BEFORE THE ENVIRONMENT COURT
AT AUCKLAND
I MUA I TE KŌTI TAIAO O AOTEAROA
TĀMAKI MAKAURAU ROHE

UNDER	the Resource Management Act 1991
IN THE MATTER	of appeals under Clause 14 of Schedule 1 of the Act
BETWEEN	**BAY OF ISLANDS MARITIME PARK INCORPORATED**
	(ENV-2019-AKL-000117)
	ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INCORPORATED
	(ENV-2019-AKL-000127)
	Appellants
AND	**NORTHLAND REGIONAL COUNCIL**
	Respondent

STATEMENT OF EVIDENCE of NICHOLAS TONY SHEARS (MARINE ECOLOGY)

TOPIC 14 – MARINE PROTECTED AREAS

19 March 2021

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INTRODUCTION

1. My name is Nicholas Tony Shears. I am an Associate Professor in the Institute of Marine Science at the University of Auckland where I have been employed since 2009. I am providing this evidence on behalf of the Royal Forest and Bird Protection Society of New Zealand Inc ("Forest & Bird"), Bay of Islands Maritime Park Inc ("BOIMP") and Ngāti Kuta Hapū ki te Rawhiti ("Ngāti Kuta").

2. My evidence relates to the proposals by those parties for marine protection:

    a. In Sub-Area A from Maunganui Bay to Oke Bay.

    b. In an adjacent "buffer" area.

    c. At Mimiwhangata.

SUMMARY OF EVIDENCE

3. The eastern coast of Northland including the Bay of Islands and open coast to Mimiwhangata includes a wide variety of ecologically important marine habitats and high diversity of species. This area is considered of high ecological significance and includes a combination of representative and significant natural ecosystems.

4. Cape Brett and Mimiwhangata in particular are areas of very high ecologically significance. The main threat to indigenous vegetation and biodiversity on shallow reefs in these areas is fishing. Currently, there is almost no protection from fishing afforded to the representative and significant natural ecosystems in this area.

5. Shallow reefs in this area support important habitats of indigenous vegetation (eg kelp and seaweed forests), which in turn support a range of important species. However, these habitats are adversely affected by fishing (through removal of kina/sea urchin predators) and large areas of kelp forests have been lost from shallow reefs in this area. Existing management under the Fisheries Act 1996 focuses on managing catch levels of certain species and does not ensure protection and restoration of the complexity of marine ecosystems or adequately address wider impacts on biodiversity. As a result, current management under the Fisheries Act does not achieve the objectives and policies of the New Zealand Coastal Policy Statement (NZCPS) or the Northland Regional Policy Statement.

6. Based on my experience and understanding of no-take protection in the coastal environment, the no-take area proposed at Mimiwhangata will be highly effective at eliminating the adverse effects of fishing and protecting, maintaining and enhancing indigenous biological diversity in the area to which it would apply. The proposed no-take area encompasses the full range of habitats at Mimiwhangata and clearly meets NZ's marine protected area (MPA) design

guidelines. Therefore, this MPA would effectively contribute to a wider network of MPAs if one was to be established.

7. The no-take area proposed from Maunganui Bay to Oke Bay (Sub-Area A) will also afford increased protection to the indigenous biological diversity in this area. The level of protection will be greatly enhanced by the proposed buffer zone that will greatly reduce fishing impacts and minimise edge effects. As proposed, the no-take area encompasses the full range of habitats in the area and meets MPA design guidelines. However, in my opinion expanding the no-take restrictions in Sub-Area A to include the proposed buffer zone would provide greater protection against the adverse effects of fishing on indigenous biodiversity.

8. Protection from all forms of fishing in Sub-Area A and the Mimiwhangata rahui tapu is necessary to maintain and enhance natural biological processes in these dynamic coastal environments. A reduction in the size of these two no-take areas would severely compromise their ability to achieve this outcome, which is a core objective of the NZCPS.

QUALIFICATIONS AND EXPERIENCE

9. I hold a BSc in Biology and PhD in Marine Science from the University of Auckland.

10. I am an Associate Professor in the Institute of Marine Science at the University of Auckland where I have been employed since 2009.

11. I have over 20 years' experience undertaking research on rocky reef ecosystems throughout New Zealand and overseas. My research has largely focussed on the impacts of fishing, sedimentation and climate change on rocky reef ecosystems, as well as the design and effectiveness of marine protected areas.

CODE OF CONDUCT

12. I have read the Code of Conduct for Expert Witnesses in Part 7 of the Environment Court's Practice Note 2014. I agree to comply with the Code of Conduct. In particular, except where I state that I am relying upon the evidence of another person as the basis for any opinion I have formed, the evidence in this statement is my expert opinion within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

EVIDENCE

Attributes and values of coastal ecosystems in the proposed protected areas

13. The majority of the area encompassed in the fishing control provisions proposed for Maunganui Bay – Oke Bay and Mimiwhangata is classified as a

Significant Ecological Area by NRC. I strongly agree with this classification and note that the area includes a combination of representative and significant natural ecosystems.

14. The complex coastline, which includes a series of headlands and many islands and embayments, provides a wide variety and high diversity of biological habitats. Of particular note are ecologically important and sensitive soft sediment habitats in the more sheltered waters (e.g. sea grass and horse mussel beds), kelp forests around much of the rocky coasts, and extensive deep reef systems off the northeast coast. The strong influence of East Auckland Current brings a unique subtropical component to this part of the New Zealand coast. The area, particularly around Cape Brett, is historically renowned for enormous schools of surface feeding fish, which attracts larger fish and marine mammals close into shore.

15. The marine environment around Cape Brett including Maunganui Bay is classified in the Northland Regional Policy Statement as an area of outstanding natural character. Areas of coast to the north and south of Maunganui Bay, plus the Maunganui Bay rahui, are part of a much larger and highly ranked marine significant ecological area - Eastern Bay of Islands and Cape Brett Coast[1]. This larger area includes an extensive and complex shallow reef system connected to a deep offshore reef system to the east of Cape Brett. There is a great diversity in the algal communities of the shallow reef habitats, reflecting the diversity of the substrate and exposure.

Sub-Area A - Maunganui Bay to Oke Bay

16. This area of coast on the western side of Cape Brett represents a unique stretch of coast in Aotearoa as it is largely protected from ocean swells, there is limited influence of land-based stressors such as sediment, and it is strongly influenced by the East Auckland Current. As a result, the relatively steep sloping reefs in this area support some of the highest diversity of reef fish in Northland, second only to the Poor Knights Islands[2]. Likely due to the unique physical setting, Maunganui Bay is a hotspot for subtropical species of fish, as well as other resident (e.g. the subtropical sea urchin *Trypneustes gratilla*) and transient (e.g. green turtles) taxa.

17. The rocky coast running south of Maunganui Bay to Oke Bay includes a number of rocky and sandy bays, and therefore encompasses a wider array of shallow benthic habitats than Maunganui Bay. There are a number of shallower more gradual sloping reef systems that support a mosaic of macroalgal habitats, including kelp forests *Ecklonia radiata, C. flexuosum* forests and shallow mixed

[1] Significant Ecological Marine Area Assessment Sheet- Eastern Bay of Islands and Cape Brett Coast https://www.nrc.govt.nz/media/9434/easternboiandcapebrettcoastsignificantecologicalmarineareaassessmentsheet.pdf

[2] Brook, F. (2002). Biogeography of near-shore reef fishes in northern New Zealand. Journal of the Royal Society of New Zealand, 32, 243-274.

algal habitat with the kelp species *Lessonia variegata*. Large areas of the shallow reef in this area are kina barrens and lacking large seaweeds. Intertidal and subtidal beds of green-lipped mussels *Perna canaliculus* were historically present in this area but were not observed on a recent visit[3]; it is unknown if the subtidal beds are still present. Subtidal mussel beds are a nationally important and increasingly rare habitat, particularly in northern New Zealand.

