



Ministry for the
Environment
Manatū Mō Te Taiao



>> New Zealand's Environmental Reporting Series



Our marine environment 2016

DATA TO 2015

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Message from the Secretary for the Environment and the Government Statistician

He taura whiri kotahi mai anō te kopunga tai no i te pu au

From the source to the mouth of the sea all things are joined together as one

As a nation, we have an obligation to ensure that we look after our coasts and oceans, so that biodiversity and our well-being are sustained for generations to come. Our successful stewardship of the marine environment depends upon having reliable information on how and why the environment is changing, and the impacts these changes have on our lives.

New Zealand's Environmental Reporting Series: Our marine environment 2016 is the third report produced in the Environmental Reporting Series, following *Environment Aotearoa 2015* and the *2014 Air domain report*. It is the first report to be produced under the Environmental Reporting Act 2015, which came into force in June 2016. The Act requires the Ministry for the Environment and Statistics New Zealand to produce regular, robust, and reliable reports on the environment. Six-monthly reports on each of the 'domains' (marine, fresh water, atmosphere and climate, land, and air) will be followed by a whole-of-environment report every three years.

Our marine environment 2016 highlights the importance of taking an international view of environmental stewardship. On a global scale, high concentrations of greenhouse gases in the atmosphere are increasing ocean temperatures. In addition, increasing atmospheric concentrations of carbon dioxide are causing the oceans to acidify. Our data show similar trends in New Zealand waters. While the full implications for New Zealand are not clear, these physical and chemical changes to our marine environment are expected to continue for generations.

Other products complement this report. The [Environmental indicators Te taiao Aotearoa](#) website contains graphs, maps, tables, and more detailed technical information. An [infographic](#) gives a pictorial view of our key findings, while our [data service](#) provides the raw data we used in our analysis.

These products are part of an ongoing effort to produce and make available more comprehensive information about our environment. To be truly effective, the products must do more than simply provide information – they need to support New Zealanders to make better decisions at all levels of society and government.



Vicky Robertson
Secretary for the Environment



Liz MacPherson
Government Statistician

New Zealand's top marine issues at a glance

Multiple, cumulative human pressures are causing changes to New Zealand's oceans, coastal marine habitats, and wildlife – these changes are serious threats to the benefits current and future generations will receive from our marine environment.

The top three issues

Global greenhouse gas emissions are causing ocean acidification and warming

Ocean acidification may cause widespread harm to New Zealand's marine ecosystems, particularly to marine organisms with carbonate shells like pāua, mussels, and oysters. Ocean warming may affect ocean currents, modify habitats, and expand or reduce the areas where marine species are found, and is a primary cause of rising sea levels. Ocean acidification and warming will continue for generations.

Native marine birds and mammals are threatened with extinction

Most of our marine bird species are threatened with or at risk of extinction, including species of albatrosses, penguins, and herons. More than one-quarter of our marine mammal species are threatened with extinction, including the New Zealand sea lion and species of dolphins and whales. These animals have important roles in marine ecosystems and are tāonga (treasures) to Māori. Their fragile state is due to multiple historic and present-day pressures, although accidental deaths of seabirds and marine mammals from fishing (bycatch) have decreased.

Coastal marine habitats and ecosystems are degraded

Of all marine environments, our coastal ecosystems are under the most pressure from human activities. Pressures interact in complex ways to degrade coastal habitats and ecosystems, and impacts can accumulate over decades. The degradation of coastal habitats undermines their functions in the wider ocean ecosystem and compromises Māori values, commercial activities, and New Zealanders' recreational enjoyment of coastlines and beaches.

The most important coastal pressures, alongside ocean acidification and climate change impacts, are:

- excess sedimentation
- seabed trawling and dredging for fish and shellfish
- marine pests
- excess nutrients carried down waterways.

Other coastal pressures include other fishing methods, dumping of dredge spoils, reclamation (infilling of harbours and estuaries for coastal development) and pollution from waste water and plastic debris.

Limitations of this report

As national data on many issues are limited, our findings also draw from scientific literature and expert opinion.

The full ecological impacts of fishing are not clear

Fishing is a highly valued economic, cultural, and recreational activity and one of the most important issues for which we did not have sufficient data. In particular, we were not able to draw firm conclusions about the full ecological impacts of commercial, recreational, and customary fishing on coastal and open ocean ecosystems.

Executive summary

An overview

The overriding finding of this report is that human pressures are causing changes to our oceans and marine biodiversity that have implications for generations of New Zealanders to come.

We are leaving uncertainty for future generations

Increasing concentrations of atmospheric carbon dioxide – largely from global burning of fossil fuels – and other greenhouse gases in the atmosphere – are changing the state of New Zealand's oceans. Our oceans are warming and becoming more acidic. These changes will continue into the foreseeable future.

In addition, past and present-day human activities have put such pressure on our native wildlife that some species and subspecies of marine birds and mammals are at risk of extinction.

