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 VICTORIA ANN FROUDE FOR BAY OF ISLANDS MARITIME PARK INC AND ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INC (NATURAL CHARACTER AND ECOLOGY)

TOPIC 14 – MARINE PROTECTED AREAS

22 JUNE 2021

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MAY IT PLEASE THE COURT

1. My name is Victoria Ann Froude

2. My qualifications and experience are set out in my primary statement of evidence dated 18 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 evidence of:

    a. Simon West

    b. Jonathan Holdsworth

Executive summary

Natural character

4. The methodology used for measuring natural character for the coastal waters between Mimiwhangata and the Bay of Islands uses a comprehensive set of parameters. The reference condition of present-potential-natural-state (PPNS*)* is the state that would be present today, if humans and the introduced species they brought with them had not arrived in New Zealand and natural processes such as landslides and volcanism had still occurred. PPNS is useful for areas where there are high rates of natural disturbance and avoids using an arbitrary date as the reference point for assessing natural character. Kelp forest can be considered to be the more natural state (in comparison to urchin barrens). Restoring kelp forest (by restoring urchin predators) restores natural character, as promoted by Policy 14 NZCPS.

Marine ecology

5. In April 2021 I resurveyed those 2016 eastern Bay of Islands benthic cover plots for Maunganui Bay to and including Oke Bay in the Bay of Islands. This assessed 18 cover classes. Kelp cover was found to have notably increased in the 10 years no-take (except for kina) Maunganui Bay. This is primarily due to the increase of urchin predators (especially large snapper and lobsters) although this has been assisted by some diver fish-feeding and limited amounts of hapū harvest.

6. The collapse of the Bay of Islands recreational scallop fishery and the sequential disappearance of green-lipped mussel beds in the eastern Bay of Islands have primarily resulted from overharvesting.

Natural character

7. My evidence in chief described the methodology and summarised the 2011-12 and the 2021 natural character assessments for the coast from the Bay of Islands to Mimiwhangata (excluding Whangaruru Harbour which was assessed in 2011-12 but is not part of the area of interest in these proceedings). Appendix 1 contains the detailed natural character assessments

for 2011-12 and 2021. Most of the area of interest was not assessed for natural character in 2011-12 and has been assessed in 2021.

8. Paragraph 51 of the Evidence in Chief (EIC) of Simon West states:

> *"[While] natural character is largely a subjective landscape planning assessment, it includes some ecological components. Dr Froude in paragraph 35 states in part the assessment compares ecological and physical process with a reference condition, supposedly prehuman influence. Given ecological science has very little current information on many parts of the proposed protection areas it is unlike comparing this with even less information from past as far back as 1840 as suggested in paragraph 48 is unrealistic".*

9. The methodology I use for natural character assessment is not "largely a subjective landscape planning assessment". It covers ecological, hydrological, and geomorphological factors; the impacts of structures, perceptual or experiential parameters including visual, sounds, lighting and odours. For subtidal open coast environments I separately assessed the natural character for the water surface versus the water column and seabed. The methodology is explained in my evidence in chief, and in Appendix 1 to that evidence.

10. Also in paragraph 51, Simon West criticises the use of reference conditions which he describes as "supposedly pre-human influence". He considers that given the large gaps in ecological knowledge trying to compare current conditions to earlier times, particularly 1840, is unrealistic. Mr West has misunderstood how I assessed natural character. As explained in paragraph 48 of my evidence in-chief:

> *"The reference condition used for assessing natural character is* ***present-potential natural state (PPNS)****. This is the state that would be present today, if humans and the introduced species they brought with them had not arrived in New Zealand and natural processes had continued. These natural processes can be large scale and major (e.g. earthquakes, volcanism and major storms); or more local (such as landslides and a mobile river mouth). PPNS is useful for areas where there are high rates of natural disturbance (as for example it avoids the need to specify the exact position of a river mouth at a particular historical date). While 1840 is often used in New Zealand as a date against which change is compared, 1840 is less relevant in much of Northland as there was relatively intensive Maori settlement in locations such as the Bay of Islands, and noticeable European settler activity prior to 1840."*

I am not using a specific historical time as the reference condition for assessing naturalness. While I stated that others often use 1840 as the date against which change is assessed, I do not use this or any other specific date. Present-potential natural state (PPNS), as defined in my EIC, accounts for natural disturbance at a range of scales right up to the present day.

