RESTORING THE MAURI TO THE PRE-MV *RENA* STATE

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Abstract

The grounding of the MV *Rena* on Ōtāiti, 5 October 2011, had significant environmental impacts that were experienced in anthropocentric terms as impacts upon social, economic and cultural well-being. The *Rena* Long-term Environmental Recovery Plan goal is to "restore the mauri of the affected environment to its pre-*Rena* state".

The stated goal of mauri restoration is significant as this positions the environmental recovery in conceptual terms aligned to the aspirations of the indigenous peoples of the affected area. The reference to mauri facilitates the recognition of important meta-physical considerations not otherwise included in conventional impact assessment and monitoring. The Mauri Model decision-making framework (Morgan, 2008) is being used to investigate this challenge and discuss the sustainability implications of the disaster mitigation strategies being promulgated.

The Mauri-ometer (Morgan, 2008) assessment uses four equally weighted mauri dimensions. The mauri dimensions equate to environmental, cultural, social and economic well-being. The impact upon mauri is determined as the change in life-supporting capacity of the indicator being considered. Mauri can be measured qualitatively or quantitatively. The conceptual basis of the Mauri Model resonates with other cultures and thus this research may suit other contexts using ecological assessment to understand indigenous impacts.

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Keywords

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Introduction

The Motor Vessel *Rena* (MV *Rena*) was a 236 m container ship with capacity for 3,351 standard containers in seven holds. The MV *Rena* had a breadth of 32.2 m and a draught of 12 m when fully laden. Gross tonnage was 38,788, with deadweight of 47,231 tonnes. The MV *Rena* ran aground at 2:20 AM on Wednesday, 5 October 2011, on Ōtāiti (Astrolabe Reef) 7 km due north of Mōtītī (10 km^2), the nearest populated island, and 25 km offshore from Ōngātoro/Maketū, Bay of Plenty, New Zealand (Figure 1). The vessel was carrying 1,700 tonnes of heavy fuel oil, 200 tonnes of marine diesel, and a cargo of 1,368 containers, eight of which contained hazardous materials.

On 11 October the Minister for the Environment, Dr Nick Smith, declared the MV *Rena* grounding and subsequent oil spill New Zealand's worst ever maritime environmental disaster. Between 300 and 600 tonnes of heavy fuel oil entered the marine environment from the MV *Rena* following the grounding and as surge-induced movement on the reef caused further damage to the hull. A week after grounding, the MV *Rena* was listing 20°, 88 containers had fallen overboard, and the hull had cracked in two. By 8 January 2012, the MV *Rena* had broken in two, the stern section settled lower in the water and was almost completely submerged 2 days later (Figure 2).

The Ministry for the Environment prepared the MV *Rena* Long-term Environmental

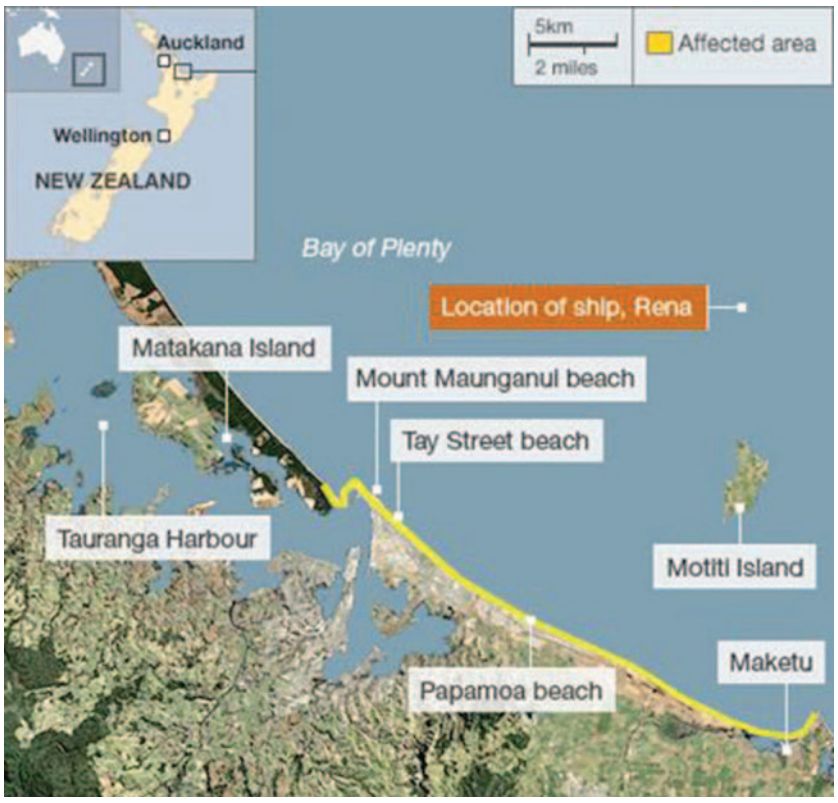

FIGURE 1 Location plan—Ōtāiti, Mōtītī, Ōngātoro/Maketū, and the Bay of Plenty coastline (BBC, 2011)

FIGURE 2: The MV *Rena* aground on Ōtāiti

Recovery Plan, which was launched on 26 January 2012. The plan has the set goal to "restore the mauri of the affected environment to its pre-*Rena* state". Mauri is defined as life-supporting capacity in this context (Ministry for the Environment, 2011).

