



Connecting Science to Indigenous Knowledge: kaitiakitanga, conservation, and resource management

Tara McAllister^{1,2*} , Daniel Hikuroa^{3,4,5}  and Cate Macinnis-Ng^{3,6} 

¹Centre for Science in Society, Te Herenga Waka | Victoria University of Wellington

²Te Aitanga a Māhaki

³Te Pūnaha Matatini, Waipapa Taumata Rau | University of Auckland, Private Bag 92019 Auckland 1142, New Zealand

⁴Te Wānanga o Waipapa, Waipapa Taumata Rau | University of Auckland

⁵Ngāti Maniapoto, Waikato-Tainui, Ngaati Whanaunga

⁶School of Biological Sciences, Waipapa Taumata Rau | University of Auckland

*Author for correspondence (Email: tara.mcallister@vuw.ac.nz)

Published online: 31 March 2023

Abstract: Indigenous Knowledge (IK) provides effective solutions to environmental threats and pressures. Using approaches that fully include Indigenous concepts, ideas, worldviews, knowledge, process, and practice helps the recovery of threatened species and endangered ecosystems, but it is essential that such work engages with Indigenous Peoples and that engagement is respectful, reciprocal, and meaningful. We support using mātauranga (Māori knowledge, culture, values, and worldview) alongside science, because incorporating socio-cultural perspectives and initiatives allows sustainability to be addressed in a more holistic way. This collaborative group of Māori and Pākehā researchers brings a range of perspectives and expertise to the challenge of working at the interface of IK and science, and practices of conservation and resource management. In developing a deeper understanding of kaitiakitanga, which is often translated as “guardianship”, “stewardship”, or the “principle and practices of intergenerational sustainability”, when working in partnership with Māori, Western-trained scientists can meaningfully acknowledge Māori values, knowledge, process, and practice in their work. This enhanced consideration of kaitiakitanga requires bringing together intricately linked concepts such as whakapapa, rangatiratanga, mana, mauri, tapu, noa, and manaakitanga. In this paper, we aim to guide Western-trained scientists and other practitioners in understanding kaitiakitanga so that they can meaningfully engage through an enhanced understanding of Māori worldviews, knowledge, process, and practice. We also aim to highlight the synergies and differences between kaitiakitanga and conservation and resource management, whilst providing examples of how kaitiakitanga can be used to enhance conservation for holistic sustainability outcomes. We emphasise the benefits and importance of working with Māori communities for long-term partnerships based on mutual trust and respect.

Keywords: conservation, decolonisation, Indigenous Knowledge, kaitiakitanga, mātauranga

Introduction: Indigenous knowledge and conservation in Aotearoa New Zealand

Aotearoa New Zealand’s already stressed natural environment is facing increasing threats and pressures (Brown et al. 2015; Norton et al. 2016; Ministry for the Environment & StatsNZ 2022). Invasive species, destructive fishing practices, extractive industries, a changing climate, and intensification of agriculture are examples of processes that are causing ongoing environmental degradation (Brake and Peart 2015; Clarkson et al. 2015; OECD 2017; Macinnis-Ng et al. 2021; Ministry for the Environment & StatsNZ 2022). We need to acknowledge customary ways to conserve threatened species and endangered ecosystems and enact resource management because the current methods and/or their implementation often exclude Indigenous peoples (e.g. Ruru et al. 2017). Using mātauranga (Māori

knowledge, culture, values, and worldview) alongside science is an effective way forward, as weaving multiple knowledge-systems, socio-cultural perspectives and initiatives allows sustainability to be addressed in a more holistic way (Lyver et al. 2018; Marques et al. 2019; Hill et al. 2021).

Indigenous practices of ecosystem management across the globe include a range of tools such as resource management and landscape patchiness incorporated with social dimensions of intergenerational knowledge transmission and the development of specific world views and cultural practices (Berkes et al. 2000). The global review by Berkes et al. (2000) draws parallels between adaptive management and Indigenous approaches because they include feedback learning and evolving understanding of dynamic systems. Recognition of the value of Indigenous Knowledge (IK), which emerges from a worldview that sees the people and the

knowledge as being of the land, is growing in the international literatures of ecology and conservation with key papers like Berkes et al. (2000) receiving over 5000 citations. Alternative perspectives and highly detailed local knowledge combined with social mechanisms and customary practices in tune with environmental and ecological processes are key aspects of Traditional Ecological Knowledge (TEK; Berkes et al. 2000; Wehi et al. 2019). Although TEK is a subset of IK and is now widely acknowledged as an empirically sound and rich resource for community-based resource management (Lauer 2017), it has also been critiqued, because as conventionally practiced it can colonise IK by removing it from its cultural context and applying it within non-Indigenous management plans (McGregor 2004). So, despite having strong alignment with the definition of TEK in Berkes et al. (2000) we find the term Indigenous Knowledge better captures the evolving nature of modern Indigenous knowledges and remains consistent with ever-growing insights and expertise. In response to the bi-cultural approach being undertaken in Aotearoa New Zealand we use IK in general, otherwise mātauranga – the knowledge, culture, values, world view, process and practice of Māori, the Indigenous peoples of Aotearoa New Zealand. Therein bi-cultural approaches to conservation that include frameworks for effective collaboration and prevent cultural appropriation can empower local communities to build strong societal relationships with the natural world while addressing declines in biological and cultural well-being (Lyver & Tylanakis 2017; Lyver et al. 2018, 2019; McAllister et al. 2019; Wehi et al. 2019). While excellent examples of collaborative research are becoming more common (Clapcott et al. 2018; McAllister et al. 2019), globally and nationally many ecologists and conservation biologists continue to operate entirely independently of IK and fail to recognise the global importance of Indigenous lands for conservation (Garnett et al. 2018). For instance, Norton et al.'s (2018) paper on restoration of native biodiversity in Aotearoa only mentioned Māori as a relevant community group, failing to acknowledge the role Māori should play in restoration (Ruru 2004).

In this review and synthesis, we explore kaitiakitanga, a key Māori concept informed by IK and often linked with conservation, and aim to give Western-trained scientists (acknowledging that Western science also marginalises Eastern cultures; Memmi 2019) and practitioners a better understanding of what kaitiakitanga is beyond (mis)interpretations of “guardianship” or “stewardship”. We also explore some synergies and dichotomies between kaitiakitanga and conservation and highlight some recent examples of co-developed research and monitoring projects. While we specifically discuss Māori worldviews and their relevance to Aotearoa New Zealand in this paper, we believe scientists across the world would benefit from being aware of these concepts because of the similarities and connectedness of many IKs. In addition, indigenising conservation policy is essential globally because colonial conservation ideologies perpetuate injustices to Indigenous human rights to the detriment of human and environmental well-being (Domínguez & Luoma 2020).

In our broad definition of conservation, we include threatened species recovery, protection of endangered ecosystems, and sustainable resource management. While these three areas are traditionally seen as siloed areas of work, each is clearly tightly interwoven and using a holistic and inclusive understanding of these concepts (consistent with te ao Māori), is essential for effective progress in all three fields.

Acknowledging and elevating mātauranga is important in

Aotearoa New Zealand in order to honour Te Tiriti o Waitangi and the Wai 262 claim (Geismar 2013; Houghton 2021; Potter & Māngai 2022). Te Tiriti o Waitangi is New Zealand's founding document: an agreement in both Māori and English languages, made between rangatira, Māori chiefs, and the British Crown. The chiefs signed the Māori language version and significant differences in the intent and meaning of key terms between the Māori and English versions created challenges from the outset, followed by deliberate breaches by successive governments through following decades (Charters & Whare 2017; Mutu 2018; Mutu 2019). Furthermore, the rule of contra proferentem which translates as “interpretation against the draughtsman” and was in use in 1840 (and continues in the present-day) is a contractual interpretation that views that, where a term, promise, or agreement is ambiguous, the meaning that is prioritised is the one that works against the interests of the party (the British Crown) who provided the ambiguous wording to begin with. Therefore, the correct version is Te Tiriti o Waitangi, the reo Māori version (Kwan-Parsons 2021). The Waitangi Tribunal, established in 1975, is a standing commission of inquiry that makes recommendations on claims brought by Māori relating to legislation, policies, actions, or omissions of the Crown that breach the conditions made in Te Tiriti o Waitangi. Settlement of Treaty breaches with a particular iwi (tribe) includes a Crown apology and the transfer of cash and assets to a Post-Settlement Governance Entity. Ataria et al. (2018) explain how the Treaty of Waitangi—English language version—specifically covers lands, estates, forests, fisheries, and other properties and the Wai 262 claim covers Indigenous culture, flora, and fauna consistent with Te Tiriti o Waitangi, the Māori language version. The Treaty settlement era has seen a resurgence and reconnection between the environment and people, which has resulted in cultural concepts, including kaitiakitanga, being incorporated in policy (Resource Management Act 1991) and research (Kawharu 2000; Henwood & Henwood 2011). Furthermore, kaitiakitanga is increasingly being incorporated as a key part of some national funding schemes (National Science Challenges; Sustainable Seas, Our Land and Water) and also in wider scientific discourse (Hikuroa et al. 2011; Dick et al. 2012; McGinnis & Collins 2013). The proliferation of iwi environmental management plans (e.g. Hauraki Māori Trust Board 2012; Mahaanui Kurataiao Ltd 2013; Te Ātiawa ki Whakarongotai Charitable Trust 2019) has also highlighted the importance of kaitiakitanga.

