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Foreword

Towards resilience in the Anthropocene: transforming conservation biology through Indigenous perspectives

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Introduction

"*I ola 'oe, i ola mākou nei*" (Hooulumahiehie 1905)
"Through your life, we have life" (translation by authors).

The goddess, Hi'iaka-i-ka-poli-o-Pele, youngest sister of Pele – a well-known deity in Kānaka 'Ōiwi (Indigenous Hawaiian) culture, uttered these words to her beloved forest before she left on an epic journey across the archipelago. The expression acknowledges and honours the existential relationship that Kānaka 'Ōiwi have with forests, which is reflected in the system of Indigenous resource management developed there (e.g. Winter *et al.* 2018*a*; Winter *et al.* 2020*b*). These words are also uttered by some Kānaka 'Ōiwi to trees during the outplanting process for contemporary biocultural restoration projects throughout Hawai'i. Not only are forests being restored, but through such utterances, the relationship between people and forests, and the deep value of forests by communities, is being re-established in the process. Such a deep care of people for biodiversity and habitats is the hope of conservation projects around the world, yet too few have have achieved this relationship between communities and the world around them. It appears that conventional approaches to conservation have much to learn from Indigenous perspectives.

Our description of this *Kānaka 'Ōiwi* (Indigenous Hawaiian) oral narrative is framed within an Indigenous worldview that does not perceive dividing lines between humanity and nature (Gon *et al.* 2021). From these oral narratives stem a rich tapestry of Indigenous language and customs including spiritual and material practices, which collectively embody a worldview that shapes the relationships between the unseen and the seen world (Kealiikanakaoleohaililani *et al.* 2021; Paul *et al.* 2021). This underlying and all-encompassing connectivity (Smith 1999) is the vantage point of this Special Issue, 'Transforming Conservation Biology Through Indigenous Perspectives'. We have begun this Special Issue deliberately situating ourselves within Indigenous worldviews to open a dialogue and to share examples in the context of conservation biology. An approach centred on worldview resonates with many (not necessarily all) Indigenous Peoples worldwide. For example, topics and authors of this Special Issue are drawn from multiple regions including Aotearoa, Australia, Burma, Oceania broadly, and Hawai'i and Tahiti specifically. Each Indigenous nation brings their own nuance to expressions of those worldviews.

For the purposes of this Special Issue, we turn specifically to focus on Indigenous perspectives of the natural world and how these worldviews shape Indigenous People's understandings, relationships, and guardianship (spiritual and physical) of the natural world. For many Indigenous peoples, the natural world is viewed as an ancestor with humans being junior in the descent line. There is a careful curation of these relationships and kinship ties, often intergenerationally. Furthermore, it is important to acknowledge that entering into an Indigenous space can, at times, mean entering into a space where intergenerational trauma – stemming from the historical injustices and institutional racism associated with colonisation – is ever present. As we journey into this space, we do so leading with empathy and compassion, as well as support for those endeavouring to decolonise the field of conservation.

Indigenous Peoples are not alone in feeling some level of connection between themselves and the biodiversity they aim to protect. Conservation biologists and other practitioners in the field of conservation may also experience a relationship with the species and ecosystems they care for, and recognise the interconnectedness of humans and nature, despite lacking an ancestral connection with a particular Place. Even with this commonality of values, Indigenous peoples and conservation biologists have sometimes found themselves on opposite sides of natural resource conflicts. Often at the core of these conflicts are sacred values, or protected values, those that a person finds

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emotionally distressing to trade off against other values due to moral or ethical reasons (Baron and Spranca 1997). Avoiding, ignoring, or minimising these underlying values systems hinders our progress toward achieving shared goals (Hanselmann and Tanner 2008), at a time when collaborative management is critical to solving complex and daunting challenges (Harmon *et al.* 2021). The editors and authors of this special issue represent both Indigenous and non-Indigenous professionals in the field of conservation biology working within Indigenous contexts. We offer this special issue as an effort to build bridges, increase understanding, expand worldviews, identify pathways for collaborative management of our natural resources, and towards more effective conservation efforts.

Working definitions for this Special Issue

There are several terms and phrases that are utilised within this Special Issue – in particular, 'Indigenous Peoples' and 'conservation biologists'. While attempts to homogenise sociocultural groupings on a global scale is fraught, and is not our intention, we have provided working definitions to appropriately juxtapose and contextualise those terms. We recognise that these concepts are socially constructed and the meanings of terms can vary depending upon worldview, use, user, listener, and context, for example.

Indigenous Peoples

Putting discussions of race aside, indigeneity can – as shared by Indigenous philosophers, such as Dr Manulani Aluli Meyer (2008, 2013) – be viewed as a function of longevity in and relationship to Place, along with its associated biodiversity. In this sense, some Places, particularly those that have several, if not tens, of millennia of human history and countless diasporas of Peoples across them, can have many layers of indigeneity. In the context of this Special Issue, however, we look to the United Nations definition of Indigenous Peoples that drew upon a more technical definition offered by Martínez Cobo (1982), but ultimately stated that 'no formal universal definition of the term is necessary, given that a single definition will inevitably be either over- or under-inclusive, making sense in some societies but not in others' (United Nations 2009). However, for all intents and purposes, we apply the term 'Indigenous Peoples' in this Special Issue of *Pacific Conservation Biology*, which is in the context of the Pacific region, to populations of people who had ancestral relationships to Place that were already several centuries if not several millennia old at the point of contact with Euro-American colonisers.