The stated goal of mauri restoration in a government strategy is significant. The specific reference to mauri positions the environmental recovery in conceptual terms aligned to the aspirations of the indigenous peoples of the area. The reference to mauri facilitates the recognition of important meta-physical considerations not otherwise included in conventional impact assessment and monitoring.

Research is progressing to improve understanding of the options to facilitate the restoration of mauri impacted by the MV *Rena* stranding on Ōtāiti. The research also provides insights into the further development of the Mauri Model as an assessment tool in its application to disaster response decision-making. The research provides capacity to hapū to make contributions based on their own knowledge in a way that can effectively influence decision-making processes. This means positive change to local government and central government decision-making from the hapū perspective. The research adds strength to the current decision-making context by incorporating culturally relevant knowledge previously ignored in decision-making based solely on a Western scientific perspective.

The choice of mauri as the base metric for assessments is opportune. The concept of mauri is a useful means of measuring the impacts of the MV *Rena* grounding. Mauri is variously explained as a binding force, the power of the gods (Barlow, 1991), existing in all things (Marsden, 1990), and the intrinsic value of ecosystems (Resource Management Act, 1991). Mauri is the fusion that makes it possible for everything to exist, by holding the physical and meta-physical elements of a being or thing together in unison. When actions impact negatively upon the mauri of something,

this essential bond is weakened, and can potentially result in the separation of the physical and meta-physical elements, resulting in death or the loss of capacity to support life.

Kaitiakitanga is identified in New Zealand's Resource Management Act (1991) as a matter to be taken into consideration, immediately following the Section 6 list of matters of national importance, which includes the intrinsic values of ecosystems. Kaitiakitanga is the active protection and enhancement of the mauri of ecosystems (Morgan, 2008). Thus when mauri is defined as the life-supporting capacity of the air, water and soil, the theoretical basis is created for relevance in terms of New Zealand legislation and a means to measure and evaluate impacts.

When the indigenous concepts of mauri and its active enhancement are coupled with systems thinking, a means of defining the absolute sustainability of decisions is provided. The Mauri Model decision-making framework (Morgan, 2008) is well suited to the MV *Rena* challenge and has been adopted as the methodological basis for this research. The Mauri Model uses a participatory action research approach that involves all stakeholders as active contributors and owners of the research outcomes. The approach does not constrain the actions of affected hapū in their roles as kaitiaki, but rather seeks to provide additional insights into how the challenge created by the MV *Rena* grounding can be addressed.

The scope of the research covered in this paper has been narrowed down to identifying the pre-MV *Rena* state of mauri. Further research will cover the investigation of the post-MV *Rena* state of mauri and future state of mauri. These investigations will include the worldview analyses of the stakeholder groups involved within this decision-making context, as part of the Mauri Model assessment of potential options for recovery of the affected environment.

The Mauri Model

The Mauri Model decision-making framework (Morgan, 2008) forms the basis of the mauri analysis proposed in this research. The Mauri Model was created by Morgan (2008) researching conflict resolution options for SmartGrowth Bay of Plenty (50-year regional planning exercise) and engineering impacts on the Waiariki (lakes in Rotorua district) affected by wastewater discharges and other interventions. The Mauri Model uses the combined analyses of stakeholder worldviews and the impact upon indicators to determine the absolute sustainability of options. The Mauri Model provides insights into the drivers of different worldviews, and how these drivers influence the selection and prioritisation of indicators used in decision-making. It is possible therefore to determine how different worldviews can best be accommodated and involved within a collective and inclusive decision-making process by guiding the generation of new options targeted to best accommodate competing priorities. The need for a system that quantitatively measures mauri is twofold: to address the complexity inherent in solving problems in a post-colonisation context and to compensate for the inability of many of the engineering practitioners to acknowledge qualitative information in their analyses.

The analysis sequence for the Mauri Model typically identifies differences in worldviews and values, quantifies these, and then leverages these to identify relevant performance indicators. The value here is that participants are assisted to better understand the limitations of their own worldviews, essential in terms of fairly representing the values of others. The modified Analytic Hierarchy Process (AHP) is a multi-attribute decision support process (Saaty, 1980) that can also guide the appropriate selection of performance indicators that represent the interests of all stakeholders. AHP is used to clarify the relationships between mauri dimensions with dissimilar attributes that defy intuitive direct comparison.