We cannot be certain that future New Zealanders will enjoy the same benefits from the marine environment as we do. The extent and rate of change from ocean acidification and warming over centuries depends on what we – and the rest of the world – do about global greenhouse gas emissions.

A lack of data makes firm conclusions difficult in some important areas

A secondary overriding finding is that gaps in national data make it hard to draw firm conclusions in some important areas. For example, we cannot quantify the state of marine habitats at a national level, or the full ecological impacts of commercial, recreational, and customary fishing on coastal and open ocean ecosystems.

Our reporting programme is committed to improving national environmental data over time, but research and monitoring of our coastal waters and vast ocean area are expensive for a small country. It may take years to substantively improve our knowledge in some areas. However, no generation of New Zealanders will ever make decisions on their relationship with the marine environment based on perfect information, and there are potentially high costs of delaying action.

The top three issues

Our reporting programme identified three top issues:

- global greenhouse gas emissions are causing ocean acidification and warming
- native marine birds and mammals are threatened with extinction
- coastal marine habitats and ecosystems are degraded.

We chose these three issues because of:

- the scale of harm, or potential harm, to natural systems – ocean warming and acidification have widespread implications for species and ecosystems across the exclusive economic zone (EEZ) and territorial sea
- the deteriorating trend – ocean warming and acidification are increasing and the overall conservation status of seabirds is worsening
- the irreversibility of change – ocean acidification and warming will continue for generations and species extinction is permanent.

We have limited national data on the degradation of coastal marine habitats and ecosystems, but we know from scientific case studies and observation that these ecosystems are under the most pressure from human activities. These pressures can interact and combine to have cumulative negative impacts on ecosystems.

Coastal habitats have critical functions in the wider ocean ecosystem. They are also the places closest to where New Zealanders live, work, and play. For these reasons, we chose the degradation of coastal marine habitats and ecosystems as a top issue even though current data do not tell the full story.

Our oceans and the climate

Top issue – global greenhouse gas emissions are causing ocean acidification and ocean warming

Global greenhouse gas emissions have increased concentrations of greenhouse gases in the atmosphere to unprecedented levels in human history (IPCC, 2013), warming the planet, including the world's oceans. The world's oceans have become more acidic as they have absorbed additional carbon dioxide in the atmosphere from human activities. These changes are also occurring in New Zealand's waters.

Based on global projections, ocean warming is set to continue for centuries to millennia, even if global greenhouse gas concentrations are stabilised (IPCC, 2013). Ocean acidification will continue for generations if substantial emissions from human activities continue (IPCC, 2013). The rate and extent of change to New Zealand's oceans over centuries will depend on whether, and how fast, human societies reduce global greenhouse gas emissions.

Ocean acidification and warming may cause widespread harm to marine ecosystems, for example, by reducing the survival and growth rates of marine species, extending or reducing the range of species, and modifying habitats. These impacts could occur across New Zealand's entire ocean area, with implications for biodiversity, Māori harvesting of mahinga kai (traditional food), and marine-based industries such as aquaculture and commercial fishing.

Ocean warming is a primary cause of rising sea-levels. Sea-level rise is a long-term threat that will increasingly affect coastal marine habitats. It has substantial implications for coastal housing and infrastructure.

Key findings

Global greenhouse gas emissions, largely from burning fossil fuels, are changing our marine environment

- Global net greenhouse gas emissions rose 33 percent from 1990 to 2011. New Zealand's overall contribution to global emissions is small; however, our emissions per person are among the highest in the world.
- New Zealand's subantarctic waters have become more acidic since measurements were first made in 1998. This ocean acidification is consistent with changes measured elsewhere in the world.
- Sea-surface temperatures in New Zealand's waters showed a statistically significant increase of about 0.71 degrees Celsius over the period 1909–2009. The increase is consistent with global average sea-surface-temperature increases. Annual average sea-surface temperatures around New Zealand measured by satellite over the past 20 years show no determinable trend. This is not surprising, as over short time scales natural variability can mask any long-term trends.
- Sea levels around New Zealand's coastline have risen between 1.31 and 2.14 millimetres a year on average since reliable measurements began in 1900, at a rate consistent with sea-level rise worldwide.

Our marine birds and mammals

Top issue – native marine birds and mammals are threatened with extinction

We do not know the overall state of New Zealand's marine biodiversity, because there is limited population data for many marine organisms. This leaves some big gaps in our understanding of the state of non-commercial fish species, plants, algae, and other marine wildlife. However, there are relatively good data on marine birds and most marine mammals.

More than one-third of our native species and subspecies of seabirds, more than half of shorebirds, and more than one-quarter of marine mammals – including albatrosses, penguins, herons, dolphins, and whales – are **threatened with extinction**. This classification has the highest risk of extinction (see [Appendix 1: New Zealand Threat Classification System](#)).

The fragile state of some of our wildlife is in part due to historic pressures when people viewed these animals as resources, game, or pests. For marine birds, present-day pressures include the loss or modification of breeding habitats, predators, and fishing bycatch. For marine mammals, pressures include bycatch, ship strike, pollution, habitat modification, and competition for food from commercial fishing.

