ATTACHMENT SIXTEEN
Assessment of Fish and Fisheries Effects (R.O.Boyd)

McCALLUM BROS LTD
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Assessment of Effects on Fish and Fisheries in Te Ākau Bream Bay

Prepared for McCallum Bros Limited®
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R O Boyd – MSc Hons
April 2025

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Glossary of Terms

Te Reo Māori	Definition
Aotearoa	New Zealand
Araara	Trevally
Haku	Kingfish
Hapu	Māori descent group of an iwi.
Hautere	Jack mackerels
Iwi	Largest political grouping in pre-European Māori society.
Kaimoana	Seafood, shellfish.
Kaitiaki	Guardian, steward, typically over an environmental area.
Kahawai	*Arripis trutta*
Kina	Sea Urchins
Kōheru	*Decapterus koheru*
Kumukumu	Gurnard
Kuparu	John Dory
Mangō	Sharks
Moana	Ocean
Mōhimohi	Pilchard
Paepae-o-Tū	Bream Tail
Patuharakeke	Hapu of Te Ākau Bream Bay
Poupouwhenua	Marsden Point
Rāwaru	Blue Cod
Rohe	Boundary, district, region, territory, area, border (of land).
Tāmure	Snapper
Tangata whenua	People of the land.
Taonga	Highly valued or prized; treasured.
Tawatawa	Blue mackerel
Te Ākau Bream Bay	Bream Bay
Te Parawhau	Hapu of Te Ākau Bream Bay
Te Whara	Bream Head
Tīkapa Moana – Te Moananui-a-Toi	Hauraki Gulf
Tipa	Scallops
Tūangi	Cockle
Tuatua	Bivalve clam
Wairua	Wellbeing

EXECUTIVE SUMMARY

Decades of fishery research trawl surveys in the area provide a reliable description of the diverse demersal (bottom dwelling) fish community present in Te Ākau Bream Bay. It is comprised of common fishes widespread on the northeast coast. Tāmure (snapper) dominates abundance but many other valued species such as kuparu (John dory), kumukumu (gurnard), mangō (sharks), pātiki (flounders) and whai (rays) are also present. The demersal fishes mostly feed on benthic organisms that live in or on the soft sediment seafloor present in the Application Area and similar habitats on the northeast coast. Most of the demersal species are generalist opportunistic predators that forage on a wide range of crustaceans, polychaetes, molluscs and echinoderms and other fish.

The pelagic fishes found in Te Ākau Bream Bay roam along the coast moving from area to area, typically aggregated in fast moving schools feeding on plankton or preying on smaller fishes. Aerial surveys indicate hautere (jack mackerels), tawatawa (blue mackerel), araara (trevally) and kahawai are the most abundant, along with valued but less abundant haku (kingfish), mōhimōhi (pilchard) and kōheru (*Decapterus koheru*). The populations of most of these species also extend all along the northeast coast.

Pipi and tūangi (cockle) occur at intertidal or shallow subtidal beaches and sandbanks on the coastal margins and around the entrance to Whangārei Harbour. These include Ruakākā Estuary, One Tree Point, Marsden Bank, Mair Bank, Snake Bank, and MacDonald Banks where shellfish surveys are routinely conducted to monitor sustainability. Tipa (scallops) occur in deeper waters, including the Application Area and shallower waters at Smugglers Cove and Urquharts Bay. Due to sustainability concerns, all shellfish harvesting is currently prohibited at Marsden and Mair Banks. The entire Northland (SCA1) tipa (scallop) fishery including Te Ākau Bream Bay was closed in 2022.

Commercial and non-commercial fishing, predominantly targeting tāmure (snapper), occurs throughout Te Ākau Bream Bay. Both fishing effort and catches are moderate compared to other areas of the greater Tīkapa Moana – Te Moananui-a-Toi (Hauraki Gulf) where catches are higher. The spatial distribution of the fishery is consistent with the spatial distribution and areas of highest abundance of tāmure (snapper) from the research surveys.

Fishes are highly mobile. They typically avoid or flee temporary disturbance and usually return when it ceases. Most coastal fishes are adapted to naturally variable suspended sediment levels arising from storms and runoff. Benthic biota recovery is expected to commence immediately post-extraction and take 2-3 years. The proposed three (3) year sand extraction cycle allows for benthic biota to recover at each location. As the benthic community recovers fish will progressively return to feed in parts of the Application Area affected by sand extraction.

The mobility of fish and their avoidance behaviour together with the minimal impact of extraction activity on water quality and underwater noise gives confidence that the effects of sand extraction activity on Te Ākau Bream Bay fish and fisheries will be **low to negligible**.

1.0 INTRODUCTION

1.1 Background

This report describes the fisheries resources and commercial and non-commercial fishing in Te Ākau Bream Bay at or near the site of the application for sand extraction by McCallum Bros (the Application Area). Te Ākau Bream Bay lies within the Patuharakeke rohe (region) (Figure 1) and the Te Parawhau rohe (Figure 2).

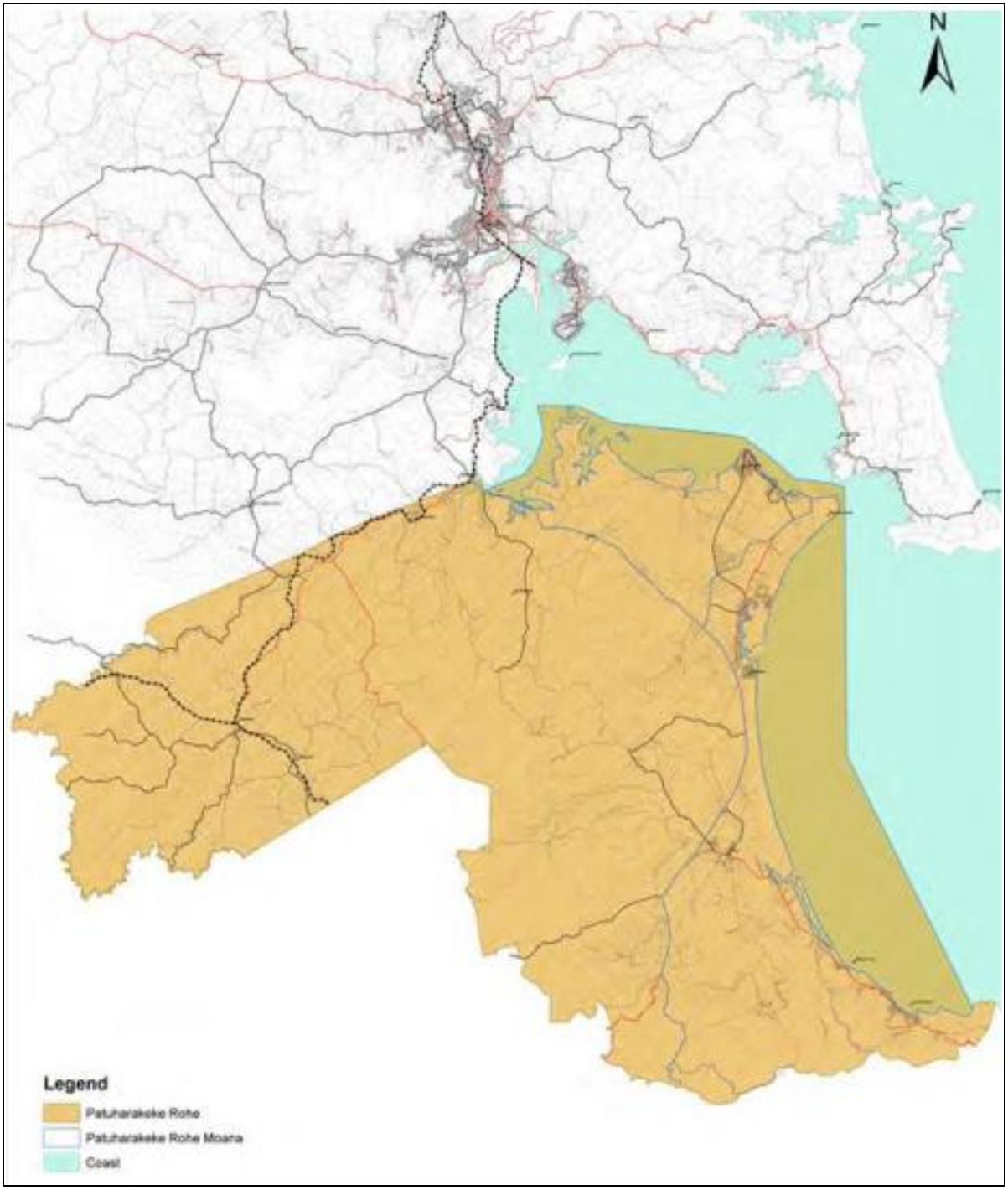

Figure 1: Patuharakeke Mainland Rohe for Contemporary Management Purposes (Source**:** Patuharakeke Hapu Environmental Management Plan 2014)

Figure 2: Te Parawhau Rohe Maunga and Te Parawhau ki Tai (Source: pers. comm. Te Parawhau).

Māori customary interests and utilisation of fish and shellfish resources in Te Ākau Bream Bay are not addressed in this report. However, it is acknowledged that Patuharakeke and Te Parawhau are the kaitiaki (guardians) of the rohe moana and are deeply interested in the wairua (wellbeing) of all kaimoana (seafood and shellfish) of the area, and its environment. Many species are taonga (highly valued or prized; treasured). While customary use of these resources is not addressed, some of the information on non-commercial harvesting in the report likely includes some fish and shellfish taken by Patuharakeke, Te Parawhau and wider tangata whenua (people of the land) for personal use.

The primary purpose of the report is to identify the fishery resources and commercial and non-commercial fishing in Te Ākau Bream Bay and the Application Area that may be affected by the sand extraction.

More than a century of fishery investigation and research has provided a comprehensive body of information on many of the most important commercial and non-commercial fish and shellfish species in the area. Commercial and non-commercial fishing is widespread throughout the coastal waters of Te Ākau Bream Bay and the adjacent Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf).

Detailed information on what is known about the principal marine fishery resources in Aotearoa New Zealand, including the most recent stock assessments, can be found in annual Fisheries Assessment Plenary reports (Fisheries New Zealand, 2024a, 2024b) (Plenary Reports). The Plenary Report for each species or stock summarises what is known about each fish stock, including the spatial distribution and abundance, biology, commercial, non-commercial, and customary harvests, and the current population (or stock) status, as well as related environmental and ecosystem considerations.

The principal sources of information for this report are the Plenary Reports, various Ministry for Primary Industries (MPI) and Fisheries New Zealand publications, scientific papers and reports as well as the published scientific literature and miscellaneous publications.

Due to the number of maps and tables presented in the report, the tables and Figures 3 to 20 are placed after the Reference list.

1.2 Structure of the Report

The report commences with a summary of the principal fish and shellfish resources found in the outer Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) area including within Te Ākau Bream Bay. Demersal species distribution information is primarily based on a series of fishery research bottom trawl surveys starting in the 1960s and continued until the present time although they were paused for two decades from 2000 to 2019. Pelagic fishes have survey coverage from periodic aerial surveys. Intertidal and subtidal shellfish surveys have been conducted around the coastal fringe and within Whangārei Harbour. Scallop dredge surveys in Te Ākau Bream Bay started in the 1980s, but were not regular, with the most recent in 2021. Basic biological information for the main species is largely drawn from the Plenary Reports. The research information summary is followed by a brief description of commercial and non-commercial fishing activity and its spatial distribution.

The final section of the report discusses the potential impacts of sand extraction on fisheries resources and on commercial and non-commercial fishing.

2.0 FISH AND SHELLFISH FAUNA OF TE ĀKAU BREAM BAY

2.1 Background - Characteristics of Fishery Resources

A key characteristic of most marine fishery resources is their mobility and ability to move, migrate, and disperse. They do so either actively by swimming (e.g., most fishes) or by passive dispersal as they are carried from one area to another by coastal currents (e.g., the eggs and larvae of fish, shellfish, and other invertebrates). Passive dispersal allows the eggs and larvae of shellfish species that are not mobile or that have limited mobility as adults, such as tipa (scallop) or pipi, to be transported over considerable distances before settling on suitable areas of seabed to develop and grow.

Overall, the mobility and dispersal of fish and shellfish populations mean that most fishery resources have no sharp boundary to their spatial distribution which may expand, contract, and vary over time. This mobility means that both their spatial distribution and local abundance in an area of interest are often most reliably determined through repeated observations over time.

The presence of each species is strongly associated with its preferred habitat and available food. The seabed in the Application Area is relatively uniform, comprised mainly of unconsolidated soft sandy sediments. The benthic organisms that live within or on the surface of these soft substrates are a source of food for many of the demersal fish species found in the area.

2.2 Te Ākau Bream Bay Fish and Shellfish Resources

2.2.1 Demersal fishes

Demersal fish are one of the most studied taxonomic groups in Aotearoa New Zealand due to their importance for commercial fisheries. Fishery research bottom trawl surveys in the wider Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) provide a wealth of information on the demersal fishes of Te Ākau Bream Bay. Regular research trawl surveys in the waters of the greater Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) as far north as Te Whara (Bream Head) were undertaken over a 34-year period from the early 1960s to 1997 when they ceased for two decades. The results of these surveys were summarised and analysed by Kendrick and Francis (2002). Because these surveys used bottom trawls, they captured species that are primarily demersal in behaviour that tend to be found on or just above the seabed. Bottom trawls are ineffective in capturing pelagic fishes which mostly inhabit mid-water or live close to the sea surface although it is not uncommon for some to be caught in small numbers.

The primary purpose of these trawl surveys was to assess and monitor the spatial distribution and abundance of key species, predominantly juvenile and adult tāmure (snapper), kuparu (John dory) and kumukumu (gurnard) to monitor changes in their populations over time. In total, 1381 individual trawl tows were undertaken throughout the Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) including Te Ākau Bream Bay.

Figure 3 shows the location of all research trawl station survey positions over the 34-year period. There were multiple stations in Te Ākau Bream Bay. It should be noted that these trawls did not take place in water depths of less than about 10 m or on/over rocky habitats. The cod end mesh size of the research trawl nets (≈40 mm) was smaller than commercial nets (minimum 125 mm) which enabled the research surveys to capture many smaller fishes, including juveniles, that may escape commercial trawl gear.

Two different research vessels undertook the surveys and there were some differences in the survey designs. RV *Ikatere* (length 19 m) stations were spread relatively evenly throughout the survey area at all times of the year, from 1964 to 1980, giving some seasonal coverage. RV *Kaharoa* (length 28 m) stations were trawled in either spring or autumn from 1982 to 1997 and were more concentrated in the inner Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf). Trawls by both vessels were typically towed for ≈0.7 nm (1.30 km) from the start point.

2.2.2 Catch Rates of the Main Demersal Species

Tāmure (snapper), kuparu (John dory) and kumukumu (gurnard) were the most frequently caught commercially valuable species (Table 1).

Figures 4, 5, and 6 give the spatial distribution of the relative abundance of tāmure (snapper), kuparu (John dory) and kumukumu (gurnard) respectively from the combined *Ikatere* and *Kaharoa* catches (note that the catch rate scale is different in each of these three plots). The catch rates of tāmure (snapper) were very much higher than either kuparu (John dory) or kumukumu (gurnard). The highest tāmure (snapper) catch rates were in the inner Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) and outer Firth of Thames. Kuparu (John dory) catch rates were also higher in the inner Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) than elsewhere. Consistently higher kumukumu (gurnard) catch rates occurred in Te Ākau Bream Bay than elsewhere. Sediment type was an important factor in the distribution of many species. Tāmure (snapper) showed a preference for mud, kumukumu (gurnard) preferred sand, and kuparu (John dory) were most associated with mud substrates but some high catches occurred over sand.

Tāmure (snapper), kahawai, and haku (kingfish) were recorded within the Application Area by underwater cameras during surveys in 2024 (West *et al*. 2025).

2.2.3 2019 and 2020 Trawl Surveys

After a two-decade hiatus, regular fishery research trawl surveys recommenced in the Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) in 2019. The survey design for the new surveys was optimised for pre-recruit (juvenile) tāmure (snapper) (Parsons et al. 2021). While strata deeper than 75 m were excluded to better sample juvenile snapper, the new series of trawl surveys largely replicated the spatial coverage of the previous series by incorporating Te Ākau Bream Bay within the survey area.

