EB.0382

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 REBECCA LIV STIRNEMANN (MARINE ECOLOGY)

TOPIC 14 – MARINE PROTECTED AREAS

19 March 2021

Royal Forest and Bird Protection
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INTRODUCTION

1. My full name is Dr Rebecca Liv Stirnemann.
2. I am a self-employed environmental consultant, working in both New Zealand and the Pacific Islands. I am presenting this evidence for Bay of Islands Maritime Park Inc ("BOIMP"), the Royal Forest & Bird Protection Society Inc ("Forest & Bird"), Ngāti Kuta Hapū ki te Rawhiti ("Ngāti Kuta") and Te Uri o Hikihiki in my capacity as an ornithologist and ecologist.
3. My evidence describes the seabirds and other coastal species of the Cape Brett to Mingiwhangata area and wider North East Northland including benthic species, and assesses the threats to the birdlife and coastal water species including the effects of fishing, and the likely effects of marine protection proposed, on birdlife, coral and other key species of interest.

Qualifications and experience

4. I hold two Masters of Science degrees. The first, from the University of Pretoria in South Africa, was in mammalogy. The second is from Trinity College in Dublin, Ireland, where I studied the impacts of climate change on ecosystems. I also hold a PhD in Ecology from Massey University in New Zealand. My PhD thesis, completed in 2016 was on the ecology and threats to endangered bird species[1].
5. I have over 12 years' experience in ecological research working on a variety of species and their interactions with human impacts and ecological drivers.
6. My area of expertise includes, but is not limited to:
    a. impacts of climate change;
    b. connectivity between populations and habitats,
    c. relationships between abiotic and biotic factors and reproduction in birds,
    d. impacts of invasive species on survival rates;
    e. impacts of consumption and illegal trade on population persistence;
    f. the impact of invasive fish species on mangrove communities; and
    g. the impact of fishing methods on bycatch rates.
7. I design and undertake ecological studies in both marine and terrestrial habitats. My research has been undertaken in New Zealand, the South Pacific, Australia, South Africa and various European countries.

[1] R. Stirnemann. Ph.D., Massey University, New Zealand (2010- 2016) *Factors leading to the decline of the endangered Mao and other bird species in Samoa*

8. I have also attended various relevant conferences and meetings including the 2021 South Pacific Regional Fisheries Management Organisation international meeting.

9. I have authored more than 25 scientific documents (articles, book chapters, reports, reviews), over 12 of which have been published in international peer-reviewed scientific journals. Many of these studies have focused on ornithology and anthropogenic influences.

Scope of evidence

10. My evidence addresses the following matters:

    a. The seabird and marine biodiversity values of the Cape Brett to Mingiwhangata area and broader Northland region.

    b. The threats to those values.

    c. What measures are needed to maintain or enhance those values.

    d. Industrial fishing activity in the proposed protection areas and existing fishing controls

    e. An assessment in terms of Policy 11 of the New Zealand Coastal Policy Statement and Northland Regional Policy Statement Appendix 5.

Expert Witness Code of Conduct

11. I confirm that I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2014 and I agree to comply with it. Except where I state that l am relying upon the specified evidence of another person, my evidence in this statement is within my area of expertise. I have not omitted material facts known to me that might alter or detract from my expressed opinions.

SUMMARY OF EVIDENCE

12. The Cape Brett to Mingiwhangata area and broader North Eastern Northland region are highly important for seabirds. Many of the seabirds utilising and breeding in this area are Threatened or At Risk with declining populations.

13. The coastal water life found in the Cape Brett to Mingiwhangata area includes a rich, diverse and sensitive ecosystem of sponges, invertebrates and ancient coral (Threatened). This area is also used by globally Near Threatened and Vulnerable (NZ listing) spiny tailed devil rays (*Mobular mobular*), manta ray (*Manta* species) (Listed as endangered by the IUCN).

14. There are substantial anthropogenic threats within the Cape Brett to Mingiwhangata area from fishing activities. Direct threats from trawling include the effects on the benthic invertebrates and indirectly the species reliant on these ecosystem drivers and bycatch impacts. Purse seining affects the availability of

workup resources, critical food resources for threatened and at risk seabird species and also contributes to direct mortality through bycatch. Longlining results in bycatch impacts including on seabirds, turtles, and threatened coral. It is possible that some of these could be further mitigated.

15. Spatial activity restrictions on both purse seining and bottom trawling are needed in the North East area of Northland to alter the direction of the current species and ecosystem declines. Ultimately the regional loss of species and ecosystem interactions is expected if activities do not alter on the Cape Brett to Mingiwhangata area contributing to continual national declines.
16. Additional controls on fishing, or fishing methods, are warranted to improve the resilience of seabird populations against both natural and human impacts as well as changing climatic effects.
17. Controls are also needed to protect threatened species, such as various coral species, seabirds and benthic ecosystems. This will also improve marine resilience to climate change impacts.
18. My recommendations include the removal of bottom trawling/precision bottom trawling, purse seining and the inclusion of mitigation devices on any longline fishing to reduce bycatch across the proposed Area C. These controls will prevent further species declines, ecosystem loss and to allow restoration of key ecosystem functions.
19. Improved protection is required to comply with Policy 11 of the New Zealand Coastal Policy Statement.

EVIDENCE

Ecological values of the Cape Brett area and surrounds, and the broader North Eastern Northland area

<u>Historical records</u>

20. It is important to have a baseline on which to measure effects. Where the history of changes to a population or ecosystem is ignored, unknown, or unknowable then that population or ecosystem is likely to be perceived as stable or not greatly impacted. In New Zealand the current status of marine ecosystems and species are assumed to be "normal" by each generation of observers ignorant of its previous states and setting the baseline only to what they recall (Pauly 1995, Dayton et al. 1998).
21. Historical records, however, suggest seabirds were once very numerous in New Zealand and the area northwest of the Bay of Islands. This can be seen in this except from· Booth's 2017 report:

"*Arthur Pycroft, stationmaster for Opua, which noted in the late 1890s how the southern black-backed gull was very common (and breeding) in the Bay, as were the red-billed gull, the white fronted tern, and the blue (reef) heron; ·all of these bred on the Black Rocks (Pycroft 1898). He also found breeding sooty shearwaters - whose nearest breeding spots these days are the Cavalli Islands (30 km northwest of the Bay of Islands) and the Hen and Chickens Islands (100 km to the southeast) - on nearby Moturoa Island, and little penguins nested in many places around the harbour. Other seabirds he saw - but did not find breeding in the Bay of Islands - were, commonly, the Arctic skua gull, Caspian tern, common diving petrel, and Australasian gannet; and, occasionally, the wandering albatross, and northern giant petrel. Among the shorebirds, the black shag was common, and there were also pied shags and little shags. 'I secured eight of these birds at one shot when a flock of about sixty were fishing in front of the Opua Railway-station."* (Pycroft 1898, Booth 2017).

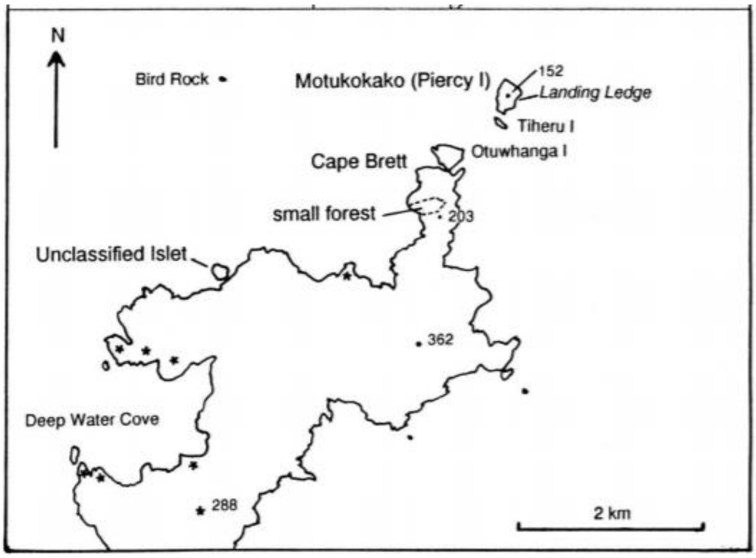

Figure 1 Motukokako (Piercy Island) (copy Taylor and Cameron 1991).

22. Motukokako (Piercy Island) (Fig. 1) has been an important breeding place for oi, the greyfaced petrel, in the Bay of Islands (Taylor and Cameron 1991). At Motukokako, birders of the nineteenth and early twentieth century took up to 500 oi each season (Booth 2017). This is indicative of the large number of birds breeding on this island in the past.

23. The historical records indicate that over the period from Cook's 1769 voyage to New Zealand to 1950, marine environments in New Zealand underwent a large change. Many of the principal exploited species in both study regions noticeable declines in abundance occurred in the late 19th century and early 20th century prior to the organised collection of fishery statistics (Booth 2017). The declines were first evident in species such as oysters, grey mullet, and flat fishes in sheltered, shallow, easily accessible areas, but later progressed to species with a wider distribution such as snapper and blue cod, or a deep-water refuge such as groper (Booth 2017).

24. In Northland hapuku were previously not uncommon in shallower waters (MacDiarmid et al. 2016), however fishing pressure continues to banish them to increasingly deeper waters (Booth 2017).

25. Knowledge held in the local marae indicates changes in both the fish works ups and associated birdlife. For instance:

> "*There used to be lots of schools of Aua (Yellow-eyed Mullet, Herring) in Ōrongo Bay, schools of kahawai would come in chasing them. I remember big schools of kahawai coming in chasing schools of aua and hundreds of little terns, that used to roost on the barges, joining in on the big boil-ups.*
>
> *The Health Department shut the oyster farm down once because of all the faecal matter in the water from some boil-ups (work-ups). That hasn't happened for ages, aren't enough fish or birds to create that level of contamination in the water now.*" (Kororāreka Marae 2020-2021).

26. The New Zealand sealion and New Zealand fur seal are also examples of how even low levels of fishing can critically impact stocks of species that have low productivity (Booth 2017).

<u>Seabirds</u>

27. New Zealand is a global centre of seabird diversity. New Zealand has 92 resident (breeding in New Zealand) indigenous seabird species and subspecies, the highest number of endemic seabirds in the world (Croxall et al, 2012).

28. The New Zealand Threat Classification System provides a tool for assigning a threat status to candidate taxa (Fig. 2).

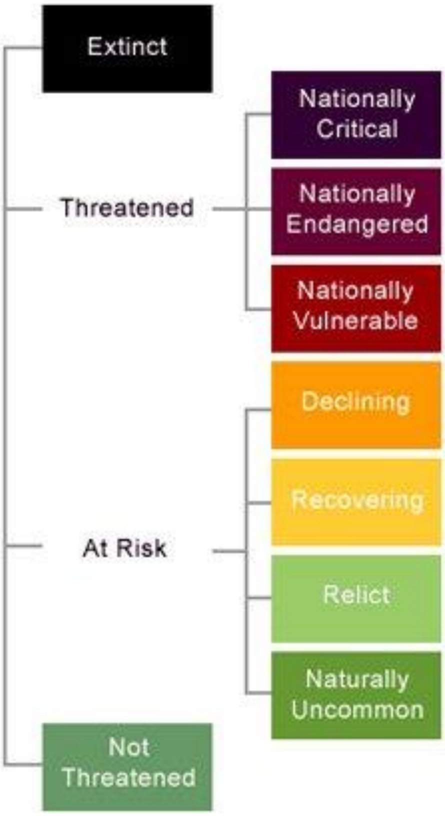

Figure 2 The structure of the New Zealand Threat Classification System (Townsend et al. 2008)[2]

29. Threatened taxa have the greatest risk of extinction.

    a. Nationally Critical taxa are the most severely threatened, facing an immediate high risk of extinction.

    b. Nationally Endangered taxa face high risk of extinction in the short term.

    c. Nationally Vulnerable taxa face a risk of extinction in the medium term.

30. At Risk taxa are not considered currently Threatened, but they could quickly become so if declines continue or if a new threat arises:

    a. Declining means the population is declining but still common.

    b. Recovering means a small population that is increasing after previously declining.

    c. Relict means a small population that has stabilised after declining.

    d. Naturally Uncommon means the taxa has a naturally small population and is therefore susceptible to harmful influences.

31. New Zealand's threatened categories have equivalents in the IUCN red listing process:

    a. Nationally Critical - equivalent to the IUCN category of Critically endangered

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[2] https://nztcs.org.nz/

b. Nationally Endangered - equivalent to the IUCN category of Endangered

c. Nationally Vulnerable - equivalent to the IUCN category of Vulnerable

32. Thirty-two (35%) of the indigenous resident seabird species or subspecies are threatened with extinction. Twelve (13%) of these are classified as nationally critical. Another 51 species (55%) are at risk of extinction.

33. The North East area of Northland and the Hauraki Gulf, with its diverse habitats and offshore islands, is one of the most diverse seabird communities in the world - a result of the high diversity of foraging habitat and breeding sites.

34. These globally important avifauna values are recognised by the Important Bird Area (IBA) programme, launched for New Zealand seabirds in 2014 to guide the implementation of national conservation strategies. IBAs are those sites that are recognised globally as internationally important for bird conservation and known to support key bird species.

35. A 73,040 km^2 area of the North Eastern North Island (termed 8NZ M002 North Eastern North Island, and shown in Figure 3 below) is designated as an IBA on the basis that it meets IBA criteria A1, A4ii, A4iii (2013 assessment (Forest & Bird-, 2014)). Those criteria are:

a. A1 Regular presence of threatened species-ie. more than threshold numbers[3] of one or more globally threatened species.

b. A4ii 1% global population

c. A4iii 10,000 pairs seabirds or 20,000 individuals water-birds

36. Trigger species relevant to those criteria are also shown in Figure 3. These species have resulted in the area around Cape Brett being triggered as a high use area and it therefore forms part of the designated IBA area. Given the long period of time seabirds spend at sea and the multiple threats they face there as well as the vast distances they cover identification of these sites are critical for ensuring the future survival.