Conservation biology and conservation biologist

Conservation biology was defined by Michael Soulé (1985), one of the 'founding fathers' of the field, as the field of scientific study that 'addresses the biology of species, communities, and ecosystems that are perturbed, either directly or indirectly, by human activities or other agents'. In his foundational paper, 'What is Conservation Biology?' (Soulé 1985), he noted that conservation biology was 'often a crisis discipline', and, importantly, recognised 'the dependence of the biological sciences on social science disciplines'. Further, he noted that 'Today…any recommendations about the location and size of national parks should consider the impact of the park on indigenous peoples [sic] and their cultures…', alongside other concerns. In common with Indigenous communities, practitioners of conservation biology place more weight on 'long-range viability of whole systems and species'. For all intents and purposes, we define a conservation biologist as a practitioner of the discipline of conservation biology as described by Soulé (1985). However, we acknowledge 'Indigenous Peoples' and 'conservation biologist' are not necessarily mutually exclusive categories, and at best there is blurriness in the definitions and delineations between each of these cultural identities and social constructs – both of which continue to evolve over time in response to changes in the social-ecological systems in which they are embedded.

A call to action: the need to transform conservation biology through Indigenous Perspectives

The most pressing issue in conservation biology is the global wave of extinctions and habitat loss that threaten ecosystem functions at both local and regional scales (Barnosky *et al.* 2011). The recognised heroes of, as well as the leading thinkers and actors within conservation biology, have thus far been dominated by those borne out of a neoclassical worldview; yet, after more than four decades of efforts, we have not been able to stem the tide of extinction and habitat loss. We recognise the need for course correction and put forth this Special Issue as a call to action to transform Conservation Biology through Indigenous Perspectives.

The need is a critical one. From our perspective, the dominant thinking and practice of conservation biology has been afflicted by a scarcity mindset that permeates conservation decisions and has become embedded within conservation policy. This has resulted in suboptimal outcomes, including a lack of significant progress toward recovery goals for threatened and endangered species, but more broadly, continuing declines in ecological health and human well-being. We then contrast this worldview with a resilience mindset, exemplified by the worldviews of many Indigenous peoples, in which integrated social-ecological systems sustain vibrant and diverse components. We describe the outcomes that are associated with applying a scarcity mindset to conservation biology, and contrast these with outcomes that are aligned with a resilience mindset.

The problem: a scarcity mindset in conservation biology

'Scarcity mindset' is a mental state where attention is hyper-focused on a limited resource, at the expense of giving attention elsewhere (Shah *et al.* 2012). It is a mindset that plagues the field of conservation biology, which emerged in the latter half of the 1900's from a concern that one in five species was likely to be extinct by the year 2000 (Douglas 1978), but has subsequently lacked funding and other resources to achieve recovery of the majority of listed species (Leonard 2008; Negrón-Ortiz 2014). In the preceding century, American writers such as Aldo Leopold, John Muir and Rachel Carson raised alarms regarding declining wildlife populations and ecosystem degradation, inspiring a protectionist mentality that led to international policy development in regions that were either directly or indirectly under American influence. This approach resulted in myriad

terrestrial and marine protected areas, and a global proliferation of government agencies and private or non-profit organisations dedicated to saving endangered species. Thus, the origins of this field and the subsequent policies and funding structures have resulted in the promulgation of a scarcity mindset in conservation biology, in which our attention is fixated on species in crisis and the limited resources available to save them.

Benefits of a scarcity mindset include a potential increase in creative use of limited resources and increased efficiency over time (Fernbach *et al.* 2015; Mehta and Zhu 2016; Hamilton *et al.* 2019), but scarcity may also lead to chronic feelings of inadequacy, uncertainty, and a lack of control (De Witte *et al.* 2016). With a chronic lack of resources, people are more likely to see all transactions as involving trade-offs, and thus they may miss potential win-win solutions (He *et al.* 2020). A scarcity mindset constrains thinking by encouraging decisions that achieve short-term gains (Griskevicius and Kenrick 2013), rather than long-term resilience. This is embodied in conservation biology by policies and goals focused on avoiding immediate extinction of critically endangered species, rather than expansive thinking that would lead to long-term investments, such as the maintenance of evolutionary potential, ecosystem function and biodiversity (Price *et al.* 2021).

Following a century in which alarms were raised regarding the sixth mass extinction, global climate change, and sea level rise, scarcity mindset has potentially constrained the thinking of many in the field of conservation biology to the point where they have lost the ability to imagine a future in which endangered species have fully recovered to appropriate levels of abundance. Implicit in our behaviour, policies and funding structures is a belief that resources will always be scarce, species will always be endangered, and recovery is an unlikely event.

Further, under a scarcity mindset, efforts to maximise gains for endangered species have ignored or devalued the sociocultural costs associated with conventional conservation strategies (Wilshusen *et al.* 2002; Goldsmith *et al.* 2018). This has been particularly apparent in the development of protected areas, an approach sometimes termed 'fortress conservation', in which minimising human interactions with particular landscapes is deemed necessary for conservation purposes. In the past decade, a number of critiques of a protectionist approach to conservation have emerged (see Dudley *et al.* 2018 for review), not the least of which is the social impact of exclusionary practices, and the existential threat they have posed to Indigenous cultures. A focus on single-objective solutions for biodiversity conservation has separated humans from nature in a process that results in biocultural hysteresis and a loss of meaning and identity (Lyver *et al.* 2019*b*). This narrow focus has compounded the intergenerational trauma that exists in Indigenous communities and potentially excludes innovative solutions for the broader social-ecological system. By framing decision making in terms of trade-offs, in which there are winners and losers, we may miss opportunities to partner across systems and achieve synergistic solutions (Stillman *et al.* 2018).