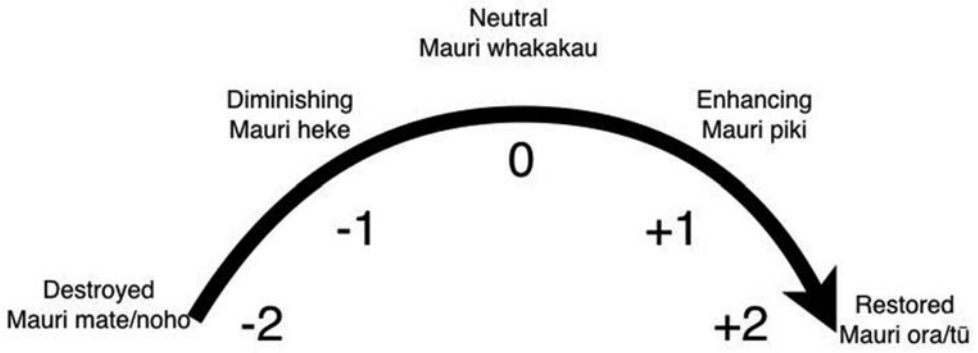

FIGURE 3 Mauri-ometer (Morgan, 2008) for performance indicator assessment

The analysis then focuses on the actual problem definition, selection and grouping of performance indicators. Potential options are assessed using the Mauri-ometer (Morgan, 2008) (Figure 3), which gives an absolute determination of the impact upon mauri for each indicator. The purpose of the Mauri-ometer assessment is to determine long-term trends, and whether the accumulating mauri impact for an option is identified as fully restoring, enhancing, maintaining, diminishing or exhausting the mauri of the performance indicator under consideration. As mauri is the measure of sustainability, how the cumulative mauri is affected indicates an option's sustainability and preference. Five ratings are possible for the mauri of the indicators for each dimension, as shown in Figure 3.

Having determined the rating (Mauri-ometer score) for each performance indicator, the scores are averaged with equal weight given to each dimension to determine the absolute sustainability of the option being assessed. In order to determine the sensitivity of the result to different worldviews, the scores are multiplied by the relative dimension weighting for that worldview (derived from the AHP), summed for each dimension, divided by the number of indicators used in each dimension, and then the four dimension values are summed to determine the perceived accumulative impact upon mauri for that particular worldview. Figure 4 depicts the analysis sequence for the Mauri Model.

Analysis of the Ōtāiti mauri restoration and consideration of the sustainability context of this project indicate that it would be prudent

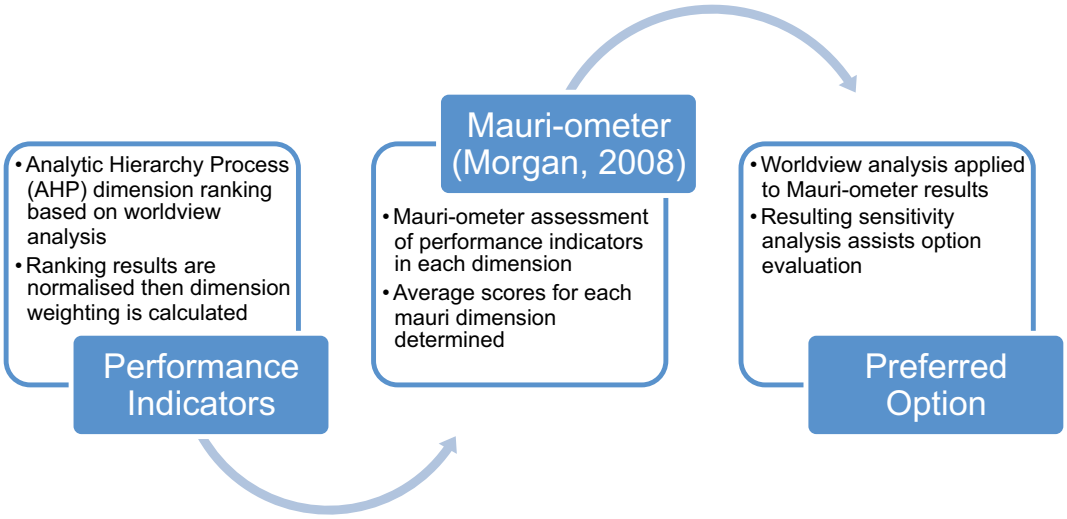

FIGURE 4 Mauri Model methodology—assessment yields preferred option

for the authors to adopt a decision-making framework that can accommodate different and potentially opposed culturally based worldviews within the research. Given the responsibilities held by the MV *Rena* Recovery Team on one hand, and the traditional responsibilities of the tangata whenua in terms of their kaitiakitanga responsibilities (enhancing the mauri of all things), the Mauri Model is considered an ideal approach to identify and more accurately define the preferred option(s).

The Mauri Model has been applied to recent research projects that contribute contexts of understanding that have relevance to the MV *Rena* grounding impact upon mauri, and will help anchor and inform the participatory action research process.