The 2019 trawl survey results (Table 2) for tāmure (snapper), kumukumu (gurnard), and kuparu (John dory) show a similar pattern of species diversity and occurrence to the earlier 34-year survey series. More than 50 species of fish and shellfish were caught in the 2019 survey. Tāmure (snapper) was the most frequently caught fish, occurring in 100% of 2019 survey trawls. The next three most frequently caught were the same as in the combined 34-year series results in Table 1: these were kumukumu (gurnard), hautere (jack mackerels), and kuparu (John dory). By weight, tāmure (snapper) comprised 89.0% of the total weight of all species caught in the 2019 survey (Parsons et al. 2021) and 89.9% of the total catch weight in the 2020 survey (Parsons & Bian 2022). In comparison, the combined weight of kuparu (John dory) dory and kumukumu (gurnard) made up only 1.0 % of the total catch weight in each of the 2020 and 2021 surveys.

Parsons & Bian (2022) provide plots showing the spatial distribution of catch quantity expressed as (kg/km^{-2}) for pre-recruit and adult tāmure (snapper), kuparu (John dory) and kumukumu (gurnard) respectively for each of the annual RV *Kaharoa* trawl surveys from 1984 to 2019. These are shown in Figures 7-10. The annual plots show that there is considerable variation in spatial distribution and abundance from year to year. It reinforces the value of using repeat surveys over time to best describe the community of highly mobile fishes in an area and to determine the relative abundance of the different species.

2.2.4 Demersal Species Presence and Diversity

In summary, more than fifty species or species groups exceeded a 1% threshold of occurrence in the combined research tows over the 34-year period, demonstrating the diversity of demersal fish present in the wider Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf), including Te Ākau Bream Bay. Many of these species are vulnerable to both commercial and non-commercial fishing and commercially valuable although only a few dominate harvests. Most of the least frequently caught species occurred in very small numbers with some only caught on a single occasion. The research trawl surveys did not target the Application Area and therefore the results cannot verify the actual presence of all the species found in the surveys as occurring within it. However, knowledge of the wide distributions of most of the species, their preferred habitat, their mobility, and their biology and behaviour is sufficiently compelling to conclude that they will be or should be presumed to be present within the Application Area either all the time or some of the time.

An atlas of fish distributions from research trawl surveys (Anderson et al. 1998) shows that almost all of the fishes caught in the Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) trawl surveys are widely distributed around coastal Aotearoa New Zealand and/or northern coastal waters. While the demersal fish community in Te Ākau Bream Bay and the Application Area is diverse and mainly comprised of common and widespread species, tāmure (snapper) clearly dominates it.

2.2.5 Pelagic Fishes

Pelagic fishes of the northeast coast and Te Ākau Bream Bay have not been systematically surveyed with a methodology aimed at monitoring species presence and abundance over time. This is partly due to their lower commercial value and partly because of the cost and difficulty of systematically surveying populations of highly mobile fishes that roam extensively along the coast. Most data on pelagic species occurrence, distribution, and relative abundance comes from aerial surveys and catch information from the commercial fishery for individual species. Aerial observational data are collected by pilots flying light aircraft in support of purse-seine vessels targeting schooling pelagic species. These aerial survey data have been collected on the northeast coast since the 1970s but are limited in that they cannot provide estimates of absolute abundance at any level of precision (Taylor 2015).

Bagley et al. (2000) provide distribution maps of the aerial sightings compiled from the Fisheries New Zealand aerial sightings database. They note that aerial surveys have been aimed only at species of interest to the purse-seine fleet and only in areas where these vessels operate. The principal pelagic species found all along the northeast coast and Te Ākau Bream Bay include hautere (jack mackerels), tawatawa (blue mackerel), kahawai (*Arripis trutta*), and araara (trevally). They mainly occupy midwater depths up to the surface and typically occur in fast moving schools that range along the coast. Schools of these species often rapidly appear and disappear from an area, hence the use of aircraft and pilots to locate schools for the purse seine vessels. Other important pelagic fishes in Te Ākau Bream Bay include haku (kingfish), kōheru (*Decapterus koheru)* and mōhimōhi (pilchard), but they are less abundant. Most of the pelagics feed on plankton or smaller fishes in the water column, with the smaller fishes such as juvenile hautere (jack mackerels), kōheru (*Decapterus koheru)* and mōhimōhi (pilchard) often forming prey for the larger and faster kahawai and haku (kingfish).

2.2.6 Other Fishes

There are nine fully protected marine fish species under the Wildlife Act 1953[1]. All of these protected species are vulnerable to fishing. Francis & Lyon (2012) and Fisheries New Zealand (2022) summarise fishery interactions and population information for these protected fish species. Based on the distributions and fishery interactions, only mangō taniwha (great white shark) are likely to periodically enter Te Ākau Bream Bay and migrate through the Application Area. Mangō taniwha (great white shark) are classified as Nationally Endangered under the New Zealand Threat Classification System (Duffy et al. 2018). Recent newspaper articles document sightings of mangō taniwha (great white shark) within and around the entrance to Whangārei Harbour[2].

A number of other fishes not found in the research trawl surveys are present within the Application Area. Long-finned sand diver (*Limnichthys polyactis*), New Zealand sand diver (*Tewara cranwellae*), sand snake-eel (*Ophisurus serpens*) and New Zealand lumpfish (*Trachelochismus pinnulatus*) were captured while undertaking benthic ecological sampling in either the benthic grab samples or in the epibenthic extraction tow samples in March 2024 (West *et al*. 2025). These species are either burrowers or are very closely associated with the surface of the seabed. All are common in northern Aotearoa New Zealand waters. Potential effects on these and other fishes found in Te Ākau Bream Bay are addressed in the assessment of ecological effects (West & van Winkel 2025).

2.2.7 Shellfish Surveys

A number of intertidal and subtidal shellfish surveys have been undertaken on a fairly regular basis along the coastal fringe of Te Ākau Bream Bay and inside the entrance to Whangārei Harbour. Over recent decades these include surveys of Mair Bank pipi (Fisheries New Zealand 2024a), Snake and MacDonald bank cockle beds (Fisheries New Zealand 2024a), intertidal shellfish surveys on Marsden Bank, in Ruakākā Estuary, and at Mangawhai Harbour to monitor the health of cockle and pipi populations (Berkenbusch & Hill-Moana 2024). Dive surveys have been conducted to monitor scallop populations at Urquharts and Smugglers Cove (Williams et al. 2024). Patuharakeke have also monitored pipi populations at Mair Bank, Marsden Bank, One Tree Point and Ruakākā estuary (Shirkey 2019). The depletion of some of these shellfish beds has led to the introduction of a range of management measures at fine spatial scales with temporary closures to shellfish harvesting currently in place at the request of tangata whenua (people of the land) at Marsden Bank and Mair Bank.

The tipa (scallop) (*Pecten novaezelandiae*) is most common in depths from 10-60 m on sand, shell and gravel substrates and occurs all around Aotearoa New Zealand. Tipa (scallop) tend to be patchily distributed in small and large beds, some of which are persistent and others ephemeral (Hartill & Williams 2014). Whilst generally considered to be sessile, the tipa (scallop) is capable of rapid short distance movement by opening and then clapping its shell closed to jet water that may propel it a metre or more over and across the seabed. They are unable to move appreciable distances and do not appear to move much from their initial settlement location during their lifetime (Morrison 1999). They are often found in enclosed and semi-enclosed harbours and bays where it is thought that circulating currents tend to retain larvae. Tipa (scallop) are broadcast spawners that reproduce by releasing their gametes into the water column. Larvae remain pelagic and drift for about three weeks before the spat settle on suitable substrates. In Northland's east coast waters, the main spat settlement occurs in January.

[1] https://www.doc.govt.nz/nature/habitats/marine/protected-marine-fishes-and-invertebrates/

[2] Northern Advocate, 23 Feb 2016; Stuff, Apr 14, 2017; Northern Advocate, Jan 15, 2025.

Research dredge surveys of Northland's tipa (scallop) beds (Figure 11) were undertaken over the period 1992 to 2021 although a commercial fishery had developed as early as the 1980s. The primary purposes of the dredge surveys were to estimate population sizes, set quotas for the commercial fishery, and monitor trends. No research surveys took place in years when their abundance was judged to be too low to potentially support a commercial fishery. The biomass estimates for each tipa (scallop) commercial bed in Northland are shown in Figure 12. From 1992 and 2007 there were regular surveys, but none were undertaken after 2007 until 2021.

The estimated Te Ākau Bream Bay tipa (scallop) biomass from dredge surveys was very low in most years except in 2005 and 2006. Te Ākau Bream Bay, does not have an untouched/pristine benthic environment, the embayment has historically been extensively dredged, with a total of 160,649 scallop dredge tows recorded from 1990 to 2021 (MacGibbon and Mules, 2023). Surveys carried out in 2021 showed an overall decline in biomass and abundance throughout Northland with biomass estimates at or below the lowest historical levels in all areas. Following these results and the deteriorating state of Northland's tipa (scallop) fisheries, the Minister for Fisheries and Oceans closed the entire Northland (SCA 1) commercial and non-commercial tipa (scallop) fishery on 1 April 2022 due to sustainability concerns. The closure includes the waters of Te Ākau Bream Bay.

2.2.7 Summary

The mobility of fishes that results in spatial and temporal variation in their presence and abundance means that a time series of data provides the most complete and representative picture of the fish community in an area. Several decades of data from fisheries research bottom trawl surveys in the Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) and Te Ākau Bream Bay indicate a wide range of demersal fishes are present, dominated by tamure (snapper). Overall, the principal demersal fishes present or likely to be found in Te Ākau Bream Bay are common, widespread, and typical of the fish community associated with the inshore soft-seabed habitat found along much of the northeast coast. Tāmure (snapper) was clearly the dominant fish in the research trawl surveys, making up nearly 90% of the total catch weight of all species. Catches of tāmure (snapper) were modest in the trawls in Te Ākau Bream Bay and highest in trawls conducted in the inner Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf). Two of the other most abundant and commercially valuable minor species, kuparu (John dory) and kumukumu (gurnard), were much less abundant overall.

There is less data on pelagic fishes. Hautere (jack mackerels), tawatawa (blue mackerel), kahawai, and araara (trevally) are the most abundant species, with haku (kingfish), kōheru and mōhimōhi (pilchard) also present in the area. These fishes form highly mobile aggregations or schools that range all along the northeast coast. Schools of these pelagic fishes are constantly entering and leaving areas such as Te Ākau Bream Bay as they move about the coast.

The shellfish resources of Te Ākau Bream Bay are typical of coastal areas. Populations of pipi and tuangi (cockle) occur in suitable intertidal habitats on the coastal fringe, tipa (scallop) occur sub-tidally near the harbour entrance and in the central part of Te Ākau Bream Bay. The tipa (scallop) fishery in Te Ākau Bream Bay was closed in 2022 due to low biomass and sustainability concerns.

3.0 TE ĀKAU BREAM BAY COMMERCIAL FISHERY

3.1 Introduction

Paul (2014) provides a comprehensive and useful overview of the history of the inshore commercial finfish fishery in the wider Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) and how it developed from its origins until the present. The tāmure (snapper) (*Pagrus auratus*) fishery in the Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) has consistently been the largest and most valuable inshore fin fishery in Aotearoa New Zealand throughout the past century. It is the primary fish species targeted by commercial fishers in Te Ākau Bream Bay. There has been little change in the commercial tāmure (snapper) fishery in Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) in the past 40 years although there has been a gradual reduction in vessel numbers and increased use of technology. Longline and set net vessels still concentrate their effort in areas closer to shore and in areas closed to trawling and Danish seining as they have done for the past century. Trawlers and Danish seiners focus a lot of their effort in areas where tāmure (snapper) aggregate in the spring and spawning season. These schooling areas lie well south of Te Ākau Bream Bay. In winter, trawlers move into deeper water of the outer Gulf where tāmure (snapper) tend to disperse after the summer.

Crossland (1981a) and Fisheries New Zealand (2024a) describe the biology of tāmure (snapper). It is one of the most abundant demersal generalist predators found in the inshore waters of northern New Zealand , occupying a wide range of habitats, including rocky reefs, and areas of sand and mud seabed. Tāmure (snapper) are serial spawners and release many batches of eggs over an extended season during spring and summer. There are high abundances of very young tāmure (snapper) in shallow harbours and estuaries. As they grow older and larger the juveniles progressively disperse into less sheltered deeper waters. Adults aggregate in schools in late spring, spawn over the summer, and then disperse. The commercial fishery targets them in areas where they aggregate during this schooling season.

The diet of tāmure (snapper) is diverse and opportunistic. It feeds on benthic crustaceans, polychaetes, echinoderms, molluscs, and other fish with crustacea the main food group (Coleman 1972; Godfriaux 1969, 1974; Stevens et al. 2011). Large fish feed on larger hard bodied crabs and bivalve shellfish.

Analysis of tagged tāmure (snapper) returns by Crossland (1982) confirmed findings of earlier studies by Paul (1967), Crossland (1976), and Tong (1978) that generally they do not move long distances. Most (> 60%) are recaptured within 9 km of the tagging site and it is not uncommon for a tagged fish to be caught very close to where it was released. Some migrate further – a few fish tagged in Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) were recovered the as far as Bay of Plenty. The tagging studies also confirm seasonal movement associated with the spring/summer spawning period.

3.2 Trawl and Danish Seine Fishery

Tāmure (snapper) is the main target species for both bottom trawling and Danish seining in Te Ākau Bream Bay although other species such as kuparu (John dory) and kumukumu (gurnard) are targeted at times. Trawling and Danish seine fishing in Te Ākau Bream Bay are both prohibited west (shoreward) of a line from Busby Head to the shore at the western entrance to Andersons Cove by regulation (Figure 13).

Detailed commercial catch quantities by species and location (by latitude and longitude) in Te Ākau Bream Bay are held by Fisheries New Zealand but are unavailable under the Official Information Act because this level of detail is deemed commercially confidential. Even if this data were available, it not possible to attribute most commercial catch data to a specific location where fish were caught – such as within the Application Area. Most inshore trawling events only report the start position of each tow. When targeting tāmure (snapper) the average trawl distance is 10-15km (Baird et al. 2015). Without an end point position, the direction of the tow is unknown. The recorded catch for each trawl event could be taken anywhere within the path of the tow.

However, aggregated information over a period of years showing the distribution of commercial fishing effort and total catches by fishing method is available in the form of maps that MPI make available online from time to time. These maps show the spatial distribution of fishing effort and catch within Te Ākau Bream Bay and the surrounding area. A number of assumptions need to be made for this kind of spatial analysis to deal with unknowns, including the tow direction and lack of an end point position for trawl events (for example see Baird et al. 2015). Nonetheless the MPI maps provide sufficient information to describe the spatial distribution of commercial fishing with confidence.

Figures 14 and 15 respectively show the spatial distribution of bottom trawl fishing effort and catch weight plotted in a 1 nm^2 grid (1 nm = 1.85 km^2). Commercial bottom trawling occurs throughout the outer portion of Te Ākau Bream Bay where it is not prohibited. The effects of the trawling prohibition and a prohibition to all fishing along a cable pathway leading out of the Waitemata Harbour can be clearly seen. In the wider area shown on the maps, both trawl effort and catch are highest in the western Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) south of Cape Rodney and in the area south of Cape Colville. They are much lower in Te Ākau Bream Bay. These are the same areas where the research trawl surveys showed higher and lower catch rates respectively for tāmure (snapper). Note that the trawl data shown in each grid is based on the starting position of each trawl event and that there have been assumptions about the direction of the trawl and that it was in a straight line.

There are no similar available maps showing the spatial distribution of Danish seine fishing in the Tīkapa Moana - Te Moamamui-ā-Toi (Hauraki Gulf). Individual Danish seine shots can encompass several square kilometres. Danish seine fishing occurs in similar areas as bottom trawling. Like bottom trawling, Danish seining predominantly targets tāmure (snapper) and occurs over soft seabeds.