Under the current trajectory, the conditions which produced a scarcity mindset in the field of conservation biology are unlikely to improve. Increased rates of invasive species introductions and the movement of disease, together with land conversion and other stressors, are intensifying pressures on endangered species and putting further demands on the limited resources available for conservation. As humanity experiences loss and uncertainty associated with a rapidly changing world, there is a growing recognition of solastalgia, as people mourn the environmental changes occurring in the places in which they live (Albrecht *et al.* 2007). While difficult, these emotions tell us when something has meaning, and help us, together with our cognitive functions, to make sense of our role and relationship with the world around us (Masterson *et al.* 2017; Norgaard and Reed 2017). Under a social-ecological systems approach, we recognise that the well-being of humans, more-than-humans, and nature are intertwined (Gon *et al.* 2021; Paul *et al.* 2021; Sato *et al.* 2021). Humans prioritise the conservation of species to which we feel connected (Echeverri *et al.* 2017), but we often lack an understanding of the complex relationships that result in thriving social-ecological systems (Sato *et al.* 2021). Thus, as loss is experienced at the personal, regional, and global scales, we must seek resilience at all of these scales, across social and ecological systems, to thrive in the Anthropocene.

Multi-scale resilience: the key to achieving recovery and abundance

Resilience in social-ecological systems, or the ability to return to an earlier functional state following disruption, is treated in this paper as a product of memory, connectivity, and diversity. In conservation biology, when released from a scarcity mindset, we can think about building multi-scale resiliency into individuals, families, communities, populations and ecosystems through integrating these three components of resilience. We view memory as contributing to resilience by providing a source of material from a past state to which one desires to return. Likewise, we view diversity as facilitating a return to an operational state following disturbance, as the loss of one or several system components is not fatal to system-level function. Finally, we view connectivity as that which facilitates the replenishment or supplementation of components into the system following disturbance.

Oral traditions and the role of memory

Resilient ecosystems contain 'ecological memory', which is in-part provided by seed banks or regenerative material of living organisms (e.g. totipotency in plants), allowing biological communities to reassemble following disturbance, as species adapted to flooding or wildfires emerge from these survivors (Johnstone *et al.* 2016), or islands of communities that remain after a disturbance that re-seed the surrounding areas (e.g. *kīpuka*). However, when ecosystems lose memory, as seed banks or other vestiges of biodiversity are depleted, these systems are more likely to undergo regime shifts following disturbance, rather than returning to a previous functional state (Folke *et al.* 2004).

Similarly, for social-ecological systems to recover following major disruptions, ancestral memory of interconnected relationships and regeneration maintained through written or oral traditions are critical (Aitken *et al.* 2021). There is a careful balance required as well to ensure that those oral traditions are not left 'only' to memory, as often is the case; sometimes those knowledge holders, due to the wider impacts of colonisation, die before that knowledge or memory can be passed on. Restoration

ecologists speak of 'reference systems' or 'reference states' that provide a memory of a past state, or the state one wants to achieve, when implementing restoration actions for degraded ecosystems (Gann *et al.* 2019). We note that, in the field of conservation biology, many people alive today have never personally experienced a state of abundance in the species they are responsible for managing, leaving them to work without an appropriate reference state. Further, given limited funding cycles and the structure of many government and non-profit jobs, people may often move among geographic locations, and lack a long-term relationship with the Place they are responsible for managing. Thus, while we recognise that memory is critical to resilience in both ecological and social systems, the practitioners of conservation biology often lack the memory necessary to achieve recovery and abundance. Indigenous peoples, with ancestral connections to Place, may have repositories of memories that can provide critical reference state information for restoration and conservation planning (e.g. Aitken *et al*. 2021; Bennet-Jones *et al.* 2021; Luat-Hū'eu *et al.* 2021).

We propose that recovery goals in conservation biology will only be achieved by re-imagining a future in which native species are not only present, but fully recovered to appropriate states of abundance. The ancestral memory carried by Indigenous Peoples is born out of living in a Place for countless generations, which facilitates access to memories of abundance. Such memories recall the abundance in landscapes and seascapes as seen in the ancestral past, and the knowledge that human populations can build and maintain such abundance. These ancestral memories can be projected forward in time as a roadmap for the future, one that guides restoration efforts (Harmon *et al.* 2021). An example of this is the Hawaiian proverb, '*I ka wā ma mua ka wā ma hope* (Pukui 1983)', which can be translated as, 'The ancestral past is our future'. This greatly expanded view of time – reflected as far into the future as it is in the past – is necessary to overcome a focus on short-term gains induced by the scarcity mindset and imagine a future in which today's endangered species achieve recovery.

The importance of connectivity

Connectivity within and among ecosystems allows for the movement of biotic and abiotic components into and out of systems to restore function following disturbance (Van Looy *et al.* 2019). This movement is important to maximise genetic diversity and avoid inbreeding, to replenish nutrients or seedbanks that may have been lost to the disturbing agent, and to allow dispersal of components out of the system as well (Bossuyt and Honnay 2008). The exchange of materials into and out of the system allows for the restoration of relationships among microbial, plant, algal and animal communities (Tambosi *et al.* 2014).

