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Perspective

Fear of failure in conservation: The problem and potential solutions to aid conservation of extremely small populations

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ABSTRACT

The potential for extirpation of extremely small populations (ESPs) is high due to their vulnerability to demographic and environmental stochasticity and negative impacts of human activity. We argue that conservation actions that could aid ESPs are sometimes delayed because of a fear of failure. In human psychology, the fear of failure is composed of several distinct cognitive elements, including "uncertainty about the future" and "upsetting important others." Uncertainty about the future is often driven by information obstacles in conservation: information is either not easily shared among practitioners or information is lacking. Whereas, fear of upsetting important others can be due to apprehension about angering constituents, peers, funders, and other stakeholders. We present several ways to address these fears in hopes of improving the conservation process. We describe methods for increased information sharing and improved decision-making in the face of uncertainty, and recommend a shift in focus to cooperative actions and improving methods for evaluating success. Our hope is that by tackling stumbling blocks due to the apprehension of failure, conservation and management organizations can take steps to move from fear to action.

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1. Introduction

One aim of species conservation is to prevent extinction. The risk of extinction, however, is high for extremely small populations (ESPs, defined here as those listed as 'critically endangered' by the IUCN www.iucnredlist.org). The small population sizes of ESPs make them particularly vulnerable to demographic and environmental stochasticity, including the random effects of variation in birth rate, sex ratio, climate, etc. (Melbourne and Hastings, 2008). This randomness increases the uncertainty associated with the conservation of ESPs. Social, political, biological, and economic components also play key roles in the success of conservation actions (Brechin et al., 2002; Clark et al., 1994; Decker and Chase, 1997; Jacobson et al., 2010; Murcia and Kattan, 2009). The precarious state of ESPs and the biological and legal requirements for their protection can magnify the conflict between human and conservation interests. This, coupled with the high level of uncertainty associated with ESP conservation actions, reinforces the fear of negative outcomes and may deter necessary conservation actions (Clark et al., 1994). At the same time, decisive and innovative management action may be crucial to reverse the declining trajectories of ESPs and ultimately avert extinction. For example, an overly cautious approach and failure to act quickly have been implicated in the extinctions of the Christmas Island Pipistrelle (*Pipistrellus murrayi*) and the Hawaiian Po'ouli (*Melamprosops phaeosoma*) (Black et al., 2011; Martin et al., 2012b). In contrast, action was taken to capture the last remaining California condors in the 1980s in the face of much fear and protest by external organizations. Today, there is little doubt that condors would now be extinct if not for that decision to establish a captive breeding program (Alagona, 2004).

The combination of uncertainty about outcomes and pressure to succeed can lead to a fear of failure playing a significant role in human behavior, where actions are delayed due to apprehension about negative outcomes (Conroy et al., 2002; Haghbin et al., 2012). The importance of the fear of failure as an obstacle to conservation and ESP management was highlighted during a special symposium, "Conservation of Extremely Small Populations", held at the University of California, Davis on February 10–11, 2012 (http://animalscience.ucdavis.edu/savesmallpops/). Thirty-eight conservation experts gathered to identify the most significant barriers to the conservation and management of species on the brink of extinction in the US. They represented the fields of law, policy, economics, management, ecology, genetics, and evolution, and worked for US management agencies, nonprofit and environmental advocacy organizations, environmental consulting companies, and academic institutions. A unifying theme emerged as participants identified important barriers to conservation (see Appendix for the full list): we need to address the fear of failure and its associated institutional constraints to improve our ability to successfully manage extremely small populations, and species of concern in general. The aversive components of failure identified by symposium participants fit within a framework from cognitive psychology that identifies five dimensions of the fear of failure (Conroy et al., 2002) that may lead to procrastination (Haghbin et al., 2012). We focused on two of those components—fear of an uncertain future and fear of upsetting important others—because they summarize the roadblocks identified by the symposium participants and can be addressed at the institutional level. Given the expertise of the authors and symposium participants, our focus is on conservation in the United States. Nonetheless, we hope these lessons will be informative to conservation efforts worldwide.

We present the major roadblocks to ESP protection identified in our symposium within this fear of failure framework and provide suggestions for institutional and cultural changes to address the roadblocks. We use the fear of failure framework not because it explains all conservation hurdles or decision-making, but because we found it a useful and novel way to approach existing challenges. Our goal is to identify how the threat of failure impedes ESP protection and the conservation process overall, and then to provide solutions. Our message is not that we should make hasty conservation decisions: there are many valid reasons for delaying a decision, including a lack of scientific information. And indeed conservation successes can bring their own challenges too (Treves and Karanth, 2003). Rather, our message is there are available approaches that would help us decrease unnecessary delays caused by apprehension about outcomes. It is our hope these tools will help us to strike a better balance between action and inaction.