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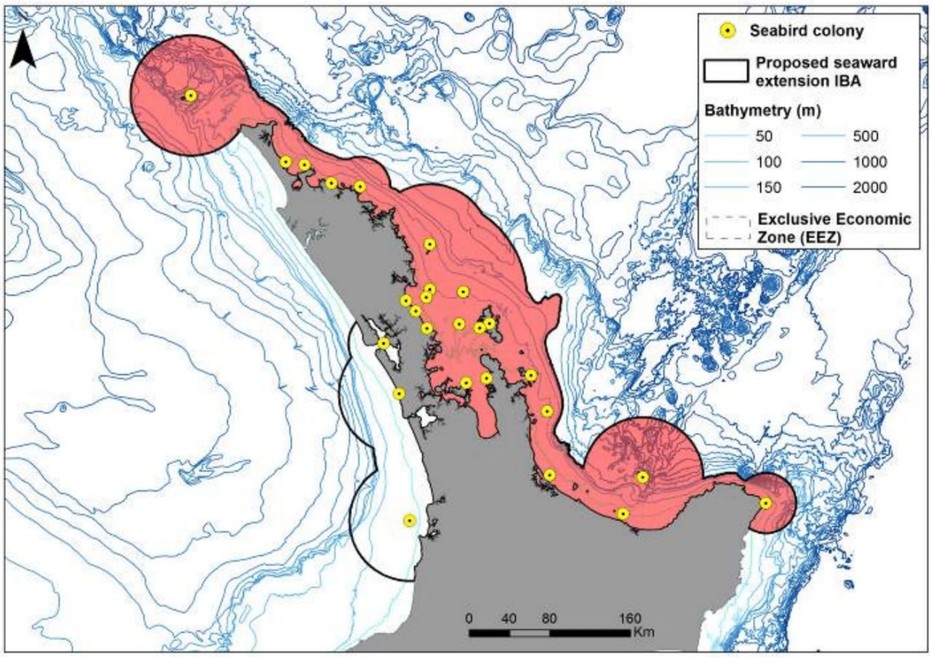
[3] Threshold numbers: More than 1% of global population regularly occurring. There are four aspects of the annual cycles of seabirds where they are most likely to occur in IBA threshold numbers. These are: 1.Seaward extensions to breeding colonies, 2.Coastal congregations of non-breeding seabirds, 3.Migration hotspots and pathways, 4.Important areas for pelagic species (Forest and bird, 2014).



Protected area	Designation	Area (km²)	Relationship with IBA
Hauraki Gulf	MPA Cable Zones	879	Protected area contained within site
Poor Knights Islands, Mimiwhangata, Cape Rodney - Okakari Point (Goat Island), Tawharanui, Long Bay - Okura, Te Makutu (Waiheke Island), Te Whanganui-A-Hei (Cathedral Cove), Tuhua (Mayor Island), Te Paepae o Aotea (Volkner Rocks).	Marine Reserve/ MPA Marine Park	101.2	Protected area contained within site

Figure 3 Designated 8NZ M002 IBA North Eastern North Island and table of trigger species (Forest and bird, 2014).

IBA trigger species:

Species	Tracking	Supporting data	Activity	IBA
Buller's Albatross [1]			Passage to colony	A1
Black Petrel [1]	GLS, GPS	Observations	Foraging, passage	A1, A4ii
Buller's Shearwater [2]	GLS	Observations	Foraging, congregations, passage	A1, A4ii
Flesh-footed Shearwater [2]		Observations	Foraging, congregations, passage	A4ii
Fluttering Shearwater [2]	GLS	Seaward extension (30km), observations	Foraging, congregations, passage	A4ii
Cook's Petrel [1]	GLS	Observations	Passage, congregations	A1, A4ii
Pycroft's Petrel [1]	GLS	Observations	Passage	A1, A4ii
Grey-faced Petrel [1]	GLS, GPS	Observations	Passage	A4ii
Fairy Prion [2]		Seaward extension (135km), observations	Foraging, congregations, passage	A4ii
White-faced Storm Petrel		Observations, seaward extension (35km)	Foraging	A4ii
NZ Storm Petrel		Observations, seaward extension (35km)	Foraging	A1, A4ii
Common Diving Petrel [2]	GLS	Observations, seaward extension (20km)	Foraging	A4ii
Australasian Gannet	GPS	Observations, seaward extension (60km)	Foraging	A4ii
NZ Fairy Tern [3]		Seaward extension (5km)	Foraging (in-shore)	A1, A4ii
Species group (multiple species including a number not listed above)		Observations		A4iii

[1] Species with pelagic ranges. Foraging extends well beyond the seaward extension shown here, however, this mIBA will capture passage to colonies and some observed feeding.

[2] Species observed regularly feeding within the area shown. They also, however range widely during breeding. As new tracking becomes available it is likely pelagic mIBAs will be added to the network (i.e. outside the seaward extension IBA).

[3] Included in Waipu, Mangawhai, Pakiri, Firth of Thames and Maketu coastal IBAs.

Threatened species (IUCN) breeding outside the region recorded in North Eastern waters: Antipodean Albatross (VU), Northern Royal Albatross (EN), Southern Royal Albatross (VU), Salvin's Albatross (VU), White-capped Albatross (NT), Buller's Albatross (NT), Black-browed Albatross (EN), Campbell Albatross (VU), Grey Petrel (NT), White-necked Petrel (VU), Providence Petrel (VU), Mottled Petrel (NT), Gould's Petrel (VU).

37. The IBA programme only identifies important bird areas and key threats where known and there are still considerable data gaps. It does not provide methods to protect the species that use it or review threats.

38. However, designation of these areas for seabirds can provide valuable information for input into the identification of marine protected areas and regional plan provisions, and in this way can contribute to efforts to ensure sustainable management of New Zealand's territorial sea and wider exclusive economic zone. IBA designation has been considered relevant by the New Zealand Environment

Court in at least one previous decision relating to the impact of mussel farms on New Zealand king shag habitat in the Marlborough Sounds.[4]

39. The Cape Brett to Mingiwhangata area is a significant breeding site and feeding site for a number of New Zealand's seabird species (Fig.4-13, Table 1). Additional seabird breeding sites are located in the surrounding area (Fig. 4 & 5). The conservation status of many of these is concerning (Table 1)[5].

Table 1 Key species utilising the area and their threat status

Species	Conservation status
Buller's Shearwater (*Ardenna bulleri*)	Nationally Vulnerable
Giant Petrel (*Macronectes halli*)	At Risk/Recovering
Fluttering Shearwater (*Puffinus gavial)*	At risk - Relict population
White-faced Storm-Petrel (*White-faced Storm-Petrel)*	At risk - Relict population
Common Diving-Petrel *(Pelecanoides urinatrix)*	At risk - Relict population
Flesh-footed Shearwater (*Ardenna carneipes*)	Nationally Vulnerable
Buller's Shearwater *(Ardenna bulleri)*	Naturally Uncommon
Sooty Shearwater (*Ardenna grisea*)	Near Threatened (Population decreasing)
Short-tailed Shearwater (*Ardenna tenuirostris*)	Least Concern (Population decreasing)
White fronted tern *(Sterna striata striata)*	At Risk – Declining
Red billed gull (*Chroicocephalus novaehollandiae scopulinus)*	At Risk – Declining
Bullers Albatross *(Thalassarche bulleri)*	Near Threatened
Black petrel (*Procellaria parkinsoni*)	Nationally Vulnerable
Little blue penguin *(Eudyptula minor)*	At Risk – Declining
Black backed gull *(Larus dominicanus)*	Not Threatened
New Zealand dotterel (*Charadrius obscurus*)	Recovering
Australasian gannet *(Morus serrator)*	Not Threatened
Cooks petrel *(Pterodroma cookie)*	At risk - Relict population
Pycroft's petrel *(Pterodroma pycrofti)*	At risk-Recovering
Grey faced petrel *(Pterodroma gouldi)*	Not Threatened
White faced storm petrel *(Pelagodroma marina)*	At risk - Relict population

[4] *RJ Davidson Family Trust v Marlborough District Council* [2016] NZEnvC 81
[5] New Zealand threat classification system https://nztcs.org.nz/

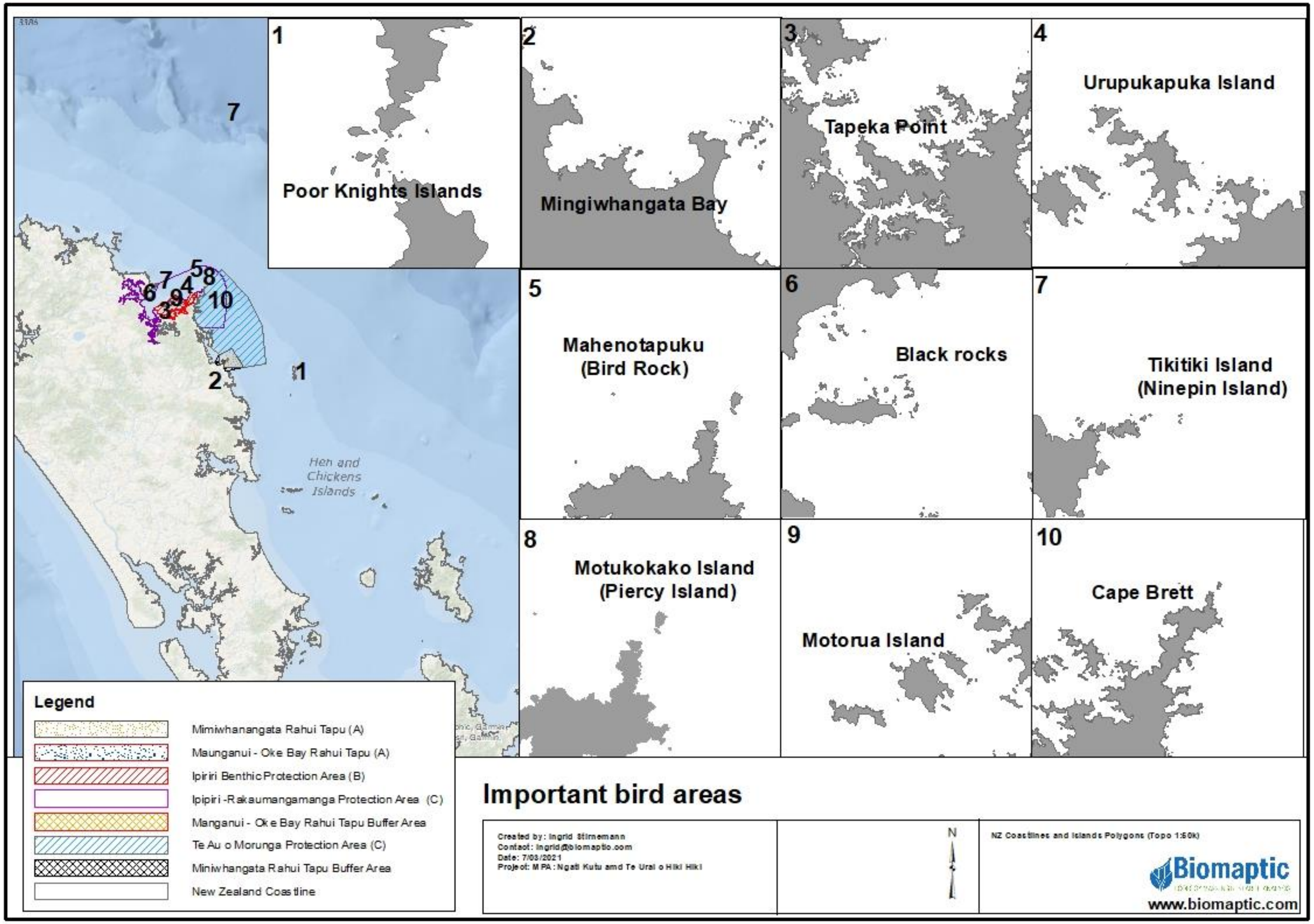


Figure 4 Key seabird sites within and surrounding area C

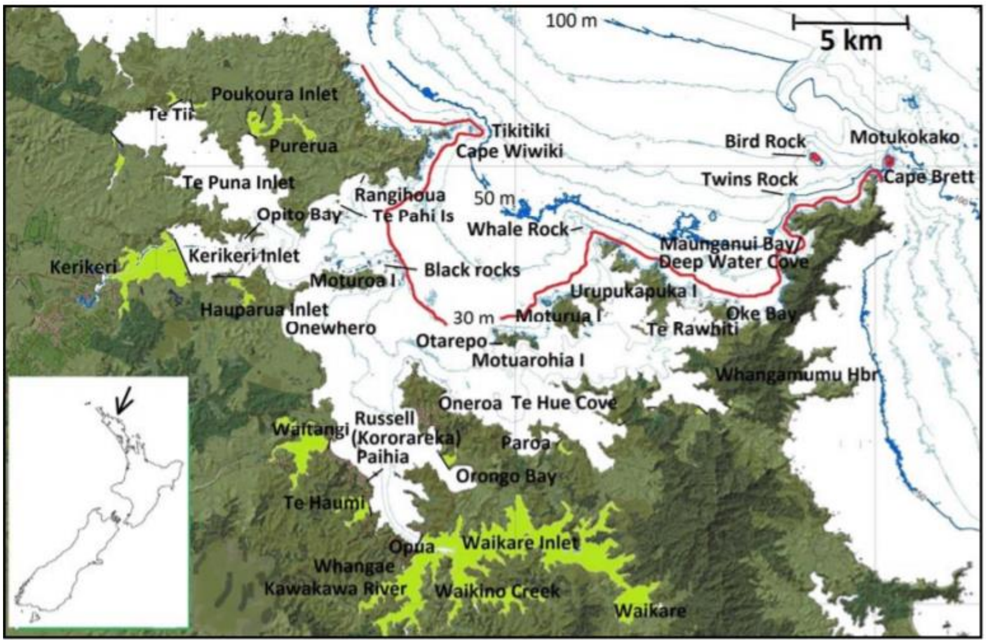


Figure 5 Key sites bay of islands (source: Booth 2017)

40. Red billed gulls, little blue penguins, gannets, white fronted terns, black faced gulls and dotterel are all recorded breeding in the Cape Brett to Mingiwhangata area (Fig. 4 & 5). Motorua and Motukokako Islands both hold breeding colonies of petrel (Fig. 4 & 13).

41. The Motokokako population is regionally significant in the upper North Island and includes both Grey faced and Black-winged Petrel (*Pterodorma nigripennis)*. Cape Brett has a significant large breeding colony of red billed gulls numbering in the hundreds. Tapeka Point has a breeding colony of Red-billed Gull (*Chroicocephalus scopulinus*) with approximately 119 nests (Fig. 4 & 12). The gannet colony of ninepin holds 75 breeding pairs. Black rocks have nesting red billed and black back gulls. Little penguins, a species that is at risk and in decline, also nest on most of the offshore islands and on the mainland. On pest free Urupukapuka and on some islands of Elliot's beach, some burrowing nesting seabirds are recolonizing indicating restoration is still possible.

42. Buller's Shearwater (*Ardenna bulleri*), Giant Petrel (*Macronectes halli*), Fluttering Shearwater, White-faced Storm-Petrel and Common Diving-Petrel Flesh-footed Shearwater (*Ardenna carneipes*), Buller's Shearwater (*Ardenna bulleri*), Sooty Shearwater (*Ardenna grisea*), Short-tailed Shearwater (*Ardenna tenuirostris*) and Fluttering Shearwater (*Puffinus gavial*) also feed in this area.

Figure 6 Bird Rock, Red Billed Gulls (RBG) roosting and feeding

Figure 7 Black Rocks nesting Red billed gulls

Figure 8 Cape Brett Red billed gulls feeding

Figure 9 Cape Brett below Lighthouse Red billed gulls nesting

Figure 10 Fish boilup/work up Cape Brett

Figure 11 Gannets nesting Nine Pin

Figure 12 Red billed gulls nesting Tapeka Point

Figure 13 Breeding populations of petrel at Motukokako

43. The interaction of currents with reefs plays a major role in determining productivity of marine areas; the more vertical the reef, the more it creates eddies or upwellings in the currents. These upwellings are a very important and productive area for filter feeding invertebrates and planktivorous fish species which in turn feeds other organisms higher in the foodweb. A range of seabirds, such as the procellariform species, are known to rely on shoaling/workups of fish schools in upwelling areas of northern New Zealand waters (Gaskin 2017).

