BEFORE THE ENVIRONMENT COURT
Auckland Registry

ENV 2015 AKL 0000134

IN THE MATTER	of the Resource Management Act 1991
AND	of an appeal under Clause 14 of the First Schedule of the Act
BETWEEN	**TRUSTEES OF MOTITI ROHE MOANA TRUST**
	Appellant
AND	**BAY OF PLENTY REGIONAL COUNCIL**
	Respondent

STATEMENT OF EVIDENCE OF DR ROGER GRACE ON BEHALF OF MOTITI ROHE MOANA TRUST

Dated 25 October 2017

Counsel Acting
RB Enright
Barrister
Level 1, Stanbeth House
28 Customs St East
Britomart
Auckland
e: rob@publiclaw9.com
m: 021 276 5787

Introduction

1. My full name is Roger Vernon Grace. I have the qualifications and expertise stated in **APPENDIX A.** I was self-employed but now retired, and have over 40 years professional experience, mainly in marine ecology of northeast New Zealand.

2. I have read and agree to comply with the Environment Court Expert Witness Code of Conduct. I have complied with the code in preparation of this evidence. I have had opportunity to review draft proposed planning provisions prepared by Graeme Lawrence and the associated maps prepared by Diane Lucas (landscape architect) as relevant background material.

SCOPE OF EVIDENCE

My evidence will discuss aspects of:

a) A site visit to Otaiti (Astrolabe Reef) and Motiti Island on 26th June, 2015.
b) Impacts of Motiti Natural Environment Area on marine ecology,
c) Impacts of many years of fishing in the Bay of Plenty,
d) Effects of the exclusion zone on fish life of Astrolabe Reef,
e) Effects on fish life of lifting the exclusion zone,

f) Effects of waahi Tapu and waahi Taonga on mauri, especially ecological matters and taonga species,
g) Marine Spatial Planning and a network of Marine Protected Areas for the Bay of Plenty,
h) Creation of Motiti Natural Environment Management Area,
i) Lessons from Mimiwhangata (partial protection) and Tawharanui (no-take) MPAs,
j) Likely outcomes of proposed Motiti Natural Environment Area (MNEA),
k) Future biological monitoring of fish, crayfish and habitats in the MNEA,
l) Conditions.

Summary of Evidence

3. I have also been asked to comment on:

(a) Whether a "do nothing" regime, where no restrictions are placed on fishing techniques and methods, including dredging, use of nets, fishing lines, the appropriateness regime to restore, protect and preserve indigenous biological diversity and relationship of tangata whenua with taonga species.

(b) Maintenance of ecological function of key taonga species eg. by restoring and maintaining the full age and size structure of the population is key to the ecological integrity of the environment, such as the life histories of snapper and crayfish, which in turn would keep kina numbers under control to avoid kina barrens and serious loss of biodiversity: and keep sufficient large schools of trevally and kahawai to push krill to the surface to support breeding success of seabirds.

(c) Maintenance of biogenic benthic structure that acts as a nursery habitat for juvenile fish.

(d) Unfortunately the "do nothing" option would simply maintain a continuation of current management regime that has led to the serious loss of ecological, biodiversity and habitat values in the Bay of Plenty. Under this regime we have seen the disappearance of hapuku stocks; the reduction of snapper to only 10% of their pre-fished biomass; a substantial drop in crayfish numbers such that the CPUE is now down to 0.28 kg per pot haul – by far the worst situation in the whole country and there are calls to close the fishery; loss of extensive biogenic structure on the continental shelf which would have been good nursery habitat; expansion of kina barrens at the expense of biodiversity-rich kelp forests on shallow reefs; and loss of the huge schools of pelagic fish like trevally which were a major feature of the Bay of Plenty 50 years ago and probably led to the name of the Bay.

(e) Alternatively to (a), whether a spatial planning regime involving resource management controls on fishing techniques and methods, including dredging, use of nets, fishing lines, is the most appropriate regime to maintain and protect indigenous biological diversity and relationship of tangata whenua with taonga species.

(f) To maintain and protect the ecological values identified in (a) there needs to be tighter controls on fishing techniques (eg. elimination of bottom-impacting methods like dredging, trawling and Danish seining), controlled within a marine spatial planning regime as suggested in (b).

4. I have also addressed my evidence in relation to the following:

(a) The regime should be permanent and incorporated into the long-term regional marine spatial planning framework for the Bay of Plenty in a strategic direction towards achieving national policy statements and regional policy statements.

(b) The relevant ecological indicators that demonstrate ecological health and restoration of marine health are coverage of kelp forests on shallow rocky reefs and the associated elimination of kina barrens; return of large extensive pelagic fish schools; seabird reproductive competency; and marine mega fauna (marine mammals, and sharks) observations throughout the Bay of Plenty; recovery of snapper populations to the current MPI target of 40% of the pre-fished biomass; recovery of crayfish stocks to at least 50% of the pre-fished biomass; return of hapuku to some of our shallow reefs, would compliment fisheries management goals and targets however these probably are only possible in suitable no-take Marine Protection Areas or their equivalent.