- Following the Christchurch earthquake in September 2010, four final-year research projects evaluated the implications for wastewater and water supply infrastructure replacement options (Fa'aui, 2011). This work indirectly assists with understanding the disaster response component of the research.
- The Mauri Model decision-making framework was used by two summer research interns over the 2011–2012 summer vacation to investigate the restoration of Ōkahu Bay within the context of long-term development impacts not dissimilar to the albeit short-term impacts caused by the MV *Rena* grounding (Fa'aui, 2012). This work informs the application of the Mauri Model from a marine/estuarine perspective.
- The Mauri Model has been used to evaluate the remediation of contaminated sites such as Rotoitipaku at Kawerau (Hikuroa, Slade, & Gravley, 2011) and the impacts of fracking on the Blood Reservation in Ontario (Rehu, 2012). This work provides insights into how different remediation strategies can be assessed holistically to ensure that evaluation of options is based on all four mauri dimensions.

These examples of recent research where the Mauri Model has been successfully adopted provide a strong basis from which to implement this research successfully.

Research methodology

The MV *Rena* grounding is the first time that the Mauri Model decision-making framework has been applied to a man-made disaster recovery situation. In the context of Aotearoa, the cultural dimension plays just as important a part in decision-making as economic, social and environmental dimensions (Resource Management Act, 1991). Applying the Mauri Model allows the changes in mauri to be accurately assessed over extended periods of time. The assessment helps to show the long-term effects of the impacts on mauri caused by the MV *Rena*.

The MV *Rena* disaster was seen and felt nationally, as well as gaining international attention. Decisions that the government intend to make, whether directly or through delegated authorities under the Resource Management Act (1991) and Local Government Act (2002), should be heavily scrutinised by the public and the groups affected. It is imperative that all research outcomes are shared in a timely manner before any major decisions are made, as long-term problems will ensue if inadequate consideration is given to the cumulative impact upon mauri that will occur.

In order to effectively engage with all hapū affected by the MV *Rena* disaster, digitisation of the Mauri Model decision-making framework is being progressed and a web-based version has been developed (www.mauriometer.com). The digitised framework allows the hapū groupings to progress their own assessments independently and at their own pace. The staggered approach is expected to provide opportunities to hone the research team's thinking regarding each of the steps in the Mauri Model framework. The research is

well positioned to incorporate existing shellfish monitoring work (Te Mauri Moana (Battershill, 2012)—a partnership between the University of Waikato, the University of Canterbury, Te Whare Wānanga o Awanuiārangi and the Bay of Plenty Polytechnic) which has created an extensive database tracking pollutant concentrations in the ecosystem since the disaster. Te Mauri Moana research findings are extremely important as the work provides an understanding of the impacts upon the mauri of the affected ecosystem and the ongoing effects.

The research is action-based and participatory in nature. The research incorporates marae-based wānanga and appropriate techniques following an established sequence that has been successful previously when dealing with reticulated wastewater proposals evaluating the impact upon hapū in an assessment integrating the environmental, social, economic and cultural impacts upon mauri. The participating hapū groupings are led by Te Arawa ki Tai (Ngāti Pikiao, Ngāti Mākino, Ngāti Whakaue, Waitaha, Tapuika, Ngāti Whakahemo and Ngāti Rangitihi), which are among the hapū who were within the area affected by the MV *Rena* disaster. These wānanga are used to aid participants in identifying relevant performance indicators for use within the mauri model by using cultural opportunity mapping techniques, prompting the identification and compilation of important factors within the decision-making process previously not considered.

Pre-MV *Rena* state of mauri determination

Much of the scientific research carried out since the MV *Rena* grounding indicates that very little information exists (Elvines, Barter, & Tremblay, 2013) to establish the pre-MV *Rena* state of the mauri of the affected ecosystems; in particular, the mauri of Ōtāiti and Mōtītī. The lack of specific data is not an impediment to a mauri-based analysis, but rather exposes one of the weaknesses of scientific research: that globally relevant knowledge is postulated on the basis of single research sites that often have no direct physical relationship with the sites to which those research findings are later applied. The contemporary case in point is Ōtāiti and Mōtītī.

Alternative means are therefore necessary to establish the pre-MV *Rena* state of mauri. The pre-MV *Rena* state of mauri is determined in terms of the four mauri dimensions analysed using the Mauri Model. Reliance is therefore placed on prior identification of the affected ecosystems in resource management and planning documentation, the culturally rich indigenous knowledge of the area, and known contemporary preferences evident in terms of priority as locations for recreation and commercial tourism activities.

Mauri of the ecosystem

The 2003 Bay of Plenty Regional Coastal Environmental Plan identifies Ōtāiti as a third schedule area of significant conservation value (Environment Bay of Plenty, 2003, Site No. ASCV-8 Map Sheet: 44). The description includes Ōtāiti being a temporary haul-out site for New Zealand fur seals who feed on fish in the surrounding waters. These waters are also rich in maomao, trevally, kahawai, kingfish, mako and striped marlin. The ecosystem is uncommon in New Zealand as it has both tropical fish and a strong pelagic school component (Environment Bay of Plenty, 2003). Therefore the pre-MV *Rena* state of the mauri can be considered excellent in contemporary terms albeit denigrated to an extent by the historic pollution of the surrounding ecosystem.

