State of our Gulf 2020

Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi
State of the Environment Report 2020

Hauraki Gulf Marine Park
Ko te Pātaka kai o Tīkapa Moana Te Moananui-ā-Toi
20 years ngā tau e rua tekau

Hauraki Gulf Forum
Tīkapa Moana
Te Moananui-ā-Toi

WHAKATAUKI

Te kai a te tangata kē, he kai tūtongi kakī
Te kai a tōna ringa he tino kai, he tino mākona

Food from another hand merely tickles the throat
That gathered by one's own hand is real and satisfying

MIHI

Kei ngā toka tū moana
Kei te whānuitanga ake o te mana tangata
Te iti me te rahi
Hoatu, piki ake ki te tihi
Kimihia te pātaka
Aue, e whātoro ana
Taihoa ka kitea
Waihotia hei tohu maharatanga mo te ao
Tīhei mauriora

From the sentinels scattered throughout the oceans
To the farthest reaches of human endeavour
Both small and large
Seek sustenance
And as we keep searching
Eventually we will succeed
Let this be our heritage to the world
For long life shall be ours

First published February 2020

Published by:
Hauraki Gulf Forum
c/o Auckland Council
Private Bag 42300
Auckland, 1142

www.haurakigulfforum.org.nz
ISBN 978-1-98-858901-5

Cover: Kōura at the Cape Rodney to Okakari Point (Goat Island) Marine Reserve in 2009.
Photo by Richard Robinson www.depth.co.nz

KI UTA KI TAI
MOUNTAINS TO SEA

Our population has increased more rapidly than expected. Coastal development has mainly occurred around existing towns and settlements. The number of marinas has increased. Mooring numbers appear to have declined in the Auckland Region. Waitematā Harbour and Tāmaki Inlet have the highest levels of metal contamination. Sediment quality at the 20 Auckland sites monitored for at least 20 years has generally improved. With few exceptions, sediments from estuaries with mainly rural catchments have low levels of key metal contaminants. Greatest man-made loads of nitrogen to the Marine Park come from rivers draining the Hauraki Plains. Combined loads of total nitrogen and total phosphorus in Hauraki rivers declined between 1991 and 2015. Proposed fish farming could substantially increase nitrogen loads. Nitrogen concentrations increased in the Firth of Thames between 1998 and 2013. Nutrient levels on the Auckland coast tend to be lower than before the Marine Park was established. Water quality at many of Auckland's urban beaches regularly poses a health risk for swimmers. Auckland's central interceptor project should improve water quality in the Waitematā Harbour. High sediment inputs occur in some estuaries. Forty-six percent of monitored sites in the Marine Park have good or extremely good benthic health. Mānawa increased in monitored estuaries. Large-scale removals occurred in some places.

PAGE 82

PAGE 36

TIAKINA TE PĀTAKA KAI
PRESERVING THE FOOD BASKET

We are taking more fish commercially. The mix of fish caught commercially in the Marine Park has shifted. Systems and processes have been refined and improved. Knowledge about the status of fish stocks has improved, but gaps remain. Stocks of some fish species have needed rebuilding. Other stocks have stayed within acceptable limits. Recreational catches of tāmure, John dory and tarakihi have reduced. The kōura population has been substantially reduced. The status of scallop beds is not known. Shellfish gathering has reduced the availability of harvestable tuangi (cockles). The use of commercial methods that disturb the seabed have been stable or declining, but Danish Seining is frequently occurring in areas where regulations prohibit it. Kelp forests have been replaced by kina barrens. Tāiko (black petrel) fishing fatalities are unlikely to be sustainable. Some fishing effects can potentially be addressed through regional council plans. The area of the Marine Park protected by marine reserves has only increased by 0.05%. Mass mortalities of fish and shellfish are a common occurrence. Potentially toxic algae blooms are now common. The scale of marine farming has increased substantially, particularly in the Firth of Thames. Further growth in aquaculture is expected.

TE TAIAO
BIODIVERSITY

More islands are free of mammalian pests. The number of whales dying from ship-strike has been reduced. More of our seabirds are threatened. New Zealand fairy tern are in a perilous situation. New Zealand storm petrel are 'back from the dead'. More of our shorebirds are threatened. The status of Northern New Zealand dotterel has improved. The number of recorded non-indigenous marine species has increased substantially. Six new marine pests have arrived.

PAGE 130

Contents

KA MAHI NGĀTAHI TĀTOU, KA ORA AKE A TĪKAPA MOANA

Healing the Hauraki Gulf – together

I am a living, breathing embodiment of mauri.
The life force that connects us all, ki uta ki tai, from the mountains to the sea.

Look at me on a good day and all seems well.
But the truth is I've been hurting. Shellfish beds decimated. Fish stocks low. My seabed suffocating with plastic and sediment. A mighty ecosystem brought to its knees.

The healing process will take time, hard mahi, and co-operation.

And it will also take more than just aroha. I need a true, unrelenting partnership. One of protection and active restoration. Every one of us has a role to play in this, but we'll also need to work as one.

Only when my mauri is fully restored will this journey end. Back where it all began. A healthy, teeming, abundant taonga, with kaimoana and opportunity for all. Mauri ora!

I can be healed. I need you all by my side.
Working together, our future looks bright.

'Healing the Hauraki Gulf – together' was the result of an exercise conducted at the 2019 Making Waves conference. Nick Sampson (Director of Strategy at Principals Brand Agency) took on the challenge of facilitating this, which saw attendees work together in groups to populate a 'story structure' about the Marine Park. The drafts were read aloud and the results were inspiring, with many common themes. Principals took the stories away and helped develop the story above, which represents a collective narrative about the Marine Park.

Sunrise at Te Arai. Photo by Shaun Lee.

E HURI ANA NGĀ TAI

The Turning Tides

"Papaki mai ngā nunui, wawaratia ngā tai rere, e ripo e ngā ngaru nunui, te rehu tai, hei konei ra"
– na Makareta Moehau Tamaariki.

It is essential to recognise the spiritual, cultural and historic connections mana whenua have with the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. This report has endeavoured to capture equally and weave together Māori and Tauiwi perspectives.

Ki uta, ki tai, from the mountains to the sea. There are constant reminders that our taiao – environment is changing. The environment and the kaupapa for preservation and protection of this taonga we call The Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi, must come first.

Let us be the voice for the voiceless. At the Hauraki Gulf Forum's 2019 Making Waves Conference all attendees were asked what they would say if they were the moana of the Hauraki Gulf, Tīkapa Moana, Te Moananui-ā-Toi. Their beautiful collective story, 'Healing the Hauraki Gulf – together', is published on the previous page.

As we enter into this new decade, we reflect on all that has been accomplished and what more needs to be done to ensure our tamariki and mokopuna can enjoy this taonga.

In May 2019 the Hauraki Gulf Forum set two major goals; 1000 square kilometres of shellfish restoration and at least 20% marine protection of the Hauraki Gulf Marine Park. These goals are a starting point from which to grow dreams and aspirations. Through good management, collaborative strategies and plans in action, the dreams and aspirations of a healthy and vibrant Hauraki Gulf, Tīkapa Moana, Te Moananui-ā-Toi will be a reality.

It is important to acknowledge the dedication and efforts of mana whenua, government agencies, local government, philanthropic organisations, learning institutions, local businesses, community groups and individuals collectively committed to making a difference.

In addition, work by local and now central government to take forward the Sea Change – Tai Timu Tai Pari Marine Spatial brings with it both hopes and expectations. The increasingly positive relationships with local and central government, in particular with the Ministers of Conservation, Fisheries and Māori Development, are a source of strength for the moana.

After 20 years of the Hauraki Gulf Marine Park, it does feel like the tides are starting to turn for the better. Together we will achieve great results.

He waka eke noa – We are all in this waka together

"Who's willing to get their butt wet?"

Ms Moana Tamaariki-Pohe
Deputy Chairperson,
Hauraki Gulf Forum
Feburary 2020

WHAKARĀPOPOTANGA MATUA

He taonga a Tīkapa Moana me Te Moananui-ā-Toi. He taonga na te mea he ataahua ngā mea katoa mai te whenua ki te moana. Mai tātahi me ngā pari teitei, mai ngā motu - ahakoa te rarahi ahakoa te pakupaku, huri atu ki ngā waitai, ngā toka, ngā wahapū, ngā ngutuawa, me te nuinga atu o ngā taonga o te taiao. He taonga mo te maha, me te rerekētanga, o ngā nohoanga o taua rohe. He taonga na te mea he tohu rangatira.

He wāhi motuhake tēnei ki ngā tangata whenua na rātou te whakapapa me ngā kōrero kua tiritiria ki papatuanuku. Rātou e pakari ana na te huhua o te kai, na ngā rauemi me ngā tohu katoa kua puta mai i te whānuitanga āke o tēnei rohe. Rātou e kaha nei te whakapakari i te mātauranga o a rātou whenua, a rātou wai, a rātou rākau me a rātou kararehe. Ā, kua tupu ake a rātou tikanga kia mau tonu a āke tonu atu.

He taonga ki ngā iwi i tipu mai i reira, i neke mai no whenua kē pea, i haere mai hei manuhiri noa iho. He taonga ki ngā whānau e haere mai ana ki konei i te raumati hararei ai. He taonga ki ngā iwi e noho ana i reira na te mea e pai ana ki a rātou te noho wehewehe. He taonga ki a rātou e tirotiro haere ana, e hī ika ana, e tākaro ana, ā, e whakataetae ana. He taonga ki ngā tāngata ruku kai, ki ngā kairangahau taiao, me ngā tāngata kohi kai. He taonga ki a rātou kei konei katoa a rātou herengi e puāwai ana.

He taonga, ēngari inā noa atu te paruparu.

Kua pēnei, nā te mahi kino a te tangata, ahakoa ka kitea kāre rānei e kitea, ahakoa te tere te pōturi rānei, ahakoa ka tarea te whakatika.

Te nuinga kāre rawa atu e taea te whakatika.

Kei roto i te ture e kiia nei ko te Hauraki Gulf Marine Park Act ka kitea te mana o tēnei rohe mai Aotearoa whānui. I whakatinanatia tēnei ture mai te Hui Tanguru o te tau rua mano. Na konā ka whakatūngia te Marine Park me te Hauraki Gulf Forum. Ko te mahi o te Hauraki Gulf Forum he whakaohooho ake i ngā mahi whakahaere o te Marine Park.
Na te putanga mai o te Marine Park ka whakaarotia anei pea te rongoa kia whakaora ai te taiao e patua haere nei tātou. Te nuinga kāre ano kia whakaora. Ēngari ngā mahi whakatikatika i ngā motu, kāre ārikarika. Ko te mate kē kei te mamae tonu te moana.

He tino uaua te mahi whakatikatika i te Gulf. E rite ana ki te hoe waka. Ka hoe tahi ka pai. Ki te kore ka hurihia koe e te tai. Ma te kaha me te pakaritanga ka kore koe e kotiti. Ēngari mena ka pīrangi ū koe ki uta me tino kaha ake tō hoe. Ki te kore kua ngaro koe.

Ki te maanu koe kāre e hapa ka tutuki koe i te toka, ka tahuri. Mena ka tarea koe te maka haika, kia rahi tonu, kia kaha tonu ki te pupuri ki te toka. Ko ngā haika o tēnei rohe, ko ngā motu kua whakatikahia, me ngā tāpui taimoana. Kei kona e tiaki ana a tātou taonga, a tātou whakapapa; ngā manu, ngā ngārara, me ngā hua rākau; ngā rimu; ngā kōura me ngā tāmure.

Photo by Shaun Lee

Ki te ngoikore ngā haika, he paku rawa pea, kāre e mau, ka riro i te tai.

Kia maha ngā kaihoe kātahi ka taea pea te haere whakamua. Ēngari me whakaara, me kaha, me tino ora pai rātou, ka taea.

Āpiti atu ki ēnei ko te ture, ko te mahi whakaū, ko te kaitūao, ko ngā mahi kōkiri a ngā hāpori me ngā marae. Ēngari, kei te patua tonu te moana e te tini tangata me a rātou mahi hokohoko.

Koianei ngā kōrero kua kōrerotia mai ngā tau rua tekau, me ngā rīpoata o te Gulf kua tuhia, mai te tīmatanga o te Marine Park.
Kei te piki haere tonu te tini tangata, me ngā mahi hokohoko, ēngari kua tata pau te hau o te taiao. Kei whea ake he kōrero.

Heoi anō, he mahi kōkiri kei te haere, ēngari mena ka tutuki pai, ka hinga rānei, ko wai ka mōhio. Ākuanei ko te pātai kē mena he tika te whakatakototanga o ngā uara i roto in te ture mo te Hauraki Gulf Marine Park - ngā uara e pā ana ki te taiao, ngā mea e pā ana ki te mahi hokohoko, me ngā uara e pā ana ki te taha tangata. Ākuanei pea kei tua ake ētahi atu huarahi hei whakatika i ngā mahi whakahaere o te Gulf. Koianei anake te ture mo te katoa o Aotearoa e hāngai pono ana ki Tīkapa Moana me te Moananui-ā-Toi, kia pūmau ai te tiaki, te whakapiki ake, me te mau tika i ngā uara e kōrerotia nei. Ēngari kāre te ture nei e kaha ki te whakatika haere i ngā raruraru e tuhia nei.

Heoi anō he nui ngā huritanga o te Marine Park, ēngari kei raro kē e putu ana. Kāre e taea te aha mo ngā mahi i mahia, mo ngā mahi kāre i mahia. Engari ka taea te whakarite i te huarahi ki mua. He tino taonga ngā uara o Tikapa Moana me Te Moananui-ā-Toi, me tiakina pai. Ma tātou tonu e whakarite te ao a muri ake nei, ā, ma tātou anō e hangā.

Ēngari me tere te mahi, kei mahue tātou.

Photo by Shaun Lee

EXECUTIVE SUMMARY

The Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi is special. It's special because of the beauty and variety of its land and seascapes. Sandy beaches, towering bluffs, islands large and small, clear open water, reefs, sheltered harbours, tidal estuaries, and a host of other natural habitats. It's special because the abundance and diversity of life those places support. It's special because it enriches our lives.

It's special to tangata whenua, whose ancestry and history are etched into its landmarks. Who prosper from the profusion of kai, materials and experiences it provides. Who continually build upon their knowledge of its land, waters, plants and animals. And who have developed and adapted customs and practices to enjoy the taonga of the Gulf, now and into the future.

It's special to the people who grew up beside it, moved to its shores, or simply come to visit. The families that spend summer days at its beaches. The island inhabitants, who treasure living in isolation and wilderness. To those seeking a more cosmopolitan experience beside its shores. It is special to the boaties that explore, fish, play and race in its waters. To divers, naturalists, and gatherers. And, to those who earn their livings from it.

It's special, but it's far from pristine. Many things have been lost or degraded.

It has been progressively reshaped by our activities. Sometimes visibly, sometimes invisibly. Sometimes slowly, sometimes fast. Sometimes reversibly. Often irreversibly.

The national importance of Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi is recognised through the Hauraki Gulf Marine Park Act. That came into effect in February 2000, establishing the Marine Park and the Hauraki Gulf Forum, tasked with improving its management. The establishment of the Marine Park held the promise of halting or reversing progressive environmental decline by promoting a more integrated approach to its management. Yet many, if not most of the issues that existed when the Marine Park was established have not been resolved. Island restoration efforts have been a spectacular success, but the situation is not as good in the marine space.

Turning the trajectory of the Gulf around has proved to be difficult. It's like paddling a waka against the tide. Everyone needs to be pulling in the same direction. Ease off and you quickly drift back. Strength and stamina are needed to simply maintain your position. More is needed to move towards your destination. Gains can quickly be lost.

If you drift back, you could hit rocks and lose everything. You can throw an anchor out, but it has to be large and strong enough to hold. Our restored islands and marine reserves are an anchor. They protect our taonga, our heritage: indigenous birds, reptiles, insects and vegetation; the golden canopies of surging kelp forests; the grandfather kōura and tāmure that were once the masters of their domains. If those anchors are too weak or small, they will not hold against the tide.

Photo by Shaun Lee

Extra paddlers help us move forward, but they must be motivated, powerful and fit. Those paddlers are the rules that govern what we do, the enforcement of those rules, voluntary work, community and Māori initiatives, and other mahi carried out to protect and enrich the Marine Park. To date, they don't appear to have the strength and stamina needed to hold against the tide of population and economic pressures on the moana.

Similar stories have been repeatedly told in the 20 years and six State of the Gulf reports since the Marine Park was established. They essentially come down to the struggle between economic development and population growth on the one hand, and environmental loss on the other. There is no free lunch.

New initiatives are happening that may help or hinder. But perhaps it is time to also consider whether we got the balance between environmental, economic and social values right in the Hauraki Gulf Marine Park Act. Whether there are better options for delivering integrated management and improved outcomes for the Gulf. It is the only Act to directly recognise the national significance of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. To make special provision for the protection, enhancement, and maintenance of its values. But it doesn't appear to have the strength to turn things around.

Changes in the Marine Park have often been rapid and unidirectional. It is too late to reverse the effects of many past actions, or inactions. However, we can decide the future. The high values of Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi still warrant special protection. It is up to us to determine what the future will be, and to take the actions needed to achieve it. That needs to be done quickly, because time is working against us.

Photo by Shaun Lee

Child collecting tuangi. Photo by Shaun Lee.

TIAKINA TE PĀTAKA KAI
Preserving the food basket

What has changed since the Hauraki Gulf Marine Park was established in 2000?

TE MAHI HĪ IKA
Fishing

We are taking more fish commercially. The total reported commercial catch of fish in the most recent three-year period was around 30% greater than in three-years before Marine Park was established.

The mix of fish caught commercially in the Marine Park has shifted. There has been a major shift in the relative proportions of the two key fish species landed commercially. Around 34% less tāmure (snapper) and 470% more blue mackerel were landed in the latest three-year period compared to when the Marine Park was established. The increase in blue mackerel is likely to reflect changes in where they are being caught (i.e. in the Marine Park), rather than a change in the overall catch.

Systems and processes have been refined and improved. The Harvest Strategy Standard introduced in 2008 provided a set of guidelines for fisheries decision making. Policies and plans including "Fisheries 2030", and national plans for inshore finfish and shellfish followed. Other milestones have included the introduction of several species into the quota management system, and the roll out of electronic reporting and GPS tracking on commercial vessels.

TE MĀTATORUTANGA O TE IKA
Fish stock sustainability

Knowledge about the status of fish stocks has improved, but gaps remain. The status of eight of the top 20 finfish stocks has been assessed (compared with three when the Marine Park was established). The status of the remaining 12 stocks are unknown.

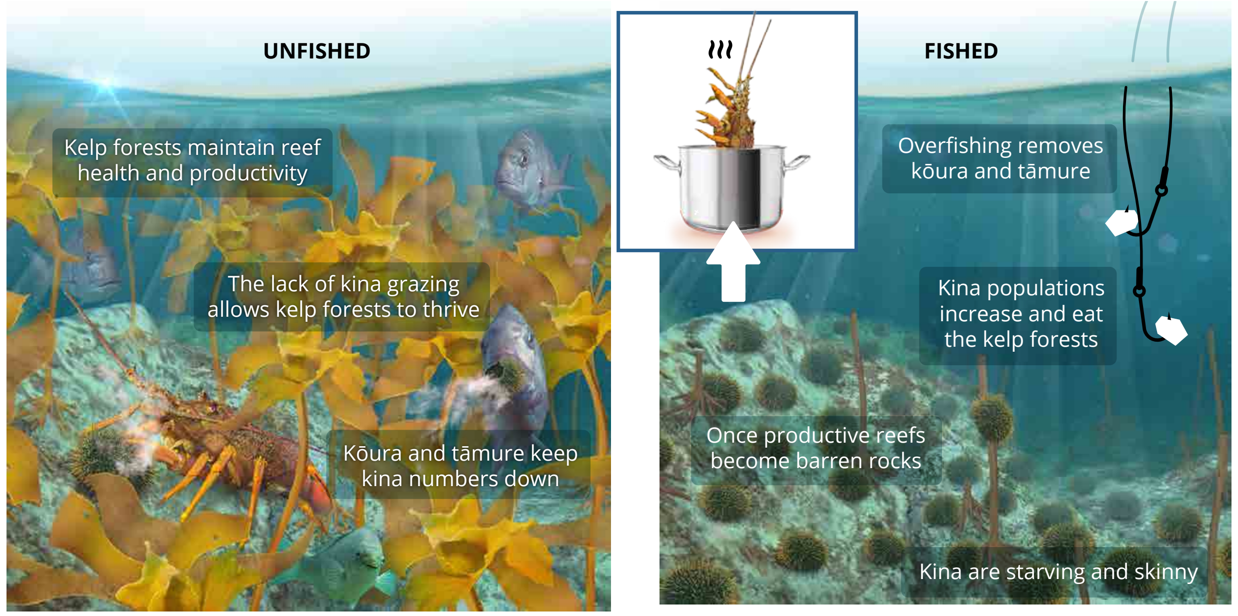
Stocks of some fish species have needed rebuilding. Tāmure and tarakihi were at levels where action was needed to actively rebuild their stocks (less than 20% of unfished stock biomass). Actions have been taken, and the rebuild of these stocks towards target levels is expected. The gemfish stock is also being actively rebuilt.

Other stocks have stayed within acceptable limits. Skipjack tuna, kahawai, gurnard and barracoota are fluctuating around target levels. John dory are possibly below target, but considered unlikely to require active rebuilding.

Recreational catches of tāmure, John dory and tarakihi have reduced. Tāmure is by far the main species caught by recreational fishers. Cuts in bag limits, increased size limits and fewer recreational fishers are likely to have contributed to recreational tāmure catches dropping by around 27% between the 2011–12 and 2017–18 aerial, boat ramp and national panel surveys. Catches of John dory and tarakihi also dropped, but more gurnard was taken in the latest survey. Little change occurred in kingfish and kahawai catches.

TE KŌURA
Crayfish

The kōura population has been substantially reduced. Kōura are now regarded as functionally extinct in heavily fished areas. In the Cape Rodney to Okakari Point (Leigh) and Tāwharanui Marine Reserves,



Kina barrens are created by overfishing

numbers are now at levels similar to those in unprotected areas in the mid-1990s (this is primarily attributed to fishing around their boundaries). Commercial fishers struggled to catch their quota and have voluntarily shelved catch. In 2018, large cuts in catch allowances were made to allow the stock to rebuild towards target levels.

TE TIPA
Scallops

The status of scallop beds is not known. The last scallop survey was carried out in 2012, so the current status of scallop beds in the Marine Park is uncertain.

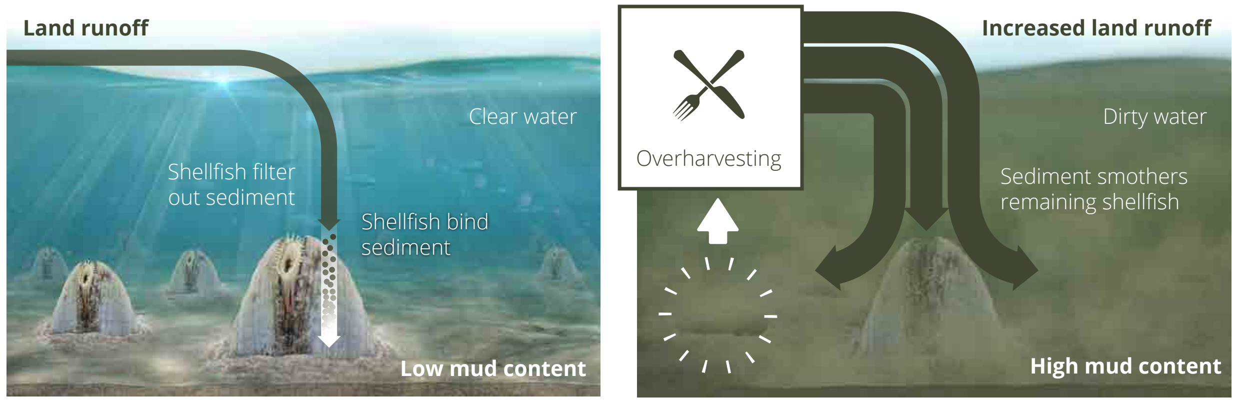
TE TUANGI
Cockles

Shellfish gathering has reduced the availability of harvestable tuangi (cockles). There has been a universal decline in the density of harvestable (>30 mm) tuangi over the last 20 years at the 12 monitored sites where harvesting is allowed year-round. Increases in harvestable tuangi have only occurred in monitored sites where seasonal harvesting bans are in place (Umupuia, Eastern Beach and Cockle Bay).

ĒTAHI ATU TUKUNGA IHO O TE MAHI HĪ IKA
Indirect effects of fishing

The use of commercial methods that disturb the seabed have been stable or declining, but Danish Seining is frequently occurring in areas where regulations prohibit it. The number of bottom trawls in the latest three-year period was 51% less than when the Marine Park was established, while numbers of Danish Seine sets were similar. Between 2016–17 and 2018–19, around 22% of Danish Seine sets occurred in 300 km² where regulations prohibit this method. Fisheries NZ acknowledges there is a discrepancy between how the legislation, which defines this area, has been interpreted and presented in this report, and what is currently understood and enforced in practice. They have committed to reviewing this discrepancy as part of management actions put forward in a fisheries plan for the Hauraki Gulf, that is being developed as part of central Government's response to the Sea Change Hauraki Gulf Marine Spatial Plan. Numbers of commercial scallop dredge tows have fluctuated with most dredging occurring in the inner Mercury Bay area.

Kelp forests have been replaced by kina barrens. Research suggests that reductions in populations of tāmure and kōura (crayfish) have allowed kina to flourish: causing the loss of kelp forests, and expansion of urchin barrens on the Marine Park's subtidal reefs. It is not known whether fisheries targets for tāmure and kōura have been set high enough to reverse the change.



Filter feeders keep the ocean healthy

Tāiko (black petrels) fishing fatalities are unlikely to be sustainable. Fatalities have declined but there is still estimated to be a 70% likelihood that mortality rates from commercial fishing are greater than what the population of threatened tāiko can sustain.

Some fishing effects can potentially be addressed through regional council plans. The Court of Appeal recently found that the Resource Management Act (RMA) does not prevent regional councils from controlling fisheries resources through their RMA functions, provided they are not doing so for Fisheries Act purposes.

The area of the Marine Park protected by marine reserves has only increased by 0.05%. Marine reserves cover 0.3% of the Marine Park. The only new reserve to be created since the Marine Park was established is Te Matuku Marine Reserve, on the southern side of Waiheke Island. The application for that reserve was lodged before 2000.

TE MATEMATENGA
Mass mortalities

Mass mortalities of fish and shellfish are a common occurrence. There have been 10 recorded mass mortality events in the Marine Park over the last 10 years. Four of these events were in Whangateau and Okura Estuaries, where shellfish populations appeared to be stressed by adverse environmental conditions.

TE PARAKORE
Harmful algae

Potentially toxic algae blooms are now common. Aotearoa's first recorded cases of shellfish poisoning caused by harmful algae occurred in 1993. Nine harmful algal blooms between 2000–2019 resulted in harvest closures and/or public warnings.

TE MAHI AHUMOANA
Aquaculture

The scale of marine farming has increased substantially, particularly in the Firth of Thames. Available data suggests that marine farms occupied around 685 ha of space in 2000. Today, consents for shellfish farms in the Waikato Region cover around 1562 ha (2690 ha if Wilson Bay farm zones A and B are used instead of farm footprints), with another 390 ha zoned for fish farms. In the Auckland Region, existing farm footprints cover around 240 ha, with recent approvals allowing for farms in another 960 ha, and applications being processed for around 334 ha. Applications for around 2270 ha of spat catching space, made prior to a 2001 moratorium halting such applications, also remain on hold.

Further growth in aquaculture is expected. Central Government's recently released Aquaculture Strategy seeks to grow the industry from one that produces $600+ million in annual sales nationally, to $3 billion in sales by 2035.

Massey University zoology staff examine a mass mortality of kororā / little penguins.
Photo by Richard Robinson www.depth.co.nz

Waihou River. Photo by Shaun Lee.

KI UTA KI TAI
Mountains to Sea

What has changed since the Hauraki Gulf Marine Park was established in 2000?

TE WHAKAWHĀNUITANGA ATU KI TE MOANA
Coastal urban and ocean sprawl

Our population has increased more rapidly than expected. Estimates from 1999 indicated Auckland's population could increase from 1.2 million people in 1999 to 2 million in 2050. By 2018, it had already grown to 1.7 million people.

Coastal development has mainly occurred around existing towns and settlements. All current coastal towns and settlements, and many man-made coastal structures already existed when the Marine Park was established. Since then, substantial, localised development has occurred in coastal towns and settlements north and east of Auckland, and in and around most, if not all, towns and settlements on the Coromandel Peninsula. Areas away from existing towns and settlements have largely remained free of substantial development.

The number of marinas has increased. Numbers have risen from 13 in 2000, to 18 (built or consented) today. In addition, two canal developments are now present on the Coromandel Peninsula and new marina has been proposed for Coromandel Harbour. Provision has also been made for a canal development along Wairoa River near Clevedon.

Mooring numbers appear to have declined in the Auckland Region. The home ports of (by far) the greatest number of boats, is in the Auckland Region. There are currently estimated to be around 4,300 swing and pile moorings in that region of the Marine Park, compared with 5800 in 2000.

NGĀ PAIHANA
Toxic chemicals

Waitematā Harbour and Tāmaki Inlet have the highest levels of metal contamination. Multiple sites in those areas are in the amber (moderate) or red (high) ranges for copper, mercury and zinc. Copper and lead concentrations tend to be stable or declining, while zinc concentrations tend to be stable or increasing.

Sediment quality at the 20 Auckland sites monitored for at least 20 years has generally improved. More sites are now in the green (low) category for copper, lead and zinc than in 1999. However, more sites are also in the red category for zinc, mainly due to sites in the Southern Waitematā shifting from the amber to red.

Diver near Ponui Island. Photo by Shaun Lee.

With few exceptions, sediments from estuaries with mainly rural catchments have low levels of key metal contaminants. The exceptions are a scattering of sites on the Coromandel Peninsula associated with historic mining activity (Tairua, Coromandel and Thames), and sites in the Upper Waitematā Harbour. At those locations, copper, lead, zinc, and/or mercury concentrations are in the amber or red ranges.

NGĀ KAIORA
Nutrients

Greatest man-made loads of nitrogen to the Marine Park come from rivers draining the Hauraki Plains. Between 2006 and 2015 total nitrogen loads from Hauraki rivers were estimated to be 3730 t per year. In comparison the load from Auckland's two largest, east coast wastewater treatment plants is around 245 t per year, while Auckland's largest river has been estimated to discharge around 120 t per year.

Combined loads of total nitrogen and total phosphorus in Hauraki rivers declined between 1991 and 2015. Those declines appear to be due to improved treatment of sewage, industrial wastewater and dairy shed effluent, rather than reductions in diffuse agricultural loads. However, trends from 2008–2017 indicate total nitrogen concentrations tend to be increasing at sites along Waihōu River (and its tributaries) and declining or stable along Piako River (and its tributaries) and Waitakaruru River.

Proposed fish farming could substantially increase nitrogen loads. The Waikato Regional Plan provides a potential discharge allowance up to 800 t of nitrogen per year for fish farms. Actual allowances will be considered during consenting.

Nitrogen concentrations increased in the Firth of Thames between 1998 and 2013. This was tentatively attributed to a reduction in the rate that nitrogen was being recycled back to the atmosphere (denitrification rates) rather than increasing catchment loads. There are signs that this is lowering oxygen levels in bottom waters of the Firth of Thames and making the water more acidic.

Nutrient levels on the Auckland coast tend to be lower than before the Marine Park was established. But, trends between 2009 and 2018 provide a confusing picture of more recent changes.

HE PAI MO TE KAUKAU
Suitability of water for swimming

Water quality at many of Auckland's urban beaches regularly poses a health risk for swimmers. In 2017–2018 summer, modeling predicted 38% of 50 sites exceeded the high-level guideline more than 10% of the time; and 14% were predicted to exceed the guideline more than 20% of the time. Three sites were assumed to always exceed it.

Auckland's central interceptor project should improve water quality in the Waitematā Harbour. The project is designed to reduce the average annual overflow volume of wastewater in the central interceptor catchment (Auckland's worst) by 80%.

TE PARAWAI ME NGĀ NGĀRARA O RŌ WAI
Sediment and benthic health

High sediment inputs occur in some estuaries. This is reflected in the increasing proportion of mud and very fine sand of many monitored sites over the last 10 years.

Forty-six percent of monitored sites in the Marine Park have good or extremely good benthic health. The healthiest sites are located in the outer areas of Waiwera, Pūhoi, Ōrewa and Okura estuaries, while the poorest quality sites are in the Upper Waitematā Harbour, southern Firth of Thames and inner Tairua Estuary. The largest estuary-wide changes in benthic health have occurred in the Waitematā Harbour (7 sites have declined), Okura (3 sites have declined) and Ōrewa (5 sites have improved).

NGĀ MĀNAWA
Mangroves

Mānawa increased in monitored estuaries. Average cover increased by 1.6% per year between 1993–2000 to 2012–2017, with largest increases occurring in Tairua (6% per year) and Pūhoi (4% per year). In other estuaries, such as Whitianga and Whangapoua, there was little change in area covered, but mangrove density greatly increased.

Large-scale removals occurred in some places. Clearances have been carried out in Whangamatā and Tairua estuaries under the direction of WRC.

TE TAIAO
Biodiversity

Bryde's Whale. Photo by Richard Robinson www.depth.co.nz

What has changed since the Hauraki Gulf Marine Park was established in 2000?

NGĀ KARAREHE ME NGĀ TIPU O NGĀ MOTU
Island biodiversity

More islands are free of mammalian pests. Pests have been eliminated from 15 motu (islands) since 2000, increasing the number of pest sanctuaries from 25 to 40. This increased the pest free area available for threatened species on the Marine Park's motu from around 1,200 ha to 10,000 ha. Populations of many native animals have flourished, increasing their resilience against future threats.

More motu have been revegetated. Significant revegetation has occurred on Motuora, Motuihe and Rotoroa, while moderate increases have occurred on Tiritiri Mātangi and Kawhitu.

TE PAKAKE
Bryde's whales

The number of whales dying from ship-strike has been reduced. Only one Bryde's whale has been killed by ship strike since a voluntary transit protocol was introduced in 2013 to limit ship speeds. By comparison, six whales were killed by ship strike in the five years before the Marine Park was established.

The conservation status of Bryde's whales remains Nationally Critical. Concerns remain about their prey being reduced by fishing.

NGĀ MANU O TE MOANA
Seabirds

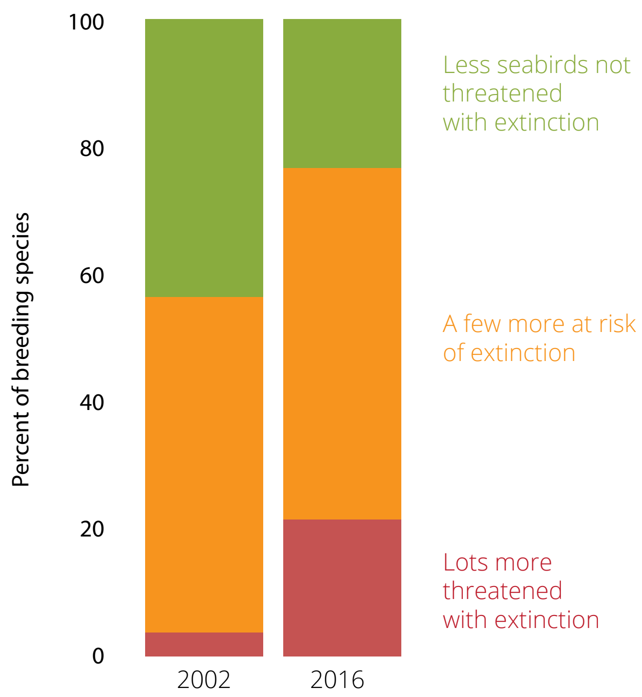
More of our seabirds are threatened. In 2000, 4% were classed as Threatened. Today 22% are.

New Zealand fairy tern are in a perilous situation. Estimates of their population size vary slightly, but there is currently considered to be a maximum of only 43 adults left anywhere in the world. Numbers have not increased over the past decade. Fairy tern require intensive management, with habitat loss, disturbances, and predation identified as significant impediments to their survival and recovery.

Tāiko (black petrels) fishing fatalities are unlikely to be sustainable. There is estimated to be a 70% likelihood that annual potential fatalities from commercial fishing are greater than what the population of threatened tāiko can sustain.

New Zealand storm petrel are 'back from the dead'. Thought extinct for many years, New Zealand storm petrel were spectacularly photographed and videoed in 2003. They were subsequently found to be breeding on Hauturu, with a potential population of hundreds, if not thousands.

Grey-faced petrel at NZ Bird Rescue. Photo by Shaun Lee.



Changes in risk of extinction for Gulf seabirds

Tāiko on Aotea. Photo by Shaun Lee.

NGĀ MANU O TĀTAHI
Shorebirds

More of our shorebirds are threatened. In 2000, three were classed as Threatened. Today five are.

The status of Northern New Zealand dotterel has improved. Active management since the 1980s has greatly increased their breeding success, with the population doubling since the programme began. As a bonus, variable oystercatchers, another 'At Risk' species, have benefited from the dotterel management programme as the two species share the same breeding habitat.

NGĀ TAONGA O TĀWĀHI
Non-indigenous marine species

The number of recorded non-indigenous marine species have increased substantially. In 2000 around 66 species had been recorded, compared to around 144 today.

Six new marine pests have arrived. In 2000, the Asian date mussel was the only known marine pest in the Marine Park. Today we also have wakame (Asian kelp), Mediterranean fan worm, Australian droplet tunicate, clubbed tunicate, Asian paddle crab and the carpet sea squirt.

WHAKAPAPA

Identity

Aotea. Photo by Shaun Lee.

Whakapapa lies at the center of Te Ao Māori (the Māori world view). It links te hunga tangata (mankind) with te taiao (the environment). It binds a child to its parents, grandparents, siblings, cousins, uncles and aunties, and back though time to distant tīpuna. To names and places; to the land and sea. To plants, birds, fish and other creatures. And further back to the deities at the core of Māori spiritual beliefs. Ultimately to Rangi (Sky father) and Papatuanuku (Earth mother). Our collective whakapapa is etched into the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. Our actions, those of our tīpuna, and those of natural processes, have shaped the Gulf we see today.

The Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi is ancient. It has been molded by powerful natural forces. Some explosive, such as the volcanoes that produced motu (islands), roto (lakes), maunga (mountains) and toka (reefs). These include the many maunga of Tāmaki Makaurau and Moehau (Coromandel Peninsula). Motu such as Rangitoto and Hauturu. Others involved the power of time, sun, wind and water to slowly weather features away, leaving only remnants of once grand formations, or exposing ancient rock that was once buried deep within the earth. Seas have risen and fallen, great rivers have been diverted, and sand and mud have washed into the sea and slowly accumulated — often far from their points of origin.

The original plants and animals of Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi also had an ancient lineage. Some, like the tuatara directly whakapapa back to Gondwana, the distant ancestor of Aotearoa. Others evolved over many thousands, if not millions, of years to create a unique assemblage of species found only here. The ancient forests and seas teemed with life. Great shoals of fish, together with seals, sharks, whales and dolphins swarmed the ocean, while flocks of seabirds swirled above. Vast beds of kuku (mussels), tio (oysters), tipa (scallops), tuangi (cockles), pipi and kina (sea urchins) peppered the seabed and toka (reefs), while masses of kōura (rock lobster) roamed the toka and sandflats, gathering together to release their larvae, search for food and mate.

Forests covered much of the land. Forests of kauri, tōtara, rimu, pūriri and a myriad of other species. Kahikatea-lined wetlands stretched across the southern shores of the inner Gulf and for miles into the hinterland of the Hauraki Plains. Birds, reptiles, and insects of all shapes and sizes flew, slithered, wandered, waded or swam, free from the threat of mammalian predators.

This is the world that Māori of the first ancestral waka encountered when they entered and settled in and around the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. The history of Māori settlement, occupation and events during the centuries that followed is recorded in waiata (song) and kōrero tuku iho (oral tradition); in the names of landmarks, waters, pā and kāinga; and in wāhi tapu. It can be seen in the physical footprints of trenches, terraces, storage pits, and middens left on the land. It is reflected in the mātauranga (knowledge) and tikanga (customs and practices) developed through centuries of occupation and experience. It is lived through the relationships that iwi, hapū and whānau have with their lands and environment.

The iwi and hapū within the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi rohe (region) are numerous and fiercely independent of each other. This is not unusual, as one size does not fit all in Māoridom. Each have their own stories, their own whakapapa and their own traditions, even if some overlap.

Tuatara. Photo by Shaun Lee.

The Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi that Māori first encountered had already changed

The diversity of tangata whenua in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi includes:

- Ngāti Wai, Ngāti Manuhiri and Ngāti Rehua – the rohe stretching from around Whāngārei to Aotea (Great Barrier Island) and Te Hauturu-o-Toi (Little Barrier Island) and back to Warkworth;
- Ngāti Whātua ō Kaipara, Ngāti Whātua ō Ōrākei and Te Uri ō Hau – covering the rohe Kaipara Harbour to Mahurangi and into Central Auckland – Tāmaki Makaurau and Waitematā harbour;
- Te Kawerau-ā- Maki, Ngāti Te Ata Waiohua, Ngāti Tamaoho, Ngāi Tai ki Tāmaki, Te Ahiwaru and Te Akitai Waiohua – from the mouth of the Waikato River to the western beaches north of Auckland, across the Auckland isthmus and inner islands back to the northern Kaiaua coastline;
- Ngāti Hako, Ngāti Hei, Ngāti Porou ki Hauraki, Ngāti Pūkenga, Ngāti Rāhiri Tumutumu and Ngāti Tara Tokanui – the Hauraki rohe;
- The Marutūāhu Confederation consisting of Ngāti Maru, Ngāti Tamaterā, Ngāti Paoa, Ngāti Whanaunga and Te Patukirikiri – from Mahurangi, the Gulf Islands, to the Hauraki rohe and extending toward Tauranga;
- Waikato-Tainui – whose interests date back to the landing of the Tainui waka in Tāmaki Makaurau before journeying south.

Change in Gulf sea life since human arrival

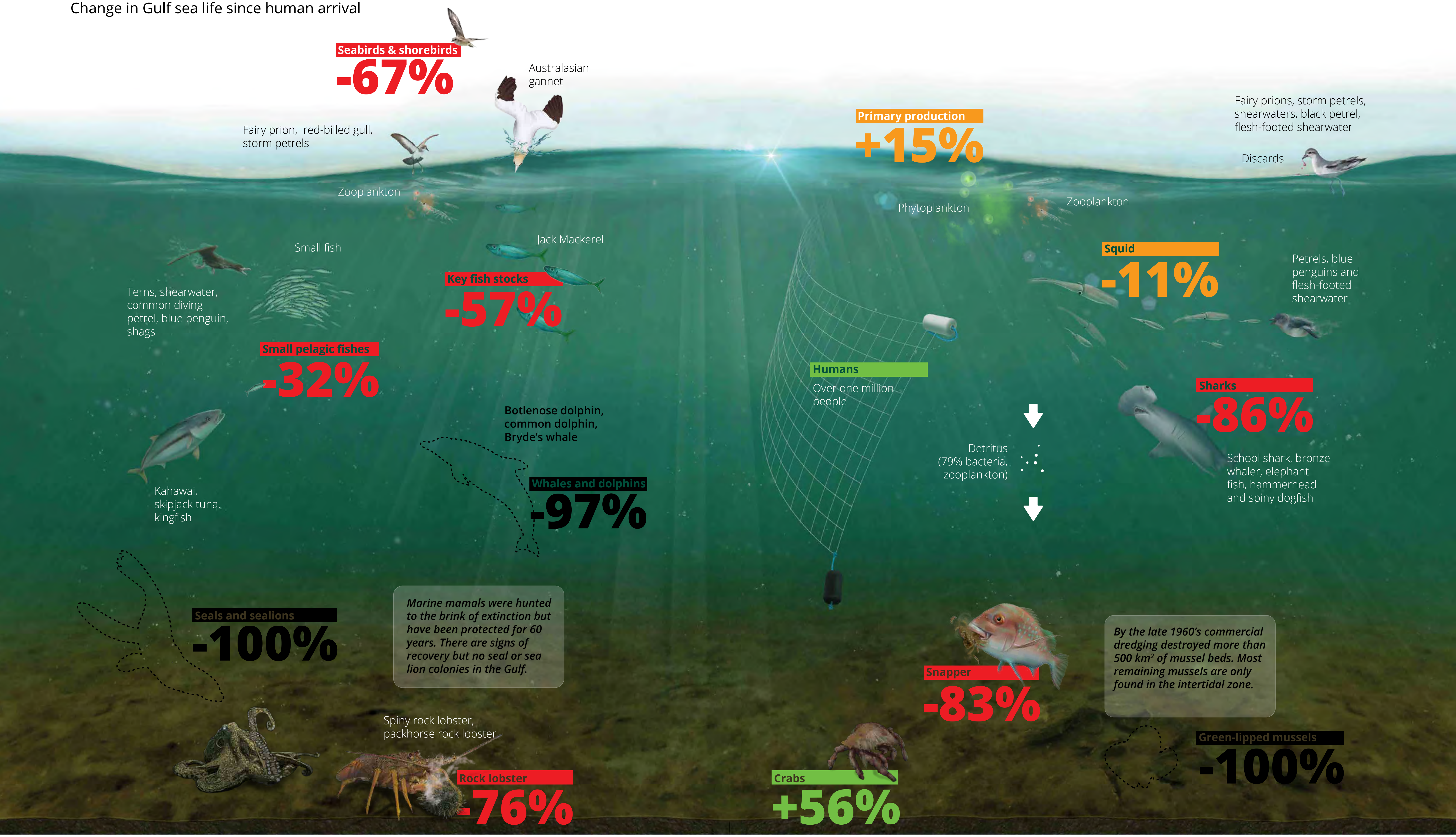


Figure 1. *Pinkerton MH, MacDiarmid A, Beaumont J, et al. Changes to the food-web of the Hauraki Gulf during the period of human occupation: a mass-balance model approach. Wellington: Ministry for Primary Industries; 2015.*

MacDiarmid AB, McKenzie A, Abraham ER. Top-down effects on rocky reef ecosystems in north-eastern New Zealand: a historic and qualitative modelling approach. Wellington: Ministry for Primary Industries; 2016.

18,000 fish in Sanford's Thames Fish Yard in October 1905. Photo by A E Court. Auckland Libraries Heritage Collections AWNS-19051026-12-4.

by the time Europeans arrived around 200 years ago. The new arrivals brought different perspectives, different values, and new governance systems. New knowledge and technology. New plants and animals. They also had the ability to accomplish previously unimaginable feats of engineering and extraction. Step-by-step, decade by decade, the lands and ocean where progressively transformed by the generations that followed. By the 1990s, we had drastically altered the ecosystem ***(see Figure 1)***. Gone were great swarms of spawning mature tāmure (snapper) that greeted Māori when they first arrived. Gone were shellfish beds that once blanketed the seabed. Gone was the vast Hauraki wetland. Gone were moa, snipe, huia and other birds, whose calls will never again be heard. And still, new and diverse pressures were facing the region. Tāmure stocks had recently reached an all-time low, concerns were growing over a 'gold-rush' for aquaculture space, our population was growing, demand for new urban development was increasing, public awareness of climate change was rising, and more species were being pushed towards extinction.

At the same time, new and exciting possibilities were emerging. Environmental awareness and knowledge were increasing. Some birds and reptiles were being brought back from the brink of extinction. Marine and terrestrial habitats were being restored, and new regulations were being hailed as world leading.

Yet reversing the historic and on-going decline was still proving difficult, with progress being hampered by agencies working in silos. Local, regional and central government therefore sought a more integrated management approach. In February 2000, the Hauraki Marine Park Act (2000) was passed by Parliament and quickly came into force. It established the park and set objectives for its management; recognised the historic, traditional, cultural and spiritual relationship of tangata whenua; and formally established the Hauraki Gulf Forum — a grouped formed to advance integrated management.

It has now been 20 years since the Act came into effect. This State of our Gulf report looks back over that time to see what has changed.

TĪKAPA MOANA / TE MOANANUI-Ā-TOI
The Hauraki Gulf Marine Park

Sediment plumes in the Gulf. Photo by Shaun Lee.

The Act

The Hauraki Gulf Marine Park Act (Act) was the first enactment of the new millennium, coming into effect on 27 February 2000. It recognises the national significance of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi.

The Act established the Marine Park and the Hauraki Gulf Forum. It recognises the historic, traditional, cultural, and spiritual relationship of the tangata whenua with the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi and its islands. It provides objectives for the management of the waters, islands, and catchments of the Marine Park, including their use. And it seeks to integrate the management of the natural, historic, and physical resources within each of those elements.

The Act specifies that the purposes of the Hauraki Gulf Marine Park (Marine Park) are to:

- recognise and protect in perpetuity the international and national significance of its land and natural and historic resources;
- protect in perpetuity and for the benefit, use, and enjoyment of the people and communities of the Gulf and New Zealand, the natural and historic resources of the Marine Park including scenery, ecological systems, or natural features that are so beautiful, unique, or scientifically important to be of national significance, for their intrinsic worth;
- recognise and have particular regard to the historic, traditional, cultural, and spiritual relationship of tangata whenua with the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi, its islands and coastal areas, and the natural and historic resources of the Marine Park:
- sustain the life-supporting capacity of the soil, air, water, and ecosystems of the Gulf in the Marine Park.

It also defines what the Marine Park does and what areas it can include.

The Marine Park

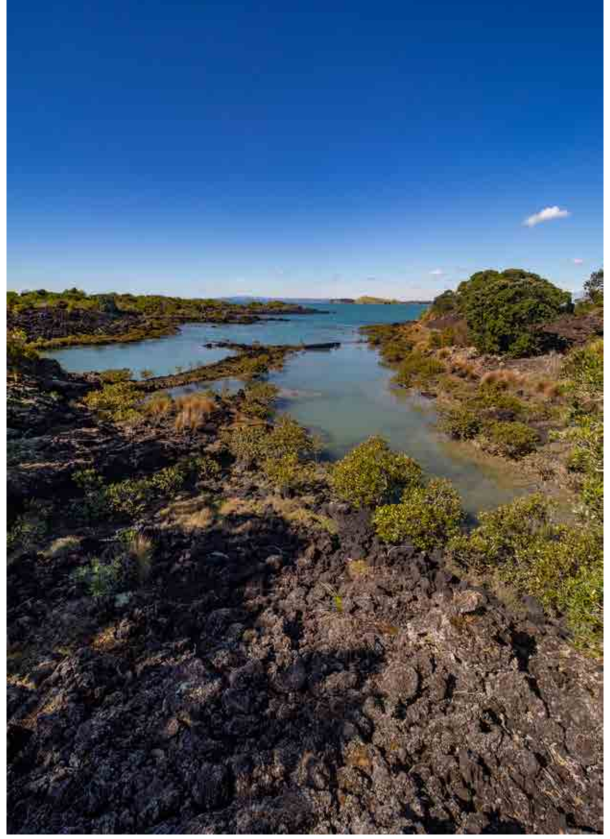
The Hauraki Gulf Marine Park (HGMP) includes the foreshore, seabed (excluding defence areas) and seawater on the east coast of the Auckland and Waikato regions, as well as Te-Hauturu-o-Toi (Little Barrier Island), the Mokohinau Islands, more than half of Aotea (Great Barrier Island), Cuvier Island, Rangitoto Island, Motutapu Island, Mount Moehau, Mansion House on Kawau Island, North Head Historic Reserve, other small islands administered by the Department of Conservation (DOC), six marine reserves, and the internationally recognised RAMSAR wetland in the Firth of Thames. It also includes a number of reserves owned by, or previously owned by, Forest and Bird, Waitakere City Council and Sir Rob Fenwick.

The marine environment in the Marine Park encompasses deep oceanic waters, shallow coastal seas, bays, inlets, harbours and broad intertidal flats. The complexity and nature of the physical environment is reflected in a diverse and highly productive marine ecosystem. The islands of the Marine Park are also a critical refuge for rare plants and animals.

Although the Marine Park does not include its entire catchment[a], the Hauraki Gulf Marine Park Act 2000 (Act) does recognise the inter-relationship between the Marine Park and its islands and catchments, and therefore contains objectives related to catchment management.

The Marine Park is economically important, and most of its catchments are intensively developed and settled. Its shores contain Aotearoa's largest metropolitan area and extensive tracts of productive farmland. Its coastal waters are of great importance to commerce in this country, containing the Port of Auckland, and many smaller ports and marinas. It is lived in and worked in, and supports commercial enterprises and transport.

[a] The area of land that collects water that flows into the Marine Park.



Rangitoto Island. Photo by Shaun Lee.

The Marine Park enriches people's lives. We live beside it. We play, swim, fish, and compete in its waters. We are invigorated by its vistas and constantly changing nature. By its dolphins, whales, sharks, rays and other fish life. By the kōura and octopus pulled from its waters. By seabirds, shorebirds and endangered forest birds brought back from the brink. We happily work together to restore island and marine biodiversity. And we are mutually saddened when its special values are degraded or lost.

The Marine Park, its islands and catchments have complex inter-relationships that need to be understood and managed, to ensure that their values are maintained, protected or enhanced in perpetuity. The Marine Park crosses territorial and departmental jurisdictions, land and water boundaries, and cultures. It is therefore essential that the objectives and approaches of management organisations are integrated.

The Hauraki Gulf Forum

In addition to establishing the park, the Act established the Hauraki Gulf Forum (subsequently referred to as the Forum). The Forum is made up of 12 representatives from local and regional councils, six tangata whenua representatives, and representatives of the Ministers of Conservation, Fisheries and Māori Development. The Forum is not a decision-making body, but among other things it is required to:

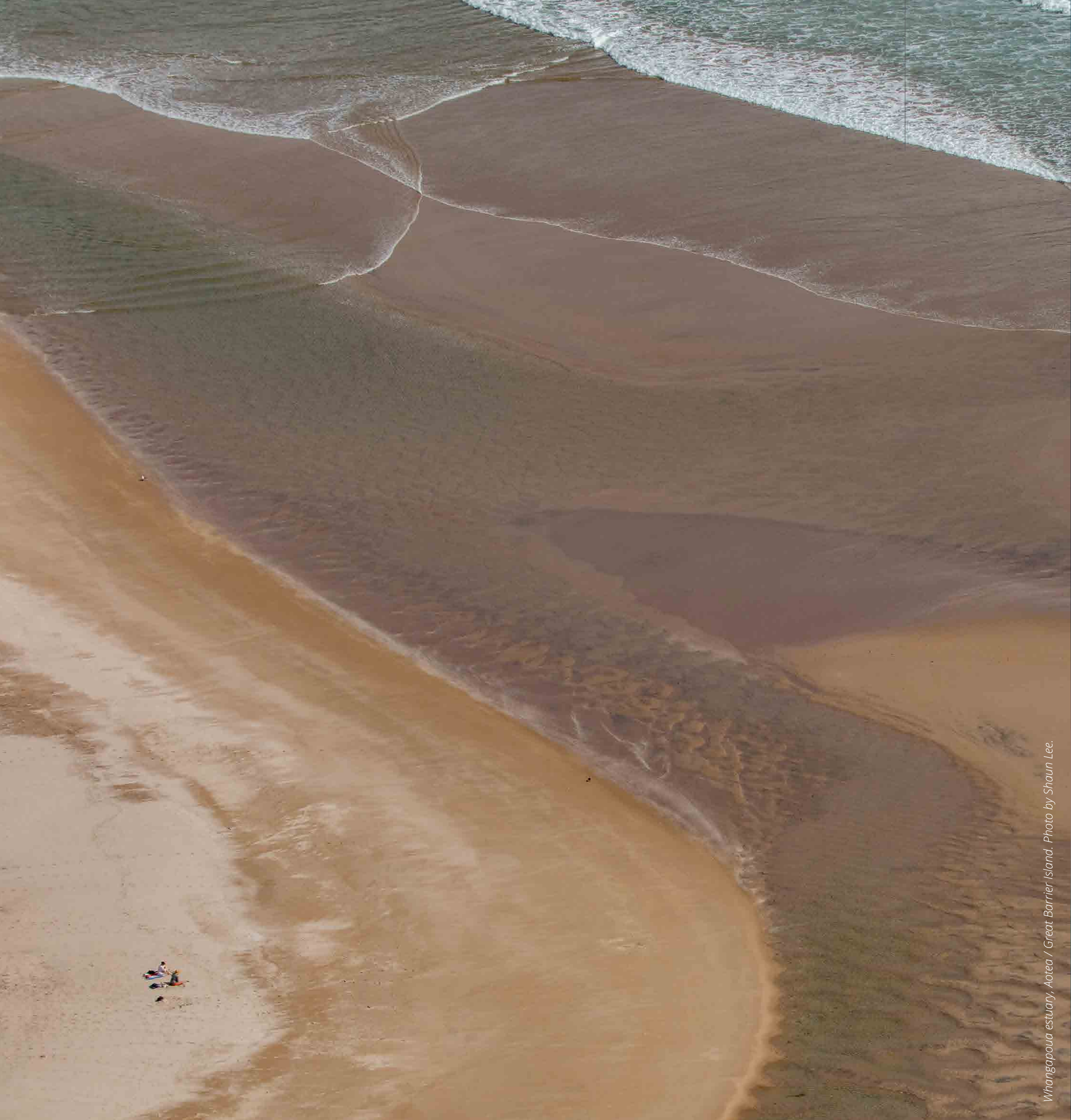
- promote and advocate the integrated management and, where appropriate, the sustainable management of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi, its islands, and catchments;
- prepare a list of strategic issues, and to require and receive reports from constituent parties[b] of the Forum regarding the development and implementation of policies and strategies for addressing those issues;
- prepare and publish a report on the state of the environment in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi every three years, which includes information on progress towards integrated management, and responses to the strategic issues it has identified.

This report

The Marine Park is now 20 years old. In this report, we look back at its starting point, reflect on what has happened since its creation, and assess where we are today. For consistency, the information presented here is largely based around the key environmental indicators used in past State of our Gulf reports since 2011, although in this report some have been regrouped or rearranged.

The final section of the report, Weaving the Strands, examines progress towards integrated management and responses to the strategic issues, and the influence of the Hauraki Marine Park Act (2000) on those matters. It recognises that the Act is only single thread in a much larger kete (basket) of historical, political, social, and regulatory events and outcomes. That context is important. The influence of the Act is considered through that lens.

[b] Constituent parties are any Minister or local authority who has the power under to appoint one or more representatives to the Forum, including tangata whenua representatives.



Whangapoua estuary, Aotea / Great Barrier Island. Photo by Shaun Lee.

NGĀ TOHU MĀORI
Core Māori values

We are also aware of the need to paint a picture of the Marine Park that is not determined solely by science-based environmental indicators on which reports of this kind are typically based. This report aims to provide a greater focus on how the Marine Park is viewed through a Te Ao Māori lens.

Essentially Te Ao Māori is defined as a value system that is pervasive throughout Māori communities, wherever they might be. It is a mosaic of checks and balances that determine how the world is seen through Māori eyes and how that world is shaped in addressing those checks and balances. There is a mingling of the spiritual and existential that calls for careful nurturing of all things animate and inanimate. Te Ao Māori does not necessarily make the distinction between the living and the non-living in the way that western science does, but it does not make the Māori world view any less relevant.

Significant Māori values (uara) that apply to environmental management are described below.

KAITIAKITANGA
Guardianship

A key overarching value in this report is kaitiakitanga (guardianship) — a means to care for and protect the environment. Tangata whenua are kaitiaki (guardians) of both the land and waterways in their rohe, and it is this responsibility that traditionally ensured the continued good health and abundance of resources. Such was the intimate relationship between people and their environment that it was said that the health of a community was reflected in its environment, and vice versa. For example, if the marine space was under stress something was obviously amiss with the people of a coastal rohe.

What is more in question these days is the ability or freedom of tangata whenua to exercise kaitiakitanga. Modern day legal and other bureaucratic constraints often get in the way of the ability of kaitiaki to practice kaitiakitanga to ensure the on-going prosperity of a taonga.

MANAAKITANGA
Caring for/showing respect

The mana (prestige/authority) of iwi, hapū, or whānau is extremely important in Māori society, and can be measured in different ways. It can, for example, be assessed by the ability to manaaki (care for/host) manuhiri (visitors), especially on important occasions such as tangihanga (funerals) or other traditional hui. Being able to cater for manuhiri, particularly with delicacies known to be rohe specialties, is expected, in some instances obligatory. For coast dwellers like those across the Marine Park's expanse it is usually generous helpings of kai moana (seafood) that manuhiri will remember. Kai moana like kōura (rock lobster), ika (fish), kina, kuku (mussels), parengo (seaweed), tītī (mutton birds) and pipi. To not cater accordingly — for whatever reason — brings great shame (whakamā) on the iwi.

Caring for the environment from which such riches are gathered is a function of kaitiaki. Without a healthy and thriving environment in which food resources are plentiful, the ability to properly host manuhiri is diminished, perhaps even nullified.

Tangata whenua are expected to be exemplary custodians of breeding grounds on the one hand, and hosts par excellence on the other. Whilst some might argue the two don't always go hand-in-hand, it is nevertheless important that there are checks and balances to ensure that they do. This is a challenge that iwi in the Marine Park rohe deal with constantly.

"Kai ana mai koe he atua, noho ana au he tangata" — You eat like a God while I sit here as a mere mortal.

MAHINGA KAI
Food gathering places

Mahinga kai in marine environments include traditional fishing grounds, diving spots, and shellfish gathering places. Some will be well known and frequented; others not so — they may be well-guarded secrets, or in out of the way, less visited, locations.

The health of mahinga kai is a perennial concern for iwi, often reflecting a yearning to recapture a time when the mahinga kai were an indisputably resplendent pātaka kai (food cupboard) full of the bounties of the sea god Tangaroa. Whilst there are various factors that contribute to a poorly performing mahinga kai, one that iwi are all too familiar with is their own inability to control how they are managed and monitored in the face of overwhelming overuse.

RANGATIRATANGA
Right to exercise authority/ sovereignty

The right of an iwi/hapū/whānau to participate in meaningful decision-making about the marine and terrestrial environment in which they hold mana whenua is fundamental in Te Ao Māori. As a Māori scholar once said: rangatiratanga is *"high-order leadership, the ability to keep the people together in order to maintain and enhance the mana of the people."*

Rangatiratanga is about being in control, having the right to determine one's own destiny, often in ways that have, until now, been absent or withheld in some way. That right is normally inherited.

HE REREKĒTANGA MO NGĀ TOHU MĀORI: TE KAUPAPA WAI ORA

Innovation in Māori indicators: Te Wai Ora Monitoring Framework

Waharoa on Rangitoto Island. Photo by Shaun Lee.

Māori perspectives of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi are grounded in whakapapa and mātauranga, together with personal experience and observation. Tangata whenua have accumulated knowledge of the moana through centuries of looking and listening, kōrero, fishing, traversing, swimming and caring for mahinga kai. Knowledge of physical elements such as tides, currents, and the comings and goings of birds, fish and other animals. Knowledge also, of intangible elements such as mauri, wairua and wāhi tapu. This knowledge has been passed from one generation to the next and is typically treated as a taonga to be handed down in the same, or a better state, than when it was received.

Māori knowledge includes elements that cannot be detected by instruments, or directly counted or measured. Strips from a test kit don't change colour when immersed in wairua or mauri. Yet these values are fundamental determinants of Māori wellbeing. This is a challenge when it comes to measuring and monitoring the values of most relevance to Māori.

Puti Wilson, of Ngāti Hinemanu and Ngāti Paki descent, works for Auckland Council's Healthy Waters Department. Puti's work involves navigating her way through these challenges. She has been leading the development of the Wai Ora Monitoring Framework, a new tool for accessing the knowledge of tangata whenua in a manner that puts them in the driver's seat and avoids the need for sensitive information to be divulged. Puti has worked with the Environmental Protection Agency and Statistics NZ to develop a robust set of attributes and methods. Importantly, the method can be tailored to meet the needs of individual groups. For instance, Te Ahiwaru have adapted the methods for their rohe with kaumātua providing historic details that put today's situation into context.

The key component of the framework is Ka Muri, Ka Mua Cultural Landscape Monitoring, with the assessment being carried out in three stages:

- Field work involving the assessment of key, overarching themes by rangatahi (youth).
- A wānanga involving kaumātua, kuia, pakeke (elders/adults), rangatahi and scientific input, to combine knowledge and gather historical information for comparison with today.
- The consolidation, analysis and presentation of findings.

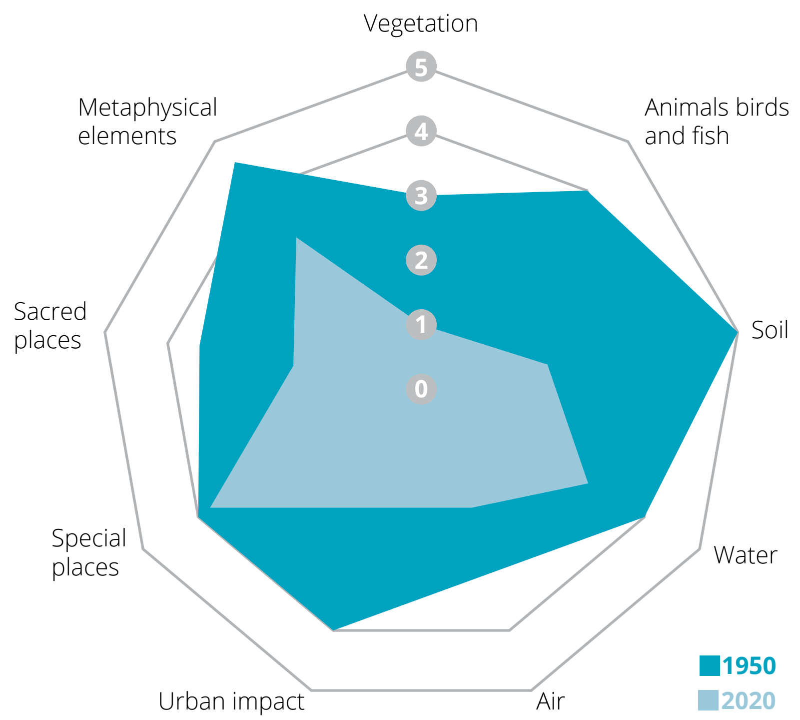
Nine overarching themes were originally developed through the Environmental Protection Agency working with Māori:

1. vegetation;
2. animals, birds and fish
3. soil;
4. water;
5. air;
6. urban impact;
7. special places;
8. sacred places; and,
9. metaphysical elements.

These provide a holistic framework for considering natural, manmade, Te Ao Māori and metaphysical elements of the environment. More specific measures sit beneath each of these themes. The information gathered, or measured, within each can be targeted at the key issues of importance to whānau, marae, hapū and/or iwi. The overall output is a 'radar plot' that provides a simple summary of how each theme is tracking along a scale from zero (worst) to five (best), as well as a picture of the overall ora (health) (*Figure 2*).

Similar tools have been developed by other Māori researchers. Puti believes the advantages of the Ka Muri, Ka Mua Cultural Landscape Monitoring method is the rigour that has gone into its development, its relative simplicity, and that it doesn't require sensitive information to be divulged. Puti is now eager to put the tool to work for Māori. She is keenly aware of the gap in Māori-specific environmental indicators and aims to assist tangata whenua of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi in filling that void.

***Figure 2:** A radar plot showing how the results of a Ka Muri, Ka Mua Cultural Landscape Monitoring assessment are summarised.*



Tahuna Torea Nature Reserve. Photo by Shaun Lee.

"Few people are lucky to have an intimate connection with the ocean on a timescale long enough to become aware of changes. Fishermen do, scuba divers do, but for most of us it's just the blue bit beside the road as we are driving around the country"
– Prof. Simon Thrush.[1]

NGĀ TOHU TAIAO

Environmental indicators

The Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi is never static. It naturally varies over time. It responds to changes in weather and climatic conditions, shoreline features, and a myriad of other factors. The influences of human actions get superimposed upon these natural rhythms. Some, such as the accumulation of sediment or small changes in fish or shellfish populations, are hard to separate from the natural ebb and flow of the Marine Park, especially over short periods. Other actions, such as reclamation, construction, island revegetation, and the reintroduction of threatened species occur more rapidly and are hard to miss.

It can be difficult and costly for scientists to separate natural from human-related change. Complex techniques are often required, and answers can be similarly complex. This feeds through to complicated regulation and management practices. In this report we try to cut through the complexity, by purposely limiting the amount of technical detail. Rather, we focus on the key results and findings that illustrate changes over the past 20, or so, years. Technical detail was presented in previous State of Our Gulf reports and readers are referred back them (and the material they reference) if they require more detailed explanations.

Child collecting tuangi. Photo by Shaun Lee.

