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Building a Monitoring Toolkit to Give Effect to Ngaa Rauru Freshwater Values

BY

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(Ngāti Kahungunu ki Wairoa, Kai Tahu, Paakehaa)

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25

1 Abstract

2 Freshwater management systems in Aotearoa New Zealand have failed on at least two fronts: (i) to
3 maintain the health of the county's waterways and (ii) to recognise the mana motuhake and
4 rangatiratanga of Maaori hapuu and iwi. For Ngaa Rauru Kiitahi, the southernmost Taranaki iwi, both
5 failings are evident in their recent experience. Historically popular swimming spots in their network
6 of freshwater streams are no longer safe to make physical contact with, and freshwater mahinga kai
7 resources dwindle in the degraded systems. Several well-documented examples exist of how the
8 freshwater management and decision-making system is unable even to recognise Ngaa Rauru voices
9 and values, let alone give effect to them. In response to recent policy shift across Aotearoa, Te
10 Kaahui o Rauru, the post-settlement governance entity for Ngaa Rauru, have secured funding to
11 implement Te Wai Koiora, a programme that seeks to build capability and capacity of uri (tribal
12 members), hapuu (sub-tribal groups) and iwi (the tribe) to take a leading role in freshwater
13 management across their rohe (territory). A key part of the programme is the development of a
14 freshwater monitoring toolkit of appropriate monitoring tools that can give effect to the full complex
15 of Ngaa Rauru freshwater values. This thesis forms an initial step in that development process. Here,
16 I use an established environmental values framework to structure a textual analysis of Ngaa Rauru
17 values articulations in hapuu and iwi Cultural Impact Assessments and policy instruments against
18 established kaupapa Maaori freshwater assessment tools. By aligning the analysis across the two
19 document sets, I provide an exploration of a more quantitative approach to assess exactly which
20 tools (or components of tools) give effect to different freshwater values. My analysis shows that in
21 many ways Ngaa Rauru freshwater values are divergent from Eurocentric freshwater values
22 embedded in established environmental values frameworks. For example, concepts like Whakapapa
23 bring a relational and intergenerational element to freshwater values that are not evident in
24 established frameworks. Textual analysis of the kaupapa Maaori freshwater assessment tools shows
25 that existing tools can indeed give effect to many Ngaa Rauru freshwater values, but with clear room
26 for further and more targeted development. Even though all values may not result in a quantitative
27 metric at the end of the assessment process, the collaborative and community-based approach that
28 the assessment tools take ensure that values like Tikanga (cultural protocol) and Whanaungatanga
29 (familial relationships) are given effect to in the process. For those Ngaa Rauru freshwater values
30 that are more difficult to give effect to with existing monitoring tools, I point to the potential of
31 reflexive kaupapa Maaori assessment tools developed by Maaori scholars in education for guidance
32 on making advancements on kaupapa Maaori freshwater monitoring tools.

33

1 Chapter 1: Introduction and Background

2 1.1 Reinstating Indigenous Environmental Values in Settler-Colonial Societies

3

4 Eurocentric notions of human nature relationships have prevailed in environmental management
5 systems worldwide, undermining the more relational environmental values held by Indigenous
6 peoples and contributing to our world's current ecological and climate crises (Groenfeldt, 2019).
7 Freshwater management is no exception, with anthropocentrism, dualism, and utilitarianism
8 prevalent in freshwater management systems globally (Parsons & Fisher, 2020; Hartwig et al., 2021).
9 Despite the many and varied efforts to embed Indigenous environmental values into freshwater
10 management systems, indigenous voices and environmental values often remain marginalised, and
11 sometimes tokenised, within hegemonic settler colonial environmental management systems (Jacob
12 et al., 2021). The outcome of these efforts by Indigenous peoples are nuanced and specific to each
13 of their own unique cultures and those of their settler colonial impositions (Percy, 2004; Medeiros,
14 2017; Yunupingu & Miller, 2009). However, there are shared elements in the experiences of
15 Indigenous peoples' ongoing struggles to give effect to their environmental values in the freshwater
16 management systems based on Eurocentric environmental values (Moewaka-Barnes et al., 2014;
17 Capano, 2009).

18 Although settler-colonial processes and systems continue to clash with indigenous environmental
19 values (Bauder & Mueller, 2023), there are ongoing efforts to reinstate indigenous environmental
20 values in decision-making across the globe. An illustrative example are the models of legal
21 personality being recognised for nature and natural landscape features, which gained momentum
22 after early initiatives like Ecuador's Constitutional recognition of Pachamama in 2008 (Humphreys,
23 2017). Many indigenous communities have leveraged these early initiatives to enact similar
24 legislative shifts in their part of the world (Clark et al., 2019; Barcan, 2020; Godden et al., 2020). In
25 Aotearoa New Zealand, legal personality of landscape features has progressed significantly, from
26 the *Te Urewera Act 2014*, turning a National Park into legal person and establishing iwi (tribe) led
27 governance system (Tănăsescu, 2020), followed by *Te Awa Tupua Act 2017*, recognising the legal
28 personality of the Whanganui River (Rodgers, 2017), and most recently, the legal personality of
29 Taranaki Maunga (Mountain) and associated iwi-led governance structure (Geddis & Ruru, 2019;
30 Martin, 2023). These models represent a significant step in reinstating Indigenous environmental
31 values into legislative instruments for specific landscape features in Aotearoa New Zealand (Barrett
32 et al., 2020; Charpleix, 2017). Despite this, there are always issues when communicating
33 environmental values across worldviews, with controlling entities having the ability to cherry pick

1 values to include within the management structure or ending with Maaori environmental values
2 being misinterpreted or watered down (Coombes, 2007).

3 Aotearoa's changing iterations of the National Policy Statement for Freshwater Management
4 (NPSFM) presents a good example of how Eurocentric environmental values have prevailed in
5 freshwater management systems, and how they have been challenged over the past decade. The
6 addition of Te Mana o Te Wai in the NPSFM 2014 marked a significant shift in the approach to
7 framing freshwater policy. The concept of Te Mana o Te Wai, as articulated in the NPSFM 2014,
8 recognised the life-supporting capacity of freshwater and the reciprocal relationship between
9 freshwater and iwi/hapuu (New Zealand Government, 2014). This was further strengthened in the
10 NPSFM 2017, and again in the NPSFM 2020, which established a hierarchy of obligations to place the
11 needs of freshwater first, followed by the needs of people, and third, the "ability of people and
12 communities to provide for their social, economic, and cultural wellbeing, now and in the future"
13 (New Zealand Government, 2020, p.5). While the inclusion and development of Te Mana o Te Wai is
14 an improvement on the older iterations of the NPSFM (Te Aho, 2018), it has not been without its
15 tensions. Regional councils have expressed concern in implementing this concept, citing the vague
16 nature of the concept, and inconsistent application across the NPSFM document, itself (Ministry for
17 the Environment, 2020; Bay of Plenty Regional Council, 2019). As well, Tūwharetoa echoes similar
18 concerns, highlighting the lack of true provisions for Te Mana o Te Wai in the policy statement
19 (Tūwharetoa Māori Trust Board, 2019), and the Waikato River Authority seeing Te Mana o Te Wai as
20 unnecessary in their rohe, due to the provisions through Te Mana o Te Awa (Waikato River
21 Authority, 2019). When regional councils have attempted to alter plans to align better with the
22 NPSFM 2020, this has been met by Federated Farmers, a primary industry lobby group, criticising the
23 policy shift for fear of debilitating costs to farmers to comply with the new standards (Federated
24 Farmers of New Zealand, 2021). The narrative of Te Mana o Te Wai policy initiative is a clear
25 example of how tensions and divergences in understanding hinder these initiatives to recognise
26 Indigenous environmental values (Hartwig et al., 2018).

27 The difficulty of reinstating complex indigenous environmental values in decision-making is
28 exacerbated when our monitoring structures continue to prioritise Eurocentric environmental values
29 (Brierley et al., 2018). Monitoring and decision-making are in many ways inseparable, the
30 information collected from monitoring forming the basis on which we make decisions (Lyons et al.,
31 2010). Despite this, when we discuss freshwater monitoring, we often neglect to include the
32 governance and decision-making conversation (Ho et al., 2020). In Aotearoa, freshwater monitoring
33 is primarily dominated by Eurocentric practices and management techniques (Evans & Kingsbury,
34 2022), mainly focusing on biophysical aspects of the environment and its use as a resource (Vollmer

1 et al., 2016). The prevalence of Eurocentric environmental values in freshwater monitoring further
2 underpins and misrepresents the environmental values of hapuu (sub-tribal groups) and iwi, whose
3 relationship with freshwater is largely underpinned by an entanglement of social, biophysical, and
4 narrative-based values (Stewart-Harawira, 2020). The same can be said for our freshwater decision-
5 making, which despite inclusions of concepts such as Te Mana o Te Wai, remains largely
6 underpinned by Eurocentric environmental values (Taylor, 2022).

7 The implications of Eurocentric environmental values in decision-making and monitoring have
8 played out explicitly in the rohe of Ngaa Rauru. Despite being left a largely landless iwi due to Crown
9 confiscations (Ngaa Rauru Claims Settlement Act, 2005), Ngaa Rauru continues to exercise Mana
10 Motuhake over the lands and waters within their rohe. Ngaa Rauru continually articulate their values
11 through Iwi Management Plans, Cultural Impact Assessments, and Values Statements. However,
12 current freshwater management practices in their rohe rely primarily on Eurocentric ways of
13 knowing and relating to the landscape, hindering the ability of hapuu and iwi environmental values
14 to be fully recognised or represented in freshwater management decision making.

15 In 2010, Ngaa Rauru engaged in a consent application process to take 24561m³ of water from the
16 Waitotara River that provides a clear demonstration of how their environmental values are
17 marginalised in decision making. In the hearing where Ngaa Rauru contested the application,
18 claimant Ester Tinirau explicitly articulates a divergence between Ngaa Rauru values and the
19 Eurocentric environmental values that are embedded in the decision-making process, when she said,
20 “[the council and iwi] were talking past each other because of divergent values and understanding”
21 (Taranaki Regional Council, 2010, p.5). Her sentiments were built upon by her co-claimant Hayden
22 Potaka, who stated that “the assessment in the Officer Report was purely scientific and did not
23 consider the cultural significance of the water or its intrinsic values to Ngaa Rauru” (Taranaki
24 Regional Council, 2010, p.7). Further co-claimants (Martin Davis, Che Wilson & Dallas Mcleod),
25 expanded this discussion, highlighting the difficulty in communicating with the council, the impact
26 water abstraction has on tikanga, and the decline of mahinga kai and waahi tapu. In this poignant
27 case, we see a clear picture that both the monitoring systems and associated decision-making
28 systems that govern the use and access of water from the Waitotara river are not representative of
29 Ngaa Rauru values. The centrality of the Waitotara River to Ngaa Rauru culture and identity makes it
30 even more concerning that Ngaa Rauru voices and values are marginalised in its management
31 systems.

32 Maaori hapuu and iwi have experienced similar marginalisation of their voices and values in
33 freshwater management all around Aotearoa New Zealand and have responded, in part, by

1 developing kaupapa Maaori freshwater assessment tools that better reflect their environmental
2 values (Moewaka Barnes et al., 2021; Hudson et al., 2020). The advantages of such tools are the
3 ability to provide outputs that can be communicated to government entities, a collaborative process
4 that builds relationships and local knowledge within communities, and informed decision-making
5 with better understanding of the impacts of land-use practices (Rainforth & Harmsworth, 2019).
6 Such outcomes aim to be achieved by placing kaupapa Maaori theory at the core of these tools,
7 seeking to fully recognise Maaori cultural values and systems while deconstructing dominant pakeha
8 ideals (Walker et al., 2006).

9 Te Kaahui o Rauru (TKoR), the post settlement governance entity (PSGE) for Ngaa Rauru Kiitahi, have
10 employed me as their Freshwater Scientist and Advisor to develop a freshwater monitoring toolkit
11 that can give effect to Ngaa Rauru voices and values in freshwater monitoring across their rohe. The
12 monitoring toolkit is a key deliverable of the Te Wai Koiora Project being delivered by TKoR and
13 funded by the Te Mana o Te Wai Fund administered by the Ministry for the Environment. This thesis
14 forms the initial phase of my workplan in developing the toolkit, where I bring a detailed analytical
15 approach to assessing which kaupapa Maaori freshwater monitoring tools can give effect to the
16 complex array of freshwater values that are held by the hapuu and iwi of Ngaa Rauru Kiitahi. My
17 specific research questions in this thesis are:

18 - How do Ngaa Rauru freshwater values align with or diverge from Eurocentric environmental
19 values frameworks?

20 - How well can existing kaupapa Maaori freshwater assessment tools give effect to the full
21 complex of Ngaa Rauru freshwater values?

22 In answering these questions, I will then look to the broader literature for future directions for
23 development of kaupapa Maaori freshwater assessment tools with a particular focus on assembling
24 a broad range of monitoring tools to create a toolkit that can best give effect to a broad complex of
25 Ngaa Rauru freshwater values.

26

1 Background

2 1.2 Divergences between Paakehaa and Maaori Environmental Values

3 The intergenerational, holistic, and relational perspective of te ao Maaori (the Maaori worldview)
4 not only shapes how one views the world but also informs the tikanga, processes, and
5 environmental values through which one engages with the world (Cheung, 2008). This is made clear
6 through oral traditions such as whakatauki (proverbs), waiata (songs), and te reo (Maaori language),
7 which are fundamental to hapuu and iwi identity (McRae, 2017). “*Ko au te awa, ko te awa ko au – I*
8 *am the river, and the river is me*” has been written about extensively since the inception of Te Awa
9 Tupua (Whanganui River Claims Settlement, 2017), capturing the intrinsic relationship held between
10 the Whanganui River and uri of Whanganui (Te Aho, 2018). We can also look to the following
11 whakatauki to demonstrate the concept of relationality:

12 “Ko te moana ehara rawa i te wai kau, no Tangaroa kei tenei marae, he maha ona hua i ora
13 ai nga manu o te rangi, te iwi ki te whenua.” “The sea is not only water, it is the marae of
14 Tangaroa, it yields life for many things, the birds in the sky, the people on the lands.” (Ngāti
15 Tukairangi & Ngāti Tapu, 2014)

16 This whakatauki informs us that the sea is not only a body of water but the residence of Tangaroa
17 and an origin of many forms of life (Jackson et al., 2017). Relationality in te ao Maaori also extends
18 through waiata, carrying intergenerational narratives of connection to people and to places (Rameka
19 et al., 2018; Helleland, 2012), and te reo itself, seen through words like “whenua” and “hapuu”.
20 When translated into English, “whenua” can mean land or landscape as well as the placenta, and
21 “hapuu” can mean both a sub-tribal grouping within an iwi (tribe) as well as the state of being
22 pregnant. With just these two words we get a sense of how intertwined humans are with nature
23 from a Maaori worldview (Mead, 2016).

24 A wide range of literature discusses how settler-colonial environmental values position humans in
25 dichotomy and duality with nature, a framing that is in tension with what we see in te ao Maaori
26 (Valentine et al., 2007; Salmond, 2014; Wheaton, 2020). This tension is often interpreted through
27 different lenses, whether expansionism (Bess, 2010), dualism (Scerri, 2016), or utilitarianism
28 (Gudynas, 2011). These all tend to highlight the same dichotomous thinking which separates people
29 and nature, and positions the environment as something that only exists to meet people’s needs
30 (Gibbs, 2010).

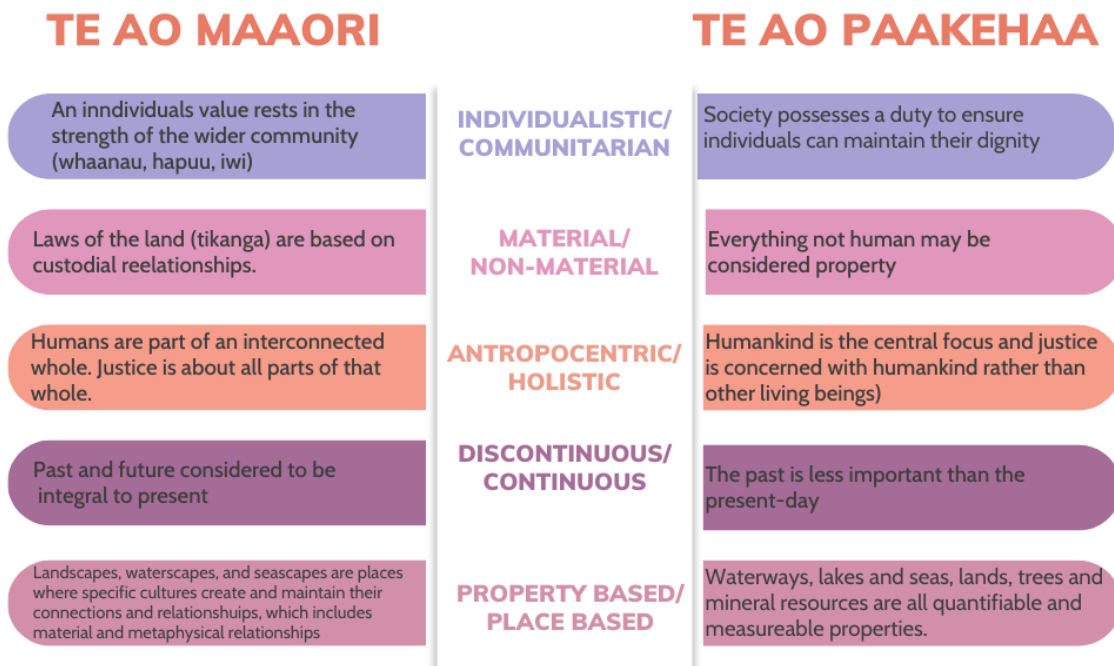
31 The settler-colonial conceptualisation of Aotearoa as Arcadia, a rural paradise with new productive
32 lands waiting to be utilised, is a good example of this worldview (Mahar, 2014; Higgins, 2017). The

1 Arcadia myth played a significant role in the inception of Aotearoa as a Crown nation; settlers were
2 sold the idea that Aotearoa is a place of “opportunity and natural abundance” where somebody
3 could “own one’s land” and “tame the wilderness” (Bell, 1997). Ultimately, this search for Arcadia
4 required the theft of lands and marginalisation of indigenous peoples (Evans, 2007). It not only
5 resulted in the import of exotic flora and fauna species but also the import of an environmental
6 values system and instruments that sit in tension to te ao Maaori and marginalises the
7 environmental values of hapuu and iwi (Ream, 2020).

8 Over time, evidence-based scientific discoveries took over from the faith-based environmental
9 values that underpinned concepts like Arcadia (Douglas, 2015). James (1990) highlights three key
10 ideas that contributed to this change: facts are produced from observation rather than tradition, the
11 divine purpose is irrelevant, and power is acquired through gaining knowledge rather than religion.
12 This thinking ushered in a positivist approach to interacting with nature, which prioritised a fact-
13 based understanding that aimed to be devoid of values (Roebuck & Phifer, 1999; Park et al., 2020).
14 However, a postpositivist critique would suggest that it is impossible to understand nature in a
15 valueless context; the scientific practices advocated for by positivists still retaining utilitarianism,
16 anthropocentrism, and dualism as primary values (Norton, 2008; Sharp et al., 2011; Love, 1997).
17 Additionally, Keat (1980) states that by creating structures where we do not have to think about the
18 values underpinning our activities because they are seen as "objective", we have set ourselves up to
19 further entrench the dominant environmental values. This sentiment is evident in Aotearoa’s
20 attitude to environmental degradation. Even in the mid to late 1900s, when environmental
21 degradation became prominent in public discourse, we still focused on aesthetic values and the use
22 of the environment, rather than our relationship with it (Beattie & Star, 2010).

23 Parsons et al. (2021) discuss this divergence between Maaori and Paakehaa environmental values
24 from an environmental justice perspective. The authors highlight how we perceive environmental
25 injustice across worldviews: a Western perspective tied to individualistic and material rights, and a
26 Maaori perspective centred on the community, holism, and tikanga (Figure 1). Beyond Parsons,
27 there is a body of literature that has advocated for this justice lens on the environmental values
28 discourse. Often this is in regard to challenging monetary value through the lens of distributive
29 justice and equality (Kallis, 2013). Moewaka Barnes and McCreanor (2019) further this point by
30 exploring what is considered unjust and just regarding the use of whenua (landscape), stating that a
31 settler-colonial gaze focuses on whenua as a determinant of wealth, and a te ao Maaori gaze focuses
32 on whenua as a determinant of health.

33



1

2 Figure 1: Summary and revisualisation of Parsons et al. (2021) figures contrasting Paakehaa and Maaori perspectives on
 3 environmental justice.

4 Salmond (2017) expands on Parsons et al.’s (2022) anthropocentric/holistic framing by highlighting
 5 the importance of intergenerational thinking and action in the environmental values held by hapuu
 6 and iwi. Salmond hones in on the concept of whakapapa, discussing its importance in how Maaori
 7 frame and manifest their environmental values. Whakapapa is often considered the means through
 8 which tangata whenua (people of the land) trace lineage back through the narratives passed down
 9 and ultimately to the emanation of Ranginui and Papatuuuanuku (Marsden & Henare, 1992;
 10 Stewart-Harawira, 2020). Whakapapa plays a significant role in establishing obligations and
 11 connections to one other, as well as the whenua (Rangiwai, 1993; Taani, 2022). This is no different
 12 for freshwater, with whakapapa being essential to understanding how people connect to freshwater
 13 systems and who has authority as mana whenua (local hapuu or iwi with authority over particular
 14 lands and waters) (Hepburn et al., 2019; Forster, 2019). The holistic and intergenerational
 15 relationship with freshwater is often articulated as a guiding principle when discussing freshwater
 16 management or monitoring. Jollands and Harmsworth (2007) state that it is the responsibility and
 17 obligation through whakapapa that is a driving force for many Maaori to engage in freshwater
 18 monitoring practices, and Rudge (1993) discusses the obligation of Maaori to make “seventh
 19 generation decisions” regarding the environment. Watene (2022) builds on this discussion from a
 20 justice perspective, highlighting the very tangible possibilities to give effect to certain values such as
 21 whakapapa and kaitiakitanga by applying an intergenerational justice lens, citing this framing’s
 22 ability to empower local communities, provide an avenue for rethinking responsibilities, and enable
 23 innovation.