11. Determining PPNS for the ecological naturalness index (ENI) can be difficult. Marine ecosystems that have not been fished (for at least 15 years

and preferably at least 25 years) provide guidance as to a more natural state for ecological community structure and composition in different environments and locations. For some larger species (e.g. groper), more time and larger no harvest areas, are needed to obtain more accurate guidance on natural population abundance and size distribution. Humans have significantly affected the populations of a number of marine mammal species making evaluations of their pre-human or even historic population sizes difficult to determine in a number of cases. Seabird populations have also significantly declined since human arrival due to a range of pressures including predation of nesting and roosting areas by introduced terrestrial predators.

12. Given the difficulty in directly assessing the relative ecological naturalness of large patches of the open-coast marine environment, especially beyond the 30m depth contour, I use pressure (rather than state) indicators coupled with information on a variety of physical parameters to identify ecological naturalness levels. Pressure indicators include the absence of regulatory provisions that would be expected to increase environmental naturalness. Examples of provisions that would increase naturalness include restrictions on the harvest of native marine biota (e.g. no-take areas) and prohibitions on damaging benthic harvesting methods (e.g. dredging and trawling). Data on the intensity of effort applied using different fishing practices are also considered as a pressure. Alien species (e.g. Pacific oyster and the brown alga *Undaria)* are clearly not part of the PPNS. The abundance and density of alien species is both a pressure and a state indicator. Habitat attributes are used to provide further guidance on the likely PPNS.

13. The second natural character index addresses hydrological and geomorphological naturalness (HGNI). Without humans all geomorphological, hydrological and hydraulic changes are natural. The HGNI is underpinned by scoring tables addressing the magnitude and spatial extent of a range of human-induced physical and chemical phenomena. In the marine environment these include: accelerated sedimentation and increased nutrients compared to the natural state, and changed sedimentation patterns resulting from the presence of a structure such as a causeway. PPNS incorporates natural changes up to the present day. It is particularly useful for environments with high levels of disturbance such as soft shore river mouths where the river mouth position frequently changes.

14. The third natural character index addresses the freedom from structures (FSI). The PPNS is no human structures. Scoring tables address the magnitude and spatial extent of structures. In the marine environment the extent and density of alien encrusting cover is also addressed.

15. The fourth natural character index addresses sound and light naturalness (SLNI). The PPNS is an environment with only natural sounds, a natural light regime and natural odours. Any human generated sounds (especially via

engines and motors), human night lighting regimes and human generated odours (e.g. from a factory or engine emissions) reduce naturalness. This index recognises that some locations are more resilient to the impacts of non-natural sounds because they have a higher level of average natural ambient noise.

16. I consider that PPNS is an entirely appropriate reference condition for natural state, and therefore for assessing natural character. A fixed, more recent, time period would effectively treat many human-induced changes as "natural" and would create problems identifying the natural state in those ecosystems with a high level of natural disturbance.

17. In paragraph 53 in Simon West's EIC he states that kelp is seen [by many] as good and "more natural" while abundant kina are bad. He then states that neither habitat should be seen as good or bad with both being potentially stable ends of a continuum.

18. Paragraph 22e in the JWS for marine ecology states that "*Prior to 1960, there is evidence that kina barrens were not a natural part of the shallow rocky reef community of east Northland*". This means that kelp forest can be considered to be the more natural state (in comparison to urchin barrens). Restoring kelp forest (by restoring urchin predators) restores natural character, as promoted by Policy 14 NZCPS.