18. In general, this area of coast **includes a combination of representative and significant natural ecosystems and a high diversity of habitat types.** As a result, the area meets a number of the assessment criteria in the Northland Regional Policy Statement for identifying significant areas of indigenous vegetation or habitat(s) of indigenous fauna. These include: Representativeness, Rarity/distinctiveness, Diversity and pattern and Ecological context[4].

19. Currently, only a small part of this ecologically significant area is protected from fishing in a rahui. The area is small, and has only been in place since 1 December 2010 (approximately 10 years). Initial video surveys of tamure (snapper *Pagrus auratus*) in 2016 found no difference in snapper size and numbers inside and outside the rahui[5]. However, preliminary evidence suggests that populations of koura (crayfish *Jasus edwardsii*) have recovered to some extent in Maunganui Bay as a result of protection under the current Rahui,[6] and evidence from hapū and dive operators[7] suggests that the number and diversity of other species has increased significantly within the Rahui.

20. Despite the recovery observed for some exploited species, given the small size of this area and fishing pressure on the boundary, any benefits only apply to a tiny fraction of the Bay of Islands. Furthermore, it is unlikely the existing area will be effective in protecting exploited species to the point that the adverse effects of fishing on wider biodiversity are reversed and the reef ecosystems are restored (see paragraph 52).

Mimiwhangata Rahui Tapu

21. The Mimiwhangata Peninsula and associated islands has very high cultural, natural heritage, and biodiversity values. Extensive marine monitoring and mapping has been carried out at Mimiwhangata since the 1970's. The extensive and interconnected reef systems of Mimiwhangata and adjoining soft bottom habitats are ranked as a high value ecologically significant areas. These complex reefs, coastline and small islands create a significant sequence of high quality

[3] Nick Shears personal observation
[4] Only one of these criteria needs to be met in order to be classified as significant.
[5] Kerr, V.C. (2016) Baited underwater video survey of fishes – Maunganui Bay and Cape Brett, Bay of Islands, New Zealand. A reported prepared for Fish Forever, Bay of Islands Maritime Park Inc.
[6] Sutton (2016) Bay of Islands Lobster Monitoring Programme https://fishforever.org.nz/images/ff/documents/reports/Sutton,%20B%20(2016)%20Maunganui%20Bay%20Lobster%20Monitoring%20Programme.pdf
[7] Evidence of Julia Riddle; evidence of Craig Johnston, Ngāti Kuta evidence.

marine habitats including shellfish beds, sea grass beds, shallow and deep water kelp forests, and deep reefs dominated by a diverse filter-feeding encrusting invertebrate community.

22. The variety of habitats around the Peninsula is reflected in the great diversity of seaweed communities, which range from sheltered forests of *Carpophyllum flexuosum* to highly exposed forests of the kelp *Lessonia variegata*. The extensive and complex reef systems also provide valuable habitat for important kaimoana species such as tamure (snapper *Pagrus auratus*), koura (crayfish *Jasus edwardsii*) and paua (*Haliotis iris*), which were once abundant in the area.

23. The proposed rahui tapu and buffer areas **includes a combination of representative and significant natural ecosystems and a high diversity of habitat types.** The area meets a number of the assessment criteria in the Northland Regional Policy Statement for identifying significant areas of indigenous vegetation or habitat(s) of indigenous fauna. These include: Representativeness, Rarity/distinctiveness, Diversity and pattern and Ecological context.

24. Some of the proposed area is currently included in the Mimiwhangata Marine Park, which prohibits commercial fishing, but allows recreational fishing. As described in paragraphs 34-38, the existing Marine Park does not avoid or remedy the adverse effects of fishing on biodiversity.

New Zealand Coastal Policy Statement (NZCPS)

25. Objective 1 of the NZCPS aims to safeguard the integrity, form, functioning and resilience of coastal environments and ecosystems by (1) **maintaining or enhancing natural biological and physical processes** in the coastal environment and **recognising their dynamic, complex and interdependent nature**; and (2) **protecting representative or significant natural ecosystems** and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna. As described in paragraphs 31-40 this objective is not being achieved with existing management measures within the areas proposed for protection.

26. The New Zealand Marine Protected Areas Policy is a statement of government policy published by the Department of Conservation and the Ministry of Fisheries. It calls for the protection of the full range of marine habitats and ecosystems as well as those which are rare, distinctive or internationally or nationally important, using a range of management tools including marine reserves, Fisheries Act tools, and tools under the Resource Management Act.[8] These goals are consistent with the protection goal of Objective 1 of the NZCPS. The NZ Marine Protected Areas Classification, Protection Standard and Implementation Guidelines was developed by DOC and MPI to implement

[8] Marine Protected Areas: Policy and Implementation Plan (December 2005), page 3.

the NZ MPA Policy so can therefore be used to provide guidance on achieving NZCPS Objective 1. It also shows that the proposed protected areas are consistent and integrated with, and will achieve, wider marine protection goals.

27. Marine habitats in the Bay of Islands include indigenous vegetation such as sea grass, kelp forests and other macroalgal dominated habitats, all of which can be directly and indirectly impacted by fishing. These habitats all provide nursery grounds, food and shelter for many ecologically, culturally, recreationally and commercially important species. As outlined above the proposed areas include a variety of **representative and significant natural ecosystems**, but there is currently only very limited protection from fishing. This includes a small rahui at Maunganui Bay and the Mimiwhangata Marine Park, which have limited protection value given small size (paragraph 52) and weak regulations respectively (paragraphs 34-38).

28. Policy 11 NZCPS requires that some specified ecological features or values are protected from adverse effects or significant adverse effects. The proposed no-take areas contain the following features and values under Policy 11(a):

    a. Policy 11(a)(iii) indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare:

        i. Subtidal sea grass beds are a rare coastal vegetation type nationally. An extensive subtidal sea grass bed occurs on the western side of Mimiwhangata Peninsula.

    b. Policy 11(a)(v) areas containing nationally significant examples of indigenous community types:

        i. Maunganui Bay is nationally significant in terms of the diversity of subtropical species that are found there (eg reef fish species, turtles and sea urchins).

    c. Policy 11(a)(vi) areas set aside for full or partial protection of indigenous biological diversity under other legislation:

        i. Both proposed no-take areas have some form of current protection (Marine Park and rahui). However, as explained in this evidence, the indigenous biological diversity in these areas is still adversely affected by fishing.

29. The proposed no-take areas will also provide protection of the following features and values under Policy 11(b):

    a. Policy 11(b)(i) areas of predominantly indigenous vegetation in the coastal environment:

        i. Both proposed areas include extensive areas of predominantly indigenous vegetation including sea grass, kelp forests and other macroalgal dominated habitats. In fact these areas are

exclusively indigenous vegetation (no non-indigenous vegetation types are present).

b. Policy 11(b)(ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species.

    i. Sea grass, kelp forests and other macroalgal dominated habitats provide nursery grounds, food and shelter for other indigenous marine species (e.g. crayfish, reef fish, paua).

c. Policy 11(b)(iii) indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh;

    i. The proposed no-take areas specifically include intertidal zones, extensive rocky reef systems and eelgrass (sea grass).

d. Policy 11(b)(iv) habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes:

    i. Coastal reefs provide home to many species, including crayfish (koura), snapper (tamure), kina and paua, that are important for all of these purposes.

e. Policy 11(b)(vi) ecological corridors, and areas important for linking or maintaining biological values identified under this policy:

    i. Both no-take areas include a variety of marine habitats (reef and soft sediment) spanning a depth continuum from the intertidal to deeper offshore water (>40 m depth). This recognises the linkages and connectivity among habitats and across depth gradients and ensures protection of these biological values.