TIAKINA TE PĀTAKA KAI

Preserving the food basket

The ability of an iwi, hapū or whānau to tiaki (take care of) the food resource in their rohe has always been important in Te Ao Māori. The successful management of a plentiful food supply, or pātaka kai, is as much a matter of iwi/hapū/whānau pride as it is about satisfying human hunger. For tangata whenua of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi rohe, this is reflected in the abundance and health of ***"ngā tamariki ā Tangaroa"*** (the children of the Sea God, Tangaroa). If they are in great abundance, fat and juicy, the pātaka is in good hands.

Tikanga (customs) guides the fishing practices of tangata whenua. Tikanga that has been passed from generation to generation. Tikanga built on mātauranga (knowledge) of hidden reefs, holes and shellfish beds. When and where to catch tāmure, kahawai and other ika, based on the time of year, tide and weather conditions, and phases of the moon. Times when shellfish are fat, kina bulge with roe, and kōura are soft or in berry. And practices to sustain the mauri of fishing grounds and ensure harvests provide for the needs of their people, now and into the future.

Tikanga adapts, but contemporary fishing practices and pressures are nothing like those experienced by tīpuna (ancestors). This is a challenge for tangata whenua and contemporary managers. This section looks at food resources in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi, and provides information on: who's catching fish, how and where are they catching them, the status of key fish and shellfish species, the broader effects of fishing on the Gulf, marine farming, kai moana safety and the incidence of mass mortalities of sea life.

INDICATOR / TOHU

TE MAHI HĪ IKA
Fishing

Longline fishing. Photo by Richard Robinson www.depth.co.nz

Tangaroa, the God of the Sea and the progenitor of fish is a central figure in Māori mythology, and in wider Polynesian mythology. He played a significant part in the separation of his parents Ranginui (Sky Father) and Papatuanuku (Earth Mother), much against the urgings of his brother Tūmatauenga (God of Man and War) who wanted them killed. Tūmatauenga was infuriated by the actions of Tangaroa. From that time, when the descendants of Tūmatauenga go fishing they are said to be continuing the war against the progeny of Tangaroa, the fish.

Fishing was, and is, an important practical and spiritual activity for Māori. It has also become a major economic and recreational pursuit. Fishing has one of the greatest environmental impacts on the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi, where over 100 different finfish and a variety of other kai moana are caught (*see Figure 3 for examples)*. Fish are caught using a variety of methods. Bottom trawling, purse seining, longlining, Danish seining and set netting provide the bulk of the commercial catch, but a range of other netting, trawling, lining and potting methods are also used (*see pages 46-47*).

Regulations govern how, where and when fishing can occur, and how much can be taken. They range from complete 'no-take' zones to areas or times where certain fishing methods are prohibited (e.g. bottom trawling or Danish seining). Other restrictions such as catch and size limits are used to regulate commercial fishing. Bag and size limits, and fishing seasons are also placed on recreational fishers, while permits are required for Māori customary fishing. Currently, there are no taiāpure or mātaitai reserves in the Marine Park, but fishing is prohibited in six marine reserves that cover around 0.3% of the Marine Park. Apart from the conversion of Tāwharanui Marine Park to a marine reserve in 2011, the last marine reserve to be approved was Te Matuku in 2003 ***(see case study on page 140).*** All forms of fishing (apart from research fishing) are also prohibited in cable protection zones, which cover around 4.9% of the Marine Park. However, there is little evidence of ecological change occurring within the largest cable protection zone in the Marine Park. The reasons for that have not been determined, but it is important to note that it was not set aside with biodiversity or habitat protection in mind.[2]

This indicator looks at key changes in commercial fishing methods and the commercial and recreational catches of fish in the Marine Park.

20 YEARS AGO

Commercial

Around 17,000 tonnes (t) of fish were reportedly caught commercially from the Marine Park[c] in the three years before it was established (between 1996–97 to 1998–99).

The greatest proportion (by greenweight[d]) of fish landed by commercial fishers was caught by bottom trawling (27%), with slightly less taken by bottom longlining (26%) and purse seining (25%). Danish seining (10%) and set netting (8%) also took significant quantities.

Nine species made up 80% of the commercial catch, with tāmure comprising over half (42%), or around 7000 t of the catch reported between 1996–97 to 1998–99. This was followed by Jack mackerel (11%), blue mackerel (8%) and skipjack tuna[e] (6%) (*Figure 4*).

Recreational

Data on recreational fishing was limited, with no detailed breakdown of catch from the Marine Park available.

TODAY

Commercial

The total reported commercial catch of fish in the most recent three-year period was around 30% greater than in three-years before Marine Park was established. Around 21,000 t of fish were caught commercially between 2016–17 and 2018–19.

The top five species caught between 2016–17 and 2018–19 were blue mackerel (7500 t, 36%), tāmure (4700 t, 23%), Jack mackerel (10%), skipjack tuna (8%) and trevally (5%) (*Figure 4*).

There has been a major shift in the relative proportions of the two key fish species landed commercially in the Marine Park. Around 34% less tāmure and 470% more blue mackerel were landed in the last three-year period compared to prior to the Marine Park being established.

Pilchards went from a minor species with reported landings of 1 t before the park was established, to being ranked 8th with reported landings of 376 t in the recent period.

Three-year landings of Jack mackerel and skipjack tuna increased by 16% and 76%, respectively, while landings of John dory, gurnard and rig decreased by around 50% to 70%.

The greatest proportion (by greenweight) of fish landed by commercial fishers was caught by purse seining (57%), followed by bottom longlining (12%), and bottom trawling (10%). A new method of fishing, precision bottom trawling, also took a significant quantity (7%) (*Figure 5*).

Recreational

Regular aerial, boat ramp and national panel surveys[3-6] have provided detailed information on recreational fishing catches and patterns (*Figure 6* and *Figure 9*). Tāmure is by far the main species caught, with nearly 2000 t estimated to have been taken from the Marine Park in the 2017–18 fishing year[f]. That catch was substantially (27%) less than in 2011–12, which was before the size limit was increased from 27 to 30 cm and the daily catch was reduced from 9 to 7 fish. Around 40,000 fewer people are also estimated to have fished in the entire snapper 1 (SNA1) management area in 2017–18 (SNA1 includes coastal areas from North Cape to East Cape).

The recreational catches of tāmure, kahawai and kingfish exceed the commercial catches. Commercial catches are greater than recreational for the other top-20 species caught in the Marine Park (*Figure 7*).

The most recent panel survey[6] indicates that recreational catches of kingfish and kahawai are currently sitting at around 20–25% of the tāmure catch and have changed little since 2011–12.

Trevally, gurnard, John dory and tarakihi make up the third tier of the recreational fishery with around 20 to 80 t of these species being caught in 2017–18. Recreational catches of trevally and John dory have decreased by 37%, tarakihi has decreased by 66%, and gurnard has increased by 10% over the six years between surveys.

Less than 20 t of other fish species is estimated to have been caught by recreational fishers in 2017–18.

[c] Includes statistical reporting areas 005, 006, 007 and 008.

[d] Unprocessed weight i.e., weight 'as caught'.

[e] A proportion of skipjack tuna catch is likely to have come from beyond the offshore boundary of the Marine Park (the statistical reporting areas straddle the Marine Park). The management of this species throughout the western and central Pacific Ocean (WCPO) is the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC). New Zealand is responsible for ensuring skipjack tuna management within our waters is compatible with their procedures.

[f] Estimates based on National Panel Survey areas 3b, 5a, 5b, 6, 7, 8, 9, and 10, data provided by MPI (Ministry for Primary Industries).

Average annual catch of the top 27 species caught in the Gulf **(tonnes)**

Figure 3. *Average annual catches (commercial (2016–17 to 2018–19) plus estimated recreational (2017–18)) catches of top 27 species (tonnes).*

Commercial catch estimates

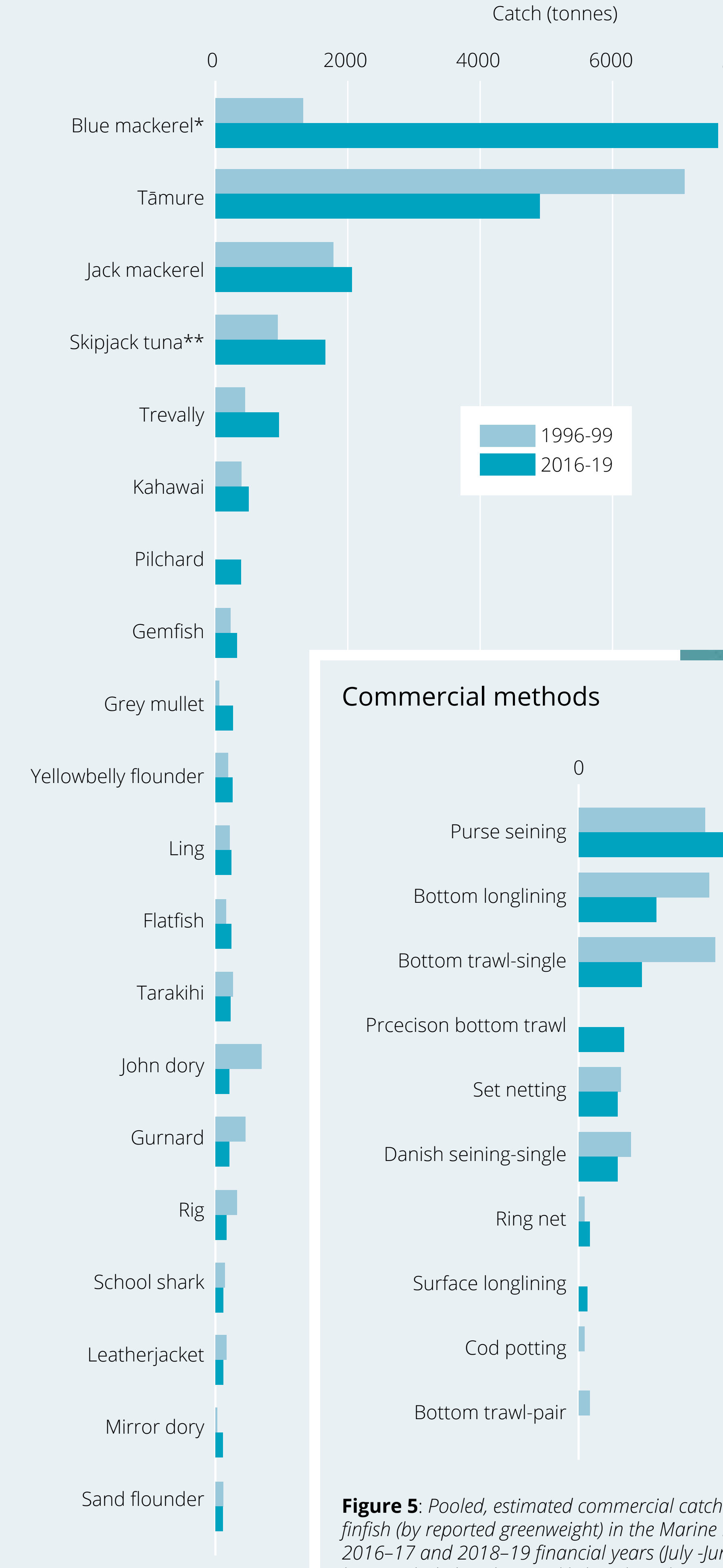


Figure 4: *Pooled, estimated commercial catch of the top 20 finfish species (by reported greenweight) caught in the Marine Park between the 1996–97 and 1998–99 and the 2016–17 and 2018–19 financial years (July–June). Orange roughy, hoki and cardinal fish have been excluded as they are likely to have been caught beyond the offshore extent of the park, and freshwater fish have been excluded) (data provided by Fisheries NZ).*

**Although there has been a 300% increase in blue mackerel catch in the Gulf, landings in the Fisheries Managment Area have been stable.*

***A proportion of skipjack tuna catch is also likely to be taken beyond the offshore boundary of the Marine Park.*

Commercial methods

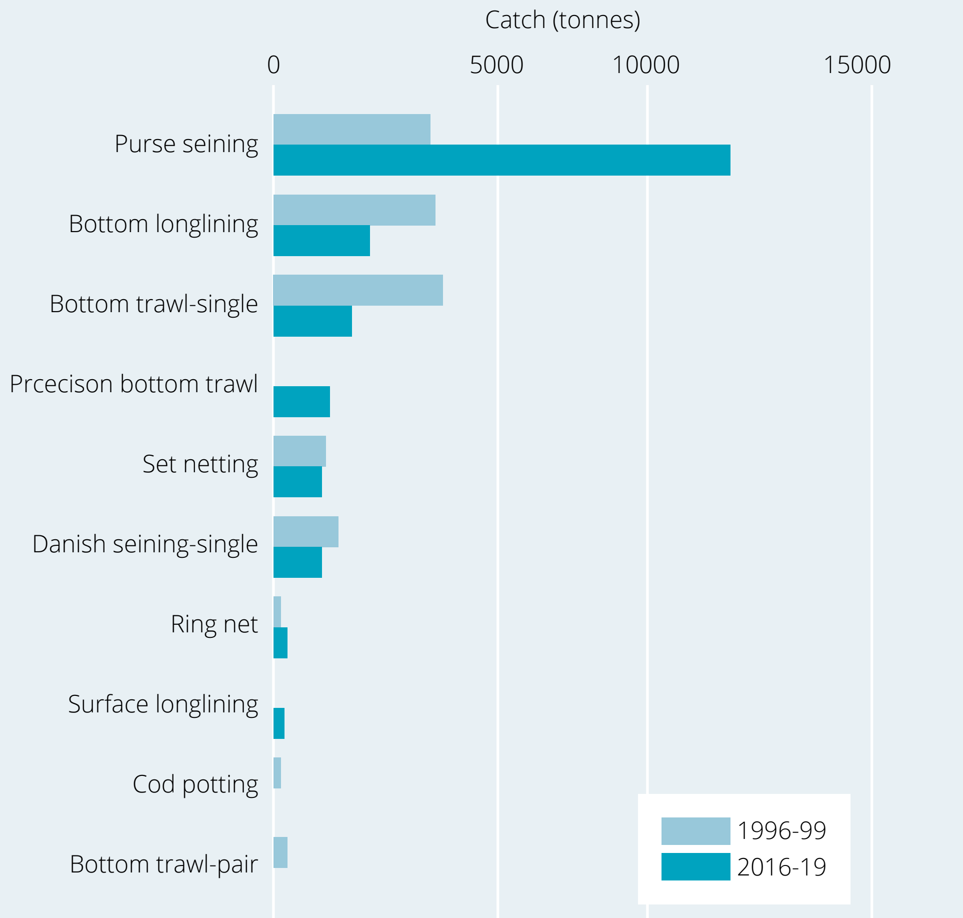


Figure 5: *Pooled, estimated commercial catch of methods that caught at least 50 tonne of finfish (by reported greenweight) in the Marine Park between the 1996–97 and 1998–99 and the 2016–17 and 2018–19 financial years (July -June for orange roughy, hoki and cardinal fish have been excluded as they are likely to have been caught beyond the offshore extent of the park, and freshwater fish have been excluded) (data provided by Fisheries NZ).*

Recreational catch estimates

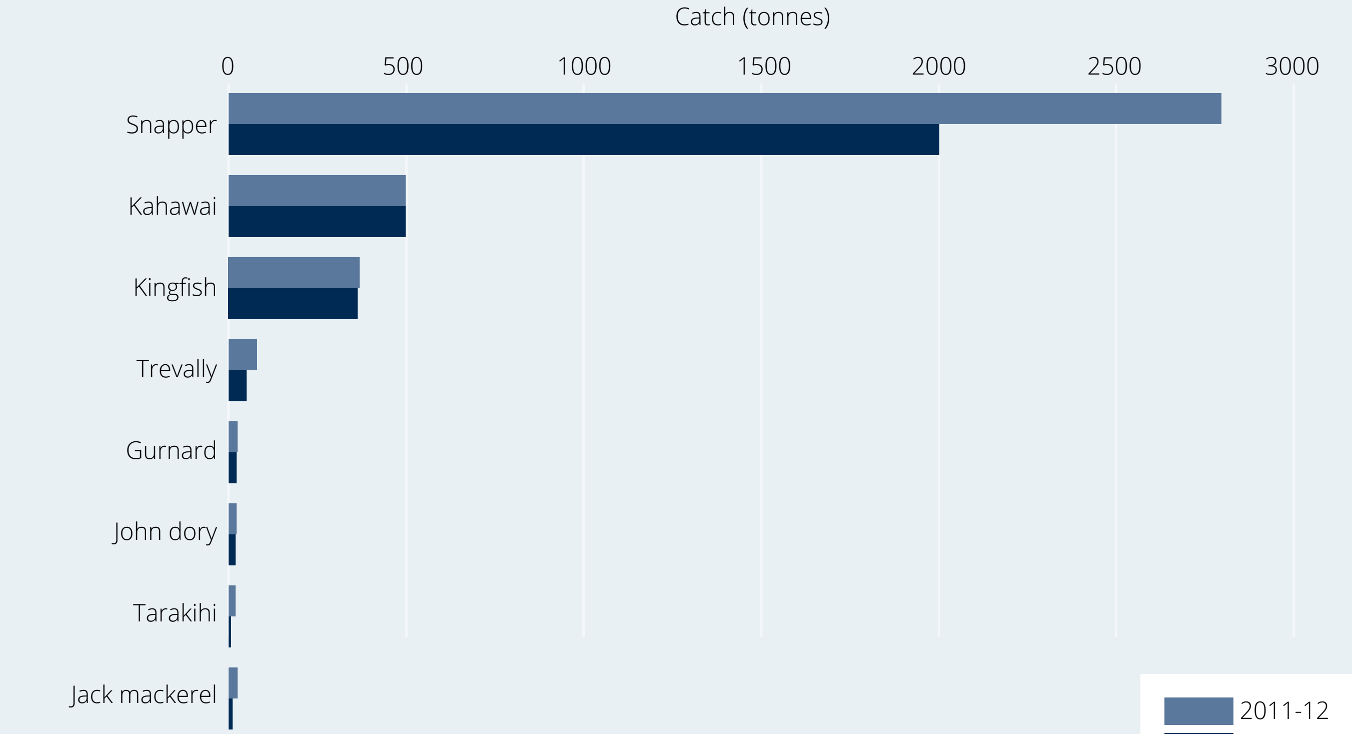


Figure 6: *Changes in recreational catch estimates of top eight species caught in the Marine Park.*

Catch of top eight recreational species caught by recreational and commercial fishers

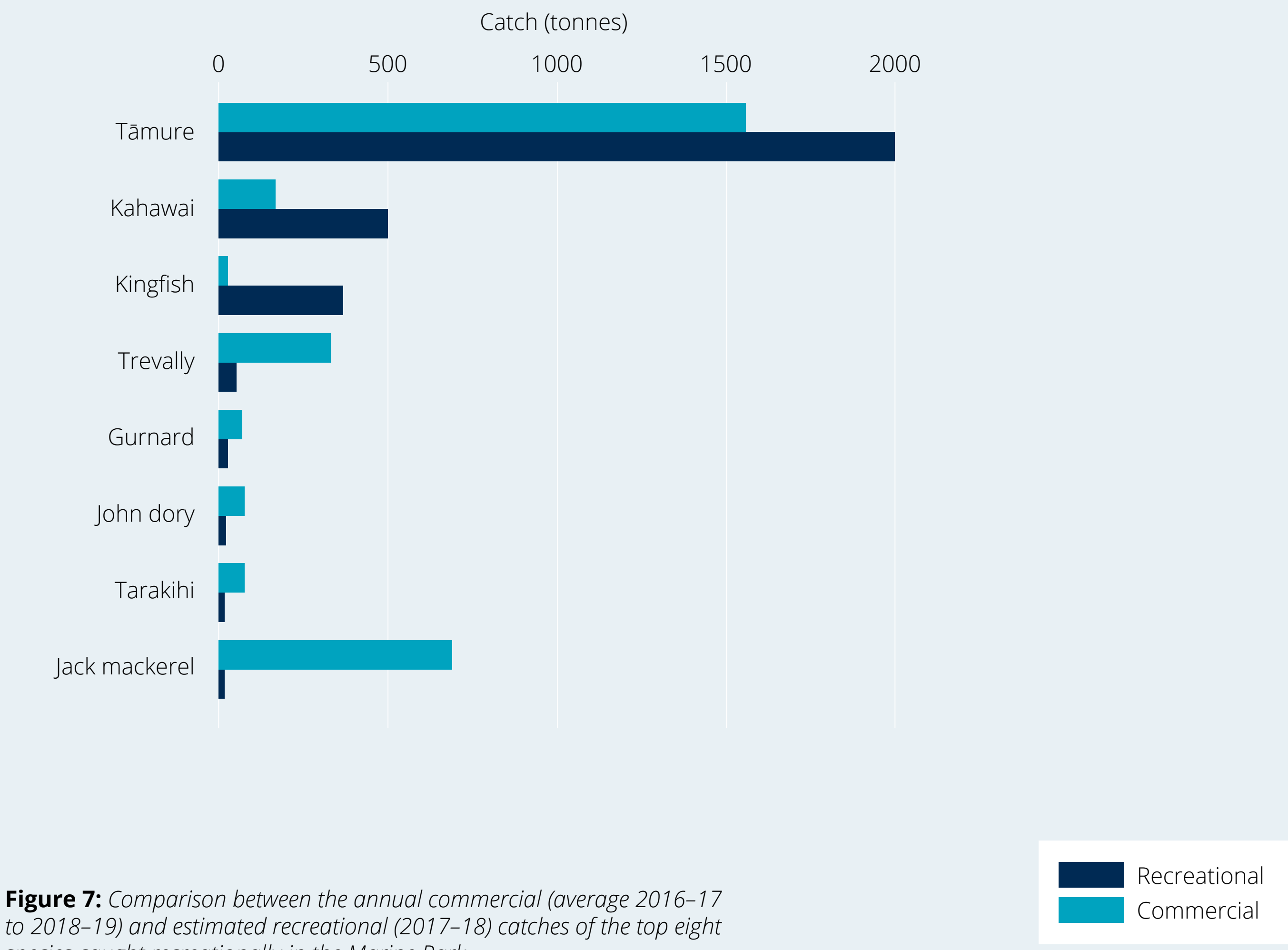


Figure 7: *Comparison between the annual commercial (average 2016–17 to 2018–19) and estimated recreational (2017–18) catches of the top eight species caught recreationally in the Marine Park.*

KEY EVENTS

The factors driving changes in reported catches and the methods used to catch fish are unclear, but they may be related to the fact that the Marine Park is only part of much larger fisheries management areas. The spatial distribution of fishing effort can vary over time and it is reasonable to assume that effort can shift toward and away from the Marine Park. This seems consistent with notable changes in the quantity of blue mackerel, tāmure and pilchards caught commercially in the Marine Park over the last 20 years. These changes appear to simply reflect increases or decreases in the proportions of catch taken from the Marine Park, as landings from the wider fisheries management area (northeast North Island)[g], have been relatively steady since 2000–01[7].

In contrast, changes in the landings of Jack mackerel, John dory, gurnard and rig within the Marine Park are reflected in similar changes in their broader management areas.

Changes in the areas targeted for pelagic (species that live and feed up in the water column) and demersal (species the live and feed near the seabed) species may also explain apparent shifts in the use of various fishing methods.

Methods and requirements for obtaining spatial data on fishing have improved significantly since 2000. Fisheries New Zealand have been rolling out electronic reporting and GPS tracking on commercial vessels. By December 2019, all commercial vessels were required to report their catch and landing information electronically as well as carry a GPS tracking device. The availability of such information will greatly assist our interpretation and understanding of local variation in catch data. (*Figures 8 and 9 provide examples of available information on the spatial distribution of commercial and recreational fishing.*)

[g] North Cape to Cape Runaway.

2004: National panel and aerial survey methods for estimating recreational harvest developed in 2003–04, with the methods being applied in 2004–05.

2011: Second national panel and aerial surveys completed in the 2011–12 fishing year.

2013: Tāmure stock assessment indicates the fishery is overfished and/or depleted. In response, new recreational limits are set.

2017: Third national panel and aerial surveys aerial completed in the 2017–18 fishing year.

2017: Tarakihi stock assessment indicates the fishery has been overfished and is depleted. A reduction of 20% made to commercial catch allowance in 2018–19 fishing year.

2018: A total allowable catch for John dory is set for the first time, introducing recreational and customary catch allowances, and reducing the existing commercial catch allowance.

2019: Minister decides on additional measures (10% cut to the commercial catch limit) to rebuild the tarakihi stock.

Recreational Fisheries patrol officers in the Gulf. Photo by Shaun Lee.

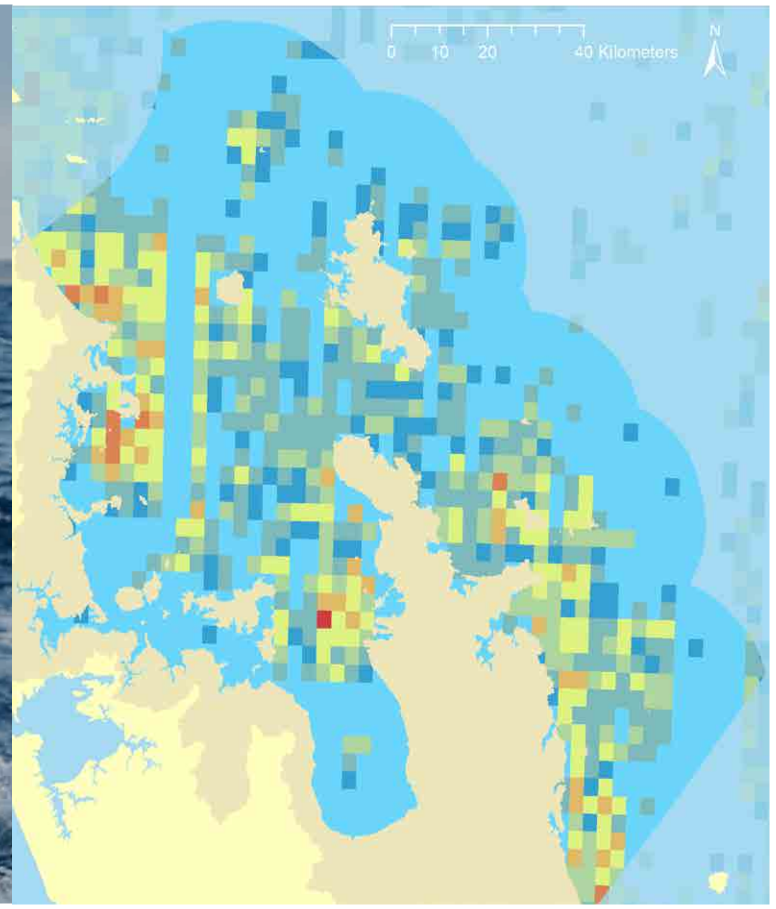


***Figure 8:** Reported number of commercial longline sets between 2016–17 and 2018–19 (data from Fisheries NZ)*[h].

Long line 2016-19

- 1
- 2 - 5
- 6 - 10
- 11 - 25
- 26 - 50
- 51 - 100
- 101 - 150
- HGMP
- HGMP Catchment
- Other Land

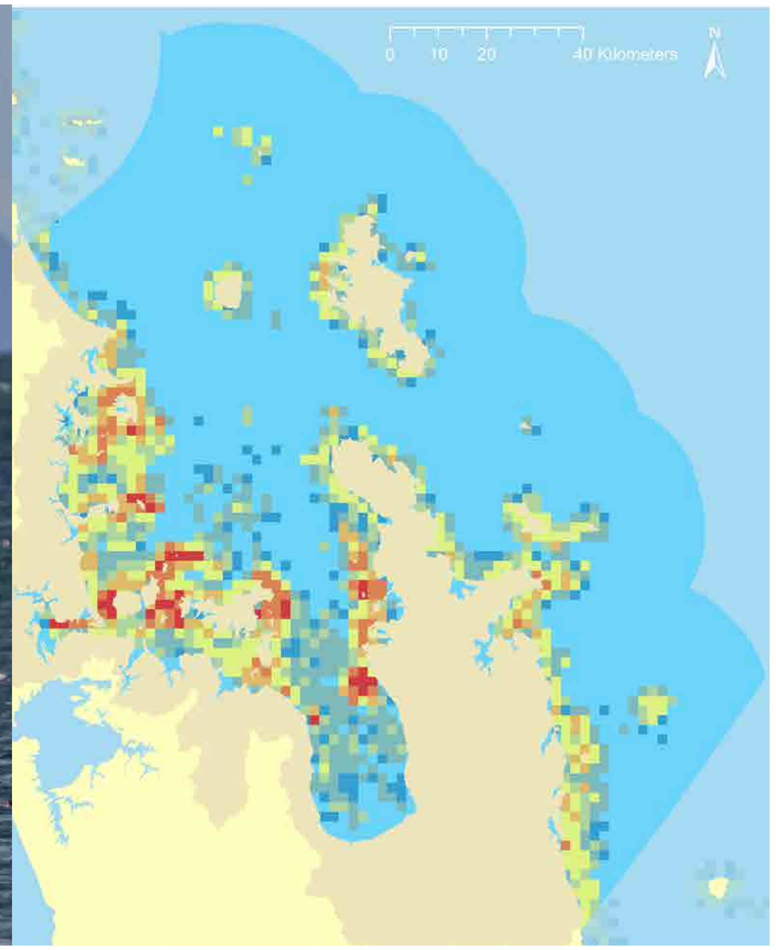


***Figure 9:** Indicative distribution of recreational boats per square kilometre in 2017–18.*[3,i]

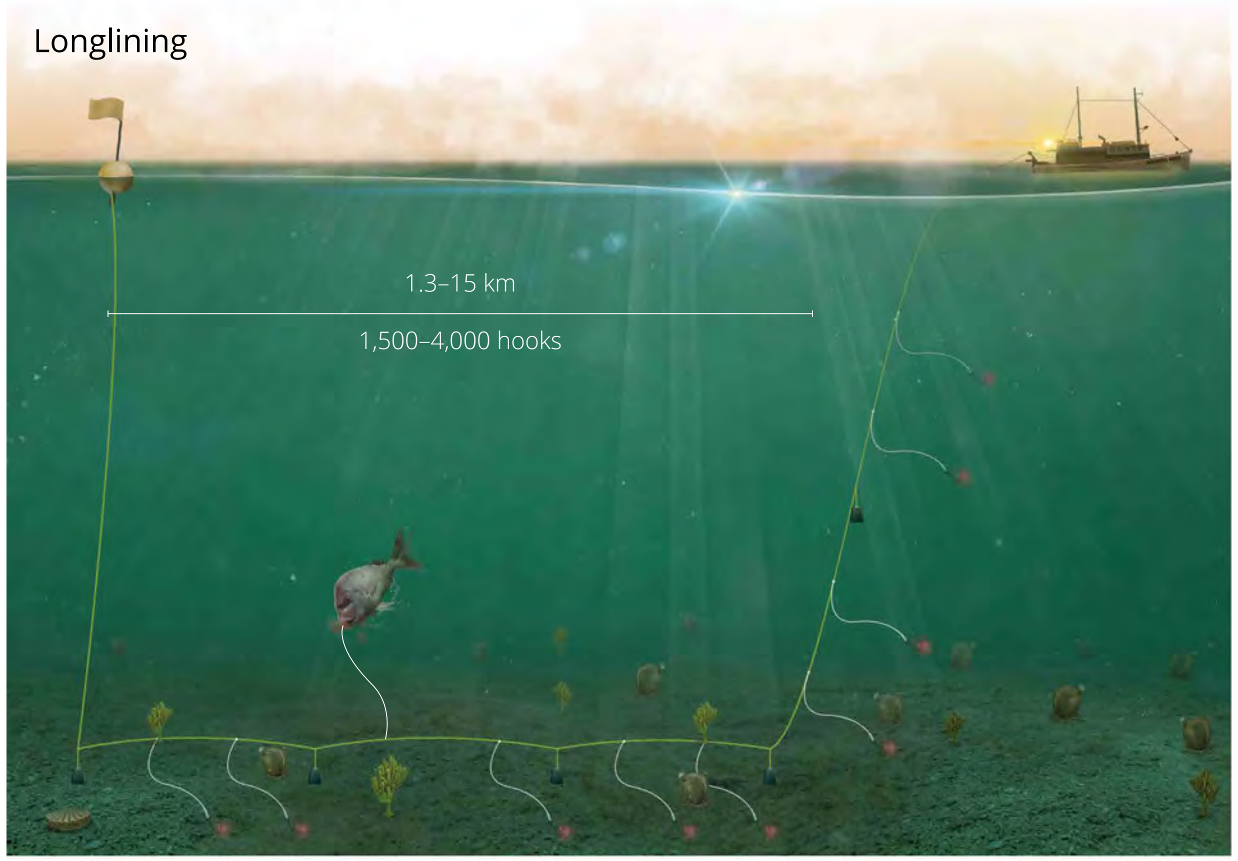
Recreational boats 2017-18

- 1
- 2 - 5
- 6 - 10
- 11 - 25
- 26 - 50
- 51 - 100
- 101 - 214
- HGMP
- HGMP Catchment
- Other Land

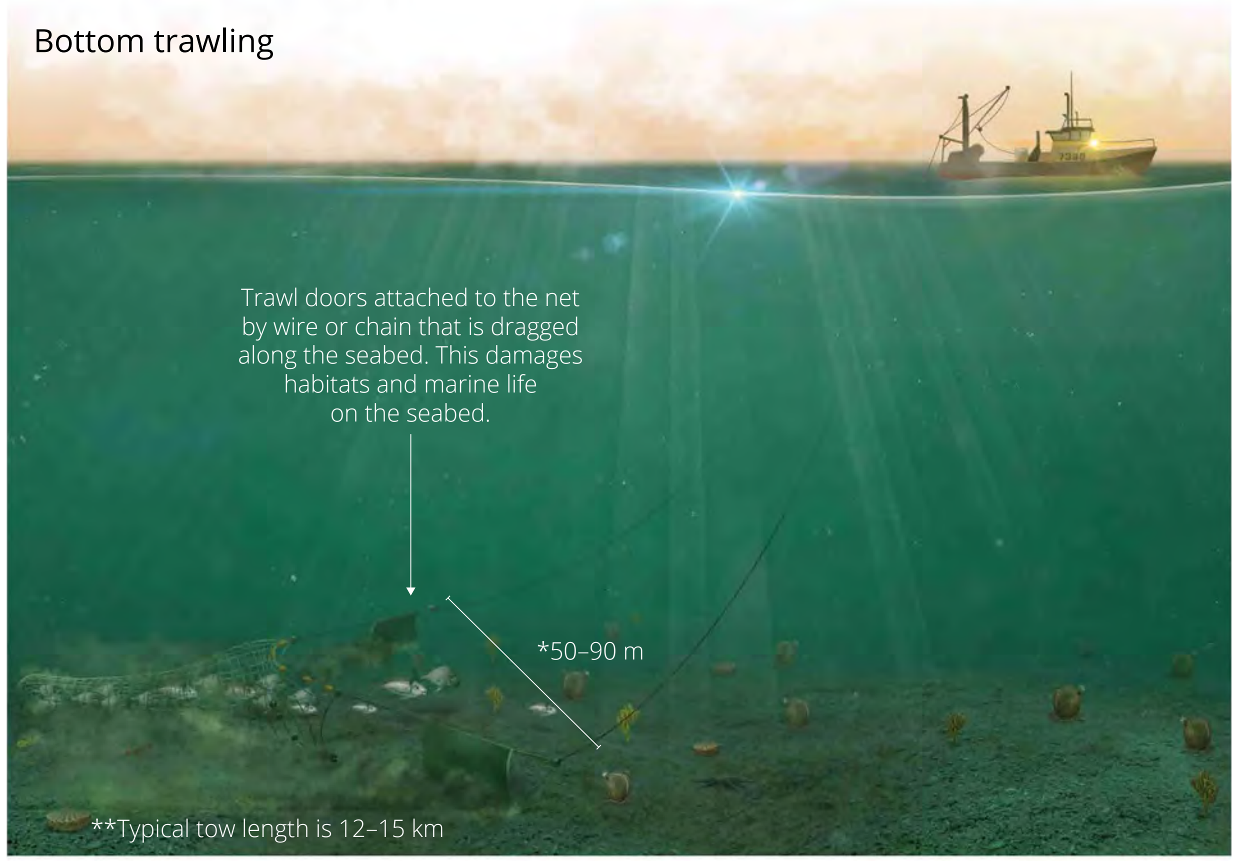
[h] Data is not available from when the Marine Park was established.

[i] Data has not been corrected for sampling effort, and thus, is not comparable to previous surveys.

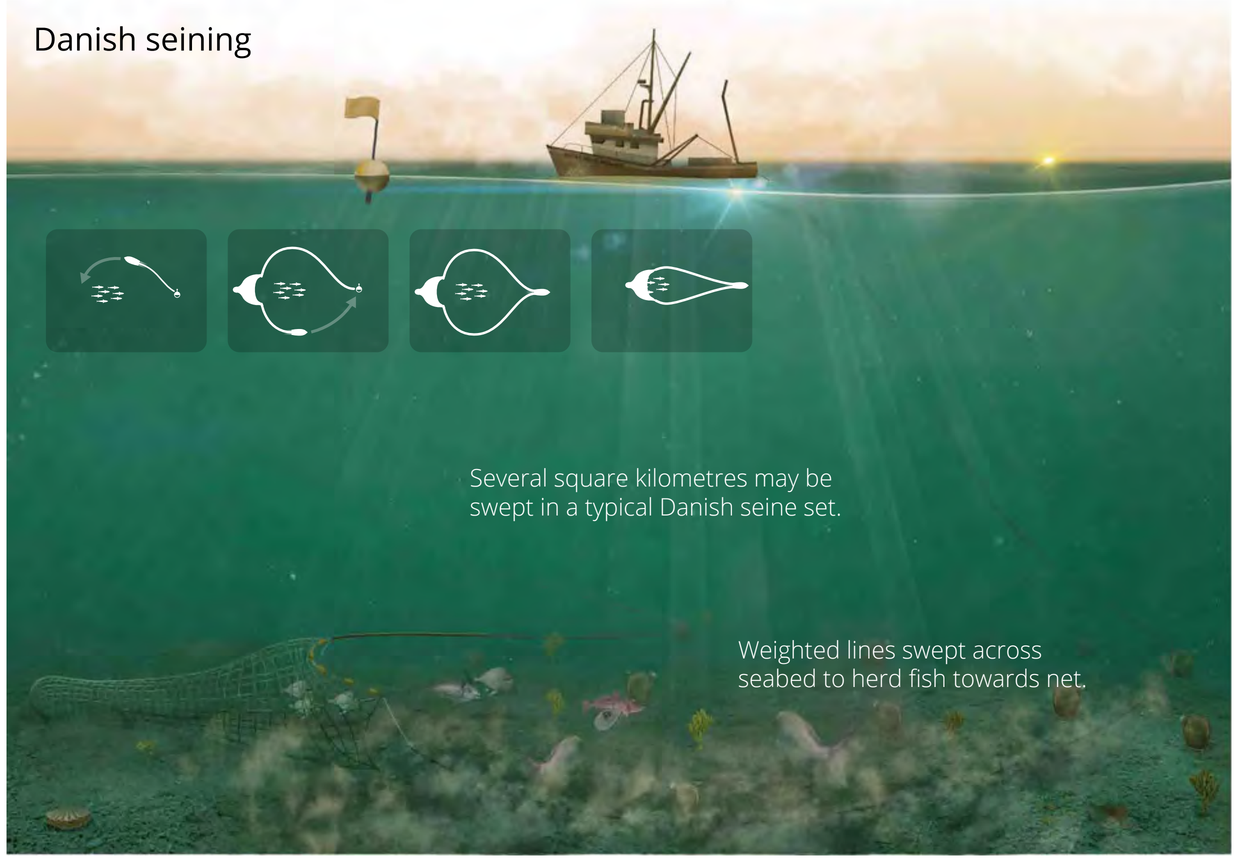
Four common commercial fishing methods



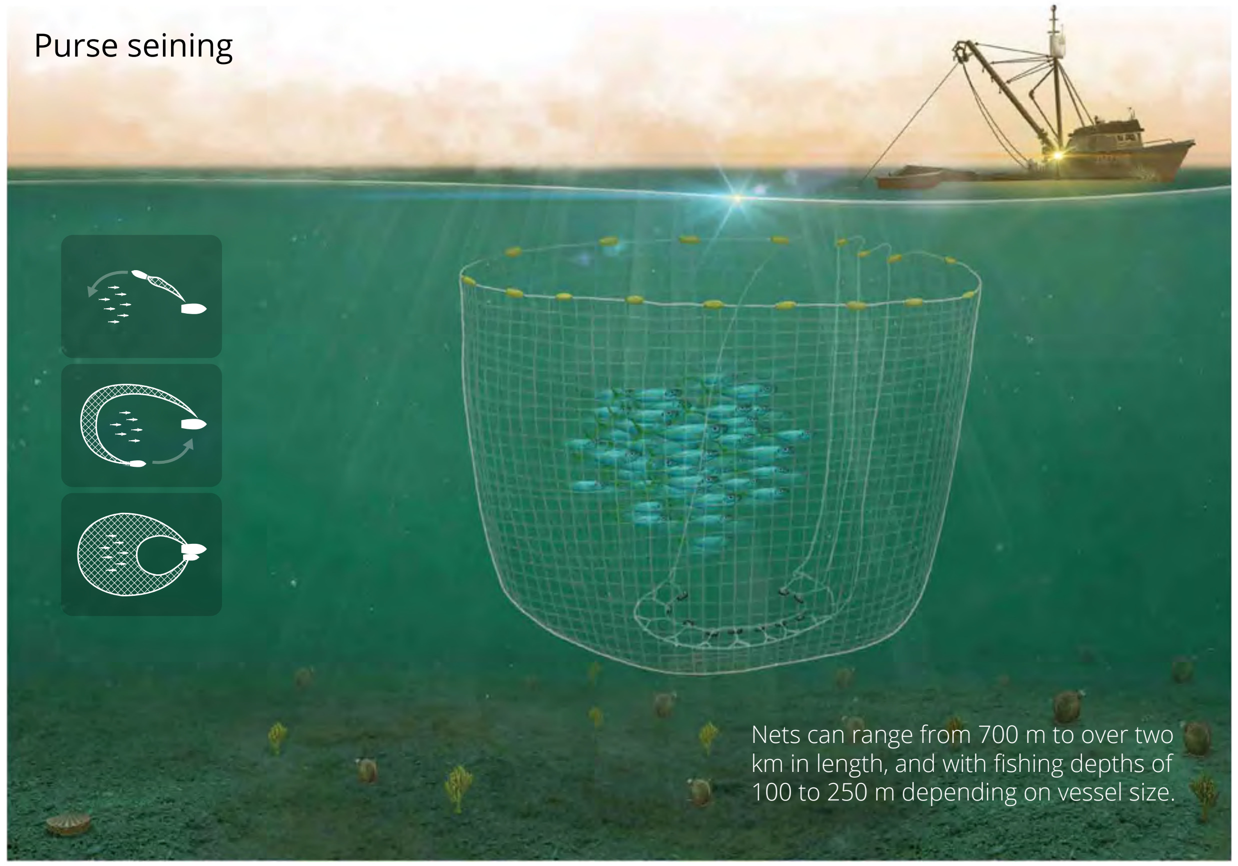
Pierre JP, Goad DW, Thompson FN, Abraham ER. Reducing seabird bycatch in bottom-longline fisheries. Wellington, New Zealand: Department of Conservation; 2013.



*Baird SJ, Wood BA, Bagley NW. Nature and extent of commercial fishing effort on or near the seafloor within the New Zealand 200 n. mile Exclusive Economic Zone, 1989–90 to 2004–05. Wellington, New Zealand: NIWA; 2011.
**Boyd R. Commercial fishing in Whangarei Harbour and Bream Bay. Wanaka: Boyd Fisheries Consultants Ltd; 2017.



Boyd R. Commercial fishing in Whangarei Harbour and Bream Bay. Wanaka: Boyd Fisheries Consultants Ltd; 2017.



Jones E, Francis M. Protected rays – occurrence and development of mitigation methods in the New Zealand tuna purse seine fishery. Auckland: NIWA; 2012.

INDICATOR / TOHU

TE MĀTATORUTANGA O TE IKA

Fish stock sustainability

Recreational fishers near Crusoe Island. Photo by Shaun Lee.

"There were eels in the local stream, caught with hook and line, and 'Kutai, pipi, pāua, kina, fish and pūpū were all readily available to us just below our homestead.' She was upset that by the 1960s the kai moana was being plundered and depleted by visiting holidaymakers. 'There were rules as to how we gathered these, and we only ever took what was needed.' Commercial fishing also took its toll on the resources of the sea, which was an integral part of their lives."

– Raukawa Balsom, talking about the food resources around her home in the 1940s near Whitianga.[8]

Fishing is a major environmental stressor that affects the whole of the Marine Park. In this report, the focus is on environmental outcomes rather than fisheries sustainability or productivity. While there is considerable overlap between the two, readers should be aware that current fisheries targets are not designed to maintain healthy, naturally functioning ecosystems. Rather, they are set to maximise productivity, while also maintaining the ongoing viability of fish stocks and sustainability of fishing. Highest, sustainable catches are typically obtained when stocks are fished down to 30 to 60% of unfished levels. The Minister of Fisheries manages stock levels by adjusting commercial catches, altering restrictions on recreational fishers, or applying other measures. Since 2008, stocks have been assessed against the *"Harvest Strategy Standard"*: a set of guidelines that aid in decision making.

The fisheries status of the top 20 finfish caught in the Marine Park relative to the targets and limits of the Harvest Strategy Standard are provided below. Note that the areas covered by stock assessments are generally much larger than the Marine Park.

KEY EVENTS

The Fisheries Act (1996) had been in effect for four years when the Marine Park was created. At that time fisheries procedures, policies and assessment methods were still being developed and refined. A key step was the implementation of the Harvest Strategy Standard in 2008. That provided a set of guidelines for fisheries decision making, that included default targets and limits for triggering management actions. That was closely followed by the release of *"Fisheries 2030"* in 2009, the Ministry for Primary Industries overarching policy for fisheries management. Draft national plans for inshore finfish and shellfish (which sit below Fisheries 2030) came in two years later, and a revised national plan for inshore finfish went out for consultation at the end 2019.

Major milestones in the management of individual finfish stocks have included the introduction of several species into the quota management system. This is expected to have a substantial effect on reported catch. Examples include pilchard, kahawai, kingfish, and blue mackerel. Stock assessments for tāmure and tarakihi have also been carried out.

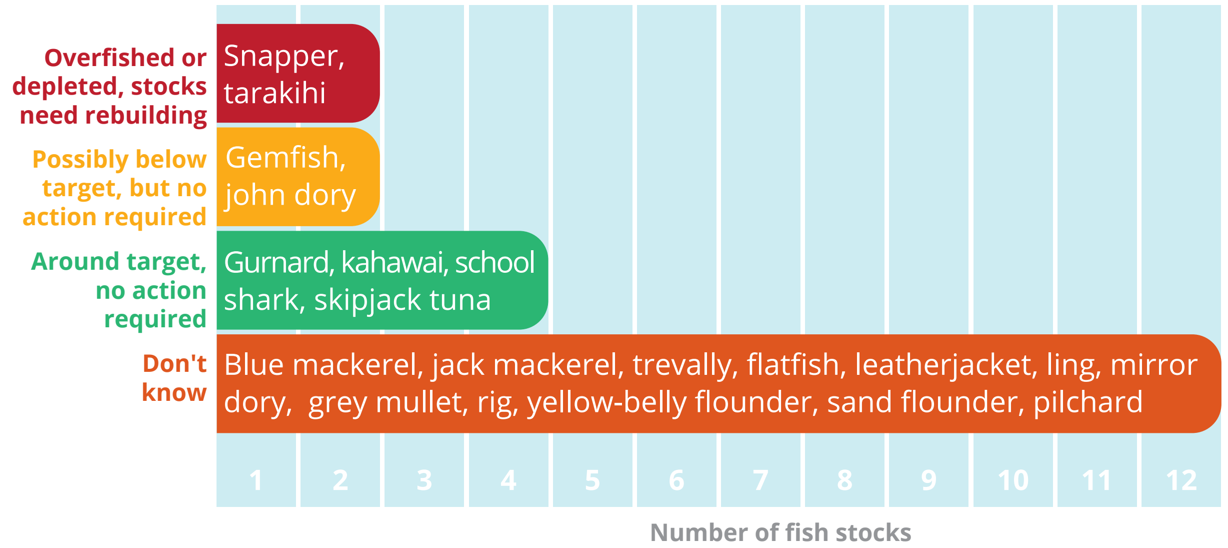


Figure 10: *Status of the top 20 fish stocks caught commercially in the Marine Park in relation to the targets set by the Minister of Fisheries.*

20 YEARS AGO

Stock size and sustainable catch assessments had been produced for three of the top 20 fish caught in the Marine Park: tāmure, John dory, and red gurnard.[9-11]

Estimates for John dory and gurnard were considered unreliable.

For the 1998–99 fishing year the tāmure stock was estimated to be around 16% of the unfished level. This was below the target[j] of 24%. Surveys of three marine protected areas[k] also indicated that legal tāmure in the protected areas were 14 times more abundant, were 6–14 cm larger on average, and produced 18 times more eggs than fish in nearby fished areas.

TODAY

Stock size and sustainable catch assessments have been produced for eight of the top 20 fish caught in the Marine Park (*Figure 10*): tarakihi, tāmure, gemfish, John dory, skipjack tuna[l], kahawai, gurnard and barracouta.[12]

Four of the eight species assessed are fluctuating around target levels (skipjack tuna, kahawai, gurnard and barracouta).[12]

The East Northland/Hauraki Gulf John dory stock was assessed in 2018.[7] It was possibly below target levels, but unlikely to need active rebuilding. The gemfish stock has been rebuilding, but it is not known whether it has reached its target.[12]

The Hauraki Gulf/Bay of Plenty tāmure substock was last assessed in 2013. An interim target of 40% of the unfished level was set, with the stock sitting just below 20%, meaning that it should be actively rebuilt (*Figure 11*).

The Aotearoa east coast tarakihi stock was assessed in 2017. The assessment indicated that the stock has been depleted since the mid-1970s, following high catches during the 1950s and early 1960s (*Figure 12*). In 2019, stock abundance was estimated to be 16% of the unfished biomass, and a catch reduction of at least 20% was needed to reduce the risk of the stock collapsing in the next 10 years. Substantially larger reductions (approaching 60%) were required to rebuild the stock to the default target level (40% of the unfished biomass)[7] in accordance with the 10 year timeframe set out in the Harvest Strategy Standard.

[j] The biomass that produces the highest, ongoing catch i.e., maximum sustainable yield.

[k] Cape Rodney to Okakari Point (Leigh) and Te Whanganui-A-Hei (Hahei) marine reserves and Tāwharanui Marine Park.

[l] A proportion of skipjack tuna catch is likely to have come from beyond the offshore boundary of the Marine Park. The management of this species throughout the western and central Pacific Ocean (WCPO) is the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC). New Zealand is responsible for ensuring skipjack tuna management within our waters is compatible with their procedures.

2002: Pilchard and blue mackerel introduced into the quota management system.

2003: Kingfish introduced into the quota management system.

2004: Kahawai introduced into the quota management system.

2008: Ministry of Fisheries implement the Harvest Strategy Standard, setting default targets and lower limits for fish stocks.

2009: Fisheries 2030 released.

2011: Draft national plans for inshore finfish and shellfish released.

2013: Tāmure stock assessment indicates the fishery is overfished and/or depleted.

2015: Review of the fisheries management system initiated.

2016: Tāmure (SNA1) management plan released and accepted by the Minister.

2017: Tarakihi stock assessment indicates the fishery has been overfished and is depleted.

2018: A total allowable catch for John dory set for the first time, introducing recreational and customary catch allowances and reducing the existing commercial catch allowance.

2018: Tarakihi commercial catch reduced by 20%.

2019: Minister decides on additional measures to rebuild the tarakihi stock.

Yellowbelly flounder for sale. Photo by Shaun Lee.

Sand flounder on Aotea. Photo by Shaun Lee.

Tāmure. Photo by Shaun Lee.

TĀMURE (SNAPPER)

In response to the 2013 tāmure assessment, the Minister:

- adopted an interim target of 40% of the unfished level;
- increased the total allowable catch of tāmure by 500 tonne;
- increased the recreational minimum legal size of tāmure from 27 cm to 30 cm; and,
- reduced the recreational bag limit from 9 to 7.

In addition, a SNA1 Strategy Group was set up and tasked with determining how the fishery should be managed. The tāmure (SNA1) management plan was released in 2016 and accepted by the Minister. No change to the total allowable commercial catch was proposed (it has not changed since before the Marine Park was established), but a list of over 70 other recommendations on managing the fishery was provided, including changes to recreational bag and size limits.

An updated stock assessment for SNA1 is planned for 2020 and will include relative abundance estimates of juvenile snapper. If necessary, management options, including TAC changes, will be considered following that assessment to keep the rebuild of the stock on track to meet the targets set by the working group. Other actions taken by Fisheries NZ include:

- production of an updated guide for responsible fishing and fish handling/release for recreational fishers; and,
- rolling out electronic reporting and GPS tracking on commercial vessels.

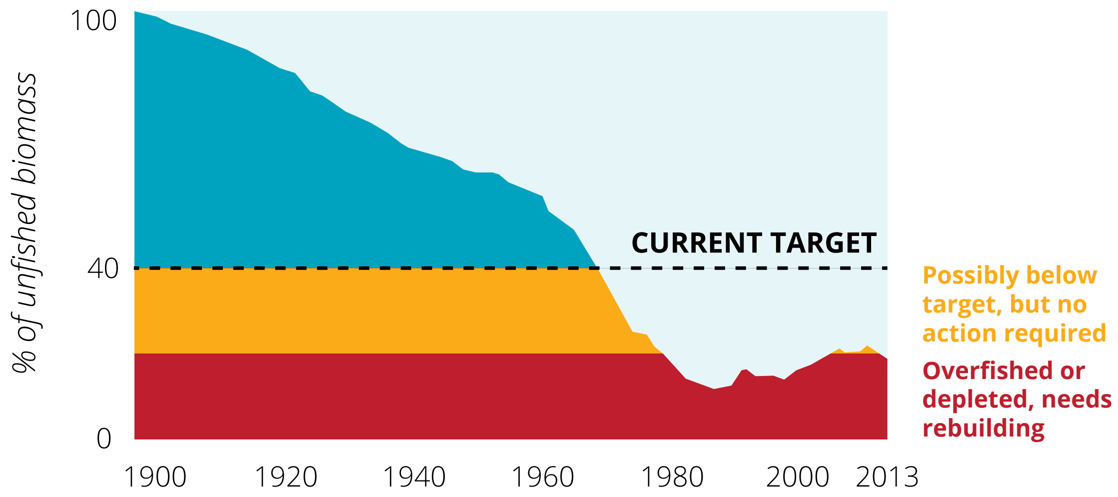


***Figure 11:** Modelled tāmure biomass for the Hauraki Gulf/Bay of Plenty substock.*

Tarakihi. Photo by Darryl Torckler www.darryltorckler.co.nz

TARAKIHI

A staged approach was adopted to rebuilding the tarakihi stock[7,13]. This was done to provide industry with a short period to plan and adjust their operations before further changes were implemented. Commercial catch rates were reduced by 20% in the 2018–19 to begin the rebuild, and three options for rebuilding the stock were put out for consideration in 2019. Two involved rebuilding the stock to 40% of the unfished biomass over 11–12 years, with additional cuts in commercial catch of 31–35% (taking the total cut since 2017 to 51–55%). An industry option was also included that proposed rebuilding the stock over 27 years through setting a target 35% of the unfished biomass, maintaining 2018–19 catch levels; the implementation of other measures such as improving gear selectivity; supporting research; and the adoption of move-on rules and voluntary 'keep clear' areas to avoid juvenile tarakihi.[14] Those, along with a fourth option (developed after consultation had ended) were put to the Minister. Among other things, the fourth option combined an additional 10% cut with an industry commitment to achieve 35% of the unfished biomass within 20 years. The fourth option was adopted by the Minister and came into effect on 1 October 2019.

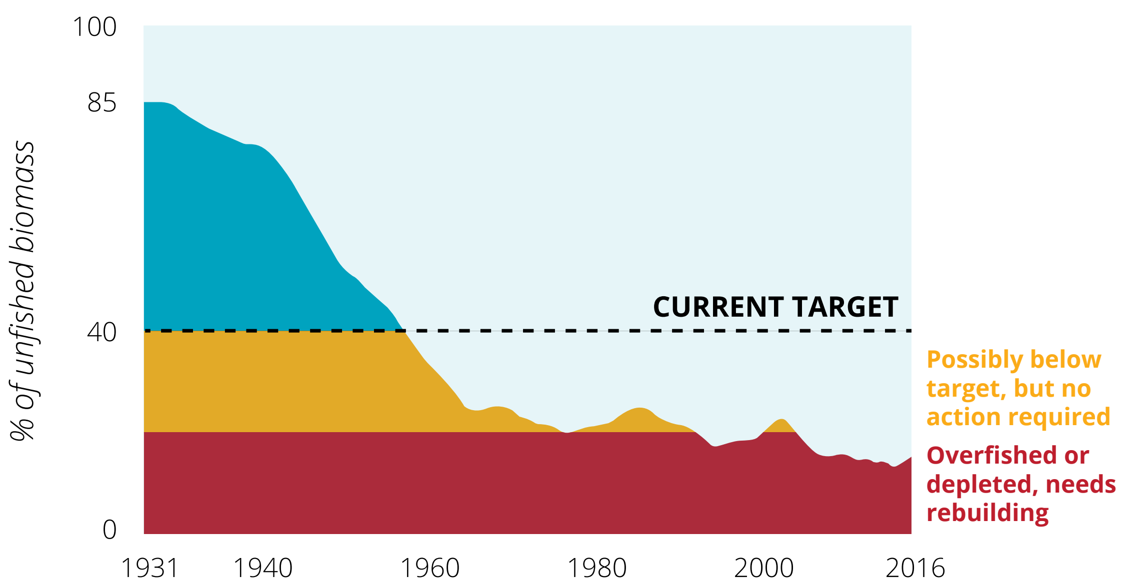


Figure 12: *Modelled tarakihi biomass for the entire east coast of Aotearoa. Note that a (relative) biomass target was not defined until 2017, when the first fully quantitative stock assessment was carried out for East Coast tarakihi.*

Juvenile crayfish at Tāwharanui. Photo by Shaun Lee.

TE KŌURA
Crayfish

"The Māori felt for the crayfish with their feet, then reached down and caught them by their feelers and threw them onto the beach. In about 20 minutes, they caught about 12–15 crayfish"

– Cameron Buchanan describing the fishing at Ahuahu / Great Mercury Island in the late 19th century.[15]

INDICATOR / TOHU

Kōura (red rock lobsters), are a relatively slow-growing and long-lived spiny lobster. They are the most important lobster species in Aotearoa, both in terms of their ecological role and their economic importance. Kōura have a broad diet, feeding on a wide variety of marine animals and seaweeds. Research on large, adult kōura in the Marine Park indicates that they make seasonal movements between inshore and offshore sites to forage, moult, mate and release their larvae (*Figure 13*). However, they usually remain in the same general area, commonly returning to the same inshore den after offshore movements. Juvenile kōura tend to be more mobile than adults, and in some parts of Aotearoa, are known to undertake large-scale migrations.

Kōura have an extended and complicated planktonic larval phase, spending around 12 to 18 months drifting in the ocean, potentially hundreds of miles from where they originated. During the latter part of this phase they metamorphose into a non-feeding puerulus larvae and swim towards the shore. The complex and extended nature of their larval phase means that settlement of kōura in the Marine Park is sporadic and unpredictable.

KEY EVENTS

The establishment of the Marine Park coincided with a large drop in the kōura populations and catch rates in the Marine Park and broader CRA 2 kōura stock. A small rebound between the 2003 and 2007, was followed by a decade of low and declining catch rates. In 2013, a joint paper on 50 years of research by Leigh Marine Laboratory scientists, concluded that in heavily fished areas, where kōura numbers where depleted, they had effectively become functionally extinct (in terms of the role they play in the ecosystem).[21]

Concerns were increasing about the state of the kōura stock, and in 2014 the total allowable commercial catch was reduced and management procedures introduced to add certainty and simplify decision making.

However, catch rates continued to decline

20 YEARS AGO

Commercial kōura catch rates had increased through the 1990's to peak at over 1.1 kg/pot lift in the 1998–99 fishing year, just prior to the Marine Park being established.

By 2000, kōura numbers in Leigh Marine Reserve and Tāwharanui Marine Park had dropped markedly from highs in the mid-1990s. Large numbers of big kōura were caught commercially around the boundaries of the protected areas during seasonal offshore movements.[16-18]

Kelp forests had expanded in the Leigh Marine Reserve and Tāwharanui Marine Park through the 1990s. This was attributed to kina numbers being controlled by plentiful tāmure and kōura in the protected areas.[19]

2000: Onset of large, rapid decline in commercial catch rates. Kōura numbers in Leigh Marine Reserve were substantially below those recorded in 1995.

2007–16: Commercial catch rates gradually decline. Similar trends in kōura numbers are picked up in marine reserve monitoring data.

2013: Scientists declare kōura functionally extinct in terms of the role they play in the ecosystem.

2014: Management procedures introduced with pre-determined triggers for adjusting commercial catch allowances based on catch per unit effort data. Total allowable commercial catch reduced from 236 t to 200 t.

2016: No change in the total allowable commercial catch, but concern about declining catch rates leads commercial fishers to voluntarily shelve 49 t of their catch allowance.

2017: Total allowable commercial catch unchanged, but commercial fishers continue to shelve part of their catch. Stock assessment brought forward by a year.

2018: Major cuts in total allowable recreational and commercial catches by the Minister aimed at rebuilding the stock in four years.

2018: Consultation on proposals to reduce the recreational daily bag limit and introduce telson clipping for recreational fishing.

2019: The Minister decides to implement proposals for reducing recreational bag limits and introduce telson clipping.

TODAY

Commercial catch rates fell sharply between 2000 and 2003 (*Figure 14*). After a slight rebound between 2004 and 2007 they bottomed out in the 2015–16 season. The latest reported catch rates are from the 2016–17 year and were slightly above the 2015–16 level.[20]

Catch rates in CRA2 (which includes the Marine Park) are well below those of the eight other kōura quota management areas in Aotearoa. They decreased over a period when catches in most other areas increased.[20]

In 2017, mature female kōura were estimated to have dropped to 18.5% of their unfished biomass. The biomass of the total mature stock is not known but is likely to be lower because males can be caught for a greater part of the year (for around four months of the year females carry eggs and can't be legally harvested).

Kōura numbers have also dropped substantially in the Cape Rodney to Okakari Point (Goat Island) and Tāwharanui marine reserves (*Figure 15*). Numbers inside the reserves are now similar to numbers outside them in the mid-1990s. This has been attributed to kōura moving beyond the offshore boundaries of the reserves during seasonal movements and getting caught.[17,18]

Kōura scientists associated with Leigh Marine Laboratory have declared kōura functionally extinct (in terms of the role they play in the ecosystem) in heavily fished areas.

without the management procedures triggering a cut in commercial catch. Commercial fishers, who were struggling to catch their entitlements, voluntarily shelved around 25% of their catch in both the 2016–17 and 2017–18 fishing seasons, producing a functional total allowable commercial catch of 151 t.

In 2017, multiple groups demanded action. MPI was made aware of concerns by iwi interests, individual recreational fishers, NZ Sports Fishing Council/LegaSea, NZ Recreational Fishing Council, commercial fishers and the general public. That resulted in a detailed review of the fishery, that included an updated stock assessment[22]. This was followed by major cuts in allowable catches aimed at rebuilding the stock towards its target in four years. These included reducing the commercial catch from 200 to 80 t and reducing the recreational allowance (but not bag limits) from 140 t to 34 t from April 2018.

Figure 13: Kōura aggregating along a reef edge during seasonal offshore movements in Tāwharanui Marine Park (mid-1990s). Photo by Shane Kelly.

Catch data from the 2018 fishing year, shows an upturn in catch rates.

Consultation about reducing the daily recreational bag limit from 6 to 3 and introduce telson clipping for recreational fishers has also been undertaken[23]. The Minister has decided to implement those measures, and they will come into effect from 1 April 2020.

The fisheries management target for kōura has been set to sustain acceptable catch rates and ensure the long-term viability of the stock. It has not been set with addressing broader environmental outcomes in mind, such as keeping kina barrens in check This was a matter considered in a recent Court of Appeal decision, which could have significan implications for fisheries management in Aotearoa ***(see the Case Study: Game changing court decision on the indirect impacts of fishing).***

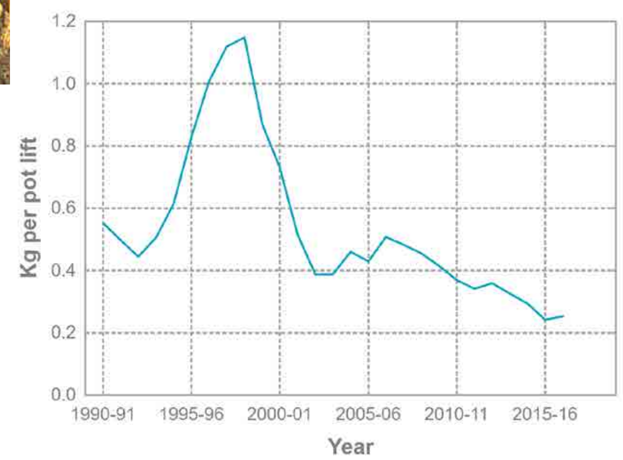


Figure 14: *Changes in catch per pot lift between the 1990–91 and 2016–17 fishing years.*

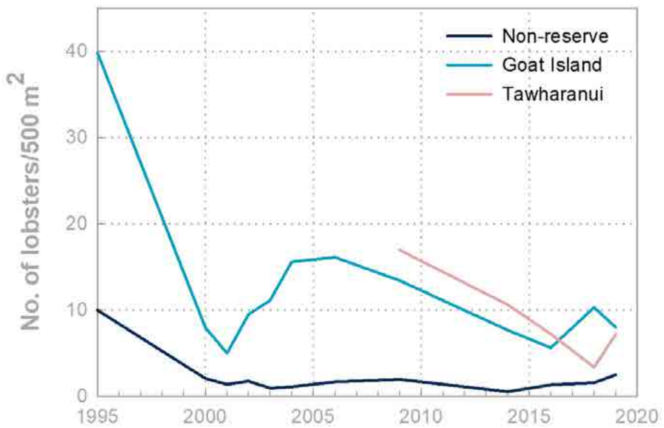
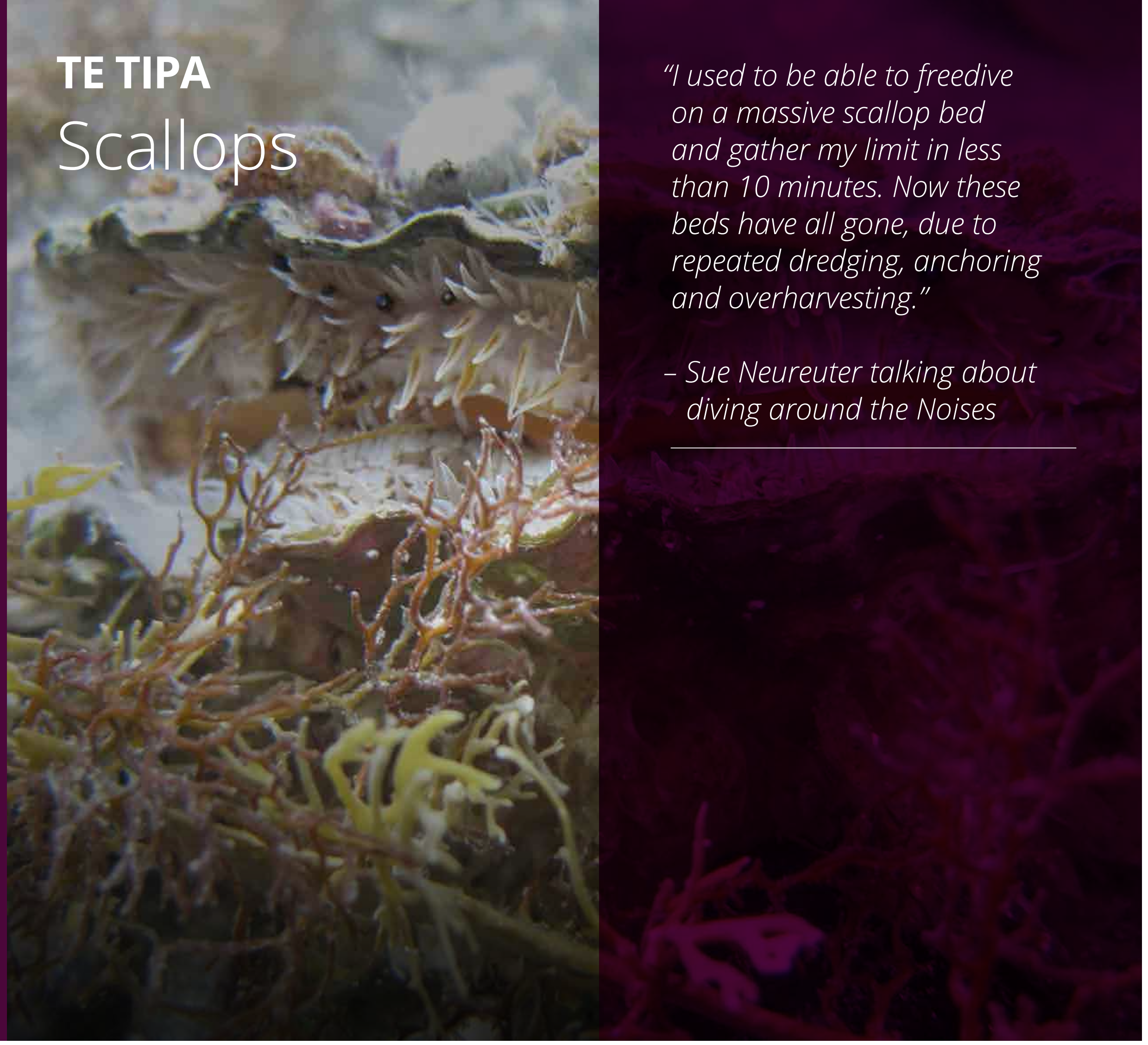


Figure 15: *Counts of kōura in Leigh and Tāwharanui marine reserves and nearby non-reserve areas.*

TE TIPA
Scallops



"I used to be able to freedive on a massive scallop bed and gather my limit in less than 10 minutes. Now these beds have all gone, due to repeated dredging, anchoring and overharvesting."