(c) At what level of use (or degree of intensity) of fishing techniques and methods will be sustainable once ecological health is restored. Clearly those techniques and degrees of intensity of the activities in the past which have led to the unsatisfactory situation we are now in, are no longer appropriate. Bottom-damaging methods such as dredging, trawling, potting and Danish seining should be eliminated permanently from areas of taonga and significant habitat and biodiversity areas in the marine space. Set-netting on or near rocky reefs is indiscriminate and can easily have unintended impacts on non-targeted species thus should also be eliminated.

(d) Carefully controlled long-lining, spearfishing, hand-lining and rod and reel fishing including trolling may be sustainable long-term provided suitable target and ecological habitat and biodiversity levels are achieved and maintained with measurable and transparent monitoring.

(e) Monitoring regime would be appropriate to achieve ecological health; Monitoring on its own does nothing. It is important to use results from monitoring to feed back into controls and information sharing with appropriate Authorities to help maintain a desired level of ecological function and achieve collective biodiversity and habitat values. To this end monitoring of crayfish and snapper populations will inform monitoring of kina barrens and kelp recovery. Surveys of pelagic fish

schools and monitoring of seabird breeding success will help an understanding of the pelagic environment, and provide information to better manage the impacts of pelagic fishing.

OBSERVATIONS ON VISIT TO O Taiti and Motiti Island

5. On Friday 26 June 2015 I visited Otaiti, also known as Astrolabe Reef.

6. An underwater video camera on a pole was mounted two metres below the hull of our vessel and we could see real-time images of marine life and remaining wreckage on a large TV screen. With good underwater visibility we could see detail down to around 15 metres depth.

7. Natural sub-tidal parts of the reef were predominantly supporting Ecklonia kelp forest, with the brown seaweeds Carpophyllum plumosum and Xiphophora chondrophylla, and several smaller red seaweeds on the shallowest rocks. It was low tide and exposed parts of the reef were covered in dense seaweed difficult to identify from the boat, but likely to be Carpophyllum maschalocarpum.

8. There were only small patches supporting numbers of sea urchins or kina, and no large areas of kina barrens seen.

9. Fish life was reasonably abundant, with 13 species seen in the approximately 45 minute view time with video camera. The fish seen included the following, with relative abundance noted (A = abundant; C = common; O = occasional; 1 = single specimen):

Demoiselle	A
Sweep	C
Blue maomao	C
Oblique-swimming triplefin	C
Spotty	O
Banded wrasse	O
Red moki	O
Marblefish	O
Kelpfish	O
Black angelfish	O
Leatherjacket	O

Porcupinefish	1
Eagleray	1

10. Although no snapper were seen this is not surprising as they tend to be shy of divers and boats unless in a long-established marine reserve.

11. The natural parts of the reef seemed to be in good shape ecologically at the time. Damaged parts of the reef[1] seen were reasonably clear of loose debris and should be on the way towards recovery.

12. We then moved to the northern end of Motiti Island and again deployed the underwater video. Ecklonia kelp forest was more lush than at Astrolabe Reef probably because of the slightly more sheltered nature of the reef at Motiti. Carpophyllum plumosum and particularly C. maschalocarpum seaweeds were prominent in very shallow water. No fish were seen in the approximately 5 minutes of video viewing.

13. The northern Motiti reefs appear more sheltered than Astrolabe Reef. Low fish numbers at Motiti probably relate to higher current fishing pressure at Motiti, whereas the nearly four years of the exclusion zone at Astrolabe is probably fostering an increase in fish life. To some extent the higher degree of wave exposure at Astrolabe would also result in higher fish diversity and abundance.

14. Floats of numerous commercial crayfish pots were present and seen over the inshore reefs near the north of the island.

15. Later in the day we flew to Motiti and briefly observed the shores and adjacent reefs on a circumnavigation of the island. Shallow reefs were dominated by kina barrens, clearly visible from the air in the following photograph as pale rock areas. These are an obvious sign of heavy fishing pressure leading to depleted snapper and crayfish populations which can no longer control kina. Exploding kina populations then eat out the kelp forest leaving bare rock showing pale in the photograph.

[1] In terms of the MV Rena wreck.

16. A visit to Wairanaki Bay on the northwest shore of Motiti revealed numerous plastic pellets from the Rena cargo still littering the beach.

IMPACTS OF FISHING ACTIVITIES

17. Fishing impacts have been ongoing for many years. Astrolabe Reef is an extremely popular fishing spot in the Bay of Plenty, and this has not been without impacts.

18. Despite the application of fisheries management through the Quota Management System (QMS) for commercial fishers, and Recreational Fishing Regulations for recreational and customary fishers, stocks of taonga species such as snapper in the Bay of Plenty have been reduced to a level much lower than that required for sustainability. Snapper stocks in the Bay of Plenty are at around 10% of their pre-fished biomass, on the verge of the trigger-point to officially close the fishery. The target biomass for sustainability is 40% of the pre-fished biomass.

19. Stocks of trevally, crayfish, and hapuku are also extremely low throughout the Bay, and around the country which is leading to recruitment potential being substantially reduced.