The specific impacts of losing species on New Zealand's wider marine ecosystems – including a high proportion of a particular group such as seabirds – are poorly understood. However, there may be consequential impacts on other species and the resilience of ecosystems.

These animals are taonga (treasures) for Māori. Their extinction would be a tangible loss for people who are inspired by, or have a spiritual connection to our marine wildlife, and their decline undermines Māori exercising of kaitiakitanga (guardianship).

Our marine fauna is of international interest and importance. Nearly half the world's whale, dolphin, and porpoise species are found in our waters. Nearly one-quarter of the world's seabird species breed in New Zealand – and we have the highest number of endemic seabird species (found only here) in the world.

Key findings

Ninety percent of our seabird and shorebird species or subspecies are threatened with, or at risk of, extinction

- Of the 92 indigenous seabird species and subspecies that breed in New Zealand, 32 (35 percent) are classified as **threatened** with extinction and 51 (55 percent) are **at risk** of extinction (see [Appendix 1: New Zealand Threat Classification System](#)). Of the 32 species and subspecies **threatened** with extinction, 12 are **nationally critical**, facing an extremely high risk of extinction, including species of albatross, shag, petrel, and penguin.
- Nine percent (8 of 92) of our indigenous seabird species and subspecies have had an increased risk of extinction since 2008; the risk decreased for only one species over the same period.
- Of the 14 indigenous shorebird species and subspecies that breed in New Zealand, eight (57 percent) are classified as **threatened** with extinction and four (29 percent) are **at risk** of extinction. There has been no change in conservation status of shorebirds since 2008.

More than one-quarter of marine mammal species or subspecies are threatened with extinction

- Of the 29 indigenous marine mammal species and subspecies that breed in New Zealand, eight (28 percent) are classified as **threatened** with extinction:
 - five are **nationally critical**, facing an extremely high risk of extinction – Bryde's whale, Māui dolphin, New Zealand sea lion, orca, and southern elephant seal
 - two are **nationally endangered**, facing a high risk of extinction – Hector's dolphin and bottlenose dolphin
 - southern right whale's conservation status has improved since 2008 due to a population increase but is still classified as **nationally vulnerable**.

Fishing bycatch is decreasing but is still a pressure on protected marine life

- Some of our rarest native albatross, shearwater, and petrel species are at a high or very high risk of death from bycatch – when they are caught and killed in fishing gear. The estimated total number of seabirds killed from commercial bycatch has decreased since 2003. Other pressures, for example, loss of nesting habitat, have not been quantified.

- The number of New Zealand sea lions and fur seals injured or killed as commercial bycatch has decreased since 1995. From 1921 to 2015, commercial and recreational bycatch was the main identified cause of death of Hector's and Māui dolphins; however, bycatch numbers have decreased over the last decade. Other pressures on marine mammals have not been quantified.

Our coastal waters, harbours, and estuaries

Top issue – coastal habitats and ecosystems are degraded

Coastal marine habitats have critical functions in the wider ocean ecosystem – such as recycling nutrients and human wastes, trapping and stabilising sediments, producing oxygen that supports other marine life, and as nursery grounds for fish. The loss or degradation of these habitats can undermine these functions, with consequential impacts on ecosystems.

New Zealanders visit our coastlines, beaches, and harbours to fish, harvest shellfish, and enjoy a wide range of recreational activities. These opportunities are diminished when the marine environment is degraded – for example, by poor water quality and limited marine life. A degraded coastal ecosystem has implications for aquaculture and recreational and commercial fishing. For Māori, the degradation of coastal waters has been a source of grievance since early European settlement, undermining cultural values, including harvesting of fish and shellfish.

The most important pressures on coastal waters

On a national scale, data are sometimes limited, but we know from expert opinion and the scientific literature that the most important pressures are:

- ocean acidification and impacts of climate change
- excess sedimentation, which accumulates over decades and can directly affect shellfish and finfish species and destroy important habitats including fish nurseries
- seabed trawling and dredging for fish and shellfish
- marine pests, which can alter ecosystem processes and modify natural habitats, potentially causing biodiversity loss and threatening marine-based industries
- excess nutrients carried down waterways, mostly from urban development and agriculture, which can reduce oxygen in seawater and contribute to algal blooms, harming marine ecosystems (see [Future reporting](#)).

The impact of pressures can accumulate over decades, and pressures can combine and interact in complex ways to cause harm. For example, the acidification of coastal waters can be exacerbated by nutrient loading.

Other pressures

Other pressures include other commercial and recreational fishing methods, dumping of dredge spoils, infilling of estuaries and harbours for building coastal infrastructure (reclamation), and other sources of pollution.

This includes pollution from:

- sewage and waste water, although New Zealand's sewage treatment improved markedly in the 1990s and most sewage is now treated before discharge into the ocean
- plastic waste, which can injure or kill marine animals, remains in the ocean for hundreds of years, and can enter the food chain.