– Sue Neureuter talking about diving around the Noises

Tipa. Photo by Javier Couper.

Tipa are a fast-growing shellfish species that form discrete beds. In the Marine Park, tipa can reach harvestable size (100 mm) within 18 months, but growth rates vary considerably with depth; among areas, years and seasons; and, probably with the nature of the seabed. Growth tends to be much faster in shallow water. Scallops live for a maximum of 6–7 years. Small, juveniles are mobile, but they become sedentary as they grow. However, adults do move short distances to escape predators and can be swept around during storms.

The aggregation of tipa into beds increases their breeding success allowing greater mixing of eggs and sperm. Interestingly, tipa are hermaphrodites, which means they have both male (white) and female (orange) gonads.

Beds can vary substantially from year to year due to natural processes and harvesting. Tipa are gathered by Māori, recreational and commercial fishers. Customary permit information indicates that substantial quantities are gathered by tangata whenua. Commercial fishing mainly occurs around Hauturu, Colville, west and south of the Mercury Islands, and around Slipper Island. Beds east of Waiheke Island and west of Cape Colville have previously been commercially fished (*Figure 17*). All commercial fishing is done by dredge. Recreational fishers target a variety of beds in the Marine Park using small dredges and diving (*Figure 16*).

Figure 16: *Recreational tipa fishers on the 2019 season opening day in the inner Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. Photo by Shane Kelly.*

20 YEARS AGO

Tipa were managed outside the quota management system using seasonal commercial catch limits (based on meat weight), and controls on dredge size, fishing hours and non-fishing days.

Commercial catch had dropped from 679 t greenweight in the 1997–98 fishing year to bottom out at 47 t in the 1999–2000 year. Results from surveys of the Whitianga (1978–99), Waiheke (1984–99) and Hauturu (1995–99) beds were the lowest on record.[20,24]

2000: Record low catch and biomass estimates for commercial tipa beds surveyed had just been reported.

2002: Tipa brought into the quota management system.

2005: Record high biomass estimates for the commercial tipa beds surveyed.

2005: Recreational rules changed to permit divers to collect bag limits for two non-divers acting as safety people.

2011: Large new bed discovered in deep water, west of Cape Colville.

2012: Last bed surveys carried out, including a survey of the bed discovered in 2011.

2012: Large increase in the commercial catch allowance for the year due to the discovery of the new bed.

2014: Bed discovered in 2011 collapsed and no longer being fished.

2016: In-season adjustments replaced by 50 t commercial catch allowance and a voluntary catch per unit effort rule limit.

TODAY

Last fishery surveys carried out in 2012.

Tipa catch managed through the quota management system with a 50 t commercial catch allowance and a voluntary catch per unit effort rule limit.

The current condition of tipa populations in the Marine Park are not known.

KEY EVENTS

In 2000, tipa were managed outside the quota management system using catch limits and a variety of other rules. They were brought into the quota management system in 2002, with the commercial catch limit for the Coromandel Fishery set at 22 t meat weight (the base allowance since 1992), and recreational and customary allowances of 7.5 t each. The system initially allowed commercial fishers to request an adjustment in their catch allowance during the fishing season. Those requests were usually supported by information obtained from in-season bed surveys.

Commercial catches and the abundance of tipa in commercial beds have fluctuated since 2000. The lowest catches and abundances on record occurred around the time the Marine Park was established, while highest recorded abundance was obtained in 2005 (*Figure 18*).[20] A large new bed was discovered in 2011 that prompted a marked in-season increase in the commercial catch allowance, and a concentration of fishing effort around the new bed over the next few years. By 2014 the bed had collapsed.

Changes in how the fishery was managed occurred in 2013. In-season adjustments were discarded, and the commercial catch was raised from 22 t to 100 t (it was subsequently reduced to 50 t in 2016). A voluntary catch-per-unit-effort rule was also introduced that encouraged harvesting to be halted in an area if catch rates dropped below a set level. These changes eliminated the cost of in-season surveys and consultation processes, but as a result, population estimates have not been obtained since 2012. Consequently, the current condition of tipa populations in the Marine Park are not known.

Changes in recreational fishing rules since the creation of the Marine Park have included a 2005 amendment to allow divers to collect bag limits for two non-divers if they are acting in a safety role, and a change in the timing of the recreational fishing season.

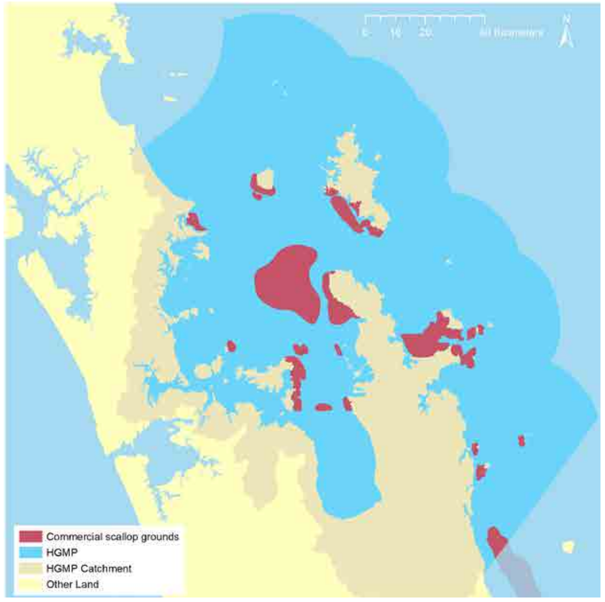


Figure 17: *Areas where tipa have been commercially fished.*[25,26]

Dredging for tipa near Pakatoa Island. Photo by Shane Kelly.

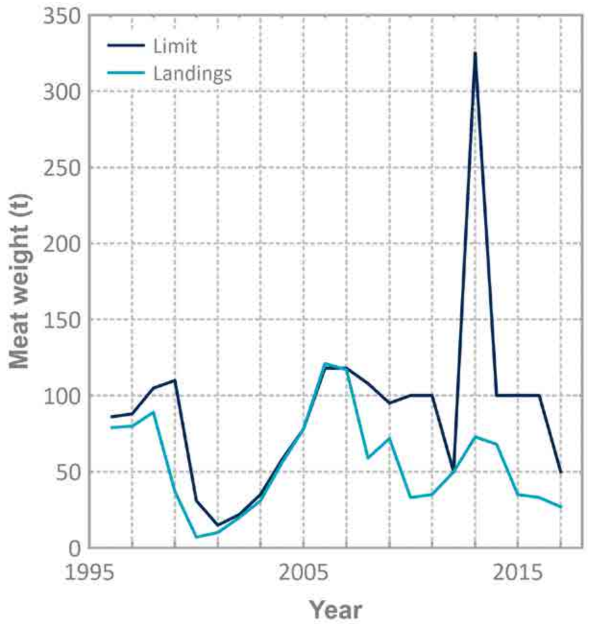


Figure 18: *Changes in tipa commercial catch limits and landings for the Coromandel Fishery between 1995–96 and 2016–17.*

Child finding tuangi. Photo by Shaun Lee.

TE TUANGI
Cockles

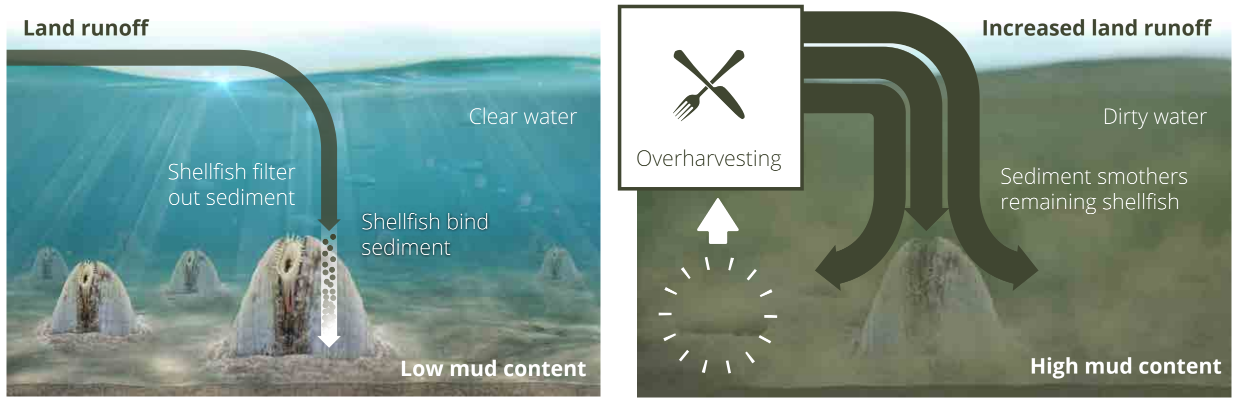
"As kaitiaki we would put rāhui over certain places when stocks got low, but today we've had to put a rāhui over the whole region from Ngārimu to Wilson's Bay."

– Pani Gage, kaumātua of Ngāti Tara Tokanui and Ngāti Koi [8]

INDICATOR / TOHU

Tuangi play an important role in our bays and estuaries. They are efficient filter feeders, removing sediment and nutrients from the water. Their burrowing activity also mixes and adds oxygen to the top 2–3 cm of the sediment. Tuangi are an important food source for numerous marine animals and waders, including mud whelks, pātiki (sand flounder), whai repo (rays) and tōrea (pied oyster catchers). Tuangi were one of the most frequently consumed marine species by pre-European Māori and they remain a valued kai moana species for tangata whenua.

Collecting a bucket of tuangi from the beach was once a common occurrence, but have become increasingly scarce over time. Tuangi populations are threatened by sedimentation, pollution, disease, environmental stress and over-harvesting. Tuangi prefer sandy mud, and their numbers decrease at high mud deposition rates and mud depth.[27,28] Mass mortalities due to disease, environmental stress and sedimentation have decimated populations (*see Page 74*), which have been slow to recover. Tuangi are not commercially harvested in the Marine Park, but they are frequently harvested by recreational and customary fishers.



Filter feeders keep the ocean healthy

20 YEARS AGO

Annual MPI shellfish surveys conducted at around 12 sites per year.

Harvest bans at Eastern Beach and Cheltenham Beach.

An average of 25% of the population was a harvestable size at the four regular Marine Park sites that were monitored in 2000.

2006: HGF started the community monitoring programme with three sites.

2008: Harvest at Cockle Bay closed annually between 1 Oct–30 Apr.

2008: Rāhui placed on harvest at Umupuia.

2008–2009: No MPI shellfish surveys conducted for two years.

2010: Harvest at Whangateau closed following a mass mortality event.

2015: Most funding for the community monitoring programme cut.[32]

TODAY

Annual MPI shellfish surveys continue to be conducted at around 12 sites per year (*Figure 19*).

Complete harvest bans in place at Umupuia, Whangateau, Eastern Beach and Cheltenham Beach, and a seasonal harvest ban in place in Cockle Bay.

Trends in total population size are highly variable due to sporadic recruitment, but there has been a universal decline in the density of harvestable (>30 mm) tuangi over the last 20 years at sites where harvesting is allowed year-round. At those sites, an average of 4% of the population is above harvestable size.

Only Umupuia, Eastern Beach and Cockle Bay, which all have harvesting bans place, have shown a marked increase in the number of harvestable tuangi since 2000. Harvestable tuangi at Cockle Bay increased until 2013 following the implementation of a seasonal closure. But they subsequently decreased, possibly because harvesting pressure rebounded when large tuangi reappeared.[29]

Numbers of harvestable tuangi in Whangateau have not increased since the harvesting ban was implemented in 2010. Repeated summer mortality is thought to be caused by post-spawning stress and hot weather, which increase the susceptibility of tuangi to disease.[30,31]

MPI have funded annual shellfish surveys at various sites around the upper North Island since 1992, which inform decisions on harvest closures. MPI surveys have been complemented by a community monitoring programme since 2006, with funding provided by DOC, AC and WRC. The number of sites monitored by volunteers and school groups increased from three to 20 in the first few years of the programme. Data generated by community monitoring supported the implementation of the rāhui at Umupuia, and were the primary source of information behind the seasonal closures of Cockle Bay.[33] However, funding cuts in 2015 reduced the number of community monitoring sites to less than eight, and the data has not been analysed or reported since then.

It is also worth noting that tuangi sit at the interface between the land and the sea. As a result, they are subject to other impacts such as sediment washed from the land and high temperatures. Environmentally stressed tuangi are also more susceptible to pathogens. The effects of these are discussed further in the *Mass mortalities — Te matemategna and Sediment and benthic health — Te parawai me ngā ngārara o rō wai sections*.

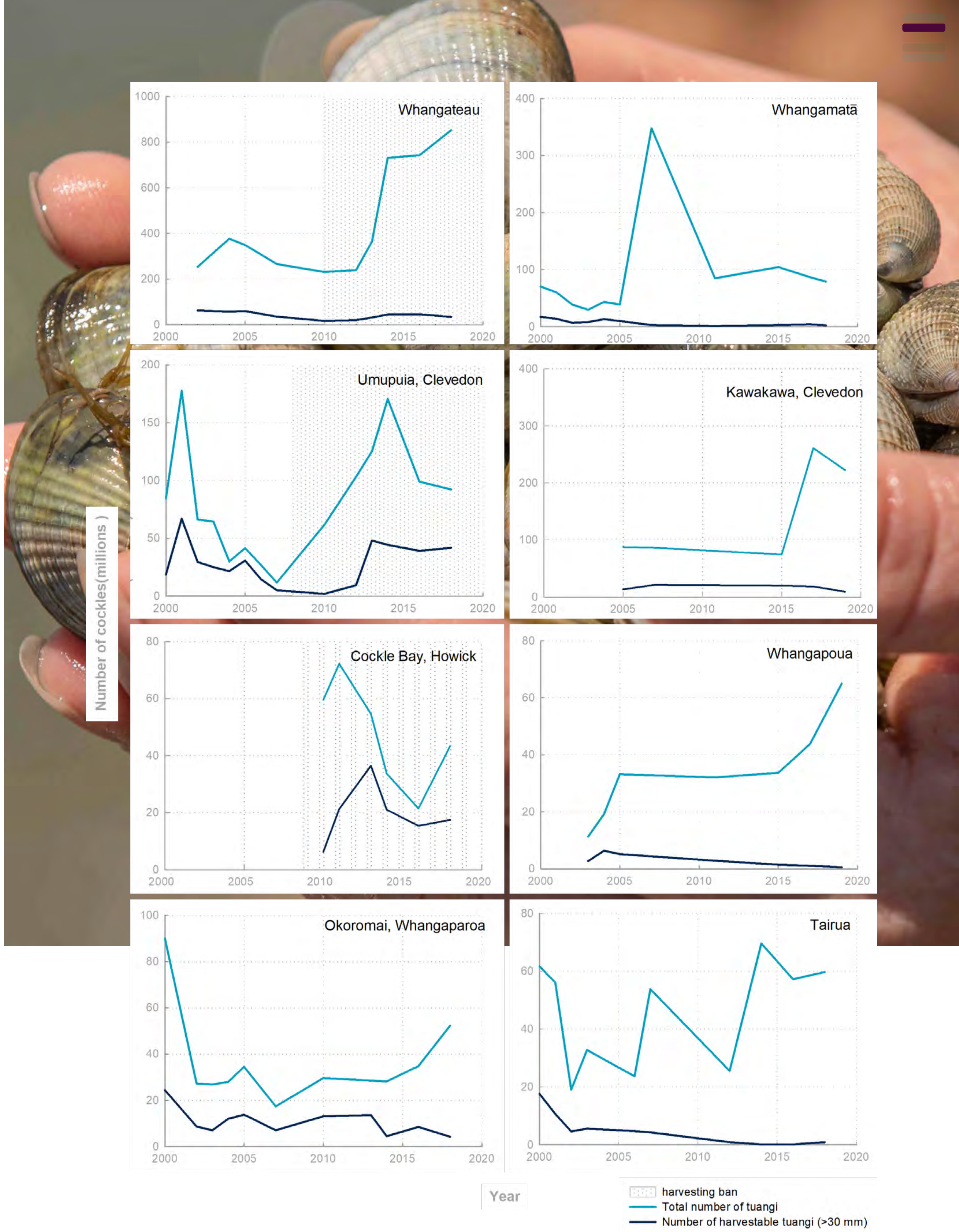
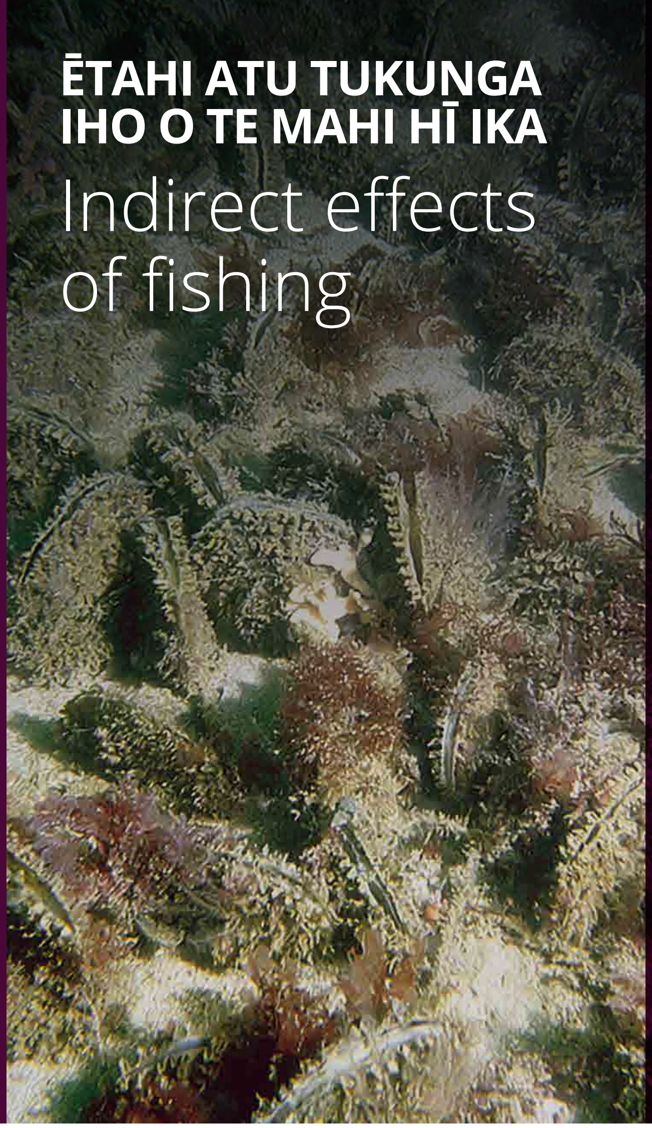


Figure 19: *Estimated total number of tuangi and number of harvestable tuangi at Marine Park sites that have been regularly monitored by MPI since 2000.*

INDICATOR / TOHU



ĒTAHI ATU TUKUNGA IHO O TE MAHI HĪ IKA

Indirect effects of fishing

"We plow our land too. Forty-five percent of New Zealand's land mass is plowed or farmland, where only 3% of New Zealand's EEZ are bottom trawled. But we make a big thing about 'that'. Emotionally I think that is wrong. We need to look at the science here."

– Volker Kuntzsch, Chief Executive Officer, Sanford. Panel discussion at the Hauraki Gulf Marine Park Conference, 2019.

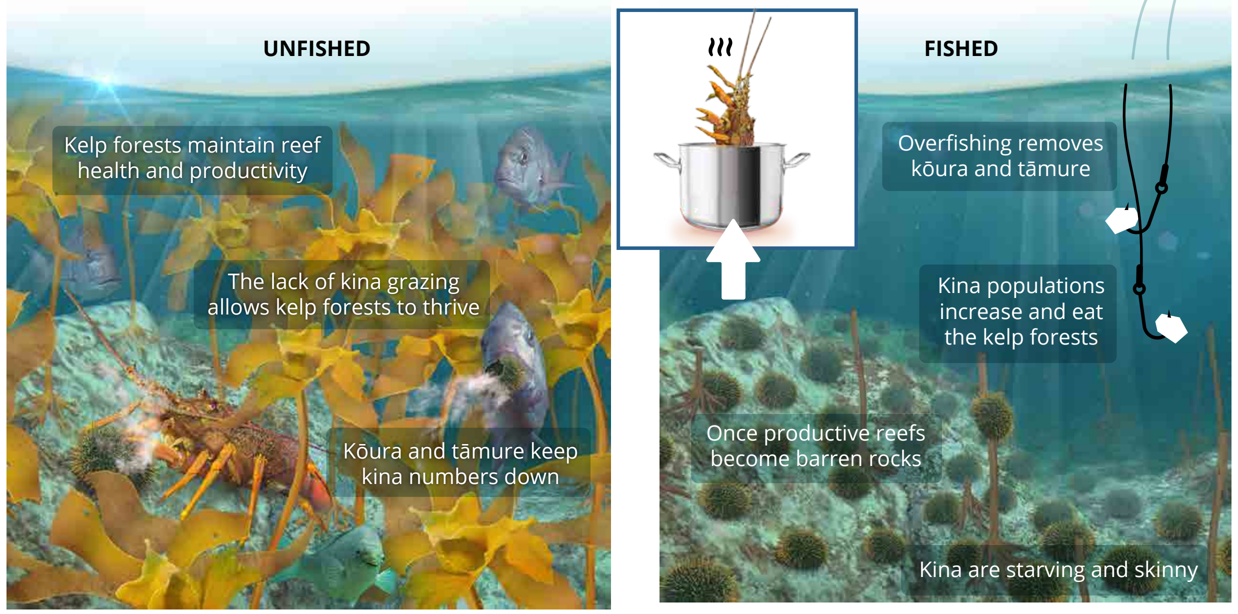
Bottom trawling and dredging destroy important seabed habitats like horse mussel beds. Photo by Professor Simon Thrush.

Fishing doesn't only affect the species captured, it also has direct and indirect impacts on non-target species and the seabed. Fishing methods such as bottom trawling, Danish seining, and tipa (scallop) dredging damage the seabed and the animals and plants that grow there. Seabirds are accidentally caught by longlines, set nets, and other fishing methods. Undersized or non-target fish are captured and discarded.

Fishing also effects the dynamics of food webs and the characteristics of marine communities. The reduction of top predators such as tāmure and kōura (crayfish) allow prey such as grazing kina to flourish. This results in the loss of kelp forests. Elsewhere, the reduction of bait fish reduces the food available for larger fish, marine mammals and seabirds. Ecosystems that are damaged by bottom trawling and are fished close to their maximum sustainable yields are less resilient other stressors, such as climate change.[34]

This section focuses on the fishing methods that disturb the seabed, the indirect effects of fishing for tāmure and kōura, and the incidental bycatch of seabirds.

Flesh-footed shearwater caught by a small vessel long lining off Aotea. Photo released by MPI.



Kina barrens are created by overfishing

20 YEARS AGO

In the three years immediately before the park was established (1996–97 to 1998–99):

around 15,800 bottom trawls and 3,666 Danish seine sets are estimated to have occurred in the Marine Park;

around 2250 tipa dredge tows occurred in reporting areas within or bounding the park. This is the highest number of tows for any three-year period since that time.

The depletion of tāmure and kōura populations was found to be linked to the expansion of kina barrens in the Marine Park.[19]

Published figures for the Marine Park are not available, but in 2000–01 an estimated 645 seabirds were caught in the entire tāmure longline fishery, which mainly occurs in northeast Aotearoa[35] ***(see Page 145 for details).***

Kina eating kelp. Photo by Shane Kelly.

TODAY

The number of bottom trawls (7658) over the three-year period between 2016–17 to 2018–19 was 51% lower than in the three years immediately before the park was established (*Figure 20* and *Figure 21*).

There has been little change in the number of Danish seine sets, but fishing effort is now more concentrated in a smaller area (*Figure 20* and *Figure 22*).

Commercial fishing regulations prohibit Danish seining by single vessels less than 20 m in length in around 300 km^2 of water, where it has been allowed to operate. In the most recent three-year period around 800 Danish seine events (22% of all events) occurred in those areas (*Figure 23*).

In the 20 years of the park's history, the total number of tipa tows varied widely between years and locations (*Figure 24* and *Figure 25*). Since 2000, running three-year totals have ranged from around 450 to 1880 tows. 1100 tows occurred between 2015–16 to 2017–2018.

Work on estimating the overall extent of urchin barrens in the Marine Park has recently begun, with accurate figures not yet available.

Published figures for the Marine Park are not available, but in 2016–17 the estimated number of seabirds caught in the entire tāmure longline fishery (399 birds[36]) was 38% lower than in 2000–01. Despite this, there is estimated to be a 70% likelihood that annual potential fatalities from commercial fishing are greater than what the population of threatened tāiko can sustain. For all other seabirds the estimated likelihood is less than 5%.[37]

2002: National workshop on reducing seabird mortality held, to the establishment of Southern Seabird Solutions.

2011: Large tipa bed was discovered in deep water, west of Cape Colville. Dredging spikes in that area over the next two years.

2012: Panel of experts rank bottom trawling 3rd equal highest threat to Aotearoa's marine habitats (behind ocean acidification and global warming).[38]

2013: Stock assessment indicates the Hauraki Gulf/Bay of Plenty tāmure substock is sitting just below 20% of its unfished state.

2014: MPI made aware of discrepancy between fisheries regulations and how the Danish seining regulations were being applied.

2014: Black petrel working group formed with the aim of reducing pressure on seabirds in the Gulf and beyond.

2014: Tipa bed discovered in 2011 collapses. Dredging effort reverts to the areas fished before it was discovered.

2014–18: Commercial kōura catches are progressively reduced as concerns grow over the depleted state of the stock. The recreational catch allowance (but not catch limits) was also reduced in 2018 (*see Page 53*).

2017: Sea Change — Tai Timu Tai Pari makes recommendations to manage the indirect effects of fishing.

2018: Changes to mandatory seabird mitigation measures for longlining. These provide for the use of hook shielding devices as a standalone measure, and amend tori line requirements to accommodate smaller vessels.

2018: Ministerial Advisory Committee established to consider Central Government's response to Sea Change.

2019: Court of Appeal rules the RMA does not prevent regional councils from controlling fisheries resources through their RMA functions, provided they are not doing so for Fisheries Act purposes (*see case study on Page 72*).

Green-lipped mussel reef. Photo by Shaun Lee.

KEY EVENTS

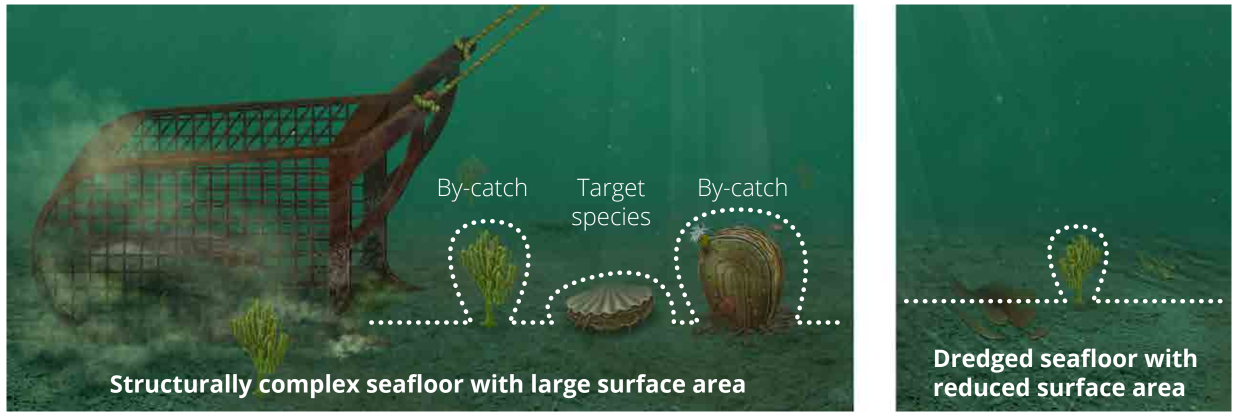
Research has substantially improved our knowledge of the indirect effects of fishing since the Marine Park was established. It is generally accepted that fishing has had a role in the decline of vulnerable seabird populations, the shift from kelp forests to urchin barrens in the Marine Park, and the disturbance and degradation of areas subject to dredging and bottom trawling.[34] More is also known about historic changes such as the loss of extensive mussel beds from overfishing. Historic mussel beds were potentially one of the most important ***"biogenic habitats"***[m] in the Marine Park. Besides losing the mussels themselves, we also lost their filtering capacity and the broader biodiversity values they supported. Ecosystem-based management is now accepted as best practice in fisheries management, but we are still managing species individually.

Dredged seabed near Waiheke Island. Photo by Shane Kelly.

Positive steps have been taken in some areas, particularly around seabirds. Those steps included the establishment of Southern Seabird Solutions Trust in 2002 and formation of the Black Petrel Working Group in 2014. The latter group having a specific focus on reducing seabird catches in northeastern Aotearoa. *A summary of achievements since 2002 is provided on page 145.*

The regulations clearly define the areas where Danish seining is prohibited. However, Fisheries NZ are of the view that the coordinates, landmarks and bearing used to define an exemption area for single vessels under 20 m in length, were an unintended outcome of regulatory changes made in 1986. A slightly amended version of the pre-1986 regulations is still being applied. Fisheries NZ

[m] Biogenic habitats (e.g. sponge gardens, shellfish beds) differ from other physical habitats (e.g. sand, rock) in that the habitat structure is formed by the plants and animals present.



Dredging indiscriminately destroys life attached to the seafloor

acknowledges there is a discrepancy between how the legislation, which defines this area, has been interpreted and presented in this report, and what is currently understood and enforced in practice. They have committed to reviewing this discrepancy as part of management actions put forward in a fisheries plan for the Hauraki Gulf, which is being developed as part of central Government's response to the Sea Change Hauraki Gulf Marine Spatial Plan.

Another significant development was the Court of Appeal's findings in relation to regional councils being able to manage the indirect effects of fishing, provided they are not doing so for Fisheries Act purposes (*see case study on Page 72*). Sea Change – Tai Timu Tai Pari also offered potential solutions, including:

- transitioning to seabed-friendly fishing methods by phasing out bottom trawling and Danish seining in the Marine Park;
- phasing out recreational and commercial scallop dredging;
- active restoration of marine habitats such as shellfish beds; and,
- establishing a variety of protected areas where fishing is more tightly controlled.

Despite these outcomes, holistic actions on managing the indirect fishing effects have not yet materialised and recent fisheries management decisions have remained largely focussed on maximising sustainable catches of target species.

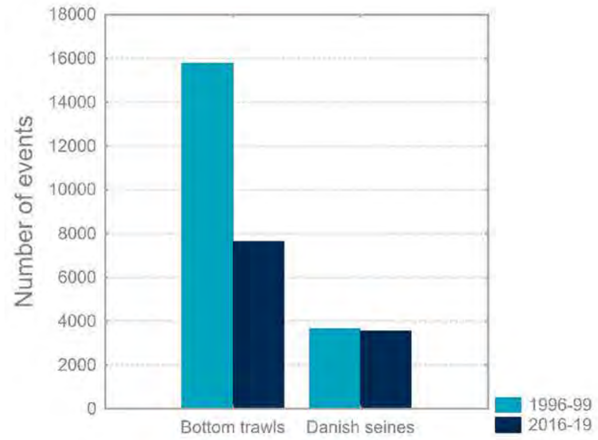


Figure 20: *Differences in the numbers of bottom trawls and Danish seine sets in the three years prior to the Marine Park being established and the most recent 3-year period.*

Baby dolphin entangled in fishing gear on Tāwharanui beach. Photo by Alison Stanes.

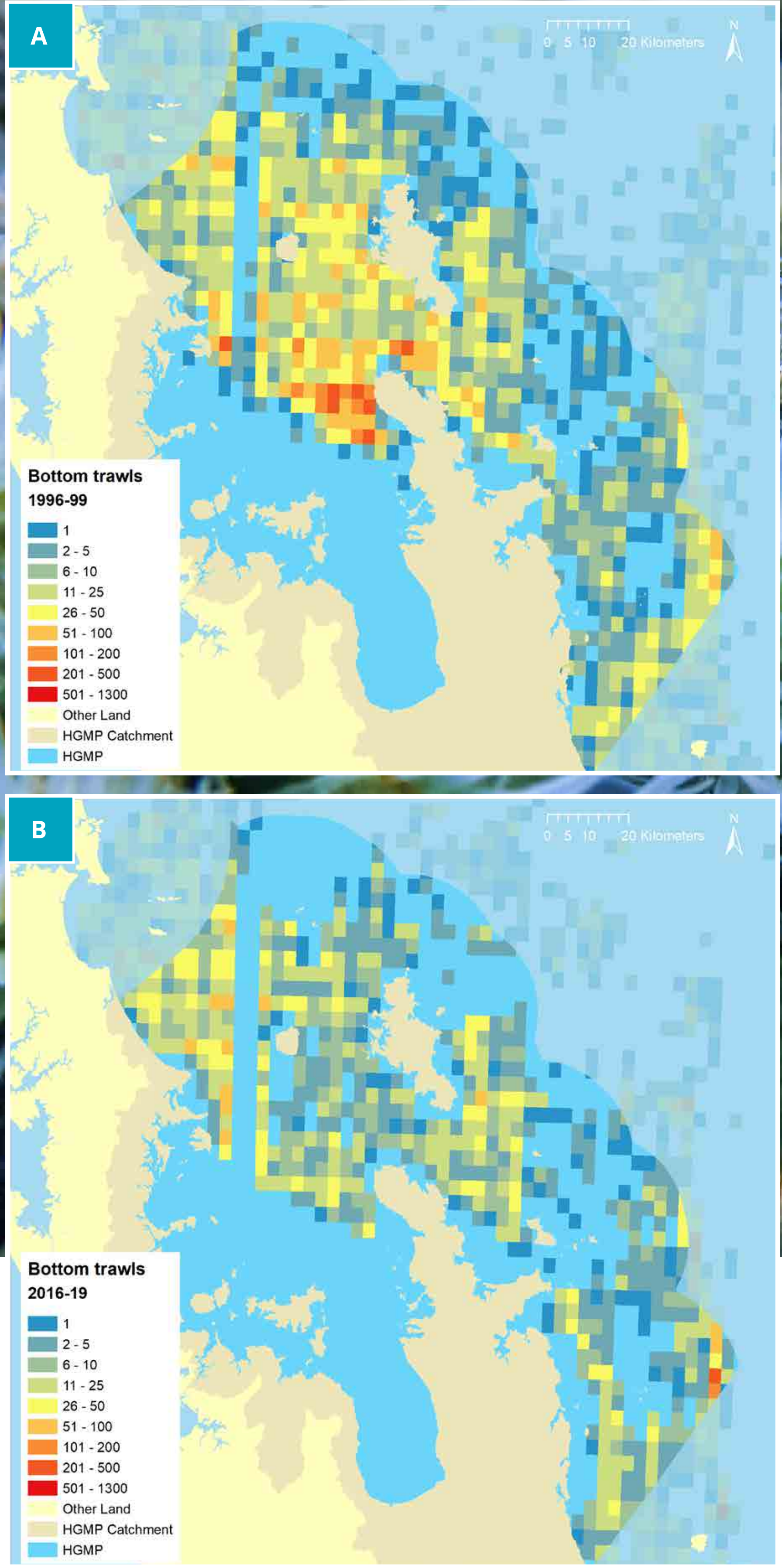


Figure 21: Number of bottom trawls that occurred between a) 1996–97 to 1998–99, and b) 2016–17 to 2018–19 (data provided by Fisheries NZ).

Anemones on a horse mussel. Photo by Shaun Lee.

Clown nudibranchs. Photo by Shane Kelly.

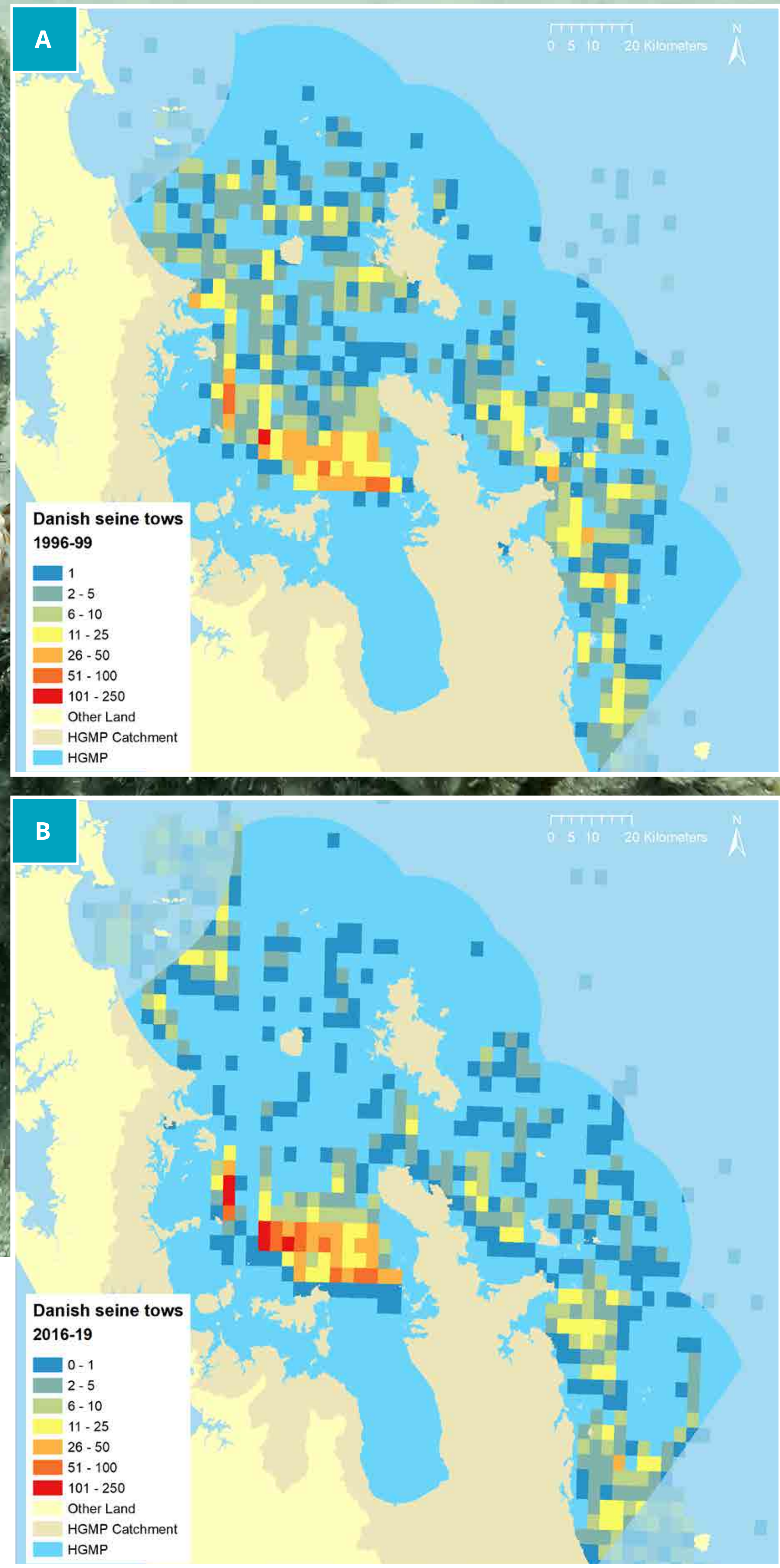
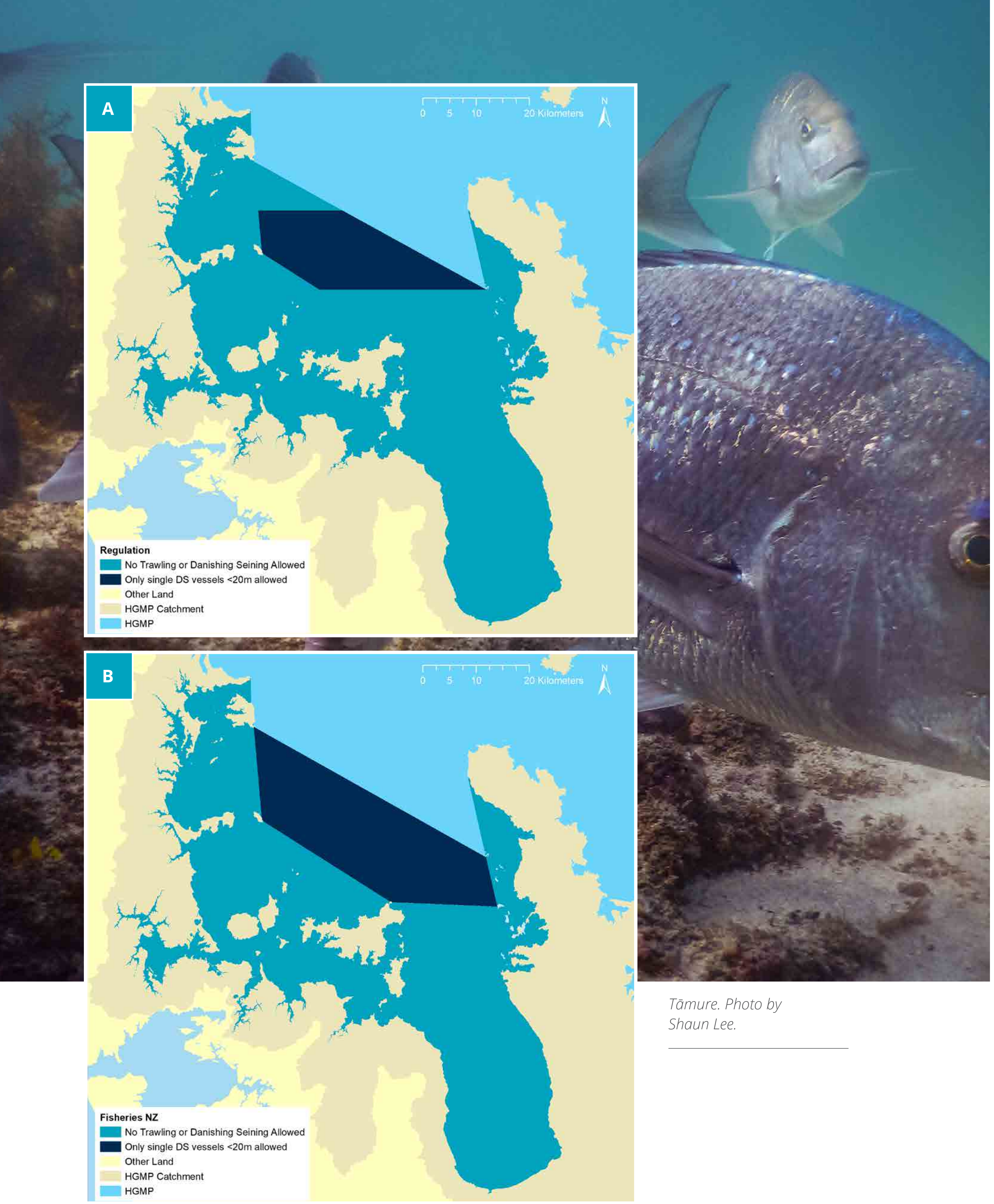


Figure 22: Number of Danish seine sets that occurred between a) 1996–97 to 1998–99, and b) 2016–17 to 2018–19 (data provided by Fisheries NZ).



Tāmure. Photo by Shaun Lee.

Figure 23: *Difference between: a) the restrictions prescribed in fisheries regulations for Danish seining, and b) the restrictions applied by Fisheries NZ.*

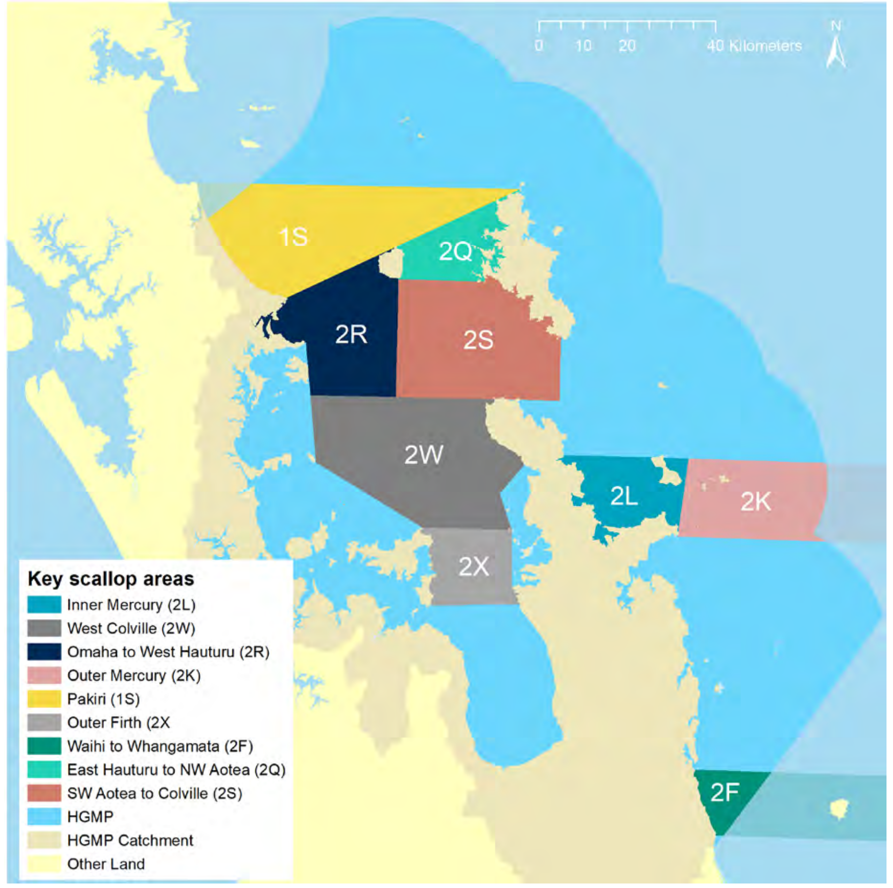


Figure 24: *Commercial tipa reporting areas.*

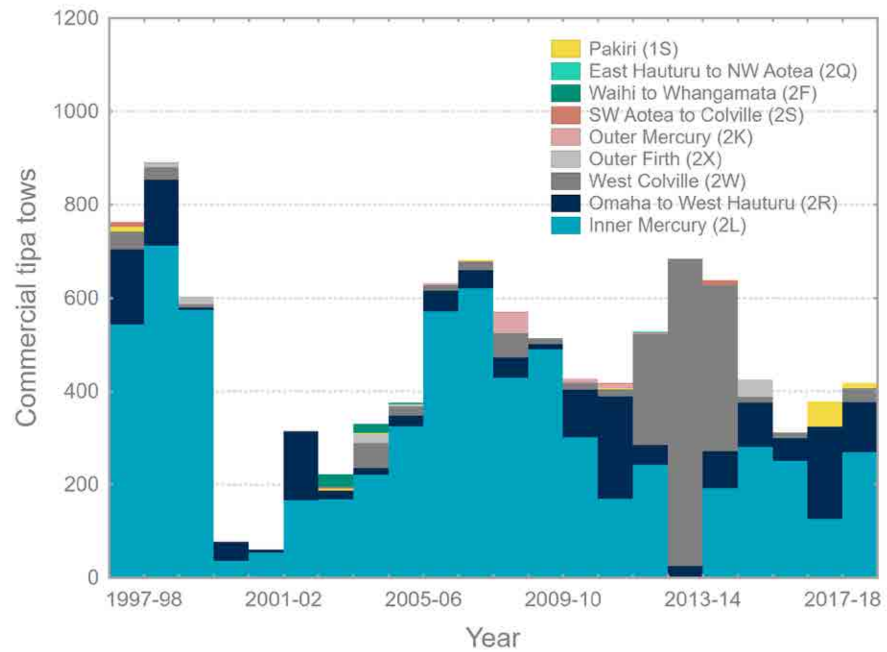


Figure 25: *Number of commerical tipa tows conducted in the Marine Park between 1997–1998 and 2017–18.*

CASE STUDY / HE MAHI RANGAHAU

TE RŌPU KAIMAHI MO TE TĀIKO

Black Petrel Working Group

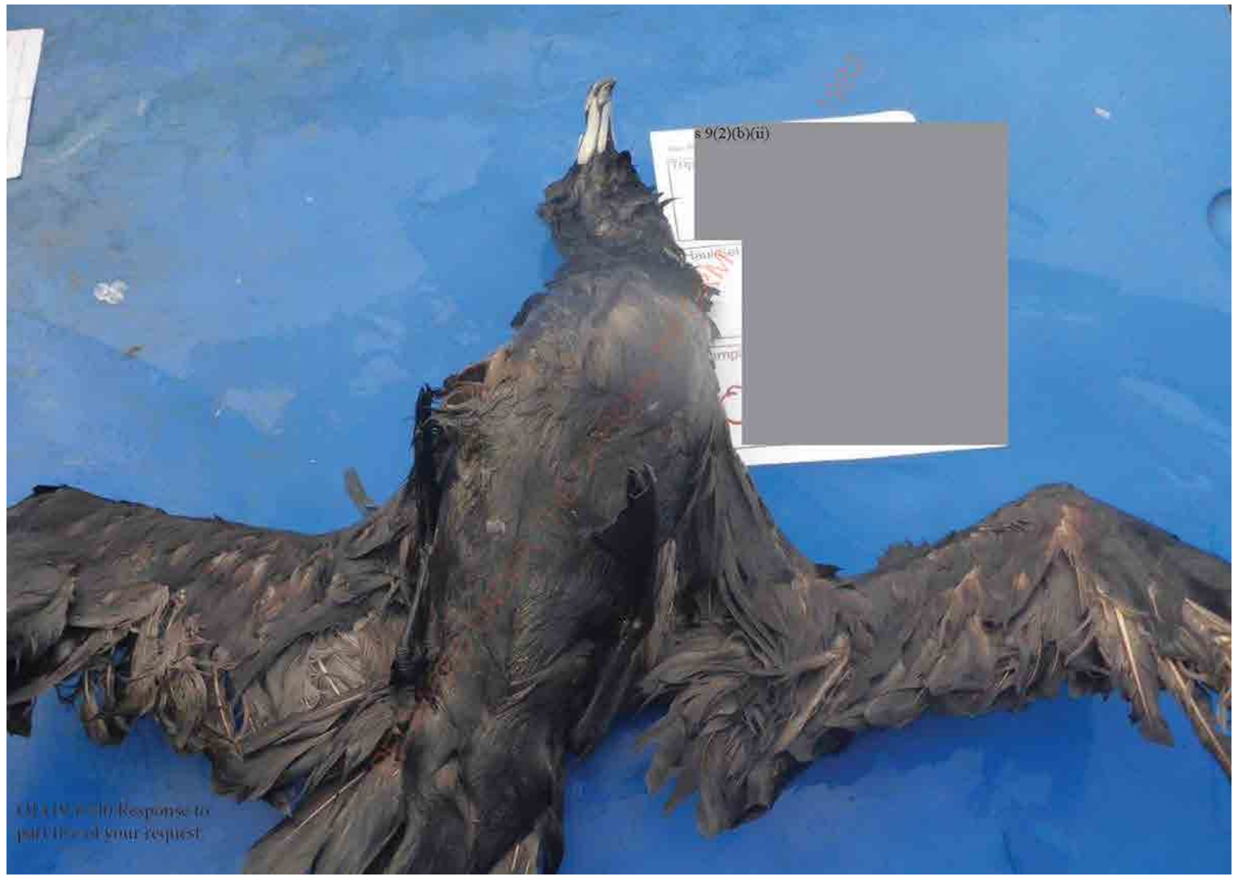
Tāiko. Photo by Shaun Lee.

Every year black petrel / tāiko return to the Hauraki Gulf after a journey that spans thousands of kilometres across the Pacific Ocean. These seabirds come home for summer, to the only place in the world where they are known to breed, on Great Barrier / Aotea and Little Barrier / Hauturu Islands. Once their breeding colonies were found through the North Island and parts of the South Island, and they numbered in the hundreds of thousands. Stoats have eliminated all of the mainland colonies and today there are only around 2500 breeding pairs remaining. Commercial and recreational fishing activity in and around the Hauraki Gulf is thought to be the main risk to the species in New Zealand nowadays. Overseas, black petrels have been reported caught in longline fisheries in Ecuador and northern Peru.

In 2014, a group of concerned fishers, fishing companies, environmental groups, iwi, and central and local government agencies joined forces to form the Black Petrel Working Group. This group made a public pledge to help black petrel regain lost ground. The group has carried out a series of actions to help black petrels thrive again in the Hauraki Gulf.

The fishing companies that have signed up to the pledge (Sanford, Moana NZ and Lee Fish Ltd) have required longline fishers to attend training that teaches them seabird smart fishing practices. The fishers also now need to have a seabird risk management plan on board. In the years since the pledge was signed almost every longline fisher operating in and around the Gulf has been through the training programme, and all longline vessels now have a seabird risk management plan on board. The Government has helped support this programme by employing two seabird liaison officers who have been working with fishers.

It is now important to find out if the measures that have been taken are working, and to update our understanding of the risk that fishing poses to different species including black petrels. This involves several types of analysis. Monitoring the rate of seabird captures over time gives the best measure of the effectiveness of actions, as it removes the confounding effect of changing fishing effort between years. As well, estimates of total numbers of seabirds being caught (broken down by species) is important, to look at the impact on populations. This data is inputted into a risk assessment model, developed by Fisheries NZ.



Tāiko caught by a small vessel inshore trawling near Hauturu in 2015–2016. Photo released by MPI.

To make these calculations requires reliable data, and the Black Petrel Working Group has spearheaded a trial to test whether cameras can be used on fishing vessels to detect when seabirds are caught. This has involved fitting cameras on between 9–12 boats, and seeing whether the cameras can detect seabird captures as accurately as a human observers. The three companies involved in the working group — Sanford Ltd, Moana NZ and Lee Fish Ltd — paid for the trial, with financial support from Fisheries NZ for an audit and additional footage review. The trial has shown that cameras are as reliable as humans in detecting seabirds, and the footage is clear enough to be able to determine what type of seabird has been caught. A side benefit has been the improved self-reporting of seabird captures by fishers with cameras on their vessels.

The next stage is to use the data collected as part of the camera trial to calculate seabird capture rates and seabird estimates over the four years, to measure the effect of the education and training undertaken by the collaborative group, and to help plan future work.

Tom Searle, operations manager, Lee Fisheries monitoring Tāiko. Photo by Shaun Lee.

CASE STUDY / HE MAHI RANGAHAU

TE WHAKATAUNGA WHAKAHIRAHIRA A TE KŌTI MO NGĀ MAHI KINO, PAI RĀNEI, O TE HĪ IKA

Game changing court decision on the indirect impacts of fishing

Grounded ship Rena on the Astrolabe reef October 2011. Photo by NZ Defence Force.

It has long been assumed that regional councils could not address the effects of fishing under the Resource Management Act (RMA). The 'position' held was that the control of fishing and fisheries resources was specifically provided for in the Fisheries Act and could not be regulated under the RMA. However, a recent Court of Appeal decision has challenged this.

The Mōtītī Rohe Moana Trust (Trust) submitted on the Bay of Plenty's Proposed Regional Coastal Environment Plan in 2015 (Coastal Plan). That submission generally opposed the Coastal Plan's provisions for not complying with principles of the Treaty of Waitangi and for Council's failure to apply mātauranga Māori or engage with Māori connected to Mōtītī and its moana. The issues raised in the submission extended back decades, encompassed the entire rohe of the Mōtītī iwi, and largely revolved around the Council and the Coastal Plan being incapable of addressing chronic, long-term degradation of the moana through a Māori lens. Another key issue raised in the Trust's submission on the Coastal Plan was the effects of fishing on indigenous biodiversity[39].

At the Council hearing the Trust raised concerns about kina barrens arising from overfishing and submitted that the Coastal plan should address this. The Council's decision was that it didn't have jurisdiction to take measures that would impact on fisheries as this was managed under the Fisheries Act. The Trust appealed to the Environment Court, then the High Court, and most recently the Court of Appeal (Court). The issues under consideration boiled down to four matters of law. Among those were whether regional councils can exercise controls for RMA purposes that impact on fishing, and if so, can they perform that function only to the extent strictly necessary.

The Court of Appeal found that there is an overlap in the functions of regional councils under the RMA and those of the Minister of Fisheries under the Fisheries Act. The two statutes complement and *"look at"* each other. It concluded that biodiversity functions of the RMA were much broader than those of the Fisheries Act. The RMA ***"protects indigenous biodiversity not just as a resource but for its intrinsic value and for its ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values"***. The Court also noted that regional councils were assigned the primary governance role in maintaining indigenous biodiversity, stating:

"This brings us to a significant point, which is that the legislative history records that a choice was made not to establish this important function under the Fisheries Act for the coastal marine area but rather to assign it to regional councils under the RMA."

The Court also highlighted that decisions under one statute may be informed by decisions taken under the other. As an example, it noted that decisions on sustainability measures under the Fisheries Act, may be influenced by controls in a regional plan, or in a management strategy or plan under the Conservation Act (1987).

Overall, the Court found that the RMA does not prevent regional councils from controlling fisheries resources through their RMA functions, provided they are not doing so for Fisheries Act purposes. It also found that regional councils are not limited to exercising this function to ***"only when strictly necessary"*** when dealing with fisheries resources controlled under the Fisheries Act. While the decision had a strong focus on indigenous biodiversity, it could also be applied to other RMA matters affected by fishing (for example, natural character, geological features, historic heritage, and the relationship of Māori with their ancestral lands and waters).

The implications of this decision appear far-reaching, as the indirect or inadvertent impacts of fishing are known to be significant. In the Marine Park, these include impacts on seabirds, the seabed, and the functioning of reef communities. The questions now are:

1. Given that available information indicates that the indirect biodiversity effects of fishing on the Marine Park are significant, is the management of those effects a required, rather than a potential or optional, function of regional councils?

2. How and when will specific controls be incorporated into Regional Coastal Plans?

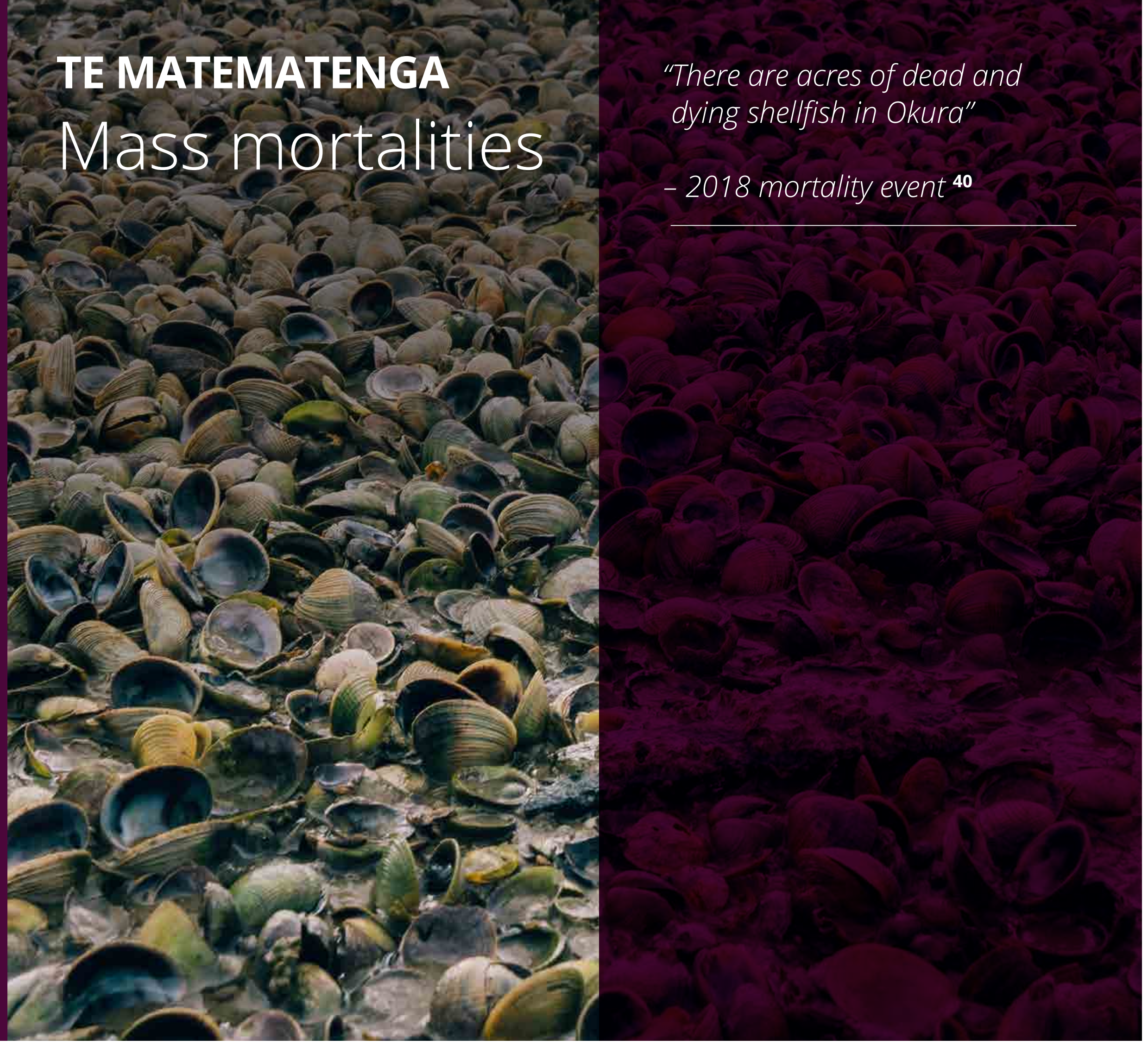
3. What will those controls look like and where will they apply?

4. Would coastal plan provisions need to be integrated with fisheries decisions, and if so, how?

5. What happens in the interim?

- **a.** Do fishing activities currently require resource consents under existing coastal plans (for example under existing rules relating to activities that disturb the seabed or adversely affect significant ecological areas)?
- **b.** If so, can activities that require consent continue prior to consent being granted?

Astrolabe Reef four years after the area was closed to fishing. Photo by Darryl Torckler www.darryltorckler.co.nz



TE MATEMATENGA
Mass mortalities

"There are acres of dead and dying shellfish in Okura"

– 2018 mortality event[40]

Mass mortality of shellfish at Okura Estuary. Photo by Geoff Reid.

Disease, extreme environmental conditions and stress can cause mass mortalities of marine life. Larvae and small juveniles are usually the worst affected, but mortality events for these early stages are rarely seen due to their small size. Even mass mortalities of large animals may go unnoticed unless they wash ashore.

Biosecurity New Zealand run a disease diagnostic service for the public to report mass mortality events or suspected diseases.

20 YEARS AGO

3 known mass mortality events in the Marine Park for the decade 1990–2000.[41]

TODAY

10 known mass mortality events in the Marine Park for the last 10 years, but four of these events are reoccurring events in Whangateau and Okura Estuaries. Shellfish populations in those estuaries appeared to be stressed by adverse environmental conditions (e.g., high temperatures and high sediment loads).

KEY EVENTS

Most reported mass mortalities in the Marine Park are not primarily caused by disease, but appear to be the result of unfavourable environmental conditions and stress, such as high temperatures, high sediment loads or post-spawning stress. The lack of mass mortalities at these estuaries prior to 2009 suggests that there has been a recent decline in environmental conditions in these two estuaries. However, very little is known about relationship between disease and stress in marine animals, and their tolerance levels.

2009: Bacterial infections and heat stress cause mass mortality of tuangi in Whangateau Estuary.[42]

2009: Mass mortality of pilchards and Jack mackerel in the Marine Park due to an unknown cause(s).[42]

2010: Oyster herpes virus causes more than 80% mortality of juvenile oysters throughout the Marine Park and beyond.[43]

2011: Environmental stress, such as high sediment loads or high temperatures were thought to cause mass mortality of shellfish at Okura Estuary.[44]

2014: Mass mortality of shellfish at Whangateau Estuary possibly due to post-spawning stress and environmental conditions.[31]

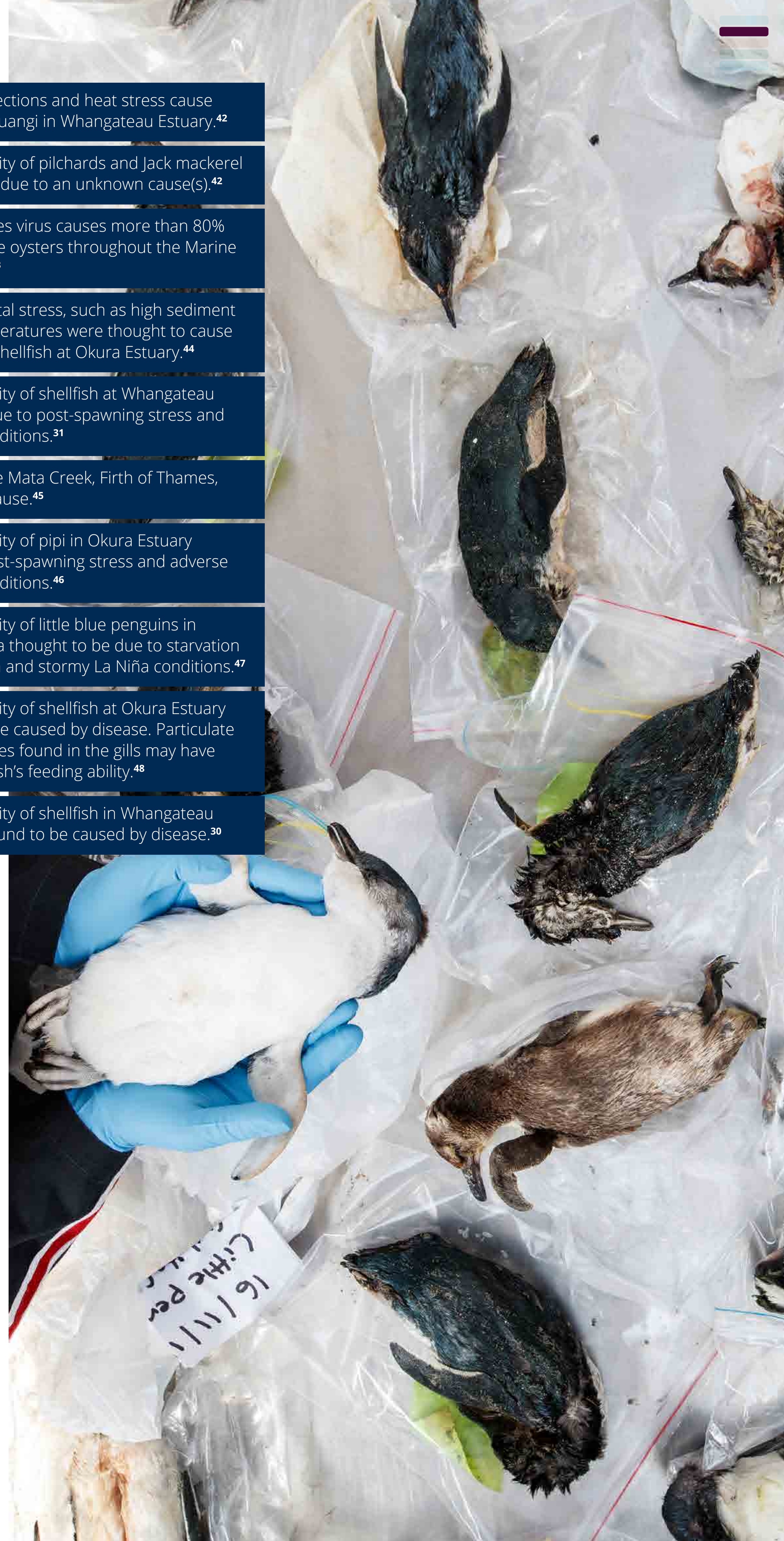
2015: Fish die in Te Mata Creek, Firth of Thames, due to unknown cause.[45]

2016: Mass mortality of pipi in Okura Estuary possibly due to post-spawning stress and adverse environmental conditions.[46]

2018: Mass mortality of little blue penguins in northeast Aotearoa thought to be due to starvation as a result of warm and stormy La Niña conditions.[47]

2018: Mass mortality of shellfish at Okura Estuary was not found to be caused by disease. Particulate matter and parasites found in the gills may have affected the shellfish's feeding ability.[48]

2018: Mass mortality of shellfish in Whangateau Estuary was not found to be caused by disease.[30]



Massey University zoology staff examine a mass mortality of kororā / little penguins. Photo by Richard Robinson www.depth.co.nz

TE PARAKORE

Harmful algae

Green-lipped mussels. Photo by Shaun Lee.