2. Fear of an uncertain future

From a cognitive perspective, uncertainty about the future can reduce felt competence (i.e. ability to act effectively), undermine motivation (Deci and Ryan, 2000), and increase procrastination (Haghbin et al., 2012). Not knowing how to effectively complete a task can reduce the motivation to try. In conservation, uncertainty often comes from a lack of information: information may be truly lacking or exist but not be shared among practitioners. This can include information about management decisions, processes, and outcomes, as well as biological information about species. Conflict and indecision in conservation efforts can stem from inadequate information gathering, processing, integrating, and/or sharing (Clark, 2009).

It is important for conservation management decisions to be based in science (Arlettaz et al., 2010; Sutherland et al., 2004), and decreasing uncertainty through rigorous scientific study will be greatly beneficial. However, the production of conservation relevant science can be challenging because the scientific timeline until publication is lengthy and can exceed the time required for management (Cook et al., 2013a; Knight et al., 2008; McNie, 2007). The imperiled nature of ESPs necessitates swift conservation decisions to prevent extinction (Martin et al., 2012b) and cannot always wait for findings to appear in peer-reviewed publications (Linklater, 2003; Meffe, 2001).

Below, we outline two factors related to uncertainty that contribute to the fear that ESP conservation actions will fail: lack of information sharing and interpretation, and lack of effective methods for decision-making in the face of uncertainty. These information-related challenges can reduce practitioners' perceived competence in enacting successful conservation actions. An associated important issue, increased production of conservation relevant science, is well discussed elsewhere (for more complete coverage of this topic see Cook et al., 2013a; Knight et al., 2008; McNie, 2007).

2.1. Roadblock 1: lack of information sharing and interpretation

Access to comprehensive and accurate information positively contributes to biodiversity conservation, while information deficits give rise to conflict, indecision, and failure to meet conservation goals (Clark, 2009). In the case of ESPs, access to relevant information is important as decisions often have to be made quickly to avoid extinction. The sometimes the geographically dispersed nature of small populations makes the compilation of multiple sources of data particularly helpful (e.g. Walters et al., 2002). Inaccurate or incomplete information can hinder and delay important decisions (Peterson et al., 2003; Slooten et al., 2000). Symposium participants identified poor information sharing as a significant hindrance to conservation of ESPs. According to participants, this lack of information sharing stems from (i) an inadequate system for disseminating/obtaining information and, (ii) cultural dynamics that inhibit the flow of information.

Given ESP's imperiled state, open sharing of available information can make the difference between timely conservation actions that lead to persistence, and extinction. The most valuable information—the biological and institutional factors that lead to conservation successes and failures—is often under-reported or inaccessible (Clark, 2009, 1997; Clark and Reading, 1994; Knight, 2009; Redford and Taber, 2000). Some underreporting of information is due to the nature of the peer-reviewed literature process, which includes time delays and a bias toward publication of positive results. For example, although the peer-reviewed journal *Conservation Biology* has a section titled Conservation Practice and Policy where "papers may address either successful applications or surprising outcomes that provided opportunities for learning," few authors submit documentation of failures (Knight, 2009). Under-reporting failures may be due to the professional risk associated with admitting failure (Knight, 2009) and organizations may be unwilling to share what they have learned from their failures due to fear of losing future funding (Redford and Taber, 2000). These concerns can be magnified for ESPs where unsuccessful management decisions can mean population extirpation. As has been called for in the past, but has yet to be actualized, we need to change the conservation culture to allow a "fail safe" environment, where failure can be viewed as a learning experience (Knight, 2006; Redford and Taber, 2000).

Information on outcomes of conservation efforts often remain in the "grey literature" of agency or NGO reports and difficult to access. Two new initiatives aim to compile an evidence base of conservation actions and outcomes, as a first step in establishing standards of practice. The Collaboration for Environmental Evidence (CEE, www.environmentalevidence.org) sponsors systematic reviews where conservation actions are evaluated based on documented outcomes; the journal *Biological Conservation* now has a section dedicated to publications in the CEE format (Pullin and Knight, 2009). The Cambridge Conservation Forum (CCF: www.cambridgeconservationforum.org.uk) is another effort to foster collaboration and evaluate conservation actions (Kapos et al., 2008). These initiatives may help combat the continued use of ineffective management practices (Keene and Pullin, 2011). However, the difficulty of getting access to the most up-to-date knowledge found in grey and pre-publication literature remains. Additionally, much information never makes it into a written form of any kind and, rather, is contained in the minds of experts (Martin et al., 2012a).

