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Learning from failure in conservation:

Individual, team, and organizational dynamics

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STATEMENT OF ORIGINALITY

I certify that except where acknowledgement has been made, the contents of this dissertation are the original work of the author alone and have not been submitted in whole or in part for consideration for any other degree or qualification in this or any other university.

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DEDICATION

To my father, Rodney Allen Wells, who we lost in the last year of my thesis. With his English professor's red pen, he proofread several of these chapters and I'll be forever glad his hand is upon them. He was loved for his humor, admired for his intellect, honored for his service to our country, and proud as hell of his daughter. I miss him every day.

PREFACE

This research project was undertaken as a "thesis by publications" and is comprised of chapters that are either published, in review, or in preparation for publication at the time of thesis submission. These articles and manuscripts have been compiled with minor formatting adjustments and are presented in their entirety. They are collectively preceded by an Introduction to the research project (Chapter One) and followed by a Conclusion (Chapter Seven) that synthesizes the research process, the key findings, and the outcomes. Each chapter was prepared as a stand-alone publication with its own Abstract, Introduction, Methods, Results, and Discussion. For ease of review, the references and appendices for each chapter have been consolidated into one 'Literature Cited' and 'Appendices' section, respectively, following the conclusion of the thesis. Per thesis submission requirements of Imperial College London, I have presented the contributions of each co-author below. Other publications produced during this candidature, presentations arising from this work, and professional affiliations and training relevant to this topic are presented in Appendices A and B.

The articles and manuscripts forming this thesis are:

Chapter Two:

Catalano, A.S., Lyons-White, J., Mills, M.M., Knight, A.T., 2019. Learning from published project failures in conservation. *Biological Conservation*. **238**:108223. https://doi.org/10.1016/j.biocon.2019.108223

The Editors of Biological Conservation selected this article as a must-read Editor's Choice. https://www.journals.elsevier.com/biological-conservation/editors-choice/learning-from-published-project-failures-in-conservation

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Chapter Five:

Catalano, A.S., Knight, A.T., in preparation. Knowledge development, learning, and failing to learn from failure in conservation.

Contributions: AK provided study design guidance, assistance with interpretation of results, feedback and manuscript review.

Chapter Six:

Catalano, A.S., Knight, A.T., in preparation. How to learn from failure in conservation

Contributions: AK provided feedback and manuscript review.

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Abstract

Conservation aims to ensure the persistence of biodiversity despite myriad and mounting threats at the intersection of biological processes and socio-economic activity, and many efforts have struggled to achieve success. Failure is inevitable in the complex contexts in which conservation initiatives take place and yet is largely underexamined. Reasons for this shortcoming are multidimensional, encompassing behavioral and cognitive limitations at the individual, group, and organizational levels. Conservation is recognized as primarily about people and the choices they make, but there is a gap in what we know about how conservation professionals themselves as people operating within teams and organizations learn from and manage failure.

My research investigates the current state of failure management in conservation, building upon existing literature in organizational learning and drawing insights from other disciplines to identify ways for conservation to more effectively learn from failure. To do this, I first conduct a literature review to investigate factors contributing to a lack of learning from failure and success in conservation. I find that failure reports are rare and largely unstandardized, and human factors such as stakeholder relationships were the most commonly cited cause of project failure. I then carry out a strategic review of organizational learning literature to provide an inter-disciplinary synthesis of thinking and practice of failure management. Armed with these broad insights, I delve into individual intentions to engage in learning from failure behaviors, finding that social norms, psychological safety, organizational support, and leader behavior play important roles in facilitating learning from failure. To place these individual motivations into a broader context, I then investigate barriers and enabling conditions for learning from failure through a multimethod qualitative study. Finally, I synthesize my findings and provide an operational model and actionable steps going forward.

Providing the first empirical examination of failure in conservation, this thesis highlights both shortfalls in failure management in conservation and, more importantly, opportunities to create a learning transformation going forward.

1 | Introduction

"Pass on what you have learned. Strength, mastery…but weakness, folly, failure also. Yes, failure most of all. The greatest teacher, failure is."

~Yoda, Star Wars: The Last Jedi

The goal of protecting nature has driven the development of modern conservation from its inception in the early 1980's as a discipline with roots in the natural sciences (Soulé 1986) to an interdisciplinary establishment and integration of new organizations and practices (Meine et al. 2006). Human survival depends on sustaining biodiversity, which provides and enables ecosystem services (e.g. water availability, provisioning, soil renewal, carbon capture, flood protection, pollination, pest control) which provide direct and indirect economic and social benefits (Balmford et al. 2002). Increasingly, the massive depletion of earth's resources constitutes a crisis (Hoffmann et al. 2010), and concern is growing that human activity has ushered in a sixth mass species extinction (Barnosky et al. 2011). Conserving biodiversity is extremely challenging, however, due to threats at the intersection of biological processes and socio-economic activity, such as habitat loss (Fitzsimons et al. 2010), alien invasive species (Hayward 2011), over-exploitation (Lawler et al. 2006), pollution (Secretariat of the Convention on Biological Diversity 2014), and climate change (Hole et al. 2011). Many initiatives aiming to address these threats fail while global biodiversity continues to decline (Butchart et al. 2010). While individual success stories exist (Conway 2011), at the macro level vertebrate abundance has declined by 68% over the last four decades (WWF 2020) and 40% of global plant species are currently threatened with extinction (Antonelli et al. 2020).

Attempts to stem this continued decline have led to a focus in recent years on improving effectiveness. This has manifested in multiple ways, including the emergence and adoption of evidence-based conservation (Pullin & Knight 2005), impact evaluation (Ferraro & Hanauer 2014), and systematic reviews (Pullin & Knight 2001; Sutherland et al. 2017). These are all useful, however, they focus primarily upon technical solutions to the challenges of managing nature in order to promote effectiveness (e.g., 'What works in conservation' (Sutherland et al. 2020)). For example, an examination of traditional conservation biology textbooks reveals a heavy emphasis on technical solutions to the challenges of measuring different dimensions of biodiversity, including genetic diversity, species endemism and rarity, species population viability, species conserved in protected areas (e.g., the SLOSS debate, which refers to a controversy in the ecological literature concerning whether a single large or several small land reserves would better protect species of conservation concern ; see Diamond 1975; Simberloff & Abele 1982; Tjørve 2010), the effects of habitat fragmentation (with much of this research spurred by the SLOSS debate), restoring habitats and ecosystems, and the extent and rate of

pressures on species, habitats and ecosystems (Soulé 1986; Caughley & Gunn 1996; Hunter Jr. 1996; Primack & Sher 2016). A quantitative understanding of these topics is essential for many effective conservation programs. As a community of practice, we do them very well. But alone these techniques are insufficient to achieve conservation goals.

Cornerstone activities in conservation have struggled to consistently achieve success, and appear to fail regularly, including translocations (Novak et al. 2021), single species management (Clark & Vernon 2015, 2017), allocation of conservation resources (Knight et al. 2008), private land conservation (Ruseva et al. 2016), restoration (Gardener et al. 2010), formally protected areas (Leverington et al. 2010), integrated conservation and development projects (Garnett et al. 2007), and community based conservation (Brooks et al. 2013). While global reviews are relatively common (Butchart et al. 2010; Maxwell et al. 2020), the published literature in the discipline of conservation biology – now commonly referred to as conservation science – is largely mute on discussions of the experience of, or learning from, failure regarding individual projects and programs, the scale at which conservation actions are often implemented on the ground (Redford & Taber 2000; Knight 2006; Hobbs 2009). Despite many calls for implementing activities to determine effectiveness for projects and programs, such as evidence-based conservation methodologies and impact evaluations that can assist in determining success and failure and the reasons for each, failures are reported less frequently than one might expect (Giakoumi et al. 2018; Godet & Devictor 2018). It would be a fair assumption to suggest that failure is likely to be more common – perhaps disturbingly more common – than is currently reported. This is a problem, in part, because failure has the potential to be the conservation sector's richest vein of learning how to conserve biodiversity more effectively, cost-efficiently and equitably.

Unlike the discipline of conservation science, the practice of conservation is primarily a value-driven social process (Soulé 1986; Bennett et al. 2017) aiming to solve "wicked" problems (Rittel & Webber 1973; Clark 2002; Game et al. 2014). There are other sectors that function in similarly complex, dynamic and diverse contexts ("complex systems" (Liu et al. 2007)) such as military and commercial aviation, medicine, and business. These more established sectors have in recent decades begun to shift from focusing exclusively on technical sources of improvement to a recognition that human factors play a critical role in achieving success and managing and

learning from failure. Aviation training evolved based on the collection and analysis of vast quantities of data revealing that further increases in safety were to be found in human systems rather than incremental refinements to aircraft technical specifications (Helmreich 1997). Similarly, medicine continues to make progress in scientific treatment protocols, technology, and pharmaceuticals, but increasingly recognizes the role that individual psychology and team dynamics play in delivering effective patient care (Edmondson 1999; Elia et al. 2016). Other areas of human endeavor have gone through similar changes. Systems thinking, for example, has evolved from "hard" systems (e.g. optimizing objective design and process elements in distinct phases to achieve clear goals) to "soft" systems thinking (e.g. building a "rich picture" of qualitative and quantitative elements of problem dimensions that emerge from and integrate human perspectives) (Checkland 1981). Behavioral economics emerged in response to the recognition that traditional models in economic theory devoid of human complexity were insufficient to model human decision-making accurately (Tversky & Kahneman 1974). These processes of evolution reflect a growing awareness that an understanding of human psychology, cognition, and interpersonal dynamics at individual, team and organizational levels are fundamental to providing solutions to challenges in complex systems.

These processes of evolution have also been accompanied by decades-long 'inward' focused research on the actors in the complex systems comprising organizations; for example, aiming to understand attitudes, motivations, behaviors, and values of doctors or aircrew themselves, as opposed to solely an 'outward' focus on the people their work impacts (e.g., Berkowitz 1956; Morris 1973). Specifically, the way that organizations and individuals operating in complex systems learn from failure has been widely studied as research has revealed the extent to which these represent sources of errors, mistakes and failures (e.g., Helmreich 2000; Gallagher et al. 2003; McArdle et al. 2003).

By contrast, researchers in conservation are predominantly 'outward' focused, with a substantial body of literature seeking to understand the attitudes, behaviors, and values of those who are the subject of, or who are impacted by, conservation actions, rather than those of conservation professionals themselves (Evans et al. 2020). For example, much has been written about people's values, attitudes, and behaviors towards wildlife and nature (Dietsch et al. 2016), human-wildlife conflict (Ogra 2009), and protected areas (Allendorf 2007), and there is also

literature examining how local communities and other stakeholders view strife-laden failure of conservation activities that impact them (Adaman et al. 2009; Moyo et al. 2016). Conservation is recognized as an activity "primarily not about biology but about people and the choices they make" (Balmford & Cowling 2006). However, there is a large gap in what we know about how conservation professionals as people operating within teams and organizations identify, manage and learn from failure.

The risk of failure in conservation actions is not widely acknowledged (Game et al. 2013), and although there has long been recognition that failure as a source of learning is underexamined in conservation (Redford & Taber 2000; Secretariat of the Convention on Biological Diversity 2011; Godet & Devictor 2018), conservation has yet to realize the potential gains from including failure as well as success in project outcome analysis. More broadly, there are fundamentally important gains to be made by incorporating into institutional awareness the immense value that failure offers which are different, substantial and uniquely valuable learning opportunities compared to those found with learning from success. Identifying and analyzing failure, paradoxically, may be the most important part of a project (Denrell 2003; Madsen & Desai 2010), and we ignore its lessons at our peril. Reasons for this shortcoming are multidimensional, encompassing behavioral and cognitive limitations at the individual, team and organizational levels (March 1991; Edmondson 1999; Winter & Zollo 2002). Conservation practitioners typically operate in complex environments with limited time and resources, so the work of managing failure is often neglected (Game et al. 2014). Coupled with a bias towards publishing success stories and reluctance on the part of donors to "fund failure", lessons that could be learned from failure are not identified, recorded, analyzed and disseminated to the wider conservation community. While some conservation professionals may argue that assessing conservation success is of primary importance, an unwillingness or inability to recognize the value of failure in learning is akin to ignoring and failing to report findings that do not confirm anticipated experimental results (Couzin-Frankel 2013). It is highly likely that the current situation of curtailing the learning process through the shunning of failure experiences has substantial negative impacts on the effectiveness of conservation projects and programs.

1.1 Organizational learning from failure and learning in conservation

Every organization is confronted with errors, mistakes and failures and must therefore learn how to manage failure in order to achieve desired outcomes. Organizational learning has been defined in various ways, but is essentially the process of transforming information and experiences of individuals into improved collective behaviors, organizational actions, and routines (Lipshitz et al. 2002; Carmeli 2007). Learning takes place through the detection and correction of errors, and can be thought of as either single-loop or double-loop (Argyris & Schön 1978). Single-loop learning consists of simply detecting and correcting an error, and is known as first-order problem-solving behavior (Tucker & Edmondson 2001). In contrast, double-loop learning involves not just the detection and correction of error but also engaging in second-order problem-solving behaviors that seek to improve the organization's underlying processes, norms, or objectives that lead to error. Engaging in these second order problem-solving behaviors is a prerequisite for learning from failure (Carmeli 2007).

Organizations learn through their people, and thus both the individual and social context of learning are necessary (Fazey et al. 2005a). Learning theories vary in their emphasis on individual or group focus, but all rely on a reflective process to create new knowledge and improve future actions (Armitage et al. 2008). Reflecting on errors, mistakes and failures may provide increased learning opportunities as compared to success (Ellis & Davidi 2005). Because errors, mistakes and failures are an inevitable part of organizational processes, a growing body of literature stretching back more than five decades stresses the importance of learning from failure as a critical component of organizational learning (Cyert & March 1963; Sitkin 1992; Denrell 2003; Baumard & Starbuck 2005; Carmeli & Schaubroeck 2008). The value of, and challenges inherent in, learning from failure is well established in the organizational learning literature, and a number of sectors that have long been studying failure have rich bodies of peer-reviewed and popular literature on the subject. For example, commercial and military aviation, business, and medicine have for decades been proactively investigating and implementing systems and protocols for actively managing and learning from failure (Sitkin 1992; Helmreich 1997; Edmondson 2004; Cannon & Edmondson 2005).

The complexity that characterizes the context in which most conservation initiatives take place make determinations of cause and effect challenging if not impossible and so hinders organizational learning (Lounamaa & March 1987). The need to learn how to learn more effectively has long been recognized as important in conservation but only by a small community of scholars (Clark 1996; Kleiman et al. 2000). There have been calls for an increased focus on learning as a means to improve effectiveness, but often in isolation and from a range of disparate conservation subdisciplines such as resource management (Rogers et al. 2000), landscape restoration (Mansourian & Vallauri 2020), endangered species management (Clark 1996), systematic conservation planning (Cowling & Pressey 2003), and adaptive management (Armitage et al. 2009). These calls have largely gone unheeded and have often been made by people with training outside traditional conservation biology attempting to introduce these ideas into the conservation sector (e.g., evaluation, policy science, development). Unlike literature in other sectors that grapple with learning from failure, these calls for a greater emphasis on learning in conservation do not explicitly describe processes for learning from failure, and little exists in the way of attempts to systematically identify factors that enable or discourage learning from failure.

1.2 Thesis aims and objectives

The study of failure in conservation could be described as piecemeal, lacking as it does a theoretical framework, an established body of literature and a clear research direction. In this thesis, I aim to address these foundational gaps and provide the first benchmark examination of failure in conservation. I focus upon the social dimensions of this challenge, as research into the failure of conservation projects and programs from an ecological perspective is comparatively well studied. I broadly define "conservation" as a sector or discipline that focuses research and activity on how to protect, restore, and ensure the persistence of biodiversity, and "conservation professionals" and "conservationists" as people who occupy either full- or part-time paid employment in the conservation sector. I distinguish between conservation professionals and volunteers, but in doing so note the large number of the latter working in the conservation sector and acknowledge the essential role they play in conservation activities. Conservation activities

can be undertaken by a range of actors (e.g., individuals, donors, government or public sector agencies, for- or non-profit organizations) at a range of territorial or administrative levels (e.g., local, national, inter- and supranational) and failure can occur in activities carried out in any of these situations.

This research identifies barriers to learning from failure across multiple institutional scales from individual to team to organization, and includes conservation professionals working in a wide range of organizations, representing perspectives as varied as local, national, and international NGOs, academic institutions, philanthropic foundations, research institutes, government agencies and supranational bodies. I identify both the current shortcomings in the thinking and practices of learning from failure in conservation, as well as what individuals, teams and organizations can do to transform this situation regardless of their organization type. I achieve this through an examination of the conservation science literature on learning from failure, which I explored through the theoretical foundation, or 'lens', of several other disciplines and sectors that, like conservation, operate in complex contexts. The thinking and practice that underpins learning from failure covers a wide conceptual and applied scope from across multiple disciplines and sectors. I explore contemporary approaches operationalized in other sectors and investigate differences and commonalities that exist between these endeavors and the conservation sector that may be usefully adopted, trialed and adapted by conservation organizations to more effectively learn from failure. This is complemented and integrated with empirical research that provides a foundational understanding of how conservation professionals think and operate, both as individuals and in teams.

Through this research process, I have developed a pragmatic interdisciplinary perspective on learning from failure for the conservation sector that culminates in the thesis with the presentation of an operational model. This operational model elucidates the mindsets and mechanisms required to enable a cultural shift towards one that recognizes and embraces the value of learning from failure, with an ultimate objective of improving the effectiveness of conservation projects and programs.

This body of research focuses on the following objectives addressed in the research questions of each chapter:

1. Provide an understanding of how individuals, teams, and organizations in the conservation sector currently operate in regard to learning from failure.

2. Identify the thinking and practices that other sectors operating in complex systems understand and implement in order to effectively learn from failure.

3. Identify the barriers and unique characteristics of conservation that are perceived by conservation professionals to discourage or enable effective learning from failure at individual, team, and organizational levels.

4. Identify how thinking and practices from other sectors could be applied in a conservation context.

5. Provide practical direction for conservation organizations on how they can learn from failure effectively.

1.3 Overview of thesis chapters

The chapters presented in this thesis have been designed to be complementary, so as to provide several conceptual and operational 'pillars' for individuals, teams and organizations in the conservation sector to engage with, reflect upon and trial through implementation.

In **Chapter Two**, I investigate the current ways in which professionals in the conservation sector approach learning from failure by examining the prevalence and content of articles on this topic through a review of the peer-reviewed conservation science literature. No comprehensive review exists of human and organizational factors contributing to the general absence of thinking and practices for learning from failure and success in conservation. This

review identifies gaps and untested assumptions about managing failure in the literature, providing conservation professionals a benchmark for the sector against which they can map their own experience, and which provides information on a number of important topics. It makes a distinction between *seeking effectiveness* (using evidence to determine what actions will be more or less likely to achieve a stated objective) and explicitly *managing failure* (the suite of organizational mechanisms and mindsets that can be applied both individually and in group settings which make it more or less likely that learning after a failure has taken place will be achieved). This chapter was published in *Biological Conservation*.

In **Chapter Three**, I explore through a strategic review how failure is viewed in the organizational learning literature. I provide an introduction to concepts regarding individual and team dynamics that impact an organization's ability to learn from failure and offer a review of pragmatic methods for managing failure in business, commercial and military aviation, and medicine. This essay provides an interdisciplinary synthesis of non-conservation thinking and practices for the management of failure in order to identify potentially useful approaches to improving the learning outcomes of conservation initiatives. This chapter presents a subset of the most important elements of a learning from failure approach identified from beyond the conservation sector. It provides conservation professionals an introduction to foundational topics including: the challenges and nuances of effective definitions of failure; the differences between failure and success; the role of cognitive dissonance in limiting learning from failure; and the importance of psychological safety for effective team learning. This chapter was published in *Conservation Biology*.

In **Chapter Four**, I present the first empirical study in the conservation science literature to investigate drivers of individual intentions to engage in learning from failure behaviors. The approach presented is founded upon the Theory of Planned Behavior (TPB) and also included a measure of psychological safety as a contextual variable, which provided an understanding of how this team construct, widely regard as critical for effective learning from failure, influenced and moderated the relationship between individuals' intentions to enact learning from failure behaviors and the TPB variables. This chapter provides conservation organizations a methodology for 1) identifying and recruiting individuals likely to enact a strong intention to engage learning from failure, both as individuals and in team contexts; 2) identifying the specific

mechanisms and mindsets an individual or team might most usefully trial to learn from failure; 3) identifying the types of training that might most usefully promote desired learning from failure behaviors; and 4) monitoring and evaluating the evolution of individuals and teams towards a desired failure orientation. Chapter Four has been published in *Biological Conservation*.

Chapter Five complements the quantitative findings of Chapter Four with qualitative research undertaken to provide a deeper, more nuanced understanding of conservation professionals' experiences with learning from failure and identifies barriers and enabling conditions for learning from failure. Using multiple qualitative data collection methods, I conducted a thematic analysis of 55 interviews, seven focus groups, and include the structured text responses from 178 participants to four open-ended questions gathered from an internet-based survey instrument. The findings from the analysis of this qualitative data provided a richer contextual understanding of how the patterns revealed in Chapters Two and Four relate to self-reported thinking and practices of conservation professionals. This qualitative study provides conservation organizations, perhaps most usefully their leadership, a deeper understanding of sector-wide barriers to learning from failure that may be compromising their own organizations' effectiveness, along with the realization that failure is very common and of great concern to conservation professionals.

In **Chapter Six**, I synthesize the results from Chapters Two to Five to provide a suite of principles that embody empirically identified best practices from business, commercial and military aviation, medicine, and conservation. These principles serve as necessary, accessible summaries of key elements of a conceptual framework that underpins an effective conservation professional's understanding (or 'thinking') of learning from failure approaches. This conceptual framework is complemented with an operational model (the 'practice') for enacting learning from failure. Together these form the first explicitly stated praxis for learning from failure in the conservation sector, where thinking can be tested by individuals, teams and organizations against their practice, the learnings from which can be used to inform new thinking. Recognizing the general lack of awareness of learning from failure thinking and practices throughout the conservation sector and the challenges of effectively implementing a learning from failure

approach, I present actionable lessons that a team or organization can trial to improve learning from failure thinking and practices in their own workplace.

Chapter Seven concludes the thesis with a summary of findings, a discussion of the contribution of this work to the advancement of knowledge and practices in the conservation sector, an overview of the limitations of the research presented, and priority areas for pragmatic future research that can contribute usefully towards expanding the effective management of failure in conservation.

1.4 Research approach

In reflecting on the ontology and epistemology that inform my philosophical perspective underpinning my research, I recognize that my experience has created basic assumptions, beliefs and values that influence the way I have approached the subject of learning from failure in the conservation sector.

Most obviously, my earliest career training was in the US Navy and in a large corporation, which through cultural norms and structured training has influenced my thinking about failure and learning in organizations. I also hold a normative position that there is an intrinsic value of biodiversity (thus efforts to ensure its persistence are worthy endeavors), that human social interaction is a valuable component of learning, and that failure is a valuable source of information. These experiences and beliefs create the 'inherited culture' which I bring to my research (Babbie 2008).

I adopt an ontological position of social constructivism, whereby reality is socially constructed and created through people's experiences and interactions with others. My epistemological position is predominantly critical realism, which assumes that our knowledge of reality cannot be understood independently of the social context of the knowledge creation process, and thus multilevel study (e.g., individual, group, and organization) about structures, mechanisms, culture, and mindset is important (Danermark et al. 2002; Saunders et al. 2012). I also acknowledge a broad streak of pragmatism to my research philosophy, driven by my

personality, experiences, and training, such that a consistent thread throughout this project has been that my findings are important insofar as they have utility and relevance for implementing conservation action (Kelemen & Rumens 2008).

My philosophical research perspective supports the adoption and application of a mixed methods approach (Creswell & Clark 2018) to my research topic, including the use of multimethod qualitative thematic analyses and quantitative analyses, to identify, explore, and generate actionable insights regarding the dynamics of learning from failure in conservation (Fig 1.1).

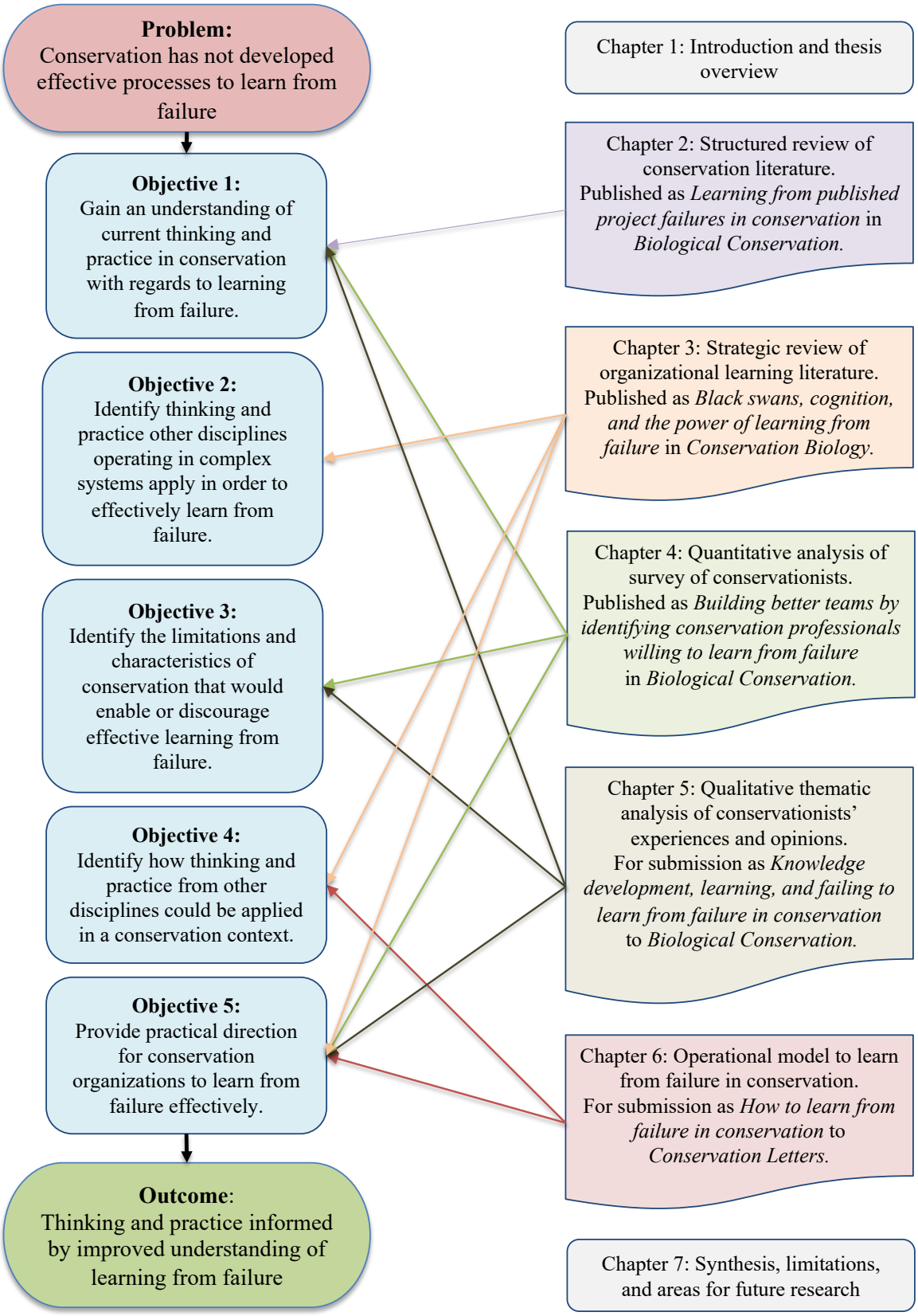


Fig. 1.1 An overview of the structure of the thesis, including methodological approach and publication status of each chapter.

2 | Learning from Published Project Failures in Conservation

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Abstract

Conservation professionals need to know what has worked and what has not when designing, implementing, evaluating and refining conservation projects. Project failure reporting is an important, but largely unexploited, source of learning that capitalizes on the learning opportunity of failure provided through the experience of navigating research-implementation 'spaces'. Learning from others through reading available literature is one way to supplement learning gained through direct experience. Learning vicariously is especially effective when presenting failure as opposed to success experiences. I reviewed the peer-reviewed conservation science literature to identify the extent and characteristics of failed project reporting, focusing my analysis upon social dimensions as opposed to biological causes, which have been comparatively well addressed. I quantified the degree to which articles reported activities commonly applied to learn from failure in business, medicine, the military and commercial aviation. These included activities for identifying, analyzing, correcting and sharing project failures. I used qualitative thematic analysis to identify the social causes of project failure. Reports of failed project experiences are rare and lack standardization. Human dimensions of project failure, such as stakeholder relationships, are more commonly reported than other causes of failure. The peer-reviewed literature has the potential to become a useful repository of lessons learned from failed projects. However, practical challenges such as identifying individuals' cognitive biases, cultivating psychological safety in teams, mainstreaming systemic team learning behaviors, addressing varied leadership styles, and confronting fear of failure in organizational culture must be overcome if conservation professionals are to effectively navigate research-implementation 'spaces'.

2.1 Introduction

Conservation professionals operate in a highly dynamic, diverse, and complex world. Contexts change, often unexpectedly, and so it is essential that individuals, teams, and organizations integrate information and knowledge from a wide variety of sources and respond in ways that facilitate learning how to effectively navigate research-implementation 'spaces' (Salafsky et al. 2002; Knight et al. 2006b). Information about the range of factors impacting project success or failure can be obtained through direct experience, but these experiences can also be shared with others through oral or written communication. This vicarious learning can be an efficient complement to direct experience by allowing people to benefit from lessons learned across a wide range of others' experiences in a short period of time, and is particularly effective in the case of vicariously shared failure reports due to the higher emotional impact (Bledow et al. 2017) and the higher value of the knowledge generated by failure compared to success (Sitkin 1992). Anecdotal evidence suggests project failures are common in conservation, however a number of studies lament the dearth of published project failures (Sutherland et al. 2004; Bottrill et al. 2011; Godet & Devictor 2018). Such failure experiences could, if systematically identified, analyzed, corrected, and shared, actively promote vicarious learning, and thereby improve individual and institutional knowledge, promote strategically targeted pragmatic research, and increase the likelihood of effectively navigating future research-implementation spaces (Denrell 2003).

Although conservation professionals have primarily directed conservation actions using information from the natural sciences (Bennett et al. 2017), conservation is inherently a social endeavor (Leopold 1935 in Meine and Knight 1999; Soulé, 1985) and the human dimension is increasingly recognized as fundamental to achieving conservation outcomes (Meine et al. 2006; Bennett et al. 2017). Conservation actions are ideally founded upon scientific evidence that synergistically integrates value-laden experiential, social and traditional knowledge (Toomey et al. 2017). Identifying both the biological *and* social dimensions of what works and what does not in conservation projects is essential for designing, implementing, monitoring, evaluating and refining effective conservation actions. The increasing emphasis on systematically gathering and

building an evidence base is a positive and foundational component of effective conservation. Reports of the outcomes of biological experiments are relatively common in the published literature (Sutherland et al. 2004; Mair et al. 2018), however project evaluations across the many phases of project implementation are rare (Bottrill et al. 2011). Moving beyond biological considerations to 'attend to the whole' by understanding the social context (e.g., human, operational, political, economic) across multiple institutional scales, inclusive of local team and organizational dynamics, that affect project success and failure is essential for effective learning (Balme et al., 2014; Knight et al., 2008; Leopold 1935 in Meine and Knight, 1999; Stirzaker et al., 2011).

Despite the learning opportunity provided by systematically identifying, analyzing, correcting and sharing *failure* experiences, conservation professionals and researchers most commonly document and recommend the replication of actions perceived to have delivered *successful* outcomes. These recommendations from the conservation literature are problematic for several reasons (Redford & Taber 2000; Game et al. 2014). Relying primarily on success as a guide for future actions can lead to overconfidence, oversampling errors, erroneous identification of causal factors, and reduced motivation to search for alternatives (Catalano et al., 2018). Disciplines and sectors beyond conservation with longer histories of systematically managing failure, such as business, medicine, the military and commercial aviation, recognize the limitations inherent in relying on replicating best practices derived from success, and instead proactively implement activities that facilitate learning from failure (Helmreich & Merritt 2000; Cannon & Edmondson 2005). These activities constitute an 'error-related learning process', and include explicit philosophies, systems and techniques for the identification, analysis, correction and sharing of failure experiences (Putz et al. 2012). Systematic implementation of these learning-from-failure activities is largely overlooked by conservation organizations (Redford & Taber 2000; Bottrill et al. 2011; Redford et al. 2018). For example, the majority of adaptive management operational models make no explicit reference to philosophies, systems and techniques specifically implemented to learn from failure.

The formal scientific literature is potentially an important vehicle for implementing learning-from-failure activities (Redford & Taber 2000; Fuller et al. 2014) but is poorly

structured and under-utilized, lacking the standardization common to other disciplines with decades of error-reporting experience (Davies & Delaney 2017). Realizing this potential in conservation begins with understanding, firstly, the extent to which learning-from-failure experiences have been reported in the peer-reviewed scientific literature, and secondly, how effectively these experiences represent the 'identification, analysis, correction and sharing' process deemed best-practice in other disciplines (see Putz et al., 2012 for a review).

As a complement to the lessons generated (typically through reductionist) biological sciences (e.g., Sutherland et al. 2018), and to capitalize fully on the rich learning potential rooted in the personal experiences of conservation professionals, I aimed to establish a benchmark for the peer-reviewed conservation literature that: 1) quantified the degree to which project successes versus failures were reported; 2) determined the structure and content of studies that described project failure; 3) identified the range of non-biological causes of reported project failures; and 4) provided direction on future research into approaches for learning from project failures. Ultimately, my goal is to increase the utility of the peer-reviewed conservation science literature to inform the learning practices of conservation professionals and organizations that promote effective navigation of research-implementation spaces.

2.2 Methods

2.2.1 Search strategy

An understanding of current thinking and practices developed from literature known to me, and from my and my supervisor's direct professional experience with failure, was used to generate a list of search terms. I then applied these to identify articles reporting conservation project success and/or failure in peer-reviewed journals for the period 1970-2016. Literature used to generate the search terms was included in the analysis if it met the inclusion criteria, even if individual papers themselves did not appear in the search results (e.g., Beier 2007).

I applied five Boolean search strings to the ISI Thompsons Web of Science Core Collection database and to Google Scholar, limiting my results to articles published in English.

The title, abstract, and keywords were included in each search. Each search string began with the term "fail*", "success*", "best practice*", "lesson*", or "learn*", and then included the combination of terms "conservation" AND (project* OR program* OR action* OR intervention* OR initiative* OR outcome* OR implement*). Google Scholar was used to source articles available to conservation professionals without access to paywall-protected databases, and the first 200 entries were reviewed for each search. Data were stored and quantitatively analyzed in Microsoft Excel (2011).

2.2.2 Inclusion criteria

Reviewed articles met three inclusion criteria: 1) the author reported empirically on one or more conservation projects; 2) the author described perceived social causes of project outcomes; and 3) the project(s) were described as a success and/or failure. I focused upon the *social* dimensions of project *failures* reported in the *peer-reviewed* literature because: 1) the learning potential from failure is greater than success (Sitkin 1992); 2) reports of failed projects were perceived as rare (e.g., Redford and Taber, 2000); 3) failures from biological causes appeared to be documented far more commonly than social causes (e.g., Sutherland et al., 2018); 4) sectors as diverse as business, medicine, the military and commercial aviation identify social factors as more pervasive than failures from other causes (Catalano et al. 2018); and 5) the peer-reviewed literature has potential to serve as a repository of lessons learned from failed conservation projects (Redford & Taber 2000).

Excluded articles included opinion pieces; literature and book reviews; introductions to special sections; and articles that made proposals or recommendations for future action without describing projects. Articles primarily presenting theoretical concepts, frameworks, or conceptual models; biological assessments of the effectiveness of interventions, tools, mechanisms or approaches; species assessments; threat assessments; development of indicators; development and/or testing of models; or genetic analyses were also excluded.

A 'project' was defined as a 'set of actions undertaken by a group of actors to achieve some defined end' (Margoluis et al. 2009, p.139). I adopted broad definitions to capture the

variety of ways failures and successes are described, defining 'failure' broadly as a conservation project that had a 'lack of success' or 'a falling short', and 'success' as a conservation project that achieved 'a favorable or desired outcome' as per the Merriam-Webster Online Dictionary. I determined if an article reported failure or success by reading the title and abstract and subjectively assessing whether the author described a project or component of a project that did not achieve its intended objective. I excluded articles that primarily discussed success from full-text analysis, reporting successes only as a proportion of all articles sourced. Titles and abstracts were not always clear in defining failure, nor provided complete summaries of project outcomes in some cases. Euphemisms for failure may potentially have resulted in relevant articles not being captured by my search terms. Given the complexity of the contexts authors reported on, the subjective character of many failure reports, and the absence of a structure for reporting failure experiences, I subjectively determined what constituted a project failure from reading the full text of each article.

2.2.3 Thematic analysis

Once the final selection of failed project articles was identified, I recorded author, article, and failure reporting characteristics (Table 2.1). I then performed a qualitative thematic analysis of the entire text of each article using QSR NVivo 11 software (QSR International, 2014). Segments of text related to causes of project failure were identified and coded, and repeatedly sorted and grouped to arrive at "primary" and "secondary" themes. This provided a systematic and transparent analysis of implicit or complex meanings in the examined material (Joffe 2012).

Table 2.1. Criteria used to categorize the final selection of articles.

(N=59)

Author	Article	Failure reporting
Lead author gender	Journal name	Reporting own or other's project
Country of lead author affiliated institution	Year published	Location of word 'fail*'
Number of authors	ISI Impact factor of journal at time article was published	• Title • Abstract • Keywords
All author affiliations • Academic • NGO • Gov't agency • Private sector	Project realm • Terrestrial • Marine • Freshwater • Coastal	Synonyms for 'failure' used
		Frequency of use of word 'fail*'
	Topic area • Protected area management • Species management • Conservation and Development (to include ICDP, CBNRM, CBC, and sustainable development) • Land use planning • Human-wildlife conflict • Restoration • Forest management	Value of failure explicitly noted
		Degree to which project team engaged in the following for failure experience (Putz et al. 2012): • Identification • Analysis • Correction • Dissemination
	Country of project	
	Number of projects	
	Author's data gathering methods • Document analysis • Personal interviews • Site visits (to include participatory observation)	

2.3 Results

The five search strings returned 4,411 articles. Of these, 'success*' returned 2904 articles, 'fail*' 852 articles, 'learn*' 583 articles, 'lesson*' 590 articles, and 'best practice*' 203 articles. Individual results for each search string do not total to 4,411 because articles were

captured in more than one search. A total of 257 articles were excluded, being unrelated to conservation (e.g., urban planning, climate change resilience, environmental law). A further 3,209 articles did not report project outcomes (e.g., theoretical papers, genetic analyses, model development), and 665 were excluded for presenting only biological factors, leaving 221 articles reporting project success and 59 reporting failure (Appendix C, Table C1).

2.3.1 Article characteristics

The 59 project failure articles reported on a total of 106 projects, with the majority (73%) reporting on only one project. The studies were undertaken in 32 countries: the United States (14%), Tanzania (8%); Indonesia (7%); Madagascar and South Africa (6% each); and Australia, Canada, Mexico, Nepal, and the Philippines (4% each). All other countries represented 3% or fewer articles (Appendix C, Table C2). The articles predominantly described projects in the terrestrial realm (78%), and marine (15%) and coastal and freshwater (3% each) realms less commonly. Topic areas included conservation and development projects (38%, including integrated conservation and development, community-based conservation, community-based natural resource management, and sustainable development; e.g. Kellert et al., 2000), terrestrial protected area management (15%; e.g. Hall et al., 2014), marine protected area management (15%; e.g. Katikiro, et al., 2015), species management (15%; e.g. Brook et al., 2014), and forest management (7%; e.g. Bissix & Rees, 2001). Remaining topic areas represented 3% or fewer articles (Appendix C, Table C3).

Lead authors were predominantly affiliated with universities (71%), with NGOs and government agencies representing 8% and 7%, respectively. Lead authors were primarily males (68%) from the United States (34%) or the United Kingdom (20%). The highest number of articles reporting project failure was in 2014 (n=7). Articles were published in 30 journals, mostly in *Conservation Biology* (12%), *Environmental Conservation* (10%), *Biological Conservation* (8%), *Marine Policy* (7%), and *Society and Natural Resources* (7%). All other journals accounted for 5% or fewer articles (Appendix C, Table C4).

A small proportion of articles reported whether project participants, as opposed simply to authors, identified failure (17%), analyzed the failure (11%), corrected the failure (13%), or shared any information about the failure experience (9%) (per Putz et al., 2012). Few authors explicitly stated the value of failure for learning (15%) or reported on projects in which they were directly involved (15%). The majority of authors reporting their direct project experiences (63%) classified 'personal experience' as their primary source of data, with the remaining authors not stating how data were obtained. Of the authors reporting other people's projects, 78% reported methods of data collection, which included interviews with local stakeholders (22%), NGO staff involved in the project (18%) and government agency staff (13%); document analysis (18%) and participant observation (11%). Interviews with private sector firms, questionnaires, and site visits (not otherwise described as interviews or participant observation) comprised the remaining methods. Twenty-two percent of authors reporting other people's projects did not state how data were obtained.

The term 'fail*' was used at least once by most authors (92%). The word 'fail*' was rarely used in the title (3%) or the keywords (2%) but was commonly used in abstracts (42%). Articles that did not include the term 'fail*' in the title, abstract, or keywords (53%), presented failure through a wide range of synonyms related to lack of success, deficiencies, and problems (Table 2.2).

Table 2.2. Synonyms used to identify instances of failure and its causes in articles.

Lack of success	Deficiencies	Problems	Other phrases
Unsuccessful	Shortcoming	Fatal flaw	Why it all unraveled
Elusive success	Deficient	Challenge	Where did things go wrong
Mixed success	Inadequate	Rapid deterioration	Demise of the project
Fleeting success	Insufficient	Unsustainable effort	Implementation remains problematic
Preventing success	Falls short	Significant negative effect	
	Substantial gap	Pyrrhic victory	Demise of the species
	Declining effectiveness	Obstacles not overcome	Non-implementation indefinitely
		Catastrophe	
	Not met expectations	Outcomes deteriorated sharply	Cock-up
		Missed opportunity	

2.3.2 Themes

The article coding process produced five 'Primary themes' comprising fifteen 'Secondary themes' (Table 2.3). When conducting and reporting the results of thematic coding, it is important to note that the frequency of a theme does not indicate level of importance, simply the number of references identified by the coder (Cvitanovic et al. 2016b).

Table 2.3. Hierarchy of themes developed during qualitative analysis of final selection of articles. (N=59) See Appendix C, Table C1 for a complete list of articles.

Primary theme	Secondary theme	Frequency	No. of articles
1. People (55)	a. Relationships between stakeholders (e.g., conflict, too many competing interests)	210	38
	b. Experiences (e.g., failure of local leaders, failure to learn from past experiences, negative past experience with conservation initiatives)	167	38
	c. Psychological reactions (e.g., fear, blame, motivation, risk aversion, trust)	164	36
2. Action (47)	a. Management problems (e.g., lack of enforcement, inadequate management, failure of project to outlast external involvement)	105	30
	b. Implementation problems (e.g., putting plans, strategies, and implementation tools in place)	86	34
	c. Lack of capacity	32	15
	d. Avoid difficult decisions or courses of action	18	8
3. Information (37)	a. Communication failures (e.g., failure to communicate with local people, manage expectations, seek information)	67	29
	b. Lack of feedback or reflection	47	16
	c. Data collection problems	15	6
4. Funding (34)	a. Lack of funding (e.g., for management, implementation, or to sustain project over longer term)	70	30
	b. Funding misallocation or mismanagement (e.g., corruption, delays)	16	10
	c. Donor conflicts	11	6
5. Economic and political (28)	a. Overriding imperative for production (e.g., no incentive for conservation, economic development trumps conservation) and alternative income problems	60	22
	b. Lack of political support, shifting political conditions, or government policies counter to conservation aims	51	17

2.3.2.1 Inter- and intra-personal dynamics

The most frequently mentioned cause of failure was 'People' (Table 2.3, Primary theme 1), which encompassed interactions between individuals as well as internal personal dynamics such as motivation, corruption, fairness, conflict, authority, or fear. Within this Primary theme, authors most commonly described difficulties with stakeholders (Table 2.3, Theme 1a) such as conflict and a lack of coordination between multiple parties (Table 2.4, Quote 1a). Also frequently mentioned were people's experiences as contributors to project failure (e.g., as stakeholders, local residents, or project team members) (Table 2.3, Theme 1b). Examples included the influence of corruption, the failure to learn from past experiences and the sense of 'alienation through conservation' derived from people's past experiences with conservation organizations and the creation of an 'us versus them' mentality (Table 2.4, Quotes 1bi-biii). Individual and group psychological dynamics were also frequently mentioned (Table 2.3, Theme 1b), such as the fear of failure or blame, a lack of trust between people, or risk aversion leading to negative impacts on decision-making ability (Table 2.4, Quote 1c).

Table 2.4. Sample of representative coded text segments used to develop themes.