Similarly, increased connectivity and network resilience in social components of a social-ecological system allow for the reconstruction of human relationships, as well as culture and governance structures, following disturbance (Winter *et al.* 2018*b*; Winter *et al.* 2020*b*). Further, framing resilience in terms of the social-ecological system helps us to see that culture, governance and ecology are not independent systems, but instead exist in relationship as interwoven subsystems (Berkes 2011).

Conservation biologists often feel a connection with the species and ecosystems they manage, but some come from a worldview founded on a social construct that has created dividing lines between humanity and nature. These arbitrary divisions are reinforced by words such as 'nature', 'wildlife' and 'wilderness', which are words and concepts that do not exist in many Indigenous languages. As a result, some conservation biologists may lack a worldview that would frame this feeling of connection in terms of relationship. Multiple contexts for maintaining relationships with the environment, however, are embedded within Indigenous worldviews (e.g. Lyver *et al.* 2019*a*; Gon *et al.* 2021; Sato *et al.* 2021; Winter *et al.* 2021). In this worldview, conservation actions, simply put, are the practices to maintain and cultivate relationships in multiple layers throughout the social-ecological system, rather than existing apart from everyday life (Ban *et al.* 2019). These relationships with the natural world may increase the feelings of loss and sadness associated with the Anthropocene, but can also provide a framework for resilience and recovery by providing meaning and purpose. In this framework, we not only are caring for nature – the natural world is also caring for us (Comberti *et al.* 2015).

Connectivity in Māori perspectives is often described as *whakapapa*, which is genealogical layering where all living things share a common descent to the primordial beings or through the concept of *whanaungatanga* (kinship). Jackson, Mita and Hakopa (2017) highlight 'the interconnections between *whakapapa*, *whanaungatanga* and kinship' (p. 6) which are described in *Ko Aotearoa tēnei: A report into claims concerning New Zealand law and policy affecting Māori culture and identity*. The 'defining principle is *whanaungatanga*, or kinship. In te ao Māori, all of the myriad elements of creation – the living and the dead, the animate and inanimate – are seen as alive and inter-related. All are infused with *mauri* (that is, a living essence or spirit) and all are related through *whakapapa*. Thus, the sea is not an impersonal thing but the ancestor-god Tangaroa, and from him all fish and reptiles are descended…Every species, every place, every type of rock and stone, every person (living or dead), every god, and every other element of creation is united through this web of common descent, which has its origins in the primordial parents Ranginui (the sky) and Papa-tūā-nuku (the earth)' (Waitangi Tribunal 2011, p. 23).

Diversity

In a stable state preceding disturbance, heterogeneity supports functional diversity by allowing multiple variations of the same theme to coexist within the system (e.g. niche partitioning). This form of diversity increases the likelihood that at least a few species from a given niche will reassemble with complementary species and resume functionality following disturbance (Keppel *et al.* 2012). Diversity increases the resilience of networks, as the disappearance of a single component is not fatal to the system (Folke *et al.* 2004). Diversity in species with key functional roles in communities (e.g. pollination) are particularly crucial to maximising recovery likelihood and avoiding a cascade of secondary extinctions (Folke *et al.* 2010; Fantinato *et al.* 2019).

Critical to achieving transformation in the field of conservation biology is the integration of diverse knowledge systems into

governance, conservation planning and education (e.g. Aitken *et al.* 2021; Belcher *et al.* 2021; Palmer *et al.* 2021; Reihana *et al.* 2021; Winter *et al.* 2021). Collaborations among multiple stakeholders in a social-ecological system often means that there is diversity in roles, knowledge systems, and expertise. Drawing on ecological theory, we suggest that the variety of perspectives from diverse individuals in collaborating organisations and communities may function similar to diversity in biological communities, increasing creativity in problem-solving and allowing people to specialise on particular tasks, or achieve synergy and innovation, leading to resilience.

The contributions of this Special Issue

In this Special Issue we aimed to build bridges among knowledge systems and approaches to conservation biology. The Special Issue editors included two Indigenous guest editors, with extensive experience working to support and integrate Indigenous communities living and working in colonised countries and institutions, and one non-Indigenous editor with experience working to bridge communities and integrate multiple knowledge systems. We would like to acknowledge that working within Indigenous knowledge systems, within non-Indigenous knowledge systems, and at the interface or across the bridge(s), is challenging. These papers offer a dialogue and examples for others to view where there may be synergies within the experiences of others.

Key themes that emerged from the Special Issue included spirituality, Indigenous sovereignty, applications of Indigenous conservation, Indigenous understandings of conservation management and the management of non-native species, and a consideration by non-Indigenous scholars regarding how to be for a Place when one is not Indigenous to that Place.

Samuel M. ‘Ohukani‘ ōhi‘a, III Gon, Kāwika B. Winter and Michael Demotta’s paper offers important positioning in this Special Issue with their paper “KUA–LAKO–MO’O: a methodology for exploring Indigenous conceptualisations of nature and conservation in Hawai‘i” (Gon *et al.* 2021). Their paper describes the term biocultural conservation, ‘that wields the relationships between a culture and the natural world to strengthen conservation efforts’, and highlights the relevance of Indigenous understandings of relationships to the natural world to deities, and how oral histories form an important repository for the ancestral memory of Indigenous Peoples that can transform conservation.