There are cultural barriers that hinder information sharing (Cook et al., 2013a) and organizational structures that prevent the incorporation of science into management (Young and Van Aarde, 2011). Bureaucratic hierarchy can block communication and create loyalties that run counter to information sharing (Clark, 2009; Mattson and Craighead, 1994). The culture of academia was identified as a barrier to information dissemination in the symposium. This includes the language and style in which peer-reviewed manuscripts are written, specifically an over-dependence on jargon and little interpretation that is meaningful for managers, and a lack of emphasis on or reward for researching applied questions. University researchers at the symposium said they also might not freely share information prior to publication for fear of losing intellectual property and authorship rights.

2.1.1. Solutions to Roadblock 1

Increased access to available information will go a long way in addressing information-sharing obstacles to ESP conservation. We present two solutions to improve information sharing: better infrastructure for curating conservation related information and increased collaboration and interaction among institutions.

2.1.1.1. Create a searchable database and repository for conservation related information. We suggest the creation of a digital repository for conservation, ESP, and species management related manuscripts, reports, and expert opinion. The creation of a central, searchable database and repository of grey and pre-published literature will make great strides toward increasing the flow of information needed to aid ESP conservation and management. Ideally such a system would integrate literature from a variety of sources, and would require an umbrella organization to host and maintain the database, and buy-in from all the major management agencies and conservation organizations. A potential example is the Global Biodiversity Information Facility (GBIF, http://www.gbif.org/), which collates occurrence records of species from hundreds of organizations in one easily searchable database that contains significantly more biodiversity data than any single member organization. This type of system would provide conservation practitioners a central location to find relevant grey literature, including endangered species surveys and annual reports housed within agencies, and also facilitate the presentation of negative results and expert opinions.

The pre-print publishing database arXiv.org, which is curated by the Cornell University Library and widely used by scientists in physics, computer science, and math (Ginsparg, 2011), provides one successful example of a system that allows quick release of information prior to the peer-review publication process and provides a record of authorship so intellectual property rights are maintained. The use of pre-publication repositories is increasing in biological sciences (http://arxiv.org/help/stats/2013_by_area/index) and there are several recently-founded and increasingly popular organizations that promote the use of such repositories, including PeerJ (peerj.com), FigShare (figshare.com), and the new biorxiv.org (also see Desjardins-Proulx et al., 2013). This model could include a rating system that allows comments on the quality of the work as well as a record of the review a manuscript has received. The design of this publishing database could be integrated with a Web of Science or GoogleScholar style central search engine that accesses not only the content in the database, but also currently available agency and organization specific resources (e.g. fisheriesreports.org, a grey literature database created by The Fisheries Society of America, and the US Forest Service's TreeSearch http://www.treesearch.fs.fed.us/). Such a database could be expanded to incorporate a repository of expert judgments about conservation related matters. There has been much recent progress in developing methods of quantifying and incorporating expert opinion into conservation decision-making (Burgman et al., 2011; Kuhnert et al., 2010; Martin et al., 2012a; Speirs-Bridge et al., 2010). The database we propose here could provide the infrastructure to elicit and collate expert judgments to fill in important information gaps. This database would allow conservation practitioners to quickly find all available information outside peer-reviewed journals in a single site, providing access to data and management approaches from relevant studies. To encourage biologists to use such a database, permitting agencies and funding sources could require authors to upload their reports to the database as part of their contract. This will be beneficial not only for time-sensitive ESP management and conservation, but also for conservation and species management in general.

2.1.1.2. Increased sharing and interpretation of information through collaboration. In addition to improving the infrastructure for data sharing, cultural changes must be promoted that support collaboration. There is often a mismatch between the research questions addressed by academics in the scientific literature and the information needed by those doing conservation *in situ*. This discrepancy occurs because academic scientists and managers are driven by different goals (Caro, 2007). An interdisciplinary, integrative approach is needed, not only for information gathering, but also for decision-making activities (Clark, 2009). There are disincentives in research institutions for conducting the collaborative and interdisciplinary research valuable to conservation management (Knight et al., 2008; Ludwig et al., 2001). Moreover, academic scientists typically do not interpret their scientific results in a way that is accessible or meaningful for managers, as there is worry about losing scientific credibility by advocating specific management policies (Lach et al., 2003). Resource managers at the symposium expressed great frustration with the lack of relevant information and recommendations resulting from academic studies. A recent review supports this frustration, finding only half of studies that detail results of conservation interventions actually provide suggestions to managers (Cook et al., 2013b).

