.

METHODS

We hypothesized that an influence of the academic literature on the content of recovery plans could be manifested as an upswing in the proportion of plans addressing a particular topic after that topic had received considerable attention in the academic literature. We defined "considerable attention" to mean that 50% of all papers published on a topic had already appeared during the years spanned by the database of recovery plans (1980–1998). We then asked whether a significantly greater proportion of recovery plans addressed that topic after the median publication year than before. Note that we might also obtain a significant result from this test if both the academic literature and recovery plans are responding to the same external influences. Significant results from these analyses, however, are consistent with the possibility that the literature is having an influence. We then used the results of these analyses to ask with finer resolution which areas of research in academic conservation biology are (and more importantly, which are not) exerting a possible influence on conservation practice to identify areas where either relevancy or communication might need to be improved. We chose the year the median article was published for several reasons. First, it is a replicable metric that can be applied consistently, and is independent of the absolute number of articles published on a topic. Second, it is likely to be conservative: if “considerable attention” were achieved after ¼ of the articles were published or after 10 or 20 early “influential” articles were published, plans approved after “considerable attention” was achieved would be placed in the “before literature median” category, thus obscuring any difference between plans approved before vs. after the literature median.

Table 1. Definitions of terms related to U.S. Endangered Species recovery plans, as used in the text.

Term	Definition
Data collection	The collection of any information on the population or species; in contrast to *Monitoring*
Monitoring	Taking direct measures of a population or species to determine if recovery is occurring; in contrast to *data collection.*
Recovery criteria	Criteria or requirements that must be fulfilled to down-list or de-list the endangered species or population.
Recovery task	A list of specific activities designed to promote recovery of the species. A list of recovery tasks is contained in the Implementation Schedule of every plan.
Task priority	Recovery tasks are ranked on a scale of 1–3, with 1 being “high priority” in our usage.

We identified the median publication year for each of our four topics by conducting literature searches with Biological Abstracts (WebSPIRS Version 4.11, coverage from 1980–1998). Searches were performed in April 2000, leaving adequate time for Biological Abstracts to index articles and include them in their database. We restricted our searches to years covered by computerized databases to minimize the influence of human error and subjective judgments. There were relatively few publications on our topics in 1980 and 1982 (between zero and two per year), suggesting that omitting articles published before 1980 did not bias our results. For PVA, metapopulation dynamics, and conservation corridors, we searched for papers with the following key terms in the title, abstract, or subject heading: "population viability analys* OR minimum viable population*", "conservation AND corridor*", "metapopulation*" (the symbol “*” refers to any string of characters). For conservation genetics, searches employing this style yielded too many references on molecular genetics and genetic engineering, so we searched for "conservation AND genetic* NOT engineering NOT evolutionary conservation" in the subject heading. Inspection of these searches revealed that conservation biology references were not excluded. We then categorized each recovery plan in the database as having been approved before or after the median publication year for each of the four literature topics. We coded all plans that were approved during the median publication year itself as having been approved after the literature median. Although this may appear counterintuitive, we made this decision to avoid strongly unequal sample sizes that would invalidate statistical analyses (see below).