1 It is important to recognise that the overly simplistic and dualistic framing of te ao Maaori versus te
2 ao Paakehaa (European New Zealander worldview) can limit our ability to engage in a nuanced
3 discussion about these worldviews. While we have framed te ao Maaori as a worldview underpinned
4 by relational environmental values, and te ao Paakehaa as underpinned by utilitarian environmental
5 values, this does not mean there is no overlap. Tangata whenua have well-established tikanga and
6 practices for cultural harvesting and hunting, which are not devoid of utilitarian sentiments (Wehi &
7 Lord, 2017). Likewise, Paakehaa hold spiritual and non-utilitarian values for freshwater, exhibiting
8 more relational environmental values (Tadaki et al., 2022). Relational environmental values are not
9 exclusive to indigenous epistemologies. There is extensive literature by non-indigenous scholars
10 challenging the utilitarian and anthropocentric focus of global hegemonic environmental
11 management systems (Talukder, 2018; Irwin, 2021; Jackson, 2011). The rich scholarly literature on
12 ecosystem services illustrates this evolving discourse. From beginning as a largely utilitarian means
13 to equate the ecosystem with monetary value (Gómez-Baggethun et al., 2010), ecosystem services
14 have more recently embraced holistic and relational framings (Bull et al., 2016). While criticisms are
15 still prevalent within models of ecosystem services (Chan et al., 2012; Hasan et al., 2020), the
16 discourse highlights that whether indigenous or not, humans often desire to connect with nature to
17 some degree, and this relationality can play out in various ways. Chan et al. (2016) discusses these
18 overlaps by giving an example of a 'sacred tree' associated with tupuna (ancestors), sustenance and
19 shared histories. A sacred tree might be intrinsically valued or instrumentally valued because of its
20 amenity.

21 We must also consider that neither te ao Maaori nor te ao Paakehaa are homogeneous perspectives.
22 Environmental values of te ao Maaori vary among hapuu and iwi, sometimes significantly, across the
23 country (Watene, 2016), with spatial variability in tikanga, protocols, and priorities (White, 2016).
24 Regarding Paakehaa, a dichotomy does not capture the diversity of environmental values and
25 cultures encompassed under the umbrella of Paakehaa or whiteness (Lovelock et al., 2011; Oliver,
26 1994). A dichotomous framing also omits social factors, such as personal or self-identity (Bouman et
27 al., 2021), the role of national identity (Milfront et al., 2020), class, or gender (Salleh, 1993).
28 However, this framing is not intended to facilitate a long, nuanced conversation around ontologies
29 and identity, but rather to highlight two different value systems that underpin one's actions and
30 obligations. Despite the problems with dichotomous framing, the fact remains that utilitarian and
31 anthropocentric sentiments embedded within Eurocentric environmental values play a major role in
32 our current freshwater management systems, and what it has produced is a system very much built
33 by and for Paakehaa (Memon & Kirk, 2012).

1 1.3 Challenging Eurocentric Environmental Values in Freshwater Monitoring

2 The positivist, utilitarian, and anthropocentric environmental values discussed above underpin
3 freshwater monitoring in Aotearoa-New Zealand (Fairweather, 1999; Karr, 1999). These Eurocentric
4 values have a large impact on how freshwater health is conceptualised. The Eurocentric
5 conceptualisation of health has provided a basis for freshwater health to be considered separate
6 from people (Chan et al., 2016), while te ao Maaori perspectives make the link between the health
7 of people and the environment clear (Moewaka-Barnes, 2019). The Eurocentric understanding of
8 freshwater health is ultimately limiting (Gibbs, 2010), and the subsequent need to produce an
9 empirical truth on freshwater health marginalises indigenous environmental values by focusing on
10 what is tangible and immediately measurable, rather than considering the holistic understanding of
11 health within te ao Maaori (Donahue & Johnston, 1998; Brierley et al., 2019). Examples are seen
12 throughout regional council freshwater management plans, which utilise indices and modelling to
13 arrive at an absolute quantitative figure regarding the health of freshwater (Taranaki Regional
14 Council, 2001). We can also look at various State of the Environment reports produced in Aotearoa
15 (Taranaki Regional Council, 2022; Horizons Regional Council, 2019). Despite the odd inclusion of
16 hapuu and iwi approaches to freshwater monitoring (see the inclusion of Mauri Compass and Ngāti
17 Mutunga in Taranaki Regional Council, 2022), the focus remains on using quantifiable data points to
18 define environmental health. Some would argue that this approach leaves little room for relational
19 environmental values to be included (Blue, 2018; Williams, 2011; Grubert, 2018), and privileges
20 people's ability to discharge or use freshwater as a resource (Tidaki & Sinner, 2014; Mclean, 2022).
21 By framing monitoring in this way, a large section of hapuu and iwi values are not included, resulting
22 in an unjust, unrepresentative, and ineffective approach to freshwater management (Evans &
23 Kingsbury, 2022).

24 Despite the focus on the biophysical health of freshwater, it is evident that our standard methods of
25 freshwater monitoring and management have not worked to ensure that freshwater health, or the
26 health of communities, is maintained (Ministry for the Environment, 2023). The health of rivers
27 across the country has dramatically declined under current monitoring and management structures.
28 This is captured in the Ministry for the Environment's most recent State of the Environmental
29 Report, which details the legacy effects of continual intensive land use, and the negative effects of
30 prioritising the productive potential of freshwater (Ministry for the Environment, 2023). However,
31 freshwater health is not only a story told through metrics, but also through the narratives of
32 kaumatua (elders), and hapuu and iwi members who share their experiences with freshwater. These
33 narratives are present throughout the many Waitangi Tribunal reports, Treaty Settlement Claims,

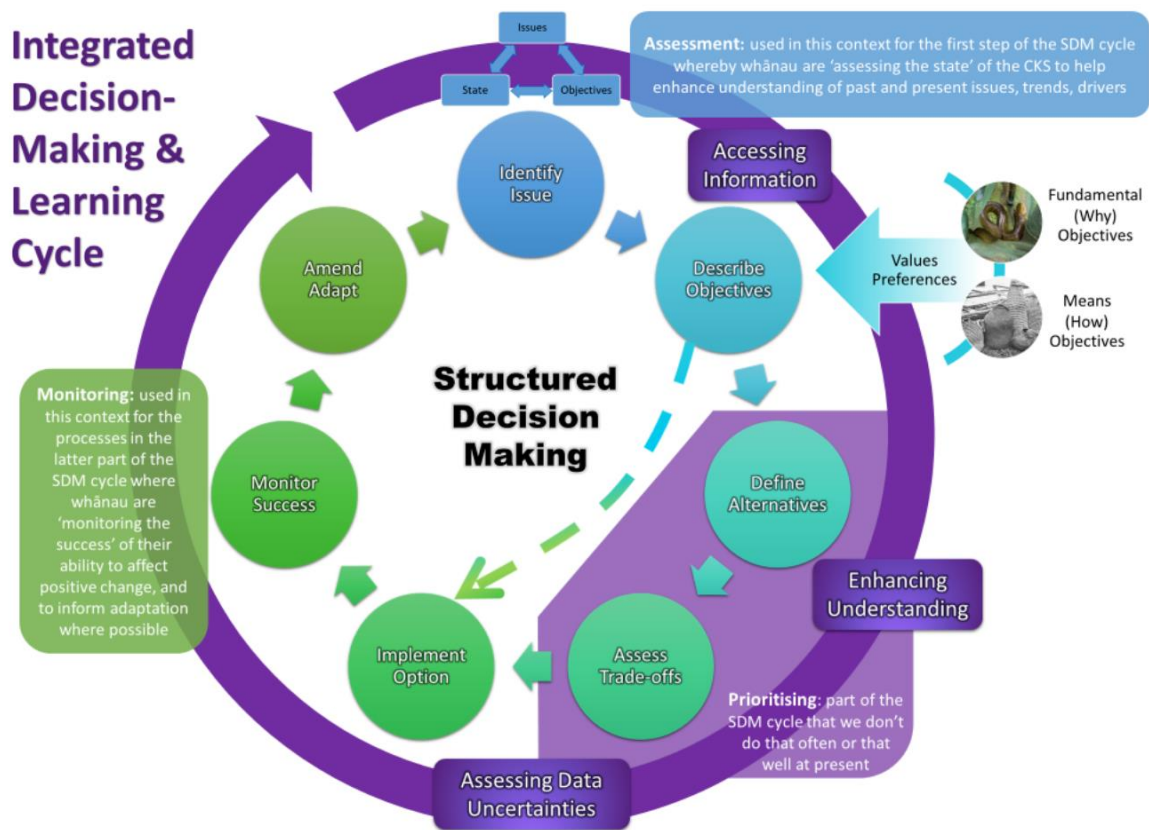
1 and consent hearing transcripts, often illustrating both a decline in freshwater biophysical health, as
2 well as a narrative of displacement, and decline in the relationship between tangata (people) and
3 whenua (Salmond et al., 2019; Stewart-Harawira, 2020; Martin, 2019). These metrics and narratives
4 tell a story not only of the diminishing quality and quantity of freshwater, but also the impact
5 prioritising Eurocentric values has had on relationships held between communities and freshwater.
6 Barnes et al. (2014), along with Levesque (2020), and Sultana (2022), place significant blame for this
7 environmental and social degradation on the Eurocentric values prevalent in Aotearoa, in what
8 Barnes et al. (2014) refers to as a prioritisation of the "colonial gaze".

9 The call to recognise relational environmental values in freshwater monitoring and management has
10 not only been limited to indigenous discourses but has also been a global movement. The
11 recognition of a much-needed shift in the way we conduct freshwater management is reflected in
12 literature (McFarlane & Šunde, 2022; Grubert, 2018; Mattijssen, 2020). In Aotearoa, we have seen
13 this through the works of Salmond et al. (2014), Tadaki et al. (2021), and Fisher et al. (2022), all of
14 whom challenge the focus on quality and quantity, instead advocating for an approach that better
15 addresses the disconnect between people and water. Many tools, models, and frameworks have
16 been developed to approach freshwater management in this more holistic manner, placing a greater
17 emphasis on relational environmental values (Ban et al., 2018; Tavares Freitas et al., 2019). When it
18 comes to implementation, this tends to play out in two ways: incorporating Maatauranga Maaori
19 (Maaori knowledge) in management practices or finding ways to balance or identify overlaps in
20 environmental values.

21 Efforts to reinstate Maatauranga Maaori as a core means of freshwater monitoring and
22 management in Aotearoa have been ongoing and prosperous. We have seen the management of
23 freshwater species incorporate Maatauranga Maaori across Aotearoa, typically resulting in co-
24 management schemes between conservation entities and hapuu and iwi (Paul-Burke et al., 2018;
25 Ogilvie et al., 2018). An illustrative case study is the development of the 'Cultural Keystone Species
26 (CKS): Co-Management and Restoration' program (Natural Institute for Water and Atmospheric
27 Research, n.d). A large part of this project has been sharing Maatauranga Maaori and Scientific
28 Knowledge to inform the protection of culturally significant species and to ultimately work in
29 collaboration on restoration activities (Maxwell et al., 2018; Noble et al., 2016). Another key
30 component of CKS is Integrated Catchment Management (ICM), which specifies the importance of
31 this monitoring feeding into decision-making. This integrated management approach adopts the
32 cycle seen in Figure 2, stressing the need to focus on how we define alternatives and assess trade-
33 offs (Harmsworth et al., 2011). This explicit integration of monitoring and decision-making aims to

1 mitigate the issue highlighted earlier, where these two knowledge traditions are being thought of in
 2 overly simplistic and often dichotomously and dualistic ways (Ho et al., 2022). The ICM of Waitaki is
 3 often presented as a case study of the success of this approach, with a statutory board set up to
 4 develop a Water Allocation Framework for the catchment, and to explicitly conduct the assessment
 5 of trade-off process (Memon, 2010). Lake Waahi is another example highlighting the ‘monitoring
 6 success’ component of ICM, with the community continually monitoring the health of the tuna
 7 population to understand the success of restoration efforts (Allen, 2018).

8



9

10 Figure 2: Integrated decision-making cycle from NIWA (n.d). Detailing a framework that may contribute to monitoring
 11 feeding into decision-making effectively.

12

13 Efforts to find ways to balance or identify overlaps in environmental values beyond and including
 14 ICM are ongoing in Aotearoa New Zealand. Sinner et al. (2014) compiles a list of ways this discourse
 15 can be conducted, highlighting twenty-two different methods. Two particularly interesting methods
 16 to draw out here are Ecosystem-Based Management (EBM) and Multi-Criteria Decision Analysis
 17 (MCDA). Ecosystem-Based Management is positioned as a framework that includes humans as part
 18 of the interactive ecological system (Reid & Rout, 2012). Under this method, the priorities, and
 19 aspirations of a range of stakeholders are collected through interviews and translated into objectives

1 and approaches for freshwater monitoring and management (Reid & Rout, 2012). An illustrative
2 example of EBM's use in Aotearoa is in the management of Kaipara harbour. The model, in this case,
3 aims to strengthen the inclusion of Maaori environmental values in the management process
4 through the means of meetings, workshops, and collaborative decision-making (Makey & Awatere,
5 2018). Multi-Criteria Decision Analysis takes a similar but more rigid approach, aiming to weigh
6 priorities and objectives based on potential impacts and outcomes (Davies, 2013). This forms the
7 basis of Aotearoa's River Values Assessment System (RiVAS), which aims to "objectively rank the
8 relative importance of different use and non-use river values" (Hughey et al., 2013, p.1). Both tools
9 have played a role in developing environmental values conversations and in forming partnerships
10 between hapuu and iwi and other organisations (Langhans & Schallenbery, 2021; Maxwell et al.,
11 2020; Reid & Rout, 2020).

12 A prevalent critique of the approaches above is the assumption of and reliance on pluralism (Butler
13 et al., 2012). Pluralism is an approach guided by the assumption that two systems may co-exist in the
14 same field (Toki, 2017). It can be seen through the two-eyed-seeing approach, first developed in
15 Canada (Bartlett et al., 2012) and later popularised in Aotearoa's environmental management
16 discourse. The two-eyed-seeing approach aims to underpin the dominance of Western science by
17 weaving indigenous knowledge and ecological knowledge together (McAllister et al., 2019).
18 However, it is not entirely clear that a pluralistic approach is truly equitable, with several academics
19 and practitioners producing critiques (Hutchinson, 1995; Evans, 2008). While the inclusion of
20 indigenous knowledge and Maatauranga Maaori has been an essential part of giving effect to Maaori
21 environmental values in freshwater management and monitoring (Broughton et al., 2015), we must
22 also consider the power dynamics and divergences. Including Maatauranga Maaori or adopting a
23 pluralistic approach does not necessarily put Maatauranga Maaori or Maaori environmental values
24 on an equal standing with Western science or Eurocentric environmental values (Russell, 2020;
25 Larned et al., 2022). When searching for overlapping or complementary values, it tends to be the
26 values prevalent in our settler-colonial structures that take precedence (DePuy et al., 2022). In many
27 ways, our efforts to conduct these conversations focus on the equal representation of knowledge,
28 but do not tend to address the ontological tensions and dynamics of governance and decision-
29 making (Wilson & Insker, 2018; Fisher et al., 2022). The established dichotomy between practice and
30 governance creates issues when giving effect to iwi and hapuu values, and the lack of equitable
31 power distribution causes continual marginalisation of indigenous environmental values (Paterson-
32 Shallard et al., 2018).

1 Legislation and Policy

2 Although many methods strive to prioritise hapuu and iwi environmental values in freshwater
3 monitoring and management, it is prudent to question the extent to which the results of these
4 efforts can contribute to decision-making. A key term we have used throughout this chapter is “give
5 effect”. The definition of this phrase is provided through Aotearoa New Zealand’s King Salmon
6 Supreme Court decision, which draws parallels between “implement” and creating a firm obligation
7 to what you are giving effect to (Atkins et al., 2019). It is often argued that the ability to give effect
8 to the full complex of environmental values held by hapuu and iwi is greatly hindered by the
9 Eurocentric focus within legislation and policy (Bennett et al., 2021; Harcourt et al., 2022), a key
10 example being the Resource Management Act 1991 (RMA). For its time, the RMA was held in high
11 regard for representing tikanga, Maaori values, and tangata whenua in Aotearoa’s legislative system
12 (Ruru, 2018). Despite these accolades, the workings of the RMA remained primarily Eurocentric, as
13 seen through the first come, first serve approach to water allocation (Kaye-Blake et al., 2014) and its
14 anthropocentric connotations of environmental management as a whole (Coombes, 2003). The RMA
15 also lacked enforceable provisions to include and give effect to tangata whenua perspectives and
16 instead set targets and limits based on a Western notion of health and wellbeing (Te Aho, 2015).

17 Aotearoa’s National Policy Statement for Freshwater Management (NPSFM) provides an illustrative
18 example of how Eurocentric environmental values have prevailed in freshwater management
19 systems and how these notions have been challenged over the past decade. Starting with the
20 NPSFM 2011, the policy employs several statements focused on maximising the use of water
21 resources “maximum the efficient allocation and efficient use of water” (New Zealand Government,
22 2011, p.5), or discussing freshwater from an economic perspective, such as “the ability to transfer
23 entitlements between users so that we maximise the value we get from water” (New Zealand
24 Government, 2011, p.3). While these sentiments remain in freshwater policy and legislation to this
25 day, each iteration of the NPSFM manifests a step forward. In the NPSFM 2014, the concept of Te
26 Mana o Te Wai was introduced, which at the time recognised the life-supporting capacity of
27 freshwater and the reciprocal relationship between freshwater and hapuu and iwi (New Zealand
28 Government, 2014). This was strengthened in a 2017 amendment, acknowledging the mauri of
29 freshwater, and stating that those utilising freshwater are to “provide for Te Hauora o te Taiao (the
30 health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te
31 Tangata (the health of the people)” (New Zealand Government, 2017, p.7). The current NPSFM 2020
32 has once again strengthened the concept of Te Mana o Te Wai, establishing a hierarchy of
33 obligations to place the needs of freshwater first, followed by the needs of people, and third, the
34 “ability of people and communities to provide for their social, economic, and cultural wellbeing, now

1 and in the future” (New Zealand Government, 2020, p.5). While the inclusion and development of Te
2 Mana o Te Wai is an advancement on previous iterations (Te Aho, 2019), it has not been without its
3 tensions. Federated Farmers, a representative body within the primary industries sector, actively
4 spoke out against the inclusion and implementation of the 2020 iteration of the concept, suggesting
5 that Te Mana o Te Wai should not be implemented as it is too wide-reaching and broad (Federated
6 Farmers of New Zealand, n.d). Maaori have also spoken against the current iteration of the concept
7 with Waikato Tainui stating that the concept is not localised enough, referring to the already
8 established Te Mana o Te Awa (Waikato River Authority, 2019). Numerous regional councils have
9 also responded negatively because of difficulties interpreting the concept of Te Mana o Te Wai and
10 approaching its implementation, with submissions advocating for clarification of the concept (Bay of
11 Plenty Regional Council, 2019).

12 Some argue that despite the significant step forward in negotiating the inclusion of Te Mana o Te
13 Wai as such an influential freshwater management instrument, there are some limitations to the
14 conceptualisation and implementation of this concept. Russell (2000) discusses this from the
15 perspective of capacity, suggesting that Te Mana o Te Wai and its implementation will likely fall on
16 the backs of hapuu and iwi. It is not a given that all hapuu and iwi have the capacity to engage
17 meaningfully in such a conversation at the local or national level, given their historical
18 marginalisation in the system. Taylor (2022) furthers this point, highlighting the ambiguity built into
19 Te Mana o Te Wai and the lack of meaningful provisions through weak policy language, stating,

20 This perpetuates the compromise of Māori rights and interests, rather than facilitating fair
21 and equitable outcomes and the ability for iwi and hapu to govern and manage their tupuna
22 awa and other freshwater taonga as per Te Tiriti (Taylor, 2022, p.88).

23 The lack of power redistribution granted by these participatory structures is often a result of
24 legislation, policy, and governance regime, which ultimately inform how monitoring will contribute
25 to decision-making and how management is conducted (Knieper et al., 2010). We have seen many
26 cases globally where central governments have emphasised the importance of indigenous
27 knowledge in water management (Mantyka-Pringle et al., 2017, Moggridge et al., 2022). However,
28 the structures remain largely underpinned by Eurocentric environmental values and understanding
29 (McGregor, 2014). It remains to be seen whether implementation of Te Mana o Te Wai will
30 overcome this pitfall experienced by Indigenous peoples in other parts of the world.

31 A significant body of literature highlights the problematic nature of integrating concepts such as Te
32 Mana o Te Wai into Eurocentric structures such as legislation and policy. Coombes (2007) discusses

1 this in terms of knowledge production, making the point that because Eurocentric institutions
2 dominate knowledge production, the subaltern (in this case, iwi and hapuu) will be stuck in a loop of
3 translating their own values in a way that works for the dominant structure. This has been a
4 common concern in the literature, with Turvey (2009) making the point that Maaori concepts often
5 become “detached from their original purpose and meaning” within Aotearoa's legal system. A good
6 example of this is the Taniwha discourse in Aotearoa. The conception of Taniwha is so separate from
7 a Eurocentric perspective that it has been a tense example of “talking past each other” in freshwater
8 discourse (Evans & Kingsbury, 2022). However, Hikuroa has made significant strides in bridging the
9 gap in this discourse, highlighting the importance of Taniwha puuraakau (stories) as hazard
10 prevention (Hikuroa, 2020). Despite Hikuroa’s work to establish the reliability of Taniwha in the
11 public zeitgeist, there is still a consistent divergence in what is considered “real”, and whether
12 conceptualising Taniwha in this way is appropriate (Kingsbury, 2022). Although there are clear
13 tensions through co-management, bicultural values discourse, and Te Mana o Te Wai, these are
14 ultimately the tools we have to give effect to iwi and hapuu values. A tool does not have to be
15 perfect to be usable, this was made clear by Thompson-Fawcett et al. (2017), who acknowledge the
16 Eurocentric underpinnings of a policy document, such as an iwi management plan, but find that
17 many participations in their study had good experiences through the use of them.

18 1.4 Tools to Better Understand, and Deconstruct Divergences in Values 19 Values Frameworks & Typologies

20 Discussions about environmental values are inherently complex, and as Aotearoa seeks to better
21 represent the relational environmental values of hapuu and iwi in freshwater management, many
22 are grappling with how to even have this conversation. For Crown governance entities, a loose
23 conversation structure is often preferred, with practitioners focusing on workshops, hui, surveys, or
24 relatively informal communication with hapuu and iwi (Manaaki Whenua, n.d; Bay of Plenty Regional
25 Council, 2020). In the case of Taranaki Regional Council and Horizons Regional Council’s
26 implementation of Te Mana o Te Wai, as I have been party to on behalf of TKoR, a loose structure
27 that facilitates room for hapuu and iwi to provide articulations of environmental values has been the
28 approach to these conversations (Taranaki Regional Council, 2018 & Horizons Regional Council, n.d).
29 While an informal approach to freshwater values conversations seems common around Aotearoa
30 New Zealand, some would argue that the lack of structure leaves room for Government agencies to
31 ignore the presence and implications of values that have been embedded within existing structures,
32 making it difficult to identify gaps, divergences or limitations (Capano, 2009). Importantly, no one is
33 then accountable for the values that have left Aotearoa’s freshwater systems in such a poor state

1 and the burden then falls to Maaori to install values that restore the health of the systems. This
2 often means regional councils retain much of the power (Ellis, 2005), and often tend to equate
3 consultation with hapuu and iwi with their consent (Moore et al., 2020). Ison et al. (2007) call for a
4 more significant focus on epistemological awareness, advocating for the adoption of a more open-
5 ended and reflective process in water use regulation. Structuring the freshwater values discourse in
6 this way will not necessarily bridge te ao Maaori and te ao Paakehaa, however, it may create a
7 structured approach that identifies current gaps in freshwater management and opportunities for a
8 more productive way forward (William & Gordan, 2014).