Primary theme	Secondary theme examples
1. People	1a. *"Lack of coordination of policies and activities, and conflicts between the main public agencies, have been some of the main problems for PA management in Honduras. For example they contributed to the failure to implement any of the five detailed management plans prepared for LTNP* [La Tigre National Park]*"* (Richards 1996, p. 214).
	1bi. *"Conservationists are now presenting Maasai as natural allies of wildlife in their attempts to expand CBC throughout the Maasai Ecosystem. However, over the past several decades, Maasai have come to view conservation, and often by association, wildlife, as enemies. These feelings reflect a history of land alienation through conservation, repeated most recently with the eviction of Maasai from the Mkomazi Game Reserve in Northern Tanzania"* (Goldman 2003, p. 853).
	1bii. *"Rather than dismissing past programmes, the PES* [payment for ecosystems services] *approach could benefit from examining lessons from previous experiences…"* (Hayes 2012, p. 150).
	1biii. *"…a general consensus existed that revenues were misappropriated by board members and used for personal gain"* (Kellert et al. 2000, p. 709).
	1c. *"Decision-makers' fear of risk and of blame (as a result of failure) perhaps hindered more intensive management actions for the now extinct endemic Hawaiian bird the Po'ouli (*Melamprosops phaeosoma*). The decision to undertake captive propagation came too late for this species"* (Brook et al. 2014, p. 28).
2. Action	2a. *"The consequences of inadequate management included theft and rapid degradation of assets, inadequate control of pests and weeds; inadequate fire prevention management and poor communication between the government and other stakeholders over management decisions"* (Hughes & Jones 2010, p. 176).
	2b. *"As long as particular program actions are implemented, program participants assume that the program is successful. This checklist approach advances bureaucracy but does little to advance actual recovery. If success were measured by population changes, the recovery program would likely be judged a failure"* (Brower et al. 2001, p. 1004).
	2c. *"…lack of planning skills among team members was a major weakness. In the AWF* [African Wildlife Fund]*/Babati District Council planning team, for example, no one had rural planning skills…lack of planning*

	skills led to use of un-streamlined planning procedures, zoning of land-uses without criteria and planning was carried out without taking into account socio-economic factors. These weaknesses in turn led to production of substandard maps and reports" (Kaswamila & Songorwa 2009, p. 132).
	2di. *"According to one program participant, the Colorado Division of Wildlife has chosen to support fish hatcheries rather than focus on key threats, such as sport fishing in native fish habitat. Similarly, water users support non-native fish eradication rather than address problems of flow management. After all, it is easier to contrast fish hatcheries and control non-native species than to restrict human water usage"* (Brower et al. 2001, p. 1004).
	2dii. *"At a personal level, the political risks of implementing unproven and unpopular conservation measures may outweigh the potential benefits of success...doing nothing is generally the easiest option"* (Brook et al. 2014, p. 28)
3. Information	3a. *"This again shows the failure of LIRDP* [Luangwa Integrated Resource Development Project] *to disseminate its project goals with sufficient clarity to the people of the Lupande GMA* [Game Management Area]*..."* (Wainwright & Wehrmeyer 1998, p. 938)
	3b. *"...Decision-makers have not received regular and conclusive feedback about the ecological and socioeconomic impacts of the EBSM* [ecosystem-based spatial management] *over Galapagos marine ecosystems and over the range of activities affecting it"* (Castrejón & Charles 2013. p. 239).
	3ci. *"Factors important to small-sized populations or preventing recovery remain unstudied…In essence, no information has yet been generated on factors preventing recovery of any subpopulation…without confident knowledge on factors preventing recovery, conservation efforts might simply amount to documenting the loss of further subpopulations"* (Flueck & Smith-Flueck 2006, p. 69, 71).
	3cii. *"Delays in implementation continued as Alberta Public Lands refused to embrace the uncertainty about grazing, insisting there was not enough information to begin adaptive trials"* (Aldridge et al. 2004, p. 98)
	3ciii. *"However, we are acutely aware that despite our carefully designed monitoring program in Booderee National Park, we nevertheless failed to anticipate the extremely rapid decline (and possible local extinction) of the Greater Glider. In addition, despite ruling out some factors as direct drivers of decline (e.g., wildfire, reduced rainfall, landscape fragmentation and logging), we were unable to diagnose the reason/s underpinning the population collapse in Booderee National Park. Thus, we were unable to instigate a targeted intervention program of management to arrest its decline and possible extinction"* (Lindenmayer et al. 2011, p. 1670)

4. Funding	4ai. *"In the end, the limited budget, enormous territory, and limited capacity of the conservation authorities to deal with the systematic illegal extraction of caracol* [conch] *was, and remains, a critical problem"* (Hoffman 2014, p. 131). 4aii. *"…the subsequent establishment of ever more conservancies across the country was primarily driven by foreign funders and donor funded non-governmental organizations who wanted to be able to list growing areas under conservation and growing numbers of conservancies in their annual reports, regardless of these conservancies' potential for long-term success. Donor spending has typically been oriented towards supporting the establishment phase of new conservancies, rather than supporting conservancies once they are fully operational"* (Humavindu & Stage 2015, p. 19) 4b. *"In 1993, the SRT* [Sumatran Rhino Trust] *was dissolved after five years and a cost of more than US $2.5 million. Virtually none of the money went to improving the protection and management of wild rhinos in existing protected areas. This program, along with the similar efforts in Sabah and Peninsular Malaysia to catch doomed rhinos for breeding were expensive failures"* (Rabinowitz 1995, p. 484). 4c. *"In addition, institutions are often competing against one another for funds, so inter-agency relationships become competitive rather than cooperative… Thus, it is not surprising that this confusion can lead to weak social and ecological results"* (Hoffman 2014, p. 129*).*
5. Economic and political	5a. *"All the examples referred to in this paper have clearly demonstrated that ecosystem management efforts cannot succeed over the long term, where resource exploitation pressures far exceed the drive for conservation and where the political will and capacity for statutory control to enhance conservation is weak"* (Bissix & Rees 2001, p. 581). 5b. *"Given the MCZ* [Marine Conservation Zone] *project was initiated under one administration (Labour) and the implementation of the project under another (first Coalition, now Conservative), it is not surprising that the shift in Government has impacted the project's outcomes"* (De Santo 2016, p. 96). *"…Subsidized credit to cattle ranchers and timber men, road construction, and the legal status of broadleaf forest as 'idle' until 1992, also justified the suspicion that the real policy* [of the government] *has been one of frontier expansion"* (Richards 1996, p. 214)

2.3.2.2 Implementation actions, information flows, and funding

Articles also frequently mentioned causes of failure directly related to implementing projects, grouped as the 'Action' Primary theme (Table 2.3, Primary theme 2). These included activities related to project planning and management, the use of implementation tools (e.g., maps), enforcement, and the failure of projects to continue once external financial support ended. Secondary 'Action' themes also included constraints, such as a lack of capacity or the avoidance of difficult actions (Table 2.4, Quotes 2a-dii).

Many articles also discussed problems related to 'Information' (Table 2.3, Theme 3). The failure of project participants to communicate their ideas effectively and the lack of effective feedback mechanisms were perceived as contributing to project failure (Table 2.4, Quotes 3a-b). Additionally, articles frequently mentioned data collection issues, which were characterized variously as problems needing to be addressed to reduce uncertainty; excuses for delaying action; or as activities, such as collecting more data, that were ultimately futile in preventing failure (Table 2.4, Quotes 3ci-ciii).

Also discussed were problems arising from 'Funding' (Table 2.3, Theme 4). Funding was frequently noted as insufficient for planning and management activities, and for sustaining projects after the initial source of funding ended (Table 2.4, Quotes 4ai-aii). There were also instances of funding being misallocated and misappropriated, and negative outcomes attributed to competition for funding between institutions (Table 2.4, Quotes 4b-c). Finally, 'Economic and political' causes of project failure were common (Table 2.3, Theme 5). Often conservation projects suffered because of 'an overriding imperative for production' leading to the subordination of conservation goals to economic considerations and inadequate political protection (Table 2.4, Quotes 5a-b).

2.4 Discussion

2.4.1 Limited reporting of project failure

The potential for conservation professionals to learn vicariously from the peer-reviewed literature through the identification, analysis, correction and sharing of failure experiences is not being realized. Anecdotal evidence from my experience, such as from conference workshops and informal discussions, suggests project failure is common in conservation, perhaps even the norm. However, the number of published studies detailing project failures is small and has not substantially increased over time despite published exhortations to do so (Redford & Taber 2000; Sutherland et al. 2004; Knight 2006; Beier 2007). This may reflect a perceived stigma or fear surrounding failure that discourages frank identification, analysis, correction and sharing of failure experiences (Bottrill et al. 2011), or a reluctance by journal editors to publish failure reports (Wamukota et al. 2012; Davies et al. 2014).

I found that successful projects are reported almost four times more often than failures. This is consistent with other recent reviews that have found project failures published at far lower rates than successes (e.g., Giakoumi et al. 2018; Godet & Devictor 2018). This suggests a belief by authors and possibly journal editors that the path to increasingly effective conservation lies in the derivation of 'best practices' from perceived 'success' factors, despite the traps and limitations of this approach for effectively navigating research-implementation spaces (Sitkin 1992; Game et al. 2014; Catalano et al. 2018).

A positive attitude towards failure significantly improves the ability of individuals and their teams to learn from it (Cannon & Edmondson 2005; Politis & Gabrielsson 2009). Although use of the word 'failure' has been decried as negative and unhelpful (Lamoreux et al. 2014), most authors do use the term. However, few authors make explicit statements that recognize the value of failure, which, if more commonly found in published literature, might contribute to reducing the stigma surrounding it. Adopting a 'growth mindset' (Dweck 2006) reframes errors and mistakes as positive learning opportunities. This might, in turn, promote the cultural transformation towards valuing the learning opportunity presented by failure experiences so

widely promoted in other disciplines. Disciplines that have developed explicit, structured processes for identification, analysis, correction and sharing of failure recognize that a prerequisite to coping effectively with it is recognizing and reframing negative emotions and countering the 'name, blame and shame' culture (except where clear violations have occurred) that may emerge from failure discussions (Cannon & Edmondson 2005; Shepherd & Cardon 2009; Putz et al. 2012). Conservation organizations and donors should promote such a culture, using existing techniques common in other sectors such as: failure reporting amnesties; training on managing cognitive biases, conducting reflective debriefing sessions, and creating psychologically safe teams; and establishing systems to encourage and even reward failure reporting.

The absence of articles documenting failure experiences may also be due to the challenge of producing published accounts of project outcomes. Data collection and documentation may be non-existent or inconsistent, and in the absence of incentives or adequate time, project reports may be undertaken months or years after the conclusion of a project, if at all (Sunderland et al. 2009). Even if the learning value of sharing a failure experience is recognized, people may weigh this against the risk of jeopardizing future funding and make a judgment in the interest of self-preservation (Bottrill et al. 2011; Davies et al. 2014; Game et al. 2014). More generally, these challenges may be further compounded by the often lengthy process of publication in the peer-reviewed literature (Nguyen et al. 2015).

Additionally, authors reporting on the work of others are necessarily limited to what participants choose to document or share. Especially in the absence of psychological safety, failure experiences can be difficult to discuss and emotionally charged, potentially limiting the information that can be collected (Edmondson 2012). Although examining lessons from a failure experience well after the conclusion of a project is clearly preferable to not doing so at all, these findings are most usefully extracted as lessons identified and documented regularly throughout a project lifespan (Schindler & Eppler 2003). First-hand accounts by conservation professionals are preferable to second-hand accounts, meaning conservation is best served if individuals document their own failure experiences.

The dearth of published failure reports means the sharing of lessons that could be vicariously learned and applied to future projects may be limited to sources such as oral accounts, unpublished internal documentation of organizations, or publicly available information that organizations are willing to share. In the absence of an over-arching regulatory body in conservation which gathers data, analyses failures and drives correction of mistakes and errors, as is present in aviation (FAA 2002; Catalano et al. 2018), internal documentation requirements in may vary. Sharing lessons across conservation organizations may be ad hoc, driven by individual egos and relationships or limited to a set of defined projects (Chapter Five), and much like an individual's decision to report project failure, subject to informal cost-benefit analyses across the conservation sector that does not favor the high perceived costs of information sharing (Schwartz et al. 2012). In extreme cases, conservation organizations may view themselves as competing for limited resources, potentially stymying lesson sharing (Chapin 2004).

Individual organizations may (or may not) facilitate the sharing of lessons by documenting and sharing lessons from specific projects, but an assessment of organizational learning structures was beyond the scope of the present study. It is an important topic for future research. Fundamentally, knowledge resides in individuals. If an employee leaves an organization and their knowledge departs with them without being stored in some way, the organization cannot be said to have learned (Schindler & Eppler 2003; Wilson et al. 2007). The culture of short-term contracts prevalent in many non-governmental organizations promotes high staff turnover which compromises the capacity to generate and sustain a learning organization (Buckingham & Külcür 2017). This can result in the unintentional replication of unsuccessful actions at the expense of time, financial resources, and public goodwill (Mace et al. 2000).

Improving conservation effectiveness depends upon learning from past mistakes, and while the peer-reviewed literature may not be the ideal repository (Sunderland et al. 2009), in the absence of a robust and widely used alternative it is currently the most readily available proxy for sector-wide institutional memory. Several conservation journals specifically acknowledge the value that failure experiences provide by committing to publishing negative, unintended, or unexpected results in the peer-reviewed literature (e.g., Schwartz et al. 2018), however the absence of an appropriate database to store this information hinders these efforts. Leadership

from the Conservation Measures Partnership or the Society for Conservation Biology (SCB), respectively through the Open Standards (CMP 2013) or the suite of SCB affiliated journals (https://conbio.org/publications) could guide the establishment of such a database.

2.4.2 Diversity of authorship, contexts, and causes of failure

Given the incentive in academia to publish articles and the high cost of publication, it is unsurprising my study found that most lead authors are affiliated with universities in developed countries (see also Sunderland et al. 2009). Unfortunately, if studies published by academics are typically the least relevant to those implementing conservation projects (Smith et al. 2009), any useful and actionable information contained in these articles is unlikely to reach those who could benefit most from it. The limited interaction of stakeholders in this research-implementation 'space' (Toomey et al. 2017), which manifests in part as a majority of local people, practitioners and policy-makers not reading the peer-reviewed literature (e.g., Pullin et al., 2004) should serve as impetus for researchers to "lead by serving" (Beier 2007) and collaborate formally and informally with local managers, planners, policy-makers and others (Knight et al. 2006b; Sunderland et al. 2009).

Unsurprisingly, my thematic analysis revealed that 'People', and in particular the Secondary theme 'Relationships between stakeholders', were the most frequently mentioned causal factors of failure. Achieving conservation goals is dependent upon understanding people's values, experiences, and expectations as much as biological systems, and my result is consistent with previous work which finds social factors and stakeholder management playing a large role in project success and failure (e.g., Giakoumi et al., 2018; Redpath et al., 2013). A project can be designed and implemented using the best available science and yet be completely derailed by the impact of the interactions between people (e.g., Beier, 2007; Knight, 2006). Sharing experiences in navigating stakeholder conflicts, overcoming the impact of a community's negative historical experience with conservation organizations, or managing a fear of failure or blame that hindered decision-making all represent useful opportunities for vicarious learning that could help others better navigate the research-implementation 'space'.

The frequency of failure causes related to 'Action' indicates the range of skills required to shepherd a project throughout its duration. Dealing with management challenges, working through capacity limitations, and recognizing the need to make difficult decisions all require persistence, flexibility, and leadership. When considered in conjunction with the theme of 'Information', which includes the importance of clarity of communication and willingness to seek and share feedback and accept contradictory information, I find that conservation projects are often greatly impacted by factors that typically fall outside most conservation biology education programs (Jacobson 1990). The skills required to gather, model, and make sense of biological data are substantially different to those required to navigate the wide range of 'People', 'Action', and 'Information' causes for failure found in my results, such as: navigating the impact of local corruption, motivating people to participate in an initiative, managing intractable stakeholder conflicts, enforcing ground-level management aims, working through the 'us versus them' mentality of a community with negative past experiences with conservation organizations, or dealing with paralysis resulting from unclear decision-making authority. My results confirm the long standing recognition that these skills are vital for conservation professionals (Jacobson 1990) and echo calls for shifting towards training in facilitation and negotiation, problem-solving and integrating knowledge in order to function effectively in research-implementation 'spaces' (Toomey et al. 2017).

In reporting individual causal factors for failure reported in the literature, I do not imply that these are independent, nor that undertaking a causal analysis will result in a solution. Causes of failure are typically diverse and interacting, complex, and dynamic. Many conservation challenges are intractable and may actually be exacerbated by conservation actions, and typically take years of ongoing effort towards often shifting objectives to produce incremental improvements, with many successes and failures along the way. Failure can ultimately result from external forces such as economic drivers or political changes that are beyond the control of the project participants (Table 2.3, Theme 5). It can be frustrating to not find a solution to a problem, but the nature of 'wicked' conservation problems means that conservation professionals must learn to become comfortable with uncertainty.

Developing a strategy for managing failure requires valuing a process of continuous improvement in a world in which the achievement of 'solutions' may be ephemeral. The need for long-term, ongoing management is underscored by the theme of 'Funding', which highlights problems related to a lack of sustainable financial resources following initial implementation. Rather than short-term funding contracts with renewal contingent on the delivery of immediately measurable outputs, donors may benefit from a shift to a different business model that takes a longer view focused on learning (Hodge & Adams 2016). This promotes both a 'safe-fail' culture and adaptive course correction, because learning from failure at one stage may result in subsequent success (Redford & Taber 2000).

2.4.3 How should failure be reported?

Projects did not typically apply systematic approaches to identify, analyze, correct and share failures and there was broad inconsistency in how failures were reported. A small number of authors reported on their own failures in detail with the goal of helping their readers learn from their experiences. A substantially larger set of authors reported on the failures of other practitioners but did not report their data collection methods. The absence of information on the methodologies and techniques applied is poor scientific practice because the basis upon which conclusions are drawn and recommendations made cannot be ascertained, the reliability of the report cannot be fairly judged, and potential biases cannot be illuminated (Roberts et al. 2006). To provide the greatest utility to the reader, inconsistencies should be addressed through a systematic approach to reporting project failure. Echoing calls for the adoption of empirical and systematic evaluations of conservation projects (Saterson et al. 2004; Wamukota et al. 2012), donors and journal editors should encourage authors to move beyond simply relating personal experiences towards capturing the failure experience in a way that produces actionable information for the reader. Providing a description of a project experience that clearly identifies the failure and an analysis of why the failure occurred would ideally be reported *after* corrective action(s) were attempted and outcomes analyzed to maximize the opportunity for vicarious learning and the likelihood of success (Bledow et al. 2017).

Mainstreaming information into the hands of people who can use it is a perennial problem in conservation (Pierce et al. 2002; Pullin et al. 2004; Cvitanovic et al. 2014). Data on why a project failed should be available to local managers, planners, policy-makers, researchers and others to reduce the chance of repeating previous mistakes (Redford & Taber 2000; Sutherland et al. 2004; Knight et al. 2008). Documenting the learning that occurs as a result of project failure should be pursued with the same level of urgency as that which drives efforts to create a database of biological evidence (Sutherland et al. 2004; Curzon & Kontoleon 2016). The perpetual focus on gathering data at the expense of understanding the social dimensions of conservation problems can reduce the effectiveness of projects, especially in contexts where too much data is gathered (e.g. Grantham et al., 2008) or where biological data is useless (e.g. in hotspots; Cowling et al. 2010). In order to ensure that project outcomes are systematically catalogued and accessible, structures should be put in place during pre-project planning that describe how learning will be captured and acted upon; specifically, how failures and errors will be identified, analyzed, corrected and shared. These practices are commonplace in other sectors and could include checklists; anonymous reporting protocols; regular structured debriefs; teamwork and leadership training on managing cognitive biases and creating psychological safety; short failure stories in internal magazines and newsletters; publishing research on how learning from failure takes place in conservation teams or organizations; or annual failure reports. These processes should be discussed openly and integrated into the project management cycle.

Ultimately, learning does not take place because a failure was identified and documented, but rather because these steps catalyzed the participative social process of reflection, investigation, sharing, and improvement (Macrae 2016). This requires a systemic approach that goes beyond simply discussing the lessons learned from failure, and instead recognizes that the mindsets of people within an organization (how we view failure) *and* the institutional systems that organizations put in place (how we manage failure) *both* influence how effectively learning from failure will occur. Lessons must be operationalized in individuals' day-to-day work practices, be embedded in team systems, and implicitly and explicitly be made part of an organizational culture that proactively promotes learning from failure. These systems and mindsets must be transparently adopted and modeled by the most senior of managers

(Edmondson et al. 2001; Nembhard & Edmondson 2006; Catalano et al. 2018). Conservation has yet to evolve to the point where reporting is widespread, but perhaps we can leapfrog medicine and avoid their fate of having a "strong culture of reporting but a poor culture of learning" (Macrae 2016, p. 72).

2.4.4 Opportunities for future research

The many dimensions of individual, team, and organizational responses to project failure demand further research. Making the most of the vicarious opportunity of learning from failure experiences requires identification, analysis, correction and sharing information about them. An individual's intention to engage in these behaviors may depend upon their attitude toward failure, the social norms present in their group, and/or the level of control they feel they have over whether they can implement those behaviors (Jimmieson et al. 2008).

There may be a link between the experience of a conservation professional and the willingness of that individual to respond positively to the information presented in a failure report (Walsh et al. 2015). Responses to project failure may also be influenced by an individual's cognitive biases (McConnachie & Cowling 2013), the way in which individuals are supported or discouraged by the level of psychological safety or team learning behaviors exhibited in their project teams (Catalano et al. 2018), the style of leadership under which they operate (Black et al. 2011), or the culture of the organization in which they work (Stirzaker et al. 2011).

My decision to limit my search to the peer-reviewed literature, while methodologically defensible, prevents me from accounting for project failure reporting that occurs within organizations, or publicly but outside the highly organized and readily searchable academic literature databases. Examining the extent to which individuals, teams and organizations implement internal learning from failure processes that include identification, analysis, correction and sharing practices, would be a fruitful area for future research.

Finally, I recognize that my decision to limit my investigation to non-biological factors does not represent an exhaustive analysis of the causes of project failure in conservation. This separation into biological and social dimensions, however, represents to me a fundamentally

important distinction in what is accomplished by the analysis of failure. Examining the failure of an intervention in biological terms adds valuable information to the conservation evidence base. Focusing on the social dimensions makes a contribution to efforts to promote self-reflection, continuous improvement, and greater understanding of the psychological and social dynamics of both those who conduct, and those who are impacted by, conservation activities.

2.5 Conclusion

Professionals implementing conservation actions need to know what has worked and what has not worked in the past, and opportunities to vicariously learn from others' experiences should be encouraged. But with biological research dominating the scientific literature, a general decline in the publication of the results of project implementation and monitoring (Mair et al. 2018), and a lack of systematic reporting (Wamukota et al. 2012; Curzon & Kontoleon 2016), learning opportunities in the published conservation literature are limited. Reference has been made to the importance of publishing failure reports in conservation (Redford & Taber 2000; Knight 2006; Sunderland et al. 2009), and a number of studies note that failures occur but are rarely reported (Giakoumi et al. 2018; Godet & Devictor 2018). However, to my knowledge, this article represents a first attempt to understand the way that failure is reported, which has a direct consequence on our individual and collective ability to learn from failure experiences and incorporate valuable and hard-won experiences into our institutional memory.

Reporting the results of project failure has many benefits. It is the final step in the process of identifying, analyzing, correcting, and sharing failure. Sharing failure experiences through documenting and sharing project reports is a critical component both in vicarious learning and in promoting a 'safe-fail' culture in conservation (Redford & Taber 2000; Bledow et al. 2017; Catalano et al. 2018). The continued pursuit of greater effectiveness in implementing conservation projects and participating fully in integrating social knowledge into the research-implementation 'space' requires a practical engagement with these learning-from-failure processes, notably because the human dimensions of project failure, such as stakeholder

interactions, are more common and more pervasive than those associated with other causes. The majority of articles that I analyzed did not include these elements, and thus are likely to be less effective at generating learning than they otherwise could be. This is obviously problematic, but also indicates that there are great opportunities for sharing learning experiences more effectively.

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3 | BLACK SWANS, COGNITION, AND THE POWER OF LEARNING FROM FAILURE

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Abstract

Failure carries undeniable stigma and is difficult to confront for individuals, teams, and organizations. Disciplines such as commercial and military aviation, medicine, and business have long histories of grappling with it, beginning with the recognition that failure is inevitable in every human endeavor. While conservation may arguably be more complex, conservation professionals can draw on the research and experience of these other disciplines to institutionalize activities and attitudes that foster learning from failure, whether they are minor setbacks or major disasters. Understanding the role of individual cognitive biases, team psychological safety, and organizational willingness to support critical self-examination all contribute to creating a cultural shift in conservation to one that is open to the learning opportunity that failure provides. This new approach to managing failure is a necessary next step in the evolution of conservation effectiveness.

3.1 Introduction

Fallor ergo sum. I err, therefore I am. St. Augustine's simple words belie our actual relationship with accidents, errors, mistakes, violations, and failures. Despite the central role failure plays in every human endeavor, the words we use to describe our deviation from an ideal outcome carry emotional baggage and social stigma. We instinctively understand that experiencing setbacks offers powerful opportunities for learning and growth but also internalize messages from an early age that failure is something to be avoided, and therefore deny ourselves the chance to learn from such failures. This challenge of openness to the potential benefits of failure influences us both individually and how we collectively as a discipline view failure and success. If the goal of conservation is to learn to be increasingly effective at saving nature (Salafsky et al. 2002; Knight et al. 2006a), and we accept that learning from failure and success offer different but equally valuable lessons (Hobbs 2009), then confronting failure and understanding its importance in conservation science and practice is critical and yet almost entirely under recognized and undervalued. This essay aims to challenge the current paradigm in conservation, expand on previous calls for a fundamental change to existing institutional frameworks (Allan & Curtis 2005), and propose a new approach to learning in conservation.

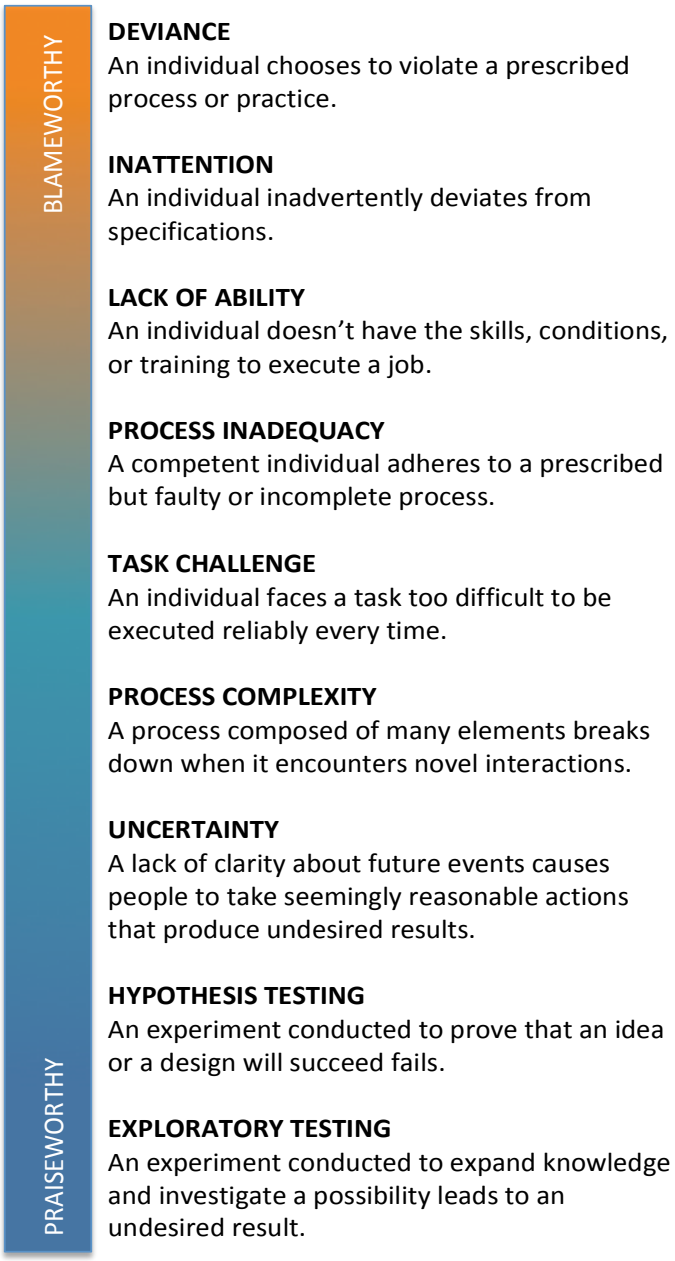
The complexity of conservation problems is surpassing the capacity of our approaches and institutions to solve them (Game et al. 2014). Paradoxically, conservation has adopted a success mindset. Success stories are more commonly reported than failures, yet evidence suggests that failure is a more common outcome whether openly discussed or not (Redford & Taber 2000; Webber et al. 2007). We position outcomes along a success spectrum, where activities not achieving stated objectives can be characterized as partial successes (e.g., Knight et al. 2008). We are highly reluctant to document and analyze failures, an important step toward a culture that recognizes failures as valuable learning opportunities (Redford & Taber 2000; Zedler 2007; Hobbs 2009). We focus on stories of hope and optimism to combat feelings of helplessness (Hobbs 2013; Ogden 2016) and to encourage continued societal support for our work. We adopt this success mindset at our peril, for it precludes the rigorous study of failure and the paradoxical success such study can bring.

In this essay, I considered well-established disciplines with institutionalized approaches to address failure in complex systems and drew lessons from them to apply to conservation. I identified pragmatic ways of defining and conceptualizing failure; why failure offers a different and potentially more valuable learning opportunity than success; and a selection of cognitive biases that limit our ability to confront failure. Finally, I introduce the concept of psychological safety and describe its fundamental importance in creating a culture that can learn from failure.

3.2 Definitions of failure

Failure can be defined simply as not achieving a stated objective or as a "deviation from expected and desired results" (Cannon & Edmondson 2001). In this regard, the term *failure* can be maddeningly imprecise and may encompass multiple outcomes across various scales and project phases muddied by different perspectives on what comprises failure (Edmondson 2012). In conservation defining failure is open to interpretation, can vary throughout a project's lifespan, and, as a label, can even be challenged as potentially not useful (Lamoreux et al. 2014).

Disciplines that learn to manage failure effectively determine what definitions best suit their organizational goals. Professionals in business, commercial and military aviation, and medicine have spent decades gathering data to refine definitions and conceptualize processes for managing and learning from failure, opting for utility rather than prescription to guide their definitions. For example, the business sector recognizes that fault and failure can be conflated (e.g., a purported human error may result, in fact, from a system failure) (Deming 1986; Reason 1990). Therefore, conceptualizing failures across a spectrum from those resulting from the potentially useful exploratory testing of new approaches (i.e., praiseworthy) to those caused by conscious deviance from acceptable practice (i.e., blameworthy) provides organizations the ability to better understand and manage deviations from desired outcomes while maintaining high performance standards (Edmondson 2011)(Fig. 3.1).



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Fig. 3.1 A spectrum of reasons for failure that can be applied to a nuanced exploration of a range of causality to facilitate understanding the relationship between failure and fault.

In systems incorporating complex technology, such as commercial and military aviation, analysis of failure has evolved beyond reductionist binary definitions and simple blame-assigning exercises (Dekker et al. 2011). Aviation-safety investigators have operationalized Reason's (1990) "Swiss cheese" accident-causation model (Fig. 3.2) in recognition that failure is inevitable in complex systems (Helmreich & Merritt 2000; Hickey et al. 2015); failure rarely has a single cause (Reason 1995); human error is implicated in the majority of accidents involving technological systems (Duffey & Saull 2003); and attributions of blame drive errors underground and limit learning opportunities (Reason 2000). For example, accepting that human error may compromise all systems, commercial airline flight-crew training intentionally does not set goals for zero errors, but rather zero accidents, an achievable goal through the active process of mitigating human error when it occurs (United Airlines 2016) and one that shifts blame away from individuals. The training program teaches pilots specific, evidence-based actions to both reduce the number of errors they commit and to respond effectively when errors inevitably emerge. Errors (as distinct from violations) are not deemed blameworthy but rather a rich source of data to be mined for further refining error-mitigation systems and the operational models used to develop crew training.

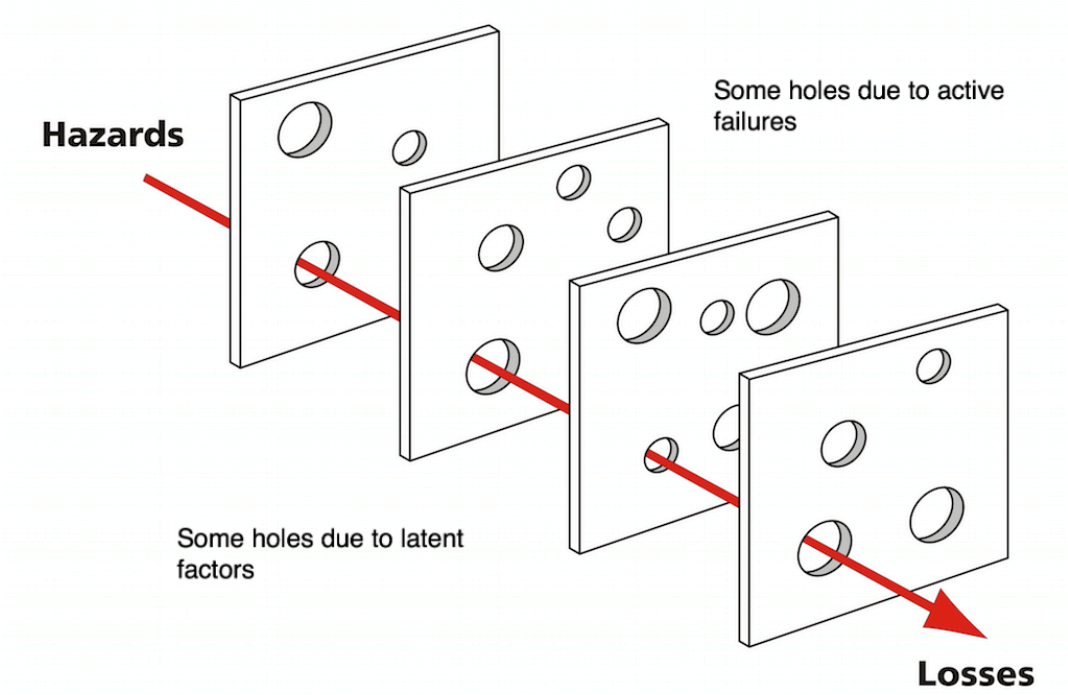


Fig. 3.2 Reason's (2000) Swiss cheese model of human error of accident causation in complex systems.
This model shows successive layers of defenses (such as automatic shutdowns, personnel training, and protocols) serving as barriers to failure, but with holes (active and latent errors, violations, mistakes, or adverse system conditions) that can line up under certain circumstances (typically due to human fallibility) allowing a failure to occur. Used with permission from David Mack, CC BY-SA 3.0, available from https://commons.wikimedia.org/w/index.php?curid=31679759

In some cases, *failure* may be most effectively defined as something one knows when one sees it, as, for example, with a catastrophic plane crash or a species going extinct. In other cases, conditional or multipart definitions of *failure* most usefully ensure the effective achievement of goals and learning. For example, military aviation may use conditional definitions of failure during warfare. The goal of complete destruction of an enemy's facility (defined as a target building being razed to the ground by aerial attack) may not be defined as a failure even if parts of the building are left standing. Upon review, a pragmatic assessment may be made of the outcome that combines evidence with expertise and experience (P. Catalano, personal communication). If the facility is deemed to no longer be functional, then the initial definition of failure is reassessed. Such pragmatic definitions result from acknowledging that failure is inevitable, the long-term outcome is ultimately of greatest importance, and the likelihood that you have enough data to make a 100% accurate assessment is inevitably zero. This is essentially a course correction based on new data, a critical step in learning from failure and ideally an integral part of conservation project assessments during all phases (Lamoreux et al. 2014).

Drawing on these ideas from other disciplines, a fundamental shift in the way failure is addressed in conservation is required, beginning with an acceptance of the inevitable nature of failure. This perspective is necessary to reduce the stigma of failure and to allow effective pre-implementation risk assessment (Lamoreux et al. 2014) and post-implementation reflection and learning to occur but is typically absent in discussion of conservation projects (Nie & Schultz 2012). This discomfort with failure is also evidenced by a strong aversion to uncertainty (Williams & Brown 2014) and the widespread tendency to reframe poor project outcomes in a more positive light when reporting to funding bodies or other stakeholders (if reported at all) (Allan & Curtis 2005; Webber et al. 2007). Whereas the aviation community has highly developed non-attribution reporting systems to publish and disseminate error information in order to drive continuous improvement (FAA 2002; Provera et al. 2010), conservation journals (with few exceptions, see Hobbs 2009) and other conservation outlets such as websites and newsletters remain reluctant to encourage the publication of failures at any scale, even unintended results (Doak et al. 2008). The resulting silence amounts to tacit acceptance of a hypocrisy that there are no failures in conservation and eliminates one potential source of

dynamic discussion and community-wide learning. The lessons from aviation indicate that far from demotivating professionals in mission-driven disciplines, operating in a culture that values learning from failure acknowledges the futility of this hypocrisy, reduces fear, and encourages transformative improvements (Provera et al. 2010).

Failure in conservation initiatives can occur at many points during a project. For example, teams may develop a comprehensive project plan but fail to gain the buy-in of key stakeholders, who subsequently refuse to cooperate. Even executing all phases of a project successfully does not guard against ultimate failure. A project to improve fish migration through the installation of fish ladders, for example, may be well planned, funded, and executed and have solid stakeholder buy-in, but ultimately it will fail if poor productivity in the ocean results in no migrating fish.

3.3 Failure versus success and searching for black swans

Our understanding of what constitutes failure is incomplete without a discussion of what it is not – specifically, success. Success has value. In both the peer-reviewed literature and popular media, success and how to measure and achieve it has been a major topic for many decades (Bass 1952; Pickle & Friedlander 1967; Peters & Waterman 1982). Success is a worthy goal for individuals and organizations; it provides motivation, increases satisfaction, and delivers monetary rewards. In conservation, success is a requirement for continued funding for conservation projects and for continued public support, but it is also personally motivating in a mission-driven discipline.

Although the benefits of success are real, there are a number of limitations inherent in relying on measures of success to determine future courses of action (i.e., best practices); examining only successful outcomes to glean lessons; and failing to recognize the value of studying failure to gain a more profound understanding of problems (Provera et al. 2010). At the most basic level, organizations tend to over sample success and under sample failure (March & Levinthal 1993), a recipe scientists recognize as leading to biased interpretations of outcomes. A

reliance on the examination of successful outcomes in the absence of a rigorous analysis of failures can lead to inaccurate causal attributions, an underestimation of the role of luck, and faulty predictions of future probabilities (Kahneman 2011). Ultimately, success breeds complacency and overconfidence, reinforces the status quo, generates a cultural milieu less tolerant of experimentation and change, and increases risk aversion (Sitkin 1992). Success suggests that corrective action is unnecessary and reduces the motivation to search for alternatives, a tendency compounded by the complacency-fostering pressure arising from assigning blame to those innovating but failing, rather than to those who fail to act.

A perspective that is open to failure can prime us to stop and rethink our existing mental models (Biggs et al. 2011a), leading to the notion that the information value of failure is higher than that provided by success. Studying and replicating success simply reinforces what is already known and discourages in-depth analysis (Gino & Pisano 2011), as well as confounding causal analysis. Philosopher and scientist Karl Popper's (1959) black swan thought experiment serves as a useful illustration of the value of a failure to confirm a hypothesis: We hypothesize, and so are attempting to falsify, the claim that all swans are white. Searching for, and consistently finding, white swans only demonstrates that we can continue to add to the existing body of evidence that white swans exist but reveals nothing about whether or not all swans are white. Finding a black swan (the failure of the hypothesis) contains much greater informational value – we now know definitively that all swans are not white. Negative results are valuable because they provide information as to whether or not a hypothesis or theory is valid. When searching for the most effective approach for implementing conservation, it is essential that we seek information about what did not work and why with a vigor equal to that with which we catalog our successes.

When we implement a conservation activity we are, consciously or not, testing a theory (Lee 1993). In seeking to understand outcomes that contradict conjectures, we are learning from our mistakes. Failure of our interventions simply reveals that the problem to be solved is difficult and requires more work—a "step forward that takes us nearer to the truth" (Popper 1963). Because failure is an exception that challenges our expectations, it serves as a clear signal that deeper analysis is warranted and can facilitate understanding of ambiguous outcomes (Sitkin

1992). For example, where models drive much of conservation decision making, unexpected or surprising results or unanticipated outcomes of interventions offer tremendous opportunities to learn (Anderson et al. 2017). However, just as models of effective cockpit crew coordination evolve both in response to errors and new information, models in conservation must be subjected to revision after thorough error and outcome analysis.

Understanding the unique power of failure in learning how to execute conservation projects more effectively is a prerequisite for driving a cultural transformation in conservation. The experience of other disciplines suggests that an alternative to the success mindset is a willingness to locate errors of any scale at any level in an organization. This is a large part of what makes creating a culture that can learn from failure challenging and necessary in equal measure. However, before we can do so effectively, there is one barrier between understanding what failure is and what we should do about it, namely, us.

3.4 Deceived by dissonance and blinded by bias

A failure transformation in conservation begins with an individual's willingness to learn from failure. Some of the blame for resistance to this task can be placed on universal susceptibility to one of the most important constructs in social psychology: cognitive dissonance (Festinger et al. 1956).

Dissonance refers to the discomfort people feel when they attempt to simultaneously hold two conflicting beliefs, opinions, attitudes, values, memories, or emotions. Dissonance is a motivating state: our drive to reduce it generates denial and self-justification, two major barriers to effectively discussing and learning from failure. For example, when discussing with colleagues why a project failed, we find it uncomfortable to be challenged because we do not like to think of ourselves as deficient. Through this tendency toward ego preservation at the expense of confronting difficult truths, the ability to effectively learn from failure can be compromised.

Recognizing, defining, and classifying failure is also inextricably linked to, and often hampered by, cognitive biases that affect the way we make decisions and analyze outcomes. Biases are a predictable consequence of the cognitive process of using heuristics, or shortcuts, in decision making when time, information, or cognitive processing ability are constrained (Kahneman 2011).

Since the concept of cognitive biases emerged in the early 1970s to explain systematic deviations from the normative responses predicted by rational choice theory (Tversky & Kahneman 1974), the fields of aviation and medicine have drawn on these ideas to confront the challenge of learning from failure (Elia et al. 2016). For example, commercial airline flight crews are trained to identify biases that potentially affect their ability to function as a team, particularly under stress (United Airlines 2016). These biases exist in every sphere of human interaction, and although conservation has begun to investigate the role of biases in decision making (Iftekhar & Pannell 2015), it has yet to apply these concepts to a full examination of how failure should be identified, analyzed, and codified and how the resulting learning should be disseminated. The list of cognitive biases and heuristics affecting decision making, behavior, social interaction, and memory is extensive and continually evolving in light of new research. Several proposed classifications exist, with the most helpful enhancing our understanding of how biases interact and affect our search for and processing of information, topics of particular relevance during team discussions of what went wrong (Fig. 3.3). Several are particularly salient for understanding our view of success and failure, as well as our willingness and ability to effectively learn from failure (Table 3.1).

Among the biases that affect our ability to constructively engage with failure, the need to create a coherent story (described by the *narrative fallacy*), coupled with retrospective biases (such as the *hindsight* and *outcome biases*), and the search for confirming evidence (courtesy of the ubiquitous *confirmation bias)* combine to promote the belief that good decisions invariably lead to good outcomes. However, luck plays a large role in outcomes, particularly in contexts of uncertainty, and confounds attributions of causality (Kahneman 2011). All these cognitive traps lead us to think we understand the past better than we actually do and to therefore believe our ability to predict future events is greater than it actually is. Absent awareness and active

management of these influences, any postmortem analysis will be insufficient and opportunities to learn from failure will be minimal.

Just as airlines have updated their operational training models to incorporate these psychological factors, conservation professionals could also benefit from acknowledging the ubiquity of these cognitive pitfalls and accounting for their effects. Two opportunities to do this are questioning preconceptions about ecological systems so as to be open to surprises and avoid confirmation bias in constructing models (Lindenmayer et al. 2010) and creating a checklist for conservation-planning teams to examine the role of these biases in project planning and execution.

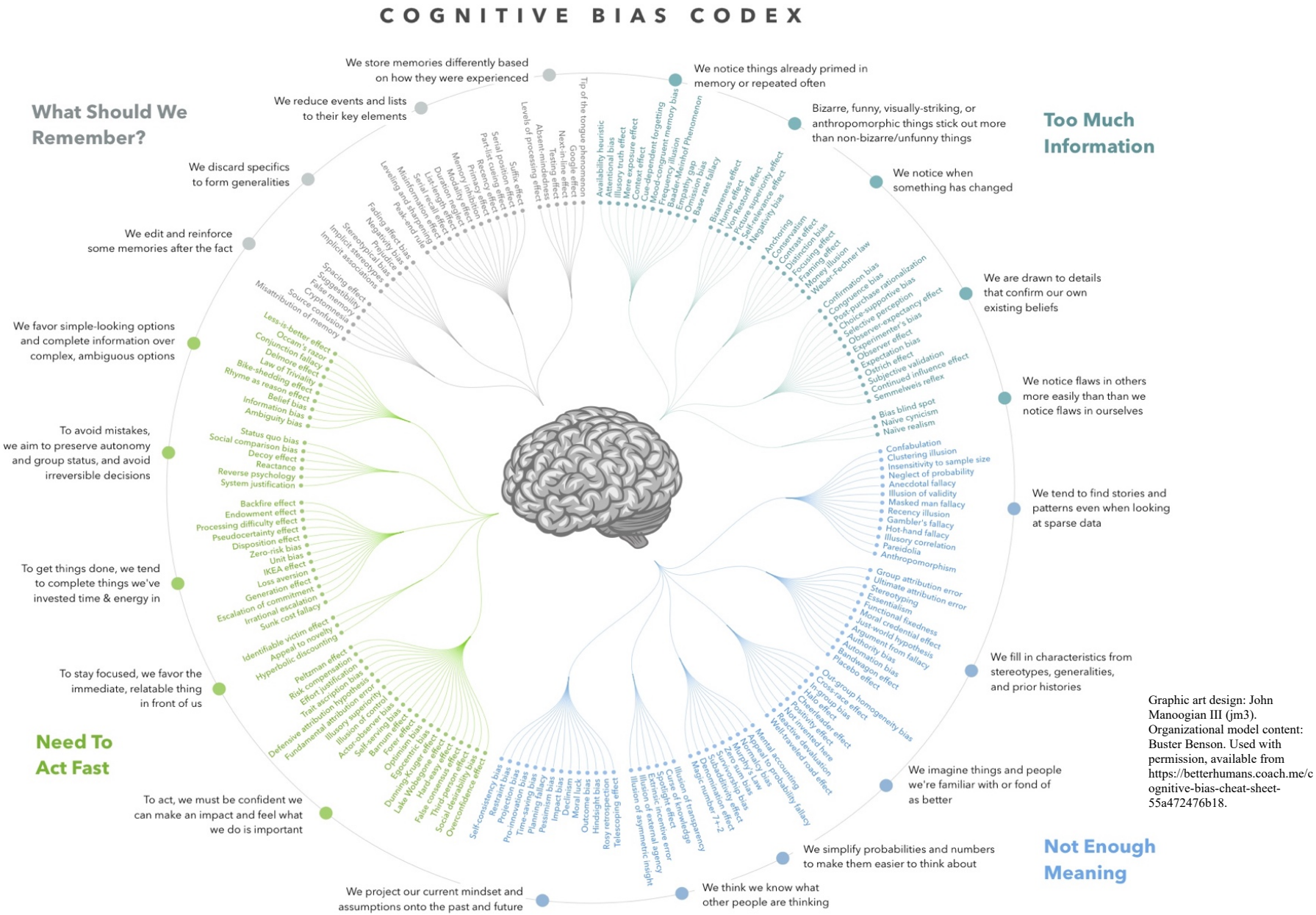


Fig. 3.3. An example of a classification scheme of cognitive biases that affect many aspects of human thought processes, from how one approaches decision making to how one evaluates outcomes.

This graphical scheme links biases with their underlying cognitive driver and enhances understanding of how biases affect the search for and processing of information and meaning.

Table 3.1. Synthesis of selected, ubiquitous cognitive biases that can affect the effective management of failure.

Cognitive trap	*Impact on managing failure*	*Management strategies**
Confirmation bias (Lord et al. 1979; Nickerson 1998; Kahneman 2011		
Tendency to selectively seek out, interpret, and give more weight to information that supports existing perceptions, opinions, or theories	Knowledge progresses by seeking contradictory information and can be found by examining the failures of hypotheses. Refusal to believe or reducing the importance of evidence contrary to expectations stymies this effort.	Cultivate critics (devil's advocates) and listen to the arguments of people who disagree. Insist on full exploration of pros and cons of hypothesis or consensus recommendation, as well as at least 2 alternatives (possibly generated by another team) and search actively for information disproving main hypothesis.
Naïve realism (Ichheiser 1949; Ross 1977; Ross & Ward 1996; Pronin et al. 2004; Nasie et al. 2014)		
Tendency to assume one's own worldview is the real one and if others do not agree they must be ignorant, unreasonable, irrational, or wrong	When one's view is unexpectedly challenged by disagreement, one forms negative opinions about the intelligence and open-mindedness of the person voicing dissent. Miscommunication, misunderstanding, and antagonism result from both failing to appreciate differing perspectives as valid and from failing to find similarities where they do exist.	Try to resist making snap judgments and attempting to figure out who is right. Make a genuine effort to see the other person's point of view. Recognize there can be, and likely are, multiple valid realities.
Bias blind spot (Pronin et al. 2002; Ehrlinger et al. 2005)		
Tendency to believe once one has become aware of biases that everyone else is subject to them except oneself	Believing oneself is immune to biases but that others are subject to them can create a culture of blame when exploring reasons for project failure.	Accept susceptibility to biases, even when they are not self-evident. Embrace meaningful feedback as the foundation for learning and resist the tendency to rationalize the criticism.

Loss aversion

(Kahneman & Tversky 1979; Thaler 1999)

Tendency for people to strongly prefer avoiding losses to acquiring gains (i.e., losses loom larger than gains), particularly when uncertainty is high	This bias may lead one to be more risk averse than is rational and therefore miss opportunities to explore alternatives. Consequently, one experiences greater regret for action than inaction, which tends to reinforce the status quo.	Conduct a premortem or prospective hindsight exercise before the project begins to identify reasons failure might occur and try to envision the worst possible outcome. Consider whether and how those risks can be mitigated.