Marine ecology

19. Paragraph 20 of Simon West's EIC states that there is little if any quantitative data available on species composition and abundance in the range of habitats present in Maunganui-Oke Bay Rāhui Tapu (Area A). The exception is *Ecklonia radiata*[1] coverage which has been surveyed "*only in a subjectively quantitative way*".

20. It is unrealistic to expect full quantitative data for the marine environment. It is very expensive to collect subtidal data, especially given the current expensive and restrictive workplace health and safety requirements for occupational scientific diving. Notwithstanding this, people (including myself) have instead contributed dive/free diving time and other resources to collect quantitative data including:

    a. Shallow water (2-10m water depth) cover and urchin barrens (2016 and 2021).

    b. Baited underwater video (2016 and 2021).

    c. Rock lobster size and abundance (2016).

    d. Assessments of the cover on the sunk frigate the Canterbury (various).

[1] A dominant subtidal tall brown alga or kelp species

e. High resolution aerial imagery using drones (various).

This information is being used inform assessments of changes observed over ten years for the no-take (excluding kina and purple/long spine urchin) management regime for Maunganui Bay. The comparison "control" areas are typically the coast to the south (but may include some areas to the north depending on what is being measured) of Maunganui Bay.

21. My supplementary evidence analysed my April 2021 resurvey of a subset of 561 cover plots focused on the eastern Bay of Islands. This evidence compared 2016[2] and 2021 cover data covering a wide range of organisms including:

    a. Tall brown algae (kelp) cover (including *Ecklonia radiata*, *Lessonia variegata*, *Carpophyllum* sp, and *Cystophora* sp)

    b. Low brown algae cover (e.g. *Zonaria)*

    c. Red algae cover

    d. Green algae cover

    e. Algal turfs (distinguishing between low and tall; and coralline and other)

    f. Coralline paints

    g. Algal felts

    h. Sponges and anemones

    i. Urchins kina (*Evichinus chloroticus)*; purple or long spine *Centrostephanus rodgersii*)

    j. Mussels (none found in 2021)

    k. Bare rock, sand, gravel

    This is clearly more comprehensive than just assessing *Ecklonia radiata* cover as stated in the EIC of Simon West. I did not report all the details in my evidence as this would be more detail than would be required by the Court. This detail was included in the report for the 2016 survey and will also be included in the full report for 2021 which has yet to be prepared.

22. Paragraph 11.4 from Mr Holdsworth's evidence notes that my supplementary evidence concluded that the Rāhui in Maunganui Bay has led to an increase in the number and size of the main predators of kina. He then states that "*no evidence is presented as to whether the primary predators responsible for*

[2] Froude, V. A. (2016). Kelp cover and urchin barrens in the Bay of Islands: a 2016 baseline. A report prepared for Bay of Islands Maritime Park. 72p. https://www.fishforever.org.nz/images/ff/documents/reports/Kelp_cover_and_urchin_barrens_in_the_Bay_of_Islands_FINAL_Dec_2016.pdf

the decline in kina barrens are large snapper, large rock lobster, or the ongoing removal of urchins by divers (to feed snapper) and by hapū members."

23. I do not consider it likely that the reduced extent of kina barrens in Maunganui Bay (relative to areas where fishing for kina predators occurs) is primarily to divers taking kina. My 2021 quantitative re-survey was of benthic cover using the categories listed in paragraph 17 above. I did not also carry out a quantitative survey of predators, nor how many kina divers were cutting open or locals were harvesting. However, divers and snorkelers with commercial operators primarily visit the sunken wreck *The Frigate Canterbury*, White Reef and the northern entrance island Putahataha. Independent divers and snorkelers are much less numerous and seem to primarily visit the same locations. Only some divers cut open kina. I am unsure of the frequency of local hapū harvest but I have only seen locals harvesting kina there on a few occasions even though I have spent many days and nights in Maunganui Bay. My observations from hundreds of in-water hours are that the predator snapper abundance and average sizes have increased notably since 2010. The abundance and average size of rock and packhorse lobster have also increased notably. During my April 2021 resurvey I observed significant differences in the abundance and average size of these predators between the Maunganui Bay Rāhui (larger) and reefs to the south (smaller).