9 Many scholars have developed structured approaches to organising conversations around
10 environmental values. While relational environmental values typologies in their current form may be
11 seen as a new development in the field, typologies as a way to organise environmental values
12 discussions date back to the 1960s and 70s. An early example is the Values Survey (Scott, 1959;
13 Feather, 1971), which aimed to provide a presence/absence measure of values through interviews
14 and surveys. At the same time, more nuanced Values-Ordination works were being conducted,
15 expanding on the presence/absence approach of the Values Survey, and instead grouping values
16 based on orientation (Kluckhohn & Strodtbeck, 1961). Such works lay the foundation for more
17 nuanced, and relational focused typologies for environmental values to be developed. This included
18 the "New Environment Paradigm", which aimed to measure group attitudes, rather than focus on
19 the individual's values (Dunlap, 2008); Kempton's American Environmental Values, which
20 determined three sources of environmental values in America: Religion, Anthropology, and Biophilia
21 (Kellert, 1996); and Kellert's Environmental Ethics Framework (2012), the typology I use in my
22 research here, and discuss in length below.

23 Over the past decade, environmental values typologies and frameworks have become more
24 sophisticated, capturing more complexity within the discourse. Rawluk et al. (2019) compiled a
25 framework by exploring the tensions between several value concepts, articulating these through two
26 axes: context dependence and level of abstractness. Raymond et al. (2013) produced what they call
27 a "multi-metaphor" approach to understanding environmental values, suggesting the use of
28 deliberation and metaphors regarding relationships with the environment may be a strong approach
29 to "foster a better understanding of the full range of values people hold with the environment. On a
30 more local scale, Tadaki et al. (2017) formed a typology based on different conceptualisations of
31 values and approaches to participatory mapping. Their typology guides organising the environmental
32 values discussions, creating a platform for practitioners to consider these approaches in various
33 ways to conceptualise values. Barnes et al. (2021) also provide a framework for organising values,

1 focusing on approaches to kaupapa through a collaborative lens. Environmental values studies have
 2 broken away from purely qualitative approaches to embrace the benefits of quantitative
 3 methodologies. This has been through structural and choice modelling to explore the connection
 4 between environmental values and behaviour (Schulz et al., 2018; Vollmer et al., 2016) or to better
 5 understand the orientation of values in relation to each other, expanding and adding rigour to the
 6 early work of Kluckhohn & Strodtbeck (1961). While quantitative methods continue to be used in
 7 problematic ways, centering the environmental values discourse in monetary or valuation terms
 8 (Satterfield et al., 2013), there is research to suggest we can use quantitative tools more
 9 meaningfully, a sentiment currently being addressed in an emerging body of literature (Shulz &
 10 Martin-Ortega, 2017).

11 **Kellert’s Framework**

12 Stephen Kellert addressed the need for more effective ways to reflect on values, limitations, and
 13 connections through his 1980s Environmental Ethics Framework (Hereby Kellert’s Framework). The
 14 framework was based on the biophilia hypothesis which states that people’s connection with nature
 15 is innate and ingrained through biology, principles, preferences, and virtues (Chan et al., 2016;
 16 Kellert & Wilson, 1993). Through interviews and discussions, Kellert and his colleagues developed a
 17 series of nine environmental ethics, which they believed did the best job of encompassing people’s
 18 relationships and values regarding wildlife (Kellert, 1997). These nine environmental ethics were
 19 later expanded on and altered slightly to incorporate ‘spiritual’ and ‘symbolic’ values, which Kellert
 20 believed encompassed not only wildlife but also landscapes and environments (Kellert, 2012).

21 Table 1: Table modified based on one produced by (Ross, Witt, & Jones, 2018). Showing the values identified in Kellert’s
 22 framework, those added or changed in 2012.

Original Version (Kellert, 1985)	Revised Version (Kellert 2012)	Definitions (Ross et al., 2018)
Aesthetic	Attraction	Aesthetic attraction to nature
Dominionistic		The urge to master and control natural environments
Ecological-Scientific	Reason	Understanding of nature The desire to know and intellectually comprehend the world, from basic facts to more complex understandings
Humanistic	Affection	Emotional attachment, affection for nature of aspects of nature
Moralistic		Sense of responsibility for caring for the earth Ethical concern for nature, restraint when exploiting nature
Naturalistic		Engagement with nature through direct experience, encounters
Negativistic	Aversion	Antipathy towards and sometimes fearful avoidance of nature. (Neutralistic merged with Negativistic)
Neutralistic		
Utilitarian	Exploitation	The desire to utilise and materially exploit the natural world
	Spiritual	Feelings of transcendence; reverence for nature
	Symbolic	Communication, language, design

23

1 While Kellert's environmental values are discreetly packaged and defined, Kellert made the
2 pluralistic, and fluid underpinnings of environmental values clear. Kellert recognised the negative
3 outcomes from the prevalence of values such as utilitarianism and stressed that conservation
4 activities will not succeed unless engaging with a complete set of environmental values (Diehm,
5 2012; Kellert, 1995). Many academics have used this framework and similar typologies to attempt to
6 extend this ethical discussion into current conservation methods (Bjerke & Kaltenborn, 1999), as
7 well as looking into the values of local community groups (Espinosa & Jacobson., 2012; Witt et al.,
8 2018), and tourists (Pratt & Suntikul., 2016), and studying children's experiences with nature (Van
9 Wieren & Kellert, 2013). In many of these cases, Kellert's environmental values have been built on or
10 altered to make them fit for purpose (Powell et al., 2012).

11 A number of limitations to implementing Kellert's environmental ethics values have been touched
12 on in the literature. Marks (2022) found these environmental values had limited ability to capture
13 the full breadth and complexity of the social environmental values communities hold. Further,
14 Sheremata (2018) and Ross et al., (2018) make the point that there may be a danger in using a
15 Eurocentric framework such as Kellert's to engage with cultural values, as there is an inherent risk of
16 an inaccurate or misguided view of cultural values. Despite this, Marks (2022), alongside others such
17 as Sheremata (2018), state that while a Eurocentric framework such as Kellert's might not be perfect
18 in capturing the breadth of values held by a community, it provides structure in facilitating a
19 reflective discourse regarding held values. What's more, these practical engagements with such
20 theoretical frameworks can help ground them with the realities of how people view and talk about
21 their environmental values.

22 1.5 Kaupapa Maaori Freshwater Assessment Tools

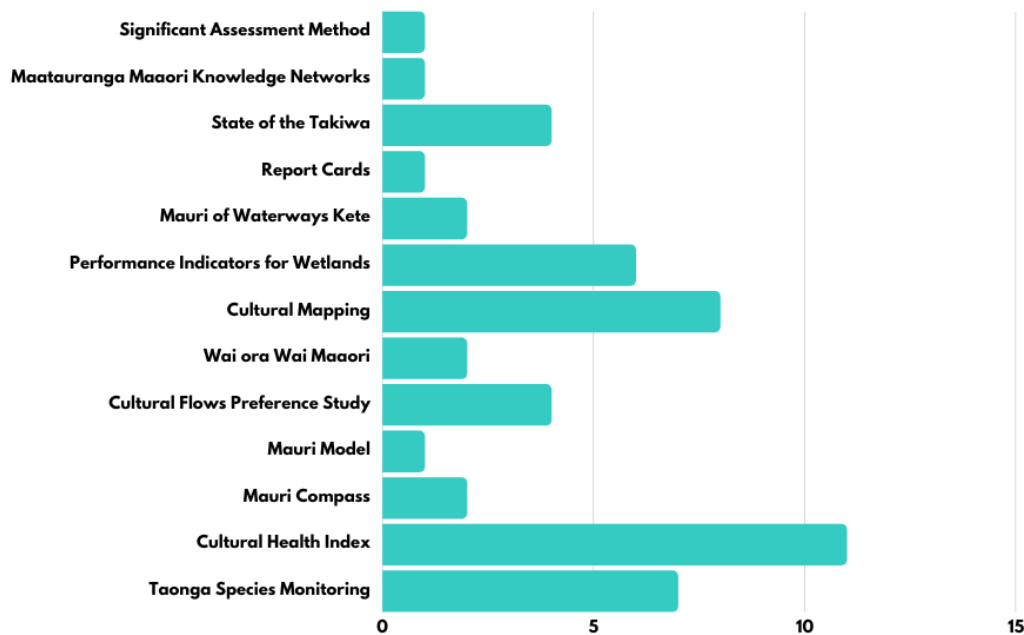
23 In addition to typologies, which can help us organise and approach the discourse on freshwater
24 values, we must also identify the tools which may give effect to the identified freshwater values. In
25 freshwater monitoring, kaupapa Maaori freshwater assessment tools have been critical. While
26 monitoring has been a central part of Maaori culture since arrival in Aotearoa, and earlier (Whaanga
27 et al., 2020; Warbrick et al., 2023), contemporary monitoring approaches focused on Maaori
28 environmental values were initiated through the Ministry of the Environment's (MfE) environmental
29 performance indicator programme (Jollands & Harmsworth, 2007). Through this programme,
30 tangata whenua were engaged to establish national indicators for environmental health that worked
31 for both Maaori and Paakehaa objectives (Ministry for the Environment, 1998; Rainforth &
32 Harmsworth, 2019). While little has been written about the success or failures of this initiative, it set
33 the foundation for the development of the Cultural Health Index, a joint venture between Kai Tahu

1 and MfE, and championed by Gail Tipa (Rainforth & Harmsworth, 2019). The success of the Cultural
2 Health Index had an influence on how cultural monitoring was conducted outside of Aotearoa, so
3 much so that it formed the basis for the Aboriginal Waterways Assessment in Australia (Mooney &
4 Cullen, 2019).

5 Since 2006, the development and use of Kuapapa Monitoring Freshwater Assessment Tools has
6 grown significantly across the country. The tools have taken on various forms and functions,
7 whether that be the further articulations of indices (Nelson & Tipa, 2012), or more complex tools,
8 such as the Mauri Compass (Benson et al., 2020), Wai Ora Wai Maaori (Awatere et al., 2017), or the
9 Mauri of Waterways Kete (Jefferies & Kennedy, 2009). While stemming from a MfE initiative,
10 kaupapa monitoring tools have become far more localised, with iwi and hapuu across the country
11 establishing tools for these specific parts of their rohe (tribal areas) (Benson et al., 2020; Awatere et
12 al., 2017; Tipa & Nelson, 2012). Many of these tools also retain elements of kaupapa Maaori theory
13 inspired by scholarship within the education research literature. With leadership by Graham
14 Hingangaroa and Linda Tuhiwai Smith and others, kaupapa Maaori theory is an approach to
15 conducting research that centres the values and tikanga of Iwi Maaori, and actively critiques
16 dominant western, positivist paradigms and practices (Smith, 2003, & Smith, 2021). The aim of many
17 of these assessments through a kaupapa Maaori approach is to achieve the following:

- 18 • *Full recognition of Maaori cultural values and systems;*
- 19 • *A strategic position that challenges dominant Paakeha (non-Maaori) constructions of*
20 *research;*
- 21 • *Determine the assumptions, values, key ideas, and priorities of research;*
- 22 • *Ensure that Maaori maintain conceptual, methodological, and interpretive control over*
23 *research;*
- 24 • *Ensure that Maaori protocol will be followed during research processes (Walker et al.,*
25 *2006, 333).*

Number of Councils Engaging with Maaori Frameworks



1

2 Figure 3: Adapted from the map produced by Rainforth & Harmsworth (2019) displaying the number of councils engaging
3 with each kaupapa Maaori freshwater assessment tool.

4 While the uptake of these tools has been significant, it is prudent to consider how effectively the
5 monitoring outputs have fed into and influenced freshwater decision-making. Ngati Mutunga's use
6 of the Mauri Compass is a good example, being included in expert evidence for consent hearings
7 (Benson et al., 2020) and in the Taranaki Regional Council's State of the Environment report
8 (Taranaki Regional Council, 2022). However, this does not give us tangible insights into the
9 effectiveness of tools. Rainforth and Harmsworth (2019) have also compiled a summary of kaupapa
10 assessment tools being used across the country in collaboration between Iwi and councils (Figure 3),
11 as well as a breakdown of what attributes or indicators each tool is able to assess. This was built on
12 by Baldawin et al., (2021), who use Rainforth and Harmsworth's work to summarise the common
13 attributes of these tools, as well as their availability. Beyond this small body of literature, we have
14 little to draw on to gauge and understand the success and limitations of these tools and how other
15 hapuu and iwi might collate a toolkit of monitoring tools that can give effect to the full complex of
16 their freshwater values.

17 Despite the rapid development of kaupapa Maaori assessment tools, Figure 3 shows that the
18 Cultural Health Index (CHI) remains prevalent and many of the newer tools are still not being taken
19 up yet. The CHI, developed by Gail Tipa and her colleagues (Tipa & Teirney, 2003), aims to use a
20 kaupapa Maaori approach to assess and quantify the values and needs of hapuu and iwi in river

1 management (Moggridge, Thompson, & Radoll, 2021). CHI aims to achieve this by producing Likert
2 scores based on indicators, which fall into site status, mahinga kai, and cultural stream health. Over
3 the last 15 years, the CHI has been adapted for local use by many hapuu and iwi across Aotearoa
4 (Bishop, 2019), each using slightly different indicators. While not reflected in Rainforth and
5 Harmsworth's paper, we have also seen the growing prominence of the Mauri Compass, a tool that
6 aims to better understand the state of mauri by identifying indicators that decision-makers believe
7 best represent and contribute to the mauri of a particular waterway (Benson et al., 2020). These are
8 often divided into environmental, cultural, social, and economic indicators. Each indicator is then
9 assessed on a scale between -2 to +2, which indicates the current state of mauri for a given indicator
10 (Hikuroa, Slade, & Gravley, 2011). While these tools do bring a broader set of indigenous
11 environmental values into a conversation dominated by Eurocentric methods, they are still
12 constrained by the need for quantitative measures and may have limited capacity to give effect to
13 the full complex of Maaori environmental values.

14 The limited literature and critical discourse about the politics, tensions, and history of kaupapa
15 Maaori freshwater assessment tools makes it difficult to develop and operationalise monitoring
16 toolkits that can give effect to Maaori environmental values. Without a detailed understanding of
17 the tensions and issues across the existing suite of kaupapa Maaori freshwater assessment tools, we
18 are unable to address them (Ison et al., 2007). A useful recent publication by Tadaki et al., (2022)
19 released during the execution of this research project, provides critical insights and support for my
20 arguments here. Through the exploration of three case studies, Tadaki et al., (2022) highlight the
21 tensions that play out when Government agencies become involved in the implementation of
22 kaupapa Maaori freshwater assessment tools and the danger of assigning value to these tools based
23 on how well they contribute to the efforts of State of the Environment monitoring.

24

1 Chapter 2: Research Methods

2 2.1 Positionality Statement

3 This research was completed as part of a Master's in Environmental Science at Te Herenga Waka –
4 Victoria University. The project was also part of my work plan as the Freshwater Scientist and
5 Advisor in Te Kaahui o Rauru (TKoR) - the Post-Settlement Governance Entity for Ngaa Rauru Kiitahi
6 iwi. The funding for the research, including my salary, was provided by the Ministry for the
7 Environment's Te Mana o Te Wai Fund, secured by Te Kaahui o Rauru to continue their Te Wai
8 Koiora freshwater management programme. The primary objective of the broader funding
9 programme is to build the capacity of Ngaa Rauru to take a leading freshwater management role
10 across their rohe. My key deliverable is to develop a freshwater monitoring framework that better
11 represents freshwater values of hapuu of Ngaa Rauru to ensure that monitoring data that informs
12 decision making can give effect to those values. My thesis presented here is a preliminary step in
13 that process. My broader work plan includes substantial engagement with Ngaa Rauru hapuu,
14 whaanau and uri from Whanganui to Patea and with Horizons and Taranaki Regional Councils. I've
15 built close working relationships with uri, who are intimately engaged within freshwater
16 management initiatives within the Ngaa Rauru rohe and with the operational elements of the
17 Puutaiao team in TKoR and the broader TKoR team. Through my work embedded within TKoR, I have
18 developed a working knowledge of the tensions and difficulties of ensuring Ngaa Rauru voices and
19 values are given effect to in freshwater policy and decision-making. The insights gained have defined
20 and guided my approach to designing the research question, data collection, and analysis.

21 I come to this research and broader work as an Environmental Science student of both Paakehaa and
22 Maaori Whakapapa with cultural links to my eastern European whakapapa. I spent my youth in
23 Taamakimakaurau; as an adult, I moved to Palmerston North to complete my BSc in Ecology and
24 continue that trajectory at Te Herenga Waka Victoria University of Wellington. My parents have
25 worked as social workers my entire life and raised my siblings and I, including two sisters with
26 intellectual disabilities. Through these circumstances, I have consistently been exposed to the
27 failings of policy and government. While my work is focused on the environment, my strong sense of
28 social justice and focus on representative decision-making, established in my formative years,
29 underpins my approach to and engagement in this research. This research and broader work has
30 been my first immersive engagement with te ao Maaori and has inspired my personal exploration of
31 my Whakapapa to Ngati Kahungunu ki Wairoa and Kai Tahu. While I did not grow up on the pa or

1 steeped in my Maaoritanga, I centre myself based on my obligation and responsibilities to my
2 tuupuna.

3 The positionality of my supervisory team is also integral to my approach to the research. My primary
4 supervisor Dr Billy van Uitregt (Ngaa Rauru, Te Aatihaunui-Paaraarangi, Tuuhoe, Dutch), is an
5 Environmental Studies Lecturer at Te Herenga Waka. Billy's research and teachings focus on how
6 Indigenous voices, values and knowledges are represented in contemporary environmental
7 management systems. Born in Australia, Billy has worked with Australian First Nations on
8 environmental projects and programmes. Since moving to Aotearoa, Billy has located himself in
9 Whanganui to do research that supports his hapuu and Iwi to assert their mana motuhake in the
10 environmental management of their rohe. Billy has also been working with TKoRs Taiao team to
11 deliver their Te Wai Koirora Programme and the project coordinator. Dr Andrew Rees is Canadian of
12 European descent with University qualifications in the Arts (BA. in Philosophy) and Sciences (BSc.)
13 and a PhD in Paleoecology from the University of New Brunswick. Andrew has been involved in
14 several community-focused initiatives through the Lakes 380 program, the aspiration of which has
15 been to support communities in building knowledge of their freshwater sources and conducting
16 restoration activities. As a collaborative team, we bring a broad and complementary suite of skills
17 and experiences to take a unique and exploratory approach to this complex research project.

18 2.2 Data Collection

19 This project had two avenues of data collection: the collection of assessment tool literature and the
20 collection of Ngaa Rauru Kiiitahi Cultural Impact Assessments (CIAs), Values Reports, submissions,
21 and consent hearing transcripts regarding freshwater. It became clear during the data-gathering
22 process that information was not readily available, with many organisations or iwi/hapuu holding it
23 internally. Because of this, the data collected does not necessarily provide a comprehensive picture
24 of both datasets. While reaching out to acquire this information would have been valuable in
25 fleshing out the data, the required effort would itself be an MSc. Based on a search through similar
26 theses, the number of documents I analysed (n=27, 15 Kaupapa monitoring tool documents, and 12
27 Ngaa Rauru documents) felt in line with others in the field.

28 Gathering Ngaa Rauru Kiiitahi Values Articulations
29 Uri o Ngaa Rauru have spent the last 20 years putting forward their koorero through CIAs,
30 submissions, value reports, and consent hearings. The articulations of Ngaa Rauru values were
31 gathered from these documents. Ngaa Rauru uri has expressed an ongoing sentiment that these
32 articulations have often been neglected in the decision-making process. Because of this, I did not
33 feel it was appropriate to conduct more interviews to gather articulations of Ngaa Rauru values, as

1 much of this koorero has already been given. This framing positions this work as one that
 2 contributes to an ongoing conversation, rather than attempting to begin one independently.

3 The documents available within Te Kaahui o Rauru’s file network were compiled and reviewed. Any
 4 further relevant documents were identified by searching all websites of relevant regional councils
 5 (Taranaki & Horizons Regional Council) and district councils (Whanganui and South Taranaki District
 6 Councils). This exploration of each website included a search for “Ngaa Rauru” and “Cultural Impact
 7 Assessment” in their respective search bar. The outcome of this exploration resulted in 12
 8 documents to analyse (table 2). While more documents were identified, after a preliminary review,
 9 these were either not in scope or were one-page documents with very little detail. The 12
 10 documents analysed were detailed and comprehensive enough to give a good picture of the breadth
 11 of Ngaa Rauru values.

12 Table 2: Summary of the Ngaa Rauru documents used in this analysis. The Name in Analysis column are the terms used to
 13 refer to these documents in the results and discussion section.

Name of Document	Name in Analysis	Type of Document	Compiled By	Year
First Gas Pipeline	NR(1)	Cultural Impact Assessment	Te Kaahui o Rauru	2022
Waiau water abstraction	NR(2)	Cultural Impact Assessment	Te Kaahui o Rauru	2022
Report for Transpower New Zealand	NR(3)	Cultural Impact Assessment	Ngaa hapuu o Ngati Puukeko, Ngati iti, me Tamareheroto	2019
Nukumarū Station Road Extension	NR(4)	Cultural Impact Assessment	Ngaati Ruaiti	2017
Otamatea Structure Plan Change	NR(5)	Values Statement	Te Kaahui o Rauru	2017
Waiinu Wastewater Treatment Plant	NR(6)	Cultural Values Report	Te Kaahui o Rauru	2017
TrustPower Waverley Wind Farm	NR(7)	Cultural Impact Assessment	Te Kaahui o Rauru	2016
Trans-Tasman Resources Limited	NR (8)	Values Statement	Te Kaahui o Rauru	2016
Waitootara Water Take	NR (9)	Cultural Impact Assessment	Te Kaahui o Rauru	2010
Pukeone Partnership & Kereone Farms Limited for Water Take	NR (10)	Statement of Evidence	Tauranga ika marae	2010
Pukeone Partnership & Kereone Farms Limited for Water Take	NR (11)	Hearing Transcript	NA	2010
Allco Wind Energy NZ LTD	NR (12)	Cultural Impact Assessment	Wai o Turi Marae Trust	2007

14

15

1 Gathering Kaupapa Maaori Assessment Tools Protocols and Implementation Documents
2 Several literature reviews compiling the available kaupapa monitoring tools have been released over
3 the last five years. These reviews focus on where, how, and which tools are currently being used in
4 Aotearoa. As these reviews are recent and comprehensive, they were used as the basis to collect
5 kaupapa monitoring tool documents (Rainforth & Harmsworth, 2019; Maanaki Whenua, n.d.;
6 Bishop, 2019; Taranaki Regional Council, 2019). Of the four literature reviews, 20 frameworks were
7 identified (table 3), encompassing freshwater, marine and wetland environment aspects.
8 Assessment tools identified in more than one literature review were included for further analysis. I
9 wanted to focus my efforts on the most well-used and written-about assessment tools to date, while
10 a methodology such as this could be fleshed out later to analyse a more considerable breadth of
11 assessment tools.

