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

REBUTTAL EVIDENCE OF NICHOLAS SHEARS FOR BAY OF ISLANDS MARITIME PARK INC AND ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INC (MARINE ECOLOGY)

TOPIC 14 – MARINE PROTECTED AREAS

22 JUNE 2021

Royal Forest and Bird Protection Society of NZ Inc
Solicitor acting: PD Anderson
PO Box 2516
Christchurch 8140
p.anderson@forestandbird.org.nz

Bay of Islands Maritime Park / Ngāti Kuta ki te Rāwhiti
Counsel: Sally Gepp
Level 1, 189 Hardy Street
Nelson 7010
sally@sallygepp.co.nz

MAY IT PLEASE THE COURT

1. My name is Nicholas Tony Shears.

2. My qualifications and experience are set out in my primary statement of evidence dated 19 March 2021. I confirm that in preparing this evidence I have complied with the Expert Witness Code of Conduct.

3. This statement of rebuttal evidence responds to the Joint Witness Statement (JWS) Fisheries and the evidence of:

    a. Simon West
    b. Jonathan Holdsworth
    c. Thomas Clark
    d. Kim Drummond

Executive Summary

4. The marine environment and associated biodiversity is subject to a number of human-induced stressors and the future impacts of climate change are uncertain. While other factors may influence marine biodiversity, it is agreed by all parties that fishing has a major impact on biodiversity in the area. The proposed control measures have been designed to effectively mitigate and reverse the impacts of fishing within the boundaries of the proposed areas.

5. My rebuttal evidence focusses on the following topics:
    a. Link between kina barrens and fishing of predators
    b. Size of rāhui tapu areas (Area A's)
    c. Displacement of fishing effort
    d. Ecosystem-based fisheries management ("EBFM") under the Fisheries Act

6. There is no credible argument presented to suggest the occurrence of kina barrens does not result from overfishing and the ecology witnesses agreed that fishing and subsequent loss of predators is the causal factor – this is supported by all the available scientific evidence.

7. Based on understanding of no-take marine reserves in north-eastern New Zealand, I consider the size of the two proposed rāhui tapu areas to be large enough to effectively protect predators and associated biodiversity.

8. Concerns raised about the effects of displacement of fishing effort from the proposed areas are speculative and raised from a fishery not biodiversity perspective.

9. Current management under the Fisheries Act is not using an ecosystem-based approach in terms of the mitigating the ecosystem effects of fishing on reef ecosystems. Marine protected areas (MPAs), such as those proposed here, can and should contribute to an ecosystem-based approach to fisheries management.

Rebuttal evidence

Link between kina barrens and fishing of predators

10. In Paragraph 8 of the JWS Fisheries, the fisheries experts respond to a number of points in the JWS Ecology on the link between kina barrens and overfishing of kina predators (Paragraph 22). They agree that "fishing can be a contributing factor to the formation of kina barrens (8(b))" but the "[fisheries] experts consider that the causes of kina barrens are complex and not fully understood" (8(c)). They also suggest "that while kina barrens may have increased in recent times, this has been at the same time as an increase in the biomass of snapper in east northland and of rock lobsters in the relevant fisheries reporting area from the Bay of Islands to Mimiwhangata" (8(e)) and "that some of the points raised in paragraph 22 of the JWS Ecology do not reflect management observations by the fisheries experts" (8(f)).

11. Whether there is a link between removal of predators from the ecosystem and the occurrence of kina barrens is an ecological question and there has been substantial research into this (reviewed in my primary evidence). None of the fisheries experts have undertaken ecological research on rocky reefs and many of the statements and "arguments" in the evidence referred to highlight a lack of understanding of the ecological dynamics of marine ecosystems in general.