Key findings

Excess sedimentation is an important threat to coastal habitats

- In 2012, marine experts ranked sedimentation as one of the top four threats to New Zealand's marine habitats. Excess sedimentation is caused by activities such as forest harvesting, clearing land for agriculture, and urban subdivision. Coastal marine habitats such as rocky reefs, sandy beaches, pipi beds, seagrass meadows, and sand and mud flats, are particularly vulnerable to sedimentation.

The levels of heavy metals in monitored estuaries and harbours are mostly at levels unlikely to cause harm to seabed species

- Heavy metals, from run-off from roads and other sources, are toxic to both animals and humans even at low concentrations. Heavy metal concentrations in estuaries and harbours are mostly at levels unlikely to cause harm to seabed species, based on data from 10 regions.

The threat from non-indigenous species in our coastal waters has increased

- The number of non-indigenous marine species in New Zealand's coastal waters has risen 10 percent since 2010. Between 2010 and 2015, 33 new non-indigenous species were recorded, of which 12 have established in New Zealand's waters.
- Non-indigenous marine species most likely enter our waters on the hulls of boats and ships, or in ballast water. Some of these species become marine pests. The economic costs to New Zealand of marine pests to aquaculture and other industries are poorly quantified but have been estimated to amount to millions of dollars a year.

Fisheries and the impact of fishing on marine ecosystems

Sustaining fisheries and protecting marine biodiversity and ecosystems

Fishing is both a highly valued economic, cultural, and recreational activity and a pressure on marine wildlife and marine ecosystems. Our reporting programme had insufficient data from which to draw firm conclusions about the full ecological impact of commercial, recreational, and customary fishing.

Fishing and aquaculture play important roles in the Māori economy and Māori ways of life. More generally, fishing and aquaculture contributed \$896 million (0.4 percent) to

New Zealand's gross domestic product in 2013, providing over 47,000 jobs. In addition, as many as one-third of New Zealanders fish, dive, or harvest shellfish to feed family and friends.

Seabed trawling and dredging are the most destructive fishing methods, causing major damage to seabed habitats and species. Most fishing methods result in the accidental death of non-target species, including fish, sharks, rays, seabirds, fur seals, sea lions, and dolphins. Fishing can disrupt the natural balance of species within the wider marine ecosystem.

New Zealand's commercial fisheries are managed by a quota management system (QMS) that sets levels of allowable commercial catch for the purpose of ensuring the continued viability of fish stocks over time. Recreational fishing is a pressure on coastal waters, particularly near our most populated urban centres.

Key findings

Seabed trawling and dredging for fish and shellfish have decreased

- The number of commercial trawl tows in New Zealand waters has decreased more than 50 percent since 1995. The number of dredge tows has decreased 83 percent over the same period. We do not have data on recreational dredging. We do not know how fast or to what extent New Zealand's seabed habitats that have been subject to trawl and dredge tows recover.

In 2015, 17 percent of New Zealand's commercial fish stocks were overfished, requiring active intervention to rebuild stock

- In 2015, 17 percent of the New Zealand fish stocks were overfished – meaning they were depleted and needed active management or had collapsed and needed to be closed.
- The status of some fish stocks in the QMS are not known but knowledge of the status of fish stocks making up most of the main commercial species has improved since 2009.
- Seventy-eight percent of total landings of fish in 2015 came from fish stock of known status (assessed against a specific management limit).
- The 17 percent of overfished New Zealand fish stocks compares with an estimated 29 percent of fish stocks overfished worldwide.

About this report and other products

Our marine environment 2016 is for all New Zealanders interested in understanding how and why New Zealand's marine environment is changing. We have simplified often complex data and science to minimise the use of technical terms, but encourage you to refer to the [glossary](#) for explanations of technical terms.

See [New Zealand's top marine issues at a glance](#) and the [Executive summary](#) for an overview of the report's main findings and conclusions.

See [Introduction to our marine environment and environmental reporting](#) for a description of New Zealand's marine environment, a discussion of Māori systems of knowledge and their relevance to environmental reporting, and some important limitations of this report.

The rest of the report focuses on four themes:

- our oceans and the climate
- our marine birds and mammals
- our coastal waters, harbours, and estuaries
- our fisheries and the impact of fishing on marine ecosystems.

Each theme has its own chapter in which we discuss the **pressures** on marine habitats and species and outline what we know about the **state of the marine environment** and how it is changing. In a summary and implications section at the end of each chapter we discuss some actual and potential **impacts** these change have on marine ecosystems and our well-being.

Download our infographic for a pictorial overview of our findings

[New Zealand's marine environment at a glance](#) is a visual representation of our key findings. Use this resource if you want basic information on our marine environment.

Go to our webpages and data service for more detailed scientific information

[Environmental indicators Te taiao Aotearoa](#) has graphs, maps, tables, and more detailed scientific descriptions of our findings.

Access the [data service](#) if you want to conduct your own analysis of the data. The data service also provides reports that explain the methodologies we used in our analysis.