12 For each assessment tool, two documents were identified for the analytical process. An informal
13 search through Google Scholar and Google was conducted for the nine assessment tools to identify
14 potential documents to analyse (table 3). The following string was used: (“assessment tool name”
15 AND“(Aotearoa OR “New Zealand”) AND (freshwater OR “wai maaori”). While using a single string
16 to conduct this search is a limiting approach, it creates transparency in the study, allowing readers to
17 understand the finer detail of the process (Mohamed Shaffril et al., 2021). The use of this string
18 resulted from the initial struggle to search for literature. While many articles were identified in the
19 initial exploration of literature, they were often not specific to Aotearoa or freshwater. The above
20 string was used to minimise irrelevant literature and narrow the scope of our search, ensuring that
21 most articles would be relevant to this project. The title and abstract of each article/report were
22 evaluated against these criteria:

- 23 - The document needed to be explicitly associated with the care or management of freshwater
- 24 - The document must detail the methodology, or process, of implementing a kaupapa Maaori
25 freshwater assessment tool.

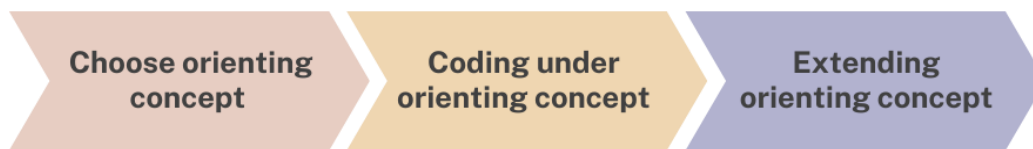
26 The documents relevant came in various formats beyond academic articles: regional council reports,
27 Post Governance Settlement Entity (PGSE) reports, and independent reports from hapuu, iwi or
28 consultants. Many of these documents would not have been identified through Google Scholar.
29 Therefore, the same string above was used through Google. For “Maori Environmental
30 Performance Indicators”, only one paper was identified. Because of this, and the fact that this tool is
31 specific to wetlands not encompassing the wider freshwater environment, the tool was omitted
32 from this analysis. Stream Health Monitoring Assessment Kit was also omitted, as this tool was
33 included in the documents chosen for State of the Takiwa.

1 Table 3: List of kaupapa Maaori assessment tool frameworks identified in four literature reviews. Bolded names are those
 2 specific to river and stream environments. Column 5 – 8 represent which tools were discussed in each literature review,
 3 those in orange indicating the kaupapa monitoring tool was discussed.

	Name in Analysis	Results from Literature Search	Maanaki Whenua, n. d	Bishop, 2019	Taranaki Regional Council, 2019	Rainforth & Harmsworth, 2019
Taonga Species Monitoring						
Cultural Health Index	KMFAT (1)	132				
Mauri Compass	KMFAT (2)	9				
Mauri Model	KMFAT (3)	91				
Cultural Flows Preference Study	KMFAT (4)	78				
Wai Ora Wai Maaori	KMFAT (5)	21				
Cultural Mapping						
Maaori Environmental Performance Indicators for Wetland Condition and Trend		2				
Mauri of Waterways Kete	KMFAT (6)	7				
Catchment Report Card	KMFAT (7)	218				
State of the Takiwa	KMFAT (8)	28				
Maatauranga Maaori Knowledge Network						
Significant Assessment Method						
Kaitiaki Tools						
Nga Waihotanga Iho						
KEIAR Framework						
Nga Atua-Based Framework						
Stream Health Monitoring Assessment Kit		21				
Stream Habitat Assessment Protocol						
Te Uri o Hau						

4
 5 **2.3 NVIVO Qualitative Analysis**

6 A mixed inductive/deductive approach was taken for our qualitative analysis, following the
 7 exploratory process detailed by Layder (2014). While deductive approaches may be the more
 8 common choice in this type of analysis, they are often criticised throughout literature, with data that
 9 falls outside the framework being forced through or not recognised (Thomas, 2006). The three
 10 critical steps to Layder’s approach (Figure 4) allowed me to structure this process while still being
 11 able to expand its confines. This coding style was essential when working with values across
 12 different worldviews.



1

2 Figure 4: Three components of Layder’s (2014) exploratory approach to textual analysis implemented in this thesis.

3 **Orienting Concept: Kellert’s Environmental Ethics Framework**

4 Kellert’s Framework (Kellert, 2012) was the orienting framework to structure this analysis. Kellert’s
 5 framework was detailed in our introduction and was selected for several reasons. Firstly, Kellert’s is
 6 one of the easier typologies of environmental values to engage with. As Kellert’s framework has
 7 been well articulated in language easily engaged with, it was a good option to conduct this research
 8 in a way that minimises barriers of entry. Secondly, Kellert’s framework is already being used in the
 9 freshwater values discourse with indigenous communities, as discussed in the introduction (Papuga,
 10 2021; Pinner et al., n.d.). As this literature is all relatively timely, the use of Kellert’s framework
 11 contributes to a growing conversation about implementing typologies in freshwater values
 12 discourse.

13 **Coding Under Orienting Concept: Ngaa Rauru Document**

14 The 12 Ngaa Rauru Kiitahi documents were analysed under Kellert’s framework. Each of Kellert’s
 15 values was assigned as a node in NVIVO 12 (Released March 2022). An extra node named ‘Other’
 16 was created for text which fell outside of Kellert’s framework, and a node called ‘Discussion Points’
 17 was created for text that warranted further discussion. Each document was read in its entirety
 18 before coding was conducted. This allowed me to organise my thoughts and become familiar with
 19 the format and content of these documents before undergoing analysis (Bruan & Clarke, 2013). Text
 20 sections were assigned to the appropriate nodes when reading through documents after the initial
 21 reading. No predefined amount of text was allocated to nodes (i.e., did not have to be a sentence or
 22 a paragraph). Instead, the amount of text coded was based on the amount required to reflect the
 23 appropriate values. After the first coding session for each Ngaa Rauru document, all nodes were
 24 reviewed to ensure the codes assigned were appropriate.

25 **Extending Orienting Concept: Ngaa Rauru Documents**

26 Any code which did not fit into Kellert’s was coded to the ‘Other’ node. This node then went through
 27 a conventional inductive thematic process. While many guides and approaches have been published
 28 that articulate this approach, we adopted the popular six-step approach (Kiger & Varpio, 2020):

- 29 - Familiarising yourself with the data
- 30 - Generating initial codes

- 1 - Searching for themes
- 2 - Reviewing themes
- 3 - Defining and naming themes
- 4 - Producing the report/manuscript

5 The first two steps were covered during the coding process under Kellert's framework. Each code
6 within the 'Other' node was analysed and assigned to new nodes that I believed would reflect the
7 value identified. These new nodes and their contents were then reviewed. During this process, we
8 ensured each node represented the value specified in the text and merged and deleted nodes if
9 needed.

10 Applying Extended Orienting Framework to Kaupapa Maaori Assessment Tools
11 The nodes created from the process above were no longer changed or reviewed. The newly
12 identified values were used alongside Kellert's framework to analyse our assessment tool data set.
13 This allows us to see how well the values articulated in assessment tools align with Ngaa Rauru
14 values documents. Each assessment tool document went through the same process as the Ngaa
15 Rauru documents. An initial reading was conducted, and the document was coded from the second.
16 While we did not regularly review the coding with the intent to make changes to our nodes, the
17 coding was periodically reviewed to ensure consistency. These reviews occurred collaboratively with
18 my supervisors, through which we pulled out random sections of code and discussed if we agreed or
19 disagreed on its placement

20 Coding for Stated and Practical in Kaupapa Maaori Assessment Tools
21 The Stated and Practical criterion (The definition for which is in the following section) was included
22 due to the ongoing reflection and review process with my supervisors. When giving effect to values,
23 there is an implication that tools will have some form of output that can feed into or inform
24 decision-making. We felt that just coding for values did not capture the nuances of this discussion,
25 and this criterion was a potential solution. Each value node had two children nodes attached, one for
26 stated and one for practical. When assigning a value to a node, I further identified whether the text
27 fits into the stated or practical categorisation. This Stated/Practical criterion was purely used on the
28 assessment tool data set.

29 A key issue throughout this analysis was the subjectivity of what is considered stated and practical.
30 Because of the subjective nature of qualitative research, it was essential to be transparent about my
31 interpretations and understandings of these concepts (Braun & Clarke, 2013). While it was not
32 necessary to establish definitions in an absolute way, it was essential to have what practical and

1 stated meant to me articulated when coding. My supervisors and I undertook several practice tests
 2 to produce this articulation. We each ran through a practice coding session independently, using this
 3 stated/practical criterion. Once done independently, my supervisors and I came together to discuss
 4 how we interpreted these articles and challenged our interpretations. Two more rounds of this
 5 confirmation testing process occurred. This process aimed not to arrive at an objective or definitive
 6 understanding of these terms, but to be confident that I had a clear understanding, and coding
 7 would be as consistent as possible.

8 Interpretations of Practical and Stated

9 While coding under Stated, I spent significant time coding for document introductions, highlighting
 10 the core te ao Maaori concepts articulated to set the scene and contextualise the works. While these
 11 are ‘stated values’, I decided the criterion needed to be more specific, landing on stated values as an
 12 “explicit value or theme the assessment tool aims to achieve”.

13 Defining ‘practical’ was a more complex process. What is practical has a much larger breadth of
 14 subjectivity than what might be considered ‘Stated’. To define this, we returned to our thesis
 15 question, “How well can existing kaupapa Maaori freshwater assessment tools give effect to the full
 16 complex of Ngaa Rauru freshwater values?” I referred to the term “give effect” and its definition
 17 through the King Salmon case law (Atkins et al., 2019). In light of this, a practical code section
 18 needed to detail some form of output that could theoretically feed into the decision-making process
 19 or describe some aspect of the assessment tools methodology. No confines were placed on whether
 20 this needed to be qualitative, quantitative, or biophysical. Confines were also not placed on whether
 21 this needed to be a reductive output. However, due to the nature of this framing, it is likely that
 22 reductive outputs will come through strongly in the category.

23 Table 4: Examples of practical and stated coding from our practice run-throughs using this criterion.

Stated	Practical
“To carry out this programme, the Trust identified the need to involve Tangata Whenua and gather water quality data that would take into account historical and cultural values associated with Te Ihutai, including mahinga kai” (Pauling et al., 2007).	“To apply the CHI, members of the iwi/hapū/rūnanga assessment team visit selected sites in a stream catchment and look over a stream reach from a vantage point. The team also walks along the river bank and views the river upstream and downstream, visually assessing the health of the site” (Tipa & Teirney, 2006).
“The Mauri Model takes the approach of incorporating health and hygiene considerations within the mauri of the community, and incorporating functional and technical considerations	“Attribute: Condition of kaitiaki/tipua/taniwha – resilience and connectivity of human beings to metaphysical beings such as kaitiaki/tipua/taniwha” (Awatere et al., 2017)

within the economic criterion”
(Morgan, 2006).

- 1
- 2

1 Interpreting the Broader Values
2 There was the same need to have this articulated for all values used in this analysis beyond the
3 stated/practical criterion. This same process detailed above was used for all identified values. While
4 Kellert had already articulated value within a framework, having articulations for myself was an
5 essential part of the process. Even though Kellert's writing shaped my interpretation of these values,
6 I also read many articles that articulated values differently. Through this process, I aimed to ensure
7 that the values encompassed in Kellert's were being interpreted as consistently as possible. This
8 contributed to the document in Appendix A, which articulated how Kellert's values were analysed in
9 this thesis.

10 2.4 RStudio Quantitative Analysis

11 Extracting data from NVIVO

12 Quantitative data was imported to RStudio (version 4.2.0) from NVIVO 12 using the 'Text Report
13 Function'. The report produced an Excel file containing the name of each document, each value
14 assigned to it, and the number of times that value was coded for. This information was converted
15 into one matrix and one frequency table for analysis in RStudio (Appendix B, C).

16 Coding Frequency Analysis

17 A key constraint in understanding the frequency of our coding was that documents were
18 inconsistent in length. Because of this limitation, the data set was treated as a whole, all assessment
19 tools as one data subset, and Ngaa Rauru documents as the second. The raw frequency table
20 (Appendix B) was imported to RStudio and split into two data frames using the 'Filter_all' function in
21 package dplyr (Wickham et al., 2023). The first data frame was for Ngaa Rauru values, consisting of
22 two columns, "Value Names" and "Coding Number". The second data frame was for assessment
23 tools, composed of three columns "Value Name", "Stated or Practical", and "Coding Number". Both
24 data frames underwent a root square transformation to reduce the impact of outliers and make
25 visualisations more readable.

26 The Ngaa Rauru dataset was plotted as a bar graph using ggplot2 (Wickham, 2016). The assessment
27 tool dataset was plotted as a stacked bar graph displaying the amount of practical and stated coding
28 for each value. This was also done using ggplot2.

29 Principal Components Analysis

30 Using the data matrix arranged as articles (row names) by values (column names) (Appendix C),
31 principal components analysis (PCA) was used to interpret the relationships between values in this
32 data set. PCA does not seem to be often used in freshwater values discourse, with more emphasis
33 on analyses which balance, order, or translate values (Sinner et al., 2014). Through my thesis, I have

1 tried to be explicit in not attempting to order values based on importance but better understand the
2 relationships between values. Because of this, standard tools to balance or rank freshwater values
3 would not be appropriate, so PCA better served this kaupapa.

4 The PCA analysis was conducted for the dataset as a whole, including all documents analysed (n=27).
5 When considering transformations to stabilise variance (e.g., square-root, Hellinger, centred log-
6 ratio, etc.), zero values can cause issues (Zuur et al., 2010). Consequently, half the minimum value
7 greater than zero in each column was added to each value. For instance, if a count of 1 was the
8 minimum value greater than 0 in a column, then 0.5 was added to each value in that column. A
9 Hellinger transformation was then applied, converting the data from absolute counts to relative
10 abundance, minimising effects of counting effort (Roberts, n.d). This thesis focuses on the relative
11 abundance of values rather than the absolute, so this transformation was appropriate. The PCA was
12 run in R v4.2.3 (R core team, 2023) using the prcomp function with values scaled to unit variance.

13 A scree plot was produced using the function fviz_eig from package factoextra (Kassambara &
14 Mundt, 2020). The scree plot splits the data into components, visualising and explaining how much
15 variance is captured by each (Wilcox, 2012). The standard elbow method and the Kaiser Criterion
16 were used to interpret this graph. The standard elbow method suggests all components above the
17 elbow of the graph are meaningful, whereas the Kaiser Criterion indicates all components above
18 10% should be retained.

19 A contribution graph was produced based on the retained components using the fviz_contrib
20 function in the factoextra package (Kassambara & Mudt, 2020). These graphs show the percentage
21 of the contribution of each value to a given component, telling us the extent to which each value
22 explains the variance within that component (Wilcox, 2021). A reference line showing the expected
23 number if all contributions were equal was included in these graphs. Any values below this reference
24 line were removed from further consideration. PCA plots were then produced using the factoextra
25 package for 2-dimensional plots and the rgl package (Murdock & Adler, 2023) for three-dimensional
26 plots. Using the same matrix for the PCA, a correlation plot was produced using the corrplot function
27 from the package corrplot (Wei & Simko, 2021).

28 Cluster Analysis and Dendrogram

29 Based on the same transformed matrix used in the PCA, clusters were identified, and dendrograms
30 were produced for both Ngaa Rauru Values Documents and Assessment Tools. The cascadeKM
31 function from package 'vegan' was used to identify clusters (Oksanen et al., 2022). Using this
32 function, a calinski criterion was applied to the matrix, which evaluates the optimal number of
33 clusters within the data. From these clusters, the documents analysed were plotted based on their

1 orientation to each other, with the clusters as groupings. The same clusters were applied to our PCA
2 graph. Using the transformed matrix, two dendrograms were produced using the Euclidean method
3 and the stats package (R Core Team, 2022). For the dendrograms created using this method, the
4 similarity and distance between values were measured, and these relationships were plotted using
5 the base package (R Core Team, 2022).

6

1 Chapter 3: Results

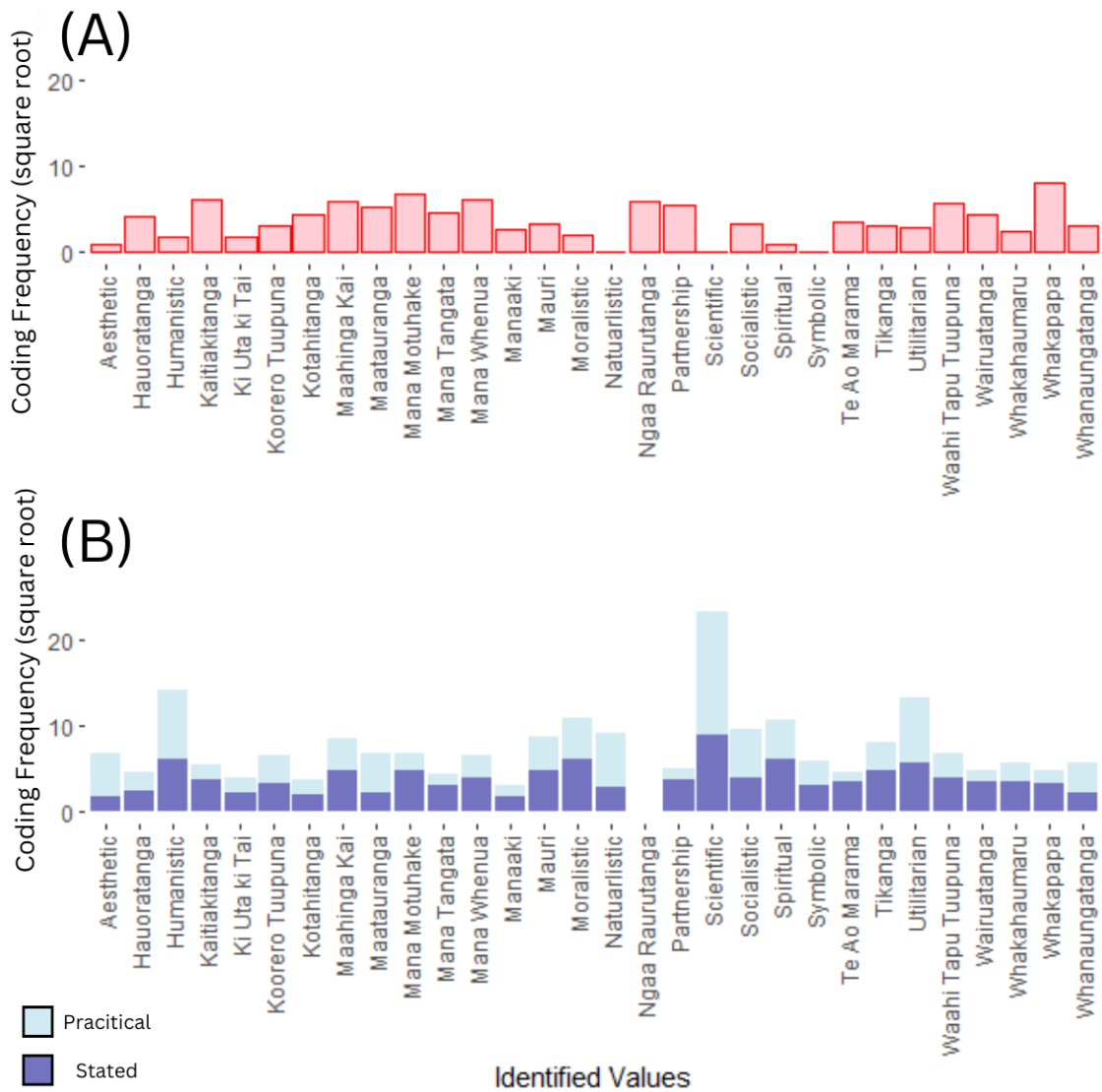
2 3.1 Frequency & Practical/Stated Criterion Analysis

3 A further 19 values were determined beyond those specified in Kellert's framework. These are listed
4 along with their articulations in Appendix A. Output divergences are immediately apparent in Figure
5 5, with many of Kellert's values having high coding frequency in the assessment tools (B) and
6 insignificant frequencies in Ngaa Rauru documents (A). The highest frequency values in Figure 5B all
7 come from Kellert's framework (Scientific, Humanistic, Utilitarian, Moralistic, Naturalistic). Only after
8 these do we begin to see the frequency of values such as Mauri, Mahinga Kai, Tikanga, and
9 Maatauranga increase. However, these are all significantly lower than many of Kellert's values,
10 particularly Scientific and Utilitarian. There is also a significant dichotomy between Ngaa Raurutanga
11 and Scientific. Both values are present at a high frequency; however, Ngaa Raurutanga is exclusive to
12 Ngaa Rauru documents, and Scientific is exclusive to Assessment Tools. Figure 5A tells a contrasting
13 story, with Whakapapa, Mana Motuhake, Ngaa Raurutanga, Mana Whenua, and Mana Tangata
14 being high in frequency, with little presence of Kellert's values. Another key divergence is
15 Whakapapa, being significantly higher in the Ngaa Rauru documents than in the Assessment tools.
16 While Whakapapa is present in the assessment tools data set, Figure 5B and Figure 6 show that the
17 coding is confined mainly to Stated rather than Practical. This is an ongoing theme throughout many
18 of the Ngaa Rauru values.

19 Mana Motuhake, Mana Whenua, Mana Tangata, Kaitiakitanga, and Mauri are all well represented in
20 both data sets. While these values are present across the data, they are largely coded to the stated
21 category rather than the practical, suggesting there may not be as many practical means of giving
22 effect to these values (Figure 5B, Figure 6). This is relatively consistent across the assessment tool
23 data set, with very few values yielding high statistics in the practical category (Figure 6). Figure 6
24 shows that the Aesthetic, Naturalistic, Utilitarian and Scientific values are all primarily represented in
25 the Practical category. However, there are a number of Ngaa Rauru values that do yield strong
26 practical results, including Maatauranga, Mahinga Kai, and Whanaungatanga. Our Practical and
27 Stated coding shows that the ability to give effect to values is not presented in the confines of a
28 dichotomy, as many of Ngaa Rauru values have some form of practical coding. This highlights an
29 opportunity within these tools to bring these practical aspects to the forefront.