12. The statement that "the causes of kina barrens are complex and not fully understood" could apply to any aspect of ecology and marine ecosystems – these systems are inherently complex and not fully understood. However, to the extent that this statement implies doubt on the link between overfishing of predators and the presence of kina barrens, I disagree. The available scientific evidence is reviewed in MPI's "Aquatic environment and biodiversity annual review (AEBAR) – 2019/20 – Chapter 13"[1]. This report concludes that predators play a role in the dynamics of shallow reefs in northern New Zealand. The role of predators in controlling kina numbers is well understood and has been clearly demonstrated in marine protected areas where predator populations are able to recover (as outlined in my evidence). There is no evidence to suggest kina barrens in Northland have formed in response to factors other than fishing.

13. The statement that a recent increase in kina barrens coincides with an increase in snapper and lobster biomass (8(e)) is presented as anecdotal evidence that predator populations and kina barrens are not linked. However, this suggestion indicates a complete lack of understanding of temperate rocky reef ecosystems and basic ecological processes. For example:

    a. ***An increase in biomass of a fish stock does not represent an effective recovery in a predator population.*** The supposed increase in predators (snapper and crayfish) refers to relatively small

[1] https://www.mpi.govt.nz/dmsdocument/42144-13-Trophic-Effects

increases in estimated stock biomass from fisheries data (i.e., CPUE). It is very unlikely that a small increase in estimated stock biomass at a fishery scale would translate to a meaningful increase in the numbers of predators on shallow reefs such that they would have an impact on kina populations. Available evidence from the latest stock assessments, and surveys inside and outside marine protected areas ("MPAs"), demonstrate that predator densities are low and populations are dominated by small individuals (see my primary evidence). I agree that rebuilding and increasing stocks are essential to produce healthy ecosystems, but to restore food web interactions and kelp forests, protection of the full size-range of predators in MPAs is also needed because of the strong size-dependent nature of the interactions between predators and kina.

b. ***Importance of predator size.*** As seen in MPAs, a reduction in kina barrens requires recovery of large predators (large snapper and crayfish are the major predators of kina) (my primary evidence). Mr Holdsworth's evidence (Section 8) explains how fishing has effectively eliminated the large old individuals from populations of these long-lived predatory species and that the populations are now dominated by young and small individuals. Mr Holdsworth does however recognise "the intrinsic value of large snapper in the ecosystem and breeding population" (Paragraph 8.5). No-take MPAs have widely been shown to allow recovery of these large individuals.

c. ***Time lags between changes in predator populations and kina barrens.*** Due to ecological feedbacks that maintain kina barrens, the recovery of predators does not result in an immediate or concurrent decline in kina barrens (or increase in kelp forests). Kelp forest recovery can take decades following the recovery of predators (Babcock et al 2010, Shears and Babcock 2003).

14. The statement "that some of the points raised in paragraph 22 of the JWS Ecology do not reflect management observations by the fisheries experts" (8(f)) is not explained. However, management observations are based on fisheries statistics (derived from catch data from target species) and this does not provide insights into wider changes in ecosystem dynamics and how they may be influenced by fishing (as outlined in Paragraph 12 above).

15. In summary, the JWS Fisheries [and other evidence] agree that "fishing can be a contributing factor to the formation of kina barrens". While the JWS Fisheries infers other factors are also important, no evidence is provided to suggest kina barrens in Northland have formed in response to factors other than fishing, and in my opinion, overfishing is the primary cause of this ecological change.

16. Mr West's evidence (Paragraphs 53-59) portrays the predator-kina-kelp interaction or "trophic cascade" as an overly simplified hypothesis that does not consider other factors relevant to kina barrens. Mr West questions the strength

of evidence from the Leigh Marine Reserve and points out that these trophic cascade effects are not evident in all marine reserves. Mr West suggests there is no discussion of actual trends in lobster or snapper abundance and all briefs have assumed that both species are overfished. Most of these points were discussed in conferencing and there was agreement on the role of predators in controlling kina populations in the JWS Ecology. However, I will make the following points in relation to some of Mr West's points.

17. Mr West refers to a review paper by Schiel (2013) to support the following statement in his evidence:

    "There are other contributing factors such as disease, climate change, interannual variations in recruitment and mortality, which modify this ecosystem relationship [predator-urchin-kelp], either by increasing the creation of "kina barrens" or preventing their creation".