Introduction to our marine environment and environmental reporting

This is the first report in New Zealand's Environmental Reporting Series focused solely on the marine environment. In this chapter we:

- give a brief introduction to New Zealand's marine environment
- discuss Māori systems of knowledge and their relevance to environmental reporting
- outline important limitations of the report.

New Zealand's marine environment

New Zealand has a very large marine area compared with our land size

New Zealand comprises two main islands and more than 700 smaller islands and islets. It has one of the longest coastlines and one of the largest marine areas in the world, compared with its land area.

New Zealand's territorial sea is the area extending from the coast to the 12 nautical mile limit. However, we have rights and responsibilities for a much larger marine area, extending from 12 to 200 nautical miles from the coast, referred to as the exclusive economic zone (EEZ). This includes the marine area offshore from our larger remote islands: Chatham Islands, subtropical Raoul Island, and subantarctic Campbell Island and Auckland Islands.

New Zealand has some limited rights to the extended continental shelf – the underwater land mass on which New Zealand's main land mass and small islands sit (see figure 1). New Zealand's marine area is between 15 and 21 times larger than our land area, depending on whether we measure to the outer limit of the EEZ or the extended continental shelf.

Our marine environment is complex and diverse

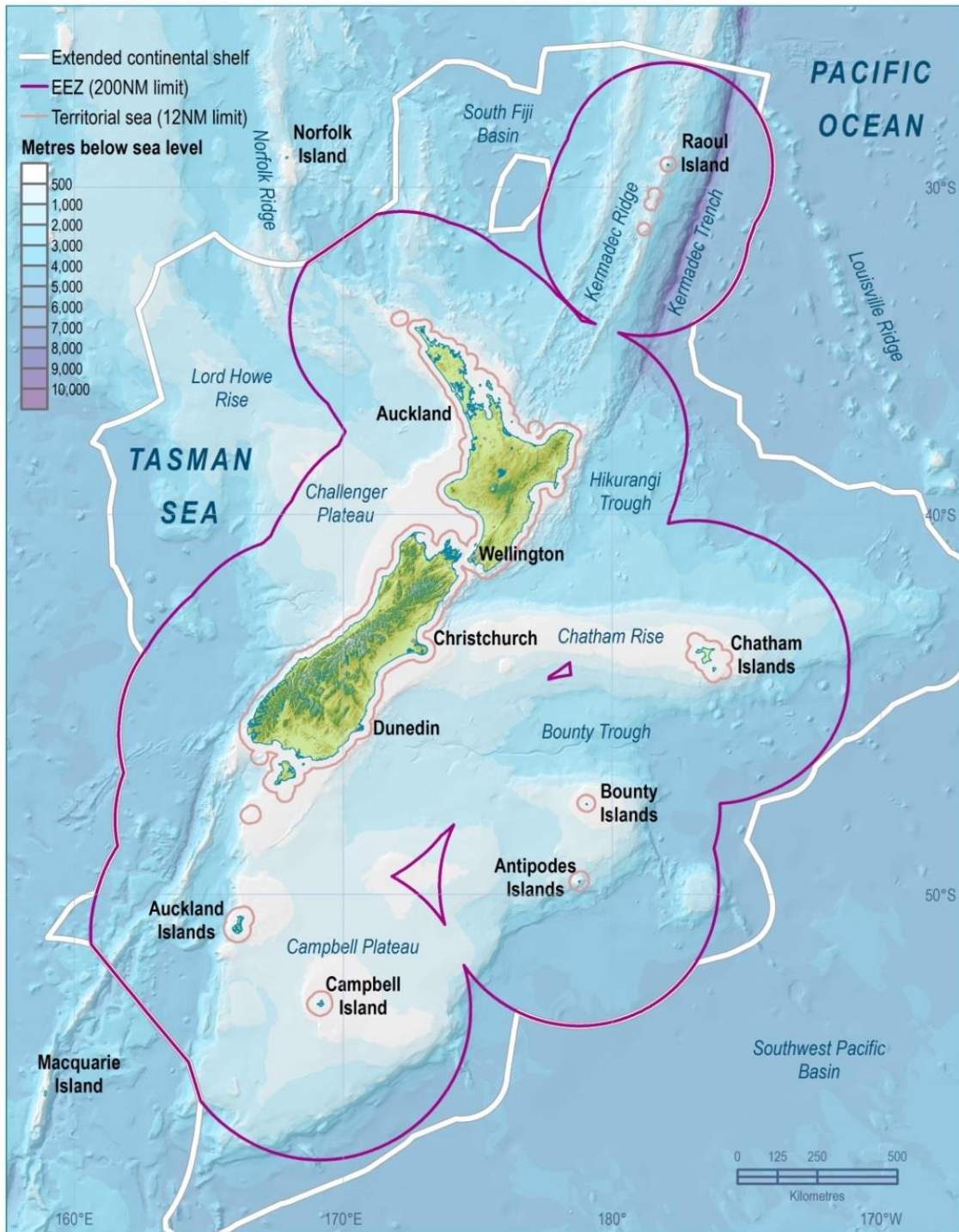
New Zealand's continental shelf has large, shallow underwater shelf areas to the north-west (Challenger Plateau and Lord Howe Rise), and to the south-east (Chatham Rise and Campbell Plateau) (see figure 1).