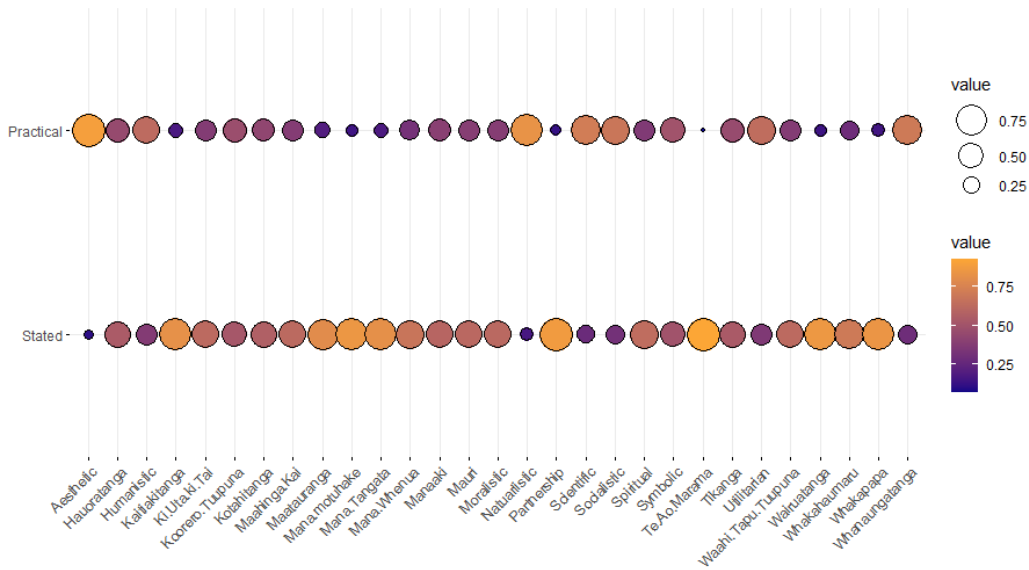
30

31



2

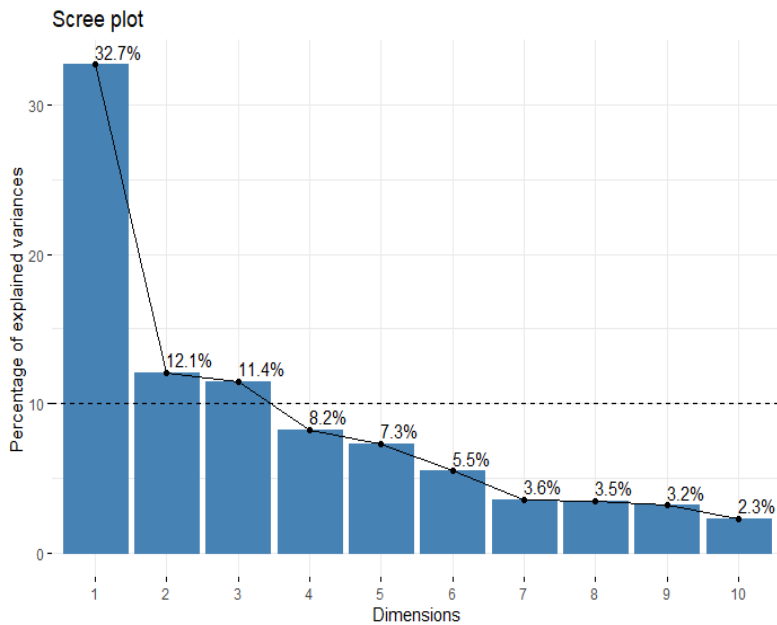
3 Figure 5: Comparative frequency of values from the Ngaa Rauru documents (A) and kaupapa Maaori freshwater
 4 assessment tool datasets (B). (B) visualises the proportion of Practical and Stated coding for each value. Frequency was
 5 taken from NVIVO coding, and a square root was applied for ease of visualisation. This figure presents a clear divergence
 6 between the frequency of Kellert’s values between these two data sets and the low frequency of practical coding for many
 7 of the Ngaa Rauru values.



1 Figure 6: Bubble plot displaying the proportion of practical and stated coding for each value. The larger orange values
 2 indicate a higher proportion, while the smaller purple values indicate a low proportion.

3 3.2 Principal Components Analysis

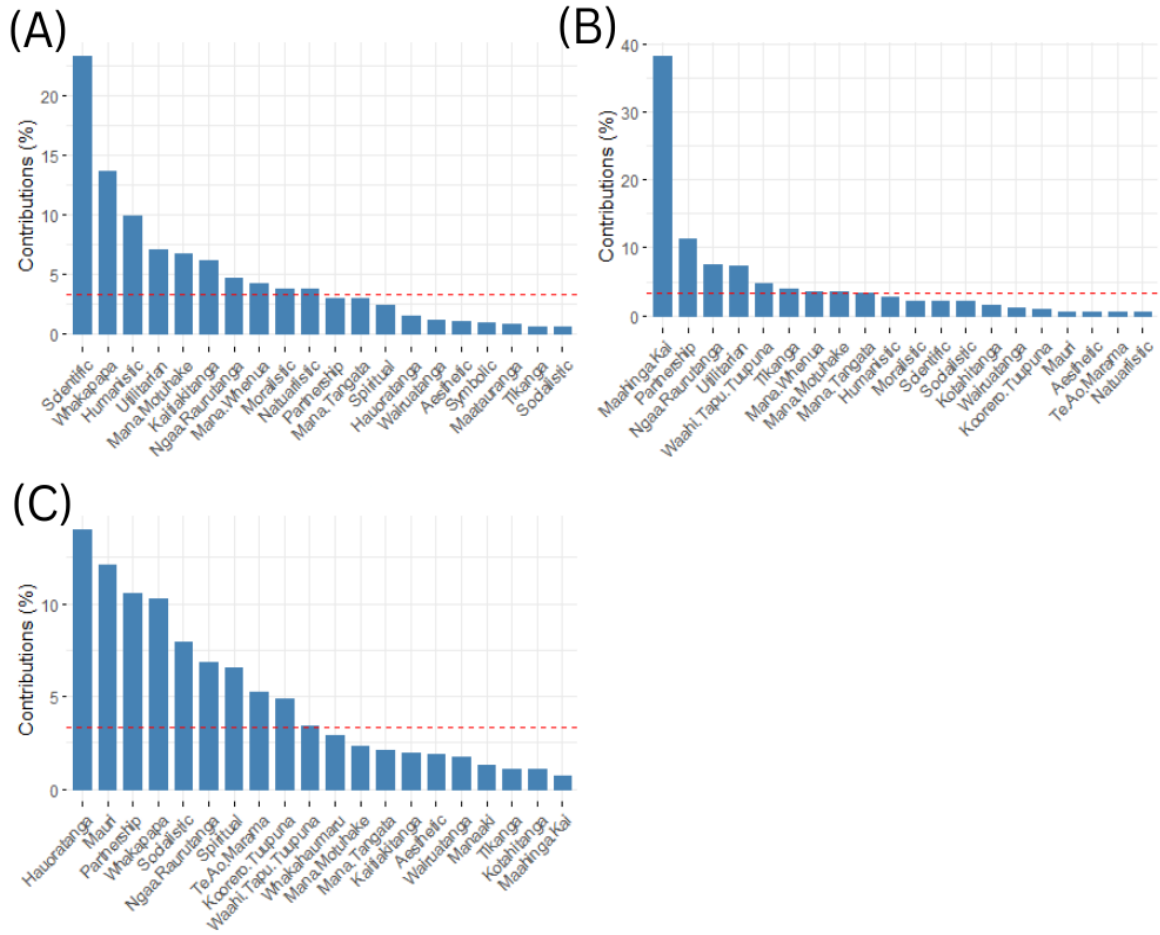
4 Out of the ten principal components identified, Figure 7 shows that the first three explained 56.2%
 5 of the variance in our data set. Both the elbow method and Kaiser’s rule suggest we keep the first
 6 three components for further analysis, as displayed by the components over the dashed line in
 7 Figure 7.



8 Figure 7: Scree plot showing the variance explained for each principal component. Based on the Kaiser rule and elbow
 9 method, I retained three components.

10 Figure 8 displays the values contributing to each principal component and to what extent. Figures 8A
 11 and 8B show that Scientific largely guides the first principal component (25% contribution) and
 12 Mahinga Kai the second (38% contribution). These are both notably higher than the remaining

1 values. Values like Aesthetic and Wairuatanga are not included in any of these components,
 2 suggesting they are not as important or that the surveyed literature did not accurately capture these
 3 values. It is important to note that all components are a mixture of various values without a distinct
 4 structure. The lack of structure may suggest a high level of complexity that linear scales could not



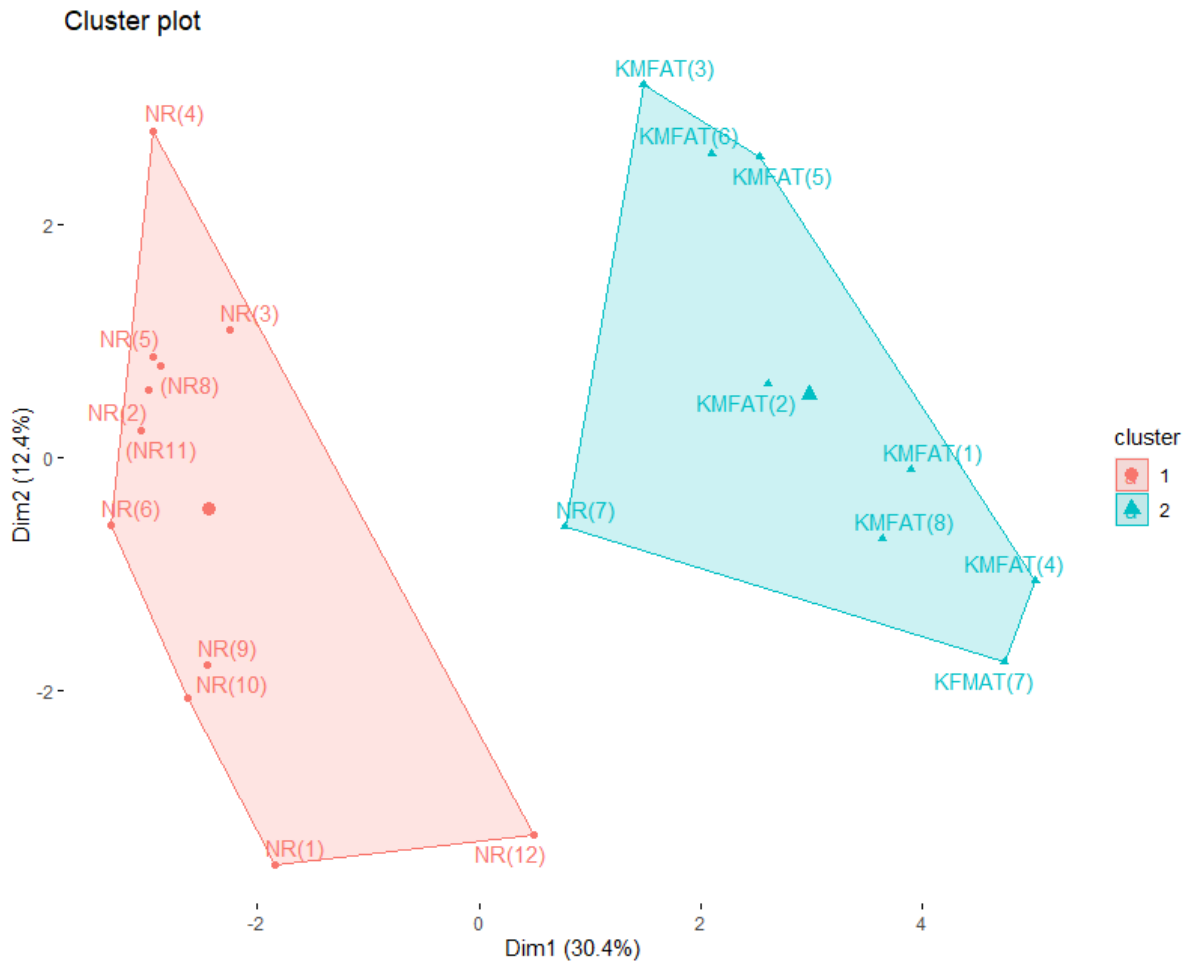
5 capture.

6 Figure 8: The contribution of values to each principal component. (A) displays the contribution to the first component, (B)
 7 the second, and (C) the third. The red reference line refers to the level we would explicitly see if all values contributed
 8 equally.

9 3.3 Identifying Clusters for PCA

10 The Calinski Criterion analysis suggests that two groupings are optimal to define the data. These
 11 groupings are displayed in Figure 9, showing a distinct separation between Ngaa Rauru Documents
 12 (NR) and Assessment Tools (KMFAT). Both clusters present relatively large spreads, however, the
 13 divergence between the two is clearly displayed, with NR(7) being the only Ngaa Rauru document
 14 that plots in Cluster 2 alongside the assessment tools. Cluster 2 of Figure 9 shows two further sub-
 15 groupings, KMFAT 3,6 and 6, which corresponds to “Mauri, Model, Mauri of Waterways Kete, and
 16 Wai ora Wai Maaori” and KMFAT 1,8,4,7 which corresponds to “Cultural Health Index, State of the
 17 Takiwa, Cultural Flows Preference Study and Report Cards”. This suggests that these groupings are

1 assessment tools close together in values coding. However, neither sub-grouping is noticeably closer
 2 or farther from Ngaa Rauru documents. There is one identifiable subgrouping in cluster 1 of
 3 NR(2,3,4,6,8,11), which the remaining Ngaa Rauru documents being spread across a relatively large
 4 distance.



5
 6
 7 Figure 9: Clustering of documents analysed. The decision for the two clusters was based on the Calinski Criterion. Dim 1
 8 refers to principle component 1 and Dim 2 is principle component 2. These two dimensions are scaled to represent the
 9 relationships between documents. This figure shows a significant divide between our Ngaa Rauru documents and kaupapa
 10 Maaori freshwater assessment tools.

11
 12

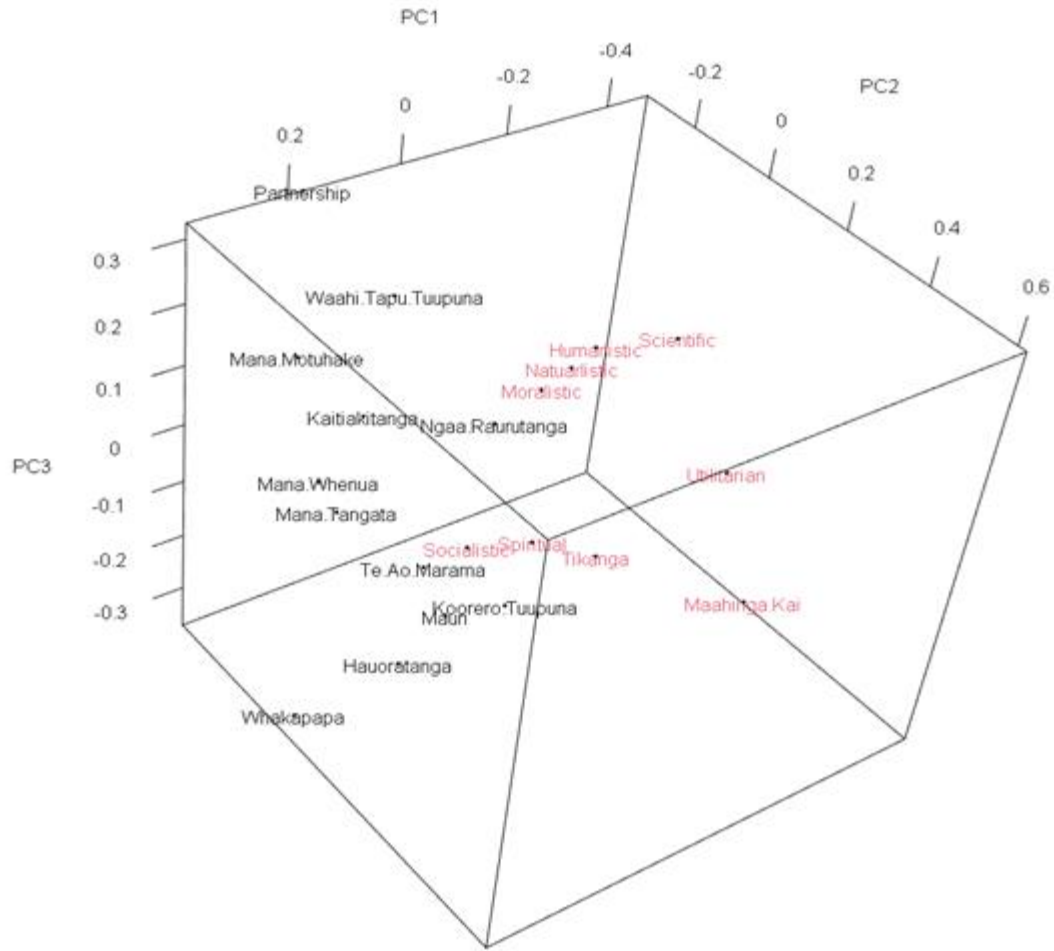
1 3.4 Principal Components Analysis

2 The cluster groups, derived from Figure 9 and applied to this PCA, show a substantial divergence,
3 with Ngaa Rauru values primarily in cluster 1 and Kellert's in cluster 2. Mahinga Kai, Tikanga, and
4 Socialistic are the exceptions to this rule, falling within cluster 2. Despite this divergence, Figure 10
5 tells a more nuanced story than what is painted in Figure 9. Values of Socialistic, Tikanga, Spiritual, te
6 ao Marama, Koorero Tuupuna, and Mauri sit close together on this graph. This grouping may
7 represent values associated with a more holistic interpretation of connections to nature. Another
8 key cluster is "Scientific, Humanistic, Naturalistic, and Moralistic", which could represent a group of
9 values underpinned by a human-centric ethic towards nature. The 3D display of Figure 10 truly
10 highlights the complexity of the relationships between these values. When rotated to purely display
11 PCA 1 and PC2 (the two components which capture the most variability), we see that most of these
12 relationships break down (Figure 10B). A new formation of groupings can also be seen as we rotate
13 this graph, highlighting a relatively consistent association between Kaitiakitanga, Mana Motuhake,
14 Ngaa Raurutanga, and Waahi Tapu. The need for three principal components and the fluidity in the
15 relationship highlights the spatially variable in how values relate to each other.

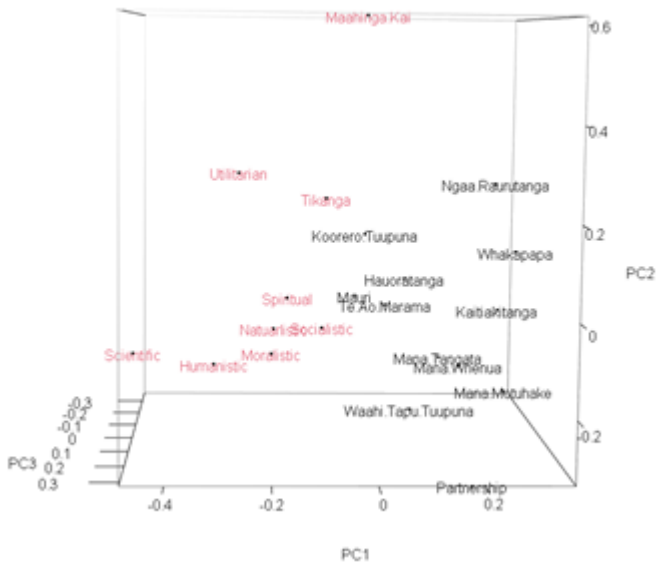
16

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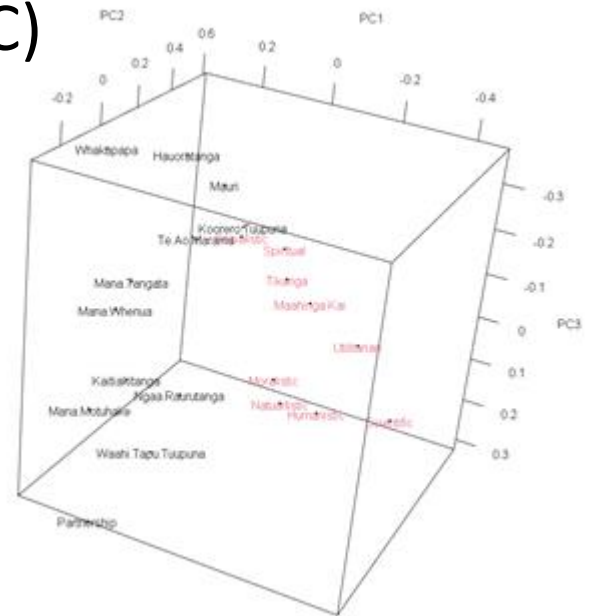
(A)



(B)



(C)



- 1
- 2
- 3
- 4
- 5
- 6

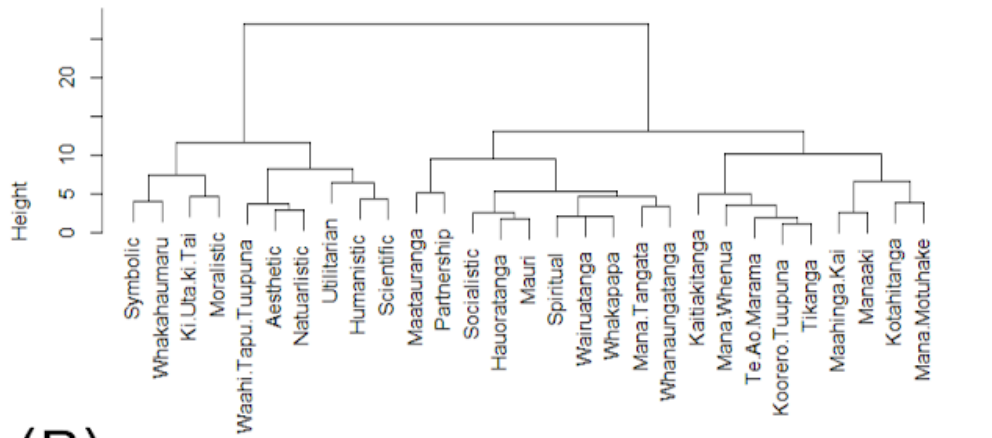
Figure 10: A 3D principal components analysis using the three components discussed in Figures 7 and 8. Each component is treated as a scale (PC1, PC2, PC3), and the values have been plotted against them. A, B and C represent the same plot at different angles of the sample data. (A) and (C) visualise different angles of looking at all three scales, and (B) visualise principal components 1 and 2.

1 3.5 Cluster Analysis for Data Subsets

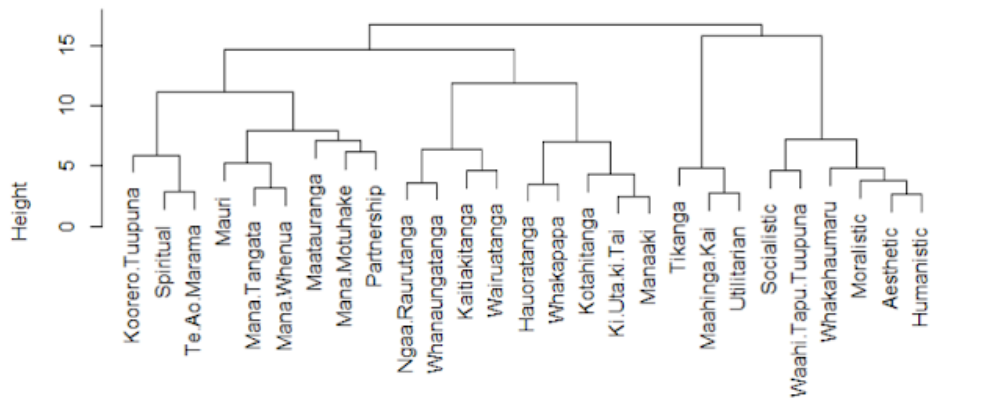
2 Figure 11 shows that the relationship between values is variable based on how and who discusses
3 them. In Figures 11A and 11B, we see very different clusters of values. Some key examples are seen
4 in Mana Tangata, Whakapapa, and Mauri. While the difference in values relationships is maintained
5 throughout, we have some consistent relationships across (A) and (B). This is primarily the case for
6 Kellert's values but also for Koorero Tuupuna and te ao Marama.