Fortunately, initiatives to foster collaboration have been successful, such as the previously mentioned CEE and CCF. The federally funded Fire Science Consortia (https://www.firescience.gov/JFSP_consortia.cfm; for a regional example, see the California consortium, at http://www.cafiresci.org) and the newly formed Science for Nature and People (SNAP, http://www.snap.is) are other examples of collaborations among scientists, managers, and stakeholders that address pressing environmental and resource management issues. Expansion and support of these types of initiatives will promote data synthesis and communication of recommendations to managers.

Academic institutions can make greater strides toward fostering a culture of collaboration on applied problems by incentivizing collaboration with agency biologists, interdisciplinary endeavors, and the creation of synthetic reports. Increasing collaboration between academic researchers and agency biologists may be particularly fruitful for protection of ESPs, because academics in population biology have focused extensively on the theoretical effects of stochasticity on population persistence (e.g. Melbourne and Hastings, 2008), but often do not collect or have access to monitoring data, while the opposite is true for resource managers. Efforts to connect research to application could include alterations to the scientific reward system to promote bridging the research-implementation gap (Arlettaz et al., 2010; Cook et al., 2013a; Knight et al., 2008). Two example programs bridging the gap between academia and application are the Cooperative Ecosystem Studies Unit Network (CESU, http://www.cesu.psu.edu/) and the Cooperative Extension System at land-grant universities. The CESU program is a consortium of agencies, tribes, academic institutions, NGOs, and other groups to support the stewardship of federal resources and "create and maintain effective partnerships among the federal agencies and universities to share resources and expertise". The Cooperative Extension System functions as a bridge between academic research and the application of that research to management, conservation, and agricultural problems. US Fish and Wildlife Service's Landscape Conservation Cooperatives (http://www.fws.gov/landscape-conservation/lcc.html) and the US Forest Service Collaborative Forest Landscape Restoration Program (http://www.fs.fed.us/restoration/CFLRP/) are two additional examples of programs that aim to increase collaboration between academic, agencies, non-profit organizations, and local communities. Expansion of such extension services and greater collaboration between academics and management/conservation practitioners are needed. Increasing collaboration and information sharing across institutions will improve the applicability of academic research to ESP conservation and the incorporation of science into management decisions.

2.2. Roadblock 2: ineffective methods to make decisions in a data poor environment

ESPs are small by definition, and often lack data on population trends, demographic rates, ecological interactions, and threats to persistence, which can hinder accurate prediction of population responses to conservation actions. There can also be uncertainty about the outcomes of conservation actions because information on successes and failures is rarely gathered, as there is often a lack of rigorous evaluation of conservation programs to see what actions are successful in achieving conservation goals (Bottrill and Pressey, 2012; Cook et al., 2010; Ferraro and Pattanayak, 2006; Miteva et al., 2012). Acquiring new information can be expensive and often only possible on time scales longer than pressing conservation actions require (Linklater, 2003). Funding organizations can address the information roadblock by increasing the speed of funding cycles for research on systems and species with urgent information needs. A model for such a system could be the National Science Foundation's Rapid Response Grants, which fund projects that have extreme urgency, such as quick-response research on natural or anthropogenic disasters.

We need to incorporate better strategies for dealing with, rather than being immobilized by, uncertainty in conservation decision-making (Regan et al., 2013). As Ludwig et al. (1993) state, "effective policies are possible under conditions of uncertainty, but they must take uncertainty into account." Conservation of ESPs requires institutions to acknowledge the existence of increased uncertainty, implementing conservation actions that are wise in expectation. When combined with the politics of conservation, uncertainty limits innovation and can lead to rigid adherence to ineffective policies (Clark, 1997) and a reliance on bureaucracy over innovation (Brewer and Clark, 1994). Additionally, uncertainty means actions may not result in desired outcomes, a risk that must be acknowledged and incorporated in conservation planning (Game et al., 2013; Tulloch et al., 2014). Through the symposium, it became clear that organizational fear of an uncertain future can result in the avoidance of decision-making.