The development, adoption, and implementation of policy frameworks like Vision Mātauranga (MoRST 2005) have incentivised and resulted in increased scientist-initiated engagement with Māori, and in some cases, Māori initiated engagement with scientists. Well-intentioned scientists and practitioners are seeking to incorporate mātauranga, but in our collective experience, a general lack of understanding of kaitiakitanga is thwarting their efforts and runs the risk of cultural appropriation. Here, we highlight the similarities and differences between kaitiakitanga and conservation, and urge non-Māori scientists and practitioners, even if they are working in genuine partnership mana whenua, to refrain from the “we're all kaitiaki now” sentiment, as witnessed by all three authors on many occasions. Ataria et al. (2018) clearly articulate the risks of poor-quality engagement with IK and describe ways forward for mātauranga to enrich contemporary scientific thinking and, globally, Latulippe and Klenk (2020) advocate for Indigenous research leadership to combat this issue.

We have collectively experienced kaitiakitanga becoming a buzzword in Aotearoa New Zealand's scientific and regulatory

community, frequently used by environmental managers and science organisations in Aotearoa New Zealand divorced from its cultural context. Despite the widespread adoption and use of the term *kaitiakitanga* by these organisations and practitioners, a deep and true understanding of its significance and meaning is usually lacking. This has resulted in the widespread belief that *kaitiakitanga* equates with conservation guardianship, and we support the argument put forward by others (Kawharu 2000) that this is an oversimplification of a rich and complex concept and set of practices, from a different worldview. Roberts et al. (1995) suggests that in order to fully understand a cultural concept (and to prevent the misuse of superficially acquired knowledge), such as *kaitiakitanga*, one must first serve an apprenticeship. In this particular case, it means *kaitiakitanga* must be understood within its cultural context, rather than severed from values and related concepts, which ground it within te ao Māori. Similarly, Wehi et al. (2020) describe the philosophical responsibilities of working with *mātauranga*. Here, we aim to guide conservation scientists and practitioners in understanding *kaitiakitanga* so that they can meaningfully engage through an enhanced understanding of the Māori worldview. Despite *kaitiakitanga* not being equivalent with conservation, its widespread use either interchangeably and/or as a proxy for conservation has prompted this article.

Kaitiakitanga misunderstood

Kaitiakitanga is a way of thinking and behaving to achieve spiritual, political, and physical well-being (Kawharu 2000; Marsden 2003; Marsden & Henare 1992). It is the practices informed by centuries of observation of achieving the principle of intergenerational sustainability. It is a way of interacting with the environment, which is based on the relational Māori worldview in which everything in the world derives from the primal parents Ranginui (Sky-father) and Papatūānuku (Earth-mother; Mikaere 2011). It is adaptive and collective decision making that is tailored to local conditions. *Kaitiakitanga* is a principle derived from *tīpuna* (ancestors) and expects that Māori have a reciprocal and balanced relationship with Papatūānuku, whereby people have user privileges, not ownership rights. An aim is to maintain abundant and healthy ecosystems, where the principle is ‘take only enough for what you need’. The aim is further achieved by uninterrupted practices passed down through the generations for various methods, including habitat enhancement, habitat creation, improvements to the quality of stock, re-seeding of strong strains, not harvesting when pregnant/spawning and not harvesting breeding stock (Williams 2006, 2012). Another way Māori managed human interactions with the environment was through methods based around the suspension of harvesting like *rāhui* (discussed below) and *taiāpure* (a fishing ground set aside as a reserve; see Fisheries Act 1996, section 9; Jackson 2008) and consequently were able to manage resources sustainably, adaptively and hence intergenerationally.

The translation of *kaitiakitanga* into one or even multiple English words is both problematic and extremely difficult, particularly because this concept is intricately linked to Māori culture, world view and belief systems. There is often a tendency for the nearest meaning in the dominant culture to be used, which will inevitably not capture the breadth, true meaning, and nature of the concept. Mutu and Rikys (1993) highlight the difficulty of translating concepts when the two cultures have inherently different knowledge systems based on different

worldviews and that subtleties including context may be lost in translation (also Mutu M, unpubl. paper). This challenge is exemplified in the Resource Management Act (1991), where *kaitiakitanga* is incorrectly defined as guardianship and/or stewardship. Guardianship and stewardship cover concepts of protection, supervision or taking care of something but neither word is accurate, nor a comprehensive or useful translation of *kaitiakitanga*. Marsden and Henare (1992) emphasise this: (1) Stewardship is not an appropriate definition since the original English meaning of stewardship is “to guard someone else’s property”, apart from having overtones of a master-servant relationship. Ownership of property in the pre-contact period was a foreign concept.

(2) Further notions and definitions of *kaitiakitanga* that we argue are not entirely accurate can be found in the Fisheries Act (1996) “the exercise of guardianship; and, in relation to any fisheries resources, includes the ethic of stewardship based on the nature of the resources, as exercised by the appropriate *tangata whenua* in accordance with *tikanga Māori*” (Part 1, section 2). Additionally, although *kaitiakitanga* is not explicitly included in the Conservation Act 1987, there is mention of *kaitiaki* in regards to the South Island freshwater fisheries and the *kaitiaki* roles of Ngāi Tahu and other South Island *iwi* over them (section 48(b)), and hence if *kaitiaki* are undertaking their roles, *kaitiakitanga* is taking place. There is some improvement with the Department of Conservation’s *Te Mana o te Taiao - Aotearoa New Zealand Biodiversity Strategy 2020* (DOC 2020), indicating *tangata whenua* should be empowered as *kaitiaki* but resourcing and implementation pathways are still needed for this.

Although the principle and intent behind incorporating Māori concepts in legislation is positive, it is harmful when defined incorrectly, when it wrongly assumes a universality in practice and by *juris prudencia* as it perpetuates mistakes enforced by colonial bodies through wider society. Lyver and Tylianakis (2017) indicate that poorly-defined or restrictive policies risk undermining the connection between Indigenous Peoples and the environment, leading to declining cultural and environmental conditions in the worst cases. We suggest that a broader, holistic definition of the principle of *kaitiakitanga* in legislation and policy is required, but how it is manifested and implemented is determined by *mana whenua* (people who hold authority over a specific area of land which is determined by *whakapapa*), consistent with Lyver et al. (2018). Until these changes are made, scientists and practitioners should behave as if the relevant legislation and policy were appropriately phrased to be truly bi-cultural in intent and implementation.

Defining *kaitiakitanga* in the context of te ao Māori

Kaitiakitanga cannot be understood in isolation from Māori epistemologies because it is integrally linked to many other concepts in te ao Māori such as *whakapapa*, *rangatiratanga*, *mana*, *mauri*, *tapu*, *noa*, and *manaakitanga* (terms discussed below; Harmsworth & Awatere 2013). Some of the tension surrounding the use of this concept by Western-trained scientists and practitioners stems from taking *kaitiakitanga* out of cultural context which inevitably severs fundamental links to te ao Māori, its history, cosmogony, *tikanga* (customs), and language. Loss of the nuance of Māori concepts also stretches to *mātauranga* more broadly. For instance, Wehi et al. (2019)

searched ‘Maori’ and ‘matauranga’ for articles published in the Proceedings of the New Zealand Ecological Society and the New Zealand Journal of Ecology between 1953 and 2018. They identified 111 articles (approximately 13%) used one or both of these terms but on closer inspection, only three of those articles engaged with mātauranga and Māori in a meaningful way (Wehi et al. 2019). The superficial use of Māori concepts in scientific research, perpetuates the colonial nature of how research has been historically conducted on, rather than with, Māori and reinforces the continuing cultural bias in conservation management practices (Lyver et al. 2018). Finally, there is a range of understanding regarding who can be kaitiaki—for some Māori, kaitiaki can never be human, for others only humans can. Being cognisant that there is a range of understandings is therefore critical for those seeking to pursue research or work on this kaupapa.

Whakapapa

Whakapapa is a fundamental and overarching principle that orders all elements within the universe and accordingly from where the rationale for kaitiakitanga stems (Kawharu 2000; Marsden & Henare 1992; Royal 1998). Whakapapa is a way of organising and understanding the world through a distinctly Māori lens (Forster 2019). It is a relational, sequential, and networked system which portrays the genealogical connection among the living world and cosmological domain, through common descent from the primal parents Ranginui and Papatūānuku (Roberts 2013). The first kaitiaki were the children of Ranginui and Papatūānuku (Roberts et al. 1995; Mead 2003). Each had kaitiaki responsibilities for particular components of the natural world (Marsden & Henare 1992). For example, Tāne-mahuta is the atua (deity) and the kaitiaki of forests and all that they contain, and Tangaroa is the atua and kaitiaki of the sea, rivers, lakes, and all that they contain.