7 Figure 11A shows a high initial split in the nodes not present in Figure 11B. The left cluster from this
8 split primarily comprises Kellert's values, and the right cluster Ngaa Rauru values. This significant
9 split is not present in Figure 11B, suggesting we do not have this core divergence within the Ngaa
10 Rauru dataset. Other than this initial split, the heights across Figure 11A and 11B are relatively
11 consistent.

(A)



(B)



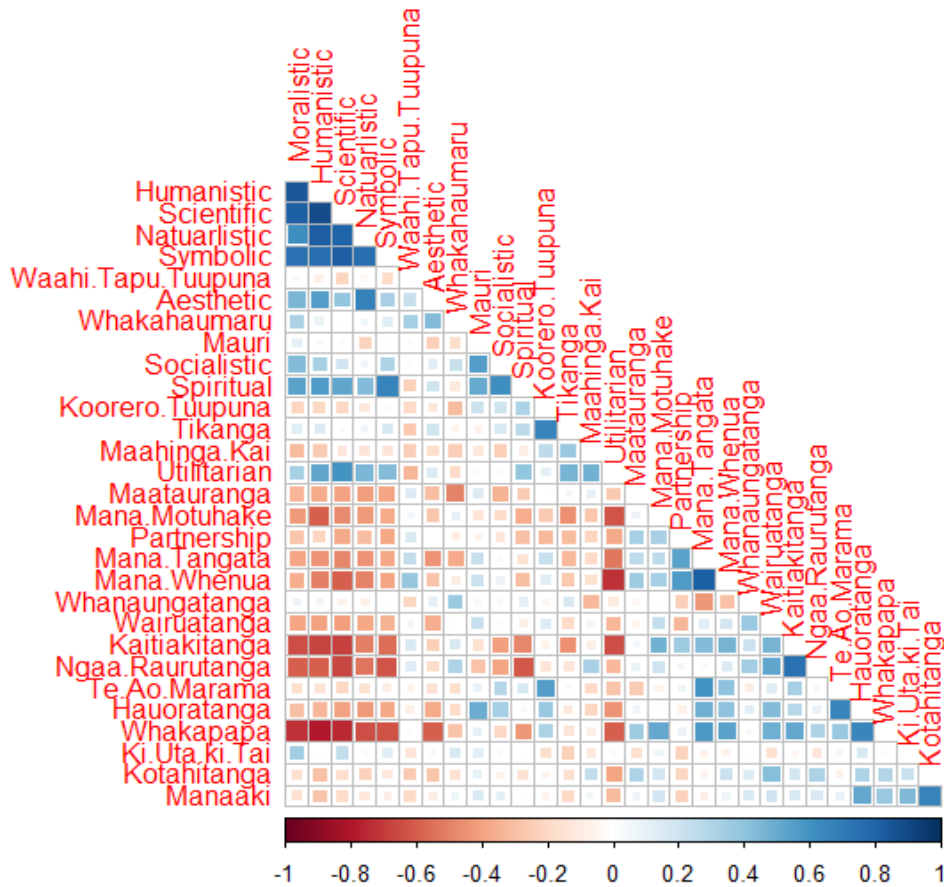
12

13

14 Figure 11: (A) Kaupapa assessment tools, (B) Ngaa Rauru documents. A higher height in the dendrogram would indicate
15 that the objects or groups being compared are more dissimilar or farther apart.

1 3.6 Correlation Analysis

2 Figure 12 reinforces many of the same findings that we have discussed above. We see a grouping of
 3 Kellert’s values highly correlated with each other and negatively correlated with Ngaa Rauru values.
 4 This is particularly true with many high-frequency values in Figure 5A (Whakapapa, Mana Motuhake,
 5 Mana Tangata, Mana Whenua, Kaitiakitanga). However, we see some overlap between our Ngaa
 6 Rauru and Kellert’s values, with Utilitarian, Mahinga Kai, and Tikanga forming a grouping. Among the
 7 Ngaa Rauru values, we also see a high level of internal correlation. This is the case for the grouping
 8 of “Mana Tangata, Whenua, Whakapapa, Hauoratanga, and te ao Marama” and a grouping of
 9 “Maatauranga, Mana Motuhake, Partnership, Mana Whenua, and Mana Tangata”. Other than these
 10 groupings, we see a lot of significant correlations in pairs: Kaitiakitanga~Ngaa Raurutanga, Koorero
 11 Tuupuna~Tikanga.



12 Figure 12: Plot of the correlation between all values this analysis identifies, to complement the visual provided by Figure
 13 10. Scale from -1 (red) to 1 (blue), -1 reflecting a negative correlation, and 1 reflecting a strong positive correlation.

14
 15
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1 Chapter 4: Discussion

2 4.1 Introduction to Discussion

3 Here, I sought to survey kaupapa Maaori freshwater monitoring tools to establish a “toolkit” that
4 can give effect to the full complex of Ngaa Rauru freshwater values. Ngaa Rauru voices and values
5 have been consistently marginalised in decision-making processes that govern access and use of
6 freshwater across their rohe. By establishing a toolkit of freshwater monitoring tools that can give
7 effect to Ngaa Rauru freshwater values, this research aims to ensure that decision-making can
8 reflect those values. My analysis of Ngaa Rauru freshwater management documents (n=12) and
9 kaupapa Maaori freshwater monitoring tools (n=15) suggests that these monitoring tools require
10 further development to give effect to the full complex of Ngaa Rauru freshwater values. Firstly, my
11 analysis illustrated a divergence between Ngaa Rauru and Eurocentric freshwater values. This was
12 evident when contrasting values stated within Ngaa Rauru freshwater management documents
13 against values stated within a well-known Eurocentric framework. A clear example is how the
14 framework I use, developed by Stephen Kellert, does not adequately incorporate the concept of
15 whakapapa, which is fundamental to understanding hapuu and iwi relationships to, and values for,
16 freshwater systems. Some Ngaa Rauru values align well with Kellert’s framework, while others
17 challenged the framings that Kellert provides. Secondly, my analysis of monitoring tools highlights
18 the many ways that Maaori hapuu and iwi are working to build the capacity of monitoring tools to
19 ensure the breadth of their values can be incorporated into decision-making. I also identify where
20 further development could be targeted for Ngaa Rauru to give effect to the full complex of their
21 freshwater values. To provide direction on where kaupapa Maaori freshwater monitoring tool
22 development might look for solutions, I return to kaupapa Maaori theory, the underlying localisation
23 of Critical Theory, to leverage the leadership of scholars in Education and Health research disciplines.

24 4.2 Ngaa Rauru freshwater values are divergent from Eurocentric environmental 25 values.

26 Applicants [farmers] and the hapu[u] had ended up “talking past each other because of
27 divergent values and understanding” (Ester Tinirau).

28 Using a Eurocentric environmental values framework to structure the conversation, I provide
29 quantitative support to the assertion that Maaori and Paakehaa are “talking past each other” in
30 freshwater management and monitoring. The principal components analysis visualised in Figure 10
31 revealed two distinct groupings of environmental values: one mainly consisting of Kellert’s
32 environmental values and the other of Ngaa Rauru’s environmental values. The low correlations
33 between Ngaa Rauru environmental values and the highly correlated grouping of Kellert’s

1 environmental values in Figure 12 provided further evidence of a divergence in values. These
2 findings agree with much of the literature discussed in the introduction. They align with the dualist
3 framing provided by Parsons et al. (2021) and build on the works of Moewaka-Barnes (2021) and
4 Salmond (2014), which similarly highlight a divergence in environmental values. The finding that
5 Kellert's Eurocentric framework is unable to fully capture Ngaa Rauru's environmental values also
6 supports Harmsworth and Awatere's (2013) argument, that Maaori environmental values are best
7 articulated and determined by the hapuu, iwi or whaanau who hold them. A framework such as
8 Kellert's, developed by a European man who spent most of his life as an academic at Yale University,
9 is not best suited to capture the localised expressions of environmental values which vary between
10 hapuu and iwi across the country (Watene, 2016). Although this is perhaps an obvious point, it is an
11 important one to recognise in framing this work, hence why I adopted a method which allowed for
12 expanding on Kellert's framework when coding (Figure 4). To give effect to the full complex of Ngaa
13 Rauru freshwater values, kaupapa Maaori freshwater assessment tools must be able to feed into
14 decision-making effectively (Ho et al., 2020). Considering the large body of literature that suggests
15 Aotearoa's decision-making is built on a Eurocentric understanding of relationships with the
16 environment (Evans & Kingsbury, 2022; Tadaki et al., 2021; Fairweather, 1999), the disconnect
17 between environmental values seen in Figures 10 and 12 may present a significant barrier to giving
18 effect to Maaori freshwater values. I highlight three key areas where Kellert's framework struggles to
19 recognise Ngaa Rauru freshwater values: intergeneration, obligation-based, and localised
20 expressions of values.

21 Whakapapa is a fundamental concept in te ao Maaori, and to understanding relational freshwater
22 values (Rangiwai, 1993; Taani, 2022). The inability of Kellert's Eurocentric framework to account for
23 this concept is significant. As Figure 10 shows, whakapapa sits far from Kellert's values in the PCA
24 plot, suggesting whakapapa was not often coded alongside Eurocentric environmental values. Figure
25 12 displays a negative correlation between whakapapa and all of Kellert's environmental values,
26 strengthening the finding that there is a misalignment between Kellert's framework and whakapapa.
27 None of the values articulated by Kellert encompass a similar degree of relationality or connection to
28 that embedded within the concept of whakapapa. Eurocentric environmental values, such as those
29 articulated by Kellert, tend to be grounded in the present, focusing on the individual's relationship
30 with nature rather than exploring environmental values in an intergenerational or social context
31 (Burgess et al., 2021). This finding supports the work of Marks (2022), who advocates for Kellert's
32 framework to be expanded to include a category for socialistic environmental values that captures
33 the complex social relations that are entangled within human relationships with nature. My analysis
34 included a socialistic category, which will be discussed further in section 4.5. While Ross et al. (2018)

1 draws a link between spiritual and intergenerational values, this is not what is seen in our analysis.
 2 The Spiritual and Whakapapa categories share a weak negative correlation, meaning that if one
 3 appears, the other value is not likely to appear (Figure 12). Assigning Whakapapa into the Spiritual
 4 category in Kellert’s framework would almost certainly overlook the complexity of whakapapa in
 5 how everything relates to each other, including people and freshwater (Roberts, 2013). It could be
 6 argued that whakapapa extends beyond spiritualism, encapsulating not only our relationship with
 7 nature but also with each other, the past, future, and present (Rameka, 2016). This is often how
 8 whakapapa is discussed in the coding, as seen in the text segments extracted in Table 5.

9 Table 5: Illustrative examples of text from Ngaa Rauru documents that express freshwater values and were coded as
 10 representing the values of Whakapapa.

<p><i>“Our heritage is important to us because it is our identity and provides physical and emotional links to our past. This makes protecting our heritage, culture and traditions vital to our continued wellbeing” - NR4</i></p>	<p><i>“It is the bridge that links us to our ancestors, defines our heritage and gives us the stories that define our place in the world. It helps us know who we are, from whom we descend, and what our obligations are to those who come after us” -NR9</i></p>
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11
 12 The inability of Eurocentric frameworks like Kellert’s to represent complex notions like whakapapa
 13 highlights the difficulty for Maaori to give effect to freshwater values that are more
 14 intergenerational, and narrative based. These concerns have been articulated to varying degrees in
 15 the literature (Sheremate, 2018). The quantitative nature of freshwater monitoring and assessment
 16 tools cannot even recognise the complex narratives of Whakapapa as valid data points (Wikaire,
 17 2020), and many Maaori are unwilling to engage in existing approaches that would seek to reduce
 18 these values into overly simplistic weighted measurements (Kawharu, 2001).

19 Similarly to Whakapapa, Figure 10 shows a considerable distance between the close grouping of
 20 Mana Whenua and Mana Motuhake to Eurocentric values in the coding. This suggests that while
 21 Mana Whenua and Mana Motuhake are often coded together, they are much less likely to appear
 22 alongside Kellert’s articulated values. Figure 12 further demonstrates this, showing a significant
 23 negative correlation between the grouping of Mana Whenua and Mana Motuhake, and Kellert’s
 24 environmental values. Mana Motuhake and Mana Whenua are values often associated with the
 25 ability to make one’s own decisions (Te Aho, 2006) or to assert authority (Michel et al., 2019). The
 26 misalignment seen here suggests Kellert’s Eurocentric framework does not have the capacity to
 27 capture these more obligation-based, or socially driven environmental values (Memon, 1997). The
 28 negative correlation between the grouping of Mana Motuhake and Mana Whenua, and Kellert’s
 29 framework also underscores a conversation about the localisation of environmental values. We can

1 refer back to the words of Harmsworth & Awatere (2013) and Marsden (1988), who state that
2 Maaori values are dictated by those communities who hold them. Values such as Mana Motuhake
3 and Mana Whenua are unlikely to be captured by a Eurocentric framework, as these values depend
4 entirely on the local expression of hapuu and iwi (Mokaraka-Harris et al., 2018). This can also be
5 seen in Figure 5 through Ngaa Raurutanga, exclusive to Ngaa Rauru documents, and negatively
6 correlated with Kellert's framework (Figure 12). Like Mana Motuhake, and Mana Whenua, Ngaa
7 Raurutanga is manifested by hapuu o Ngaa Rauru; it makes sense that broad Eurocentric
8 environmental values do not capture this.

9 Although Kellert's and Ngaa Rauru environmental values are misaligned, we can see from Figures 10
10 and 12 that some overlaps occur. Figure 10 shows a cluster of environmental values comprising
11 Tikanga, Spiritual, Socialistic, te ao Marama, Koorero Tuupuna, and Mauri. While one interpretation
12 of this grouping could be that Kellert's framework is somewhat capable of recognising these values,
13 however, we can look further into our data to contextualise this finding. Figure 12 shows that te ao
14 Marama, Kooreo Tuupuna, and Mauri are highly correlated with Mana Tangata and Mana Whenua,
15 two values entirely separate from Kellert's cluster. However, even if a Maaori environmental value is
16 correlated with Kellert's, we cannot be sure that all aspects of that environmental value are
17 recognised, due to its high correlation with surrounding Maaori environment values. We see a
18 similar story play out with Mahinga Kai and Tikanga. Figure 10 shows that Mahinga Kai and Tikanga
19 have been included in the cluster mostly composed of Kellert's environmental values, suggesting
20 some alignment between the two. Mahinga Kai is prevalent in freshwater monitoring. The
21 biophysical health of freshwater is often articulated as a component of giving effect to this value,
22 something which many consider aligns nicely with a Western paradigm (Harmsworth et al., 2011;
23 Collier et al., 2014). However, it is important to recognise the other aspects of Mahinga Kai, as
24 visualised through its high correlation with Tikanga, Ngaa Raurutanga, Kotahitanga, and
25 Hauoratanga (Figure 12). While Figures 10 and 12 might display overlaps between Maaori and
26 Eurocentric environmental values, the high internal correlation between Ngaa Rauru freshwater
27 values might indicate that the full understanding of these environmental values is lost when a
28 Eurocentric worldview is prioritised (discussed further in 5.3). As seen in Chapter 1, the dilution, or
29 misinterpretation of Maaori environmental values, is a well-established issue within the literature
30 (Evans & Kingsbury, 2022; Turvey, 2009; McGregor, 2014). The findings here further support these
31 concerns.

32

1 In Chapter 1, I discussed the many ways we attempt to conduct conversations across Maaori and
2 Paakehaa environment values: through unstructured hui and communication (Manaaki Whenua,
3 n.d; Bay of Plenty Regional Council, 2020), through co-management efforts (Maxwell et al., 2018;
4 Noble et al., 2016), and through methods such as Ecosystem-Based Management (Reid & Rout,
5 2012), and Mutli-Criteria Decision Analysis (Davies, 2013). The analysis here adds credence to the
6 critiques that Eurocentric based freshwater management is unable to fully recognise Maaori
7 environmental values, and that nuance is lost even when we do manage to find overlaps (Coombes,
8 2007; Taylor 2022). Because Eurocentric values do not capture the nuances of Maaori environmental
9 values, it's important to have strong, meaningful, and well-thought-out partnerships, through which
10 hapuu and iwi have the platform to articulate and manifest their held environmental values as they
11 see fit.

12 Writings regarding the legislative barriers to effective partnerships are well established in the
13 literature (Bargh, 2016; Harmsworth, 2005; Paterson-Shallard et al., 2018). However, less has been
14 written about this from an ontological perspective. Through this thesis, the results highlight the need
15 for more attention to be placed on the ontological perspective of governance. Fisher et al. (2022)
16 writes about this from an ecosystem-based management perspective, suggesting four pou to
17 generate effective governance: "enacting interactive administrative arrangements, diversifying
18 knowledge production, prioritising equity, justice, and social difference, and recognising
19 interconnections and interconnectedness" (p.609). Likewise, Smith (2012) talks about the politics of
20 truth, the importance of owning up to limitations, and where compromises are made. There is
21 potential to forge a path forward by building of Parsons et al. (2021) and Smith (2012) to establish
22 reflective, ontologically constructive, and self-aware relationships. Only then can be Maaori
23 environmental values be adequately considered in their own right, rather than through the lens of
24 Eurocentric environmental value sets, which are implicitly adopted by management bodies like
25 Regional Councils.

26 4.3 Where Kaupapa Monitoring Tools Give Effect To Ngaa Rauru Values

27 Giving Effect to Whanaungatanga and Tikanga

28 The analysis here indicates that some existing kaupapa Maaori freshwater assessment tools can give
29 effect to Ngaa Rauru freshwater values (Figure 5; Figure 6). The nature of kaupapa Maaori
30 freshwater assessment tools ensures that values of Whanungatanga and Tikanga are implicit in the
31 assessment process. Whanaungatanga has a high frequency of practical coding in kaupapa Maaori
32 freshwater assessment tools (Figure 6). On inspection of the coded text, it seems that
33 Whanaungatanga is often prevalent in the practical category due to explicitly reflective elements in

1 the assessment process of the tools, for example, the inclusion of waananga (focus groups) that
 2 allow for collective engagement and intergenerational knowledge transfer (Table 6).

3 Table 6: Illustrative examples of text from three different kaupapa Maaori freshwater assessment tools that were coded as
 4 reflecting the freshwater value of Whanaungatanga in a practical way that provided an output from the assessment
 5 process.

State of the Takiwa	Wai ora Wai Maaori	Mauri of Waterways Kete
<i>“Before departing, a general kōrero/discussion was held about the site, and travel and other details about the next site and/or activity.”</i>	<i>“Attribute: Can whanau participate effectively in whanaungatanga? The ability to practise taonga tuku iho – intergenerational knowledge transfer, e.g. maramataka, rahui, and wananga etc.”</i>	<i>“Wananga The study was qualitative, utilising kaupapa Māori tikanga through wananga (formal learning involving activities, workshops, presentations and field trips to particular sites along the Papanui stream).”</i>

6 Rainforth and Harmsworth (2019) suggest three key contributions of kaupapa Maaori freshwater
 7 assessment tools: to provide outputs that can be communicated to government entities, build
 8 relationships and maatauranga within communities, and understand the impacts of land-use
 9 practices to make decisions going forward. My research here supports the suggestion that kaupapa
 10 monitoring tools have the capacity to build relationships and maatauranga within communities,
 11 through the practical implementation of whanaungatanga. As whanaungatanga is a core means of
 12 communication, decision-making, and knowledge transfer in te ao Maaori (Rameka, 2018), it was no
 13 surprise that this value was presented in a practical way. Whanaungatanga is prevalent throughout
 14 kaupapa Maaori research and is a core component of *Decolonising Methodologies* (Smith, 2012;
 15 Vaeau et al., 2020). Such concepts have been extensively employed in the humanities, forming the
 16 basis for many frameworks (Durie 1995; Hamley et al., 2022), as well as finding their place in
 17 freshwater monitoring and management (Clapcott et al., 2018). However, the question of this thesis
 18 is whether these tools can give effect to Ngaa Rauru environmental values, specifically in the context
 19 of decision-making. It could be argued that by including strong provisions for values such as
 20 Whanganunga in methods, there is an inherent effect on decision-making outputs (Jones, 2016).
 21 However, the Wai Ora Wai Maori Assessment Tool goes even further; rather than exclusively laying
 22 out an engagement methodology aligned with whanaungatanga, this monitoring tool asks if
 23 whaanau can effectively engage in whanaungatanga. This particular section of coded text is the only
 24 section on Table 6 coded alongside socially driven values such as Mana Motuhake, Mana Whenua,
 25 and Kotahitanga. This aspect of Wai Ora Wai Maaori improves our ability to further integrate
 26 concepts such as Whanaungatanga into methodologies, actively asking to what degree giving effect
 27 to this value is possible. By framing it in this way, there may be more room to influence decision-

1 makers to build the capacity for Whanaungatanga rather than potentially prescribing a restrictive
2 methodology.

3 The way that Tikanga is manifested in kaupapa Maaori freshwater assessment tools and their
4 processes gives further confidence that these tools can in some ways give effect to Ngaa Rauru
5 freshwater values. Again, this is not by virtue of tikanga being neatly reducible to a quantitative
6 metric, but by the way that the methodology for knowledge generation in the assessment process
7 encourages localised expressions of tikanga as integral to the process. Tikanga is not explicitly
8 referenced in any relative high frequency as other values (Figure 5; Figure 6), but closer engagement
9 with the coded text highlights the fluidity and localisation built into kaupapa monitoring tools. This is
10 captured through aspects of methodologies, which direct those using particular tools to apply
11 appropriate protocols throughout the process.

12 Table 7: Illustrative examples of text from two different kaupapa Maaori freshwater assessment tools that were coded as
13 reflecting the freshwater value of Tikanga.

State of the Takiwa	Wai Ora Wai Maaori
<i>“After arriving at the site, the monitoring team gathered together so that any appropriate mihi, karakia and/or kōrero could be given.”</i>	<i>“Attribute: Kaitiaki are effective – the ability to practise what is correct from an iwi/hapū position (tikanga), e.g. maramataka, rāhui, karakia, and wānanga, etc.</i>

14

15 Kaupapa monitoring tools can be moulded in a way that works for iwi and hapuu, as the coding for
16 values such as Whanaungatanga and Tikanga has demonstrated. This is a specified aim of many
17 kaupapa monitoring tools (Rainforth & Harmsworth, 2019), and this malleability is clear when
18 exploring the differences in use across the country. Bishop (2019) highlights the different ways the
19 Cultural Health Index, for example, has been altered for local expression. This adaptability is further
20 evidenced in the way other tools have borrowed elements from the Cultural Health Index (Lyver et
21 al., 2017; Mooney & Cullen, 2019). The coding for Whanaungatanga and Tikanga also highlights an
22 inherent limitation of the method used in this thesis. While we search for 'practical' means by which
23 we can give effect to Ngaa Rauru freshwater values, giving effect might not fall into the confines of
24 our interpretation of 'practical'.