2.2.1. Solutions to Roadblock 2: improve strategies for making decisions in a data poor environment

We identified two areas that can aid in making conservation decisions for ESPs: adopting (1) methods that improve our ability to forecast conservation outcomes while accommodating uncertainty, and (2) decision-making processes that include evaluation of uncertainty. These changes may directly improve conservation decision-making and help managers with the seemingly greater risk associated with ESP conservation decisions by increasing practitioners' perceived competence in making decisions. Increasing one's perceived competence is one intervention suggested by Haghbin et al. (2012) to reduce procrastination associated with fear of failure. The goal is to actively engage with uncertainty, rather than allow it to halt the decision-making process.

2.2.1.1. Improve ability to incorporate uncertainty into forecasts. Advanced statistical and modeling methods that incorporate uncertainty into projections (e.g., stochastic matrix models, ensemble modeling) and quantify multiple aspects of uncertainty in observations (e.g., process versus observation uncertainty in state-space models, uncertainty at different scales in hierarchical models) have been a fertile area of research (e.g. Fieberg and Ellner, 2001; Regan et al., 2013). These methods can be used to evaluate predicted outcomes under different management approaches, and may be particularly important for forecasting population fluctuations of ESPs, for which stochastic effects can be magnified and the proximity of the population to the persistence threshold a pressing management concern. Agencies can collaborate with academics who have advanced statistical and modeling knowledge, or train employees in these methods, to improve their ability to quantify the uncertainty inherent in management options for ESPs (Cook et al., 2013a). Although these are not easy tasks, the former may be possible through Cooperative Agreements (see Solution to Roadblock 1). The latter can be achieved if agencies managing ESPs provide employees with opportunities for technical training and a culture that empowers their workforce to adopt innovative techniques. The National Conservation Training Center (NCTC, http://nctc.fws.gov/index.html) offers educational training for US Fish and Wildlife Service (USFWS) employees and their conservation partners through online courses, webinars, and in-person classes. Expansion and support of this platform and others like it, including dedicated funding for professional development training, would facilitate the spread of technologies, techniques, and research methods that could aid in ESP management. Recent budget cuts at agencies may limit the funds available to support professional development (Shear and Nixon, 2013; U.S.Senate, 2011). However, free or low-cost online courses (e.g. http://www.coursera.org) exist and are a promising avenue for accessible training on advanced statistical techniques. Organizations can invest in their employees' skill base by allowing paid time to complete such courses.

2.2.1.2. Improve the decision-making process. Improvements to decision-making processes would allow conservation managers to more effectively engage with the increased uncertainty associated with ESPs. Potential improvements range from tactical use of a decision-support tool, to application of iterative decision-making processes, to strategic adaptation of decision-making frameworks encompassing all aspects of a conservation problem. These improvements are not mutually exclusive; strategic frameworks often require the use of iterative processes or quantitative tools.

Decision-support tools provide methods to determine which decisions are optimal under a set of assumptions. Examples include Bayesian belief networks, which address uncertainty by combining expert opinion with empirical data to evaluate management options (Newton et al., 2007; Smith et al., 2007), partially-observable Markov decision processes used to allocate resources when dealing with incomplete information (Conroy and Peterson, 2012; McDonald-Madden et al., 2011), and benefit scoring to weigh actions and outcomes to focus efforts (Gregory et al., 2012a,b). Decision-support tools are complex to implement, but may be complemented by common sense approaches like setting trigger points (e.g., previously identified levels of population abundances) that spur associated actions, as suggested by Lindenmayer et al. (2013).

Decision-making processes, when combined with quantitative decision-support tools, enable learning from past decisions, while frameworks ensure stakeholder involvement in the strategic context in which learning takes place. As ESP management often affects a diverse stakeholder group with potentially competing goals, a framework may be particularly beneficial for alleviating concerns over ESP conservation. One decision-making process, adaptive management (AM) has long been recommended in resource management. A newer strategic framework, structured decision-making (SDM), is now being applied to resource problems. A combination of these would ease the contentious process of managing ESPs.

Adaptive management (AM), which allows for learning in the face of management uncertainty, is often invoked but rarely fully implemented (Allen et al., 2011; Rist et al., 2013). Rigorous AM allows managers to balance risk with knowledge gains (Clark et al., 1994) and to incorporate scientific uncertainty into the determination of management practices (Mattson and Craighead, 1994). Expert opinion can be incorporated in a systematic way (Martin et al., 2012a) to develop hypotheses and identify key uncertainties (Runge et al., 2011). Strategic monitoring that is focused on gaining information about key uncertainties with high expected value of information is vital to AM (Runge et al., 2011), yet is rarely executed. Misconceptions about AM and its implementation abound, and it is generally underutilized for threatened and endangered species (Runge, 2011). Educational measures (CMP, 2007; Schwartz et al., 2012) that counteract these misconceptions may help. More fundamentally, AM is not put into practice due to failure to embrace uncertainty (Keith et al., 2011).