24. In paragraphs 53-59, Simon West described why he thinks urchin barrens are not necessarily caused by a lack of urchin predators; and that kelp forests (compared to urchin barrens) are not necessarily more natural. He proposes that kelp forests and urchin barrens are both potentially stable states at either end of a continuum. He also states (in para 58) that there is no discussion of snapper or rock lobster abundance and that all briefs have assumed that both species are overfished. He concludes this section by stating that there are other factors and that fishing is not solely responsible for the creation of urchin barrens. He notes that most of the evidence for urchin barrens comes from NE New Zealand and that barrens are not very common elsewhere.

25. This opinion appears to have been supplanted by the Ecology joint witness statement, but I provide some further comments by way of response. I note that extensive urchin barrens have been found in a range of international locations including Tasmania, the Aleutian Islands in Alaska and California. Reversing urchin barrens requires that the predators of the relevant urchin species increase in size and abundance sufficiently for them to exert sufficient pressure on urchin populations for the kelp to begin to recover. Sometimes the key predator of urchins is not always identified initially and so recovery can take longer than expected.

26. In New Zealand urchin barrens are most commonly observed along the Coast from East Cape to North Cape (NE New Zealand). The Joint Witness Statement for Ecology (JWS Ecology) (paragraph 21) states the crayfish

biomass and populations in east Northland are seriously depleted and are well below MPI management targets. A 2017 report by Dr Booth[3] describes the fisheries and other marine harvesting in the Bay of Islands from first human contact to the present. He states[4] :

> "*In northeast New Zealand, (mainly) commercial fishing had, by the mid-1980s, reduced the biomass of snapper (and probably other predatory finfish species), and rock lobsters, to less than one quarter of their unfished state. Consequently, freed from the pressure of their main predators, sea-urchin grazing burgeoned, resulting in loss of much of the shallow-reef kelp in places like the Bay of Islands. Whereas until now kina has been the only species implicated, it is now clear that the long-spined urchin is also overgrazing reefs. Ongoing intense recreational fishing pressure, together with the commercial effort, within and near the Bay of Islands means little or no recovery of the kelp is likely in the near future*".

27. Paragraph 22 of the JWS on marine ecology summarises the relationship between kina barrens and kina predators.

28. The Joint Witness Statement on Fisheries (JWS Fisheries) states:

"*With regard to paragraph 22(h) of the JWS Ecology, Mr Holdsworth's evidence indicates 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*".

29. In response I refer firstly to paragraph 28(c) of the JWS Ecology which states:

"The recovery of ecosystems in MPAs takes considerably longer than the recovery of exploited species. For example, the decline in kina barrens and the recovery of kelp forests in a no-take MPA at Leigh and Tāwharanui took between 15 and 25 years (Shears and Babcock 2003, Babcock et. al. 2010). This is because it takes predators a long time to reduce kina numbers below the density threshold required to maintain barrens. The recovery of kelp forests in MPAs is dependent on effective protection of predators, in particular the presence of large individuals that are more effective predators of kina."

30. Apart from Maunganui Bay temporary Rāhui there is an absence of no-take areas between Mimiwhangata and Bay of Islands inclusive.