The impacts upon ecosystem mauri have been significant, affecting water quality, the seabed and extensive reaches of foreshore, Ōtāiti, Mōtītī, marine life and avifauna. In a marine disaster of this magnitude, the environmental impacts due to the oil spilled by the vessel are most likely to be of most concern. The MV *Rena*

spilled between 360 tonnes and 1,700 tonnes of heavy fuel oil when it ran aground on Ōtāiti (Anderson, 2012). After pumping procedures to remove the remainder of the oil on board the vessel, 5–6 tonnes still remain on board, due to the degree of difficulty of extracting this oil. The oil that remains on board the vessel will continue to leak out over time. After the initial series of oil spills, 1,367 dead sea birds soiled by oil were collected from affected beaches (67 percent of the total number of dead birds found during the MV *Rena* wildlife response) (Fuseworks Media, 2013). Heavy motor oil has adverse effects on sea birds. Oil clogs their plumage, restricting movement and making the birds vulnerable to sinking; oil reduces the natural insulating qualities of feathers, causing many birds to succumb to hypothermia; and sea birds ingest the toxic oil as they attempt to clean themselves (Riddell & Kessels, 2013).

There were originally 1,368 containers aboard the MV *Rena* when it ran aground on Ōtāiti. Of that 1,368, 1,007 containers have been recovered, with the remaining 361 so far unrecovered containers (as at 17 January 2013) on the seabed (31), in the front section of the hull (18) or in a location currently unknown—possibly in submerged sections of the vessel, on the seabed or drifted out of the area (Elvines et al., 2013). Much of the cargo (excluding containers in the hull sections) has suffered partial or entire loss of their container contents. Examining the manifest of the contents of the containers, several environmental issues arise concerning particular items and substances contained in the cargo and the impact upon the ecosystem mauri, mainly water quality and subsequently, flora and fauna. Potentially environmentally hazardous substances in the cargo include trichloroisocyanuric acid (TCCA), aluminium trisodium hexafluoride (cryolite), potassium nitrate (KNO3), caustic calcined magnesia (MgO), plastic beads (nurdles) and milk powder (Elvines et al., 2013). The presence of these substances has the potential to cause adverse effects in water quality, such as increased toxicity levels (TCAA), increased turbidity (milk powder), changes in water pH (TCAA, MgO) and reduced dissolved oxygen levels. These adverse effects on water quality can also adversely impact fauna, which usually have very specific living conditions.

Mauri of the affected hapū and iwi groupings

The general public were advised not to gather food and resources from the sea immediately after the disaster and then for an extended period after (more than 5 weeks). Ambiguity of results regarding safety of consuming fish, shellfish and crayfish from Tauranga moana ("Seafood Rahui", 2011) has forced some Māori to change their diet to supplement the lack of food from the sea. Residents on Mōtītī have been the most affected by these health restrictions to seafood species, due to their heavy reliance on subsistence living (Steiger, 2012). Apprehension to harvest kai from the surrounding sea has also affected Māori ability to provide kai for visitors and for special occasions, clearly evident in the disappointment expressed in the following statement:

> Then there's the issue of mana. You're expected to provide a certain level of hospitality and when you can't even put on the table what's right at your back doorstep, it's embarrassing to say the least. (Wall, 2012, para. 15)

Sacred sites were damaged and/or not shown the proper respect during clean-up procedures. There are many wāhi tapu along the affected coastlines and on the islands (Mōtītī and Matakana). These included many sites on Mōtītī, in close proximity to Ōtāiti (7 km), which recovery operations used as a base, landing helicopters and ships with little if any regard for the sacred sites on the island (Anderson, 2012).

There are also many sacred reefs and rocks surrounding Mōtītī (Ōtāiti, Okarapu and

Motuhaku), Ōtāiti being most prominent and most fished out of the reefs and rocks in the area. These reefs are all taonga and tapu to the tangata whenua, requiring certain rituals to be done before being fished or anchored on. Ōtāiti is especially sacred to the tangata whenua, being blessed by the tohunga Ngātoro-i-rangi (hence imbued with his mana) (Ministry for the Environment, 2011) during the journey of the Te Arawa waka to Aotearoa. The tangata whenua, especially those on Mōtītī (Te Patuwai) have a connection to Ōtāiti, it being part of their identity, similar to the reverence and esteem placed on maunga by other iwi on the mainland (Kahotea, 2013). An excerpt from the Muriwhenua report best describes the impact of the MV *Rena* upon the mauri of the hapū:

> The fisheries taonga includes connections between the individual and tribe, and fish and fishing grounds in the sense not just of tenure, or "belonging", but also of personal or tribal identity, blood and genealogy, and of spirit. This means that a "hurt" to the environment or to the fisheries may be felt personally by a Maori person or tribe, and may hurt not only the physical being, but also the prestige, the emotions and the mana. (Waitangi Tribunal, 1988, pp. 174–175)

For the tangata whenua, the hurt experienced by Ōtāiti is not only to the physical environment and ecology, but also spiritual—being a tipua and taonga (Kahotea, 2013). The cultural pain felt by the tangata whenua due to the MV *Rena* is similar to a very sacred place having been desecrated: "How would you like it if I came and opened your mother's coffin and put my rubbish on top of her? That's exactly what they've done" (Wall, 2012, para. 26).