"In addition to the electronic search, voice recordings stored on the database were reviewed, by direct listening, and again the exercise showed no reference to poisoning or illness caused from the consumption of kaimoana".

– Hauraki Māori Trust Board search of their Digital Library for historic korero about toxic kaimoana.[49]

Clean water is important for the harvest of kai moana. Filter-feeding shellfish such as tuangi, pipi and kūtai (mussels) concentrate any chemicals or toxins present in the water, such as toxins produced by naturally occurring harmful algae. This can make shellfish unsafe to eat when there are high concentrations of harmful algae in the water. High concentrations of harmful algae have been also linked to mass mortalities in marine life.[50,51] Algal blooms (both harmless and harmful) are more common during hot and calm conditions, and where there is a plentiful supply of nutrients. This makes areas where these conditions frequently occur, such as the Bay of Plenty, more prone to algal blooms.[52]

Aotearoa's first recorded cases of shellfish poisoning caused by harmful algae occurred in 1993. Now levels of harmful algae in coastal waters are regularly monitored by the government and the aquaculture industry to ensure that shellfish are safe to eat. Areas are closed to harvest if high levels of toxins are found in samples.

20 YEARS AGO

Monitoring programme for harmful algae in place.

TODAY

There have been nine harmful algal blooms between 2000–2019 that have resulted in harvest closures and/or public warnings.[n]

KEY EVENTS

Shellfish have been monitored for harmful algae since 1993 when the toxins were first discovered in Aotearoa. Since then, around 30 people have suffered shellfish poisoning symptoms after eating recreationally harvested shellfish (often from areas that have public warnings in place). There have been no cases of shellfish poisoning from the consumption of commercially harvested shellfish due to stringent monitoring requirements.[53]

[n] data provided by the Coromandel Marine Farmers Association and MPI.

Sep 2005: Diarrhetic shellfish poison present in shellfish from West Coromandel.

Jul–Aug 2006: Diarrhetic shellfish poison present in shellfish from West Coromandel.

Nov 2007: Paralytic shellfish toxin present in shellfish from Whangaparāoa.

May 2009: Paralytic shellfish toxin present in shellfish from Aotea.

Dec 2010: Paralytic shellfish toxin present in shellfish from Whangamatā.

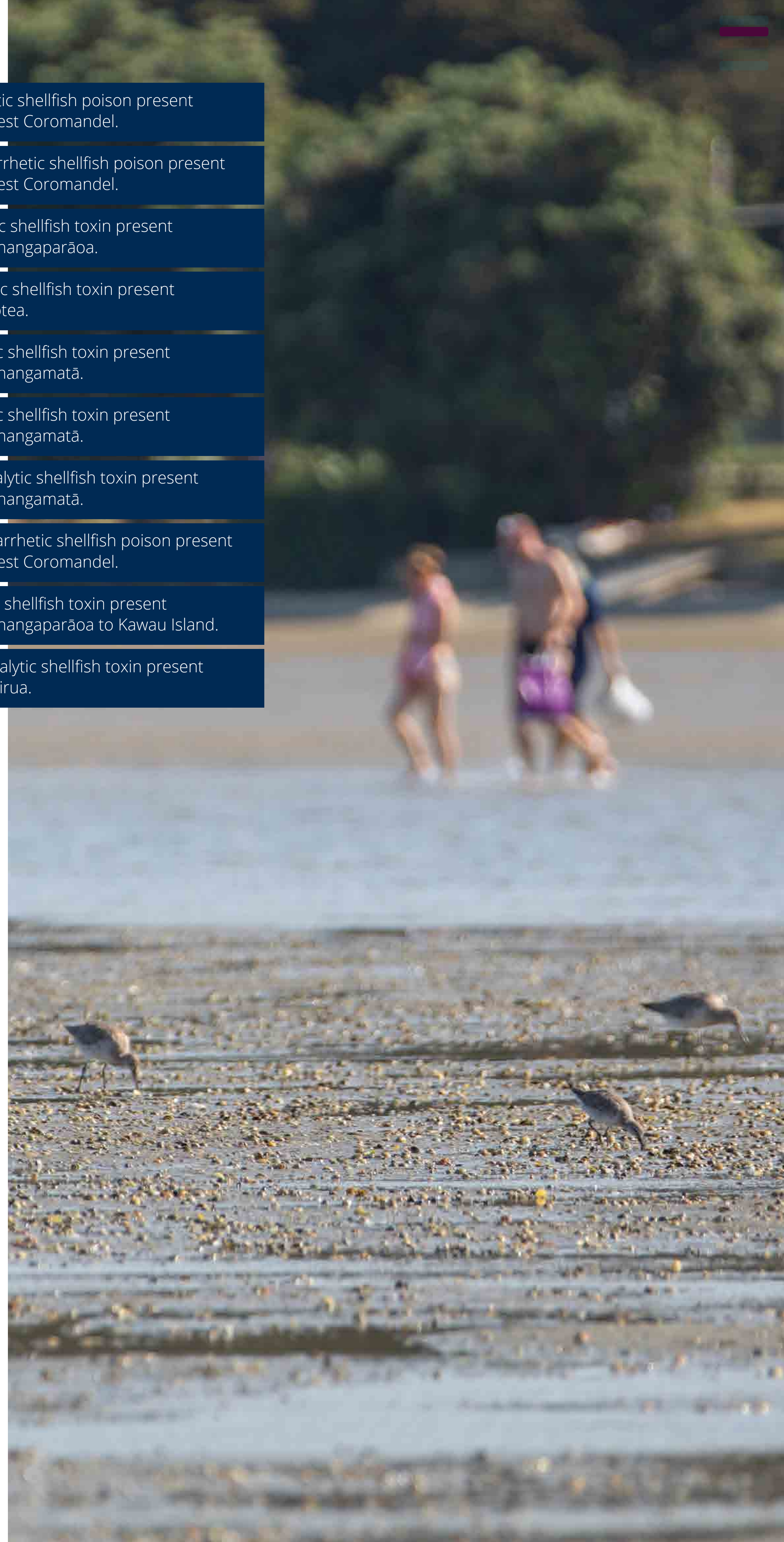
Dec 2011: Paralytic shellfish toxin present in shellfish from Whangamatā.

Apr–Jul 2015: Paralytic shellfish toxin present in shellfish from Whangamatā.

Aug–Oct 2015: Diarrhetic shellfish poison present in shellfish from West Coromandel.

Jun 2016: Paralytic shellfish toxin present in shellfish from Whangaparāoa to Kawau Island.

Jan–Apr 2019: Paralytic shellfish toxin present in shellfish from Tairua.



Shellfish foragers. Photo by Shaun Lee.

TE MAHI AHUMOANA
Aquaculture

Green-lipped mussel farm. Photo by Richard Robinson www.depth.co.nz

"Sustainability is at the heart of the strategy. Aquaculture is a primary industry leading in environmentally sustainable practices across the value chain. The strategy commits us to always ensuring aquaculture growth is sustainable and considers other uses and values of our coast and waterways."

– The Hon. Stuart Nash, Minister of Fisheries, talking about the New Zealand Government's Aquaculture Strategy, Aquaculture Conference speech, September 2019.

Aquaculture has grown from small experimental mussel rafts in the 1960s to a major industry in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi rohe.

The ecosystem effects of culturing filter-feeding shellfish such as mussels and oysters are generally well understood, and largely depend on the location and scale of farm activities.

The effects of shellfish farms of most concern in the Marine Park are benthic effects caused by the deposition of living and waste material on the seabed, and the hosting and spread of invasive species. Conversely, mussel farms offset some of the lost biodiversity and natural functions arising from the destruction of once-extensive, natural mussel beds.

Benthic effects (positive and negative) are generally confined to the areas directly beneath shellfish farms. The scale of shellfish farms is therefore an indicator of the likely scale of benthic effects, but it should be noted that effects vary depending on farm location.

The potential for other effects also increases as the scale of shellfish farming increases.

No farms in the Marine Park are currently growing fish or other fed species, but 390 ha in the Firth of Thames/Coromandel area has been zoned for this activity. The ecosystem effects of any future farming of fed species are likely to be more significant that shellfish farming. Of particular note are:

- the potential for high nitrogen loads from fish farms to compound the effects of land-based nutrient run-off;
- the overlap of the fish farm zone west of Coromandel with an area that is used by endangered Bryde's whales;
- seabed effects are likely to be greater than those caused by shellfish farms.

Marine farms also have the potential to diminish natural character and landscape values and create navigational hazards.

Given that aquaculture effects are largely location and scale dependent, the indicator looks at changes in the scale of marine farming in the Marine Park and where growth is occurring.

Green-lipped mussel farm. Photo by Shane Kelly.

20 YEARS AGO

Aquaculture was still a relatively small industry, but demand for marine farming space was high. Farmed areas were around 475 ha for the Waikato Region and around 210 ha for the Auckland Region, but inaccuracies in early records means these figures should be treated as approximate.

Small mussel farms were located in sheltered bays and inlets along the western Coromandel, western Aotea, Port Charles, Kennedy Bay and eastern end of Waiheke Island. A larger concentration of farms was present in Wilson's Bay.

Oyster farming was concentrated in the upper harbours of western Coromandel, Whangapoua, Whitianga, Mahurangi Harbour and Tāmaki Strait.

Regulation prevented farmers from applying for new farming consents, but a loophole allowed them to apply for spat-catching consents. As a result, Auckland and Waikato Regional Councils were being inundated with spat-catching applications.

TODAY

The scale of mussel farming has increased substantially, particularly in the Firth of Thames. The shellfish farming area in Wilson Bay is almost fully consented and major new developments have recently been approved or applied for in the Auckland Region *(Figure 26).*

Consented shellfish farms in the Waikato Region cover around 1562 ha (2690 ha if Wilson Bay farm zones A and B are used instead of farm footprints).

In the Auckland Region, existing farm footprints cover around 240 ha, recent approvals allow for farms in another 960 ha, and applications are being processed for around 334 ha.

A successful tenderer has been awarded the right to apply for consents to develop a fish farm in a 300 ha zone west of Coromandel.

Development of a 90 ha fish farm zone in Wilson Bay is yet to be tendered.

In the Waikato, marine farming is still prohibited outside of prescribed areas. As a consequence, spat-catching consent applications are once again on the rise. Meanwhile applications for around 2270 ha of spat catching space made prior to a 2001 moratorium remain on hold.

2000: Aquaculture was still a relatively small industry, but demand for marine farming space was high.

2001: Resource consents were granted for mussel farming in Area A of the Wilson Bay Marine Farming Zone.

2001: A moratorium on new aquaculture applications is put in place, delaying the development of Area B in Wilson Bay.

2002: Central Government formalises a two-year moratorium to allow a new framework for managing aquaculture to be developed.

2004: New rules introduced that restrict marine farming to aquaculture management areas (AMAs).

2004: Māori Commercial Aquaculture Claims Settlement Act 2004 comes into effect, providing cash and/or farm space entitlements to iwi.

2008: AMA status granted to Area B of Wilson Bay, allowing development to begin.

2011: Regulatory changes remove requirements for AMAs, provide for fish farming in the Firth of Thames/Coromandel area, and for the limited expansion of existing marine farms.

2016: Auckland Unitary Plan becomes operative, easing requirements for new aquaculture development in the Auckland Region.

2018: A successful tenderer is awarded the right to apply for consent to develop a fish farm in the 300 ha Coromandel Marine Farming Zone.

2019: Release of NZ Aquaculture Strategy.

Oyster farm in Mahurangi Harbour. Photo by Shaun Lee.

KEY EVENTS

Major shifts in aquaculture regulatory frameworks have occurred since 2000. These changes have largely been in response to three competing factors:

1) a desire by industry, central government and councils to increase aquaculture production;

2) competition among users of marine space; and,

3) concerns about the environmental impacts of large-scale aquaculture development.

In 2002, Central Government attempted to resolve these issues by limiting marine farming to AMAs, yet it did not require Councils or marine farmers to actually establish these areas. The task of balancing competing demands eventually proved too difficult and the initiative failed. Further regulatory changes in 2011 and the adoption of the Auckland Unitary Plan in 2016, opened up development in the Auckland Region, which is now occurring on a largely piecemeal basis.

It also provided for fish farming in the Waikato Region and limited expansion of shellfish farming. However, a prohibition under the Waikato Coastal Plan still prevents marine farms from being developed outside of prescribed areas. As a consequence, farmers are again applying from spat catching consents, as they were doing when the Marine Park was originally established.

Additional aquaculture development is likely, as Central Government seeks to grow the industry from one that produces $600+ million in annual sales nationally, to $3 billion in sales by 2035. The Government's Aquaculture Strategy[54] is seeking to do this through sustainable, productive, resilient and inclusive development.

Green-lipped mussel farm. Photo by Richard Robinson www.depth.co.nz

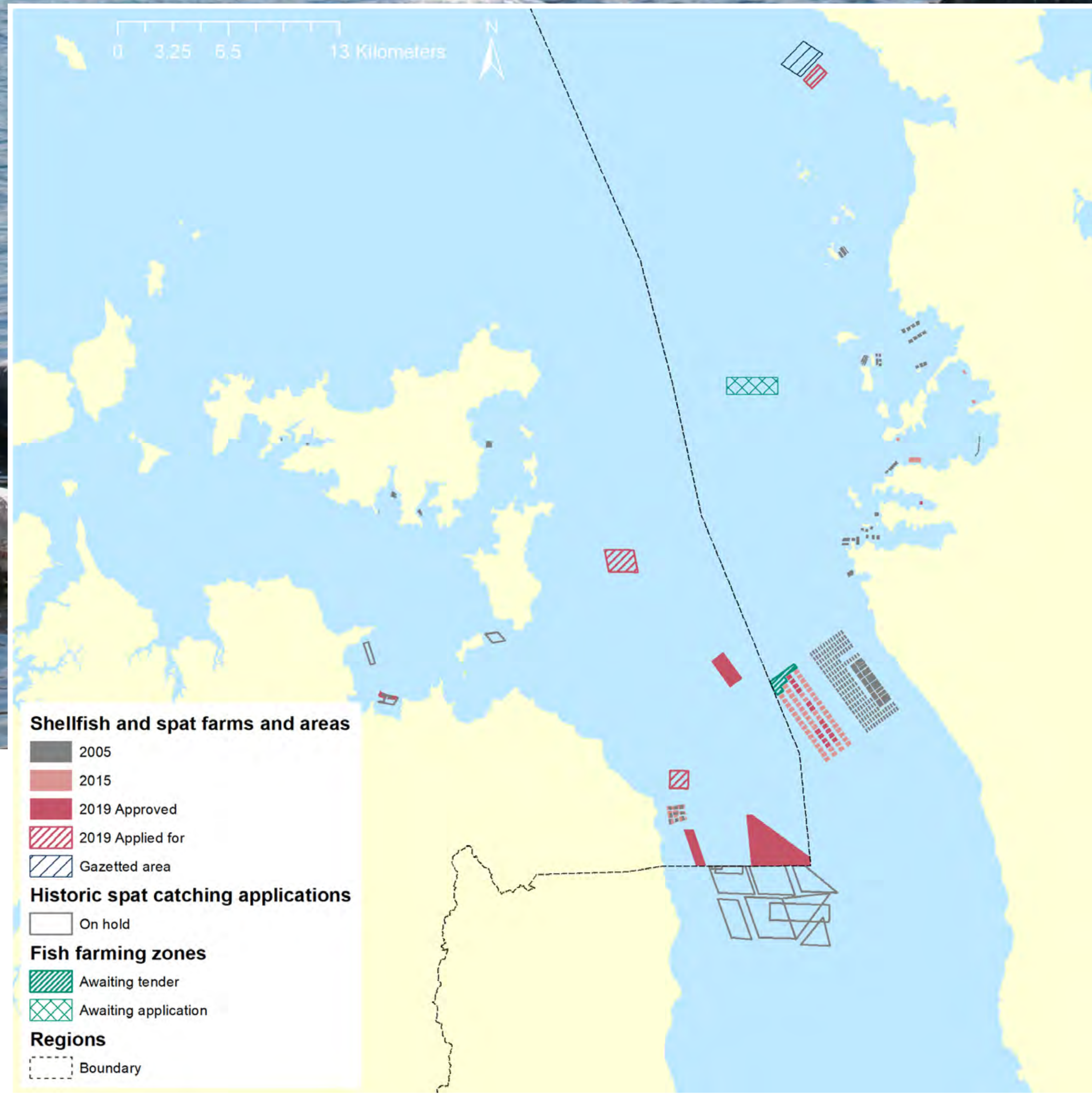


Figure 26: *Current and potential aquaculture areas in the Firth of Thames and inner Marine Park.*

Waihou River. Photo by Shaun Lee

KI UTA KI TAI

Mountains to Sea

Ki uta ki tai is a concept in Te Ao Māori that characterises kaitiakitanga starting from mountains and other inland geographic features down rivers and valleys to the sea. It is a total catchment management approach that is not alien to western science, though they are defined through different cultural lenses.

Te Ao Māori recognises that all things animate and inanimate derive from Ranginui (sky father) and Papatuanuku (earth mother). The natural world was divided into realms ruled over by gods who were the offspring of Rangi and Papatuanuku. Tangaroa was the God of the Sea and Fishes, Tāne Māhuta the God of Forests and Birds, Haumietiketike the God of Uncultivated Food, Rongomātāne the God of Cultivated Foods, and Tāwhirimātea the God of Weather, to name a few of those most relevant to this section.

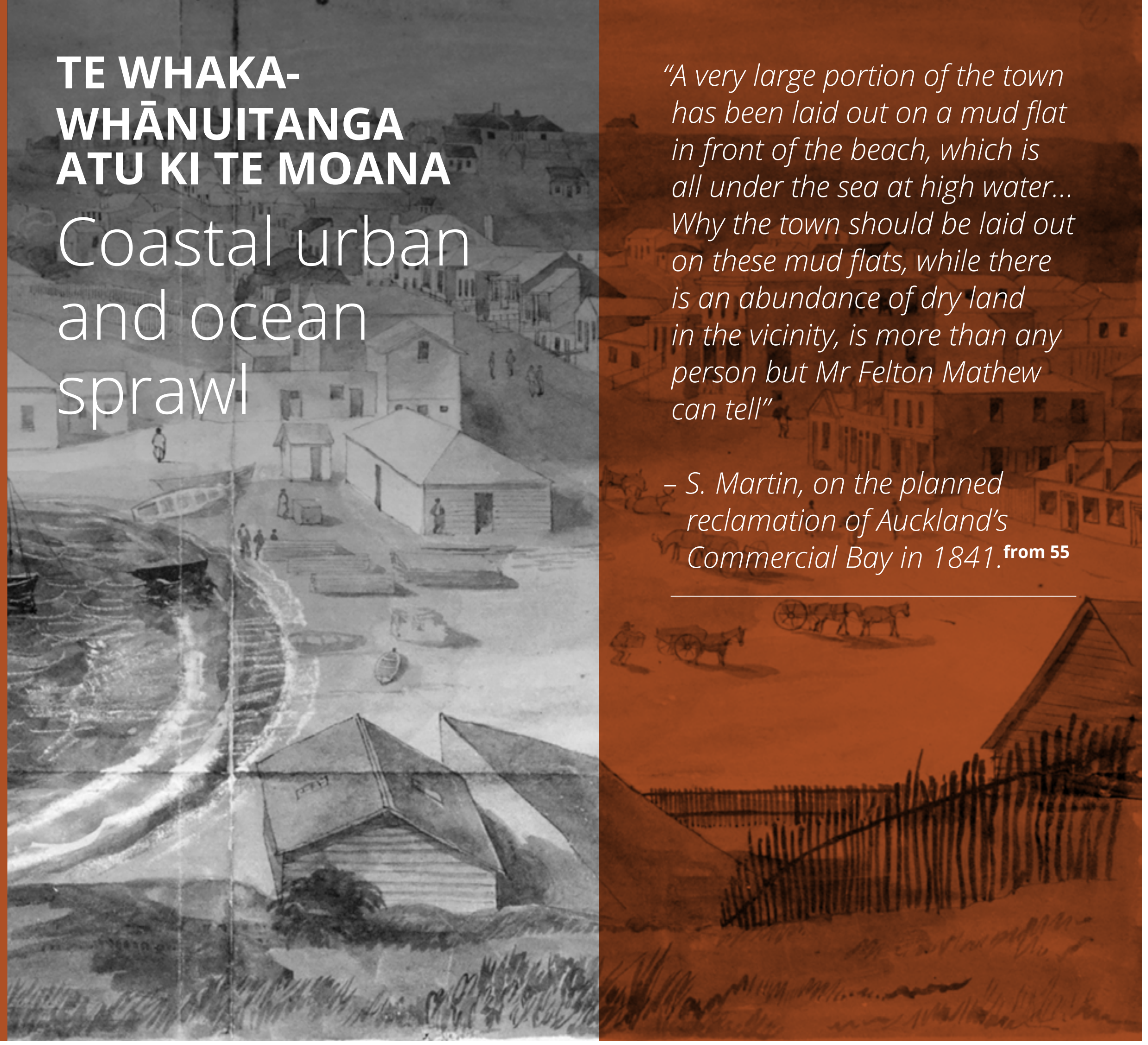
Here, we look at relationships between the whenua and moana and other waterways such as awa (rivers), roto (lakes), hāpua (lagoons) and wahapū (estuaries) in and around the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi rohe. Those relationships have changed markedly since the distant tūpuna of tangata whenua first inhabited this takiwā (region). They continue to change during our reshaping of the natural world. Some of those relationships, such as plumes of sediment flowing from our rivers, are obvious. Others, like the accumulation of heavy metals, nutrients and disease-causing pathogens in our water are hidden from our sight, or they occur over such imperceptibly slow timeframes that if we are not vigilant, they can catch us unaware.

The key indicators covered in this section include coastal and ocean sprawl, toxic chemicals (paihana), nutrients (toiora), the suitability of water for swimming, sediment and benthic health, and mangroves (mānawa).

INDICATOR / TOHU

TE WHAKA-WHĀNUITANGA ATU KI TE MOANA

Coastal urban and ocean sprawl



"A very large portion of the town has been laid out on a mud flat in front of the beach, which is all under the sea at high water... Why the town should be laid out on these mud flats, while there is an abundance of dry land in the vicinity, is more than any person but Mr Felton Mathew can tell"

– S. Martin, on the planned reclamation of Auckland's Commercial Bay in 1841. **from 55**

Looking east from Smales Point showing Commercial Bay in 1843. Auckland Libraries Heritage Collections AWNS-4-1047.

The concept of 'urban sprawl' is well-understood and relates to the global trend of villages, towns and cities growing and sprawling out across the surrounding landscape. The term 'ocean sprawl' is used to describe coastal engineering works and structures that are increasingly sprawling out into our estuaries, harbours and oceans. These include marinas, wharves, structures for coastal protection and flood defence, roads and bridges, pipes, cables, dredging and disposal areas, shipwrecks, aquaculture structures, and reclamations. The growing number and cumulative effects of artificial structures in the coastal environment affects marine ecosystems, landscapes, amenity values and options for future uses.

Urban and ocean sprawl go together, as many of our main centres were built beside the sea. Ports and wharves are needed to move people and goods. Facilities are required to launch, store, maintain and refuel vessels. Important land transport corridors traverse coastal sections, and groynes are used to protect seaside homes from coastal erosion. Expansion and protection of this infrastructure is commonly accommodated through progressive reclamation. Stormwater, wastewater and industrial discharges often occur through coastal or ocean outfalls. Navigational aids are needed to safely guide vessels into ports and harbours. Marine farming is an important source of income and employment. As a result, many parts of the Marine Park and its shores have been highly modified.

Councils do not routinely collate information on this issue, but this indicator provides a snapshot of information on major development, structures and associated activities in the Marine Park and along its shores. Note that marine farms make up a large proportion of coastal structures but have already been covered in this report *(see Page 78).*

20 YEARS AGO	TODAY
All current coastal towns and settlements existed when the Marine Park was established.	In Auckland, levels of urban development have been greatest within the metropolitan urban limit. This includes greenfield development in areas such as Albany, Long Bay, Hobsonville, Highbrook and Flatbush, and brownfield development throughout Auckland (with pockets of greater intensification in central Auckland, East Tamaki and western suburbs) (*Figure 28*).
Many man-made coastal structures also existed when the Marine Park was established, with the Waitematā Harbour being the most intensively developed coastal area (*Figure 27*). Significant and extensive land reclamation had also occurred on the Coromandel Peninsula.	Substantial localised development has occurred in coastal towns and settlements north and east of Auckland.
Auckland Regional Policy Statement provided a framework for managing growth through quality, compact urban development within a metropolitan urban limit (MUL).	Localised development has also occurred in and around most, if not all, towns and settlements on the Coromandel Peninsula. This includes significant canal projects in Whitianga and Pauanui.
Development on the Coromandel Peninsula was managed under the interim Thames-Coromandel District Plan. A new plan had been proposed and was under appeal.	Areas away from the existing towns and settlements have largely remained free from substantial development.
Ports of Auckland had started work on extending Fergusson container terminal at the eastern end of the port.	The number of marinas has increased. Thirteen marinas[p] (and additional drystack facilities) in Auckland Region provide around 5,700 berths, with an additional 186 berth marina development approved for Kennedy Point, Waiheke. There are now four marinas and two canal developments on the Coromandel Peninsula and new marina has been proposed for Coromandel Harbour. The Auckland Unitary Plan also includes provisions for a canal development along Wairoa River near Clevedon.
Auckland had nine marinas providing berths for around 4,200 vessels, plus around 5,800 swing and pile moorings[56]. Whitianga and the Thames Sailing Club[o] had the only marinas on the Coromandel Peninsula, but work had started on Pauanui Waterways. Historic records for the number moorings in the Waikato section of the Marine Park are not available.	A "marine gateway" is proposed for Coromandel township that among other things includes a ferry terminal, facilities for fishing charter operators, a hardstand, boat dry stacks, and short-stay wet and dry marina berths. Channel dredging will provide all tide access between the harbour and the Coromandel township.
	Numbers of moorings in the Auckland Region appear to have declined, with numbers of swing and pile moorings currently around 4,300[57]. Moorings have been removed from Ōkahu Bay (*see case study on Page 90*) and have largely disappeared from some semi-exposed areas such as Maraetai and Kawakawa Bay. By comparison there are currently 287 mooring consents in the Waikato area of the Marine Park.
	Demand for alternative boat storage options has increased with around 1000 drystack berths available in the Marine Park.
	Ports of Auckland have completed the extension of Fergusson container terminal and obtained new 35-year dredging and disposal consents for maintaining navigable depths in access channels and port berths.

Dredging Pine Harbour Marina. Photo by Shaun Lee.

[o] Thames Sailing Club has a small marina with limited tidal access.

[p] Bayswater, Buckland Beach, Gulf Harbour, Half Moon Bay, Hobsonville, Milford, Orakei, Outboard Boating Club, Pine Harbour, Sandspit, Silo Marina and adjoining berths, Viaduct Marina and Westhaven (a small facility at Warkworth has been excluded).

2000: Auckland Regional Growth strategy provides a roadmap for the Region's growth and development.

2000: Work on Ports of Auckland's, Fergusson container terminal extension, and Pauanui. Waterways canal development underway.

2001: Work begins on Whitianga Waterways.

2006: Construction of Orakei marina provides 179 additional berths.

2008: Construction of the 209-berth, Whangamatā marina begins.

2009: Coromandel Peninsula Blueprint provides a strategy for future growth and development.

2010: Thames Coromandel District Plan becomes operative.

2011: Consent granted for a 95-berth marina in Tairua.

2013: Application lodged to build and operate a marina in Matiatia, Waiheke Island (subsequently declined).

2016: Construction of a 131-berth marina at Sandspit complete.

2016: Waikato Regional Policy Statement becomes operative, formally recognising the Coromandel Peninsula Blueprint.

2016: Decision version of updated Thames-Coromandel District Plan notified (subsequently appealed).

2017: Consent granted for a 186-berth marina in Putiki Bay, Waiheke.

2016: New 307m Fergusson North Wharf completed.

2018: A 35-year consent to dump sediment from sources in the Northland, Auckland and Waikato Regions at a site 25km east of Aotea / Great Barrier Island is granted. The decision was successfully appealed to the High Court, and has been referred back to the Environment Protection Authority for reconsideration.

2019: Moorings cleared from Ōkahu Bay, Auckland.

2019: Ports of Auckland granted a 35-year consent to dump sediment from capital and maintenance dredging of berths and the Rangitoto Access Channel at a site 50 km east of Cuvier Island.

2019: Pauanui waterways development nearing completion.

2019: Work begins on America's Cup Base on the Auckland waterfront.

KEY EVENTS

The Auckland Regional Growth Strategy 2050, written in 1999, set a quality compact vision for Auckland's growth, focusing most growth within the existing urban area, and in specific new areas earmarked for growth. The strategy anticipated that Auckland's population could increase from 1.2 million people in 1999 to 2 million in 2050. By 2018, it had already grown to 1.7 million people with around 540,000 dwellings[58] in the region. Auckland's population in 2050 is now projected to be 2.4 million. Most of growth over the past 20 years took place within existing urban areas. Development is still occurring in many of the future urban growth areas earmarked in the 1999 growth strategy: Ormiston / Flat Bush, Hingaia, Westgate /Redhills, Albany / Greenhithe, Long Bay and Silverdale. However, new housing supply has not kept pace with population growth, and there has been a substantial departure from the strategy with an additional 15,000 ha of future urban land being identified as potentially suitable for future urban expansion. Around 8100 ha of that is within the Marine Park catchment.

In 2000, the regulatory framework for Coromandel Peninsula sought to concentrate development in and around seven settlements with reticulated wastewater services. However, growing community concern about changes actually occurring, led to the production of a 2009 blueprint for future use and development on the Peninsula. It recommended a strategy of (among other things) concentrating development and future services and infrastructure within three main urban hubs (Thames, Whangamatā, and Whitianga), providing more control of rural / coastal subdivision, and protecting and enhancing biodiversity and landscape values. The blueprint was formally adopted under the Waikato Regional Policy Statement and given effect to through the Thames Coromandel District Council District Plan. In general, the district plan discourages development and growth in most settlements where it would increase demand for additional water, wastewater, stormwater and roading infrastructure.

Sign at Medlands Beach, Aotea. Photo by Shaun Lee.

Population growth and commercial development are key drivers of coastal structures. Aotearoa already has one of the highest rates of boat ownership in the world. Ongoing population growth has fuelled the demand for additional boats and marina berths, with six new marinas approved or built over the past two decades and more proposed. Strong demand for boat storage facilities is expected to continue for the foreseeable future[57]. There is also a clear trend for increasing vessel sizes and larger marina berths. To accommodate this, marinas are looking at alternative storage options including land-based boat stackers and hard stands for smaller vessels up to 12m in length.

Ports, marinas and other marine facilities require dredging to maintain berth and access channel depths. By the mid-2000s the disposal of most material dredged inshore from areas had been moved to offshore sites beyond the Marine Park. The consenting of offshore disposal permits is a function of the Environmental Protection Agency. A recent decision to permit dumping offshore of Aotea (Great Barrier Island) proved to be highly contentious. A High Court appeal succeeded in getting the decision overturned and referred back to the Environmental Protection Agency for reconsideration.

Ports of Auckland have a long history of operating one of Aotearoa's busiest ports on Auckland's waterfront. Yet over the past 20–30 years the area has been transformed by other commercial and residential development. Alternative visions for the waterfront are now being championed that see port operations being phased out and wharf-space released for other uses. This has caused tension between Ports of Auckland, who seek to develop and improve their operations, and other parties looking at alternatives for the waterfront. Those tensions 'boiled over' in 2015 when the Port proposed extending Bledisloe Wharf 98 m out into the harbour. A decision by independent commissioners to process the application as 'non-notified' was appealed to the High Court by a community group 'Urban Auckland'. The court ruled that the application for expansion should have been notified and overturned the consents. A Consensus Working Group subsequently set up in 2015 recommended the Port's current footprint be maintained. As a result, further expansion now seems unlikely. Local options for its future relocation were proposed by the Consensus Working Group, along with a recommendation that the current site continuing to be used for cruise ships. But events have since overtaken that work, with other options for the Port now being considered by Central Government.

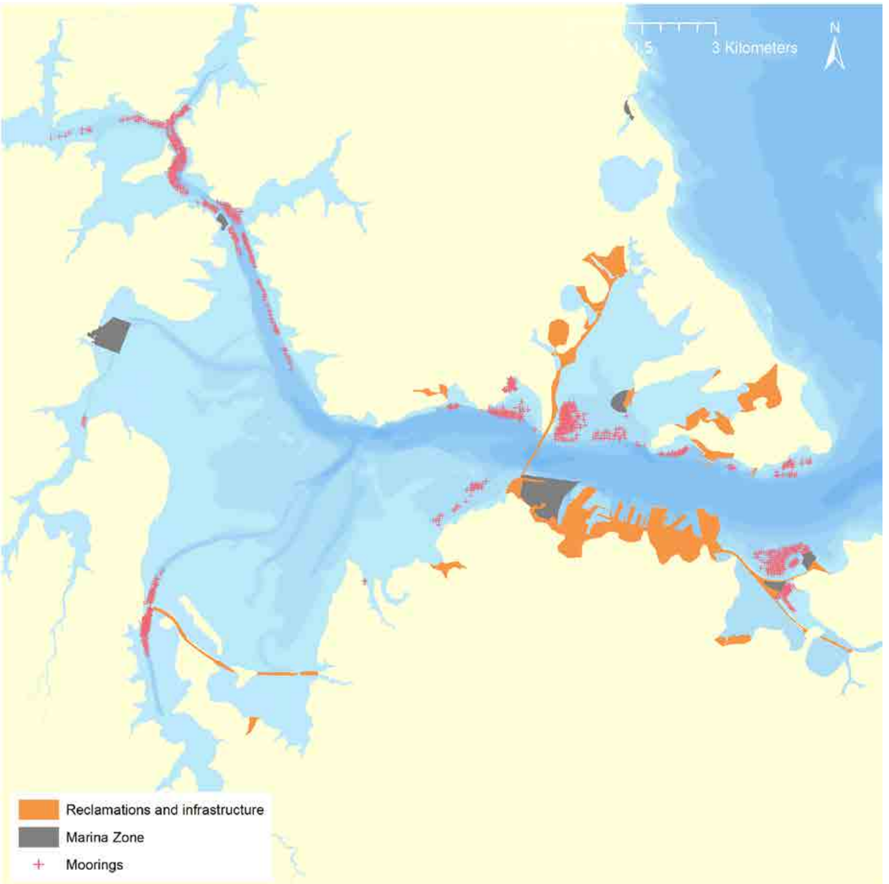


Figure 27: *Key coastal sprawl features in the Waitematā Harbour. Data provided by Auckland Council, Auckland Transport and adapted from "Entrances to Auckland harbour" Hydrographic Office of the Admiralty 1857.*

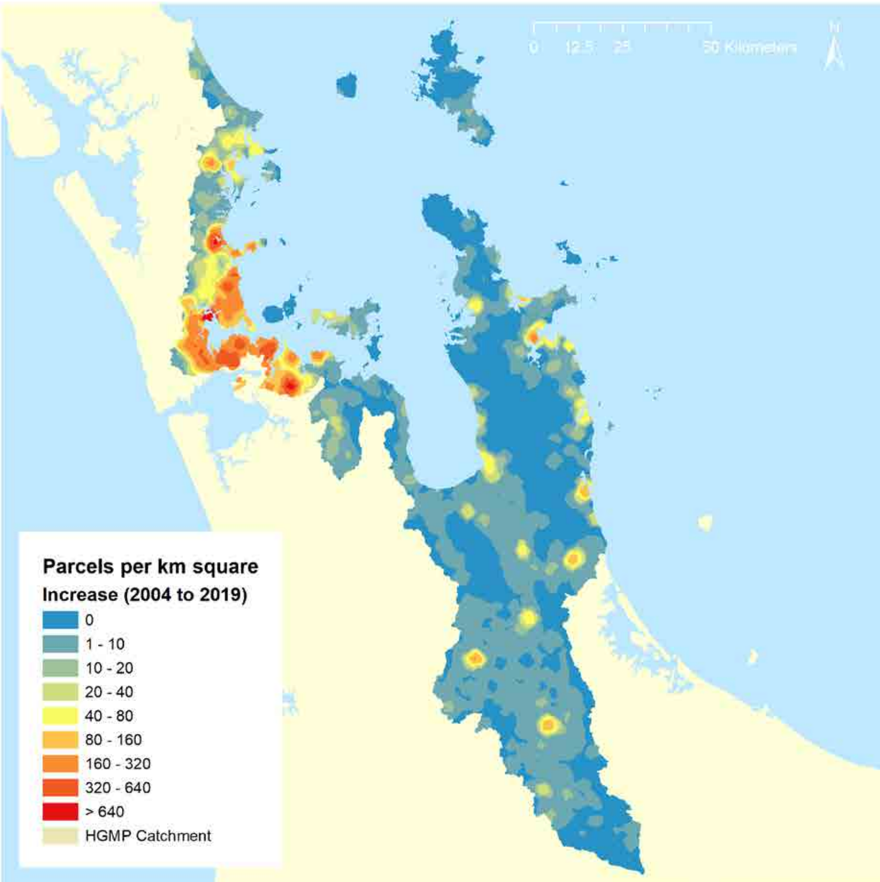


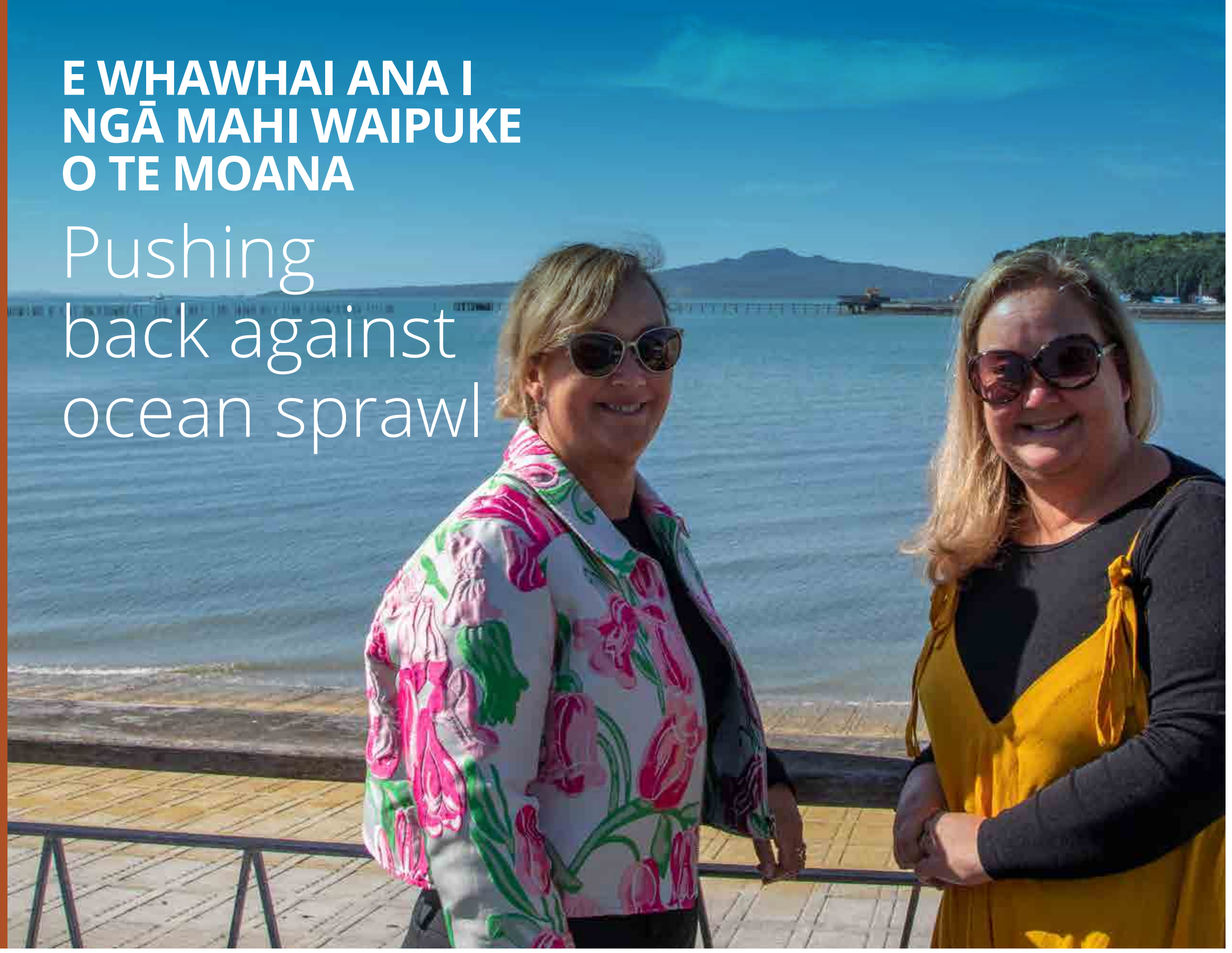
Figure 28: *Land intensification between 2004 and 2019, as indicated by the subdivision of land parcels (changes in parcel numbers per square kilometer). Primary parcel data provided by Land Information New Zealand (LINZ).*

Ocean sprawl impacts in the Gulf

CASE STUDY / HE MAHI RANGAHAU

E WHAWHAI ANA I NGĀ MAHI WAIPUKE O TE MOANA

Pushing back against ocean sprawl



Donna Tamaariki and Moana Tamaariki-Pohe. Photo by Shaun Lee.

They have dedicated their lives to the restoration and sustainability of Ōkahu Bay, their tūrangawaewae. Sisters Moana and Donna Tamaariki of hapū Ngāti Whātua o Ōrākei, noted decades of environmental abuse, the loss of kai moana, and the degradation of water. And they did something about it.

Ngāti Whātua o Ōrākei had witnessed Auckland's main wastewater pipe built across Ōkahu, separating the old village from the beach, untreated wastewater discharge seeped into the bay, typhoid killing their tūpuna, and contaminants still running off Tāmaki Drive, a flotilla of over 150 moored boats sprawled across their bay, many of them derelict, a call to action was needed. They had been seeking to remove moorings from the bay since the 1930s.

Moana and Donna created the groundswell of support that was needed, including enlisting Richelle Kahui-McConnell, and canvasing local businesses, the Māori Statutory Board, Hauraki Gulf Forum, Councillors, local board members, the Harbourmaster, and council staff. That effort highlighted the idea of restoring the moana and was the potential blueprint for rejuvenating one bay at a time.

The big break came when the proposed Auckland Unitary Plan was notified in 2013. That included provisions permitting moorings in Ōkahu Bay. That proposal was opposed by Ngāti Whātua who sought the removal of a mooring zone in the bay and presented extensive evidence to support that position at the Unitary Plan hearings in 2015. Their submission was accepted by the hearing panel. Yet it wasn't until May 2018 that the coastal provisions came into effect, giving owners another 12 months to remove their moorings. Over the following year all owners gradually removed their boats, and on the 2 August 2019 the final boat, Little Blue, was removed from Ōkahu Bay ending a more than 80-year process for Ngāti Whātua o Ōrākei. The occasion was marked with karakia, celebration and a surprise visit by a pod of dolphins.

By taking people with them, Moana and Donna had achieved their personal goal and the wishes of their hapū without the need for Council enforcement and with little push-back by mooring owners. They believe this is a model that other communities could follow.

Ōkahu Bay 2018 and 2019. Photos by Shaun Lee.

Staff from Auckland Council also learned from the experience. It reinforced the need for councils to understand the broader statutory and cultural context of Mana Whenua submissions. It highlighted the power of prohibiting activities through their plans, and that implementation strategies should be in place before rolling out new plans.

The sisters now look out across the bay from the clubhouse of Ōrākei Water Sports. It's a sunny day, and the water is still, glassy, unobstructed. The clubhouse buzzes with korero about Tāmaki Makaurau hosting of the Nacra world championships. There is now space within the bay for waka ama, kayaking, sailing and other water sports to be freely and safely carried out. Moana comments that when she recently sent a photo of the bay, she got a reply saying ***"Wow, where's that?"***. These outcomes are reward for years of effort that Moana, Donna, their tupuna, hapū and

Waka ama in Ōkahu Bay. Photo by Shaun Lee.

INDICATOR / TOHU

NGĀ PAIHANA
Toxic chemicals

"But it was the heavy metal run-off from traffic on Tāmaki Drive...that was really killing the sea life. The zinc and copper was adding to the sediment suffocating shellfish and clogging the seafloor"

– Moana Tamaariki-Pohe, Ngāti Whātua Ōrākei [59]

Pollution event in Omaru Creek. Photo by Shaun Lee.

Human activities generate a variety of toxic heavy metals and other compounds that are used in the coastal environment (e.g., anti-fouling paints, oils and fuels), or which enter coastal waters through spills, run-off and discharges. The main causes of contamination in the Marine Park are urbanisation, historical mine activity, and agriculture. Major spills sometimes have immediate and catastrophic effects. These tend to be obvious and localised. Contaminant loads from individual sources such as port, industrial and mine activities, marinas and landfills, can also be very high and persistent, causing localised impacts. But many contaminants come from small sources scattered throughout catchments, which combine to produce large loads that affect broad areas in harbours and estuaries.

Contaminants commonly bind to sediments and other particles, which settle out and accumulate on the seabed. Elevated contaminant concentrations in coastal sediments affects the survival, reproduction and/or behaviour of animals that live on the seabed, and may cause flow-on effects on other parts of the ecosystem, natural character or amenity values. Māori are particularly concerned about effects on the mauri of the coastal areas, and the health, abundance and safety of kai moana for consumption.

Primary contaminants of concern are the heavy metals, copper and zinc, with lead and mercury of secondary concern. Other contaminants may also accumulate, including new contaminants that are constantly emerging. Environmental scientists are struggling to keep pace with the rapidly increasing list.

This indicator looks at concentrations and trends in the primary and secondary contaminants of concern, copper, lead, mercury and zinc. The status of sites is presented using the environmental response criteria (ERC) used by Auckland Council, where green indicates low levels of contaminants, amber indicates some elevation, and red indicates higher levels.

20 YEARS AGO

Research by Auckland Regional Council, NIWA and others in the 1990s highlighted that stormwater contaminants were accumulating in urban estuaries. Regular contaminant monitoring of 20, mostly urban, State of the Environment monitoring (SoE) sites in the Marine Park began in 1998.

In 1999, eight of the 20 sites were in the green category for copper and zinc, while 12 sites were in the green category for lead.

Around a quarter of the sites had copper and/or lead concentrations in the red category, while nearly half of the sites were in the red category for zinc.

Little was known about sediment contamination on the Waikato coast.

Discharges to waterways and the coast were still being managed under transitional coastal and regional plans. They filled the gap between the RMA being introduced and new regional plans being developed under that Act.

KEY EVENTS

The creation of the Marine Park occurred at a time when knowledge was building about the effects of urban stormwater and coastal sediment contamination. Research by the ARC, NIWA, and Diffuse Sources had shown that Auckland's urban estuaries were polluted, and regular contaminant monitoring had begun. National guidelines for sediment quality[61] were about to be released and new regulatory requirements were being implemented. Proposed regional plans introduced requirements for network operators to identify and apply best practicable options for managing stormwater, rather than setting water quality standards that had to be met. This key decision largely set the direction for the management of urban stormwater contamination in the region.

In 2001, wastewater and stormwater network operators (mainly local councils and council owned organisations) applied for resource consents to continue their operations. The ARC established the Regional Discharges Project (RDP) to coordinate the processing of these applications and assist local councils by helping to fill environmental knowledge gaps. This included developing: more conservative sediment quality guidelines (ERC) for Auckland; a blueprint for monitoring urban estuaries; and, the ARC manual for designing stormwater management devices. A variation to regional plans was also proposed to improve their alignment, incorporate the ERC, and clarify outcomes that discharges were expected to meet.

TODAY

Sediment quality at Auckland's 20 original SoE sites has generally improved since 1999. More sites are now in the green category for copper, lead and zinc than in 1999. However, more sites are also in the red category for zinc, due to sites in the Southern Waitematā shifting from the amber to red ***(Figure 30).***

Auckland and Waikato Councils now run much more extensive sediment monitoring programmes (***Figure 31***). Data from 160 sites in the Marine Park in available[q], 46 of which have enough information to estimate trends.

Rural coastal sites and sites outside Auckland's central harbours and estuaries mostly have metal concentrations in the green category. The exceptions are some sites around Thames, Coromandel and Whitianga that were subject to historic mining activity. At those sites, copper, lead, mercury and/or zinc concentrations are elevated.

Multiple sites in the southern and upper Waitematā Harbour and upper Tāmaki River are amber for copper and mercury.

A few sites in the southern Waitematā Harbour are amber for lead.

Multiple sites in the southern Waitematā Harbour and upper Tāmaki River are red for zinc.

Copper and lead concentrations are mostly stable or decreasing at the 46 sites with sufficient information to estimate trends (***Figure 32***). The decline in lead can be attributed to it being banned as a petrol additive in the 1990s. The reasons for the decline in copper concentrations are less clear. They could be related to global measures such as reducing copper in brakepads, local measures such as improving stormwater treatment, or incidental factors such as an increase in sediment loads (which would dilute copper in estuary sediments). It's most likely to be a combination of such things.

Zinc concentrations are mostly stable or increasing at the 46 with sufficient trend information. Concentrations tend to be increasing at sites adjoining Auckland's older urban areas and in the upper Waitematā Harbour. This trend is generally consistent with model predictions[60]. Key sources of zinc are galvanised steel cladding on older buildings and tyre wear.

[q] For four sites the most recent data was obtained between 2007 and 2009. For the other 156 sites, the most recent data was obtained since 2010.

2000: The main source of lead had already been removed, by banning its use as a petrol additive.

2000: Interim sediment quality guidelines published for Australia and Aotearoa (ANZECC guidelines).[61]

2001: Regional Discharges Project (RDP) established.

2002: ARC develops more conservative sediment quality guidelines (ERC) and a blueprint for monitoring urban estuaries.

2002: Variations to regional plans proposed to improve their alignment, incorporate the ERC, and clarify the outcomes that discharges are expected to meet.[62]

2003: ARC manual for designing stormwater management devices released.[62]

2004: Major stormwater funding shortfalls identified; ARC approves a 10-year Stormwater Action Plan to improve environmental outcomes; Auckland Regional Coastal Plan becomes operative in part.

2007: Ministry for the Environment announces funding to remediate Tui Mine, which was leaching heavy metals into creeks that flow to Waihōu River.

2013: Variation to Auckland Regional Coastal Plan in relation to managing network discharges adopted; notification of the Proposed Auckland Unitary Plan.

2013: Tui mine remediation complete.

2016: Auckland Unitary Plan becomes operative in part.

2019: Auckland Council granted a region-wide stormwater network discharge consent, which was subsequently appealed.

It quickly became apparent that the cost of achieving good stormwater and environmental outcomes would be significant. Estimates put those costs well beyond the existing budgets of local councils, with estimated 20-year funding gaps ranging from $2.3 to $9.3 billion in 2004.[63]

Seed funding from Infrastructure Auckland was therefore used by the ARC to develop and implement a 10-year stormwater action plan for improving stormwater and environmental outcomes. A dedicated team was formed and tasked with stormwater research, education, advocacy and providing financial support to assist local councils in the development of integrated catchment management plans. Key outputs from that process were the development of models for estimating catchment contaminant loads and contaminant accumulation rates in Waitematā Harbour, and for assessing the health of intertidal communities in harbours and estuaries. Stormwater devices in new developments also proliferated, with Auckland Council recently estimated to be managing over 900 of them.[64]

A transitional period for stormwater management followed the formation of Auckland Council in 2010. International benchmarking in 2014 indicated that the council aspired to be a 'Waterways City', that managed pollution and flooding impacts, improved the ecological, cultural and recreational values of its waterways, connected communities with their waterways and increased a sense of place. However, Council's on the ground actions were consistent with it being a 'Drained City', one that simply provided drainage services for protecting people and property from flooding and making land available for property development (*Figure 29*).

The Auckland Unitary Plan became operative in 2016 introducing new provisions to help contain contaminants at source. Conversely, it also provided for the expansion of the urban area, and by doing so, potentially increased the

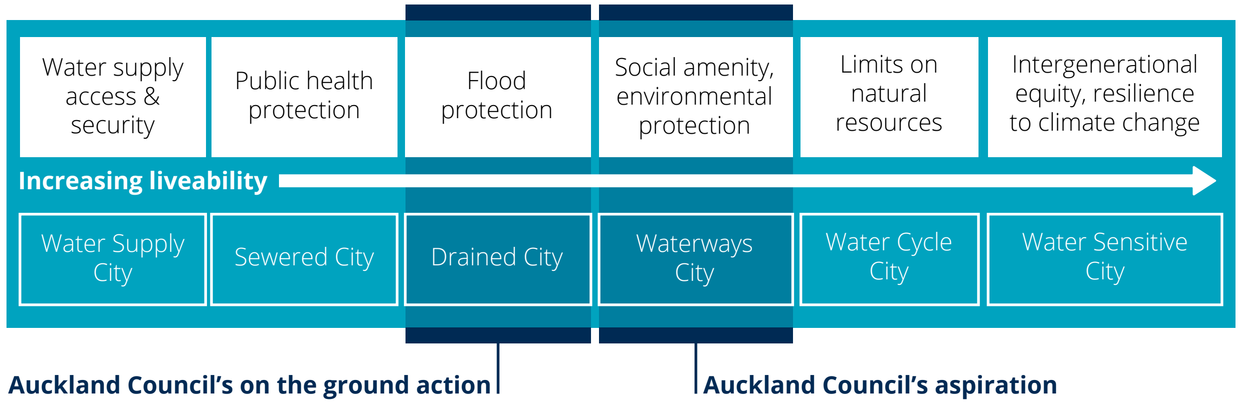


Figure 29. *Liveability and the Urban Water Management Transition Framework (adapted from Freguson et al 2014)*

Stormwater pipe in Rothesay Bay. Photo by Shaun Lee.

future footprint of urban contamination. A consent for the discharge of stormwater from Auckland Council's stormwater networks was also granted in 2019. The consent compliments the Unitary Plan by specifying requirements for new, private connections to the public stormwater network, but other actions for addressing coastal contamination are not clearly stipulated.

Waikato Regional Council began assessing and monitoring sediment quality at five Firth of Thames sites in 2003, and now have information from 55 sites. Historic mining and agriculture are considered to be the main sources of contaminants. Of particular concern, was the Tui Mine on the western slopes of Mount Te Aroha. Abandoned in 1973, it left one of Aotearoa's most metal-polluted sites to drain via Tui and Tunakohoia Streams to Wairoa River and the southern Firth of Thames. Funding for the remediation of the site was approved in 2007, and the work was completed in 2013.

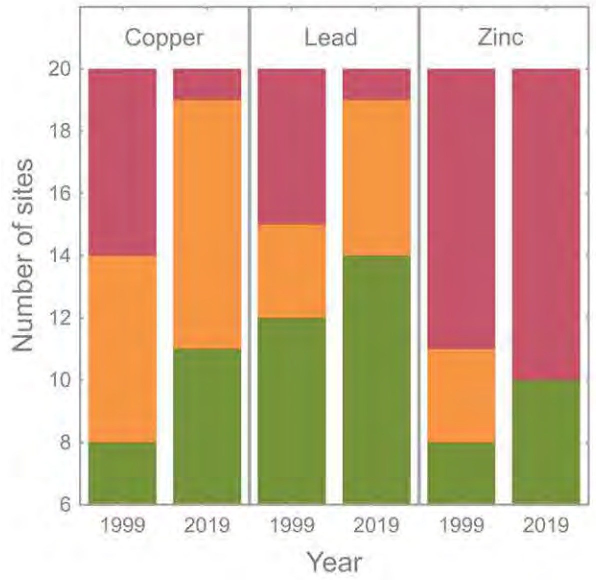


Figure 30: *Changes in the ERC status of Auckland Council State of the Environment monitoring sites for copper, lead and zinc between 1999 and 2019.Green indicates the number of originally monitored sites with low levels of contaminants, amber indicates some elevation, and red indicates high levels.*

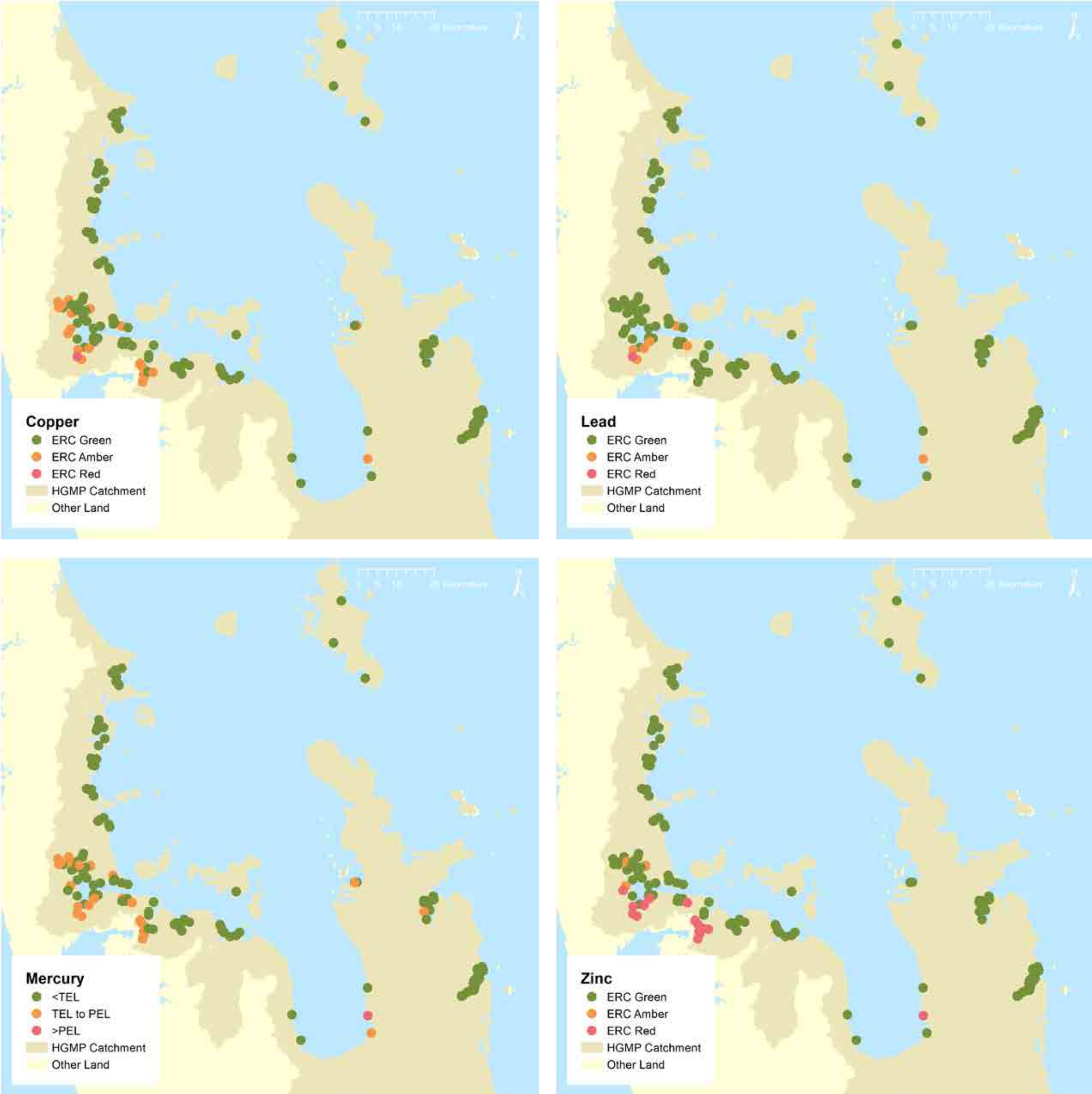
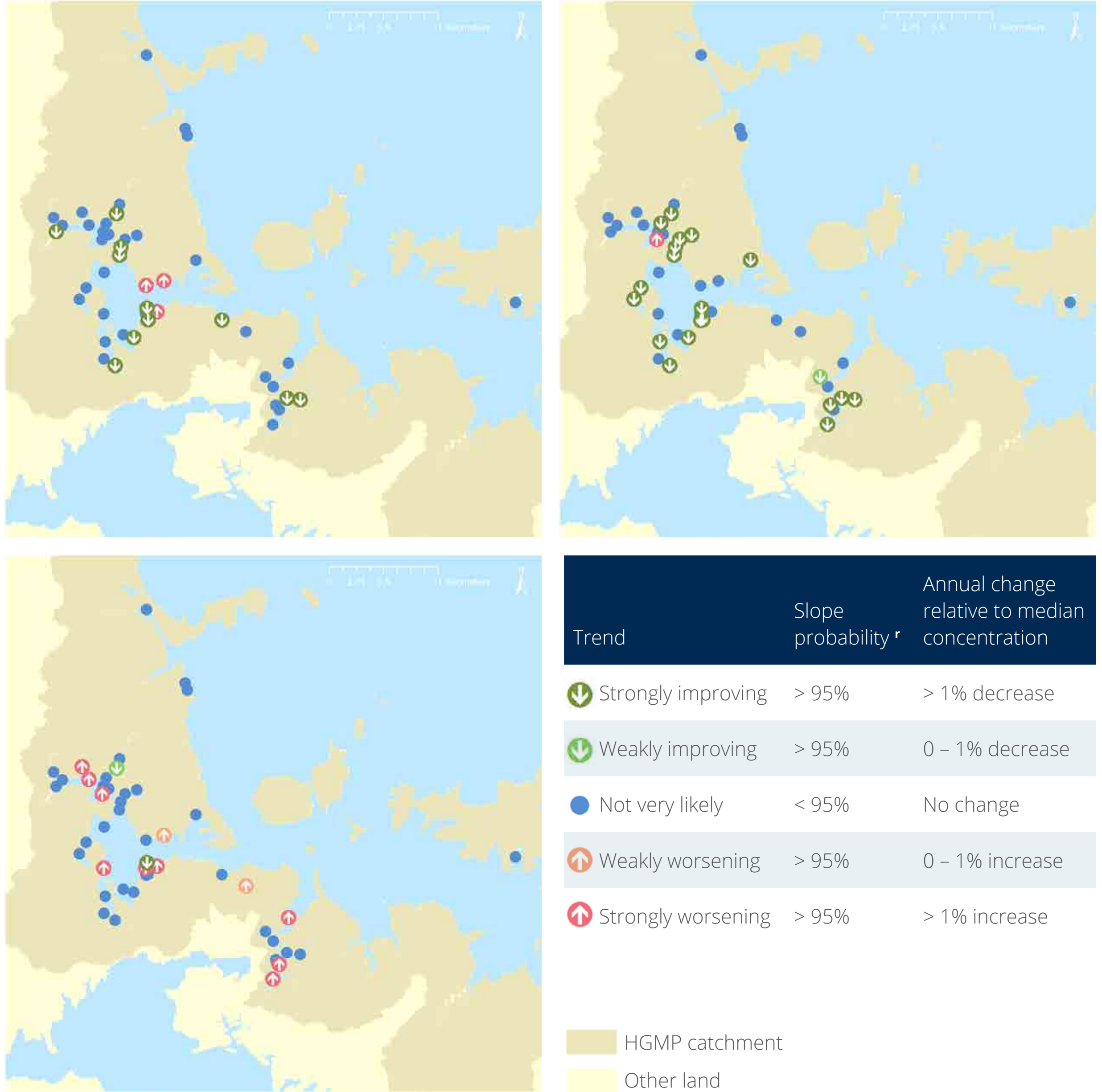


Figure 31: *Most recent monitoring results available for each site in the Marine Park showing the ERC status of sites for copper, lead and zinc; and Effects Level status for mercury (unlikely (green), threshold effects level (amber, TEL=0.13 mg/kg) and probable effects level (red, PEL=0.71 mg/kg)). For four sites the most recent data was obtained between 2007 and 2009. For the other 156 sites, the most recent data was obtained since 2010.*



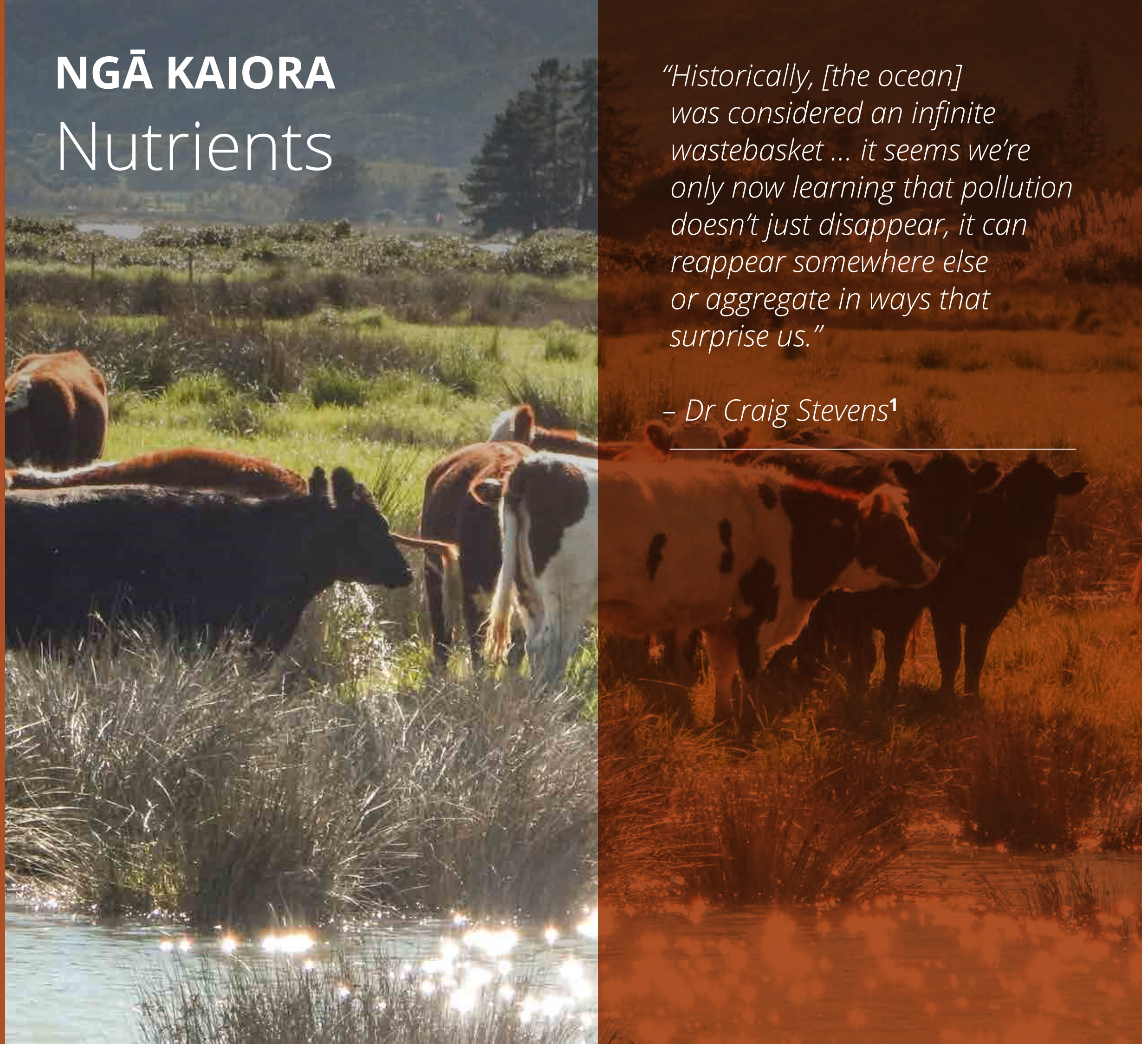
Trend	Slope probability[r]	Annual change relative to median concentration
Strongly improving	> 95%	> 1% decrease
Weakly improving	> 95%	0 – 1% decrease
Not very likely	< 95%	No change
Weakly worsening	> 95%	0 – 1% increase
Strongly worsening	> 95%	> 1% increase

Figure 32: *Trends in copper, lead and zinc for sites with sufficient long-term data.*

[r] Based on the Sen slope.