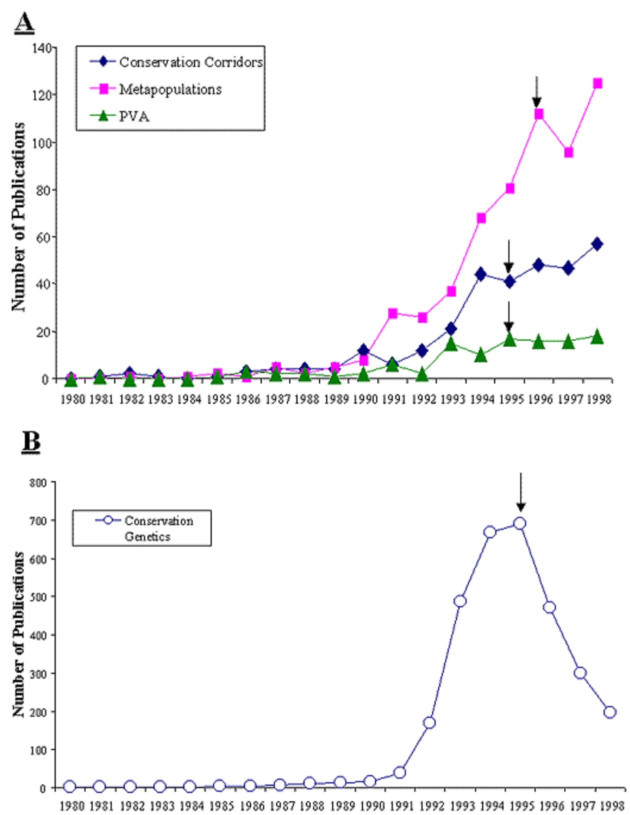
To evaluate plan content, we focused on seven questions for each conservation topic. We formulated our questions to take advantage of features common to all endangered species recovery plans. The definitions of the terms we use here are provided in Table 1. In particular, we asked the following "yes" or "no" questions of each plan in the database: (1) were data on the topic presented, or did the plan state that such data would be beneficial? (2) were recovery tasks assigned specifically to collect data on the topic? (3) were those tasks assigned a high priority? (4) were tasks assigned to monitor or manage factors related to the topic? (5) were those tasks given a high priority? (6) were the data collected on the topic during monitoring intended for use in a model for predictive analyses? and (7) were data related to the topic used to develop recovery criteria? Detailed information on how we extracted data from the publicly accessible database, SCB Recovery Planning Homepage, is available in the appendix. We emphasize that these data only pertain to plan content at the time of approval; even though these data may not reflect the up-to-the-minute actions of recovery efforts, they are a consistent, quantifiable metric of plan content that can be applied to all plans.

Answers to survey questions that were clearly inappropriate (e.g., metapopulation information for species with only a single remaining population) were scored as missing data. As the survey data pertain to individual species but an entire recovery plan is the appropriate unit of analysis (because the decisions to gather genetic data or perform a PVA, for example, are not likely to be independent for two species in the same recovery plan), we reduced the data in the following manner. If, for example, a PVA had been performed for one species in a multi-species plan, we coded the entire recovery plan as being influenced by PVA.

Statistical analysis

To test for differences in plan content before vs. after a topic became popular in the literature, we conducted likelihood-ratio chi-square tests and Fisher's exact tests (PROC FREQ; SAS Institute, 1990). We restricted use of likelihood-ratio chi-square tests to cases in which the expected value for each cell in the chi-square table was at least 5 (Sokal and Rohlf 1995) and there were 20 or more plans approved after the literature median. If the expected value for a cell in the chi-square table was less than 5, we used the right-hand tail of Fisher's Exact test, which is less sensitive to small expected numbers (Sokal and Rohlf 1995). To preserve statistical power, topics for which there were fewer than 20 plans approved after the median citation year were instead analyzed with respect to the median plan approval year. We interpret significant chi-square or Fisher's Exact tests as evidence that recovery plan content differs before vs. after a topic became popular in the literature—in other words, a greater proportion of plans after the literature median included data on the topic than did plans created before the literature median.

Fig. 1. The number of publications on population viability analysis, metapopulations, conservation corridors (panel A), and conservation genetics (panel B) is plotted by year. Arrows indicate the year the median publication was published. Note the difference in scale on the y-axis between panels A and B; in addition, because of the scale of the figure, values less than 5 in panel A and less than 11 in panel B are difficult to distinguish from the x-axis.



RESULTS: DOES RECOVERY PLAN CONTENT TRACK THE ACADEMIC LITERATURE?

Trends in the academic literature

The median publication year for PVA and conservation genetics was 1995 (Fig. 1a, b). Publications on PVA have continued apace since 1995, whereas conservation genetics publications peaked in that year. The median publication years for conservation corridors and metapopulations were 1995 and 1996, respectively, with publication numbers for both topics continuing to increase thereafter. The median plan approval year was 1991. Of the 136 plans in our database, 100 were approved before the median publication year for PVA, conservation genetics, and conservation corridors (1995) and 110 were approved before the median publication year for metapopulations (1996).