Sunk cost fallacy

(Kahneman & Tversky 1979; Arkes & Blumer 1985; Simonson & Nye 1992; Kahneman 2011)

Tendency to focus on costs that have already been incurred and that cannot be recouped when considering future courses of action (i.e., throwing good money after bad)	Learning from mistakes and making better decisions going forward requires evaluation of options based on a current frame of reference, not one anchored to a past starting point. Allowing failing projects to continue past the point that they should be cut off prevents accurate assessment of success and failure.	All alternative continuing courses of action should be evaluated based only on their future costs and benefits. Visualize evaluating the project as a new manager with no personal involvement in choosing this course of action. Consider whether you would invest in it.

Fundamental attribution error (FAE)

(Miller 1976; Ross 1977; Edmondson 2012; Fiske & Taylor 2017)

Describes propensity to blame bad outcomes on another person's personal shortcomings rather than situational factors that may have been beyond this person's control	This bias can hamper one's ability to fully investigate one's own role in mistakes and failures, as well as negatively affect interpretation of other group members' behavior. Attributing failure to another person's personal shortcomings (even when not shared openly) increases mistrust and destroys open communication.	Foster an environment of trust and openness so that each team member can be heard and understood. Encourage each team member to voice concerns and recognize that reasonable people may disagree and have experiences that can lead to equally valid opinions.

Self-serving bias

(Miller & Ross 1975; Arkin et al. 1980; Fiske & Taylor 2017)

Tendency to attribute one's failures to external factors and one's successes to personal abilities	This bias can lead one to deny responsibility for failure, blame others too readily, and ultimately negatively affect team dynamics. This bias can also lead to overconfidence in one's our own abilities or judgment.	Learning from our mistakes begins with recognizing them in the first place. Accept that failure is not always someone else's fault.

Overconfidence

(Lichtenstein & Fischhoff 1977; Koriat et al. 1980; Plous 1993; Kahneman 2011)

Tendency for people to overestimate their own skills and abilities, believe themselves to be better than others, and to view their decisions with excessive certainty	Although a certain level of confidence is healthy, overconfidence can lead to one taking more credit than is warranted, disregarding of conflicting opinions without due evaluation, rejecting ion of evidence that does not support one's opinions, and disregarding the role of luck in outcomes. Under the influence of this bias, one tends to take credit for success but avoid responsibility for failures, inhibiting effective discussion of project outcomes.	Strategies that consider opposing or contradictory evidence can mitigate this bias effectively. Ensure that a full discussion of pros and cons of the decision takes place, with particular emphasis on considering why the decision might be wrong. The premortem or prospective-hindsight strategy of envisioning the decision resulting in failure and then generating reasons for that failure may also provide some defense against this bias by legitimizing doubts that may have been suppressed as the group converged on a course of action.

Hindsight bias

(Fischhoff 1975; Slovic & Fischhoff 1977; Pezzo & Pezzo 2007; Roese & Vohs 2012)

Belief that an event is more predictable after the outcome is known than it was before the outcome became known (i.e., one knew it all along).	This bias causes one to see the path to failure or success as inevitable and results in a flawed assessment of the past during post event analysis. It can lead to overlooking causes for failure and thus to repeating the same errors in future projects. It also contributes to selective causal attribution that tends to minimize personal responsibility.	The consider-the-opposite strategy encourages reflection and explicit discussion of how outcomes that did not occur could have occurred and can reduce hindsight bias.

Outcome bias

(Baron & Hershey 1988; Lefgren et al. 2015)

Tendency to overweight outcome information in assessing the quality of decisions that led to that outcome; hindsight bias judges what the decision maker should have known, whereas outcome bias judges what the decision maker should have done	This bias tends to confuse the evaluation of decisions with the evaluation of the outcome, such that decision makers can be judged more harshly than is warranted by the information that was available at the time the decision was made. Punishment for bad outcomes may be applied regardless of decision quality, leading to fear of failure. If applied to oneself, one may become overconfident in one's decision-making abilities if the outcome is good or overly self-critical if the outcome is poor, regardless of the quality of our decisions. Applying this to others can lead to incorrect attributions of blame. Ultimately, future courses of action can be too optimistic or not appropriately revised after fortuitous successful outcomes or too pessimistic and radically altered after failed outcomes, regardless of decision quality.	It can be useful to analyze the decision from the decision-maker's point of view at the time the decision was made. Recording assessments of decisions as they are made and before the final outcome is achieved is also helpful in post event analysis.

Narrative fallacy or what you see is all there is (WYSIATI)

(Taleb 2007; Kahneman 2011; Kahneman et al. 2011)

Tendency to link an unrelated series of events together into a logical story by imposing a pattern of causality on what one observes	Because the human mind tends to create a coherent narrative based on available information and fills in any missing pieces, one cannot see what evidence is lacking. This can lead to post hoc rationalizations and results in flawed assumptions about causality that lead us to think we understand the past well enough to predict the future. Therefore, one may be liable to take successful outcomes as prescriptions for future actions and to exaggerate the role of skill and underestimate the role of luck.	Accept that success should not be viewed as a how-to manual; rather, it should serve as a source of inspiration and alternatives. Actively search for gaps in evidence or knowledge by imagining making the decision at a point in the future and asking yourself what information you would want and whether you can get it.

Bounded awareness

(Chugh & Bazerman 2007; Grant & Quiggin 2013)

Tendency to systematically overlook critical, easily accessible, and relevant information	During group discussions about project outcome, this bias can result in limiting analysis to information that is easily accessible, rather than that which is most relevant to the situation at hand. Thus, both the implications and probabilities of future events are circumscribed by this informational limitation. This bias causes individual group members to discuss shared information more often than individual information, negating a major strength of group discussion.	Recognize that bounded awareness is a normal psychological limitation and accept that overlooking crucial information is likely. Cultivate psychological safety to encourage contributions from all team members. Leverage the benefit of multiple perspectives by ensuring team members are aware that unshared information has value.

* Debiasing is very difficult. Just being aware of biases is no guarantee that one is necessarily immune to their influence; thus, getting an outsider perspective is critical. Trust and openness within teams (key elements of psychological safety) is of particular importance.

3.5 Learning from failure

Researchers who study organizational failure have identified a number of significant barriers to effective learning from failures. For example, although managers may genuinely want to improve their organizations' ability to learn from failure, they typically believe that failure is invariably bad and that learning from it is a simple process consisting largely of reflecting on an error and trying not to repeat it. Furthermore, even if all failures are not the result of wrongdoing, most end with an allocation of blame (Edmondson 2011). As a consequence of these attitudes, any lessons that failure could provide are squandered. Creating a fundamental change in the way failure is managed requires a shift in organizational culture and individual mindsets, coupled with the creation of systemic processes to detect and respond to failure, such that we can undertake the interpersonal work of confronting failure as well as the conceptual work of figuring out what went wrong (Schulz 2010).

In conservation practice, managers can take on a leadership role within teams to create a culture in which individuals and groups can learn from failure. Critical steps in this process include acknowledging that failure is inevitable in complex systems; identifying, discussing, and analyzing failures to explore underlying causes; seeking and accepting feedback; proactively and productively managing conflict and disagreement; and widely disseminating lessons learned (Barach & Small 2000; Helmreich 2000; Cannon & Edmondson 2001; Tucker & Edmondson 2001). These processes go beyond error identification to determine underlying causes and challenge the policies, norms, and objectives of an organization. Edmondson (2012) calls this strategy creating a "learning approach to failure." When leaders adopt this orientation, team members understand that dissent is not just tolerated but seen as a necessary component of learning and recognize the value in exploring different perspectives and ideas. Conservation project team leaders can also use exploratory responses to challenge existing assumptions, embrace ambiguity, combat confirmation bias by proactively gathering disconfirming information, and search for opportunities to experiment (Edmondson 2012; Hirak et al. 2012).

For their part, those who teach conservation can ensure their students understand the cognitive biases and institutional dynamics that make it so difficult to learn from failure. Case

studies of mistakes made by senior conservationists and personal reflection can be used to prompt students' understanding of the importance of building on failure to improve practice.

The power of leaders in foundations and other funding organizations in generating a wider cultural transformation cannot be overstated. Their first priority should be to set a tone that accepts the inevitability of occasional failure and then ensure that grantees report on their failures and how they learned from them. Providing support so that groups of related grantees can meet to share failure and learning is a powerful way to begin a culture change. However, waiting for this transformation is not an excuse for team leaders to avoid undertaking learning from failure behaviors. For example, a small U.S.-based regional conservancy, despite facing a similar funding environment and sense of urgency as other conservation organizations, currently undertakes activities such as experimenting and acknowledging the inevitability of failure, surfacing errors in group discussions, seeking feedback within and outside the organization, and reflecting on and documenting outcomes (A.C, personal observation).

A learning approach to failure is especially critical given not only the complex context of conservation but also the types of teams in which conservation professionals often participate. We may find ourselves in interdisciplinary research teams, integrated conservation and development teams, restoration-education project teams, or even teams of instructors. Given these realities, it is even more important for team leaders to set a tone that failure is worthy of being examined, that team members contributions are not just valued but desired, and that it is safe to share difficult conversations. Individuals can embrace the notion that there is value in discussing failure, which begins with admitting when failure has happened and resisting the temptation to generate excuses, blame others, or recast it as a success. Instead of relying on a "success mindset" to replicate past wins and avoid deep examination of failures, we can adopt a "growth mindset" (Dweck 2006) that views failure as learning opportunities. Once we can discuss failure openly, we create the opportunity for others to offer solutions we could not imagine alone (Tavris & Aronson 2007).

3.6 The importance of psychological safety

If the willingness of individuals to discuss errors and express ideas to generate solutions is critical to learning from failure, psychological safety provides the foundation for mobilizing these activities. Psychological safety describes the degree to which people feel comfortable taking interpersonal risks in a group setting (Edmondson 1999). This group-level construct is foundational to organizational change and is characterized by an environment of trust and respect that enables people working in groups to take perceived risks in expressing personal opinions and alternative views. In a psychologically safe workplace, people do not fear asking for help, making mistakes, or being labeled as ignorant, incompetent, negative, or disruptive for speaking up (Edmondson 2012).

Psychological safety underpins the widely emulated no-rank practice of military aviation debriefs, where pilots are trained from their first postflight debrief to seek and give direct, useful, fact-based feedback regardless of rank, status, or ego, a process honed and institutionalized from failure's lessons written in blood (S. Kartvedt and P. Catalano, personal communication; McGreevy & Otten 2007). Teams in medicine and business are working to adopt similar systems in recognition of psychological safety's critical role in learning from failure (Carmeli 2007; Hirak et al. 2012; Edmondson & Lei 2014). For example, to investigate traits of successful teams, Google analyzed more than 250 attributes of over 180 teams; psychological safety emerged as the only clear commonality and by far the most important of the team dynamics identified (Rozovsky 2015; Duhigg 2016). The two behaviors exhibited by high-performing teams included "conversational turn-taking" (providing every team member an opportunity to speak up) and "social sensitivity" (i.e., empathy), both of which are key functions of psychological safety (Edmondson 1999; Woolley et al. 2010; Duhigg 2016).

Creating a safe space for team members to share ideas and give constructively critical feedback are essential for effectively collaborating, reducing the negative impacts of organizational hierarchy, surfacing errors to those who can enact change, and identifying novel opportunities for improvement (Milliken et al. 2003).

3.7 Conclusion

Success in achieving conservation goals paradoxically requires a new approach to managing failure because unanticipated failure is inevitable as we seek solutions to challenging problems in a complex world. The difference between success and failure can often be attributed to the timely identification, analysis, and mitigation of errors (Mittelstaedt 2005), which can be difficult to confront in light of our cognitive biases, aversion to failure, and our inability to perfectly predict the future. Creating and implementing strategies to enable individuals, teams, and our entire discipline to effectively manage failure is essential. Just as aviation training and business and medical schools have moved beyond simply examining technical causes of failure and are now teaching awareness of cognitive biases and the psychology of decision making, conservation professionals too can benefit immensely from an awareness of these phenomena. Adopting a new mindset (both individually and in teams) that is open to learning from failure is possible, and my future research will examine this failure-opportunity orientation in conservation professionals. Ultimately, the lesson from other disciplines is that until the benefit of embracing learning from failure outweighs the costs, conservation will continue to squander these learning opportunities and remain less effective than it otherwise might be.

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4 | Building Better Teams by Identifying Conservation Professionals Willing to Learn from Failure

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Abstract

Despite abundant literature from beyond the conservation sector on learning from failure, few studies examine conservation professionals, their teams, and their organizations. Using the Theory of Planned Behavior to investigate the drivers of conservation professionals' intentions to engage in learning from failure behaviors, I found that conservation professionals who intend to participate in learning from failure activities are influenced by perceptions of social norms. Higher levels of psychological safety were found to strengthen the positive relationship between self-efficacy and intentions to engage in learning from failure behaviors with a higher degree of interpersonal risk, whereas lower levels of psychological safety undermined high levels of self-efficacy. Organizations seeking to empower those who are confident they can learn from failure must recognize the key role that psychological safety plays in supporting such individuals, implement team training to foster psychological safety, and ensure leaders promote, by their own example, learning from failure as an opportunity to more effectively, cost-efficiently, and equitably deliver conservation outcomes.

4.1 Introduction

Failure is inevitable in conservation, as in every area of human endeavor. Conservation professionals confront problems occurring at the intersection of complex, dynamic, and diverse social and ecological systems, making successful outcomes difficult to predict, replicate, or sometimes even identify (Game et al. 2014). When evaluating project outcomes, examining failure provides a source of valuable information that is distinct from, and often overlooked in favor of, successful outcomes (Catalano et al. 2018). Willingness to engage in activities that lead to effective learning from failure is a crucial mindset for conservation professionals, and one that conservation organizations must develop in their leaders and teams (Stirzaker et al. 2011).

Researchers from a broad spectrum of sectors and disciplines, including aviation, medicine, and business have identified behaviors that enable effective learning from failure (see Catalano et al. 2018 for a review). These include: team members identifying errors; participating in individual and team reflection sessions; promoting open, constructive debate in team meetings; seeking feedback from internal and external sources; experimenting with new approaches for completing tasks; and sharing and documenting lessons learned (Cannon & Edmondson 2005; Savelsbergh et al. 2009; Decuyper et al. 2010; Putz et al. 2012). Despite widespread implementation in sectors with longer histories of proactively managing failure, such practices remain poorly instituted in conservation organizations and thus valuable opportunities for learning how to avoid or navigate future failures are wasted. The conservation sector would benefit from studying and strategically trialing and adopting the thinking and practices that have been developed over decades in these other sectors to more effectively manage the failure that is inevitable in conservation programs and projects. In the absence of such systematic activities, learning is limited, and the time, funding, and human resources allocated to securing conservation goals are not effectively, efficiently, and equitably deployed.

Effective conservation projects develop holistic understandings of social-ecological systems (Johnson et al. 1999; Cowling & Wilhelm-Rechmann 2007), but little research in conservation is focused on social systems (13% according to Fazey et al. 2005) or conservation professionals' and their organizations' internal activities. This contrasts with the wide range of

studies on these topics in aviation, medicine, and business (Lemieux-Charles & McGuire 2006; Delarue et al. 2008; Salas et al. 2008a). Fortunately, an appreciation of the benefits of 'reflexive' research is emerging to understand how conservation professionals themselves operate, including studies examining leadership (Black et al. 2011), teamwork (Jacobs 2017), education (Chapman et al. 2015), integration and application of interdisciplinary and transdisciplinary research techniques (Sutherland et al. 2018; Moon et al. 2019), and praxis for effective individuals, teams, and organizations (Knight et al. 2019). Little is known, however, about conservation professionals' beliefs and attitudes about failure, their willingness to engage in learning from failure behaviors, or about the learning from failure activities implemented by individuals and teams.

Engaging in workplace learning from failure behaviors entails interpersonal risk. Psychological safety is a belief that one will not be punished or humiliated for taking interpersonal risks, including seeking and providing honest feedback; openly discussing errors; experimenting; or raising ideas, questions, or concerns (Edmondson 1999). This team-oriented construct has received substantial research attention in the organization and management sciences for more than two decades. Psychological safety matters greatly for individual and team performance, and is of particular relevance when work takes place in the presence of uncertainty and requires collaboration to achieve an objective (for reviews see Edmondson & Lei 2014 and Newman et al. 2017). It also is considered foundational for enabling the learning behaviors critical for navigating complex and dynamic situations. In this respect, psychological safety bolsters creativity, encourages error reporting, facilitates the open communication required to analyze and correct errors, and increases knowledge sharing. Despite this wide-ranging body of research in other sectors, psychological safety within conservation organizations is yet to be empirically investigated.

Understanding what drives individual's intentions to enact learning from failure behaviors allows managers to design and target activities to encourage these behaviors in the workplace. This research aimed to identify the factors that drive conservation professionals' intentions to engage in learning from failure behaviors, including if, and how, psychological safety influences these intentions. This research also aimed to understand, through an analysis of

underlying behavioral beliefs, why learning from failure practices have been, or not, embraced by conservation professionals, and what individual, team and organizational factors might contribute to greater adoption of these behaviors. My goal is to increase the effectiveness of team leaders and members by providing strategic direction for implementing specific activities promoting learning from failure behaviors.

4.2 Materials and Methods

4.2.1 Theoretical framework and hypotheses

I employed the Theory of Planned Behavior (TPB) to identify and predict conservation professionals' intentions to engage in learning from failure behaviors (Fig. 4.1). The TPB is a widely used theory positing a relationship between beliefs, intentions, and behavior, with the most proximal determinant of behavior being intention (Ajzen 1985, 1991). Intentions comprise three independent direct antecedents: 1) a*ttitudes*, the degree to which a person has a positive or negative appraisal of a target behavior; 2) *subjective norms*, the perceived level of social pressure to perform the behavior; and 3) perceived behavioral control (PBC), a person's perception of their ability to perform the behavior (Ajzen 1991). Attitudes, subjective norms, and PBC are based on a cognitive foundation comprising underlying beliefs, namely: attitudes resulting from *behavioral beliefs* about the likely consequences of a behavior, subjective norms arising from *normative beliefs* about others' expectations regarding the behavior, and PBC generated by *control beliefs* regarding factors affecting the performance of the behavior (Ajzen 2002a).

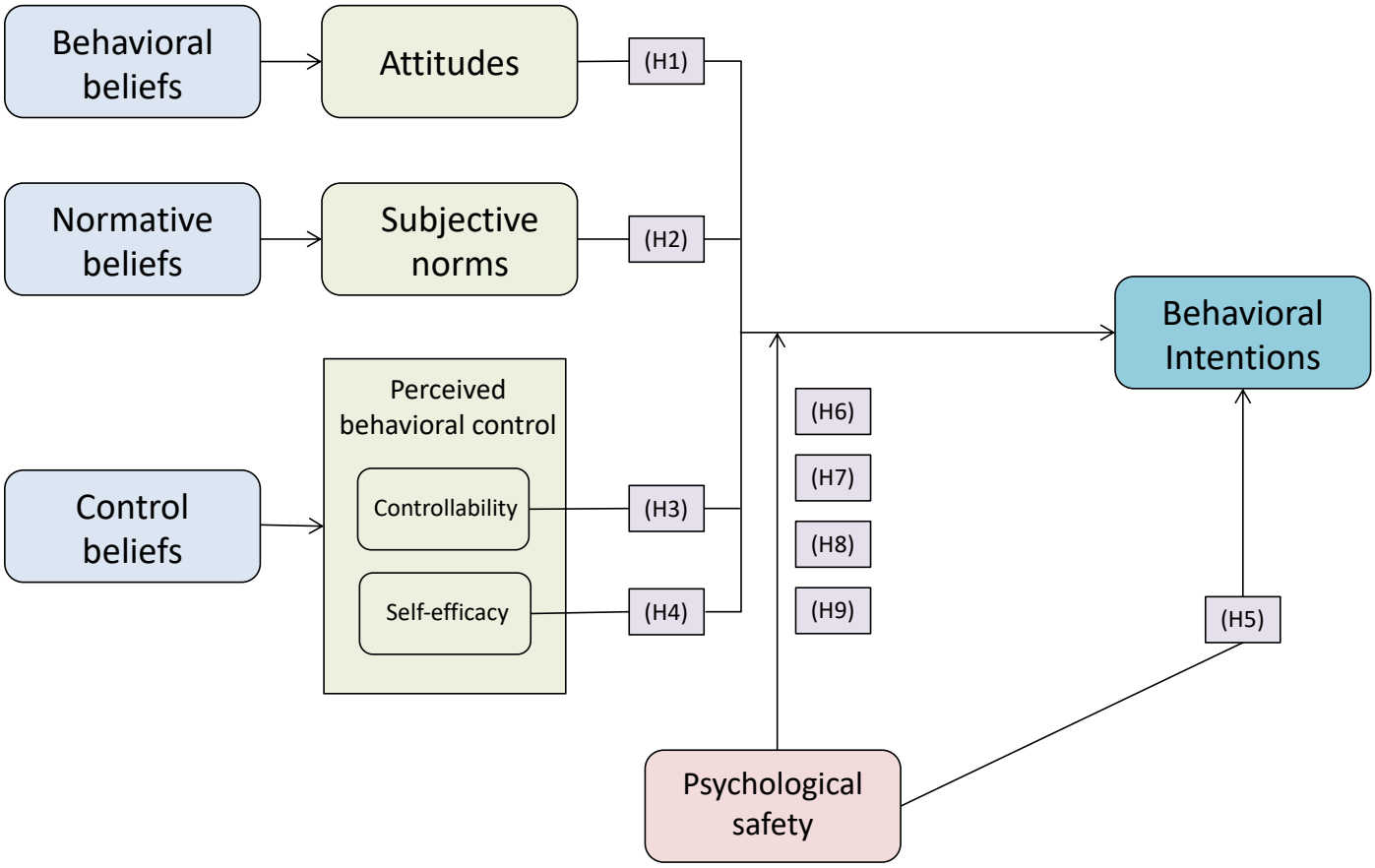


Fig. 4.1 The Theory of Planned Behavior (TPB) research framework.
This framework depicts the cognitive foundation of beliefs (light blue) underlying the primary TPB variables (green) of attitude, subjective norms, and perceived behavioral control. Psychological safety (red) is hypothesized as a moderator between the TPB variables and behavioral intentions to engage in learning from failure behaviors (adapted from Ajzen 1991). Purple boxes, for example labeled (H1), represent hypotheses tested during this study.

Additionally, PBC can directly impact behaviors, often conceptualized as a larger construct comprising two dimensions that may operate differently: controllability (the belief that one's behavior is volitional) and self-efficacy (confidence in one's ability to perform a behavior) (Ajzen 2002a; Pertl et al. 2010). Controllability and self-efficacy can contribute separately to the overall model (Terry & O'Leary 1995; Armitage & Conner 2001; Ajzen 2002a; Lee et al. 2015). Accordingly, I differentiate between and examine these two constructs so as to identify, design, and implement more targeted learning from failure mechanisms.

The TPB has been successfully applied to predict intentions across a range of situations (Armitage & Conner 2001; Miller 2017), including predicting employee behaviors in workplaces (Dawkins & Frass 2005; Jimmieson et al. 2009; Xie 2009); understanding intentions regarding nature and soil conservation activities (Mathijs et al. 2009; López-Mosquera et al. 2014; Rex et al. 2015); exploring human-wildlife conflict issues in protected areas (Martin & McCurdy 2009; Hughes 2013; Miller 2019); and predicting green workplace and consumer behaviors (Greaves et al. 2013; Choi & Johnson 2019). In line with previous research, I hypothesized that:

1) *Attitudes, subjective norms, controllability, and self-efficacy have positive associations with intentions to enact learning from failure behaviors (Hypotheses 1-4, respectively).*

Addition of variables to the TPB may improve the predictive utility of the model when investigating a specific behavioral context (Ajzen 1991; Tonglet et al. 2004; Rex et al. 2015). A person's individually held attitudes, beliefs about normative pressure, and whether they believe a behavior is subject to their volitional control are not sufficient predictors of intentions in the absence of a supportive situational environment (Ajzen 1991; Armitage & Conner 2001). Psychological safety fosters development of organizational cultures that view failures as opportunities to learn (Edmondson 2004a). In team contexts, the presence of psychological safety increases the likelihood that individuals will engage in a range of learning from failure behaviors.

Thus, my research investigates psychological safety as a contextual variable to understand the degree to which it moderates the relationship between the TPB variables and intentions to enact learning from failure behaviors. I hypothesized that:

2) *Psychological safety will have a direct positive effect on intentions to enact learning from failure behaviors (Hypothesis 5);*
3) *The positive associations between attitudes, social norms, controllability, and self-efficacy on intentions will be stronger when psychological safety is high (Hypotheses 6-9, respectively).*

The strengthening effect of high psychological safety is a logical prediction in light of existing research, but more theoretically interesting may be what happens in contexts characterized by low psychological safety. Several possibilities exist, including that the moderating effect of psychological safety on the interaction between the TPB variables and intentions becomes weaker but remains positive, in line with Hypothesis 5; the presence of psychological safety has no moderating effect (i.e., the slope of the interaction is not significantly different than zero), or that the moderating effect is negatively related to the predictor variable (in which case low psychological safety turns a normally positive resource into a negative situation). In the absence of previous research on this topic, my aim is thus exploratory for the utility of the TPB variables at low psychological safety.

4.2.2 Procedure

I identified 11 key activities essential for learning from failure from the organizational learning literature. An elicitation study was conducted following the guidelines for TPB scale development (Ajzen 2002b; Francis et al. 2004). Open-ended questions were posed to 23 conservation professionals across four focus groups selected through convenience sampling to identify salient behavioral, normative, and control beliefs about these learning from failure behaviors (See Appendix D, Table D1 for the list of questions).

Based on the elicitation study results, a pilot survey was developed and delivered to seven test respondents. Results were used to refine the final direct and indirect TPB measures in accordance with established TPB questionnaire construction guidelines (Ajzen 2002b; Francis et al. 2004; Fishbein & Ajzen 2010). The final questionnaire was distributed electronically (via Qualtrics 2005) directly to 423 global conservation professionals known to me and my supervisor via email, as well as to four online conservation community forums, with requests for recipients to further disseminate the questionnaire link (Imperial College London ethics approval #18IC4559; See Appendix D, Fig. D1 for Participant Information Sheet and Informed Consent Form).

4.2.3 Measures

Participants were informed that they would be asked questions related to learning from failure, and 11 specific learning from failure behaviors were listed. The questionnaire comprised: demographic items (age, gender, nationality, years in conservation, years at organization); items measuring TPB constructs (direct and indirect measures of attitude, subjective norms, controllability, self-efficacy, and intentions); and items measuring psychological safety (Table 4.1).

Table 4.1. Measures used in questionnaire to analyze constructs of interest within the Theory of Planned Behavior.

Construct of interest	Method	Example items	Response options
Intentions Factor 1 ("Information Seeking")	Respondents were asked the degree to which they intended to conduct each of six specific learning from failure activities in the next six months	"I will search for information from previous projects that did not go well to inform my current project	1 (*extremely unlikely*) to 7 (*extremely likely*)
Intentions Factor 2 ("Active Engagement and Reflection")	Respondents were asked the degree to which they intended to conduct each of four specific learning from failure activities in the next six months	"I will participate in a critical reflection or debrief with my team"	1 (extremely unlikely) to 7 (extremely likely)
Direct attitude	A direct measure of attitude towards engaging in the specified learning from failure activities in the subsequent six months was assessed using the mean of seven cognitive semantic differential scales	bad/good harmful/beneficial worthless/valuable	1 (very negative) to 7 (very positive)
Direct subjective norms	Three items were used to calculate direct subjective norms. Both injunctive (what important others think a person should do) and descriptive (what important others actually do) norms were captured.	"Most people at work who are important to me think that I should engage in learning from failure behaviors within the next six months during a conservation project."	1 (*strongly disagree*) to 7 (*strongly agree*)
Controllability	C*ontrollability* was measured using two items that identified whether performing the behavior was up to them and whether factors beyond their control determined their ability to enact the behavior (Francis et al. 2004)	"The decision for me to engage in learning from failure behaviors in the next six months during a conservation project is beyond my control"	1 (*strongly disagree*) to 7 (*strongly agree*)

Self-efficacy	*Self-efficacy* (SE) was composed of two items that reflected an individual's sense of how difficult it is to effectively perform a behavior and how confident they are that they could do so (Francis et al. 2004)	"I am confident that I could engage in learning from failure behaviors in the next six months during a conservation project if I wanted to"	1 (*strongly disagree*) to 7 (*strongly agree*)
Belief-based attitude	Behavioral beliefs (belief-based attitudes) were assessed by asking respondents how likely it would be for six benefits and five costs (identified in the elicitation study) to occur as a result of engaging in the learning from failure activities.	"I will increase my personal learning" "My workload will increase due to time required to engage in these activities"	1 (*extremely unlikely*) to 7 (*extremely likely*)
Belief-based subjective norm	The belief-based subjective norm was measured using nine referents identified during the elicitation phase of the study. Participants were asked how likely each referent would be to think they should conduct learning from failure activities during a conservation project in the next six months.	"Project team leader"	1 (*extremely unlikely*) to 7 (*extremely likely*).
Belief-based perceived behavioral control	Twelve factors identified during the elicitation study were used to assess control beliefs. Participants were asked how likely each factor would affect their ability to conduct learning from failure activities during a conservation project in the next six months.	"Lack of time"	1 (*extremely unlikely*) to 7 (*extremely likely*)
Psychological safety	Psychological safety was measured using Edmondson's (1999) nine-item scale.	"It is safe to take a risk on this team" "It is difficult to ask other members of this team for help" (reverse scored)	1 (*very inaccurate*) to 7 (*very accurate*)

4.2.4 Exploratory factor analysis to identify types of intentions

An exploratory factor analysis using principal axis factoring and selected varimax orthogonal rotation (Osborne 2015) was used to explore latent constructs among the 11 specific intention variables (Table 4.2). I removed one item that reflected a privately held belief ("I will view a setback or failure as a learning opportunity") and one item that did not reflect a response to error ("I will experiment with a new approach in my work"), and the remaining nine behaviors that were observable by others loaded onto two distinct factors. Factor 1 ("Information Seeking", or IS intentions), with a Cronbach's (1951) alpha (α) coefficient of 0.85, included searching for information from previous projects that did not go well, seeking feedback, and documenting and sharing lessons learned. Factor 2 ("Active Engagement and Reflection", or AER intentions), with an alpha coefficient of 0.85, included discussing errors openly with team members and initiating and participating in critical reflections or debriefs with team members. I determined that the level of interpersonal risk-taking distinguished between the two sets of items. The two scales were correlated at r=0.433, p<0.001.

Table 4.2. List of learning from failure behaviors and results of an exploratory factor analysis of intentions to engage in these behaviors using principal axis factoring with varimax rotation.
(N=146)

Learning from failure intentions	Factor loading	
	1	2
1. I will ask for feedback from external stakeholders (those who have a stake in the outcome of my project)	.765	.180
2. I will ask for feedback from team members	.737	.284
3. I will share or disseminate lessons learned	.737	.213
4. I will document lessons learned	.694	.156
5. I will ask for feedback from external partners or collaborators (those with whom we are carrying out the project work)	.615	.179
6. I will search for information from previous projects that did not go well to inform my current project	.504	.087
7. I will initiate a critical reflection or debrief with my team	.324	.832
8. I will participate in a critical reflection or debrief with my team	.171	.924
9. I will discuss my errors openly with my team	.142	.614

4.2.5 Predictors of intentions

I conducted two hierarchical multiple regressions with mean-centered predictor variables to test hypotheses predicting both types of learning from failure intentions (Table 4.3). To control for the effects of demographic variables, I entered these at Step 1. In Step 2, I entered the TPB variables, in Step 3 I added the psychological safety variable, and in Step 4, I entered the product terms for the interaction between each of the three TPB variables and psychological safety.

4.2.6 Differences in belief-based measures

I analyzed underlying belief-based measures of attitude, subjective norms, and PBC to determine their effects on IS and AER intentions (Table 4.4). I conducted six one-way multivariate analyses of variance using IS and AER intentions as independent variables and the individual items for behavioral beliefs, normative beliefs, and control beliefs as dependent variables. I divided the IS and AER intention scales at the median points (5.76 and 5.75, respectively) to create dichotomous independent variables that split the distributions into groups representing people with high versus those with moderate intentions.

Table 4.3. Results of hierarchical regression predicting intentions with controllability (CTR) and self-efficacy (SE).

Predictor (N=124)	*Specific Intentions Factor 1: Information Seeking*		*Specific Intentions Factor 2: Active Engagement and Reflection*	
	β	ΔR^2	*β*	ΔR^2
Step 1		.049		.096*
Age	.135		.158	
Gender	-.003		.234*	
Years at organization	.132		.080	
Years in conservation	-.025		.076	
Step 2		.165***		.277***
Attitude	.054		.120	
Subjective norm	.463***		.406***	
Controllability (CTR)	-.184		.075	
Self-efficacy (SE)	-.041		.043	
Step 3		.012		.087***
Psychological safety (PS)	.137		.320***	
Step 4		.050		.049*
Attitude X PS	-.069		-.140	
Norm X PS	-.118		-.171	
CTR X PS	-.034		-.035	
SE X PS	.316*		.230*	
R^2 *Final*		.276		.508

**p<.05, **p<.01, *** p<.001*

Standardized beta coefficients for predictors are reported at the step in which they were entered in the model.

Table 4.4. Mean scores in underlying beliefs for respondents with moderate and high intentions to engage in learning from failure behaviors.

	Mean	IS intentions§		AER intentions§§	
		Moderate *n=70*	High *n=73*	Moderate *n=73*	High *n=70*
Behavioral beliefs					
I will increase my personal learning *(benefit)*	6.21	5.94	6.47***	5.90	6.53***
My project will have a better chance of a successful outcome *(benefit)*	5.90	5.63	6.15***	5.55	6.26***
My project team will be better able to avoid repeating mistakes that have been made before *(benefit)*	5.82	5.53	6.10***	5.52	6.13***
My team will be more effective *(benefit)*	5.64	5.27	5.99***	5.19	6.10***
My project team will be able to adapt to changing circumstances more easily *(benefit)*	5.62	5.23	6.00***	5.21	6.06***
My workload will increase due to time required to engage in these activities *(cost)*	5.48	5.09	5.86***	5.48	5.49
My organization will make better use of limited resources *(benefit)*	5.48	5.17	5.77**	5.12	5.84***
Tension will arise between those who carry out the learning activities and those who do not *(cost)*	3.80	3.60	3.99	3.92	3.67
I will feel vulnerable to shame, criticism, or blame *(cost)*	3.43	3.54	3.32	3.79	3.04*
My organization's funding will be jeopardized *(cost)*	2.81	2.69	2.93	2.97	2.64
I will experience a negative impact on my career or reputation *(cost)*	2.71	2.71	2.70	3.04	2.36**
Normative beliefs (referents)		*n=70*	*n=68*	*n=72*	*n=66*
My direct supervisor	5.28	5.01	5.54	4.60	6.02***
My project team leader	5.15	4.83	5.49*	4.56	5.80***
Other conservation professionals like me	5.02	4.73	5.32*	4.69	5.38*
Field level implementers or field staff	4.69	4.46	4.93	4.22	5.20***
My organization's senior management	4.48	4.17	4.79*	3.82	5.20***
External partners or collaborators	4.46	4.07	4.87**	4.06	4.91**
The organizations that fund my work	4.17	3.81	4.53*	3.86	4.50*
External stakeholders	4.17	3.74	4.60**	3.69	4.68***
The general public	3.94	3.73	4.16	3.71	4.20

Control beliefs (barriers)		*n=72*	*n=69*	*n=73*	*n=68*
Lack of time	5.38	5.22	5.54	5.51	5.24
Inadequate time for project monitoring and evaluation	5.29	5.35	5.23	5.66	4.90
Inadequate funding for project monitoring and evaluation	4.68	4.35	5.03*	4.90	4.44**
Team members or supervisors with egos that do not admit failure or mistakes	4.10	4.29	3.90	4.55	3.62**
Senior management or board members expectations of success	4.07	4.21	3.93	4.64	3.46***
Not seeing anyone else around me engaging in these activities	3.62	3.89	3.35	4.37	2.82***
An organizational culture that stigmatizes failure	3.38	3.51	3.23	3.89	2.82**
Fear of being blamed, shamed, or criticized	3.27	3.57	2.96*	3.77	2.74**
Our partners (or project collaborators) losing trust in us	3.18	3.31	3.04	3.44	2.90
Fear of losing face in front of team members	3.11	3.36	2.84	3.63	2.54***
Jeopardizing my organization's funding	3.04	3.15	2.93	3.25	2.82
Implicit or explicit organizational punishment	2.75	2.89	2.61	3.12	2.35*

§*IS=information seeking;* §§*AER=active engagement and reflection*

** p<0.05, ** p<0.01; *** p<0.001*

4.3 Results

Of the 253 respondents who opened the online link, 166 completed the questionnaire. After listwise deletion, 146 responses were analyzed. Due to uncertainty in the number of forwarded surveys, an accurate response rate was not possible to calculate.

4.3.1 Respondent characteristics

The sample comprised 57% female and 43% male conservation professionals. Respondents' average age was 41.7 years (SD=13.40), ranging from 21-74 years. Age groups 26-35 and 36-45 accounted for more than half of all respondents (29.5% and 23.3%, respectively). Respondents represented 25 nationalities, with American (31.5%), British (23.3%), Australian (11.6%), and South African (11.6%) participants comprising the majority of the sample (78.1%). Respondents with 10 or fewer years at their organization comprised 65.1% ranging from <1 year-36 years. Less than half of the respondents (43.2%) had worked in conservation for 10 or fewer years, ranging from <1-46 years. Respondents were primarily engaged in work protecting or managing species (64.4%) and land or water (56.8%) (see Appendix D, Tables D1-D5 for details).

4.3.2 Correlations for the demographic variables

Age was significantly positively correlated with all of the TPB variables and both IS and AER intentions (Table 4.5). The number of years at an organization was significantly correlated with self-efficacy and with both sets of intentions, whereas the number of years in conservation was significantly correlated with all variables except attitude. Of the demographic variables, only years in conservation was significantly correlated with psychological safety. The demographic variables were treated as covariates in the regressions.

Table 4.5. Results of descriptive statistical analyses and correlations among examined variables analyzed for significance. (N=143 to 160)

Variables	α	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Age		41.74	12.92										
2. Gender				-.262***									
3. Years at organization		7.35	7.24	.586***	-.179*								
4. Years in conservation		15.24	10.65	.783***	-.242***	.625***							
5. Direct attitude	0.84	6.08	0.66	.203*	.105	.118	.151						
6. Direct subjective norm	0.82	4.82	1.42	.208*	.026	.151	.196*	.465***					
7. Controllability	0.76	4.36	1.62	.302***	-.082	.153	.202*	.273**	.470***				
8. Self-efficacy	0.71	4.94	1.44	.195*	.045	.218*	.242**	.348***	.618***	.576***			
9. Psychological safety	0.78	5.35	1.02	.106	.037	.072	.182*	.298***	.253**	.153	.246**		
10. Information seeking intentions	0.85	5.48	1.12	.181*	-.053	.186*	.196*	.277***	.402***	.035	.176*	.192*	
11. Active engagement and reflection intentions	0.85	5.61	1.17	.202*	.129	.171*	.207*	.413***	.553***	.319***	.408***	.418***	.433***

$^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$

4.3.3 Predictions for intentions to enact learning from failure behaviors

Addition of the TPB variables in Step 2 produced a significant increment of variance in the intentions scores for both IS and AER, $R^2ch.$=0.165, $F(4,115)=6.043$, $p<.001$, and $R^2ch.$=0.277, $F(4,115)=12.704$, $p<0.001$, respectively. There was no support for the role of attitude (Hypothesis 1), controllability (Hypothesis 3) or self-efficacy (Hypothesis 4) on either IS or AER intentions. However, across both IS and AER intentions, conservation professionals perceiving social pressure to do so were more likely to intend to enact learning from failure behaviors (Hypothesis 2).

Addition of psychological safety in Step 3 resulted in a significant increment of variance in the intentions score for AER, $R^2ch.$=0.087, $F(1,114)=18.339$, $p<0.001$, but not for IS intentions (Hypothesis 5). Psychological safety had a strong significant positive relationship with AER intentions, β=.320, $p<.0.001$.

In Step 4, psychological safety did not moderate the relationship between intentions and attitude (Hypothesis 6), social norms (Hypothesis 7) or controllability (Hypothesis 8). However, the interaction term between self-efficacy and psychological safety on IS intentions, β=0.316, $p<0.05$, and AER intentions, β=0.230, $p<0.05$, was significant (Hypothesis 9). To probe these relationships, I graphed this significant interaction for IS and AER intentions (Fig. 4.2a and 4.2b, respectively) using simple slopes analysis (Aiken & West 1991).

For IS intentions, at higher levels of psychological safety, the slope was positive but not significant, $t(122)=1.456$, $p=0.148$. For respondents perceiving lower levels of psychological safety, SE had a significant negative relationship with intentions, $t(122)=-2.051$, p=0.046. Conversely, for the perceived riskier behaviors of the AER intentions, the positive relationship between self-efficacy and intentions was significant for those with higher psychological safety. This slope differed from zero, $t(122)=2.286$, $p=0.024$. The relationship between self-efficacy and AER intentions was not significant at lower levels of psychological safety, $t(122)=-1.052$, $p=0.295$, but exhibited a negative trend.

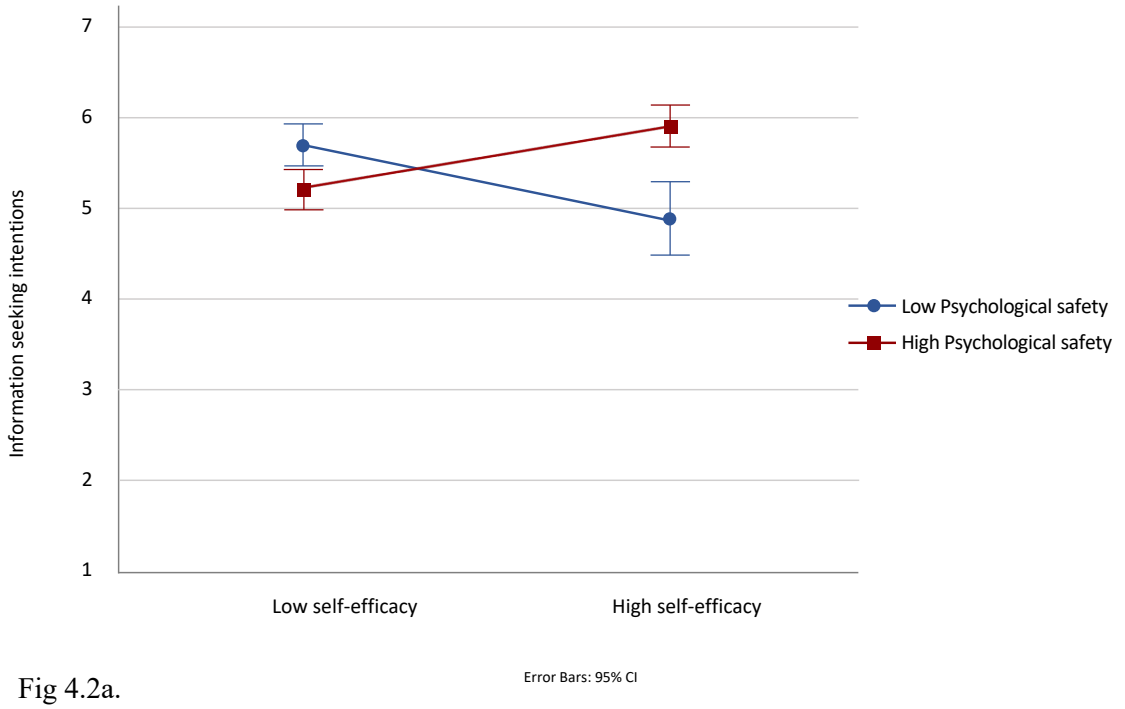


Fig 4.2a.

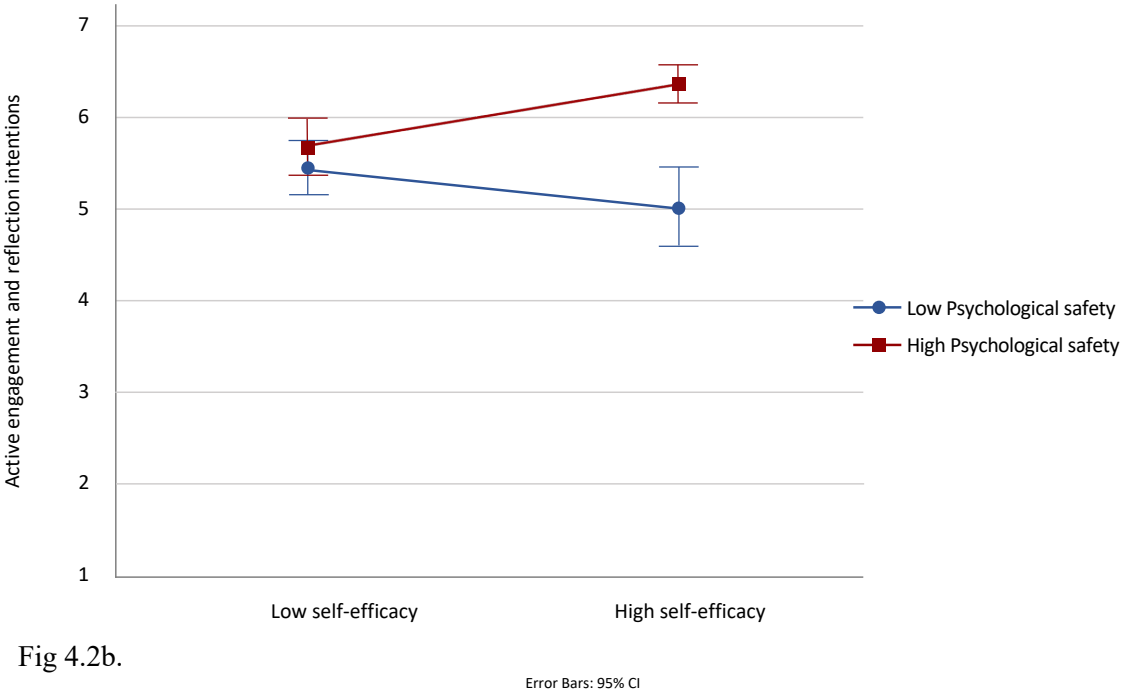


Fig 4.2b.

Fig. 4.2 The graph of two-way interaction of self-efficacy and information seeking (Fig. 4.2a) and active engagement and reflection (Fig. 4.2b) intentions moderated by psychological safety, with slopes plotted at 1SD above and below the mean with 95% confidence intervals.

4.3.4 Behavioral beliefs

Using Wilk's criterion, I found a significant multivariate effect of both IS and AER intentions, $F(11,131)=3.962$, $p<0.001$, $\eta 2=0.250$, and $F(11,131)=5.112$, $p<0.001$, $\eta 2=0.300$, respectively. Univariate tests revealed that respondents with stronger AER intentions differed significantly from those with moderate AER intentions in their assessment of all six benefits but only two costs ("feeling vulnerable to shame, criticism, or blame" and "experiencing a negative impact on my career or reputation") associated with conducting learning from failure behaviors. Those with stronger IS intentions, in contrast, differed significantly from those with moderate IS intentions on all six benefits and a different cost ("my workload will increase due to time required to engage in these activities"). Interestingly, the benefit of increasing personal learning had the highest overall mean score across all participants, significantly differentiating between respondents with high and moderate intentions. The benefit with the lowest mean related to an organization making better use of limited resources, significantly differentiating both IS and AER intentions. The cost with the highest mean was the workload increase due to time required to engage in the activities. The belief item with the lowest mean was the cost of experiencing a negative impact on career or reputation, and there was a significant difference between high and moderate intenders only for AER intentions.