INDICATOR / TOHU

NGĀ KAIORA
Nutrients



> *"Historically, [the ocean] was considered an infinite wastebasket ... it seems we're only now learning that pollution doesn't just disappear, it can reappear somewhere else or aggregate in ways that surprise us."*
>
> *– Dr Craig Stevens[1]*

Cattle in a Coromandel estuary. Photo by Shaun Lee.

Nutrients sustain the growth of microscopic algae, seaweeds and the other marine plants that form the base of the ocean food chain. In the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi, nutrients come from the surrounding ocean, are recycled from the seabed, and washed in from the land. We increase nutrient loads to the Marine Park through our wastewater discharges, use of fertilisers, and the effluent produced by our livestock. Fish farming may be a significant source of nutrients in the future.

Slight increases in nutrients can promote healthy plant growth. The extra energy and matter produced flows up the food chain, supporting greater numbers of fish, birds and other sea creatures. But problems occur if nutrient levels get too high. Then, microalgae and nuisance seaweed blooms can occur. Microalgae blooms reduce water clarity and light levels, which can stunt the growth of seaweed and seagrass. When the microalgae or seaweed dies, decomposing bacteria can reduce oxygen levels in the water to harmful levels. On the shore, rotting seaweed can create an unsightly, smelly mess.

Nitrogen is generally considered to have the greatest effect on marine water quality, but phosphorus is also a key nutrient of concern[5]. By far, the largest source of nutrients produced through our activities are the rivers draining the Hauraki Plains. Estimates from 2016 indicate that Waihōu and Piako rivers contribute around 97% of the nutrient load to the southern Firth of Thames, with agricultural sources (particularly dairy farming) estimated to account for 73% of the nitrogen and 41% of the phosphorus loads.[65]

KEY EVENTS

Concern about nutrient effects have greatly increased since 2000, largely due to dairy intensification at a national level. The key regulatory response has been through the introduction and revision of National Policy

[5] In freshwater systems phosphorus is usually the primary nutrient of concern, and nitrogen the secondary nutrient of concern.

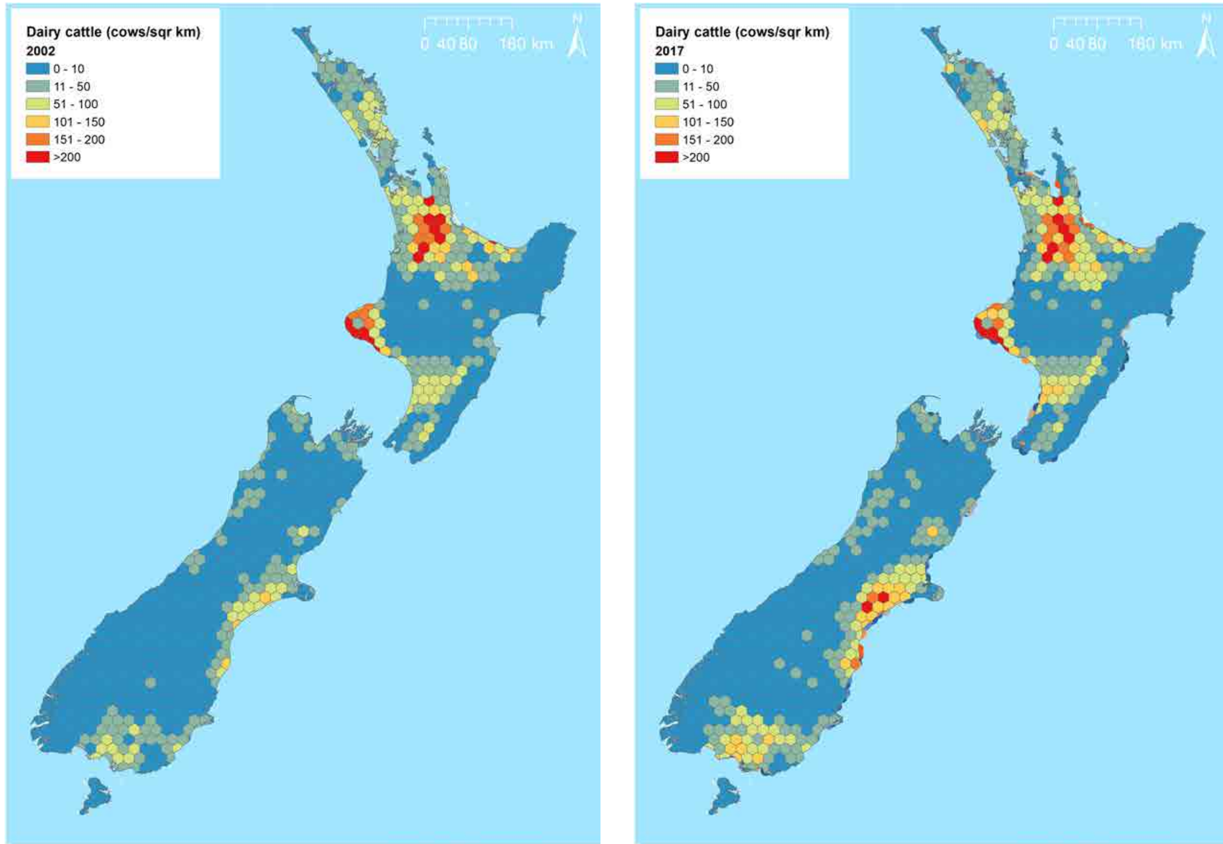


Figure 33: *Distributions of dairy cattle density in Aotearoa in 2002 and 2017.*[72]

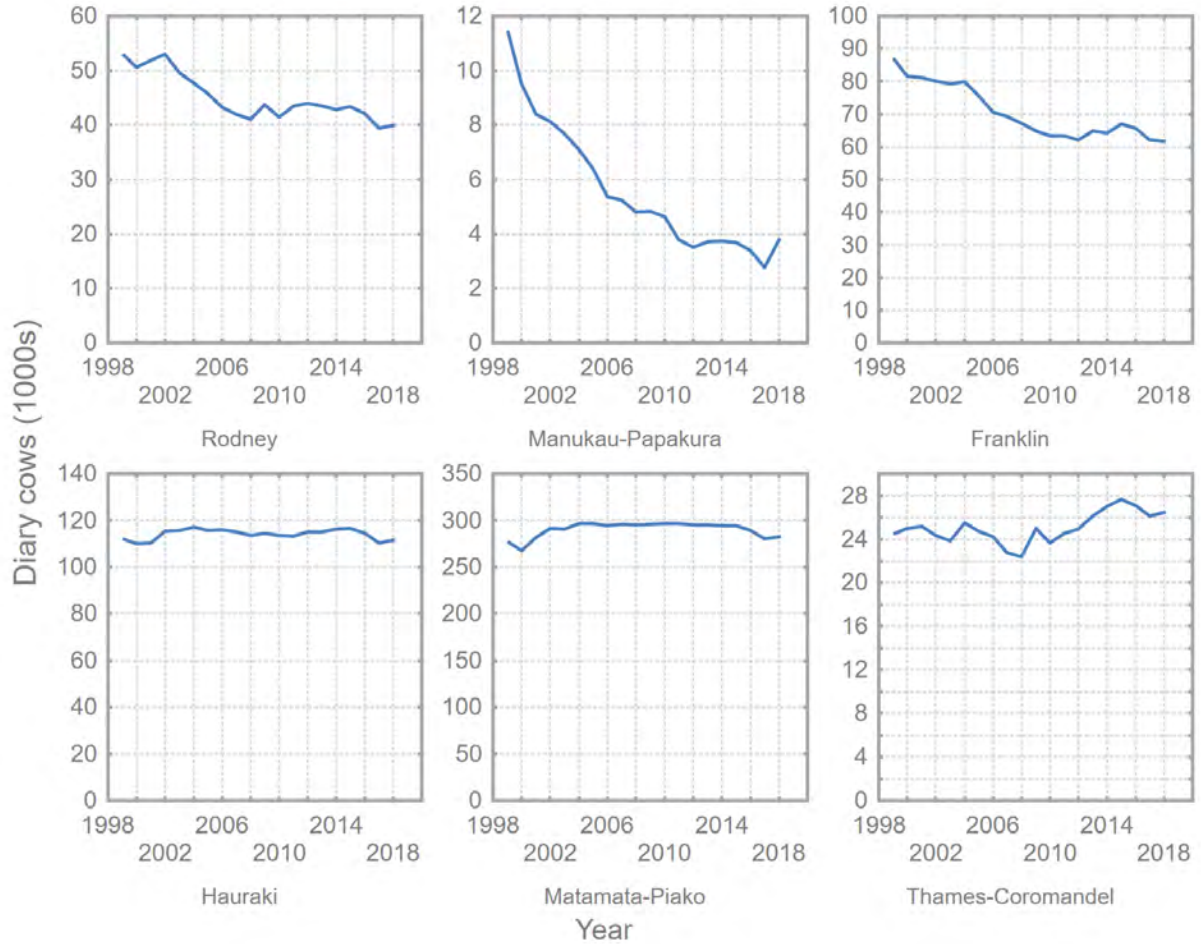


Figure 34: *Numbers of dairy cows in districts within the Marine Park catchment.*[66]

20 YEARS AGO

The Waikato, including the Hauraki Plains, is a key area of intensive dairy farming in Aotearoa, and had been for some time (*Figure 33*).

Dairy stock numbers on the Hauraki Plains had plateaued at high levels, while numbers in Auckland were relatively low and declining.[66]

Between 1990 and 2002, 24 sites were monitored along Waikato rivers draining to the Marine Park. Nine sites had increasing total nitrogen concentrations, five decreasing, and 10 showed no trend. Five sites had increasing trends in total phosphorus levels, two had decreasing trends, and 17 had no trend.[67]

Auckland had been monitoring nutrient levels in coastal waters at several sites for over a decade. Results showed that nutrient levels were most elevated in the Upper Waitematā Harbour and Tāmaki Inlet. Most sites had stable or declining trends in key coastal nutrients. The exceptions were increasing trends in ammonia-nitrogen in Upper Waitematā and Upper Tāmaki sites, and increasing phosphorus trends at some other sites.

Waikato Regional Council had not established a regular long-term monitoring programme for coastal water quality, but NIWA had been monitoring a site on the outer boundary of the extended Firth of Thames area since 1998.[68]

TODAY

Sources of nutrients

The Waikato, including the Hauraki Plains, remains a key centre of intensive dairy farming, but dairy stock numbers on the plains have been relatively stable since 2000. In contrast, stock numbers in Auckland have declined substantially since 2000 (*Figure 34*).

Total combined loads of nitrogen and phosphorus in Hauraki rivers declined between 1991 and 2015[65]. Those declines appear to be due to improved treatment of sewage, industrial wastewater and dairy shed effluent, rather than reductions in diffuse agricultural loads.

Between 2006 and 2015 total nitrogen loads from Hauraki rivers were estimated to be 3730 t per year.

The combined average annual discharge loads from Auckland's two largest east coast wastewater treatment plants is around 245 t per year (minor loads are also discharged from other plants), while Auckland's largest river has been estimated to discharge around 120 t per annum. Representative loads from other Auckland rivers were much lower.[69]

A successful tenderer obtained the right to apply for resource consent to establish a fish farm in the outer Firth of Thames. The Waikato Regional Coastal Plan provides a potential discharge allowance up to 800 t of nitrogen per year for this area.

Statements (NPS) for Freshwater Management, which were first introduced in 2011. Issues with that version were quickly identified, particularly the need to improve national consistency by providing councils with more direction and guidance. A replacement Freshwater NPS, introduced in 2014, sought to achieve that outcome by creating a national framework for setting freshwater management objectives and establishing some national bottom lines. Further amendments were made in 2017 to limit nutrient effects.

In 2011, the Waikato Regional Coastal Plan was amended to provide for fish farming in the Firth of Thames. The changes included provision for an annual discharge of up to 800 t of nitrogen from the Coromandel Marine Farm Zone and 300 t from the Wilson Bay zone (resource consents are still required to develop those areas). In 2017, Waikato Regional Council called for tenders from potential fish farmers interested in developing the Coromandel Marine Farm Zone. The winning tender was selected in 2018, but the consent application to develop the site has not yet been submitted.

Obtaining accurate estimates of nutrient loads to the coast and determining the effects nutrient on coastal ecosystems is not straightforward. Nutrient concentrations and river flows used to calculate actual loads vary from place to place, day to day, month to month, and year to year. Intensive, long-term data sets are required to separate natural variation from trends caused by human activities. Furthermore, the effects of nutrients are complex and include significant step-changes that occur suddenly with little prior warning. The methods used to analyse and present nutrient trend data has evolved since the Marine Park was established, as has our understanding of nutrient sources and effects. Regional Councils and research organisations have built up a valuable data resource over the past 30+ years, which is now analysed by increasingly sophisticated nutrient models. These provide us with a better understanding of nutrient trends and forecasting. Despite that progress, significant knowledge gaps remain.

TODAY

Nutrient concentrations in streams and rivers

Latest state (2013–2017) and trend (2008–2017) analyses for streams and rivers draining to the Marine Park indicate:[70]

- In the Waikato section of the Marine Park catchment, total nitrogen concentrations tend to be highest in rivers on the central Hauraki Plains, and lowest in upper and forested river sections.
- Total nitrogen concentrations tend to be increasing at sites along Waihōu River (and its tributaries) and declining or stable along Piako River (and its tributaries) and Waitakaruru River (*Figure 35*).
- Auckland river and stream total nitrogen levels are generally highest and increasing in East Tāmaki, and with a few exceptions, low and declining elsewhere.
- Total phosphorus concentrations tend to be high, but stable or declining in most of Auckland's urban streams, and in rivers on the central Hauraki Plains (*Figure 35*).

2000: Dairy intensification on the Hauraki Plains had plateaued.

2011: Waikato Regional Coastal Plan amended to provide for fish farming included a combined allowance for the discharge of up to 1,100 t of nitrogen per annum.

2011: National Policy Statement for Freshwater Management introduced.

2013: Sustainable dairying water accord launched.

2014: National Policy Statement for Freshwater Management updated.

2017: National Policy Statement for Freshwater Management updated.

2017: Waikato Regional Council call for tenders from parties seeking authorisation to apply for fish farming consents within the 240 ha Coromandel Fish Farming Zone.

2018: Fish farming tender awarded.

TODAY

Nutrient concentrations in coastal waters

10-year medians for indicators of coastal nitrogen, phosphorus and primary productivity on the Auckland coast tend to be lower than they were before the Marine Park was established (*Figure 36* to *Figure 38.*)

Recent 10-year trends[t] for indicators[u] of coastal nitrogen, phosphorus and primary productivity provide a mixed picture (*Figure 39*):

- the number of sites with increasing ammoniacal-nitrogen trends is higher than in the decade before the park was established. This is possibly an artefact of a recent change in the laboratory analysing Auckland's water samples;
- all but one site had stable or declining (improving) nitrate-nitrogen concentrations, but fewer sites were improving than in the decade before the park was established;
- soluble reactive phosphorus has increased at more sites recently, than in the decade before the park was established;
- total phosphorus concentrations were similar or lower than they were in the decade before the park was established;
- chlorophyll *a* concentrations were lower than they were in the decade before the park was established, with a greater proportion of sites very likely to be improving.

NIWA detected an increase in nitrogen concentrations in the Firth of Thames between 1998 and 2013. This was tentatively attributed to a reduction in the rate that nitrogen was being recycled back to the atmosphere (denitrification rates) rather than increasing catchment loads.[71] There are signs that this is lowering oxygen levels in bottom waters of the Firth of Thames, and making the water more acidic (*Figure 40*).

Waikato Regional Council still hasn't established a regular long-term monitoring programme for coastal water quality.

[t] Note that the methods used to report on water quality have changed since 2000. The method used for presenting the latest trends align with those used by StatsNZ, the MfE and Auckland Council. A trend is now classified as: 'very likely' when there is a 90–100 % certainty of an improving or worsening trend; 'likely', when the certainty of the trend is 67–89 %; and, 'indeterminate' when there is not enough statistical certainty to determine trend direction (less than 67 % certainty). This method is more sensitive to changes than earlier methods, which presented trends as statistically significant increases or decreases.

[u] Auckland Council have not been monitoring total nitrogen concentrations on the coast for long enough to determine trends inorganic nitrogen forms (ammonium-N and nitrate-N) are therefore used as indicators for coastal nitrogen.

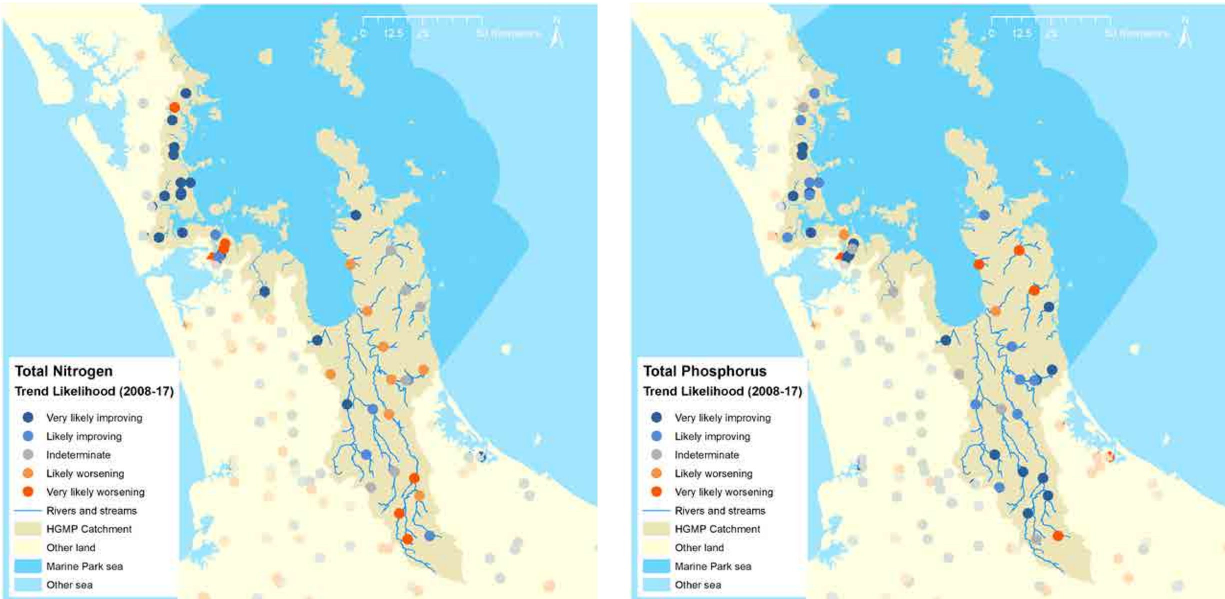


Figure 35: *Trends in total nitrogen (left) and total phosphorus (right) concentrations in monitored rivers and streams draining to the Hauraki Gulf Marine Park. Trends were estimated by StatsNZ for the period 2008–2017 (Data from MfE).*[70]

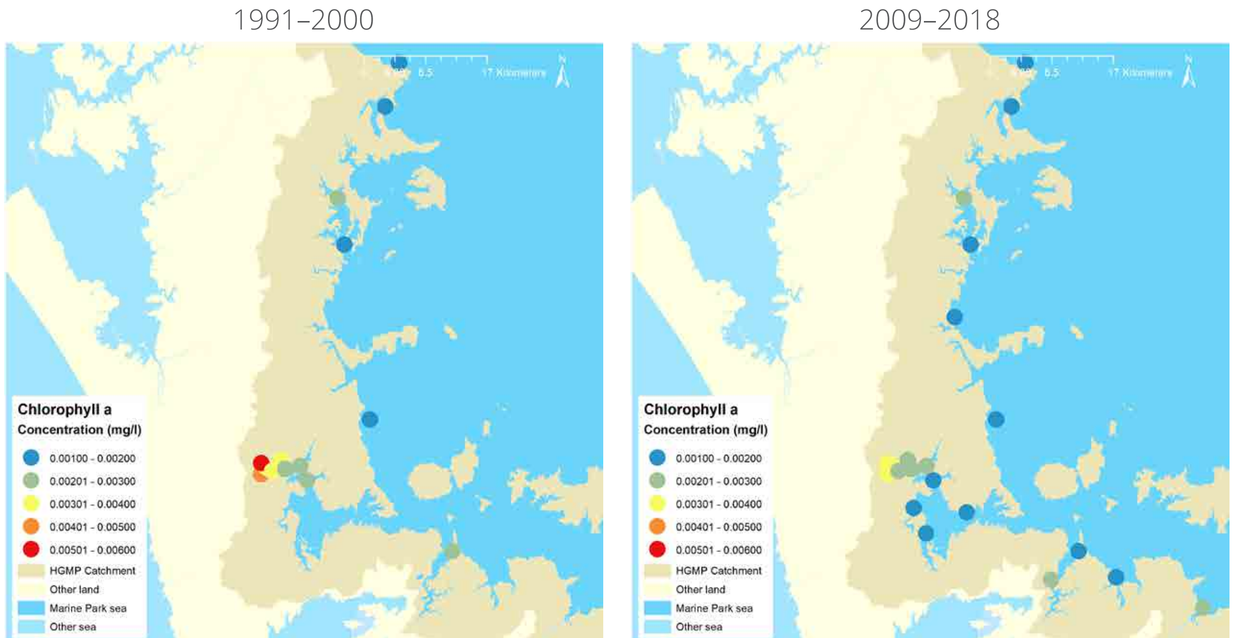


Figure 36: *Median total chlorophyll a concentrations at monitored coastal sites between 1991–00 and 2009–18.*

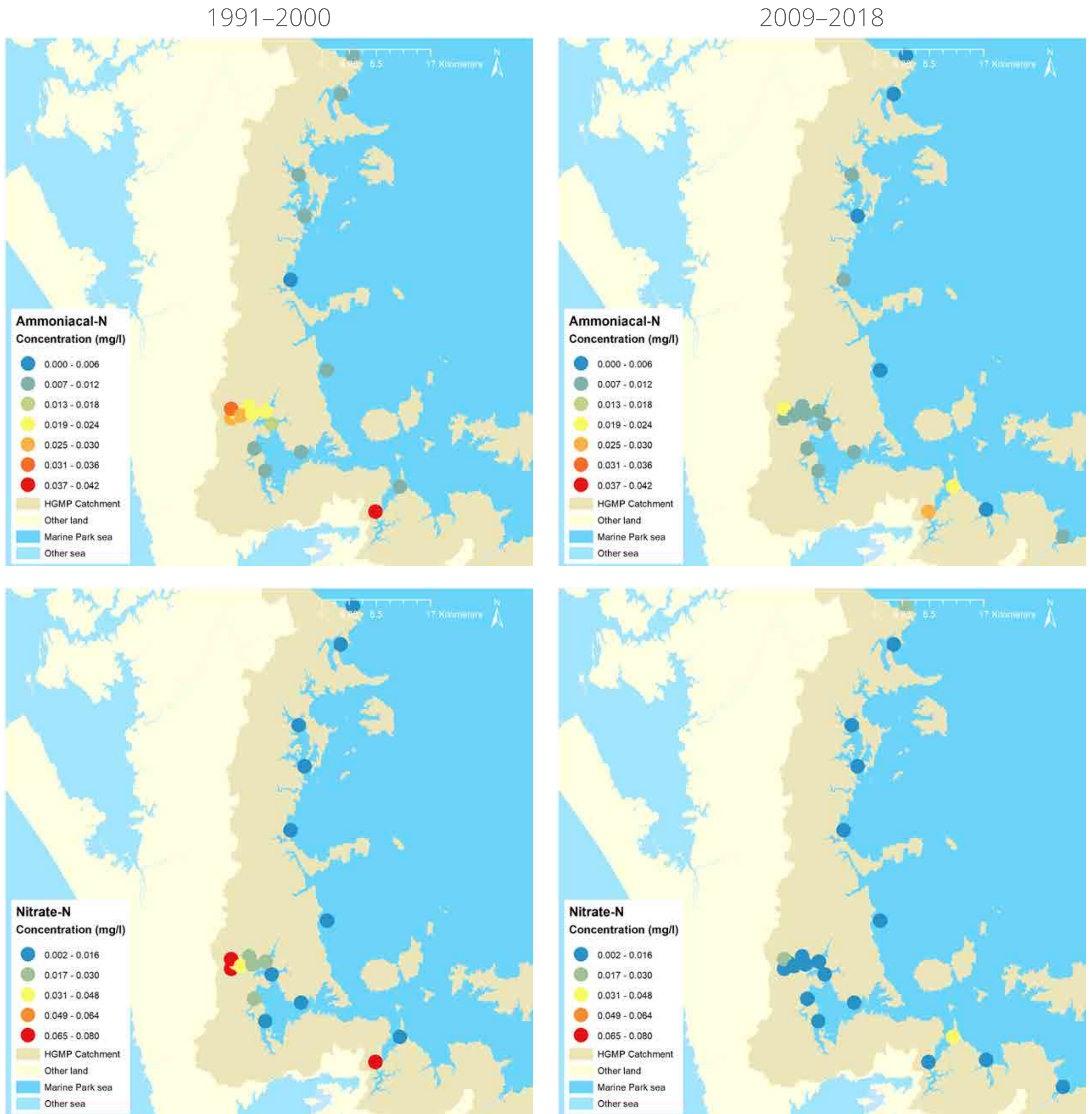


Figure 37: *Median ammoniacal nitrogen (top) and nitrate nitrogen (bottom) concentrations at monitored coastal sites between 1991–00 and 2009–18.*

Algal bloom at Lake Whangape. Photo by Shaun Lee.

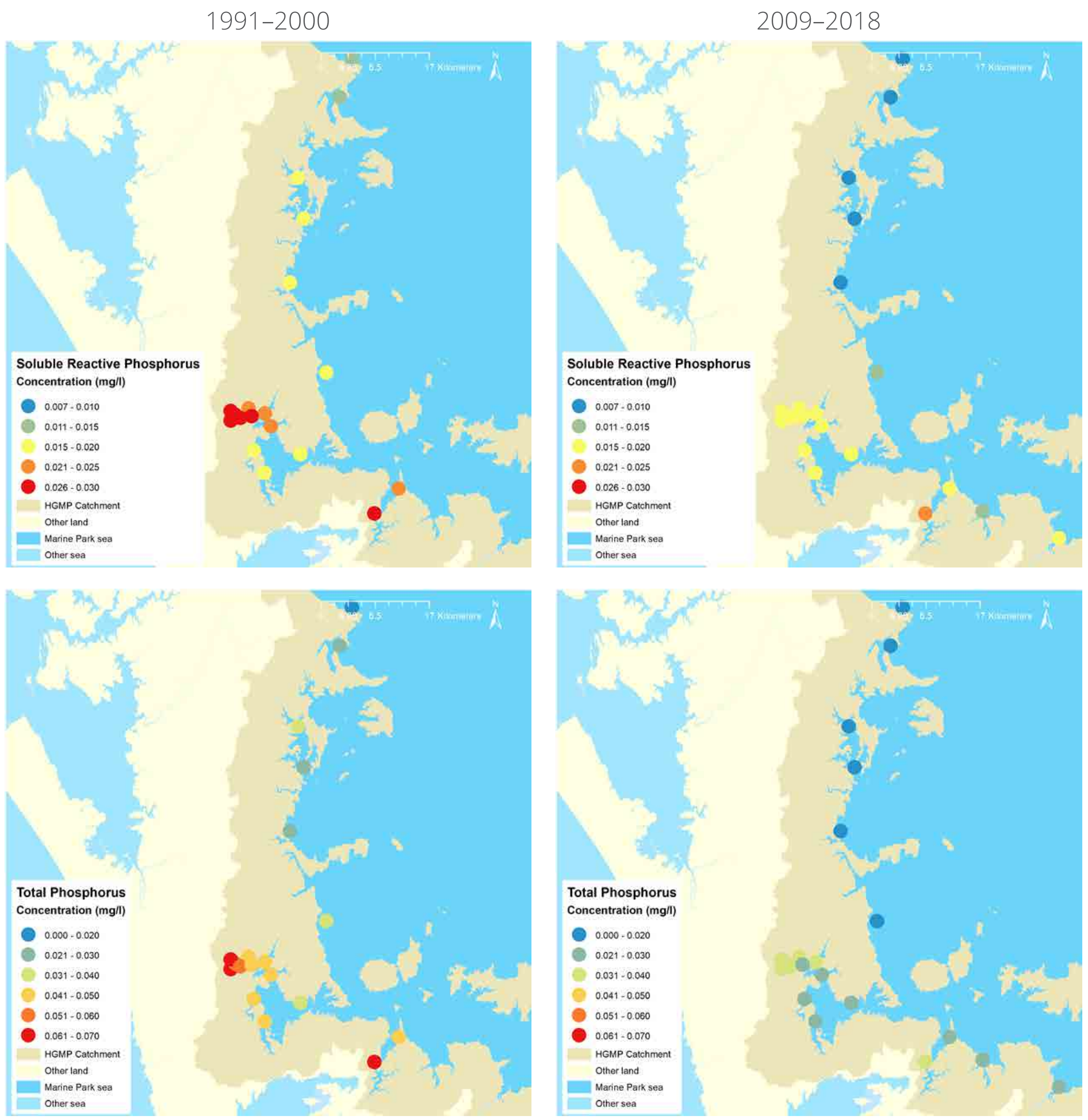


Figure 38: Median soluble reactive phosphorus (top) and total phosphorus (bottom) concentrations at monitored coastal sites between 1991–00 and 2009–18.

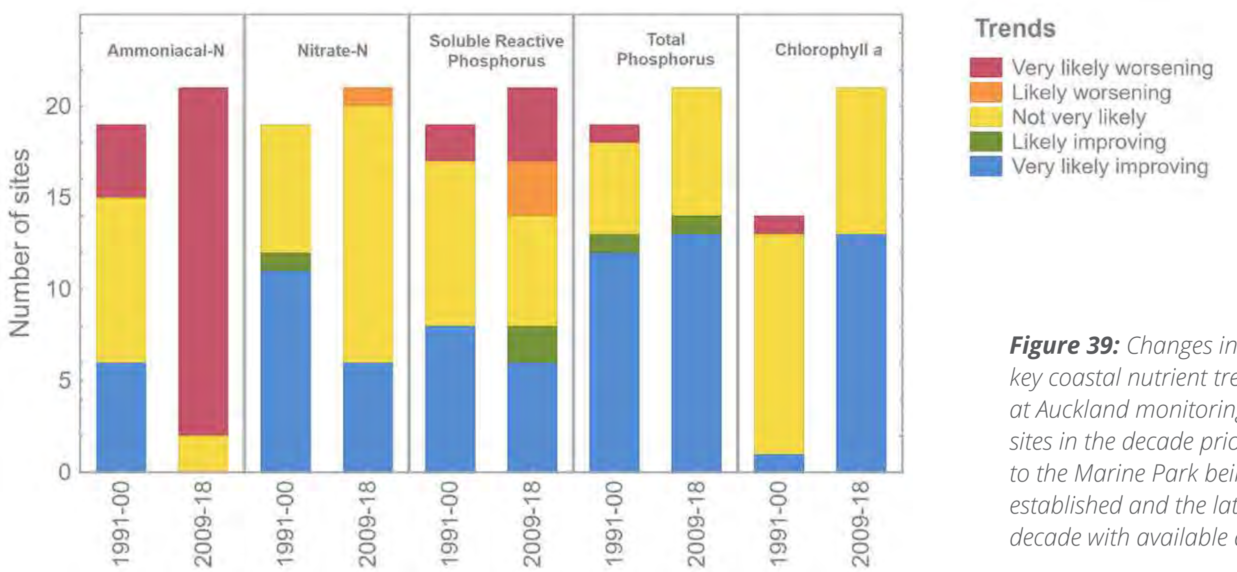
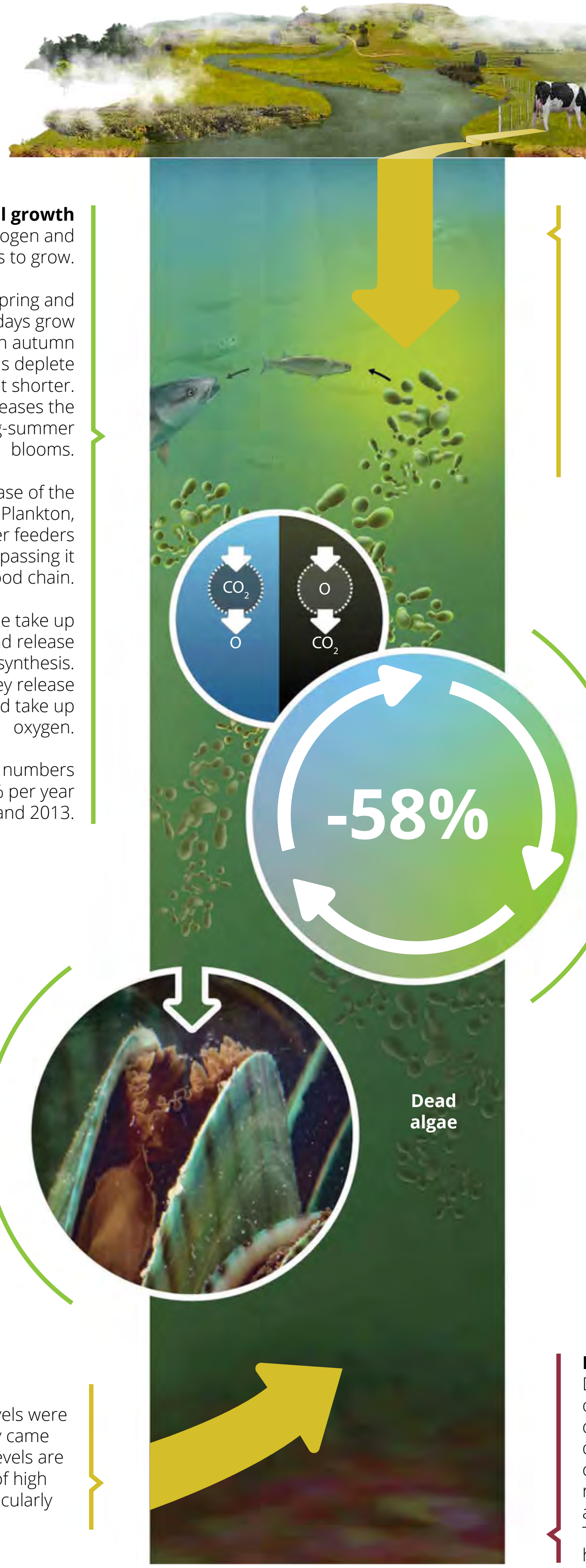


Figure 39: Changes in key coastal nutrient trends at Auckland monitoring sites in the decade prior to the Marine Park being established and the latest decade with available data.

Figure 40. *Signs of nitrogen effects in the Firth of Thames (FoT)*



Algal growth
Algae require light, nitrogen and other nutrients to grow.

Algae bloom in spring and summer as the days grow longer. They die-off in autumn and winter as blooms deplete nutrients and days get shorter. Adding nitrogen increases the strength of spring-summer blooms.

Algae form the base of the Gulf's **food chain**. Plankton, shellfish and other filter feeders eat microscopic algae passing it up the food chain.

During the day algae take up carbon dioxide and release oxygen during photosynthesis. When it is dark, they release carbon dioxide and take up oxygen.

Planktonic algae numbers increased by 7% per year between 1998 and 2013.

Nitrogen
Human sources of nitrogen are estimated to account for 78% of the nitrogen from the plains, with most coming from agriculture. This is estimated to have increased inorganic nitrogen loads by 66%.

Forms of nitrogen that can be absorbed by algae (inorganic nitrogen) **increased by 5%** per year between 1998 and 2013.

Denitrification
In a healthy system, nitrogen is recycled in sediments and released back into the water column and atmosphere through a process called denitrification. There are signs that denitrification rates are decreasing in FoT causing nitrogen levels to build up and produce **stronger algae blooms**. Denitrification averaged over 2012–2013 was only 42% of the average rate in 2000–2001.

Filter feeders
Shellfish, such and cockles and mussels filter out algae and particles from the water column. Vast shellfish beds were destroyed in the FoT by dredging and sedimentation.

Changing sources
Historically nitrogen levels were much lower and largely came from ocean sources. Levels are higher today because of high catchment inputs, particularly from agriculture.

Impacts
Dead algae and animals settle on the seafloor and decompose. Excessive decomposition can decrease oxygen to **harmful levels**, reduce sediment quality, and acidify overlying water. There are signs of this happening in the FoT.

For more information see Zeldis and Swaney (2018). Estuaries and Coasts. 2018:1559–2731.

INDICATOR / TOHU

HE PAI MO TE KAUKAU

Suitability of water for swimming

"It was unacceptable, he declared, for Aucklanders to be forced to "swim in their own excreta". Wholesale discharge into the harbour must cease"

–Dove-Myer Robinson, Mayor of Auckland from 1959–1965 [73]

Herne Bay Beach. Photo by Richard Robinson www.depth.co.nz

Human and animal faeces contain bacteria, viruses and other disease-causing organisms that can make swimmers, or other people, who come into contact with contaminated water sick. Today, most of the ill-health effects are minor and short-lived, but there is potential for contracting more serious diseases, such as hepatitis A, giardiasis, cryptosporidiosis, campylobacteriosis and salmonellosis.

Treated and untreated wastewater are major sources of disease-causing organisms. Wastewater enters the sea through discharges from wastewater treatment plants, sewer overflows, seepage from septic tanks, discharges from boats, and through contaminated stormwater. Auckland has a vast reticulated wastewater system that includes 18 wastewater treatment plants, around 8,000 km of pipe and about 420,000 wastewater connections. Smaller networks are found in towns and villages throughout the Marine Park catchment.

All wastewater networks are deliberately designed so that in the event of heavy rain, pipe blockages or breakages, pressure is relieved by allowing wastewater to overflow to the environment through gully traps, manholes and engineered overflow points rather than backing up into homes. This reduces the potential for wastewater to create a serious public health hazard, but it also means wastewater overflows to land, streams and the coast can occur (see *Figure 41*).

The central Auckland isthmus is a particularly problematic. Around 20% of the connections in its Western Isthmus (Central Interceptor) catchment go to the old combined stormwater and wastewater pipe system (*Figure 42*). Three combined system conveys wastewater to Mangere Wastewater Treatment Plant in dry weather. However, when it rains stormwater run-off enters the pipe network, which quickly reaches capacity and discharges to waterways. While only 20% of Watercare's engineered overflows are within the combined system area, it contains 68% of the ones that overflow most frequently, with approximately 50 overflowing every time it rains. Outfalls in the Western Isthmus catchment are estimated to discharge around 2,200,000 m³ of diluted wastewater on an average annual basis.

The discharge of untreated sewage into the coastal marine area (except from ships and offshore installations) is a prohibited activity in the Waikato Region, but relatively small amounts of wastewater occasionally gets into waterways. In the 2018–19 financial year, only two minor discharges were recorded to streams on the Coromandel Peninsula.

Fifteen percent of the 34 treatment plants in the Marine Park catchment discharge directly to the sea, but those that do include the largest ones. Greater numbers discharge to rivers (47%) or land (35%, including 9 of the 13 plants on Coromandel Peninsula) (*Figure 43*). Meanwhile, many coastal communities still rely on septic tanks whose performance varies widely.

This indicator uses measured, modelled and assumed data on the concentrations of a gut bacteria, Enterococci at Marine Park beaches. Enterococci is present in faeces and is used as a proxy for other disease-causing organisms that can make people sick. Beaches should be closed when repeat samples have concentrations greater than 280 Enterococci/100 ml (the 'Action' level threshold).

20 YEARS AGO

The Safeswim programme was initiated by North Shore City Council in 1998. Auckland City joined the programme in 1999, with Rodney District Council joining in the following year. Waitakere City Council and Manukau City Council independently monitored sites in their districts.[74]

Waikato Regional Council intermittently monitored 16 beach sites over the December to February summer periods.

Between the 1998–09 and 2001–02 December to February summer periods, 73% of the 75 sites that were sampled more than 20 times exceeded the threshold for beach closures at least once. 17% of sites exceeded that threshold in more than 5% of samples, and 7% of sites exceeded the threshold in more than 10% of samples (*Figure 44*).[74]

TODAY

Auckland Council has stopped using weekly water sampling for assessing health risks for beach goers, and instead uses modelling to provide 'real-time' health risk information. This means current results are not comparable with those from 2000. In 2017–18, assessments were available for 59 sites. Nine sites had not been modelled due to consistently good water quality at six of them, and permanent beach closures at three. Of the modelled sites, 76% were predicted to exceed the Enterococci trigger more than 5% of the time; 38% were predicted to exceed the trigger more than 10% of the time; and 14% were predicted to exceed the trigger more than 20% of the time (*Figure 45*).

Waikato Regional Council have reduced their weekly monitoring to seven Coromandel Peninsula beaches between the summers of 2016–17 to 2018–19. Fewer than 5% of samples exceeded the 'Action' level threshold on their first test. Buffalo Beach in Whitianga was the worst of the Coromandel beaches with around 10% of samples exceeding the 'Action' level threshold on their first test (*Figure 45*).

Swimmers in the Viaduct Harbour. Photo by Shane Kelly.

2000: Local and regional councils monitored 75 Marine Park beaches for summer water quality.

2000: Regulations introduced that prohibit the discharge of untreated sewage from vessels, including recreational boats, in waters less than 5 m deep or within 500 m of the shore or a marine farm.

2003: New microbiological water quality guidelines released by the Ministry of Health and Ministry for the Environment.

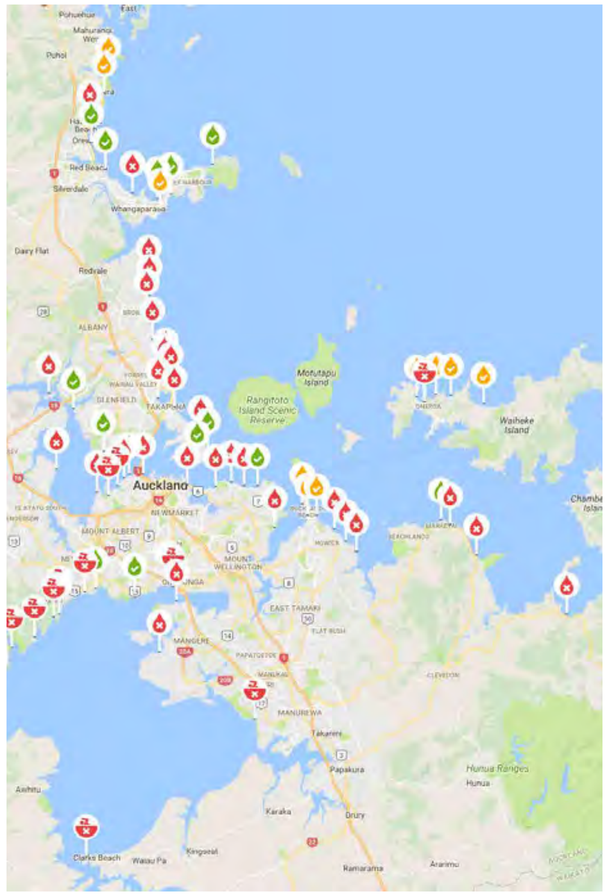
2008: Auckland Three Waters Strategic Plan identifies the provision of a new central interceptor as a matter of urgency for the Auckland's sewer system.

2013: Consent granted for Auckland's Central Interceptor project.

2014: Watercare Services granted an Auckland-wide, 35-year discharge consent for discharging wastewater from existing and specified future networks.

2017: Auckland Council begins reporting 'real-time' health risk information through their Safeswim web portal.

2019: Construction of Auckland's Central Interceptor begins.



www.safeswim.org.nz 12 Feburary 2018

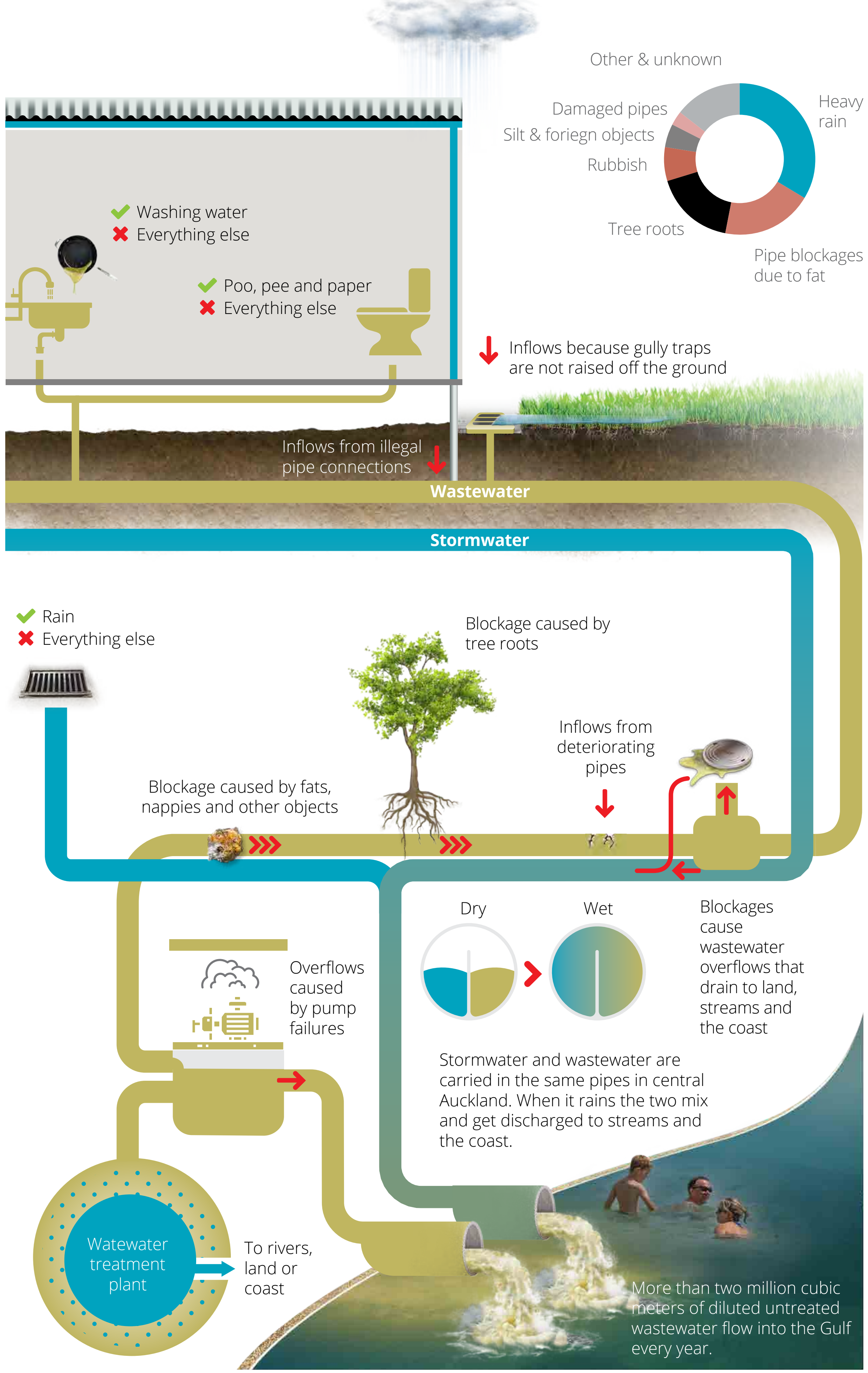
KEY EVENTS

The past 20 years has seen a mix of incremental and transformational changes likely to affect the suitability of water for swimming. Population growth and new development has strained local wastewater facilities. New or significantly upgraded treatment plants have been built at Warkworth, Kawakawa Bay, Whitianga, Coromandel, Thames and Matarangi. Upgrades have also begun or are being planned for the Snells-Algies and Army Bay treatment plants. Despite this, spikes in the populations of beach settlements over holiday periods can still be a challenge, due to 'shock loads' on sewage treatment systems.

The construction of the 'central interceptor' will potentially be a game-changer for central Auckland beaches. This $1 billion initiative involves constructing a 13 km tunnel between Western Springs and the Mangere Wastewater Treatment Plant. The project is designed to reduce average annual overflow volumes in the central interceptor catchment by 80%, cater for Auckland's ongoing population growth and to provide resilience to at-risk sections of the sewer system. It has involved over five years of initial planning prior to it being consented in 2013, with construction starting in 2019. Completion is expected by 2025.

The provision of real-time data on Auckland's wastewater and stormwater networks, forecasts of water quality, and up-to-the-minute advice on swimming conditions at sites around the Auckland region has also been a technological step-change for the assessment and reporting health risks for beach goers. We now have a much better understanding of beach water quality. Unfortunately, the new model indicates that the quality of urban beaches is generally much worse than weekly sampling suggested.

Figure 41. *Causes of wastewater overflows: Blockages and inflows*



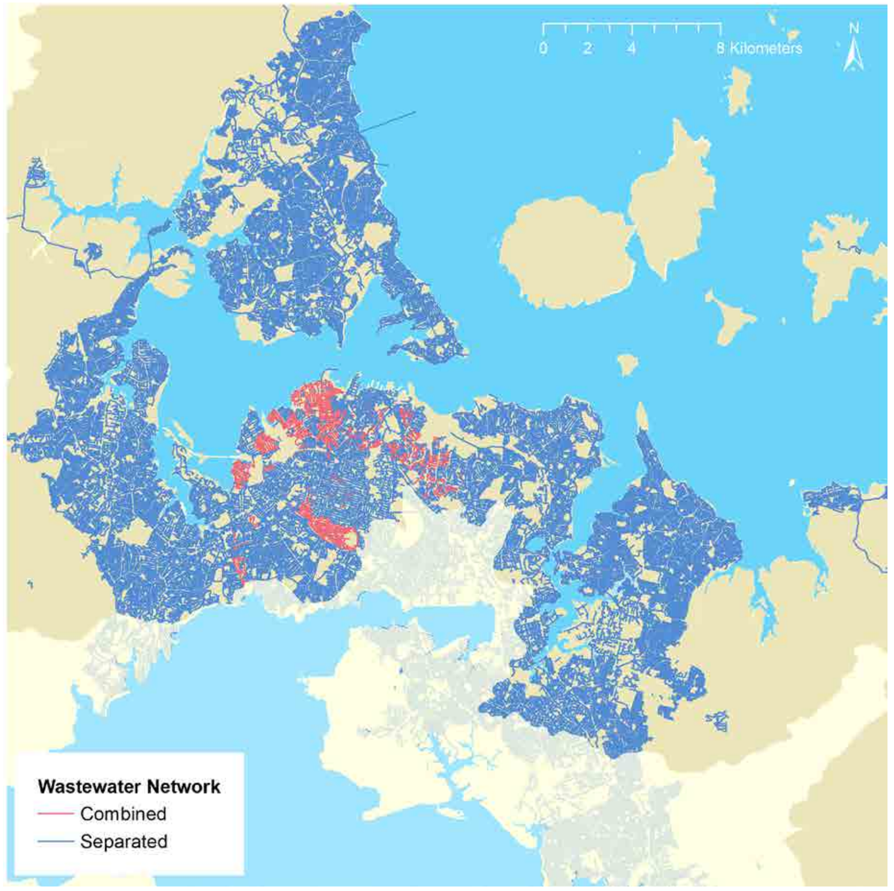


Figure 42: *Central Auckland areas that have a combined wastewater and stormwater system, and areas that have a separated system.*

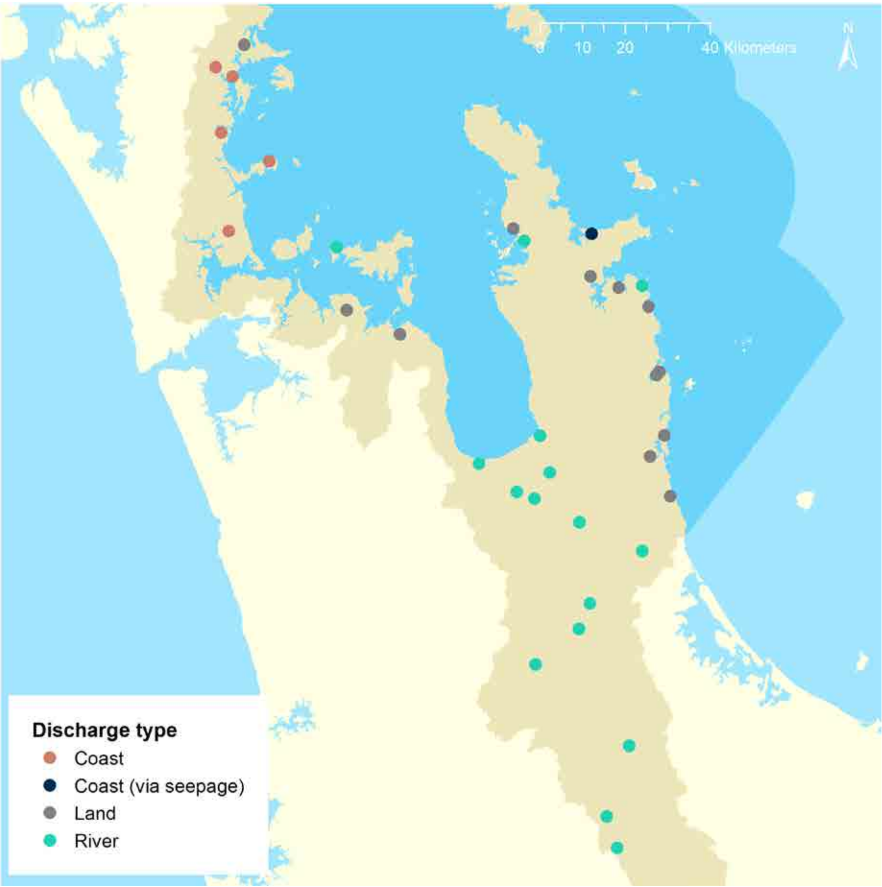


Figure 43: *Wastewater treatment plant discharge types.*

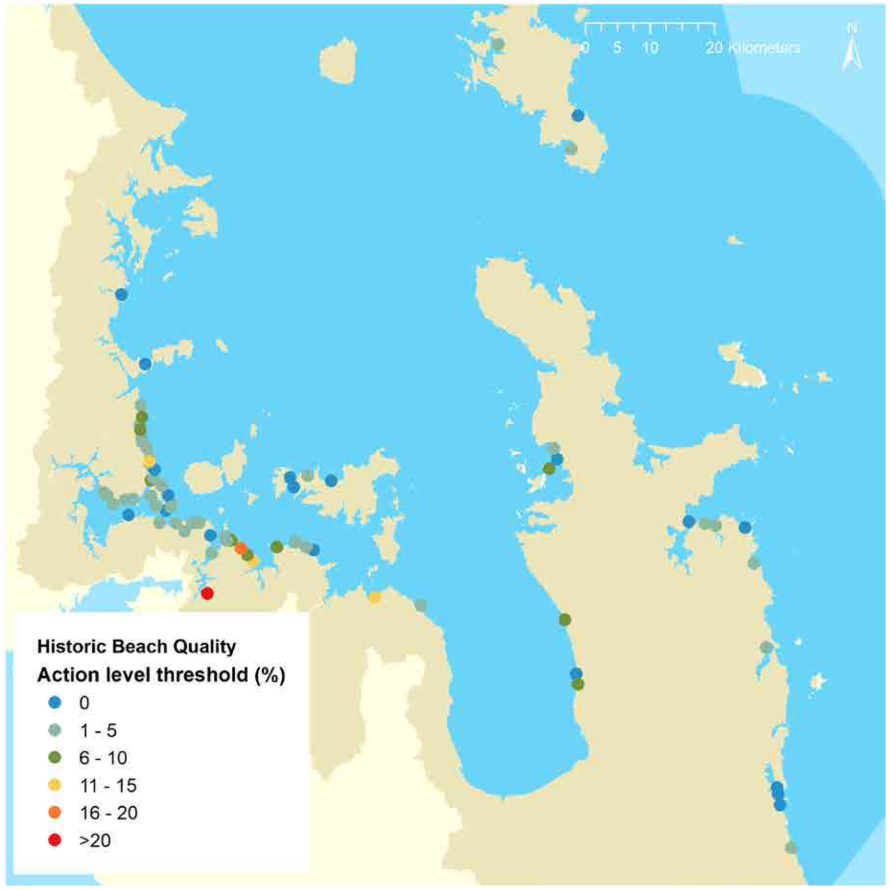


Figure 44: *Percentage of times that beach monitoring sites have exceeded the 'action' level threshold for Enterococci concentrations between 1998–2000.*

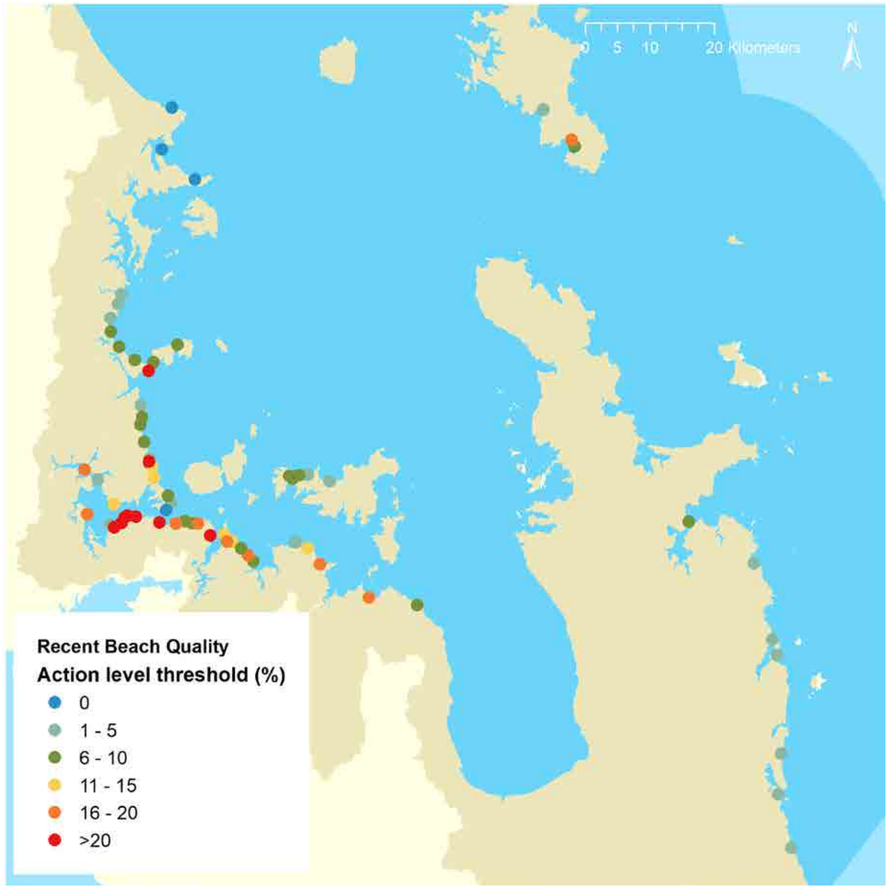


Figure 45: *Percentage of beach monitoring sites that have exceeded the 'action' level threshold for Enterococci concentrations between 2017–2019.*

CASE STUDY / HE MAHI RANGAHAU

NGĀ MAHI KIKINO O TE PARATIKI KI TE MOANA

Marine plastic pollution

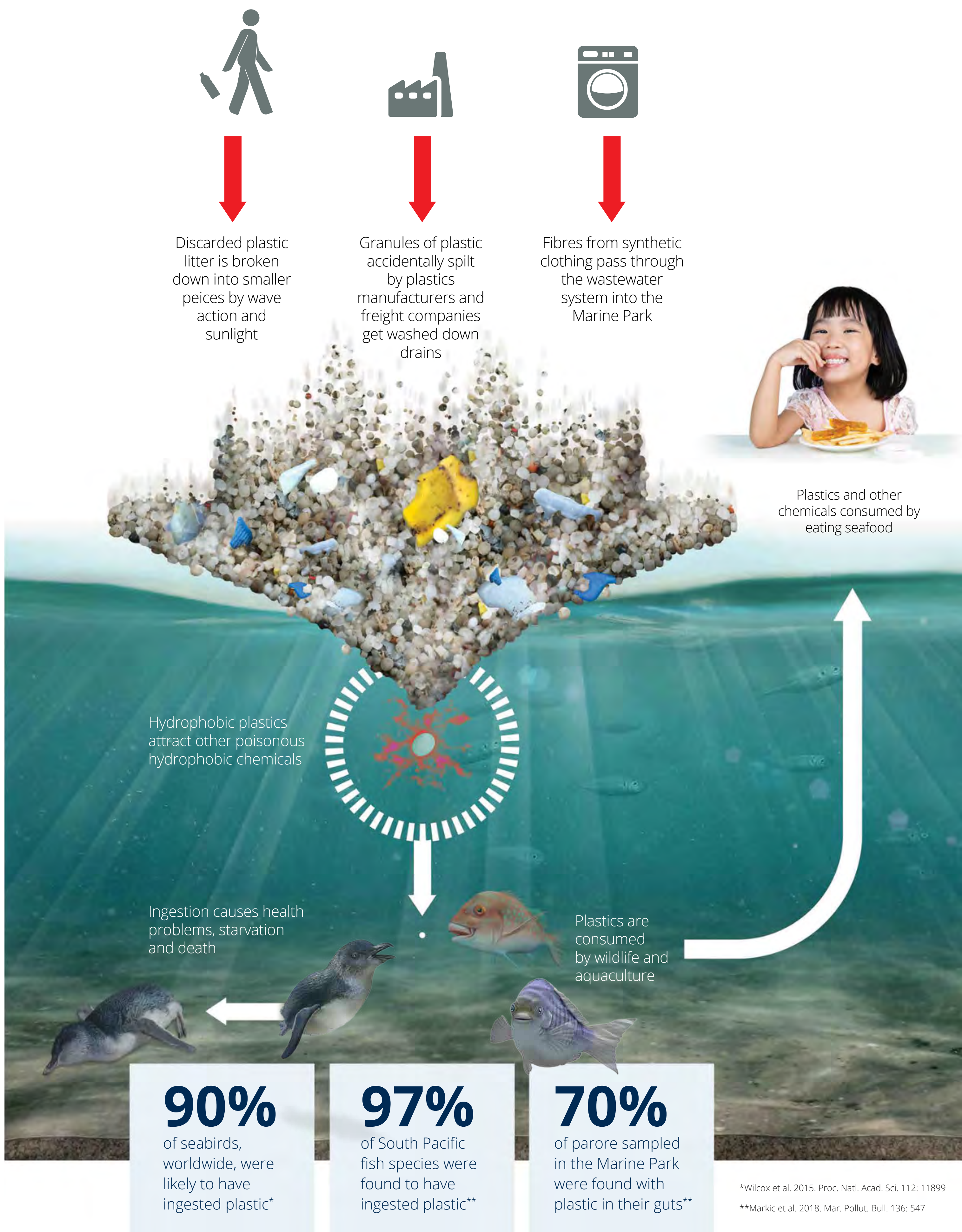
Pōtoke killed by plastic ring on Tiritiri Matangi. Photo by Diane Fraser.

It's hard to envisage a life without plastic. Over the past 70 years plastic products have become a staple in our lives, from food wrapping and milk bottles, to keyboards and home appliances. The properties that makes plastics so popular — their versatility, low cost, durability, lightness and imperviousness to water — also makes them so problematic. They are now present in nearly all manufactured products, they are so cheap that they are designed to be disposable, and they persist in the environment for a very, very long time.

Sadly, much of this plastic ends up in our oceans. Worldwide, it is estimated that between 4.8 to 12.7 million t of plastic enters our oceans each year, which is equivalent to dumping the contents of one rubbish truck into the ocean every 38 seconds.[75,76] Closer to home, New Zealanders litter over 9,000 t of plastic each year, which could end up in our oceans[75]. Seventy one percent of all beach-cast marine litter collected in Aotearoa is plastic.[77] Unlike other types of marine litter that rapidly sink, most plastics float in surface waters where they can be entangled or eaten by fish, seabirds, turtles and marine mammals, causing health problems, starvation and death.[36] A global study on plastic ingestion by seabirds predicted that 90% of seabirds, worldwide, were likely to have ingested plastic.[78] Aotearoa waters are predicted to have the highest plastic impact on seabirds due to the diversity and number of seabirds. Similarly, 97% of South Pacific fish species were found to ingest plastic, including eight common species found in the Marine Park (parore, leatherjacket, kingfish, grey mullet, tarakihi, tāmure, jack mackerel and red gurnard). Parore and leatherjacket were found to have the highest plastic ingestion rates, with 70% of parore and 37% of leatherjacket sampled in the Marine Park having plastic in their guts.[79]

Concerned New Zealanders are volunteering with not-for-profit organisations such as Sea Cleaners (*www.seacleaners.com*), Sustainable Coastlines (*www.sustainablecoastlines.org*) and Ghost Fishing NZ (*www.ghostfishing.co.nz*) to collect marine litter from our beaches and coastal waters. Sea Cleaners have removed over 8.8 million litres of rubbish from Auckland, Whangarei and Coromandel waterways since 2002, involving over 160,000 volunteer hours. The trust currently operates a fleet of four boats and removes around 100,000 litres of litter each month from the waters of the Marine Park. Similarly, around 7,500 volunteers with Sustainable Coastlines have collected around 950,000 pieces of rubbish from

Sources and impacts of marine plastic



*Wilcox et al. 2015. Proc. Natl. Acad. Sci. 112: 11899
**Markic et al. 2018. Mar. Pollut. Bull. 136: 547

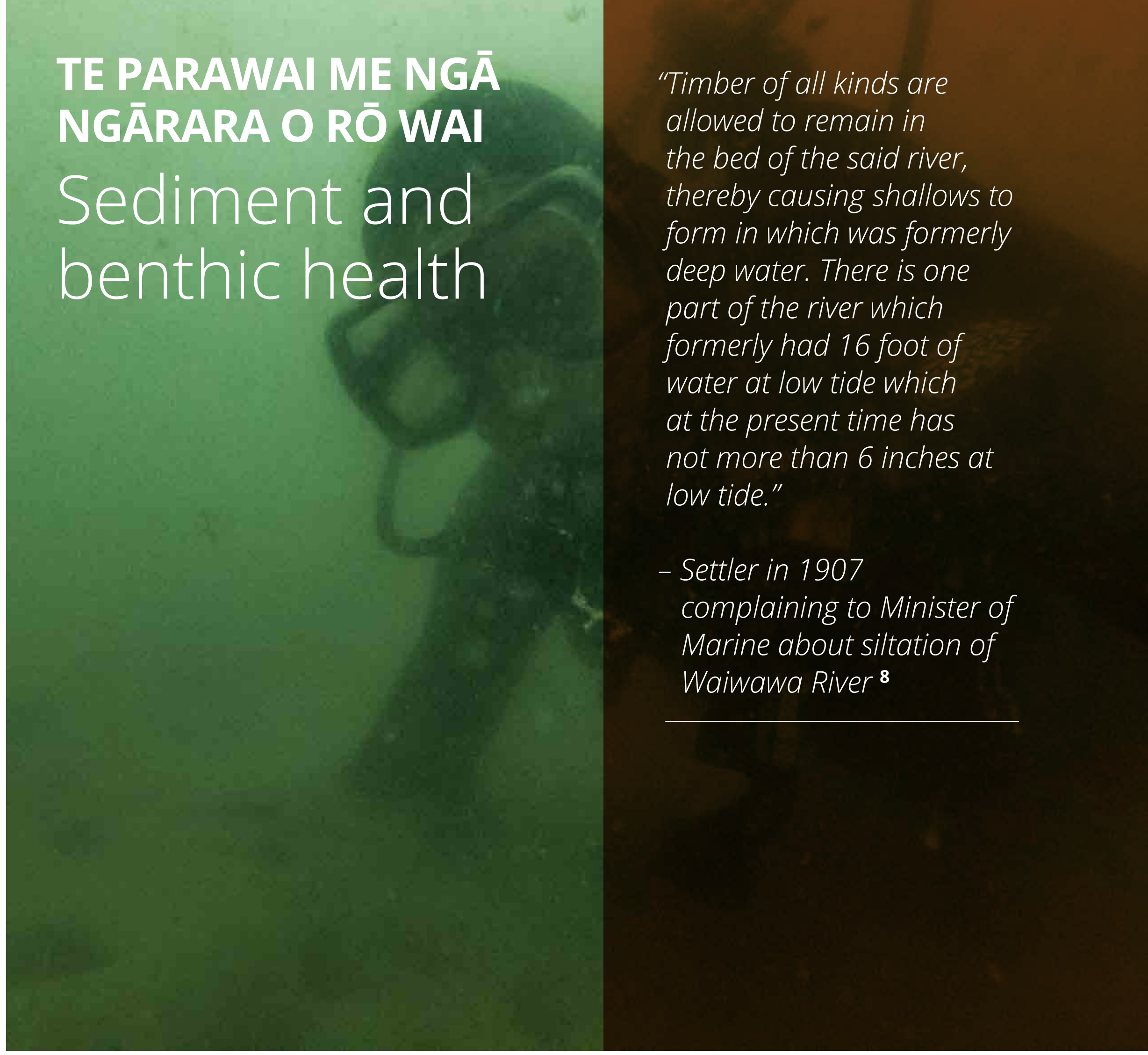
Plastic granules near a plastics manufacturing company. Photo by Shaun Lee.