Shifts in plan content in response to the academic literature

PVA. The focus on PVA in the academic literature appears to be percolating into recovery planning (Table 2). A significantly higher proportion of plans approved after the median citation year provided information on PVA or explicitly stated that such information would be useful (42% after vs. 22% before). Significantly more plans assigned tasks to collect information on PVA/models after the median citation year (46% after vs. 26.0% before), although the proportion of plans assigning a high priority to these tasks did not differ (Table 2). Finally, significantly more plans approved after the median citation year stated that monitoring data were to be incorporated into predictive models (47% after vs. 17% before). Thus, most of the trends suggest PVA is gaining currency in recovery plans.

Conservation genetics. The acknowledgement of genetic factors in recovery plans also appears to be influenced by the academic literature (Table 2). A higher proportion of plans approved after the median publication year provided information on genetics or specifically stated that it would be useful (69.4% after vs. 58.6% before), although this trend was not statistically significant. However, the proportion of plans assigning tasks to collect genetic information did increase significantly after the median publication year (73.5% after vs. 54.1% before), and we detected marginal support ($p = 0.06$) for an increase in the priority of information collection tasks. Significantly more plans assigned monitoring of genetics as a recovery task after the median citation date (41.7% after vs. 15.3% before), but this was not accompanied by a commensurate shift in priority assigned to these tasks (Table 2). However, the sample size of plans that call for monitoring of genetics is small (30 of 136 plans). These trends suggest that increasing academic interest in conservation genetics has been accompanied by increasing consideration of genetics in the development of plans, although not necessarily by an increased priority given to genetics in the recovery process.

Metapopulations. Most recovery plans included or called for information on the spatial structure or migration patterns of the species. Although 87.5% of plans written before the metapopulation literature median included or called for such information, all plans approved after the literature median did so, but the statistical significance of this difference is marginal ($p = 0.08$). There was no trend in the number of plans that assigned tasks to collect information on spatial structure or migration patterns, but plans approved after the literature median that did assign such tasks were significantly more likely to give them a high priority (Table 2). More plans after the metapopulation literature median assigned tasks to monitor the number of populations, population turnover, or species movement patterns (95% after vs. 79% before), although statistical support for this trend is also marginal ($p = 0.06$). The proportion of plans assigning high priority to these monitoring tasks was higher after the literature median (57% after vs. 42% before), but this was not statistically significant (Table 2). Metapopulation features also appear to be playing a larger role in recovery criteria. Significantly more plans approved after the literature median included the number or the trend in the number of subpopulations as recovery criteria (68% vs. 40%; Table 2).

Conservation corridors. Few plans referred to conservation corridors, so we analyzed trends relative to the plan approval median. In contrast to the other topics, we found no evidence that the literature was influencing whether recovery plans gave consideration to conservation corridors. Plans written after the plan median were no more likely than earlier plans to include or recognize a need for data on corridors, or to call for acquisition or maintenance of corridors (Table 2).

Table 2. Summary of the statistical analysis of the influence of academic publication on endangered species recovery plans. *P*-values are reported for likelihood-ratio chi-square tests with 1 d.f. Underneath these entries, we report the proportion of plans with positive responses before and after the median year. For conservation corridors, all questions were examined in relation to plan median because of the small number of plans which contained corridor information that were approved after the literature median. Significant results are in **BOLD**, marginally significant results in *Italics*. N/A indicates that the relevant data were not available from the survey.