30. The only Policy 11 clause relating to specific taxa are Policies 11(a)(i) and (ii), which relate to species listed as Threatened or at risk based on relevant threat classification systems. It is important to note that these systems are not well developed for the marine environment and only a few marine fishes for example are listed as threatened or near-threatened.[9] For example, black spotted grouper *Epinephelus daemelii*, which is occasionally found at Cape Brett and Mimiwhangata (pers. obs.), is listed on the IUCN red list as Near Threatened and is totally protected from fishing. In contrast, the harvest of all other fish species is allowed and currently managed under the Fisheries Management Act 1996. Because stock assessments are only carried out at large spatial scales on a relatively small proportion of species, that for most species there is limited information on the state of populations and the extent to which they have been

[9] https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/resources/identification-guide-protected-fish-and-reptiles.pdf

impacted by fishing (but see paragraphs 33 and 35 for state of snapper and crayfish populations).

Adverse impacts of fishing on indigenous vegetation of rocky reefs

31. Fishing is the primary threat to biodiversity in the outer Bay of Islands and along the northeastern coast to Mimiwhangata. Fishing activity is managed under the Fisheries Act 1996, which gives commercial, recreational, and customary fishers access to resources while ensuring fish stocks are managed sustainably. While there are provisions for avoiding, remedying or mitigating any adverse effects of fishing on the aquatic environment, implementation of the Fisheries Act is focussed on setting sustainable catch levels on a species by species basis and determining how many fish can be harvested from large-scale fishery management areas. Sustainability targets are set according to fishery rather than biodiversity values. As recognised in the NZCPS, coastal ecosystems are complex and interconnected. This single species approach does not maintain natural and biological processes, having regard to the dynamic, complex and interdependent nature of ecosystems.

32. Extraction of key species via fishing can have effects that flow through the entire marine system and impact on indigenous vegetation and the species that rely on it. A clear example of this is evident on shallow rocky reefs where overexploitation of snapper and crayfish, results in predatory release of sea urchins (kina), which graze down shallow water vegetation (kelp forests) and create kina barrens (Figure 1). These kelp forests represent significant indigenous vegetation in the coastal environment, providing food and habitat for many species and a major source of primary production. The primary threat to these kelp forests and rocky reef ecosystems at Cape Brett and Mimiwhangata is fishing. Land-based impacts such as sedimentation are minimal in these coastal areas compared to harbour and estuarine ecosystems such as within the inner parts of the Bay of Islands. Below I describe the state and current approach to managing snapper and crayfish fisheries, how this leads to proliferation of kina and loss of shallow reef vegetation, and how effective marine protection can avoid and reverse the adverse effects of fishing on shallow reefs.

Figure 1 *Shallow reef dominated by indigenous vegetation in the Poor Knights Islands Marine Reserve (top) and an area of kina barrens in the Mimiwhangata Marine Park where indigenous vegetation and associated biodiversity has been lost due to an overabundance of sea urchins (kina). This loss of underwater vegetation is an ecosystem-level effect of long-term exploitation of snapper and crayfish, the main predators of sea urchins. Photos: N. Shears – January 2021*

33. Snapper populations in the proposed areas are managed as part of the SNA 1 management area which extends from North Cape to East Cape. SNA 1 is currently under assessment, but the last assessment in 2012 suggested the Northland substock was at 24% of unfished spawning stock biomass, with the overall SNA 1 fishery near its soft limit of 20% and well below target levels of 40%[10]. Snapper spawning biomass trajectories show substantial declines up until 1999 for East Northland, and a comparatively small increase since (see Figure 2 [11]).

[10] The Harvest Strategy Standard (Ministry of Fisheries policy) provides that fish stocks should be managed to fluctuate around a target level, which in the case of snapper is 40% of unfished biomass. If a stock falls below a "soft limit" – in the case of snapper this is 20% of unfished biomass – it is considered overfished, and the policy provides that it should be managed in a way that rebuilds the fishery.
[11] https://fs.fish.govt.nz/Doc/23986/FAR-2015-76-SNA1-assessment-2013.pdf.ashx

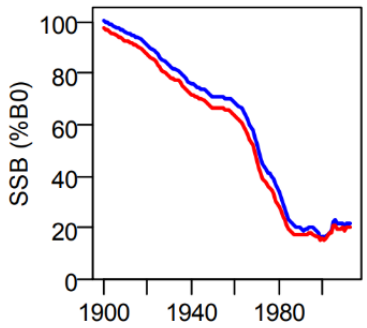

Figure 2 *Long-term trend in spawning stock biomass, relative to unfished biomass (B0), for the East Northland snapper fishery*[11]

34. Snapper *Pagrus auratus* are heavily targeted in the proposed areas. The impact of fishing on snapper populations is evident through comparisons of snapper populations in the Mimiwhangata Marine Park (recreational fishing allowed) and at Cape Brett (recreational and commercial fishing allowed) with the nearest no-take protected area - the Poor Knights Islands Marine Reserve. Biomass of snapper at Cape Brett are estimated to be ~14% of that within the Poor Knights[12]. The snapper populations at Cape Brett and Mimiwhangata are dominated by small snapper, with only a small proportion of the population above the legal-size limit[12]. In contrast, snapper populations within the Poor Knights Islands Marine Reserve are dominated by large individuals (>minimum legal size), which is typical for protected populations in northern New Zealand[13]. Prior to full no-take protection at the Poor Knights large snapper were rare[12], indicating that this is an effect of the removal of fishing pressure rather than natural variability.

35. With regard to crayfish (*Jasus edwardsiii*), both Cape Brett and Mimiwhangata are located in statistical area 904 of the CRA 1 management area. The total allowable catch in CRA 1 was reduced in 2020 and further cuts are currently under review[14]. Vulnerable biomass in 2020 was estimated at 15% of unfished levels in CRA 1, with the long-term trajectory of vulnerable biomass in the fishery showing a steep decline until the early 1990's and consistently low levels since (Figure 3). The CPUE in statistical area 904, where Mimiwhangata is located, is considerably lower than the other statistical areas in CRA 1 to the north[15].

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[12] Denny, C.M., Willis, T.J. & Babcock, R.C. (2004). Rapid recolonisation of snapper Pagrus auratus: Sparidae within an offshore island marine reserve after implementation of no-take status. Marine Ecology Progress Series, 272, 183-190; Denny, C.M. Babcock, R.C (2004). Do partial marine reserves protect reef fish assemblages? Biological Conservation, 116, 119-129; Roux de Buisson, P. (2010). Poor Knights Islands Marine Reserve and Mimiwhangata Marine Park fish monitoring 2009. Unpublished report prepared for the Department of Conservation Northland Conservancy; Available from: http://www. marinenz. org. nz/documents/poor-knights-fishmonitoring-2009.pdf

[13] Willis, T. J. et al 2003 Protection of exploited fish in temperate regions: high density and biomass of snapper Pagrus auratus (Sparidae) in northern New Zealand marine reserves. Journal of Applied Ecology 40: 214-227.