44. The area around Motokokaoko and Cape Brett is a significant national and regional upwelling area (Sharples & Greig, 1998). Productivity levels of the upwelling area are among the highest NZ wide fuelling the shelf and coastal ecosystems. It is estimated that upwelling introduces a net supply of 10 ± 3 mmol m-3 of nitrate to the shelf waters between Cape Brett and Hauraki Gulf (Sharples & Greig, 1998). It brings nutrients from the deep and recycles them up to the surface waters splitting at Motokokako sending nutrient rich waters into the Bay of Islands and along the coast South to Mimiwhangata. These upwelling areas are particularly important

during the breeding season for seabirds such as Fluttering shearwater, Buller's shearwater, Fairy prions, Red billed gulls and White fronted terns.

45. Within the Cape Brett to Mingiwhangata area fluttering Shearwater, Terns and Red billed gulls have been observed in large flocks over fish workups. Albatross species and Black petrel (*Procellaria parkinsoni*) also forage within the proposed area C (appendix 2).

Benthic life from Cape Brett to Mingiwhangata

46. The area from Cape Brett to Mingiwhangata is a sensitive benthic habitat. Included in this environment is a variety of corals, sponges and invertebrates.

47. In the coastal waters from Cape Brett to Mingiwhangata, sponges play an important role in creating three-dimensional habitat structures and therefore function as an ecosystem engineer. Sponges are also important carbon sinks in the coastal waters – they are capable of filtering more than 90% of bacteria and organic matter from seawater, sequestering carbon at a rapid rate.

48. An "Analysis of remote camera sea floor photographs, Cape Brett to Mingiwhangata" (Grange 2021, Appendix 1), revealed 38 taxa including a variety of Threatened and restricted distribution species[6] within the proposed Area C, including species protected under the Wildlife Act 1953. These included glass sponge (restricted, rare), black coral *Antipathies lilliei* (a protected species), pink black coral (a protected species), red coral (a protected species), and a potentially new to science species of sea pen (see Appendix 1 for full table and report) as well as tube worms *Galeolaria hystrix*.

49. *Galeolaria hystrix* is a large long lived calcareous serpulid tube worm. This is a significant reef forming organism. The sub-tropical counterpart to tropical coral reefs. They can form living structures up to 1.5m tall and 1-5 and upwards in diameter and live for 9-50 years old. They form dense 3D mounds. These forms support habitat for many different fish species and is highly vulnerable to physical disturbance such as bottom trawling.

50. Hayward et al. (1981) reported both living and dead rhodoliths from an area of coarse sediment in the shallower coastal Bay of Islands south of Urupukapuka

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[6] For terrestrial vertebrates and plants, restricted-range species are defined by the IUCN as those species that have a limited extent of occurrence (EOO) of less than 50,000 square kilometres (km^2). For marine systems the IUCN defines, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km2. These are world distributions of less than 50,000km2 (KBA Standards and Appeals Committee, 2019). Species having a global range size less than or equal to the 25th percentile of range-size distribution in a taxonomic group within which all species have been mapped globally, up to a maximum of 50,000 km^2. Species with narrow distribution ranges are at higher risk of extinction. It has been shown that species with restricted geographic distributions also have the highest risk of extinction under most future climate scenarios (Roman-Palacios & Wiens, 2020).

Island and studied during field work undertaken by NIWA (ZBD2004-07; Bay of Islands OS20/20 project).

51. Rhodoliths are free-living calcified red algae they form structurally and functionally complex habitats (sometimes called maerl). The complex morphology of rhodoliths provides a very heterogeneous habitat. These heterogeneous rhodolith beds feature high benthic biodiversity supporting many rare and unusual species. Productive fisheries are often coincident with rhodolith beds and it is thought that the high level of functional diversity that they provide may be an important driver in maintaining productivity. The complex habitat structure provides refugia for juvenile fish and settlement habitat for shellfish larvae (Steller et al. 2003, Nelson et al. 2012, Neill et al 2014, see evidence by Morrison)

52. Sponge gardens in the New Zealand EEZ include areas of medium species diversity, high morphological diversity, small individuals, medium density, medium percentage cover, and mixed distribution in the outer Bay of Islands.

53. Grange (2021) found "that area C as well as featuring rare and range restricted species is representative of the wider NE coast offshore, dominated in large part by soft sediments of sand and mud, interspersed with small rocky outcrops".

54. Though for some taxa it is possible confidently to list and assess the risk of extinction of all species known to exist in New Zealand (e.g. terrestrial birds), the task is large for many groups, including the marine invertebrates. For example, over 3000 marine mollusc species and subspecies are known from New Zealand waters, of which more than a third remain undescribed (Freeman et al. 2009). Many species therefore have no threat status defined in the marine environment.

55. Despite this a large number of New Zealand's deep sea/cold water coral are listed as 'nationally vulnerable' - facing the risk of extinction in the medium term. This is the same threat level as South Island Takahe, Black Petrel, Blue Duck, Great Spotted Kiwi and South Island Long Tailed Bat.

56. Some of the taxa are grouped in the threat classification at the genus level (and therefore may include more than one species) to reflect difficulties in identification and the large number of undescribed but apparently endemic and in some cases, threatened species. For example, red coral, *Errina novazealandica* is within the grouping Errina spp (Freeman et al. 2009). All were assigned to this category because of their patterns of decline as a result of existing threats (Freeman et al. 2009).

57. Coastal coral have long lifespans, slow growth rates, long reproductive cycles and low recruitment (Marriott et al. 2019). These slow life history traits make these corals highly vulnerable to anthropogenic impacts. Many of New Zealand's deepsea coral are endemic, like the kiwi, to New Zealand (Freeman et al. 2009).

58. Deep sea corals are protected, under the New Zealand Wildlife Act (1953). Protected species include black corals (all species in the order Antipatharia),

gorgonian corals (all species in the order Gorgonacea), stony corals (all species in the order Scleractinia) and hydrocorals (all species in the family Stylasteridae).

59. Antipatharian black coral species, *Bathypathes patula*, is a long-lived species, with ages in excess of 385 years having been recorded, with linear growth rates of 5.2–9.6 mm yr-1, and radial growth rates ranging from 11.1–35.7 μm yr-1" (Marriott et al. 2019, Tracey et al. 2007). Bamboo coral likewise are slow growing. They range in size from 10-300 cm and forming large structures over time (Tracey et al. 2007). Given the slow growth of many New Zealand's deep-sea coral, their resilience to damage is low (Marriott et al. 2019, Tracey et al. 2007).

Threats to marine and terrestrial ecological values

Compounding impacts from land use

60. Impacts from the terrestrial environment such as changes in land use, fires, deforestation, agriculture, and more recently by urbanisation have modified the marine environment. These impacts have likely led to changes in the food webs as predator and prey populations have been modified and caused homogenisation of the sediment characteristics especially in the Bay of islands which are now dominated by silt and mud (Handley 2006). Some of the effects of sedimentation are seen in area C (See Appendix 1 for examples).

Effects of fishing activity

Bycatch in general across fishing methods

61. Commercial fisheries have historically had a large impact on marine ecosystems through the capture of non-target species, or bycatch. Bycatch take by various fisheries is concerning since a number of the unintended bycatch species are declining or threatened (Gray & Kennelly 2018).

62. Globally, seabird and marine mammal capture by commercial fisheries is a serious threat to many species (e.g., Abraham et al 2016). In New Zealand there is ongoing research estimating the bycatch of seabirds and marine mammals. The most frequently caught species reported by observers or fishers were petrels. However, albatross, gannets, penguins, shags and terns also suffer high mortality. Set nets present the greatest threat to penguins globally and a recent global review showed that little penguins are also at risk (Crawford et al. 2017).

63. Over the last 10 years (2009-2019) a number of seabirds have been reported as bycatch due to fishing activities within the Cape Brett to Mimiwhangata area (See Table 2). Seven individuals were Nationally Vulnerable black petrel (Table 2). Fishing activities include bottom long lining, bottom trawling, precision bottom trawl and surface vessel long lining (Table 2).

Table 2 Bycatch of seabirds in area the Cape Brett to Mimiwhangata over a 10 year period (2009-2019). Fishing methods used include bottom long lining (BLL), bottom trawling (BT), and precision bottom trawl (PRB) and surface vessel long lining (SLL).

	Fishing method				
Species	**BLL**	**BT**	**PRB**	**SLL**	**TOTAL**
Black (Parkinson's) petrel	3	1	1	2	**7**
Common diving petrel	2				**2**
Common diving petrel	7				**7**
Flesh-footed shearwater				1	**1**
Black-bellied storm petrel	5				**5**
Gulls and Terns	1				**1**
Buller's and Pacific albatross	1				**1**
Sooty shearwater	1	7			**8**
Petrels, Prions and Shearwaters	10	3	4		**17**
Procellaria petrels		7			**7**
Antipodean and Gibson's albatross				2	**2**
Shy albatross				1	**1**

Fishing method effects on marine mammals and rays

64. A number of threatened species and species of global concern were killed as bycatch in the Cape Brett to Mingiwhangata area (Table 3). The effect on Spine-tailed devil ray is particularly high with a total of 23 being killed in the Cape Brett to Mingiwhangata area alone. Of this, 21 individuals were captured through purse seine activity and two through surface long lining. Bottom trawling also led to the loss of a sealion, a nationally critical species. Purse seining also led to the loss of a mantra ray listed globally as endangered.

65. Additional species caught as bycatch in the coastal northland waters included green, loggerhead and leatherback turtles and a large variety of seabirds (Table 4). There is high loss of coral and other benthic ecosystems from fishing activity around Northland within 10 nm (Table 5) (Fig 14).

Table 3 Additional bycatch mortality in species captured in the Cape Brett to Mingiwhangata area during 2009-2019

Fishing method	**Bycatch**	**N # of incidents reported**	**Threat classification**
Bottom trawling	Sealion	1	Sealion are classified by DOC as 'nationally critical'
	NZ fur seal	1	least concern (population trend: increasing)

Purse seine	Spine-tailed devil ray	21	Near Threatened globally and Vulnerable throughout Southeast Asia by the IUCN Red List of Threatened Species
	Manta ray	1	Globally listed in the IUCN Red List as endangered
Surface long line	NZ fur seal	1	least concern (population trend: increasing)
	Spine-tailed devil ray	2	Near Threatened globally and Vulnerable throughout Southeast Asia by the IUCN Red List of Threatened Species

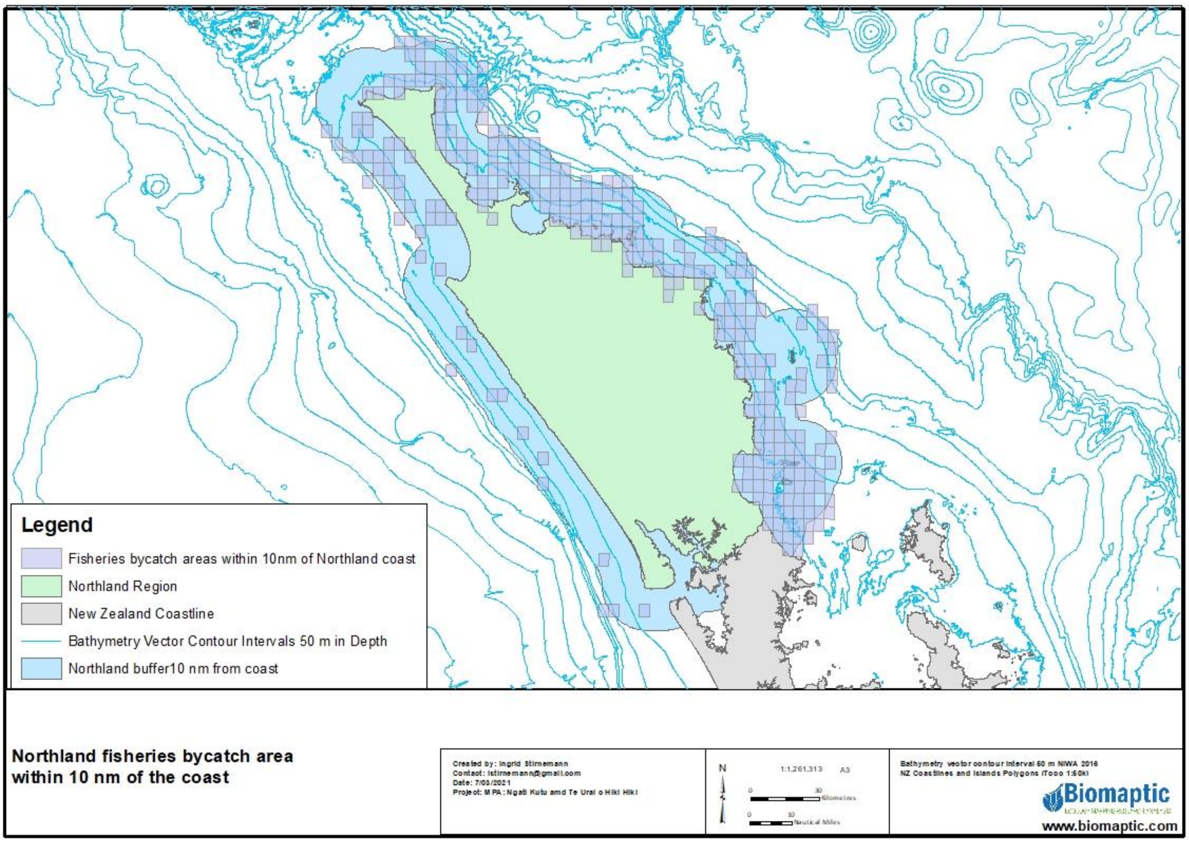


Figure 14 Northland bycatch area of interest over a ten year period (2009-2019) taken within 10 nm of the coast with sites of bycatch mapped.

Table 4 Bycatch of seabirds and other taxa of interest (benthic bycatch in following figure) in the area surrounding coastal Northland over a 10 year period (2009-2019) within 10nm of the coast (covering area in Fig 14) by fishing method.