Mauri of the local communities affected

After the MV *Rena* ran aground on Ōtāiti, beaches along the coastline from Pāpāmoa to Whakatāne (Harper & Lundy, 2011) were closed to the public as heavy oil slicks washed ashore along with containers and their contents from the vessel. Oil and debris continued to wash ashore the coastline, leaving these beaches closed to the public for 6 weeks (Maritime New Zealand, 2011). This meant that the public couldn't gather food from the seashore or ocean during this time, and other recreational activities were also restricted or not allowed. This disaster was felt deeply by local residents, who are ever conscious of the beaches and coastlines that they call home. This prompted action amongst the community, with residents starting to clean up the beaches on their own—before the authorities' clean-up effort had started. These early clean-up efforts were initiated as many residents were frustrated by the apparent lack of planning and action by the government. Cleaning up the oil and debris washed ashore without the proper safety equipment (overalls, facemasks etc.) had many dangers, which came primarily from handling the heavy oil globs with their hands and without face masks (Anderson, 2012). The threat of poisoning through breathing fumes or absorption through skin and the long-term danger posed by the confined carcinogens is a serious concern.

The danger to public health due to unsafe beach clean-up practices was mostly mitigated once the authorities had established the beach restoration operations (2 to 3 days after initial disaster). Authorities and iwi groups led volunteer clean-up teams (8,000 registered volunteers) made up mainly of local residents in clean-up efforts along the impacted coastline and islands. Volunteers were instructed on proper disposal and collection techniques, and provided with some of the tools and protective equipment ($350,000 worth of personal protective equipment) required to clean up

(Fraser, Monchy, & Murray, 2012). During this period of clean-up, local communities banded together to help progress the clean-up—providing food to volunteers, extra equipment and even housing workers. The uniting of the community in the face of adversity was one positive aspect of the disaster on the mauri of the community.

Tauranga moana contains many popular recreational fishing sites, especially in the areas of waters close to the reef. For many weeks after the initial disaster, fishermen were discouraged from taking to the waters and fishing due to continual leakages of oil and fuel, and debris from the cargo on board the vessel ("Rena: Boaties", 2011). "Boaties" travelling through affected areas were at risk of dragging oil to clean areas—complicating clean-up procedures. This caused significant disturbances for recreational users, especially the timing at the start of summer. After the Department of Conservation had completed early studies on the fish in the area and established they were safe for consumption, fishermen were allowed to fish the area again, except for the exclusion zone (2 nautical miles around the MV *Rena*) (Maritime New Zealand, 2011).

The presence of pelagic fish and unique topography has led to Ōtāiti being regarded as a nationally significant scenic dive site. The pelagic fish show a preference for the vertical rock faces, caves and tomes, including a prominent 80 m pinnacle and very large boulders, and strong, nutrient-rich currents. The wreck means that this dive site will not be able to be explored recreationally until recovery efforts have been substantially completed. Although it has been said that leaving the wreck on the reef as a dive attraction would provide valuable amenity for the diving community, possibly providing a tourism attraction for the community, without an extensive study on the long-term impact on the reef of the wreck and the cargo still on board, there is no way of knowing the impact upon the ecosystem including the fish and wildlife that inhabit the reef.

Mauri of the families resident in the affected area in economic terms

The leaked heavy oil and diesel that has come from the MV *Rena*, and continues to leak out of the vessel when agitated, has been detected in the biota in the vicinity of Mōtītī. This news has made the island residents of Mōtītī hesitant to harvest food from the sea, being only 7 km from Ōtāiti, where the MV *Rena* ran aground. The hesitance stems from the initial spill that saw large amounts of crude oil and debris wash ashore at Mōtītī. The impacts due to oil spilling into the ocean compounded with effects due to contents of other containers (milk powder, TCCA, cryolite) meant that for several months after the incident, the island residents were advised not to harvest and consume food from the surrounding Tauranga moana. Whilst the rāhui on harvesting seafood from the sea was lifted on 20 December 2011 ("Seafood Rahui", 2011), news of continual oil leakages and potential unsafe cargo on board the vessel in such a close proximity to the island has made it difficult for island residents to fully trust the authorities' claims that seafood is safe for consumption, more than a year after the "all clear" was given to harvest food from the sea. The latest spill of contaminants into the environment was a container load of plastic pellets which was identified on the Maketū coastline on 27 April 2013. The island residents have a subsistence-based diet. A large proportion of their food is grown locally or harvested from the island and from the sea, such as vegetables, fish and shellfish (Steiger, 2012). They have lived like this for generations, being isolated from the mainland and having limited opportunity to travel to Tauranga for supplies. Products brought over from the mainland are more expensive, meaning items such as meat are not regularly consumed (when compared to the diets of those living on the mainland) as it is more expensive, especially since food from the sea is readily available to be harvested. With the integrity of the local seafood being compromised after the initial oil and

fuel leakages, island residents were forced to source a much higher proportion of food from the mainland. This had a substantial economic impact upon some residents on the island as the price for purchasing food from the mainland was much more expensive than the food harvested from the sea, which is essentially free. This initial impact to Mōtītī islanders' expenses has become a lasting impact as island residents are relying more and more on meat and other products from the mainland, carrying a larger economic burden—effectively increasing the already expensive cost of living.