20. Recreational fishing has increased dramatically over recent years with the increase in population in the Tauranga area and surrounding areas, and the concurrent rapid increase in the number of boats carrying fishermen to the islands and reefs around Motiti.

21. Technological advances in fishing equipment, fish finders and sounders, GPS and other navigational aids and equipment mean that the fish no longer have anywhere to hide. It is easy now for fishermen to find and repeatedly target submerged reefs and pinnacles, and to effectively clean them out of vulnerable species like hapuku, cray fish and other residential marine life.

22. The widespread occurrence of kina barrens observed around Motiti is a clear indication that fishing pressure is intensė around the island and its reefs, and this is likely to be largely due to the high numbers of small boats regularly coming out to the island to fish, particularly on weekends with suitable weather.

EFFECTS OF THE RENA EXCLUSION ZONE

23. Soon after the Rena ran aground, an exclusion zone was imposed by the Harbour Master for safety and navigation reasons while salvage vessels worked on the Rena and its cargo recovery. An exclusion zone of three nautical miles was initially established, but reduced to two-nautical miles radius around Astrolabe Reef in its latter years.

24. Although intended for safety reasons, the exclusion zone also had the effect of excluding most fishing within the zone, except for a small amount of fishing carried out by salvage crews while on site.

25. The exclusion zone remained in place for approximately four and a half years, and allowed the beginnings of a recovery of fish life from many years of intense fishing pressure.

26. Despite the many impacts of the Rena wreck and release of contaminants and cargo, the overall effect on fish life of the exclusion zone and lack of fishing appears to have been positive.

27. Anecdotal evidence indicates that fishers working from the salvage vessels had good catches of snapper and had no difficulty getting their bag limits of good sized fish.

28. Captain Roger King of TMC Marine Consultants also indicated that he got good catches of crayfish in pots occasionally set from the salvage vessels he was working on.

29. Roger King also related that a hapuku was caught from one of the salvage vessels working on the site, which indicates that hapuku may return to the reef given space to populate and survive potential extraction.

30. Several containers remained on the seafloor within the exclusion zone and a sounder trace over one of these on our site visit showed a cloud of fish over the container. Clearly isolated containers like that will attract fish, and may be allowing terakihi to find refuge in the exclusion zone.

EFFECTS ON FISH LIFE OF LIFTING THE EXCLUSION ZONE

31. With the positive effects of the lack of fishing, a Fisheries Act section 186 application was lodged with MPI by Motiti Rohe Moana Trust seeking to maintain the "no fishing" effect of the exclusion zone. MPI did not approve this application and the exclusion zone was eventually lifted, opening the area to fishing. Predictably fish life which had built up over four and half years was (I understand) largely removed within a few weeks of fishing activity, including intense crayfish potting in the area by a commercial fisherman.

32. Although many surveys and monitoring of contaminants on Taonga species have been carried out, there were no surveys of abundance of fish and crayfish around the ecological state of reef apart from in-situ reports that I am aware of, so any changes in abundance, ecological composition and functions have not been documented, despite recommendation from Dr Debbie Freeman that she would support such monitoring. In her RMA evidence of 3 July 2015 she supported at para 117.2 "Monitoring of the abundance, distribution and size structure of previously harvested species, including species of cultural importance." This means that there is a lack of baseline data relating to the current state of Astrolabe Reef and its future state. This should be addressed as part of future monitoring programmes within the MNEA.

EFFECTS ON MAURI

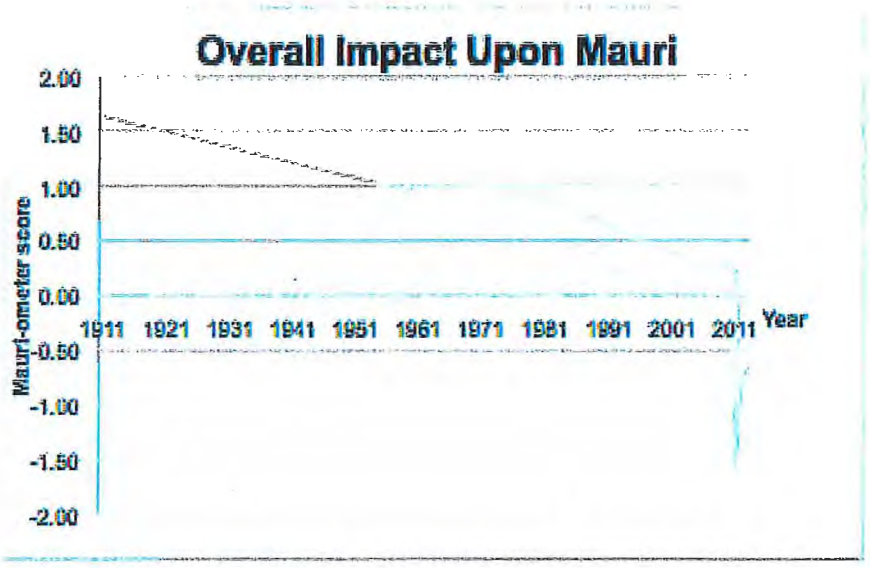
33. The Ministry for the Environment prepared the MV Rena Long-term Environmental Recovery Plan, which was launched on 26 January 2012. The plan has the set goal to "restore the mauri of the affected environment to its pre-Rena state." Mauri is defined as life-supporting capacity in this context.