Plastic granule clean up. Photo by Shaun Lee.

beaches in the Marine Park since 2008, much of which is food-related litter. Sea Cleaners founder, Hayden Smith, has noticed large changes in marine litter in the Marine Park since he began in 2002. In the first few years, large rubbish convergence zones were present in the Waitematā Harbour and inner Marine Park, where they could spend all day collecting rubbish and still not remove all that was present. Due to on-going efforts by the trust and volunteers, these rubbish convergence zones no longer exist. Hayden has also noticed an increasing awareness in the public about the problem of marine litter, which was highlighted by the public's support for the ban of single-use plastic bags. However, he believes that a greater public awareness is still needed of the fact that most litter on our streets will eventually end up in our waterways.

Large items of litter are unsightly and easily collected. However, there is a growing awareness of the problems that 'invisible' microplastics can cause to our environment. Plastics become brittle when exposed to sunlight, wind and seawater, and subsequently break into smaller and smaller pieces. Other microplastics, such as microbeads and microfibres, enter our environment mainly through wastewater as micro-sized pieces. Microplastics are now found throughout our oceans, and their occurrence is predicted to continue rising. They are ingested by a wide range of marine animals, and can cause physical and chemical harm at high concentrations, through gut blockages or the leaching of harmful chemicals from the plastics. Microplastics pose a greater toxicity risk than large plastic items because their larger surface area to volume ratio increases the chemical absorption rate. Currently, ecological risks from microplastics are very rare, but, risks will increase with increasing concentrations in our oceans.[80] Microplastic concentrations in Auckland streams are similar to that found within large rivers in more heavily populated countries such as Europe and the United States.[81] Nearly 90% of microplastics found in Auckland beaches and waterways were fibres that come from washing synthetic clothing.[82]

People's attitudes to plastics are changing, with a gradual switch to practices that reduce plastic pollution. Government actions taken to reduce plastic pollution in Aotearoa include: the ban on microbeads in wash-off cosmetic products, toothpastes and abrasive cleaning products in 2018; the ban on single-use plastic bags in 2019; and allocation of $12.5 million dollars of funding to research the impacts of microplastics in Aotearoa.[83] This research includes the development of novel solutions such as the use of plastic-eating bacteria to reduce microplastics in our waterways.[84] However, there is still much room for improvement — our daily plastic waste is 159 g per person, compared to Norway, which only generates 26 g of plastic waste per person.[85]



Diver with his arm buried in sediment near Ponui Island. Photo by Shaun Lee.

INDICATOR / TOHU

TE PARAWAI ME NGĀ NGĀRARA O RŌ WAI
Sediment and benthic health

"Timber of all kinds are allowed to remain in the bed of the said river, thereby causing shallows to form in which was formerly deep water. There is one part of the river which formerly had 16 foot of water at low tide which at the present time has not more than 6 inches at low tide."

– Settler in 1907 complaining to Minister of Marine about siltation of Waiwawa River [8]

Sediment is ranked the 3rd highest threat[v] to Aotearoa's marine habitats (after ocean acidification and global warming).[38] It is a serious pollutant that degrades our coastal habitats and smothers marine life. Land activities, such as forestry, farming, mining, draining of wetlands and urban development, have greatly increased the amount of sediment that enters our waterways and harbours. Sedimentation rates in the Waikato over the past 100 years were around 100 times those of pre-human times.[86]

This has led to major changes in our coastal marine communities, such as the widespread loss of shellfish beds. High levels of suspended sediments prevent life-supporting light from reaching seaweeds and seagrass, damages the gills of fish, and stops filter-feeders such as shellfish and sponges from feeding efficiently. This sediment eventually settles on the seafloor, where it smothers marine life, resulting in the loss of mud-sensitive species such as tuangi and pipi, and the increase in mud-tolerant worms.

Suspended sediment (total suspended solids or TSS) in our waters, the muddiness of our estuaries, and the health of intertidal animal communities (Benthic Health Model$_{Mud}$) around the Marine Park are monitored by Councils. Site health is graded from 'extremely good' to 'unhealthy with low resilience' depending on the number and type of animals present, as different communities are present on sandy shores versus muddy shores.

[v] Equal with bottom trawling.

20 YEARS AGO

Benthic animal communities and sediment texture had been monitored in the Mahurangi Harbour since 1994. Results show that the percentage of fine sand more than doubled at all sites, and there were estuary-wide decreases in horse mussels and wedge shells, and increases in the worm *Cossura* sp. at some sites, which is consistent with increasing sedimentation.[87]

Monitoring programmes for Okura Estuary and the Central Waitematā Harbour commenced due to concerns about sedimentation.

Total suspended solids had been monitored at 19 sites for up to a decade. Results showed that levels were most elevated in the Upper Waitematā Harbour and Tāmaki Inlet. Most sites had stable or declining trends including those with the highest median concentrations. The exception was the Goat Island site where TSS concentrations were increasing.

1994: Monitoring of Mahurangi starts.

2000: Monitoring of Okura starts.

2001: Monitoring of the Firth of Thames starts.

2002: Monitoring of Pūhoi, Waiwera, Ōrewa and Mangemangeroa starts.

2004: Monitoring of Turanga and Waikopua starts.

2004: Mahurangi Action Plan started by Council in response to concerns about sedimentation in the harbour.

2006: Benthic Health Model$_{metals}$ developed.[90]

2010: Benthic Health Model$_{mud}$ developed.[91]

2010: Mahurangi Action Plan, 2010–2030 released.

2010: Monitoring of Whangateau starts.

2013: Monitoring of Tairua starts.

2018: Implementation of a National Environmental Standard for Plantation Forestry.

TODAY

Benthic animal communities and sediment texture are monitored in Ōkura, Mahurangi, Mangemangeroa, Ōrewa, Pūhoi, Tūranga, Waikōpua, Waiwera, Whangateau and Tairua estuaries, the Waitematā Harbour, and the Firth of Thames.

The monitoring shows that:

High sediment inputs are still occurring in some estuaries, which is reflected in the increasing proportion of mud and very fine sand at many of the monitored sites over the last 10 years, including sites in Kuranui Bay, Miranda, Okura, Mangemangeroa, Turanga and the Upper Waitematā *(Figure 47).*

Ecological communities at some sites in Mahurangi Harbour have not recovered from major stepwise changes caused by sedimentation in the 1990s, such as large reductions in the tuangi, wedge shells and polydorid polychaetes at Hamilton's Landing.[88]

Only 46% of monitored sites in the Marine Park have good or extremely good benthic health (*Figure 48* to *Figure 50*). The healthiest sites are located in the outer areas of Waiwera, Pūhoi, Ōrewa and Okura estuaries, while the poorest sites are in the Upper Waitematā Harbour, southern Firth of Thames and inner Tairua Estuary. The majority of sites have not changed status over the last decade.

The largest estuary-wide changes in benthic health have occurred in the Waitematā Harbour (7 sites have declined), Okura (3 sites have declined) and Ōrewa (5 sites have improved). The decline in health status of communities at Okura and the Upper Waitematā Harbour are consistent with increasing muddiness,[89] while the improvement in health status of communities in Ōrewa is consistent with the decreasing muddiness at 8 out of 10 sites in the estuary.

10-year medians for TSS on the Auckland coast are generally lower (better) than they were before the Marine Park was established, but concentrations in western parts Waitematā Harbour have been increasing over the past decade. Elsewhere TSS levels are stable or declining *(Figures 51 and 52)*.

Mahurangi Harbour seafloor. Photo by Shaun Lee.

KEY EVENTS

Concern about the effects of sedimentation in our estuaries led to Council-funded research on sedimentation in high risk areas, including the Firth of Thames, Waitematā Harbour, Whitford embayment, and Okura and Mahurangi estuaries.[86,92-95,96] This has increased our understanding of the sources of sediment, historic and future accumulation rates, and the effects of sedimentation on marine communities. The main source of sediment accumulating in the Firth of Thames in recent times (2005–2015) is from catchment subsoil (around 50%), but around 45% is from resuspended marine sediments that originated from deforestation and erosion that occurred over 100 years ago. Forestry and pasture topsoils were only found to contribute a minor portion of more recent sediment in the Firth.[92]

Catchment management plans have been developed for Mahurangi, Whangamatā, Wharekawa, Tairua and Whangapoua estuaries to try and reduce sedimentation rates. The Mahurangi Action Plan was initiated in 2004 by the Auckland Regional Council (ARC) in response to dramatic changes in benthic animal communities in the harbour that were consistent with increased sedimentation. The plan aimed to reduce sediment entering the harbour, mainly through fencing and riparian planting, which was jointly funded by the ARC and the landowner. The ARC led the plan for the first five years and contributed $3 million to work on the plan. It was then handed it over to the local community to manage. However, the lack of ongoing funding and project leadership resulted in little additional progress being made.[96,97]

Other work towards reducing sedimentation in our estuaries includes:

Fencing of nearly all the grazed harbour margin in Whangapoua Estuary;

Planting of steep hillsides and riparian areas in the Tairua Estuary;

Saltmarsh restoration, planting of steep hillsides, and erosion control of riverbanks in Wharekawa Estuary;

Planting of around 3,700 native plants in riparian and wetland areas in the Matamata-Piako District.

Much of this work has been jointly funded by private landowners and Councils.

Implementation of a National Environmental Standard for Forestry in 2018 will help reduce erosion and sedimentation generated from forestry activities. Better methods for managing sediment in land-run-off on construction sites have also been implemented. These include methods for capturing sediment on construction sites, installation of stormwater settlement ponds, addition of flocculants to stormwater, and decanting methods to remove the clear water from settlement ponds.[98]

However, there is still a long way to go in managing sediment run-off. Higher intensity rainfall events and greater extremes in river flows due to climate change will further exacerbate this issue (*Figure 46*).

Figure 46: *Muddy stream of water pouring into Tāmaki Strait in the aftermath of a 2017 storm event. Photo by Shane Kelly.*

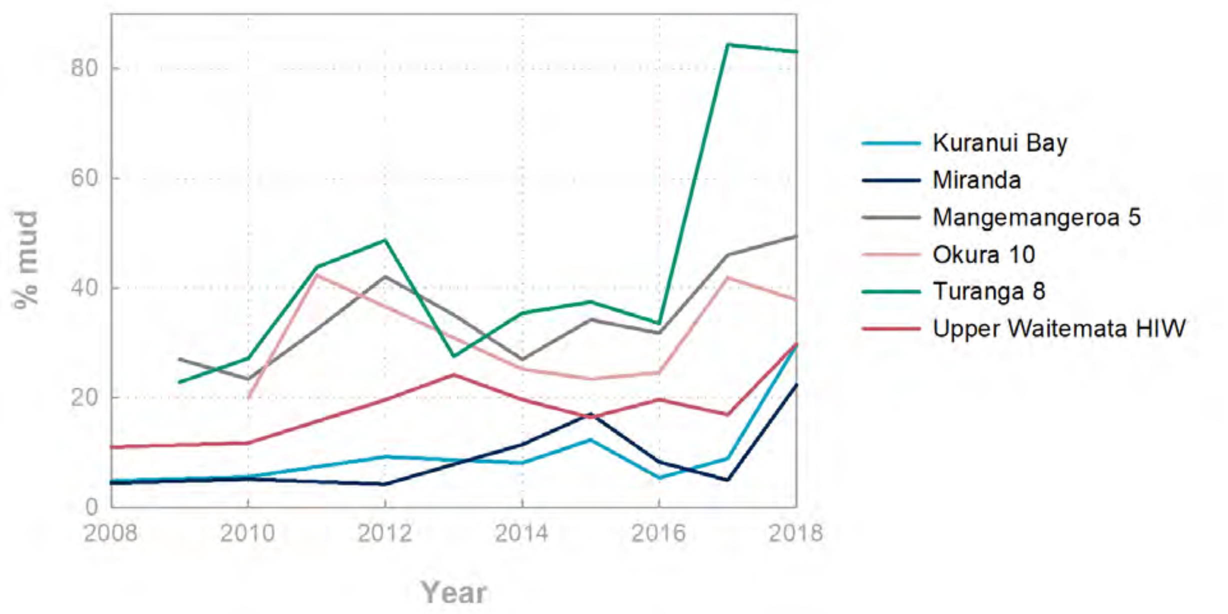


Figure 47: *Sites that have shown the greatest increase in mud content over the last 10 years (data provided by Auckland Council and Waikato Regional Council). Grainsize methodology has been consistent since 2008.*[89,99]

Figure 48: *Benthic Health mud scores for Auckland for 2018.*

Figure 49: *Benthic Health mud scores for Waikato for 2018.*

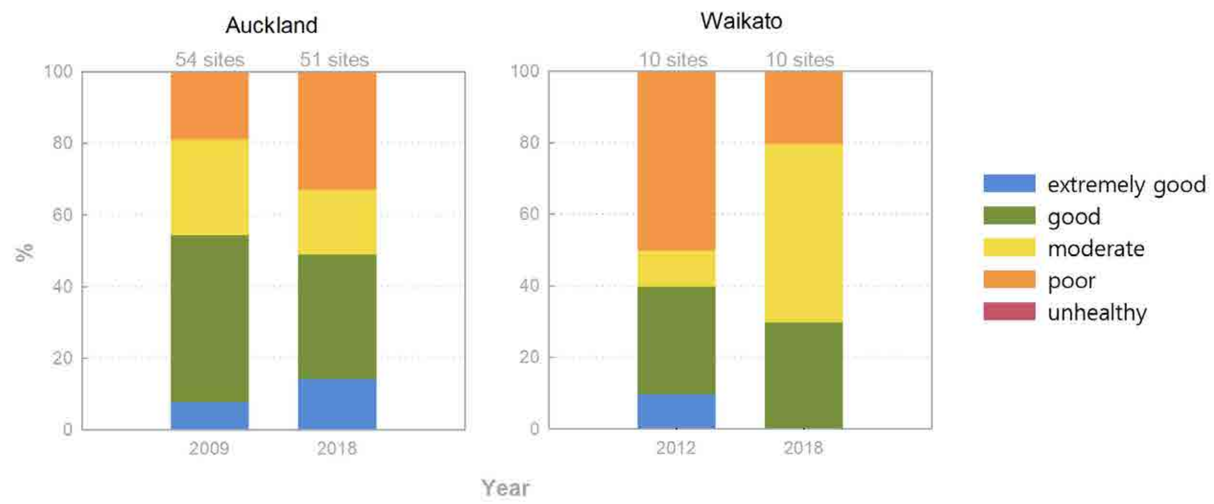


Figure 50: *Percentage of sites ranked from very healthy to poor in the Marine Park between 2009 and 2018.*

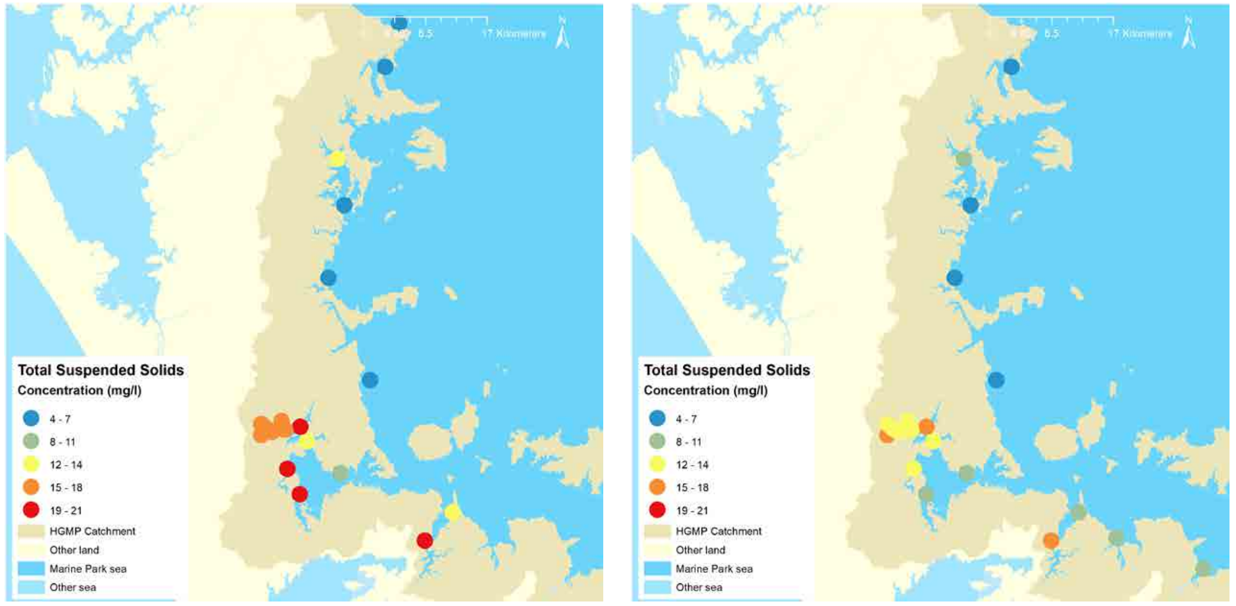


Figure 51: *Median total suspended solid concentrations at monitored sites between 1991–00 and 2009–18.*

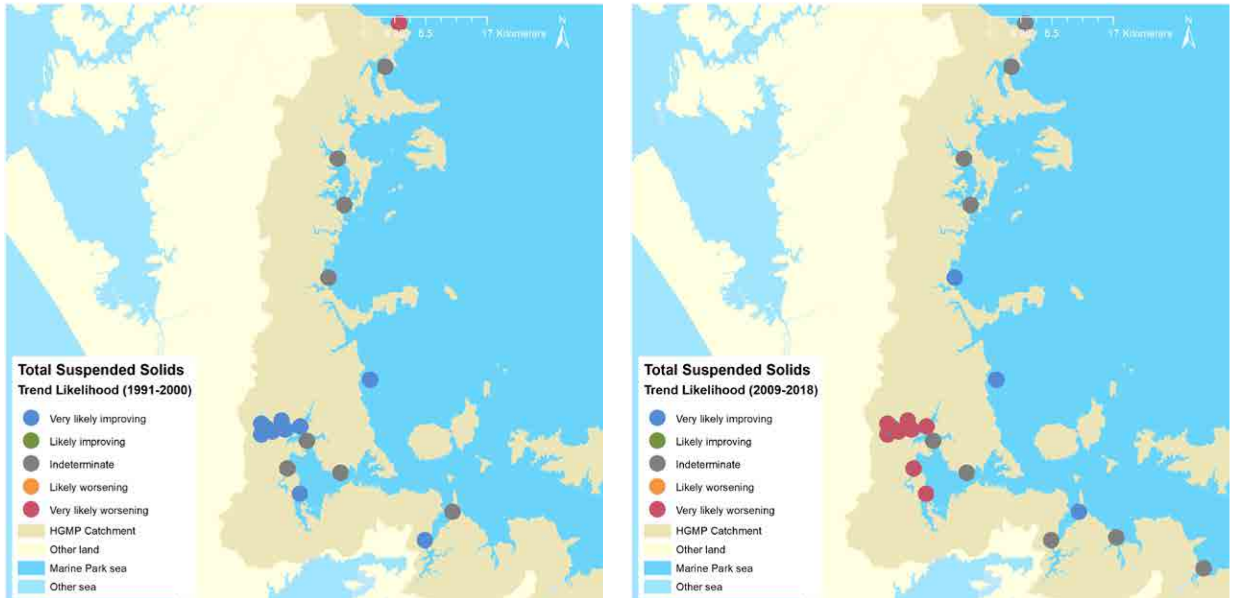
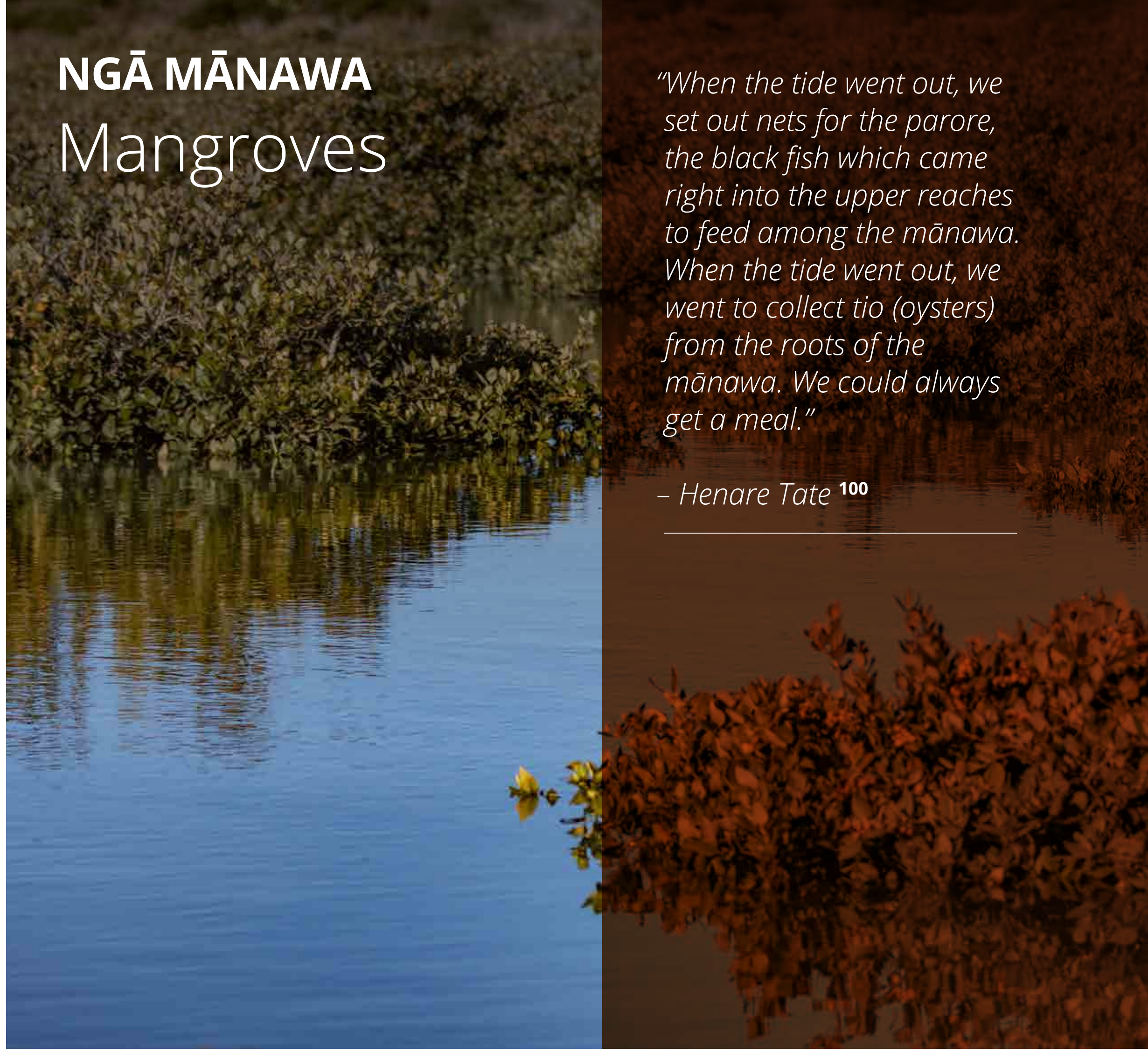


Figure 52: *Trends in total suspended solid concentrations between 1991–00 and 2009–2018.*

Tahuna Torea Nature Reserve. Photo by Shaun Lee.



NGĀ MĀNAWA
Mangroves

"When the tide went out, we set out nets for the parore, the black fish which came right into the upper reaches to feed among the mānawa. When the tide went out, we went to collect tio (oysters) from the roots of the mānawa. We could always get a meal."

– Henare Tate [100]

INDICATOR / TOHU

Mānawa are found in sheltered coastal and estuarine areas in the upper North Island. They provide a habitat for a range of native animals, including several species of fish, birds, and insects, but are a non-essential habitat for most species. The only species that are dependent on mānawa are two endemic insects (a moth and a mite), whose larvae are only found on mānawa. Banded rail, which has a 'Declining' conservation status, are also becoming increasingly dependent on mangroves because of the loss of their preferred saltmarsh habitat. Trees that are well submerged each tide are also thought to provide an important habitat for juvenile parore, short-finned eels, and grey mullet).[101,102] Mānawa also store carbon (like all trees) and provide coastal protection from waves.[103,104]

Mānawa thrive in muddy, water-logged conditions that are above the mid-tide level. The expansion of mānawa in many of our estuaries is symptomatic of the infilling of estuaries from land erosion — sedimentation increases the intertidal area suitable for mānawa (rather than mānawa causing the increase in muddy habitat).[105] The expansion of mānawa can result in the loss of other habitats, such as seagrass and shellfish beds, and can decrease the roosting area available to shorebirds such as wrybill and bar-tailed godwit that required open sand or mudflats. Mānawa expansion can also affect social and cultural values, such as recreational use of the estuary, scenic values, and kai moana harvesting.

20 YEARS AGO

Average mangrove cover of monitored estuaries was 22%.

Small-scale clearances of mangroves conducted in the 1990s and 2000s were community initiatives using hand tools.

2012: consent granted to remove 23 ha of mānawa from Whangamatā Harbour.

2013: consent granted to remove 22 ha of mānawa from Tairua Harbour.

2017–present: Mangrove Management Bill under consideration.

TODAY

Average mangrove cover of monitored estuaries was 25%.

Mānawa cover in the monitored estuaries has increased by an average of 1.6% per year, which is less than the average increase of around 3–4% per year for the second half of the 20th century.[106,107] However, large increases have still occurred in Tairua (6% per year) and Pūhoi (4% per year) *(Figures 53 & 54)*. In other estuaries, such as Whitianga and Whangapoua, there has been little change in area covered, but mangrove density has increased greatly.[108,109]

Since 2013, large-scale removals of mangroves have occurred in Whangamatā and Tairua estuaries under the direction of WRC, using a combination of machinery and hand tools.

KEY EVENTS

Removal of mānawa is a contentious issue. Removals (both consented and unconsented) have occurred in many estuaries for a variety of reasons e.g., protection of areas of seagrass, saltmarsh and sand flats, enhancement of recreational and amenity values, protection of shellfish beds for kai moana harvesting, and maintenance of channels for flood control. Currently, clearance of mature mānawa in the Auckland and Waikato regions requires a resource consent. Auckland's Proposed Unitary Plan sought to make the clearance of mangroves back to the 1996 state a permitted activity (no consent required). However, this change was not implemented in the Operative Unitary Plan, which only permits the clearance of seedlings (from most areas), and small areas of mature mangroves to ensure public health and safety or the use of existing infrastructure.

The Thames–Coromandel District Council have proposed a Mangrove Management Bill that would allow for the clearance of mangroves in Whangamatā Harbour in accordance with a mangrove management plan, but without the need for a resource consent. This bill is currently in its second reading, but even if passed, it is likely to be temporary, with a current clause to repeal the bill after five years.

Monitoring of cleared areas indicate that mangrove removal is unlikely to enable muddy estuaries to revert to former sandy conditions, especially in sheltered areas, and/or areas that continue to have high sediment inputs. Three years after large scale mangrove clearances in Whangamatā Harbour, the sediment properties and benthic community composition were more similar to that within uncleared mangroves, than to nearby sandy areas.[107,110]

Mānawa. Photo by Shaun Lee.

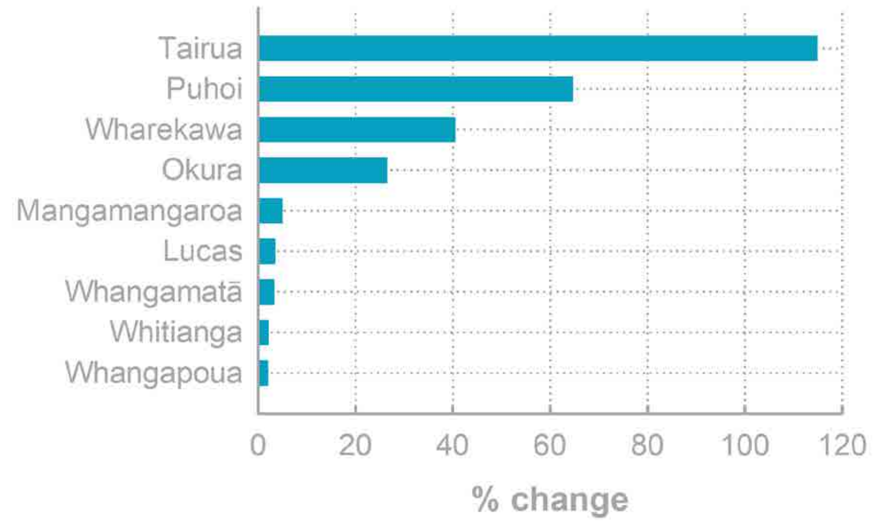


Figure 53: *Percentage change in mangrove cover from 1993–2000 to 2012–2017. Data excludes the large-scale clearances that have since occurred in Whangamatā and Tairua. Most of the data was mapped from aerial photographs. Some GIS layers were provided by WRC. Aerials for the start period for Okura, Lucas, Mangamangaroa and Whitianga were not available and this data was taken from the literature[102,109]. The 2000 aerial photograph for Whangapoua was provided by NIWA with permission from Ernslaw One.*

Figure 54: *Changes in the mangrove cover (orange areas) in Tairua Estuary between 1994 and 2012.*

CASE STUDY / HE MAHI RANGAHAU

Mission Bay January 2018. Photo by Shaun Lee.

E TŪ PAKARI ANA KI NGĀ NGĀ MAHI UAUA A TĀWHIRIMĀTEA

Responding to climate change

Climate change due to global warming is happening. The effects are already obvious — over the last century Auckland's mean annual temperature has increased by 1.6°C (*Figure 55*) and sea levels have risen by an average of 20 cm (*Figure 56*).[111] Extreme weather events are more common and low-lying areas are experiencing repeated flooding. Despite these warning signs, Auckland's greenhouse gas emissions are still rising. Between 2000 and 2016, Auckland's emissions increased by 5.6%. If we continue this trend, then emissions will increase by 27% by 2050. Drastic action is needed to counteract this trend, and in June 2019, Auckland Council declared that a climate emergency is facing the region.[112] Both Auckland and Waikato regions have also made climate change a focus of the committee structure.

Clevedon March 2017. Photo by Shane Kelly.

The magnitude of climate change effects depends on future emissions. Models based on stabilisation of global emissions by 2100 (RCP4.5) or 'business as usual' emissions (RCP8.5), predict that by the end of the 21st century for the Upper North Island:[w 111,113,114]

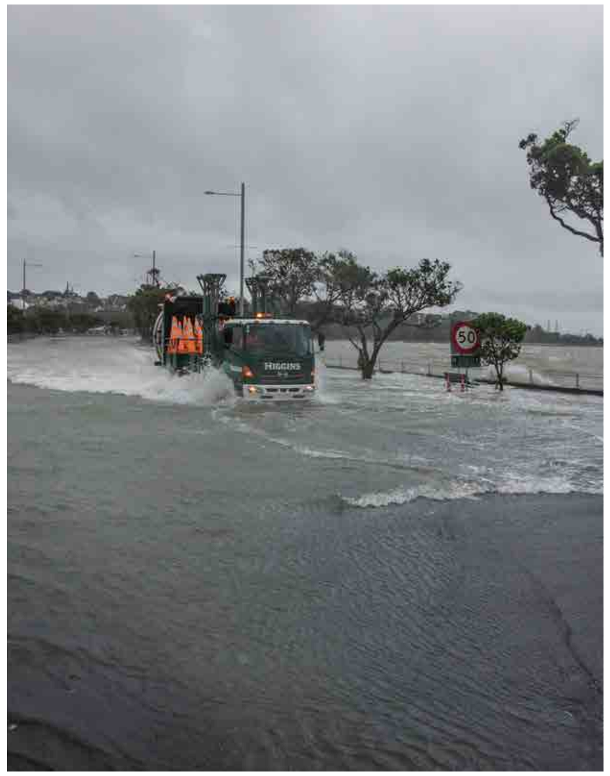
- average temperatures will increase by 1.25–3.3°C (*Figure 59*), and the number of 'hot' days (over 25°C) will increase by 3 to 4 times;
- sea levels will rise by 0.5 to 1 m;
- there will be more extreme rainfall events, but less rainy days overall;
- autumn will become wetter and spring will become drier;
- soils will become drier;
- average wind speed will decrease, but the intensity of tropical cyclones will increase; and,
- ocean waters will become more acidic.

[w] Sub-national climate zone 1

The impacts of climate change are likely to be varied and far-reaching. It is expected that:[115-117]

- 1.5–4% of Auckland could be affected by rising sea levels and around 400–500 km^2 in the Hauraki Plains (*Figure 57* and *Figure 58*), which will cause flood damage to infrastructure, increased erosion and loss of coastal and freshwater habitats. The areas that are most sensitive to flooding are the Hauraki Plains, Kaiaua, Clevedon, Whangateau and Mission Bay;
- sea level rise and coastal flooding may increase disease risk by increasing the number of wastewater overflows and contaminating water supplies;
- periods of drought will become more common, resulting in an increased fire risk, higher irrigation requirements, and a reduction in food security;
- the intensity of extreme rainfall events and river flows are expected to increase, particularly in the Hauraki and Thames-Coromandel districts and Hunua Ranges. This is likely to increase land and river erosion, and coastal sedimentation;
- ocean acidification may cause a decline in the health of marine life, particularly those that have calcium carbonate skeletons that become malformed in acidic conditions, such as shellfish, kina and certain plankton;
- animals and plants that live in coastal ecosystems are likely to lose significant habitat due to coastal squeeze. In particular, threatened shorebird roosting and breeding habitat is likely to be especially vulnerable to storm and flood damage;
- the health of freshwater animals is likely to decline due to lower river levels, higher water temperatures, and increased erosion potential and degraded water quality during high rainfall events;
- air quality is likely to decrease due to less windy and rainy days, so pollutants and allergens stay suspended in the air;
- there is a greater chance that subtropical/tropical pests and diseases can arrive and survive in New Zealand due to warmer temperatures and changes in ocean currents;
- people's physical and mental well-being may be affected by the increase in temperatures, decrease in air quality, and the decline in the mauri of ecosystems.

Aotearoa has agreed to the 2015 Paris Agreement to limit future global temperature increase to 1.5°C. The government also passed the Zero Carbon Bill in November 2019, which aims to reduce our net emissions, excluding biogenic methane, to zero by 2050. This means that we will need to reduce our greenhouse gas emissions by 5% by 2020 and 50% by 2050 (below the 1990 level).[118,119] To meet these targets, Auckland will need to reduce its current net emissions by 25% by 2020, and by 58% by 2050[120]. The majority of emissions in Auckland are generated by transport (40%), energy used in buildings (30%), and industrial processes (21%).[112] Council is proposing to reduce Auckland's emissions by increasing public transport and cycle/walking pathways, encouraging the use of zero/low emission vehicles, planting more trees, making new developments supportive of low-carbon lifestyles, retrofitting existing buildings to make them more energy efficient, and shifting to more renewable energy sources.[112] In Waikato, the majority of emissions are generated by agriculture (76%), followed by transport (12%) and energy used in buildings (10%). Waikato Regional Council have not published emission reduction targets, but they would need to focus on reducing agriculture emissions to substantially reduce the region's emissions.[121]



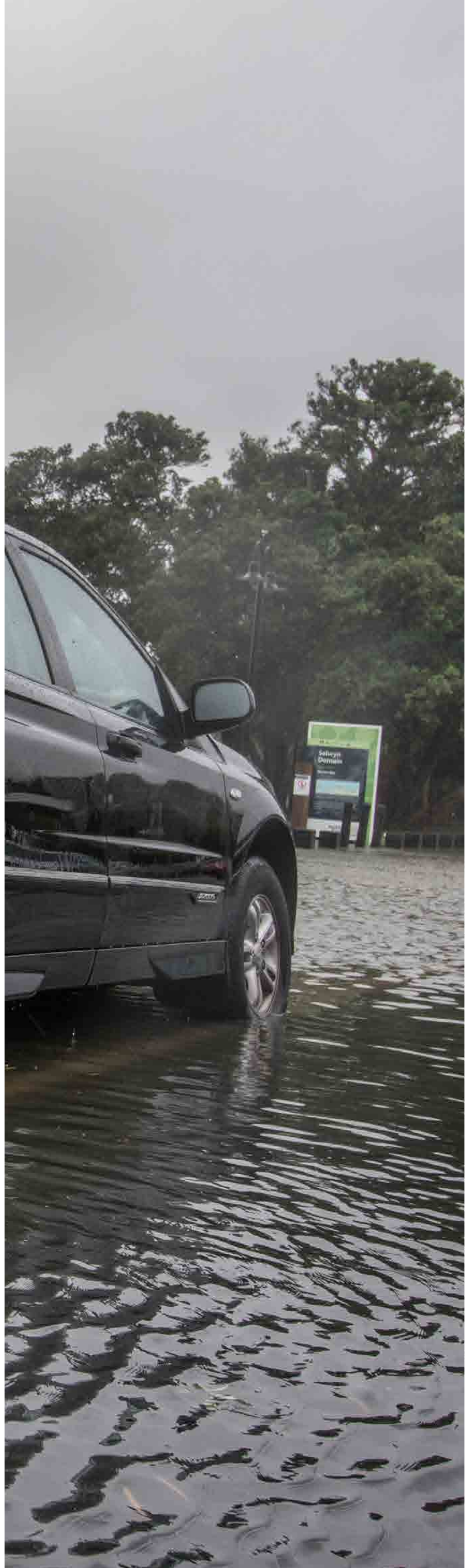
Tāmaki Drive January 2018. Photo by Shaun Lee.

School Strike 4 Climate Aotea Square. Photo by Shaun Lee.

Even if we manage to limit global warming to 1.5°C, climate change impacts will affect Aotearoa. Across the country, over five billion dollars of council infrastructure is estimated to be at risk to a sea level rise of 1 m.[122] In the Auckland and Waikato regions around 7,500 homes are located within 1.5 m of mean high water spring[123]. Councils are starting to address the risks of climate change by:

- providing information about coastal inundation and the effects of climate change;
- identifying and working with communities that are vulnerable to sea-level rise;[124,125]
- preparing risk assessments for the effects of climate change;[126]
- developing action and management plans, including investigating options for retreat, flood protection and the development of sustainable infrastructure;[112,124] and,
- considering the risks when developing coastal areas that are likely to be affected by coastal hazards over the next 100 years.

Planning for future climate change effects is difficult as the location, extent and type of impact is uncertain.



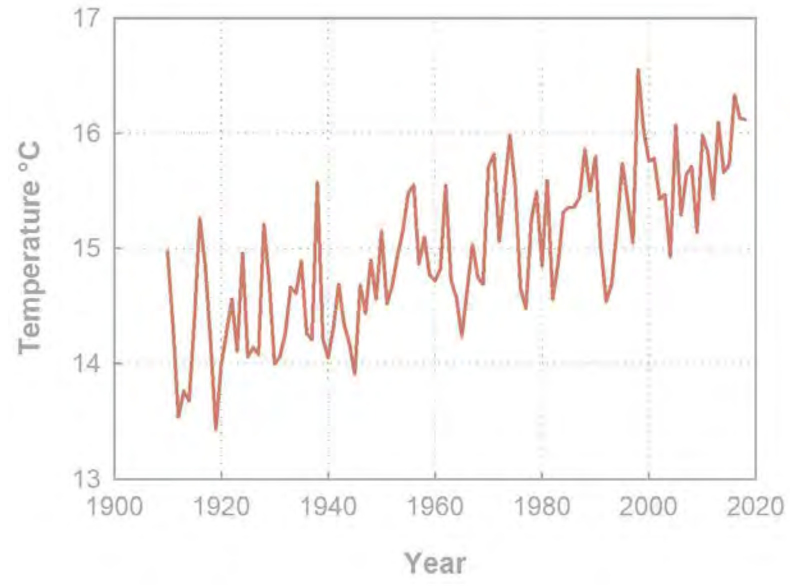


Figure 55: *Mean average temperature in Auckland since 1910 (data from NIWA).*[127]

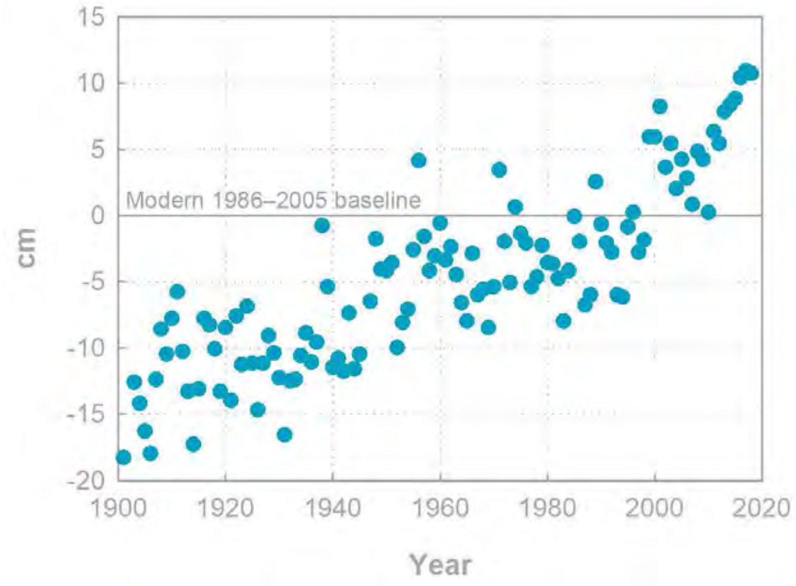


Figure 56: *Observed sea level rise in Auckland since 1901 (data from MfE).*[128]

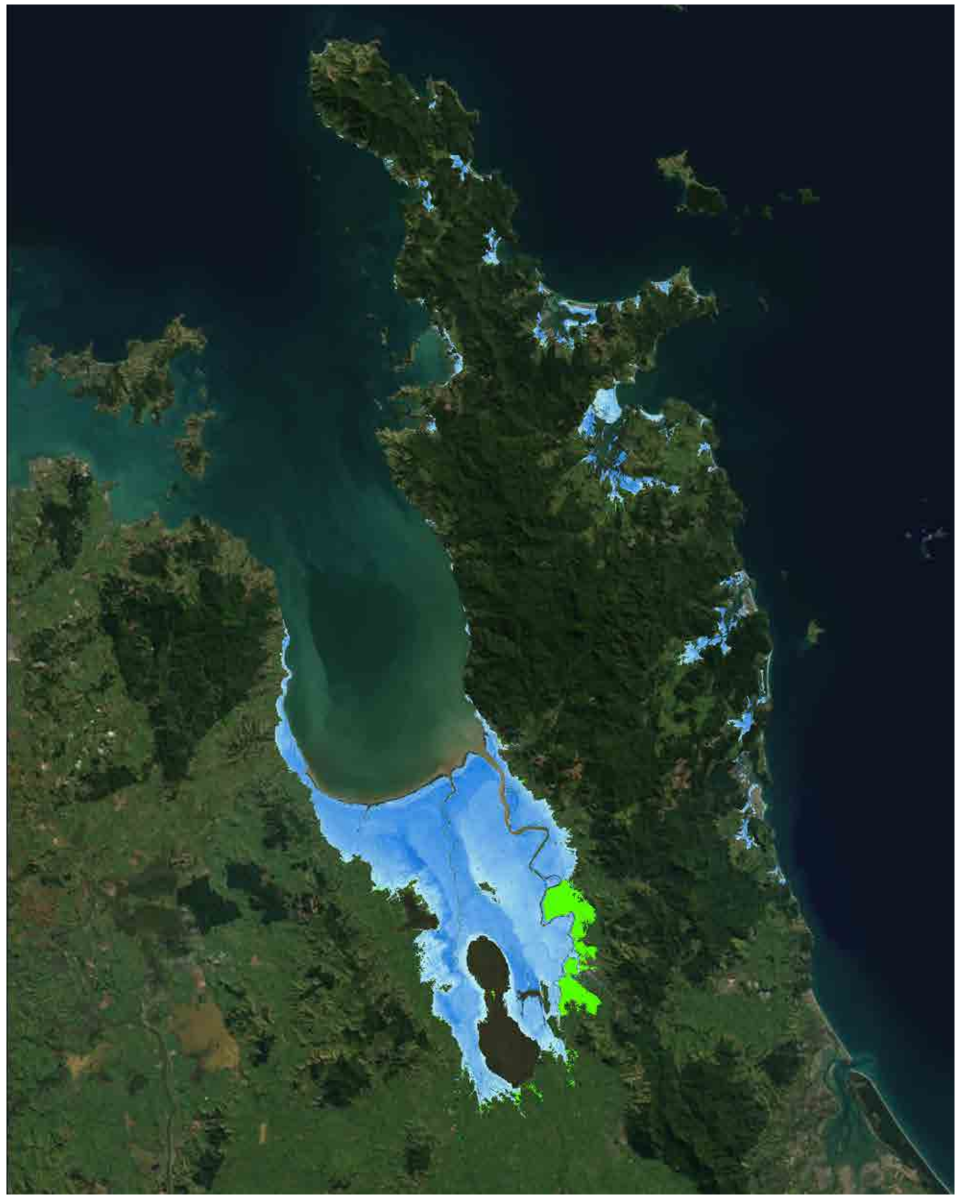


Figure 57: *Projected extent of coastal inundation in Waikato with a 1 m sea level rise and during a storm event. Blue shows direct inundation from the sea while bright green shows indirect inundation. Map from https://coastalinundation.waikatoregion.govt.nz*

Piako paddock becoming tidal. Photo by Shane Kelly.

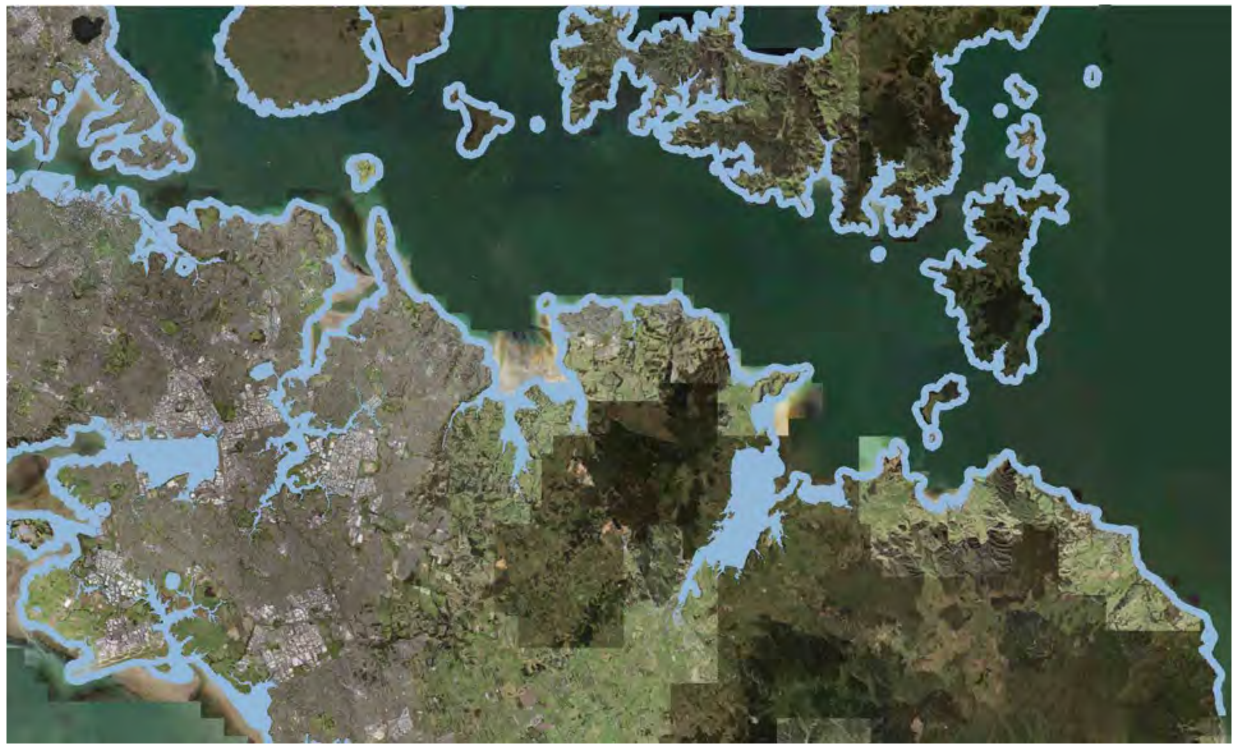


Figure 58: *Projected extent of coastal inundation in Auckland with a 1 m sea level rise during a 50-year storm event. Map from https://geomapspublic.aucklandcouncil.govt.nz*

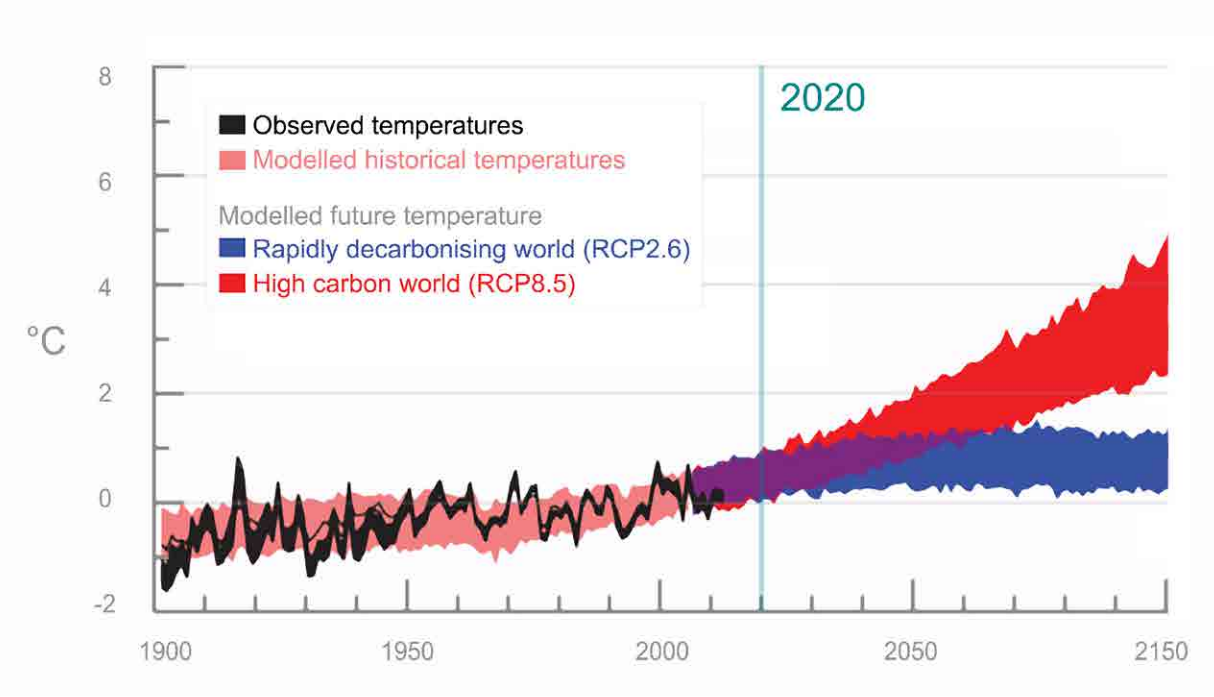


Figure 59: *Historical and predicted average temperature for New Zealand to 2100 for two Representative Concentration Pathways (RCP). RCP8.5 represents 'business as normal' while RCP2.6 represents a rapidly decarbonsing world (graph from NZ Climate Change Centre).*[129]

TE TAIAO

Biodiversity

Bryde's whale. Photo by Richard Robinson www.depth.co.nz

In Māori tradition, all elements of the natural world are related through whakapapa, starting with the creation of the world through the union of Ranginui and Papatuanuku and extending to all living things through their descendants. Traditional stories describe the origins and connections between species, as diverse as kauri and tohorā (whales). According to Ngāti Wai kaumātua, Hori Parata when Tāne (god of the forest) was making kauri he also decided to make a tohorā, which he gave to his brother Tangaroa (God of the sea). After a time, the tohorā returned to see the kauri, asking why don't you come and live with me in the sea. Upon the kauri refusing, the tohorā said that's all right, but take some of my skin. The kauri turned and said, ***"what would I want your skin for?"*** to which the tohorā replied, because ***"one day man is going to cut you down and turn you into a waka"***. [x]

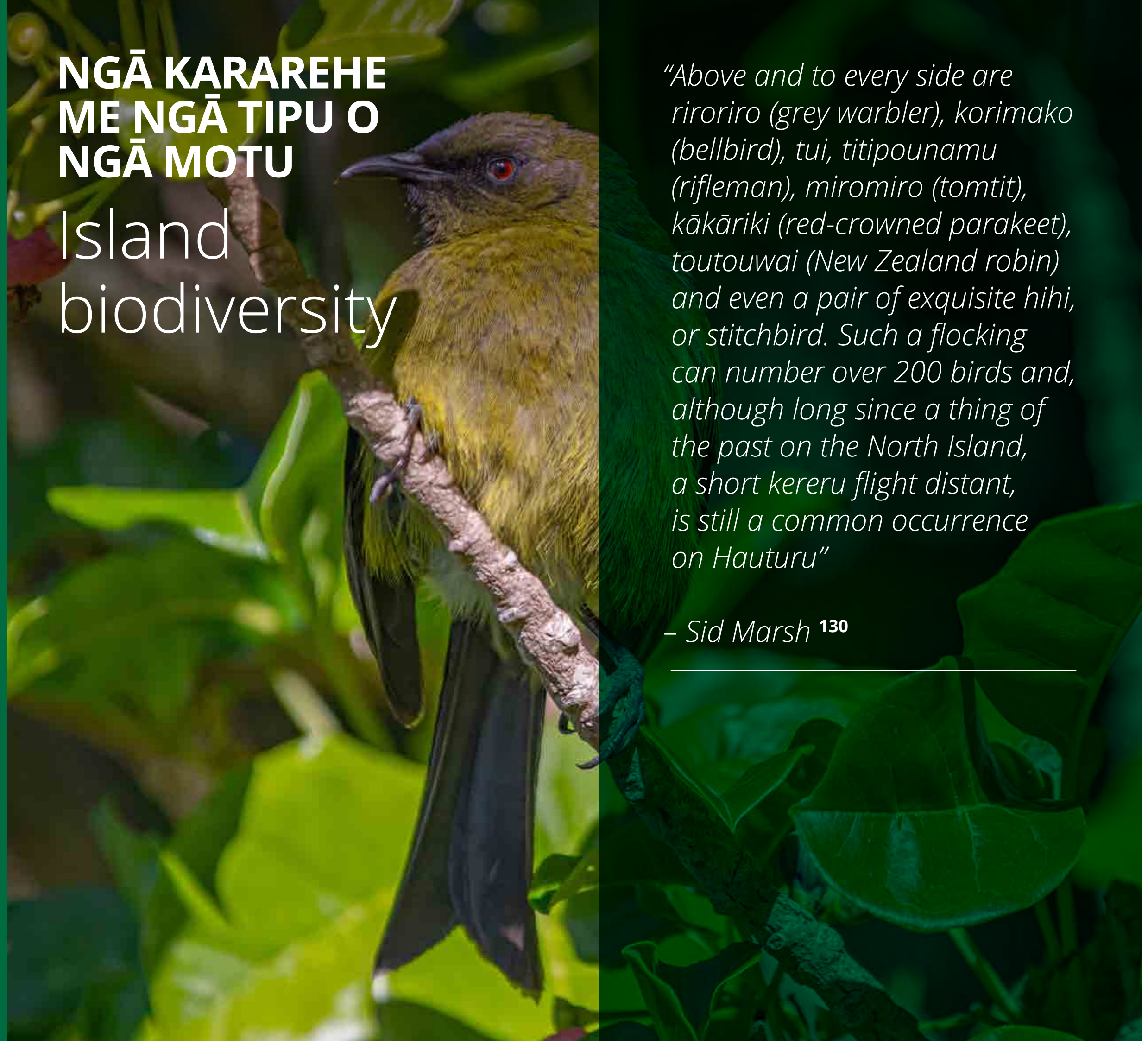
The inter-relatedness between people and the elements of nature underpins a belief that we belong to nature, rather than the other way around. In the Māori world view, we, along with plants, animals, and even inanimate objects all have a mauri (life force), which must be nurtured to maintain its strength. It is within that context we examine biodiversity in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. Note however, that biodiversity is an important component of most indicators in this report. Here we simply put the spotlight on five high-profile biodiversity topics: island biodiversity, Brdye's whales, seabirds, shorebirds, and the threat posed by non-indigenous marine species.

[x] https://vimeo.com/90155187

INDICATOR / TOHU

NGĀ KARAREHE ME NGĀ TIPU O NGĀ MOTU

Island biodiversity



"Above and to every side are riroriro (grey warbler), korimako (bellbird), tui, titipounamu (rifleman), miromiro (tomtit), kākāriki (red-crowned parakeet), toutouwai (New Zealand robin) and even a pair of exquisite hihi, or stitchbird. Such a flocking can number over 200 birds and, although long since a thing of the past on the North Island, a short kereru flight distant, is still a common occurrence on Hauturu"

– Sid Marsh [130]

Korimako on Hauturu. Photo by Shaun Lee.

The Islands of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi provide vital sanctuaries for Aotearoa's plants and animals. In particular, Hauturu and Aotea provide critical habitats or exclusive breeding locations for threatened species such as hihi (stitchbird), tīeke (North Island saddleback), North Island kōkako, New Zealand storm petrel, tāiko (black petrel), wētā punga, chevron skink and tuatara.

Most of the islands have been highly modified by human activities such as farming and urban development, and the introduction of pests and weeds. Eradication of mammalian pests and restoration of native vegetation on many of the islands have been instrumental to helping threatened species recover. Following pest eradication, birds, reptiles and insects can be moved to these safe havens to help establish new populations in multiple locations, which provide 'insurance' against catastrophic events.

Pest-free islands and their inhabitants are continuously threatened by re-invasions from mammalian pests that stowaway on boats, are deliberately brought onto the islands (including pets), or swim there. Islands are also threatened by diseases, weeds and non-mammalian pests, such as Argentine ants and plague skinks.

KEY EVENTS

Island restoration has been a massive undertaking by conservation workers and the community, who have worked for countless hours eradicating pests and weeds, and replanting trees. Over the last 20 years, mammalian pests have been eradicated from 16 islands, totaling 9,300 ha, in the Marine Park. Large revegetation programmes led by volunteer community groups and the Department of Conservation have occurred, or are in progress, on Tiritiri Matangi, Motuora, Motutapu, Motuihe and Rotoroa, which complement the pest eradications that have occurred on these islands.

20 YEARS AGO

25 islands were free of mammalian pests, covering an area of 1200 ha.

Average native forest cover on islands was 54%.

Re-invasions by mammalian pests can rapidly undo all this hard work, with a single pregnant female rat and her offspring able to produce up to 300 rats within one year.[132] Biosecurity staff and detection dogs deal with up to a dozen pest incursions in the Marine Park each year, from pests that have been deliberately introduced, accidentally landed with cargo, or have swum over.

Our most threatened species often require help with breeding. Captive breeding and translocation programmes have been established for several endangered species. A few such stories include:

Mercury Island tusked wētā, which have come back from the brink of probable extinction to 'Recovering' over the last 20 years due to a successful breeding programme and translocation to pest-free islands in the Marine Park.[133]

Tīeke, whose national population has increased from around 500 birds at the beginning of the 20th century to more than 6000 birds, mainly as a result of translocations to pest-free islands.[133,134]

North Island weka, North Island kōkako and pāteke (brown teal), which have improved from 'Nationally Endangered' to 'Recovering' over the last 20 years.

There are many more success stories. Species have been saved from certain extinction, pests have been eliminated, habitats restored, and population resilience built to protect against catastrophic events such as fire, pest reinvasion or disease.

South Island takahē on Tiritiri Mātangi. Photo by Shaun Lee.

TODAY

40 islands are free of mammalian pests[y], covering an area of around 10,000 ha (*Figure 60* and *Figure 61*).

Rākino Island is partially pest-free (domestic cats are allowed).

Rakitu Island was eradicated of pests in 2018 but has not been declared pest-free yet (requires two years).

Average native forest cover on islands in 2012 was 56% (*Figure 64*). Significant revegetation has occurred on Motuora (see *Figure 62* and *Figure 63*), Motuihe, Rotoroa, and moderate increases have occurred on Tiritiri Mātangi and Kawhitu.

2004: Hauturu became pest-free.

2009: Rangitoto and Motutapu became pest-free.

2014: Ahuahu become pest-free.

2016: Argentine ants eradicated from Tiritiri Matangi after a 15-year programme.

2016: Programme started to make Waiheke free of wild mammals.

2018: Introduction of the National Environment Targeted Rates in Auckland provides an addition $35.8 million for island biosecurity over the next 10 years.[131]

Dylan van Winkel with Mercury Island tusked wētā.

[y] This total is less than reported in the previous report due to better information on the status of some of the islands. Motuhaku, Broken, Motuoruhi, Waimate and Motutapere Islands are not completely pest-free.

Figure 60: *Mammalian pest free islands in the Marine Park. Rakino Island is partially pest-free as domestic cats are allowed on the island. A recent eradication has been conducted on Rakitu Island but it has not been declared pest-free yet.*

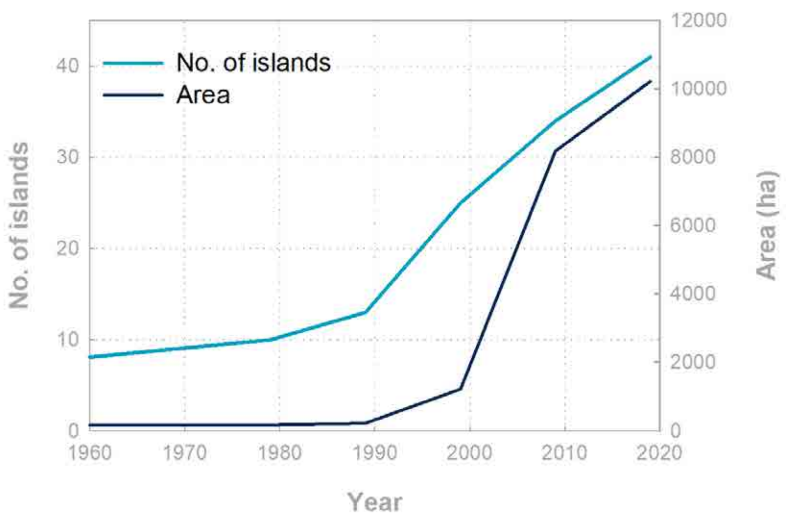


Figure 61: *Cumulative number of islands and land area that are free of mammalian pests in the Marine Park.*

Suter's skink on Motutapu Island. Photo by Shaun Lee.

Figure 62: *Motuora Island in 2000. Photo by Ray Lowe.*

Figure 63: *Motuora Island in 2012. More than 300,000 plants have now been planted on the island by the Motuora Island Restoration Trust. Photo by Tony Shanley.*

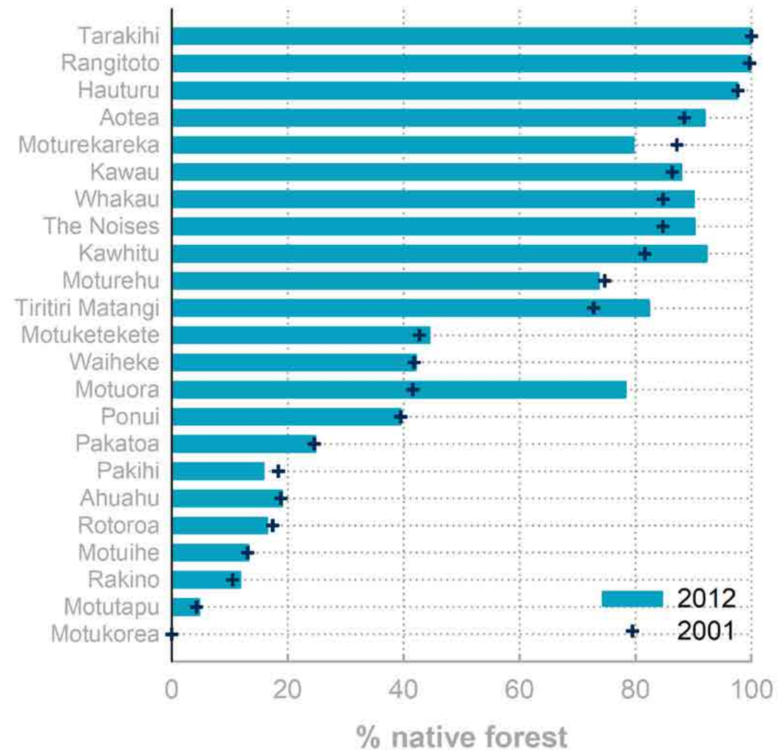
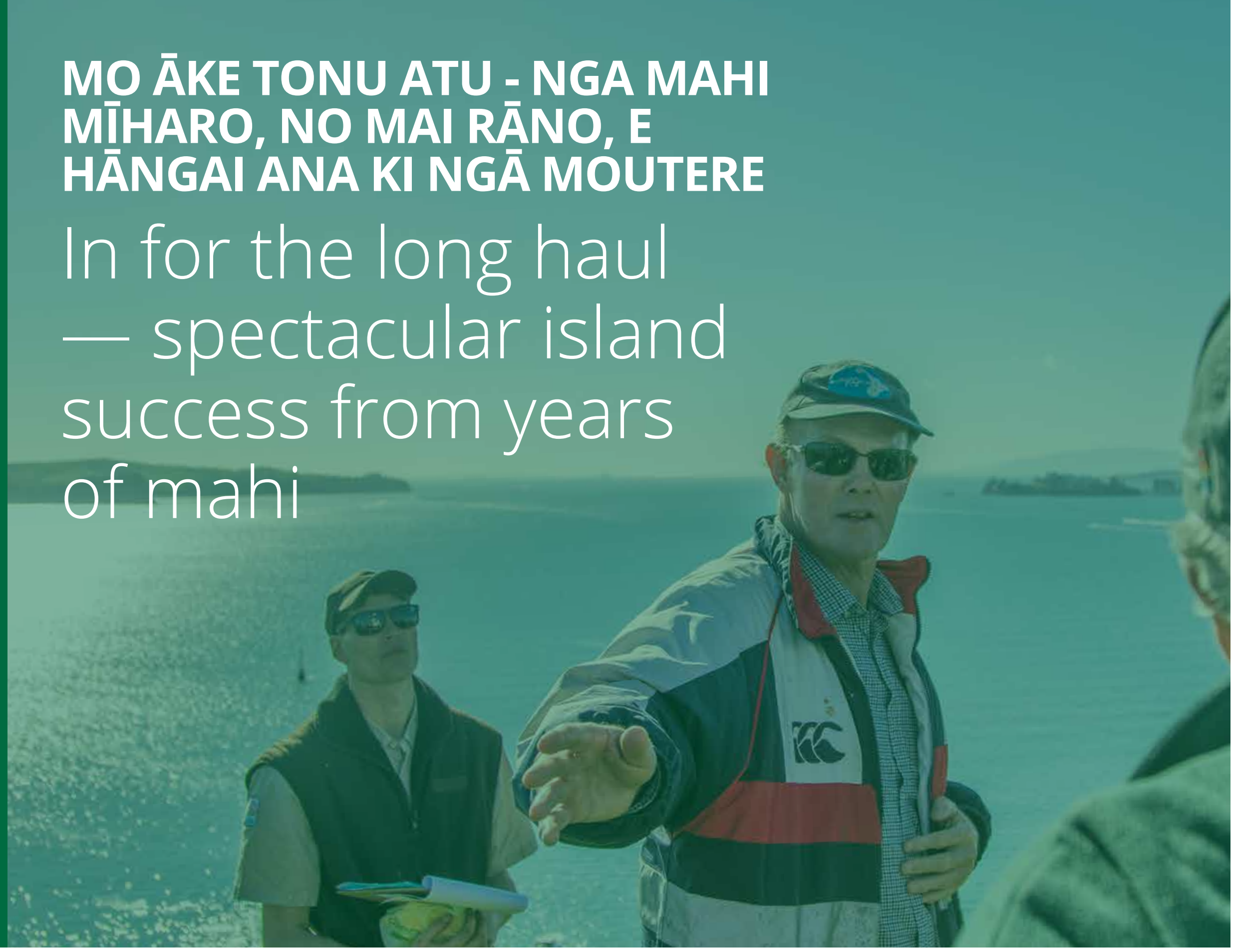


Figure 64: *Change in the percentage of island covered by native forests between 2001 and 2012. Data from LCDB 2 and LCDB 4.1.*

CASE STUDY / HE MAHI RANGAHAU

MO ĀKE TONU ATU - NGA MAHI MĪHARO, NO MAI RĀNO, E HĀNGAI ANA KI NGĀ MOUTERE

In for the long haul — spectacular island success from years of mahi



Weeding team on Motukorea. Photo by Shaun Lee.