Fishing method	Species effected	Total effected
Unidentified fishing	XFP - Fairy prion	3
	XFS - Flesh-footed shearwater	1
	XWM - White-capped albatross	1
Total		5
Bottom long lining	GNT - Green turtle	1
	LHT - Loggerhead turtle	2
	SEA - Seals and Sealions	1
	SRB - Southern ray's bream	1
	WPS - White pointer shark	4
	XBP - Black (Parkinson's) petrel	22
	XBS - Buller's shearwater	4
	XCC - Cape petrel	1
	XDP - Common diving petrel	3
	XFL - Fluttering shearwater	1
	XFS - Flesh-footed shearwater	53
	XFT - Black-bellied storm petrel	3
	XGF - Great-winged (Grey-faced) petrel	1
	XGM - Grey-headed albatross	1
	XLA - Gulls and Terns	1
	XPB - Buller's and Pacific albatross	3
	XPG - Penguins	2
	XRB - Red-billed gull	1
	XSH - Sooty shearwater	4
	XXP - Petrels, Prions and Shearwaters	22
BLL Total		131
Bottom trawling	BDO - Bottlenose dolphin	3
	CDD - Common dolphin	1
	FUR - New Zealand fur seal	1
	LBT - Leatherback turtle	2
	SBG - Spotted black grouper	1
	SEA - Seals and Sealions	2
	WPS - White pointer shark	5
	XAL - Albatrosses (Unidentified)	2
	XBG - Black-backed gull	1
	XBP - Black (Parkinson's) petrel	7
	XFP - Fairy prion	1
	XFS - Flesh-footed shearwater	20
	XPB - Buller's and Pacific albatross	1
	XPC - Procellaria petrels	3
	XPM - Mid-sized Petrels & Shearwaters	1
	XSH - Sooty shearwater	19
	XTS - Short-tailed shearwater	2
	XWM - White-capped albatross	3
	XXP - Petrels, Prions and Shearwaters	15
BT Total		90

Precision bottom trawling	SEA - Seals and Sealions	1
	WPS - White pointer shark	4
	XBP - Black (Parkinson's) petrel	7
	XDP - Common diving petrel	2
	XFC - Fiordland crested penguin	1
	XSH - Sooty shearwater	2
	XST - Storm petrels	1
	XWF - White-faced storm petrel	2
	XWM - White-capped albatross	1
	XXP - Petrels, Prions and Shearwaters	6
PRB Total		27
Purse seining	MJA - Spine-tailed devil ray	15
	RMB - Manta ray	4
	XDP - Common diving petrel	2
	XPM - Mid-sized Petrels & Shearwaters	1
PS Total		22
Long Lining	XAL - Albatrosses (Unidentified)	1
SLL Total		1
Seine net	SBG - Spotted black grouper	4
	SEA - Seals and Sealions	1
	WPS - White pointer shark	9
	XHG - Shags	1
	XLB - Little blue penguin	1
SN Total		16

Table 5 Numbers of bycatch impacts on benthic species in the area surrounding coastal Northland over a 10 year period (2009-2019) within 10nm of the coast (covering area in Fig 14) by fishing method.

Fishing method	Taxa	**Total**
Unidentified fishing	ONG - Sponges	1
Total		**1**
Bottom long lining	COB - Black corals	17
	COR - Hydrocorals	1
	COU - Coral (Unidentified)	19
	CSB - Corals, Sponges and Bryozoans	25
	ONG - Sponges	248
	STI - Black coral	12
	STL - Rose lace corals	1
BLL Total		**323**
Bottom trawling	BOO - Bamboo coral	2
	COB - Black corals	48
	COU - Coral (Unidentified)	8
	CSB - Corals, Sponges and Bryozoans	50
	ONG - Sponges	174
	STP - Solitary bowl coral	1
BT Total		**283**
DS	ONG - Sponges	10
DS Total		**10**
Precision bottom trawling	COB - Black corals	6
	COU - Coral (Unidentified)	14

	CSB - Corals, Sponges and Bryozoans	4
	ONG - Sponges	130
PRB Total		**154**
Seine net	COB - Black corals	8
	COU - Coral (Unidentified)	2
	COZ - Bryozoan	1
	ONG - Sponges	2
SN Total		**13**

Trawls and dredges

66. Destructive fishing practices such as trawls and dredges may modify or destroy habitat and thus impact species in the upper trophic levels (Sainsbury, 1993). Reviewers are in general agreement that benthic disturbance from mobile fishing varies in relation to the habitat, fishing gear, and environment, and is likely to have predictable and potentially substantial effects on benthic community structure and function (Tuck et al. 2017). Indeed Tuck et al. 2017 stated "*Fishing is considered the greatest threat to slope habitats (defined as 200 – 2000 m), vents, seeps and seamounts (less than 2000 m depth), while ocean acidification is considered the greatest threat to seamounts and other habitats deeper than 2000 m*".

67. Repeated trawling of an area can reduce diversity and productivity of an area. Research comparing trawled and sites not effected by trawling around Separation Point, between Tasman and Golden Bays, identified significant differences. Fishing appears to have reduced epifaunal biomass and productivity (whole community and fish prey) by up to 50% in some of the study sites (Tuck et al. 2017). Trawled areas also show a reduction in the size, biomass and productivity of marine life in the area, with the original shell-gravel substrate transformed to silt-mud, and larger long-lived species replaced by smaller opportunistic species (Tuck et al. 2017).

68. Grange (2021) similarly noted "*Throughout all transects analysed in the Cape Brett to Mingiwhangata area there was evidence of sediment disturbance (See Appendix 1, Figures). In these photographs there were fewer burrows, often broken shells, and a lack of diatom film on the sediment surface.*" Grange suggests the observed damage is likely to be from bottom trawling.

69. The species that have been consistently identified as being negatively impacted nationally by fishing pressure are species that either stand upright out of the seabed (e.g., horse mussels, sponges, bryozoans, hydroids, sea pens, tube building polychaetes), or live on the sediment surface, and thus are particularly sensitive to physical disturbance through either direct physical impact (e.g., Echinocardium), smothering (e.g., small bivalves) or increased vulnerability to predation following disturbance (e.g., brittle stars) (Tuck et al. 2017).

70. Tuck et al. 2017 found that even low levels of trawl fishing effort (i.e., fishing an area between once and twice per year) reduced the density of long lived sedentary

habitat forming species and individual species group densities of holothurians, crinoids, cnidarians and bryozoans by at least 50%.

71. Effects from the severe impact of bottom fishing activities such as trawling include the modification of sedimentary characteristics through removal and turnover of sediment, and the damage or destruction of many species, particularly large, habitat-forming epibenthos. Bottom trawling fishing activities not only impact the benthic communities and habitats, but also effect key ecosystem functions (Thrush & Dayton 2002).

72. In the Cape Brett to Mingiwhangata area, coral including black coral, unidentified corals and sponges have been significantly damaged by fishing activity (Table 6). Coral were damaged though bottom long lining, precision bottom trawl and bottom trawl activities. There were 47 incidents recorded in total.

Table 6 Reported industrial bycatch loss of sponges and coral from the Cape Brett to Mingiwhangata area over a 10 year period 2009-2019. Any invertebrate catch retained by the net is likely to only include part or whole organisms that are trapped in amongst the fish catch. This catch is identified to the lowest taxonomic level possible by the survey science staff, weighed, and recorded.

Bycatch loss	N # of incidents reported	Fishing method
Black coral/ Unidentified coral/Corals and sponges	43	Bottom long lining
Black coral	4	Precision bottom trawl and Bottom trawl
sponges	112	Bottom long lining
	2	Precision bottom trawl and Bottom trawl
	1	Danish Seine

73. It is important to interpret the data presented (Table 6 & 5) with caution since the dataset is unlikely to cover all bycatch incidents and fishing effort for the various methods are not equal over years or space.

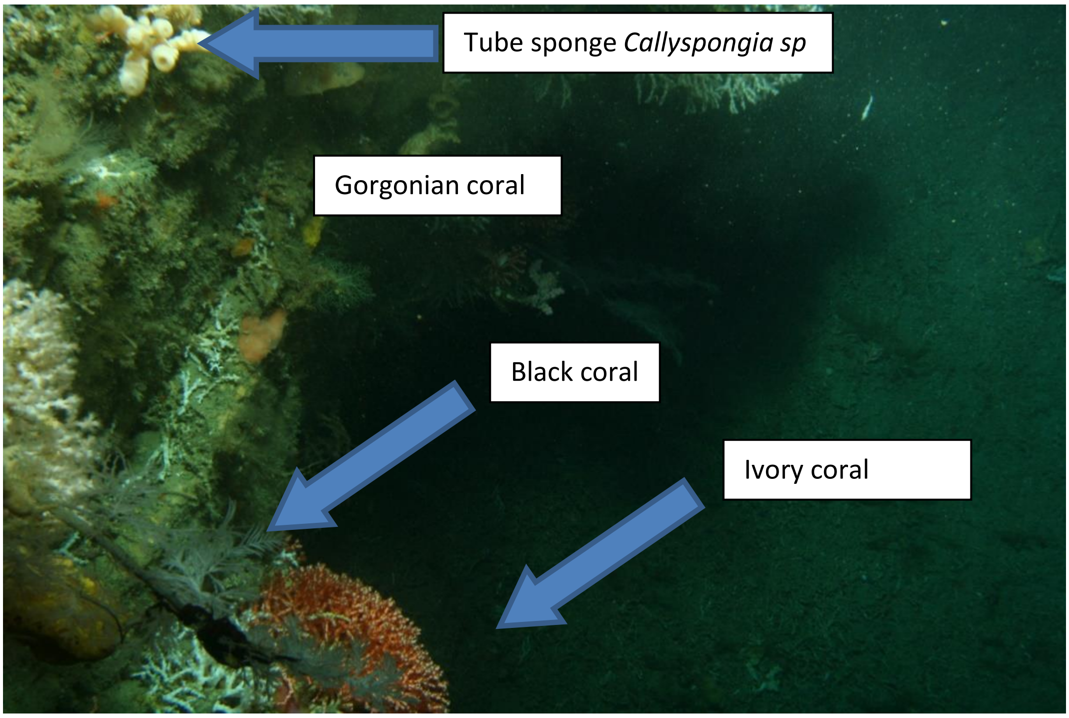
74. The significance of the impact of bottom long lining and bottom trawling on coral should consider not only the bycatch extracted but also the likely true impact below the surface. Pitcher et al. 2019 stated "*trawl catches greatly under sample benthos biomass*" damaged by the fishing activity "*and that therefore their impacts may be greatly underestimated by landed bycatch*".

75. Small catches of sessile benthos in fish trawls scale to large impacts on the seabed, particularly for fragile corals and bryozoans. Fish trawls may gather up only ~100 g/Ha of coral when benthic cover with corals is about 4%, only ~100 g/Ha of sponges when benthic cover with sponges is about 9%, and only ~100 g/Ha of gorgonians when benthic cover with gorgonians is about 16% (Pitcher et al. 2019).

76. Industrial fishing activity in the proposed protection areas and existing fishing controls

77. Within 10nm of Northland (Fig 14) over a ten year period (2009-2019) bycatch damage by trawling has resulted in 1540kg of benthic species which were extracted from the marine area (Table 7, Appendix 2) including 3 kg of bamboo coral, 108 kg of black coral, 13 kg of unidentified coral and 209 kg of mixed sponges and bryozoans and 600kg of solitary bowl coral (Table 7). Bottom long lining damaged 50kg of coral/sponges in total (see Table 7).

Figure 15 Station 61 at 120m depth within area C 3km NE of Cape Brett at 114m showing ivory coral and black coral (protected species) (part of the survey described by Grange Appendix 1 in area C).



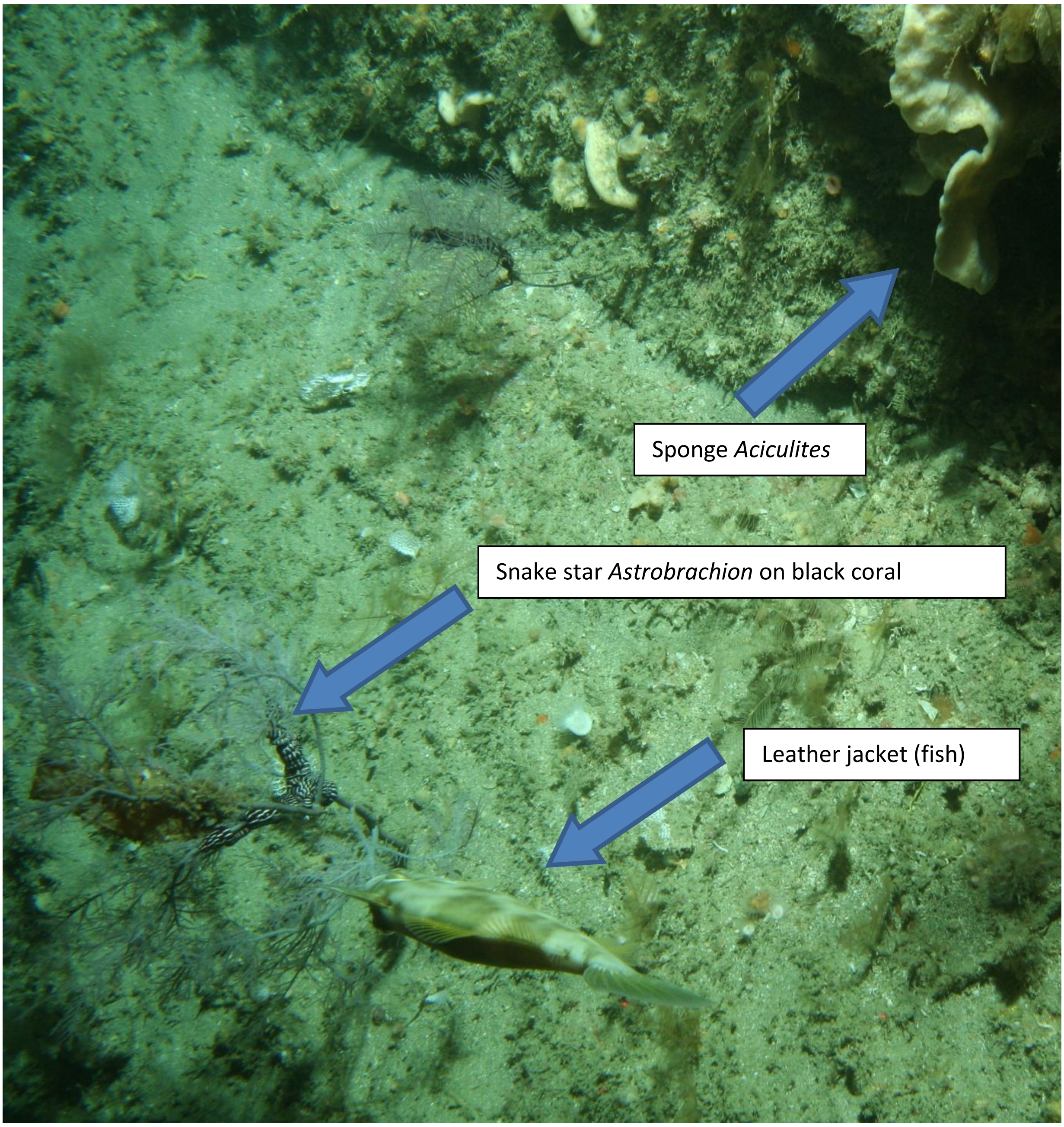


Figure 16 Benthic area 120m area C 3km NE of Cape Brett showing black coral (part of the survey described by Grange Appendix 1 in area C).