4.3.5 Normative beliefs

There was a significant multivariate effect of AER, but not IS, intentions, $F(9,128)=4.356$, $p<0.001$, $\eta 2=0.234$, and $F(9,128)=1.361$, *NS*, $\eta 2=0.087$, respectively. Univariate tests revealed that respondents with stronger AER intentions were significantly more likely than those with moderate intentions to perceive that direct supervisors, project team leaders, people in similar roles to themselves, field staff, senior management, external partners, funders, and external stakeholders would approve of them enacting learning from failure behaviors in the subsequent six months. Although the multivariate effect for IS intentions was not significant, several univariate effects emerged that distinguished between respondents with high and moderate intentions. Compared to those with moderate IS intentions, those with high IS

intentions were significantly more likely to perceive that their project team leaders, peers, senior management, external partners, funders, and external stakeholders would approve of them enacting learning from failure behaviors in the subsequent six months. The referent group with the highest mean was the direct supervisor.

4.3.6 Control beliefs

The multivariate effect of IS and AER intentions on control beliefs were both significant, $F(12,128)=2.473$, $p<0.01$, $\eta 2=0.188$, and $F(12,128)=3.654$, $p<0.001$, $\eta 2=0.255$, respectively. Significant differences existed between IS intention groups for inadequate funding and fear of blame control beliefs. Respondents with moderate, but not high, AER intentions were significantly more likely to perceive the following barriers to engaging in learning from failure behaviors in the subsequent six months: inadequate funding for monitoring and evaluation, team members or supervisors who do not admit mistakes, senior manager expectations of success, not seeing peers engage in the learning from failure behaviors, an organizational culture that stigmatizes failure, fear of blame or shame, fear of losing face, and organizational punishment. Lack of time and funding were perceived to be the most prevalent barriers but only lack of funding significantly distinguished between high and moderate intenders.

4.4 Discussion

The value of, and research into, learning from failure in organizations is well established in sectors and disciplines beyond conservation (Tjosvold et al. 2004; Edmondson 2004b; Carmeli & Gittell 2009; Hirak et al. 2012; Newman et al. 2017). This is the first study to have identified the factors that influence conservation professionals' intentions to engage in learning from failure behaviors, and highlights the role of psychological safety. Perceptions of social norms were important for supporting both IS and AER intentions and high levels of psychological safety in teams was an important driver of intentions to engage in LFF behaviors considered to

be higher in interpersonal risk. Psychological safety also moderated the way in which self-efficacy influenced both types of intentions.

4.4.1 Psychological safety underpins effective learning from failure

Psychological safety was significantly correlated with both sets of intentions, but much more strongly for AER than IS. After controlling for the demographic and TPB variables, only the effect on AER remained significant. This finding for AER is unsurprising given the critical role that psychological safety plays in enabling the difficult conversations required to learn from failure, and the fear of interpersonal risk accompanying learning from failure activities (Milliken et al. 2003). If team leaders ask their team members to initiate or participate in critical reflection sessions or discuss errors openly, the likelihood of gaining buy-in for these activities is far higher in the presence of psychological safety.

In past studies, psychological safety has been positioned as an antecedent of attitudes and social norms in the context of willingness to report errors and mistakes (Pfeiffer et al. 2010), with empirical results supporting psychological safety predicting social norms and PBC (Lee et al. 2015). Interestingly, in my research, attitude towards failure, perceived social norms, and self-efficacy also were correlated with respondents' perceptions of psychological safety.

My findings extend beyond these direct effects and provide insights into the relationship between self-efficacy and intentions, with the type of learning from failure behavior and the level of perceived psychological safety driving the pattern of these interactions. Despite the wide body of research employing the TPB, I am not aware of any studies that examine the moderating effect of psychological safety on the relationship between the TPB variables and intentions in any context, or any studies that query whether the nature of moderation could depend on the type of intentions and how interpersonally risky or routine they are or the level of moderation present.

Notably, higher psychological safety levels strengthen the positive effect of self-efficacy on learning from failure behaviors considered more interpersonally risky (AER intentions). Accordingly, people believing they are capable of adopting learning from failure behaviors are more likely to do so when they feel safe in their teams. In contrast, at high psychological safety,

IS intentions were high and stable across both high and low levels of self-efficacy for behaviors considered lower risk in nature, as indicated by the non-significant slope.

It is of interest to note that lower psychological safety levels were associated with a significant negative relationship between self-efficacy and IS intentions. Conservation professionals with high confidence in their ability to enact learning from failure behaviors are discouraged from doing so, as team dynamics undermine the positive effects of self-efficacy on IS intentions. For behaviors perceived as interpersonally high risk, although the slope for low psychological safety is not significant, it trends negatively. Thus, a workplace with employees high in self-efficacy but low in psychological safety is, at best, not boosting employees' intentions to engage in learning from failure behaviors and, at worst, actively discouraging it.

4.4.2 Thoughtful leadership promotes team learning

Many barriers to adopting learning from failure behaviors were perceived by respondents as being within the control of their organizations. I do not discount the importance of external factors beyond an individual's control; however, such factors did not discriminate between high and moderate intenders for the learning from failure behaviors, suggesting there are internal activities organizations can implement to support willingness to adopt learning from failure behaviors.

Insufficient time was perceived as a major barrier to engaging in learning from failure behaviors, as were expectations of success by senior leadership. Other perceived barriers related to establishing psychological safety were reported, including the perception that leaders and team members do not admit failures; an absence of peers and/or leaders undertaking these activities; and fear of blame, reputational damage, or punishment. The relationship between leadership and psychological safety is well established (Nembhard & Edmondson 2006; Ortega et al. 2014; Newman et al. 2017). Creating psychological safety to promote a 'safe-fail' culture (Redford & Taber 2000; Catalano et al. 2019) that fosters workplace conditions maximizing learning from failure should be a primary goal of team leaders and senior managers, given the significant influence of supervisors on respondents' intentions to engage in learning from failure behaviors.

Leaders who encourage the reframing of failures as learning opportunities and who demand that time be allocated for reflection lay a foundation for psychological safety to be established as organizations work towards establishing a learning from failure culture. This shift will likely resonate with conservation professionals, as increased personal learning was the most commonly perceived benefit. Given the significance of subjective norms in influencing behavioral intentions, leaders should empirically benchmark and assess whether their organizational culture is conducive to establishing psychological safety. If not, training leaders and team members in how to respond respectfully to interpersonal risks perceived by others is likely to prove useful (Bradley et al. 2012). Admitting fallibility, acknowledging errors and mistakes, inviting participation in discussions, and holding people accountable for meeting clearly articulated expectations in fair and consistent ways are critical leadership behaviors that support a psychologically safe team (Edmondson et al. 2001; Edmondson 2012). In practice, psychological safety cannot be mandated, but is generated over time through repeated interactions where leaders clearly demonstrate these non-judgmental, coaching-oriented behaviors (Edmondson 2012).

Unfortunately, the conservation sector has historically recruited and promoted managers who are highly qualified natural scientists with strong technical skills but who lack competencies in transforming teams into learning units (Englefield et al. 2019). Leaders seeking to build effective teams can engage in self-reflection, and ask questions such as: Do I approach problems with curiosity or blame? Do I ensure everyone has a chance to speak up? How ready am I to admit when I am wrong? Do I view failures as learning opportunities? Do I communicate this effectively to my team?

4.4.3 Limitations

Several methodological limitations are acknowledged. Respondents interested in the topic may have been more inclined to participate, so self-selection bias may mean my sample is not representative of the population and restrict the extent to which the findings can be generalized (Etikan 2016). Respondents were also primarily from developed countries, thus, given the likely

cultural differences regarding learning from failure (e.g., Harris & Li 2008), caution should be exercised in directly extrapolating the extent to which predictors of learning from failure will prove robust in situations different to those examined here (Newman et al. 2017). That said, my sample was demographically broadly consistent with the composition of typical conservation organizations headquartered in developed countries (Taylor 2014). My findings can therefore be reasonably extrapolated to similar situations, but I urge the empirical assessment of willingness to learn from failure in specific individual contexts.

Second, while my statistical tests were appropriate, my sample size was small and thus caution is warranted when drawing inferences from these results. Although the sample was sufficiently powered to detect large effect sizes for the full regression model and MANOVAs, the achieved power to detect small and medium effects was below the 80% threshold (see Appendix D, Table D6). It is important to note, however, that statistical power is influenced by factors beyond sample size and my use of theoretically robust and widely applied methods, plus the inclusion of relevant covariates, lends predictive power to the analysis (Hopkin et al. 2015). Future work to replicate or extend such research, while building upon my parameters as a useful starting point, should aim to recruit a larger sample.

4.4.4 Future Research

Conservation organizations can implement recruitment practices to create more effective teams by identifying individuals more likely to engage in learning from failure behaviors. However, recruiting a person who feels they are capable of learning from failure into a team that lacks psychological safety appears more likely to discourage that individual than improve the team dynamic. Effort may be better spent improving an existing team's level of psychological safety, creating social norms that model openness to learning from failure, and instituting learning from failure activities (like debriefs; see Kolbe et al. 2019 for specific ways to create psychological safety in debriefs). Future research examining how these activities are undertaken in a range of conservation organizations would provide helpful illustrative case studies.

Given the paucity of research on psychological safety in conservation, future work also might be usefully undertaken into the relationships between psychological safety and other factors, including perceptions between donors and conservation professionals, high risk versus low risk projects (e.g., politically controversial reintroductions of large predators), gender, team composition, or degree of stakeholder diversity. Finally, while the role of leaders is critical in creating a workplace supportive of learning from failure, psychological safety relies on more than the leader's behavior. Future research might usefully examine other drivers of psychological safety, such as development of trust, employee engagement, constructive conflict, and the degree to which individuals in non-leadership positions undertake learning from failure behaviors and how this influences workplace dynamics in conservation.

4.5 Conclusion

Failed conservation programs and projects and programs provide a richer source of learning than those that are successful because failure contains more salient information to practitioners than the potentially causally confounding information resulting from a success (Lounamaa & March 1987; Catalano et al. 2018). Given that the failure of conservation programs and projects is almost certainly more common than is reported (Catalano et al. 2019), valuable learning opportunities are being squandered. The challenge of delivering intended outcomes in the complex, dynamic and diverse social-ecological systems in which conservation projects are implemented demands that conservation professionals and the teams and organizations in which they work have a strong commitment to, and effective techniques for, learning from failure. Specifically, they require mindsets and mechanisms that systemically and systematically identify, analyze and institutionalize learning from failure behaviors. The first step in creating a 'safe-fail' culture is to identify the drivers of individual intentions to engage in these learning activities. Transforming a team into a learning unit requires leaders who place a continual emphasis on creating psychological safety, remove barriers to enacting learning from failure activities, encourage attitudes that view failure as a learning opportunity, and personally model mindsets and behaviors supporting these ideas.

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5 | KNOWLEDGE DEVELOPMENT, LEARNING, AND FAILING TO LEARN FROM FAILURE IN CONSERVATION

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Catalano, A.S., Knight, A.T., in prep. Knowledge development, learning, and failing to learn from failure in conservation.

Abstract

A fundamental component of effective learning is the ability to manage and learn from failure. Learning from failure is of particular importance in the complex contexts characterized by high levels of uncertainty in which conservation initiatives take place. Conservation scholars recognize the need to 'learn how to learn more effectively' and that failure is an underexamined source of learning. However, despite the availability of a range of approaches and tools designed for learning, conservation individuals, teams, and organizations rarely implement systematic learning from failure processes. Efforts to shift conservation towards a 'learning culture' suffer from a paucity of empirical research on conservation professionals' values, attitudes, behaviors, and motivations concerning learning from failure. This research aims to address that gap through a multiple method qualitative approach to investigate conservation professionals' opinions and experiences with learning from failure. Specifically, I investigated: 1) opinions on the effectiveness of learning from failure in the sector broadly; 2) perceptions of barriers to learning from failure; and 3) opinions of key enabling conditions for improving learning from failure. I found that while respondents view failure as a valuable part of learning, they do not perceive that conservation as a sector is effective at learning from failure due to a range of barriers that exist at individual, team, organizational, and sector-wide levels. Building on existing strengths, I identify strategic ways forward to contribute to a learning effectiveness revolution in conservation.

5.1 Introduction

> *We're just so driven by the continued wheel of delivery that you don't have time to reflect…but it doesn't matter because it wouldn't be connected into any new future action because a different donor is paying for a different thing…the structural issues around not being able to reflect compound the emotional stress of the failure and it's just a constant wheel of 'doing' that drives people crazy…"*
>
> Conservation professional at international NGO

Conservation professionals are busy. Threats to biodiversity such as overexploitation, habitat fragmentation, and habitat loss continue to rise, exacerbated by factors including climate change, population growth, and political instability (Ceballos et al. 2017; Bonebrake et al. 2019). The social-ecological systems in which conservation professionals work are recognized as complex, with diverse, interrelated, and unpredictable elements with no clear boundaries and multiple direct and indirect feedbacks; consequently, problems are 'wicked', being difficult to define, lacking clear solutions, and multi-dimensional (Rittel & Webber 1973; Rogers et al. 2013; Game et al. 2014). Meanwhile, the maturation of the field of conservation science from its founding in the natural sciences to one that explicitly includes social and other dimensions has meant that the range of skills and activities expected of conservation professionals has expanded (Blickley et al. 2013; Bennett et al. 2017). Alongside traditional discipline-specific knowledge and competencies, contemporary conservation professionals must be proficient with knowledge and competencies from non-traditional, trans-disciplines (Knight et al. 2019) such as evaluation, systems thinking, problem-solving, conflict resolution, stakeholder management, policy analysis, behavior change, decision-making, and community engagement as well as the ability to collaborate across disciplinary boundaries in project teams (Touval & Dietz 1994; Jacobson et al. 1998; Newing 2010; Gibert et al. 2017).

Conservation professionals know that the development of knowledge is important, and several authors have proposed that learning is the ultimate goal of conservation initiatives (Salafsky et al. 2002; Knight et al. 2006b). Indeed, the need to 'learn how to learn more effectively' (Clark 1996, p.5) has long been recognized in conservation scholarship (Holling 1978; Daniels & Walker 1996), including areas such as adaptive management (Biggs et al. 2011b), social-ecological systems analysis (Fazey et al. 2007), and natural resource management (Rogers et al. 2000). However, this 'knowing' has rarely been fully enacted in practice or in espoused values (Allen et al. 2011; Catalano et al. 2018; Redford et al. 2018). Formal learning processes such as adaptive management are widely adopted but usually are not implemented through to 'closing the learning loop'. For example, in a review of the first decade of deployment of the Open Standards for the Practice of Conservation (OS), a framework for adaptive project management, nearly half of all projects did not complete the full adaptive cycle (Redford et al. 2018). More informally, a quick search of several of the largest conservation NGOs' mission statements available online as a proxy for espoused values reveals that, with the sole and therefore noteworthy exception of WCS's '2020 Strategy' (WCS 2020), 'learning' as an explicit goal, aim or process is entirely absent. Learning from failure in particular receives scant attention in conservation, although it offers a richer source of learning than success (Sitkin 1992; Madsen & Desai 2010; Catalano et al. 2018). The absence of a widespread, systematic, and robust learning culture, reliance on attempts to replicate best practice, and a general lack of awareness of the need to manage cognitive biases that may hinder judgement and decision making mean learning opportunities from both successful and failed project experiences are wasted.

Learning has been defined as the process of detecting and correcting errors (Argyris & Schön 1978). Errors, mistakes and failures are commonplace in conservation, but are rarely discussed or examined (Redford & Taber 2000; Adams 2010; Catalano et al. 2019). Our perceived (and unperceived) failures are inherent characteristics of complex systems, and hence are often unavoidable (Dekker 2011). More fundamentally, when attempting to tackle wicked problems in complex systems, so many things *can* go wrong that they likely *will* go wrong (Heyman 2009), thus learning from failure is of paramount importance. Other disciplines with longer histories of implementing error management systems recognize the value of engaging in processes to identify, analyze, correct, and share learning gleaned from failure experiences (Putz

et al. 2012; Catalano et al. 2019). However, conservation project outcomes are rarely comprehensively evaluated (Kleiman et al. 2000; Bottrill & Pressey 2012; Curzon & Kontoleon 2016) and failure is widely under examined (Catalano et al. 2019).

A now classic organizational management book succinctly captured the idea of a persistent gap between 'knowing' (what to do) and 'doing' (taking action based on that knowledge) (Pfeffer & Sutton 2000). A mismatch exists between what conservation professionals 'know' about learning from failure and what they 'do' in this regard. Previous scholarship has identified failure as commonplace across a wide range of conservation activities including systematic conservation planning (Knight et al. 2008), invasive species management (Matzek et al. 2014), ecological restoration (Hobbs 2009), and endangered species management (Arlettaz et al. 2010). While the importance of systematic monitoring, evaluation, adaptive management and other learning approaches that explicitly discuss failure has been widely recognized for decades (Clark 1996; Kleiman et al. 2000; Ferraro & Pattanayak 2006), the lack of consistent implementation of these practices that contribute to learning from failure has been broadly lamented (Schwartz et al. 2012; Wamukota et al. 2012; Curzon & Kontoleon 2016).

Researchers have recently called for reconceptualizing these 'knowing-doing' and 'research-implementation gaps' as 'spaces' rather than as 'gaps', recognizing that linear methods of communication, knowledge transfer, and mechanism efficacy do not account for system complexity and the social process of conservation (Toomey et al. 2017). This framing provides the freedom to 'loosen' the problem space to uncover a wider range of options for engagement (Rogers et al. 2013). Importantly, it encourages reflexivity for conservation professionals to examine their *own* roles as actors in a social-ecological system, rather than focusing on 'solving' conservation 'problems' (Rogers et al. 2013) perceived by conservation professionals as resulting from the activities of *others* (e.g., stakeholders, community members, or those outside the project team members themselves). While research undertaken to understand stakeholders' attitudes, knowledge and behavior is recognized as fundamental to conservation practice, conservation research has only very recently begun to look inwards to understand how conservation professionals – as stakeholders themselves - conduct their work (Sutherland et al. 2018a; Moon et al. 2019; Evans et al. 2020).

This paper explores the 'knowing-doing space' of conservation professionals' relationship with learning from failure. Before conservation organizations and the wider sector can be said to have fully embraced the thinking, practices and ideals of a 'learning culture' (Popper & Lipshitz 2000; Stirzaker et al. 2011), greater understanding of conservation professionals' values, attitudes, motivations and behaviors regarding learning from failure must be achieved (as discussed in Section 4.1). The goal of this study was to gain insights into the individual experiences and opinions of learning from failure to maximize understanding of the phenomenon (Onwuegbuzie & Collins 2007). In line with calls for further research into understanding conservation professionals own perspectives and values as drivers of their effectiveness (Sandbrook et al. 2019), and recognizing the indisputable importance of failure as a source of improving the effectiveness of all human activities, this study aimed to: 1) provide a baseline understanding of how conservation professionals view the effectiveness of learning from failure in conservation; 2) identify perceptions of barriers preventing effective learning from failure; and 3) identify key enabling conditions for improving effective learning from failure in conservation. This research contributes to growing reflexivity in conservation research and practice by examining how conservation professionals themselves currently conduct and seek to continuously improve the effectiveness of their work.

5.2 Methods

This study used multiple concurrent qualitative data collection instruments in an explanatory design in which the strengths of specific qualitative methods were linked to enhance the performance of each individually (Morgan 2014). These instruments included interviews, focus groups, and four open-ended text responses from an online survey. Purposive, non-probability sampling was used to select respondents aimed at achieving representativeness across geographies, type of organization, work role, and professional engagement (e.g., donor, species focused NGO, government agency working to protect land or water).

5.2.1 Interviews and focus groups

I conducted a series of 55 semi-structured individual interviews and seven focus groups with a total of 34 respondents. Failure can be a difficult subject to discuss because of the emotional valence of past personal experiences, fear of reputational damage, and societal stigma (Newton et al. 2008). Semi-structured interviews and focus groups were chosen as qualitative research methods because they are useful for exploration of complex and sensitive topics, can encourage a high degree of reflexivity, and enable collection of a diversity of opinions and experiences (Longhurst 2016). Respondents were chosen through my and my supervisor's networks and subsequent sequential sampling and were recruited via email invitations. Interviews were held both via remote conferencing and in person and lasted from 17 to 96 minutes (with an average of 56 minutes), while the focus groups were conducted in person and lasted between 75 to 174 minutes (with an average of 124 minutes). Interviews and focus groups began with a set of introductory questions (see Appendix E, Table E1) and then were allowed to proceed in an open-ended fashion to enable respondents' thoughts, opinions, and reflections to emerge spontaneously. Recordings of interviews and focus groups were transcribed electronically (www.temi.com) and checked for accuracy. All respondents were presented with an information sheet and consent form (Imperial College ethics approval number #18IC4559).

5.2.2 Online survey

Four open-ended text questions in an online survey instrument ("Qualtrics" 2005) were used to gather qualitative information (See Appendix E, Table E2 for the list of questions). This method was chosen to allow for data collection from geographically dispersed respondents and to provide anonymity for discussing a personal and sensitive topic (Phellas et al. 2012). The survey questions were designed *a priori* to complement the interviews and focus groups through eliciting respondents' perceptions of how failure is viewed in conservation. The survey was delivered electronically to 423 global conservation professionals known to me and my supervisor as well as to online community forums.

5.2.3 Thematic analysis

Text from the survey, interview and focus group transcripts were concurrently thematically coded to present a rich description of the patterns present in the entire dataset through predominantly inductive coding from a primarily interpretivist world view (Braun & Clarke 2006). An initial reading of all materials was undertaken to achieve familiarity and generate a preliminary coding frame related to the research questions:

1. Is the discipline of conservation generally perceived by its members as effective or not effective at learning from failure?
2. What are the perceived barriers to effective learning from failure in conservation?
3. What are the key enabling factors perceived to be necessary for improving the effectiveness of learning from failure in conservation?

Initial codes were then reviewed to identify areas of similarity and overlap, and then refined through iterative sorting and collating into "primary" and "secondary" themes representing patterns in the dataset related to the research questions (Braun & Clarke 2012). Quotes were selected from 110 respondents to illustrate the themes, and used throughout the results as a way of "honoring the participants' own words" (Chandler et al. 2015). I felt it was important that the voices of these conservation professionals were heard to validate them as well as provide a degree of permanency, therefore I included a large number of direct quotes to capture and express the perspectives of these participants. Data analysis was facilitated through the use of NVivo qualitative coding software (QSR International 2014).

5.3 Results

Of the 253 respondents who opened the online survey link, 178 completed the demographic and open-ended text questions. Due to uncertainty in the number of forwarded surveys, an accurate response rate was not possible to calculate.

5.3.1 Respondent characteristics

Study respondents represented 31 nationalities, with the majority from the United States (46.1%), the United Kingdom (20.5%), Australia (8.5%), and South Africa (7.8%) (See Appendix E, Tables E3-E8 for all respondent characteristics). Respondents were relatively evenly divided between female (51.2%) and male (48.4%). They ranged in age from 21-74 and were most commonly aged 26-35 years (22.5%), 36-45 years (26.0%), and 46-55 years (24.4%). The length of time respondents had been at their current organization varied from <5 years to 39 years, with the majority at their organizations for 9 years or less (65.3%). The length of time respondents had been working in conservation ranged from < 5 years to 49 years, most commonly from 5-9 years (18.5%), 10-14 years (17.0%), and 20-24 years (14.3%). Most respondents were employed in government organizations (38.8%), sub-international NGOs (32.6%), international NGOs (14.7%), and universities (14.0%). Respondents were primarily engaged in work focused on protecting or managing species (33.9%), protecting or managing land or water (25.5%), education (15.2%), or fundraising (8.5%). Respondents identities were kept anonymous, identified by source and assigned a unique number (e.g., INT3=Interview #3; FG5.1=Focus Group #5, respondent #1; SID42=Survey respondent ID #42).

5.3.2 Perceptions of effectiveness at learning from failure

Respondents were asked whether they perceived conservation as a sector to be generally effective or not effective at learning from failure. Responses to this question were coded only if the respondent expanded upon their response so as to minimize acquiescence bias (Newing 2011). The majority of respondents (Table 5.1, 1a) viewed conservation as generally not effective at learning from failure, with some respondents unequivocal in their statements. "Oh no, not at all," in the words of one respondent with 20 years of experience in conservation both as a donor and field scientist (Int27). Another respondent expressed a view commonly held by respondents that:

> "I think we should be learning from failure and conservation…I think most people would agree with that. I think most people would say absolutely we should learn from failure and then keep moving forward. But I don't actually see it put into practice at all" (Int17).

Many respondents shared examples of personal experiences with effective learning from failure, while simultaneously expressing the view that the wider discipline lacks effectiveness at learning from failure:

> "There are cases where learning is yielding positive results…and failure is increasingly mentioned at conferences and within organizations…and an increasing recognition that conservation needs to improve at this if we are to meet our targets" (SID42).

But the same respondent also added:

> "Examples of learning from failure are still the exception rather than the norm. With the best examples often resulting from work carried out by a particular project team or program, rather than processes and methods that are broadly applied across the sector" (SID42).

Another respondent similarly reflected that their personal experience was different than their perspective on conservation as a whole:

> "Yes and no. I mean, I do think overall we are. I think the adaptive management cycle is, especially in this organization, something that we are constantly doing...we're constantly assessing, constantly tweaking and making things better and better and learning from the process. I think what makes the bigger conservation community not as effective is because we don't share information as much as we could and part of that is because just the nature and the speed of conservation, you know…we've got to move forward, we've got to move forward, we've got to move forward and there's not a lot of time to be able to sit back and reflect." (Int39)

This distinction between personal experience and the broader conservation context also took the form of how learning from failure is viewed at different scales, with respondents noting that effectiveness can be a "scale issue" (SID143), where in smaller activities "perhaps the stakes don't feel as big to say we made a misstep but we're correcting it and the bigger goal is still on track", [but failure at the scale of a] "big programmatic or policy goal…isn't widely discussed" and "the discipline is not great at taking a step back from our pressing work and reflecting on what's working or not working" (SID190).

Table 5.1. Hierarchy of themes developed during qualitative analysis of participant comments.

Research objective #1 reflects a standalone tally of the number of participants who responded with comments that indicated they perceived conservation as generally effective or not effective at learning from failure, with the content of their comments included in the thematic analysis. Values in parenthesis next to Primary themes represent frequency of mentions of that theme. (total respondents=258).

Research objectives			No. of respondents
1. Effectiveness of conservation at learning from failure			
	a. Conservation is generally not effective…		244
	b. Conservation is generally effective…		63
2. Key barriers to effective learning from failure			
	Primary barrier theme	*Barrier subtheme*	
Unit of analysis themes	a. Individual experiences (305)	i. Individual fear of failure (e.g., reputational risk of speaking up, fear of being judged or punished, defeatism, emotionally difficult to admit/discuss, burnout)	
		ii. Mission driven (e.g., stakes are high, pressure for success)	
		iii. Personal attributes (e.g., gender, ego, self-examination, courage, humility, biases, mindset, conflict aversion, culture)	
	b. Interpersonal relationships (204)	i. Team dynamics (e.g., psychological safety, blame, competition, egos, accepting feedback)	
		ii. Leadership or supervisor influence (e.g., support, modeling)	

	c. Organizational structure and function (340)	i. Limited or lack of learning structures (e.g., identify, correct, institutionalize, staff turnover; reputational fear)
		ii. Inhospitable culture and norms (e.g., learning value of failure not recognized, hard to change culture, buy-in)
		iii. Too big to fail well
	d. Conservation as a sector (292)	i. Complexity inherent in the system
		ii. Entrenched dogma
		iii. Conservation as a crisis discipline
Contextual themes	e. Funding (379)	i. Fragile, fair-weather funding (e.g., incentive for success, mismatched perceptions)
		ii. Competition for funding (e.g., "dance of deception"; fear of risking finite resource; chain of funding from public to grantee)
	f. Learning (508)	i. Lack of maximizing information resources (e.g., evaluations, goals and metrics; documentation)
		ii. Too busy to learn (e.g., no time for reflection)
		iii. Not refining future actions based on learning (e.g., adaptive management)
	g. Illusion of success (121)	i. Failure is not valued
		ii. Success bias
	h. Temporal challenges (90)	i. Mismatch of scales
		ii. No time to invest in learning

3. Key capacities enabling learning from failure

Primary enabling theme	*Enabling subtheme*
a. Individual mindset (72)	i. Viewing failure as a learning opportunity
	ii. Personal attributes
b. Individual activities (56)	i. Sharing stories
	ii. Building trust
	iii. Seeking feedback
	iv. Professional development (training)
c. Group culture (122)	i. Psychological safety
	ii. Getting buy in
	ii. Leadership contribution to culture
d. Group activities (93)	i. Group reflection
	ii. Sharing learning
	iii. Activities to normalize failure
	vi. Process for institutionalizing learning
e. What funders can do (66)	i. Reward learning
	ii. Acknowledge the inevitability of failure

A small number of respondents were unequivocal in their perception of conservation's effectiveness at learning from failure (Table 5.1, 1b), and "see a lot of learning happening" (SID212), and that the discipline has "learned a lot from past successes and failures" (SID130), for example: "Oh, absolutely. Because I think conservation as a discipline is really, really flexible and can adapt to changes incredibly fast and seek new opportunities and create new levers" (Int35). More commonly, respondents who thought conservation was effective at learning from failure expressed perceptions that the discipline "is changing, but slowly," (SID157) and "beginning to recognize early failures in its approaches (e.g., Fortress conservation)" (SID230), which represents hope that:

> "There is finally a movement to understand failure…we are slowly starting to talk about what went wrong in the open, in front of peers. Brave stuff in a field so obsessed with positive outcomes ALL the time [emphasis in original text]" (SID227).

Many respondents acknowledged that the topic is "messy" (SID169) and "not black and white" (SID164), noting that:

> "The issue for me is defining what constitutes success or failure in what we do. It is not a binary issue. Much of what we do as practitioners is about making things 'less worse' or slowing decline while seeking longer-term strategies that work. Also, in the world of 3- to 5-year projects success may be delivering the project effectively and efficiently, even if the conservation impact is unproven" (SID169).

5.3.3 Barriers to effective learning from failure

The coding process produced eight 'Primary barrier themes' and 20 'Barrier subthemes' (Table 5.1). Of the eight Primary themes, four concerned barriers faced at the individual, group, organizational, or sectoral level of analysis (Babbie 2008) and were grouped as 'Unit of analysis' themes. The remaining four were classified as crosscutting 'Contextual' themes that form part of the broader system (Fig. 5.1). It is important to note that when reporting the results of thematic analysis, the frequency of a theme simply indicates the number of references identified by the coder as opposed to the importance of the theme to the respondents (Cvitanovic et al. 2016a).

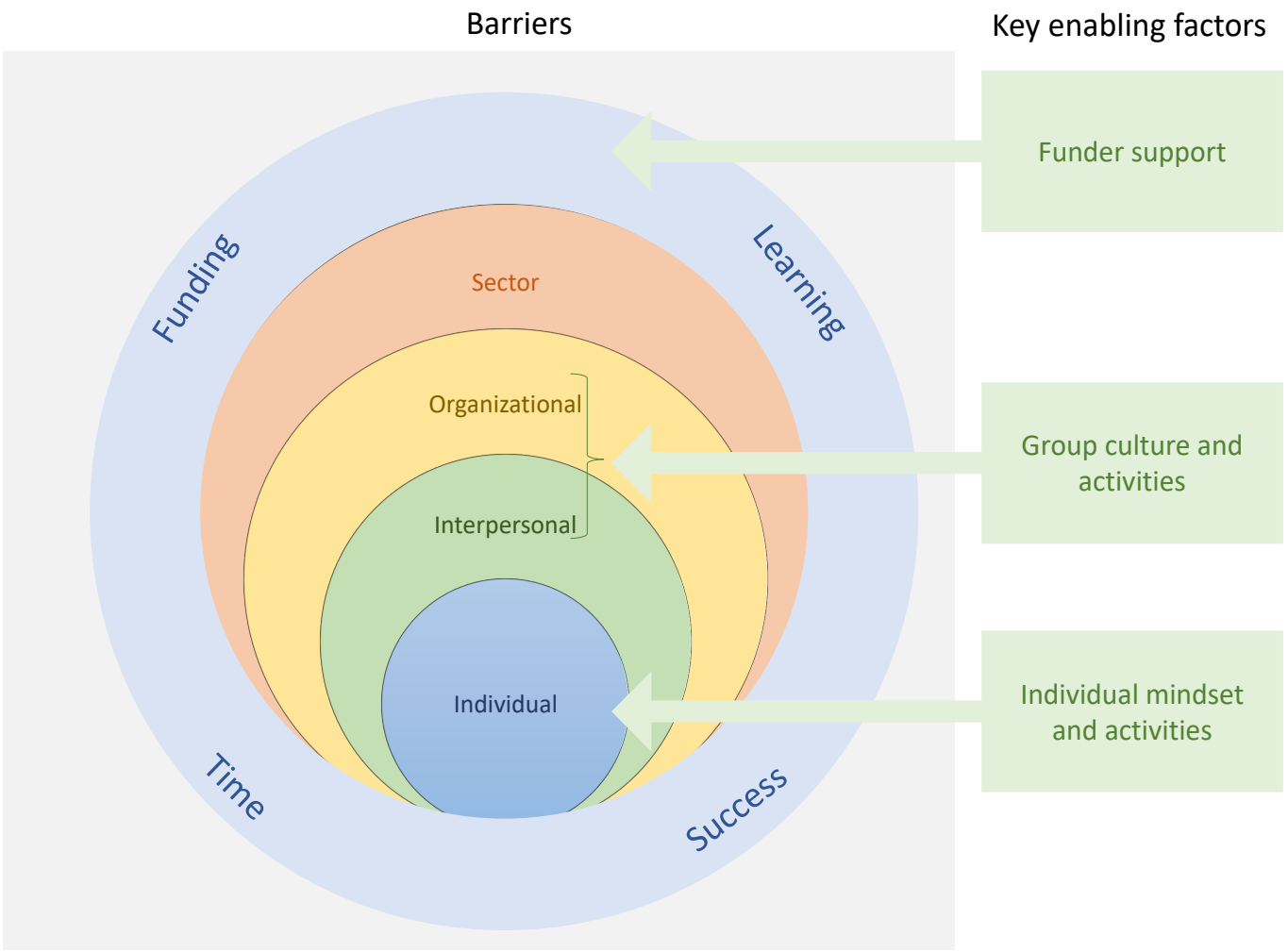


Fig. 5.1 Barriers and key enabling factors to learning from failure as identified by respondents.
For the barriers, the units of analysis are represented by the nested circles, while the contextual factors provide a backdrop in which the units of analysis operate. The key enabling factors are linked to the institutional scale they most impact. (N=258).

5.3.3.1 Individual experiences

Many respondents described various aspects of their 'Individual experiences' (Table 5.1, Primary theme 2a) that they perceived made learning from failure "very difficult to deal with on a personal level" (FG1.2). Within this Primary theme, respondents expressed an *individual fear of failure* (Table 5.1, Theme 2a.i.), fearing they would be "punished" for "owning up to failures or mistakes" rather than being "encouraged to grow and learn from them" (SID215). Failure was seen as "difficult to confront" (FG1.2) and "burns people out" (INT11), and feelings of defeatism were common among respondents:

> "To be brutally honest, I'm sort of running away from the bad feelings at my last job…the way I feel about learning from failure kind of depends on the day. Sometimes I didn't feel competent. Some days I felt guilty wondering if I could do more to solve the problem…Some days I wondered why I was working in conservation" (FG1.1)

In addition to the emotional dimension of failure, it was difficult for some respondents to feel they could learn from failure, because "there's no benefit, it's all downside from a career perspective" (FG1.3). Respondents were concerned with being "perceived as incompetent or blamed for the failure, with negative career impacts" (SID149), often exacerbated by power differences:

> "…at the [field tech] level, the techs are too worried to say things to the lead researcher because they know they'll need positive glowing ratings…rather than speaking up, they just put their nose to the grindstone. The bottom line was that they were too nervous to say anything, too worried about their reputation and future projects" (FG5.2).

Many respondents expressed difficulty learning from failure because of a sense of being *mission driven* (Table 5.1, Theme 2a.ii.), and feeling "a lot of pressure not to fail" (Int17) because of a "passion for what the stakes are in conservation…Save the world, right?" (Int31). Admitting failure "is admitting you can't save the things you set out to save that you believe have a massive intrinsic value…that's very difficult to deal with on a personal level" (FG1.2). One respondent felt "kind of held hostage because it's something you really love to do…There is a lot of demand and very little opportunities for jobs" (FG5.5). This pressure frequently manifested as a sense that "there's no time to reflect on failure" (Int31), and many respondents

acknowledged the paradox that "we always say how high stakes everything is and how what we're doing is so important, but we don't stop to take stock of [what] we're achieving" (FG4.1).

Respondents also described several *personal attributes* (Table 5.1, Theme 2a.iii.) that made learning from failure difficult, such as the sense that "a person's ego gets in the way of recognizing failure" (SID118). The ego problem was expressed in several forms, for example, "when you are told you are the subject matter expert throughout your career, that doesn't leave a lot of room for saying, 'I don't know'" (FG5.4); and the view of several respondents summed up as the need to "let go of [one's] ego and stop taking shit personally" (Int11). But the latter was widely recognized as difficult, with one respondent stating, "I still internalize it…it's not that my project failed, or my program failed, it's that *I* failed. I just take it too personally" (Int17).

Many respondents recognized that learning from failure requires a "totally different mindset" (Int5) that is open to reflection and self-examination, but because it is "human nature to shy away from failure" (Int44) and instead "talk about what's going well" (Int 40), therefore "it is hard to get the courage to talk about failure" (FG2.3). Avoiding self-examination is exacerbated by "the natural tendency to think you're the only one who's had this problem" (Int22). Many respondents found that learning from failure was not possible because people prefer to "stay within their comfort zone and keep doing what they know how to do well rather than trying something new" (Int15).

Some respondents experienced issues related to gender that affected how they were able to respond to failure, noting, "As a woman in science, I often feel the need to prove myself. Talking about failures feels like giving fodder to critics" (SID35). Another respondent felt similarly:

> "We [women of color] are often held to really high standards and being perceived as a failure is almost as bad as actually being one. I notice that there are a lot of white men that claim that they did everything right and have a lot of hubris. The moment that I "admit" that something did not go well, I get taken less seriously as a minority and a woman" (SID253).

One respondent acknowledged this gender divide directly: "being a straight, white, male has got a lot of factors where in general there's less organizational risk for me inherently for who I am" (Int49).

5.3.3.2 Interpersonal relationships

Respondents perceived several aspects of 'Interpersonal relationships' (Table 5.1, Primary theme 2b) that made learning from failure difficult. The most frequently mentioned subtheme was related to *team dynamics* (Table 5.1, Theme 2b.i.). This included experiencing a lack of psychological safety, for example, "lots of scientists at [a big international NGO] were saying, 'I'm not comfortable speaking up'" (Int49). Many respondents feared voicing their concerns, wondering, "am I going to be judged?" (Int26); feeling that "others will think everything you do is wrong" (FG2.2); and being "uncomfortable saying 'this really didn't work'' because people would say, 'How could you be so dumb as to try that? Couldn't you see that wasn't going to work?'" (Int26).

Some respondents felt unable to learn from failure because of the hierarchy in a team, feeling that "the power structures can make people less likely to bring up or own up to failure…I never felt I had the 'rank' or the 'right' to bring to light something that hadn't worked out" (SID215). Feedback among team members was perceived as difficult because "everyone wants to be in a position of authority to say no, but almost no one wants to be told no" (FG4.4). Teams could be derailed from learning from failure through "finger-pointing" that "creates internal conflict that prevents teamwork and prevents, well, really sort of like forgiveness" (FG5.5). Respondents often described difficulty with team discussions because "people in our field are generally 'nice' people who are conflict averse and avoid uncomfortable conversations" (SID67), and the "passive aggressive" nature of some team members means "we work really hard to act as if we are getting along even if we're not" (FG4.4). Ultimately, "it all comes down to people management, and that's the really difficult thing" (Int14). Getting a group of disparate people to "buy-in" when "everything has to be their way or no way at all" results in learning from failure "running into a wall" (Int19).

The presence of barriers related to *leadership or supervisor influence* (Table 5.1, Theme 2b.ii.) also played an important role in learning from failure, with respondents expressing the view that "it's not going to change until someone higher up does it" (FG2.3). "What do I see my boss doing?" (Int49) sets the example and experiencing negative reactions to bringing up bad news like being "told to change the language [that was honest about projects that had failed] because 'we can't have this in our institution'" (FG2.3) was perceived as a disincentive to efforts aimed at learning from failure. The perception of a supervisor's reaction can thwart attempts to learn from failure:

> "I would like to have the opportunity to talk about my failures and mistakes, particularly with my supervisor, but I feel like I can't. This is primarily a result of [an] image on my supervisor's part that anything that does not align with their image of the organization is seen as wrong. Though I would like to discuss failure in a healthy manner and learn from my mistakes, I often find myself silently correcting those mistakes, hoping that they can be resolved before my supervisor notices, which is not the right way to handle such situations" (SID240).

Ultimately, "bosses evaluate employees, they want to see success, and success is not measured in what you learned" (SID45).

5.3.3.3 Organizational structure and function

Elements of the Primary theme 'Organizational structure and function' (Table 5.1, Primary theme 2c) of conservation organizations were mentioned by a large number of respondents as contributing to a lack of learning from failure. A *limited or lack of learning structures* (Table 5.1, Theme 2c.i.) was the most frequently cited subtheme, with a widespread desire expressed for "some detailed reporting about things that worked or didn't work…a formal administrative structure to collect and document learning" (FG1.2), with respondents feeling that with each project they are "starting from scratch…because a system of documenting and sharing, it just doesn't exist now" (FG4.3). As one respondent said:

> "I have been a part of three different organizations. The first severely looked down on failure and actively suppressed any failures. The second was hit or miss depending on the location. The last has not talked about any failures or mistakes. I'm sure there are some out there, but it is not talked about" (SID200).

Some respondents expressed frustration as a result, because with "no structure in the organization to help us learn from mistakes…we just kept doing the same things over and over again" (FG1.3). On the other hand, there was a perception of risk in instituting an internal formal documented learning from failure system, as "people might be more comfortable sitting around a table and chatting…because once you put it in writing there's always that risk of where's it going to end up?" (FG7.4), thus not wanting to be "too transparent about internal workings" (Int25) if there is even a "slight danger that external clients are going to say, 'Well, looks like they have problems'" (Int26).

The influence of *inhospitable culture and norms* (Table 5.1, Theme 2c.ii.) was noted by many respondents. The "culture of conservation still views failure as something to be ashamed of rather than something to learn from" (SID157), and "it's hard to change the culture within conservation" (Int3). Sometimes "the institution is not ready to receive" (Int10) new ideas about learning from failure, and there is a need "to create a no-blame environment before people will come forward to speak because failure is viewed negatively rather than as a learning opportunity" (FG1.1). People who identify problems risk being "insulted", with "everyone jumping on all the reasons why the bad news is wrong" (Int49). Some respondents reflected that less experienced people "don't want to say a word, you just want to be a team player…but I don't think that's the best culture that we create" (FG5.5). For some respondents, an "internal culture to learn from failure just doesn't exist" (Int7), and "we just hoped we'd succeed and expected we'd succeed, and we were surprised when we did not" (Int53). Creating a learning from failure culture is difficult, because "you have to be able to demonstrate what the benefit is of documenting [failure] and learning from it. It's conceptual at the moment and nobody buys into it" (FG4.3). The challenge people feel in many organizations is "how do you highlight the opportunity without criticizing the current paradigm?" (Int49).

Many respondents discussed the size of NGOs as a barrier to learning from failure, with a sense that some are *too big to fail well* (Table 5.1, Theme 2c.iii.). Large organizations were

viewed as resisting being "transparent" and "unwilling to share" (Int36), and as "fearful of putting their reputations on the line" (FG2.1). In person, people from large NGOs may be willing to "talk openly about what doesn't work and that failure is really common…but it's nowhere on their website, not a mention at all anywhere that anything they've ever done hasn't gone perfectly, just like every other large NGO" (FG1.3). One respondent's view was that at larger organizations, there is

> "…a disconnect between the workers who actually are out in the field doing the work (along with their direct supervisors), and the supervisors of the supervisors who handle the funding and the rules but are only ever in the office. These higher ups don't seem to understand or relate to the conditions that can lead to failures in the field, and as such are not tolerant of failures being reported" (SID101).

The perception of some respondents was that large, international NGOs have "de-grounded" themselves "from the messy realities of conservation on the ground" and are "basically led by communications teams based on fundraising and membership…so you can't really talk about failure" (Int20). Some respondents viewed larger organizations as unable to look at what is not working because they "don't want everyone to see the emperor has no clothes" (Int36), and one interview respondent told me: "If I were mean, I would say to you, 'Go to the HQ of [a specific large NGO] and ask them if they've done anything wrong!'" (Int37). Smaller organizations were seen as possibly more effective at learning from failure "on the whole because there's a bit more flexibility, a little more self-reflection, less a sense that you're reporting to somebody and more of a 'well, how did that go, guys?'" (Int26). There is

> "a level of trust and respect where you are able to report on all the bad decisions you've made and stuff that didn't work as acceptable human practice…you can do that in a good supervisor relationship, you can do that in a smaller organization. As it gets into a bigger organization of unrelated individuals—at some level consciously or subconsciously jockeying for position and status and recognition—that honesty and trust kind of breaks down" (Int37).

5.3.3.4 Conservation as a sector

Respondents frequently discussed elements of the context in which conservation work takes place, labeled 'Conservation as a sector' (Table 5.1, Primary barrier theme 2d). One of the most frequently mentioned barriers to learning from failure under this Primary theme was the *complexity inherent in the system* (Table 5.1, Barrier subtheme 2d.i.). Many of the issues respondents raised concerned the 'wickedness' of the "dynamic and uncertain environments and situations" (FG5.3) in which conservation operates, with respondents wishing there were some "easy stats, like the daily sales reports" (FG 4.1) that businesses generate. Several respondents noted that the natural sciences attempt to make sense of the complexity of the systems in which conservation takes place but recognize that many other factors impact these systems. Along with the dependence of conservation activities on "political and economic decisions and systems" (FG1.2), "actually dealing with people is the big issue" (Int14), and conservation "is as much about power, influence, and advocacy as it is anything else" (Int1). Respondents often expressed frustration that "we may know exactly what the problem is, but we can't do anything about it because of the politics and society and culture and all of that intertwined…the only way we can learn from failure is if we become different kinds of people, because things don't work not because of the animals but because of people" (Int11). There were two competing views shared by respondents on the generation of evidence and the application of lessons from other disciplines to grapple with this complexity. One respondent expressed the view that the current drive for "standards of evidence they are going to try to hold things up to, like randomized control trials and models from medicine" are just "total bullshit…complex social ecological political systems don't look anything like the human body" (Int9). Another respondent expressed the opposing view, that the notion that conservation is too complex to evaluate "is complete bullshit…the rules apply the same in epidemiology as they do in conservation" (Int36).

The lack of incentives for experimenting, the lack of systematic evaluation, and the replication of "best practices instead of best learning" (Int1) were viewed by many respondents as contributing factors to the presence of *entrenched dogma* that created a barrier to learning from failure (Table 5.1, Theme 2d.ii.). There was a sense among many respondents that "we can't talk about failure in conservation because we would have to expose the fundamental moral

tension within elements of the conservation movement" (Int20). For example, it can be difficult to move forward on a controversial topic like wildlife trade because even "after 40 years of failures…people are not prepared to try something new because they are not prepared to give up their ideologies" (Int52). Conservation professionals continue to enact strategies that lack evidence of effectiveness because "entrenched dogma prevents objective assessments"; for example, local communities have

> "vastly different opinions of the legitimacy of 'law enforcement', but we remain blissfully unaware of this, endlessly promoting law enforcement-based interventions despite lack of evidence that they actually work. We are collectively unable to review our assumptions, because we don't realize we operate under any assumptions" (SID234).