[14] https://www.mpi.govt.nz/dmsdocument/43003-Review-of-Rock-Lobster-Sustainability-Measures-for-202122

[15] Fisheries Assessment Plenary November 2019 https://www.mpi.govt.nz/dmsdocument/38960/direct

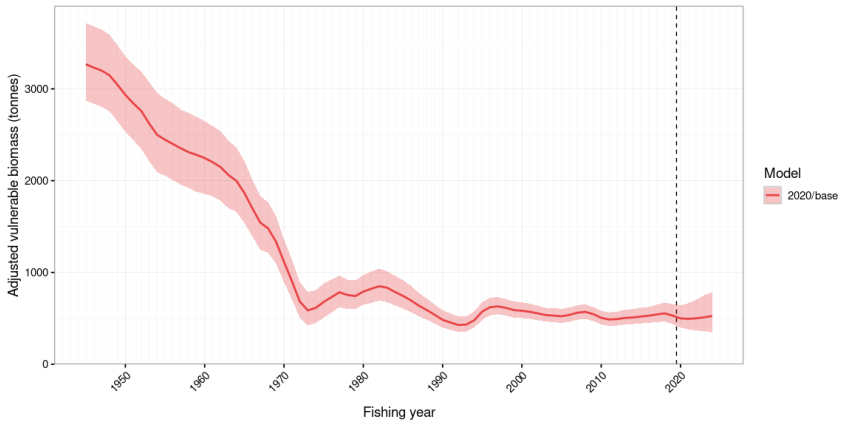


Figure 3 *Long-term trend in vulnerable biomass of the Northland (CRA 1) crayfish fishery* [14]

36. The Mimiwhangata Marine Park (established 1984) prohibits commercial fishing but allows recreational fishing. Despite this "partial protection" the crayfish abundance and size within the Mimiwhangata Marine Park are reflective of a heavily fished population[16]. Densities of legal-sized lobster in the Marine Park have declined since the 1970's and are at very low levels (<1 per 500 m^2 of reef) both inside and adjacent to the Marine Park[16]. In contrast, crayfish populations have been shown to have increased substantially over this same period in no-take marine reserves[16]. These studies unambiguously demonstrate recreational fishing is having a significant impact on crayfish populations inside the Mimiwhangata Marine Park. The reported increase in crayfish within the Maunganui Bay rahui area[17] provides a locally relevant example of how no-take protection leads to recovery of crayfish populations. It has widely been demonstrated globally that partial protection (e.g. allowing recreational fishing in MPAs) is not effective at protecting exploited species[18].

37. The above examples (paragraphs 33-35) clearly demonstrate how fishing has greatly diminished the abundance and size of important species from coastal areas, and that while current fisheries management approaches has limited further declines in the particular stocks being managed, there is little evidence of recovery over recent decades. As a result, the current approach to fisheries management has not been effective in maintaining indigenous biodiversity.

38. Snapper and crayfish are important predators of sea urchins (kina) and large-scale reduction in the abundance and size of these predators from coastal reefs

[16] Shears NT, Grace RV, Usmar NR, Kerr V, Babcock RC (2006) Long-term trends in lobster populations in a partially protected vs. no-take Marine Park. Biological Conservation 132: 222-231.; Freeman, D. T., A. B. Macdiarmid, R. B. Taylor, R. J. Davidson, R. V. Grace, T. R. Haggitt, S. Kelly, and Shears NT. (2012) Trajectories of spiny lobster Jasus edwardsii recovery in New Zealand marine reserves: is settlement a driver? Environmental Conservation 39:295-304

[17] https://fishforever.org.nz/images/ff/documents/reports/Sutton,%20B%20(2016)%20Maunganui%20Bay%20Lobster%20Monitoring%20Programme.pdf

[18] Lester, S.E. & Halpern, B.S. (2008). Biological responses in marine no-take reserves versus partially protected areas. Marine Ecology Progress Series, 367, 49-56.

has facilitated the loss of shallow water kelp forests due to overgrazing by kina[19]. These changes are a clear indicator of the adverse effects of fishing on indigenous vegetation and habitats in the coastal environment. This adverse effect is evident along the Cape Brett-Mimiwhangata coast where large areas of kelp forests have been lost and the shallow reefs are now dominated by kina barrens (Figure 1). Kerr and Grace[20] demonstrate using historical aerial imagery that kina barrens at Mimiwhangata were dominated by kelp forests in the 1950's. The area of kina barrens in the Mimiwhangata Marine Park has increased substantially since it was originally mapped in 1973 [20]. The area of kina barrens has increased from 11 to 36% between 1973 and 2019. Kina barrens are also a commonly occurring habitat on the steep sloping reefs in Maunganui Bay, but are particularly prevalent on more gradual sloping reefs to the south such as in Oke Bay[21]. In the absence of predators, the extent and depth distribution of urchin barrens varies in relation to a number of factors including wave exposure and reef topography[22].

39. There is emerging evidence that the large subtropical sea urchin *Centrostephanus rodgersii* is increasing in northern New Zealand (Shears unpubl. data), which poses further risk to kelp forests. This species has increased dramatically in Tasmania with ocean warming and had dire impacts on kelp forests and associated biodiversity.[23] With ocean warming in northern New Zealand this species would be expected to continue to increase, particularly at headland locations like Cape Brett and Mimiwhangata. The emergence and potential impact of *C. rodgersii* on biodiversity has been raised as a concern in a number of reports on Maunganui Bay and Cape Brett[21]. As seen in Tasmania, the impacts of *C. rodgersii* on biodiversity is exacerbated by lack of large predators, in particular large crayfish. Consequently, protection of predator populations in no-take areas will help to prevent an increase in *C. rodgersii* and maintain

[19] Babcock RC, Kelly S, Shears NT, Walker JW, Willis TJ (1999) Changes in community structure in temperate marine reserves. Marine Ecology Progress Series 189: 125-134; Shears NT, Babcock RC (2002) Marine reserves demonstrate top-down control of community structure on temperate reefs. Oecologia 132: 131-142; Shears NT, Babcock RC (2003) Continuing trophic cascade effects after 25 years of no-take marine reserve protection. Marine Ecology Progress Series 246: 1-16; Babcock RC, Shears NT, Alcala AC, Barrett NS, Edgar GJ, Lafferty KD, McClanahan TR, Russ GR (2010) Decadal trends in marine reserves reveal differential rates of change in direct and indirect effects. Proceedings of the National Academy of Sciences USA 107:18256-18261.

[20] Kerr, V. & Grace, R.V. (2005). Intertidal and subtidal habitats of Mimiwhangata Marine Park and adjacent shelf. Department of Conservation; Lawrence, K (2020) Mapping long-term changes in reef ecosystems using satellite imagery. MSc thesis, University of Auckland

[21] Froude, V.A. (2016) Kelp cover and urchin barrens in the Bay of Islands: a 2016 baseline. A report prepared for the Bay of Islands Maritime Park Fish Forever Working Group. Russell, Pacific Eco-Logic Ltd. 71p; Kerr, V.C., 2016. Urchin barrens and algal community zonation; a transect-based study, Maunganui Bay and Cape Brett. Prepared by Kerr and Associates for Fish Forever, Bay of Islands Maritime Park Inc.; Kerr, V.C., 2016. Marine habitats of the proposed Maunganui Bay Marine Reserve. A report prepared for Fish Forever, Bay of Islands Maritime Park Inc.

[22] Shears NT, Babcock RC, Salomon AK (2008) Context-dependent effects of fishing: Variation in the kelp forest trophic cascades across environmental gradients. Ecological Applications 18: 1860-1873.

[23] Ling, S., Johnson, C., Frusher, S. & Ridgway, K. (2009). Overfishing reduces resilience of kelp beds to climate-driven catastrophic phase shift. Proceedings of the National Academy of Sciences, 106, 22341-22345.

biodiversity. Policy 3 of the NZCPS calls for a precautionary approach and this is particularly relevant given the uncertainty of how climate change will impact on the coastal environment and interact with other activities such as fishing.