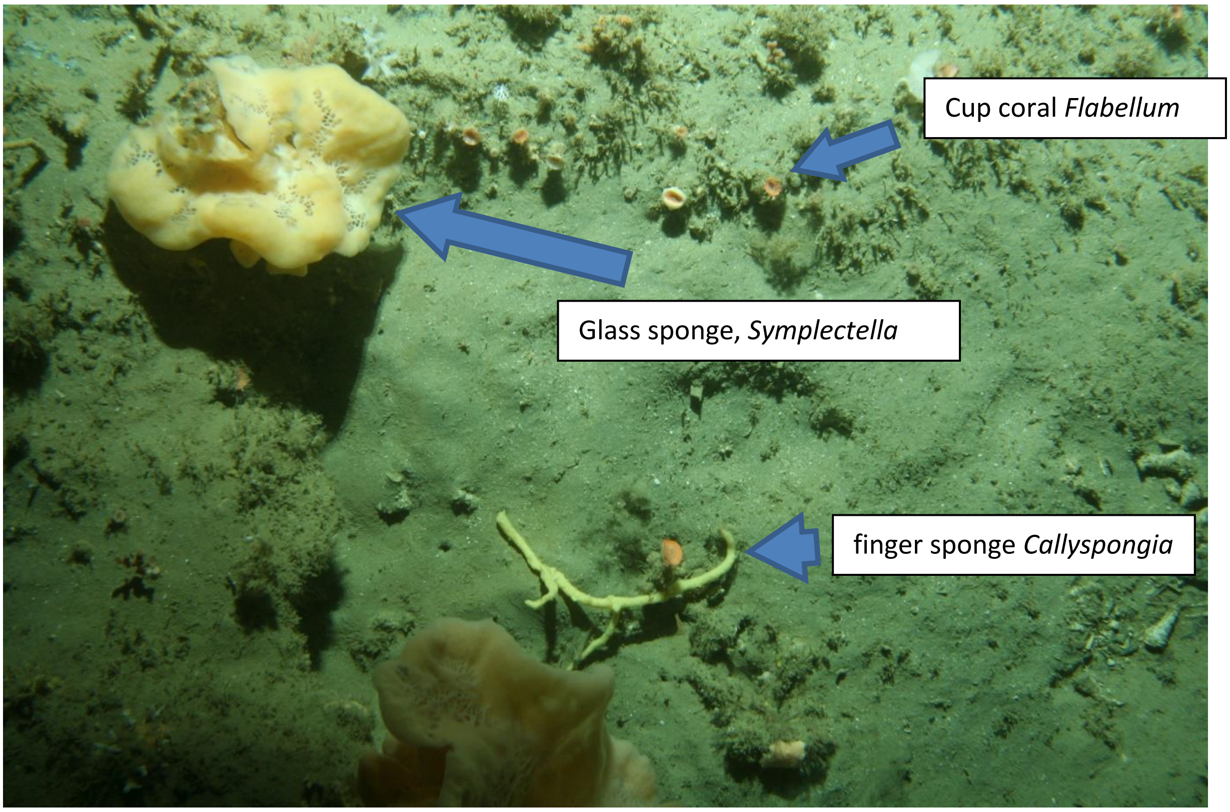


Figure 17 A variety coral found in the benthic area of (part of the survey described by Grange Appendix 1). At Station 41 at 116m depth East of Rakaumangamanga within area C.

78. Though sand and mud habitats may appear homogeneous, the habitat-engineering activities of some of the organisms found there often make these systems highly heterogeneous and rich in species (Fig. 15-17). Many of the habitat-forming species, as well as others that serve important functional roles in these seafloor ecosystems, are sensitive to physical disturbance because of biological traits associated with their morphology, life style, and ability to recolonize disturbed areas (Fig. 15-17)(ICES 1994).

Figure 18 Species like the sponge (*lophon minor*) in this picture are particularly sensitive to bottom trawling because they are large and erect (Photo by Northland dive, Maunganui bay). Lophon minor sponges occur in a depth of 10-80m and are wide spread around the coast providing structural fish habitat.

79. ICES (1994) assessed the potential vulnerability of organisms to trawling on a variety of criteria including life history characteristics, physical fragility/robustness, habitat and behavioural characteristics (e.g. whether epifaunal/infaunal/deep burrowing/rapid burrowing). It considered the most vulnerable organisms to be fragile long-lived species with infrequent recruitment, which may be nearly exterminated by a single passage of a trawl and which are unlikely to recover `within a foreseeable future'. Coral patches may require more than 100 years to recover (ICES 1994).

80. Corals are habitat engineers, and changes to coral communities create flow-on effects on species that rely on complex reef habitat. In many reef ecosystems, the populations of priority fisheries species are directly related to the health and diversity of corals. This is better known for shallow coral systems.

81. Recovery from this trawl disturbance is likely to take decades and possibly hundreds of years due to the very slow growth rates of some species. In some areas where trawling has been proportionally high the area may never recover.

82. Bottom trawling also changes sedimentation and increases sub-marine erosion and sediment plumes are a risk factor for coastal waters ecosystems[7].

[7] https://www.nature.com/articles/srep43332

83. Trawl activity also affects recruitment and recovery from past trawl activity. Suspension of sediments by trawls may smother coral larvae and settlement surfaces.

84. In shallower water corals are vulnerable to damage by anchors, rock lobster pots, droplines, careless divers and collectors. However, these effects are insignificant compared to the proportional damage from trawl activities.

85. Loss of any coral species and the loss of coral as a habitat is a significant effect from fishing activity. Given their slow growth, age and ecosystem value it is comparable to losing the ancient Kauri tree forests of the marine space.

86. Structurally complex habitats (e.g. biogenic reefs) and those that are relatively undisturbed by natural perturbations are more adversely affected by fishing. Structurally complex and stable habitats also have the longest recovery trajectories in terms of the recolonization of the habitat by the associated fauna (Kaiser et al. 2003).

87. Comparative studies of areas of the seabed that have experienced different levels of fishing activity demonstrate that chronic fishing disturbance leads to the removal of highbiomass species that are composed mostly of emergent seabed organisms. These organisms increase the topographic complexity of the seabed and have been shown to provide shelter for juvenile fishes, reducing their vulnerability to predation (Kaiser et al. 2003).

88. It is also important to note that only a small fraction of New Zealand's marine invertebrate fauna have a listed threat status. Many taxa remain 'data deficient' or may not even be listed at all.

89. In my opinion the impact of both precision bottom trawl and bottom trawling have significant adverse effects on both the ecosystem and the threatened species found there which cannot be mitigated and should be avoided.

90. Bottom trawling fishing activities not only impacts the benthic communities and habitats, but also effect key ecosystem functions (Thrush & Dayton 2002).

91. When adverse benthic fishing activity effects essential fish habitat and diversity the long-term viability of higher trophic levels such as seabird populations can be threatened. It is therefore essential there are areas of refuge and protection for already heavily exploited fish species to maintain key food resources.

Purse seine effects

92. North-eastern North Island waters have extensive purse-seine fisheries, due to the presence of the large workups of fish. Fish species include kahawai (*Arripis trutta*), trevally (*Pseudocaranx georgianus*), skipjack tuna (*Katsuwonus pelamis*), jack mackerel (*Trachurus declivis*), blue mackerel (*Scomber australasicus*), saury (*Scomberesox saurus*), pilchard (*Sardinops sagax*) and anchovy (*Engraulis australis*). By targeting fish species

which are also part of workups utilised by various seabird species; purse-seine fisheries potentially negatively impact these seabird populations (Gaskin 2017).

93. Various observers (see Booth's report) have reported reductions in fish numbers and size throughout the Northern East coast of New Zealand waters within the century. Hapuka is a clear example of this having once been common at 50m. Fishing pressure continues to banish them to increasingly deeper waters (Booth 2017).

94. The loss of, and reduction in abundance of large shoaling fish schools in the north east coast of New Zealand has significant implications on the reproduction and function of avifauna (Gaskin 2017). Many seabirds rely on food being driven to the surface by subsurface predators where they become more accessible to birds. Research in NZ has revealed dependencies for some procellariforms on these systems (Hebshi 2008). Upwelling areas are also critical since they concentrate the plankton and zooplankton such as krill which bring it close to the surface so seabirds such as Fluttering shearwater, Buller's shearwater, Fairy prions, red billed gulls and White fronted terns can feed (Gaskin 2017). This ecosystem service is particularly critical during breeding season, enabling these seabirds access to this food source during this critical period of its life cycle (Gaskin 2017).

95. Several studies describe a threshold in forage-fish (prey) abundance (often due to overfishing) below which seabirds experience consistently reduced and more variable productivity (Cury 2011). This response was common to all seven ecosystems and 14 bird species examined within the Atlantic, Pacific, and Southern Oceans (Cury 2011).

96. The impact is not merely restricted to the total abundance of prey but may also extend to its spatial distribution and the encounter rate between prey and predators (Furness, 1982). Fishing may even eliminate trophic groups or keystone species and result in a complete change to the overall community structure (Botsford, 1997).

97. This is likely to have had significant impacts up the food chain to seabirds by affecting both their food supply directly or by impacting the large pelagic fish schools/balls/workups on which they were dependent (see below). Indeed observations while surveying seabirds in area C suggest shallow feeding birds appear to have significantly diminished in number around the bay of islands and Cape Brett area (eg. Terns) compared to the number once seen and recorded in photos and historical records.

98. Furthermore, wide scale impacts of climate change are already having a large impact on seabirds (e.g. Thomson et al 2015). In order to maintain populations, it is important that non-climatic threats are reduced or eliminated to improve resilience to changing climatic events. Reducing anthropogenic competition for resources is likely to be increasingly important as increased impacts are observed on seabird populations (Thomson et al 2015).

Longlining mitigation devices for seabirds

99. There are a range of mitigation devices and practices that longline vessels can employ to reduce harm or mortality to protect from bycatch of species such as seabirds and turtles. Some of these measures are compulsory under the fisheries mitigation measures for surface longlines[8] and bottom longlines[9]. Other measures are voluntary and recommended best practice.

100. Seabirds are generally caught either on the set, haul, or during the soak depending on how close the hooks are to the surface. Fishing methods that can reduce seabird bycatch include the use of seabird mitigation devices such as the following:

a. A tori line or streamer line- is a mitigation tool in longline fisheries. This device scares the birds away from the mainline and therefore the hooks as they sink. The condition, position and aerial extent of the tori line will determine how effective they are. Aerial extent is determined by the height at attachment point, the drag device used at the end of the line and the setting speed.

b. Hook shielding devices shield hooks from seabirds when setting the line by covering the barb of hooks until the baited hook is below the diving range of seabirds. Effective hook shielding devices should release hooks from their protective encasements at a depth of at least 10 m or after an immersion time of at least 10 minutes, to ensure that the baited hooks are released beyond the foraging depth of most seabirds. Hook pods are not expected to be problematic for other non-seabird bycatch species. There is also potential for these devices to reduce sea turtle bycatch but this is yet to be examined.

101. I support the use of these devices to minimise effects of longlining on seabirds.

102. Additional measures other than seabird mitigation devices can include:

a. Sink hook rate. Birds are most at risk during the period hooks leave the vessel to when they sink below the diving range of seabirds. Limiting the availability of baited hooks to seabirds may reduce captures. Weighting close to the hooks and have a fast setting speed are can increase the sink rate.

b. Discard management. The discharge of offal and fish waste attracts seabirds. Management the timing of discharge can reduce seabird bycatch.

c. Timing of fishing activity. Night setting can reduce the incidental capture of diurnal species of seabirds. However high light moon phases can increase nocturnal seabirds' detection of baited hooks. Low deck lighting can reduce seabird attraction to fishing vessels.

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[8] https://www.legislation.govt.nz/regulation/public/2018/0213/latest/whole.html
[9] https://www.legislation.govt.nz/regulation/public/2018/0116/latest/whole.html

d. Underwater setting techniques are means of deploying baited hooks below the surface of the sea, out of the sight and reach of foraging seabirds. None are currently recommended as a mitigation method, though they are noted as under development (ACAP 2019).

e. Mitigation can also include a change in fishing practice, such as avoiding protected species 'hot spots'.

f. A number of marine turtle bycatch mitigation techniques have been utilised outside New Zealand these include replacing squid with fish bait, using circle hooks (Using wide circle hooks has been shown to significantly reduce sea turtle interactions without compromising catch rates of target species), dynamic spatial and temporal measures to avoid key sites and improved FAD design.

Threats to seabirds threaten terrestrial ecological function and restoration

103. Seabirds carry out an important ecological function or service by linking sea to land, aerating the soil and supporting larger populations of plants, birds, insects and lizards, as well as adjacent coastal ecosystems, which in turn improve the rate of ecosystem functioning. Marine nutrient inputs from seabirds benefits terrestrial flora and fauna by enabling the transfer of matter across ecosystem boundaries, bringing ashore nutrients in the form of guano and dead tissue. This activity elevates soil nutrients and plant growth with subsequent benefits to invertebrate and vertebrate populations of island communities (W.B. Anderson, Polis G. A. 1999).

104. Insect and lizard populations, as well as plants benefit from the high nutrient content of guano that is dug into the ground (Mulder et al. 2009). The recovery of some coastal plants is linked to the recovery of seabird populations (Norton et al. 1997). The decline of seabirds on the mainland to scattered colonies of typically fewer than 50 pairs has resulted in the loss of nutrient transfer, particularly of nitrogen, from the sea to the land, resulting in declines in terrestrial productivity and biodiversity (Mulder et al. 2009). If population numbers of seabirds are adversely impacted by offshore threats to feeding habitat and loss of prey diversity, restoration of mainland colonies of seabirds may be impacted.

Effects on climate change/carbon sequestration in the marine area

105. Studies indicate that marine sediment carbon stocks in maritime nations can be similar in magnitude to those of soils. Therefore, if human activities in these areas are managed, carbon stocks in the oceanic realm—particularly over continental margins—could be considered as part of national GHG inventories (Avelar et al 2017).

106. Coastal shelf regions are important for carbon burial and deliver some of the most valuable ecosystem services. Shelf sediments may contain 30– 50% inorganic

and 80% organic carbon). The continental shelves may also contribute up to 50% of the organic carbon supplied to the deep ocean (Greenpeace 2017).

107. Shelf sediments, defined here as those deposited in <200 m water depth (7.6% of the global marine area) but globally sequester as much carbon as tropical forests (Luisetti et al 2020). Shelf sediment stores are vulnerable to human activities such as trawling, marine mining and oil and gas exploration, and <200 m water depths have the potential to release CO2 into the atmosphere within a year of their disturbance Luisetti et al 2020).

108. Marine sediments, particularly nearshore sediments, represent a large and globally important carbon sink and the lack of protection for marine carbon stocks makes them highly vulnerable to human disturbances (such as bottom-trawling) that can lead to their remineralization to CO_2, further aggravating climate change impacts (Luisetti et al 2019; Atwood et al 2020). Further Atwood et al (2020) concluded that their results suggest that as nations strive to protect more of the ocean, the design of new MPAs should consider the inclusion of carbon storage as a conservation objective. Anthropogenic disturbance of shelf sea sediments may exacerbate climate change effects and reduce human wellbeing due to potential future welfare damages estimated in the range of billions of US dollars (Luisetti et al 2019).

109. In the UK the Marine Conservation Society estimated the cost of mitigating the carbon release from seabed trawling in UK offshore MPAs to be roughly USD$1.37 billion by 2040. This represents over 20 megatons of carbon mitigation in other areas of the economy.