Whakapapa locates Māori within an environmental context, linking the intangible to the tangible, and grounds Māori as part of the environment. Just like all other flora and fauna, Māori have user privileges to the bounties of Papatūānuku, but not ownership (Marsden & Henare 1992). Due to whakapapa, Māori also have an obligation to the environment, and how that obligation is defined and manifested is through tikanga. As descendants of Papatūānuku, Māori have an inherited responsibility to protect, sustain and enhance their relationship with Papatūānuku me ōna tamariki (and her children) for the next generation. An understanding of kaitiakitanga begins with whakapapa because everything is connected and related and whakapapa determines kaitiaki responsibilities.

Mātauranga Māori

Mātauranga Māori is described as the epistemological foundations of Māori society and it represents a nexus of Māori knowledge, culture, values, and worldview (Marsden & Henare 1992; Hikuroa 2017; Clapcott et al. 2018; Mercier 2018). Mātauranga Māori grows and develops from the close relationship Māori have with the environment so kaitiakitanga requires a strong grounding in mātauranga ā iwi, mātauranga ā hapū and mātauranga ā whānau (knowledge, culture, values, and worldviews of tribes, groups of families, and families respectively). It is created through lived experiences, empirical research and cause and effect experiments, resulting in a unique IK system that is intricately linked to both the physical and spiritual worlds (Reilly et al. 2018). Mātauranga Māori incorporates the knowledge or understanding of everything

visible and invisible existing in the universe, including present-day, historic, local, and traditional knowledge, systems of knowledge transfer and storage, and Māori goals, aspirations, and issues (Landcare Research 1996; Hikuroa 2017). It is “the unique Māori way of viewing the world, encompassing both traditional knowledge and culture” (Waitangi Tribunal 2011). Mātauranga Māori is the knowledge system which informs kaitiakitanga (Moller et al. 2009) and what actions we take to fulfil our obligations.

Tikanga Māori

Tikanga holds connotations of correctness or a correct way of doing things, through the root word ‘tika’, which means correct, right, just, and fair. Furthermore, tikanga also means, rule, plan, method, custom, and habit (Williams 1971). Similar to many other Māori concepts and principles, tikanga has been insufficiently defined as Māori customary values and practices in legislation (i.e. Resource Management Act 1991). Mead (2003) states that tikanga Māori can also mean the Māori way or doing things according to Māori custom. It is an ethical system of common law and practice that underpins a way of living (Mead 2003; Mikaere 2012). Tikanga Māori has its foundations in mātauranga Māori and is also derived from experiences with the environment. Tikanga serves to protect the wellbeing of all life and represents the connection of the natural and spiritual worlds (Reilly et al. 2018). Tikanga therefore underpins and guides how kaitiakitanga is practiced. Mātauranga is the theory behind tikanga (Mercier 2018) and kaitiakitanga is a manifestation of tikanga practices (Roberts et al. 1995).

Rangatiratanga

Rangatiratanga has many meanings including sovereignty, chieftainship, self-determination, the right to self-governance, and to exercise authority and is another important concept which is intimately linked to kaitiakitanga. Blair (2002) posits that kaitiakitanga is a key dimension of rangatiratanga, hence without rangatiratanga it would be difficult if not impossible to practice kaitiakitanga. In an environmental context, it is described as whānau (family), hapū (sub-tribe), and iwi being sovereign authorities with the right to manage and interact with the environment, as was guaranteed under Te Tiriti o Waitangi under Article Two (Selby et al. 2010). Being able to exercise kaitiakitanga is therefore both an expression and affirmation of rangatiratanga (Jackson et al. 2017).

Mauri

Mauri is another fundamental concept in understanding kaitiakitanga (Morgan 2004). It is a force or energy which binds spiritual and physical realms and is derived from whakapapa (Harmsworth & Awatere 2013). In te ao Māori, all living and non-living things not only have a whakapapa but they also have a mauri (Pere 1982; Marsden 1992). However, mauri can be denigrated through activities which reduce its life-sustaining capacity. For example, the mauri of water can be reduced through pollution from wastewater or land-use activities. McCully Matiu, Ngāti Kahu kaumātua, stated “kaitiaki must ensure that the mauri or life force of their taonga is strong” (p. 167, Matiu & Mutu 2003) and the Hauraki Māori Trust Board (2004) posit that the aim of kaitiakitanga is to restore and enhance mauri. Through kaitiakitanga, mauri can be enhanced which may result in the restoration of an ecosystem, habitat, or species. When rangatiratanga was held by Māori, thriving

mauri was clear evidence of kaitiakitanga, but in contemporary times this could be the manifestation of kaitiakitanga. Lyver et al. (2016) linked measures of mauri with cultural ecosystem services of forest as a way of linking the biological and cultural (biocultural) aspects of environmental management.

Mana

Mana can be loosely translated into English words like prestige, power, authority, spiritual power and can be inherited, earned, and acquired (Mead 2003). From an environmental perspective, Harmsworth and Awatere (p. 275, 2013) define mana as “having control over the management of natural resources”. The physical and spiritual health of Papatūānuku and all that she nourishes reflects the mana and identity of iwi, hapū, and whānau. Mana whenua is a related term which refers to the iwi, hapū, or whānau who has authoritative rights dictated by whakapapa to a certain area of land (Roberts et al. 1995). The ability of mana whenua to provide a hākari (feast) of traditional food for visitors also enhances their mana and demonstrates effective kaitiakitanga (Kirikiri & Nugent 1995). Importantly, whakapapa denotes who holds mana whenua and consequently who can be kaitiaki of a certain area. Some argue that all people can practice kaitiakitanga, but only Māori who are mana whenua can be kaitiaki of their whenua. We caution scientists and others against gifting themselves this role.

Manaakitanga

A central tenet of kaitiakitanga is the reciprocal nature of relationships which is encapsulated within the concept of manaakitanga. It is a key feature of kaitiakitanga which ensures balance and acknowledges that relationships are mutual. Manaakitanga involves practices that nurture and enhance these relationships over time (Bioethics Panel 2019). Papatūānuku provides physical and spiritual sustenance for humans and in return they must protect her and advocate for her long-term survival. Harmsworth and Awatere (2013) emphasise the reciprocal nature of this relationship through the existence of clear links, for Māori, between healthy environments and the spiritual and cultural well-being of people. These sentiments are strongly reflected in this whakatauaikī (ancestral saying) “E rere kau mai te awa nui mai i Te Kāhui Maunga ki Tangaroa. Ko au te awa, ko te awa ko au”—“The great river flows from the mountains to the sea. I am the river, the river is me” (Rangiwaiaata Rangitihī Tahuparae in Wilson 2010). Manaakitanga and, as an extension of it, kaitiakitanga are about assisting and uplifting others because all things are linked through whakapapa and therefore are interdependent (Bioethics Panel 2019).

Tapu and Noa

Tapu denotes the intersection between human and the divine and is indicative of states of prohibition and restriction (Benton et al. 2013). Tapu can be defined as sacred, prohibited, inviolable (Williams 1971), and requiring consideration (Prytz-Johansen 2012). All elements of the natural world have tapu and mauri, and variations in either effect the other. The concept of tapu is closely related to and inseparable from mana and is an important aspect in all tikanga Māori (Mead 2003; Prytz-Johansen 2012). The concept of tapu and associated tikanga were used to control how people behave towards each other and the environment by creating regulation, restrictions, and prohibitions on society to ensure that it flourishes (Roberts et al. 1995). Restrictions associated with tapu are extensions

of the influence used to protect people, places, or objects that are, or may come into contact with, tapu. These restrictions are dynamic and can change with time and the environment as needed (Mead 2003). Tapu and noa are interlinked concepts, which cannot exist in isolation. Noa often refers to the restoration of a balance and tikanga can be used to reduce tapu to a level where it becomes safe (Mead 2003). Rather than being the opposite of tapu, noa is better understood as the reciprocal: free of restriction and balanced (Williams 1971). Kaitiakitanga seeks to achieve a balance between people and the environment, which is conceptualised as tapu and noa (Te Wai-Puanga-Aqua-Rigel 1993; Harmsworth 2002).

An example of kaitiakitanga in practice: Rāhui

Although rāhui are in practice a temporary restriction, they incorporate a nexus of beliefs and concepts that span spiritual, political, social, and environmental dimensions (Kawharu 2018). McCormack (2011) highlights the three interlinked principles in which rāhui are best conceptualised. First, rāhui should be considered as part of a holistic system of tikanga relating to the environment. Second, rāhui have a spiritual dimension, which is linked to protecting the mauri and hence tapu of a resource, person(s), or area. Finally, rāhui are related to social and political control (McCormack 2011). Mead (2003) describes three common types of rāhui, which serve different purposes; a drowning rāhui, a political rāhui, and a conservation rāhui. Rāhui are inextricably linked to tapu and are a mechanism to either separate things that are tapu from those that are noa (e.g. people from an area following a drowning) or enable a taonga that is depleted, and hence mauri is reduced, return to a state of mauri ora and therefore noa (Reilly et al. 2018). Rāhui are a dynamic tool, which can be applied to both extensive and confined areas and be relatively short-lived or last years, being lifted when a state of noa is attained (Mead 2003).