40. Fishing is the primary threat to biodiversity in the outer Bay of Islands and along the northeastern coast to Mimiwhangata. It has significant adverse effects on ecological features and values listed in Policy 11(a) and (b) (paragraphs 28-29 above), and on areas that meet the Appendix 5 criteria in the Northland RPS. In my opinion, it is necessary to control fishing in order to avoid significant adverse effects on those features and values. It is also necessary in order to restore and enhance indigenous species, ecosystems and habitats. Restoration is practical and achievable through the removal of fishing pressure, as demonstrated within long-established northern New Zealand marine reserves[19].

Controls necessary to manage effects of fishing

41. Effective protection of large reef predators (e.g. snapper and crayfish) in no-take areas has been clearly demonstrated to remedy the adverse effects of fishing on shallow reefs, by reducing kina barrens and restoring indigenous vegetation[19]. This is evident in New Zealand's oldest marine reserve at Goat Island near Leigh (and other long-established reserves such as Tawharanui and Hahei), where areas of kina barrens have been replaced by kelp forests following long-term protection and recovery of large snapper and crayfish (see example of changes at Goat Island in Figure 4). Due to complex ecosystem dynamics, the shift from kina barrens to kelp forest is dependent on the recovery of large snapper and crayfish and this process can take decades to occur[19].

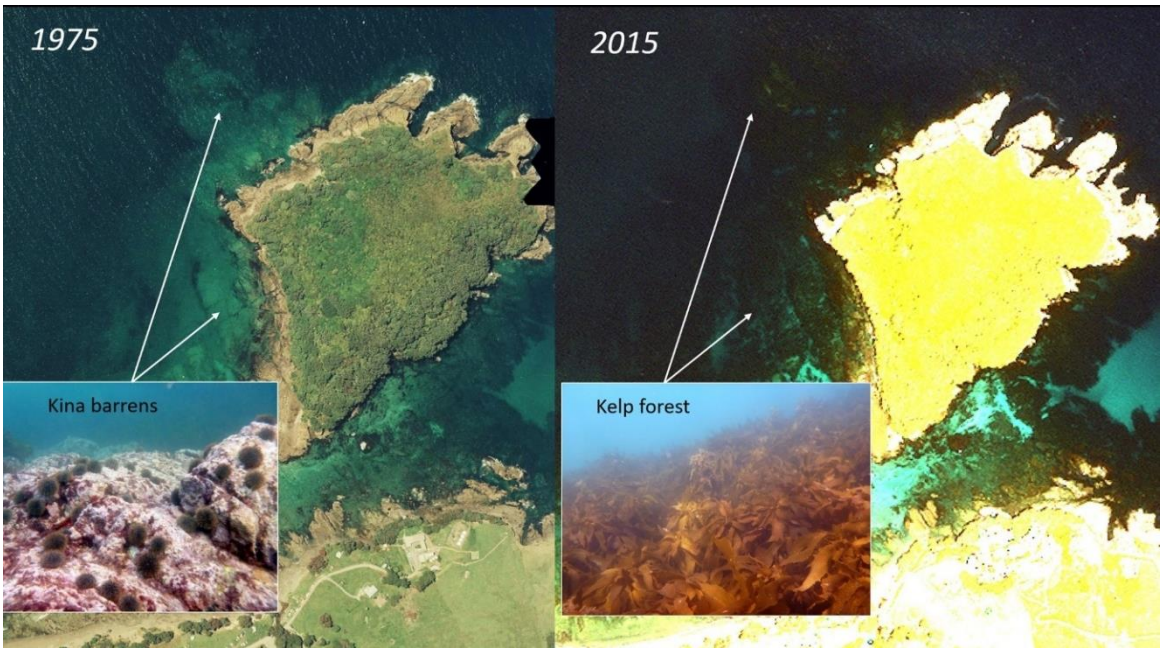


Figure 4. Long-term recovery of indigenous vegetation at Goat Island within the Cape Rodney to Okakari Point Marine Reserve. Approximately 40% of the reef was classified as kina barren in 1975 when the reserve was established (left). 40 years later (right) kina barrens are rare within the reserve and kelp forests predominate.

42. To effectively maintain and restore indigenous biological diversity on reef ecosystems it is therefore necessary to effectively protect exploited predatory species within marine protected areas. This requires:

    a. protection from all forms of fishing; and

    b. effectively designed marine protected areas.

43. Protection from commercial fishing, without also preventing recreational fishing, does not maintain indigenous biodiversity. There is conclusive evidence for this from the Poor Knights Islands Marine Reserve that allowed recreational fishing up until 1998, and from the Mimiwhangata Marine Park that allows recreational fishing[24]. In the four years following implementation of full no-take protection in the Poor Knights Islands Marine Reserve there was an 818% increase in snapper biomass[25]. Snapper biomass at control (fished) areas including Cape Brett and the Mokohinau Islands remained low and constant over this period.

44. MPAs need to be large enough to encompass the movements of exploited predatory species and have simple boundaries that minimise edge effects and aid in compliance and enforcement. MPA design guidelines developed by DOC and the former Ministry of Fisheries[26] provide clear guidance on this and are referred to in the following sections which evaluate the merits of the two proposed no-take areas.

Mimiwhangata Rahui Tapu

45. The boundary of the proposed rahui tapu area at Mimiwhangata has been developed through an iterative and inclusive process over many years aimed at increasing the level of effective marine protection at Mimiwhangata (Appendix 1A). The proposed rahui tapu boundary takes into account hapu aspirations, scientific knowledge and existing uses, and was recommended by DOC following formal assessment in 2005 that incorporated extensive consultation (including with NRC) and considered biodiversity and cultural heritage values[27]. The boundary recommended by Fleming and Hawkins is the same as the boundary of the proposed rahui tapu Area. Fleming and Hawkins note that "these recommendations reflect some of the significant issues raised by submitters to the Discussion Document and by other interested parties. They also achieve the highest range of attributes for combining marine protection and

[24] Denny, C.M. Babcock, R.C (2004). Do partial marine reserves protect reef fish assemblages? Biological Conservation, 116, 119-129

[25] Denny, C.M., Willis, T.J. & Babcock, R.C. (2004). Rapid recolonisation of snapper Pagrus auratus: Sparidae within an offshore island marine reserve after implementation of no-take status. Marine Ecology Progress Series 272: 183-190

[26] https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-protected-areas/mpa-classification-protection-standard.pdf

[27] Fleming, A. and Hawkins, K. (2005) Boundary options assessment report associated with the Mimiwhangata marine reserve proposal. Department of Conservation Report, December 2005, 86p.

practical management". The proposed rahui tapu area is substantially larger than the existing Marine Park, but considerably smaller than other options considered at the time. It should therefore be considered a compromise and the bare minimum area required to effectively maintain the marine biodiversity of Mimiwhangata.

46. The existing Mimiwhangata Marine Park (established in 1984) allows recreational fishing and was not designed in relation to basic MPA design principles[26]. The existing marine park has a complex boundary, only extends approximately 500 m offshore, and does not encompass the entire reef ecosystems and adjacent sand areas to allow the effective protection of key species and habitats (Appendix 1). Due to edge-effects (see paragraph 47.b. below), this means that even if the Marine Park was no-take, it would be too small to effectively maintain most exploited species and restore indigenous vegetation. Considerable research and assessment has been undertaken that unequivocally demonstrates the inadequacies of the existing Marine Park, both in terms of its small size, poor design and limited restrictions on fishing[28].