The idea that conservation is a c*risis discipline* (Table 5.1, Theme 2d.iii.) took several forms, all of which discouraged effective learning from failure. Many respondents felt the incongruity that "on the one hand, conservation organizations can't really talk about failure, but on the other hand, they depend upon the crisis narrative" (Int20) for their continued existence. One respondent from an African country expressed this frustration cynically:

> "These huge NGOs do have long-term strategies, and that's to make themselves bigger and to increase their donation flows. And they do that by keeping crises going. They are not in the business of solving problems. They are in the business of raising donations. And in order to raise donations, they need problems. They need orphaned elephants; they need rhinos with their faces chopped off. They need orangutans being burned out of their habitat, they need overfishing, they need starving people because that's what keeps people hitting the donation buttons…If they solve the problems, they might be out of business, and it is a business, make no mistake about that" (Int52).

The continuing description of conservation as a crisis discipline also is at odds with the need expressed by many respondents to "professionalize the field of conservation…because until we do it's just a bunch of black magic voodoo" (Int36). The idea of professionalism included the need for increased training on teamwork, leadership, and decision-making; accountability for the development of systems for learning from failure; and the "acceptance that some percent of failure is inevitable" which means "we need to spend some money on communication and organizational capacity improvements instead of forcing people to spend every dollar on

fieldwork" (FG1.3). One funder recalled experiences with trying to institute some experiments and finding that "many of the people who grew up in traditional conservation organizations, who were conditioned in the professional conservation system, could not adapt because they had an abhorrent fear of failure" (Int54). Some respondents who had come to conservation from other fields found that small conservation NGOs in particular were lacking in professional structure: "vague proposals spun to get funding, technical work by untrained volunteers on short-term appointments, lax financial controls and no quality control" (SID119). Another respondent noted that the crisis narrative resulted in a lack of strategic focus, because "we are challenged to say 'no' generally in [a large global NGO]. And I would even say the same in the conservation world generally, because it is all so important. We believe that everything is important, and you know what they say: 'If everything is important then nothing is important'" (FG4.1).

5.3.3.5 Funding

One frequently mentioned cross cutting 'Contextual' theme that ran through a majority of the data was related to 'Funding' (Table 5.1, Primary theme 2e). Many respondents described the donor structure of funding in conservation as a barrier to learning from failure because it is overwhelmingly "*fragile and 'fair-weather'* (Table 5.1, Theme 2e.i.) and admitting failure in conservation is seen as very risky to ensuring continuing support" (SID 68). There appeared to be a mismatch between what grantees experience in this regard and what funders believe they incentivize, with one respondent describing a discussion in a professional forum with funders: "funders believe what they do now is just fine…and that their recipients have plenty of incentives to report failure. I was dumbfounded that they seemed to sincerely believe that" (SID115). The widespread perception among respondents was that "there is a lot of pressure from donors for successes and they really don't want to hear about failures, which is unfortunate" (Int15). As one grantee experienced, 'project-based funding is problematic…despite what our donor had all over their website we couldn't actually say what we were doing wasn't working" (Int9). There was a widespread sense that grantees had to

> "…find the good in everything we've done because otherwise we won't get the funding…So the pressure is always to say, what's the impact of this money we've been

> spending—the *positive* impact of this money we've been spending—which just completely suppresses any real discussion of failure" (Int26).

One funder acknowledged there is a "stereotype that funders do not like failure…it's a stereotype has a basis in reality for sure" because "what do we do with the information about projects that fail? Do we really daylight them and take a hard look or do we set them aside in a drawer and try and forget about it and not fund that type of project again? I'd say more of the latter" (Int3). Another funder recognized that "people are reluctant to tell funders when things aren't going well…it's just a reality…and to some extent more successful projects get rewarded and less successful ones get dinged a little bit, and that's a constant issue" (Int23). As one funder put it bluntly: "We fund people who already have a history of success" (Int21). Another funder recognized the dilemma and expressed frustration with the current structure:

> "As a donor I feel like our recipients don't want to openly share failure with us. They are often afraid that failure will equal not getting future funding. We as donors don't communicate well that failure can be an important step towards future successes. Discussions about challenges or failures will often come out during face-to-face discussions, but not in reports. I believe there is shared blame for this communication gap from both the donors and recipients" (SID151).

One component of the funding structure many respondents said inhibited learning from failure was *competition for funding* (Table 5.1, Theme 2e.ii.). Funding was perceived "to often mean the difference between success and failure" (FG6.4), so competition is fierce. Funding is a finite resource, and with both grantees and funders themselves competing for funds, a fear of jeopardizing funding was seen as pervasive in the system. Respondents recognized that "funding is tight, and failures are threats to future funding" (SID145), so "we all work hard to earn our 'slice of the pie', which seems to shrink annually" (SID122). As one funder said, it is "not necessarily the funders' fault, but the fact is there isn't enough funding available" (Int2). Fear drives the system, with one employee of a large NGO reflecting that "dependency on donor funding has been one of the foremost things that has shaped experiences I would consider failures…it's the fear of 'what if this gets out that we didn't succeed?'" (FG4.3). Many

respondents shared a strong perception that regardless of what they do internally as an organization, "externally, it's a completely different story…we have to show success" (FG3.1). There may be lots of money flowing to large NGOs, but "a huge chunk of it never hits the ground", and what does

> "is frittered away on small, short term projects run by people who are enthusiastic but really aren't very good at what they do…there are exceptions, probably in Africa you could count those exceptions on one hand, but mostly it's people running around looking very busy with funding inadequate to do what they need to do…and they won't admit the funding is inadequate because they are frightened of upsetting their funders" (Int52).

The current funding structure was viewed as a "dance of deception with donors" (Int47): grantees are incentivized to report project successes to funders, because "if your project isn't successful, where are you going to get your next three years' funding?" (Int12), and funders are incentivized to report grantee successes to donor organizations because "the difficulty of raising funds makes it important to keep selling the successes because we can't make the donor foundations nervous" (SID89). At the beginning of the chain of competition for funding is the public, which "expects conservation to work quickly and return positive results…failure is seen as wasting public money" (FG1.3). The funding situation was described as "zero sum…Conservation International, World Wildlife, they are all going after the same money, and if you start showing failure, why would you think you are going to get more money?" (Int5).

The consequences of this competition and fear of losing funding throughout the system were perceived to be that "organizations waste limited resources" (SID83), cooperation is stymied, and it is "detrimental to conservation outcomes at the end of the day…you are all committed to saving the species, but you have different ways of thinking about how to do it, and by God you're not going to give up your way or your spotlight because that's how you get your funding" (Int11). Competition between organizations is exacerbated and calls for greater collaboration fall on deaf ears when people feel "it's a battle…there is a war amongst us conservationists of who has the money and who has to struggle" (Int19). The assumption that the "goodwill of large organizations and wanting to do the right thing is what's going to propel them into a state of [learning] is not correct…the carrot approach will only get you so far", and for the

system to fundamentally change to one that values failure and incentivizes learning, funders are the ones who will have to "deliver the message that's it's a new world" (Int36).

Many respondents expressed frustration with the current system structure, noting, "if we stopped fighting over who's going to save nature and started thinking about how we could work together to save nature, we might actually get somewhere" (Int9). There was a perception that egos and career aspirations of "people leading these various NGOs just won't let them collaborate effectively with other groups, so they are doing similar things with different catchy phrases because they are directly competing for the same donor funds" (Int53). Learning from failure ultimately was not seen as happening because "most conservation failures are invisible to those that aim to achieve conservation goals, or if not invisible, they are *made* invisible so that funding continues to flow" (SID129), and "if funders demand success, by God, that's what the NGOs are going to deliver" (SID115).

5.3.3.6 Learning

Several aspects of the Primary cross cutting theme of 'Learning' (Table 5.1, Primary theme 2f) were discussed by a majority of respondents. One of the most frequently discussed subtheme barriers was a *lack of maximizing information resources* (Table 5.1, Theme 2f.i.) that could enable learning from failure. One potentially valuable source of information for learning frequently mentioned by respondents was monitoring and evaluation (M&E), but many respondents generally viewed "the mechanism for evaluating what works and what doesn't" as "underdeveloped throughout a lot of the history of conservation" (SID127). One respondent summed up the widely held perception that conservation lacks both incentives as well an "architecture" to effectively conduct M&E activities, and described the current practice as "a vague sense that you can just learn by doing", with evaluation at best "a formulaic evaluation template that gets done and shows some bad and some good but not really insightful in any way" and at worst either not doing any evaluation at all or "finding the cheapest thing to do and checking it off" (Int5). The information resource problem was also widely thought to arise not necessarily from a *lack* of information— "the information deficit model is so rarely true"

(Int49)—but rather *how* to make use of the available information. One respondent articulated this widely held frustration:

> "People say they want M&E... they get buckets and buckets of information and don't know what the hell to do with it…lots of data collection happens but never analysis to make better decisions or figure out what worked or what didn't…You're spending all this time and effort collecting all this data and there's never any utility in it. Zero. So why would any organization want to do M&E in its current state?" (Int36).

Project teams also run into funding limits, often trying to "shave off as much as possible…it can look like project bloat to add in the evaluation piece, so we strip it down to what's the minimum that we need to actually get this thing implemented?" (Int7). While many respondents reported a lack of incentives for evaluation from funders, others recognized that there is no evaluation at the end of a project regardless of the source of funding, simply because there is no internal system for evaluating and learning from failure:

> "It certainly wasn't in the plan to evaluate it five years down the road, and by five years there's some new hot topic and all of a sudden their research doesn't happen fast enough to stay relevant. So, you hit the end and there's no adequate assessment as to whether it worked or didn't work because it's not required…I was going to say by funders but that's not the model here…there's just no one above you saying how did that work out? If things go well there's no real follow up, but if the poo hits the fan it is not positive…it's like, 'What the hell happened, what are you doing', not like, 'This is a great learning experience'" (FG5.3).

Linked to the limitations of the existing evaluation structure were challenges inherent in setting goals and metrics. Part of the challenge many respondents expressed with learning from failure had to do with "not recognizing the failure" because of difficulty defining success, such as using "the metric of number of acres treated" to improve the habitat for a species, achieving that metric and "touting it as a huge success", and yet simultaneously seeing "the population [of the species you are trying to save] drop from 200 to 50 in five years" (FG5.1). As another respondent described:

> "We may say in the planning phase, 'We're trying to get these fish safely from point A to point B around this massive dam'…but in reality, what we're trying to do is put in a fish

> way. We think the goal is to get the fish safely from point A to B, but if [that] were really the goal we would be monitoring whether or not the fish actually got safely from point A to B instead of monitoring whether or not the fish way got built" (Int4).

When a 15-year reintroduction project has "only 475 individuals at the end, basically a cost of 90,000 Euros per lynx to move them from critically endangered to endangered…is that very high cost good news or bad news? Maybe it is a failure" (FG1.3). As one respondent noted, it is admittedly difficult to corral the "amount of resources required to articulate the outcome and know if you are achieving it" when there is "so much noise" in the system and "determining causality is extremely difficult" (FG4.4). Respondents widely acknowledged that "conservation implementation is messy—and results can be confounded by a multitude of factors—not all of which are obvious or visible", but by the same token, implementers "rarely draw up hypotheses or results chains" (SID158).

Another source of information that was not perceived as being used to its full potential was documentation of what is not working, whether internally to an organization or more broadly in the conservation literature. Many respondents expressed concern over a lack of documentation because "you can hold workshops and you can build capacity…but people drift off and do other things so leaving a written trail behind is really, really important" (Int15), and "a lot of information is lost because it is not being documented…so people are trying to reinvent the wheel" (FG5.5). The value to an organization of gleaning this information was recognized: "This sounds so obvious when you say it…but [we discovered that] one of the factors that determines whether or not we understand the progress we're making on a project is the number of different people that have written reports…but this is quite a big failing because overall we have a lack of this institutional history" (FG7.2). Learning from failure within an organization was perceived as stymied by staff turnover because "loads of this stuff gets lost when people leave the building" (FG7.1). If an organization has "a limited culture of documenting actions in a way that allows assessment of success and failure" then

> "…what data there is gets tossed out or shelved by successive people coming into a post…so the effectiveness of learning from failure depends on the communication skills and record keeping abilities—which may be good or not—of people who have been in positions long term" (SID2).

The peer-reviewed literature "is one of the primary ways conservation shares information" (SID127) and could be a valuable source for documenting learning from failure, as "there are thousands of interventions and experiences around the world…that you could learn from" (Int16). But "either people don't submit them—because who wants to write about their failures? —or if they are submitted, they're not accepted" (Int7).

A second 'Learning' subtheme was the frequently expressed notion that conservation professionals are *too busy to learn* (Table 5.1, Theme 2f.ii.). Respondents frequently discussed a focus on implementation and action over learning or reflection throughout the system. Many respondents widely acknowledged that reflecting on past projects is valuable and "until we understand where we failed, we cannot make progress…we have to make time for that" (Int41). However, respondents perceived a bias towards action over reflection, as "conservationists are notoriously 'do' rather than 'reflect'…people see that time for reflection as time away from action" (Int26). A widely held attitude was that "it is always full steam ahead" (SID2) and "it is almost a badge of honor to have way too much to do" (FG4.4). One respondent involved with private land conservation expressed frequently held sentiments that capture a range of factors that make it challenging to reflect, and the toll this takes on individuals:

> "You're failing every day in some way and you always have to be able to believe that you are contributing to making things less bad or much better and that takes a high-level optimism to keep your head in the game, particularly when you're facing the struggles these guys face with macro issues, whether that's the real estate market, climate change or what's happening with the appraisal world these days. To keep going, the folks in these roles are like sharks. You know, they can't stop moving. They have to be figuring out what's the project for three years down the road, to be figuring out the one for next year, and to be working on the three or four they're doing now…. We don't have the freedom to pause and reflect. We have to move so quickly…It's constant motion and if you're not an optimist is easy to just go, 'fuck it, it's too hard'" (FG6.2).

Some respondents felt that "it is more exciting" to "start something new…and by the time you get to the end of a project, you're thinking about your next job…you don't reflect and it's so sad because all the lessons are there and it's so rich" (Int15). Ultimately, "there's no incentive for managers to report because they say, 'we are so busy doing stuff we can't collect data and report

back because frankly that's not going to be in our performance evaluation…it's not part of the job description'" (Int8).

In addition to the individual sense of unrelenting forward momentum, the "funding apparatus" of conservation was viewed to be "overwhelmingly focused on delivery of conservation action [which] creates an incentive for projects to emphasize what went well and hide what went wrong…and lacks funding bodies whose main aim is to drive learning and so allow room for experimentation and failure" (SID42). A consequence of the focus on implementation was perceived to be that learning is devalued, risk is unacceptable, and opportunities to build evidence and discover new opportunities are squandered:

> "…nobody is actually very happy about funding proper blue-sky research where stuff might not work. They want to see a nice, planned project, where everything's got quarterly deliverables, and at the end we are guaranteed to come up with X. But if there's a guarantee at the end it's not research. Basically, it's just implementation. And for it to be implementation, that means we already know what the answers are" (Int52).

A related "Learning' subtheme shared by many respondents was the challenge of *refining future actions based on learning* (Table 5.1, Theme 2f.iii.). Respondents frequently highlighted the importance of changing course, recognizing that while "most people are moving to outcomes or impact reporting" it is "actually more useful to understand how you are adapting to what you're doing rather than that you did what you did…it's great that you did the things you said you would do, but how do you respond to change?" (Int2). Project teams on the ground "want to be able to adjust [their] theory of change to responsibly adapt to what changes in the situation" (Int1), but "in the middle of projects it's kind of hard to do because you've already committed to the goal" (FG4.5). Respondents frequently mentioned adaptive management as one approach for adjusting course based on learning, but the predominant view was that it was rarely fully embraced. Respondents wanted to "adaptively manage" but "closing the loop is still a challenge…like 'how do we take this failure and learn from it and change what we're doing' is still an issue" (Int3). The evaluation phase may reveal that "we're falling short of our goals, but the political will to actually change the adaptive management plan is rarely there because no one is willing to stick their neck out to push the change" (Int27). One respondent put it bluntly:

> "Adaptive management is a failure across the board in being implemented…everyone agrees with the right way to do AM and it falls down almost every time…it's the monitoring piece, it takes a lot to set it up and the will and funding and resources to continue running it and update models and make new recommendations based on data coming in…we're just not closing the loop" (FG4.4).

Part of the challenge with changing course was seen as knowing when to do so and guarding against the effects of a sunk cost bias, as "we tend to fail with a fizzle…we should pull the plug on things a lot earlier and just say, 'this isn't working, let's be done with it', but we create ownership around things" (FG4.4).

5.3.3.7 The illusion of success

Another commonly cited theme that ran through a majority of the data was the pervasiveness of an 'Illusion of success' (Table 5.1, Primary theme 2g) as a barrier to learning from failure, an "illusion that everything is going just fine until you go out and have a beer with somebody…It's a real stumbling block, because when a problem occurs we cover it up or rephrase it so the truth doesn't come out and still makes us look like we're doing a good job" (Int47).

This illusion was perceived to arise and be sustained because *failure is not valued* (Table 5.1, Theme 2g.i.), but rather "success is highly valued" (SID67) and there is "a lot of pressure to show success" (SID216). In addition to "not airing dirty laundry in public" (FG7.3), people are very reluctant to "admit failure…and you ensure that you can't fail by never promising anything that you can't deliver" (Int52). Respondents widely perceived that "everyone knows someone who is going to overly sell success" (Int2). Many respondents expressed frustration that failure is not widely or systematically discussed or documented. Sharing learning within organizations was viewed as prioritizing the highlighting of success, with one respondent emphatically stating, "I have not ever seen a project team that wasn't successful being asked to give a webinar, like, 'hey, tell us why that didn't work out.' I've never seen that" (Int7). At conferences, "failure tends not to be what is highlighted…presentations are all about successful projects" (SID146). But a

widely held view was that "conferences are not even close to enough…the written publication process is what is considered most valid in the field and until the tone of publications begins to change, there will be no real change" (SID253).

Systematically undervaluing failure was widely perceived by respondents as contributing to a pervasive *success bias* (Table 5.1, Theme 2g.ii.). Respondents recognized that focusing on success rather than failure "and continuing to do what you're succeeding at is a natural human tendency, but it doesn't really help when you are trying to learn and improve" (Int17). There was a perception of "an inherent bias from grantees through to program officers to see success where maybe success didn't exist…like rose colored glasses" (Int25). The success bias also was perceived to lead to an overreliance on replicating best practice, when in fact "it is very hard to replicate things" (Int1). The fear of admitting failure throughout the system was viewed as resulting in best practice being "diluted…and really quite anodyne without the spicy bit of reality about *why* it became a best practice" (Int26). Lessons learned are "toned down and toned down until it's just water", and reports are reframed as "'best practice', and you can't be specific, even if it's something that should have been stated as what didn't work…so you read it and think, 'Yeah, I'm doing all these things' and you throw it away, but there is one thing you haven't thought of, which is why they made the report in the first place, but it's buried in there and you miss it" (FG2.2).

Many respondents recognized that overvaluing success could lead to problems understanding the systems in which conservation professionals work: "when things work, you keep doing what you did before, and it will keep working. But when things don't go so well, it's easier to sweep failure under the rug rather than examine what's going on" (SID141). In general, "people want successes, they don't look at problems in new ways, they just look at them through existing structures" (FG5.3). But favoring success over failure was understood to leave success unexamined and result in asymmetrical analyses:

> "If I say I'm going show an effect and explain it as reciprocity or pro-social behavior or whatever, people are like, 'great, awesome, amazing.' But if I do a large-scale experiment and it doesn't work, people say 'why no effect? Maybe you didn't do it long enough, maybe the implementation wasn't great, maybe it was all these things.' But that analysis

> should be applied to *both* success and failure, because how do you know the effect is from the mechanism you thought?" (Int5).

More generally, something akin to self-serving bias was viewed as happening: "if we see something that looks like success, we immediately agree that our underlying model of how the world works is correct, but if we see something fail, we tend to focus on why implementation was the problem, rather than examining our underlying model of the world" (SID115). This success bias also limits the appetite for experimentation:

> "…conservation is not effective at learning from failure, because when a strategy that works is identified it is kept and maintained. There is usually no great push after that point to find something that works better, because you found something that already works, and looking for something better may cause something that doesn't work at all" (SID101).

5.3.3.8 Temporal challenges

The final Primary cross cutting barrier theme had to do with 'Temporal issues' (Table 5.1, Primary theme 2h) that make learning from failure difficult. Respondents widely recognized that "time is a big issue" (FG7.1), and this issue took various forms across the data. There was the perception of a *mismatch of scale* (Table 5.1, Theme 2h.i.) between the nature of conservation funding and the "decades and centuries" (Int8) over which natural processes occur. As one regional conservancy director put it: "It's surprising how uncoupled from data we have to become by necessity, even though monitoring is so important, because the timeframe is so out of sync with our actions, with the rate at which we need to act" (FG3.1). Because conservation actions often involve "making a decision with an uncertain future over a long time horizon" (FG5.2), many respondents felt there was a need for funders that were "willing to commit to the long term to adapt over time with a group" (Int1). Commonly, respondents felt they "had to make sure once you get your money you can hit the ground running to implement and report successes on a one-or two-year project" because it is "really hard to get an organization to say we're going to invest five years into it" (Int17). One respondent expressed frustration with a

large NGOs' ability to take the financial risk involved in long-term habitat preservation on a scale needed for species recovery:

> "They [the large NGO] won't do it because it jeopardizes their money, and because it's a very hard sell to say, when will the lappet-faced vulture be viable? Twenty years from now? And they reach reproductive age at 10-12 years of age? So, we might have a breeding pair 30 years from now? Forget it. We don't do those timescales. Thirty years to fight for the habitat just to reintroduce lappet-faced vultures? The answer is going to be no. So, they spend millions on breeding them…it makes for wonderful conferences and seminars…it's a wonderful conservation-oriented case study. But you have to look at the complete picture, the whole ecosystem…you need some place to release these animals, otherwise you are just breeding for the zoo" (Int19).

The scale mismatch was seen as impacting the understanding of success and failure, such as the manager who removed a dam and reintroduced salmon to a river early in his career and "got runs for five years, project complete, and 'tick', I had success. But I went back 20 years later and there are no salmon any longer. We think it was an overwintering condition in this area, not because of anything I did…but did I fail, or did I succeed?" (Int4). Another respondent also tied the timeframe issue directly to goals and adaptive management, reflecting the widespread view that "we struggle to incentivize learning from failure" because measuring things like "bucks and acres" makes sense from

> "a marketing perspective, but it's not great for adaptive management. It's not great for long term credibility…if we don't invest in the measures and science now, we can show success for three or five years, but if we invest in a water fund and the water isn't going to be clean over the long term, that's a problem if we want to be in the community for longer than five years. It's a problem ethically regardless, but from a long-term vision standpoint, we have to be able to measure and adapt and learn from failure" (Int 49).

Other respondents challenged the idea that the conservation funding structure is fully to blame for the difficulty in determining success and failure in conservation due to the timescales involved. Rather, respondents also perceived *an insufficient investment in time for learning* (Table 5.1, Theme 2h.ii.), that manifested during all stages of a conservation initiative. For

example, as one respondent pointed out, other disciplines such as epidemiology also operate over decades, but conservation has not embraced the same level of systematic investment in efforts to

> "break things down into incremental relationships between enabling conditions and threats and conservation outcomes…and build evidence as you're moving forward…Yes, there are long term changes, but you should be able to demonstrate that your underlying theory of change is supported by evidence…and see whether or not you are on track…It's just such a lousy excuse that people like to hide behind, that you can't measure us because these things take so long…The uncertainty level is so high in terms of the efficacy of any of our interventions that you can never assume you're going to get where you want to get to. So, it's important to value learning as much as we are evaluating outcomes, but you can't value outcomes more right now given the highly uncertain arena we're working in. It's inexcusable that we've been saying this for 30 years" (Int36).

Many respondents noted an underinvestment in due diligence at the beginning of a project, the general lack of "a pre-project period where you spend a few days finding out what's already been done" that would "make us more effective and efficient in decision-making…I mean, you make a whole plan to develop a tool and you don't even know for sure if someone has already done this. We have time to schedule meetings but no time to do some initial research? That's frustrating" (FG4.3). It was not uncommon for respondents to feel they "don't even have the fundamentals well understood" because they have not taken the time to invest in understanding the systems they are operating in; rather, the tendency is to "skip over the basic questions…we skip steps two, three, four, five and start on step 25" (Int36). Commonly, respondents did not perceive there was much "thinking before we start something about what success and failure look like…no, we just go do it!" (Int27).

During a project, feedback may be desired, but time was not set aside for these reflective activities because oftentimes "people want feedback, but then this fire burns over here and all your time goes to that" (Int31). Also, respondents noted that it can be difficult to give and receive honest feedback in the middle of projects, because "you've already committed to the goal…there are some things you just can't say throughout a project" (FG4.5). While most respondents reported that post-project discussions of successes or failures rarely occurred, one respondent did participate in a facilitated discussion of a large failure, and "one of the main conclusions was that if the team hadn't been so busy and they had come together more often

during the project to do a high-level analysis of the bigger picture, they might have been able to see what was going on" (Int1).

At the end of a project, while people are "increasingly recognizing the importance of reflecting on what worked and what didn't work", people tend to "not see the benefit for themselves" (Int26). Thus, this reflective process tends to be "undervalued…it is seen as 'nice to do' rather that 'need to do' so it falls to the bottom of the to do pile" (Int25). Because time was not systematically made to invest in the learning, "the worst thing that can happen is that if something doesn't work out, you just drop it, and everyone scatters. That's terrible, because you got nothing out of it, and everyone feels bad about it" (Int1). One respondent had a particularly pessimistic view of the impact of time on learning, finding that the capacity constraints under which many conservation project teams operate given the pace of work needed to be running a two- or three-year project while simultaneously raising money for the next project "means that nothing ever lasts long enough for anybody to learn anything" (Int52). Another respondent experienced a post-mortem that was essentially useless, because despite surfacing issues with the outcome that should have provided future learning, the funder was not interested because their primary goal was "finding a problem to fit the solution they wanted to promote" (Int3).

5.3.4 Key factors enabling learning from failure

Five 'Primary enabling themes' emerged with 15 'Enabling subthemes' (Table 5.1) as key to creating conditions conducive to learning from failure.

5.3.4.1 Individual mindsets

Many respondents described elements of 'Individual mindsets' (Table 5.1, Primary theme 3a) as important for enabling effective learning from failure and recognized that attempting to learn from failure "is a useless exercise unless you have the right mindset" (Int 11). Within this Primary enabling theme, respondents frequently discussed the importance of "looking at *failure as a learning opportunity"* (SID4) (Table 5.1, Subtheme 3a.i.) rather than "being afraid of

failure" (SID16). Failure was widely perceived as "crucial for any learning curve" and as holding "the key for future success provided that rigorous evaluation is conducted" (SID123). Many respondents also felt that if we had "no failures, in all likelihood we are not pushing hard enough to find creative solutions" (SID172). Failure not only "provides data that can be used to focus future activity" (SID235), it "changes the boundaries of what is possible and challenges the mind" (SID243). Respondents felt that in viewing failure with a learning orientation, the experience of failure becomes "a huge learning curve that makes you stronger" (FG2.2). Some respondents were able to identify transition periods during their professional lives when they "came to consciously realize that actually you can learn a lot more from failure than you can from success if you are open to recognizing it and admitting it" (Int15). As one respondent noted, "I'm not embarrassed to admit it, but I finally figured out that learning was better than continuing on the same path and wondering why it wasn't working out better" (Int13).

Many respondents discussed the *personal attributes* (Table 5.1, Subtheme 3a.ii.) they felt were necessary for learning from failure. Being willing to "accept reality" and "taking to heart that failure happens" (Int31) was often discussed. Many respondents felt that a "healthy dose of realism shared more openly" (FG4.2) coupled with a "high-level optimism" (FG6.2) is an outlook that helps them see the learning embedded in failure and stay motivated. Elements of intellectual humility were frequently mentioned, such as "not always having to know the right answer and having to be right all the time" (FG5.3). Respondents felt that it was important to be honest with themselves, take responsibility and "own the blame" for problems, and be willing to say, "I really screwed up, this is a big deal…I know how to fix it, but it will take some time and slow us down" (Int49). Respondents expressed the necessity of "letting go of the need for power and control…it's about being humble" (Int20). A willingness to examine ones' own biases, such as confirmation bias (Int49), the discipline to "constantly ask yourself, 'what am I not seeing?'" (Int40), and the capacity for persistence in the face of failure were also widely noted. Other attributes respondents felt enabled effective learning from failure were "creativity" and "flexibility" (Int35) in approaching problems. Respondents also described a sense of resilience, feeling "more competent and confident, and more willing to speak up" after having gone through "setbacks and mistakes" (FG1.3).

5.3.4.2 Individual activities

Respondents also discussed the 'Individual activities' (Table 5.1, Primary enabling theme 3b) they found to be useful in enabling learning from failure. Specific actions people took included *sharing personal stories* (Table 5.1, Enabling subtheme 3b.i.). One respondent described building up the courage to give a presentation on a failed project at a major conservation conference, which was a difficult but cathartic process of self-examination and learning that was "very well received by the audience, who weren't used to someone standing up and talking about failures that were of direct relevance to them" (SID98). This respondent chose to do this after realizing that "if I'd heard someone talk honestly about their failures and hitting rock bottom, I would have felt more comfortable entering my own period of difficulties" (SID98). Another respondent reflected that while it is "always hard to get the courage to talk about it…you have to build up the habit of getting through the horrible feeling of being scared to share" (FG2.4).

Respondents also mentioned the need to *build trust* (Table 5.1, Enabling subtheme 3b.ii.). One respondent described an early career experience of being punished for an honest mistake, and who now ensures that in the NGO she now runs, "our people know that if stuff breaks or gets lost, they can tell us, no punishment…you have to build up the trust so that people can tell you when things go wrong" (FB2.2). In a related subtheme, respondents also frequently noted the value of *seeking feedback* (Table 5.1, Enabling subtheme 3b.iv.) in order to more effectively learn from failure. People "want to know how to improve" (FG2.2), and if you are in a situation where "some line managers don't do appraisals (FG7.2) then you "have to actively ask for how [you] are doing" (FG2.2). Many respondents also discussed the value of taking advantage of opportunities for *professional development* (Table 5.1, Enabling subtheme 3b.iv.) in enabling learning from failure. One respondent's agency offered individuals the chance to take part in leadership programs, which he felt started to address existing problems "with having a lot of experts who may or may not look at failure as a good thing…and the folks going through the training are starting to get into the highest levels so things are getting better" (FG5.5). Another respondent recognized that she was lacking in the "big skill" of people management and

"figuring out how to create a learning culture", and wished she had access to training in how to do this (FG5.2).

5.3.4.3 Group culture

Several aspects of the Primary enabling theme 'Group culture' (Table 5.1, Primary enabling theme 3c) were frequently mentioned by respondents who felt "the values within an organization are the real key driver in learning from failure" (SID215). Within the organizational culture, many respondents felt that "learning is totally dependent on the team members involved" (SID51), and described elements of *psychological safety* (Table 5.1, Enabling subtheme 3c.i.) such as the need to "create a no-fail environment before people will come forward to speak" (FG1.1). For effective learning from failure in teams, "everyone has to be encouraged to speak up, no matter the hierarchy" (Int14). One respondent found that in order to speak with "honesty about what did and didn't work, we needed Chatham House Rules, making sure that this is a safe space to discuss and we're not here to assign blame for what went badly" (Int1). Creating psychological safety was viewed as even more important for people working in teams that did not know each other well. For example,

> "in close-knit groups, you know that they know you are competent, so it's OK to admit fault…they know it's not you. But if someone doesn't know you well, you know their opinion might be based on that one interaction, so you can't admit failure because they don't necessarily have faith in your ability. They'll think it was just you and attribute it to you personally" (FG1.1).

Many respondents felt that creating a culture open to learning from failure "depends on *leadership"* (SID30) (Table 5.1, Enabling subtheme 3c.iii.), because "agency leads and mid-level managers set the tone and expectations for being open to failure discussions" (SID43). This was seen as beginning with establishing norms during onboarding: "when new people come in, saying from the start, "If something happens that's not working please talk about it so we can all learn'" (FG2.3). Through their actions, leaders "send the signal that, 'This stuff is super important'… they set the example that it is a priority and a valuable use of my time" (FG7.5).

However, it can be "difficult to get top managers to buy into this…and until you have leaders at the very top saying, 'Yes, this is the way we want to go,' it's just not going to happen" (Int36).

5.3.4.4 Group activities

Many respondents discussed 'Group activities' (Table 5.1, Primary enabling theme 3d) that they felt were key to enabling learning from failure. The most frequently mentioned activity was *group reflection* (Table 5.1, Enabling subtheme 3d.i.). Respondents felt that "recognizing the failure is necessary but not sufficient", because "you can recognize it but that doesn't actually help improve if you're not talking about, 'what would we do differently, what do we learn from this?'" (Int40). Many respondents described experiences involving group reflection that they felt improved their work performance. For example, one respondent reflected that after having taken part in a "big debrief" she was able to "take those lessons to heart and get up to speed on where I needed to be in dealing with issues of justice, equity, and inclusion…we all understood where we screwed up" (Int27). Other respondents said they learned the benefit of group reflection from people coming from other disciplines such as the business sector or the fire service, who brought with them a "culture of doing regular postmortems because that's just standard practice for them" (Int3).

Sharing learning (Table 5.1, Enabling subtheme 3d.ii.) in both formal and informal settings was frequently mentioned as a group activity that facilitated learning from failure. One respondent was part of an inter-organizational "peer learning network" that "presented to each other at least every three months about what our failures were, what didn't work, and what we would do better and how we could learn…and that's how we grew our stewardship network so fast" (Int12). One funder described the value of meeting every other week with a small group of fellow program officers as a way to "share ideas about what you're having trouble with and seek input…which is a small group so you can share pretty openly" (Int25).

In less formal settings, many respondents valued spontaneous opportunities to share learning from failure experiences. Some respondents recognized that these informal interactions can be less frequent once an organization grows to a certain size, so it is even more important to

create opportunities to 'put on the kettle' to share learning in small groups. As one respondent said, their organization has grown over time, and when it was smaller, "we used to boil the kettle and that was the time we caught up and shared what we were learning, it was even pretty private so you could have a conversation. But now we're bigger, we don't all know each other, and now we have a hot tap [this elicited some laughter] so much less time to do that" (FG7.4). Having time and space to engage in the activity of sharing failure experiences with others was seen as valuable by many respondents, who found that "conversations about what I'm struggling with, what's keeping me up at night, helps me calibrate whether I'm worrying about the right things or not" (Int40), and is important for "sharing the weight" of failure (Int42). Many respondents found other opportunities to engage in informal sharing networks by reaching out for information or help through list serves or internal organizational social networks or affinity groups.

Many respondents shared their experiences with *activities to normalize failure*, which helped to reduce stigma and make discussions of failure easier. For example, several respondents had been part of Fail Fests in their organizations, which were seen as particularly impactful when "the CEO kicks it off with a personal story of failure, so you feel more normal talking about it" (Int3). Another respondent described a project cycle professional development course available for teams in their organization, which included lighthearted sharing exercises to get people talking about things that had not worked and raise awareness of the risks of not learning from failure (FG7.2). Many respondents discussed ways that failure discussions could be incentivized, such as requiring people to discuss all the setbacks they experienced before they can share a successful project outcome, celebrating the idea that changing course when something is not working is actually saving time and money, or making sure to "promote people who are open about sharing failures, not just people who only show successes" (Int49).

Respondents widely acknowledged, however, that learning from failure was enabled not just by sharing experiences, but also be being able to draw upon information stored from previous experiences. Many respondents thought that it was important to follow up on the reflection and analysis of failure with a process to *institutionalize the learning* (Table 5.1, Enabling subtheme 3d.iii.), which included documentation for future retrieval as well as incorporating the learning into future actions. As one respondent noted:

> "it would have been nice to see some detailed reporting about things that worked or didn't work, or any past record of things to look out for…we needed a more formal administrative structure to collect and document learning, we were pretty informal and nothing was recorded from our past projects so we struggled to learn…we needed someone to bring all the bits and pieces together, but we couldn't be seen to be doing too much admin because it was seen as "capacity building" or "overhead" and we couldn't include it in our grant applications" (FG1.1).

In terms of documenting for future retrieval, many respondents recognized the need for a "multi-pronged approach" (SID43), with organizations having internal processes to "document the learning for institutional memory" (Int1), coupled with "published scientific journals taking the lead since that directs the practice of reporting across agencies and academia" (SID43). Recognizing the latter, one respondent said when she is researching

> "how a particular conservation action works, I go to the published literature even though I know it's a problem to find project failures, because either people don't submit them or if they are submitted, they're not accepted. In fact, I still remember maybe the only time when I read a paper where I got to the results section and I literally went, 'Oh my God, it didn't work!' And that was the whole point of the paper. Like, you know, 'we set up this project, it looked great, we had funding, we implemented it for 10 years. Everybody thought it was going to work out. But then when we did the monitoring, we realized there was no difference between our control and the place where we implemented it.' I had never seen that before and it was absolutely stunning. I still refer to that paper" (Int7).

One funder recognized the need to create capacity for better understanding previous history of successes and failures before designing program interventions and is "moving to explicitly put in an exploration phase…doing due diligence on what has already been done instead of starting from scratch"; however, because overall the "documentation of successes and failures still isn't valued" (Int36) this process continues to prove challenging. Another respondent also reflected on the importance of documenting learning, and expressed a desire to see

> "some system of documentation and sharing, which doesn't exist now. That's what I need. Like a business school case studies model, where you have a body of successful case studies and a body of unsuccessful case studies and I don't have any of that to draw on. Even though case studies are usually very qualitative. When I start a new project, I

> feel like I'm starting from scratch. Even when you inherit a project sometimes it feels like you are starting from scratch" (FG4.4).

Institutionalizing learning also was seen as including a process for changing future action based on the analysis of what didn't work. For example, after a thorough and occasionally contentious debrief of a large project failure, one respondent described her organization as "understanding the whole thing a lot better…and with this more sophisticated understanding we could see what was possible going forward" (Int23). Another respondent explained that when their team gathers to discuss lessons learned, the focus is on "learning in the context of how that shapes our next year's plan…and then we revisit those actions every couple of months" (Int9).

5.3.4.5 Financial structure of conservation

The final Primary enabling theme relates to 'What funders can do' (Table 5.1, Primary enabling theme 3e). Respondents frequently mentioned "the important role funders play in learning from failure" (Int10) because the incentives to discuss failure are driven by "the power dynamic between funders and grantees" (Int23). Respondents perceived that a critical step would be for funders to *reward learning* (Table 5.1, Enabling subtheme 3d.i). As one funder said, learning from failure "has to start with a change in funders' attitudes to failures…getting away from the negative perception and realizing that it's actually highlighting a gap in our understanding of how things operate" (Int22). One respondent described it as a "collective action problem" and wished that

> "…all the BINGOs would tell the funders, 'You are creating incentives to do behaviors we don't want to be doing anymore…we sometimes show you bullshit, and we are not being transparent because we don't think you reward that" (Int5).

Specific activities respondents said that funders could do to enable learning from failure and "help grantees fail safely" (Int3) included being more transparent about how grants are made and

how funders will work with their grantees to problem solve together. Additionally, as one funder said, learning from failure could be enabled through allocating "some unrestricted funding" (Int24) for grantees to spend some portion of their project time engaged in learning activities.

However, funders who wanted to "allocate more money for grantees to spend time learning" (Int23) recognized that they first needed to *acknowledge the inevitability of failure* (Table 5.1, Enabling subtheme 3e.ii), and "anticipate at least a 50% chance of failure and that has to be OK…we need to structure grants so that people don't get their funding pulled from them if things don't work out" (Int3). Respondents widely perceived that "everybody wants the evidence, but they don't reward for evidence" (Int5), and that shifting from a system that rewards successful implementation instead of for building evidence and generating learning means accepting that "things don't always go according to plan" (Int22).

5.4 Discussion

5.4.1 Why don't we learn from failure?

Failure is widely understood to offer a richer source of learning than success (Cyert & March 1963; Sitkin 1992; Mcgrath 1999; Madsen & Desai 2010), so the ability to learn from failure is an important individual skill, team process, and organizational competency. This is the first study to have investigated conservation professionals' perceptions and experiences of barriers and enablers to learning from failure. Failure is common in conservation, but the majority of respondents in this study do not believe that conservation as a sector is effective at learning from failure. This may reflect a wider perception that failure is not valued as a learning opportunity, as evidenced by conservation organizations largely lacking systems to effectively capture learning (Bottrill et al. 2011) and a bias towards publication of successful rather than failed project reports (Catalano et al. 2019). While there is evidence of isolated efforts being made, the conservation sector is fundamentally broken in this regard for reasons that are varied, complex, interacting, and dynamic. This paper demonstrates that in the absence of a systemic approach to learning from failure in conservation, individual conservation professionals bear the

brunt of this situation both emotionally and in terms of professional effectiveness. However, the value of learning from failure is also broadly acknowledged by respondents and some of the necessary ingredients for change are present, albeit dispersed and disconnected.

The failure of conservation initiatives often share a common denominator of uncertainty (Doak et al. 2008). Uncertainty manifests because of the highly complex, diverse, and dynamic systems in which conservation professionals operate and is a feature of all aspects of conservation, including conservation planning (Langford et al. 2009), natural resource management (Rist et al. 2013), and implementation (Nuno et al. 2014). Activities such as learning from failure represent an attempt to reduce uncertainty (Madsen & Desai 2010). Sources of uncertainty identified by respondents in this study are varied and bridge both personal and professional domains. Some are related to aspects of work life that are typically common across sectors when trying to learn from failure, such as concern about job security or reputation, unpredictability of responses to failure in the workplace, or pressure to achieve success. Other sources arise from factors that are unique to conservation, such as uncertainty surrounding obtaining or sustaining funding, determining what constitutes a successful outcome, the likelihood of achieving project objectives, or the mismatch of time scales at which natural processes occur versus the time scale over which a project is funded. Uncertainty in conservation is often addressed as a biological problem, but also includes factors arising from human behavior, differing world views, and decision-making (Kujala et al. 2013). Reducing uncertainty requires adoption of organizational learning mechanisms such as formal learning processes, training, and information dissemination, storage and retrieval systems (Ellis & Shpielberg 2003) to address the failure that is inevitable in undertaking conservation activities.

Learning is a socially complex process that requires exploration of the interactions and interdependencies between units of analysis (individual, group, organization, environment) and internal and external forces such as power, politics, perceptions, and schemas (Antonacopoulou & Chiva 2007). Learning from failure is challenging when dealing with complex systems, delays in feedback, and ambiguous outcomes (Frese & Keith 2015), all of which characterize work in conservation. Barriers to learning from failure identified by respondents spanned institutional levels (individual, interpersonal, organizational, and cross-sectoral) and included dynamic

contextual processes such as learning, mythologies about crisis and success, entrenched dogma, the funding structure of conservation, and temporal challenges. This level of complexity coupled with the ubiquitous uncertainty inherent in conservation requires a systemic, integrated approach to engaging with learning from failure, one which avoids reductionism and recognizes that the system is a product of the interactions between elements rather than the nature of the elements themselves (Rogers et al. 2013).

Conservation professionals want to discuss failure and manage it more effectively but there are few mechanisms and little support for doing so. Learning may be a complex process but learning from failure is not rocket science. Instead of reinventing the wheel, conservation can benefit from the experience of other disciplines to find approaches to begin effectively learning from failure (see Catalano et al. 2018 for a review). Researchers in other domains have identified a series of failure-related learning processes that can be synthesized into three crucial steps integrating multiple institutional levels and contextual factors (Cannon & Edmondson 2001; Tjosvold et al. 2004; Van Dyck et al. 2005; Putz et al. 2012). The first step is identifying and surfacing failure and mistakes (Cannon & Edmondson 2001), which is hindered by individual fear of failure, cognitive biases, ambiguous outcomes, and system complexity, and enabled through supportive interpersonal work contexts, investment in data collection, and rigorous feedback processes. Part of this process is to clarify responsibility and cope with negative emotional responses to failure. Attributing failure to external, uncontrollable causes is a natural tendency but precludes recognition of opportunities to learn. Insufficient attention to the emotional component of failure at the individual level can affect team interpersonal processes and hinder organizational effectiveness (Frese & Keith 2015). The second step of systematic analysis and correction of the circumstances that led to the failure occurs in interpersonal discussions and requires reflexive practices, constructive conflict, critical thinking, and psychological safety. Organizational support is required to engage in such activities, such as resisting time pressure and emphasizing system fallibility and improvement rather than personal blame and punishment. The final step is institutionalizing the learning through methods such as interpersonal knowledge exchange and organizational information dissemination, storage, and retrieval. The complexity of conservation requires a solution that integrates individual, team, organizational, and contextual factors. Despite being widely applied in other sectors, these

processes have yet to be broadly instituted in conservation and should be adapted and trialled if we hope to improve our collective effectiveness.

5.4.1.1 Perceptions and feelings

Learning in organizations begins with individuals (Kim 1993), who often react to failure with anxiety, shame, guilt, and other negative emotions that can prevent analysis and correction of problems and therefore inhibit learning (Keith & Frese 2005). The presence of factors identified by respondents that generate a fear of failure in conservation are commonly recognized as inhibiting learning from failure in other sectors, such as the fear speaking up (Kish-Gephart et al. 2009), fear of appearing incompetent (Edmondson 1999), concern about negative career impacts of failures (Husted & Michailova 2002), and fear of blame (Holden 2009). Failure in conservation carries additional weight because of the grief that accompanies ecological loss (Windle 1992; Hobbs 2013; Gordon et al. 2019) and the attachment many conservation professionals feel to their work, often describing themselves as being 'mission driven' (Meine et al. 2006).

The heavy emotional toll of failure expressed by respondents pervades the findings of this research, indicating that either by design or by default, conservation has embraced the 'person approach' rather than the 'system approach' in the management of failure (Reason 2000). The former focuses on the individual as the weak link, creating a culture in which either implicitly or explicitly failure is seen as an aberration and fear of failure is widespread. The latter recognizes that failure is a normal and expected outcome of complex systems, so that failures are seen as "consequences rather than causes", with origins in the complexity of the system itself (Reason 2000). Emotions drive motivation (Vince & Saleem 2004), and if the emotional component of failure is ignored at the individual level, any attempts to productively manage failure and create a learning culture are doomed to failure (Shepherd 2003). For example, healthcare organizations that have instituted systems for reducing error through improved incident reporting motivate participation in learning through an approach of 'caring for the caregiver', which includes both an implicit assumption that mistakes happen as well as the

provision of support and guidance to individuals confronting errors (Wilf-Miron et al. 2003). A prerequisite for engaging productively with failure in conservation is recognizing that failure is an inherent and unavoidable feature of complex systems and not the fault of any one individual.

5.4.1.2 Relationships and power

Individual learning takes place in the context of teams and organizations (Edmondson 2002; Senge 2006). The nature of complex systems are determined by the interactions between components, thus relationships are fundamental (Decuyper et al. 2010). Given that conservation projects are frequently carried out through teams and in partnership with stakeholders, it was unsurprising that 'Interpersonal relationships' was a frequently mentioned barrier to learning from failure. Concerningly, the most prevalent sub-theme related to 'team dynamics', indicating that respondents perceived that these relationships are often not conducive to effective learning from failure in conservation. Individual learning behaviors such as asking questions, sharing information, reflecting on current or past performance, seeking feedback, discussing mistakes, and asking for help take place within the context of teams and require a willingness to take interpersonal risks (Edmondson 2003a). The degree to which people believe their work environment is conducive to taking these interpersonal risks is defined as psychological safety (Edmondson 1999). The intention of conservation professionals to participate in learning from failure activities is affected by the presence of psychological safety (Catalano et al. 2021). Teams with high psychological safety are able to access individual learning, engage in creative conflict, create shared mental models, and improve performance (Edmondson 1999; Bradley et al. 2012). When teams fail to learn, the wider organization suffers (Wiese & Shawn Burke 2019).