Integrating adaptive management into the framework of SDM could alleviate this longstanding issue with implementation. The SDM framework emphasizes making decisions while incorporating uncertainty in a methodical and transparent way (Gregory et al., 2012a,b). SDM demands engagement of all stakeholders to jointly navigate opinions, evaluate alternative management options, and identify areas of study that will result in the most beneficial information gains (Allen et al., 2011). In addition, SDM accommodates both biological- and process-based thresholds as triggers for conservation and management decisions (Martin et al., 2009). The USFWS has adopted SDM in many areas of endangered species decision-making (Runge, 2011). Our suggestion that AM is most profitably pursued within SDM is not novel. For example, the US Department of the Interior advises this integration explicitly (Gregory et al., 2012a,b).

By adopting formal decision-making frameworks, institutions may facilitate a transition from outcomes-oriented thinking to a focus on evaluating if conservation processes are wise. When learning through actions is seen as a beneficial outcome, success is possible even if the conservation goal is not met. There should be an incorporation of program evaluation in the AM/SDM process to ensure adequate and robust evaluation of conservation actions, which can then go toward informing future management decisions to ground them in solid scientific findings (Bottrill and Pressey, 2012; Cook et al., 2010; Ferraro and Pattanayak, 2006; Miteva et al., 2012). The critical aspect of adopting AM/SDM is the transparent commitment to formal learning on the part of all stakeholders.

We have so far framed timid conservation investment decisions under uncertainty as the "fear of failure". But in economics one can also frame investment under uncertainty as a balancing act between investing now versus investing later based on how much a person "values flexibility" when spending scarce and irreversible resources. This is called real options theory, and is a well-known and powerful rational counter-argument to the psychological argument we present herein (Dixit and Pindych, 1994). Given risk and irreversible commitment, people who value flexibility will delay investment until "enough" uncertainty about the nature of the damages is revealed over time. For example, Sims and Finnoff (2013) use real options theory to define analytically the rational conditions that would justify a "wait and see" approach given relative rates of invasive species spread and degrees of uncertainty. In this world, a psychological "fear of failure" is not the motivation for waiting to invest in conservation—rather it is a rational balancing of the irreversible costs of investment against the benefits of flexibility. The solutions we present here address this cause of procrastination as well, as it clarifies the uncertainty associated with the damages and provides better methods for forecasting in the face of uncertainty.

3. Upsetting important others

Upsetting important others, the second component of the fear of failure we discuss, includes the anticipation of criticism, disappointment, and loss of trust from others whose opinions are valued (Conroy et al., 2002). In the conservation world, there are multiple stakeholders with conflicting interests to whom managers are accountable, and the legal mandates surrounding ESPs incur additional constraints.

3.1. Roadblock 3: multiple stakeholders with conflicting interests

A frequent topic at the symposium was the many positive and negative aspects of protecting species via the United States Endangered Species Act (ESA). This act is one of the nation's strongest environmental laws and, since 1973, has been used to limit human activities responsible for the rapid decline of populations. Those fighting both for and against greater protections have used the US legal system to enact their agendas, with substantial litigation costs (Doremus, 2001). A focus on outcomes, coupled with a fear that litigation may derail efforts, and fear of upsetting constituents, funders, and other stakeholders, can lead to paralysis. Agency aversion to controversy and political opposition can delay conservation action and compromise ESP protection (Doremus, 2001). However, citizen-initiated litigation remains a powerful way to force politically unpopular action (Doremus, 2001). Combining a focus on processes with realistic, shared expectations by stakeholders is necessary for timely and effective ESP conservation action.

3.1.1. Roadblock 3 solution: promote collaboration

The ESA's requirements play a complicated role in conservation of ESPs. While the ESA can be beneficial in forcing positive action, the fear of upsetting important others or of litigation may lead to overly cautious approaches to conservation and recovery actions. Shifting from a culture of antagonism between agencies and key stakeholders to collaboration may help address this roadblock to ESP management. While we acknowledge required conservation actions may not please all stakeholders, improving mechanisms for building consensus among environmental advocates, land management agencies, and private landowners about the appropriate course of action to conserve ESPs could ensure greater protections for species and habitats and avoid conflicts that may lead to litigation that ultimately detracts from needed action.