47. The proposed rahui tapu area represents a well-designed MPA that meets the core objective of the NZ MPA Policy of protecting the full range of marine habitats and ecosystems as well as those which are rare, distinctive or internationally or nationally important. The proposed area also meets the following MPA design guidelines from the NZ Marine Protected Areas Classification, Protection Standard and Implementation Guidelines[26]:

    a. **Protects whole habitats and ecosystems** – The proposed area encompasses the entire Mimiwhangata peninsula and associated islands, and the majority of reef areas as well as adjacent sand habitats (Appendix 1B).

    b. **Size of protected areas** - Based on extensive research in existing northern New Zealand marine reserves I am confident that this area is of sufficient size (~45 km^2), and is appropriately designed, to effectively protect important predator species (snapper and crayfish) and therefore maintain overall biodiversity within the area. Appendix 2(A) shows the proposed Mimiwhangata Rahui Tapu with a 0.5 km edge effect (red), which is based on literature for key target species such as rock lobster and snapper[29]. Due to movement of exploited species within reserves and attraction to bait and burley plumes, exploited species such as

[28] Denny, C.M. Babcock, R.C (2004). Do partial marine reserves protect reef fish assemblages? Biological Conservation, 116, 119-129; Shears NT, Grace RV, Usmar NR, Kerr V, Babcock RC (2006) Long-term trends in lobster populations in a partially protected vs. no-take Marine Park. Biological Conservation 132: 222-231; Fleming, A. and Hawkins, K. (2005) Boundary options assessment report associated with the Mimiwhangata marine reserve proposal. Department of Conservation Report, December 2005, 86p

[29] Freeman, D.J., MacDiarmid, A.B. & Taylor, R.B. (2009). Habitat patches that cross marine reserve boundaries: consequences for the lobster Jasus edwardsii. Marine Ecology Progress Series, 388, 159-167; Willis, T. J. et al 2003 Protection of exploited fish in temperate regions: high density and biomass of snapper Pagrus auratus (Sparidae) in northern New Zealand marine reserves. Journal of Applied Ecology 40: 214-227.

snapper and crayfish on the edges of reserves are vulnerable to fishing and densities are typically depressed within 500 m of reserve boundaries. When allowing for an 0.5 km edge effect (red shading) the proposed area effectively protects 71% of the overall area including extensive reef systems and adjacent soft sediment habitats of high ecological value (green shading Appendix 2(A)).

c. **Maximise connectivity** – The proposed MPA encompasses an entire headland and associated islands with high tidal flows, which will maximise larval dispersal from the MPA to adjacent fished areas.

d. **Consider sea and adjacent land uses in planning protected areas** – The proposed rahui tapu area adjoins the Mimiwhangata Coastal Park, a land reserve run by the Department of Conservation with extensive planting and pest control programs.

e. **Keep boundaries simple and aim for low boundary to area ratio** – The proposed area is a simple square shape with straight boundary lines that minimise the perimeter-to-area ratio and aid in compliance and enforcement.

48. I consider the MPA design guidelines provide an appropriate methodology for designing marine protected areas in accordance with the outcomes in Objective 1 and Policy 11 of the NZCPS. Meeting these guidelines ensures the area will be effective in maintaining and enhancing the biodiversity of the area. The proposed area would effectively allow the recovery of predator populations (snapper and crayfish) within its boundaries which would be essential to promoting the recovery of kelp forests and associated biodiversity. It will also increase the resilience of the ecosystems within the proposed area to further biodiversity loss directly or indirect a result of fishing. Inclusion of the entire peninsula, entire reef areas and adjacent sand habitats is essential to this success. Reduction in the size of this protected area, or weakening of the restrictions on fishing, would greatly undermine the ability of the Northland Regional Plan to give effect to the NZCPS in this area.

49. Meeting these national guidelines would also ensure that the Rahui Tapu would effectively contribute to a wider network of protected areas, if such a network was to be established through a systematic planning process.

50. Assuming a high level of protection (no-take), the ***Mimiwhangata Rahui Tapu Buffer areas*** that are proposed to the west and east of the Mimiwhangata Rahui Tapu area would increase the overall area of the rahui tapu by 30% and effective area of protection by 42% (Appendix 2B). It would protect an additional ~5 km of coastline, but greatly enhance the effective area of the entire rahui tapu by reducing the boundary to area ratio, including the entire Mimiwhangata Bay to the west and to Parepare Bay in the east. These buffer areas would reduce the edge effects along the western side of Mimiwhangata

Peninsula and provide greater protection for exploited species using the deep reef systems northwest of the peninsula.

51. Development of Hapu Management Plans for the buffer areas could provide additional opportunities for adaptive management and restoration, such as control of kina numbers in order to accelerate recovery of indigenous vegetation and associated biodiversity.

Sub-Area A— Maunganui Bay - Oke Bay

52. Sub-Area A would extend the existing no-take rahui at Maunganui Bay to Oke Bay. The current rahui area is very small (~1.6 km^2) and therefore the biodiversity values are greatly impacted by edge-effects/fishing on the boundary (Appendix 3(A): effective area of MPA is only ~1km^2). High levels of fishing for snapper on the boundary at the entrance of the bay likely explains the limited response of snapper to protection in the rahui area. By increasing the size of the protected area this will encompass a wider range of habitats, reduce the adverse effects of fishing on the area, and provide more effective protection for indigenous biological diversity.

53. The proposed Maunganui Bay-Oke Bay no-take area would meet the following MPA design guidelines in the NZ Marine Protected Areas Classification, Protection Standard and Implementation Guidelines[30]:

    a. **Protects whole habitats and ecosystems** – The proposed no-take area would encompass the entire convoluted coastline (~17 km) from Maunganui Bay to the western end of Oke Bay. The reef along this coast drops relatively steeply into deeper water to sandy habitats, so the proposed area encompasses the entire reef system and an adjacent area of deep (30-40 m) soft-sediment habitat.

    b. **Size of protected areas** – The size of the proposed no-take area (~6km^2) is similar in size to the Leigh and Tawaharanui Marine Reserves which have been shown to have significant value in protecting biodiversity and reversing the impact of fishing (see previous evidence). However, in contrast to the Leigh and Tawharanui marine reserves, the reefs in the proposed no-take area drop steeply into deep water and the offshore boundary is located in considerably deeper water (~40 m). Appendix 3(B) shows the proposed no-take area with a 0.5 km edge effect (red). When allowing for a 0.5 km edge effect (red shading) the proposed area effectively protects 62% of the overall area (green shading Appendix 3(B)). Some areas such as Motuwheteke Island towards the centre of the no-take area may be affected by edge effects given the close proximity (~350 m) to the offshore boundary. However, given the deep water on the offshore boundary it is unknown the extent to which exploited species such as snapper and crayfish will move beyond this boundary. Offshore movements of crayfish in the Leigh and Tawharanui reserves lead to capture on the offshore boundary (~800 m offshore)[31], which is the likely cause of recent declines in crayfish

[30] https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-protected-areas/mpa-classification-protection-standard.pdf

[31] Kelly, S., Scott, D. & MacDiarmid, A. (2002). The value of a spillover fishery for spiny lobsters around a marine reserve in northern New Zealand. Coastal Management, 30, 153-166.

observed in the Leigh and Tawharanui reserves[32]. While such offshore movements may be more restricted in the proposed area given the depth of the offshore boundary, this edge-effect will be reduced by the proposed buffer zone (as outlined in paragraph 56 below). In my opinion, extending the western boundary of the proposed no-take area further offshore (e.g. to include the proposed buffer zone) would reduce these edge-effects and increase the effective area of the MPA by 108% (Appendix 3C). This would ensure greater protection of key species undertaking offshore movements and also aid in compliance and management.

c. **Consider sea and adjacent land uses in planning protected areas** – The adjacent land is a DOC reserve that is covered in regenerating native forest.

d. **Keep boundaries simple and aim for low boundary to area ratio** – The proposed area has a simple, single straight-line boundary that will aid in compliance and enforcement.