31. In addition, the purported increase in snapper biomass in east Northland from Bay of Islands to Mimiwhangata does not appear to be supported by the publicly available data. The latest (2016) snapper assessment by Fisheries NZ[5] states (p1308) that there is a 90% probability that the current catch is

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[3] Booth, J D. 2017. Characterising fisheries and other marine harvesting in the Bay of Islands, with ecological consequences, from first human settlement to the present. New Zealand Aquatic Environment and Biodiversity Report No. 186. Ministry of Primary Industries, Wellington. 86p. https://www.fishforever.org.nz/images/ff/documents/reports/Characterising-marine-fisheries-of-the-Bay-of-Islands.pdf

[4] Page 72, above reference

[5] https://fs.fish.govt.nz/Doc/24153/85_SNA_2016_FINAL.pdf.ashx

very likely to cause overfishing to continue in East Northland. The assumed and derived recreational catch for East Northland is shown (p1268) to have increased since 1990. There has been no increase in commercial catch over the same time. The stock status graphs for East Northland show a steady decline from at least 1900 to about the year 2000 when it dropped below 20% of B_0 (or virgin biomass). Since then it has increased slightly but remained relatively steady in the low twenties over the ten years leading up to the 2013 stock assessment. Appendix 1 shows the snapper historical stock status trajectory graphs for Eastern Northland and Hauraki Gulf/ Bay of Plenty. Dr John Booth's 2016 paper on recreational fishing in the Bay of Islands[6] states (page 2):

"T*he East Northland snapper substock of SNA1 is overfished, and recreational fishing in the Bay of Islands contributes significantly to this overfishing through the large numbers of vessels going out to fish year round*".

32. Dr Booth[7] also evaluates the status of the CRA1 fishery (rock lobster Northland). The biomass from this stock collapsed from 3000 tonnes in the mid-1940s to just 600 tonnes in the early 1980s. He states that stock has fluctuated since, with a modest overall increase. The projections are that it will remain steady. He states that "*because the target biomass is that associated with the stock during 1979-1988 when the vulnerable biomass was near its nadir, it is little wonder that this fishery is not considered overfished*"

33. Figure 20 below is from Dr Booth's report [8] and shows CRA1 vulnerable biomass in tonnes. At the base of Figure 20 is a note describing the severe regional depletion in Rock Lobster Statistical Area 904 (Takou Bay to Bream Bay). Here, commercial CPUE for the four years prior to 2015 was only 20% of the other CRA1 statistical areas.

[6] Booth, J. 2016. Recreational fishing in the Bay of Islands: intense pressure contributes to stress on fishstocks and to local degradation. A paper prepared for Fish Forever. https://fishforever.org.nz/images/ff/documents/reports/J-Booth-BoI-Recreational-Fishing.pdf
[7] As above
[8] As above

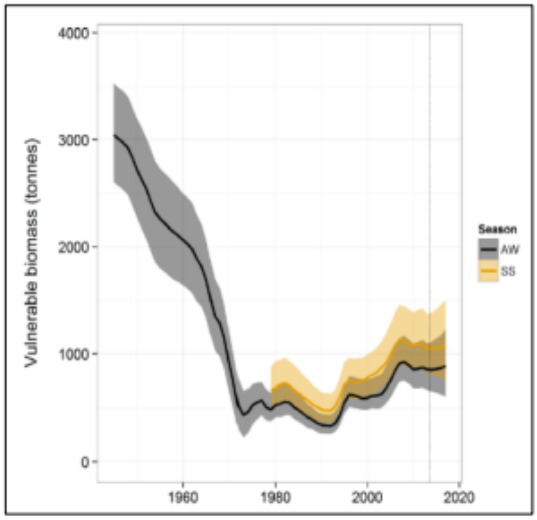


Figure 20. CRA 1 vulnerable biomass and projected vulnerable biomass by season (AW, autumn/winter; SS, spring/summer) (Plenary 2015). Shading shows the 90% confidence zones.

Bay of Islands lies within Rock Lobster Statistical Area 904 (Takou Bay to Bream Bay; Appendix 4) where commercial CPUE over the past four years has averaged around 0.5 kg per pot lift, only 20% of that of the other CRA 1 statistical areas (Plenary 2015). This points to severe regional depletion.