18. The factors listed by Mr West can influence the relationship between predators, kina and kelp, and therefore where the trophic cascade model applies, and kina barrens can occur. However, these factors do not detract from the importance of predators in controlling kina populations. Furthermore, Schiel (2013) specifically states that the trophic cascade model applies in north-eastern New Zealand, provides no alternate explanation for the cause of kina barrens, and does not question the robustness of the science upon which these conclusions are based.

19. Mr West and Mr Clark's evidence (Paragraph 113) both state that the tropic cascade phenomenon has not occurred in all reserves, and other factors (in addition to predators) affect the abundance of urchins and the prevalence of kelp forests. These statements refer to Shears et al (2008), which show that the ecosystem effects of fishing on rocky reefs, as indicated by kina barrens, are context dependent and vary with factors such as depth, wave exposure and turbidity. Kina have a preferred set of environmental conditions and in the absence of predators they can proliferate and form barrens within these areas. As a result, not all reefs are prone to becoming kina barrens (e.g., they have a preferred depth range that varies with wave exposure). This is captured in the JWS Ecology statement 22(i) and is recognised in the evidence presented by Shears, Kerr and Froude in terms of the discussion of the amount (i.e., % of reef) of kina barrens in the different areas.

20. Mr West refers to a study from the Canary Islands (Hernandez et al. 2020) to support the idea "that increases in sea surface temperature can benefit the expansion of sea-urchin/kina barrens and decline of macroalgae beds" and therefore that other factors (specifically temperature) can be responsible for the creation of kina barrens. While this study shows higher urchin settlement in warm years the authors specifically state that this is in the "absence of predatory control" (i.e., insufficient large predator fish) and that "conservation policies need to focus on protecting healthy macroalgal bed habitats and the predatory fishes within them. … Such management actions could improve ecosystem functioning by maintaining equilibrium between sea urchins and macroalgae and

could even mitigate the effects of seawater warming that will otherwise give sea urchins the upper hand." Therefore, this study is highlighting the importance of protecting predator populations in a changing environment. I agree with the authors' view that considering rising temperatures associated with climate change it becomes even more important to address other stressors, in particular by protecting large predator fish.

Size of rāhui tapu areas (Area A's)

21. Mr Holdsworth (11.17) suggests that the no-take MPAs (Area A's) are too small to effectively protect predators to levels that will greatly reduce kina barrens, without stock wide increases in abundance kina. He refers to a recent paper (LaScala et al 2021) that demonstrates that crayfish populations have declined in three small north-eastern New Zealand marine reserves to support this.

22. As the senior author on the LaScala et al. 2021 paper I will make the following points:

    a. The main message in this paper is that the offshore boundaries of the MPAs assessed in the paper are not far enough offshore to encompass seasonal movements of crayfish out onto the sand. As a result, many individuals are seasonally vulnerable to fishing on the offshore boundary and are in fact being fished (hence the declines). The paper's authors are therefore suggesting that the boundaries be extended further offshore to protect these individuals. If MPAs are larger and well-designed then the exploited species within them are effectively protected and will not reflect what is happening in the wider fishery. This has been recognised in the recent Government proposal for Revitalising the Hauraki Gulf that includes plans to extend the offshore boundary of two of these MPAs (Leigh and Hahei)[2].

    b. Despite the observed declines in abundance in the reserves, the size and abundance of crayfish in all three reserve are considerably higher than on the surrounding fished coast.

    c. The suggestion that low crayfish densities at the fished sites adjacent to the reserves is due to the displacement of fishing effort from the reserves is completely unfounded. The fished sites in the study are not located immediately adjacent to reserves and are up to 8km away. There is no evidence of displacement effects. The densities at fished sites are very low (<1 legal size individual per 500 m^2), which is typical of fished reefs in the region.