54. Meeting these guidelines ensures the area will be effective in protecting and enhancing the biodiversity of the area. Reduction in the size of this protected area, or weakening of the restrictions on fishing, would greatly undermine the ability of this area to achieve the objectives of the NZCPS.

55. Meeting these national guidelines also ensures the MPA would effectively contribute to a wider network of MPAs if one was to be established through a systematic planning process.

56. The proposed ***buffer zone for Sub-Area A*** will minimise the effects of fishing on the boundary of the no-take area. It will only allow very restricted forms of fishing including hand fishing (single line and hook) and hand gathering without implements (e.g. nets, pots, scuba gear and spears). Given the close proximity of the offshore boundary of the no-take area in places such as Motuwheteke Island and Moturahurahu Island these restrictions will help reduce the impact of edge-effects on the no-take zone. For example, if crayfish potting was allowed in the proposed buffer zone this would impact on crayfish populations inside the long-shore boundaries of the no-take area due to bait plumes and would also remove crayfish along the offshore boundary if they are undertaking seasonal movements onto deep sandy areas (i.e. edge effect shown in Fig. 2(B)). Hand gathering in the buffer zone would not have the same impact on crayfish populations inside the no-take area and therefore reduce any edge-effect. While the buffer zone will greatly limit extractive activities, and therefore reduce fishing impacts on exploited species within the no-take zone, in my opinion greater biodiversity protection outcomes could be achieved if the proposed no-

[32] LaScala-Gruenewald, D.E., Grace, R.V., Haggitt, T.R., Hanns, B.J., Kelly, S., MacDiarmid, A. Shears, N.T. (2021). Small marine reserves do not provide a safeguard against overfishing. Conservation Science and Practise, e362.

take area (Sub-Area A) was simply extended to include the proposed buffer zone. This would also simplify management and enforcement.

Proposed Schedule

57. I have reviewed the draft Schedule of characteristics, qualities and values for the proposed Te Hā o Tangaroa Protection Area Rakaumangamanga-Ipipiri. I consider that it appropriately describes those characteristics, qualities and values.

Conclusion

58. Management of coastal environments to date has focussed on resource utilisation rather than maintaining or enhancing natural biological processes and biodiversity. Decades of scientific research has highlighted the direct impacts of fishing on exploited species and the indirect impacts of fishing on wider ecosystems, such as the loss of indigenous vegetation and associated biodiversity from coastal reefs. However, this research has also demonstrated how these adverse effects can be reversed and how natural biological processes can be restored and maintained through effective marine protection. The proposed no-take areas and associated buffer zones will be effective in mitigating the adverse effects of fishing within their boundaries and promote the restoration of indigenous vegetation and associated biodiversity. While these areas only represent a tiny fraction of the marine habitats in the regions, they would effectively contribute to a wider and more comprehensive network of protected areas if one was to be established through a systematic planning process.

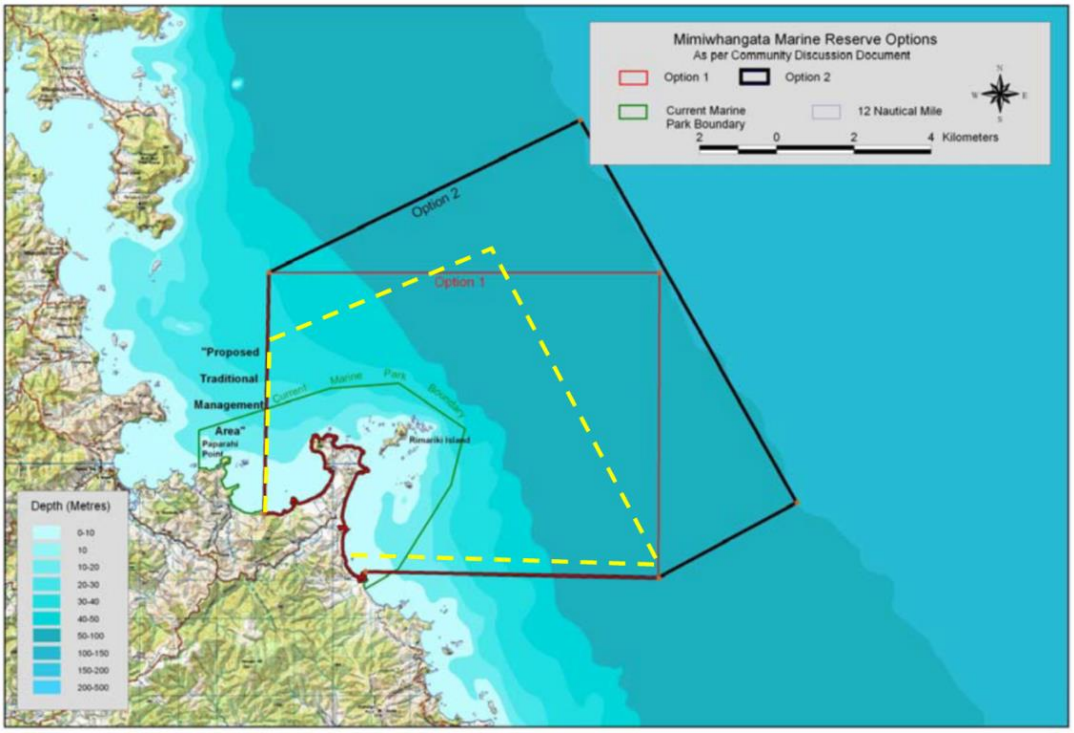
Nick Shears

19 March 2021

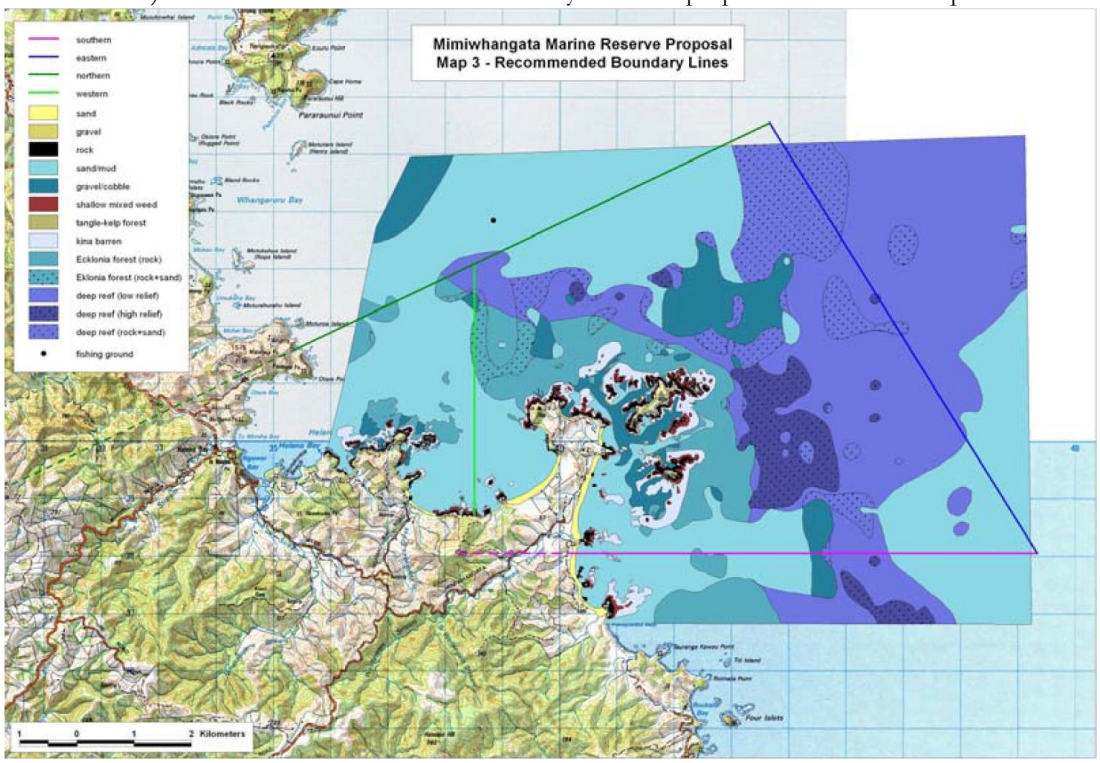
Appendix 1

Mimiwhangata Marine Protected Area boundaries (A) and habitat map with recommended boundary (B).