34. My understanding is that Mauri can be represented by the physical occurrence and the presence of taonga at a given time and place. This supports the intrinsic view point of the ecological inter-connectivity that is present in the marine environment.

35. The Mauri-ometer assessment, devised by Dr Kepa Morgan in 2008, uses four equally weighted mauri dimensions, equating to environmental, cultural, social and economic well-being.

36. Although I am not an expert in this field, I do want to comment within the environmental and ecological dimension of mauri that I am qualified to speak on.

37. As an example the following graph from Dr Morgan's 2014 paper provides an assessment of mauri for Astrolabe Reef beginning in 1911 and continuing to soon after the Rena grounding in 2011.



38. Mauri was in fairly steady decline through most of the 20th century. It was in the latter part of this time that fishery resources in particular were suffering serious decline, and this will be reflected in the decline in mauri score from 1.00 to about 0.25. Over this period the snapper population was reduced to only 10% of its pre-fished biomass, large spectacular schools of trevally once common throughout the Bay virtually disappeared, and the valuable taonga species hapuka was decimated throughout the Bay. Crayfish were also severely depleted. During this time reef health declined as kina barrens developed where once healthy kelp forests thrived.

39. Then there was a sudden and dramatic drop in mauri down to -1.5 when the Rena went aground and spilled its contents throughout the Bay, followed by a moderate bounce-back after initial clean-up efforts.

40. The stated goal of the Environmental Recovery Plan, to "restore the mauri of the affected environment to its pre-Rena state", may be difficult to achieve while any of the wreckage remains on the site. Considerable progress could be made, however, if the main taonga species could be encouraged to recover. These are hapuka, snapper and crayfish. As indicated earlier these species were showing signs of recovery at Astrolabe due to the fishing-ban effect of the exclusion zone.

41. With mauri beginning a slow recovery partly due to recovering taonga species, it was a great pity that the reef was opened to fishing again and the gains to biodiversity and mauri during the exclusion period were squandered in a few weeks of intensive fishing. Tangaroa is working hard to repair the damage caused by the wreck. We could have acknowledged this work best by building on the recovery, not tearing it down by opening the area to fishing. This was a lost opportunity to maximize mauri recovery.

42. Lifting the exclusion zone without some other means to continue protection of the reef from fishing, inevitably squandered the biodiversity and habitat gains in fish stocks and mauri that had been made during the four years with the exclusion zone in place.

BUILD ON THE RECOVERY

43. It made better long-term sense to build on the recovery that was taking place and carry over some form of fishing ban within the established exclusion zone. In the last three to four years fishermen had found alternative sites to fish so they did not need to fish waahi tapu areas.

44. The most difficult time for fishermen to accept a no-fishing zone, be it a marine reserve, MPA, rahui, or recognizing the tapu and protection, for the first few years when all they see is that they are banned from fishing in an area. It takes several years for the benefits of protection to become obvious. Experience from marine reserves in other areas suggests that, for example,

not only do fish numbers and sizes build up in the protected zone, but the numbers of fish that move beyond protected areas increases, creating greater opportunities for catch. This is called "spill over".

MARINE SPATIAL PLANNING

45. The MNEA integration of waahi tapu and waahi taonga will see the long term environmental degradation and biodiversity loss decrease over time (Hauraki Gulf Forum 2011, 2014). Spatial conflict such as that in the Hauraki Gulf has prompted a Marine Spatial Planning process in the Hauraki Gulf Marine Park. There is a similar need for Marine Spatial Planning in the Bay of Plenty, which could address the many spatial conflicts, fishery resource depletions and other impacts becoming increasingly obvious in the Bay. There is a need to establish an ecological solution through the expression of indigenous biodiversity and cultural values.

46. As part of the Marine Spatial Planning process, a comprehensive and representative network of Marine Protected Areas (or their equivalent) should be considered which is underpinned by Māori values of waahi tapu and taonga.

47. I understand that there is no provision for waahi tapu or waahi taonga in the Fisheries Act as these spaces don't relate to the act of fishing. But the significance of the space to the relationship they provide for the community could be substantial. Graeme Lawrence addresses this further in his evidence. My evidence outlines the bio-physical benefits of a marine protected area through biodiversity and cultural values framework as defined in Nepia Ranapia and Umuhuri Matehaere's evidence..

NETWORK OF MPAs FOR BAY OF PLENTY

48. The Government's MPA process (DOC & Ministry of Fisheries 2005) should be implemented in the Bay of Plenty as soon as possible. The national goal in the Biodiversity Strategy 2000 (DOC 2000) is for 10% of the territorial sea to be in MPAs effective for protection of biodiversity. This policy should apply regionally as well as nationally and integrate these cultural value areas with rules that reflect the importance to community. I understand that the RMA

provides an alternative means to achieve protection of indigenous biodiversity and Māori cultural values, but this a legal and planning issue.