Our main islands also lie on the boundary between two tectonic plates – huge moving segments of Earth's crust – and in the pathway of warm subtropical and cooler, subantarctic surface water masses flowing from the west. The meeting point of these warm and cold water masses, known as the Subtropical Front, creates ideal conditions for plankton and the fish species that feed on them. The Subtropical Front flows from the west around the southern waters off the far south of the South Island, up the lower west coast, and out across the Chatham Rise – one of the most productive areas for fishing in New Zealand's EEZ.

This complex geology and mix of sea temperatures and ocean currents mean our marine area has many diverse marine habitats, from saltmarsh and mangrove forests, to rocky coastal reefs, to deep sea trenches, canyons, undersea volcanoes, and seamounts.

Figure 1

New Zealand's marine environment



Sources: NIWA; Land Information New Zealand

Note: EEZ – exclusive economic zone; NM – nautical miles. The small triangles within the larger EEZ border are international waters outside the EEZ.

Our marine environment contributes \$4 billion to the economy

In the year ended March 2013, the marine economy contributed \$4.0 billion to New Zealand's economy (1.9 percent of total gross domestic product) and provided over 102,000 filled jobs (Statistics NZ, 2016a).

Offshore minerals (primarily oil and gas) were the largest contributor to the marine economy at 48 percent, followed by shipping (24 percent), and fisheries and aquaculture (22 percent) (Statistics NZ, 2016a).

These industries can also put pressure on the marine environment, the environmental costs of which have not been quantified.

For more detail see *Environmental indicators Te taiao Aotearoa*: [Marine economy](#).

Māori ways of knowing and monitoring the marine environment

A Māori world view (te ao Māori) acknowledges the interconnectedness of all living things, their dependence on each other, and the links between the life-supporting capacity of healthy ecosystems and people's well-being (Harmsworth & Awatere, 2013). Mātauranga Māori (Māori systems of knowledge) have developed over hundreds of years since Polynesian settlement and are intricately woven with te reo Māori (Māori language) and whakapapa (ancestral lineage).

For Māori, the deep kinship between people and the natural world creates an obligation to care for the environment and maintain it for future generations. This obligation is expressed as kaitiakitanga – the cultural practice of guardianship and environmental management grounded in mātauranga Māori (Royal, 2015).

Māori cultural health indicators can support environmental decision-making

Māori communities are putting kaitiakitanga into practice around New Zealand to restore environmental health and reclaim their traditional knowledge (Royal, 2015). Some iwi and hapū are regularly monitoring marine areas using cultural health indicators to show trends or changes in the health of the marine environment.

Cultural health indicators support kaitiakitanga and Māori use of the environment, but they can also benefit all New Zealanders by providing a deeper understanding of the marine environment.

In this report, we tell the story of one hapū's work to develop indicators for monitoring the health of Ōkahu Bay, near Auckland (see [Ngāti Whātua Ōrākei, Ōkahu Bay – aligning mātauranga and science to restore mauri](#)). We are committed to evolving our programme to support Māori decision-making and well-being. See [Reporting environmental impacts on te ao Māori: A strategic scoping document](#) for our strategic direction on using te ao Māori in our environmental reports.

Limitations of *Our marine environment 2016*

There is much we do not know about New Zealand's marine environment. The remoteness and large size of New Zealand's marine area presents a huge research challenge for a small country. For example, most of our marine environment has never been surveyed, and while scientists have identified more than 17,000 marine species in our EEZ, experts estimate as many as 65,000 species are still unidentified (Gordon et al, 2010; Department of Conservation, nd).

Data and knowledge gaps make environmental reporting challenging

One of the challenges for our reporting programme is accessing data of sufficient quality and national breadth to include in our reporting products. Many human-related pressures on our marine environment are not routinely monitored (MacDiarmid et al, 2012a; Hewitt, 2014).

Agencies with monitoring roles include: regional councils, Ministry for Primary Industries, Environmental Protection Authority, Department of Conservation, and Maritime New Zealand. A range of public and private organisations run research programmes on the marine environment. Some hapū and iwi run their own monitoring programmes.

Our marine environment 2016 is primarily based on datasets that have passed our Environmental Reporting Programme's [quality standards](#). The datasets are available on our [data service](#). In the absence of suitable national data for some issues, we have supported our findings with information from other reports and scientific literature, which we reference.

Data on sea-surface temperature and filling critical knowledge gaps

Data on sea-surface temperature provide a good example of a tension that can arise between reporting using the highest-quality data and providing a comprehensive report. Our reporting programme has very reliable satellite data on sea-surface temperature available from 1993, available from our [data service](#). These data showed no determinable trend over the past two decades. This is not surprising, as on such short time scales – from year to year and decade to decade – natural variability can mask long-term trends.