Conservation rāhui are a form of kaitiakitanga tikanga which prohibit people from either harvesting food resources or accessing a particular area (i.e. land or water; Mead 2003) and they express broader rights of mana whenua to exercise kaitiakitanga. It is an effective means of regulating human activities in order to sustain resources, re-balance our relationship with, and ultimately protect Papatūānuku (Wheen & Ruru 2011). Conservation rāhui are often used contemporarily over a depleted or polluted resource or resource area in order to allow the replenishment and revitalisation of its mauri (Kawharu 2000). Rāhui has been used successfully by Māori for centuries (Maxwell & Penetito 2007), but it is important to note that this type of rāhui was traditionally used not only to manage kai (food) but also other taonga including harakeke (flax; Best 1904). A rāhui of this type could be instituted during spawning/breeding seasons for mahinga kai species, when abundances of flora and fauna began to dwindle, to replenish a food resource, or when it was necessary to conserve and enhance supplies of a particular organism for a special occasion (McCormack 2011). Williams (2012) describes Ngāi Tahu examples of resource husbandry including growth and harvest, preparation, distribution, storage, and other management techniques, further noting that “the associated ethic transcended purely economic considerations and became environmental in its focus” (p. 90). Whaanga and

Wehi (2017) highlight the forward-thinking ethos of Māori in the recurring and uniting theme that the use of this form of rāhui was to safeguard resources for use by future generations. Interestingly, kaitiakitanga did not appear in any niupepa Māori (Māori newspapers) which the authors attribute to its use being predominately as a “broader environmental ethos” (Whaanga & Wehi 2017). This also supports Kawharu’s (2000) assertion that kaitiakitanga is a relatively new term.

There are many examples of iwi and hapū asserting their rangatiratanga and kaitiakitanga rights through the implementation of rāhui (see Table 1 for selected examples that demonstrate the range of bio-physical settings, temporal and spatial scales, and the specific restrictions of rāhui). One such example, in 1963, was the implementation of a rāhui by mana whenua of Moutohorā (Whale Island), which was initiated in response to declining kuia abundances (grey-faced petrel, *Pteridroma macroptera gouldi*; Imber 1976. Ngāti Awa, who are mana whenua, expressed an interest to reinstate traditional harvests and in turn revitalise the associated mātauranga and tikanga, if populations could sustain a small customary take (Jones et al. 2015). Jones et al. (2015) used population models in 2012 to posit traditional harvesting could be undertaken sustainably and this resulted in the first harvest of chicks later that year from Moutohorā. Lyver et al. (2015) expanded on this and provided evidence that customary harvest of burrow-nesting seabirds, like kuia, were likely to be effective in sustaining their populations. This is an excellent example of how science can assist kaitiakitanga and enhance the ability of Māori to actively engage with the environment and taonga species. Other examples (covered in Table 1) include rāhui implemented by iwi, hapū and trust boards, covering forests, lakes, beaches, and marine areas and including durations of days to decades, showing that rāhui are widely used but highly specific to local conditions.

What is conservation management?

Conservation biology is the discipline of science concerned with preserving biodiversity. As such, conservation biology includes both pure and applied science (Soulé & Wilcox 1980), but while the field draws on a range of long-established scientific approaches (especially systematics, genetics, ecology, and evolutionary biology), conservation biology was only defined as a scientific discipline in the mid-1980s. The science of conservation was motivated by the conservation movement that includes political and social activists and has a much longer history. Within the conservation movement, perspectives are heavily influenced by personal characteristics such as gender and ethnicity, but Indigenous views are not often prioritised (Sandbrook et al. 2019). Central to conservation biology is the description, understanding of, and protection of biological diversity. Centuries of natural history therefore inform conservation biology. Associated concepts include wilderness protection, sustainable yields, wildlife protection and management, ecological restoration, sustainability, and ecosystem health (Meine 2010). Conservation biology is often seen as being crisis-driven and problem-solving. As the human population has grown, environmental threats and damage have increased, causing declines in ecosystem health and function and increased extinctions (Vitousek et al. 1997). The sixth mass extinction is the global crisis that conservation biology seeks to solve (Shivanna 2020). Modern conservation biology is an interdisciplinary field and includes studies of extinction risk, fragmentation effects, spread of invasive organisms, conservation genetics, global change effects on biodiversity, conservation management, and restoration ecology. Conservation management aims to sustain specific species or biodiversity in general by regulating human activities to minimise negative impacts in certain areas or on certain

Table 1. Examples of rāhui. Note: References are generally main-stream media as this is how rāhui are communicated to the general public, in addition to signs in appropriate locations. Examples were selected to cover a range of mana whenua and reasons.

Mana whenua/ tribal organisation	Rāhui	Take (reason)	Duration	Reference
Ngāti Paoa	Closed one nautical mile around Waiheke	Falling populations of marine life	2 years	Rolleston (2021)
Ngāti Whātua Ōrākei	Close Ōkahu Bay to swimming and mahinga kai	Adjacent urupā was flooded	Days	Horgan (2017)
Te Whānau a Rangiwahakaahu (hapū); Ngāti Wai	Close Rangitapu and Te Wai o Taniwha (Mermaid Pools) Matapouri Bay	Pools and marine life damaged by sunscreen and urine; litter left there.	Indefinite, “several years”, until mauri of taonga restored	Moger (2019)
Ngāti Whakaue ki Maketu and Te Arawa Lakes Trust	Okurei Point, Maketū	Human bones on the beach following landslide.	6 weeks (from 14 January 2019)	Small (2019)
Tūwharetoa Trust Board	Tapuaeharuru Bay, Lake Taupō, and upper reaches of Waikato River	Wastewater (sewerage) spill into the lake.	8 weeks from 5 July–29 August 2019	Rotorua Daily Post (2019)
Ngāti Tūwharetoa	Close upper reaches of Tongariro River	Stop spread of didymo	Days 31 October–November 2007	
Ngāti Awa	Cease collecting kuia from Moutohorā	Falling population	Decades	Jones et al. (2015)
Te Kawerau-a-Maki	Te Wao Nui a Tiriwa (Waitakere forest)	Stop spread of kauri dieback	Indefinite until effective and appropriate research, planning and remedial work is completed to ensure the risks are neutralised or controlled	Lambert et al. (2018), Te Kawerau a Maki (2017)
Te Whānau Moana and Te Rorohuri (hapū); Ngāti Kahū	Maitai Bay south to Waikato Bay	To allow marine life to recover	Years, from 20 December 2017–March 2020	Swannix (2017)

species (Sale et al. 2002).

In Aotearoa New Zealand, the colonial government established conservation in line with European norms, which marginalised Māori rights and responsibilities (Ruru 2004; Lyver et al. 2018). These paradigms continue to manifest globally in a protectionist conservation ethic (Lyver et al. 2018; Hernandez 2022). The Conservation Act (1987) defines conservation as “the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for appreciation and recreational enjoyment by the public, and safe-guarding the options of future generations”. The act further outlines the main mechanism in which conservation is to be achieved which involves setting aside and management of land, which ultimately champions a preservationist philosophy. Section 27A describes Nga Whenua Rahui kawenata as agreements to manage for conservation purposes so as to preserve and protect (1) the natural and historic values of the land; or (2) the spiritual and cultural values which Maori associate with the land.

When and Ruru (2011) also note the use of rāhui in the Fisheries Act 1996 and that there are some important differences between what is meant by rāhui as a legislative construct and rāhui as it was originally intended. These differences include only drawing on one type of rāhui, when as previously mentioned there are three. The authors suggest that the differences may be indicative of the lack of understanding or unwillingness of legislators to create a legislative construct which accurately encompasses what a rāhui is.

Our interpretation of conservation management is that it is an intentional counter-capitalist paradigm that seeks to protect and defend, in the case of the Royal Forest and Bird Protection Society of New Zealand (an independent conservation organisation), for nature’s sake. In contrast, biocultural approaches incorporate both biophysical and socio-cultural components of socio-ecological systems (Lyver et al. 2018). The shift towards including humans within nature has highlighted the need to empower local communities, strengthening the relationship between people and place, a key focus of many IK systems. Lyver et al. (2016) explored key values of a range of conservation partner groups, including Māori communities. There was some commonality among motivations and values of different groups (including personal engagement, connection with people, and place and transfer of knowledge and wisdom), and cross-cultural understanding was an effective lever for local restoration evaluation tools based on economic gains but many of these approaches failed to account for the complex and often intangible values of Māori. Worse, Māori engagement is often bounded by conservation policies designed to preserve flora and fauna rather than centring on the rights and aspirations of Māori to access and use native biodiversity once populations reach sustainable levels (Lyver et al. 2018). Lyver et al. (2018) describe the cultural bias in conservation in Aotearoa New Zealand and we encourage researchers and practitioners to be sensitive to this when engaging with Māori communities and learn about and understand iwi and hapū needs, goals, and aspirations as a first step.