49. The basic principles of MPA network design have evolved and been discussed in several papers, reports and presentations (eg. Ballantine 2014, Thomas & Shears 2013, Grace 2014). The five main principles for successful network design for Type 1 MPAs (no-take marine reserves) are:

    a) **REPRESENTATION**. All marine habitats in the area should be represented in the network.

    b) **REPLICATION**. There should be more than one example of each habitat represented in the network to safeguard against accidental compromise and loss of a habitat type.

    c) **NETWORK DESIGN**. The network should be designed with connectivity in mind, so that marine life has a chance to use the protected areas as "stepping stones" from one sanctuary to the next.

    d) **PERMANENT**. The MPAs should be permanent. They increase in biodiversity value as time progresses and should be allowed to continue this process toward maximum value.

    e) **SUFFICIENT QUANTITY**. There should be enough MPAs and of sufficient size for the network to be self-sustainable and viable. A loose goal of 10% for the Bay of Plenty is compatible with the goal in the Biodiversity Strategy 2000 (DOC 2000) but is minimal in terms of modern international goals (20 to 40%, Thomas & Shears 2013).

50. At present there are only two marine reserves in the Bay of Plenty (Tuhua/Mayor Island and Te Paepae o Aotea/Volkner Rocks), totalling approximately 0.1% of the Territorial Sea of the Bay. This is nowhere near the national goal of 10%. The MNEA would significantly increase the protection areas in the Bay of Plenty to reflect the national policy statement in addition to the marine reserves of the Bay of Plenty, and be part of the beginnings of a network for the Bay.

SIZE OF LOCAL PACKAGE OF Marine Protection Areas

51. The suggested size of the waahi tapu at Astrolabe Reef is a three nautical mile radius. Research at Leigh and other marine reserves suggests that some of our existing marine reserves are too small to be effective at restoring natural populations. Snapper for example need at least 40 square kilometres of total protection to get back to a natural population structure.

52. The 3nm radius at Astrolabe and other parts of the MPA package will also help the satisfactory recovery of trevally schools and other pelagics around the reefs and islands, fostering a return to fish populations expected in the "Bay of Plenty".

53. The Waahi tapu of other sites has been related to 1Nm as this is a minimum representive support of a marine habitat however the larger the space the more effective the protection of life and mauri would be.

IMPACTS OF Motiti Natural Environment Area

54. The Motiti Natural Environment Area and Rules associated with them being that of Waahi Tapu and Waahi Taonga would have significant positive impact in the marine environment from an ecological perspective.

Waahi Tapu

The Motiti Hapu Management Plan identified waahi tapu within Motiti Rohe Moana. Several but not all of these have been listed in the schedule for ASCV -25 but their area and buffers required to protect their intrinsic and cultural values and attributes are now mapped.

The restoration protection and enhancement of natural and cultural heritage, through management of any activities that would damage destroy or remove indigenous flora or fauna, or harm the mauri, tapu or mana of the area, has the potential, to generate significant benefits over time for biodiversity in the Bay of Plenty.

Waahi Taonga

Waahi taonga areas are identified and described in the Motiti Hapu Management Plan and several but not all the sites values and attributes are referred to in the schedule for ASCV 25. The areas subject to these sites and areas are now mapped to show their spatial extent within the Motiti Natural Environment Area identified as having High or Outstanding Natural Character in the RPS.

The impact of waahi tapu on the biological and ecological environment would support restoration of the marine space. It would provide for the exclusion of marine activities that remove or disturb the natural state of the habitat. This would have a positive effect on the biodiversity and habitat.

55. The impact of Waahi Taonga with protection levels that are not as comprehensive as that which is in a waahi tapu, will provide the restorative means to re-establishing taonga species within the MNEA.

FULL OR PARTIAL PROTECTION

56. Although there appear to be valid cultural reasons for full protection in waahi tapu areas, I can really only comment on ecological values and not cultural grounds.

57. The main potential future ecological benefits to shallow and medium depth reef life through waahi tapu management would provide for resilience to storm events and climate change, and any other physical marine processes such as sedimentation and erosion.

58. Stable reef systems may support existing marine life which become havens for both attached and mobile organisms. There is no reason why deeper reef systems would not benefit from these protections as well. If protected from fishing, these deep reefs would become covered in marine growths such as sponge and encrusting gardens and become a habitat for fish such as hapuku and golden snapper to name a couple.

EXAMPLES OF MIMIWHANGATA (PART PROTECTION) AND TAWHARANUI (NO-TAKE)

59. The Application of waahi taonga is partly protected and gives recognition to the importance of a space that supports taonga. It is my understanding that it may be applied in a similar way to a partial protection area such as Mimiwhangata however with a restorative threshold for fishing and extractive activities.

60. Two examples of outcomes from different degrees of protection are very helpful to inform the types of protection sought within the MPA package proposed for MNEA. These are the partly protected marine park at Mimiwhangata in Northland, and the fully protected marine reserve at Tawharanui north of Auckland.

61. I have personally carried out long-term monitoring of crayfish, fish, and habitats (kelp forest/kina barrens) using consistent methods since the mid 1970's. These are some of the longest data sets of this type in NZ.