Long-term data on sea-surface temperature do show a statistically significant trend. These data come from a range of measurement instruments and sites. While the data do not have the consistent and broad spatial coverage of satellite-only data across the entire time series, scientists still have high confidence in the findings.

Given the importance of long-term data to understanding how the state of our environment is changing, we report on both the satellite-only data and the long-term data in our key findings and the body of the report. However, we did not acquire the long-term data as part of our reporting programme and these are not available on our data service.

We discuss some of the most significant gaps in data in the chapter on [future reporting](#).

Our oceans and the climate

New Zealand's seas are part of the vast interconnected system of water that makes up Earth's ocean, covering about 70 percent of the planet. The ocean is part of a very complex natural system, which for thousands of years has provided the planet with a stable climate favourable to human life. Two critical roles the ocean has in the climate system are the capture and storage of carbon and the regulation of global temperature.

This chapter is about human activities that, on a global scale, are changing the ocean and wider climate system, including here in New Zealand. Global greenhouse gas emissions are increasing the concentration of these gases in the atmosphere, warming the atmosphere and ocean, and causing sea levels to rise. As well as having a warming effect, some of the additional atmospheric carbon dioxide is being absorbed by the ocean, causing it to acidify.

Ocean acidification and a warmer ocean are serious threats to New Zealand's marine ecosystems, and subsequently, to commercial and recreational fishing and aquaculture.

We report on global greenhouse gas emissions, concentrations of greenhouse gases in the atmosphere, ocean acidification, sea-surface temperature, and coastal sea levels.

Top issue

Greenhouse gas emissions are causing ocean acidification and warming

Ocean acidification

The world's oceans are absorbing some of the additional carbon dioxide in the atmosphere from global carbon dioxide emissions, causing them to become more acidic. New Zealand's ocean waters are also becoming more acidic.

Ocean acidification will continue for generations as long as substantial carbon dioxide emissions continue. In the future, ocean acidification may cause widespread harm to species and ecosystems across our marine environment.

Ocean warming

High concentrations of global greenhouse gas emissions are warming the planet, including the world's oceans. New Zealand's oceans are warming at a similar rate as the world's oceans.

Ocean warming will continue for centuries to millennia even if atmospheric greenhouse gas concentrations are stabilised. Ocean warming may extend or reduce the range of marine species and modify marine habitats. In the future it may cause widespread harm to marine ecosystems. Ocean warming is a primary cause of rising sea levels.

Global greenhouse gas emissions are a serious pressure on New Zealand's marine environment

Global greenhouse gas emissions largely come from:

- burning fossil fuels – for example, burning coal for electricity production and using fossil-fuelled vehicles for transport
- cement production
- burning natural gas associated with oil extraction (flaring)
- land-use changes – for example, clearing tropical rainforests and other vegetation for human settlements and agriculture (IPCC, 2014).

Global net greenhouse gas emissions show a statistically significant increasing trend. In 2011, estimated global net greenhouse gas emissions were 33 percent higher than 1990 levels. From 2000 to 2010 emissions were the highest they ever have been (IPCC, 2014).

New Zealand's overall contribution to global emissions is small, but our emissions per person are among the highest in the world

Between 1990 and 2011, New Zealand emitted an average of 0.1 percent of global net greenhouse gas emissions. While New Zealand's overall contribution to global emissions is small, in 2012 our emissions per person were the fifth-highest of 41 developed countries with international commitments on climate change (Ministry for the Environment, 2016).

In 2014, the agriculture sector (for example, from nitrous oxide from fertiliser and methane from livestock) contributed 49 percent to New Zealand's gross emissions. The energy sector, which includes road transport and electricity production, contributed 40 percent to gross emissions (Ministry for the Environment, 2016).

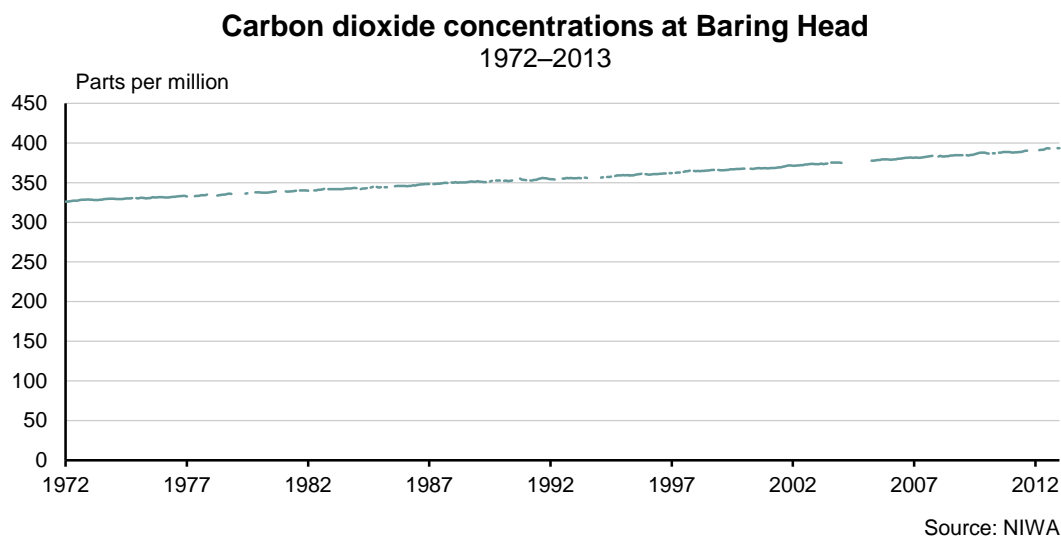
For more detail see *Environmental indicators Te taiao Aotearoa: Global greenhouse gas emissions*.