Similarly, Aimee Y. Sato, Tamara Ticktin, Lehua Alapai, Erica I. von Allmen, Wilds P. I. Brawner, Yvonne Y. Carter, Keoki A. Carter, Roberta K. Keakealani, Arthur C. Medeiros and Rakan A. Zahawi in their paper, ‘Biocultural restoration of Hawaiian tropical dry forests’, identified four categories of biocultural measures of success, and demonstrated that, ‘a biocultural approach to restoration can provide purpose and meaning to a person’s relationship to Place’ (Sato *et al.* 2021).

Their work sets the scene for two additional papers which focus specifically on spirituality; arguably one of the most challenging yet important aspects in Indigenous conservation management when brought into conversation alongside non-Indigenous viewpoints and ways of being. Kekuhi Kealiikanakaoleohaililani, Aimee Sato, Christian Giardina, Creighton Litton, Smrity Ramavarapu, Leslie Hutchins, Evelyn Wight, Michelle Clark, Susan Cordell, Kainana Francisco, Heather McMillen, Pua‘ala Pascua and Darcy Yogi’s contribution ‘Increasing conservation capacity by embracing ritual: kuahu as a portal to the sacred’ opens with a, ‘*Pule Ho‘oulu* (prayer for inspiration)’, as a dual ritual to their paper and to their work (Kealiikanakaoleohaililani *et al.* 2021). The specific ‘chant initiates the process of *kuahu*, an altar of Native Hawaiian spiritual practice within *Hālau ‘Ōhi’a*, a ritual-based stewardship program in Hawai‘i led by *kumu* (master teacher, a primary holder and source of knowledge for the community) Kekuhi Kealiikanakaoleohaililani. They ‘describe how kuahu practice can serve as a coparticipant, catalyst, and portal to sacred conservation, allowing learners to engage and grow more personal relationships with the environment, our communities, and ourselves’.

Andrew Paul, Robin Roth and Saw Sha Bwe Moo’s paper ‘Relational ontology and more-than-human agency in Indigenous Karen conservation practice’ centred in the, ‘Karen territory of Kawthoolei, on the border between Thailand and Burma, or Myanmar’, describes the, ‘relations with more-than-human beings, including spirits, constitute environmental governance in Karen communities (Paul *et al.* 2021). These findings compel externally situated conservation biologists to take relational ontologies seriously, allowing local interlocutors’ lived experience, knowledge, and theory to challenge culturally bound concepts such as resources, management, and conservation’. They posit that, ‘in order to transform conservation biology through Indigenous perspectives, it is essential to pay attention to the relational world in which many Indigenous Peoples live. Doing so helps support a conservation practice attentive to the interdependence of all life in ways that uphold Indigenous Peoples’ rights of self-determination, cultural identity, and social relations with their ancestral lands’. This leads into the next group of papers which focus on Indigenous sovereignty.

Indigenous sovereignty is a relevant emergent theme of this Special Issue and three papers focus on different aspects of sovereignty. Tamatoa Bambridge, Paul D’Arcy and Alexander Mawyer’s paper ‘Oceanian Sovereignty: rethinking conservation in a sea of islands’ borrows Tongan philosopher Epeli Hau‘ofa’s title from a 1994 essay ‘Our sea of islands’ (Bambridge *et al.* 2021). The authors ask us to reimagine the ocean and islands within an Oceanian Sovereignty. The authors coin the phrase ‘tidal thinking’ which, ‘refers to Indigenous and local peoples’ fluid responses to current challenges around conservation and sustainable management of island and ocean futures and the linked wellbeing of human and non-human entities within them’.

Kawika Winter, Mehana Blaich Vaughan, Natalie Kurashima, Christian Giardina, Kalani Quiocho, Kevin Chang, Malia Akutagawa, Kamanamaikalani Beamer and Fikret Berkes’ entry entitled ‘Empowering Indigenous agency through community-driven collaborative management to achieve effective conservation: Hawai‘i as an example’ explores the role of Indigenous agency in conservation (Winter *et al.* 2021). Their work provides numerous examples and strategies for partnership and power sharing from Indigenous perspectives.

From an Aotearoa Māori context, Symon Palmer, Ocean Mercier and Alan King-Hunt focus on a Māori understanding of

sovereignty through rangatiratanga in their paper 'Towards rangatiratanga in pest management? Māori perspectives and frameworks on novel biotechnologies in conservation' (Palmer *et al.* 2021). They question whether a social license to operate is in alignment with a Māori approach. Findings from their paper highlight that, '*rangatiratanga* and *tikanga* are underlying considerations for Māori in relation to novel biotechnologies'.

The prior papers set the scene for the emergence of a variety of species-specific applications that are examples of conservation management led through Indigenous perspectives. In their paper entitled, 'Translocation of black foot pāua (*Haliotis iris*) in a customary fishery management area: transformation from top-down management to kaitiakitanga (local guardianship) of a cultural keystone', authors L. Bennett-Jones, G. Gnanalingam, B. Flack, N. Scott, D. Pritchard, H. Moller, and C. Hepburn demonstrate how multiple knowledge sources can be integrated to inform translocation of a culturally-important mollusk (Bennett-Jones *et al.* 2021). Indigenous knowledge was important not only in designing the translocation, but also in interpreting the outcomes of this effort and informing conservation planning for improved decision making.