62. Mimiwhangata was designated a marine park in 1984, in which there were some additional controls on recreational fishing (single hooks, no sinkers, no nets, one craypot) and a planned phase-out of commercial fishing which was finally banned in 1994. In the 23 years since then, Mimiwhangata has had no commercial fishing, but recreational fishing has continued.

63. In contrast Tawharanui was fully protected from fishing in 1981 so has had no fishing for 36 years.

64. Both areas had substantial areas of kina barrens on their shallow reefs in the early days of monitoring which started in the mid 1970's. Kina barrens are a clear indicator of very low populations of snapper and crayfish. The following photo illustrates a typical kina barren, in which kelp forest has gone because of the intense grazing effect of sea urchins. This is a serious loss of biodiversity on our shallow reefs brought about by not leaving sufficient snapper and crayfish in the sea to carry out their normal ecological function of eating kina and keeping their population under control.

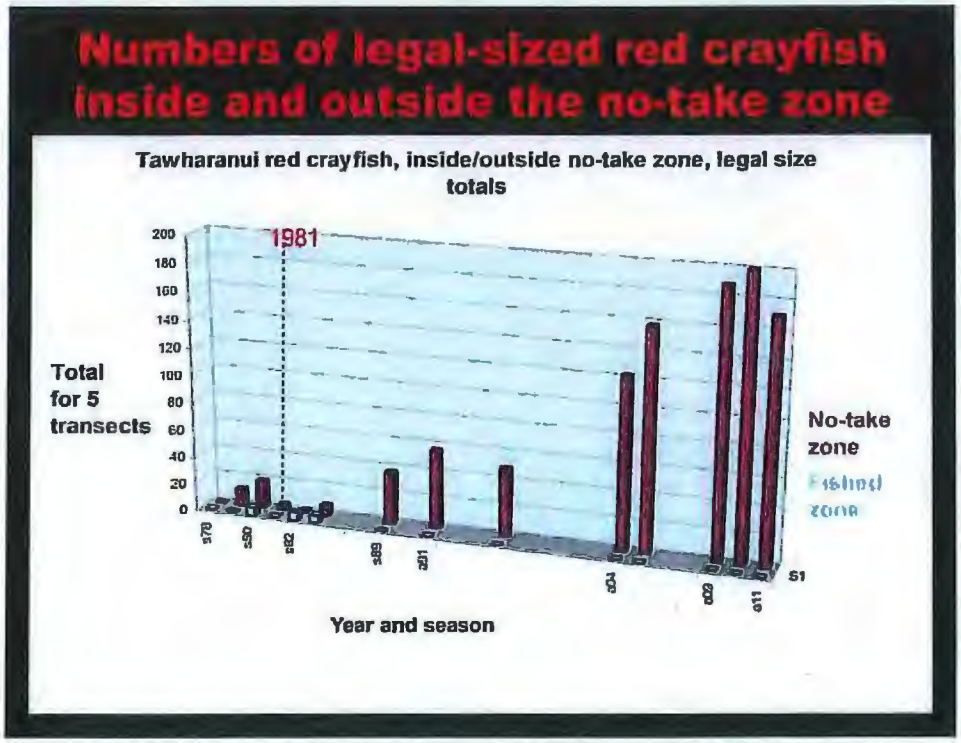
65. Despite no commercial fishing at Mimiwhangata, kina barrens continued to expand and are now very extensive. There is virtually no difference between the fish and crayfish populations, and the degraded reef habitats, inside the marine park and the generally fished coastline to the north and south.

66. The aerial photo below shows a large part of the Mimiwhangata Marine Park. The pale reef areas in the photo are extensive kina barrens representing seriously degraded shallow reef ecology and loss of kelp forest.

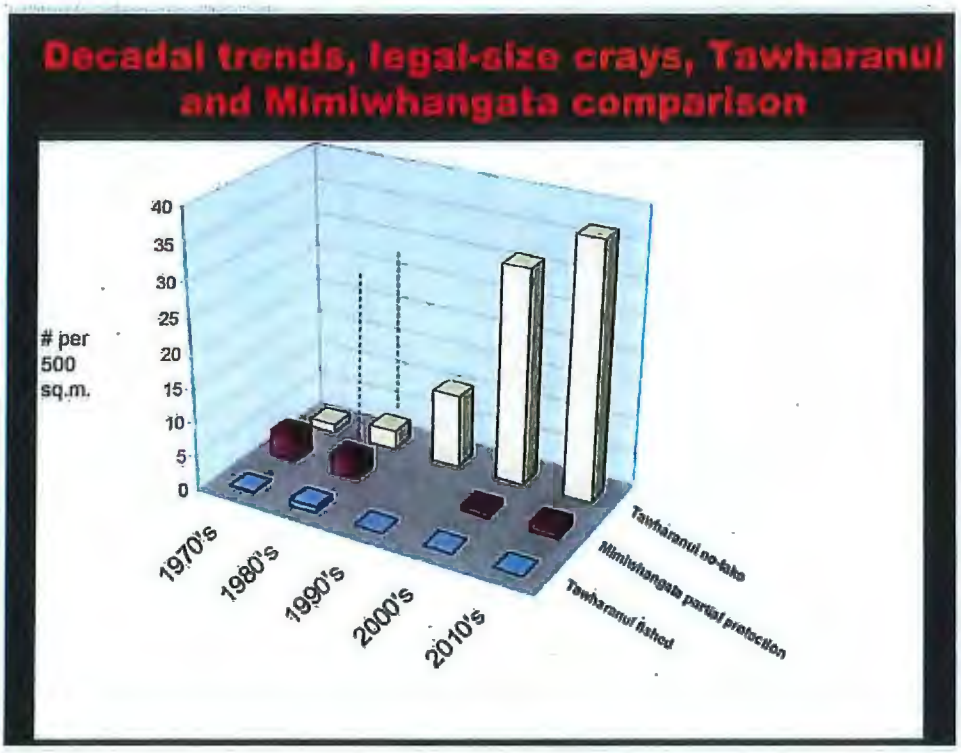
67. Simply removing commercial fishing from Mimiwhangata has been ineffective at restoring snapper and crayfish populations and kelp forests. There is still too much recreational fishing going on to allow restoration.