Though legal settlements have served to align conservation priorities after a crisis was reached (e.g. recent ESA work plan agreement, USFWS Listing Work Plan 2013–2018), negotiation among parties with the same ultimate goals of species and habitat protection but different priorities may be more efficient. Collaborative planning approaches that involve representatives of diverse interests (e.g. conservation organizations, landholders, industry, tribal governments), conflict resolution, and prior agreement should preclude later legal opposition (Cooke et al., 2011), but require a high degree of trust from the outset. Habitat Conservation Plans (HCPs) under the ESA are agreements between private parties or state agencies and the USFWS that are intended to comprehensively address development and species conservation by allowing incidental take of endangered species for development in exchange for long term conservation and mitigation (Schwartz, 2008). Recent evidence demonstrates that species fare better with an HCP than without, especially when plans encompass larger geographic areas (Langpap and Kerkvliet, 2012); however, HCPs have not been without controversy (Schwartz, 2008; Shilling, 1997), and implementation of the conservation measures has been an ongoing problem with many HCPs. We believe it is the responsibility of all stakeholders to increase good-faith efforts at collaboration to increase the efficacy and implementation of conservation and recovery projects and ensure resources are put toward meaningful science-based conservation.

Supportive conservation team structures that share responsibility can mitigate the worry over upsetting important others (Clark and Westrum, 1989). Concern about negative judgment may be particularly high surrounding ESP management because small changes can result in population extirpation. Ensuring that all stakeholders have access to the best available science and information (Roadblock 1) to inform the conservation process may encourage science-based conservation action and also make action more defensible when outcomes are negative. Multi-authored, multi-organization conservation strategies, opinion papers, and recovery planning documents for ESPs can increase buy-in from groups. Broad coalition-based plans will simultaneously reduce the individual risk of being "blamed" for failures (Clark, 1997; Clark et al., 1994). Additionally, team decision-making may be more resilient in the face of partisan political pressures, compared to individual decision-making (Mattson and Craighead, 1994). Formation of multi-agency, multi-organizations committees that work to address topic-specific pressing conservation issues would also help address this roadblock. An example format is California's Interagency Ecological Program Project Work Teams (http://www.water.ca.gov/iep/activities/teams-iep.cfm). These teams generally meet quarterly and focus on specific research and monitoring topics, grouped around species or ecosystems. Their aim is to "organize new studies, to review study plans and proposals, to write scientific papers and reports, and to promote collaboration among different groups working on the topic of interest." The information gained from these work teams is then easily shared across organizations and the discussion helps achieve consensus on how to approach pressing issues. Increased collaboration such as this would help address both Roadblock 1 and 3.

3.2. Roadblock 4: outcome-based performance metrics

Conservation actions can be expensive, yet funds are limited (James et al., 1999). Short funding cycles and expectations of a return on investment generate pressure for programs to claim success and "bury failure" (Bottrill et al., 2011). This pressure to appear successful is strong, as costs of failure are both direct (e.g. negative press or professional censure) and indirect (diversion of funding from unsuccessful programs). Conservation programs face increased accountability from governmental (Keene and Pullin, 2011; U.S.House, 2010) and non-governmental sectors (Bottrill et al., 2011).

At the symposium, it became clear that programs and managers are commonly evaluated based on the outcomes of the conservation/management actions concerning ESPs. However, with substantial amounts of uncertainty (see Roadblock 1), multiple threats facing ESPs, and rapidly changing social and ecological landscapes, there are bound to be conservation actions that fail. Even the most competent managers and conservation teams make decisions that do not result in successful conservation (Clark and Westrum, 1989). But since we focus on outcomes, rather than processes, the fear of inevitable failure and its resulting censure can stymie meaningful action for ESP conservation.

Participants in the symposium identified fear of negative professional consequences as an additional barrier to making recommendations or providing expert opinion about conservation actions. They identified apprehension about upsetting peers or superiors if recommendations proved to be incorrect, and academic scientists were particularly concerned about losing the appearance of objectivity if they provided management recommendations. Scientists may be reluctant to risk their individual reputations on the success or failure of a suggested conservation action (Clark and Westrum, 1989), and this may be even more so for ESPs where action may be seen as inherently risky. These issues can be addressed through increased information sharing (Roadblock 1), better handling of uncertainty (Roadblock 2), collaboration (Roadblock 3), and by clarifying expectations and rethinking measures of success.