The motu (islands) of the Marine Park have benefited from decades of hard graft by a multitude of people, many of them volunteers. That work started more than a century ago and has built into an enthusiastic assemblage of people and organisations who are directly involved in, or support, the restoration and preservation of terrestrial biodiversity in and around the Marine Park. Trusts, societies, groups and landowners are now involved in conservation efforts on Ahuahu (Great Mercury), Aotea (Great Barrier Island), Hauturu (Little Barrier), Kaikōura, Motuihe, Motuora, Motutapu, Noises, Pakihi, Rangitoto, Rotoroa, Tiritiri Mātangi, Waiheke, and no doubt, other islands. Conservation groups are also supporting efforts in mainland ***"islands"*** including the Shakespear and Tāwharanui open sanctuaries.

The isolation of motu has allowed them to become bastions of indigenous biodiversity. Over the years many have been replanted, introduced mammalian and other pests eradicated, and native birds, reptiles and insects have been translocated among areas, allowing populations to rebuild. Risks of inbreeding and catastrophic events such as fire, disease, or the reintroduction of predators are reduced by moving animals among islands.

Many motu are (or have) ***"open sanctuaries"***, meaning the public is allowed access. This gives people the opportunity to observe landscapes being transformed, hear birdsong return and see vulnerable creatures that have long disappeared from the mainland. For some motu such as Hauturu (Little Barrier), the taonga (treasures) they protect are too rare and precious to allow open public access. The threats that weeds, soil fragments, and animal pests pose to the rare indigenous plants and animals are simply too great to allow people to land without a permit and proper biosecurity screening.

The gains we have seen could not have been achieved without a steady stream of volunteers, who give their time and energy to planting trees and carrying out a variety of other chores. What may not be obvious, is the incredible amount of work that sits behind every tree planted or trap checked. That happens behind the scenes, usually by small teams of dedicated individuals, often working on a voluntary basis. They engage with tangata whenua; liaise with management organisations; manage health and safety, take bookings, organise resources, answer queries; plan work; fundraise; and spend their evenings sharing knowledge with others.

Conservation efforts don't come cheap. Money is needed for nurseries, traps, bait, fencing, walkways, facilities, transport, expertise and the plethora of other resources needed to enable and sustain conservation efforts. Small donations are a big part of that. Large grants are also essential. Major funders such as Foundation North with its Gulf Innovation Fund Together (G.I.F.T) initiative allow the big, ambitious projects to be undertaken. Te Korowai o Waiheke's, Predator Free Waiheke programme is one example. If successful, that project will see Waiheke Island become our first predator-free populated island, paving the way for similar efforts in other areas. Another example is the innovative approaches to conservation on Rotoroa Island funded by the NEXT Foundation. In 2008, the Foundation obtained a 99-year lease of Rotoroa and immediately set about transforming its landscape by removing pine trees and planting natives. It then moved to creating a wildlife sanctuary in partnership with Auckland Zoo, where endangered animals, including takahē, tīeke (saddleback), kiwi, skinks and pāteke (brown teal) could be released.

A common thread that runs through the individuals and organisations involved in conservation within the Marine Park is a tireless drive to nurture and grow our ledger of indigenous biodiversity, to leave a better legacy for the future. The people involved require enthusiasm, vision and stamina. They know they are in for the long haul. The mahi (work) of rebuilding populations of rare species and keeping them safe is unlikely to end anytime soon.

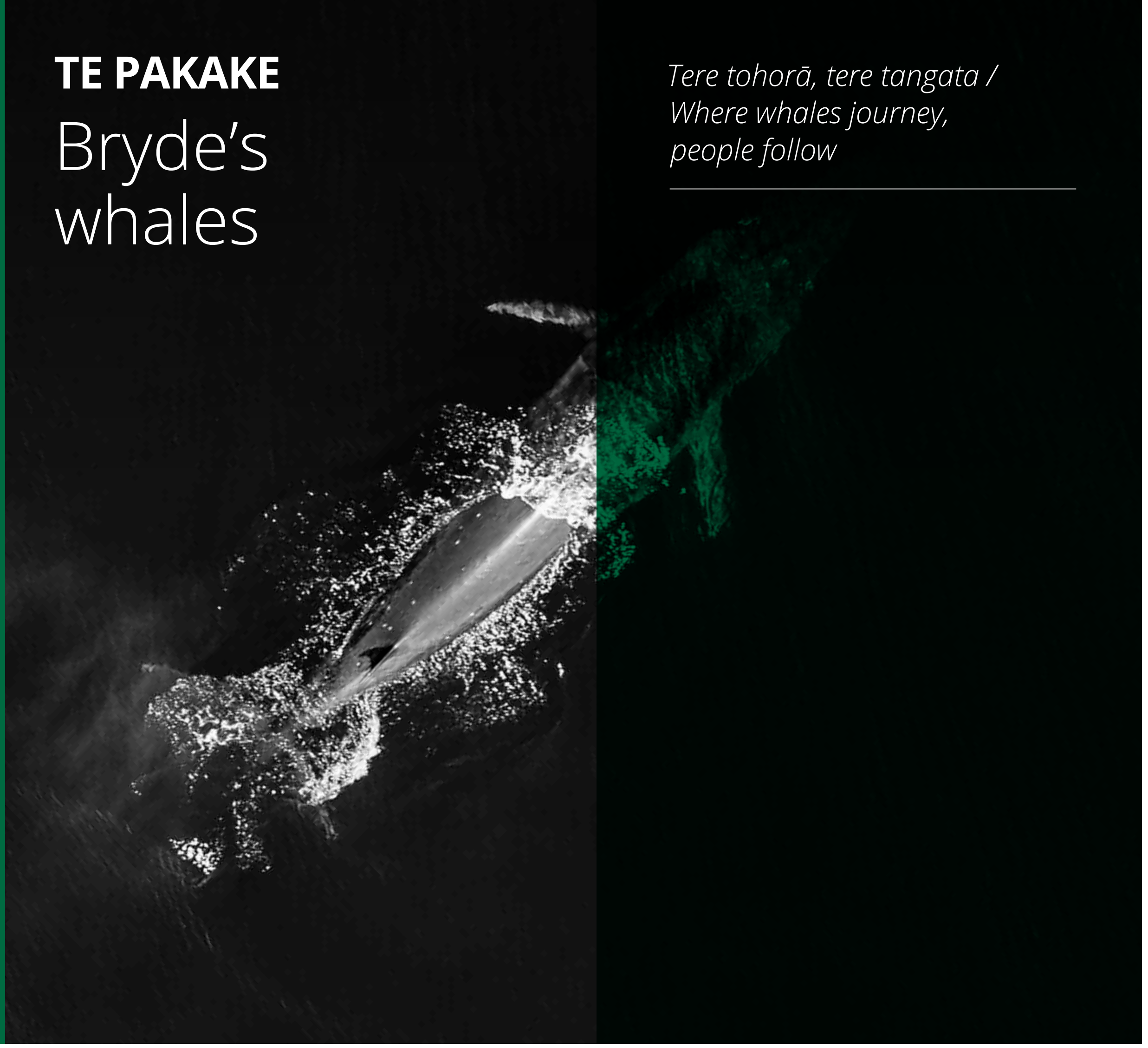
Large crane flies mating on Motutapu Island. Photo by Shaun Lee.

Kakariki on Tiritiri Matangi. Photo by Shaun Lee.

INDICATOR / TOHU

TE PAKAKE
Bryde's whales

Tere tohorā, tere tangata / Where whales journey, people follow



Bryde's whale. Photo by Richard Robinson www.depth.co.nz

The Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi is a special place for the Nationally Critical Bryde's whale. It is one of only three places in the world where these whales live in coastal waters, with around 135 Bryde's whales using the Marine Park.[135] Bryde's whales are most frequently seen in the area between Kawau Island, Waiheke and Aotea (*Figure 65*), where they spend around 90% of their time in surface waters resting and feeding on small schooling fish and zooplankton[136]. They need to eat a lot (600–650 kg per day) to maintain their body size,[137] making them vulnerable to declines in prey availability due to fishing, environmental degradation or climate change.

20 YEARS AGO

Bryde's whale had a Nationally Critical conservation status in 2002.

Between 1995 and 2000, six whales had, or were likely to have been killed by ship strike in the Marine Park.[138]

Small fish such as pilchards and saury were the primary food for Bryde's whales.[139]

TODAY

No change in the conservation status of Bryde's whales due to their small population size.

There has been only one ship strike death since the voluntary transit protocol introduced in 2013 limited ship speeds to 10 knots *(Figure 66).*

Zooplankton, especially krill, copepods and salps, are the main food for Bryde's whales. The reason for this switch to lower calorific zooplankton is unknown, but it might be an indication of declines in the abundance of baitfish, such as pilchards, in the Marine Park.[136,140,141]

2013: Voluntary transit protocol was introduced by the Ports of Auckland.

Bryde's whale. Photo by Aucklandwhale.

KEY EVENTS

In the past, a key threat to Bryde's whales was ship strike. The Marine Park is one of the busiest waterways in Aotearoa, with the Ports of Auckland handling around 1,400 ship calls per year. Bryde's whales are particularly vulnerable to being hit by fast-moving ships because they spend most of their time in surface waters. Between 1989 and 2014, 17 whales were likely to have been killed by ship strike, three whales died from entanglement with fishing or aquaculture gear, and 25 whales died from unknown causes.

An average ship strike rate of 2.3 whales per year was unsustainable for the Marine Park's Bryde's whale population given their small population size and low reproductive rate (1 calf every 2–3 years).[139] Concerned scientists, environmental organisations, the shipping industry, government staff and tangata whenua started working together in 2011 to try and reduce the ship strike rate. The most feasible solution was to try and get large ships to slow down to 10 knots in the Marine Park. In 2013, a voluntary transit protocol was introduced by the Ports of Auckland and largely adopted in 2014. There has been overwhelming support for this protocol amongst the shipping industry, and the average speed of large vessels has dropped from 13.2 knots to 10 knots.[139] Only one whale has been killed by ship strike since the protocol was introduced (*Figure 66*), showing that the speed reduction has had a major positive impact on local Bryde's whales.

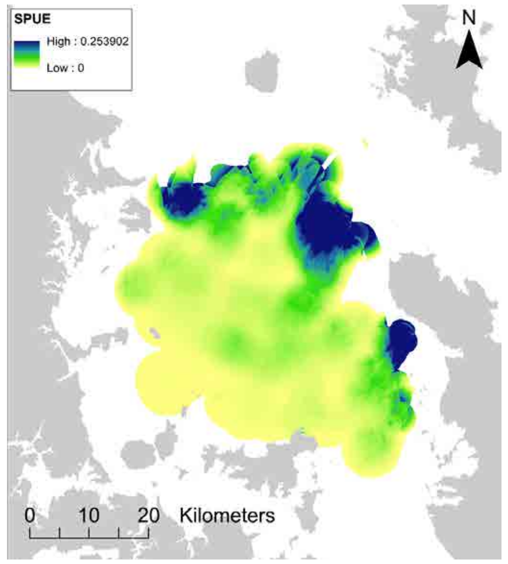


Figure 65: *Sightings per unit effort of Bryde's whales in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi between October 2014 and September 2016. Figure reproduced from Ebdon, 2017.*[142]

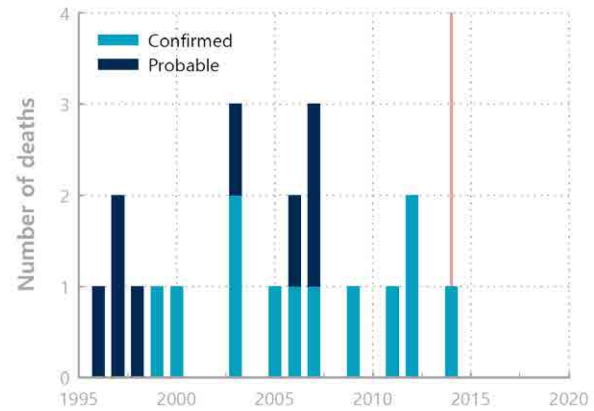


Figure 66: *Number of confirmed and probable ship strike deaths of Bryde's whales in the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. The pink line shows when the voluntary transit protocol was adopted (Data from the Department of Conservation).*

CASE STUDY / HE MAHI RANGAHAU

E ĀTA HAERE ANA NGĀ MAHI KAITIAKI I TE MOANA

Slow progress on marine protection

Child snorkeling at Cape Rodney to Okakari Point (Goat Island) Marine Reserve. Photo by Shaun Lee.

Protected areas such as marine reserves are a critical tool for marine conservation. They don't protect against everything we do, but amazing things can happen if you put large enough reserves in the right place. Despite this, progress on building a network of marine protected areas in the Marine Park has stalled.

When announcing her decision to approve the proposal for Te Matuku Marine Reserve in 2002, the Hon Sandra Lee, Minister of Conservation stated *"The government will be introducing a new Marine Reserves Bill later this year to streamline the process of creating marine reserves, and change their focus to gave [sic] greater concentration on the protection of marine biodiversity"*[z]. Eighteen years later, the 1971 Marine Reserves Act remains unchanged and no new marine protected areas (MPAs) have been created in the Marine Park[aa].

The polarised nature of public, political, industry, tangata whenua and broader Māori standpoints on MPAs and has contributed to the lack of progress. The story of the marine reserve proposed for Aotea (Great Barrier Island) in 2003, illustrates the difficulties involved. The proposal by the Department of Conservation, was met with enthusiasm by supporters of marine protection, but not by tangata whenua, island locals, and broader recreational and commercial fishing groups.

Despite approval by the Minister of Conservation and Minister of Transport in 2004, the proposal was ultimately rejected in 2008 by the Fisheries Minister, Hon Jim Anderton. In a media statement on his decision, Mr Anderton cited concerns about Ngāti Rehua being excluded from traditional fishing grounds and wāhi tapu sites. He also noted that many island residents rely on the sea for food and income. Effects on recreational and commercial fishers were also considered. Mr Anderton concluded that:

"Balancing marine protection and these varied interests requires careful consideration. The way forward is to use the Marine Protected Areas Policy and Implementation Plan (MPA Policy) to explore further protective measures around Great Barrier Island and the northeast bio-geographical region that extends from the tip of the North Island to East Cape."

Since then, no progress has been made through that process.

However, the Hauraki Gulf Marine Spatial Plan, Sea Change – Tai Timu Tai Pari released in 2016 provides a potential blueprint for breaking through barriers to new MPAs. It contains several novel elements:

- Being developed through a collaborative process, with tangata whenua, conservation groups, fishers and other stakeholders coming together to produce a plan that specifically provides for MPAs.
- Proposing broader purposes for MPAs than that provided under the Marine Reserves Act (1971), that includes having a network of four types of MPAs in the Marine Park:
  - **Type 1**: no take marine reserves (other than for customary purposes on a case by case basis by special permit).
  - **Type 2**: benthic protection (restrict all commercial and recreational fishing methods that impact on the benthic habitat).
  - **Special Management Areas** (no commercial fishing allowed and restricted recreational fishing allowed).
  - **Ahu Moana** (mana whenua and community co-management areas).
- Proposing a nested design, whereby heavily restricted areas could be nested within larger areas where some recreational and commercial activity is permitted but benthic protections remain.
- Identifying specific areas for the MPAs.

Juvenile crayfish at Tāwharanui Marine Reserve. Photo by Shaun Lee.

Central government is considering how to respond to Sea Change, and the Hauraki Gulf Forum adopted an ambitious goal of protecting 20% of waters in the Marine Park.

One of the areas identified in Sea Change was around part of the Noises Island group, owned by the Neureuter whānau. Over the year's family members have watched flotillas of boats reap their harvest of fish and shellfish around the islands. They talk about losing kōura. Scallop beds being depleted. Fish getting smaller and harder to catch. Seabird numbers in decline. In response the family have been advocating for protection around the islands and have been building a groundswell of support.

Another grass-roots initiative is the Waiheke Collective's *"Waiheke Marine Project"* being championed by Ngāti Paoa and supported by locals. Ngāti Paoa leadership is essential, with whānau representatives highlighting:

As descendants of Ngāti Paoa, we continue to uphold our rangatiratanga to Tāmaki Makaurau, Tikapa and Te Waitematā. Our whakapapa and deep cultural narratives affirm our relationship and association to our many sites of significance across the rohe.

This hononga between past, present and future is exercised through active kaitiakitanga, manaakitanga and rangatiratanga. We acknowledge those pathways laid before us by our ancestors and our ongoing commitment to uphold our mana motuhake for our future generations[bb].

The project aims to address marine issues through collaboration and the fostering of whanaungatanga (kinship). It is hoped that bringing people together to share stories, experiences and knowledge, will naturally lead to collective action and positive marine outcomes. Proposals to establish MPAs may be part of the package, but decisions about that will be made further down the track.

Against this 20-year background, it is worth reflecting on the fact that to date, only 40 km^2 of the around 14,000 km^2 of coastal habitat

[z] The current Marine Reserves Act preserves for scientific study, areas of New Zealand that contain underwater scenery, natural features, or marine life, of such distinctive quality, or that is so typical, beautiful, or unique, that it is in the national interest for them to be preserved.

[aa] Tāwharanui Marine Park was converted to the Marine Reserve, but the change had no tangible effect on its level of protection.

[bb] Personal communication Lucy Tukua, Ngāti Paoa.

Benefits of fully protected marine reserves

No-take marine reserves have been around for more than 40 years. They protect taonga like giant koura and tāmure you rarely see elsewhere. Their benefits are well proven. New forms of marine protection may compliment no-take reserves in the future, but we also need more places where Our Taonga, Our Heritage doesn't get eaten.

Education
Marine reserves provide a natural classroom for teachers and students to learn about the natural environment and obtain experiences that aren't available elsewhere. They are utilised by classes from primary to tertiary levels.

Photo by Kennedy Warne

As kaitiaki in the broadest sense, we have an obligation to preserve natural examples of marine ecosystems. *"It is surely ridiculous, if not actually contemptible, that while boasting to our grandchildren of the crevices we knew packed with crayfish we cannot even show them one like that."* Ballantine (1991) Marine reserves for New Zealand. University of Auckland, Leigh Laboratory Bulletin 25.

Benchmarking
Reserves provide reference points for assessing the impacts of our activities elsewhere.

Complimentary data source
Data obtained from marine reserve monitoring compliments fisheries information and that provided through matauranga Māori.

Science
Marine reserves are a natural laboratory. They have contributed massively to our understanding of marine ecology and ecological processes. Many of our leading marine scientists studied and conducted research in marine reserves at Leigh, Tāwharanui, Hāhei and elsewhere.

Spillover
The spillover of fish larvae from marine reserves can make a disproportionate contribution to populations outside. Adult snapper within the reserve at Leigh were estimated to contribute 10.6% of newly settled juveniles to the surrounding 400 km^2 area, with no decreasing trend up to 40km away*.

23.3X
more snapper eggs!

Fished
Reserve

300,000
people visit the Cape Rodney-Okakari Point Marine Reserve every year.

Recreation and tourism
Marine reserves provide rich, natural experiences that people seek out in the Marine Park.

Return On Investment
The benefits of marine reserves can be achieved with little direct cost, a 2008 study of the reserve at Leigh indicated it generated $18.6 million a year for the local economy at a cost of around $70,000 for DoC.

$.07m ➔ **$18m**

Marine conservation
Fully protected marine reserves allow natural populations and communities to regenerate. The behaviours of marine species often change as individuals and populations grow. Reserves are now the only places where "natural" populations, and behaviours of species like kina and kōura can be reliably seen in the Marine Park.

Insurance
Marine reverses provide an insurance against calamity and uncertainty. The world is uncertain and there is a lot about the ocean we don't know. Networks of marine reserves build resilience into coastal management.

*However, the spillover of adults can diminish reserve populations, as has happened to kōura at Leigh. Reserves therefore need to be sized to contain key species.

in the Marine Park has been set aside to protect marine life — for scientific study. Of that, 33 km² existed when the Marine Park was established. In comparison, around 744 km² of the marine space has been set aside to protect cables. And no areas have been established to simply conserve marine biodiversity for its natural intrinsic values, as that is not provided for under the current Marine Reserves Act. This seems to suggest that protecting marine biodiversity is an extremely hard thing to do.

But is it? According to the father of marine reserves in Aotearoa, Dr Bill Ballantine, we simply need to do nothing[cc].

"People think the reserve is the experiment because in human terms you have to pass laws, make arrangements. When in actual terms, what you do in a marine reserve is nothing. So you can't claim any credit for it. What happens outside is what we did. And that's comparatively speaking a desert."

"The first thing I try and tell people is how amazing a negative is. There's no razor wire. There's no armed guard. There isn't even a uniformed ranger. It's no big deal. It's just a piece of sea we decided not to disturb."

Red moki at the Cape Rodney to Okakari Point (Goat Island) Marine Reserve. Photo by Shaun Lee.

John dory at the Cape Rodney to Okakari Point (Goat Island) Marine Reserve. Photo by Shaun Lee.

[cc] Excerpts from RNZ interview with Dr. Bill Ballantine (5 Nov. 2015) discussing the Cape Rodney to Okakari Point (Goat Island) Marine Reserve.

Spotted shag. Photo by Shaun Lee.

NGĀ MANU O TE MOANA
Seabirds

"The decline of the spotted shags may tell a larger story about the state of Auckland's waterways and particularly the Hauraki Gulf. Spotted shags feed on small baitfish such as anchovies and pilchards and those species are now in short supply"

– Dr Tim Lovegrove [143]

INDICATOR / TOHU

Seabirds are a diverse group of birds that all spend part of their life feeding over open sea. The Marine Park is a globally significant seabird hotspot. Over 70 seabird species (around 20% of the world's seabird species) utilise the region and 27 species are known to breed in the region, of which, 59% are endemic to Aotearoa. Four species (Buller's shearwater, Pycroft's petrel, black petrel, and New Zealand storm petrel), breed exclusively in the Marine Park. The Marine Park also includes significant populations of other species (New Zealand fairy tern, grey-faced petrel, Cook's petrel, fluttering shearwater, Australasian gannet, and flesh-footed shearwater).[144,145]

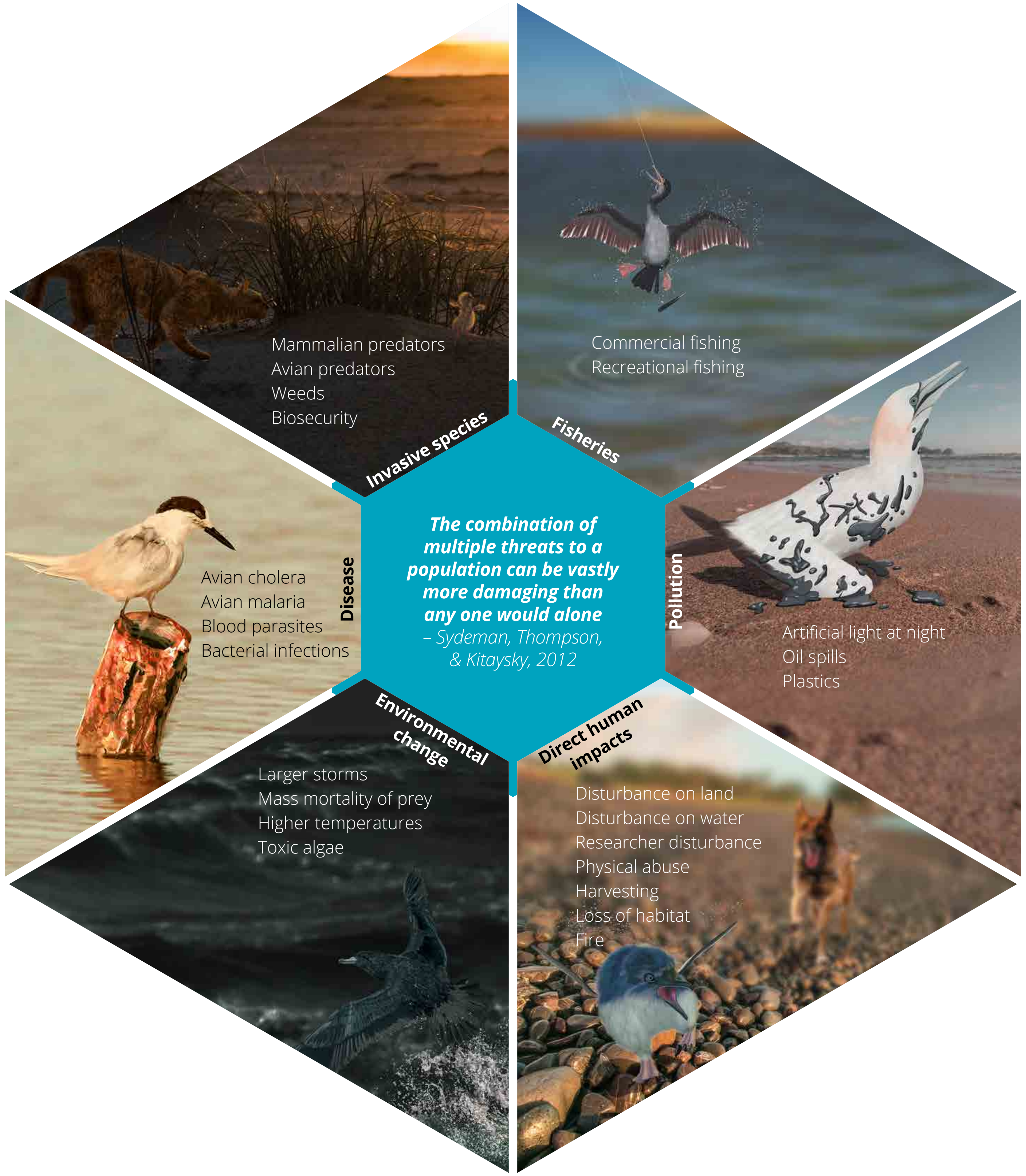
Seabirds are important ecosystem engineers for islands — their droppings add nutrients to the soil that is mixed by their burrowing activity, which alters the composition and growth of plants, invertebrates and reptiles on the island.[146]

Seabirds are often used as indicators of the health of the marine environment because they are sensitive to changes in prey availability. Seabirds are generally long-lived, slow to mature, and have low fecundity, making them vulnerable to key threats such as fishing, predation, marine pollution, human disturbance, disease, climate change, and loss of prey and habitats (*see Figure 67*).[147]

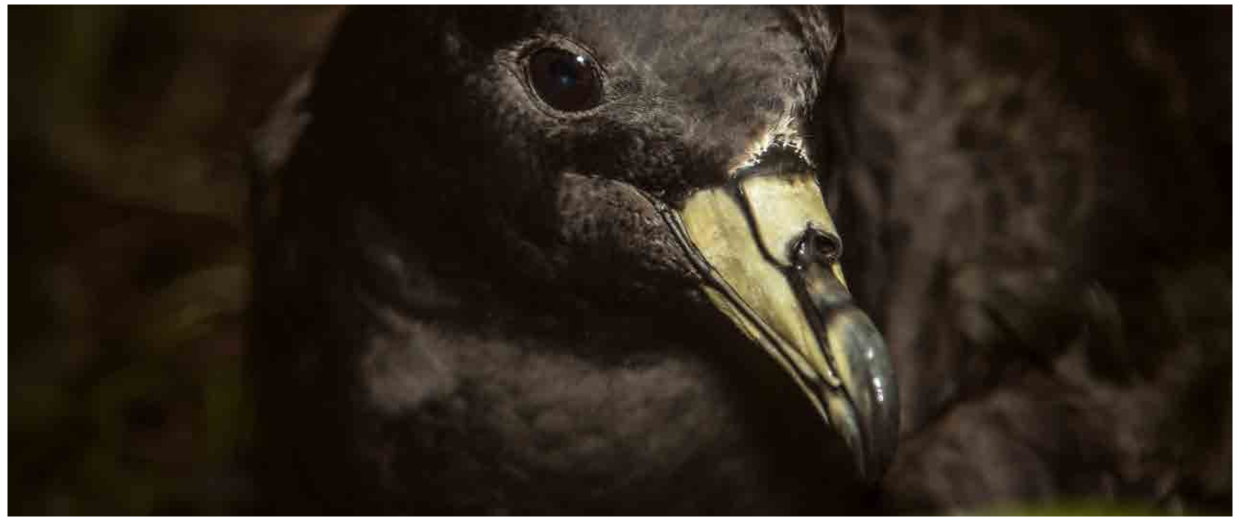
KEY EVENTS

Aotearoa seabirds have not evolved to deal with mammalian predators, and have very poor breeding success when mammalian predators are present. All mammalian pests have been eradicated from 16 islands in the Marine Park since 2000 (*see Page 132*) and the seabird breeding success on these islands has greatly improved.[152,153] However, despite this, the conservation status of the majority of seabirds that breed in the Marine Park has not improved.

Figure 67: *Seabirds in the Gulf are subject to multiple threats throughout their range*



For more information see Whitehead 2019



Tāiko on Aotea. Photo by Shaun Lee.

20 YEARS AGO

Of the seabird species that breed in the Marine Park: 4% were Threatened, 53% were At Risk, and 44% were Not Threatened[148].

Over 9000 seabirds were estimated to be captured by commercial fisheries nationally, which included nearly 500 tāiko (black petrel) and a similar number of toanui (flesh-footed shearwaters).

2003: New Zealand storm petrel found to be living.

2004: First National Seabird Action Plan released.

2010: Appointment of a seabird liaison officer to work with the northeast Aotearoa longline fishing industry to reduce seabird bycatch.

2013: Second National Seabird Action Plan released.

2014: DOC start a Protected Species Liaison Project for inshore fisheries. A liaison officer helps fishers develop and implement management plans to reduce seabird bycatch.

2014: Establishment of the Black Petrel Working Group that includes members of the fishing industry, environment groups, iwi and government, who pledge to decrease tāiko bycatch rates in northeastern Aotearoa.

2018: Mass mortality of little blue penguins in northeast Aotearoa was thought to be caused by starvation due to warm and stormy La Niña conditions[47].

2018: Auckland Council establishes a regional Seabird and Shorebird Monitoring and Research programme that received funding from the Natural Environment Targeted Rates.

2019: 2020 National Seabird Action Plan released for consultation.

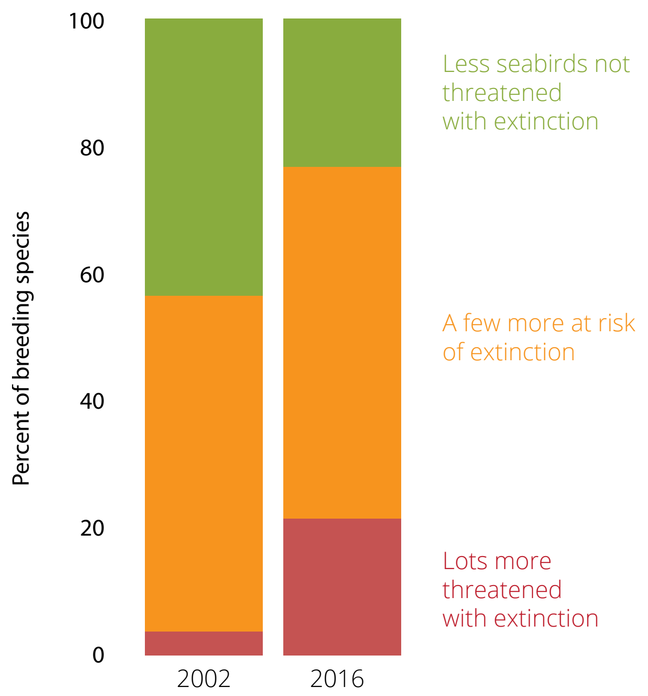
TODAY

Of the seabird species that breed in the Marine Park:

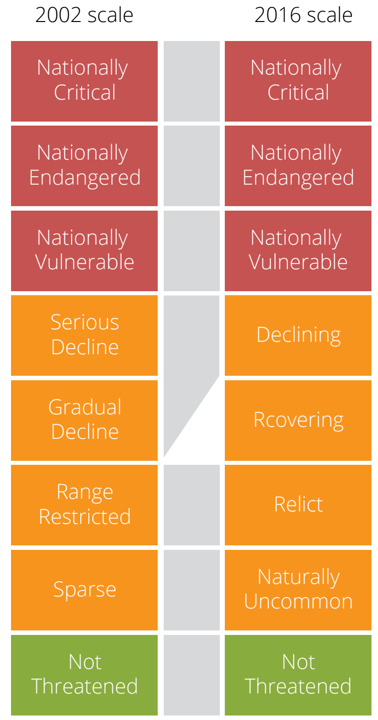
- 22% were Threatened, 56% were At Risk, and 22% were Not Threatened (*Figure 68*)[149];
- only one species has improved in status — the NZ storm petrel has improved from presumed Extinct to Nationally Vulnerable;
- New Zealand fairy tern are in a perilous situation. Estimates of their population size vary slightly, but there is currently considered to be a maximum of only 43 adults left anywhere in the world, and numbers have not increased over the past decade. Fairy tern require intensive management, with habitat loss, disturbances, and predation identified as significant impediments to their survival and recovery (Anthony Beauchamp, Department of Conservation, Whangarei).
- black-billed gulls have decreased from Serious Decline to Nationally Critical;
- red-billed gulls have decreased from Not Threatened to Declining;
- tāiko and toanui have decreased from Gradual Decline to Nationally Vulnerable.

The number of seabirds captured by commercial fisheries has decreased by 54% (*Figure 69*). Similar reductions have been made in the number of tāiko (-61%) and toanui (-52%) captured (*Figure 70* and *Figure 71*).

The New Zealand storm petrel has been rediscovered. Decades after they were considered extinct, New Zealand storm petrel were spectacularly photographed and videoed in 2003.[150] They were subsequently found to be breeding on Hauturu, with a potential population of hundreds, if not thousands of birds.[151]



Changes in risk of extinction for Gulf seabirds



Minor changes in threat classification scale

Figure 68: *Change in the conservation status of seabirds that breed in the Marine Park. Note that the assessment criteria and category names have changed slightly between 2002 and 2016.*

Other threats to seabirds, both within and beyond the boundaries of the Marine Park, are likely to be preventing population recovery. For example, the mass mortality of thousands of little blue penguins in 2018 was thought to be caused by warm and stormy La Niña conditions, which resulted in less prey and more difficult feeding conditions.

In addition, around 188 tāiko and 239 toanui were captured by the small vessel bottom longline fishery in 2016–17, with the majority of these captured in northeastern Aotearoa[36]. Implementation of a variety of mitigation methods have successfully decreased bycatch rates by over 50% since 2002. These methods include providing training to longline fishers on seabird smart fishing practices and employment of seabird liaison officers to assist industry in the development of seabird risk management plans. However, current capture rates are still of grave concern due to the small size of the populations. Tāiko was assessed as the species most at risk from commercial fishing. The likelihood that the annual potential fatalities from commercial fishing is greater than what the population can sustain was estimated to be 70%. All other seabirds had a likelihood of less than 5%.[37]

Research conducted under Auckland Council's new Seabird and Shorebird Monitoring and Research programme will help provide us with a better understanding of seabirds that utilise the Marine Park. Seabird surveys are underway on the Mokohinau Islands, shag surveys have been conducted in the inner Marine Park, and a decoy pārekareka / spotted shag colony has been created on Otata Island (Noises Group) to try and attract wild shags to the island.

Tāiko caught by a small vessel inshore trawling. Photo released by MPI.

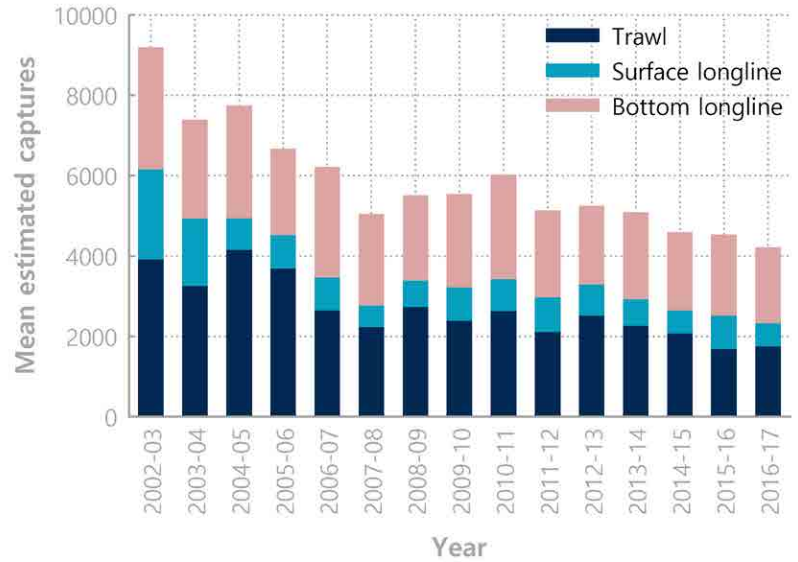


Figure 69: *Estimated number of seabirds caught nationally by commercial fisheries between 2002–03 and 2016–17.*[147,154,155]

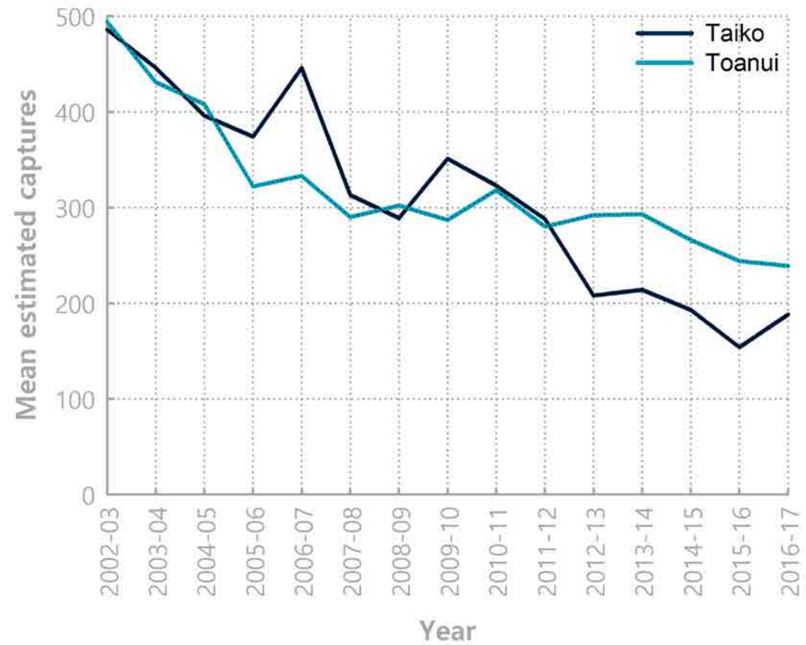


Figure 70: *Estimated number of tāiko and toanui caught nationally by the small vessel bottom longline fishery between 2002–03 and 2016–17.*[147,154,155]

Toanui caught by a small vessel snapper longlining. Photo released by MPI.

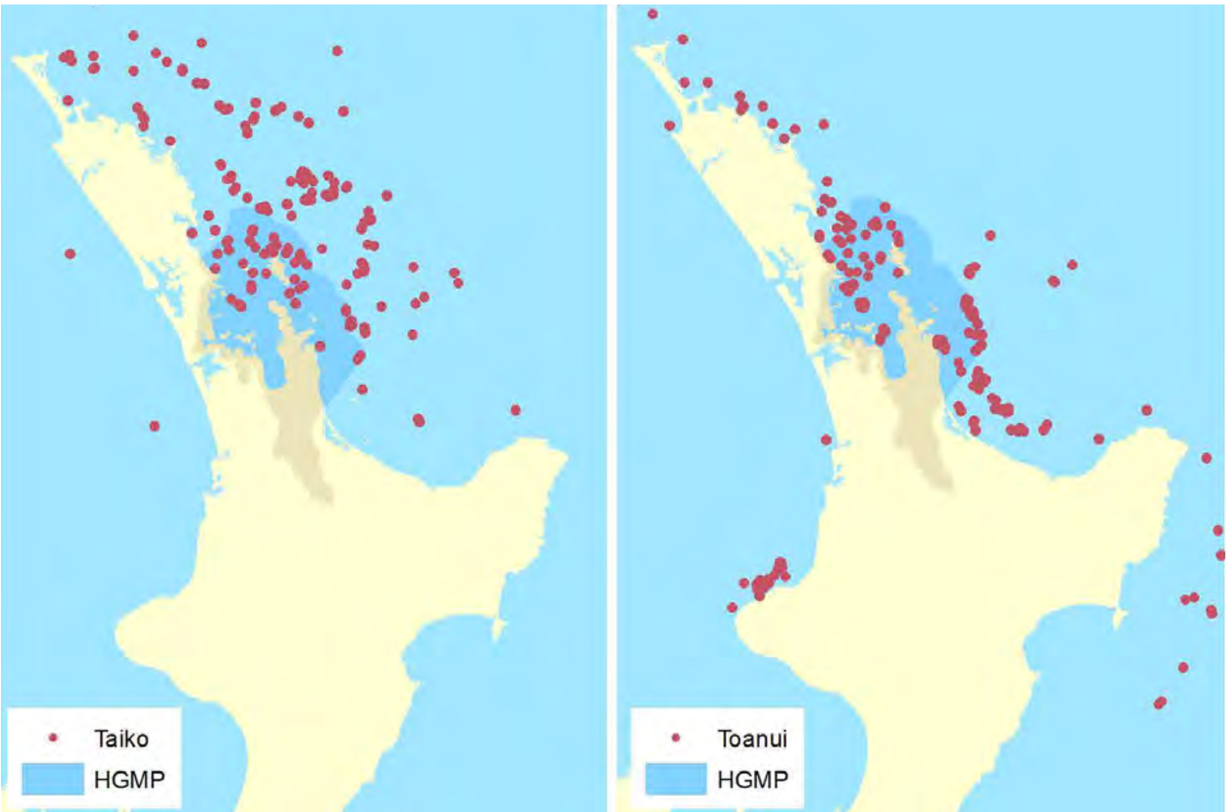
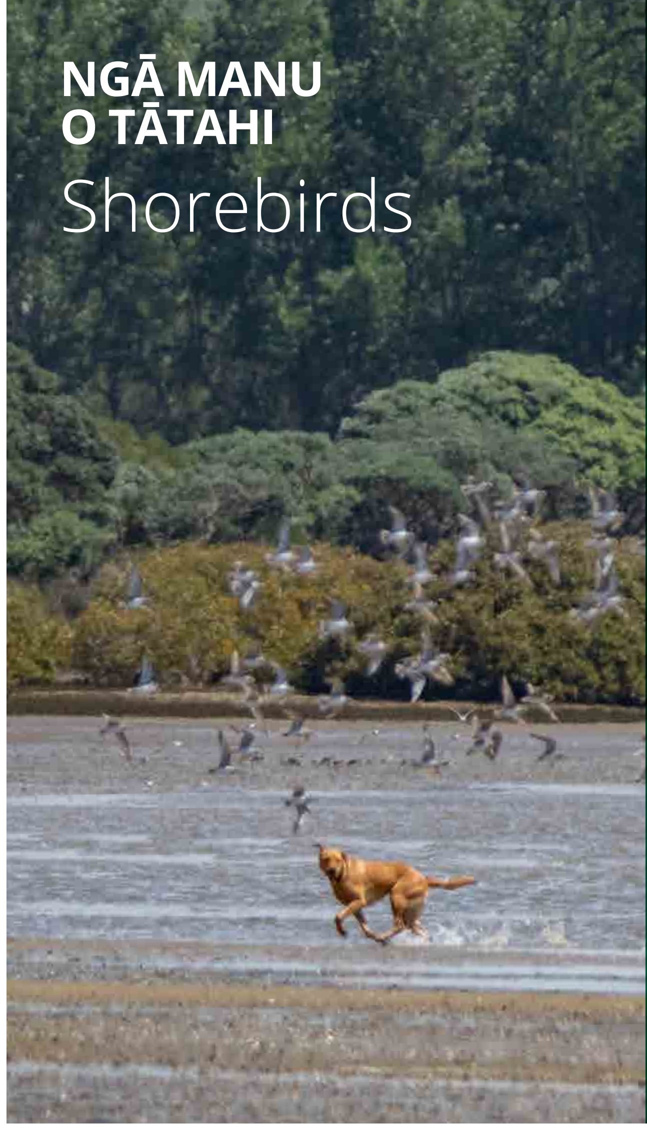


Figure 71: *Locations of observed captures of tāiko and toanui by commercial fisheries between 2002–2003 and 2017–18.*[156]



Dog chasing lesser knot at Tern Point. Photo by Shaun Lee.

NGĀ MANU O TĀTAHI
Shorebirds

"Most of the world's surface is useless to a shorebird...so the relatively few places that still suit the birds' needs are important beyond measure"

– Scott Weidensaul [157]

INDICATOR / TOHU

Shorebirds or waders are birds that feed on our coastal shores. Many species are migratory, flying between the northern and southern hemisphere. The Firth of Thames is an internationally important feeding ground for shorebirds with around 35,000 birds from 43 shorebird species using the area each year. The most common species seen are South Island pied oystercatcher, bar-tailed godwit, wrybill, pied stilt and lesser knot. These five species have made up 95% of the birds counted in the Firth of Thames in the last few years.

The Miranda Coast is the most important wintering ground for the Nationally Vulnerable, endemic wrybill. Up to 40% of the population over winters in the Firth of Thames before returning to South Island rivers to breed. The Firth is also a breeding ground for the endemic[dd] Northern New Zealand dotterel and variable oystercatcher.[158]

KEY EVENTS

Eradication of mammalian pests from island and the creation of mainland sanctuaries such as Tāwharanui, Shakespear Regional Park and Omaha Shorebird Sanctuary have helped provided safe habitats for vulnerable shorebirds.

Two species of shorebird, New Zealand dotterel and shore plover, are actively managed in the Marine Park. The management programme for New Zealand dotterel started in the 1980s. Predator control, fencing of nest sites, and watching of nests by volunteer 'dotterel minders' and Department of Conservation staff has greatly increased the breeding success of birds. The population of northern New Zealand dotterel has doubled since the programme began to 2,500 birds, and the conservation status of the subspecies has improved from 'Threatened' to 'At Risk'.[159] As a bonus, variable oystercatchers, another 'At Risk' species have benefited from the dotterel

[dd] species that are only found in New Zealand

New Zealand dotterel displaying so the walker should follow it away from its chicks or eggs. Photo by Shaun Lee.

20 YEARS AGO

Three shorebird species were Threatened and two species were At Risk[ee].

Department of Conservation protection programme for New Zealand dotterel underway.

TODAY

Five species are Threatened and five species are At Risk.

Northern New Zealand dotterel has improved in conservation status from Nationally Vulnerable to Recovering (*Figure 72*).

Counts of wrybill, banded dotterel, variable oystercatcher and New Zealand dotterel have increased since 2000 (*Figure 72*).

Counts of bar-tailed godwit and pied stilt have been stable since 2000 (*Figure 72*).

Counts of South Island pied oystercatcher and lesser knot have declined since 2000 (*Figure 72*).

2003: Pūkorokoro Miranda Shorebird Centre starts running annual dotterel management courses.

2004: Predator-proof fence built at Tāwharanui.

2011: Predator-proof fence built at Shakespear Regional Park.

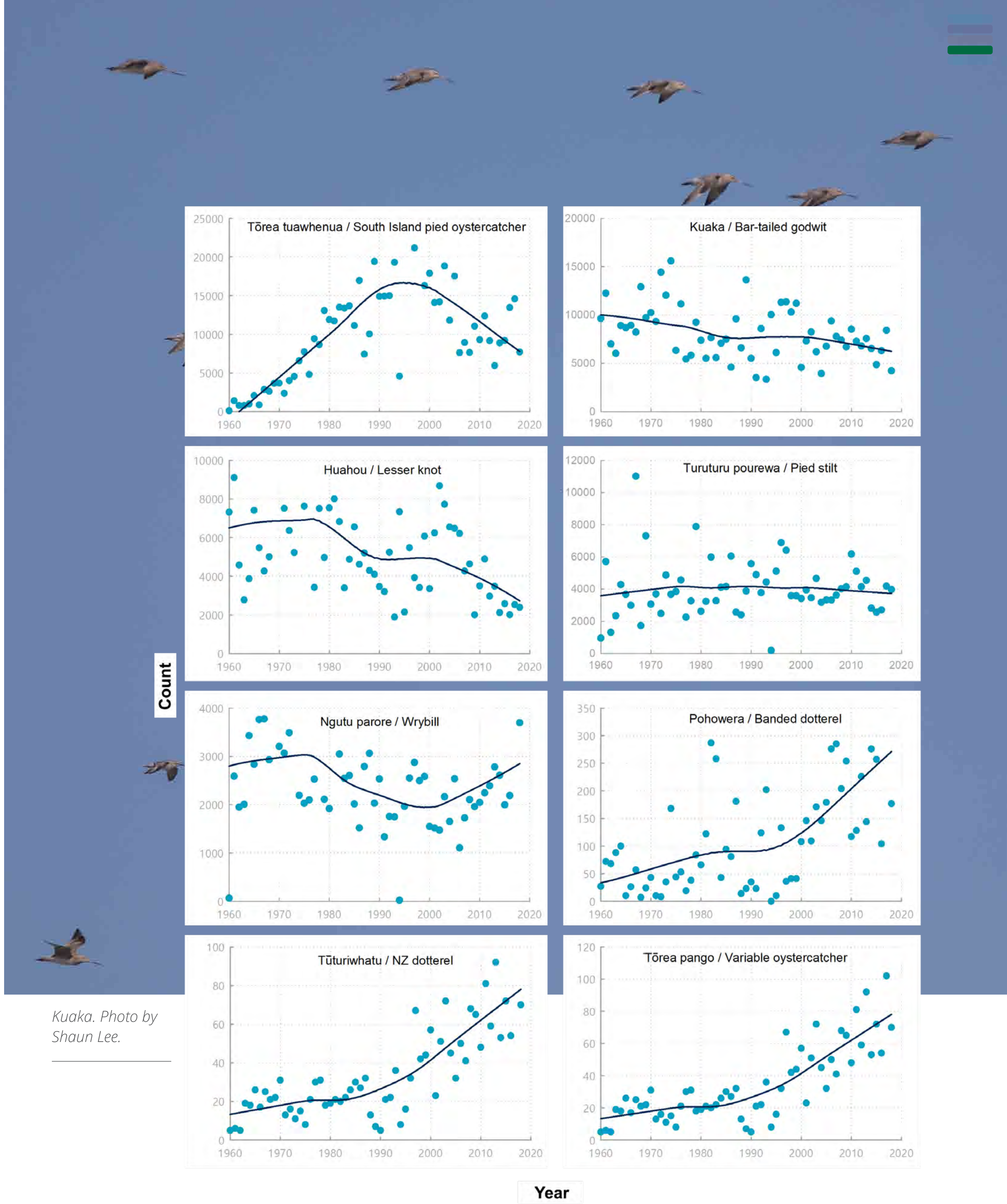
2012: Predator-proof fence built on Omaha's northern spit.

2016: Aotearoa and China signed a Memorandum of Arrangement to protect migratory shorebirds and their habitats in their countries.

management programme as the two species share the same breeding habitat.

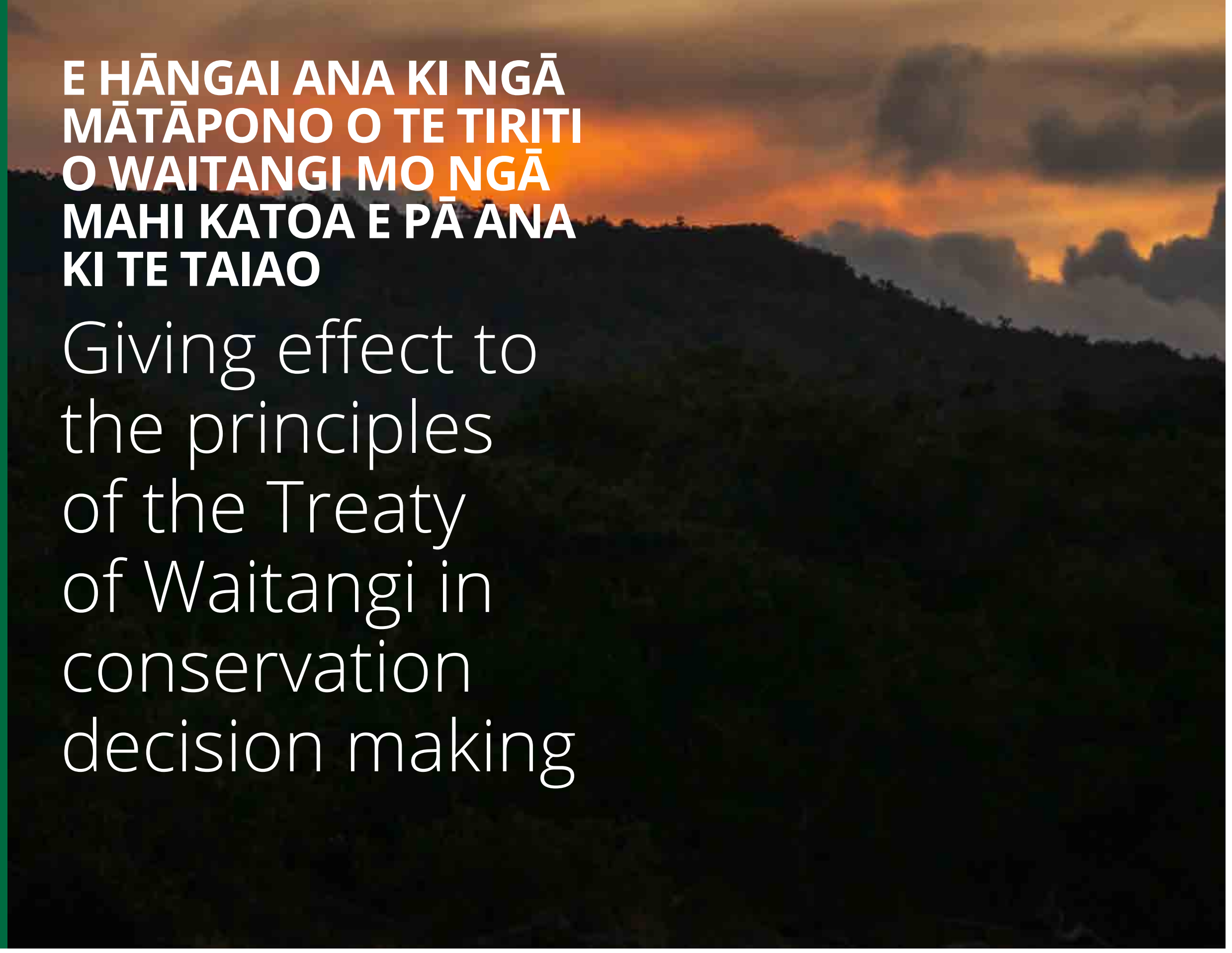
The population of shore plover plummeted to 130 birds in 1990, which were only present on Rangatira Island in the Chatham Islands. A captive breeding programme was started for them in the 1990s and has supplied more than 500 birds to pest-free islands. In 2012, 17 birds were released on Motutapu Island — the only population in the Marine Park. In 2018, seven shore plover chicks were hatched on Motutapu and a further 15 were released there in 2019. However, despite these efforts, the total population in the Marine Park is still around 18 birds, which is likely due to predation of chicks by other birds such as kāhu (swamp harrier), magpie and ruru (morepork). The total population of shore plover nationwide has increased to 245, but the species' status is still Nationally Critical.[160,161]

[ee] Note that the conservation status of birds that are migrants was not assessed.



Kuaka. Photo by Shaun Lee.

Figure 72: *Trends in the number of shorebirds counted during summer and winter surveys conducted by volunteers of Birds New Zealand in the Firth of Thames (data provided by Birds New Zealand).*



E HĀNGAI ANA KI NGĀ MĀTĀPONO O TE TIRITI O WAITANGI MO NGĀ MAHI KATOA E PĀ ANA KI TE TAIAO

Giving effect to the principles of the Treaty of Waitangi in conservation decision making

Sunrise on Rangitoto Island. Photo by Shaun Lee.

Tangata whenua involvement in conservation management has been strengthened by a 2018 Supreme Court (Court) decision. The case arose from a local, and seemingly isolated, issue about concessions for tourist operations on Rangitoto and Motutapu. However, the Court's finding has national implications for conservation decision making.

Rangitoto and Motutapu are popular destinations for visitors and locals, and are iconic local landscapes. They are also of significant historical and spiritual significance to local iwi Ngāi Tai ki Tāmaki.

In 2015 the Department of Conservation (DOC) granted five-year concessions to Fullers Group Limited (Fullers) to conduct guided walking and tractor/trailer tours on Rangitoto Island, and to the Motutapu Restoration Trust (MRT) to conduct guided walking tours on nearby Motutapu Island. The Fullers concession was a rollover of an existing one, while the MRT concession was new.

The Ngāi Tai ki Tāmaki Tribal Trust (the Ngāi Tai Trust) subsequently sought a judicial review of the two decisions. They opposed the granting of the concessions to anyone other than tangata whenua. Their argument emanated from the fact that they — Ngāi Tai ki Tāmaki — had mana whenua over both motu. The Chair of the Ngāi Tai Trust, James Brown, claimed that Ngāi Tai ki Tāmaki's whakapapa ties to, and kaitiaki responsibilities for, Rangitoto and Motutapu meant that the Crown had to ensure that Ngāi Tai ki Tāmaki could exercise their rangatiratanga over those two motu. He argued their role had been eroded over the years and would continue to do so with the granting of the concessions to Fullers and MRT.

The Ngāi Tai Trust had in 2014 been granted a concession to operate guided walking tours — with a Māori cultural focus — on both motu for a period of 9 years and 11 months. A key issue for Ngāi Tai ki Tāmaki was to be able to welcome and manaaki all visitors in a culturally appropriate and proper manner onto their motu. They asserted that could not be achieved by Fullers and MRT. Their argument was essentially that manaakitanga is an important aspect of Treaty rights that had to be actively protected.

Recognition of Ngāi Tai ki Tāmaki tikanga in their traditional rohe was fundamental according to Mr Brown. He submitted that Ngāi Tai ki Tāmaki should have been accorded a degree of preferential entitlement with respect to the ongoing decision making and management associated with the two motu.

Rangitoto and Motutapu. Photo by Shaun Lee.

Ngāi Tai ki Tāmaki also submitted that DOC's granting of concessions to other parties was inconsistent with its duty to actively protect Māori interests through giving effect to the principles of the Treaty of Waitangi. At the time the concessions were granted this was particularly relevant, as Ngāi Tai ki Tāmaki were also in the process of negotiating their treaty claim with the Crown (which was settled in 2015, and came into force in 2018).

The challenge ultimately went to the Supreme Court after failing at the High Court and Appeal Court. While the lower courts agreed that DOC might have erred in its decision making, they found that the department's actions were still consistent with the principles of the Treaty of Waitangi. The Supreme Court disagreed with that finding.

In releasing its decision on Ngāi Tai ki Tāmaki versus the Minister of Conservation (2018), the Supreme Court decided that the concessions needed to be reconsidered in a manner that involved proper application of the principles of the Treaty of Waitangi under the Conservation Act 1987. This included building and supporting effective conservation partnerships with tangata whenua at the local level as well as enabling the active protection and right to development of resources in their rohe.

In this case, applying the principles of the Treaty of Waitangi required the consideration of according some preference to Ngai Tai ki Tāmaki, and the associated economic benefit of doing so. But it did not create a power of veto for iwi or hapū over the granting of concessions, nor any exclusive right to concessions in their rohe. The decision also quashed MRT's concession, and ordered DOC to reconsider their decisions on the MRT and Fullers applications.

The Supreme Court judgement has fundamental implications for the way public conservation land and waters are administered. Particularly around the ongoing development of the Crown/Treaty Partner relationship, and to the delivery of conservation outcomes on the ground. For instance:

1. Ngāi Tai ki Tāmaki noted that the Crown had failed in its "active protection" of Māori interests, and in doing so may have limited or denied opportunities for Māori. The application of this principle may also influence the allocation of commercial rights and interests on other public conservation land and waters.

2. Māori have a great deal of interest in this matter because it cuts to the essence of their engagement and relationship with DOC. Iwi and hapū throughout Aotearoa have kept a close watch on how this appeal has been dealt with and are eagerly awaiting the eventual outcome.

3. This case also highlighted the increasing pressures being placed on conservation resources from tourism. Competition among operators has increased, and is likely to continue doing so. It raised questions about whether existing management regimes are sufficiently robust to cope with such pressures.

DOC is now reconsidering its decisions on the two concessions. It is also assessing potential impacts on other concession applications and processes, and the implications for its broader decision-making processes. Other Government agencies and organisations may also be affected, but it is unclear which and how they will respond.

INDICATOR / TOHU

NGĀ TAONGA O TĀWAHI

Non-indigenous marine species

Australian droplet tunicate and Mediterranean fan worm in Algies Bay. Photo by Shaun Lee.

"Biosecurity is Taiao (environment) and it's Kaitiakitanga (guardianship and conservation). It's a different perspective but the underlying issues and answers are the same"

– Waiaria Rameke [162]

Most non-indigenous species hitchhike into Aotearoa on the hulls of ships or floating in ballast water. Not all species that arrive here are capable of surviving or pose a threat to our environment. However, some of the species that arrive here flourish in our waters and become invasive pests. These pests may compete with our native species for food and space, or consume our native species. They often also cause major fouling problems for boats, marine farms and other submerged structures (*Figure 73*), which can result in large costs due to cleaning and decreases in aquaculture production rates.

Once here, marine species will naturally spread around the region, but the rate of spread is greatly accelerated by boats, aquaculture activities, and movement of marine equipment.

Non-indigenous species also change the characteristics of our native marine communities. Several pest species (e.g., Mediterranean fan worm, clubbed tunicate, wakame) are now a common sight in inner areas of the Marine Park, particularly around marinas, wharves and marine farms. Once established, eradication of non-indigenous marine species is extremely difficult and expensive. None of the marine pests that have established themselves in Aotearoa have been eliminated. Prevention of introduction and spread is therefore the key to their management.

KEY EVENTS

Over the past 20 years the government has implemented several measures to try and reduce the number of non-indigenous species arriving and becoming established in Aotearoa. Overseas vessels are now required to exchange or treat all their ballast water and have a clean hull before arriving in our waters. A six-monthly surveillance programme of high-risk ports and harbours has been running since 2002 to provide an early warning system for the arrival of new species, and to record the spread of non-indigenous species around the country.[168,169]

20 YEARS AGO

Around 66 non-indigenous species recorded from the Marine Park.[163,164]

One known marine pest present in the Marine Park — the Asian date mussel.

- **1998:** A ballast water import health standard was implemented for international ships arriving in Aotearoa.
- **2000:** Asian paddle crab fist discovered in Auckland.
- **2001:** Carpet sea squirt first discovered in Whangamatā.
- **2001–2007:** Biosecurity NZ conducted baseline surveys in 27 ports and marinas for non-indigenous species.
- **2002:** Marine High-Risk Surveillance programme started in major ports.
- **2002:** Wakame spread to the Marine Park (first found in Aotearoa in 1987).
- **2005:** Marine Invasives Taxonomic Service started to provide pest identifications.
- **2005:** Clubbed tunicate first discovered in Auckland.
- **2009:** Mediterranean fan worm first found in the Marine Park (first found in Lyttelton in 2008).
- **2010:** Australian droplet tunicate spreads to the Marine Park (first found in Northland in 2005).
- **2013:** Waikato Regional Council Marine Biosecurity Programme established.
- **2014:** A biofouling import health standard was implemented for ships arriving in Aotearoa. Initially voluntary, the standard become mandatory in 2018.
- **2016:** Auckland Council Marine Biosecurity Programme established.
- **2016:** Top of the North Marine Biosecurity Partnership formed (Northland down to Hawkes Bay).
- **2017:** Auckland Council establishes an annual regional hull surveillance programme.
- **2017:** Marine pest surveillance of Aotea started, as well as an incursion response and monitoring programme of Mediterranean fan worm.
- **2018:** Auckland Council introduces a Natural Environment Targeted Rate, which provides an additional $2.1 million over the next 10 years for marine biosecurity.131

TODAY

Around 144 non-indigenous species recorded from the Marine Park, though not all of these have become established here (*Figure 74*). A large proportion of this increase is due to increased surveillance effort, with many new pest species discovered during the initial baseline surveys[165,166]. The rate of increase in new species has slowed over recent years, with only one new species[ff] discovered in the Marine Park in the last two years.[167]

At least seven marine pests present in the Marine Park — the Asian date mussel, wakame, Mediterranean fan worm, Australian droplet tunicate, clubbed tunicate, Asian paddle crab and carpet sea squirt (see *Figure 75* for examples[gg]).

Figure 73: *Invasive pests including Mediterranean fanworm, wakame and carpet sea squirt growing on Coromandel mussel lines. Photo by Shane Kelly.*

[ff] The sea squirt, *Clavelina oblonga*.

[gg] Asian date mussel (*Arcuatula senhousia*), wakame (*Undaria pinnatifida*), Mediterranean fan worm (*Sabella spallanzanii*), Australia droplet tunicate (*Eudistoma elongatum*), clubbed tunicate (*Styela clava*), Asian paddle crab (*Charybdis japonica*) and carpet sea squirt (*Didemnum vexillum*).

Asian paddle crab on Aotea / Great Barrier Island. Photo by Shaun Lee.

Once a pest is established in a region, regional councils are also responsible for pest management. WRC and MPI implemented a programme to try and control Mediterranean fan worm from becoming established in the Coromandel Harbour, but the programme was unsuccessful at achieving eradication. Auckland Council currently has an incursion response and monitoring programme for Mediterranean fan worm underway in Aotea, and have recently established an annual hull surveillance programme. WRC also conduct annual dive surveys at various locations around the region to check for the presence of marine pests.

No marine pests are currently listed in Auckland or Waikato's Pest Management Plans, but Auckland Council is, at the time of writing, at mediation in the Environment Court around the issue of addressing marine pests in the Plan. Regional councils from the top of the North Island, with support from Biosecurity NZ, are focusing on developing a joint pathway management plan to control the spread of marine pests and develop consistent rules across the regions.

Although marine pests such as the clubbed tunicate and Mediterranean fan worm are now a common component of the Marine Park, we currently have little understanding about how they affect our native community. Research is underway on the impacts of marine pests in Aotearoa[170], and the development of novel tools to limit their spread[171].