68. In contrast, at Tawharanui with no fishing, snapper and crayfish populations have increased dramatically and the kina barrens have gone, the shallow reefs now being dominated by healthy kelp forest as shown in the following aerial photograph in which the dark coloured reef indicates kelp.

69. The following graph shows the increase in crayfish at Tawharanui inside the protected area, to a peak of 800 legal sized crayfish per hectare in 2010, while outside in the fished area crayfish virtually disappeared and have remained at a very low level.



70. A comparison of changes in the crayfish population at Mimiwhangata, Tawharanui, and the fished areas outside Tawharanui gives a clear indication of the relative success of restoration under three different scenarios: open fishing; partial protection (no commercial); and total protection. The following graph shows a decadal-scale comparison of the crayfish population at Mimiwhangata, Tawharanui, and fished areas outside Tawharanui.



71. These long term studies at Mimiwhangata and Tawharanui emphasise the need for total protection at Astrolabe in order to foster a recovery of taonga species such as hapuka, snapper and crayfish.

72. These studies also emphasise the need for better management at Motiti where urchin barrens are extensive. The proposed waahi taonga must rely on better management tools available that may be available under the RMA than simply banning commercial fishing if it is to lead to shallow reef habitat recovery and substantial increase in stocks of crayfish and snapper.

LIKELY OUTCOME For the MNEA

73. With total protection in a 3nm-radius marine reserve at Astrolabe we are likely to see the following changes over time:

74. Recovery of snapper to full natural population structure and abundance, with many large breeding fish in the population.

75. Recovery of crayfish populations to a peak of around 800 legal-sized crayfish per hectare of reef, including many large breeding individuals.

76. Development of substantial schools of trevally and other pelagic fish, probably supporting flocks of feeding birds and a return of a small part of the Bay of Plenty to its former spectacular glory.

77. Restoration of breeding stocks in a small part of the Bay, which will likely provide eggs and larvae to other depleted parts of the Bay.

78. Replenishment of fish stocks at Astrolabe will result in some spillover of adult fish into surrounding areas and into the wider Motiti Natural Environment Area.

79. There is a reasonable likelihood that hapuku will gradually return to the deep parts of the Astrolabe marine reserve, and probably occupy any remaining parts of the wreck of the Rena.

80. Mauri of the Astrolabe reef area (in terms of indigenous biodiversity) will gradually improve as fish, crayfish and other taonga species recover from the impacts of fishing and the impacts of the wreck of the Rena.

81. Changes within the waahi taonga are dependent on the details of management of the triggers for activities. As indicated above, simply banning commercial fishing is not likely to result in the desired degree of recovery from many years of too much fishing. A more targeted reduction in fishing effort will be required before substantial improvement will be seen. With the right management leading to habitat and stock recovery, the eventual productivity of the waahi taonga marine space could be much higher than it is currently.

MONITORING, BUV (BAITED UNDERWATER VIDEO) SURVEY, UVC (UNDERWATER VISUAL COUNTS – DIVER TRANSECT SURVEY), AERIAL PHOTOGRAPHY

82. The success of the Motiti Natural Environment Management Area will depend to a large degree on the amount and quality of on-going monitoring and feedback from that monitoring into management decisions. This is

particularly important in the waahi taonga where information can be fed back into fisheries management.

83. One of the simplest ways to monitor fish populations, particularly snapper and other predatory fish, is the use of baited underwater video. This is a tried and true monitoring technique and is relatively easy to carry out, providing good comparative results. It could also be adapted to monitor any return of hapuku and other taonga species to deep parts of the reef including any remains of the Rena.

84. The best way to monitor crayfish recovery is using underwater visual counts carried out by divers on permanent fixed underwater transects. In this way, direct counts over time on exactly the same sections of reef can show clear increases in numbers and sizes of crayfish.