While individuals are the agents of organizational learning (Argyris & Schön 1978), individual learning is significantly impacted by organizational practices and orientation towards learning (Antonacopoulou 2006). The organizational culture and the presence of structural support for learning from failure activities influences whether learning from failure takes place (Putz et al. 2012). Respondents' perception of organizational barriers related to 'inhospitable culture and norms' in conjunction with barriers related to 'leadership or supervisor influence' are

concerning, as researchers widely recognize the crucial role of leaders in creating both social norms and accountability for adopting processes to learn from failure (Edmondson 2003a; Carmeli & Gittell 2009; Hirak et al. 2012). In the conservation domain, previous research demonstrates the importance of social norms and supervisor behavior in conservation professionals' willingness to engage in learning from failure activities (Catalano et al. 2021). Team leaders and upper-level management in conservation organizations play a crucial role in creating a culture that supports learning from failure, instituting systems to enable and incentivize these processes, and modelling the desired attitudes and behaviors (Black et al. 2011; Catalano et al. 2018). If respondents perceive that in their organizations success is the only outcome of value and failure is at best ignored and at worst punished, learning will be lost and effectiveness will suffer.

At the inter-organizational level, the structure of relationships and power in conservation contributes to the complexity of the system and creates disincentives to uncovering the learning opportunities of failure. Respondents perceived what previous research has identified: funders hold significant power over implementers (Craigie et al. 2015). Conservation organizations compete for funding, and so are incentivized to produce success (Chapin 2004). This organizational pressure is internalized, and thus it is unsurprising that individuals and teams within conservation organizations feel powerless to institute reflection and evaluation practices, and efforts to identify, analyze and correct, and institutionalize the lessons from failure are not rewarded (Wahlén 2014). It is not enough to exhort team leaders to foster psychological safety and encourage people to speak up about mistakes and failures if we do not mitigate the fear of negative consequences; acknowledge underlying structures of power, influence, and politics; and shift the focus from 'fixing the silenced' to 'fixing the system' (Reitz & Higgins 2020).

5.4.1.3 Reflection and reframing

The pressure to produce outcomes leaves little time for reflection, a theme that permeated respondents' perceptions and manifested in the related but distinct themes related to 'Learning' ('too busy to learn') and 'Temporal challenges' ('an insufficient investment in time for learning'.

Conservation has been called a "discipline with a time limit" (Brussard & Ehrlich 1992) and has long been influenced by its self-characterization as a "crisis discipline" (Soulé 1985), conditioning conservation professionals to view their individual activities as essential for the survival of the natural world and to prioritize taking action over pausing for reflection. If, as a consequence, conservationists perceive the need to rush from project to project and have no incentive or support for making time to reflect (Wahlén 2014), this narrative may have outlived its usefulness at best and be contributing to a mental health crisis in conservation at worst. Conservation professionals know that learning is important, and are busy implementing conservation activities, but rarely pause to reflect whether these activities are effective or examine project failures to glean lessons learned (Catalano et al. 2019; Mansourian & Vallauri 2020).

This could be described as an inverse manifestation of the knowing-doing gap, being busy 'doing' in the absence of 'knowing' whether what you are doing is effective. The mythology that conservation professionals need to hurry up and do something to save nature, and therefore cannot pause to conduct a reflection on whether that action is effective, is not borne out by the experience of other sectors operating in complex systems that place a high premium on reflection (Allen et al. 2018). Reflection is a foundational component of learning (Boyd & Fales 1983; Schön 1983; Schippers et al. 2014) and the key to improved performance across sectors (Tannenbaum & Cerasoli 2013; Di Stefano et al. 2014). In the absence of overarching regulatory bodies such as those that direct requirements for safety improvements in aviation and medicine, jettisoning this dogma and the unproductive schemas affecting learning from failure arising from it is an ethical duty for those holding power in conservation.

The emerging focus on hope (Swaisgood & Sheppard 2010; Park et al. 2020) and optimism (Balmford & Knowlton 2017; Knowlton 2021) are understandable attempts to reframe narratives of despair and crisis and to provide motivation, and are welcome additions to address issues of mental health and well-being in conservation professionals. As a complement to these efforts, a cultural shift in conservation is required to normalize failure through acknowledging its inevitability, validating the emotional coping required, and resisting the drive to highlight success and bury failure. Reframing failure towards a learning orientation is proactive step

conservation professionals can take to make a change that is based on what has worked in other disciplines. Optimism is useful for providing hope and motivation, but a more robust, fundamental and effective form of optimism comes from the satisfaction of putting in place and trialling mechanisms through which we demonstrably learn from failure, thereby productively addressing failure and effectively learning from it. If we are trying to encourage, motivate, and address mental well-being through pursuing a reframing of the crisis narrative into messages of optimism and hope, taking the actionable step of reframing the inevitable failures that happen in conservation as learning opportunities rather than events to be avoided or quickly swept under the rug is a true expression of optimism, concretely contributing to emotional well-being and organizational effectiveness (Edmondson 1999; Van Dyck et al. 2005; Madsen & Desai 2010). There is a trade-off between short-term action that achieves reasonably good outcomes at the expense of focusing on longer-term strategies for learning that may entail short-term costs (Einhorn & Hogarth 1981).

5.4.1.4 Absence of systems for learning from failure

Perhaps the most fundamental problem identified in this study is that respondents recognized the importance of systems for learning from failure and expressed frustration at their widespread absence, as highlighted in the 'Organizational' sub-theme related to 'limited or lack of learning structures.' This is in stark contrast to other sectors operating in complex contexts, where the development of error management systems and other approaches for managing failure have long histories, are well developed, and are continually refined (Helmreich 2000; Frese & Keith 2015). Systems to identify, analyze and correct, and institutionalize learning from failure are critical because failures are emergent properties of complex systems, features which cannot be explained on the basis of the component parts doing their 'normal' work (Dekker et al. 2011). Failure in conservation is a feature, not a bug. Acknowledging the inevitability of failure in complex systems requires moving beyond trying to find 'the solution' to 'the problem' and towards a commitment to an ongoing process of improving learning structures alongside changing mindsets and behaviors (Rogers et al. 2013).

5.4.2 Strategic directions for moving forward

Although objectives in other complex systems may vary from 'safe flight operations' to 'improving patient outcomes', underpinning these goals is a focus on a proactive approach to learning, seeking to identify factors that could contribute to future failures. Adopting such an approach in conservation does not displace an objective such as 'conserving biodiversity', rather, it focuses attention and resources on identifying learning opportunities available from examining past events, building in ongoing reflection on current practice, and checking assumptions about future actions and decisions (Davies & Delaney 2017). This proactive learning stance includes systems and mindsets aligned with desired outcomes and is a manifestation of recognizing the learning value of failure.

5.4.2.1 Build on our strengths

Replicating the playbook of other disciplines is not the way forward, just as medicine has not adopted every aspect of the aviation model but rather has adapted concepts applicable to the healthcare context (McGreevy & Otten 2007). In the decades since the first calls for conservation to learn more effectively generally and to learn from failure specifically (Clark 1996; Redford & Taber 2000), it is becoming increasingly morally indefensible to ignore the lessons from other sectors at the expense of the wellbeing of conservation professionals and the biodiversity of the planet. The foundation for effective learning from failure in conservation is already in place as the respondents have shown. Conservation professionals are passionately committed to their work. Learning from failure is intuitively understood to be valuable despite being emotionally challenging. Many of the necessary tools already exist, such as evaluation guidelines, adaptive management approaches, and theory of change concepts, along with networks of experts who can train on their use. The change required involves shifting our mindsets and how we behave in our professional relationships as well as instituting an integrated set of learning mechanisms, so fortunately transforming our sector is within our control and not dependent on outside forces.

5.4.2.2 Accept responsibility and transform accountability

We have to take responsibility for our own actions. Funding organizations hold a great deal of power and can take the lead in creating new ways of working with grantees building on relationships of trust that already exist. It is undoubtedly true that funders have an urgent responsibility to take action aimed at dispelling beliefs based on experiences that those who report failures will not be competitive for funding with those who report successes (Wahlén 2014). It is equally true that the funding structure of conservation is highly unlikely to change in any significant way. Structural reforms in the way conservation projects are funded, reported, and evaluated are necessary in order to embed a culture of learning from failure, with funding agencies explicitly rewarding learning. However, blaming funders for creating the current dynamic relieves organizations and individuals of responsibility for instituting learning systems and modelling normalization of failure that they could be doing internally. Leadership sets the tone and expectations, and if committing to being a learning organization is not a stated organizational aim with support cascading to teams and individuals, it is well past time for leaders to set this in motion. Given the importance of supervisor behavior to creating social norms in conservation (Catalano et al. 2018, 2019, 2021), leaders can take responsibility to act with humility, acknowledging limitations and mistakes, modelling openness toward learning, and creating time for reflection. These behaviors support psychological safety, legitimize uncertainty, and foster a learning environment (Owens & Hekman 2012; Walters & Diab 2016). Individuals at all levels can take responsibility for their own learning by seeking feedback from trusted peers, contributing to organizational learning networks, sharing information, and taking time to reflect on past actions (Singer & Edmondson 2006). Training conservation professionals to understand the relationship between blame and trust, and how trust relates to psychological safety, creativity, and high performing teams will almost certainly enhance the capacity for learning from failure.

Holding oneself and others accountable for actions cannot be an exercise in allocating blame or fault-finding. Learning from failure in conservation involves tackling tough problems with uncertain outcomes, coping with negative emotions and being willing to risk making mistakes. Traditional approaches to performance management such as ranking metrics destroy psychological safety, discourage learning, trigger a ‘fight or flight’ response, and supplant

'growth' mindsets with 'fixed' mindsets (Rock et al. 2014). Creating a learning culture depends upon seeking and receiving feedback, which can be difficult to do. Creating a healthy culture of accountability starts with interactions that replace surveillance with curiosity and dignity, treat mistakes restoratively, and reward not just success but also efforts that fell short of a goal but generated learning (Carucci 2020).

5.4.2.3 Stop 'doing' without reflecting

A culture where value is measured by the number of hours worked instead of progress towards the objective has been observed in conservation organizations (Wahlén 2014) and is anathema to dedicated, mission-driven conservation professionals. Making progress on conservation goals is difficult enough to achieve without rewarding busyness over productivity. Busyness can mask uncertainty over how to be effective (Pressey et al. 2017), and in the presence of uncertainty people often exhibit a bias toward action and choose 'doing' over 'thinking' (Gino & Staats 2015), a phenomenon the respondents noted. Ironically, the activities that could make a substantial contribution to effectiveness, such as monitoring, evaluating, and instituting learning systems, were identified by the respondents as largely absent.

The choice to engage in more activity rather than pausing for reflecting and codifying already accumulated experience is a sub-optimal strategy because opting to engage in reflection increases performance and learning (Di Stefano et al. 2014). It is possible for conservation to learn more effectively and work 'smarter' rather than 'harder', but the experience and perceptions of respondents indicate calls for increased reflection in conservation have not been widely heeded (Allan & Curtis 2005; Biggs et al. 2011b; Rogers et al. 2013; Evans et al. 2020). While it may seem to entail a high opportunity cost, what other sectors can teach us is that prioritizing time for reflection is critical for increased effectiveness of individuals, teams, and organizations (Lipshitz et al. 2002; Ron et al. 2006; Schippers et al. 2014; Crowe et al. 2017).

5.4.2.4 Don't force collaboration, focus on building effective teams

Continued calls for conservation professionals to collaborate and work together (e.g. Mace et al. 2000), while laudable, are naïve as they ignore the competitive dynamics that pervade much of the conservation sector (Chapin 2004; Schwartz et al. 2012; Redford et al. 2018) and that were identified by the respondents. Transformational, sector-wide change is unlikely to come from large conservation organizations suddenly abandoning their funding-driven market niches. It is akin to asking airlines to collaborate on pricing structures, luggage handling technology, or customer service offerings. These are competitive differentiators and thus proprietary, while inter-organizational collaboration happens only when all respondents benefit, such as those arising from collaborative improvements in industry-wide safety that promotes air travel sector wide (Murdock 2017). More broadly, calls for collaboration made in the peer-reviewed literature between conservation professionals and other stakeholders typically provide little detail on any specific useful approach, which is unhelpful, as this underestimates the complex and complicated nature of establishing functional relationships fundamental to implementing learning from failure processes. For example, while private landholders can seek to actively collaborate with government agencies (Selinske et al. 2019), they may demonstrate clear preferences in which levels of government they will collaborate with or conditions under which they will agree to manage their land (Knight et al. 2010). A scientific approach to creating and sustaining collaborative arrangements is essential but rarely applied in conservation. Multiple modes of how to approach collaboration exist in other sectors (e.g., coalitions, collaboration mapping, alliance portfolios, seeking a 'third alternative' (Hoffmann 2007; Covey 2011; USAID 2021)). An examination by conservation organizations into these models and how they could be applied would likely lead to improved learning from failure in conservation situations.

In order for collaborations to be effective, the teams involved in the collaborative efforts need to be effective. Thus, rather than repeating calls for greater collaboration, the focus should first be on building teams that are effective at learning, supported by their organizations to engage in team learning behaviors such as information sharing, error management, collective reflection, experimenting and boundary spanning, behaviors that are also critical for successful

collaborative relationships (Edmondson 1999, 2016; Savelsbergh et al. 2009; Decuyper et al. 2010). Teams are the critical learning units in organizations (Senge 2006), as learning is an active participatory process involving people reflecting on shared experience, knowledge and creating new practices (Macrae 2016). This is intuitively understood by respondents, who recognized that learning is enabled through small groups reflecting and sharing learning together and that team dynamics greatly impact their ability to do so. Organizations can explicitly foster this learning by creating formal sharing networks such as peer-learning networks as well as intentionally designing workspaces and workflow to create informal opportunities to 'put on the kettle' and share stories, a powerful way to learn from failure (Kim & Miner 2007; Bledow et al. 2017).

5.4.2.5 Align culture and systems to learn from failure

Learning from failure is a process as much as an outcome (Cannon & Edmondson 2005). Shifting to widespread effectiveness at learning from failure is not a one-time intervention but rather a continuous process that requires a steady infusion of energy into the complex system to move it in the desired direction. Discrete or disconnected interventions that do not account for the dynamism of the system will not be effective. However, even instituting integrated systems and processes for learning from failure such as the ideal process described earlier (Section 5.4.1) is insufficient without a managerial shift in mindset towards viewing failure as both inevitable part of complex work and as a learning opportunity (Cannon & Edmondson 2005). If the organizational learning mechanisms such as reflection sessions, teamwork and leadership training, and databases to store lessons learned are the 'hardware', the culture in which these exist are the 'software' (Lipshitz et al. 2002). The starting point is perhaps deceptively simple: acknowledging the learning value of failure.

An example of an organization operating in a similar context to conservation that has effectively combined systems and culture to support learning from failure can be found in the international development organization CARE (www.care.org). Recognizing widespread barriers to talking about failure, they were willing to experiment and ultimately adopted a multifaceted

set of integrated approaches. They demonstrated a public commitment to accountability, seeking feedback, and learning from failure beginning with their online Core Values Commitment ("We strive to improve constantly, learn from mistakes, and embrace change", https://care.org/news-and-stories/resources/care-core-values-commitment/). Top management made public statements demonstrating support at the highest level ("We know this is about so much more than reporting—it is about how open and honest we are, and how quick we are to learn and adapt", CARE International Secretariat 2018). These lofty ideals are carried out in practice through evaluations that explicitly seek to learn from failure, such as annual failure meta-analyses publicly shared as "Learning from Failure Reports" (CARE International 2020a). Adopting a 'pre-mortem' mechanism further contributed to normalizing discussions of failure and improved project outcomes (Klein 2007). They also created a "CARE Failing Forward" podcast, now numbering more than 60 episodes, that kicked off with top leaders sharing their perspectives to show that they encourage and expect learning from failure as a norm, and including individual case studies as stories to share and learn from (CARE International 2020b). Critically, they recognized early that reframing failure as a learning opportunity reduced the stigma and blame attached to failure and made sharing safe, and they also identified easy ways to create change rather than instituting a complex, top-down process (Janoch 2019).

5.5 Limitations and opportunities for future research

Qualitative research methods are ideal for exploring the value and meanings of personal experiences (Babbie 2008). The choice of a multimethod qualitative design using data collection methods including interviews, focus groups, and open-ended responses to questionnaire items are suitable for conducting thematic analysis (Tashakkori & Teddlie 2010), but necessarily impose a degree of structure on respondents' thinking (Joffe 2012). Future research that is more naturalistic, such as participant observations in case studies, might be profitably undertaken to obtain further insights into conservation professionals' behaviors in realistic settings. Objections to thematic analysis occasionally include presumptions that inter-coder reliability is required to prove that the data has been represented 'accurately'. However, this presumes that there is one

objective reality that can be captured through coding, which is counter to the reflexive and organic process that indelibly reflects the position of the researcher (Braun & Clarke 2019).

The experience of failure can be emotionally and professionally difficult to confront. Respondents who agreed to participate in my study self-selected based on their willingness to discuss a topic that some may find challenging to discuss. Thus, my results are focused upon those who recognize the value of failure as a learning opportunity. I was not, however, seeking to determine how common failure is in the sector through obtaining a representative sample. Rather, my aim was to investigate and gain an understanding of the phenomenon of failure through respondents' opinions and experiences. Therefore, it did not include conservation professionals who either have no opinion on the topic or choose not to discuss it because of the sensitive nature of the subject or for other reasons. In order to further examine individual, team, and organizational learning dynamics, future research that includes *all* members of a group, such as through an in-depth case study, and not just those who are willing to discuss failure may prove useful.

Respondents were primarily from developed countries, thus there may be differences in barriers and enablers to learning from failure experienced by conservationists in developing countries that were not fully surfaced or explored in this research. Additionally, the majority of the respondents were employed in employed in government agencies (38.8%) and NGOs (47.3%). Further investigation into issues faced by conservationists working in other employment contexts and outside the US, UK, Australia, and South Africa should be undertaken.

5.6 Conclusion

The absence of a widespread culture of, and structures for, learning in conservation as noted by respondents is worrying, as project failure is common and widely under examined. If failure is not viewed as a learning opportunity, it is unlikely that failure discussions with their attendant emotional baggage and potential for conflict will be undertaken and thus important learning will be lost. Fortunately, there are learning mechanisms and tools that already exist

within conservation, as well as direction for implementation of these provided by the experiences of other sectors that can be applied. Leaders at all levels in conservation organizations can begin immediately taking steps to shift toward a learning culture, trialling ideas that have been shown to be effective, adopting those that enable learning while discarding those that do not prove fruitful. Accepting responsibility for our effectiveness and creating a new culture takes courage, as does all transformational change. However, we have a moral imperative to learn how to learn from failure not only for the sake of our own well-being but to increase our effectiveness at ensuring the persistence of biodiversity.

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6 | How to Learn from Failure in Conservation

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Catalano, A.S., Knight, A.T. How to learn from failure in conservation.

6.1 Introduction

6.1.1 Conservation organizations need to learn from failure

Failure is present in every human endeavor and inherent in every complex system. Despite its ubiquity, it is difficult to confront and manage effectively in organizations. In conservation, failure can come at a great cost, and therefore learning to manage failure, and more importantly to learn from it, is of great importance. Many conservation initiatives fail or are not entirely effective in achieving their goals (e.g., Webber et al. 2007; Knight et al. 2008; Catalano et al. 2018), but the conservation literature is largely silent when it comes to addressing failure (Redford & Taber 2000; Knight 2006; Catalano et al. 2019). Attempts to systematically understand what is driving failure and ways to learn from it may exist in individual organizations but are not widely mainstreamed across the sector at large. As a consequence, learning is limited, and so funding and time are wasted, stakeholders' mental health suffers, and species and ecosystems decline. A new approach is needed.

Explicit, recognized approaches for managing failure are largely absent from the practices of conservation organizations (Chapter Five; Bottrill et al. 2011; Wahlén 2014; Redford et al. 2018; Catalano et al. 2019). Unlike conservation, other sectors such as business, medicine, and commercial and military aviation have over many decades invested tremendous resources and effort into understanding the structural and cultural elements of organizations that contribute to effective learning from failure. These efforts are continuously being refined in light of evolving understanding both of human individual and group psychology, as well as the way that humans understand and interact with complexity. There is a large body of peer-reviewed and non-academic literature in these sectors that describe approaches that have been developed and tested to learn from failure. For example, the term 'intelligent failure' was coined (Sitkin 1992) to describe the process of knowledge generation through intentional productive analysis of failure experiences to deliver learning that cannot be obtained from analyzing only success. Intelligent failure is a process that generates positive learning outcomes, is a consequence of taking actions in inherently uncertain situations, and reveals the boundaries of our existing knowledge and improves our future actions (Sitkin 1992; Edmondson 2011; McGrath 2011). The

conservation sector would benefit immensely from studying these approaches and adapting those elements that improve learning and capture the knowledge contained in failure experiences that are inevitable in conservation situations. Individuals and teams need to understand why and how their projects and programs succeed or fail, whether in part or in full, so that the time and funding allocated to the achievement of our goals is used effectively, cost-efficiently and equitably.

Conservation as a sector bears some similar characteristics to other sectors. It is a mission-driven discipline operating in complex contexts characterized by high uncertainty, sharing some of those traits with medicine, commercial and military aviation, wildland firefighting, and development. However, the impacts of failure in conservation tend to be less apparent in comparison to the cost of a failure in sectors such as aviation or nuclear power generation. For example, the absence of an obvious corollary to a public catastrophic failure such as a plane crash or reactor meltdown may play a role in the apparent difficulty of driving institutional change in conservation organizations. Somewhat like conservation, the medical sector suffers from widespread but highly decentralized errors, which only began to be addressed in a systematic way with publication two decades ago of a seminal Institutes of Medicine report collating the scale of medical error (Kohn et al. 2000), a 'watershed' moment for healthcare that made patient safety and learning from failure a priority (Bates & Singh 2018). Regardless of sectoral similarities and differences, there is no reason to suspect that the conservation sector is somehow immune to errors and failures; or conversely, immune to the substantial benefits that may accrue from learning from failure.

6.1.2 How learning from failure happens

Organizational learning is not solely the sum of individual learning processes; rather, it includes the interactions between individuals, between organizations as entities, and between the organization and its contexts (Wang & Ahmed 2003). Learning from failure experiences, more so than successes, contributes to creating and sustaining a learning organization (Sitkin 1992; Baumard & Starbuck 2005; Ellis & Davidi 2005; Senge 2006). Additionally, learning from

failure experiences goes beyond single-loop learning (Argyris & Schön 1978) or first-order problem solving (Tucker & Edmondson 2001), which focus on detection and correction of errors; and instead focuses on double-loop learning or second-order problem solving, which is concerned with not only solving the immediate problem but challenging underlying systems, structures and mindsets such that fundamental change occurs (Armitage et al. 2008). These behaviors entail regular reflective engagement with the assumptions that inform actions (Carmeli 2007).

Fundamentally, organizational learning involves detecting and correcting errors and mistakes and transforming the resultant knowledge of individuals and teams into improved collective attitudes, behaviors, norms, policies, and practices (Argyris & Schön 1978; Lipshitz et al. 2002). This process can be thought of as being carried out through a dual-faceted approach encompassing both structural and cultural dimensions (Fig. 6.1). The structural facet consists of the "institutionalized structural and procedural arrangements that allow organizations to systematically collect, analyze, store, disseminate, and use information" relevant to its performance (pg. 170, Popper & Lipshitz 1998). Structures consist of organizational learning mechanisms (OLMs) and associated supporting tools and are tangible, concrete, and directly observable systems operated by individual organization members. Examples could include training programs, site visits or tours, participation in after action reviews, weekly patient reviews, knowledge management systems, clearly communicated team goals, and provision of adequate resources (e.g., time, information, incentives, or rewards) (see Appendix F, Table F1 for a partial list of OLMs related to learning from failure). The presence of structures is a necessary but not sufficient condition for organizational learning, however. Effective organizational learning cannot occur in the absence of a culture that "promotes inquiry, openness, and trust…a normative system of shared values and beliefs that shape how organization members feel, think, and behave" (pg. 172, Popper & Lipshitz 1998). In contrast to the structural facet, the cultural facet is often not observable, but rather is inferred through organization members' espoused values and behaviors. Examples could include personal attitudes (e.g., viewing learning from failure as valuable), productive team behaviors (e.g., creating shared mental models, seeking feedback, communicating knowledge, or engaging in

constructive conflict), and leader behaviors (e.g., coaching, working to foster psychological safety, and direction setting).

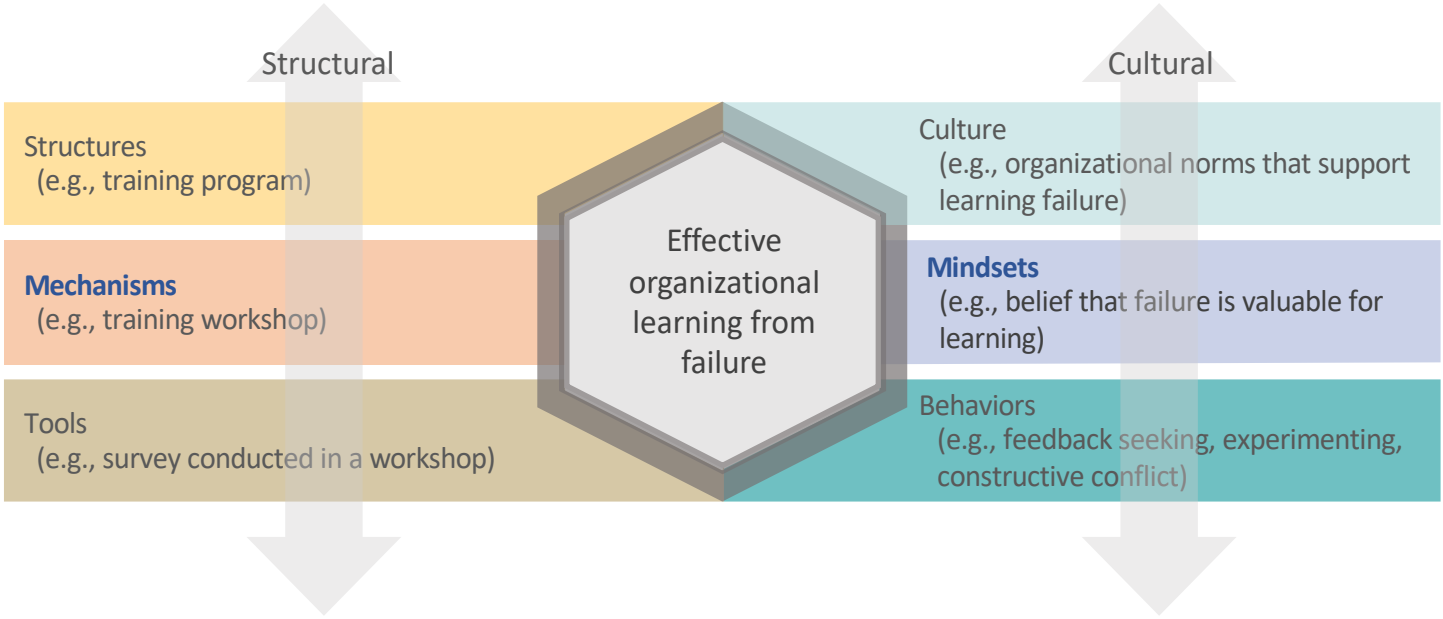


Fig. 6.1 Structural and cultural facets of organizational learning from failure. Structures designed to enable effective learning from failure are made up of mechanisms which in turn are supported through the use of tools. These structures are insufficient, however, without a supportive culture, which consists of individual and collective mindsets which drive engagement in learning from failure behaviors. Words in bold blue text represent elements highlighted in the learning from failure operational model.

The structural and cultural facets have been variously described in the literature as 'operational' and 'conceptual' (Kim 1993), 'technical systems' and 'social systems' (Cannon & Edmondson 2005), 'systems' and 'attitudes' (Cannon & Edmondson 2001), 'technical systems' and 'human systems' (Helmreich 1997) and 'systems' and 'mindsets' (Catalano et al. 2019). Regardless of how they are described, both are necessary for effective learning from failure.

Learning has been identified as the ultimate goal of conservation projects and programs (Clark 1996; Salafsky et al. 2002; Knight et al. 2006b), but conservation organizations have not widely embraced cultural facets of learning from failure, nor generally implemented and maximized the use of structural learning systems, at the expense of financial, human, and natural

capital. Here I draw on literature from the sectors of conservation, commercial and military aviation, business, and medicine (Catalano et al. 2018), as well as empirical examination of conservation professionals' experiences (Chapters Four and Five) and the peer-reviewed conservation literature (Catalano et al. 2019) to develop an operational model and provide a series of actionable steps to guide implementation of more effective learning from failure in conservation. My objective is the promotion of 'intelligent failure' throughout the conservation sector, which recognizes the value of outcomes that may not (yet) have achieved their initial objectives but yield critical learning for future efforts (Sitkin 1992; Cardon & Mcgrath 1999).

6.2 Praxis for effective learning from failure in conservation

Conservation projects and programs that embody learning from failure require a body of knowledge (the 'knowing' or thinking) and a set of practices (the 'doing' or actions) (Knight et al. 2006b). Effective conservation professionals move consciously and routinely between these perspectives of their situations (Figure 5 in Knight et al. 2006b; Lawton 1996; Hobbs & Harris 2001; Sayer & Campbell 2004), a process that manifests a 'praxis for effective conservation' whereby theory informs practice and practice informs theory (Fig. 6.2) (Knight et al. 2019). For an organization to effectively learn from failure four elements are essential (denoted in bold blue text in Fig. 6.2). A *conceptual framework* (bottom left quadrant in Fig. 6.2) represents the 'knowing' elements supporting conservation activities, establishing the bodies of knowledge required to effectively implement learning from failure actions that deliver conservation outcomes. The conceptual framework underpinning the thinking behind this work is presented here as a suite of five principles that integrate and place into context *mechanisms* and *mindsets* that conservation professionals should develop, enact and reflect upon when implementing an operational model.

An *operational model* (top right quadrant in Fig. 6.2) represents the 'doing' elements of learning from failure in conservation activities, guiding implementation of proactive, systematic processes and activities that mobilize people, funding and resources to deliver specific outputs and achieve stated outcomes (Cannon & Edmondson 2005; Knight et al. 2006b).

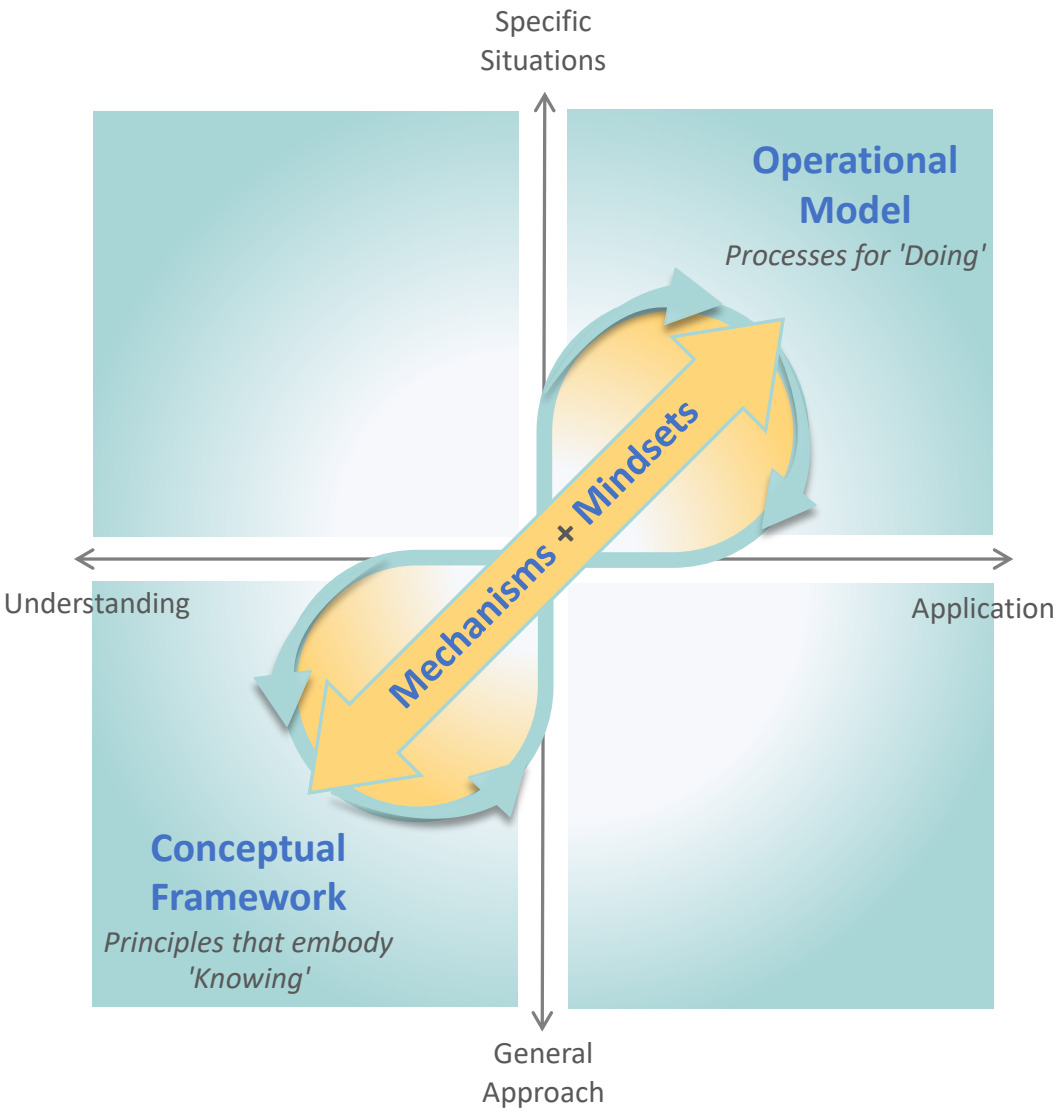


Fig. 6.2 Praxis for effective learning from failure in conservation.
The operational model should aim to provide mechanisms on the 'doing' of learning from failure in a specific situation, and the conceptual framework should aim to provide a general understanding (a 'knowing') of social-ecological systems and the learning from failure approach. The arrow represents a path adopted by conservation professionals effective at translating 'knowing' into 'doing' across institutional scales (e.g., individuals, teams, organizations) by focusing upon learning processes and outcomes (as opposed simply to conservation outcomes defined by the successful securing of elements of biodiversity) where practice in applying an operational model informs conceptual advances and vice versa. Text in blue denotes elements discussed explicitly in this chapter. Adapted from Lawton (1996) and Knight et al. (2006b).

6.3 Conceptual framework: principles for learning from failure

Implementing the operational model requires operationalizing a set of general *principles* that underpin the thinking and practice of learning from failure and aid in achieving an 'intelligent failure' orientation. These principles have been synthesized from the literature of other sectors and previous thesis chapters and tailored to the broader context of the conservation sector and the characteristics of common specific situations in which conservation projects and programs operate.

Principle 1. Failure is inevitable in conservation.

Failure is inevitable, learning from failure is not. Disciplines with longer histories of operating in complex systems recognize that acknowledging the inevitability of failure is the first step to managing it effectively *when*, not *if*, it happens (Catalano et al. 2018). For example, high-reliability organizations (HROs) such as nuclear power plants, wildland firefighting teams, emergency room departments, and airlines, which are complex organizations that persistently have fewer failures than expected, are distinguished by their 'preoccupation with failure' (Weick & Sutcliffe 2001). The distinction between error *prevention* (attempting to avoid mistakes altogether) and error *management* (failure is unavoidable, so focus on mitigating negative consequences and learning) has long been made in organizational learning literature, with the latter approach widely recognized as delivering more effective learning (Frese 1991; Keith & Frese 2005; Frese & Keith 2015; Dimitrova et al. 2017). In complex and dynamic situations, failure is unavoidable because it is wired into, and emerges from, the very structures and processes that we implement to ensure success (Dekker 2011), and so is a necessary component of innovation and learning (Nicolaides & Poell 2020). Knowing that errors, mistakes and failures will certainly occur, the choice we face is to avoid, deny, or distort it; or, we can reframe our thinking and practice into a 'learning approach to failure' (Edmondson 2012). Adopting this approach is important because failure typically provides more valuable learning opportunities than success (Cyert & March 1963; Sitkin 1992; Starbuck & Hedberg 2001; Catalano et al.

2018), and thus *not* learning from failure represents a waste of resources at best and declining human, financial and natural capital at worst. Conservation organizations' widespread (and unfortunate) focus on success at the expense of a thorough examination of failure (Catalano et al. 2019) is counter-productive and stands in stark contrast to other sectors that invest in robust learning from failure systems. This situation demonstrates that conservation professionals and organizations are prepared to discount the improvement of practices generated by learning (and ultimately the achievement of conservation outcomes) against acknowledging failure (Knight et al. 2019). Humility and courage are individual attributes that are prerequisites for embracing the inevitability of failure (Edmondson 2003b; Owens & Hekman 2012).

Principle 2. Learning from failure is an ongoing process, not a one-time intervention.

The 'wicked' problems confronting many conservation projects and programs manifest as situations of high complexity, diversity and dynamism (Game et al. 2014). The high levels of ongoing uncertainty and change that these situational characteristics produce means the need to continue learning never stops (Chapter Five). There is no panacea to all, or even similar types of, conservation problems (Ostrom et al. 2007) so ongoing learning is essential.

Learning from failure establishes an ongoing commitment to a participative social process of investigation, reflection, sharing, experimentation and improvement (Catalano et al. 2019). A systemic approach to learning from failure includes sustained effort at constructively reframing mindsets (how we view failure) as well as trialing and instituting effective learning from failure mechanisms (how we manage failure). This approach requires recognizing that efforts to manage failure effectively constitute a 'learning journey' that takes time and ongoing effort to create and maintain (Cope 2011). Social learning institutions (Knight et al. 2006b), convened as teams, for example, are essential for institutionalizing learning from failure as they can demonstrate tangible support from senior leadership and formalize mechanisms for learning from failure which can promote psychological safety and avoid the (all too common) drift away from uptake and testing.

Anecdotal evidence suggests that there is a misconception throughout the conservation sector as to the form and scale at which learning from failure operational models operate (Chapter Five). Neither formal monitoring, evaluation, adaptive management, scenario planning, nor the practices codified in the Open Standards for the Practice of Conservation (Conservation Measures Partnership 2020), constitute a learning from failure operational model. Learning from failure operates at multiple institutional levels (individual, team, and organizational) *within* broader planning approaches. Transforming individual mindsets and organizational culture, training people at all institutional levels, and instituting new structures to manifest learning from failure behaviors are required as a suite of ongoing complementary processes. The progress of individuals, teams and organizations towards embodying a learning culture should itself be monitored and evaluated to engage in reflexivity and 'learn about our learning'.

Principle 3. Social norms that support learning from failure are driven by leadership.

The mindsets and behaviors that are necessary for learning from failure may be counter-intuitive; are often counter-cultural; require proactive surfacing and neutralizing of obstructive cognitive biases; and require individuals to view errors, mistakes and failures as essential and positive opportunities for learning.

A culture of learning, which is free of blame and shame, must be created, modeled, and sustained by an organization's leaders (Tucker & Edmondson 2001; Provera et al. 2010; Edmondson 2011), and conservation professionals are influenced by social norms that support engaging in learning from failure behaviors (Catalano et al. 2021). Leaders create the conditions that support a learning culture – an 'intelligent failure orientation' – by modeling behaviors and developing and implementing policies and practices that explicitly reward learning, demonstrate a tolerance for error, intolerance for blame, a willingness to prioritize time and establishment of systems for reflection (e.g. debriefs), experimentation, and the institutionalization of learning (Chapter Five; Lipshitz et al. 2002; Catalano et al. 2018, 2019).

Principle 4. Team dynamics determine the effectiveness of learning from failure.

Learning from failure begins with a willingness to engage the emotional challenges associated with learning at the individual level, but teams are the unit at which work in most organizations takes place (Tjosvold et al. 2004). The effectiveness of individual learning is shaped by the interpersonal interactions through which work is accomplished (Edmondson 2003). Interpersonal learning processes are of particular importance in conservation, where learning can occur in discrete teams but more frequently happens in loosely defined groups (Fazey et al. 2005a) such as informal networks. Additionally, learning may need to take place within and across a 'team' that comprises representatives from distinct stakeholder groups that may often have diverse and divergent values and goals and/or histories of disagreement. Interactions among group members do not automatically generate productive learning, but may instead produce negative processes such 'groupthink', closed-mindedness, and allocations of blame and shaming (Tjosvold et al. 2004). The iterative team learning processes of action, reflection, integration of knowledge, and ongoing course corrections rely on reflexive team dynamics that support these activities (Edmondson 2003a), processes which can be highly emotionally challenging. Passionate debate and dissenting opinions are part of the 'creative abrasion' process that is critical for leaders to manage so that diverse points of view are heard and ideas are challenged (Black et al. 2011; Leavy 2015; Catalano et al. 2018). These challenges, long examined in the organizational science literature, have been framed as part of the 'forming, storming, norming, and performing' dynamic of team development, which includes encouraging dissent, co-creating norms, and sharing feedback (Tuckman 1965). Teams whose members work to manage emotional challenges; mitigate cognitive biases; create psychological safety and shared mental models; adopt a problem-solving approach towards errors, mistakes and failures; and who are willing to take responsibility for their own errors and hold each other accountable for mistakes (while driving out overt and covert expressions of blame) are more likely to learn from failure (Tjosvold et al. 2004; Senge 2006). Creating these team dynamics is a responsibility of team leaders, and the need for leaders to encourage 'a dialogue of constructive criticism and informed challenge' is an idea that is increasingly recognized in the conservation sector (p. 336, Black et al. 2011).

Principle 5. Action without reflection is a waste of time.

One of the primary ways to encourage ongoing detection and analysis of errors, mistakes and failures is through instituting a regular opportunity, or indeed a requirement, for *reflection*. Reflection alone, however, does not lead to learning, but it is the key mechanism through which experience can be accessed to inform future adaptation, an iterative cycle defined as learning (Boyd & Fales 1983; Schippers et al. 2007; Choi 2014). Conservation professionals often view time as being too limited to to make reflection a priority, or work in a culture where professional status is determined (in part) by 'busyness' (Chapter Five; Wahlén 2014). This culture has resulted in a sector-wide state where conservation professionals prioritize 'doing' actions over 'knowing' whether their actions are effective (Chapter Five).

At the individual level, it can be difficult to identify one's own errors due to emotional barriers or cognitive biases, thus reflection in groups provides opportunities to share varying perspectives, constructively challenge assumptions, and integrate shared knowledge (Schippers et al. 2007; Putz et al. 2012). Additionally, the mental models held in individuals' minds are where the majority of an organization's knowledge is stored, and learning mechanisms such as group reflection involves making those models explicit and developing mechanisms to codify, store, analyze and transfer organizational knowledge through time so as to create an 'organizational memory' (Kim 1993). Enabled through a psychologically safe team dynamic, individuals can structure a collective learning process at the team level characterized by group reflexivity, or 'reflection-in-action' (West 2000; Edmondson 2003a).

This process of integrating experiential knowledge and feeding it back into future actions corresponds to closing the learning "loop" in adaptive management and results-based management, much like learning and decision cycles found in other sectors, such as quality control's PDCA ('plan-do-check-act', Deming 1986), medicine's ADPIE ('assessment-diagnosis-planning-implementation-evaluation', Orlando 1961), and the military's OODA ('observe-orient-decide-act', Osinga 2007) and PBED ('plan-brief-execute-debrief', Department of the Navy Office of the Chief of Naval Operations 2013). Worryingly, completing this final step - and hence securing the full value of learning from failure – is typically a struggle in conservation (Chapter 5; Muir 2010; Redford et al. 2014; Wahlén 2014). This is probably due to

multiple, perverse, and sometimes re-enforcing factors. These might include, for example, the mistaken belief that time spent reflecting is less valuable than 'doing' work (people tend to invest time in that which they view as important); that learning from experience happens organically and mechanisms for learning are not required; the uncertainty surrounding projects which compromises the ability to predict effective theories of change; and/or an absence of the mechanisms available to enact learning from failure (Chapter Five). Because we are not reflecting or examining our assumptions, we are subject to making very blunt assessements of our performance. Akin to making a Type 2 error (Burgman 2005), which is when our test incorrectly fails to detect the presence of a condition that actually exists, we fail to see we are failing.

In complex contexts where failure is inevitable, groups cannot learn in the absence of reflection, thus deliberate allocation of time to this activity is critical (West 2000). Debriefs, or after-action reviews, can improve performance outcomes by 20-25% (Tannenbaum & Cerasoli 2013) and are simple to implement, but can be challenging to institutionalize regularly into organizational systems because they require interpersonal skill to conduct, buy-in for effective participation, and a commitment to setting aside consistent time. Allocating time, modeling the behavior, and setting the expectation for regular reflection sessions, perhaps even through automated reminders or other tools, should be a management priority in order to mainstream the practice.

6.4 An operational model for learning from failure in conservation

An operational model provides a simplified conceptualization of how a system functions and broadly outlines the 'real-world' activities essential for effective implementation (Knight et al. 2006b). The learning from failure operational model for conservation was developed through a strategic review of mindsets and systems common in other sectors (Catalano et al. 2018) and through the review of conservation peer-reviewed literature (Catalano et al. 2019). Empirical investigation of individuals' willingness to engage in learning from failure behaviors and the role of psychological safety in conservation (Catalano et al. 2021), coupled with individuals' lived

experiences (Chapter Five) added further understanding of the barriers to, and opportunities for, learning from failure. The learning from failure operational model also sits within and builds upon existing operational models that have been applied in conservation situations, such as Tuckman's team development (Tuckman 1965; Kirk-Lawlor & Allred 2017), Deming's System of Profound Knowledge (Black & Copsey 2014), and the Conservation Excellence Model (Black & Groombridge 2010), specifically elucidating the role of individuals, the impact of team dynamics, and the enabling conditions required at organizational levels when exploring ideas and actions related to learning from failure. I offer the operational model to help 'jump start' learning from failure across the conservation sector and encourage conservation professionals to adopt, trial and report on the implementation of the learning from failure operational model so as to improve their own, and others, thinking and practice.

The learning from failure operational model for conservation consists of two primary components (Fig. 6.3). The first is the outer ring, representing the three steps required to learn from failure. The second component is comprised of the inner quadrant of four interlocking pieces, representing the mindset and mechanism features (the 'operational' dimension) that are operationalized at the individual and group levels (the 'human' dimension) that are required in order to move around the outer ring and carry out the three-step learning process. Achieving 'intelligent failure' (the blue sphere at the center of the model) means understanding, implementing, and continuously working to improve all elements of the model, representing alignment of culture and structures towards proactive, effective learning from inevitable failure experiences.

In the interest of clarity and parsimoniousness, I have placed the majority of the mindset and mechanism features of the model in the quadrant in which they fit most logically. In reality, however, these features often overlap or function simultaneously. For example, 'mental models' are both an individual and group mindset feature, and participation in the basic learning cycle activities of 'action, reflection, adaptation' also takes place at both the individual and group levels. Thus, these features are represented as spanning dimensional boundaries.

Viewing the mindset and mechanism features holistically in the context of the cultural and structural systems in which they exist provides a way to think about these interactions. For

example, an individual may be willing to take part in the activities that foster learning from failure such as surfacing errors or seeking feedback, but if the organization has a culture of viewing failure as blameworthy, this organization will not learn. Similarly, if the individual does not feel safe to share his or her opinion in a group setting, he or she will not be willing to participate in group reflection discussions about learning from what did or did not work.