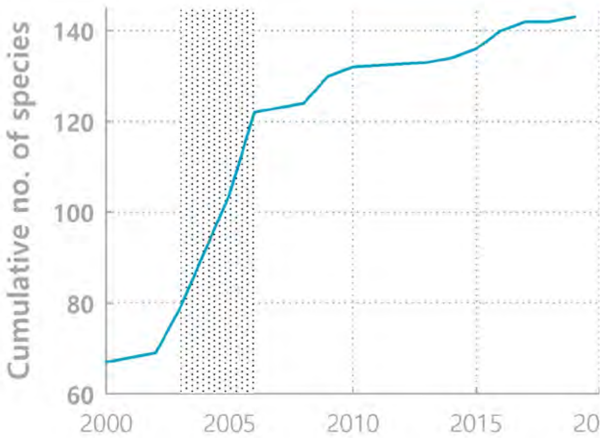
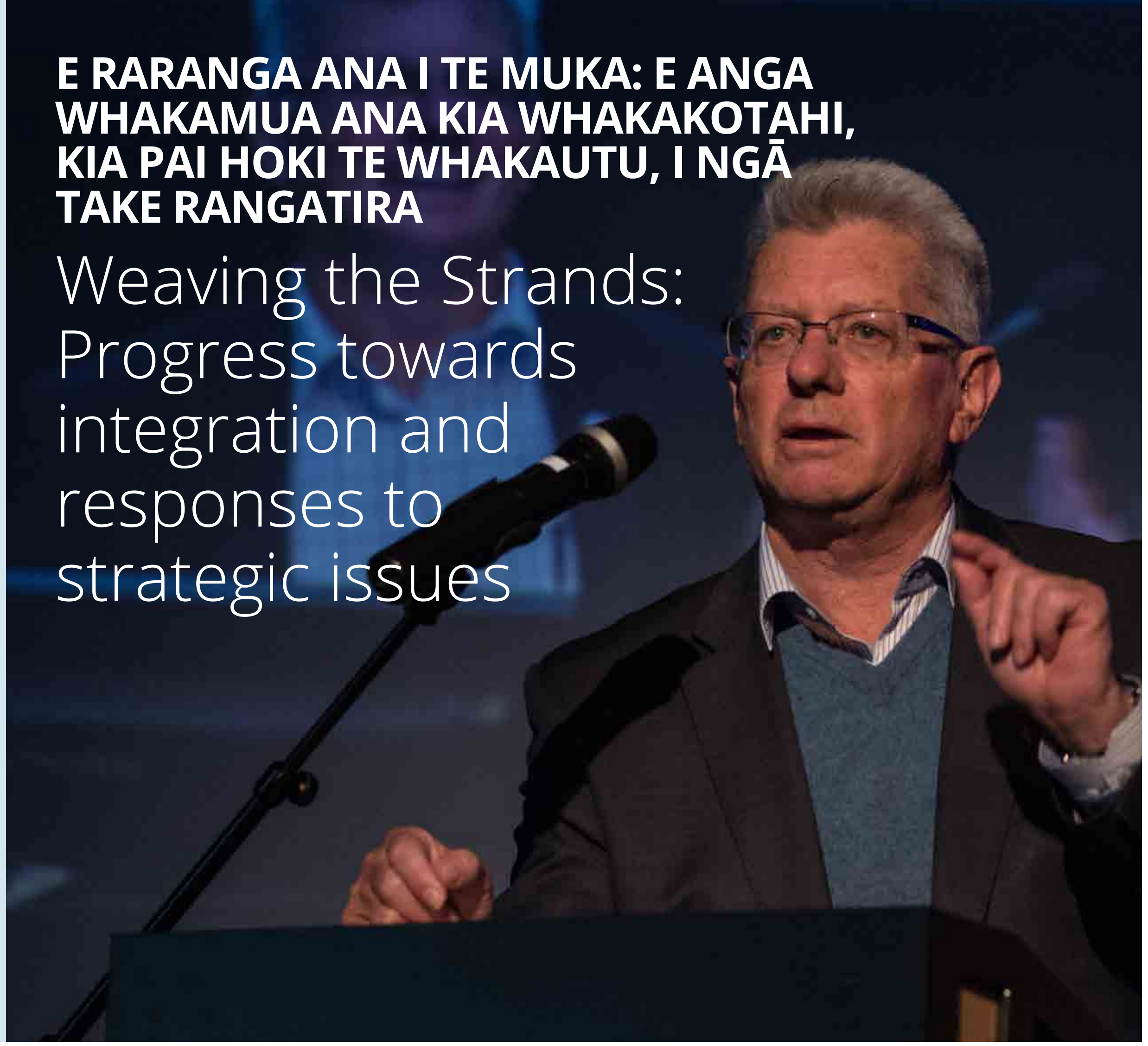


Figure 74: *Cumulative number of non-indigenous marine species recorded from the Marine Park between 2000 and 2019. Not all of these species become established. The shaded area shows when the Auckland ports and harbours baseline surveys were conducted.*

Mature Mediterranean fanworm near Ponui Island. Photo by EMR / Lorna Doogan.

Figure 75: *Distribution of secondary target non-indigenous species in the Marine Park in 2000 and present. Records for the Asian date mussel prior to 2000 were taken from published literature. All other records are taken from www.marinebiosecurity.org.nz and www.inaturalist.nz (research grade observations). Photos by Shaun Lee.*



E RARANGA ANA I TE MUKA: E ANGA WHAKAMUA ANA KIA WHAKAKOTAHI, KIA PAI HOKI TE WHAKAUTU, I NGĀ TAKE RANGATIRA

Weaving the Strands: Progress towards integration and responses to strategic issues

Ex Forum Chairperson John Tregidga at the 2018 Marine Park Conference. Photo by Shaun Lee.

"The report provides a basis for the Forum to prioritise future action. It also provides a tangible example of what the Forum is all about — taking a holistic and integrated approach to the management of the Gulf: an approach that crosses statutory functions and deals with the Gulf as a single natural and social system."
– Laly Haddon, Ngāti Wai kaumātua and Chair of the Hauraki Gulf Forum. Forward to the first State of the Gulf Report, 2004.

One of the purposes of the Hauraki Gulf Marine Park Act is to ***"integrate the management of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments"***. The Marine Park Act also requires the Hauraki Gulf Forum to prepare and publish of a State of the Environment report every three years, that includes information on progress towards integrated management and responses to strategic issues identified by the Forum.

The Forum's strategic issues have evolved four times over the 20 years since the Act came into effect. Their identification was a key focus for the Forum in the early years of the Marine Park, with an initial list of 11 issues released in 2002 (***see Page 166***). This was amended in 2008, shifting specific focus away from sedimentation, biosecurity, fisheries and aquaculture, relationships with tangata whenua and community, and knowledge and monitoring. Instead the focus was directed toward maintaining the Marine Park as a pātaka kai, promoting the Marine Park's significance, climate change, and integrated management. Further changes in 2012 involved a shift towards defining five strategic outcomes sought by the Forum, under the acronym ***"REMAK"***: Regenerating islands and protected areas, Enhanced fisheries, Mana whenua relationships, Active land management, and Knowledge providing a shift toward ecosystem-based management.

In 2018, the Forum refined its focus further, seeking to make progress on three priority topics:

1. Improving integrated management through collaborative planning, informed decision-making and action.
2. Restoring water quality values by addressing land use activities that degrade those values.
3. Recognising those critical marine values and ecosystems through advocating for protection, restoration and enhancement.

A range of issues are encompassed within each of these topics. Of particular relevance, are two long-term aspirational goals the Forum set in 2019:

- that at least 20% of the waters of the Marine Park be protected;
- that restoration efforts establish 1000 km^2 of shellfish beds and reefs.

This section considers progress towards integration and responses to the issues identified by the Forum over the past 20 years.

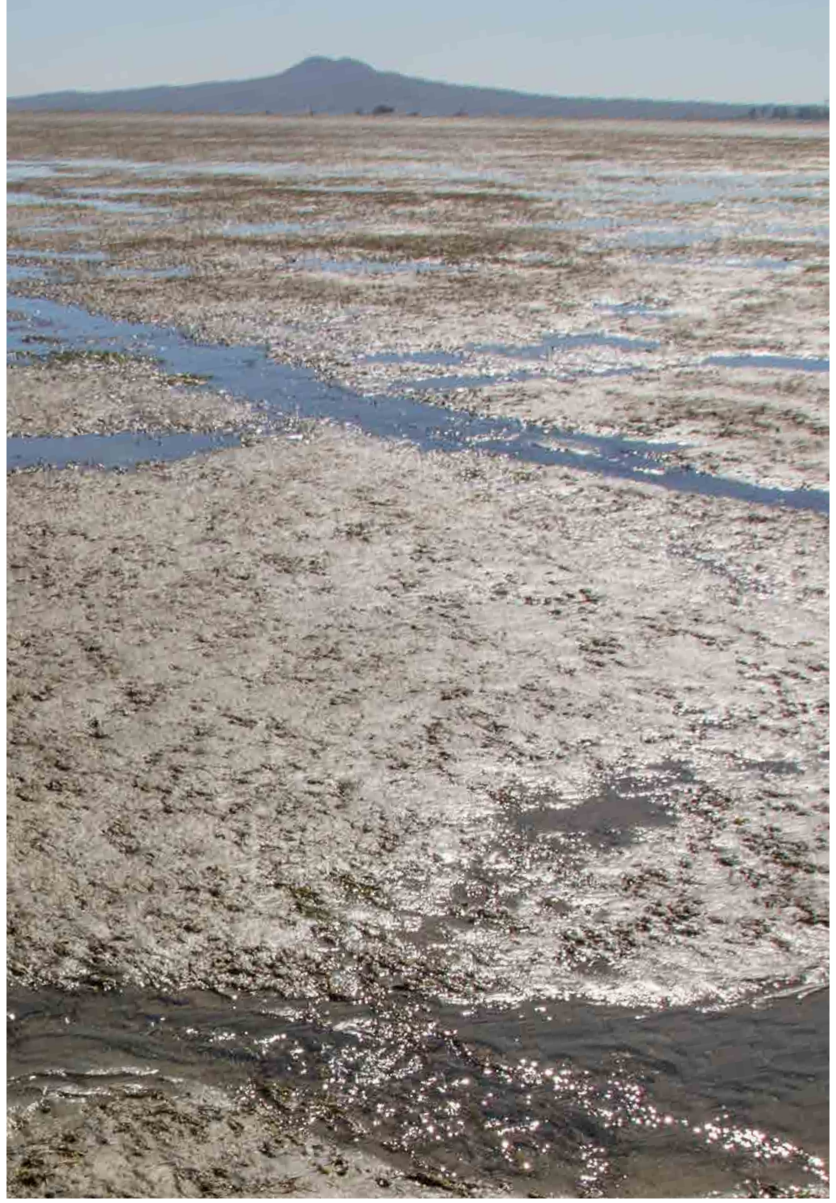
Hon Eugenie Sage at the 2019 Marine Park Conference. Photo by Shaun Lee.

Shellfish restoration. Photo by Richard Robinson www.depth.co.nz

Learnings from the State of Our Gulf reports

This is the sixth report on the state of the Marine Park prepared by the Hauraki Gulf Forum. The first, released in 2004, brought together a wealth of information on the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi. It noted that determining whether the state of the Marine Park is better or worse depends on your reference point, but there could be little argument that it was degraded compared to its pre-human or even pre-European state. Estuary sedimentation had increased massively; sediment contamination had increased; the number of species present, specific habitats and populations had reduced; access to coastal areas was more limited, landscape and natural character values had changed markedly (in some cases irreparably); significant cultural heritage has been lost forever; and, the risk associated with natural hazards had increased. Some positive changes were happening, such as better protections, improvements or stability in the quality of some areas and resources, and the adjustment of some natural systems to a new balance. On the other hand, concerns remained about poor beach quality, sedimentation and sediment contamination, shellfish depletion, and coastal development (particularly in areas north of the Auckland metropolitan area and on the Coromandel Peninsula).

The 2008 report provided a brief update on the earlier report. The big issues for waters of the Marine Park were identified as the build-up of heavy metals in Auckland harbour sediments and nutrient flows into the Firth of Thames. The report highlighted that sedimentation was changing the character of estuaries and promoting the spread of mangroves. Habitat modification and disturbance resulting from urban development were also identified as putting significant pressure on biodiversity and there was a paucity of native vegetation in large parts of the Marine Park catchment. Growth in the number of dwellings on Coromandel Peninsula was noted, with an increase of 18% between 2001 and 2006, even though the permanent population barely changed. On the positive side, many seabirds, terrestrial birds and lizards seemed to be making a recovery thanks to pest control on islands. The report also noted that total commercial catch of fish in the previous three-year period was higher than in the three years prior to the Marine Park being established, with snapper being the *"most valued"* species taken. Concerns about the overharvesting of cockle populations in areas such as Umupuia Beach were also reported. Climate change was identified as a significant, emerging threat.


Tāmaki Estuary. Photo by Shaun Lee.

The 2011 State of Our Gulf Report described in greater detail the incredible transformation the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi has undergone, and how that process was continuing in the sea and around the shores of the Marine Park. Encouraging signs were apparent in a few indicators, but most pointed towards ongoing degradation. Overall the report concluded that further loss of natural assets was inevitable unless bold, sustained and innovative steps were taken to better manage the utilisation of its resources and halt progressive environmental degradation.

The 2014 State of Our Gulf Report again confirmed that pressures on the Marine Park were high and increasing, with many indicators showing that past and present actions were continuing to degrade the environment or suppress and maintain environmental values in a degraded state. It noted that a range of management action had been taken since 2011, including amendments to the Resource Management Act, and the implementation of reforms to aquaculture management. The National Policy Statement for Freshwater Management 2011 was also implemented and had subsequently been reviewed and updated. Auckland Council released its Auckland Plan and the proposed Auckland Unitary Plan, while the Proposed Waikato Regional Policy Statement was adopted by the Waikato Regional Council, and the proposed Thames Coromandel District Plan was notified. Annual operational plans had been produced for inshore finfish and shellfish fisheries, and national plans of action were updated for sharks and seabirds. Conservation Management Strategies were being reviewed for Auckland and Waikato, and the creation of the Aotea Conservation Park on Great Barrier Island had been approved. Changes had also been made to the biosecurity and maritime transport acts to reduce biosecurity risks throughout the country. But integration in management decisions, and progress towards addressing the strategic issues framework adopted by the Forum had been mixed.

In relation to the five strategic outcomes (REMAK) sought by the Forum, progress was being made in island restoration, the involvement of mana whenua in decision making, and expanding the knowledge needed to guide and support management responses. Positive steps were also being taken in marine biosecurity and reducing seabird mortality. However, both Central and Regional Government were struggling to balance the pressures associated with providing for economic development and population growth on the one hand, with a worsening environmental situation on the other. The 2014 report also highlighted that recent fisheries decisions were poorly aligned to the outcomes being sought by the Forum.

The 2017 State of Our Gulf Report again highlighted that while progress was being made in some areas, pressures continued to mount, and gradual improvements were not enough to reverse legacy effects, counter already-triggered trophic shifts, and prevent further degradation. Gains could be easily undone by new activities or from the emerging effects of climate change. It noted that a key issue for the Marine Park appears to be that the pace of change is outstripping the ability of current management frameworks to respond effectively. Several reasons were provided for this:

Technical constraints — some of the issues facing the Marine Park are incredibly difficult to resolve because scientific or engineering solutions weren't available, and/or legacy actions and emerging global issues are likely to constrain what can practicably be achieved.

The commercialisation of natural resources — the coast is the new frontier for development. If commercial opportunities exist, they are likely to be explored.

Financial implications — the costs of resolving environmental issues can be high, both for management agencies (and by implication the community), and the private sector.

Legislative and regulatory frameworks — the issues facing the Marine Park are difficult to manage. Management agencies have struggled to develop effective controls for some issues, and there are tensions between regulations such as the Hauraki Gulf Marine Park Act, Resource Management Act and Fisheries Act.

Institutional delays — the development and implementation of regulation can be exceedingly slow.

The lack of an accepted, holistic, and integrated plan for the Marine Park — the delivery of Sea Change – Tai Timu Tai Pari Plan was a significant step towards integration. The plan was developed through the collaboration of tangata whenua, a range of stakeholders and key management agencies. The outcome was a plan for managing the Marine Park that provides options for moving beyond business as usual.

Today

Now, as we approach 20 years, our knowledge of the Marine Park has grown substantially. However, by and large, most of the issues that existed when the Marine Park was established have not been resolved. Island restoration efforts have been a spectacular success, but the situation is not as good in the marine space.

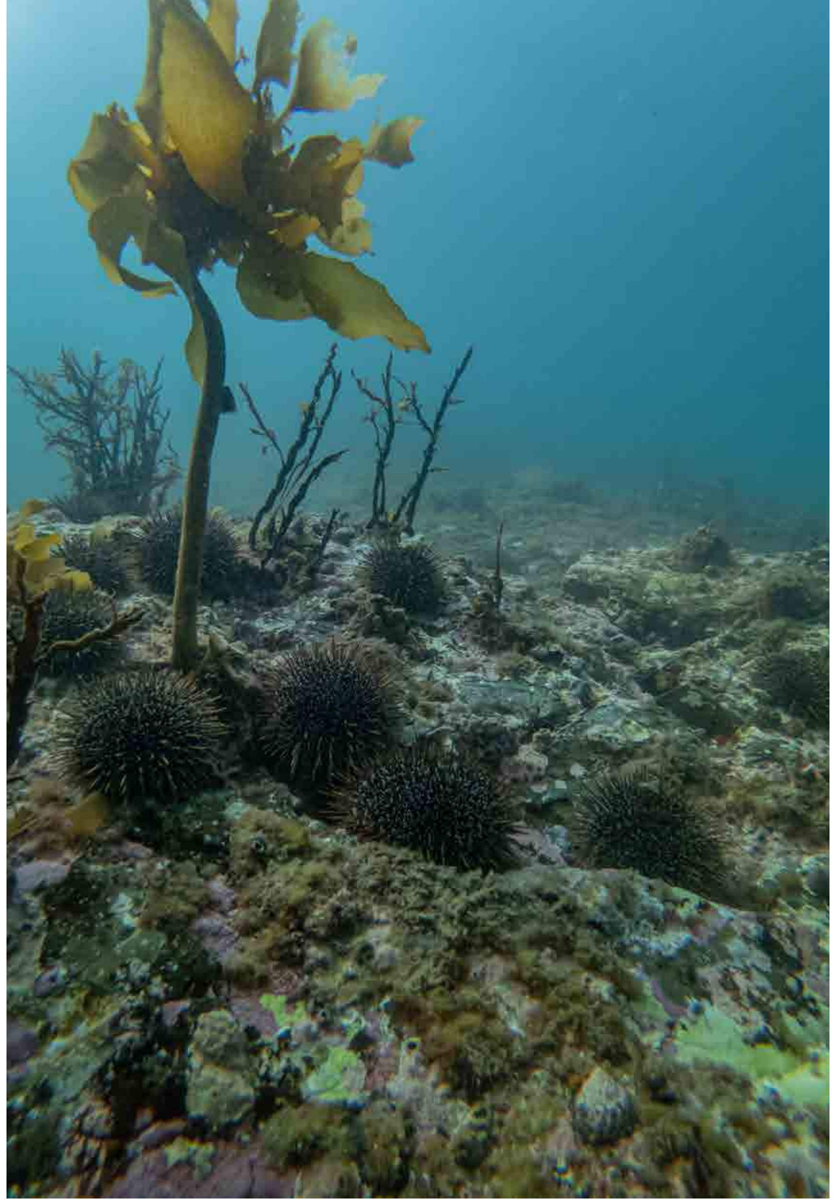
We have eliminated mammalian pests from 15 more islands, going from around 1,200 ha of pest free islands to around 10,000 ha. Significant native revegetation has occurred on motu such as Motuora and Tiritiri Matangi, and populations of native animals on pest-free islands have flourished, increasing the resilience of many of our threatened species against future threats.

Fishing continues to have a major impact on the entire Marine Park ecosystem. It substantially reduces populations of target species; disturbs seafloor habitats and communities; and, inadvertently kills threatened seabirds. Fishing has also altered the dynamics and characteristics of marine communities (particularly inshore reef communities).

A substantial reduction in the number of bottom trawls since 2000 is a positive finding. However, around 22% of Danish seine sets have been occurring in areas where this method has been prohibited since 1986. Fisheries NZ acknowledges there is a discrepancy between how the legislation, which defines this area, has been interpreted and presented in this report, and what is currently understood and enforced in practice. They have committed to reviewing this discrepancy as part of management actions put forward in a fisheries plan for the Hauraki Gulf, which is being developed as part of central Government's response to the Sea Change Hauraki Gulf Marine Spatial Plan.

Since 2000, tāmure, tarakihi and kōura have been at, or fell to, levels where action was needed to actively rebuild their stocks. Changes to the recreational bag and size limits for tāmure, and the commercial catch allowances for kōura and tarakihi, should allow these stocks to rebuild towards fishery targets. But they may not be high enough to reverse the proliferation of kina barrens.

Complete bans on shellfish gathering have been imposed or maintained in four areas since the Marine Park was established, and a seasonal ban in one area. Marked increases in the number of harvestable tuangi has only occurred in three of the five areas where harvesting is banned for some, or all, of the year. However, a universal decline in the density of harvestable tuangi has occurred at monitored sites where harvesting is allowed year-round.



Kina barrens near Otata Island. Photo by Shaun Lee.

There has been a substantial increase in coastal sprawl. Since 2000, seven new marinas have been constructed or consented, and canal developments have occurred at Whitianga and Pauanui. Provision has also been provided in the Auckland Unitary Plan for a canal development along Wairoa River, and a 'marine gateway' is proposed to service Coromandel township. Shellfish farms have grown from occupying around 685 ha in 2000, to occupying around 1800 ha today. An additional 960 ha has been approved for development and further applications have been received for 334 ha. In addition, 390 ha has been set aside to farm fish. Around 2270 ha of spat catching applications from the early 2000s remain on hold.

Population growth has led to increases in coastal urban development. Most of this has occurred within Auckland's Metropolitan Urban Limit, or in and around existing coastal towns and settlements. This has confined the footprint of environmental effects. However, the Auckland Unitary Plan provides for an additional 8100 ha, or so, of future urban development in the Marine Park catchment.

New Zealand fairy tern. Photo by Shaun Lee.

There are worrying signs that nutrient run-off from the Hauraki Plains is adversely affecting the Firth of Thames. Conversely, nutrient concentrations in Auckland's coastal waters are now lower than they were before the Marine Park was established, although the situation appears to be worsening again with concentrations of some key nutrients increasing on the Auckland coast over the past 10 years.

Sediment concentrations of copper and lead are elevated, but declining, in coastal areas that adjoin older urban suburbs in Auckland. Declines in lead concentrations are expected because its major source (leaded petrol) was banned in the 1990s. The reason for the declining copper concentrations is unclear. Zinc concentrations are elevated and increasing in coastal areas that adjoin Auckland's older urban suburbs. Key sources of zinc are galvanised steel cladding on older buildings and tyre wear. Localised sediment contamination is also present in parts of the Coromandel Peninsula coast historically affected by mining. Elsewhere, sediment metal concentrations are relatively low.

Better information indicates that the risk of getting sick from swimming on Auckland's beaches is higher than previously thought. Auckland Council has developed better tools for informing the public of those risks, and major improvements to the wastewater network are expected to reduce risks in Waitematā Harbour.

Sediment run-off and accumulation remains a serious issue that is linked to the loss of ecological values, the expansion of mangrove forests, and potentially to recent mass mortalities of shellfish. Sediment controls have improved over the past 20 years, but there is still a lot of work to do. Increases in the severity of storms and river flows due to climate change will exacerbate this issue.

Six marine pests of serious concern have arrived in the Marine Park over the past 20 years. Species including Mediterranean fan worm and the clubbed tunicate quickly spread and are now flourishing in many parts of the inner Marine Park. In places they dominate seafloor communities, and they commonly foul ports, marinas, marine farms and other structures. No marine pests have been successfully controlled or eradicated.

The number of threatened seabird species has increased since the Marine Park was established. The situation for fairy tern is perilous, with only 43, or less, adults remaining. Improvements have been made in breeding success and reductions in number of seabirds caught by commercial fishers. Yet threats within and beyond the boundaries of the Marine Park (such as reduced prey availability and plastic pollution) are still likely to be preventing population recovery. Large improvements have been made in reducing seabird captures in commercial fisheries, thanks to voluntary initiatives by the sector working with conservationists, but capture rates of 188 tāiko (black petrel) and 239 toanui (flesh-footed shearwater) are still of grave concern due to their threatened status. In particular, tāiko capture rates are very likely to be more than the population can sustain.

The risk of fatal ship strikes on Bryde's whales has been substantially reduced through a voluntarily reduction in the speed of large commercial ships. The lack of ship strikes over the past five years suggests whales can now safely feed and rest within the Marine Park.

Matheson Bay. Photo by Gray Milmine.

Evolution of strategic issues

2002	2008	2012	2018
Water quality Natural character and landscape Cultural heritage Coastal hazards Natural heritage and biodiversity Recreation, tourism and access Soil erosion and sedimentation Biosecurity Fisheries and aquaculture Relationships with tangata whenua and community Knowledge and monitoring	Water quality Natural character and landscape Cultural heritage Coastal hazards Biological diversity Access to the Marine Park Maintaining and enhancing the Marine Park as a pātaka (storehouse of food and knowledge) Climate change Integrated management Raising awareness, understanding and recognition of the national significance of the Marine Park	**R**: A regenerating network of marine protected areas and island sanctuaries. **E**: Enhancement of fisheries with improved environmental outcomes. **M**: Mana whenua relationships reflected in resource management practice. **A**: Active land management to minimise inputs of sediments, nutrients and contaminants. **K**: Knowledge utilisation within an ecosystem-based management framework.	Improving integrated management through collaborative planning, informed decision-making and action. Restoring water quality values by addressing land use activities that degrade those values. Recognising those critical marine values and ecosystems through advocating for protection, restoration and enhancement.

Where to from here?

The Hauraki Gulf Marine Park Act came into effect at the turn of the new millennium, on 27 February 2000. Upon its signing into law the then Minister of Conservation, Hon Sandra Lee said *"It is appropriate that the first enactment of this millennium celebrates and protects this special part of New Zealand. This Act is a commitment by this Government to future generations, about the care for the waters and islands of the Hauraki Gulf"*. Hopes were high. The timing also coincided with a number of other government initiatives, which together signaled an intended change in how we viewed and managed our oceans:

The Parliamentary Commissioner for the Environment (PCE) had recently released a report Setting Course for a Sustainable Future: The Management of New Zealand's Marine Environment. It highlighted the lack of an overarching framework for the sustainable management of our marine environment and recommended the development of an Ocean Policy. The release of the New Zealand Biodiversity Strategy, also in February 2000, outlined how Aotearoa proposed to fulfil commitments made under the United Nations Convention of Biological Diversity. The strategy sought to turn the tide on the loss of biodiversity. In its foreword, Prime Minister

Helen Clark in 2012. Photo by National Assembly for Wales.

Helen Clark noted *"...we need to put our marine fisheries on an ecologically sustainable basis and protect more of the dazzling array of habitats and marine communities in our oceans"*. Among the actions listed in the strategy were:

to develop and implement a strategy for establishing a network of areas that protect marine biodiversity;

to achieve a target of protecting 10 percent of Aotearoa's marine environment by 2010; and to review the Marine Reserves Act 1971 to better provide for the protection of marine biodiversity.

While the marine issues persisted and worsened, both ocean policy development and proposed actions on marine protection faded away. The potential of the Hauraki Gulf Marine Park Act to improve outcomes for the waters of Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi also appears to have fallen short.
Six reports have now been prepared on the state of the Marine Park. All tell similar stories of legacy impacts and ongoing pressures.
By and large, the same issues have repeatedly been highlighted. In some areas progress is being made, or appeared/appears to be.
But in general, the major marine environmental issues are still a long way from being resolved.

Having said that, the potential to generate real environmental improvements is once again emerging with multiple strands starting to come together:

The Hauraki Gulf Marine Spatial Plan, Sea Change – Tai Timu Tai Pari, developed through the collaboration of tangata whenua, a range of stakeholders and key management agencies provides options for moving beyond business as usual. Central government has established a Ministerial Advisory Committee to help shape its response to the conservation and fisheries related proposals. This follows the lead of regional councils, who have been taking forward relevant aspects over the past few years.

A recent Court of Appeal decision — Attorney-General v The Trustees of the Mōtītī Rohe Moana Trust & Ors — appears to open up new options for protecting indigenous biodiversity through coastal plan provisions prepared under the Resource Management Act.[172]

Tangata whenua involvement in conservation decision making has been strengthened by a recent Supreme Court decision — Ngāi Tai Ki Tāmaki Tribal Trust v Minister of Conservation that confirmed that the obligation in the Conservation Act to give effect to the principles of Ti Tiriti o Waitangi is a 'powerful' one for the Department of Conservation.[173,174]

Tangata whenua of Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi have applied for Protected Customary Rights and Customary Marine Title under the Marine and Coastal Area Act. Customary Marine Title gives applicant groups the ability, with some

Decades old plastic bottle in the Orewa Estuary. Photo by Charlie Thomas.

exceptions, to say yes or no to activities that need resource consents or permits in the customary title area. Protected Customary Rights let the applicant group carry out the protected activity without needing a resource consent. Local authorities can't issue resource consents that would have adverse effects that are more than minor on a protected activity, unless the applicant group agrees.[175]

A comprehensive review of the resource management system is being undertaken, with the aim of improving environmental outcomes and better enabling urban and other development within environmental limits.[176]

Auckland's central interceptor project is underway, which is expected to reduce the average annual overflow volume of wastewater in the central interceptor catchment (Auckland's worst) by 80%.

Central Government is progressing its "Essential Freshwater" work programme, with the objectives of stopping further degradation and loss of freshwater resources, waterways and ecosystems; reversing past damage; and, addressing water allocation issues.[177]

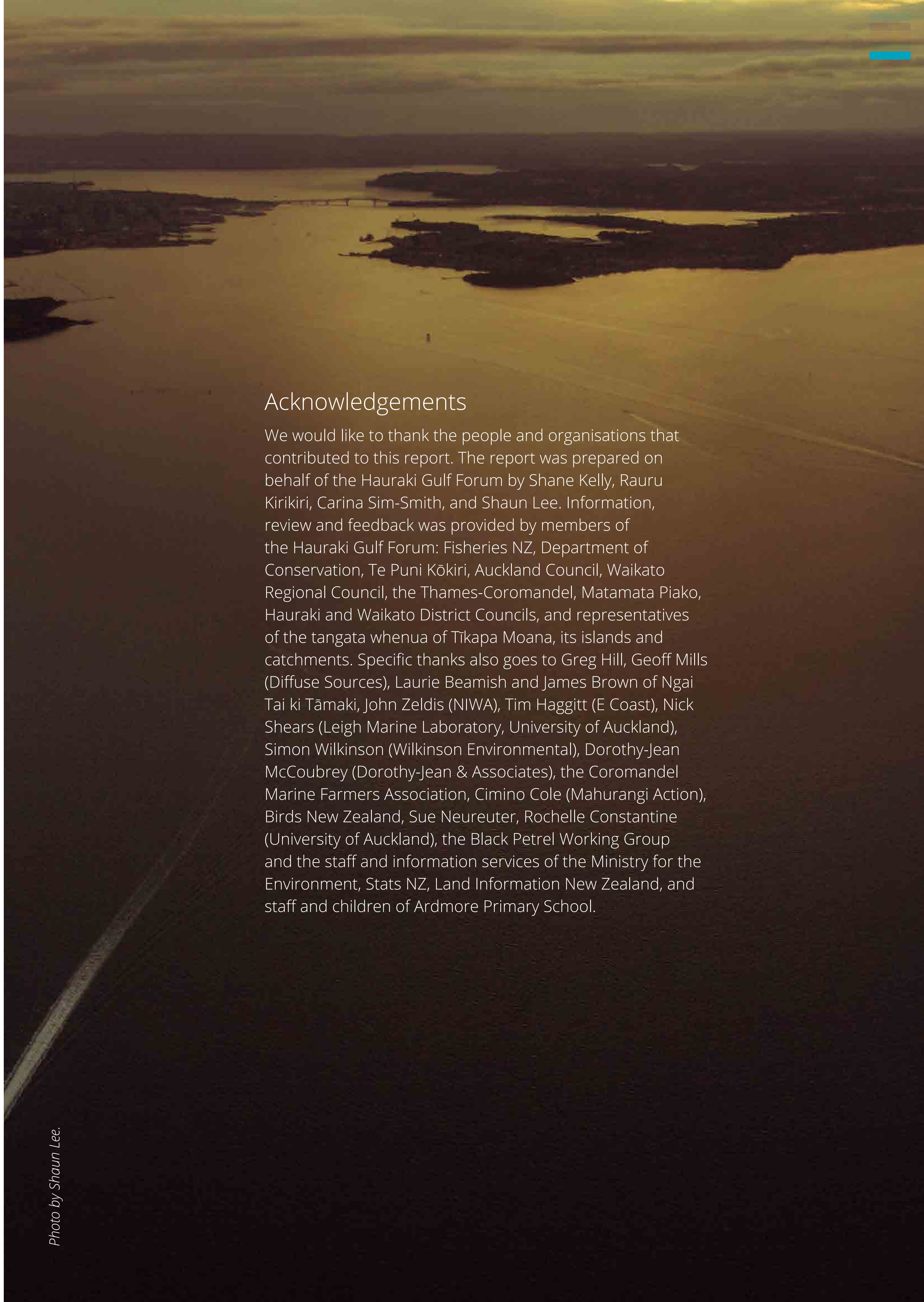
An updated New Zealand Biodiversity Strategy is due for release in 2020 and a National Policy Statement for Indigenous Biodiversity is being proposed and consulted on. While the proposed policy statement does not apply to the coastal marine area, it could benefit seabirds, shorebirds and coastal wetlands.[178]

Fisheries NZ are consulting on their National Inshore Finfish Fisheries Plan, which provides the overarching framework for the management of inshore finfish fisheries for the next five years, including in the Marine Park. Fisheries NZ highlight that the fisheries landscape is changing and in response, they are seeking to *"reshape, improve, and modernise fisheries management"* by progressing towards ecosystem-based management.[179]

An enormous amount of effort is also being made by iwi/hapū, individuals, organisations and community groups that are seeking to (and particularly on motu, are) improving environmental outcomes in the Marine Park.

20 years and six reports after the Marine Park was established, it is time to also consider whether we got the balance between environmental, economic and social values right in the Hauraki Gulf Marine Park Act, and whether there are better options for delivering integrated management and improved outcomes for the Gulf. It is the only Act to directly recognise the national significance of the Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi and make special provision for the protection, enhancement, and maintenance of its values. Yet that appears to not have been enough. The high values of Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi warrant greater protection. The past six State of our Gulf reports suggest the current weighting is tipped too far toward development and utilisation.

Many of the changes happening in the Marine Park are rapid and unidirectional. It is too late to reverse the effects of many past actions, or inactions. However, we can decide the future. It is up to us to determine what that will be, and to take the actions needed to achieve it. That needs to be done quickly, because time is working against us.



Acknowledgements

We would like to thank the people and organisations that contributed to this report. The report was prepared on behalf of the Hauraki Gulf Forum by Shane Kelly, Rauru Kirikiri, Carina Sim-Smith, and Shaun Lee. Information, review and feedback was provided by members of the Hauraki Gulf Forum: Fisheries NZ, Department of Conservation, Te Puni Kōkiri, Auckland Council, Waikato Regional Council, the Thames-Coromandel, Matamata Piako, Hauraki and Waikato District Councils, and representatives of the tangata whenua of Tīkapa Moana, its islands and catchments. Specific thanks also goes to Greg Hill, Geoff Mills (Diffuse Sources), Laurie Beamish and James Brown of Ngai Tai ki Tāmaki, John Zeldis (NIWA), Tim Haggitt (E Coast), Nick Shears (Leigh Marine Laboratory, University of Auckland), Simon Wilkinson (Wilkinson Environmental), Dorothy-Jean McCoubrey (Dorothy-Jean & Associates), the Coromandel Marine Farmers Association, Cimino Cole (Mahurangi Action), Birds New Zealand, Sue Neureuter, Rochelle Constantine (University of Auckland), the Black Petrel Working Group and the staff and information services of the Ministry for the Environment, Stats NZ, Land Information New Zealand, and staff and children of Ardmore Primary School.

Photo by Shaun Lee.

References

1. **Arnold N.** What we do in the shallows. New Zealand Geographic. 2018;Jul–Aug.
2. **Morrison M, Tuck ID, Taylor RB, Miller A.** An assessment of the Hauraki Gulf Cable Protection Area, relative to the adjacent seafloor. Auckland, New Zealand: Auckland Council;2016.
3. **Hartill B, Rush N, Armiger H, Bian R.** Aerial-access recreational harvest estimates for snapper, kahawai, red gurnard, tarakihi and trevally in FMA 1 in 2017–18. Wellington: New Zealand Fisheries;2019.
4. **Hartill B, Bian R, Rush N, Armiger H.** Aerial-access recreational harvest estimates for snapper, kahawai, red gurnard, tarakihi and trevally in FMA 1 in 2011–12. Wellington, New Zealand: Ministry for Primary Industries;2013.
5. **Wynne-Jones J, Gray A, Hill L, Heinemann A.** National panel survey of marine recreational fishers 2011–12: Harvest estimates. Wellington: Ministry for Primary Industries;2014.
6. **Wynne–Jones J, Gray A, Heinemann A, Hill L, Walton L.** National panel survey of marine recreational fishers 2017–18. Wellington: New Zealand Fisheries;2019.
7. **Fisheries New Zealand.** Fisheries assessment plenary, May 2018. Stock assessment and stock status. Wellington, New Zealand: Compiled by the Fisheries Science and Information Group, Fisheries New Zealand;2018.
8. **Waitangi Tribunal.** The Hauraki Report. Wellington: Waitangi Tribunal;2006.
9. **Hanchet SM, Coburn RP, Field KD, et al.** Assessment of red gurnard (*Chelidonicthys kumu*) stocks GUR 1 and GUR 2. Wellington: Ministry of Fisheries;2000.
10. **Horn PL, Hanchet SM, Stevenson ML.** Catch history, CPUE analysis, and stock assessment of John dory (*Zeus faber*) around the North Island (Fishstocks JDO 1 and JDO 2). Wellington: Ministry of Fisheries;1999.
11. **Davies NM, Gilbed DJ, McKenzie JR.** Assessment of the SNA 1 and SNA 8 stocks for the 1998–99 fishing year. Wellington, New Zealand: Ministry of Fisheries;1999.
12. **Fisheries New Zealand.** Fisheries Assessment Plenary, May 2019: Stock assessments and stock status. Wellington, New Zealand: Compiled by the Fisheries Science and Information Group, Fisheries New Zealand;2019.
13. **Hon Stuart Nash.** Changes to sustainability measures and other management controls for 1 October 2018, and closure of the Kaipara Harbour to the taking of scallops. Wellington: Minister of Fisheries; 2018.
14. **Fisheries New Zealand.** Review of Sustainability Measures for Tarakihi (TAR 1, 2, 3 and 7) for 2019/20. Wellington, New Zealand: Fisheries New Zealand;2019.
15. **Buchanan C.** Ahuahu (Great Mercury Island): memoirs of Cameron Buchanan, 1859–1873. Whitianga: Mercury Bay Historical Society;1977.
16. **Kelly S, MacDiarmid AB, Babcock RC.** Characteristics of spiny lobster, *Jasus edwardsii,* aggregations in exposed reef and sandy areas. Marine & Freshwater Research. 1999;50:409–416.
17. **Kelly S, MacDiarmid AB.** Movement patterns of mature spiny lobsters, *Jasus edwardsii*, from a marine reserve. New Zealand Journal of Marine and Freshwater Research. 2003;37(1):149–158.
18. **Kelly S, Scott D, MacDiarmid AB.** The value of a spillover fishery for spiny lobsters around a marine reserve in northern New Zealand. Coastal Management. 2002;30:153–166.
19. **Babcock RC, Kelly S, Shears NT, Walker JW, Willis TJ.** Changes in community structure in temperate marine reserves. Marine Ecology Progress Series. 1999;189:125–134.
20. **Ministry for Primary Industries.** Fisheries Asessment Plenary, November 2017: stock assessments and stock status. Wellington: Ministry for Primary Industries;2017.
21. **MacDiarmid AB, Freeman D, Kelly S.** Rock lobster biology and ecology: contributions to understanding through the Leigh Marine Laboratory 1962–2012. New Zealand Journal of Marine and Freshwater Research. 2013;47(3):313–333.
22. **Webber DN, Starr PJ, Haist V, Rudd MB, Edwards CTT.** The 2017 stock assessment and management procedure evaluation for rock lobsters (*Jasus edwardsii*) in CRA 2. Wellington: Ministry for Primary Industries;2018. 2018/17.
23. **Fisheries New Zealand.** Review of the CRA2 rock lobster fishery. Fisheries New Zealand. https://www.mpi.govt.nz/protection-and-response/sustainable-fisheries/review-of-the-cra2-rock-lobster-fishery/. Published 2018. Accessed November 2019.
24. **Cryer M.** Northland and Coromandel scallop stock assessment for 2001. Wellington: Ministry of Fisheries;2001.
25. **Tuck I, Parkinson D, Dey K, Oldman J, Wadhwa S.** Information on benthic impacts in support of the Coromandel Scallop Fishery Plan. In. Wellington: Ministry of Fisheries; 2006.
26. **Williams JR.** Abundance of scallops (*Pecten novaezelandiae*) in Coromandel recreational fishing areas, 2009 and 2010. In. Wellington: Ministry for Primary Industries; 2012.
27. **Norkko J, Hewitt JE, Thrush SF.** Effects of increased sedimentation on the physiology of two estuarine soft-sediment bivalves, *Austrovenus stutchburyi* and *Paphies australis*. Journal of Experimental Marine Biology and Ecology. 2006;333:12–26.
28. **Anderson MJ, Ford RB, Feary DA, Honeywill C.** Quantitative measurements of sedimentation in an estuarine system and its relationship with intertidal soft-sediment infauna. Marine Ecology Progress Series. 2004;272:33–48.
29. **Lawrence M.** East Aucklanders shell out concerns over local cockle harvesting. Stuff. 24 July, 2017.
30. **Taylor M.** Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases. Surveillance. 2018;45(4):18–19.
31. **Bingham P.** Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases. Surveillance. 2014;41(4):23–24.
32. **Meadows H, Ford R.** Hauraki Gulf Forum community monitoring programme annual report 2014–15. Auckland, New Zealand: Auckland Council and Waikato Regional Council;2015.
33. **Ross L, Williams J.** Hauraki Gulf Forum community monitoring programme annual report 2012–2013. Auckland, New Zealand: Hauraki Gulf Forum;2013.
34. **Ministry for Primary Industries.** Aquatic environment and biodiversity annual review 2017. Wellington: Compiled by the Fisheries Science Team, Ministry for Primary Industries;2017.
35. **Abraham ER, Richard Y, Berkenbusch K, Thompson F.** Summary of the capture of seabirds, marine mammals, and turtles in New Zealand commercial fisheries, 2002–03 to 2012–13. Wellington, New Zealand: Ministry for Primary Industries;2016.
36. **Abraham ER, Richard Y.** Estimated capture of seabirds in New Zealand trawl and longline fisheries, to 2016–17. Wellington, New Zealand: Fisheries New Zealand;2019.
37. **Richard Y, Abraham ER, Berkenbusch K.** Assessment of the risk to commercial fisheries to New Zealand seabirds, 2006–07 to 2016–17. Wellington: Fisheries New Zealand; 2020.
38. **MacDiarmid A, McKenzie A, Sturman J, Beaumont J, Mikaloff-Fletcher S, Dunne J.** Assessment of anthropogenic threats to New Zealand marine habitats. Wellington, New Zealand: Ministry of Agriculture and Forestry;2012.
39. **Noble J.** Supplementary report on submissions to the Proposed Regional Coastal Environment Plan 2014. Tauranga: Bay of Plenty Regional Council;2015.
40. **Moger L.** Mass of dead shellfish line the shores of an Auckland marine reserve. Stuff. 16 May, 2018.
41. **Hauraki Gulf Forum.** State of our Gulf: Tikapa Moana Hauraki Gulf state of the environment report 2011. Auckland, New Zealand: Hauraki Gulf Forum;2011.
42. **Bingham P.** Quarterly report of investigations of suspected exotic diseases. Surveillance. 2009;36(4):21–27.
43. **Barratt-Boyes M.** Pacific oysters will become a pricey delicacy. New Zealand Aquaculture. 2012;45(January/February 2012):11.
44. **Bingham P.** Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases. Surveillance. 2011;38(3):63–65.
45. **Bingham P.** Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases. Surveillance. 2016;43(1):25–27.
46. **Bingham P.** Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases. Surveillance. 2017;44(1):25.
47. **Robson S.** Hundreds of blue penguins die off, starved by La Niña. Radio New Zealand. 11 April, 2018.
48. **Taylor M.** Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases. Surveillance. 2018;45(3):61–62.
49. **Hauraki Maori Trust Board.** Matauranga Maori on toxic events in Tikapa Moana. Hauraki Maori Trust Board;2011.

50. **Wear RG, Gardner JPA.** Biological effects of the toxic algal bloom of February and March 1998 on the benthos of Wellington Harbour, New Zealand. Marine Ecology Progress Series. 2001;218:63–76.

51. **MacKenzie L.** Toxic and noxious phytoplankton in Big Glory Bay, Stewart Island. Journal of Applied Phycology. 1991;3:19–34.

52. **NZFS.** Toxic algal blooms. New Zealand Food Safety. https://www.mpi.govt.nz/travel-and-recreation/fishing/shellfish-biotoxin-alerts/toxic-algal-blooms/. Published 2019. Accessed October 2019.

53. **McCoubrey D-J.** PSP can paralyse shellfish consumers and the industry. Aquaculture Magazine. 2018;July–August:16.

54. **The New Zealand Government.** Aquaculture strategy. Wellington: The New Zealand Government;2019.

55. **Stone RCJ.** From Tamaki-Makau-Rau to Auckland. Auckland: Auckland University Press; 2001.

56. **Auckland Regional Council.** Auckland Council Regional Plan: Coastal. 2004.

57. **Comer M.** Marina berth supply and demand trends. Auckland: Panuku Development Auckland;2018.

58. **Statistics NZ.** 2018 census private dwelling count, Auckland Region. https://www.stats.govt.nz/information-releases/2018-census-population-and-dwelling-counts. Published 2019. Accessed September 2019.

59. **Nielson M.** Our big, blue backyard. New Zealand Herald. 27 May, 2019.

60. **Green M.** Central Waitematā Harbour contaminant study. Predictions of sediment, zinc and copper accumulation under future development scenario 2, 3 and 4. Auckland Regional Council;2008. Technical Report 2008/044.

61. **ANZECC.** Australian and New Zealand guidelines for fresh and marine water quality. Canberra, Australia: Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand;2000.

62. **Auckland Regional Council.** Stormwater treatment devices design guideline manual. Auckland: Auckland Regional Council;2003.

63. **Ira SJT.** A review of alternative funding solutions for stormwater management. Auckland: Auckland Council;2018.

64. **Auckland Council.** Auckland stormwater network discharge consent: Application and assessment of environmental effects. Auckland: Auckland Council;2017.

65. **Vant B.** Water quality and sources of nitrogen and phosphorus in the Hauraki rivers, 2006–15. Hamilton: Waikato Regional Council;2016.

66. **Livestock Improvement Corporation, DairyNZ Incorporated.** New Zealand dairy statistics. Livestock Improvement Corporation (LIC) and DairyNZ Incorporated. https://www.dairynz.co.nz/. Published 2018. Accessed August 2019.

67. **Vant B, Smith P.** Trends in river water quality in the Waikato Region, 1987–2002. Hamilton: Environment Waikato;2004. 2004/02.

68. **Green M, Zeldis J.** Firth of Thames water quality and ecosystem health—a synthesis. In. Hamilton: Waikato Regional Council; 2015.

69. **Hauraki Gulf Forum.** State of our Gulf 2014: Hauraki Gulf Tikapa Moana/Te Moananui a Toi state of the environment report 2014. Auckland: Hauraki Gulf Forum;2014.

70. **Statistics NZ, Ministry for the Environment.** Environment Aotearoa 2019. River water quality: nitrogen. https://www.stats.govt.nz/indicators/river-water-quality-nitrogen. Published 2019. Accessed September 2019.

71. **Zeldis JR, Swaney DP.** Balance of catchment and offshore nutrient loading and biogeochemical response in four New Zealand coastal systems: implications for resource management. Estuaries and Coasts. 2018:1559–2731.

72. **Statistics NZ, Ministry for the Environment.** Environment Aotearoa 2019: Livestock numbers. https://www.stats.govt.nz/indicators/livestock-numbers. Published 2019. Accessed August 2019.

73. **Warne K.** No swimming. New Zealand Geographic. 2017;May–Jun.

74. **Environmental Management Services.** Auckland Regional Council: Bathing beach microbial water quality monitoring. Napier: Environmental Management Services;2002.

75. **Jambeck JR, Geyer R, Wilcox C, et al.** Plastic waste inputs from land into the ocean. Science. 2015;347(6223):768–771.

76. **Royal Society Te Apārangi.** Plastics in the environment. Te Ao Hurihuri – the changing world. Wellington, New Zealand: Royal Society Te Apārangi;2019.

77. **Coastlines S.** Insights. Sustainable Coastlines. Litter Intelligence Web site. https://litterintelligence.org/. Published 2019. Accessed October 2019.

78. **Wilcox C, Van Sebille E, Hardesty BD.** Threat of plastic pollution to seabirds is global, pervasive, and increasing. Proceedings of the National Academy of Sciences. 2015;112(38):11899–11904.

79. **Markic A, Niemand C, Bridson JH, et al.** Double trouble in the South Pacific subtropical gyre: Increased plastic ingestion by fish in the oceanic accumulation zone. Marine Pollution Bulletin. 2018;136:547–564.

80. **SAPEA.** A scientific perspective on microplastics in nature and society. Berlin, Germany: Science Advice for Policy by European Academies;2019.

81. **Dikareva N, Simon KS.** Microplastic pollution in streams spanning an urbanisation gradient. Environmental Pollution. 2019;250:292–299.

82. **Graichen F.** Turning the tide on plastic microparticles: results. Scion. https://www.scionresearch.com/about-us/news-and-events/news/2019/turning-the-tide-on-plastic-microparticles-results. Published 2019. Accessed November 2019.

83. **Woods G.** ESR microplastics work winds multi-million-dollar funding. Institute of Environmental Science and Research. https://www.esr.cri.nz/home/about-esr/media-releases/esr-microplastics-work-wins-multi-million-dollar-funding/. Published 2018. Accessed November 2019.

84. **Anon.** Plastic pollution and solutions. The University of Auckland. https://www.auckland.ac.nz/en/science/our-research/research-institutes-and-centres/george-mason-centre/our-research/plastic-pollution-and-solutions.html. Published no date. Accessed October 2019.

85. **Kaza S, Yao L, Bhada-Tata P, van Woerden F.** What a waste global database. What a waste 2.0: a global snapshot of solid waste management to 2050. World Bank Group. https://datacatalog.worldbank.org/dataset/what-waste-global-database. Published 2018. Accessed November 2019.

86. **Hunt S.** Summary of historic estuarine sedimentation measurements in the Waikato region and formulation of a historic baseline. Hamilton, New Zealand: Waikato Regional Council;2019.

87. **Cummings V, Funnell GA, Schultz DL, Thrush SF, Berkenbusch K, Nicholls PE.** Mahurangi Estuary ecological monitoring programme – report on data collected from July 1994 to January 2001. Hamilton, New Zealand: National Institute of Water and Atmospheric Research;2001.

88. **Cummings VJ, Hailes SF, Edhouse S, Halliday J.** Mahurangi Estuary ecological monitoring programme: report on data collected from July 1994 to January 2015. Auckland: Auckland Council; 2016.

89. **Hewitt J, McCartain LD.** Auckland east coast estuarine monitoring programme: report on data collected up until October 2015. Auckland, New Zealand: Auckland Council;2017.

90. **Anderson MJ, Hewitt JE, Ford RB, Thrush SF.** Regional models of benthic ecosystem health: predicting pollution gradients from biological data. Auckland, New Zealand: Auckland Regional Council;2006.

91. **Hewitt JE, Ellis J.** Assessment of the benthic health model. Auckland, New Zealand: Auckland Regional Council;2010.

92. **Swales A, Gibbs M, Olsen G, Ovenden R, Costley K, Stephens T.** Sources of eroded soils and their contribution to long-term sedimentation in the Firth of Thames. Hamilton, New Zealand: Waikato Regional Council and Dairy NZ;2016.

93. **Senior A, Oldman J, Green MO, et al.** Risks to estuarine biota under proposed development in the Whitford catchment. Auckland, New Zealand: Auckland Regional Council;2003.

94. **Swales A, Gibbs M, Ovenden R, Budd RG, Hermansphan N.** Sedimentation in the Okura–Weiti–Karepiro system. Auckland, New Zealand: Auckland Regional Council;2008.

95. **Gibbs M.** Sediment source mapping in Mahurangi Harbour. Auckland, New Zealand: Auckland Regional Council;2006.

96. **Cole C.** Phase 3 of action plan to connect the dots. Mahurangi Magazine Web site. http://www.mahurangi.org.nz/2018/11/24/phase-3-to-connect-the-dots/. Published 2018. Accessed October 2019.

97. **Mahurangi Forum.** Mahurangi Action Plan: a strategic plan for the catchment 2010–30. Auckland, New Zealand: Mahurangi Forum;2010.

98. **Leersnyder H, Bunting K, Parsonson M, Stewart C.** Erosion and sediment control guide for land disturbing activities in the Auckland region. Auckland, New Zealand: Auckland Council;2018.

99. **WRC.** Sediment sampling and depositon. https://www.waikatoregion.govt.nz/environment/natural-resources/coast/coastal-monitoring/regional-estuary-monitoring-programme/methods/sediment/. Published no date. Accessed December 2019.

100. **Crisp P, Daniel L, Tortell P.** Mangroves in New Zealand: trees in the tide. Wellington, New Zealand: GP Books; 1990.

101. **Morrison MA, Jones EG, Consalvey M, Berkenbusch K.** Linking marine fisheries species to biogenic habitats in New Zealand: a review and synthesis of knowledge. Wellington: Ministry for Primary Industries;2014.

102. **Morrisey D, Beard C, Morrison M, Craggs R, Lowe M.** The New Zealand mangrove: review of the current state of knowledge. Auckland: Auckland Regional Council;2007.

103. **Bulmer RH, Schwendenmann L, Lundquist CJ.** Carbon and nitrogen stocks and below-ground allometry in temperate mangroves. Frontiers in Marine Science. 2016;3:150.

104. **Montgomery J, Bryan K, Horstman E, Mullarney J.** Attenuation of tides and surges by mangroves: contrasting case studies from New Zealand. Water. 2018;10(9):1119.

105. **Swales A, Bentley SJ, Lovelock CE.** Mangrove-forest evolution in sediment-rich estuarine system: opportunists or agents of geomorphic change? Earth Surface Processes and Landforms. 2015;40(12):1672–1687.

106. **Swales A, Gorman R, Oldman JW, et al.** Potential future changes in mangrove habitat in Auckland's east-coast estuaries. Auckland: Auckland Regional Council;2009.

107. **Horstman EM, Lundquist CJ, Bryan KR, Bulmer RH, Mullarney JC, Stokes DJ.** The dynamics of expanding mangroves in New Zealand. In: Makowski C, Finkl C, eds. Threats to mangrove forests. Vol 25. Cham: Springer; 2018.

108. **Halliday J, Thrush SF, Hewitt J.** Ecological monitoring for potential effects of forestry activity on the intertidal habitats of Whangapoua Harbour: long-term review 1993–2006. Hamilton, New Zealand: National Institute of Water and Atmospheric Research;2006.

109. **Jones H.** Coastal sedimentation: what we know and the information gaps. Hamilton: Environment Waikato;2008.

110. **Bulmer RH, Lewis M, O'Donnell E, Lundquist CJ.** Assessing mangrove clearance methods to minimise adverse impacts and maximise the potential to achieve restoration objectives. New Zealand Journal of Marine and Freshwater Research. 2017;51(1):110–126.

111. **Ministry for the Environment, Statistics New Zealand.** Our marine environment 2019. Wellington, New Zealand: Ministry for the Environment;2019.

112. **Auckland Council.** Draft Te Tāruke-ā-Tāwhiri: Auckland's climate action framework for consultation. Auckland, New Zealand: Auckland Council;2019.

113. **Lorrey AM, Pearce PR, Barkus C, Anderson SJ, Clement-Jones A.** Auckland Region climate change projections and impacts: summary report. 2018.

114. **Pearce P, Bell R, Bostock H, et al.** Auckland Region climate change projections and impacts. Auckland, New Zealand: Auckland Council;2017.

115. **ARUP.** Climate change risks in Auckland. Auckland, New Zealand: Auckland Council;2019.

116. **Li Y, Storey L, Ye W, Bornman JF.** Strategic assessment of the impacts of climate change on the Waikato Region. Hamilton, New Zealand: Waikato Regional Council;2011.

117. **Ministry for the Environment.** Climate change projects for the Waikato region. https://www.mfe.govt.nz/climate-change/likely-impacts-of-climate-change/how-could-climate-change-affect-my-region/waikato. Published 2018. Accessed December 2019.

118. **Ministry for the Environment.** About the Paris Agreement. Ministry for the Environment. https://www.mfe.govt.nz/climate-change/why-climate-change-matters/global-response/paris-agreement. Published 2018. Accessed November 2019.

119. **Ministry for the Environment.** New Zealand's greenhouse gas emissions reduction targets. Ministry for the Environment. https://www.mfe.govt.nz/climate-change/climate-change-and-government/emissions-reduction-targets. Published no date. Accessed November 2019.

120. **Xie S.** Auckland's greenhouse gas inventory to 2016. Auckland, New Zealand: Auckland Council;2019.

121. **Stancu C, Marquart M.** Waikato region greenhouse gas inventory – July 2015 to June 2016. Hamilton, New Zealand: Waikato Regional Council;2018.

122. **Simonson T, Hall G.** Vulnerable: the quantum of local government infrastructure exposed to sea level rise. Wellington, New Zealand: Local Government New Zealand;2019.

123. **Ministry for the Environment.** Preparing for coastal change. Wellington, New Zealand: Ministry for the Environment;2017.

124. **TCDC.** Protecting our coast. Thames-Coromandel District Council. https://www.tcdc.govt.nz/Your-Council/Documents-incl-Bylaws-Policies-and-Strategies/Coastal-Management-Strategy/. Published 2018. Accessed November 2019.

125. **Fernandez MA, Golubiewski NE.** An assessment of vulnerability to climate change in Auckland. Auckland, New Zealand: Auckland Council;2019.

126. **Foley MM, Carbines M.** Climate change risk assessment for Auckland's marine and freshwater ecosystems. Auckland, New Zealand: Auckland Council;2019.

127. **NIWA.** Seven station' series temperature data. National Institute of Water and Atmospheric Research. https://niwa.co.nz/our-science/climate/information-and-resources/nz-temp-record/seven-station-series-temperature-data. Published 2019. Accessed November 2019.

128. **Ministry for the Environment.** Coastal sea-level rise 1901–2018. Ministry for the Environment. New Zealand's Environmental Reporting Series Web site. https://data.mfe.govt.nz/table/104055-coastal-sea-level-rise-1901-2018/metadata/. Published 2019. Accessed November 2019.

129. **Hollis M.** Climate Change. IPCC fifth assessment report. New Zealand findings. New Zealand Climate Change Centre;2014.

130. **Marsh S.** Hauturu – resting place of the wind. New Zealand Geographic. 2002;Jan–Feb.

131. **Petherick M.** Komiti Taiao a-Hapori Hoki/Environment and Community Committee. Open Agenda 12 February 2019 Web site. https://infocouncil.aucklandcouncil.govt.nz/Open/2019/02/ENV_20190212_AGN_6847_AT.PDF#page=37. Published 2019. Accessed December 2019.

132. **Russell JC, Towns DR, Clout MN.** Review of rat invasion biology: implications for island biosecurity. Wellington, New Zealand: Department of Conservation;2008.

133. **Nelson NJ, Briskie JV, Constantine R, et al.** The winners: species that have benefited from 30 years of conservation action. Journal of the Royal Society of New Zealand. 2019;49(3):281–300.

134. **Parker KA.** North Island saddleback. New Zealand Birds Online Web site. www.nzbirdsonline.org.nz. Published 2013. Accessed August 2017.

135. **Tezanos-Pinto G, Hupman K, Wiseman N, et al.** Local abundance, apparent survival and site fidelity of Bryde's whales in the Hauraki Gulf (New Zealand) inferred from long-term photo-identification. Endangered Species Research. 2017;34:61–73.

136. **Izadi S.** Behavioural ecology of Bryde's whales [PhD]. Auckland, New Zealand, University of Auckland; 2018.

137. **Anon.** Bryde's whales. NOAA Fisheries. https://www.fisheries.noaa.gov/species/brydes-whale. Published no date. Accessed October 2019.

138. **Constantine R, Johnson M, Riekkola L, et al.** Mitigation of vessel-strike mortality of endangered Bryde's whales in the Hauraki Gulf, New Zealand. Biological Conservation. 2015;186:149–157.

139. **Ebdon P, Riekkola L, Constantine R.** Testing the efficacy of ship strike mitigation for whales in the Hauraki Gulf, New Zealand. Ocean & Coastal Management. In press.

140. **Constantine R.** Dr Rochelle Constantine - whale poo divulges its secrets [Internet]; 2019 4 May 2019 [cited October 2019]. Podcast. Available from: https://www.rnz.co.nz/national/programmes/saturday/audio/2018693571/dr-rochelle-constantine-whale-poo-divulges-its-secrets

141. **Carroll EL, Gallego R, Sewell MA, et al.** Multi-locus DNA metabarcoding of zooplankton communities and scat reveal trophic interactions of a generalist predator. Scientific Reports. 2019;9(1):281.

142. **Ebdon P.** Testing the efficacy of ship strike mitigation for whales in the Hauraki Gulf, New Zealand [MSc]. Auckland, New Zealand, University of Auckland; 2017.

143. **Evans K.** Where are all the spotted shags? New Zealand Geographic. 2019;May–June:68–87.

144. **Gaskin CP, Rayner MJ.** Seabirds of the Hauraki Gulf: natural history, research and conservation. Auckland, New Zealand: Hauraki Gulf Forum;2013.

145. **Gaskin C.** Description of seabird life and use of the area associated with the Coromandel Marine Farming Zone. Whangateau, New Zealand: Northern NZ Seabird Trust;2019.

146. **Orwin KH, Wardle DA, Towns DR, et al.** Burrowing seabird effects on invertebrate communities in soil and litter are dominated by ecosystem engineering rather than nutrient addition. Oecologia. 2016;180(1):217–230.

147. **Whitehead E, Adams N, Baird KA, et al.** Threats to seabirds of northern Aotearoa New Zealand. Auckland, New Zealand: Northern New Zealand Seabird Charitable Trust;2019.

148. **Hitchmough R.** New Zealand threat classification systems lists—2002. Wellington, New Zealand: Department of Conservation;2002.

149. **Robertson HA, Baird KA, Dowding JE, et al.** Conservation status of New Zealand birds, 2016. Wellington, New Zealand: Department of Conservation;2017.

150. **Stephenson BM, Flood R, Thomas B, Saville S.** Rediscovery of the New Zealand storm petrel (*Pealeornis maoriana* Mathews 1932): two sightings that revised our knowledge of storm petrels. Notornis. 2008;55:77-83.

151. **Gaskin CP.** New Zealand storm petrel. New Zealand Birds Online Web site. www.nzbirdsonline.org.nz. Published 2013 [Updated 2017]. Accessed 13/01/2020.

152. **Rayner MJ, Hauber ME, Imber MJ, Stamp RK, Clout MN.** Spatial heterogeneity of mesopredator release within an oceanic island system. Proceedings of the National Academy of Sciences. 2008;104(52):20862–80865.

153. **Bellingham PJ, Towns DR, Cameron EK, et al.** New Zealand island restoration: seabirds, predators, and the importance of history. New Zealand Journal of Ecology. 2010;34(1):115–136.

154. **Abraham ER, Richard Y.** Estimated capture of seabirds in New Zealand trawl and longline fisheries, 2002–03 to 2015–16. Wellington, New Zealand: Fisheries New Zealand;2019.

155. **Abraham ER, Richard Y.** Estimated capture of seabirds in New Zealand trawl and longline fisheries, 2002–03 to 2014–15. Wellington, New Zealand: Ministry for Primary Industries;2018.

156. **Dragonfly Data Science.** Protected species bycatch in New Zealand fisheries. https://psc.dragonfly.co.nz/. Published 2019. Accessed October 2019.

157. **Weidensaul S.** Living on the Wind: across the hemisphere with migratory birds. New York, USA: North Point Press;1999.

158. **Anon.** Shorebirds at Miranda. Pūkorokoro Miranda Shorebird Centre Web site. http://www.miranda-shorebird.org.nz/shorebirds-at-miranda. Published 2019. Accessed September 2019.

159. **Anon.** Northern dotterel back form brink after protection programme. Radio New Zealand. https://www.rnz.co.nz/news/national/387513/northern-dotterel-back-from-brink-after-protection-programme. Published 2019. Accessed September 2019.

160. **Anon.** Rare shore plover chicks hatch on Motutapu Island. Department of Conservation. https://www.doc.govt.nz/news/media-releases/2018/rare-shore-plover-chicks-hatch-on-motutapu-island/. Published 2018. Accessed September 2019.

161. **Anon.** Rare shore plover/tūturuatau release on Motutapu. Department of Conservation. https://www.doc.govt.nz/news/media-releases/2019/rare-shore-plovertuturuatu-released-on-motutapu/. Published 2019. Accessed September 2019.

162. **Anon.** An interview with...Waiaria Rameke (Ngati Tuwharetoa, Ngati Raukawa). TMBC. http://www.tmbiosecurity.co.nz/news/an-interview-with-waiaria-rameka-ngati-tuwharetoa-ngati-raukawa/. Published 2019. Accessed August, 2019.

163. **Cranfield HJ, Gordon DP, Willian RC, et al.** Adventive marine species in New Zealand. Wellington, New Zealand: National Institute of Water and Atmospheric Research;1998.

164. **Biosecurity New Zealand.** Marine biosecurity porthole. www.marinebiosecurity.org.nz. Published 2019. Accessed August 2019.

165. **Inglis G, Gust N, Fitridge I, et al.** Gulf Harbour Marina baseline survey for non-indigenous marine species (Research Project ZBS2000/04). Wellington: Biosecurity New Zealand; 2005.

166. **Inglis G, Gust N, Fitridge I, et al.** Port of Auckland baseline survey for non-indigenous marine species (Research Project ZBS2000/04). Wellington: Biosecurity New Zealand; 2006.

167. **Anon.** Marine invader found in Great Barrier Island waters. Auckland Council. Our Auckland Web site. https://ourauckland.aucklandcouncil.govt.nz/articles/news/2019/08/marine-invader-found-in-great-barrier-island-waters/. Published 2019. Accessed November 2019.

168. **Woods C, Seaward K, Rodgers LP, et al.** Marine high risk site surveillance. Annual synopsis report for all high risk sites 2018–19 (SOW18048). Wellington, New Zealand: Biosecurity NZ;2019.

169. **Woods C, Seaward K, Pryor Rodgers L, Inglis G.** Marine high risk site surveillance programme: annual synopsis report for all high risk sites 2017–18. Wellington, New Zealand: Ministry for Primary Industries;2018.

170. **Anon.** What's at stake? Biosecurity New Zealand and NIWA. Marine Biosecurity Porthole Web site. https://www.marinebiosecurity.org.nz/a-dummy-research-page/. Published 2017. Accessed Nov 2019.

171. **Anon.** Cawthron Institute to lead vital collaborative research with goal of future proofing New Zealand's marine biosecurity. Cawthron Institute. https://www.cawthron.org.nz/biosecurity/news/2019/cawthron-institute-lead-vital-collaborative-research-goal-futureproofing-new-zealands-marine-biosecu/. Published 2019. Accessed Nov 2019.

172. **Court of Appeal.** Attorney-General v The Trustees of the Motiti Rohe Moana Trust & Others. Courts of New Zealand;2019. NZCA 532.

173. **Office of the Minister of Conservation.** Responding to the Ngāi Tai ki Tāmaki Supreme Court decision and giving effect to treaty principles in conservation. Wellington: Office of the Minister of Conservation;2019.

174. **The Supreme Court Of New Zealand.** Ngai Tai ki Tāmaki Tribal Trust versus the Minister of Conservation & Others. Courts of New Zealand;2018. NZSC 122.

175. **Hauraki Gulf Forum.** State of our Gulf 2017: Hauraki Gulf/Tīkapa Moana/Te Moana-nui-a-Toi state of the environment report 2017. Auckland: Prepared by Kelly, S., Sim-Smith, C., Bartley, J., Cowie, B., and Murray, C., Coast and Catchment;2017.

176. **Ministry for the Environment.** Terms of reference: resource management review panel. Wellington: Ministry for the Environment;2019.

177. **Ministry for the Environment, Ministry for Primary Industries.** Essential freshwater: Healthy water, fairly allocated. Wellington: Ministry for the Environment and Ministry for Primary Industries;2018.

178. **Ministry for the Environment.** He Kura Koiora i hokia: A discussion document on a proposed National Policy Statement for Indigenous Biodiversity. Wellington: Ministry for the Environment;2019.

179. **Fisheries New Zealand.** National inshore finfish fisheries plan. Wellington: Fisheries New Zealand;2019.

Harataonga coastal walkway. Photo by Shaun Lee.

Under the Hauraki Gulf Marine Park Act 2000 the Hauraki Gulf Forum is required to prepare and publish, once every three years, a report on the state of the environment in the Hauraki Gulf, including information on progress towards integrated management and responses to prioritised strategic issues.

The Hauraki Gulf Forum is a statutory body charged with the promotion and facilitation of integrated management and the protection and enhancement of the Hauraki Gulf / Tīkapa Moana. The Forum has representation on behalf of the Ministers of Conservation, Fisheries and Māori Development, elected representatives from Auckland Council (including the Aotea / Great Barrier and Waiheke local boards), Waikato Regional Council and the Waikato, Hauraki, Thames-Coromandel and Matamata-Piako district councils, plus six representatives of the tangata whenua of the Hauraki Gulf and its islands.

www.haurakigulfforum.org.nz

Hauraki Gulf Forum
Tīkapa Moana
Te Moananui-ā-Toi