Were plans approved after the literature median more likely to...	PVA/MVP	Conservation Genetics	Metapopulations	Conservation Corridors
...present information on the topic or state that it would be beneficial?	**Yes, χ^2 = 4.64 *p* = 0.28 Pre: 22/98 Post: 15/36**	No, χ^2 = 1.34 *p* = 0.247 Pre: 58/99 Post: 25/36	*Possibly, p = 0.08** Pre: 71/81 Post: 22/22*	No, χ^2 = 0.217 *p* = 0.641 Pre: 14/30 Post: 8/20
...assign recovery tasks specifically intended to collect information on the topic?	**Yes, χ^2 = 4.78 *p* = 0.029 Pre: 25/97 Post: 16/35**	**Yes, χ^2 = 4.10, *p* = 0.043 Pre: 53/98 Post: 25/34**	No, χ^2 = 0.18, *p* = 0.672 Pre: 59/81 Post: 17/22	No, χ^2 = 0.005 *p* = 0.946 Pre: 10/45 Post: 8/35
...assign those recovery tasks a high priority?	No, *p* = 0.98** Pre: 9/25 Post: 2/15	*Possibly, χ^2 = 3.54, p = 0.06 Pre: 29/88 Post: 17/36*	**Yes, *p* = 0.024** Pre: 23/58 Post: 12/17**	No, χ^2 = 0.724, *p* = 0.395 Pre: 2/9 Post: 4/6
...assign monitoring or management tasks devoted to the topic?	N/A	**Yes, χ^2 = 9.73, *p* = 0.002 Pre: 15/98 Post: 15/36**	*Possibly, p = 0.06** Pre: 64/81 Post: 21/22*	No, χ^2 = 0.034, *p* = 0.853 Pre: 11/53 Post: 12/54
...assign those monitoring/management tasks a high priority?	N/A	No, *p* = 0.123** Pre: 3/12 Post: 7/15	No, χ^2 = 1.387, *p* = 0.239 Pre: 28/66 Post: 12/21	No, χ^2 = 1.120, *p* = 0.290 Pre: 4/11 Post: 7/12
...use those monitoring data in a model for predictive analyses	**Yes, *p* = 0.03** Pre: 6/34 Post: 8/17**	N/A	N/A	N/A
... use information from this topic as recovery criteria?	N/A	N/A	**Yes, χ^2 = 5.295, *p* = 0.021 Pre: 33/81 Post: 15/22**	N/A

DISCUSSION

A mixed picture emerges from our analysis of whether the academic conservation biology literature has had an influence on endangered species recovery plans. On the one hand, we uncovered significant evidence that the literature has an influence on the actions proposed in recovery plans (Table 2). Thus, the caricature of academic conservation biology being completely isolated from conservation practice does not appear to be strictly true—if this were the case, one would not expect differences in plan content before and after the literature medians. In more cases than one would expect at random, however, we are able to reject that null hypothesis. To use Kinnaird and O'Brien's (2001) analogy, there appears to be some evidence of communication between the architects and the builders. On the other hand, despite this evidence of a potential influence of the literature, the amount of attention the plans give to different topics from the literature varies, with some topics barely mentioned in the plans. This suggests that some literature topics are perceived by conservation practitioners as being more useful than others, or that, despite some influence, impediments (including the lack of practicality) restrict the flow of ideas from the literature to recovery planning. In the following paragraphs, we hypothesize about why attention to different topics varies, and we suggest ways to improve two-way communication between academic scientists and conservation planners and managers.

Several potential caveats apply to our analysis. First, our analyses are based upon the hypothesis that the published literature, and trends in the published literature, are accurate indexes of academic conservation biology. Obviously, publication bias for or against certain topics or empirical results will bias this index (see Møller and Jennions (2001) for a thorough review of publication bias). We also realize that conferences, workshops, lectures, and working groups are other methods for disseminating scientific information, and that information shared in these forums could also directly or indirectly affect recovery planning. A second potential caveat that must be considered is that both the academic literature and endangered species recovery plans are responding in concert to some external unmeasured factor, rather than the literature exerting a one-way influence on the plans. For example, it is possible that both the academic literature and the recovery plans are advocating the gathering of genetic data simply because of the relative ease of DNA extraction and the widespread availability of PCR technology. Finally, we note two factors that are likely to make our conclusions conservative. First, the Endangered Species Act was amended in 1988, and these amendments could have potentially led to increases in the number and nature of recovery tasks, recovery criteria, and so on. Changes in plan content in response to the amendment, however, would have occurred before the literature medians (1995 and 1996), thus minimizing our chances of detecting significant differences in plan content before vs. after the literature median. Second, the sample sizes of plans approved after a given literature median was consistently smaller than the sample size of plans approved before the median year. Thus, both these factors suggest that it is possible that the non-significant trends we observed are real, but that small sample sizes precluded sufficient statistical power for this to become apparent in all cases. Nevertheless, we note that seven of the 20 tests we performed in Table 2 uncovered significant trends in the plans.