3.3 Bottom Longline Fishery

Tāmure (snapper) is the main target species of the bottom longline fishery. The maps in Figures 16 and 17 respectively show the spatial distribution of the starting positions of longline fishing effort and catch plotted in a 1 nm^2 grid. Longlines may be set in any direction from the start point and may extend for up to several kilometres.

Effort is higher immediately inside the trawl limit line and in the area closer to the shore. This is particularly evident between Ruakākā and Poupouwhenua (Marsden Point) where Te Whara (Bream Head) also gives shelter from northerly seas. It may also be that longliners fish there because they experience higher catch rates west of the trawl and Danish seine limit line.

Overall, the maps in Figures 16 and 17 show longlining is spread throughout Te Ākau Bream Bay including within the Application Area.

3.4 Set Net Fishery

Set nets target a range of species, including but not limited to tāmure (snapper), mango (various shark species), kahawai, and araara (trevally). The maps in Figures 18 and 19 respectively show the spatial distribution of the starting positions of commercial set netting events in Te Ākau Bream Bay and the wider Tīkapa Moana Te Moananui-ā-Toi (Hauraki Gulf). There is a concentration of set netting in the area around the outer entrance to Whangārei Harbour. This reflects the targeting of fish that migrate in and out of the harbour, such as mango (sharks), that enter the harbour seasonally to reproduce. Many set net vessels are small and the spatial distribution of set netting closer to the sheltered waters around the entrance to Whangārei Harbour also reflects this.

3.5 Tipa (Scallop) Fishery

The Northland tipa (scallop) fishery (SCA1) was closed in 2022. However, the SCA1 commercial fishery was formerly important to a small number of commercial fishers based in the local area.

Hartill & Williams (2014) provide a detailed characterisation of the Northland tipa (scallop) fishery. Issues faced by Northland fishers over the years were low tipa (scallop) numbers with only small patches of higher density worth fishing, poor condition, and a high proportion of the population falling below the minimum legal size of 100mm (Hollings, pers. comm.). Catches required considerable sorting at sea. Overall, the fishery was small and the operating costs were high. Returns from the Northland tipa (scallop) commercial fishery were always modest even though tipa (scallops) are a high-value product. In the period from the 1980s until 2022 when the SCA1 fishery was closed, Te Ākau Bream Bay beds generated a modest commercial catch two times – in 2005 and in 2006.

There has been a gradual decline in almost all commercial tipa (scallop) populations in Aotearoa New Zealand in the past 30 years. The three main commercial fisheries in Aotearoa New Zealand (Northland, Coromandel, Nelson/Marlborough) are now all closed due to low biomass and sustainability concerns. Whether there is a single common environmental factor affecting these populations is uncertain although warming and acidification of the oceans have been suggested as contributing factors.

4.0 NON-COMMERCIAL FISHERIES

Non-commercial fishing and seafood gathering is widespread throughout the Tīkapa Moana-Te Moananui-ā-Toi (Hauraki Gulf) with a significant proportion of the population reporting as actively participating in fishing. Aerial-access survey harvest estimates are available for the Tīkapa Moana Te Moanui-ā-Toi (Hauraki Gulf) in 2003–04 (Hartill et al. 2007a), 2004–05 (Hartill et al. 2007b), 2011–12 (Hartill et al. 2013) and in 2017-18 (Hartill et al. 2019). Due to the survey design, the harvest estimates are for the entire Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) and are not able to be partitioned into specific areas such as Te Ākau Bream Bay.

The surveys show that in the wider Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) including Te Ākau Bream Bay, tāmure (snapper) dominates the recreational catch. Kahawai, araara (trevally) and kumukumu (gurnard) are the next most harvested non-commercial species. Tipa (scallops), pipi, tūangi (cockles), tuatua (bivalve clams), and kina (sea urchins) dominate the shellfish catch. Most of the finfish are caught using a rod and line from small recreational craft. Shellfish except

kina (sea urchins) and tipa (scallops) are hand-gathered on the shore. Kina (sea urchins) are harvested from rocks and reefs by hand gathering and diving. Tipa (scallops) are harvested by diving and recreational dredge (Wynne-Jones et al. 2019).

The aerial survey results shown in Figure 20 indicate that non-commercial effort from boats is spread throughout Te Ākau Bream Bay. The number of recreational fishing vessels was highest south of Te Whara (Bream Head), north of Ruakākā and around Paepae-o-Tū (Bream Tail) and generally lower in the vicinity of the Application Area. The areas with higher non-commercial fishing activity appear to offer greater shelter to small vessels from weather and are all relatively close to a convenient launch point (Whangārei Harbour, Ruakākā, and Mangawhai respectively).

It is proposed to limit sand extraction activity to 3.5 hours from 12:00 pm – 6:00 pm (April-September) and 12:00 pm – 8:00 pm (October-March) year-round. Boat ramp interview data from recreational fishing surveys indicated that daily peak recreational fishing activity occurs around 10:00 am (Hartill et al. 2007a). Limiting sand extraction to afternoons/early evening will avoid this peak.

5.0 POTENTIAL SAND EXTRACTION EFFECTS

5.1 Acoustics

Popper and Hawkins (2019) provide an overview and summary of fish bioacoustics and the effects of anthropogenic sounds on fish. There is a general consensus that the single most important issue of noise impacts is the effect of anthropogenic sound on fish behaviour, rather than mortality or physiological effects. Anthropogenic sounds can mask biologically important sounds and cause fish to avoid areas they may otherwise use. There is little data available internationally to reach conclusions on the significance of any effects of anthropogenic noise on fish.

Styles Group (2025) have undertaken a comprehensive assessment of the underwater noise effects from the proposed sand extraction activities in the Te Ākau Bream Bay embayment, including the effects on fishes. That assessment indicates the following:

- The noise assessment found that fish will be exposed to acoustic-related disturbances.
- Modelling showed **no risk** of auditory injury to fishes and no temporary threshold shift beyond 0.5 m from the *William Fraser* when it is actively extracting sand.
- **Small** behavioural responses in fishes are unlikely to occur beyond 205 m, which is the range at which auditory masking effects are likely too low (i.e., below 75% reduction in active listening space) for the onset of small behavioural effects.
- Masking effects in fishes was found to be **medium** up to 165 m and 205 m (i.e., above 50% in active listening space) from the *William Fraser* when it is operating. The specialist hearing structures in the NZ bigeye that allow it to detect sound pressure at lower levels represents the upper limit (worst case) of masking effects in fishes found in the sandy bottom habitats in Te Ākau Bream Bay.
- Increases in the monthly average and cumulative sound exposure levels within the whole of Te Ākau Bream Bay, particularly between the extraction area and shoreline, are expected to be **low**.

Almost all the demersal and pelagic fishes found in the vicinity of the Application Area are highly mobile. Most fish, including tāmure (snapper), kuparu (John dory) and kumukumu (gurnard), are vagile and typically exhibit avoidance behaviour to sudden noise and disturbance. Along with other fishes in the area, they can be expected to move away from and avoid the immediate area around the *William Fraser* when it is operating. There is no information to indicate how far away fish will move, or to reach conclusions on any temporary or long-term effects. In an experiment to measure the effect of motorboat sound on tāmure (snapper) inside and outside a marine reserve, Mensinger et al. (2018) found the effect of noise from a small boat transiting an area was transient. Fish numbers and feeding behaviour at bite stations quickly returned to pre transit levels although bite frequency remained depressed in some fish for at least 10 minutes after boat passage. This suggests noise avoidance by fish is probably temporary. Overall, the effects of underwater noise on fishes in Te Ākau Bream Bay can be expected to be **low to negligible**.

5.2 Water Quality/Suspended Sediment

Wilson (2025) found the overall level of effects of sand extraction on key water quality parameters (including TSS, turbidity, nutrients, pH and contaminants) to be **negligible**. Sea trials showed the plume created by *William Fraser* during sand extraction will be localised and any effects are highly likely to be very short-term/temporary increases in TSS only, returning to ambient levels within an hour of the activity ceasing.

Tāmure (snapper) and the other coastal fishes present in Te Ākau Bream Bay are well adapted to the dynamic environment within their natural habitat which includes temporarily elevated suspended sediments and turbidity arising from natural events such as land-based runoff after heavy rain or from major storm events. Based on Wilson's (2025) findings on negligible changes to water quality, any effects on fish and shellfish from the localised and temporary water quality changes arising from sand extraction can be expected to be **negligible**.

5.3 Physical Impact/Direct Mortality

Any direct mortality on mobile fishes from the physical impact of sand extraction, including from entrainment, on mobile fishes is unlikely as they are able to avoid the suction head.

If they are present, fish eggs, larval and very small fishes too small to escape could be drawn into the suction intake and may be killed. Zeldis & Francis (1998) found that the numbers of tāmure (snapper) eggs were highest in the inner Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) and very low in the central and outer Gulf. Tāmure (snapper) eggs are initially positively buoyant and become neutrally buoyant as they age (Kitajima et. al. 1993). The eggs of other taonga species including kumukumu, hautere (jack mackerels) and mōhimōhi (pilchard), are widely distributed throughout Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) (Crossland 1981b). The typically wide distribution of fish eggs of most species means they will have limited vulnerability to the suction head which operates on small areas of the seabed. It indicates there should be minimal, if any, impact of egg losses on the population of tāmure (snapper) or other fishes from localised sand extraction activity in a small part of Te Ākau Bream Bay.

Sessile bottom-dwelling shellfish species such as tipa (scallop) are more vulnerable to be pulled into the suction intake. As noted earlier in the report, tipa (scallops) can move (swim) distances up to several metres quickly by clapping their shells together and they are well adapted for making short distance escape reactions. This behaviour indicates they will be able to respond to avoid entrainment. In the initial sand extraction report (West *et al*. 2025) tipa (scallop) of various sizes were present in in the Application Area.

Overall, any direct mortality of fishes and shellfish from the extraction activity is expected to be **negligible**.

5.4 Effect on Availability of Benthic Fauna as Food for Fishes

This section of the report discusses the effects on fishes from potential losses of, or changes to, benthic biota on which most demersal fish feed. West *et al*. (2025) describes the benthic habitat and the benthic fauna of the Application Area from the Initial Sand Extraction Assessment. There are moderately abundant populations of a diverse group of 150 taxa of biota of nationally and locally common species and the community is typical of the wider area. There are no 'at Risk' species. West & van Winkel (2025) classifies the benthic biota faunal community as of **moderate ecological value**.

The discussion below relies on the mobility of fishes, and the generalist and opportunistic feeding behaviours of the taonga species tāmure (snapper) and kumukumu (gurnard) and a range of other demersal fishes such as whai keo (eagle ray) that occupy Te Ākau Bream Bay.

Benthic fauna (on which feed) will be drawn into the suction head, some will be lost but a substantial proportion will survive and will be released in the discharge from *William Fraser*. At Pākiri, Bioresearches (2019) estimated that a high proportion of benthic macrofauna were undamaged could be deemed to have survived the pumping and screen system. It is highly probable that there will be immediate predation by fishes of some of the benthic biota disturbed on the seabed and/or released into the water column from the discharge by *William Fraser*, particularly the more fragile smaller organisms. However, some of the benthic organisms released in the discharge are likely to settle to the seabed and survive there. They will be available to contribute to recovery of the benthic fauna as well as for fishes to feed on. Not all the benthic infauna will be removed by sand extraction (due to the shallow 100mm depth of extraction). These fauna will remain available as food for foraging fishes. There is no estimate of the proportion of fauna that will remain, but some feeding opportunities will remain in the excavated track immediately after extraction. Bioresearches (2020) found that many larger burrowing worms and crustaceans were not entrained by the extraction process.

The patchwork of disturbed strips assists recolonisation from adjacent undisturbed or partly recovered areas. Importantly, the migration of benthic biota from unaffected areas can help to progressively re-establish fauna in each strip or cell because the proposed sand extraction cycle of approximately 3 years provides a sufficient period of habitat stability for recovery to take place. West & van Winkel (2025) predict the relatively shallow extraction depth of 100 mm will result in a relatively short recovery time with mobile biota starting to recolonise within a week, recolonization of non-mobile biota occurring within a year, and growth of larger biota to similar sizes as pre-extraction by 2 to 3 years after extraction. Although seasonality of reproduction means commencement of recolonisation/recovery of some organisms may be delayed, there will be a progressive increase in biomass of diverse taxa. It is this biomass comprised of a range of taxa, rather than individual species, that fish rely on. Most benthic feeding fishes common to the area, such as tāmure (snapper), kumukumu (gurnard), and benthic feeding araara (trevally)[3] are opportunistic feeders. All eat a range of taxa (Colman 1972; Godfriaux 1968, 1969, 1970,

[3] Araara (trevally) are both pelagic (open water) and demersal (living close to the sea floor) in behaviour. Adult araara (trevally) shift between pelagic and benthic phases.

1974; Stevens et al. 2011), with crustacea the main food group of each of these species. Polychaetes, echinoderms and molluscs also feature as important food groups in their diets.

Overall, the effects of the temporary loss of benthic biota from small areas of Te Ākau Bream Bay at any one time is **highly unlikely to have an adverse effect** on abundance or presence of benthic fishes in areas immediately adjacent to the sand extraction tracks, or within the Application Area, or Te Ākau Bream Bay as a whole. While the entire Application Area will have an altered benthic biota with some overall reduction in biomass, diversity, and species size/life history stage, the reduction in total prey biomass and prey availability to the community of fishes in the area will be very small. The mobility of fishes together with their opportunistic feeding on a diverse range of organisms means they can move to unaffected nearby areas to feed. There will be undisturbed benthic fauna available outside of the extraction area and recovering benthic fauna within the extraction area. Overall, the effect of the proposed sand extraction on the availability or abundance of food for benthic fishes is expected to be **negligible**.

6.0 DISCUSSION

A number of factors need to be considered when assessing the effect of sand extraction on the fishes of Te Ākau Bream Bay. There is very good information on the fish community of the area, particularly demersal fishes, from decades of fishery research. This provides a good knowledge base which is important to assessing potential effects.

The diverse fish community of Te Ākau Bream Bay is comprised of populations of common inshore species distributed widely around the coast of northern Aotearoa New Zealand. These fishes, including benthic and pelagic varieties, are highly mobile. Tāmure (snapper), which is common, widespread, and occupies a wide range of habitats, is clearly the most abundant fish. It is the most economically valuable and popular non-commercial recreational species. It is a taonga species of great significance to tangata whenua.

Fisheries research has provided knowledge that most of the demersal fishes are generalist and opportunistic feeders of the diverse taxa that form the community of benthic organisms present in the Application Area. That habitat and the benthic community present within the Application Area and Te Ākau Bream Bay is typical of that found in similar inshore areas found along the northeast coast.

West *et al*. (2025) and West & van Winkel (2025) expect recovery of the benthic biota in the Application Area to occur within 2-3 years after sand extraction, with very minor losses of biota abundance and very minor changes in diversity. Te Ākau Bream Bay and the Application Area form a small fraction of the total area that the fish populations found in the area occupy. Sand extraction will impact small areas at any one time. There will be little change in the total availability of benthic fauna as food for demersal fishes in Te Ākau Bream Bay.

Tāmure (snapper) is the most targeted and important fish for commercial and non-commercial fishing. Although fishing occurs throughout the area, the spatial distribution of commercial fishing indicates Te Ākau Bream Bay is not as heavily fished as other areas. This is consistent with the spatial distribution of the areas of higher and lower abundance of tāmure (snapper) from research trawl data. Although Te Ākau Bream Bay appears to be less important for fishing than other areas of the wider Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) it does make an important contribution to the overall fishery in the region. It is a valuable fishery habitat for both fish and shellfish and is particularly important to Patuharakeke and Te Parawhau.