Industrial fishing activity in the proposed protection areas and existing fishing controls

110. In the Cape Brett to Mingiwhangata statistical area in the 5 year trawl period during 2007-08 to 2011-2012, trawl gear affected 30-40% of the seabed (see Fig. 19). A large proportional area of this seabed habitat in this statistical area has therefore been adversely affected in recent times. This will have had a large negative effect on the benthic species present. This effect is comparable to clear felling 30-40% of a terrestrial forested area.

111. Fishing effort is variable in Area C between years with a high amount of fishing effort at Cape Brett (Fig 19-22).

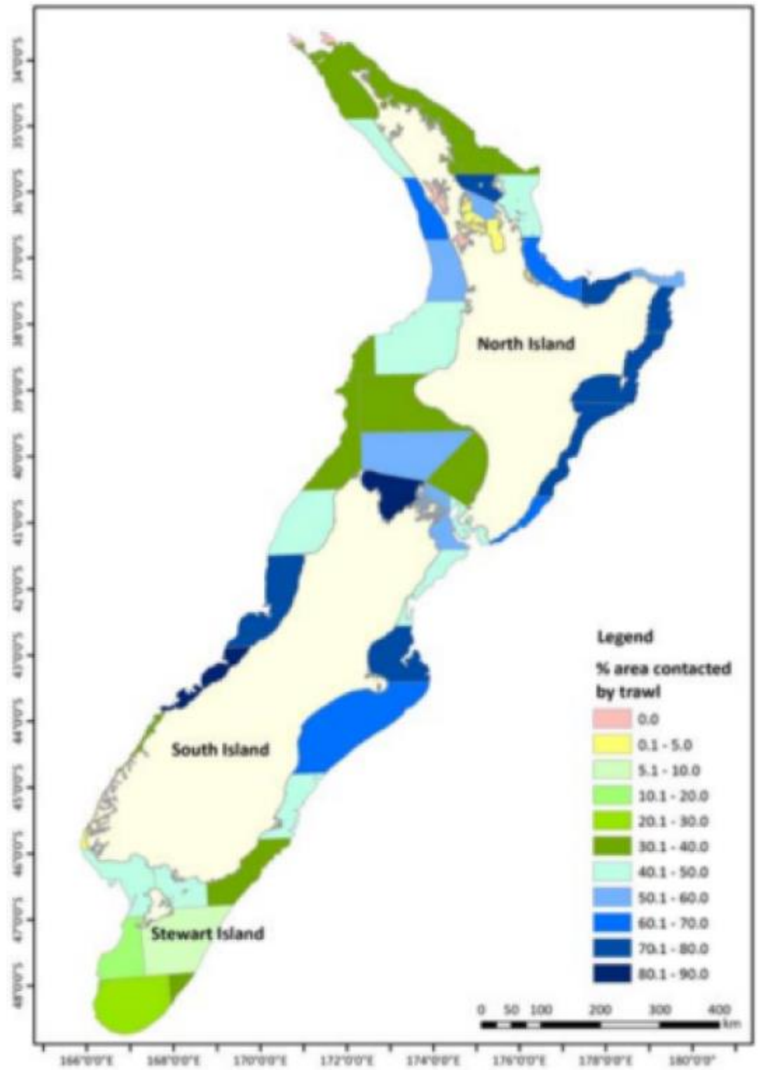

Figure 19 Percentage of each statistical area contacted by trawl gear during 2007-08 to 2011-2012 (5 year trawl footprints). NIWA

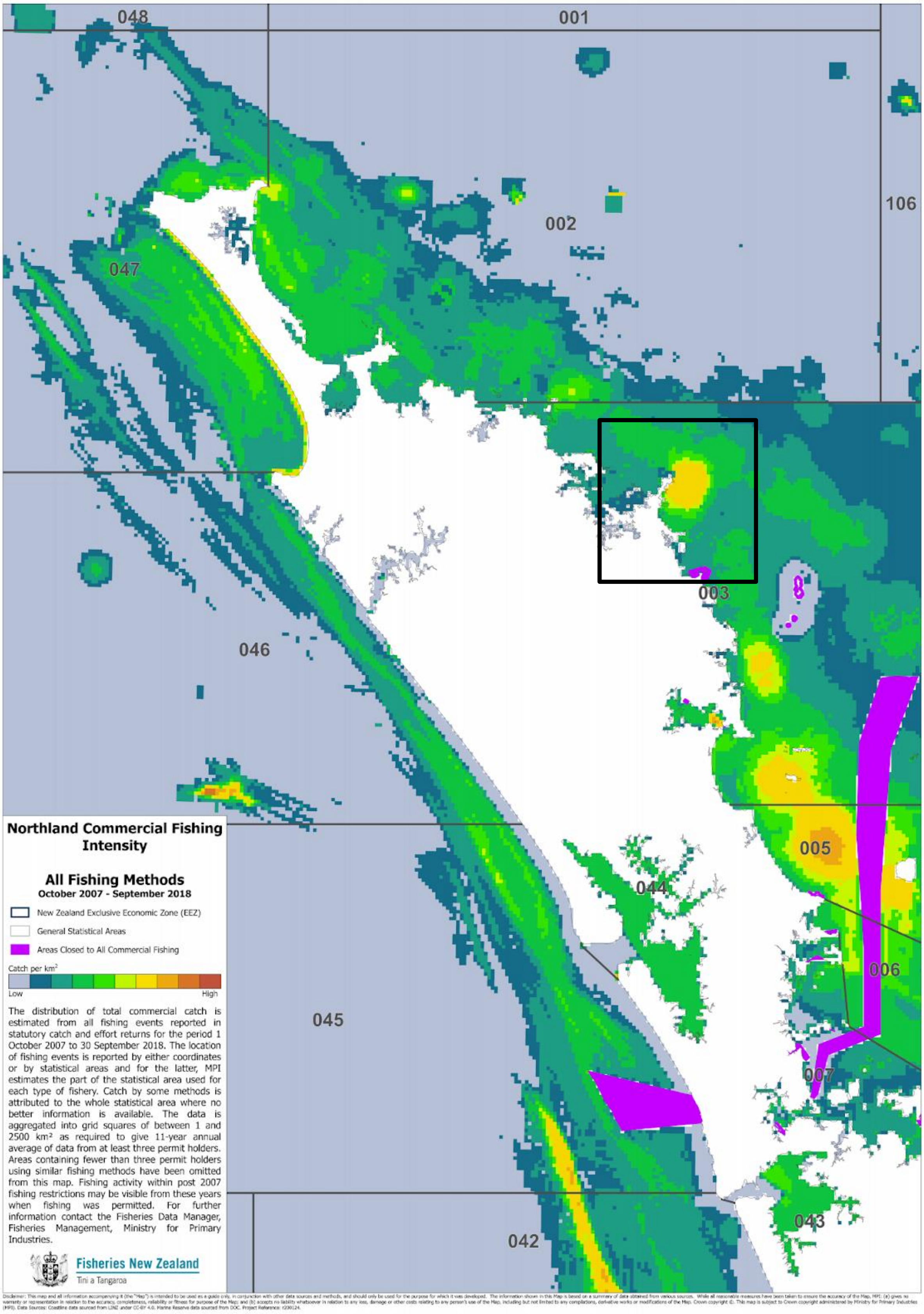

Figure 20 Northland commercial fishing intensity Oct 2007- Sept 2018.

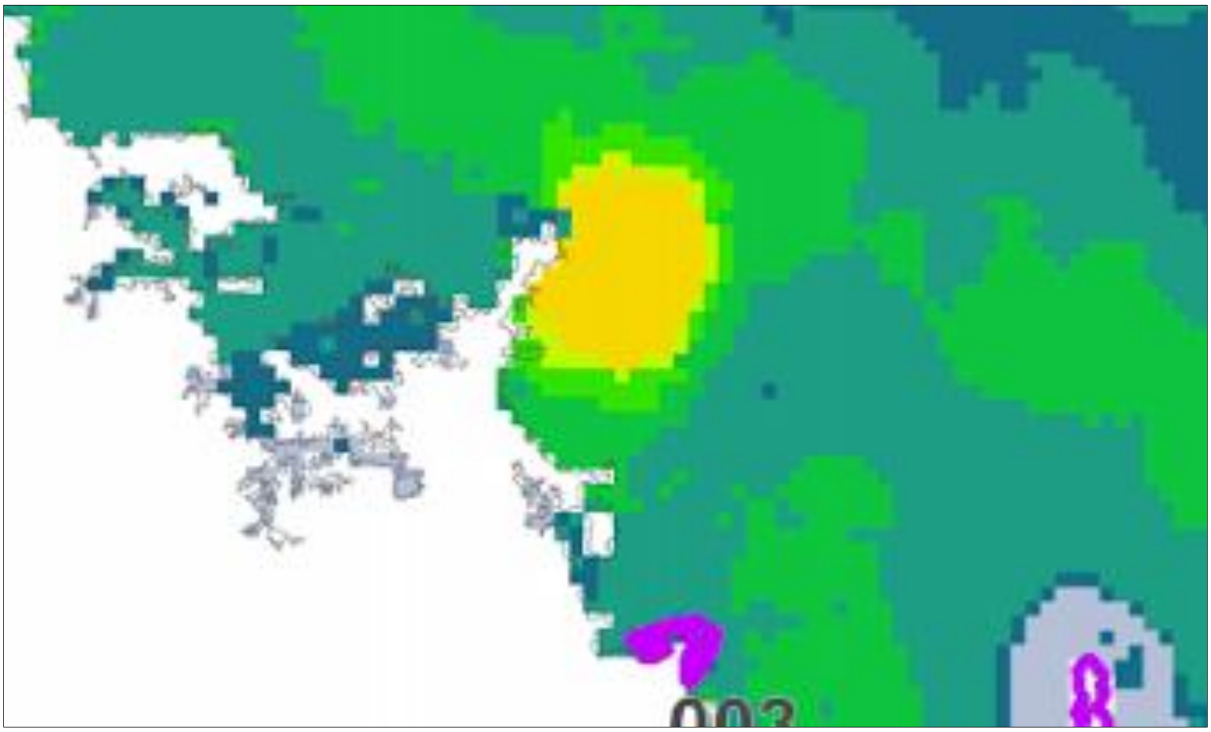

Figure 21 Close up of area of interest showing fishing pressure (see yellow area) by Northland commercial fishing Oct 2007- Sept 2018

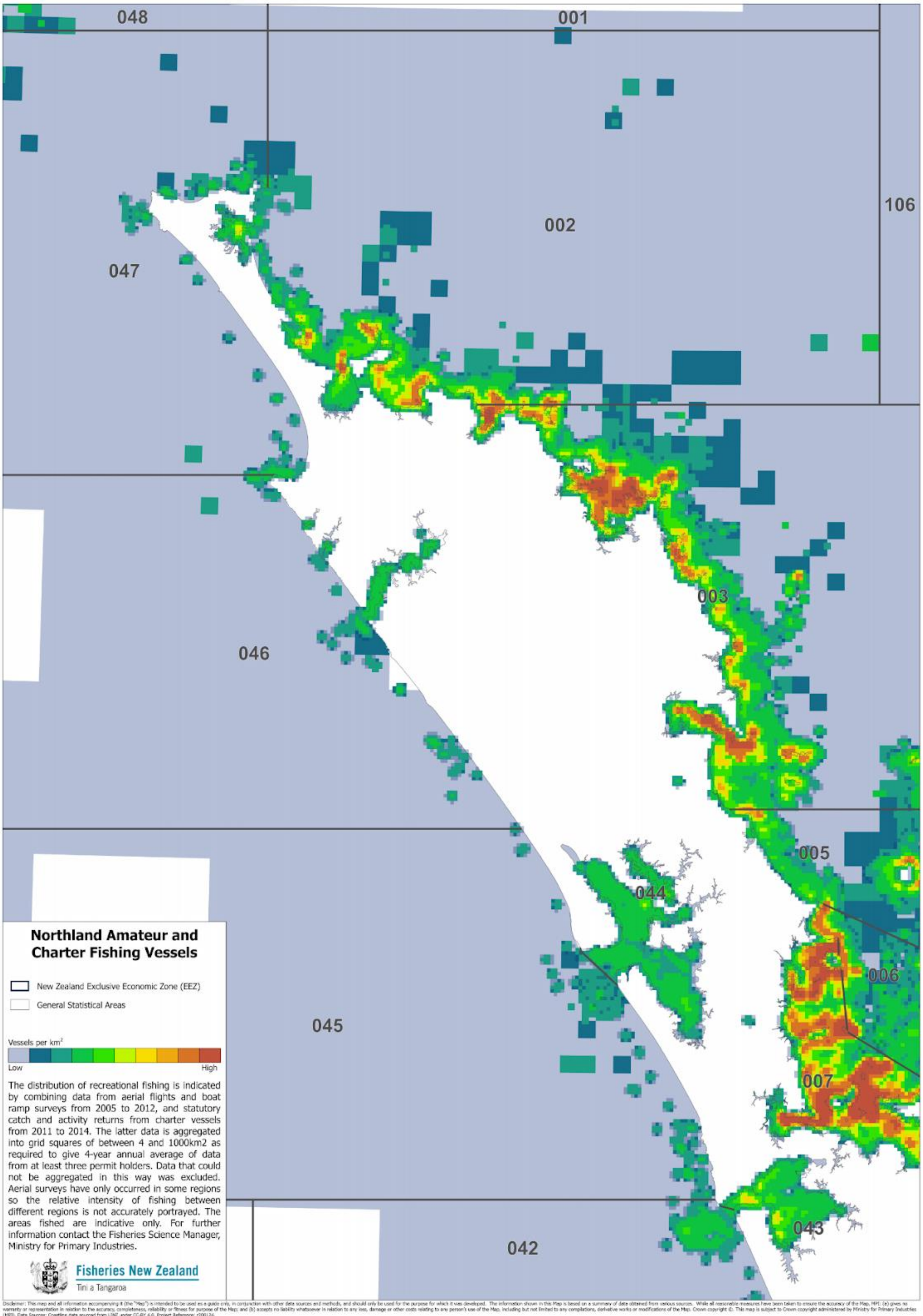

Figure 22 Northland Amateur charter fishing vessels fishing pressure zones

Measures necessary to maintain and enhance ecological values

Seabirds

112. Marine spatial planning, including designation of rules and methods within regional planning frameworks applying to specified areas that are important for seabirds, has the potential to offer seabirds refuge from particular fishing activities that adversely affect seabirds. This is likely to:

a. increase food availability for species feeding in and close to the designated areas. This is likely to be particularly beneficial for some species which breed in the area since they will not have to travel as far to forage and then return to feed chicks e.g. red billed gulls and little blue penguins.

b. provide a safe area for feeding to occur and allow for restoration of the natural ecological trophic relationships away from fishing practices which are affecting survival and nesting success.

c. provide a restorative function to ecological process. In my opinion the bigger the area with fishing restrictions, the more likely the recovery of large fish schooling activity. The main species likely to directly benefit from activity restrictions which restore fish workups are fluttering shearwaters, red billed gulls, Buller's and flesh-footed shearwaters, and white-fronted terns.