An alternative approach to the one we used here would be to pursue these questions with methods commonly used by historians of science. For example, by interviewing conservation practitioners, historians could determine if planners were aware of or influenced by certain ideas, workshops, research and academic training, and the like. In conjunction with interviews, a historical analysis of documents related to recovery plans—drafts of recovery plans, public announcements, meeting notes and memoranda, preliminary reports on species threats and abundances—may be more effective at detecting subtle and nuanced influences of academic conservation biology on recovery planning. Although our approach offers breadth and the ability to survey many recovery plans, it is necessarily "coarse-scaled" in its attempts to analyze an intangible effect such as "influence" with traditional statistical methods. Conversely, although the historical approach offers the possibility of greater detail and precision, it would likely be prohibitively expensive to implement for more than a handful of recovery plans at a time. Therefore, the historical approach and ours are likely to be complementary.

Keeping these caveats and alternative methods in mind, we note that our analyses did detect a mismatch between the significant increase in the proportion of plans assigning tasks to collect information on PVA, consevation genetics, and metapopulations and a lack of increase in the priority assigned to those tasks. This may simply reflect the fact that task priorities are a zero-sum game. It may not be possible to increase the priorities of tasks assigned to PVA, conservation genetics, and metapopulations simultaneously while maintaining a meaningful distribution of tasks among priority categories—in other words, if all tasks are high priority, having a high priority ranking loses meaning. Alternatively, inconsistent prioritization of tasks may reflect a lack of scientific consensus in the literature about the relative merits of devoting attention to each of these topics. For example, plans may assign tasks to collect genetic data for endangered species but not assign those tasks high priority because it is unclear how often such data will even be relevant to conservation management (e.g., Caughley 1994).

Of the four literature topics we investigated, some (e.g., metapopulation dynamics) were addressed in plans far more often than others (e.g., corridors). Nearly universal recognition of the need to address metapopulation processes of population turnover and dispersal even before 50% of all papers on the topic had appeared probably reflects the widespread attention ecologists devoted to island biogeography and habitat fragmentation before the first recovery plans required by the 1973 Endangered Species Act were drafted (e.g., MacArthur and Wilson 1967, Levins 1969). At the other end of the spectrum, conservation corridors do not seem to have gained any currency in recovery planning. There was no detectable change in the amount of support for corridors in recovery plans before or after either the plan or literature median. Moreover, our analyses of corridors had the lowest overall response rate of the four topics we examined. One reason for the discrepancy between the attention devoted to corridors in the academic literature and their infrequent use in recovery planning may be the lack of agreement in the literature about the value of corridors (see e.g., Simberloff and Cox (1987) and Simberloff et al. (1992) vs. MacClintock et al. (1977) and Noss (1987)). Corridors may also be a minor element in recovery plans because securing them is both expensive and politically challenging (e.g., Beier 1993). The potential influence of these social, economic, and political factors suggests that our results for conservation corridors may not be strictly comparable to our results for the three other topics. However, we note that the influence of socioeconomic and political factors (Beier 1993, Stinchcombe 2000) does not imply that scientific debate or theoretical work in conservation biology (e.g., Doak and Mills 1994, Hess 1996) cannot make a constructive contribution.

Perhaps the most important message to emerge from our analysis is that academic scientists could provide a valuable service to recovery planners by seeking to identify situations in which one factor (e.g., genetics) may take precedence over others (e.g., metapopulation dynamics or the need for a quantitative assessment of viability). Indeed, there has already been some movement towards this type of resolution for conservation genetics (e.g., Schemske et al. 1994, Hogbin and Peakall 1999), but much more work remains to be done. For instance, in the absence of such guidance, recovery planners may choose to focus on those topics that are feasible to implement and ignore those (e.g., corridors) that face difficult financial, political, or logistical challenges. Alternatively, some topics may be deliberately ignored by planners because the academic literature has yet to achieve consensus. Similarly, an increase in the proportion of plans assigning tasks to investigate a topic without increasing the priority of those tasks may reflect a lack of guidance from the academic literature on which of several topics should receive attention first. That is, should more effort be expended to perform a PVA for an endangered population, to measure its genetic parameters, to quantify dispersal and other metapopulation processes, or to protect a conservation corridor linking it to other populations?