34. The JWS Fisheries states:

- *"(c) Scallop populations are highly variable and have declined in a number of locations in east Northland. The experts agree that there is no evidence to demonstrate that this has resulted primarily from fishing.*

- *(d) The experts acknowledge that there has been a die off of green-lipped mussels and note that significant numbers of empty shells have been observed in some of the bed areas. This suggests that it was not harvesting alone that caused the decline."* This is reflected in the evidence of Mr Holdsworth (paragraph 11.12).

35. The JWS Ecology (paragraph 27) correctly attributes the collapse in scallops in the Bay of Islands and sequential disappearance of green-lipped mussels from the eastern Bay of Islands to fishing. Since arriving in the Bay of Islands in 2006 I have spent considerable time observing (and on a few occasions partaking) in the harvest of scallops and green-lipped mussels (kutai) within the Bay. I have also undertaken a number of surveillance scuba dives (on the deeper scallop beds in the Bay of Islands) and snorkel/ free dives for existing, potential and now former mussel beds in the eastern Bay of Islands. I have also surveyed (on snorkel) the former, existing remnant and potential mussel beds in the western Bay of Islands, but not as frequently as for the eastern Bay of Islands. I have recorded the surveillance dives and snorkel/ free dives (most of which were for about two hours). A 2021 NIWA survey[9] in the Bay of Islands (and various other locations) found very few remaining scallops in their Bay of Islands dives.

36. The harvest pressure on the primary Bay of Islands scallop beds since 2006 has been intense. During the summer period there were (and still are) many,

[9] Dr James Williams, NIWA, personal communication.

often large, vessels from, Whangārei, Auckland and beyond that harvested intensely. Progressively, the number scallops declined as people moved around trying to find better harvest sites. For the last few years scallop harvest success has been very low, reflecting the reduced mean size and significantly reduced absolute numbers.

37. I have tracked the sequential disappearance of kutai beds from the eastern Bay of Islands. When the mussels were present, at any one time there were several highly used locations that were mostly harvested at low tide. People used knives and machetes, filling up buckets or sacks. People I spoke to were often unaware of the numerical bag limits and so harvested everything (rather than only selecting a few larger mussels). While I have only ever used snorkel to harvest green-lipped mussels, I observed others on scuba[10] with knives, again harvesting everything rather than selecting a few mussels. Repeated visits allowed me to track declines in multiple beds over time. Some of these intertidal and subtidal beds previously extended along several hundreds of metres of shoreline.

38. In May 2020 marine shellfish scientist Dr John Booth carried out an evaluation of potential factors affecting kutai at Black Rocks in the western Bay of Islands[11]. He found that there had been a significant decline in kutai abundance since 2015 although there had been insufficient formal surveying to quantify the level of reduction. This was primarily because the earlier extent and density of the subtidal beds was uncertain. He found that it was unlikely that poor water quality had contributed to the decline as no key water-quality indicators had failed to meet Australasian guidelines. He thought it was unlikely that a lack of food (phytoplankton) had contributed to this decline as there were no accounts of reduced condition (e.g. little or no roe development) and no evidence of reduced condition among other nearby filter feeders. There was no evidence of increased predation or competition and no evidence of heavy parasitism at Black Rocks. He thought recruitment at Black Rocks had been sparse. Kutai elsewhere in New Zealand had not been found to be massively affected by disease[12], there were no significant reports of dead kutai among the living intertidal or subtidal beds, there no known accounts of reduced condition for kutai at Black Rocks, and certain close-by kutai populations remained intact, and kutai recruitment was occurring elsewhere in the Bay of Islands. He considered that overharvesting had almost certainly contributed to the decline. The intertidal populations had steadily declined through (sometimes bulk and

[10] This has been legal since about 2005 but has made previously hard to access subtidal beds easy to access so reducing the resilience of mussel beds with a significant subtidal component

[11] Booth, J D 2020. Water quality, shellfish disease and harvesting pressure in northwest Bay of Islands: implications for kutai (green-lipped mussel) recruitment, survival and abundance. A desk top review prepared by Fish Forever for Te Komiti Kaitiaki Whakature I nga Taonga o Tangaroa. 41p.