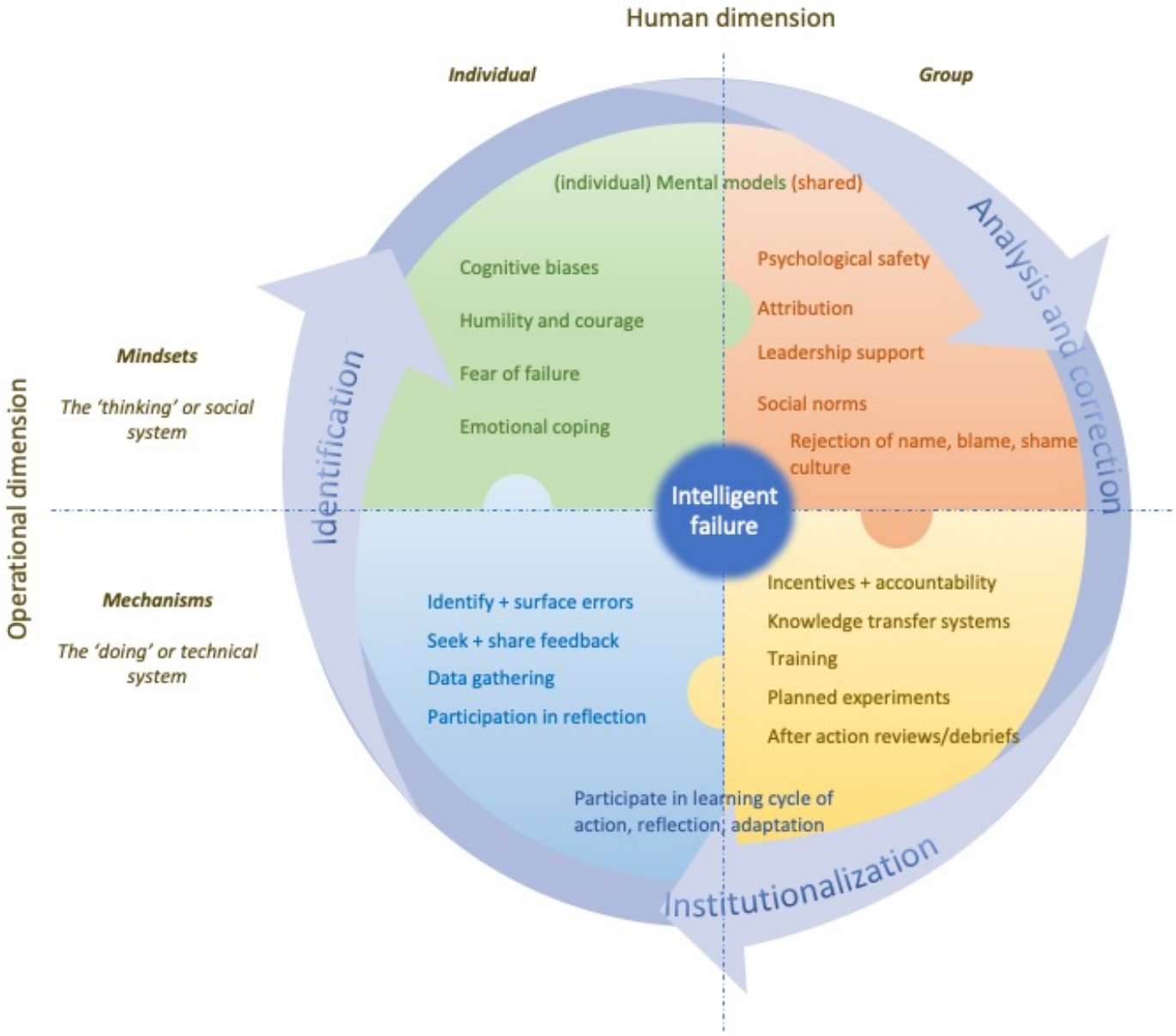


Fig. 6.3 The learning from failure operational model for conservation.
The outer ring comprises three steps that constitute a learning from failure process. The inner four quadrants reflect the human (individual and group) and operational (mindsets and mechanisms) dimensions necessary to enact the three-step learning from failure process. The mindsets and mechanisms listed are representative rather than exhaustive. Understanding, implementing, and continuously working to improve each element of the model represents 'intelligent failure', denoted as the central blue sphere.

6.4.1 The three-step learning process: key mindsets and mechanisms

Step 1. Identification: Failures and errors must be identified and surfaced.

Learning from failure begins with identifying and surfacing failures and mistakes ("Identification" in Fig. 6.3) (Cannon & Edmondson 2001). This process relies on an individual willingness to confront errors, which can be challenging due to barriers such as cognitive biases that inhibit the ability to identify failure (Cannon & Edmondson 2005; Shepherd et al. 2014; Catalano et al. 2018); fear of reprisals, blame, or career reputation costs (Chapters Four and Five; Edwards 1997; Newton et al. 2008; Catalano et al. 2018, 2019), and negative emotional consequences (Chapter Five; Keith & Frese 2005; Zhao et al. 2013; Frese & Keith 2015). Because it can be difficult for individuals to overcome psychological barriers to identifying failure, a supportive work context is critical to prevent errors from being ignored or covered up, including dismantling any structures or mindsets that contribute to a 'name, blame, and shame' culture, encouraging feedback seeking behavior, creating incentives for sharing failure experiences, and instituting de-biasing strategies. When the wider organizational culture supports the idea that failure is inevitable, failure discussions become more normalized and individuals are less likely to succumb to the natural inclination to avoid failure. Coupling these behaviors with organizational structures that generate data to indicate the existence of problems aids in identification (Cannon & Edmondson 2005).

Identifying failure can sometimes be difficult in conservation contexts because failure can be difficult to define (Chapter Five; Catalano et al. 2018, 2019), data collection can be challenging (Rissman et al. 2017; Siddig 2019; Junker et al. 2020), and implementation is often valued over collecting the data that is critical to identify failures (Bottrill et al. 2011; Lemke et al. 2011; Smith et al. 2015). An airplane crash, a person dying on an operating table, a business that goes bankrupt, or simply not achieving a stated goal can easily be defined as failures, and the aviation, medicine, and business sectors spend a great deal of resources on gathering data to feed into analysis determining future actions. The lesson from these other sectors, especially high-reliability organizations (HROs), is that the complexity of the context drives demand for learning and error management, rather than serving as an excuse to avoid examining failure

(Weick 2003). In these sectors, refusal to underestimate the complexity of the system is partnered with a fixation on catching failures and mistakes early and aggressively seeking 'to know what they don't know' (Roberts & Bea 2001, pg.71). Conservation could profit from thinking about failure in a different manner, beginning with emulating these other professions and acknowledging the inevitability of failure, building failure as well as success scenarios into initial planning, and adopting definitions of failure that are fit-for-purpose. From this starting point, applying the lesson of putting blame in the appropriate context and finding pragmatic ways to define and think about failure are critical steps towards effectively learning (Catalano et al. 2018).

Step 1 key mindsets and mechanisms:

a. Data gathering systems to measure relevant metrics to enable identification of errors and failure
b. Individual willingness to confront mistakes and failures
c. Atmosphere free from blame and fear of failure
d. Culture that supports feedback-seeking and help-seeking behavior from colleagues, supervisors, and partners
e. Recognition and management of emotional barriers to identifying and responding to failure (e.g., fear of failure; tendency to avoid, deny, downplay, distort, or cover up failure in atmosphere of blame)

Step 2. Analysis and correction: Failures and errors must be analyzed and corrected.

Failures will not result in learning unless people can thoughtfully discuss and analyze them, engaging in an iterative process of double-loop learning that examines and addresses underlying causes rather than the immediate problem ("Analysis and correction" in Fig. 6.3) (Argyris & Schön 1978; Tucker & Edmondson 2001; Fabricius & Cundill 2014). The psychological barriers to identifying failure also present problems during the analysis and correction phase, highlighting the critical need for supportive team learning dynamics (Chapter Five; Catalano et al. 2018, 2019). People tend to avoid taking responsibility for mistakes, but a group process of individual attribution without individual blame is important to prevent rationalization and to create ownership of the learning process (Ellis & Davidi 2005). The group

then needs to systematically engage in productive learning from failure behaviors such as feedback seeking and sharing, speaking up, critical thinking, collective reflection, error management, constructive conflict, exploration, and learning by doing (experimenting) (Carmeli 2007; Savelsbergh et al. 2009; Decuyper et al. 2010; Putz et al. 2012; Wiese & Shawn Burke 2019). These behaviors are not automatic, but depend upon the existence of cultural norms supporting a shared mental model that views analysis of failures as a valuable use of time and critical source of learning that improves future performance (Cannon & Edmondson 2001).

Psychological safety is a key component of team learning from failure, and is defined as a shared belief that the team is safe for interpersonal risk-taking (Edmondson 1999). Psychological safety has a number of benefits, including encouraging people to speak up about concerns, removing the fear that can inhibit creative problem solving and innovative risk taking, and supporting productive and honest discussions. But the most important benefit of psychological safety is that it promotes learning from failure behaviors such as open communication, asking for help, seeking and giving feedback, and identifying, discussing, and analyzing failure (Van Dyck et al. 2005; Edmondson 2012).

Leaders play an important role in facilitating these team dynamics (Chapters Four and Five; Catalano et al. 2018, 2019) through reframing failure as essential to learning by setting expectations, modeling desired behaviors, creating incentives, and providing time for structured reflection sessions. What leaders do is more important than what they say, so rewarding successful conservation outcomes while asking for learning from failure will have everyone focused on chasing success (Chapter Five; Roberts & Bea 2001). Leaders are instrumental in cheerleading the value of productive failures over unproductive successes. Productive failures contribute to greater insights and learning, while unproductive successes occur when something goes well but no one knows how or why (Garvin 1993). An individual stepping forward to share information about what is not working in a conservation project should be publicly rewarded rather than punished or blamed (Chapter Five).

Step 2 key mindsets and mechanisms:

a. Leaders model and reward growth mindsets vs. fixed mindsets and productive failures vs. unproductive successes so that failures are seen as opportunities to learn (a "learning approach to failure")
b. Leaders model and enforce blameless reporting
c. Formal and informal training on creating psychological safety and creating an error management culture
d. Leaders set expectation of and give support to structured reflection sessions in atmosphere of psychological safety
e. Recognition and management of cognitive biases that hinder or enable group discussions of failure (e.g., naïve realism, attribution error, confirmation bias)
f. Willingness to engage in constructive conflict ("creative abrasion"), share opinions, and challenge groupthink
g. Support for deliberate experimentation that leads to constructive adaptation

Step 3. Institutionalization: Failure learning experiences must be documented, disseminated, and stored for future retrieval and use.

The learning generated from identification, analysis, and correction of failure experiences must then be embedded into organizational practices, structures, procedures, and strategy ("Institutionalization" in Fig. 6.3) (Crossan et al. 1999). This institutionalization of learning represents the retention at an organizational level of the learning produced by individuals, and can be accomplished through documentation, dissemination, and storage of information. However, the most important use of institutionalized learning is codifying it in useable forms and ensuring efficient knowledge transfer and mainstreaming throughout the organization (Garvin 1993; Naot et al. 2004). A balance between formal and informal transfer mechanisms should be the focus. Learning is a continuous process of building, using, and changing knowledge, and managers should be wary of overemphasizing the creation of cumbersome repositories of ever-expanding but rarely accessed data warehouses at the expense of building robust sharing capacities to get the right information to the right people at the right time (Edwards 1997).

Many formal and informal activities support efficient knowledge transfer, including: formal program evaluations; written notes and interpersonal communication generated during

reflection sessions; decision journals to aid in post-hoc decision analysis; small group discussions; 'go and see' tours and exchange visits to share in situ learning (Chapter Five); training programs (particularly effective when linked to practicing desired skills); storytelling workshops; mentoring partnerships; 'FailFest' events; sabbaticals to write up project experiences; and good practice guides and manuals (Garvin 1993; Edwards 1997; Lipshitz et al. 2002). Mechanisms should be adopted, trialed, evaluated, and discarded if not effective (Wang 2016). None of these mechanisms are complicated, but they can be challenging to implement in the absence of a culture that has embraced the learning value of failure because they require investment of time, organizational buy-in, a change in mindsets, and overcoming the natural inclination to avoid failure.

Step 3 key mindsets and mechanisms:

a. Identify and track data on internal performance that captures learning outcomes
b. Systematically document outcome of reflection sessions
c. Establishment of effective repository of knowledge management (user-friendly, appropriately comprehensive, and easily retrievable)
d. Accountability for maintaining learning databases or other repositories and participating in reflection sessions
e. Identify and adopt appropriate mechanisms to effectively disseminate and share learning

6.5 How to begin learning from failure

The operational model will likely prove challenging to mainstream institution-wide for most conservation organizations, so I also include *actions* that a team or organization can take to begin to implement the operational model so as to navigate the 'knowing-doing' spaces (*sensu* Toomey et al. 2017) in their specific situations. The model is offered as a useful guide to taking action, but if implementation is not attempted it will serve as just another example of the failure to successfully navigate a 'knowing-doing' space. These ideas can be enacted in work groups in conservation organizations and through sector-wide learning networks, as has been done with the

Conservation Excellence Model, for example through action learning sets (Revans 1971; Black 2019, Simon Black, personal communication). The most important thing is to trust in one's judgement and experience and make a start at more effectively learning from failure. Try something, see how it works, change course as necessary, and above all be open to learning. Here are some actions conservation organizations can take to get started.

Action 1. Leaders at all levels in an organization should adopt a learning approach to failure.

The mindsets and behaviors that are necessary for learning from failure are often counter-cultural, requiring individuals to see mistakes and failures as critical opportunities for learning. Organizational vision statements, while inspiring, are insufficient to create the enabling environment to encourage these learning-oriented beliefs. Organizational change that senior leaders endorse but do not practice themselves engenders cynicism and results in resistance (Larrick 2004). Daily interactions with team leaders, managers, and other people in positions of authority modeling the new behaviors are critical for internalizing the change and fostering support. Because organizations typically reward success and penalize failure, either explicitly or implicitly, the first priority for leaders who wish to improve their organization's ability to learn from failure is to examine how failure is treated in their organizations, and to ensure that failure and errors are reframed as essential ingredients for learning (Cannon & Edmondson 2001, 2005).

Team leaders and managers can support this reframing in several ways. First, managers can adopt a coaching-oriented leadership style. This includes owning up to their own mistakes, modeling non-defensive responses to questions and challenges, and coaching team members in how to manage constructive conflict in potentially emotionally difficult discussions about failure (Cannon & Edmondson 2001).

Second, through their actions and words, team leaders and managers are responsible for creating a culture where blame is placed in the appropriate context. Efforts to assign blame is one of the major obstacles to learning from failure (Madsen & Desai 2010). Truly blameworthy failures are those caused by intentional violations and are quite rare. Treating any other failure as blameworthy rapidly results in a cultural fear of failure; causes people to resist identifying

mistakes and failures; and precludes effective, learning-oriented discussion (Edmondson 2012). Simply declining to discuss failures or errors, even if not obviously seeking to place blame, sends a strong signal that leaders do not value the learning opportunity these situations provide. Leaders who want to create robust learning organizations acknowledge that failure is inevitable in complex systems, communicate clearly that analysis of failure and errors is fundamental to learning and will not be punished, and act upon these beliefs by holding themselves and their team members accountable for early and ongoing detection and evaluation of problems.

Action 2. Adopt a more nuanced understanding of failure, appropriate to specific contexts.

Business, aviation, and medicine offer some examples of ways to think about failure that indicate the need for fit-for-purpose definitions rather than narrow prescriptions. For example, failure has been usefully defined in the business literature as preventable, complex, or intelligent (Sitkin 1992; McGrath 2011; Edmondson 2012). Preventable failures occur in well-understood domains and are typically caused by lack of skill or motivation. Complex failures occur as a result of system complexity and are not preventable as such, but rather serve to indicate a need for the types of adaptive and ongoing learning from failure mindsets and activities described in this thesis. As noted earlier, intelligent failures are those that result from taking action in situations of uncertainty to develop new knowledge (Sitkin 1992; McGrath 2011; Edmondson 2012) . Classifying failures in this way allows for a more pragmatic understanding of the role of blame. Researchers have found that executives and managers say that only about 5% of failure is blameworthy, but up to 90% of failure is treated as such (Edmondson 2012). Given the range of causes for failure and the negative impacts of blame, this view is highly detrimental to learning. Organizations that adopt a learning orientation to failure are much more likely to see failure and fault along a spectrum, such that violations can be treated appropriately and everything else can serve to increase learning. This spectrum is reproduced in Chapter Three.

While a crash is certainly a failure, military aviation also uses conditional definitions of failure during wartime or simulation exercises to assess the achievement of objectives. For example, if the goal is the complete destruction of a three-story building and only the top two floors are destroyed, a pragmatic assessment of the outcome may be made that combines

evidence with expertise and experience. If the facility is no longer functional, despite still have one floor standing, the initial definition of failure can be reassessed in line with the overall objective of rendering the building unusable (Catalano et al. 2018).

In medicine, failures have been quantified and defined along a range of behaviors and scales, including near misses, slips, mistakes, and errors. Taking lessons from aviation, medicine seeks to more rigorously collect data, drive blame out of reporting, and manage counter-productive hierarchical structures. But broadly speaking, failures in medicine can be seen as process or outcome failures. For example, a terminally ill patient will certainly die, but the tragedy lies in failing to manage pain or provide a death with dignity. This would be a failure of the process. An outcome failure would be an otherwise healthy patient dying during a routine operation. These are two different types of failures, but both require examining the underlying systems and human factors involved (Catalano et al. 2018).

Conservation organizations could adopt similarly nuanced approaches to defining failure, to begin to remove the stigma associated with the word and more importantly, to allow learning to take place. From this starting point, applying the lesson of putting blame in the appropriate context and finding pragmatic ways to define and think about failure are critical steps towards effectively learning.

Action 3. Understand how to do effective debriefs and institute them.

Extracting useful knowledge from a failure experience is difficult but necessary for learning (Madsen & Desai 2010). Essentially, reflective discussions seek to combine the experience and perspectives of team members to achieve greater understanding of what happened and what should be done going forward ("reflection-in-action", Schön 1983). Data collection and comprehensive quantitative analysis is an important tool for learning from failure and error, with the gold standard in this area set by aviation and emulated by medicine and increasingly by conservation. However, an effective debrief is largely a qualitative exercise. After a certain point, it is not the quantity of information, but the deeper processing of the available information that generates better outcomes (De Dreu 2007). Often taking team

members outside of their comfort zones, these discussions include both constructive conflict and a co-creation of meaning (or sharing) and thus integrate differences of opinion and generate new knowledge (Decuyper et al. 2010). A wide body of literature supports the finding that debriefs are the cornerstone of learning from failure, and thus should be a top priority for the conservation organizations to institute first internally, and then to encourage adoption by grantees. Beware of falling into the trap of thinking that busyness is an acceptable excuse for not making time for reflection.

Key elements of successful debriefs

The first step to successful debriefs is to set the expectation that they will happen and hold team leaders accountable for making sure they do. If a project is important enough to spend money on, it is important enough to learn from.

Military aviators use a checklist to guide debriefs after every flight, to ensure that every important element of the mission is covered. Checklists can be helpful but are not necessary as long as the debrief has a consistent structure that serves the needs of the organization. The basic components of a debrief should include what went right, what went wrong, and what should be done differently. One rule of thumb is that the greater proportion of time (approximately 80%) should be spent discussing what went wrong, as what went right is useful for codifying best practices, not adapting future action based on learning in complex situations. The debrief should also include system factors such as organizational policies and practices that contributed to the failure or error; interpersonal dynamics that contributed to the error; and each individual's contribution to the problem, beginning with the project manager or leader (Austin & Hopkins 2004).

Most importantly, there is no "rank" in a debrief: all members are treated equally and only the content, not the emotion, leaves the room. Debriefs focus on *what* went right and wrong, not *who* was right or wrong. Debriefs should be framed and carried out as developmental, non-punitive learning exercises, not as an evaluation of performance (Tannenbaum & Cerasoli 2013).

If anyone is present who inhibits others from speaking frankly, that person should be trained on the purpose of and proper conduct in a debrief.

Reflection sessions should occur at regular intervals during the life of a project as well as at the conclusion. The scope of the session should be limited to focusing on specific activities, episodes, or events, rather than a comprehensive evaluation of a program (Ron et al. 2006). The important point is to not allow too much time to pass between the experience and the reflection.

The facilitator or team leader should open by explaining the purpose of the debrief (learning through critical reflection). Through a series of open-ended exploratory questions (what, how, why, when, what if), the debriefing process should attempt to uncover unstated assumptions and mismatches in reasoning, decisions and outcomes (Dreifuerst 2015). The facilitator or team leader should ensure that everyone contributes and resist making evaluative comments. The participants are just that: participating in active learning, not passively receiving information (Tannenbaum & Cerasoli 2013).

The process should drive towards actionable outcomes that can be applied as soon as possible (Ron et al. 2006). Outcomes of debrief sessions should be recorded and disseminated, because failing to embed the learning effectively into the organization is equivalent to not having learned at all. For example, if the knowledge generated from experience in a project leaves when an employee leaves, that organization cannot be said to have learned (Wilson et al. 2007). The actual mechanism to achieve this might vary between organizations or even between work groups, and trial and error should be employed to determine how people will actually use the information generated from reflection sessions. These mechanisms could range from a formal template that captures learning points entered into an internal database, to a regular brief bulletin that shares (and rewards) learning from failure through stories and case studies.

Action 4. Commit to developing psychologically safe teams.

Conservation happens in teams, and projects rarely follow a straight path from plan to outcome. Input from every team member is valuable for discovering new pathways and figuring out what has gone wrong. Identifying errors and discussing how to correct them in front of other

people is not psychologically easy because of fear of loss of face or being perceived as incompetent (Ron et al. 2006). If someone is afraid of speaking up or is reluctant to raise a concern or put forth a suggestion, their contribution is lost. Psychological safety in teams is not a function of individual personalities, it is a group construct that depends upon the leader and team members to create and foster through daily interactions (Edmondson 2012).

Although the idea of psychological safety has been discussed for several decades, the business world began to take note when Google identified it as the most significant predictor of team effectiveness in a comprehensive study of teamwork in 2012 (Duhigg 2016). The concept, if not the term, has also been found in conservation literature, with descriptions of ideal team skills and activities such as a "willingness to place one's observations in front of the group" in complex wildlife restoration project discussions (Clark & Westrum 1989). Findings from Chapter Four revealed that the level of psychological safety perceived by conservation professionals influenced their willingness to engage in learning from failure behaviors. Importantly, this study identified factors within teams that play a role in learning from failure (Catalano et al. 2021). However, this subject is the exception, not the norm, in the published conservation literature.

The idea of feeling safe to share in teams should not be taken to suggest that people should be coddled and that everyone has to agree so that no one feels bad. Just the opposite is true. Discussions characterized by "creative abrasion" where people's opinions are allowed to clash and be hashed out can generate new insights and deeper learning (Leonard-Barton 1995; Cannon & Edmondson 2001). Individuals in a team with high psychological safety feel they can challenge the consensus, will not be embarrassed by trying out new ideas, and can admit mistakes without fear of retribution or shame. When the focus during difficult discussions shifts from self-preservation to creative problem solving, individuals are cognitively free to learn and adapt.

There are a number of steps leaders can take to create a psychologically safe environment. These include: being accessible and approachable so that sharing is encouraged; demonstrating a tolerance for failure by admitting one's own mistakes; acknowledging that failure and errors happen to everyone; modeling an appropriate sense of humor and perspective

in the face of difficult discussions; avoiding blame and instead cultivating a learning mindset characterized by curiosity; co-creating a set of boundaries or rules to live by that guide discussion and set clear direction for team efforts; and holding people accountable for their actions to ensure a just culture (Edmondson 2012; Delizonna 2017). Levels of psychological safety can also be measured periodically, using a self-generated scale or one that has been developed and validated in the organizational learning literature (see Appendix F, Table F2). All of these activities and mindsets support not just a psychologically safe workplace, but ultimately support a culture that can more effectively learn from failure.

Action 5. Identify the presence and impact of cognitive biases and mitigate their effects.

While a number of cognitive antagonists can make discussions around learning from failure difficult, for the purposes of providing a starting point for taking action this discussion will be limited to three biases that stand out as particularly salient. A more complete list can be found in Chapter Three.

Naïve realism is the "unshakable conviction" that we are each privy to an objective reality that rational others should perceive the same way (Ross 1977). Thus, we are convinced that our point of view and opinion on an experience is the "real" one, and we assume that if our team member were presented with all the salient facts (as we see it) he or she would agree. When he or she does not, it can only be because that person is ignorant or willfully ignoring reality. These assumptions prevent opportunities for exploring other perspectives and the co-creation of meaning that is critical for learning.

Fundamental attribution error and *self-serving attribution* are closely related attribution biases, which are unthinking explanations for, or assumptions about, our own and others' behavior (Ross et al. 1977). The assumptions we make tend to fall into two groups, internal (our disposition or personal attributes) and external (things over which we may have limited or no control). These assumptions become important in discussions about failure because of our tendency to ascribe internal causes for our successes and external causes for our failures, but external causes for others' successes and internal causes for others' failures. In short, we deny

personal responsibility for our own shortcomings if something fails while reveling in our brilliance in the face of good outcomes, but view others as the beneficiaries of a lucky set of circumstances when success occurs or suffering some type of moral ineptitude or character flaw when the outcome is not so rosy. It is not difficult to imagine that thinking that your team member failed because of a personal weakness while denying responsibility for your own role (even if lip-service is paid) would be detrimental to group discussions about a failure or error. Attribution errors lead easily to blame, which stifles productive discussion, and are further compounded by the impact of naïve realism, which leads us to believe we have correctly assessed the situation (Edmondson 2012).

Confirmation bias is the pervasive and ubiquitous tendency to search for and accept only information that supports what we already think, whereby contrary information is viewed suspiciously, downplayed, distorted, or ignored (Nickerson 1998). People like to be right, tend to search for support for their positions, and generally do not like to be challenged. In a team setting, this behavior can lead to a less than fruitful search for explanatory factors that may be outside the experience of the group, and thus hinder learning and adaptation outcomes.

Mitigating the effects of these three biases, or de-biasing, is difficult and requires ongoing effort. The first step is to make people aware of the biases through training (Morewedge et al. 2015). The next step is to adopt some specific strategies to actively work to minimize these impacts, and to do so in teams given that individuals cannot effectively de-bias themselves (Larrick 2004).

1. *Consider-the-opposite* is a simple but powerful strategy that involves actively searching for support for outcomes that did not happen but could have (Lord et al. 1984; Hirt & Markman 1995). It can be as straightforward to implement as making sure the group asks, "What are two or three reasons that our initial judgment might be wrong?" (Larrick 2004). Its power lies in directing group attention to alternatives that might not have been considered.
2. Appointing a formal *devil's advocate* for planning and debrief sessions is another robust way to challenge group consensus and provide suggestions for why things might not be as they seem. This is akin to *getting an outsider's perspective*, which can be useful when an actual outsider is not available (Milkman et al. 2009).
3. Explaining the importance of *strong opinions, weakly held* and not getting too attached to one's position can counter confirmation bias and relieve the pressure of needing to save

face when challenged, giving people permission to abandon ideas and courses of action that are counterproductive and stymying progress (Sutton 2006).

4. Coupled with a dose of *intellectual humility*, individuals can be more open to other people's views and opinions and be less rigid in their own. People with high levels of intellectual humility tend to not make attribution errors, are more open to admitting fallibility, and are less likely to get defensive when presented with evidence contrary to their beliefs (Leary et al. 2017).
5. Finally, there are homegrown, locally developed responses that emerge from the bottom-up as groups learn more about what cognitive biases are most likely to impact their effectiveness. These *cognitive repairs* include such examples as Wall Street bankers using a simple phrase ("Don't confuse brains with a bull market") to combat self-serving bias, and Toyota and other companies using the "5 Whys" to go to a deeper level of analysis during debriefs to combat confirmation bias and others (Larrick 2004). The benefit of these strategies is that they are tailored to their context and engender a sense of ownership.

Practicing these strategies and cultivating these de-biasing behaviors takes time but should be a part of an ongoing commitment to learning.

Action 6. Acknowledge that conservation organizations compete and think realistically about how to drive collaboration.

Calls for conservation organizations to share and collaborate towards a greater goal have a purpose in rallying participation and motivating higher aspirations. Many efforts exist at multiple scales to bring together conservation organizations to share knowledge; however, many of these efforts fail, are only marginally productive, or exist in name only. Instead of expecting conservation organizations to work together on broad collaborations (e.g., Mace et al. 2000), and then either punishing them when they fail to do so or allowing cynicism to destroy relationships and infect organizations, those seeking to create such collaborations should identify the specific areas where collaboration can be properly incentivized. Broad collaborative goals that simply ask organizations to work together for the benefit of ensuring the persistence of nature are not sufficient to overcome the natural tendency for organizations and individuals to protect their "turf" (Chapter Five; Stirzaker et al. 2011). Participants must ensure that the specifics of the collaboration do not run counter to the self-interest of the organizations involved.

Acknowledging that self-interest will win out over collaboration at the start frees the participants to determine and communicate the real extent of the sharing that will take place over the course of the relationship. This approach recognizes the competitive dynamics that exist between conservation organizations (Chapter Five, Chapin 2004).

Action 7. Experiment with the operational model and adopt mindsets and mechanisms identified as effective.

Like professionals in other complex disciplines, training of conservation professionals should include non-technical, "soft" skills. Aviation has long recognized that piloting an aircraft is just one component of professional skills, and that achieving safe operations requires crewmembers to be trained in non-technical skills such as teamwork, leadership, situational awareness, and decision-making. Medicine has begun to follow suit in recent years, with some areas such as surgery and anesthesia more developed than others (Kapur et al. 2015). In contrast, there is no systematic, industry-wide training on these topics in conservation.

Conservation professionals are aware in a general sense of those things required for increased learning, with many journal papers ending with recommendations such as "communicate better," "engage stakeholders," or "collaborate more effectively." These prescriptions are far too broad to be of any use, and there is a near total absence of literature in conservation describing specifically how to enact these exhortations. The popular and peer-reviewed organizational science literature contains a vast store of evolving information about how to improve team learning, and increasingly, a body of literature concerned with learning from failure specifically. But in conservation, there is no precise and accurate understanding of those skills that are required to effectively learn from failure, and the average conservation professional has no formal training on the thinking and practices of learning from failure that have long been established in other disciplines. Conservation activities can be far more complex than many other sectors, so adopting, trialing, and adapting learning from failure mindsets and mechanisms presented in this chapter is of critical importance.

Some of the topics that should be covered in a systematic way throughout conservation training programs include: conflict management, project management, causes of project failure,

team coordination, fostering psychological safety, awareness of cognitive biases and de-biasing strategies, stakeholder engagement, how to conduct debriefs, and leadership effectiveness.

6.6 Conclusion

The operational model for learning from failure in conservation, along with the principles underpinning it and the actions derived from it, are offered to aid in guiding implementation and trialing of thinking and practices widely acknowledged to be necessary for learning from failure. The ideas presented here are not complicated. They have all been trialed and perfected in other sectors through persistence and effort. It is no coincidence that the industries that have made the most progress in learning from failure are those for whom the impetus is the greatest—those for whom failure is the most costly, visible and immediate. Conservation suffers from being a widely dispersed effort without a governing body with the power to enforce industry-wide standards; it typically lacks highly visible failures resulting in immediate loss of life to drive change; and rarely if ever is it characterized by problems and solutions that fit neatly into quarterly reports or other clear metrics of performance. Instead, individual conservation organizations wishing to be more effective must marshal the motivation of their mission-driven employees, wade through complicated problems, and focus daily effort into embracing the power of learning from failure through a reframing of mindsets and adoption of new mechanisms. While the ideas are simple, the challenge is doing the work required to make learning from failure a part of every level of the organization, from everyday tactical decisions to the highest strategic vision-setting exercises.

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7 | CONCLUSIONS

The field of conservation science is focused upon preventing the loss of nature but has yet to comprehensively adopt structural systems and cultural norms that support effective learning from failure. Failure is inevitable in the complex contexts in which conservation activities take place. Understanding and learning from these experiences is vital to making progress towards ensuring the persistence of biodiversity and in becoming a sector that truly embraces a culture of learning (Clark 1996; Game et al. 2013). Such a transformation would benefit current conservation practitioners as well as students preparing to enter the field (Chapman et al. 2015).

Implementation of conservation initiatives suffers when previous mistakes are repeated (Redford & Taber 2000; Knight 2006), which is a common symptom of a failure to learn from errors and mistakes. It is clear from the thinking and practices well mainstreamed into other sectors that conservation organizations are likely to benefit substantially by embracing the philosophy that every failure provides an opportunity for learning (Chapman et al. 2015).

It is apparent, however, from the research presented in this thesis, that while the potential importance of learning from failure is recognized, it is not valued to the extent that learning from failure thinking and practices are widely adopted within teams, organizations and the sector as a whole. Relatively little has been written about the topic in the peer-reviewed and non-peer-reviewed literature and most participants involved in this research had little knowledge of learning from failure applications.

The conservation sector struggles to learn from failure because the structure of conservation is fundamentally broken, and "more 'doing' of the same practices will not resolve the state of systemic failure" (p. 138, Reynolds et al. 2019). Relationships between NGOs and funders, between funders and stakeholders, and between NGOs and stakeholders are underpinned by a funding system that rewards implementation over learning, a situation entirely unsuitable for addressing the challenges of 'wicked' problems. The current culture within

organizations does not value failure as an important source of knowledge generation nor create enabling conditions for the mindsets and mechanisms required for effective learning from failure. People who feel capable of engaging in learning from failure activities are discouraged from doing so through dysfunctional team dynamics (Catalano et al. 2021). Training on how to learn from failure is widely absent. The existing tools charged with providing a learning mechanism (monitoring, evaluation, and adaptive management) are not widely effective (Miteva et al. 2012; Baylis et al. 2016; Redford et al. 2018) and longer-term impacts or outcomes are rarely examined (Miller et al. 2017). While there are small signs of hope, including a small number of inter- and transdisciplinary in-depth examinations of complex situations that defy neat categorization of success and failure (Borgerhoff Mulder et al. 2021) and attempts to reflect on our own effectiveness (Mansourian & Vallauri 2020; Montana et al. 2020), we ultimately need to ask ourselves: are we focusing too narrowly on the implementation of conservation activities at the expense of achieving conservation's purpose (Black 2015)?

The research presented in this thesis provides an important foundation that conservation professionals can engage with to more effectively, cost-efficiently and equitably deliver upon their values and goals. For example, it establishes a baseline understanding of the status quo of the conservation science peer-reviewed literature through a review of the current state of learning from failure in the conservation sector (Chapter Two) and an operational model for assisting teams and organizations to institutionalize learning from failure into their thinking and practices (Chapter Six). This research also raises many questions that can usefully serve to direct much needed investigation into this topic.

More specifically, in this thesis I examined how conservation currently manages failure and identified ways to improve the sectors' capacity to learn from failure through building on existing strengths and adopting ideas about failure management from other sectors that could prove fruitful. To date, this type of research has not been undertaken in conservation. This thesis contributes to a deep level of understanding of the current state of learning from failure and the potential for transformative cultural shifts in the effective management of failure in conservation initiatives by:

1. providing an understanding of how individuals, teams and organizations in the conservation sector currently operate in regard to learning from failure;

2. identifying the thinking and practices that other disciplines operating in complex systems understand and implement in order to effectively learn from failure;

3. identifying the limitations and unique characteristics of conservation that would enable or discourage effective learning from failure at individual, team, and organizational levels;

4. identifying how thinking and practices from other disciplines could be applied in a conservation context; and

5. providing practical direction for conservation organizations on how they can learn from failure effectively.

The literature review I conducted in **Chapter Two** provides the first benchmarking of the degree to which the published literature reports on the individual, team, and organizational factors that contribute to project failure in conservation. I found that failure is rarely reported, that biological factors contributing to failure are more widely documented than social dimensions of project failure, and that reports of successful projects outnumber those of failures by a factor of almost four to one. This indicates the presence of a success bias whereby conservation professionals rely primarily on success as a guide for future actions, even though success can often be attributed to luck (Kahneman 2011) and failure offers greater learning potential than success (Sitkin 1992). The success bias in conservation identified in Chapter Two is further elucidated in, and can be contrasted with, Chapter Three which introduces well-established thinking and practices from other sectors that could be adopted by conservation professionals to more usefully frame success and failure to promote learning.

Effective conservation is widely regarded as being founded upon an understanding of, and an ability to manage, human behavior (Schultz 2011). Other disciplines with longer histories of managing failure have shown that this requires examination not only of those we work with, but equally importantly of our own behaviors. I found that the primary theme related to causes of failure presented in the peer-reviewed literature has to do with 'people', which encompassed both individual's internal psychological reactions such as fear of failure and risk aversion and interactions between individuals such as team dysfunction and stakeholder conflict.

Findings in Chapter Two indicate a clear need for further research into the way conservation professionals approach failure, not only as a matter of professional learning and organizational effectiveness, but also accounting for the psychological dimensions of individuals and the complexities of group dynamics. Chapters Four and Five undertake these reflexive investigations through examination of individual motivations and the role of group culture and structures in learning from failure. For example, the findings of the literature review (Chapter Two) and the examination of other sectors (Chapter Three) regarding the success bias prominent in the conservation sector provided the impetus for the empirical study of conservation professionals and teams (Chapters Four and Five), which examined this and other topics in greater detail and scope using quantitative and qualitative methods to develop a rich picture of the sector.

I identified and introduced the concept of an 'error related learning process' synthesized from the literature of other sectors that consists of identification, analysis and correction, and institutionalization and dissemination (Putz et al. 2012), and suggest that implementation of this type of process is largely overlooked by conservation organizations. I provide suggestions aimed at increasing the likelihood of learning from failure experiences, recognizing that both a shift in mindsets (how failure is viewed) and the introduction of mechanisms (how we manage failure) are required to achieve this aim. These efforts could include trialing techniques common in other sectors such as: putting in place structures during project pre-planning that describe how learning will be captured and acted upon; conducting formal and informal reflection sessions; training on managing cognitive biases; training on how to create and sustain psychologically safe teams; and incentives to encourage and even reward failure reporting. Ultimately, learning does not take

place just because we identified a failure, but because these steps catalyzed the participative social process of reflection, investigation, sharing, and improvement (Macrae 2016).

Chapter Two suggests that the peer-reviewed literature may be an appropriate repository for the publication of failure experiences. I did not search the non-academic literature as part of my aim was to assess the current state of publishing of failure in conservation journals and because the non-academic literature is usually not indexed or organized making replicable searches difficult. Some authors are already willing to publish in journals and subject their failure experiences to peer-review and wider circulation. That said, journals have been slow or reticent to specifically call for manuscripts documenting failed projects (for example, see the Editor's note atop Knight 2006). Whether the peer-reviewed literature can provide vicarious learning opportunities and facilitate the institutionalization of learning is a question that remains to be answered (Denrell 2003; Bledow et al. 2017), firstly because easy access is likely curtailed as most research remains behind paywalls, and secondly, because a repository stores information but does not necessarily mobilize it. Research into the utility of the peer-reviewed literature as a repository for failure experiences would be useful for potentially improving failure management practices.

Chapter Three provides a scaffold of concepts from sectors beyond conservation with longer histories of learning from failure, specifically the business, medicine, and commercial and military aviation sectors. These include: the relationship between the complexity of operational situations and the need for effective failure management; the challenge and opportunities inherent in defining failure and the limitations of relying on success; the importance of individual experiences and psychological barriers that confound efforts to confront failure; the role of team dynamics such as psychological safety and trust in enabling effective failure management; and the nature of organizational leadership, culture and structures in supporting learning from failure. These fundamental concepts set the themes identified from the literature review (Chapter Two) in context; provide a framework for the exploration of drivers of learning from failure behaviors in individuals (Chapter Four) and for understanding the barriers and enabling conditions to learning from failure within the conservation sector (Chapter Five); and serve as a foundation for

the 'actionable steps' that comprise the operational model to guide implementation of learning from failure practices within teams and conservation organizations (Chapter Six).

One concept of primary importance is recognizing the need for a fundamental shift in the way failure is viewed in conservation. Acknowledgment of the inevitability of failure in the presence of uncertainty and complexity in which many conservation initiatives take place would begin to clear away the current climate of fear and secrecy and allow a flourishing of our richest potential source of learning through which to navigate the 'wicked' problems these conditions present. Coming to terms with the inevitability of failure in order to learn effectively from it has been noted by other researchers (Clark 1996; Redford & Taber 2000; Knight 2006; Game et al. 2013; Chapman et al. 2015), but this thesis marks the first attempt to systematically assess the multiple dimensions of the problem and identify potential solutions. Fundamentally, the fear of failure (examined in the context of conservation in Chapters Two, Four and Five) is a universal human condition and thus there is value in identifying the ways other disciplines have grappled with failure. Paradoxically, other disciplines can teach us that far from demotivating professionals in mission-driven disciplines, operating in an organization that values the learning that failure affords reduces fear, breeds optimism and encourages transformative improvements. Ultimately, what other disciplines offer is a roadmap, an alternate way of being, that challenges us to have the courage to view failure as invaluable.

In **Chapter Four**, continuing the theme of reflexive self-examination, I investigated conservation professionals' beliefs and motivations concerning learning from failure. Building upon findings from Chapter Three that researchers studying aviation, business, and medicine have identified behaviors that enable effective learning from failure, I examined the intention of conservation professionals to engage in these behaviors. I also investigated the role of psychological safety in supporting these intentions, as it is widely acknowledged as critical to effective team dynamics both broadly (Edmondson 1999) and more specifically when confronting failure (Edmondson 2012).

I found that individuals' perceptions of social norms and the presence of psychological safety in their teams were important drivers of behavioral intentions, building a bridge between individuals (where learning from failure begins) and teams (where it is operationalized). The

importance of social norms and the difficulty of changing them cannot be overstated (Schultz 2011), and this study continues the theme of the critical role of leadership in creating and sustaining supportive social norms. The relationship between individual and group learning raised here is further explored in Chapters Five and Six.

I also found that 'increasing personal learning' was the highest perceived benefit of engaging in the learning from failure behaviors, and beneficial beliefs in general outweighed beliefs of the potential costs, providing an optimistic benchmark upon which to build a learning culture. The highest perceived costs were the additional workload due to time required to engage in these activities and expectations of success by senior leaders. Importantly, many of the significant barriers to adopting learning from failure behaviors were perceived as being within the control of respondents' organizations, such as allocating time for, and setting expectations of, engaging in reflection sessions. This again is a positive sign, suggesting that there are internal activities organizations can implement to create supportive social norms and enable transformational change despite external pressures such as the funding or political constraints identified in Chapters Two and Five. For example, once again, the importance of leaders in adopting a learning approach to failure through creating and sustaining supportive social norms emerges as a strong theme. Many of these findings mirror results found in Chapter Five, which adds a layer of qualitative richness to the personal motivations and social dynamics this quantitative study raised and begins to lay the groundwork for understanding why, despite this study's finding of awareness of benefits, learning from failure activities are so rarely implemented.

The research I undertook in **Chapter Five** to understand barriers to, and enabling conditions for, learning from failure in conservation was the most personally rewarding part of this research project, as it involved in-depth, often very personal, conversations with a wide range of conservation professionals and thought-provoking written experiences to reflect upon. I found that people felt strongly that we need to 'learn how to learn' more effectively, that learning from failure is widely viewed as valuable and desirable, and that a number of enabling conditions are already in place, for example a passion for improving effectiveness at saving nature; a combination that offers a sense of hope and a potential foundation upon which to begin

transformational change. Chapters Two and Three established the essential importance of knowledge of both mindsets and systems in organizations that seek to effectively learn from failure, and Chapter Five documents that many of the theories, mechanisms and approaches required to mobilize both are typically absent in conservation organizations despite their perceived value. I documented a range of individual, team, organizational, and sectoral factors that serve as significant barriers to learning from failure. For example, the individual experiences of fear of failure that were surfaced in the literature in Chapter Two, given a multidisciplinary context in Chapter Three, and quantified in Chapter Four were investigated in greater detail as an important barrier to learning from failure, and included respondents sharing often emotional perceptions concerning reputational risk, fear of being judged harshly, defeatism, and the pressure from superiors and donors to succeed.

This chapter also expanded upon findings from Chapters Two, Three and Four on the critical role of team dynamics, leader behavior, organizational structures, and funders in creating social norms and systems that support a learning approach to failure, providing rich examples of how blame, competition, power differences, supervisor responses, egos, and a bias towards success can erode psychological safety and derail learning opportunities. I believe that allowing the voices of respondents to be heard, who were often expressing strong emotions and relaying challenging personal experiences, is of critical importance in beginning to understand the tangible personal toll that avoiding effective management of failure exacts. Chapter Five reveals that – beyond failing to secure conservation goals – conservation professionals are the prime, very real, casualties of a conservation organization that fails to implement a learning from failure operational model (see Chapter Six), as their mental health can be highly impacted (for example, Gordon et al. 2019). Conservation organizations that humbly and genuinely embody a learning from failure operational model look inwards upon themselves and their staff, as well was outwards from themselves towards the nature that they aim to protect.

In **Chapter Six** I synthesized the findings from Chapters Two through to Five as an operational model to guide implementation of learning from failure thinking and practices. The operational model consists of a three-step learning process that encompasses key mindsets and mechanisms and that integrates the influence of individuals' attributes, social norms, leadership,

group dynamics and the broader context around conservation organizations that emerged as recurrent themes throughout the research presented in this thesis (see Figure 6.3) To my knowledge, this is the first operational model addressing failure in conservation. I developed it not just as an academic exercise, but in response to an unmet need I sensed in the lived experiences of conservation professionals who were gracious enough to share their experiences with me over the last few years. I always intended to undertake research with a strong practical outcome, and my intention in presenting this operational model was to provide direction to aid in implementing the thinking and practices necessary to create organizations capable of learning from failure. Given that individual conservation activities are typically situation-specific, individual personalities and team dynamics vary widely, and that no two organizations' cultures are the same, my intent was not to attempt to exhaustively catalogue every permutation of why failure occurs or how it could be handled. Rather, the operational model serves to drive necessary discussions of how to develop, trial, and implement an organization-wide learning from failure orientation, adapted to the specific organization, team, and individual, for the benefit of the people whose primary mission is to continuously improve their ability to carry out the work of saving nature.

In practice, operationalizing this model means creating supportive social norms through incentivizing acceptance of the inevitability and learning value of failure alongside designing and instituting rigorous processes that allow failure to be effectively identified, analyzed, corrected, and institutionalized. Conservation organizations and their composite teams need not develop learning from failure thinking and practices from scratch, but can identify, trial and adopt these directly from the other sectors, building upon the current strengths inherent in the conservation sector, such a strong sense of being mission-driven, experience with the power of shared learning opportunities, unleashing the latent power and influence of funding organizations, and a long history of advancement through the scientific method. This operational model for learning from failure should also be integrated into existing operational models for conservation planning, such as the Open Standards for the Practice of Conservation.

7.1 Limitations

I acknowledge a number of limitations to this work in addition to the limitations presented in each chapter. I initially had thought to conduct this research project embedded within a single organization to gain a deep insight into the workings of one institution. I established an agreement with an internationally recognized carbon mitigation firm, but after working with them for several months they terminated the arrangement due to a previously undisclosed unwillingness of senior staff to examine many topics related to learning from failure including the role of feedback, psychological safety, and reflection. As a consequence, while I did learn a great deal about leader behavior, I realized quickly that conducting a complete research project founded upon an embedded case study methodology within one single organization would not be possible. This may have been fortuitous, however, since as a result my investigations included a range of people from a variety of organizations, roles, and countries, a broader undertaking that is more suitable for establishing a foundational body of work. I learned that flexibility and openness to changing my approach based on the circumstances, while initially causing a degree of stress, was critical to allow me to gather useful data given my available time and resources.

Despite the broad nature of my investigations, the respondents were primarily from developed countries, which unintentionally perpetuates the ongoing bias of developed world researchers and practitioners overlooking their developing world peers – and local communities – in their research (Smith et al. 2009). This was due to time and funding constraints on travel and the challenges of securing respondents from developing countries. The respondents I was able to secure from developing world countries raised important and unique perspectives, for example, issues related to developed country researchers and funding agencies divorced from local priorities, timescales, and cultural norms. Additionally, my understanding of the barriers to learning from failure was enriched by contributions from developed country respondents who raised issues such as gender and racial diversity, equity and inclusion in workplace discussions of failure. With additional resources, I would have examined these important issues in greater detail so as to understand the situational and contextual differences regarding approaches to

learning from failure. I learned that I had to accept the limitations of my time and financial resources on the scope of this project, and I plan to pursue further research into these dimensions.