Finally, we echo the call for greater communication between academic conservation biologists and conservation planners. If the creation of readily accessible journals such as *Conservation Ecology* or the new journal *Conservation Biology in Practice* achieves this goal, these journals will be valuable endeavors. Improved communication between academic scientists and conservation planners can also come from increased collaboration in developing recovery plans (Boersma et al. 2001). To date, academic scientists have played only a minor role: only 5% of the plans in the database were authored by academic scientists, and only 34% had academic scientists as members of the recovery team that developed the plan (Stinchcombe, *unpublished data*). Unfortunately, the percentage of plans with academic authors remained relatively constant from 1980 to 1998 (Gerber and Schultz 2001), and there is no increasing trend in the percentage of recovery plans with academic scientists as members of the recovery team (Stinchcombe, *unpublished data*). To improve these statistics, we encourage the USFWS and NMFS to continue inviting more academic conservation biologists to join recovery teams, in keeping with recent policy decisions to diversify team expertise

(Boersma et al. 2001). Similarly, we encourage academic conservation biologists to serve on such teams if asked to do so. Such collaborations between conservation managers and academic scientists may benefit both parties. Academic scientists may gain a better understanding of how to make the work they publish in academic journals more directly relevant to conservation practice. Conservation planners may benefit from the different perspectives brought to recovery planning by academic conservation biologists. Although it is clearly important that the detailed biology of an endangered species be taken into account when planning recovery efforts (Simberloff 1988), general concepts from the academic literature may encourage planners to think comparatively about species that, although unrelated to the focal species, share similar life histories or face similar threats. As Asquith (2001) has noted, a wealth of perspectives may indeed have a positive effect on the outcome of conservation efforts.

Responses to this article can be read online at:
http://www.consecol.org/vol6/iss2/art15/responses/index.html

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Appendix 1.
Source data and data transformation procedures.
The location of the website is: http://www.nceas.ucsb.edu/recovery/.

i. Literature median analyses. The table below is a copy of Table 2, but instead notes the source of the data we used for each analysis. "N/A" indicates that the survey did not contain the relevant data to answer that question.

ii. General format. Column descriptors followed by question numbers. Composite letter descriptors (e.g., A–B) indicate that we combined the data from those two columns in the following manner: if either column A or column B contained any positive data, the composite column AB was scored as a 1. If neither column A nor column B contained any positive data, the composite column AB was scored as a zero. Multiple question numbers indicate that we combined answers across questions in the same manner—e.g., "A–F 114–117, M227" indicates that a plan received a score of 1 if we could determine that the plan presented information on conservation genetics or stated that it would be beneficial in any of the following questions: A114–117, F114–117, or M227. Plans would receive a zero only if no data on conservation genetics were presented in *all* of those questions. Raw survey data that indicated "cannot determine," "not applicable," or "evaluator did not determine the answer" were scored as missing data. iii. Data transformations. Question I is a no/yes question in the survey, and was transformed to 0 and 1, respectively, for analysis. Questions II and IV called for numerical answers (i.e., the number of tasks), so these were transformed to 1 for survey responses ≥1, and 0 for survey responses equal to 0. For questions III and V, we coded priority 2 and 3 tasks (the two lowest priorities) as 0, and priority 1 tasks (the highest priority tasks) as 1. For question VI, if monitoring data were to be used in predictive analyses, we coded them as a 1; if monitoring data were compiled for descriptive or unspecified analyses, they were coded as a 0. For question VII, all survey answers ≥1 were coded as 1, and all zeroes coded as zero.

Were plans approved after the literature median more likely to...	PVA/MVP Columns – Questions	Conservation Genetics Columns – Questions	Metapopulations Columns – Questions	Conservation Corridors Columns – Questions
(I)...present information on the topic or state that it would be beneficial?	A105, F105	A–F 114–117, M227	A–F 98, 101, 119	A–F 93
(II)...assign recovery tasks specifically intended to collect information on the topic?	G146	G 155–158, X289	G 139, 142, 160	G134
(III)...assign those recovery tasks a high priority?	H146	H 155–158, Y289	H 139, 142, 160	H 134
(IV)...assign monitoring or management tasks devoted to the topic?	N/A	OO356	OO 347, 350–352, 357	FF 329,330
(V)... assign those monitoring/management tasks a high priority?	N/A	PP356	PP 347, 350–352, 357	GG 329, 330
(VI)...use those monitoring data in a model for predictive analyses	SS353–355	N/A	N/A	N/A
(VII)... use information from this topic as recovery criteria?	N/A	N/A	EEE406, 409	N/A

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