(A) Existing marine park boundary (green line), previous marine reserve boundary options considered (black and red lines), and marine reserve boundary recommended by Fleming and Hawkins[33] following consultation (yellow dashed line). Map adapted from Fleming and Hawkins[31]. Note that the recommended boundary is what is currently proposed as the Rahui Tapu Area.



(B) Habitat map of Mimiwhangata showing marine reserve boundary recommendation from Fleming and Hawkins 2005). Note that the recommended boundary is what is proposed as the Rahui Tapu Area.



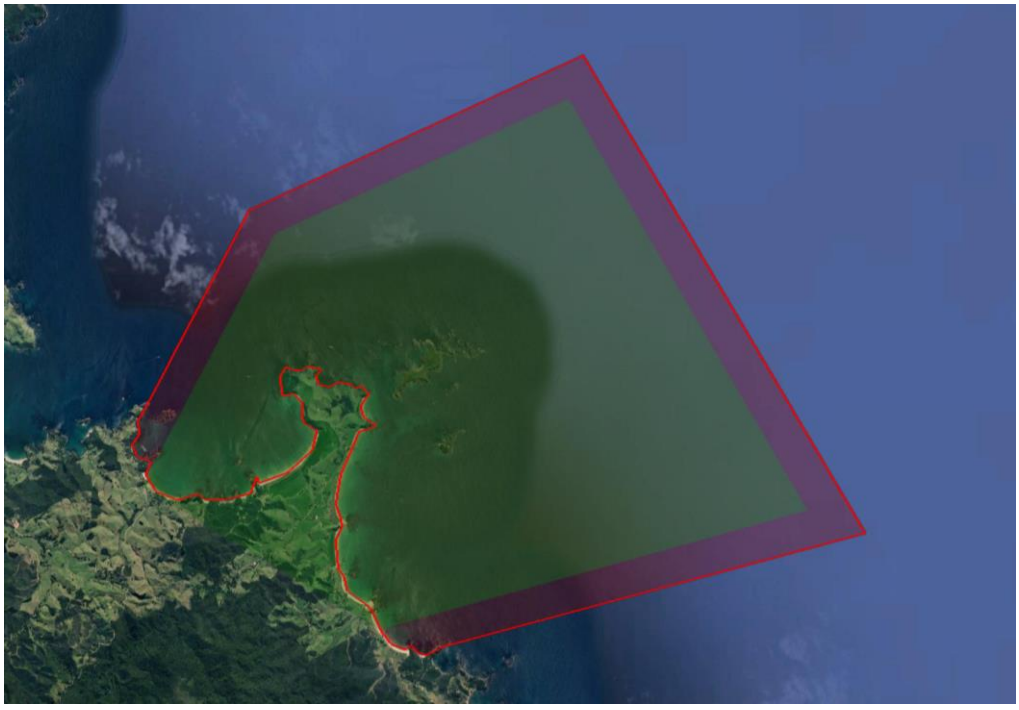
[33] Fleming, A. and Hawkins, K. (2005) Boundary options assessment report associated with the Mimiwhangata marine reserve proposal. Department of Conservation Report, December 2005, 86p.

Appendix 2

Edge-effect analysis of Mimiwhangata rahui tapu (A) and with buffer areas included assuming no-take status (B). Red shading shows a 0.5 km edge effect where many exploited species would be vulnerable to fishing on the boundary. Green area shows effective area of MPA based on 0.5 km edge effect. Effective area in (A) is 71% of total MPA; effective area in (B) is 78% of total MPA. Total area is 30% bigger in (B) than (A), whereas effective area is 42% bigger in (B) than (A).

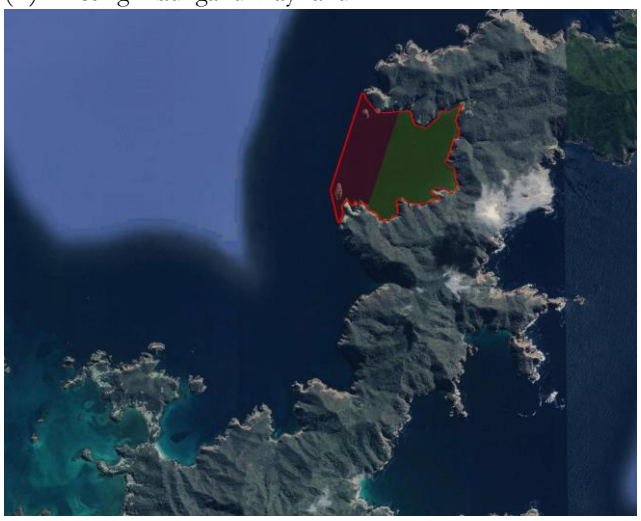
(A) Mimiwhangata rahui tapu

(B) Mimiwhangata rahui tapu with buffer areas included

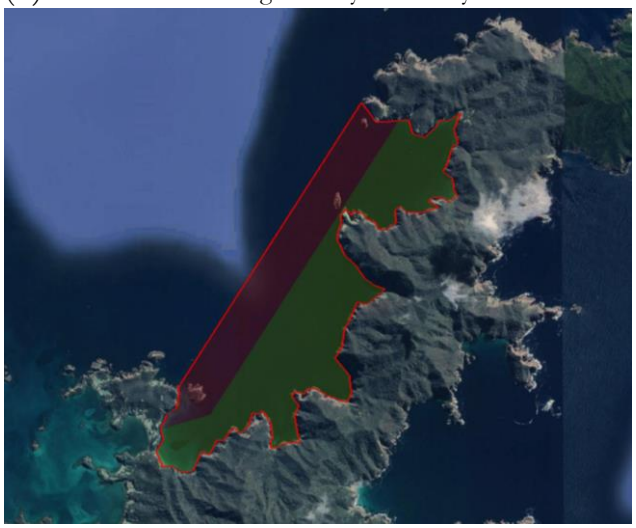


Appendix 3. Edge-effect analysis of existing Maunganui Bay rahui (A), proposed Sub-Area A-– Maunganui Bay - Oke Bay (B) and with the proposed buffer zone included under no-take status for comparison (C). Red shading shows a 0.5 km edge effect where many exploited species would be vulnerable to fishing on the boundary. Green area shows effective area of MPA based on 0.5 km edge effect. Effective area in (B) is 62% of total MPA; effective area in (C) is 76% of total MPA. Total area is 70% bigger in (C) than (B), whereas effective area is 108% bigger in (C) than (B).

(A) Existing Maunganui Bay rahui



(B) Sub-Area A-– Maunganui Bay - Oke Bay



(C) Sub-Area A-– Maunganui Bay - Oke Bay and with the proposed buffer zone included under no-take status.