7.0 SUMMARY AND CONCLUSIONS

Research trawl surveys and the spatial distribution of commercial fishing catch and effort data show:

- The fish community in Te Ākau Bream Bay is comprised of common species that form part of populations that are widely distributed throughout the northeast coast.
- There is no evidence from more than 20 years of research trawl surveys that unique or threatened species are present.
- Tāmure (snapper) is by far the most abundant fish with much lower abundances of the next most commercially important species, kuparu (John dory) and kumukumu (gurnard).
- Research trawl surveys indicate that the relative abundance of tāmure (snapper) in Te Ākau Bream Bay is not as high as other nearby areas in the adjacent Tīkapa Moana – Te Moananui-o-Toi (Hauraki Gulf).
- Commercial and non-commercial fishing takes place throughout Te Ākau Bream Bay including within the Application Area although both effort and catch are lower than elsewhere in the wider Tīkapa Moana – Te Moananui-o-Toi (Hauraki Gulf).

Based on all available information, including the separate benthic, underwater noise and water quality effects assessments, any adverse effects arising from sand extraction on both fish populations and fishing activities will be **low** to **negligible** if they occur at all:

- The area of benthic seabed where sand extraction is proposed and where there will be impacts on benthic fauna that fish feed on is a small proportion of the coastal habitat occupied by the fish and shellfish species present in Te Ākau Bream Bay.
- Fishes are mobile and mostly able to avoid both disturbance and physical effects arising from the extraction activity, including small areas of temporarily elevated suspended sediments.
- No direct mortality of adult or juvenile fishes is likely although fish and shellfish eggs, larvae, and very small fishes immediately around the suction head may not be able to avoid being impacted by extraction or by temporarily elevated suspended sediments.
- Experience in other areas nearby and the scientific literature indicates a relatively rapid re-establishment of an altered benthic community on which fishes can feed.
- The mobility of fishes means not only are they able to avoid any effects of extraction activities, but that they can be expected to remain available for commercial and non-commercial fishers to catch, probably nearby.
- The period when the extraction activity is proposed to occur each day will further minimise any potential effects, including any effects on non-commercial fishing.
- The former small Te Ākau Bream Bay commercial scallop fishery is closed indefinitely and any recovery of the scallop population to previous levels is very uncertain.

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Tables and Figures

Table 1: Fish and squid species or species groups occurring in more than 1% of *Kaharoa* trawl tows, sorted by descending percentage occurrence in *Kaharoa* tows. (Source: Table 3 in Kendrick & Francis 2002)[4]

			Occurrence (%)	
Common name	**Maori name**	**Latin name**	***Kaharoa* tows**	***Ikatere* tows**
Snapper	Tāmure	*Pagrus auratus*	97.40	99.05
Jack mackerels	Hautere	*Trachurus novaezelandiae & T. declivis*	85.97	76.13
John dory	Kuparu	*Zeus faber*	84.62	77.33
Gurnard (Red)	Kumukumu	*Chelidonichthys kumu*	76.82	74.94
Sand flounder	Pātiki	*Rhombosolea plebeia*	41.16	37.71
Leatherjacket	Kōkiri	*Parika scaber*	31.60	29.59
Arrow squid	Wheketere	*Nototodarus sloani and N. gouldi*	27.34	8.83
Spotted stargazer	Moamoa	*Genyagnus monopterygius*	26.09	7.88
Broad squid	Ngū	*Sepioteuthis australis*	24.84	3.82
Rig	Pioke	*Mustelus lenticulatus*	23.39	63.25
Eagle ray	Whai keo	*Myliobatis tenuicaudatus*	22.25	48.21
Barracouta	Mangaa	*Thyrsites atun*	20.89	14.56
Lemon sole	Pātiki	*Pelotretis flavilatus*	19.96	35.32
Spotty	Pakete	*Notolabrus celidotus*	19.85	11.46
Trevally	Araara	*Pseudocaranx dentex*	19.65	39.62
Blue mackerel	Tawatawa	*Scomber australasicus*	18.71	16.47
Ray	Whai	*Dasyatis brevicaudata and D. thetidis*	15.70	32.94
Yellow-belly flounder	Pātiki-tōtara	*Rhombosolea leporina*	14.45	13.13
Opalfish	Kohikohi	*Hemerocoetes monopterygius*	14.03	2.63
Red mullet	Kanae	*Upeneichthys lineatus*	13.72	17.42
Kahawai	Kahawai	*Arripis trutta*	13.41	12.41
Scaly gurnard	–	*Lepidotrigla brachyoptera*	13.41	6.92
Skates	Whai	*Dipturus nasutus and D. innominatus*	12.27	13.13
Pilchard	Mōhimōhi	*Sardinops neopilchardus*	9.56	6.92
Soles	Pātiki	*Peltorhamphus novaezeelandiae and P. latus*	7.38	13.60
Crested flounder	Pātiki	*Lophonectes gallus*	7.17	12.89
Porcupinefish	Koputotara	*Allomycterus jaculiferus*	7.07	7.88
Yellow-eyed mullet	Makawhiti	*Aldrichettaforsteri*	7.07	6.92
Blue cod	Rāwaru	*Parapercis colias*	6.86	7.40
Witch	Mahue	*Arnoglossus scapha*	6.55	4.54
Tarakihi	Tarakihi	*Nemadactylus macropterus*	6.13	10.26

[4] Note: This table is based on the Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) trawl surveys whereas Appendix 3 in the Assessment of Ecological Effects prepared by West & van Winkel (2025) is based on fish reported from Te Ākau Bream Bay and supplemented with fish caught during the benthic surveys.

School shark	Kapetā	*Galeorhinus galeus*	5.51	21.48
Parore	Ngāoheohe	*Girella tricuspidate*	4.99	2.63
Anchovy	Kokowhaawhaa	*Engraulis australis*	4.57	4.54
Sea perch	Pūaihakarua	*Helicolenus percoids*	4.57	1.43
Spotted gurnard	–	*Pterygotrigla picta*	4.37	1.19
Carpet shark	Pekapeka	*Cephaloscyllium isabellum*	4.16	4.30
Frostfish	Pāra	*Lepidopus caudatus*	3.95	0.72
Silverside	–	*Argentina elongata*	3.53	0.48
Kingfish	Haku	*Seriola lalandi*	3.12	5.25
Cucumberfish	Pōrohe	*Chlorophthalmus nigripinnis*	2.81	0.48
Hammerhead shark	Mangōpare	*Sphyrna zygaena*	2.70	9.31
Electric ray	Whai repo	*Torpedo fairchildi*	2.39	8.35
Snipefish	–	*Macrorhamphosus scolopax*	1.77	0.48
Conger eels	Ngōiro	*Conger verreauxi and C. wilsoni*	1.66	1.67
Capro dory	–	*Capromimus abbreviates*	1.56	0.24
Northern spiny dogfish	Koinga	*Squalus mitsukurii*	1.56	1.67
Mirror dory	–	*Zenopsis nebulosus*	1.46	0.72
Red cod	Hoka	*Pseudophycis bachus*	1.25	3.82
Gemfish	Mātataharaki	*Rexea solandri*	1.14	0.48

Table 2 Fish and other species or species groups occurring in *Kaharoa* trawl tows, sorted by descending percentage occurrence in the 2019 trawl survey of the Tīkapa Moana – Te Moananui-a-Toi (Hauraki Gulf) (data from Appendix 5, Parsons et al. 2021).

Species	Maori name	Latin name	% occurrence in trawl tows
Snapper	Tāmure	*Chrysophrys auratus*	100.0
Gurnard (Red)	Kumukumu	*Chelidonichthys kumu*	97.7
Yellowtail jack mackerel	Hautere	*Trachurus novaezelandiae*	79.5
John dory	Kuparu	*Zeus faber*	79.5
Leatherjacket	Kōkiri	*Meuschenia scaber*	50.0
Trevally	Araara	*Pseudocaranx georgianis*	47.7
Airy finger sponge	–	*Callyspongia ramose*	43.2
Rig	Pioke	*Mustelus lenticulatis*	38.6
Eagle ray	Whai	*Myliobatis tenuicaudatus*	34.4
Porcupine fish	Koputotara	*Allomycterus jaculiferus*	34.1
Kahawai	Kahawai	*Arripis trutta*	29.5
Short–tailed black ray	Whai	*Dasyatis brevicaudata*	18.2
Astropecten spp.	–	*Astropecten spp.*	18.2
Sponges	–	*Porifera*	13.6
Fanworms	–	*Sabellidae*	13.6
Sand flounder	Pātiki	*Rhombosolea plebeia*	13.6
Blue mackerel	Tawatawa	*Scomber australicus*	11.4
School shark	Kapetā	*Galeorhinus galeus*	9.1
Hammerhead shark	Mangōpare	*Sphyrna zygaena*	9.1
Fleshy club sponge	–	*Suberites affinis*	9.1
Wood	–	*Wood*	6.8
Spotted stargazer	Moamoa	*Genyagnus monopterygius*	6.8
Tarakihi	Tarakihi	*Nemadactylus macropterus*	6.8
Broad squid	Ngū	*Sepioteuthis australis*	6.8
Barracouta	Mangaa	*Thyrsites atun*	6.8
Spotty	Pakete	*Notolabrus celidotus*	6.8
Arrow squid	Wheketere	*Nototodarus sloanii*	6.8
Pilchard	Mōhimōhi	*Sardinops sagax*	6.8
Demosponges	–	*Demospongiae*	4.5
Electric ray	Whai repo	*Torpedo fairchildi*	4.5
Rough skate	Whai	*Zearaja nasuta*	4.5
Ecklonia	–	*Ecklonia*	4.5
Sowfish	–	*Paristiopterus labiosus*	4.5
Asteroid	–	*(starfish)*	4.5
Eleven–arm seastar	–	*Coscinasterias muricata*	4.5
Sea cucumber	Rori	*Stichopus mollis*	4.5
Red mullet	Kanae	*Upeneichthys lineatus*	4.5
Bronze whaler shark	Horopekapeka	*Carcharhinus brachurus*	2.3
Thresher shark	Mangō ripi	*Alopias vulpinis*	2.3
Sea squirt	–	*Ascidiacea*	2.3
Porae	Pōrae	*Nemadactylus douglasii*	2.3

Conger eel	Ngōiro	*Conger spp.*	2.3
Fragments	–	*shell*	2.3
Kingfish	Haku	*Seriola lalandi*	2.3
Mussels	Kutai		2.3
Carpet shark	Pekapeka	*Cephaloscyllium isabellum*	2.3
Bryozoan	–	*Bryozoa*	2.3
Horse mussel	Hururoa	*Atrina zelandica*	2.3
Parore	Ngāoheohe	*Girella tricuspidata*	2.3
Lemon sole	Pātiki	*Pelotretis flavilatus*	2.3
Sea pen	–	*Pennatulacea*	2.3
Pyrosoma atlanticum	–	*Pyrosoma atlanticum*	2.3
Striped sandgoby	–	Acentrogobius pflaumii	
Red bandfish	–	*Cepola haastii*	2.3
Opalfish	Kohikohi	*Hemerocoetes spp.*	2.3
Anemones	–	*Anthozoa*	2.3
Clubbed tunicate	–	*Styela clava*	2.3
Witch	Mahue	*Arnoglossus scapha*	2.3

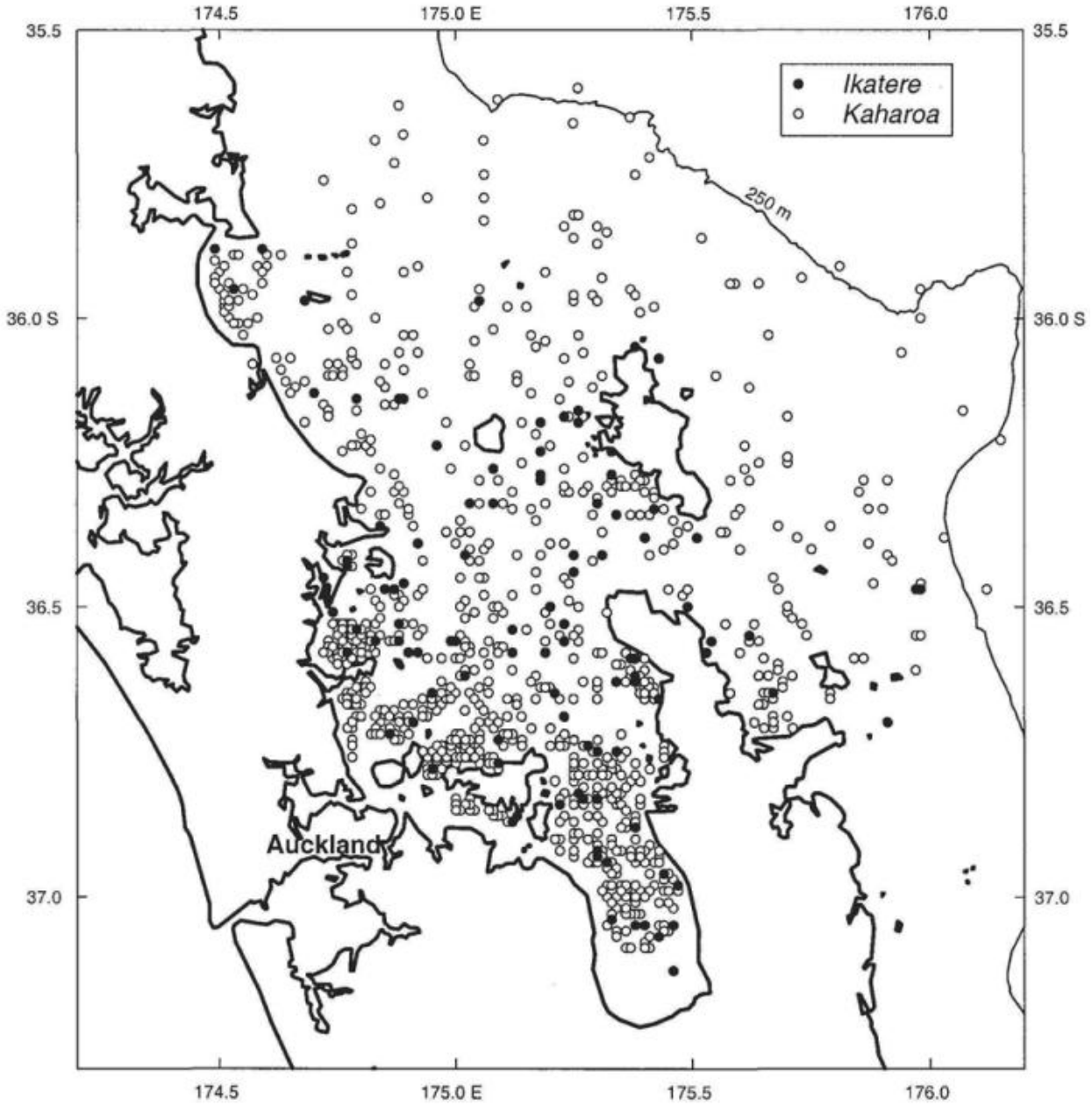

Figure 3: Locations of bottom trawl tows conducted in the Tīkapa Moana – Te Moananui-ā-Toi (Hauraki Gulf) by RV *Ikatere (N* = 419) and RV *Kaharoa (N* = 962*). Ikatere* trawl stations were repeated in many surveys, each point represents multiple tows. (from Kendrick & Francis 2002).