Similarities and differences between kaitiakitanga and conservation management

One of the major dichotomies between values and concepts from te ao Māori, like kaitiakitanga, and the Western conservation

ethic stems from Māori being part of the environment, whereas from a conservation perspective there is a disconnection between people and land. Rather than descending from the land and being an intrinsic part of it as Māori are, a Western approach often seeks to commodify Papatūānuku and her resources. Broadly, conservationists seek to manage nature, whereas through kaitiakitanga Māori seek to manage their relationship with the environment. The intimately bound relationship between Māori and the environment is exemplified through kupu Māori (Māori words) with dual meanings like hapū, whenua, and wai. For example, whenua is a common name for the earth or land, but it also means placenta. Marsden (1992) eloquently explained this as follows: “Just as the foetus is nurtured in the mother’s womb and after the baby’s birth upon her breast, so all life forms are nurtured in the womb and upon the earth’s breast. Man is an integral part therefore of the natural order and recipient of her bounty. He is her son and therefore, as every son has social obligations to fulfill towards his parents, siblings and other members of the whanau so has man an obligation to mother earth and her whanau to promote their welfare and good.”

The Western conservation ethic typically involves the active separation of people from the environment, which is in direct conflict with kaitiakitanga and the Māori conservation ethic. Kirikiri and Nugent (1995) argued that in New Zealand the western conservation movement has a predominately preservationist approach which values the Western perspective of separating humans from the natural environment. In this view, parts of the environment are compartmentalised and set-aside and all human influences, except protection and restoration, are removed. This conservation ethic precludes some important aspects of kaitiakitanga, including the active management ethic of harvesting. To understand kaitiakitanga one must first understand certain aspects and principles of Te Tiriti o Waitangi and address issues of equity and power sharing (Taiepa et al. 1997). Under Article Two of Te Tiriti o Waitangi (1840), Māori ceded their right to govern Aotearoa New Zealand but did not cede their rights and rangatiratanga over their taonga (treasure) and were guaranteed undisturbed possession of their lands, forests, fisheries, and taonga. However, a series of laws enacted since 1862 (e.g. Native Lands Act 1862; Tohunga Suppression Act 1907; Forests Act 1949; Wildlife Act 1953; Reserves Act 1977; Conservation Act 1987; Fisheries Act 1996) have actively prevented Māori from exercising their rights to harvest, which is in direct conflict with the principles of Te Tiriti. This highlights a salient difference between conservation and kaitiakitanga. It illustrates how conservation has alienated Māori from our kin, the environment, for example by severing their links to mahinga kai, food gathering places and practices carried out there, which has resulted in the loss of mātauranga around sustainable harvesting of resources (Kirikiri & Nugent 1995).

Kirikiri and Nugent (1995) provide an excellent example of the “Māori conservation ethic” in the traditional harvest of birds, which was particularly important for the survival of inland iwi, hapū, and whānau. Harvesting was seasonal and only those skilled as hunters were permitted to do so. The methodologies employed to harvest were based on mātauranga collected and adapted over time. Māori had an intimate knowledge of the ecology of birds including their behaviours and feeding habits. Rights to harvest in particular areas were clearly delineated and passed down through generations. There was also a strong spiritual component of harvesting. For example, karakia to appropriate atua (i.e. Tāne-mahuta in

Table 2. Some differences between the concepts underpinning kaitiakitanga and conservation management but see Mace (2014) and Evans (2021) for a review of the ways conservation biology is evolving. Similarly, Bataille et al. (2021) provide specific examples of how landowners and Māori environmental guardians prioritise different values in wetland ecosystem management.

Kaitiakitanga	Western conservation
Not based on intrinsic value; traditionally managing for abundance (i.e. kai)	Based on intrinsic value of each component of the ecosystem
Based on a deep connection with the environment derived by whakapapa	Often driven by concepts of risk management or problem solving to avoid or fix environmental issues that are often caused by humans (such as invasive species)
Explicitly active management, including management of relationship with the environment	Includes a passive management component but can be active (e.g. control of invasive species, relocation of threatened birds to offshore islands, breeding intervention programmes)
Based on Mātauranga Māori	Based on Western science, highly data-driven
Holistic management of a system (ki uta ki tai, from the mountains to the sea)	Compartmentation/ fragmentation of systems, often with a focus on single species, although there has recently been a resurgence of Western conservationists recognising the value of a holistic view.
In te ao Māori, humans are part of the environment and Māori descend from it	Anthropocentric/separatist/preservationist
Has spiritual, inanimate, animate elements	Not spiritual
Entrenched in many core Māori values (i.e. whakapapa, reciprocity, rangatiratanga, mauri etc.)	Can be in conflict with Māori values (i.e. through preventing traditional harvest)
Underpinned by whakapapa and tikanga Māori	Governed by legislation and ownership

this case) and other rituals (e.g. the first bird would be offered back to Tāne) would be performed. Harvests were regulated by tohunga (chosen expert) and rangatira (chiefs) predominantly through the imposition of rāhui and tapu, which resulted in near-absolute compliance.

Through kaitiakitanga, Māori strive to restore the balance between humans and the environment, whereas conservationists often prioritise preservation without intervention as the best way to effectively conserve species and environs. Māori and other Indigenous peoples have frequently emphasised the requirement for conservation to consider management holistically (Posey 1999), this stems from the recognition that everything is connected through whakapapa. Approaches that seek to integrate the interdependencies, interrelationships, and intricacies among environs, rather than fragmenting and compartmentalising, will result in improved conservation outcomes (Selby et al. 2010).

Kaitiakitanga and conservation biology both draw on a range of other concepts and are therefore both complicated and interdisciplinary activities as described above. The similarities between kaitiakitanga and conservation are seemingly more subtle than the differences as detailed in Table 2. Both kaitiakitanga and conservation are environmental ethics which aim to protect both species and environs for future generations. Underlying the concept of kaitiakitanga is the inherited duty of Māori, as descendants of Papatūānuku to enhance, sustain, and to preserve her life-giving and life-sustaining ability. This framing is embodied in the Ngāi Tahu whakataukī “mō tātou, ā, mō kā uri ā muri ake nei” meaning for us, and for our children after us. Similarly, included in the 1987 Conservation Act’s definition of conservation is the statement “safe guarding the options of future generations”. Thus, conservation and kaitiakitanga broadly have the same objective to preserve biota and environs, but significantly diverge on the methods and actions required to achieve it, and on the ultimate ends.

Kaitiakitanga working with conservation

There are growing numbers of successful and respectful codeveloped research and management projects in Aotearoa New Zealand that act as excellent models for scientists and practitioners (including special issues of *The New Zealand Journal of Ecology*, *The New Zealand Journal of Marine and Freshwater Science*, and *New Zealand Science Review* all focusing on mātauranga and science). We highlight some exemplars of conservation-based codeveloped projects in Table 3. There are also a number of ongoing pieces of work in progress, such as the mātauranga-based environmental decision-making framework being developed by the Environmental Protection Authority (EPA) and their Māori partnerships (Jones et al. 2020). With alignment of aspirations, willingness and capability building within the EPA, this process will allow the EPA to use mātauranga as evidence, allowing a more holistic approach to environmental management.

Practitioners working with different types of conservation approaches (e.g. species recovery versus ecosystem restoration) often engage with Māori in different ways (or not at all). We encourage Western-trained scientists to explore the details of the examples in Table 3 as inspiration and a guide. Enduring partnerships built on mutual respect and trust with common values and goals are key to bringing together different knowledge systems and world views in a productive way. Establishing these partnerships can be intimidating and time-consuming but if we approach this with humility, treat Māori communities with esteem (including paying for their time at consultant rates), be open to learning and be considerate of their needs, we can create a powerful cooperative team.

Hei whakakapi (conclusions and opportunities)

Respecting, valuing, and engaging with the Māori concepts that are intimately bound to kaitiakitanga is an essential

Table 3. Recent examples of successful co-developed conservation and resource management. This is not an exhaustive list, but selected examples provide an illustration of a range of approaches for successful collaboration, which overcome many of the issues raised in this paper.