Kaleonani K. C. Hurley, Maia Sosa Kapur, Margaret Siple, Keli'iahonui Kotubetey, A. Hi'ilei Kawelo and Robert J. Toonen's paper 'A codeveloped management tool to determine harvest limits of introduced mud crabs, *Scylla serrata* (Forskål, 1775), within a Native Hawaiian fishpond' modelled how to sustainably manage this nonnative species (Hurley *et al.* 2021). They utilised, 'Indigenous harvest practices and the mark–recapture study…[to codevelop]…a versatile crab population model that can be tailored to changing management objectives', such as native biodiversity, food security and harvest, or invasive species removal.

Although a number of culturally important nonnative species, such as the mud crab, have been introduced in the past 300 years following an increase in global travel and species introductions, a number of non-native species in the Pacific were carried among islands in voyaging canoes for millennia and thus have longstanding relationships with Indigenous People. For example, *kiore* (*Rattus exulans*, Pacific rat), was introduced to Aotearoa by Māori as a food source. In their article, 'Managing for cultural harvest of a valued introduced species, the Pacific rat (*Rattus exulans*) in Aotearoa New Zealand', authors Priscilla M. Wehi, Deborah J. Wilson, Clive Stone, Hayley Ricardo, Chris Jones, Richard Jakob-Hoff and Phil O'B. Lyver studied a population of *kiore* maintained for cultural use, to determine population health for management purposes (Wehi *et al.* 2021). As most populations of *kiore* in Aotearoa are managed today for extirpation due to impacts on native species, this population is critical to maintain longstanding cultural practices and relationships, and research such as this can inform management practices that balance management of native and non-native species that are all of importance to Indigenous people.

Similarly, the *pua'a* (Polynesian pig, *Sus scrofa*), was brought to the Hawaiian Islands by Polynesian voyagers, and relationships between Indigenous people and this animal reach back millennia. In the paper, 'Understanding the co-evolutionary relationships between Indigenous cultures and non-native species can inform more effective approaches to conservation: the example of pigs (*pua'a*; *Sus scrofa*) in Hawai'i', authors Kūpa'a K. Luat-Hū'eu, Kawika B. Winter, Mehana Blaich Vaughan, Nicolai Barca and Melissa R. Price explore how the relationship between Indigenous people and pigs evolved over time from one of animal husbandry to a hunter-prey relationship as a result of dramatic changes in the social-ecological system in the past 250 years (Luat-Hū'eu *et al.* 2021). Indigenous cultures are living cultures, responding to external and internal changes. Thus, emerging practices in recent centuries are no less Indigenous than those that existed prior to contact with external cultures. Further, an understanding of the historical and present-day relationships with nonnative species can enable critical conversations toward meeting social and ecological goals.

The incorporation of Indigenous knowledge into decision making and education is critical to transforming conservation biology through Indigenous perspectives. Three of the papers in this special issue address this need. In the first, 'Contemporary *Rāhui*: placing Indigenous, conservation, and sustainability sciences in community-led conservation', authors Pauline Fabre, Tamatoa Bambridge, Joachim Claudet, Eleanor Sterling and Alexander Mawyer examine revival of Indigenous practices in two communities in Tahiti regarding aquatic resource management (Fabre *et al.* 2021). Importantly, their results show that local conceptions, perceptions, and expectations differ in meaningful ways, and must be considered prior to and during conservation planning and implementation.

To enable the integration of Indigenous knowledge into decision making, the Ecological State Assessment Tool (ESAT) was, 'developed to assess quantitative scientific data using Māori ecological indicators' (Belcher *et al.* 2021). In their paper, 'Ecological State Assessment Tool (ESAT): a cross-cultural natural resource management tool from Aotearoa, New Zealand', authors Sara M. Belcher, O. Ripeka Mercier, Jeffery P. Foley and Julie Deslippe demonstrate the application of this tool by examining conservation outcomes for a short-tailed bat colony (*Mystacina tuberculata*), *Pekapeka O Puketīī-Piopio* under different management practices. In line with the intentions of this Special Issue, this study demonstrated the central importance of social aspects, alongside ecological aspects, in determining conservation outcomes.

The paper by authors Jodanne G. Aitken, Marcus-Rongowhitiao Shadbolt, James Doherty, Melanie Mark-Shadbolt, Mariella Marzano and James Ataria is entitled 'Empowering the Indigenous voice in a graphical representation of Aotearoa's biocultural heritage (flora and fauna)' (Aitken *et al.* 2021). Their paper explores how to access ancestral memory through graphic art, specifically the coupled decline of biodiversity and linguistic diversity, and the associated decline of language and cultural knowledge. Of particular interest is the Indigenous elders' led development of a resource which depicts the current localised Māori language terms of the flora or fauna that have also been accurately drawn.

'Indigenisation of conservation education in New Zealand', by authors Kiri Reihana, Priscilla Wehi, Nichola Harcourt, Pam Booth, Joanne Murray and Mina Pomare-Pieta explores the development of a bilingual Māori environmental gaming application with youth from Māori centric schools in Aotearoa. They found that 'utilising Māori engagement mediums and mentors that resonate with youth are key to encouraging more Māori

youth into conservation science. Therefore, empowering youth to draw from Indigenous ways of knowing, being and doing can create a step-change in science participation and leadership' (Reihana *et al*. 2021).