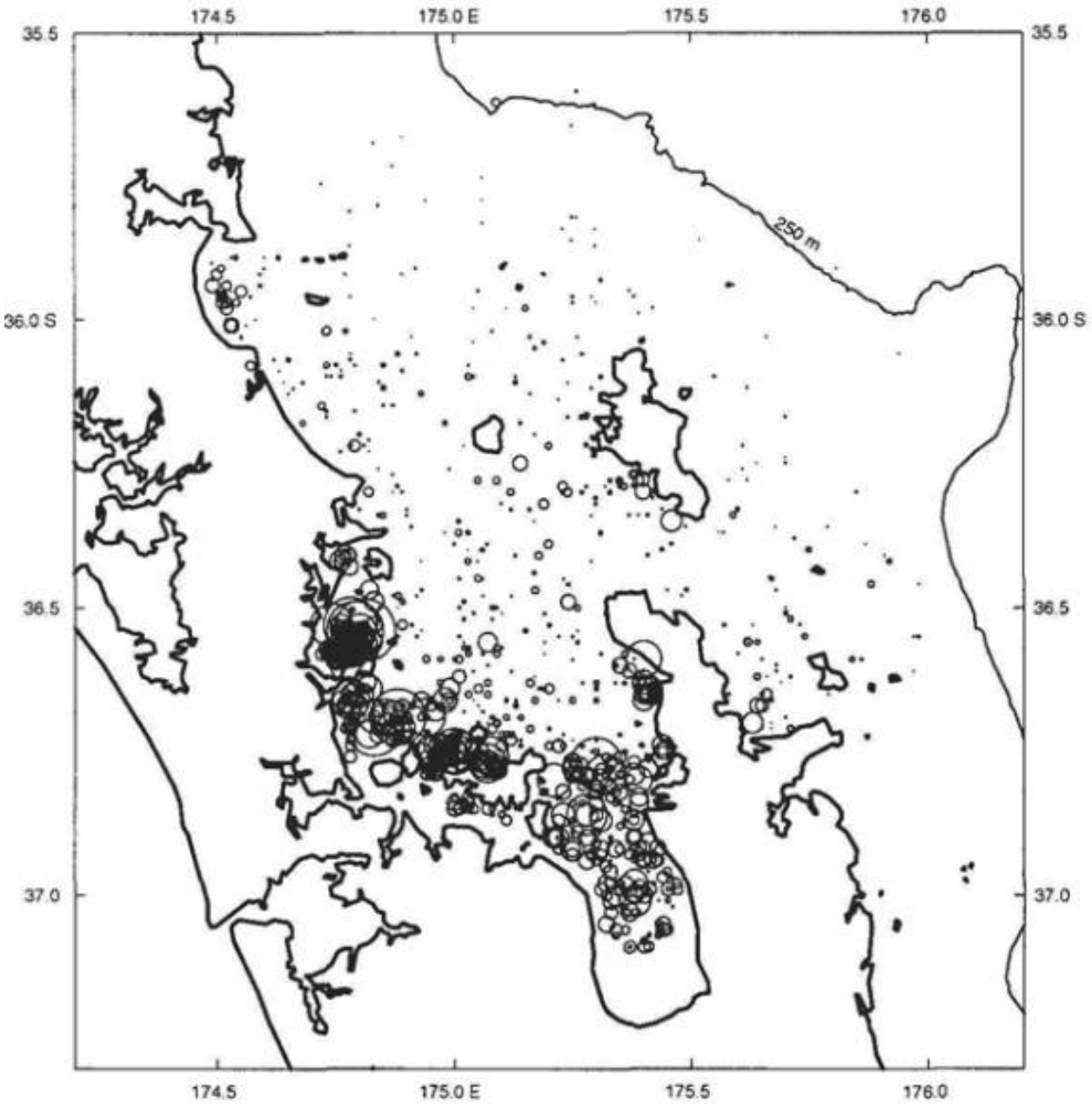

Figure 4: Catch rate of tāmure (snapper) (*Pagrus auratus*) at RV *Kaharoa* trawl stations. Circle diameter is proportional to catch rate (max catch rate 56 441 kg km^{-2}). (from Kendrick & Francis 2002).

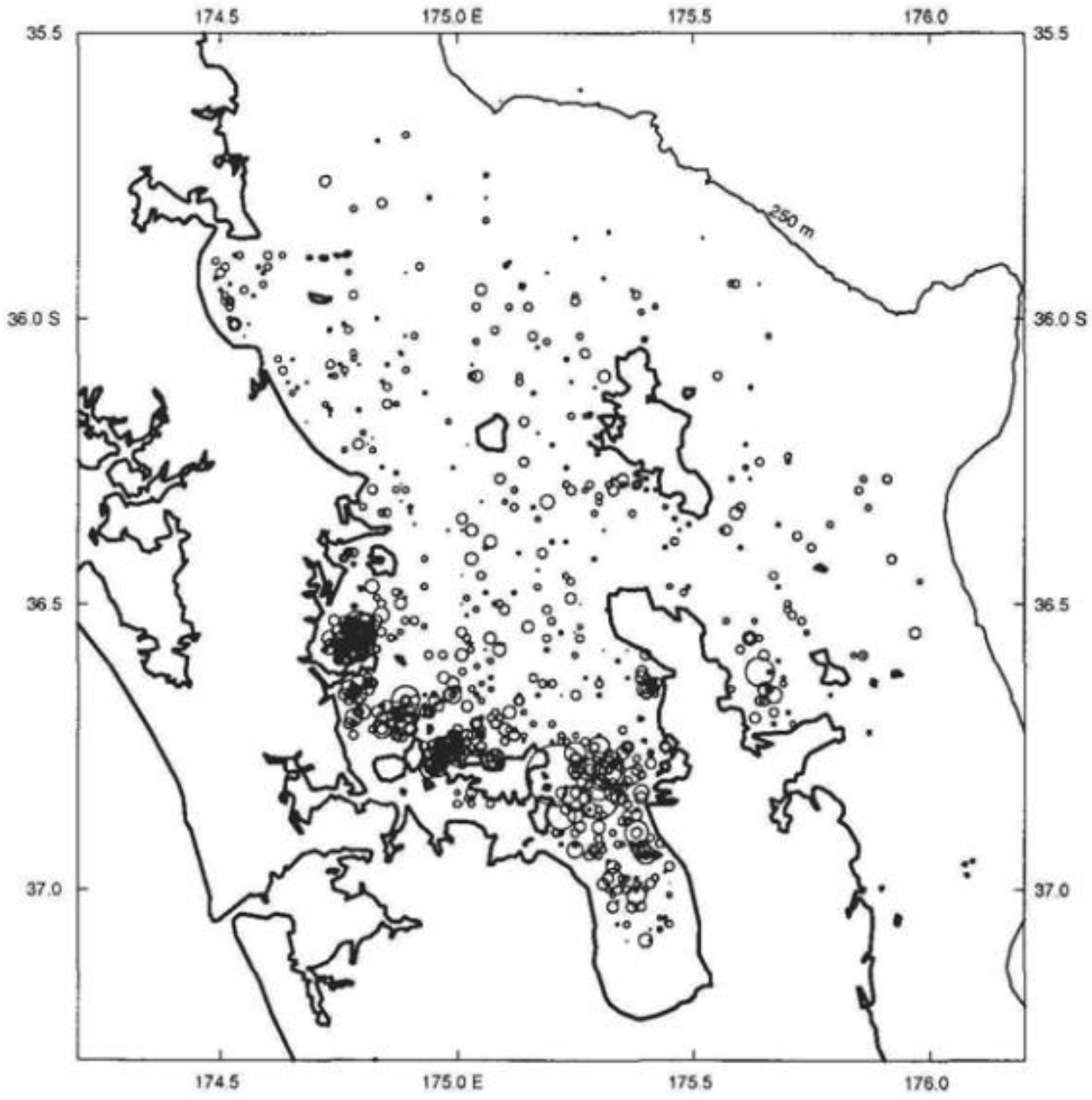

Figure 5: Catch rate of kuparu (John dory) (*Zeus faber)* at RV *Kaharoa* trawl stations. Circle diameter is proportional to catch rate (max catch rate 2 613 kg km^{-2}). (from Kendrick & Francis 2002)

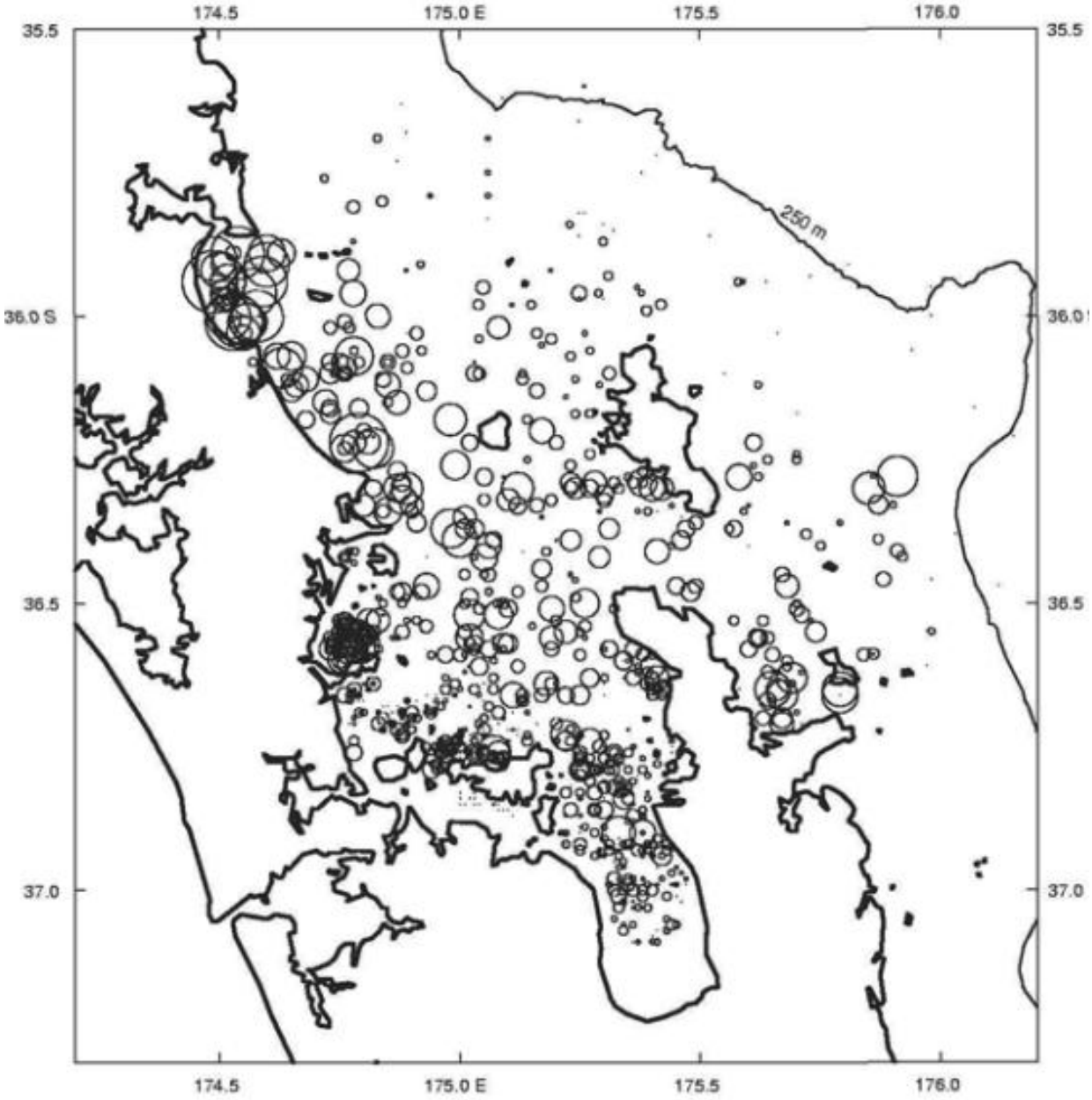

Figure 6: Catch rate of kumukumu (gurnard) (*Chelidonichthys kumu*) at RV *Kaharoa* trawl stations. Circle diameter is proportional to catch rate (max catch rate 782 kg km^{-2}). (from Kendrick & Francis 2002)

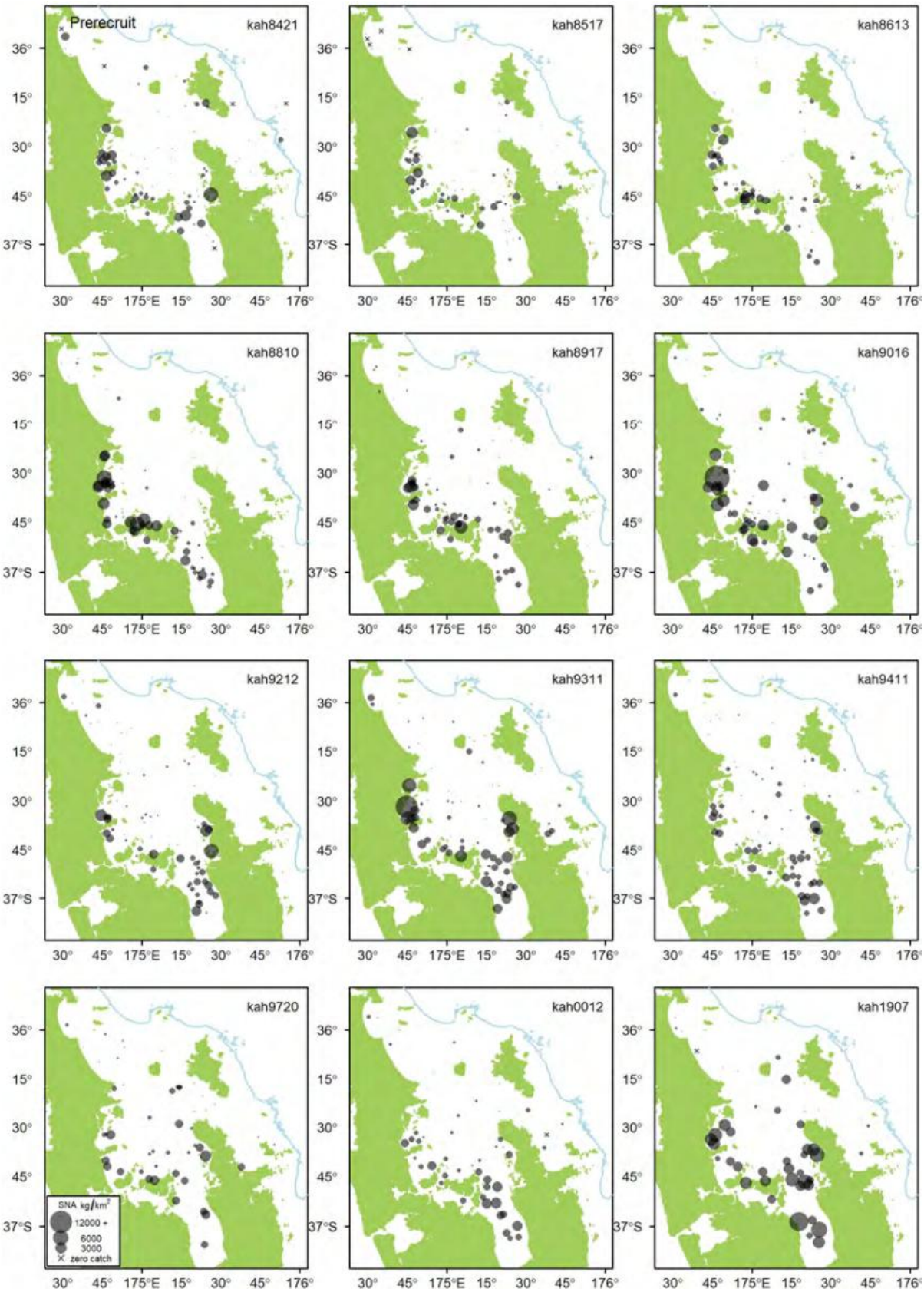

Figure 7: The spatial distribution of catch kg km^{-2} of pre-recruit tāmure (snapper) in *Kaharoa* trawl surveys by year 1984 to 2019. (from Parsons & Bian 2022)