[12] Some people have considered dead shells on the seabed at 18m to be indicative of disease. In the relatively sheltered Bay of Islands it is unlikely that large swells would extend down 18m to mobilise kutai shells. So the accumulation could be from many years as decomposition without physical abrasion /movement is likely to be slow.

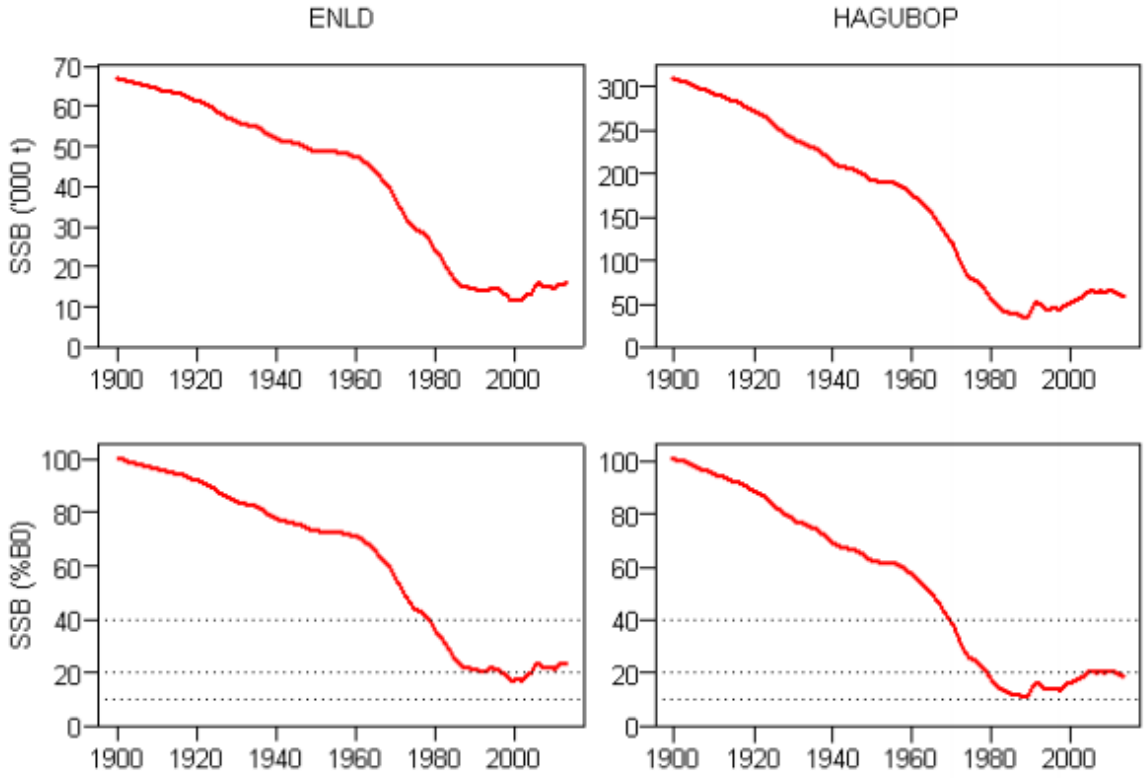
destructive harvesting); subtidal populations had been heavily harvested for community events; while some nearby hard to access intertidal populations appeared to be relatively intact.

Victoria Ann Froude

22 June 2021

Appendix One: Snapper trends in East Northland and Hauraki Gulf-Bay of Plenty

Historical Stock Status Trajectory and Current Status



MCMC base model SSB and status trajectories by stock (dotted lines indicate target (40%B_0), soft limit (20%B_0) and hard limit (10%B_0)).

Source: https://fs.fish.govt.nz/Doc/24153/85_SNA_2016_FINAL.pdf.ashx Page 1307