The final paper offers a unique addition to this Special Issue with a focus on non-Indigenous understandings of how to approach conservation of a Place as a non-Indigenous person. As previously stated, transformation of conservation management through Indigenous Perspectives does not preclude non-Indigenous peoples nor non-native species. A team of early-career Fellows with the Society for conservation biology were invited to consider what it means to be for a Place, when one is not Indigenous to that Place. Authors Stephanie Borrelle, Jonathan Koch, Kurt Ingeman, Bonnie McGill, Max Lambert, Joan Dudney, Charlotte Chang, Amy Teffer and Grace Wu, in their paper 'What does it mean to be for a Place?', assert, 'that a non-Indigenous conservationist who is *for a Place* advocates for inclusive stewardship with Indigenous Peoples and other marginalised communities to conserve species and ecosystems and the connections that bind communities to their landscapes' (Borrelle *et al.* 2021).

Conclusions

Conservation biology currently suffers from a scarcity mindset, in which we struggle to simply prevent extinction of species, and have lost the ability to imagine recovery of endangered species to appropriate levels of abundance. Indigenous worldviews, practices and knowledge offer the potential to transform conservation biology as a field, and reimagine reference states of abundance to which we can aspire. However, conflicts in conservation biology may arise from opposing worldviews that either place humans as a part of or separate from nature, differential weighting of values among stakeholders including in particular of spirituality, power differentials associated with governance and sovereignty, institutional racism that structurally imbeds the superiority of one worldview over another, and/or intergenerational trauma related to colonisation. Rather than reactive and protective measures to prevent biodiversity loss in the Anthropocene, our vision of the future must be as expansive and interconnected as the challenges we face. Counter-intuitively, in an era high in uncertainty, we must regain the ability to remember the past, and plan for a resilient future. This agenda must include the recovery of Indigenous knowledge, practice and cultural identity which sits in a wider milieu of intergenerational well-being not only of those Places and endangered species, but also of people.

For Indigenous people living in a colonised state, continuing losses in biodiversity and habitats that contribute to a cultural landscape may compound historical grief and intergenerational trauma associated with past losses of language, cultural identity and religious practices (Kingston 2015). The Industrial Era launched complex regime shifts that altered ecosystem function and collapsed social-cultural institutions, resulting in a global economy built on a model of perpetual growth that demands expansion and further consumption (Diaz *et al.* 2019). As biodiversity forms the basis for biocultural diversity, extinctions not only impact ecosystem function, but may also result in losses of components of cultural identity (Winter and McClatchey 2008; Winter *et al.* 2018*b*). Ecological grief is now well-recognised as impacting the mental health of scientists (Cunsolo and Ellis 2018; Conroy 2019). Impacts can be even greater for Indigenous peoples who identify a genealogical or otherwise familial relation to biodiversity and Place.

The success of biodiversity conservation on Indigenous-managed lands demonstrates that biodiversity conservation and human well-being goals can simultaneously be achieved (Frank and Schaeffler 2019; Hartel *et al.* 2020). Historically, due to the existential importance of biodiversity to Indigenous cultures, various methods of protections were placed on biodiversity and habitats via sociocultural institutions within Indigenous societies (Berkes 2018; Winter *et al.* 2020*a*). Today, Indigenous peoples are responsible for more than 25% of the Earth's land (Garnett *et al.* 2018), and a notable portion of coastal and open-ocean waters (e.g. Office of Hawaiian Affairs 2021). Of those that are Indigenous-managed Places, not only is biodiversity of native species maintained (e.g, Uchida and Kamura 2020; Winter *et al.* 2020*b*), they may actually be more species rich than government-designated protected areas (Schuster *et al.* 2019). This suggests that not only Indigenous perspectives, but Indigenous Resource Management philosophies, strategies and practices, along with Indigenous-led governance, are likely crucial to maximising joint outcomes and achieving recovery of endangered species, alongside other social-ecological system goals (Artelle *et al.* 2019; von der Porten *et al.* 2019).

The path that the field of conservation biology has taken in the four decades since its inception into the modern world has not matched the scale of the global crises we are facing, and biodiversity continues to decline at both regional and global scales. To achieve abundance and resilience, it is time to shift our thinking and reframe our vision around memory, connectivity and diversity, integrating multiple knowledge systems and social and ecological values. We have but to look to the Indigenous peoples in the Places we are working to understand practices associated with increasing resilience, and maintaining health and function in the social-ecological systems of their Places.

Epilogue

In this Special Issue we explored areas of potential conflict and commonality, as well as the transformative potential in applying Indigenous perspectives to the field of conservation biology. We paid particular attention to the appropriate inclusion of Indigenous knowledge, perspectives and approaches in conservation scholarship. We recognise that while academia has made some positive gains in relation to Indigenous development in its broadest sense (e.g. language recovery, culture, research, impacts of colonisation, health and well-being), the issues of misappropriation of Indigenous language, culture and worldviews, the lack of representation of Indigenous peoples and voices, and the marginalisation of Indigenous peoples through the systems and structures of the majority, still exist. Throughout the course of undertaking this Special Issue, important ethical questions continually emerged, such as:

- What is the appropriate positioning of Indigenous and non-Indigenous scholars in research?
- What are the appropriate roles of non-Indigenous scholars within Indigenous spaces?

- How do we navigate entangled conversations on intergenerational trauma, anti-racism, white fragility and other related topics?
- Is it appropriate for Indigenous scholars to openly express opinions about how other Indigenous nations choose to engage with researchers?

The emergence of these questions made it clear that this Special Issue exists in the context of an evolving conscientisation and decolonisation process that is currently ongoing in academia.