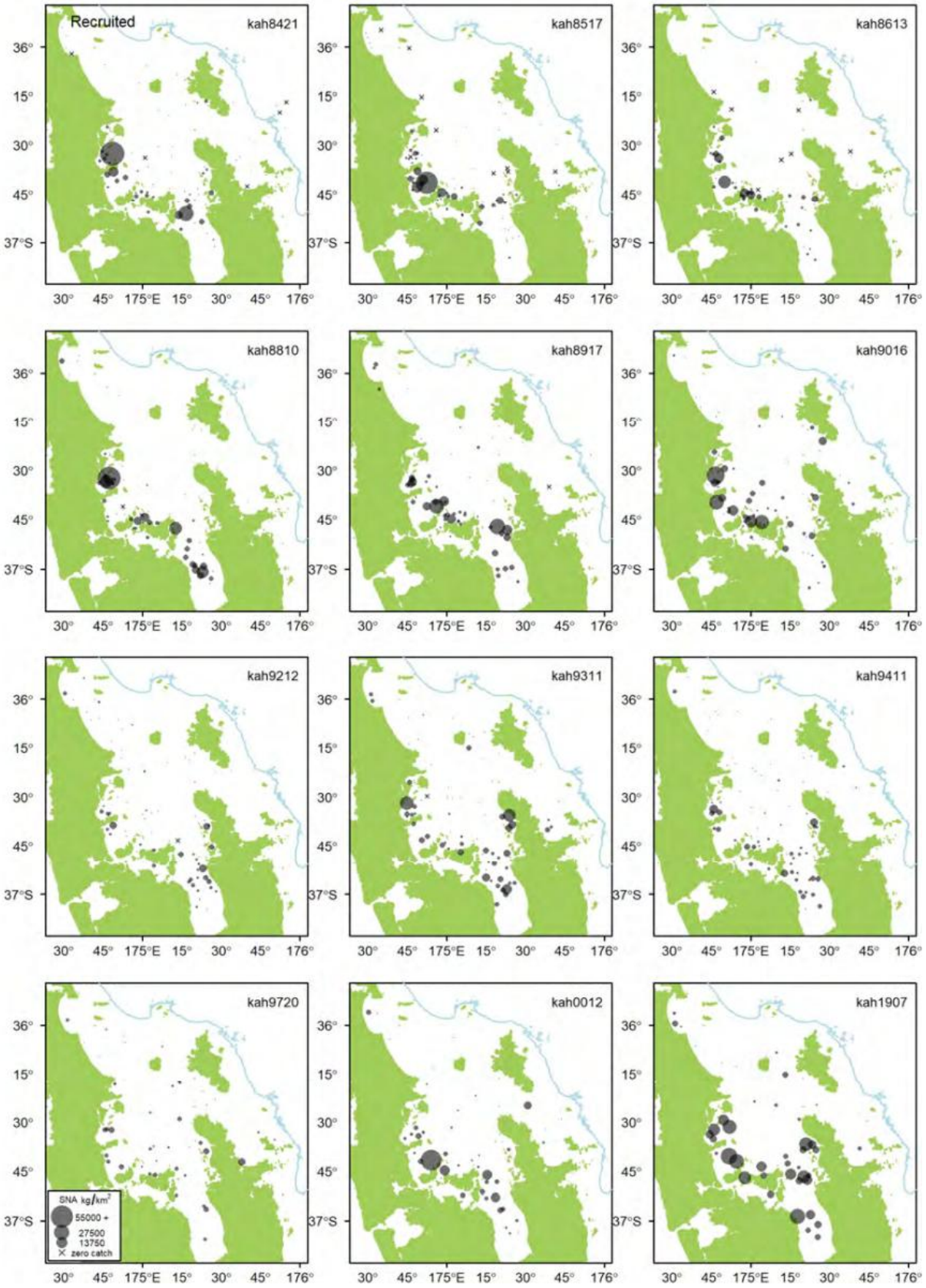

Figure 8: The spatial distribution of catch kg km^{-2} of adult tāmure (snapper) in *Kaharoa* trawl surveys by year 1984 to 2019 (from Parsons & Bian 2022).

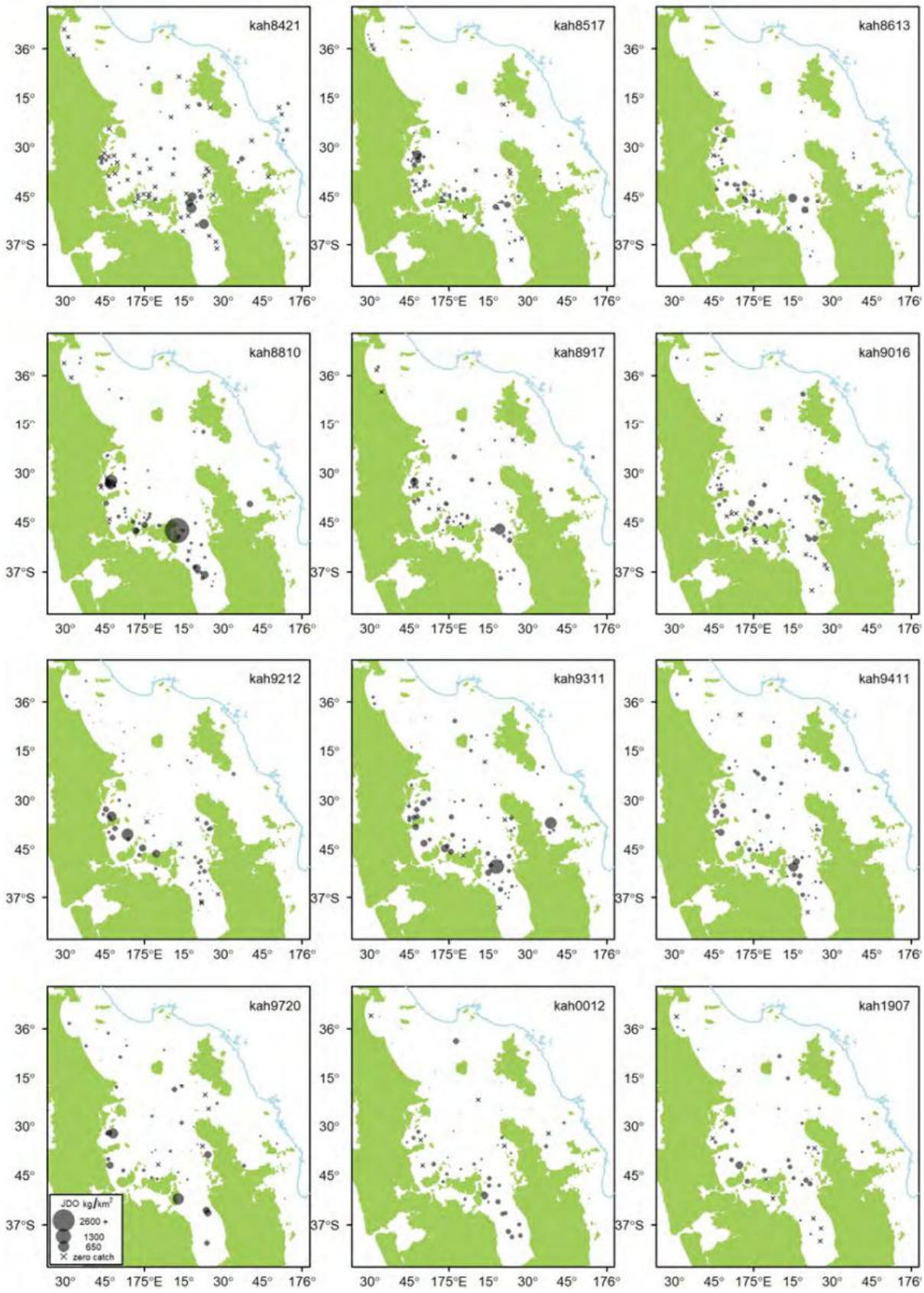

Figure 9: The spatial distribution of catch kg km^{-2} of kuparu (John dory) in *Kaharoa* trawl surveys by year 1984 to 2019. (from Parsons & Bian 2022)

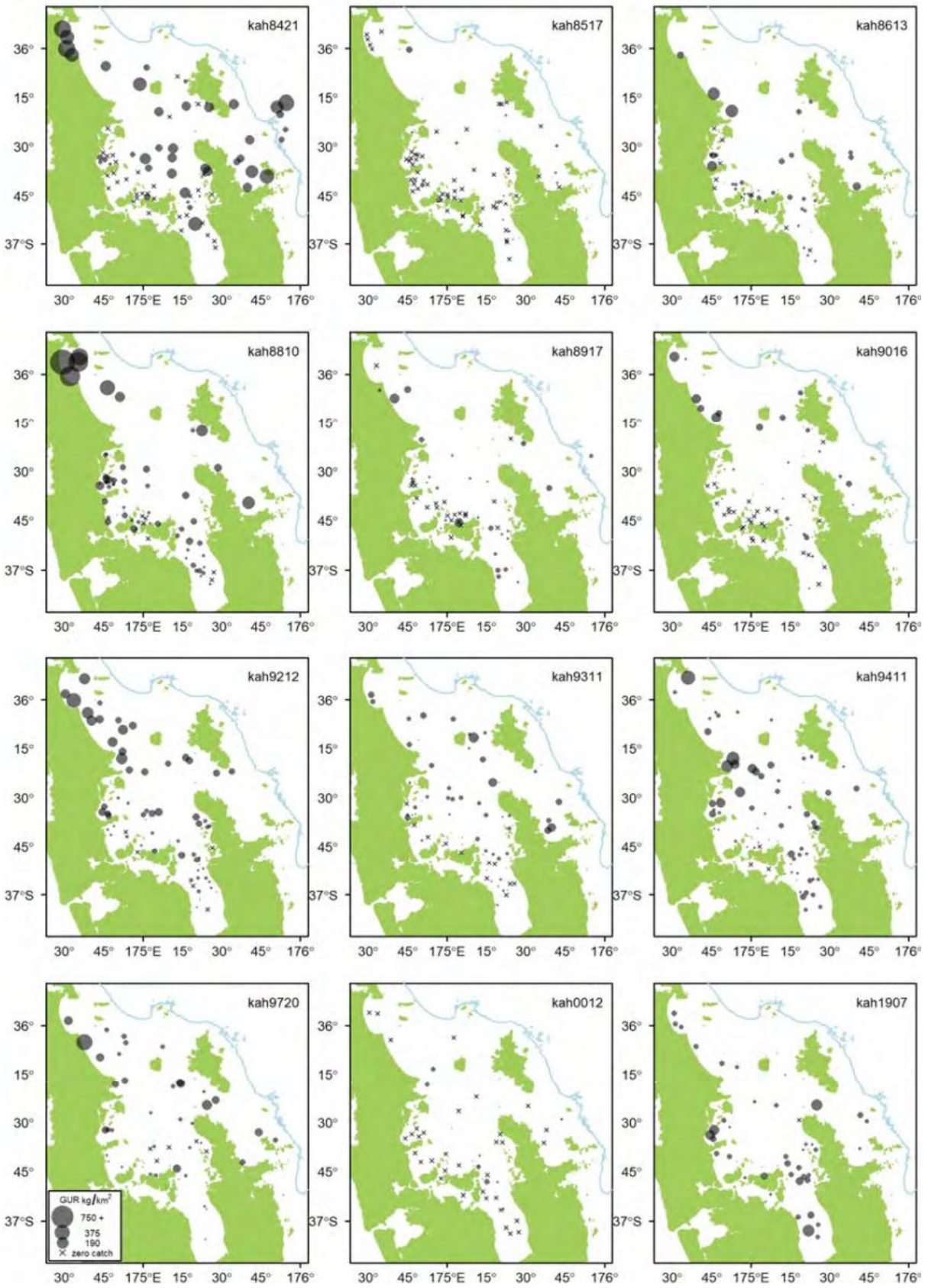

Figure 10: The spatial distribution of catch kg km^{-2} of kumukumu (gurnard) in *Kaharoa* trawl surveys by year 1984 to 2019. (from Parsons & Bian 2022)

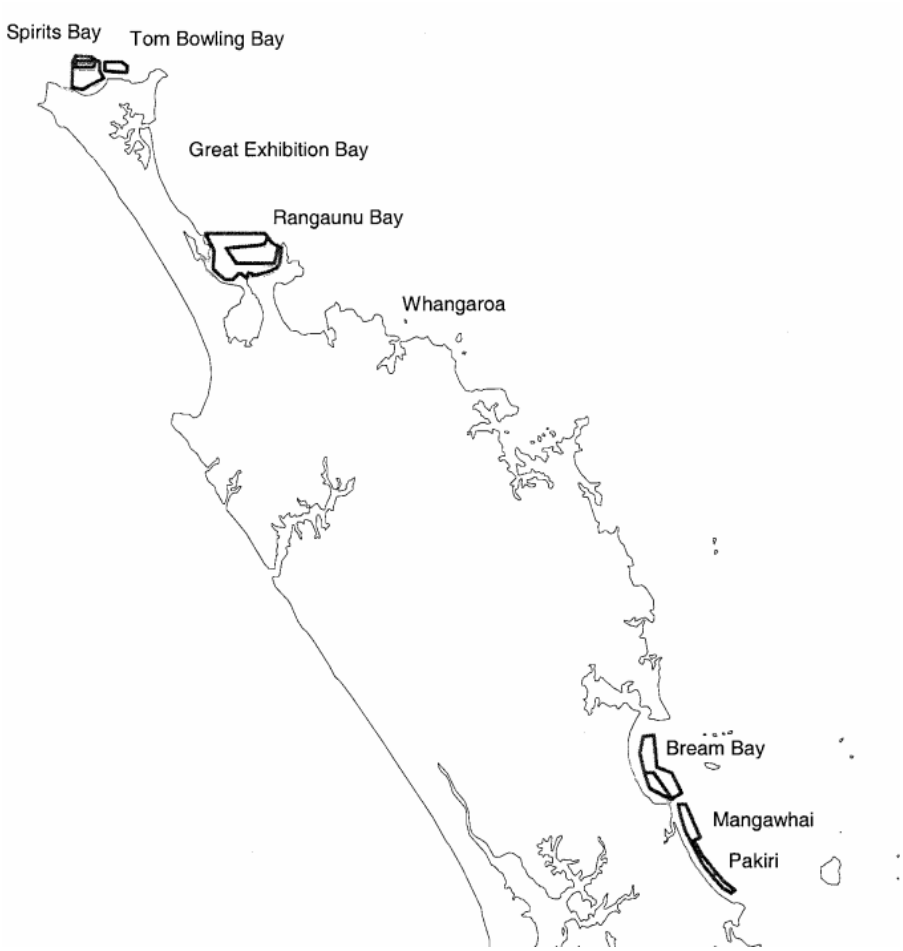

Figure 11: Commercial scallop dredge survey areas within the Northland (SCA1) scallop management area. (from Fisheries New Zealand 2024b)

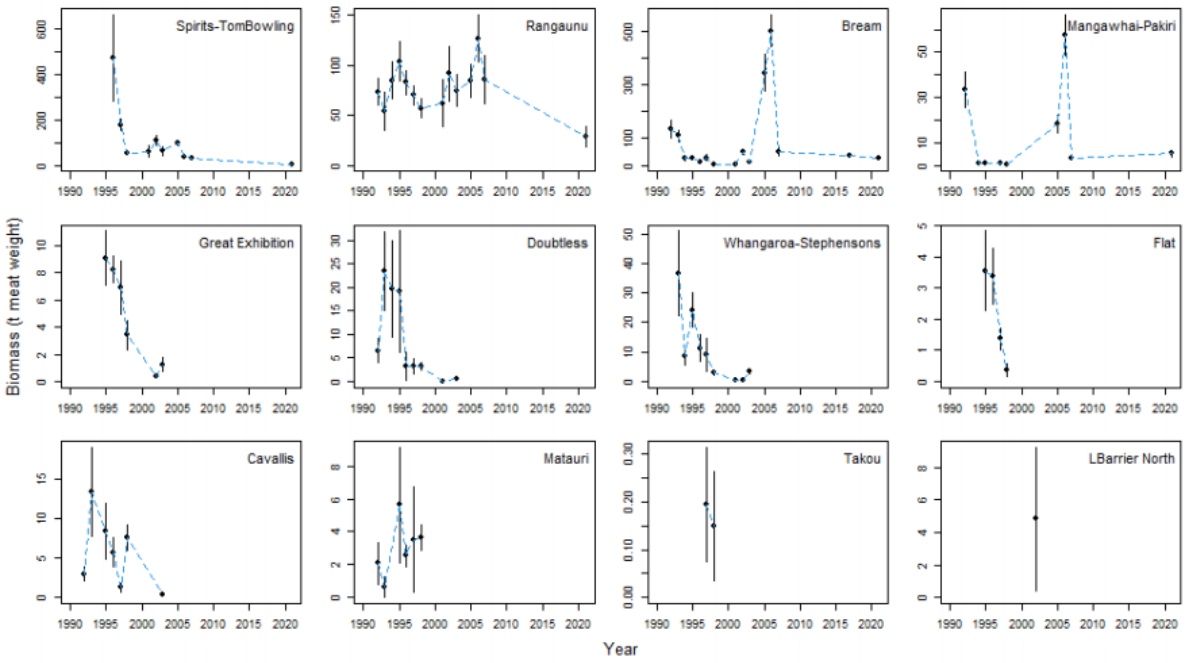

Figure 12: Time of survey estimated absolute biomass (meatweight and CV) 100mm or larger shell length in SCA1 commercial fishing locations for all survey years between 1990 and 2021. (source Fisheries New Zealand 2024b) Note that the biomass scale (X axis) is not the same for each survey area.