Project type	Who	Key successes	Reference
Participatory processes	Ngāti Pāoa and Waiheke Marine Project	Collaborative mana whenua and community partnership to protect and regenerate Waiheke marine environment. Ngāti Pāoa placed a rāhui, followed by a Section 186A temporary closure.	Rolleston (2021)
Conservation Accord	Department of Conservation and Waikato-Tainui	Collective commitment to the restoration and protection of the health and well-being of the Waikato River for future generations.	Minister of Conservation, Director-General of Conservation, Waikato-Tainui Conservation Accord (2008)
Taiāpure	East Otago Taiāpure	Mana whenua and wider community driven conservation and protection of mahinga kai resources and taonga species. Learning opportunities.	Jackson et al. (2018), Hepburn et al. (2019)
Customary harvest	Te Atiawa and Ngāti Kuia, Marlborough Sounds	Mātauranga increases understanding of historic sooty shearwater harvest, abundance, and management but declining bird numbers have coincided with loss of IK. Long-term conservation management strategy must include relationship between Māori and tīti.	Geary et al. (2019)
Participatory processes	Integrated Kaipara Harbour Management Group	Widespread buy-in and action across the catchment.	Hepi et al. (2018)
Participatory processes	Waikato River Restoration; Maurea Islands Restoration	Physical restoration without using herbicide is achievable.	van Schravendijk-Goodman et al. (2017)
Participatory processes	Te Korowai o te Tai o Marokura	Established several marine protection and sustainable fisheries measures, empowered Te Korowai's co-evolved governance framework.	Kaikoura (Te Tai-o-Marokura), Marine Management Act (2014)
Participatory processes	Zealandia and Taranaki Whānui ki Te Ūpoko o Te Ika, Wellington	Restoration of Kaiwharawhara Stream catchment through the development of a collaborative partnership that respects diverse knowledge systems.	Michel et al. (2019)
Participatory processes	Frog conservation Department of Conservation, Auckland Zoo, Ngāti Peehi, Ngāti Te Kanawa and Te Hau Kainga o Pureora - Waikato	Development of a conservation framework of 'get together, work together, write together' to establish the relationship, learn from each other and share knowledge.	Cisternas et al. (2019)
Participatory processes and engaging youth with the natural world	Curious Minds–Waikato schools Te Wharekura o Maniapoto and Te Wharekura o Rakaumanga	Using digital approaches to enhance cultural practices and increase ecological knowledge in immersion schools	Reihana et al. (2019)
Species translocations	Revival of customary practice to enhance resilience in kēkēwai (freshwater crayfish) and kōwaro (Canterbury mudfish <i>Neochanna burrowsius</i>) populations together with conservation genomics	Indigenous approaches increase resilience of biocultural relationships	Rayne et al. (2020)

part of understanding kaitiakitanga. Kaitiakitanga cannot be understood out of cultural context or in isolation from the many Māori concepts and values that underpin it. Despite the inherent differences between kaitiakitanga and traditional conservation (Table 2), there are some similarities and ways in which the two environmental management ethics can complement each other. The focus of kaitiakitanga on regulation and sustainability of people and natural resources (Clapcott et al. 2018) is a key facet shared with conservation. Rāhui are an example of kaitiakitanga in action, which have

been an effective tool for conservation and management used successfully by Māori for centuries. Their contemporary success, however, is dependent on support from the wider community and environmental managers. Conservation can be enhanced by kaitiakitanga and by the mechanisms which were traditionally used by Māori to manage the environment. Likewise, science can be used to assist Māori in exercising their rights and responsibilities as kaitiaki.

Acknowledgements

We thank Tammy Steeves for thoughtful discussion and extensive feedback during the development of this manuscript. We also thank Leilani Walker for comments on the manuscript. We acknowledge the MBIE Vision Mātauranga Capability Fund and Te Pūnaha Matatini for funding this project. TGM's postdoctoral fellowship was funded by TPM and the VMCF.

Author Contributions

TGM led the conceptualization of this manuscript. TGM, DH, and CMN contributed equally to the writing, reviewing, and editing of this manuscript.

References

- Ataria J, Mark-Shadbolt M, Mead ATP, Prime K, Doherty J, Waiwai J, Ashby T, Lambert S, Garner GO 2018. Whakamanahia Te mātauranga o te Māori: empowering Māori knowledge to support Aotearoa's aquatic biological heritage. *New Zealand Journal of Marine and Freshwater Research* 52(4): 467–486.
- Bataille CY, Malinen SK, Yletyinen J, Scott N, Lyver POB 2021. Relational values provide common ground and expose multi-level constraints to cross-cultural wetland management. *People and Nature* 3(4): 941–960.
- Benton R, Frame A, Meredith P 2013. *Te Mātāpuenga: A compendium of references to the concepts and institutions of Māori customary law*. 1st edn. Wellington, Victoria University Press. 560 p.
- Berkes F, Colding J, Folke C 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10(5): 1251–1262.
- Best E 1904. Notes on the custom of rahui: Its applications and manipulation, and also its supposed powers, its rites, invocation and superstitions. *Journal of the Polynesian Society* 13(2): 83–88.
- Bioethics Panel 2019. *Predator Free New Zealand: Social, cultural, and ethical challenges*. BioHeritage Challenge. 26 p.
- Blair N 2002. Tamaki Kaitiakitanga in the concrete jungle. In: Kawharu M ed. *Whenua: Managing our resources*. Auckland, Reed Books. Pp. 62–74.
- Brake L, Peart R 2015. *Sustainable seas: managing the marine environment*. Auckland, Environmental Defence Society Incorporated. 400 p.
- Brown MA, Stephens RTT, Peart R, Fedder B 2015. *Vanishing nature: Facing New Zealand's biodiversity crisis*. Auckland, Environmental Defence Society Incorporated. 208 p.
- Charters C, Whare T 2017. Shaky foundations: The fundamental flaw at the heart of a "model" treaty involving New Zealand and the Indigenous Māori community. *World Policy Journal* 34(4): 11–14.
- Cisternas J, Wehi PM, Haupokia N, Hughes F, Hughes M, Germano JM, Longnecker N, Bishop PJ 2019. Get together, work together, write together. *New Zealand Journal of Ecology* 43(3): 3392.
- Clapcott J, Ataria J, Hepburn C, Hikuroa D, Jackson AM, Kirikiri R, Williams E 2018. *Mātauranga Māori: shaping marine and freshwater futures*. *New Zealand Journal of Marine and Freshwater Research* 52: 457–466.
- Clarkson B, France-Hudson B, Gumley W, Miller C, Ruru J, Somerville R, Williams M 2015. *Mining. Resource Management Journal 2*.
- Conservation Act 1987. (65) New Zealand Government, Wellington.
- Department of Conservation (DOC) 2020. *Te Mana o te Taiao - Aotearoa New Zealand biodiversity strategy 2020*. Wellington, Department of Conservation. 72 p.
- Dick J, Stephenson J, Kirikiri R, Moller H, Turner R 2012. Listening to the kaitiaki: consequences of the loss of abundance and biodiversity of coastal ecosystems in Aotearoa New Zealand. *MAI Journal* 1: 117–130.
- Domínguez L, Luoma C 2020. Decolonising conservation policy: How colonial land and conservation ideologies persist and perpetuate indigenous injustices at the expense of the environment. *Land* 9(3): 65.
- Evans MC 2021. Re-conceptualizing the role (s) of science in biodiversity conservation. *Environmental Conservation* 48(3): 151–160.
- Fisheries Act 1996. (88) New Zealand Government, Wellington.
- Forster M 2019. *He Tātai Whenua: Environmental genealogies*. *Genealogy* 3(3): 42.
- Garnett ST, Burgess ND, Fa JE, Fernández-Llamazares Á, Molnár Z, Robinson CJ, Watson JE, Zander KK, Austin B, Brondizio ES, Collier NF 2018. A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability* 1(7): 369–374.
- Geary AF, Nelson NJ, Paine G, Mason W, Dunning DL, Corin SE, Ramstad KM 2019. Māori traditional harvest, knowledge and management of sooty shearwaters (*Puffinus griseus*) in the Marlborough Sounds, New Zealand. *New Zealand Journal of Ecology* 43(3): 3384.
- Geismar H 2013. Resisting settler-colonial property relations? The WAI 262 claim and report in Aotearoa New Zealand. *Settler Colonial Studies* 3(2): 230–243.
- Harmsworth G 2002. Indigenous concepts, values and knowledge for sustainable development: New Zealand case studies. 7th Joint Conference on the Preservation of Ancient Cultures and the Globalization Scenario, India November 2002. Hamilton, University of Waikato. 12 p.
- Harmsworth GR, Awatere S 2013. Indigenous Māori knowledge and perspectives of ecosystems. In: Dymond, J. ed. *Ecosystem services in New Zealand—conditions and trends*. Lincoln, Manaaki Whenua Press. Pp. 274–286.
- Hernandez J 2022. *Fresh banana leaves: healing indigenous landscapes through indigenous science*. North Atlantic Books. 256 p.
- Hauraki Māori Trust Board 2012. *Whaia te Mahere Taiao a Hauraki*. Hauraki Iwi Environmental Plan. 54 p.
- Henwood W, Henwood R 2011. *Mana whenua kaitiakitanga in action: Restoring the mauri of Lake Ōmāpere*. *AlterNative: An International Journal of Indigenous Peoples* 7(3): 220–232.
- Hepburn CD, Jackson AM, Pritchard DW, Scott N, Vanderburg PH, Flack B 2019. Challenges to traditional management of connected ecosystems within a fractured regulatory landscape: A case study from southern New Zealand. *Aquatic Conservation: Marine and Freshwater Ecosystems* 29(9): 1535–1546.
- Hepi M, Foote J, Makey L, Badham M, Te Huna A 2018. *Enabling mātauranga-informed management of the*