All of the papers in this Special Issue included Indigenous authorship (authors Indigenous to the Place in which the research was conducted), with the exception of one paper (Borrelle *et al.* 2021), of which all authors were non-Indigenous to the Place (Hawai'i) that led to their perspectives piece. The authors of Borrelle *et al.* 2021, as early-career postdoctoral fellows with the Society for Conservation Biology, were invited to submit non-Indigenous views, via a perspective paper, on how those not from a Place might work for a Place. Following publication of that article, there were concerns raised regarding the lack of Indigenous authorship, as well as potential plagiarism of an Indigenous scholar's tweets. These concerns were handled via a formal process through the journal, following the Committee on Publication Ethics guidelines (COPE 2021), with leadership from experienced Indigenous scholars who have expertise regarding appropriate engagement with Indigenous communities. Subsequently, the authors of Borrelle *et al.* (2021) prepared a Corrigendum, now published, that included references to other influences on their thinking, including three of these tweets.

As co-Editors, we acknowledge that tweets may be cited in published manuscripts in cases where concepts or content are not published elsewhere in peer-reviewed literature, and thus represent leading-edge thoughts in a field. That said, we do not feel that it is appropriate to cite tweets in cases where content is part of common discourse and extensively published upon in peer-reviewed literature. In such cases, peer-reviewed literature provides the appropriate citations. In this case, there are extensive peer-reviewed papers by Indigenous scholars on the topic of how non-Indigenous researchers should engage in Indigenous spaces, which have been published over the past few decades. Any tweets containing similar concepts can be assumed to derive from these sources, as knowledge is shared through formal and informal networks, such as coursework, workshops, conferences and public discourse. Importantly, even when included as citations in peer-reviewed literature, sources such as 'personal communication', social media posts (e.g. tweets), and other non-catalogued forms of information (i.e. grey literature) are not tracked under current citation index metrics. As such, citing social media posts in place of peer-reviewed literature by Indigenous scholars could actually perpetuate inequities, because doing so would detract from their tenure dossiers and other forms of academic metrics for career advancement, which, irrespective of criticism (MacRoberts and MacRoberts 2018), still lean heavily on citation indices to document academic impact. Furthermore, social media posts may be deleted at any time, and are therefore not a permanent form of documentation in the public sphere that are available for others to read and build upon. Thus, the editors of this Special Issue advocate for the submission of both perspectives and research manuscripts on decolonisation and related topics to peer-reviewed journals, to facilitate civil discourse on these topics in a manner that supports Indigenous scholarship and career advancement of Indigenous scholars.

While the intentions of this Special Issue were to take a significant step towards decolonising the field of conservation biology for the betterment of Indigenous Peoples, recovery of biodiversity and for the advancement of emerging scholars, it is clear that some people experienced emotional duress in the process. For some, one of the perspective pieces within this Special Issue re-opened the wounds of intergenerational trauma; for others, the ensuing dialogue on social media led to a slandering of their professional reputations. For the role that this Special Issue played in that reality, for those that have been adversely affected, we (the co-editors of this Special Issue) apologise.

To the Indigenous communities named in the Borrelle *et al.* (2021) paper, we note that Borrelle *et al*. had the support and consent of the Indigenous people whom they worked with as they developed and published the manuscript. We respect the autonomy of Indigenous communities to self-determine who they work with, and, therefore, who may speak with, about and for them. We apologise for any encroachment into your self-determination that may have occurred from other people's speaking on your behalf through the subsequent processes that occurred on social media regarding this paper. It is not up to others, either Indigenous or non-Indigenous, to determine who works in your communities.

To the complainant, while the formal review process found that plagiarism did not occur, we apologise that you have experienced harm and continue to experience harm, through the wider context of this paper and the deliberation process. While our views differ on plagiarism, our views do not differ in common goals of Indigenous self-determination.

To the non-Indigenous authors of the Borrelle et al. (2021) paper, including those who removed their names from the corrigenda, we apologise for the harm you have experienced and are continuing to experience through this process. Non-Indigenous voices are an important part of the conversation in this Special Issue; and we value the perspectives of all people on these topics.

Conflict and discomfort are commonplace during decolonisation processes, part of the reality of working with communities that have experienced intergenerational trauma caused by authoritative structures of colonisation (e.g. educational institutions, governments). Furthermore, many Indigenous people have emigrated away from their ancestral lands to escape violence, or have been forced to move away from their ancestral territories against their will (e.g. slavery), ultimately becoming ethnic or cultural minorities in other lands. These peoples collectively represent historically marginalised groups, who have all experienced intergenerational trauma via various forms of institutionalised racism. Acknowledging the shared experience of intergenerational trauma between Indigenous Peoples and non-Indigenous minorities is necessary for healing at both individual and community scales. We must do so if we are to achieve success as we work together toward common goals, such as biodiversity conservation. It is our hope that through the

work we do as Indigenous and non-Indigenous communities, we can address issues of social- and environmental justice so that future generations do not continue to experience these patterns of intergenerational trauma.

Institutional racism is real, rampant and repugnant. We are thankful for global efforts to improve systems, root out the causes of institutional racism and do better moving forward. Special Issues such as this one on Transforming Conservation Biology Through Indigenous Perspectives, led by a team of which the majority are Indigenous scholars, containing 17 papers in which all but one included Indigenous authorship, and with a goal of ensuring fair review of Indigenous scholarship and ideas, are part of these efforts to increase visibility of Indigenous scholarship, while challenging those in historically racist fields, such as conservation biology, to wrestle with how we can do better. We wish to express our deep appreciation to the authors and reviewers for their service toward achieving this future.

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