25

1 Giving Effect to Koorero Tuupuna, and Waahi Tapu/Tuupuna

2 This analysis provides evidence that kaupapa monitoring tools can give effect to certain
 3 environmental values associated with the biophysical environment. This is supported by the high
 4 frequency of practical coding for Koorero Tuupuna & Wahi Tapu/Tuupuna (Figure 6). In the coded
 5 text, Koorero Tuupuna often refers to returning the environment to what it was for tuupuna in the
 6 past, and Waahi Tapu/Tuupuna refers to the protection of culturally significant sites (Table 8).

7 Table 8: Illustrative examples of text from two different Kaupapa Maaori Freshwater Assessment Tools that were coded as
 8 reflecting the freshwater values of Koorero Tuupuna and Waahi Tapu in a practical way that provided an output from the
 9 assessment process.

Koorero Tuupuna	Waahi Tapu
<p>“Comparison between the species present today and those sourced traditionally from the site. A score is given based on the number of species of traditional significance that are still present.” - <i>Cultural Health Index</i></p>	<p>“In the end we; . . . shared the historical significance of each site” - <i>Mauri Compass</i></p>

10

11 The ability of kaupapa monitoring tools to give effect to environmental values more directly
 12 correlated with the biophysical environment also comes through in Figure 9. Figure 9 shows a clear
 13 separation between Ngaa Rauru documents and kaupapa monitoring tools, despite the fact that we
 14 have highlighted several places where kaupapa monitoring tools can give effect to Ngaa Rauru
 15 freshwater values. However, one Cultural Impact Assessment falls into the kaupapa monitoring tool
 16 cluster. This was written for Trust Power to inform the development of the Waverly wind farm. A
 17 significant amount of the coding from this CIA was regarding the ability of uri to access sites for
 18 mahinga kai practices and undertake those practices under the appropriate tikanga or the effect of
 19 contaminations on those practices:

20 Table 9: Illustrative examples of text from the 2016 TrustPower Waverley Wind Farm Cultural Impact Assessment (NR7 in
 21 Tab. 2), which included Ngaa Rauru freshwater values articulations that aligned more closely with values articulation in
 22 kaupapa Maaori freshwater assessment tools than with other Ngaa Rauru freshwater values documents (Figure 9).

<p>“Many families would stay during the warmer months to harvest the varied and numerous kai on offer, puupuu, mussels, kotoretore [red sea anemone], rori [sea slug], nga mea hii ika te katoa (and other seafood delicacies).” - NR7</p>	<p>“The operations of Waipipi Ironsands saw many of the mussel beds ruined due to contamination from waste water and oil deposits overflowing from the waste outlets then into the sea. Other contaminants came from the iron ore, very fine particles of ore were found inside the mussels. Mussels were obtained however from other areas, by those who knew where to go.” - NR7</p>
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23

1 We can explore the coding of the Cultural Impact Assessment produced for First Gas (NR1), which is
2 clustered separately (Figure 9). In this CIA, more of a focus is placed on the rights, responsibilities,
3 and obligations of Ngaa Rauru – both towards the whenua and towards each other:

4 Our Ngaa Raurutanga (cultural values and identity) are based on our whakapapa and
5 whanaungatanga to these landscapes and all of its living and non-living parts. As mana
6 whenua of this rohe, kaitiakitanga, or our authority and responsibility to maintain and care
7 for these relationships, is fundamental to our Ngaa Raurutanga (NR1)

8 The contrast between NR1 and NR7 reinforces conclusions drawn in section 5.1, but in the context of
9 kaupapa monitoring tools. While there are places where we can give effect to environmental values
10 through kaupapa monitoring tools, this tends to break down when we move into more complex
11 environmental values in our data set. While we could compare social and environmental values, as
12 many have done in the literature (Dietz, 2005), this comparison is not nuanced enough to capture
13 this conversation. It seems clear from this section that this question cannot be laid out as a binary,
14 and there are consistent tensions and messiness in assessing whether certain values are given
15 effect.

16 Giving Effect to Mana Motuhake, Mana Whenua, and Mana Tangata

17 While we have mostly focussed the discussion on the values with a high frequency of practical
18 coding up to this point, we cannot ignore the fact that all Ngaa Rauru values (with the exception of
19 Ngaa Raurutanga) seem to have at least some practical coding in the data. The practical coding
20 suggests that within the variety of kaupapa monitoring tools, there is some capacity to give effect to
21 at least a broad, if not the full, complex of Ngaa Rauru freshwater values. Mana Motuhake, Mana
22 Whenua, and Mana Tangata are good examples of this. While these are all low frequency in practical
23 coding, we can look at the practical coding present to get an idea of how kaupapa monitoring tools
24 might give effect to these environmental values. The practical coding for these environmental values
25 is largely confined to the Wai Ora Wai Maaori, and the Mauri of Waterways Kete. This might explain
26 the cluster seen in Figure 9, consisting of these two kaupapa monitoring tools and the Mauri Model.
27 All three tools have elements that seek to “audit” the relationship between the regional council and
28 iwi and hapuu to improve the decision-making power of iwi and hapuu (Table 10). Giving effect to
29 environmental values such as these is a vital part of representing Ngaa Rauru environmental values
30 in decision-making. As seen in Figure 5, all these freshwater values are highly articulated across the
31 Ngaa Rauru documents, symbolising their importance in this discourse.

1 A large part of Chapter 1 discussed the power imbalances which hinder iwi and hapuu ability to fully
 2 give effect to their environmental values in decision-making (Russell, 2020, & Larned et al., 2022;
 3 Pearson-Shallard et al., 2018). Giving effect to values, such as Mana Motuhake, would likely play a
 4 significant role in addressing this issue and reinstating these environmental values. The analysis also
 5 suggests that a larger push needs to be made to represent the relational and social elements of Ngaa
 6 Rauru environmental values. As we saw in the section above, kaupapa monitoring tools seem to
 7 better give effect when considering the relationship Ngaa Rauru holds with the environment in a
 8 biophysical context. However, as we saw in our discussion regarding Whakapapa, and the discussion
 9 directly above, misalignment occurs when we bring in more complex, social values. The need to
 10 prioritise socially driven environmental values through these tools was touched on by Tadaki et al.
 11 (2022), who state the importance of Crown entities not “cherry picking” biophysical results from
 12 cultural monitoring. The good news here is that in many cases, kaupapa monitoring tools seem to
 13 have the means to give effect to these values (particularly Wai Ora Wai Maaori and the Mauri of
 14 Waterways Kete), we just need to shift our focus and amplify them.

15 Table 10: Illustrative examples of text from three different kaupapa Maaori freshwater assessment tools that were coded
 16 as reflecting the freshwater values of Mana Motuhake, Mana Whenua, and Whakapapa, in a practical way that provided an
 17 output from the assessment process.

Value	Name of Monitoring Tool	Extracted Text
Mana Motuhake	Mauri of Waterways Kete	extent to which Local Authorities acknowledge Mana Whenua; extent to which Other Government Agencies acknowledge Mana Whenua; extent to which Tangata Whenua assert Mana Whenua
Mana Whenua	Mauri of Waterways Kete	Whaka mihi: – acknowledgement is given to the mana whenua who are connected to the whenua, awa where the proposed research study is likely to be located. This first phase will identify the mandated mana whenua to gain their consent and approval or rites of passage to heal and restore the mauri.
Whakapapa	Wai Ora Wai Maaori	Taiao Ora – flourishing nature (biophysical), Whanau Ora – thriving families (social), and Mauri Ora – the essence of vitality (metaphysical)

18

19

1 4.4 Tensions in Giving Effect to Values Through Kaupapa Monitoring Tools

2 Although all identified Ngaa Rauru freshwater values have been captured in the kaupapa monitoring
3 tools to varying degrees, the high frequency of Kellert's environmental values in kaupapa monitoring
4 tools (Figure 5), alongside the separate clustering of documents (Figure 9), suggests that kaupapa
5 monitoring tools are better aligned with Kellert's framework than with Ngaa Rauru freshwater
6 values. This is particularly the case for Scientific, Humanistic, and Utilitarian values. This finding was
7 relatively surprising, as these kaupapa monitoring tools aim to present the environmental values of
8 tangata whenua in freshwater monitoring (Rainforth & Harmsworth, 2019). Therefore, I expected
9 them to be more in line with Ngaa Rauru freshwater values. To better understand the nuances of
10 this relationship, we can explore why Kellert's values are so prominently included in these tools.

11 The emphasis on cross-cultural communication may explain why Kellert's environmental values are
12 so prominent in Kaupapa monitoring tools (Figure 5). Operating under tikanga while producing
13 outcomes that can be communicated to Crown entities is a stated intent for many kaupapa
14 monitoring tools analysed.

15 The Mauri Compass was developed as a comprehensive environmental assessment tool
16 where matauranga Maori and western science stand as unique bodies of knowledge in
17 their own right (Mauri Compass, n.d).

18 Based on cultural values and knowledge, the [Cultural Health] Index provides a means by
19 which iwi can communicate with water managers in a way that can be understood and
20 integrated into resource management processes (Ministry for the Environment, 2006).

21 A closer look at the coding reveals that the text associated with Kellert's values are primarily
22 assigned to the practical category (Figure 5). These largely relate to the results or outputs of kaupapa
23 monitoring tools, often referring specifically to the metrics or measurements used to communicate
24 or quantify the information gathered through these tools (Table 11).

25 Table 11: Illustrative examples of text from kaupapa Maaori freshwater assessment tools that were coded as reflecting the
26 freshwater values of Scientific, Humanistic, and Utilitarian, in a practical way that provided an output from the assessment
27 process.

Scientific	Humanistic	Utilitarian
"Identification of mahinga kai species present at the site. A score is given depending on the number of species present. The productive capacity of a site is reflected in the ability of the freshwater resource to yield mahinga kai."	"re-establish the relationship between the people and the rivers"	"Flow will enable use of the site for kai gathering"

28
29

1 The high frequency of Kellert's articulated values in kaupapa monitoring tools, and the fact that a
2 large amount of this code is associated with outputs, highlights a potential risk in watering down or
3 misinterpreting Ngaa Rauru freshwater values through the use of kaupapa monitoring tools. This
4 was a critique by Taylor (2022) and Coombes (2007) discussed in Chapter 1 of this thesis. Both
5 authors highlight how values can be oversimplified when communicated across worldviews, as well
6 as the nuances lost through bicultural rhetoric. We can explore the code attached to the
7 Utilitarianism and Spiritual categories to see this. There are many places within the coding where
8 Utilitarianism and Mahinga Kai are correlated (Figure 10, Figure 12). As discussed above, this coding
9 does not mean that these values are completely reflective of each other. There is a risk that mahinga
10 kai may be perceived as overly similar to utilitarianism. However, utilitarianism does not capture the
11 wider focus on reciprocity, tikanga, and intergenerational knowledge transfer seen through mahinga
12 kai.

13 The same sentiment can be applied to Spiritual and Mauri, which also share a correlation in Figure
14 12. While Mauri has spiritual components, the concept is far more wide-reaching (McLennan, 2010).
15 The wide-reaching nature of concepts such as Mauri and Mahinga Kai is further captured in Figure
16 12, showing that these values are highly correlated with several other Ngaa Rauru values, which are
17 not captured within the Eurocentric environmental values articulated by Kellert. While this might not
18 be an issue if one uses these metrics internally, for whaanau already familiar with the nuances of
19 these values, potential issues may arise when these results must be communicated across
20 worldviews, leading to potential misunderstandings or lost nuances (Wilson & Insker, 2018; DePuy et
21 al., 2020).

22 Although the production of outputs largely aligned with Eurocentric environmental values may be
23 seen as damaging, there might be some cases where their inclusion may be beneficial in giving effect
24 to Ngaa Rauru freshwater values. For example, while Ngaa Rauru have expressed concerns regarding
25 the dominance of Western-scientific practices in Aotearoa, uri have also expressed a desire to better
26 understand freshwater biophysical health (Table 12). This sentiment was articulated through the
27 Ngaa Rauru documents analysed in the data and internal policies, such as their Puutaiao
28 Management Plan and Climate Change Strategy (Te Kaahui o Rauru, 2013 & Te Kaahui o Rauru,
29 2021).

30
31
32

1 Table 12: Illustrative examples of text from Ngaa Rauru freshwater management documents that were coded as reflecting
 2 the freshwater values of Scientific expressing concern for the use of Science and something which could be partially
 3 achieved by science.

	Concerns	Use
Scientific	"He stated that the assessment in the Officer Report was purely scientific and did not take into account the cultural significance of the water or its intrinsic values to Nga Rauru Kiiitahi" (NR11).	"It is important to reiterate the Maaori worldview in relation to freshwater, that our wai is whole and indivisible, meaning that any activity within a catchment should not be considered in isolation but with the consideration of the cumulative impacts on the mouri of the rohe as a whole" (NR1).

4
 5 To explore potential positive outcomes from the scientific value, we can look at Mahinga Kai and
 6 Kaitiakitanga. When discussing Mahinga Kai, a substantial amount of the coded text advocates for
 7 species to be present to the extent they were in the past, and, in doing so, retain tradition and
 8 tikanga. Similarly, when discussing Kaitiakitanga, concern was expressed about the general
 9 biophysical health of the river (Table 13).

10 Table 13: Illustrative examples of text from Ngaa Rauru freshwater management documents that were coded as reflecting
 11 the freshwater values of Mahinga Kai and Kaitiakitanga that illustrate how the values can partly given effect to by Scientific
 12 practices.

Mahinga Kai	Kaitiakitanga
"The sources of kai they caught or collected were kaakahi (fresh water mussels), tuna-heke (migratory eel), whitebait, smelt, kahawai, flounder, and sole. The Waitootara River mouth was plentiful with kai and resources that would sustain the hapuu" (NR6).	"He also expressed general concern about the general condition of the awa, which he said 'was straining to sustain life' being impacted by human waste from the village, car wrecks, and general household rubbish. He pointed out their responsibilities as kaitiaki of natural resources and expressed concern that the applications put their taonga at further unnecessary risk" (NR11).

13
 14 While science may serve some aspects of Ngaa Rauru environmental values, we must not forget the
 15 decontextualisation inherent in reductive processes attached to science (Ashmore, 2015). The
 16 decontextualisation of values through a quantitative means of outputs is seen in our analysis. Within
 17 the Ngaa Rauru documents, there is no coding towards the Scientific value, leading to no correlation
 18 between Science and Ngaa Rauru environmental values in Figure 12. Issues with quantification are
 19 also captured in the discourse around measuring Mauri. This is detailed in a Boffa Miskell Iwi
 20 Perspectives report from 2017, where a diversity of perspectives around mauri were identified,
 21 some highlighting the biophysical aspects of mauri, and others highlighting a broader definition.
 22 Academics such as Blue (2018) and Harrison (2001) have advocated for more contextualised
 23 approaches to measurement. It is clear that scientific practices will need to be approached

1 differently to better understand the biophysical health of the rohe and ensure that the nuances of
2 values are not lost along the way.

3 The Hua Oranga program, developed by Durie & Kingi (2000) is an example of what I would consider
4 a strong approach to retaining nuance in monitoring. The Hua Oranga programme aims to assess
5 mental health and wellbeing outcomes of tangata whenua (McClintock et al., 2013). It does this by
6 focusing on four key components: taha wairua (spiritual), taha hinengaro (cognitive and emotional),
7 taha tinana (physical), and taha whaanau (family and relationships). While Hua Oranga produces
8 quantitative metrics for these categories, there is an integrated self-reflective component, asking
9 participants to reflect and articulate their perspectives on the outcomes. While this was written
10 from a mental health perspective, I believe this also applies to freshwater monitoring and
11 governance. While it could be argued that this approach still translates wellbeing to quantitative
12 measures, which can be problematic for concepts such as mana motuhake, the focus on self-
13 reflection and contextualisation of quantitative outputs apparent in Hua Oranga, supports more
14 robust and representative outputs.

15 4.5 Implications of Complex and Interrelated Values

16 The importance of recognising the complexity of the freshwater values discourse in order for Ngaa
17 Rauru values to be given effect to within kaupapa assessment tools, cannot be overstated. This
18 complexity is evident through Figures 7 and 8. It became immediately clear through these figures
19 that we would not be able to explain our data using two axes. While we have been able to visualise
20 groupings to some extent through Figure 10, the rotated PCA in Figure 10B shows that many of
21 these relationships are unidentifiable without the third axis. When this is the case, it is difficult to
22 determine relationships in the data without a holistic exploration of the graph. In Chapter 1, we
23 discussed Rawluk et al. (2019), who propose two axes when organising values: “abstractness of what
24 is important” and “context dependence”. Rawluk et al. (2019), suggest this might be an appropriate
25 way to organise how environmental values are spoken about in an interdisciplinary way. However,
26 our analysis suggests that this sort of conceptualisation of values may not be nuanced enough to
27 capture the complexity of this conversation.

28 While the spatial specificity of values is part of the conversation, values are also embodied by
29 communication style and tikanga. Kinloch and Metge (2014) go into detail in this, discussing
30 divergences not just in values, but also in body language, lines of questioning, and approaches to
31 decision-making. While an argument could be made that the divergence in communication style is
32 an explicit result of a divergence in values, the methodology of this thesis is not set up to capture
33 that aspect of the conversation. However, we can look towards our dendrograms in Figure 11 to get

1 a sense of the diverse ways values are spoken about. Figure 11 illustrates a clear diversity in the
 2 ways values are discussed within the Ngaa Rauru documents and the kaupapa monitoring tools. An
 3 example of this can be seen in the coding of Partnership. In our Kaupapa monitoring tool analysis,
 4 Partnership is clustered with Maatauranga. The coded text for Partnership from kaupapa monitoring
 5 tools often refers to communication between Paakehaa and Maaori to achieve best outcomes (Table
 6 14). However, partnership is used differently in the Ngaa Rauru documents, including both
 7 Maatauranga and the addition of Mana Motuhake in the cluster. The way partnership is spoken
 8 about here is moreso focused on inclusion of hapuu throughout the entire process of freshwater
 9 governance (Table 14).

10 Table 14: Illustrative examples of text from Ngaa Rauru freshwater management documents and kaupapa Maaori
 11 freshwater assessment tools that were coded under the freshwater values of Partnership, that shows how relationships
 12 between Maaori and freshwater managers are considered critical to successful freshwater monitoring.

Kaupapa Monitoring Tool Cluster	Ngaa Rauru Document Cluster
"Use of the CHI in discussions with water managers and others involved in rivers and streams also provides a way of better understanding Māori perspectives and concerns about streams and rivers of value and incorporating these into management decisions"	"Relationships into the Future: the resource consent process needs to include and involve hapū as a partner at the highest level for any mitigation outcomes to be achieved. The hapū acknowledges that in the past, there has been a feeling of historic disregard for obligations under Te Tiriti o Waitangi in regards to the values the hapū hold dear"

13
 14 Another example of this is the coding for Mauri. Figure 11A shows Mauri clustered alongside
 15 Socialistic and Hauoratanga, while Figure 11B shows the cluster including Mana Tangata and Mana
 16 Whenua. While Figure 11A indicates the components of health and wellbeing encompassed in
 17 Mauri, Figure 11B highlights the importance of Mana Whenua determining the state of Mauri. While
 18 these differences highlight that values can be spoken about in different ways and contexts, it does
 19 not mean one is more correct. We again return to the work of Durie (1988): values are articulated
 20 and determined by the hapuu, marae, and whaanau who hold them. My analysis does not inform us
 21 of how values are discussed and manifested more broadly, however, this analysis shows that even in
 22 our small data set, we see diversity in the way values are discussed, and how they align.

23 Stephenson (2005) makes the point that unless divergences are visible, they will continue to imbed
 24 within our current structures. Without sufficiently nuanced tools, identifying these divergences is
 25 extremely difficult. The limitations in Kellert's framework to identify relationships between
 26 environmental values has been evident throughout this process. Marks (2022) and Whitt et al.
 27 (2019) have already stated Kellert's framework is not capable of capturing social values for nature .

1 Marks (2022) goes on to explicitly advocate for a “Socialistic” category to be included within Kellert’s
2 framework. However, a socialistic value may also be an imperfect addition for indigenous
3 communities. While figure 12 shows that the Socialistic category yields positive correlations for
4 values such as Koorero Tuupuna, Tikanga, Hauoratanga, it did not capture values such as Mana
5 Motuhake, Maatauranga, Kaitiakitanga, and Ngaa Raurutanga. These values are those that are more
6 representative of local expression and obligation, as discussed in section 4.2. Sheremata (2018)
7 make this comment in their critique of Kellert's framework suggesting "over simplifying Inuit
8 expressions of their relational values could lead to a contrived view of ‘cultural values’" (p.79). This
9 seems to hold true in our analysis - many of Kellert's values encompass aspects of Ngaa Rauru values
10 (Spiritual, Utilitarian, Moralistic) but are too broad to capture the nuances within the Ngaa Rauru
11 values. Sheremata goes on to suggest their own typology tailored to Inuit relational values. While
12 Sheremata’s framework does present a similar relationality to what we see in Maaori environmental
13 values, this was developed for Inuit communities, and as discussed in Chapter 1, indigenous
14 environmental values are spatially nuanced (Watene, 2016), and best dictated by the communities
15 who hold them (Durie, 1988). However, despite its limitations, Kellert’s framework was successful in
16 structuring this conversation and is a useful tool as long as we are aware of its limitations from the
17 beginning of the process.

18 4.6 Conclusion

19 The analysis provided here of Ngaa Rauru freshwater values articulations and kaupapa Maaori
20 freshwater assessment tools will be very instructive in developing a toolkit to give effect to the full
21 complex of Ngaa Rauru freshwater values. I show quite comprehensively that established
22 environmental values frameworks, such as Kellert’s typology, are not sophisticated enough to
23 capture complex cultural notions that are central to Maaori and, in particular, to Ngaa Rauru
24 freshwater values. Perhaps the best example to illustrate this point is the concept of Whakapapa.
25 While some might assign such a freshwater value to a Spiritual category, there is quite explicitly a
26 deeper relational and even intergenerational element that isn’t represented. This divergence of
27 values from established frameworks that are Eurocentric in nature, highlights the importance of
28 Ngaa Rauru uri, and Maaori more broadly, being allowed the space and platform to articulate and
29 even theorise these values and associated frameworks on their own terms. This emphasises not only
30 the importance of building meaningful relationships across iwi/hapuu and regional councils, but also
31 the importance of those relationships being cognisant of the ontological diversity and divergences.
32 These relationships should be structured to negate any power imbalances that would see one
33 ontology to marginalise the other, like that seen and felt by Maaori all around the country. By
34 building on the works of Fisher et al. (2022) and Smith (2012), there is potential to forge a path

1 forward, through which the nuances of values are not lost, and te ao Maaori values can be
2 adequately considered in their own right, rather than through the lens of Eurocentric environmental
3 values.