3.2.1. Solution to Roadblock 4: build consensus expectations around both processes and outcomes

We propose that conservation actions be judged on a review of the process taken instead of the loss of a population, similar to the evidence-based practice of human medicine where practitioners are not held liable for negative outcomes unless the actions taken were negligent. Evaluation of conservation and recovery efforts should be based on a track record of following the best process toward recovery, rather than upholding agency culture and ideals which may be antagonistic to species recovery (Mattson and Craighead, 1994). However, this is not to say that there shouldn't be continual evaluation of conservation approaches to ensure use of the most effective approach for achieving conservation goals (Bottrill and Pressey, 2012; Miteva et al., 2012). This information should be collected and evaluated as part of the conservation AM/SDM process (See Roadblock 2) and shared widely (See Roadblock 1) so there is a rigorous understanding of the most effective conservation methods.

What constitutes the 'best process' depends on the specific ESP and priorities. Public entities should set priorities in a way that is transparent and preferably involves stakeholders, to allow project evaluation (Game et al., 2013; Mace et al., 2007). The ESA itself, however, has much ambiguity in it, including timeframes for management, protocols for managing uncertainty, and explicit biological goals (Clark, 1994; Mattson and Craighead, 1994). Developing agreed-upon protocols, or standards of practice for each ESP, would help provide structure in the face of uncertainty and reduce blame when something goes wrong. Additionally, well-designed conservation programs will also necessarily include reasonable time frames for projects and consultation, realistic resource allocation, and a process for data organization and monitoring (Bottrill et al., 2011). However, the best process need not be based on only established recovery processes, and can also include novel approaches to conservation that are tested following hypothesis-driven methods and well-documented throughout their implementation to improve learning.

Evaluation of the conservation decision-making process could be accomplished through the establishment of a review board that tracks conservation actions associated with ESA permitting, similar to state medical review boards. The review board could be composed of representatives from management agencies and conservation scientists, and could assess both management/scientific negligence and compliance for permit actions. The review findings could be included in project reports and made publicly available. By increasing this information-sharing, we can continue to learn from these processes, regardless of their outcomes.

4. Conclusions: harnessing fear of failure as motivation

The roadblocks presented here are not necessarily unique to ESP conservation and the lessons learned can be applied to all species conservation. ESP conservation, however, represents the scenario in which the fear of failure can be most acute, given the high likelihood for extinction. The outcome of the "Conservation of Extremely Small Populations" symposium made it clear that the anticipation of conservation failure, brought about through an uncertain future and the potential for upsetting important others, is hindering ESP conservation progress. While we certainly do not encourage overly aggressive and ill-planned conservation actions, we think a better balance between action and caution can be found through effective methods for engaging with fear at the institutional level. This will improve our ability to conserve and manage critically endangered species. We propose attacking uncertainty about outcomes by improving information sharing, adopting techniques for incorporating uncertainty in forecasts, and improving decision-making processes. We suggest addressing the fear of upsetting important others by changing culture through increased collaboration across sectors and by shifting the focus of performance metrics from outcomes to processes.

In addition to providing a useful framework for considering hurdles in the conservation of ESPs, cognitive psychology may also suggest useful solutions. Fear of failure can have contrasting effects—either to de-motivate or motivate action—depending on the individual's level of felt competence (Haghbin et al., 2012). Individuals who score themselves low on a scale of perceived competence (i.e. rate themselves as ineffective) show a positive relationship between fear of failure and procrastination; by contrast, individuals who score themselves as competent show a negative relationship between fear of failure and procrastination (Haghbin et al., 2012). For individuals who feel competent, fear of failure appears to be highly motivating. This potential for fear of failure to decrease procrastination is encouraging, as it suggests improving felt competence will have the benefits of both better and swifter conservation actions. The solutions we provide are often technical in nature and we think they are the most tangible and efficient way for dealing with the identified hurdles and improving felt competence; there is evidence from organizational psychology that changing work culture can positively influence motivation and performance in organizational settings (Deci and Ryan, 2000; Gagné and Deci, 2005).

We hope the suggestions outlined herein provide solutions to combat the fear of failure and its resultant procrastination. Through effectively collating and leveraging available information and engaging with remaining unknowns, we can reduce apprehension about uncertainty. By changing the emphasis from conflict avoidance to collaboration, along with evaluating conservation process over outcomes, we can minimize the apprehension around upsetting important others. We hope to shift the role of fear of failure from a hurdle to a motivating force in the conservation of extremely small populations.

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Appendix A. Supplementary material

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