- Kaipara harbour, Aotearoa New Zealand. *New Zealand Journal of Marine and Freshwater Research* 52(4): 497–510.
- Hikuroa D 2017. Mātauranga Māori—the ūkaipō of knowledge in New Zealand. *Journal of the Royal Society of New Zealand* 47(1): 5–10.
- Hikuroa D, Slade A, Gravley D 2011. Implementing Māori Indigenous knowledge (mātauranga) in a scientific paradigm: Restoring the mauri to Te Kete Poutama. *MAI Review* 3(1): 9.
- Hill R, Díaz S, Pascual U, Stenseke M, Molnár Z, Van Velden J 2021. Nature's contributions to people: Weaving plural perspectives. *One Earth* 4(7): 910–915.
- Horgan L 2017. Rahui imposed after Okahu Bay urupā flooding. *Te Ao Māori News*. <https://www.teaomaori.news/rahui-imposed-after-okahu-bay-urupa-flooding> (Accessed 18 May 2020).
- Houghton J 2021. The New Zealand government's response to the Wai 262 report: the first ten years. *The International Journal of Human Rights* 25(5): 870–893.
- Imber MJ 1976. Breeding biology of the grey-faced petrel *Pterodroma macroptera gouldi* 118(1): 51–64.
- Jackson AM 2008. Towards understanding Indigenous knowledge in environmental management practise: A discursive analysis of the East Otago taiāpure proposal. *MAI Review* 1: Intern Research Report 2.
- Jackson AM, Mita N, Hakopa H 2017. Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment. Report for Ngā Moana Whakauka, Sustainable Seas National Science Challenge. 167 p.
- Jackson AM, Hepburn CD, Flack B 2018. East Otago Taiāpure: sharing the underlying philosophies 26 years on. *New Zealand Journal of Marine and Freshwater Research* 52(4): 577–589.
- Jones CJ, Lyver POB, Davis J, Hughes B, Anderson A, Hohapata-Oke J 2015. Reinstatement of customary seabird harvests after a 50-year moratorium. *The Journal of Wildlife Management* 79(1): 31–38.
- Jones D, Hikuroa D, Gregory E, Ihaka-McLeod H, Moko-Mead TT 2020. Weaving mātauranga into environmental decision-making. *New Zealand Science Review* 76: 49–53.
- Kaikōura (Te Tai o Marokura) Marine Management Act 2014. (59) New Zealand Government, Wellington.
- Kawharu M 2000. Kaitiakitanga: A Maori anthropological perspective of the Maori socio-environmental ethic of resource management. *Journal of the Polynesian Society* 109(4): 349–370.
- Kirikiri, R, Nugent G 1995. Harvesting of New Zealand native birds by Maori. In: Grigg GC, Hale PT, Lunney D eds. *Conservation through sustainable use of wildlife*. Brisbane, University of Queensland. Pp. 54–59.
- Kwan-Parsons I 2021. Applying tikanga Māori in arbitration. *New Zealand Law Review* 2021(2): 249–276.
- Lambert S, Waipara N, Black A, Mark-Shadbolt M, Wood W 2018. Indigenous biosecurity: Māori responses to kauri dieback and myrtle rust in Aotearoa New Zealand. In: Urquhart J, Marzano M, Potter C eds. *The human dimensions of forest and tree health*. Switzerland, Palgrave Macmillan. Pp. 109–137.
- Landcare Research 1996. Definition of mātauranga Māori. <http://www.landcareresearch.co.nz/about/sustainability/voices/matauranga-maori/what-is-matauranga-maori> (Accessed 18 May 2020).
- Latulippe N, Klenk N 2020. Making room and moving over: knowledge co-production, Indigenous knowledge sovereignty and the politics of global environmental change decision-making. *Current Opinion in Environmental Sustainability* 42: 7–14.
- Lauer M 2017. Changing understandings of local knowledge in island environments. *Environmental Conservation* 44(4): 336–347.
- Lyver POB, Tylianakis JM 2017. Indigenous peoples: Conservation paradox. *Science* 357 (6347): 142–143.
- Lyver POB, Jones CJ, Belshaw N, Anderson A, Thompson R, Davis J 2015. Insights to the functional relationships of Māori harvest practices: customary use of a burrowing seabird. *The Journal of Wildlife Management* 79(6): 969–977.
- Lyver POB, Akins A, Phipps H, Kahui V, Towns DR, Moller H 2016. Key biocultural values to guide restoration action and planning in New Zealand. *Restoration Ecology* 24(3): 314–323.
- Lyver POB, Timoti P, Gormley AM, Jones CJ, Richardson SJ, Tahī BL, Greenhalgh S 2017. Key Māori values strengthen the mapping of forest ecosystem services. *Ecosystem services* 27: 92–102.
- Lyver POB, Richardson SJ, Gormley AM, Timoti P, Jones CJ, Tahī BL 2018. Complementarity of indigenous and western scientific approaches for monitoring forest state. *Ecological Applications* 28(7): 1909–1923.
- Lyver POB, Ruru J, Scott N, Tylianakis JM, Arnold J, Malinen SK, Bataille CY, Herse MR, Jones CJ, Gormley AM, Peltzer DA 2019. Building biocultural approaches into Aotearoa–New Zealand's conservation future. *Journal of the Royal Society of New Zealand* 49(3): 394–411.
- Mace GM, 2014. Whose conservation? *Science* 345(6204): 1558–1560.
- Macinnis-Ng C, Mcintosh AR, Monks JM, Waipara N, White RSA, Boudjelas S, Clark CD, Clearwater MJ, Curran TJ, Dickinson KJM, Nelson N, Perry GLW, Richardson SJ, Stanley MC, Peltzer DA 2021. Climate-change impacts exacerbate conservation threats in island systems: New Zealand as a case study. *Frontiers in Ecology and the Environment* 19(4): 216–224.
- Mahaanui Kurataiao Ltd 2013. Mahaanui Iwi Management Plan 2013. <https://www.mkt.co.nz/wp-content/uploads/2016/05/Mahaanui-IMP-web.pdf> (Accessed 20 May 2020).
- Marsden M 2003. *The woven universe: Selected writings of the Rev. Māori Marsden*. Ōtaki, Estate of Rev. Māori Marsden. 187 p.
- Marsden M, Henare TA 1992. *Kaitiakitanga: A definitive introduction to the holistic world view of the Māori*. Wellington, Ministry for the Environment. 21 p.
- Marques B, McIntosh J, Hatton W, Shanahan D 2019. Bicultural landscapes and ecological restoration in the compact city: The case of Zealandia as a sustainable ecosanctuary. *Journal of Landscape Architecture* 14(1): 44–53.
- Matiu M, Mutu M 2003. *Te Whānau Moana. Ngā kaupapa me ngā tikanga. Customs and protocols*. Auckland, Reed Books. 254 p.
- Maxwell KH, Penetito W 2007. How the use of rāhui for protecting taonga has evolved over time. *MAI Review* 2: Intern Research Report.
- McAllister TG, Beggs JR, Ogilvie S, Kirikiri R, Black A, Wehi PM 2019. Kua takoto te mānuka: mātauranga Māori in New Zealand ecology. *New Zealand Journal of Ecology* 43(3): 3393.