4 While we have found some ways kaupapa monitoring tools can give effect to Ngaa Rauru
5 environmental values, we have also found a number of tensions in this discourse. While Tadaki et al.
6 (2022) focus on the tensions and arising issues in crown entity involvement with kaupapa
7 monitoring, the local and place-based example provided here illustrates this point further. The
8 findings here suggest that the focus on cross-cultural communication within these tools, and the
9 external pressure impact the way outputs are derived through the use of kaupapa monitoring tools,
10 seen through the reliance on quantitative outputs. Despite these tensions, we also found a number
11 of effective ways to give effect to Ngaa Rauru freshwater values. Many of these tools are ingrained
12 with explicitly Maaori ways of conducting research and engaging with the environment. There are
13 also elements of several tools (Wai Ora Wai Maaori and Mauri of Waterways Kete), which engage in
14 more socially driven environmental values, however, there is a need for this to be strengthened,
15 deepened, and made a more explicit element of freshwater monitoring tools. Pairing kaupapa
16 monitoring tools with self-reflective and self-referential methodologies would be a step forward. The
17 Hua Oranga programme, discussed above, is one model of assessment tool that has potential to
18 guide advancement of freshwater monitoring tools to include iterative processes that return to the
19 outputs of the assessments to contextualise and re-evaluate. Such advancements may be useful and
20 even necessary for complex socio-environmental values that are prominent in te ao Maaori.

21 Finally, the potential for kaupapa Maaori theory to drive advancement of Maaori freshwater
22 monitoring tools cannot be overstated. The literature of practitioners in the humanities utilising
23 kaupapa Maaori theory to undermine Eurocentric structures and forge meaningful and productive
24 paths has been extensive (Pihama et al., 2020; Smith, 2012; Durie et al., 2017). Expressing a need for
25 reflective methodologies has been at the heart of kaupapa Maaori theory, and decolonising research
26 methodologies since their inception. This is seen through Smith's (2012) four questions: Are both
27 practical and theoretical elements present? What is the record of the researcher/commentator that
28 lends legitimacy to their work in this area? Does the commentary or analysis adequately take
29 account for culturalist and structuralist aspirations and political analysis? What positively changes
30 for Maaori as a result of your engagement or your application of kaupapa Maaori? Building reflective
31 elements such as these questions into existing kaupapa monitoring tools might provide a productive
32 means to embed the full complex of Ngaa Rauru (and Maaori) freshwater values into Aotearoa's
33 freshwater management system.

34

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- 27

1 Appendix A: Notes when building an understanding of values

2

Practice	Stated
Text is focused on the actual outcomes from using the framework.	Text summarises concepts associated with framework.
Text is focused on the implementation or processes of the framework.	Text is focused on the goals or aspirations the framework hopes to achieve.
Text is referring to indicators used in the framework.	Text is referring to conceptual underpinnings of using such indicators.
Text is interpreting data gathered.	Text with attributes values to an awa in a general sense.
Text is focused on the practical inclusion of concepts.	

3

Aesthetic	Focused on visual and tangible beauty, aesthetic value is often found in the function of landscapes and ecosystems. expressed through a focus on physical character.
Moralistic	Not based on the services that might be provided by the landscape, but a valuing of landscape which stems from a respect for the intrinsic qualities which nature, landscapes, and species keep.
Humanistic	Refers to an emotional attachment to nature and landscapes. An importance in places which facilitates communities' heritage, identity, and shared experiences.
Utilitarian	Source of material goods and services. services such contribute to the wellbeing of the landscape, and therefore the surrounding people.
Scientific	Valuing and pursuing an understanding of the structure, function, and relationships in nature. Looking to importance the biophysical health of a river is not inherently a scientific value.
Symbolic	Names, images, stories, metaphors, myths, and dreams which represent reality.
Dominionistic	A desire to control and master the environment. reshaping the world in a way which better contributes to the lives of you and your community. Control is the important word in this case.
Spiritual	Emotive connection with water or seeing water as a unifying element. This is often seen as stemming from an underlying connection between people and nature. This connection between because people and nature encourage a 'reverence' for life.
Naturalistic	Focus is more on direct experiences. The value is derived from sensing the landscape (smell, touch, feel).
Negativistic	An avoidance or fear of nature. Also referred to as 'Aversion'.
Mana Motuhake	Autonomy. self-governance. ability to make decisions and guides one's own future.
Manaaki	respect, generosity and care for others. Ability to show hospitality, support others.
Tikanga	correct procedure, custom, of practice. Unique of iwi and hapuu.

Whakahaumanu	Revive, restore to health, rejuvenate.
Whakapapa	Genealogy, decent connection. Not necessarily linear.
Mauri	life principle, life force, vital essence, special nature, a material symbol of a life principle, source of emotions - the essential quality and vitality of a being or entity.
Haurantanga	Health and wellbeing. Refers to the passing of breath between Tane and Hine Ahuone and the emergence of the human essence into form, whereby human life was conceived.
Waahi Tapu	sacred place, sacred site - a place subject to long-term ritual restrictions on access or use, e.g. a burial ground, a battle site or a place where tapu objects were placed
Waahi Tuupuna	Waahi Tuupuna are landscapes and places that embody the relationship of mana whenua and their culture and traditions. Spatially specific.
Mauri	life principle, life force, vital essence, special nature, a material symbol of a life principle, source of emotions - the essential quality and vitality of a being or entity. Also used for a physical object, individual, ecosystem or social group in which this essence is located.
Wairuatanga	Holistic wellbeing of the collective (including human and non-human).
Kaitiakitanga	guardianship, stewardship, trusteeship, trustee.
Nгаа Raurutanga	values, rights, and responsibilities that Nga Rauru Kaitahi hold according to custom, including those values, rights, and responsibilities
Whanaungatanga	Connection. Shared experience. Collective strength.
Waahi Tapu/Tuupuna	Site important to hapuu or iwi. Spatially specific.
Ki uta ki tai	From mountain to sea.
Maatauranga	Knowledge based town from tuupuna, or spatially specific. Held by hapuu and iwi.
Mana tangata	Drawn from definition in Te Kaahui o Rauru strategic plan. "the people are our wealth"
Mana Whenua	Drawn from definition in Te Kaahui o Rauru strategic plan. "Our rohe is our geographical inheritance. It must be protected"

1

2

1 Appendix B: Raw matrix from NVIVO coding

Row Labels	LiType	Aesthetic	Hauoratanga	Humanistic	Kaitiakitanga	Ki Uta ki Tai	Koorero Tuupuna	Kotahitanga	Maahinga Kai	Maatauranga	Mana Motu Mana Tari	Mana Whi Manaaki	Mauri	Moralistic
NR(12)	Ngaaraur	1	0	1	1	0	0	0	0	1	1	0	0	1
NR(11)	Ngaaraur	0	2	0	3	0	1	3	0	5	5	0	1	0
NR(7)	Ngaaraur	0	0	0	0	0	1	0	7	1	0	0	0	0
NR(4)	Ngaaraur	0	3	0	5	0	3	0	0	1	5	4	0	0
NR(6)	Ngaaraur	0	2	0	9	0	1	11	22	8	5	3	10	3
NR(3)	Ngaaraur	0	1	1	1	0	1	1	2	2	6	3	8	1
NR(1)	Ngaaraur	0	0	0	3	0	0	0	1	0	3	0	0	0
NR(2)	Ngaaraur	0	4	0	6	2	0	4	2	1	7	1	3	1
NR(9)	Ngaaraur	0	0	0	2	0	0	0	1	2	1	2	0	1
NR(5)	Ngaaraur	0	4	0	3	1	1	0	0	5	5	6	1	3
NR(10)	Ngaaraur	0	0	0	1	0	0	0	1	7	1	1	0	0
NR(8)	Ngaaraur	0	2	1	5	0	1	0	1	1	0	3	0	0
KMFAT(4)	Kaupapa	1	0	11	0	0	0	0	0	2	0	0	0	3
KMFAT(1)	Kaupapa	23	1	25	8	3	7	0	9	2	6	1	3	1
KMFAT(2)	Kaupapa	1	0	16	4	0	3	4	13	10	5	4	1	1
KMFAT(3)	Kaupapa	0	5	7	0	0	1	0	1	3	0	2	1	0
KMFAT(6)	Kaupapa	0	2	9	5	2	7	1	0	3	8	4	11	0
KFMAT(7)	Kaupapa	2	0	15	0	0	0	0	1	0	1	0	1	0
KMFAT(8)	Kaupapa	0	0	8	0	3	0	1	3	3	3	0	0	1
KMFAT(5)	Kaupapa	1	3	7	0	0	3	1	10	2	4	0	2	2

	Natuariist	Nгаа Raur	Partnersh	Scientific	Socialistic	Spiritual	Symbolic	Te Ao Mar	Tikanga	Utilitarian	Waahi Tapu	Tuupuna	Wairuatar	Whakaha	Whakapa	Whanaungatanga
1	0	2	3	0	0	1	0	0	0	1	0	3	0	2	0	1
2	0	3	0	0	0	0	0	0	2	0	0	0	3	0	12	5
3	0	1	0	0	0	0	0	0	3	4	0	0	0	0	1	0
4	0	1	2	0	3	1	0	6	1	0	0	3	1	0	8	0
5	0	14	4	0	1	0	0	0	0	0	4	7	0	0	5	0
6	0	1	3	0	3	0	0	1	2	1	4	3	0	0	8	0
7	0	4	0	0	0	0	0	0	0	1	1	2	1	1	1	1
8	0	5	2	0	2	0	0	2	0	0	0	1	2	0	8	1
9	0	1	5	0	0	0	0	0	0	1	2	0	0	1	1	0
10	0	1	5	0	0	1	0	1	0	0	16	2	1	15	0	0
11	0	0	5	0	0	0	0	0	0	0	0	0	0	0	2	0
12	0	3	5	0	0	0	0	3	1	1	0	1	0	4	1	1
13	5	0	1	17	1	2	1	0	1	6	2	0	0	0	0	1
14	24	0	5	70	4	12	3	4	10	24	8	3	4	1	3	3
15	6	0	3	50	2	13	4	4	7	12	7	3	0	2	1	1
16	0	0	3	10	8	6	0	1	2	8	1	3	0	0	2	2
17	2	0	1	24	13	13	5	3	9	5	2	3	3	7	5	7
18	7	0	1	46	3	0	2	0	1	8	4	0	5	0	0	0
19	1	0	1	43	1	1	1	0	1	12	0	0	0	0	0	1
20	2	0	2	20	16	11	2	2	5	14	0	2	1	3	2	2

2

1 Appendix C: Raw Matrix for Frequency

2

3

Value	Criterion	Kaupapa	NgaaRauru
Aesthetic	Stated	3	1
Aesthetic	Practical	25	0
Hauoratanga	Stated	6	18
Hauoratanga	Practical	5	0
Humanistic	Stated	38	3
Humanistic	Practical	64	0
Kaitiakitanga	Stated	14	39
Kaitiakitanga	Practical	3	0
Ki Uta ki Tai	Stated	5	3
Ki Uta ki Tai	Practical	3	0
Koorero Tuupuna	Stated	11	9
Koorero Tuupuna	Practical	10	0
Kotahitanga	Stated	4	19
Kotahitanga	Practical	3	0
Maahinga Kai	Stated	23	36
Maahinga Kai	Practical	14	0
Maatauranga	Stated	5	28
Maatauranga	Practical	20	0
Mana Motuhake	Stated	23	45
Mana Motuhake	Practical	4	0
Mana Tangata	Stated	9	21
Mana Tangata	Practical	2	0
Mana Whenua	Stated	16	39
Mana Whenua	Practical	7	0
Manaaki	Stated	3	7
Manaaki	Practical	2	0
Mauri	Stated	24	11
Mauri	Practical	15	0
Moralistic	Stated	37	4
Moralistic	Practical	23	0
Natuarlistic	Stated	8	0
Natuarlistic	Practical	40	0
Ngaa Raurutanga	Stated	0	36
Ngaa Raurutanga	Practical	0	0
Partnership	Stated	14	30
Partnership	Practical	2	0
Scientific	Stated	79	0
Scientific	Practical	205	0
Socialistic	Stated	15	11
Socialistic	Practical	33	0
Spiritual	Stated	37	1
Spiritual	Practical	21	0
Symbolic	Stated	9	0
Symbolic	Practical	9	0
Te Ao Marama	Stated	13	13
Te Ao Marama	Practical	1	0
Tikanga	Stated	23	10
Tikanga	Practical	11	0
Utilitarian	Stated	32	8
Utilitarian	Practical	57	0
Waahi Tapu Tuupuna	Stated	15	33
Waahi Tapu Tuupuna	Practical	9	0
Wairuatanga	Stated	12	20
Wairuatanga	Practical	2	0
Whakahaumaru	Stated	12	6
Whakahaumaru	Practical	5	0
Whakapapa	Stated	11	65
Whakapapa	Practical	2	0
Whanaungatanga	Stated	5	9
Whanaungatanga	Practical	12	0

1 Appendix D: Coding from RStudio to conduct analysis

2

3 # Set Up -----

4 rm(list = ls())

5 library("ggcorrplot")

6 library("ggplot2")

7 library("dplyr")

8 library("ggpubr")

9 library("janitor")

10 library("factoextra")

11 library("rgl")

12 library("tidyverse")

13 library("Hmisc")

14 library("gplots")

15 library("cowplot")

16 library("plotly")

17 library("corrplot")

18 library("rgl")

19 library("compositions")

20 library("analogue")

21 library("ggforce")

22 # 1.0 Frequency -----

23 MixedFrq <- read.csv("MixedFrq.csv")

24 Rauru <- MixedFrq %>% filter_all(any_vars(. %in% c("Stated")))

25 Rauru <- Rauru[,-c(2,3)]

26 Kaupapa <- MixedFrq[,-c(4)]

27 Rauru <- column_to_rownames(Rauru, var = "Value")

28 Rauru <- tran(Rauru, method = "sqrt")

29 Rauru <- rownames_to_column(Rauru)

30 Kaupapa\$Kaupapa <- tran(Kaupapa\$Kaupapa, method = "sqrt")

31 Kaupapa\$Kaupapa[,1] <- as.vector(Kaupapa\$Kaupapa[,1])

32 names(Kaupapa)[3] <- "Kaupapa"

33 class(Kaupapa)

34

```

1
2 RauruPlot <- ggplot(data=Rauru, aes(x=rowname))+
3   geom_bar(aes(y=NgaaRauru), stat="identity", position="identity", alpha=.8, fill='pink', color='red')+
4   theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust = 1),panel.border = element_blank(),
5   panel.grid.major = element_blank(), panel.grid.minor = element_blank(), panel.background = element_blank())
6   + labs(x = "Identified Values", y = "Number of Times Coded For") + scale_y_continuous(limit = c(0,28))
7 RauruPlot
8 KaupapaPlot <- ggplot(data = Kaupapa, aes(x=Value, fill = Criterion)) +
9   geom_bar(aes(y=Kaupapa[,1], colour = c("blue", "green"), alpha = 0.8), stat = "identity", position = "stack") +
10  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust = 1),panel.border = element_blank(),
11  panel.grid.major = element_blank(), panel.grid.minor = element_blank(), panel.background = element_blank())
12  + labs(x = "Identified Values", y = "Number of Times Coded For") + scale_y_continuous(limit = c(0,28))
13 KaupapaPlot <- ggplot(data = Kaupapa, aes(x = Value, fill = Criterion)) +
14   geom_bar(aes(y = Kaupapa[,1], alpha = 0.8), stat = "identity", position = "stack") +
15   theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust = 1),
16     panel.border = element_blank(), panel.grid.major = element_blank(),
17     panel.grid.minor = element_blank(), panel.background = element_blank(), legend.position = "none") +
18   labs(x = "Identified Values", y = "Number of Times Coded For") +
19   scale_y_continuous(limit = c(0, 28))+scale_fill_manual(values = c("lightblue", "darkblue"))
20 KaupapaPlot
21 plot_grid(RauruPlot, KaupapaPlot, cols = 1)
22 # 3.0 Practical/Stated Criterion -----
23 PracStatProb <- read.csv("PracStatFinal.csv", row.names = 1)
24 #Graphing data
25 ggballoonplot(PracStatProb, fill = "value") + scale_fill_gradient(low = "#0D0887FF", high = "#FCA636FF",space
26 = "Lab", na.value = "grey50",guide = "colourbar", aesthetics = "fill")
27 # 2.0 Import PCA data -----
28 Matrix <- read.csv("TotalMatrixFinal.csv", row.names = 1)
29 # 3.0 PCA for Total -----
30 MatrixPCA <- Matrix[,-1]
31 ## Convert to percentage abundance
32 MatrixPCA <- tran(MatrixPCA, method = "percent")
33 ##Log transformation
34 col.min <- vector() #creates an empty vector for column
35 for(i in 1:ncol(MatrixPCA)){
36   col.min[i] <- min(MatrixPCA[MatrixPCA[, i] > 0, i])
37 }

```

```

1  str(col.min) #for loop finds minimum value greater than zero
2  Matrix.mod.nozero <- matrix(nrow = nrow(MatrixPCA), ncol = length(col.min))
3  for(i in 1:ncol(MatrixPCA)){
4    Matrix.mod.nozero[, i] <- MatrixPCA[, i] + col.min[i]/2
5  }
6  Matrix.mod.nozero <- as.data.frame(Matrix.mod.nozero)
7  colnames(Matrix.mod.nozero) <- colnames(MatrixPCA)
8  rownames(Matrix.mod.nozero) <- rownames(MatrixPCA)
9  head(Matrix.mod.nozero)
10 matrix.hll <- as.data.frame(tran(Matrix.mod.nozero, method = "hellinger" ))
11 ##Set up for PCA
12 data.pca <- prcomp(matrix.hll)
13 ## Scree Plot For Total
14 fviz_eig(data.pca, addlabels = TRUE) + geom_hline(yintercept = 10, linetype = "dashed")
15 ## Contribution
16 fviz_cos2(data.pca, choice="var", axes = 1:3)
17 Total_Contrib_1 <- fviz_contrib(data.pca,choice = "var", top = 20, axes = 1)
18 Total_Contrib_2 <- fviz_contrib(data.pca,choice = "var", top = 20, axes = 2)
19 Total_Contrib_3 <- fviz_contrib(data.pca,choice = "var", top = 20, axes = 3)
20 Total_Contrib_Df.1 <- data.frame(name = Total_Contrib_1$data$name, contrib =
21 Total_Contrib_1$data$contrib)
22 Total_Contrib_Df.2 <- data.frame(name = Total_Contrib_2$data$name, contrib =
23 Total_Contrib_2$data$contrib)
24 Total_Contrib_Df.3 <- data.frame(name = Total_Contrib_3$data$name, contrib =
25 Total_Contrib_3$data$contrib)
26 plot_grid(Total_Contrib_1, Total_Contrib_2, Total_Contrib_3)
27 ##Extract contribution names
28 total_contrib1.names <- Total_Contrib_Df.1 %>%
29   arrange(desc(contrib)) %>%
30   filter(contrib > 3) %>%
31   dplyr::select(name)
32 total_contrib2.names <- Total_Contrib_Df.2 %>%
33   arrange(desc(contrib)) %>%
34   filter(contrib > 3) %>%
35   dplyr::select(name)
36

```

```

1  total_contrib3.names <- Total_Contrib_Df.3 %>%
2  arrange(desc(contrib)) %>%
3  filter(contrib > 3) %>%
4  dplyr::select(name)
5  total.sign.values <- as.character(unique(c(total_contrib1.names$name,
6  total_contrib2.names,total_contrib3.names$name)))
7  total.sign.values
8  values.pca.dataframe <- as.data.frame(data.pca$rotation)
9  values.pca.dataframe <- values.pca.dataframe[,c(1,2,3) ]
10 values.pca.dataframe <- rownames_to_column(values.pca.dataframe)
11 values.pca.dataframe <- filter(values.pca.dataframe, rowname %in% total.sign.values)
12 document.pca.dataframe <- as.data.frame(data.pca$x)
13 document.pca.dataframe <- document.pca.dataframe[,c(1,2,3) ]
14 document.pca.dataframe <- rownames_to_column(document.pca.dataframe)
15 # Getting Clusters -----
16 total.kmeans.cas <- cascadeKM(matrix.hll, inf.gr = 2, sup.gr=10, iter = 10000, criterion = "calinski")
17 total.kmeans.cas
18 plot(total.kmeans.cas)
19 citation("vegan")
20 km <- kmeans(matrix.hll, centers = 2, nstart = 10000)
21 fviz_cluster(km, data = matrix.hll, axes = c(1:2), repel = TRUE) + theme( panel.border = element_blank(),
22 panel.grid.major = element_blank(), panel.grid.minor = element_blank(), panel.background = element_blank())
23 correlationfunction <- function(x) {
24   if(x > 0) {y <- "1"
25   } else if(x < 0) {
26     y <- "2"
27   }
28   return(y)
29 }
30 document.pca.dataframe$Group <- sapply(document.pca.dataframe$PC1, correlationfunction)
31 values.pca.dataframe$Group <- sapply(values.pca.dataframe$PC1, correlationfunction)
32 # Plotting 3d PCA with Clusters -----
33 open3d()
34 with(values.pca.dataframe, plot3d(PC1, PC2, PC3))
35 with(values.pca.dataframe, text3d(PC1, PC2, PC3, rowname, col = Group))

```

```

1  with(values.pca.dataframe, legend3d("topright", legend = paste('Group', c('1','2')), pch = 16, col = Group))
2  open3d()
3  with(document.pca.dataframe, plot3d(PC1, PC2, PC3))
4  with(document.pca.dataframe, text3d(PC1, PC2, PC3, rowname, col = Group))
5  with(document.pca.dataframe, legend3d("topright", legend = paste('Group', c('1','2')), pch = 16, col = Group))
6  # Correlation Plot -----
7  Corr_Matrix <- cor(matrix.hll)
8  Corr_Matrix
9  corrplot(Corr_Matrix, method = 'square', order = 'hclust', type = 'lower', diag = FALSE)
10 # Dendrogram for Kaupapa Assessment Tools -----
11 KaupapaMatrix <- matrix.hll
12 KaupapaMatrix <- KaupapaMatrix[-c(1:12), ]
13 RauruMatrix <- matrix.hll
14 RauruMatrix <- RauruMatrix[c(1:12), ]
15 KaupapaCorr <- cor(KaupapaMatrix)
16 RauruCorr <- cor(RauruMatrix)
17 KaupapaCorr <- KaupapaCorr[-c(17), ]
18 RauruCorr <- RauruCorr[-c(16,19,22), ]
19 ##Dendrogram for each
20 dd <- dist(scale(KaupapaCorr), method = "euclidean")
21 hc <- hclust(dd, method = "ward.D2")
22 KaupapaDendrogram <- plot(hc, labels = NULL, hang = 0.1, main = "Cluster Dendrogram", sub = NULL, xlab =
23 NULL, ylab = "Height")
24 dd <- dist(scale(RauruCorr), method = "euclidean")
25 hc <- hclust(dd, method = "ward.D2")
26 plot(hc, labels = NULL, hang = 0.1, main = "Cluster Dendrogram", sub = NULL, xlab = NULL, ylab = "Height")

```