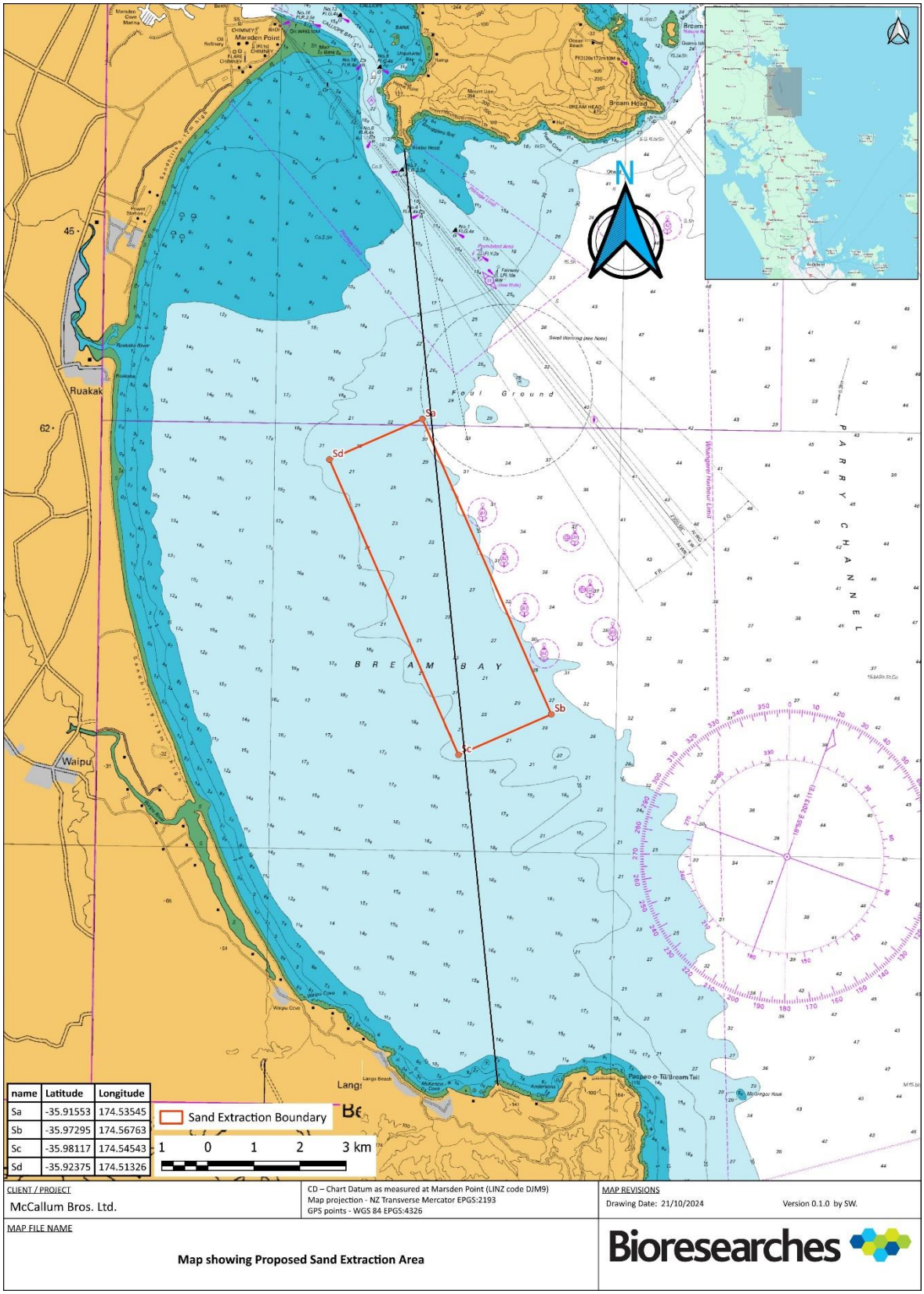

Figure 13: The trawl and Danish seine limit line in Te Ākau Bream Bay.

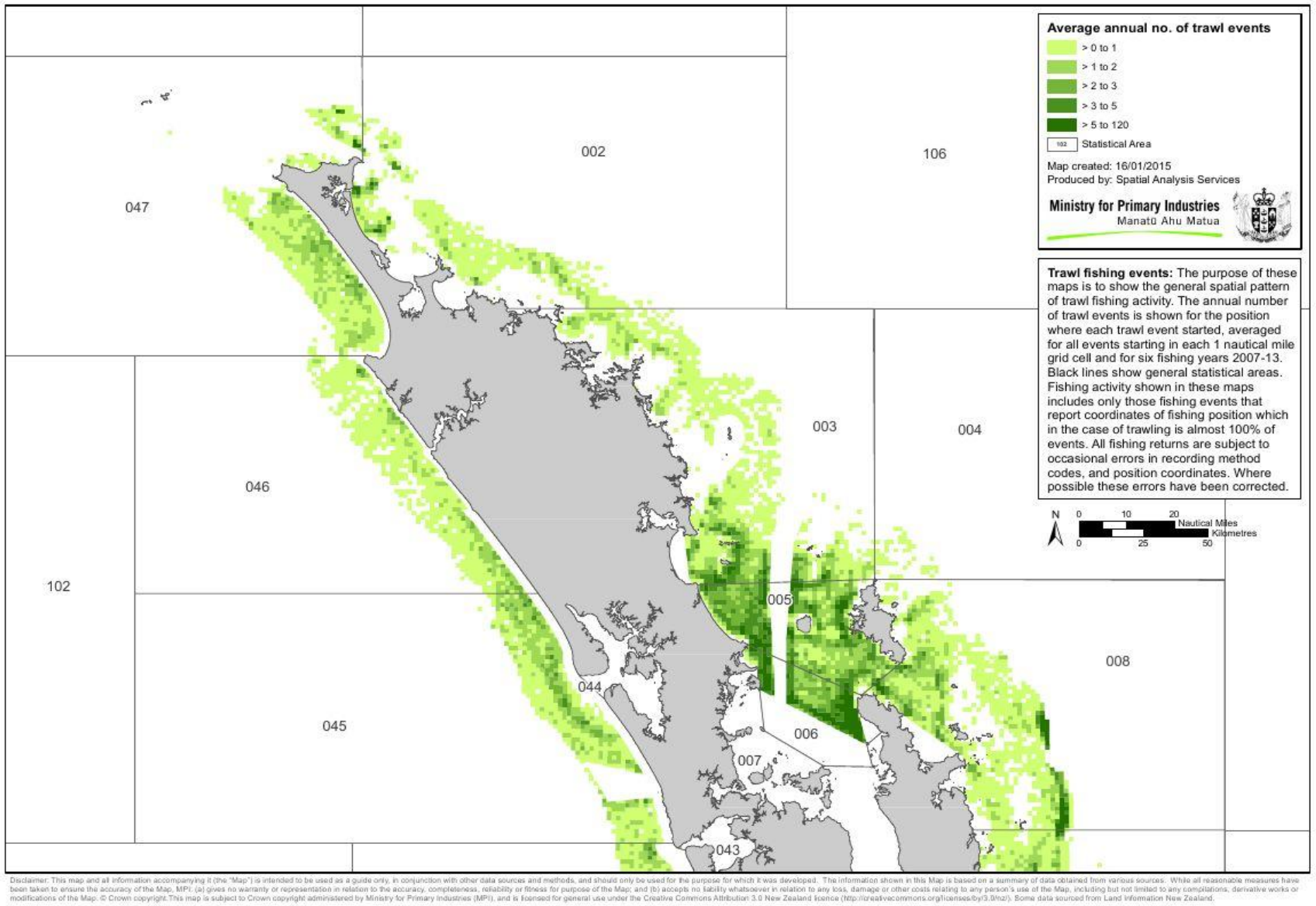

Figure 14: Annual average no. of trawl tows (events). (Source http://fs.fish.govt.nz/Page.aspx?pk=91 downloaded on 24/03/2017)

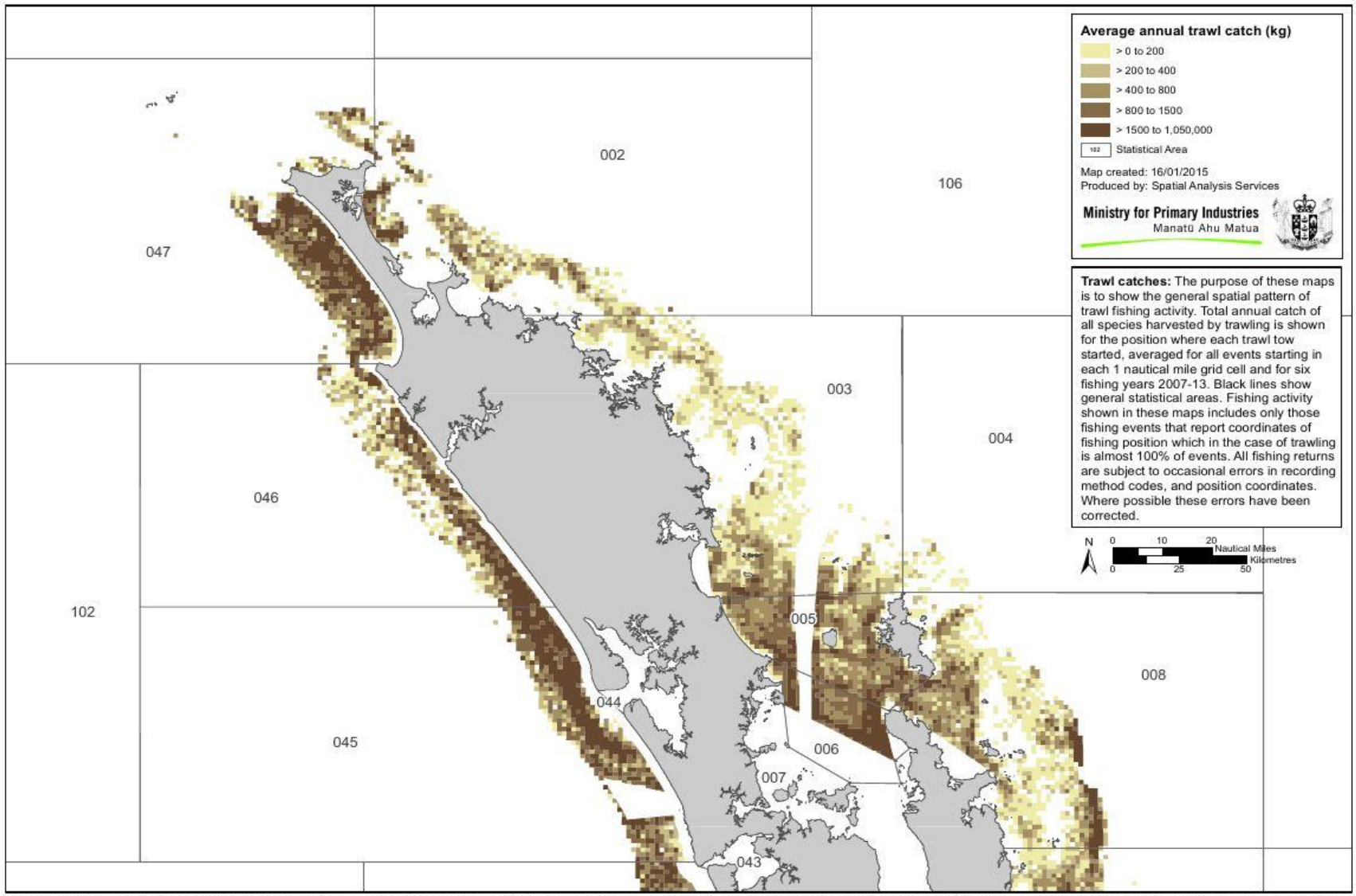

Figure 15: Average annual trawl catch (all species combined). (Source http://fs.fish.govt.nz/Page.aspx?pk=91 downloaded on 24/03/2017)

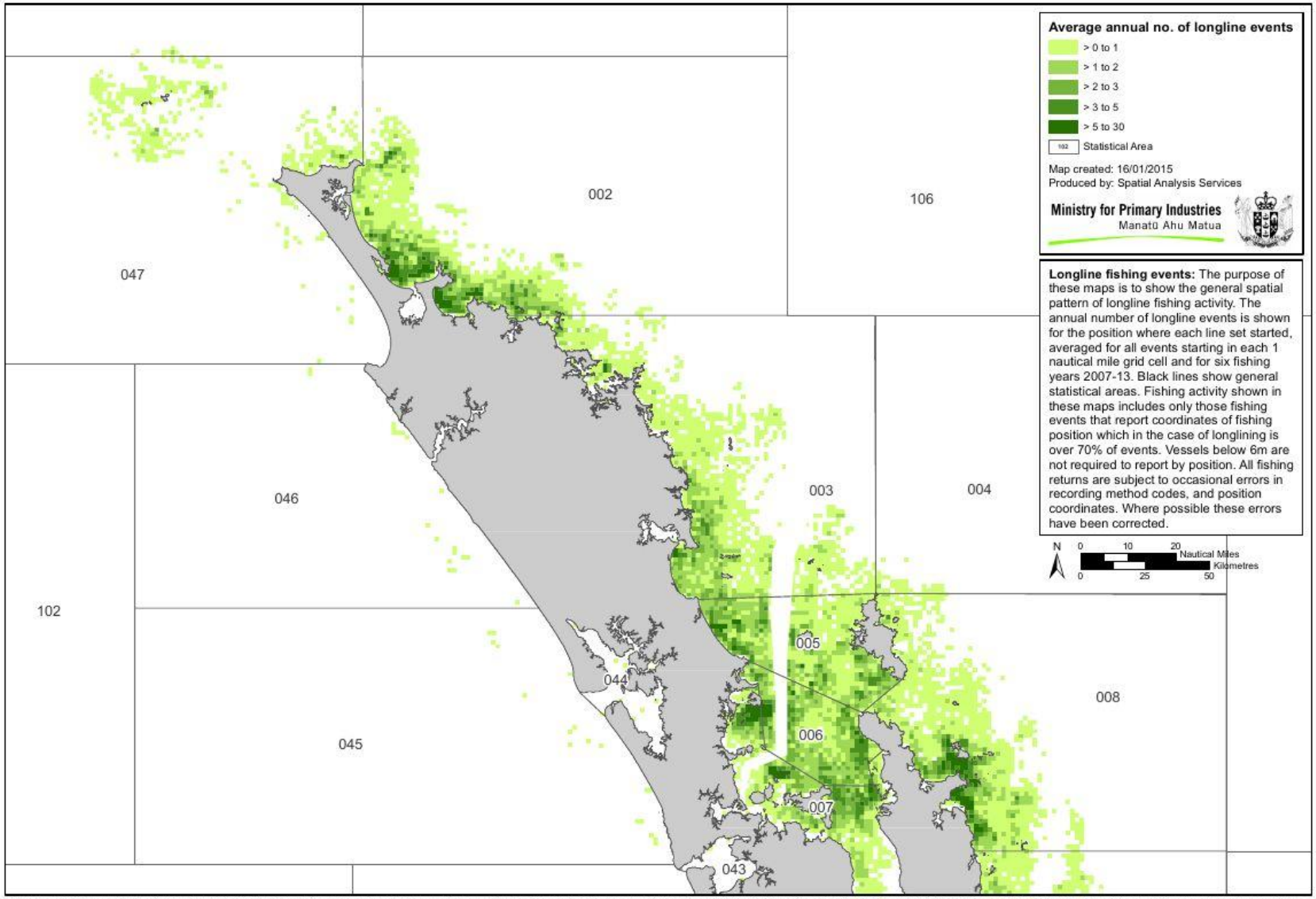

Figure 16: Annual average no. of longline events or sets. (Source http://fs.fish.govt.nz/Page.aspx?pk=91 downloaded on 24/03/2017)