- McCormack F 2011. Rāhui: A blunting of teeth. *The Journal of the Polynesian Society* 43–55.
- McGinnis MV, Collins M 2013. A race for marine space: science, values, and aquaculture planning in New Zealand. *Coastal Management* 41(5): 401–419.
- McGregor D 2004. Coming full circle: Indigenous knowledge, environment, and our future. *American Indian Quarterly* 28(3/4): 385–410.
- Mead HM 2003. *Tikanga Māori: Living by Māori values*. Wellington, Huia Publishers. 398 p.
- Meine C 2010. Conservation biology: past and present. *Conservation biology for all* 7–26.
- Memmi D 2019. The relevance for science of Western and Eastern cultures. *AI & Society* 34(3): 599–608.
- Mercier OR 2018. Mātauranga and science. *New Zealand science review* 74(4): 83–90.
- Michel P, Dobson-Waitere A, Hohai H, McEwan A, Shanahan DF 2019. The reconnection between mana whenua and urban freshwaters to restore the mauri/life force of the Kaiwharawhara. *New Zealand Journal of Ecology* 43(3): 3390.
- Mikaere A 2011. Colonising myths - Māori realities: He rukuruku whakaaro. Wellington, Huia. 380 p.
- Mikaere A 2012. Changing the default setting: making trouble to restore tikanga. In: Hutchings J, Mikaere A eds. *Kei Tua o Te Pae Changing worlds, changing tikanga - educating history and the future*. Ōtaki, Te Wānanga o Raukawa. Pp. 25–30.
- Ministry for the Environment & StatsNZ 2022. *New Zealand's environmental reporting series: Environment Aotearoa 2022*.
- Ministry of Research, Science & Technology (MoRST) 2005. *Vision Mātauranga: Unlocking the innovation potential of Māori knowledge, resources and people*. MoRST, Wellington. 28 p.
- Moger L 2019. Rāhui placed on Matapouri mermaid pools, closing them to visitors. *Stuff NZ*. <https://www.stuff.co.nz/travel/112171005/rhui-placed-on-matapouri-mermaid-pools-closing-them-to-visitors> (Accessed 29 May 2020).
- Moller H, O'Blyver P, Bragg C, Newman J, Clucas R, Fletcher D, Kitson J, McKechnie S, Scott D, Rakiura Titi Islands Administering Body 2009. *Guidelines for cross-cultural participatory action research partnerships: A case study of a customary seabird harvest in New Zealand*. *New Zealand Journal of Zoology* 36(3): 211–241.
- Morgan TKKB 2004. A tangata whenua perspective on sustainability using the mauri model. Paper presented at the International Conference on Sustainability Engineering and Science, New Zealand July 2004. 14 p.
- Mutu M 2018. Behind the smoke and mirrors of the Treaty of Waitangi claims settlement process in New Zealand: No prospect for justice and reconciliation for Māori without constitutional transformation. *Journal of Global Ethics* 14(2): 208–221.
- Mutu M 2019. The treaty claims settlement process in New Zealand and its impact on Māori. *Land* 8(10): 152.
- Mutu M, Rikys P 1993. *Statutory resource management and Indigenous property rights. A report prepared for the Ministry for the Environment*. Auckland, Auckland, Uniservices.
- Norton DA, Young LM, Byrom AE, Clarkson BD, Lyver POB, McGlone MS, Waipara NW 2016. How do we restore New Zealand's biological heritage by 2050? *Ecological Management & Restoration* 17(3): 170–179.
- Norton DA, Butt J, Bergin DO 2018. Upscaling restoration of native biodiversity: A New Zealand perspective. *Ecological Management & Restoration* 19: 26–35.
- OECD 2017. *OECD environmental performance reviews: New Zealand 2017*. Paris, Organisation for Economic Co-operation and Development. 252 p.
- Pere RR 1982. *Concepts and learning in the Māori tradition*. Hamilton, University of Waikato. 96 p.
- Posey DA 1999. *Cultural and spiritual values of biodiversity*. London, Intermediate Technology. 731 p.
- Potter, H, Māngai R 2022. *A Wai 262 best practice guide for science partnerships with kaitiaki for research involving taonga: Lessons from Māori voices in the New Zealand science sector*. Dunedin, MBIE. 40 p.
- Prytz-Johansen J 2012. *Index and brief vocabulary*. HAU: *Classics of Ethnographic Theory Series 1*: 291–295.
- Rayne A, Byrnes G, Collier-Robinson L, Hollows J, McIntosh A, Ramsden M, Rupene M, Tamati-Elliffe P, Thoms C, Steeves TE 2020. Centring Indigenous knowledge systems to re-imagine conservation translocations. *People and Nature* 2(3): 512–526.
- Reilly M, Duncan S, Leoni G, Paterson L, Carter L, Rātima M, Rewi P eds. 2018. *Te Kōparapara: An Introduction to the Maori World*. Auckland, Auckland University Press. 484 p.
- Resource Management Act 1991. (69) *New Zealand Government*, Wellington.
- Roberts M 2013. Ways of seeing: Whakapapa. *Sites: A Journal of Social Anthropology and Cultural Studies* 10: 93–120.
- Roberts M, Norman W, Minhinick N, Wihongi D, Kirkwood C 1995. *Kaitiakitanga: Maori perspectives on conservation*. *Pacific Conservation Biology* 2(1): 7–20.
- Rolleston TA 2021. Two-year rāhui for Waiheke Island waters to protect kaimaona. *Radio New Zealand*. <https://www.rnz.co.nz/news/te-manu-korihi/435470/two-year-rahui-for-waiheke-island-waters-to-protect-kaimaona> (Accessed 20 May 2020).
- Rotorua Daily Post 2019. *Tūwharetoa Māori Trust Board lifts rāhui on Lake Taupō following wastewater spill*. *NZ Herald*. https://www.nzherald.co.nz/nz/tuwharetoa-maori-trust-board-lifts-rahui-on-lake-taupo-following-wastewater-spill/3LFKO377HRGZYJTSGGZZ5FHBFGA/?c_id=1&objectid=12263359 (Accessed 20 May 2020).
- Royal TAC 1998. *Te ao mārama: A research paradigm*. *He Pūkenga Kōrero* 1(4): 1–8.
- Reihana K, Taura Y, Harcourt N 2019. *He tohu o te wā—Hangarau pūtaiao/Signs of our times—Fusing technology with environmental sciences*. *New Zealand Journal of Ecology* 43(3): 3382.
- Ruru J 2004. *Managing our treasured home: the conservation estate and the principles of the Treaty of Waitangi*. *New Zealand Journal of Environmental Law* 8: 243–266.
- Ruru J, O'Lyver PB, Scott N, Edmunds D 2017. Reversing the decline in New Zealand's biodiversity: empowering Māori within reformed conservation law. *Policy Quarterly* 13(2): 65–71.
- Sale PF 2002. *The science we need to develop for more effective management*. In: Sale PF ed. *Coral reef fishes: Dynamics and diversity in a complex ecosystem*. San Diego, Academic Press. Pp. 361–376.
- Sandbrook C, Fisher JA, Holmes G, Luque-Lora R, Keane A 2019. *The global conservation movement is diverse but not divided*. *Nature Sustainability* 2(4): 316–323.
- Selby R, Moore P, Mulholland M 2010. *Māori and the environment: Kaitiaki*. Wellington, Huia Press. 359 p.

- Shivanna KR 2020. The sixth mass extinction crisis and its impact on biodiversity and human welfare. *Resonance* 25(1): 93–109.
- Small Z 2019. Landslide reveals human bones in Maketū, Bay of Plenty. *Newshub*. <https://www.newshub.co.nz/home/new-zealand/2019/01/landslide-reveals-human-bones-in-maket-bay-of-plenty.html> (Accessed 20 May 2020).
- Soulé ME, Wilcox BA 1980. Conservation biology: its scope and its challenge. In: Soulé ME, Wilcox BA eds. *Conservation biology: An evolutionary-ecological perspective*. Sunderland, Sinauer Associates, Inc. Pp. 1–8.
- Swannix JM 2017. Northland's Maitai Bay faces seafood ban to replenish stocks. *Newshub*. <https://www.newshub.co.nz/home/new-zealand/2017/12/northland-s-maitai-bay-faces-seafood-ban-to-replenish-stocks.html> (Accessed 20 May 2020).
- Taipapa T, Lyver P, Horsley P, Davis J, Bragg M, Moller H 1997. Co-management of New Zealand's conservation estate by Maori and Pakeha: a review. *Environmental conservation* 24(3): 236–250.
- Te Ātiawa ki Whakarongotai Charitable Trust 2019. *Whakarongotai o te moana, Whakarongotai o te wā: Kaitiakitanga plan for Te Ātiawa ki Whakarongotai*. Waikanae. 60 p.
- Te Kawerau a Maki 2017. *Waitakere rahui*. <https://www.tekawerau.iwi.nz/index.php?q=node/13> (Accessed 20 May 2020).
- van Schravendijk-Goodman C, Falwasser J, Brown J 2017. Maurea Islands – A restoration journey. In: Taura Y, van Schravendijk-Goodman C, Clarkson B eds. *Te Reo o te Repo. The voice of the wetland. Connections, understandings and learnings for the restoration of our Wetlands*. Manaaki Whenua Landcare Research and Waikato Raupatu River Trust. Pp. 135–150.
- Waikato-Tainui Conservation Accord 2008. Minister of Conservation, Director General of Conservation, Waikato-Tainui, Wellington.
- Waitangi Tribunal 2011. *Ko Aotearoa Tēnei: a report into claims concerning New Zealand law and policy affecting Māori culture and identity*. Wellington, Waitangi Tribunal reports. 268 p.
- Wehi PM, Beggs JR, McAllister TG 2019. Ka mua, ka muri. *New Zealand Journal of Ecology* 43(3): 3379.
- Wehi P, Whaanga H, Watene K, Steeves TE 2020. Mātauranga as knowledge, process and practice in Aotearoa New Zealand. In: Thornton TF, Bhagwat SA eds. *The Routledge handbook of Indigenous environmental knowledge*. London, Routledge. Pp. 186–197.
- Whaanga H, Wehi P 2017. Rāhui and conservation? Māori voices in the nineteenth century niupepa Māori. *Journal of the Royal Society of New Zealand* 47: 100–106.
- When N, Ruru J 2011. Providing for rāhui in the law of Aotearoa New Zealand. *The Journal of the Polynesian Society* 120(2): 169–182.
- Williams HW 1971. *A dictionary of the Maori language* (orig. 1844). Wellington, AR Shearer, Government Printer. 499 p.
- Williams J 2006. Resource management and Māori attitudes to water in southern New Zealand. *New Zealand Geographer* 62(1): 73–80.
- Williams J 2012. Ngāi Tahu kaitiakitanga. *MAI Journal* 1(2): 89–102.
- Wilson C 2010. Ngā hau o tua, ngā ia o uta, ngā rere o tai. Whanganui, Te Puna Mātauranga o Whanganui. 50 p.

Received: 31 August 2022; accepted: 07 February 2023
Editorial board member: Jason Tylianakis