113. Though most birds will benefit from fishing restrictions which are likely to reduce direct mortality. Some seabird species will also have additional benefit through increased chick provisioning potential through the improvement of food resources near to their breeding grounds e.g. little blue penguins and red billed gulls.

New Zealand Coastal Policy Statement and Northland Regional Policy Statement

114. Birdlife within Area C meets several of the criteria in Policy 11 of the New Zealand Coastal Policy Statement and Appendix 5 of the Northland Regional Policy Statement ("RPS"):

a. Policy 11 (a) NZCPS and RPS Appendix 5.2(b) is met by the presence of species listed as (a) Threatened or (b) At Risk (see Table 1, though note that Seabirds are understudied and there is a general lack of data on their spatial use in waters surrounding New Zealand therefore many additional At Risk and Threatened species may be found within the area than are listed in Table 1).

b. RPS Appendix 5.2.b: Area C includes areas containing nationally significant examples of indigenous community types, important to migratory species (Fluttering and Buller's shearwaters flesh-footed, black petrel, red billed gulls and white-fronted terns would be the main species affected)

c. Area C is likely to be an important foraging habitat for these species, and provides a safe area for feeding to occur where the adverse effects, as described above, are avoided or reduced. This meets Policy 11.b.ii.

115. Benthic life within Area C also meets several of the Policy 11/Appendix 5 criteria:

a. **Representative** The ecological site is largely comprised of indigenous habitat of indigenous fauna. Appendix 5.1 is met by the presence of representative natural diversity and contains a combination of landform and habitat of indigenous fauna that are considered to be a good example of its type.

b. **Policy 11(a)(i) and RPS Rarity/distinctiveness.** 2.b This criterion is difficult to apply to marine ecosystems where, apart from marine mammals and invertebrates, due to the limited threat assessment information and fact assessment systems are not well developed. However, despite this Area C has been shown to support species that are listed in the National Threats classification system as threatened, at risk, data deficient or uncommon nationally (see Appendix 1, Table 1). Fishing activity has been shown to result in destruction or damage of these endangered taxa. This includes threatened coral taxa. 2-d Areas C is also an example of nationally or regionally rare habitat. Examples within area C include bryozoan beds, rhodolith beds, tube worm mounds, sponge gardens and cold-water corals.

c. **Policy 11bii and RPS Ecological context** These criteria are also met by the presence of a benthic habitat which contains a high diversity of Indigenous ecosystem or habitat types. Habitats within area C are important for critical life history stages of indigenous fauna both as a foraging and breeding grounds Appendix 5.4.

116. Area C also comprises habitat of indigenous marine mammal fauna and ray species that are threatened, at risk and data deficient (Policy 11ai, RPS rarity/distinctiveness criterion). Area C is likely to be an important foraging habitat for rays, marine turtles and marine mammals. This meets Policy 11bii.

117. Policy 11 of the NZCPS requires protection of indigenous biological diversity in the coastal environment by avoid adverse effects of activities on indigenous taxa that are listed as threatened or at risk in the New Zealand. I consider that certain fishing methods have adverse effects that do not meet this requirement:

a. **Bottom trawling:** given the threat status of coral and sponges in Area C, adverse effects of bottom trawling and bottom pair trawling should be avoided.

b. **Danish seining**: to avoid the adverse effect of habitat loss (workups for foraging) on already declining and threatened seabird species it is important that danish seining and purse seining is avoided in Area C. This will also allow restoration of this critical ecosystem service. Purse seining should also be avoided because of the adverse effect on threatened marine species such as devil and manta ray, sealions and marine mammals.

c. **Longlining without approved seabird/coral/turtle mitigation devices**- given the threat on threatened seabirds, coral species and marine turtles, mitigation devices are needed to avoid adverse effects on threatened species.

d. **Drift netting**- Because drift nets are not selective of species, their use results in a large by-catch of non-target fish, sharks, turtles, seabirds, and marine mammals. Given this threat, to avoid adverse effect they should not be used.

118. Preventing damaging fishing activities is necessary to avoid adverse effects and significant adverse effects on ecological values described in Policy 11, to safeguard Northland's ecological integrity (RPS Objective 3.4) and to avoid more than minor effects on indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System (RPS Policy 4.4.1(1).

119. It would also provide for restoration of natural habitats and processes (RPS Policy 4.7.1):

a. The restoration of fish work ups in upwelling areas such as the underwater area of Area C would enable areas containing nationally significant examples of indigenous community types, important to migratory species (Fluttering and Buller's shearwaters flesh-footed, red billed gulls and possibly white-fronted terns would be the main species affected) to be restored and maintained.

b. The restoration of fish workups in Area C and their function is critical if we are to enhance, restore and support ecosystems for a number of New Zealand's declining threatened seabird populations. It is particularly important to provide feeding habitat for critical life history stages (breeding) of indigenous seabird fauna. This aim is consistent with an objective of maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature, and promotion of management to restore ecosystems.

c. In order to avoid adverse effects on those species, it is necessary to control anthropogenic influences including destructive fishing practices which have resulted in a loss of ecosystem functioning as described above. The restoration of large fish schools is particularly critical since they provide a critical mechanism by which the seabirds (mentioned above) access plankton and krill for food during the breeding season. Activities, such as purse seining, which target workups, should be avoided in area C to allow this ecological function to be restored.

d. The maintenance and restoration of coastal water coral and sponge ecosystems in Area C requires recognition of the destructive and long term impact of bottom trawling and the need for avoidance of this significant adverse effect. To maintain and enhance these complex and dynamic ecosystems it is critical that bottom trawling is removed. This will enable us to protect and restore a representative and sensitive ecosystem of biological importance and its associated threatened species.

120. A precautionary approach should be adopted towards proposed activities whose effects on the coastal environment and threatened and at risk species are potentially significantly adverse (NZCPS). This is particularly critical as marine ecosystems are altering due to climatic changes and marine acidification affecting prey density and availability which flow on to higher trophic levels, with effects on abundance, productivity, behaviour and community structure of seabirds (Chambers et al. 2011). The combined impact of fishing methods and climate change has a cumulative impact. A precautionary approach requires controls on the fishing methods described above, because:

a. We do not presently know what effect climate change is going to have on these ecosystems; and

b. By reducing current stressors, such as food restrictions, we can increase resilience to additional adverse environmental effects.

Proposed Schedule

121. 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

Rebecca Stirnemann

19 March 2021

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Appendix 1

Analysis of remote camera sea floor photographs, Cape Brett to Mingiwhangata

Ken Grange, January 2021

This short report provides an analysis of remote camera photographs of the sea floor beyond 100 m depth along the NE Northland coast, from approximately Cape Brett to Mingiwhagata. The photographs were collected by NIWA from the Research vessel Tangaroa using DTIS, the Deep Towed Imaging System, and the images retrieved from the freely available database (https://marinedata.niwa.co.nz/project-map/).

For this report, photographs along 7 transects, each approximately 900 m in length, were examined. Although each transect took approximately 250 high-resolution photographs (total of 1750 photographs), some were out of focus or blank, probably due to the flash not firing. As a result, a total of 1,600 photographs were available for analysis. These ranged from 107 – 147 m water depth. Each image was variable in the area of sea floor photographed, depending on the height above the seabed the camera was when fired, but most were approximately 900 x 700 mm, each covering an area of over 0.6 m^2. This report therefore describes the main features and taxa across approximately 1,008 m^2 of sea floor beyond 100 m depth.

Photo transects were analysed firstly for sediment characteristics and listed into 3 main types:

1. Soft sediment, divided into 2 types
   a. Coarse sand with shell gravel
   b. Fine sand and mud
2. Rock outcrops, commonly with sediment lying on the rock base. A photograph was characterised as rocky outcrop if rock covered more than 30% of the area of the photo.
3. Biogenic reefs. These were identified in only one transect, Station 61, off Cape Brett. Biogenic reefs were defined as hard substrata comprised of the hard shells of organisms. In the case of Station 61, the biogenic reefs comprised large colonies of the calcareous tubeworm *Galeolaria hystrix*.

The number of photos of each sediment type were recorded along each Station (transect) and analysed as a percentage of the total number of photos in that Station (Figure 1).

Figure 1. Percentage of sediment habitats at each Station

In general, the entire area had very similar sediments, with over 90% sand or mud at all stations, dominated by coarse sand around Cape Brett (Station 61), but finer sand and mud at all other stations. Some photos at Station 61 showed clear patterns of rippled sand. Since this station was probably too deep (120 m) for waves to have caused the ripples, it is likely they were made by tidal currents associated with the upwelling currents around Cape Brett. It was also notable that the sediments at this station were coarser than others, which also suggests stronger currents near the seabed.

Once the sediment types at each station were analysed, the photos were scanned to record the dominant species occupying each habitat. It was not possible to identify every species seen in the photos, especially the sand/mud habitats where only burrows could be seen on the surface. A total of 38 taxa were recorded from the 1,600 photos analysed from the 7 transects. In general, all stations supported a very similar community of species, dominated by the species listed in Table 1 below.

Table 1. Species recorded along each transect. CR = common on rock, OR = occasional on rock; CS = common on soft sediment; OS = occasional on soft sediment.

Species	Common name	61	31	41	29	32	27	19	Comments	# Stns
Bryozoa	Fragile colonies	CR	CR	CR	CR	CR	CR	CR		7
Symplectella rowi	Glass sponge	CR	CR	CR	CR	CR	CR	CR	Restricted distribution, rare	7
Monomyces rubrum	Red cup coral	CR	CR	CR	CR		CR	CR		7
Callyspongia sp	Finger spongs	CR	CR	CR	CR	CR	OR	CR		7
Errina sp	White hydrocoral	CR	CR			CR	CR	CR		5
Antipathes lilliei	Black coral	OR			OR	OR	OR		Protected species	4
Ophidiaster kermadecesis	Sea star		OR		OR	OR	OR			4
Polymastia sp	Yellow sponge		OR	OR	OR			OR		4
Axinella sp	Cup sponge		CR	OR				CR		3
Iophon sp	Tube sponge		OR	OR	OR					3
Primnoides sp	Fan gorgonian		OR	OR	OR					3
Antipathes sp	Pink black coral		OR					CR	Protected species	2
Alcyonium aurantiacum	Sogt coral		OR		OR					2
Astrea heliotropium	Circular saw shell		OR		OR					2
Desmophyllum sp	White cup coral					OR	CR			2
Oculina virgosa	Red coral	OR							Protected species	1
Galeolaria hystrix	Calcareous tubeworm	OR							Biogenic reef forming	1
Asterodiscus truncatus	Fire-brick starfish					OR				1
Large echinoid	Black/white urchin					OR				1
Pagurus sp	Hermit crab					OR				1
Diadema palmeri	Long-spined urchin					OR				1
Psammogorgia sp	Gorgonian					OR				1
Polychaete burrows	Worm burrows		CS	CS	CS	CS	CS	CS		6
Bivalve burrows	Unidentied					CS	CS	CS		3
Alcithoe sp	Volute		OS		OS			OS		3
Austrofusus glans	Whelk		OS	OS						2
Dentalium nanum	Tuck shell	OS						CS		2
Tucetona laticoststa	Dog cockle	CS								1
Tawera spissa	Morning star cockle	CS								1
Echinocardium cordatum	Heart urchin	OS								1
Sea pen	Unidentified	OS							Yellow, may be a new species, not recorded before	1
Maoricolpus sp	Turret shell		OS							1
Ophiuroid	Brittle star holes				OS					1
Unident actinia	Sand anemone					OS				1
Cerianthus sp	Tube anemone					OS				1
Pteroeides bollonsi	Sea pen						OS			1
Brissus gigas	Giant urchin						OS			1
Unidentified shrimp	Shrimp							OS	Partly in burrow	1

Although remote camera photographs are not ideal at sampling fish (the camera and frame can disturb and scatter fish), 10 fish species were recorded throughout the photographs across all habitats (Table 2).

Table 2. Fish recorded in the remote camera photographs. (Note that some other fish were present but could not be identified).

Eagle ray
Lord Howe Is coral fish
Leatherjacket
Snapper
Terakihi
Sea perch
Pink maomao
Gurnard
Scorpion fish
Witch flounder

Discussion

These photographs probably represent the most comprehensive survey yet undertaken offshore (> 100 m depths) along the outer coast of the Bay of Islands south to Mimiwhangata. The results show that the area is surprisingly uniform, comprising over 90% soft sediment (sand and mud) supporting a variety of burrowing animals (see Appendix), although further identification of species is not possible without grab or dredge samples. The transect closest to the upwelling zone around Cape Brett has coarser sediments, with sand and shell gravel. This is possibly a result of stronger currents associated with the upwelling and tidal currents bending around the Cape. Biogenic (living) reefs of calcareous tubeworms (*Galeolaria*) were also present in this area (see Appendix). Throughout all the transects analysed there was evidence of sediment disturbance. In these photographs there were fewer burrows, often broken shells, and a lack of diatom film on the sediment surface. The depths of the stations, > 100 m, suggests wave action is not the cause. A feasible interpretation of the disturbance is damage from fishing trawls (see Appendix for examples).

The rock outcrops support a large variety of species, many of which could not be identified to species level either because the photographs were not sufficiently high resolution, or because the species appear to be rare or not recorded in the formal scientific literature previously. The widespread occurrence of the glass sponge (*Symplectella rowi*) is an example of a species widespread in the area, but previous recorded only from North Cape (and sporadically in the unique environment of Fiordland). The abundance of this species in these photographs was surprising. Similarly, the occurrence of black coral colonies, one of NZ's few fully protected marine invertebrates, had not been recorded in the area previously. Apart from the black coral (*Antipathes lilliei*) that is known from the wider Northland area, a second, smaller and more busy species with pink polyps was identified in some photographs and is likely to be a new species. Other widespread and common species recorded on the rock outcrops include small white hydrocorals (another protected species), tree-like bryozoan colonies, and cup corals (see Appendix), all of which are extremely susceptible to trawling impacts and disturbance.