23. My primary evidence provides an edge effect analysis and extensive explanation of the likely effectiveness of the two proposed no-take areas based on understanding of no-take marine reserves in northern New Zealand. In short:

[2] https://www.doc.govt.nz/globalassets/documents/our-work/sea-change/revitalising-the-gulf.pdf

a. The proposed Mimiwhangata Rāhui Tapu area is large and well-designed and will be highly effective at protecting important predator species and associated biodiversity.

b. The proposed Whaunganui-Oke Bay Rahui Tapu is 6 km^2 and the offshore boundary ranges from ~0.5-2 km. The size is similar to the Leigh and Tāwharanui Reserves, which have been shown to be effective in protecting predator populations and restoring kelp forests (reversing kina barrens) despite recent declines in crayfish. An important difference is the reefs in the proposed area drop quickly onto sand and into deep water, and as a result the offshore movement of crayfish beyond the reefs may be reduced (See my primary evidence at paragraph 53 for more detail). Obviously the larger the area protected, the greater the benefit in maintaining and restoring biodiversity. But given the steep topography of the reef, and length and complexity of the coast in the proposed area, I believe it will be of sufficient size to afford protection to reef predators and associated biodiversity.

Displacement of fishing effort

24. Concerns are raised in the JWS Fishing and in various evidence (Torkington, Holdwsworth) that the proposed MPAs will displace and therefore increase fishing effort in areas surrounding the proposed MPAs.

25. These concerns are speculative and raised from a fishery not biodiversity perspective. No evidence is presented to suggest if or how these displacement effects would impact on key species or biodiversity in the surrounding areas, yet clear evidence is presented demonstrating the benefits of protection on key species and biodiversity within the proposed areas.

26. In the case of the proposed no-take areas (Area A's), the overall area to be protected is only a small fraction of the overall area. In the case of snapper and crayfish populations the stocks are already seriously depleted throughout the region (JWS Ecology) and considered functionally extinct (i.e. not playing a role in the ecosystem). As a result, *if* further decline in these species were to occur through displacement this would not yield any further impact on biodiversity beyond the impact already occurring currently.

Ecosystem-based fisheries management ("EBFM") under the Fisheries Act

27. Paragraph 6 of the JWS Fishing outlines how EBFM can be implemented under the Fisheries Act and provides a few measures in place such as benthic protection areas. It specifically refers to Mr Drummond's evidence (paragraphs 119-122) where he expands on this in relation to fishing of predators leading to loss of kelp forests due to kina. He argues the evidence for this trophic cascade

with some anecdotes, and then suggests that if the problem was found to be due to an absence of large snapper (and/or large rock lobster) the case could be addressed under the framework of the Fisheries Act by protecting large fish (i.e., by returning large fish when caught).

28. It is important to reiterate that there is clear evidence for a role of predators in controlling kina numbers and this is recognised in MPI documents[3] yet to date this "problem" has not been addressed under the Fisheries Act. Instead, the two main predators of kina in northern NZ (snapper and crayfish) are managed as single (individual) species and at low levels, and the ecosystem-effects of fishing these species to those levels are not considered.

29. The effectiveness of returning large fish when caught (i.e., having a minimum and maximum size limit) in terms of rebuilding a predator population and controlling kina numbers is unknown and would require consideration of post-release mortality among other factors. In contrast, we know that no-take MPAs are effective at restoring predator populations and associated biodiversity within their boundaries.

30. Other witnesses (Torkington, Holdsworth) have also promoted a move towards ecosystem-based fisheries management and suggested that while MPAs can have local-scale value to biodiversity, much wider measures are needed to rebuild fished populations and "return to a more natural balance on a much broader scale".

31. I agree wider measures are needed and an ecosystem-based approach to managing the marine environment, not just fisheries, is needed. However, we do not know if this can be achieved at larger scales through rebuilding fish populations or other measures implemented through the Fisheries Act. For example, it is unknown what target level a predator stock would need to be at to restore predatory interactions and control kina populations generally. Given the prevalence of kina and difficulty reversing tipping points I suggest stocks would need to be rebuilt to very high levels.

32. We know from no-take MPAs that we can restore predator populations and biodiversity within their boundaries, and that globally MPAs are considered a major part of ecosystem-based management, beyond just fisheries.

Nicholas Shears

22 June 2021

[3] https://www.mpi.govt.nz/dmsdocument/42144-13-Trophic-Effects