Discussion

The MV *Rena* was visited by representatives of Te Arawa ki Tai and the research team on 19 January 2013, more than a year after the bow and stern sections of the MV *Rena* separated. The visit was undertaken under the supervision of Resolve, who hold the current contract for removal of the MV *Rena* debris from the wreck and Ōtāiti reef. This visit was the first time a group of iwi representatives had visited the site since the disaster. Representatives of Te Arawa Ki Tai (Tahana, 2013) are of the firm belief that efforts have been made to thwart access to Ōtāiti by senior officials, raising fears that information is being kept from the public to privilege a particular preferred recovery option.

The Resolve contract only extends to the removal of MV *Rena* debris in water depths up to 20 m and removal of the bow section wreck exposed above the water line ("Resolve to Remove", 2012). The contractual limitation to only remove the visible parts of the wreck and debris indicate a prioritisation of cosmetic outcomes ahead of reducing contaminant dispersal into the local ecosystem. The limitations of an approach prioritising cosmetic outcomes is evident in that there are still containers with potentially toxic contents on board the MV *Rena* stern section, which lies on the seabed (approximately 60 m depth), and in the debris scatter zone. These containers are theoretically easier to recover than parts of the wreck and debris on Ōtāiti due to the complications and risk created by surface conditions and localised currents and surge. While the containers are at a depth greater than 20 m, which necessitates decompression procedures for divers, the containers are less than one-third the mass of the sections of wreck currently being removed in more challenging conditions. Such actions and priorities suggest the prioritisation of a cosmetic approach—"out of sight, out of mind"—rather than recovering the potentially dangerous cargo, and minimising the harmful effects of more heavy metals, oil and toxic chemicals leaching into the water. The bias inherent in the contract scope definition is clearly prioritising the values of specific stakeholders in the recovery process.

Wreck recovery efforts for the MV *Rena* have been slow and sporadic due to the unpredictability of the weather at sea. High winds and currents can be dangerous for divers, who require relatively calm conditions to work in given the close proximity to the reef and the wreck. Recovery efforts more distant from Ōtāiti are less sensitive to weather conditions and could therefore allow greater productivity.

To date, hapū have been given a limited role to participate in the recovery process. The recent visit to Ōtāiti (19 January 2013) was also the first opportunity to conduct karakia intended to aid the meta-physical recovery alongside the physical changes occurring, after multiple requests since the recovery process was underway (Tahana, 2013). Limitations hampering active iwi involvement and meaningful engagement are not conducive to the goals stated in the government's recovery plan.

Results from Te Arawa ki Tai workshop

A Mauri-ometer (Morgan, 2008) analysis has been conducted during a workshop with Te Arawa ki Tai representatives. The analysis

looked at the change in mauri, using the Mauri-ometer (Morgan, 2008), over a period of 100 years (1911–2011). The knowledge and experience of those who have lived in the area was incorporated into the analysis allowing their experience of the changes in mauri to be included, strengthening the results that are produced from the assessment. The analysis showed the change in ecosystem mauri (environment), whānau mauri (economic), community mauri (social) and Te Arawa ki Tai mauri (cultural) over time. The results for these four dimensions were combined to give the overall impact upon mauri shown in Figure 5.

The results show an overall decline in mauri from 1911 to 2011. There is a sharp decrease in mauri attributed to the MV *Rena* running aground Ōtāiti, negatively impacting all mauri dimensions. This assessment especially highlights the change in mauri from before the MV *Rena* incident occurred to what is currently being done to remediate the situation. In order to return the mauri to its pre-MV *Rena* state, more of the indicators will need to return positive scores on the Mauri-ometer (Figure 3) to mitigate the accumulating negative impacts upon mauri.

The pre-MV *Rena* assessment will be used as a baseline for future assessments where the impacts upon mauri due to the different recovery options for the MV *Rena* can be assessed and compared with the present state. The assessment will provide a guideline for recovery indicating the likely impacts on mauri of the different recovery options, and option effectiveness in restoring the mauri to its pre-MV *Rena* state. This process will be guided by the stakeholder worldview analysis, which is to be completed in the future.