Figure 2. Representative remote photos of various sea floor features

A. Rippled sand, 120 m depth off Cape Brett.

B. Typical sandy mud showing worm burrows.

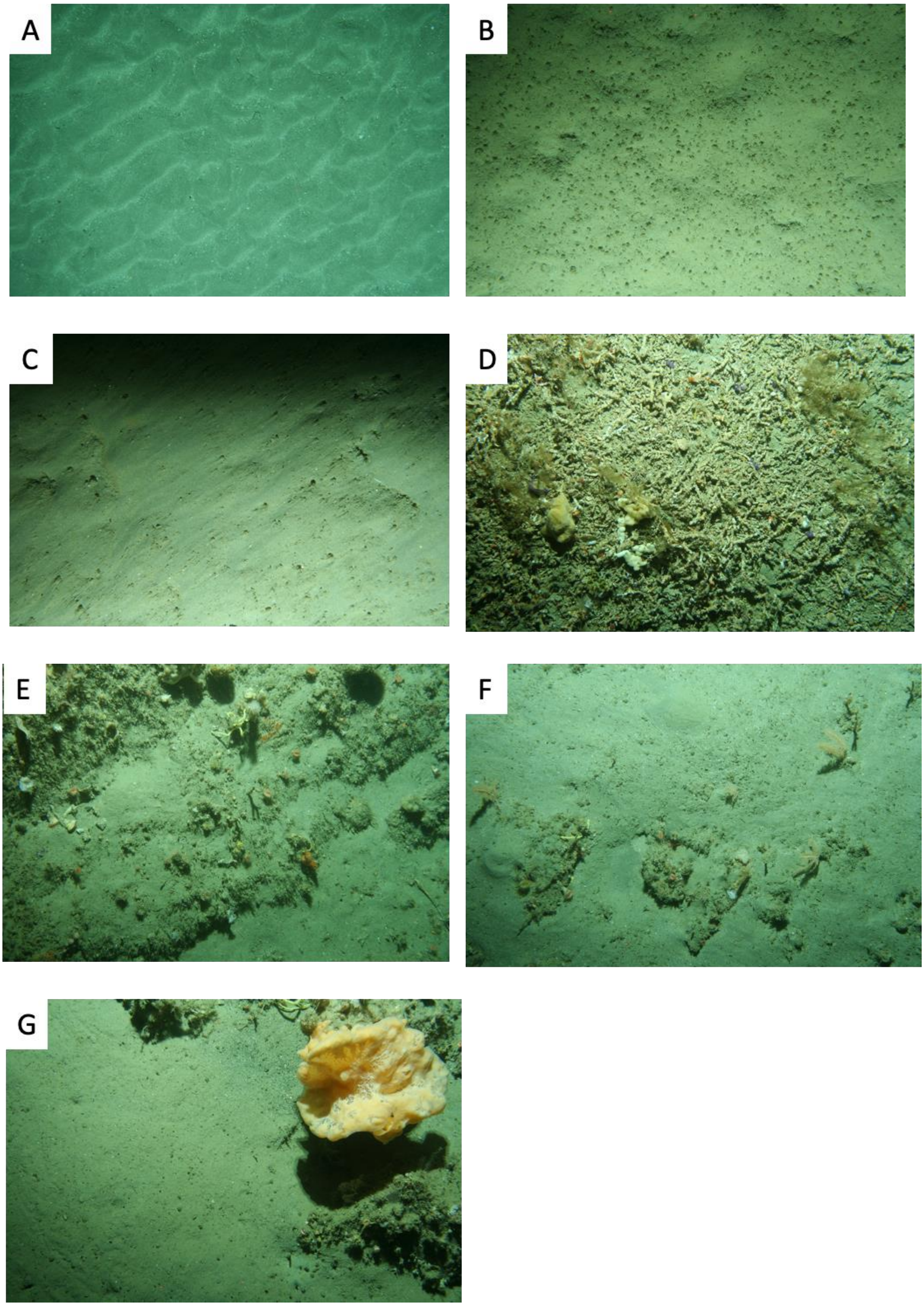
C. Similar sediment to B, but disturbance possibly due to trawling.

D. Large clump of biogenic habitat dominated by the calcareous tubeworm, *Galeolaria*. Some damage is also apparent with scattered broken tubes.

E. Typical small rock outcrop with cup corals (some broken and lying over), fragile bryozoan colonies, small sponges, soft coral and a circular saw shell.

F. Sediment covered small rock outcrop with pink Antipatharian black coral, sponges and bryozoan colonies.

G. Large glass sponge (*Symplectella rowi*) on a rock outcrop.


A
B
C
D
E
F
G

Appendix 2

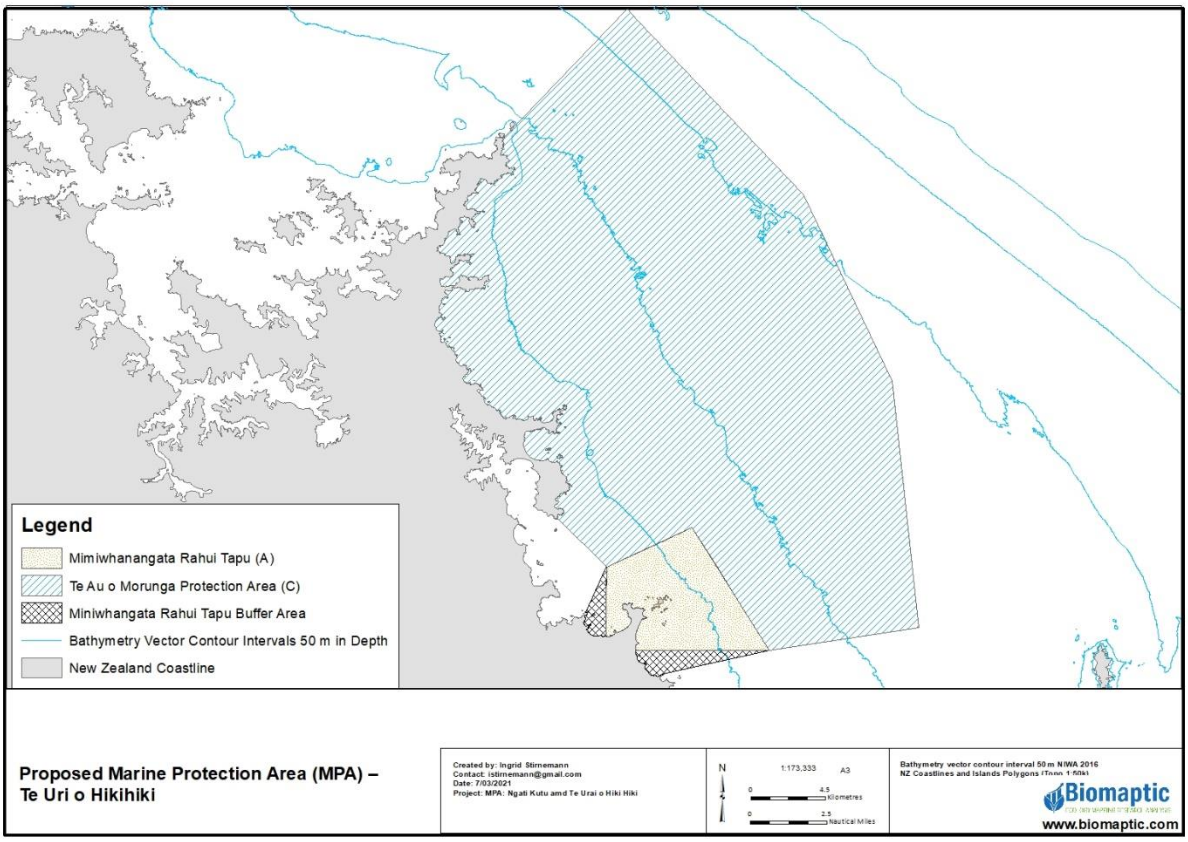


Figure 23 Maps 1 of proposed controls including identification of area C

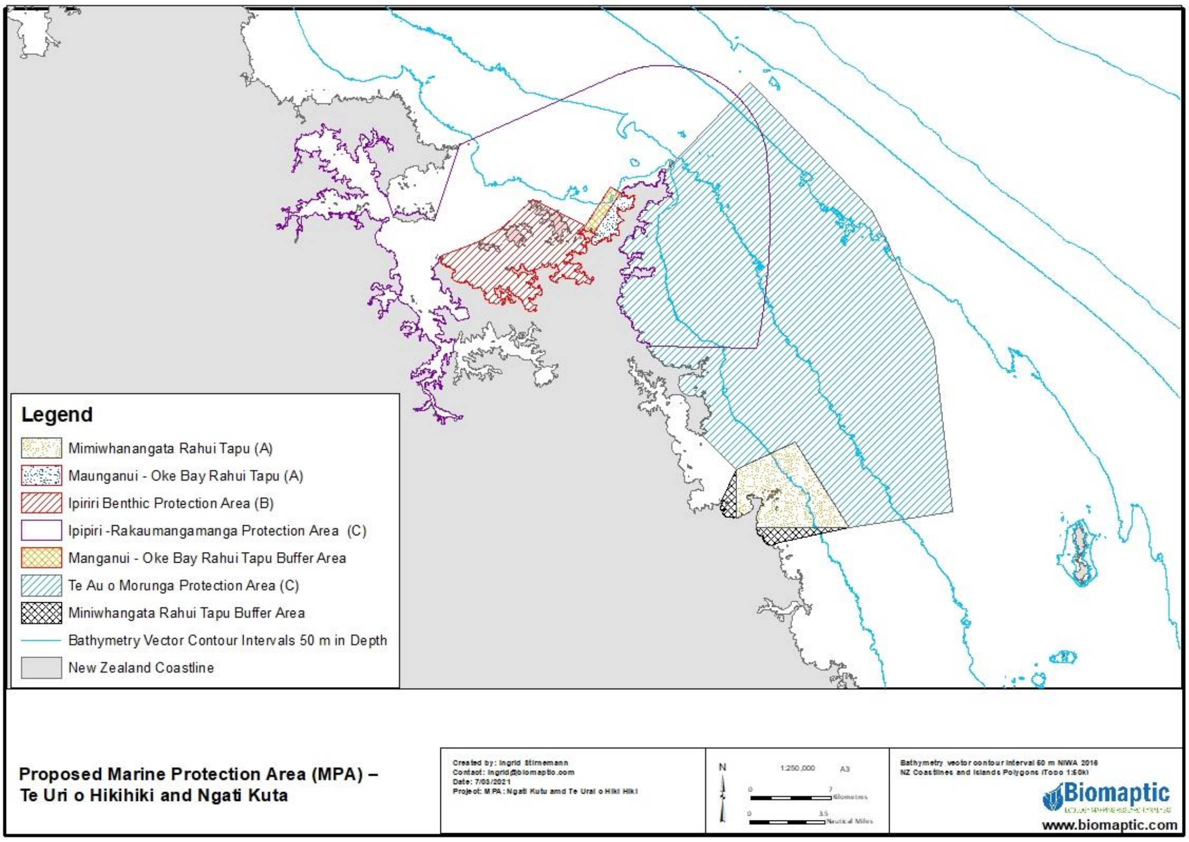


Figure 24 Maps 2 of proposed controls including identification of area C

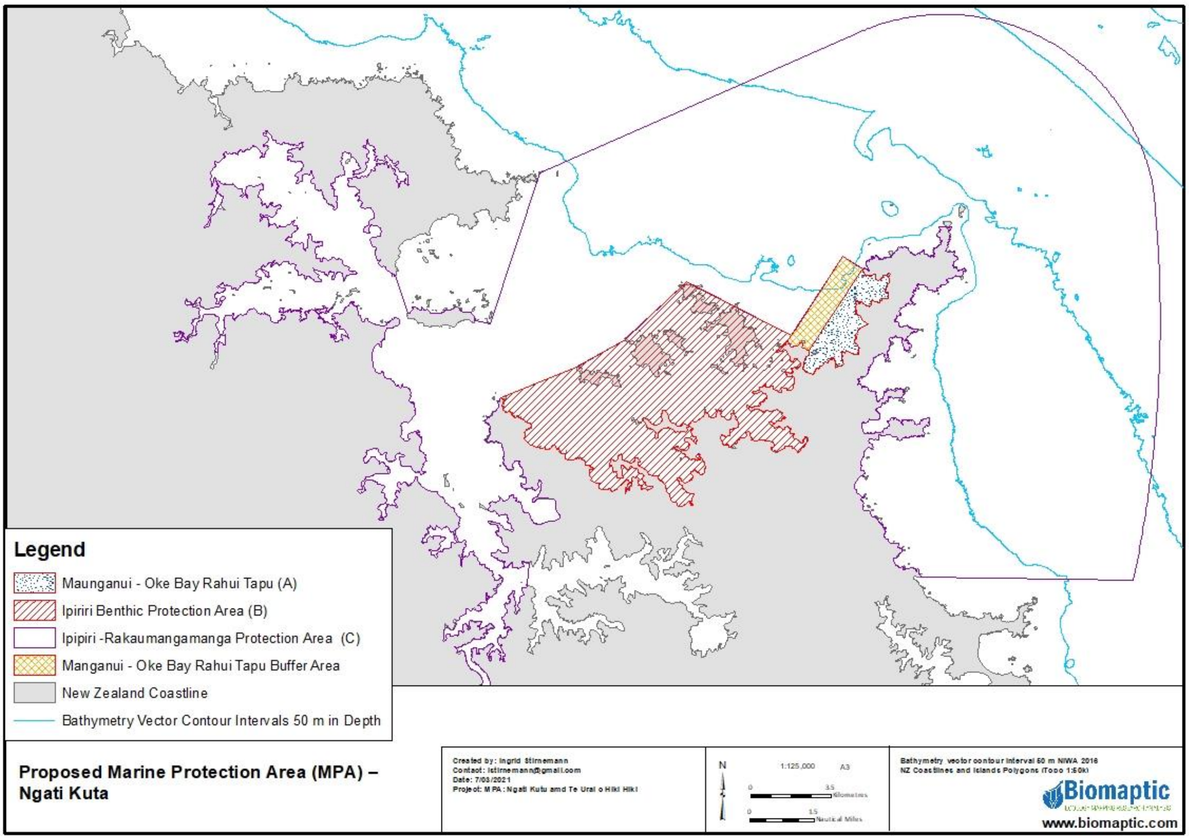


Figure 25 Maps 3 of proposed controls including identification of area C

Table 7 Benthic bycatch by kg for all recorded events in the area surrounding coastal Northland over a 10 year period (2009-2019) within 10nm of the coast (covering area in Fig 14) by fishing method.

Fishing method	Effected taxa	Weight of taxa per event where weight recorded
	ONG - Sponges	3
	ONG - Sponges Total	
Total		3
Bottom long lining	COB - Black corals	0
		0.3
		1
		2
		3
		4
	COR - Hydrocorals	2
	COU - Coral (Unidentified)	0
		1
		2
	CSB - Corals, Sponges and Bryozoans	0
		1
		2
		3
	ONG - Sponges	0
		0.1
		0.2
		0.4
		1
		2
		3
		4
		5
	STI - Black coral	1
		2
		5
	STL - Rose lace corals	5
BLL Total		50
Bottom trawling	BOO - Bamboo coral	1
		2
	COB - Black corals	1
		2
		3
		5
		7
		10
		12
		15
		16
		17
		20
	COU - Coral (Unidentified)	1

		2 3 7
	CSB - Corals, Sponges and Bryozoans	1 2 3 4 5 8 10 12 15 30 200
	ONG - Sponges	1 2 3 4 5 6 7 8 10 15 20 30 40 45 60 70 80 120
	STP - Solitary bowl coral	600
BT Total		1540
Danish Seine	ONG - Sponges	1 2 3 4 6
		16
Precision bottom trawling	COB - Black corals	0.5 1 8 9.5
	COU - Coral (Unidentified)	0 1 2
	CSB - Corals, Sponges and Bryozoans	2 25
	ONG - Sponges	1 2 3 4 5

		10 15 20 30 40 60
Total		239
Seine net	COB - Black corals	2 3
	COU - Coral (Unidentified)	1
	COZ - Bryozoan	0.5
	ONG - Sponges	1 5
Total		12.5