85. Habitat recovery, such as the disappearance of kina barrens and their replacement with bio-diverse kelp forests, is most easily carried out by regular aerial photography. This is further discussed in the report "Estimated extent of urchin barrens on the east coast of Northland, New Zealand". Kerr and Grace Oct 2017, for Motiti Rohe Moana Trust, (annexure B to the evidence of Vincent Carlye Kerr).

86. I have had an opportunity to review proposed evidence of Vince Kerr and I confirm I agree with paragraph 50 in relation to kina count monitoring threshold methodology and that triggers may be appropriate when consecutive results are achieved in two successive monitoring events.

CONDITIONS

87. The Application of the proposed MNEA needs to be approved in order to safe guard the biodiversity and habitat values of the marine environment.

88. The proposed rules framework for the Waahi tapu and waahi taonga areas are likely to have significant positive ecological effects in the medium to long term on the marine environment. Short term benefits will also accrue for remnant populations of taonga species.

89. There must be provision for secure and long term funding for establishment of the MNEMA package and ongoing monitoring to foster the successful management of the area. This will measure the recovery of marine life and mauri to the reef ecology, and associated megafauna and bird life which supports the intrinsic value of the marine environment.

90. I recommend support of the proposed MNEMA rules framework for the reasons stated above.

Dated this 25th day of October 2017

Dr Roger Grace

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ANNEXURE A.

QUALIFICATIONS AND EXPERIENCE

1. My name is Roger Vernon Grace.

2. I have a B.Sc., M.Sc. (Hons.), and Ph.D in Zoology (marine biology) from the University of Auckland (1972), and have carried out marine ecological studies for over 40 years.

3. For a few years in the late 1970's I was employed part time by a biological consulting firm in Auckland, gaining wide experience in field work, lab processing and reporting on studies in estuarine and coastal environments. Since then I have been a self-employed consultant with clients in Government Departments, local authorities, and the private sector, and various NGO's involved in environmental matters, in New Zealand and overseas. I was awarded a Queen's Service Medal (QSM) for public service in 2005. In 2016 I was awarded the Forest and Bird Old Blue award for many years of conservation effort in the marine environment around New Zealand.

4. My specialist fields include intertidal and sub-tidal benthic ecology, long-term monitoring of marine life in coastal and shallow benthic areas, including marine protected areas with various levels of protection, and effects of dredging and dredge spoil disposal and offshore sand extraction. My main experience has been gained in northern New Zealand.

5. In the mid 1960's as a student I spent two separate summer weeks camping at Mayor Island, snorkelling and diving amongst what was then abundant and rich fish life. Huge schools of trevally, kahawai and kingfish were abundant, scattered through the sea stretching from the Tauranga coast to Mayor Island, in what was truly the "Bay of Plenty". Sadly that abundance is now just a memory.

6. I have many years diving experience around offshore islands in Northland and the Bay of Plenty, and have good knowledge of shallow and deeper reef ecosystems in the Northeastern Bioregion from North Cape to East Cape.

7. As part of the Offshore Islands Research Group, derived from the Auckland University Field Club, I have camped on, and researched marine life at many offshore island groups

in Northland, the Hauraki Gulf and several in the Bay of Plenty. Our interdisciplinary studies were published over many years in *Tane,* the official journal of the Auckland University Field Club. These studies now form a valuable scientific reference series for the natural history of many of our offshore islands.

8. In 1994 I was contracted for a short time by Bay of Plenty Regional Council to describe and assess sediment-bottom habitats within the limits of the Territorial Sea as part of their background information for various planning and statutory documents in the CMA.

9. From 1990 to 2007 I participated in many oceanic ship-based expeditions investigating fisheries, marine pollution, marine protection, Antarctic ecosystems, coral reefs, global warming and other issues in the Pacific and Indian Oceans, Southern Ocean, Scottish waters, Tasman Sea and the Mediterranean Sea.

10. In the 1990's I appeared as an expert witness in two hearings regarding the then proposed marina at Whangamata, presenting evidence on ecological and natural character matters, for Government and iwi clients.

11. For over twenty-five years I have carried out biological investigations into harbour ecology and the ecological effects of dredging the harbour channels in the Port of Tauranga, as well as the impacts of dredge spoil disposal offshore.

12. My first scientific investigations at Tauranga were in 1988 when I carried out informal sampling using a small biological dredge offshore from the Mount Beach and in the vicinity of the disposal grounds. This information was used to help plan the environmental assessment programme for the Port of Tauranga capital dredging works of 1992.

13. As a marine ecology consultant to Port of Tauranga Ltd. I have been involved in the planning and execution of biological programmes associated with channel deepening and widening, dredge spoil disposal and monitoring, dive surveys and sample processing, detailed photographic monitoring of subtidal rocky reef sites on the islands off the Mount, student research projects, boulder reef construction, assessment of life on wharf structures, impacts of dredging on pipi populations, impacts of log storage

runoff on shellfish beds, appearing as an expert witness at Council and Environment Court hearings, and most recently discussions with iwi representatives on the Kaimoana Restoration Programme sponsored by PTL.

14. Early in 2014 I was approached by the Motiti Rohe Moana Trust to act on their behalf as an expert witness on marine biological matters in relation to the Rena application. The Trust is no longer involved in that application process.

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