Research reports by various consultants were released in February 2013 with the status draft for review. With the exception of a dispersant modelling report and cultural values reports, all have recommended that the wreck be made safe. "Option 3: Remove or contain cargo and make safe" has been identified as the preferred option from most perspectives, and the most beneficial option for avifauna (Riddell & Kessels, 2013). The predilection of the authors of these research reports to select a preferred option based upon focused studies of compartmentalised aspects of the environment raises significant concerns. The limited understanding of these authors of the full breadth of relevant issues raises the precautionary principle, in that such recommendations must be considered to be highly subjective and too narrowly focused to be given any significant weight in influencing the selection of a recovery option. The assumptions relied upon to justify these recommendations are sourced from the lead consultant for the resource consent application, and in several cases are inconsistent or discuss topics that are outside the focus of the research being conducted.

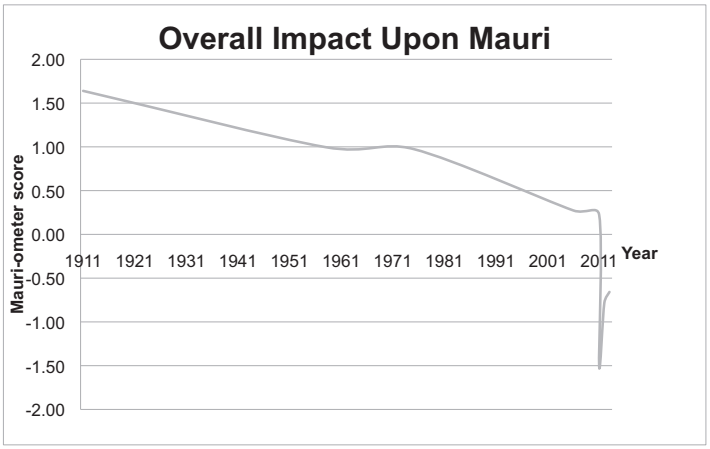

FIGURE 5 Workshop results determining change in mauri 1911–2011

The accumulation of mauri impacts and potential for further degradation is assessed by the authors in a manner consistent with the pre-MV *Rena* state shown in this research, relying on reports produced since the MV *Rena* grounding and recorded observations of hapū provided at wānanga.

Summary/Conclusions

The focus of this research is primarily to understand the changes in mauri at the subject site. The research will also identify the most preferable strategies to facilitate the restoration of mauri impacted by the MV *Rena* stranding on Ōtāiti and consequent despoiling of Te Moana Nui A Toi (the Bay of Plenty). The topics discussed within this paper have been focused on identifying the pre-MV *Rena* state of mauri. The restoration of the environment and assessing the environmental and cultural impacts on hapū resulting from the MV *Rena* grounding are priority issues for the five most impacted areas of Maketū, Mōtītī, Matakana Island, Mauao/Pāpāmoa and East Cape. The work streams by hapū are already underway, and therefore some urgency is necessary in establishing structures that will support robust research in the very near future.

From observations and meeting with salvage operations directors during the visit to Ōtāiti, it is apparent that removal of containers potentially containing toxic chemicals, such as cryolite, could be carried out more expeditiously than the procedure currently being employed. The current focus on removal of the visible portion of the wreck above sea level raises issues about the recovery operation priorities. The quality of decision-making has resulted in ecosystem degradation evident in other studies and highlights the need for a decision process that can adequately integrate all impacts upon the mauri dimensions. The removal of containers and other debris leaching contaminants into the ecosystem from the sea-floor is less susceptible to localised surge around the reef and weather conditions on the surface. Removal of the entire bow section from Ōtāiti while the barge is in close proximity to the reef also seems a less costly approach if removal of the entire wreck is actually intended.

The Mauri Model decision-making framework provides a basis of assessment of the impacts of the MV *Rena* grounding, using mauri as the base metric for comparative assessment allowing all cultural, environmental, social and economic factors to be included in decisions. This is important as it allows mātauranga Māori to be incorporated in the decision-making process, especially as the primary goal of the recovery effort is to "restore the mauri of the affected environment to its pre-*Rena* state" (Ministry for the Environment, 2011).

The initial phase of this research has been expanded into digitisation of the Mauri Model decision-making framework giving iwi and hapū the tools to carry out their own assessments in a time frame that suits them, allowing better understanding and wider use of the decision-making framework.

Glossary

Aotearoa	Māori name for New Zealand
hapū	sub-tribe
iwi	tribe
kai	food
kaitiaki	guardian, protector and enhancer of mauri
kaitiakitanga	enhancing the mauri of all things
karakia	ritual chants/incantations using traditional language
mana	spiritual force within a person
marae	traditional Māori meeting place
mātauranga Māori	traditional Māori knowledge
maunga	mountain
mauri	life force
moana	sea

rāhui	cultural restriction on resources
tangata whenua	indigenous peoples of Aotearoa
taonga	anything considered valuable
tapu	sacred
Te Moana Nui A Toi	the Bay of Plenty
tipua	supernatural being
tohunga	priest
wāhi tapu	culturally important site
wānanga	workshop/think-tank
whānau	family

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