A reviewer of the manuscript comprising Chapter Four (which is in final stage review as of the submission date of this thesis) questioned whether I had secured a sufficiently large enough sample size for my theory of planned behavior study in Chapter Four, without specific guidance on what a 'large enough' sample size would be and despite the study being sufficiently powered. This was discouraging, as this study was designed and carried out under the primary supervision of someone outside the field of conservation, and the number of subjects and research methods were consistent with good academic practice in her field. However, I realized at the start of this research project that I had to accept the risk of a lack of acceptance of multidisciplinary research methods. As a result, this thesis drew from multiple literatures including anthropology for grounding the research, sociology for respondent recruitment and interview methodology, psychology for the analyses, and the economic, impact assessment and conservation literatures for the application and interpretation of results.

Finally, given more time and resources, I could have pursued formal interviews with people from the sectors I drew upon for the ideas in Chapter Three. These perspectives could have further added richness and detail to the project as a whole and the operational model specifically. I did have many informal conversations with business professionals, pilots, and healthcare workers, as well as attending non-conservation conferences and workshops discussing these ideas, but these conversations were not systematically recorded and analyzed. They did, however, undoubtedly influence my thinking and formulation of the operational model. I hope to pursue further research that more systematically draws together these multi-disciplinary concepts.

7.2 Future research

Very little research has been conducted on the topic of learning from failure in conservation. The research comprising this doctoral project was designed to deliver several

benchmark studies that collectively provide a foundation for future action and direction for future research. As a result, it raises many new avenues of potential investigation. Here I outline the highest priority topics for moving the conservation sector forward on the topic of learning from failure. Researchers investigating these and similar topics are recommended to (in the main) work directly with donors, practitioners and policymakers, so as to ensure that the research is as relevant as possible to those delivering conservation outcomes. There is a very real danger that the discipline of conservation science 'hijacks' the undertaking of pragmatic research into learning from failure (see Fazey et al. 2005 for review), as has occurred with tropical forest conservation (Whitten et al. 2001), rhinoceros conservation (Linklater 2003), spatial conservation prioritization (Knight et al. 2008), invasion biology (Esler et al. 2010), and conservation genetics (Taylor et al. 2017). It would be a deep irony if research into failure in conservation failed to usefully address failure.

The role of funders in conservation was a strong recurring theme in my research. Respondents perceived funders to hold a great deal of power in the relationship with grantees. Presently the funding community is neither requiring robust learning from failure nor building capacity to do so in any systematic or sector-wide way. How could donors structure their relationships and grantmaking processes to better encourage and co-create opportunities for learning? More broadly, how could organizations build learning from failure awareness into the entire life cycle of projects, from the planning and design stage through to implementation and evaluation, and what role could and should funders play in enabling this process? There are models that exist for the type of collaborative funding partnership effective learning from failure requires, such as integrating into project planning concepts from developmental evaluation, an adaptive approach that explicitly engages with the innovation required in dynamic, complex conditions (Patton 2011).

I briefly mention current operational models related to project planning and implementation (and tangentially, learning) in conservation, such as the Open Standards for the Practice of Conservation (Conservation Measures Partnership 2020) and the Conservation Excellence model (Black & Groombridge 2010), but future research could usefully investigate how learning from failure mindsets and systems could be integrated into, or operationally

complement, these existing operational models. This would be one way to continue to normalize in the minds of conservation professionals the inevitability of failure and to institutionalize the management of failure experiences into project life cycles. This could be complemented by research that trials and documents the effectiveness of learning from failure mechanisms, such as reflection sessions, in order to provide data to organizations seeking to improve their learning outcomes.

While aviation, business, and medicine have provided a rich source of information about learning from failure to draw upon for this research, other sectors and disciplines such as education, development, and conflict resolution could also usefully be explored. They have the potential to provide additional models, thinking, and practices that could be applied to conservation. For example, USAID has developed a broad suite of tools to integrate learning throughout their project cycle through the Collaboration, Learning, and Adaptation Framework (with specific acknowledgement that failure is an important part of knowledge generation), and importantly, to ensure this process is integrated into all levels of their operating environments (USAID 2021b).

My research captured the frustration of conservation professionals who lament a general absence of due diligence in project planning, which mirrors the paucity of understanding of the social contexts and issues that underpin the opportunities and constraints of implementation (Cowling & Wilhelm-Rechmann 2007). This stands in contrast to other sectors, for example, in business, where due diligence reporting is viewed as an essential part of any project planning. Future research could investigate the impact of this shortcoming and ways to address it.

Respondent experiences with gender and cultural differences in approaching failure were mentioned in the interviews conducted as part of Chapter Five but were not fully explored in the scope of my thesis. Research on the subtle cultural differences between staff that impact operations and inhibit team performance and learning from failure in the airline industry, for example, is used to drive data collection and training (Strauch 2010). Similarly, conservation could begin to more systematically investigate these differences and ways to build stronger links between headquarters and field operations.

Finally, the role of leadership in creating and maintaining effective teams able to learn from failure emerged repeatedly throughout this research. While scholars have begun to study leadership in conservation (Black et al. 2011; Bruyere 2015), a range of opportunities exist to investigate leader effectiveness, influence on team learning behaviors, and leadership training utility that could offer valuable long-term benefits to conservation organizations seeking to sustain operational excellence.

7.3 Final thoughts

Understanding failure in conservation practice is a priority if we are to be a learning discipline. One could argue that we invest in what we value. If we are not investing in creating proactive approaches to manage failure, the conclusion could be reasonably drawn that learning is not valued. For example, the widespread perception amongst conservation professionals that there is no time for reflection is simply a manifestation of the low value placed on this activity compared to the value placed on taking action, despite the rhetoric common across the sector that evaluation (of which reflection is a component) is essential. If this is the case, it raises the question: how much do conservation professionals *really* want to save nature?

Perceptions that constrain learning from failure are real and reflect a set of choices based on a bias towards success. Unwinding the cult of positivity requires that we accept that progress has always been characterized by iterative and incremental adjustments from error, not unalloyed perfection. Moving forward more wisely requires that we allow ourselves and others to return from error with grace and wisdom. Perhaps we think our own organization's culture and our own performance is fine, but are we asking the right questions? Maybe we should be asking: is our culture everything it could be? How can we find our blind spots? Are we missing something because of the way we have traditionally approached our work? We might achieve success, but how do we sustain it? How do I personally respond to failure, and how can I improve? Failure is difficult to confront, but resisting the natural urge to avoid failure is a challenge worth accepting if it moves us forward with greater wisdom in efforts to make a positive impact on our natural world.

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9 | Appendices

Appendix A. Other publications produced during PhD candidature

Other publications and articles produced during PhD candidature

The following peer reviewed publications and non-peer reviewed articles were produced during the period of this research project.

Peer reviewed:

Catalano, A.S., Knight, A.T., 2016. Does procrastination promote failure in conservation of extremely small populations? A response to Meek. *Biological Conservation.* 194, 217. https://doi.org/10.1016/j.biocon.2015.12.013

(Included as Appendix G)

Lyons-White, J., Pollard, E.H.B., **Catalano, A.S.**, Knight, A.T., 2020. Rethinking zero deforestation targets beyond 2020 to more equitably and effectively conserve tropical forests. *One Earth.* 3, 714-726. https://doi.org/10.1016/j.oneear.2020.11.007

Lyons-White, J., Jespersen, K., Gallemore, C., **Catalano, A.S.**, Ewers, R.M., Knight, A.T., in review. "Leaning in" to the wicked problem of tropical deforestation with mixes of mechanisms.

Non-peer reviewed:

Catalano, A.S., 2020. Failure by any other name is still…a great learning opportunity. *LinkedIn*. [online]. Posted March 3, 2020. https://www.linkedin.com/pulse/failure-any-other-name-stilla-great-learning-allison-catalano

Catalano, A.S., Fisher, J., Kretser, H. 2021. Never waste a good failure. Medium.com. [online]. Posted March 17, 2021. Part 1:https://medium.com/wcs-conservation-solutions/never-waste-a-good-failure-barriers-to-learning-part-1-ad464a20fe86 Part 2: https://medium.com/wcs-conservation-solutions/never-waste-a-good-failure-opportunities-for-learning-part-ii-e9ad87bf6ac0

Appendix B. Presentations arising from work in this thesis

January 2021: Invited guest speaker for The Stewardship Network's monthly webcast: "Never waste a good failure". https://www.stewardshipnetwork.org/webcasts/; https://www.youtube.com/watch?v=y3gi6yYuDo8&feature=youtu.be.

November 2020: Invited presenter; created and hosted 90-minute virtual interactive session for Pew Marine Fellows annual private scientific conference: "Learning from failure in marine research and conservation".

July 2020: Created and hosted 2-hour virtual interactive session, "Never waste a good failure: what you can do to fail intelligently and why it matters", at the Society for Conservation Biology North American Congress for Conservation Biology (NACCB) 2020. https://www.xcdsystem.com/scbna/program/P5i9hSN/index.cfm?pgid=3768&sid=43950

June 2020: Created presentation for first Society for Conservation Biology Social Science Working Group Student Twitter Conference. #SSWGTC20 https://twitter.com/ASCatalano/status/1272995073731579906

April 2020: Co-facilitator for WildHub's Smithsonian Earth Optimism Summit 2020 virtual capacity building panel discussion: "Dive into the world of WildHub's conservationists." https://wildhub.community/videos/dive-into-the-world-of-wildhub-s-conservationists-webinar-recording

November 2019: Co-facilitator of inaugural Wildlife Conservation Society's Failure Factors Initiative held at Smithsonian's National Zoo Conservation Pavilion.

September 2019: Invited plenary speaker at North American Invasive Species Management Association (NAISMA) 2019 Annual Conference. http://www.naisma.org/annual-conference

August 2019: Presented 2-hour workshop on learning from failure strategies for individuals, teams, and organizations at Forest & Livelihoods: Assessment, Research, and Engagement

(FLARE) 2019 Annual Conference, University of Michigan. http://www.forestlivelihoods.org/annual-meeting-2019/workshops/

August 2019: Presented 1.5-hour workshop on learning from failure and sharing session at Conservation Optimism 2019 Annual Conference, University of Oxford.

January 2019: Invited plenary speaker at The Stewardship Network's Annual Conference, Lansing, MI. Also presented breakout session on cognitive biases and de-biasing strategies. https://stewardshipnetwork.org/

March 2018: Presented "Learning from failure in conservation" at Gordon and Betty Moore Foundation Learning Round Table, Palo Alto, CA.

July 2016: Organized a half-day symposium, "Realizing failure's learning opportunity", at the Society for Conservation Biology North American Congress for Conservation Biology (NACCB), Madison, WI.

Appendix C. Chapter Two supplementary material

Table C1. List of articles selected for review reporting social causes of project failure.

1	Aldridge, C.L., Boyce, M.S., Baydack, R.K., 2004. Adaptive management of prairie grouse: How do we get there? Wildl. Soc. Bull. 32, 92–103. doi:10.2193/0091-7648(2004)32[92:amopgh]2.0.co;2
2	Balint, P.J., Mashinya, J., 2006. The decline of a model community-based conservation project: Governance, capacity, and devolution in Mahenye, Zimbabwe. Geoforum 37, 805–815. doi:10.1016/j.geoforum.2005.01.011
3	Beier, P., 2007. Learning like a mountain. Wildl. Prof. 1, 26–29. doi:10.4004/1933-2866(2007)1[26:LLAM]2.0.CO;2
4	Bissix, G., Rees, J.A., 2001. Can strategic ecosystem management succeed in multiagency environments? Ecol. Appl. 11, 570–583
5	Brook, S., Van Coeverden De Groot, P.J., Mahood, S., Long, B., 2011. Extinction of the Javan Rhinoceros (Rhinoceros sondaicus) from Vietnam. WWF.
6	Brower, A., Reedy, C., Yelin-Kefer, J., 2001. Consensus versus conservation in the Upper Colorado River Basin Recovery Implementation Program. Conserv. Biol. 15, 1001–1007.
7	Castrejón, M., Charles, A., 2013. Improving fisheries co-management through ecosystem-based spatial management: The Galapagos Marine Reserve. Mar. Policy 38, 235–245. doi:10.1016/j.marpol.2012.05.040
8	Dahlberg, A.C., Burlando, C., 2009. Addressing trade-offs: Experiences from conservation and development initiatives in the Mkuze wetlands, South Africa. Ecol. Soc. 14. doi:10.5751/ES-03183-140237
9	Davis, G.E., 2005. Science and society: Marine reserve design for the California Channel Islands. Conserv. Biol. 19, 1745–1751. doi:10.1111/j.1523-1739.2005.00317.x
10	De Santo, E.M., 2016. Assessing public "participation" in environmental decision-making: Lessons learned from the UK Marine Conservation Zone (MCZ) site selection process. Mar. Policy 64, 91–101. doi:10.1016/j.marpol.2015.11.003
11	Dixon, A., Carrie, R., 2016. Creating local institutional arrangements for sustainable wetland socio-ecological systems: Lessons from the Striking a Balance project in Malawi. Int. J. Sustain. Dev. World Ecol. 23, 40–52. doi:10.1080/13504509.2015.1107861
12	Dressler, W., Büscher, B., Schoon, M., Brockington, D., Hayes, T., Kull, C.A., McCarthy, J., Shrestha, K., 2010. From hope to crisis and back again? A critical history of the global CBNRM narrative. Environ. Conserv. 37, 5–15. doi:10.1017/S0376892910000044

13	Elbakidze, M., Angelstam, P., Sandström, C., Stryamets, N., Crow, S., Axelsson, R., Stryamets, G., Yamelynets, T., 2013. Biosphere Reserves for conservation and development in Ukraine? Legal recognition and establishment of the Roztochya initiative. Environ. Conserv. 40, 157–166. doi:10.1017/S0376892912000434
14	Flueck, W.T., Smith-Flueck, J.M., 2006. Predicaments of endangered huemul deer, Hippocamelus bisulcus, in Argentina: A review. Eur. J. Wildl. Res. 52, 69–80. doi:10.1007/s10344-005-0020-4
15	Gelcich, S., Edwards-Jones, G., Kaiser, M.J., Castilla, J.C., 2006. Co-management policy can reduce resilience in traditionally managed marine ecosystems. Ecosystems 9, 951–966. doi:10.1007/s10021-005-0007-8
16	Goldman, M., 2003. Partitioned nature, privileged knowledge: Community based conservation in the Maasai ecosystem, Tanzania. Dev. Change 34, 833–862. doi:10.1111/j.1467-7660.2003.00331.x
17	Gray, A.N., 2000. Adaptive ecosystem management in the Pacific Northwest: A case study from Coastal Oregon. Ecol. Soc. 4, 1–20.
18	Gubbi, S., Linkie, M., Leader-Williams, N., 2009. Evaluating the legacy of an integrated conservation and development project around a tiger reserve in India. Environ. Conserv. 35, 331–339. doi:10.1017/S0376892908005225
19	Hall, J.M., Burgess, N.D., Rantala, S., Vihemäki, H., Jambiya, G., Gereau, R.E., Makonda, F., Njilima, F., Sumbi, P., Kizaji, A., 2014. Ecological and social outcomes of a new protected area in Tanzania. Conserv. Biol. 28, 1512–1521. doi:10.1111/cobi.12335
20	Hayes, T.M., 2012. Payment for ecosystem services, sustained behavioural change, and adaptive management: Peasant perspectives in the Colombian Andes. Environ. Conserv. 39, 144–153. doi:10.1017/S0376892912000045
21	Helvey, M., 2004. Seeking consensus on designing marine protected areas: Keeping the fishing community engaged. Coast. Manag. 32, 173–190. doi:10.1080/08920750490276236
22	Hickey, V., 2010. The quagga mussel crisis at lake mead national recreation area, Nevada (U.S.A.). Conserv. Biol. 24, 931–937. doi:10.1111/j.1523-1739.2010.01490.x
23	Hoffman, D., 2014. Conch, cooperatives, and conflict: Conservation and resistance in the Banco Chinchorro Biosphere Reserve. Conserv. Soc. 12, 120. doi:10.4103/0972-4923.138408
24	Holmes, G., 2013. Exploring the relationship between local support and the success of protected areas. Conserv. Soc. 11, 72. doi:10.4103/0972-4923.110940
25	Hughes, M., Jones, R., 2010. From productivism to multi-functionality in the Gascoyne-Murchison Rangelands of Western Australia. Rangel. J. 32, 175–185. doi:10.1071/RJ09079
26	Humavindu, M.N., Stage, J., 2015. Community-based wildlife management failing to link conservation and financial viability. Anim. Conserv. 18, 4–13. doi:10.1111/acv.12134

27	Jepson, P., Jarvie, J.K., MacKinnon, K., Monk, K.A., 2001. The end for Indonesia's lowland forests? Science (80-.). 292, 859–861. doi:10.1126/science.1061727
28	Jepson, P.R., 2016. Saving a species threatened by trade: A network study of Bali starling Leucopsar rothschildi conservation. Oryx 50, 480–488. doi:10.1017/S0030605314001148
29	Kaswamila, A.L., Songorwa, A.N., 2009. Participatory land-use planning and conservation in northern Tanzania rangelands. Afr. J. Ecol. 47, 128–134. doi:10.1111/j.1365-2028.2008.01059.x
30	Katikiro, R.E., Macusi, E.D., Deepananda, K.H.M.A., 2015. Challenges facing local communities in Tanzania in realising locally-managed marine areas. Mar. Policy 51, 220–229. doi:10.1016/j.marpol.2014.08.004
31	Kellert, S.R., Mehta, J.N., Ebbin, S. a, Lichtenfield, L.L., 2000. Community natural resource management: Promise, rhetoric, and reality. Soc. Nat. Resour. 13, 705–715. doi:10.1080/089419200750035575
32	Klein, J., Réau, B., Kalland, I., Edwards, M., 2007. Conservation, development, and a heterogeneous community: The case of ambohitantely special reserve, Madagascar. Soc. Nat. Resour. 20, 451–467. doi:10.1080/08941920701211900
33	Knight, A.T., Cowling, R.M., Boshoff, A.F., Wilson, S.L., Pierce, S.M., 2011. Walking in STEP: Lessons for linking spatial prioritisations to implementation strategies. Biol. Conserv. 144, 202–211. doi:10.1016/j.biocon.2010.08.017
34	Křenová, Z., Kindlmann, P., 2015. Natura 2000 - Solution for Eastern Europe or just a good start? The Šumava National Park as a test case. Biol. Conserv. 186, 268–275. doi:10.1016/j.biocon.2015.03.028
35	Lejano, R.P., Ingram, H.M., Whiteley, J.M., Torres, D., Agduma, S.J., 2007. The importance of context: Integrating resource conservation with local institutions. Soc. Nat. Resour. 20, 177–185. doi:10.1080/08941920601052511
36	Lewis, R.R., 2000. Ecologically based goal setting in mangrove forest and tidal marsh restoration. Ecol. Eng. 15, 191–198. doi:10.1016/S0925-8574(00)00070-7
37	Lewis, D.M., Phiri, A., 2003. Wildlife snaring–an indicator of community response to a community-based conservation project. Oryx 32, 111–121.
38	Lilieholm, R.J., Weatherly, W.P., 2010. Kibale forest wild coffee: Challenges to market-based conservation in Africa. Conserv. Biol. 24, 924–930. doi:10.1111/j.1523-1739.2010.01527.x
39	Lindenmayer, D.B., Wood, J.T., McBurney, L., MacGregor, C., Youngentob, K., Banks, S.C., 2011. How to make a common species rare: A case against conservation complacency. Biol. Conserv. 144, 1663–1672. doi:10.1016/j.biocon.2011.02.022
40	Linkie, M., Smith, R.J., Zhu, Y., Martyr, D.J., Suedmeyer, B., Pramono, J., Leader-Williams, N., 2008. Evaluating biodiversity conservation around a large Sumatran protected area. Conserv. Biol. 22, 683–690. doi:10.1111/j.1523-1739.2008.00906.x

41	Mahanty, S., Russell, D., 2002. High stakes: Lessons from stakeholder groups in the biodiversity conservation network. Soc. Nat. Resour. 15, 179–188. doi:10.1080/089419202753403346
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Table C2. Countries of final selection of articles (n<59 because articles may discuss more than one country).

Country of project(s)	Count (n=71)	Frequency (% of n)
USA	10	14%
Tanzania	6	8%
Indonesia	5	7%
South Africa	4	6%
Madagascar	4	6%
Canada	3	4%
Mexico	3	4%
Australia	3	4%
Philippines	3	4%
Nepal	3	4%
Zimbabwe	2	3%
Malawi	2	3%
Zambia	2	3%
Uganda	2	3%
Brazil	2	3%
Vietnam	1	1%
Ecuador	1	1%
UK	1	1%
Ukraine	1	1%
Argentina	1	1%
Chile	1	1%
India	1	1%
Columbia	1	1%
Dominican Republic	1	1%
Namibia	1	1%
Nicaragua	1	1%
Czech Republic	1	1%
Kenya	1	1%
Borneo	1	1%
Honduras	1	1%
Bahamas	1	1%
Solomon Islands	1	1%

Table C3. Topic areas of final selection of articles

Topic	Count (n=59)	Frequency (% of n)
Conservation and development	22	38%
Protected area management	9	15%
Marine protected area management	9	15%
Species management	9	15%
Forest management	4	7%
Land use planning	2	3%
Human wildlife conflict	2	3%
Restoration project management	1	2%
Alien plant management	1	2%

Table C4. Journals of final selection of articles.

Journal	Count (n=59)	Frequency (% of n)
Conservation Biology	7	12%
Environmental Conservation	6	10%
Biological Conservation	5	8%
Marine Policy	4	7%
Society & Natural Resources	4	7%
Ecology and Society	3	5%
Conservation and Society	3	5%
Oryx	3	5%
Biodiversity and Conservation	2	3%
World Development	2	3%
Wildlife Society Bulletin	1	2%
Geoforum	1	2%
The Wildlife Professional	1	2%
Ecological Applications	1	2%
International Journal of Sustainable Development and World Ecology	1	2%
European Journal of Wildlife Research	1	2%
Ecosystems	1	2%
Development and Change	1	2%
Coastal Management	1	2%
The Rangeland Journal	1	2%
Animal Conservation	1	2%
Science	1	2%
African Journal of Ecology	1	2%
Ecological Engineering	1	2%
Restoration Ecology	1	2%
Journal for Nature Conservation	1	2%
Tropical Conservation Science	1	2%
Journal of Agricultural & Environmental Ethics	1	2%
Conservation Letters	1	2%
Journal of Coastal Conservation	1	2%

Appendix D. Chapter Four supplementary material

Table D1. List of questions presented to pilot study participants (n=23) to elicit behavioral, normative, and control beliefs to create TPB questionnaire.

Behavioral:

What do you believe are the *advantages* of your engaging in learning from failure behaviors in the forthcoming month?

What do you believe are the *disadvantages* of your engaging in learning from failure behaviors in the forthcoming month?

Is there anything else you associate with your engaging in learning from failure behaviors in the forthcoming month?

Normative:

Are there any individuals or groups who would *approve* of your engaging in learning from failure behaviors in the forthcoming month?

Are there any individuals or groups who would *disapprove* of your engaging in learning from failure behaviors in the forthcoming month?

Are there any other individuals or groups who come to mind when you think about engaging in learning from failure behaviors in the forthcoming month?

Control factors:

What factors or circumstances would *enable* you to engage in learning from failure behaviors in the forthcoming month?

What factors or circumstances would make it *difficult or impossible* for you to engage in learning from failure behaviors in the forthcoming month?

Are there any other issues that come to mind when you think about the difficulty of engaging in learning from failure behaviors in the forthcoming month?

Fig. D1. Participant information sheet and informed consent.

Imperial College
London

Participant Information Sheet

Title of Project:

Learning from Failure: Individual and Team Psychological Dimensions and Learning Processes

Introduction

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

To investigate the motivations for conservation professionals to learn from the experience of failure.

Why have I been chosen?

You have replied to the advert for this study and satisfy the criteria for participating. We believe your participation can provide us with useful information about these problems.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not disadvantage you in any way.

What are the possible benefits of taking part?

Taking part is of no direct benefit to you. The information we get from this study will be used to refine further research.

Will my taking part in this study be kept confidential?

All information that is collected about you and the responses you give during the course of the research will be kept strictly confidential and reported anonymously.

What will happen to the results of the research study?

The results of this study are likely to be published in scientific journals. You may request a copy of the published results if you wish. No personally identifiable information will be published.

Contact for further information

Dr. Andrew Knight
Email: andrew.knight1@imperial.ac.uk

Allison Catalano
a.catalano16@imperial.ac.uk

Imperial College
London

INFORMED CONSENT FORM

Title of Project:

Learning from Failure: Individual and Team Psychological Dimensions and Learning Processes

Name of researcher(s): Allison Catalano and Dr. Andrew Knight

Pease each initial box

1. I confirm that I have read and understood the participant information sheet dated ..... for the above study. I may keep this information sheet for my records and I have had the opportunity to ask questions which have been answered fully. ☐

2. I understand that my participation is voluntary and I am free to withdraw, without giving any reason and without being penalised or disadvantaged in any way. ☐

3. I understand that sections of my recorded comments and transcript text may be looked at by responsible individuals from Imperial College London. I give permission for these individuals to access this data as relevant to this and future research. ☐

4. I am willing to have this interview/focus group audio/video recorded. ☐

5. I understand that this consent form will be kept separate from the data and that the researchers will maintain my anonymity throughout the project, including in publication. ☐

6. I agree to take part in the above study. ☐

_____	_____	_____
Name of Participant (Printed)	**Date**	**Signature**
_____	_____	_____
Name of Researcher (Printed)	**Date**	**Signature**

1 copy for subject; 1 copy for researcher

Table D1. Age of questionnaire respondents *(n=146)*

Age groups *(range=21-74)*	% of total
21-25	11.0%
26-35	29.5%
36-45	23.3%
46-55	16.4%
56-65	10.3%
66-74	6.8%
Not stated	2.7%

Table D2. Nationalities represented in the questionnaire responses *(n=146)*

Nationality	% of total
American	31.5%
Australian	11.6%
British	23.3%
Benin	0.7%
Brazilian	0.7%
Bulgarian	0.7%
Canadian	2.7%
Chilean	0.7%
Colombian	0.7%
Dutch	1.4%
German	1.4%
Ghanaian	0.7%
Irish	0.7%
Italian	1.4%
Japanese	0.7%
Kenyan	2.1%
Mauritian	0.7%
Mexican	0.7%
Namibian	0.7%
New Zealand	0.7%
Nigerian	0.7%
Portuguese	0.7%
South African	11.6%
Spanish	0.7%
Uruguay	0.7%
Not stated	2.1%

Table D3. Length of respondents' years at their organizations *(n=146).*

Years	% of total
<1 to 10	65.1%
11-20	18.5%
21-36	8.2%
Not stated	8.2%

Table D4. Length of respondents' years in conservation *(n=146).*

Years	% of total
<1 to 10	43.2%
11-20	23.3%
21-30	17.8%
31-40	4.8%
41-50	4.1%
Not stated	6.8%

Table D5. Main focus of respondents' work *(n=146).*

Focus	% of respondents*
Conservation implementation working primarily to protect or manage species	64.4%
Conservation implementation working primarily to protect or manage land or water.	56.8%
Education, including formal education settings, workshops or training to build stakeholder or practitioner capacity, or raising public environmental awareness.	44.5%
Funding, fundraising or marketing conservation activities.	20.5%
Development or implementation of law and policy, including work with government agencies at all levels, private sector standards and codes, voluntary standards, and compliance and enforcement.	20.5%
Development or implementation of livelihood, economic, and other incentives, including developing enterprises directly dependent on natural resources (such as ecotourism) and using market mechanisms to change behaviors and attitudes (such as certification).	6.8%
Other	14.4%

* Percentage does not total to 100% because respondents could select more than one main focus of their work.

Table D6. Computation of achieved power given sample size, α = .05, and effect size.

To check whether our insignificant results were due to a lack of statistical power, and given our small sample size, we used G*Power 3.1 (Erdfelder et al. 2009) to conduct an achieved power analysis. This also provides the sample sizes required to detect significance at the .05 level at varying effect sizes.

For the given sample sizes for each of the MANOVA belief measures and their respective number of response variables (DVs), our sample was sufficiently powered to detect large sample sizes. At 80% power and assuming the same other parameters, detection of a medium effect (f^2 = .06) (Cohen 1988; Koran 2016) for behavioral beliefs, normative beliefs, and control beliefs required sample sizes of 290, 270, and 300, respectively.

For the hierarchical regression, we conducted achieved power analyses for each step of the regression model as well the full regression model that includes the 2-way interactions. For the full model at a sample size of 124, we achieved 77% power to detect a medium effect size (f^2 = .15), given thirteen predictors and α = .05. This is below the generally accepted minimum level of 80% power (Cohen 1988). At 80% power and assuming the same other parameters, detection of a large effect (f^2 = .35) required a sample size of 64, whereas detection of a small effect (f^2 = .02) required a sample size of 904. Our sample size of n=124 therefore is likely to detect a medium effect, but does not approach the level required to detect small effects, as recruiting 904 respondents was not feasible in this project.

Test				Achieved power		
MANOVA	Groups	DVs	Sample size	Small ES* f^2=.01	Medium ES f^2=.06	Large ES f^2=.14
Behavioral beliefs	2	11	143	11%	42%	85%
Normative beliefs	2	9	138	10%	45%	87%
Control beliefs	2	12	141	9%	40%	82%

Sample size required for 80% power for medium effect sizes:	*Behavioral beliefs*	*n=290*
	Normative beliefs	*n=279*
	Control beliefs	*n=300*

Test			Achieved power		
Hierarchical regression	Predictor variables	Sample size	Small ES f^2=.02	Medium ES f^2=.15	Large ES f^2=.35
Step 1	4	124	20%	94%	99%
Step 2	8	124	15%	86%	99%
Step 3	9	124	14%	84%	99%
Step 4 (full model)	13	124	12%	77%	99%
Sample size required for 80% power for all effect sizes for full model:			*n=904*	*n=131*	*n=64*

*Effect size (Cohen 1988)

Appendix E. Chapter Five supplementary material

Table E1. List of introductory interview and focus group questions.

This list was used to generate conversation, and does not represent an exhaustive or exclusive list of questions asked as the interviews and focus groups were conducted in a semi-formal manner to allow participant insights to emerge with minimal guidance.

1. Tell me about what you do. What are your roles and responsibilities?
2. What is your background?
3. If you had to describe to an outsider how conservation as a discipline views failure, what would you say?
4. Do you think that conservation could be said to be effective or not effective at learning from failure? Why or why not?
5. Have you ever worked in an organization that you thought was particularly good at learning from failures, and if so, what made it so?
6. Have you ever been part of a team that encountered setbacks or difficulties when trying to accomplish an objective?
7. What were some of the constraints you either overcame or were unable to overcome (either personally or as a team)?
8. Did your team or your larger organization have any processes in place intended to capture learning either during or after a project?
9. If you could create a culture of learning from failure in conservation, what would it look like?

Table E2. List of open-ended text questions from survey instrument.

Respondents were invited to complete the following four statements in an open-ended text box of unlimited size:

"Conservation is generally effective at learning from failure because…"

"Conservation is generally not effective at learning from failure because…"

"I have another thought about this…"

"Any further thoughts?..."

Table E3. Age of participants (n=267).

Age groups	% of total
21-25	7.8%
26-35	22.5%
36-45	26.0%
46-55	24.4%
56-65	12.8%
66-74	4.7%
Not stated	1.9%

Table E4. Nationalities of respondents *(n=267)*

Nationality	% of total
American	46.1%
British	20.5%
Australian	8.5%
South African	7.8%
Dutch	1.9%
Canadian	1.6%
German	1.6%
Italian	1.2%
Brazilian	0.8%
Chinese	0.8%
Colombian	0.8%
Ethiopian	0.8%
Kenyan	0.8%
Bulgarian	0.4%
Cameroonian	0.4%
Chilean	0.4%
Costarican	0.4%
Egyptian	0.4%
French	0.4%
Guatemalan	0.4%
Indian	0.4%
Indonesian	0.4%
Iranian	0.4%
Irish	0.4%
Israeli	0.4%
Japanese	0.4%
Mexican	0.4%
Namibian	0.4%
Nigerian	0.4%
Pakistani	0.4%
Spanish	0.4%

Table E5. Length of participants' years at their organizations *(n=267)*

Years	% of total
<5	42.5%
5-9	22.8%
10-14	13.1%
15-19	7.7%
20-24	6.9%
25-29	2.7%
30-34	0.8%
35-39	0.4%
Not stated	3.1%

Table E6. Length of participants' years in conservation *(n=267)*

Years	% of total
< 5	10.0%
5-9	18.5%
10-14	17.0%
15-19	10.0%
20-24	14.3%
25-29	11.2%
30-34	8.9%
35-39	3.1%
40-44	1.9%
45-49	1.5%
Not stated	3.5%

Table E7. Type of organization participants work in *(n=267)*

Organization type	% of total*
Local, state/regional, or national government	38.8
Local, state/regional or national NGO	32.6
International NGO	14.7
University	14.0
Consultancy/private sector	8.5
Donor/funding agency	5.0
Research institute	2.7
International agency/Intergovernmental agency (e.g. World Bank, GEF, IUCN, etc)	2.3

* *Total does not equal 100% because participants may work for more than one type of organization.*

Table E8. Main focus of respondents' work *(n=267)*

Focus	% of respondents
Conservation implementation working primarily to protect or manage species	33.9%
Conservation implementation working primarily to protect or manage land or water.	25.5%
Education, including formal education settings, workshops or training to build stakeholder or practitioner capacity, or raising public environmental awareness.	15.2%
Funding, fundraising or marketing conservation activities.	8.5%
Development or implementation of law and policy, including work with government agencies at all levels, private sector standards and codes, voluntary standards, and compliance and enforcement.	4.8%
Development or implementation of livelihood, economic, and other incentives, including developing enterprises directly dependent on natural resources (such as ecotourism) and using market mechanisms to change behaviors and attitudes (such as certification).	2.4%
Other	9.7%

Appendix F. Chapter Six supplementary material

Table F1. A short selection of organizational learning mechanisms that support an individual or team looking to develop and implement their own learning from failure approach.

Mechanism	Description	Examples	Purpose	References
After action reviews/debriefs	A reflective process to allow individuals and teams to discuss performance, identify errors, and develop plan to improve. Can be regular recurrent events or triggered by specific incidents or milestones.	Aircrew debriefing after routine flight (e.g., post-flight debrief) or after each phase of flight (e.g., phased debrief, conducted after take-off once stable at cruising altitude). Medical team debriefing response to emergency (e.g., critical incident debrief).	Provide diagnostic feedback to enhance individual and team performance.	(Ellis & Shpielberg 2003; Ron et al. 2006; Salas et al. 2008b)
Boundary spanning	Externally oriented communication, information gathering, and relationship building activities.	Site visits, conferences, symposiums, cross-functional meetings.	Acquire and exchange information to improve team performance and meet objectives through stimulating the exchange of ideas, considering competing perspectives, scanning the environment for innovation, and negotiating and coordinating activities.	(Ancona & Caldwell 1992; Tyre & Von Hippel 1997; Ellis & Shpielberg 2003; Marrone et al. 2007)
Formal training	Planned learning activities, often with clear objectives and goals, that take place outside the working environment to acquire knowledge and skills to perform work functions.	Examples include: training on psychological safety, de-biasing, or error management processes. Formal training can be in-person or online.	Structure knowledge sharing, measure delivery of information to create baseline of employee knowledge, and communicate organizational values.	(Keith & Frese 2005; Putz et al. 2012; Manuti et al. 2015)

Reflective learning journals	Deliberate articulation and recording of thoughts and ideas that an individual has processed and clarified through the act of writing or otherwise recording.	Journaling can be daily or weekly and can consist of prompts such as: What did I accomplish today? What did I do well? What could I have done better? What decision did I make that needs to be documented? Journaling by healthcare workers reduces stress and combat burnout; Wipro BPO customer service agents journal for 15 minutes at the end of each day to improve task performance.	Contributes to reflection, making sense of complex situations, integration of experience and theory (praxis), improved job performance, greater self-awareness, emotional coping, and analysis of own practice.	(Killion 1999; Cyboran 2005; Di Stefano et al. 2014; Dimitroff et al. 2016; Dimitroff 2018)
Knowledge management tools	Structures to classify, sort, and store information for later retrieval and use.	Database for storing after action reports or lessons learned; intranet webinars; content management systems; decision support systems; data warehousing.	Codify knowledge for later access, counteract 'brain drain' due to employee turnover.	(Garvin 1993; Gold et al. 2001)
Failure sharing	Events, publications, workshops, and other fora designed to communicate failure experiences.	CARE International Learning from Failure reports (http://careevaluations.org/?s=failure); Engineers Without Borders Annual Failure Report (https://www.ewb.ca/wp-content/uploads/2018/08/EWB_FAILURE-REPORT_EN_03-08-2018-pages.pdf); Minneapolis Children's Hospital Patient Safety Steering Committee, a forum to learn from failure; Engineers Without Borders USA Failure Forum (https://www.harvardewb.org/failureforum.html); Conference FailFests and workshops (e.g., NACCB "Never Waste a Good Failure" interactive symposium https://www.xcdsystem.com/scbna/program/P5i9hSN/index.cfm?pgid=3768&sid=43950; IEEE VIS2020 Annual Conference FailFest https://virtual.ieeevis.org/session_w-failfest.html)	Normalize failure, reduce stigma, communicate organizational values and norms, transfer knowledge.	(Cannon & Edmondson 2005; CARE International 2020a)

Storytelling	Sharing of knowledge and experiences through narrative and anecdotes, either written or verbal.	Storytelling workshops; *Approach* magazine to share mishaps in military aviation; DuPont lessons learned narratives (what happened, why, what the corrective action was; circulated to entire company)	Sharing knowledge, communicating social norms, building trust, normalizing failure, testing new ideas, generating psychological safety and emotional connection.	(Sole & Wilson 2002; Bledow et al. 2017)
Failure rewards	Incentives to reduce the stigma of failure, particularly when attempting to innovate.	Proctor and Gamble "Heroic Failure" award; TATA "Dare to Try" award; Adobe "KickStart" ($1000 to test an idea), Eli Lilly "Failure parties".	Reduce fear of failure, encourage innovation, communicate organizational values and social norms, normalize failure, reduces inefficiencies, recognize the role failure plays in success.	(Edmondson 2011; Morgan 2015; Birkinshaw & Haas 2016)

Table F2. Psychological safety scale

Team psychological safety, 7-point scale from “very inaccurate” to “very accurate”.

(R) indicates reverse scoring (Edmondson 1999)

1. If you make a mistake on this team, it is often held against you. (R)
2. Members of this team are able to bring up problems and tough issues.
3. People on this team sometimes reject others for being different. (R)
4. It is safe to take a risk on this team.
5. It is difficult to ask other members of this team for help. (R)
6. No one on this team would deliberately act in a way that undermines my efforts.
7. Working with members of this team, my unique skills and talents are valued and utilized.

Appendix G. Reproduced copy of "Does procrastination promote failure in conservation of extremely small populations? A response to Meek."

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Letter to the Editor

Does procrastination promote failure in conservation of extremely small populations? A response to Meek

Keywords:
Failure
Management
Fear
Psychology
Imperiled species
Endangered

Conservation practitioners face a myriad of challenges when pursuing actions to mitigate threats to biodiversity, including highly time-sensitive threats to species with extremely small populations (ESPs). The complexity of the natural, cultural, political and economic systems in which a given conservation action is situated, exacerbated by varying degrees of uncertainty surrounding the likelihood of preferred outcomes, means that managers routinely face the possibility of failure. We offer a response to Meek et al. (2015) that briefly addresses several concerns with their discussion of the results of a workshop convened to address perceived delays in conservation actions with regard to the management of ESPs. This response is intended not as a rebuttal but rather to promote the appropriate application of social science and encourage robust discussion of the causes of failure in the context of conservation actions.

Participants at the workshop identified a list of important barriers to conservation of ESPs and threatened species in general. One scientifically defensible outcome of this list would have been to use it to generate a theory about why conservation actions are delayed and then test this theory to validate it. However, the authors defined the delayed conservation action as procrastination and then turned to the field of cognitive psychology to look for causes of this presumed procrastination. An incomplete understanding of the relationship between procrastination and the fear of failure was used to link these two concepts. The relationship between procrastination and fear of failure is complex, and correlational studies examining direct links between the two concepts have found the association to be either not significant or weak (Haghbin et al., 2012).

Meek et al. compounded the error of mischaracterizing the strength of the connection between procrastination and fear of failure by fitting workshop findings to only two of five dimensions of one multidimensional fear of failure construct (Haghbin et al., 2012). This selective application is akin to retrofitting the workshop findings to fit the theoretical construct, a reductionist approach undermining rigorous scientific process. Recommendations drawn from such a process should be viewed skeptically.

Finally, Meek et al. ascribed causality where none has been experimentally proven. Causation in the relationship between procrastination and fear of failure is an assumption that has not been tested and any causality inferred by current research should be treated with caution (Haghbin et al., 2012). The study of failure in ESP conservation actions could be a fruitful endeavor with implications for other threatened species, and attempts to introduce new ways of thinking about the causes of failure should be encouraged. However, care must be taken in the use of constructs from other academic disciplines, and scientific rigor must be applied to the analysis. While all procrastination is delay, research has shown that not all delays are procrastination (Pychyl, 2013), and the hasty conclusion that extinctions are the result of manager procrastination could result in unintended offense towards those hardworking professionals the academy professes to want to engage.

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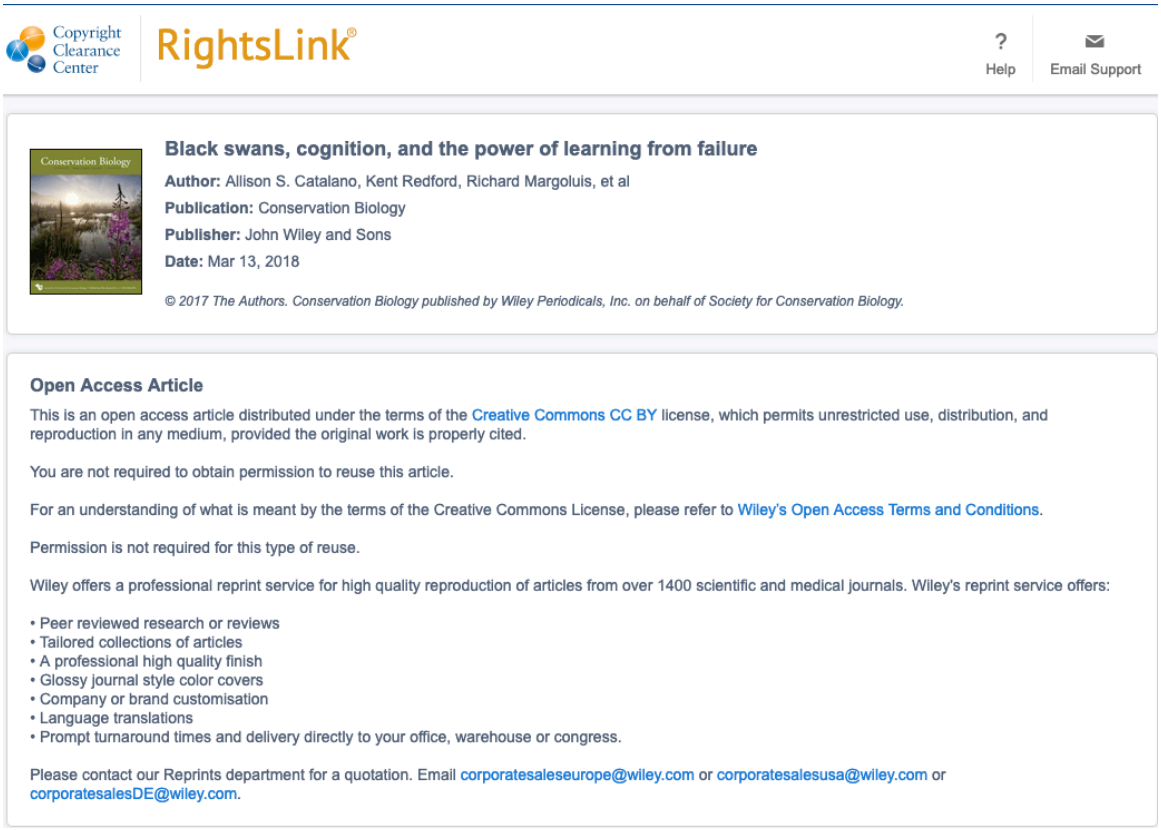
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Black swans, cognition, and the power of learning from failure

Author: Allison S. Catalano, Kent Redford, Richard Margoluis, et al

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Catalano, Allison

Aug 12, 2016, 14:57 EDT

Hello,

I am a PhD student in the Life Sciences Department at Imperial College London preparing my first paper for publication. I am writing about failure in project teams in environmental conservation initiatives. I would like to use the attached image created by Dr. Amy Edmondson in the April 2011 issue of HBR to describe the spectrum of reasons for failure, and introduce this concept to conservation

scientists. I am planning to submit my paper to the journal Conservation Letters. I do not know how to fill out the request form on your website, as I do not have funds to pay for this permission. I wanted to make sure I got permission correctly, as I have not done this before. How should I proceed?

Thank you for any help you can provide,

Allison Catalano

PhD Candidate
Imperial College London

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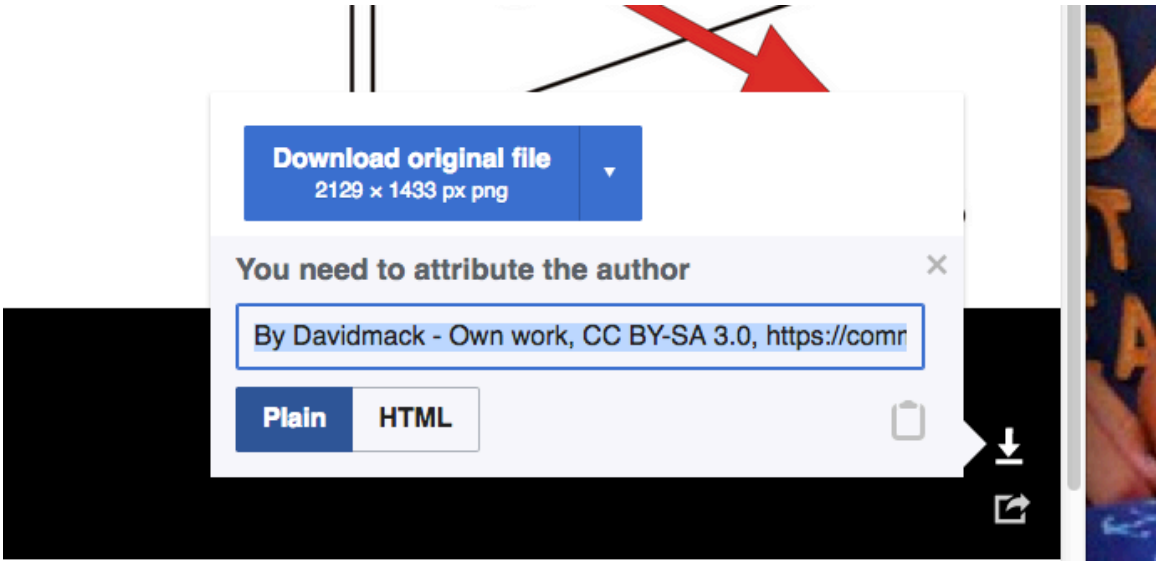
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Thanks, look forward to seeing the paper.

John

Catalano, Allison

jm3@designhacks.co

Sent Items

Hello John,

I recently came across your brilliant codex and would like to ask permission to use it in an academic paper I will shortly be submitting for publication.

I am a PhD student at Imperial College London studying why environmental conservation professionals struggle with learning from failure. A major part of my work deals with trying to overcome cognitive biases that prevent people from effectively looking at failure. I had a very basic, really ugly, really boring list of biases I was going to attach as an appendix, but I think the audience would much prefer to see the beautiful and logical representation you have created.

Would this be OK?

Thank you,

Allison Catalano

PhD Candidate
Imperial College London
Silwood Park Campus, Life Sciences Department