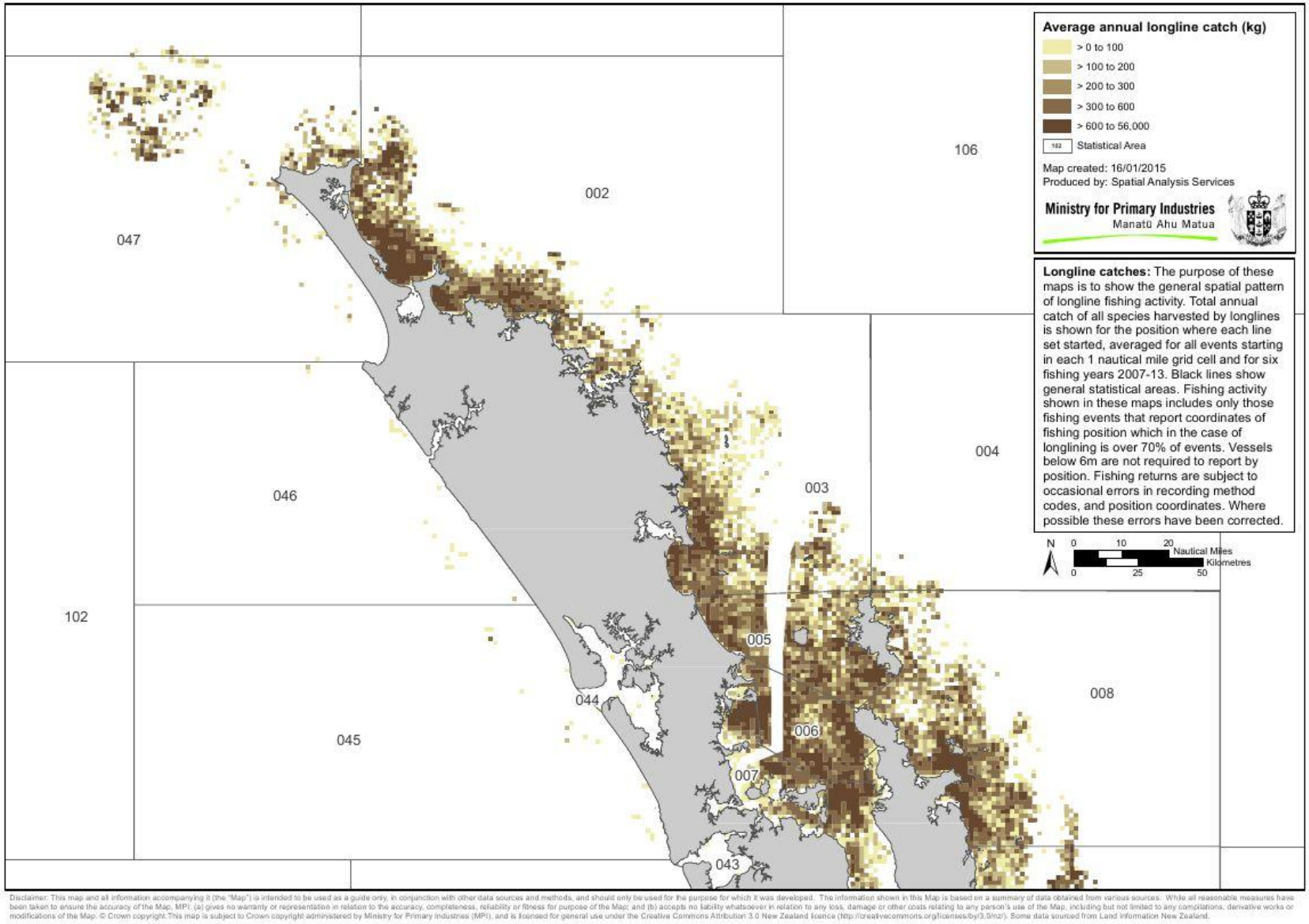

Figure 17: Annual average-longline catch, all species combined. (Source http://fs.fish.govt.nz/Page.aspx?pk=91 downloaded on 24/03/2017)

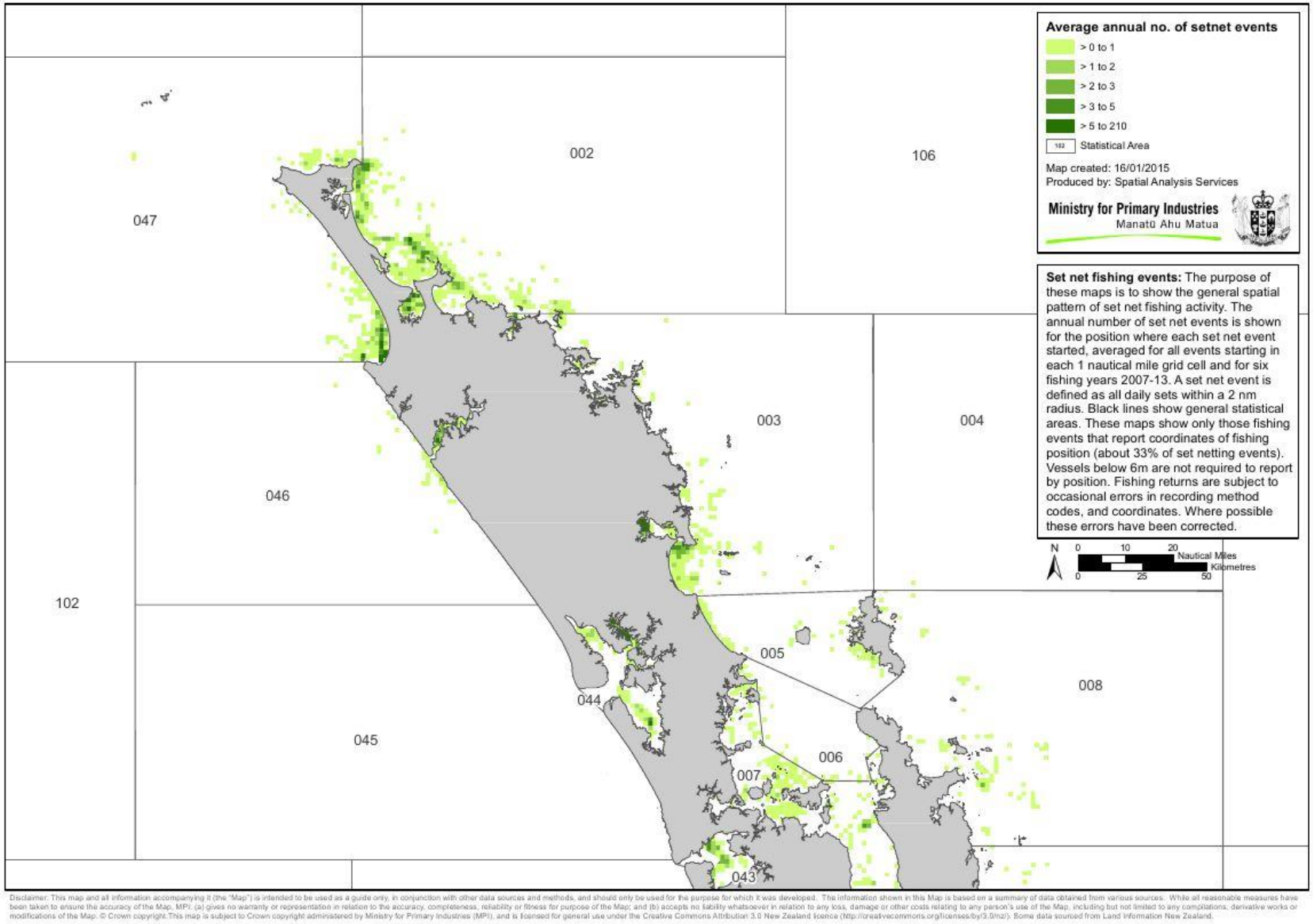

Figure 18: Annual average number of set net events or sets. (Source http://fs.fish.govt.nz/Page.aspx?pk=91 downloaded on 24/03/2017)

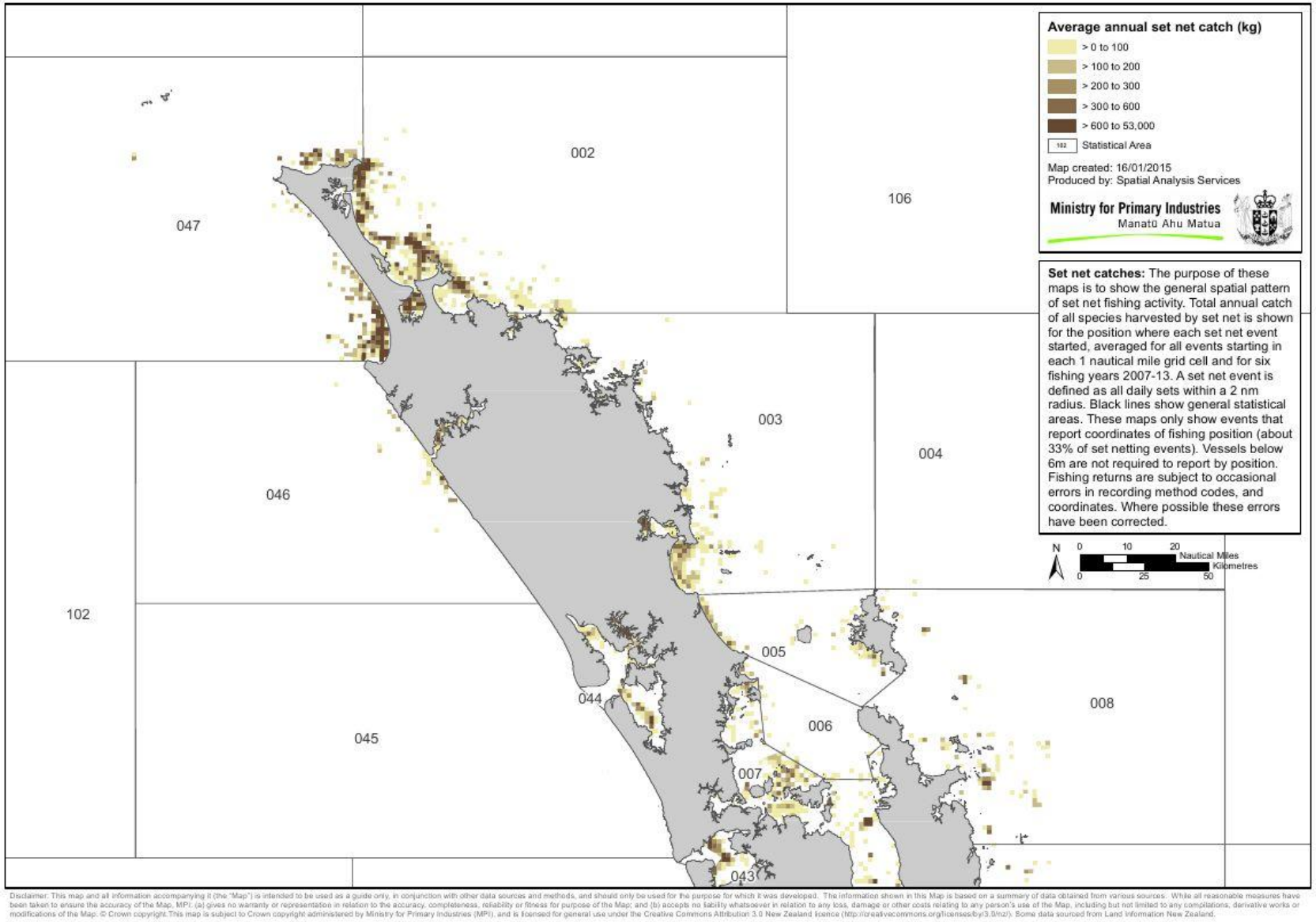

Figure 19: Annual average catch by set net, all species combined. (Source http://fs.fish.govt.nz/Page.aspx?pk=91 downloaded on 24/03/2017)

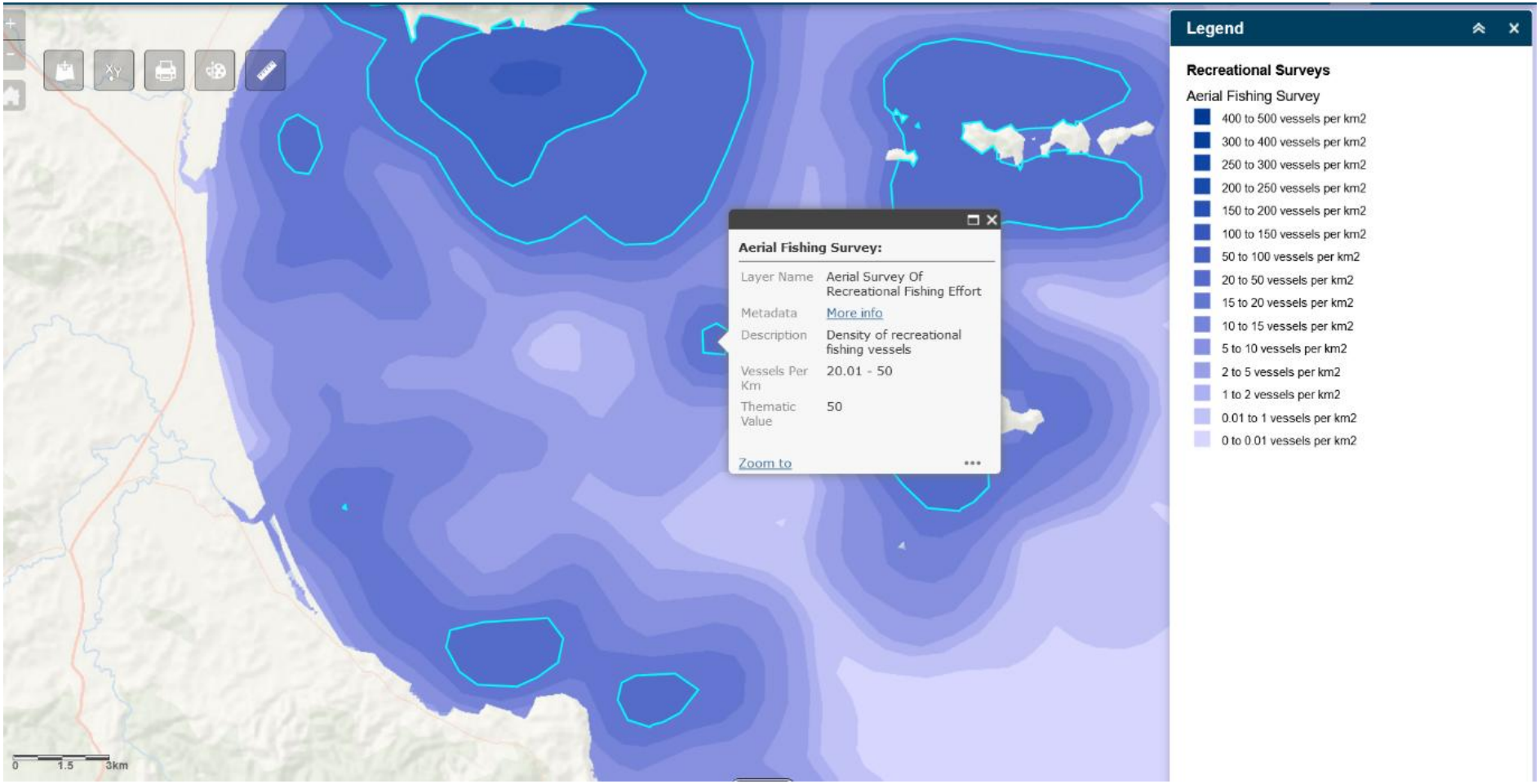

Figure 20: Distribution of recreational fishing effort (estimated vessels/km^2 per year) in Te Ākau Bream Bay from the 2013 aerial survey. The 20.01-50 vessel contour is identified for reference. (source https://maps.mpi.govt.nz/templates/MPIViewer/?appid=96f54e1918554ebbaf17f965f0d961e1 downloaded on 04/06/2024)