Global concentrations of atmospheric carbon dioxide are at levels unprecedented in human history

Carbon dioxide is the greenhouse gas that has the greatest impact on warming the planet over the long term because it persists in the atmosphere longer than other natural greenhouse gases. Global atmospheric concentrations of carbon dioxide are now at levels unprecedented in at least the past 800,000 years, which is the period for which records from ice cores are available (IPCC, 2013).

In New Zealand, the concentration of carbon dioxide in the atmosphere has increased 21 percent since observations began in 1972 at Baring Head near Wellington (see figure 2). The increase is statistically significant and is a major shift in the state of our atmosphere over a short time period. The Baring Head record is one of the world's longest records of atmospheric carbon dioxide data, and shows similar results to observations in other locations around the world.

Figure 2



Note: Baring Head is near Wellington. Observations are made only when the wind is blowing from the south and away from any likely local sources of gas emissions. This gives a measure representative of the concentrations over the Southern Ocean. Data are unavailable for some periods.

For more detail see *Environmental indicators Te taiao Aotearoa: Greenhouse gas concentrations*.

The chemical and physical states of New Zealand's oceans are changing

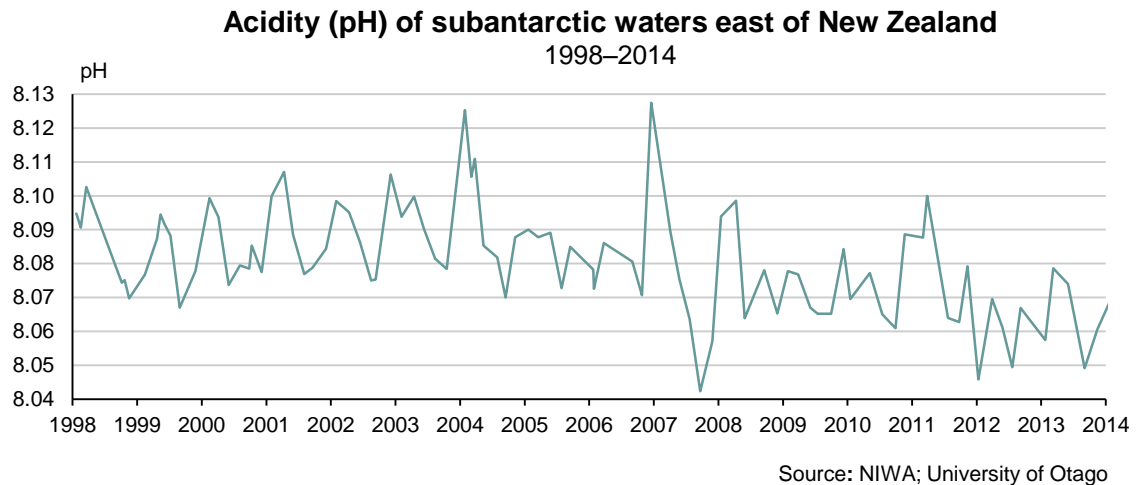
The world's oceans are a large carbon sink, with almost all marine habitats having some role in capturing and storing carbon. This role as a carbon sink means the oceans play a major role in determining the concentrations of carbon dioxide in the atmosphere. The world's oceans have absorbed about one-quarter the total amount of carbon dioxide emitted by human activities since pre-industrial times. This has significantly reduced greenhouse gas levels in the atmosphere and minimised some of the impacts of global warming (IPCC, 2013).

Our oceans are becoming more acidic

The uptake of carbon dioxide by the oceans is a natural process. However, high concentrations of carbon dioxide in the atmosphere have caused carbon dioxide to be absorbed by oceans at a faster rate. As the world's oceans have absorbed carbon dioxide emitted by human activities, they have increased in acidity.

The longest record of acidity of New Zealand's oceans is from measurements in the subantarctic ocean off the Otago coast. Acidity is measured by seawater pH – a reduction in pH indicates increased acidity. Since 1998, the pH in the east subantarctic ocean had an average decrease of 0.0015 units a year (see figure 3).

Figure 3



Note: The decreasing pH over an extended time period indicates the ocean has become more acidic. The fluctuations from year to year reflect strong natural variability due to a myriad of complex biological, physical, and geological processes.

This increase in New Zealand's ocean acidity is a statistically significant amount, and is consistent with changes measured elsewhere in the world (Bates et al, 2014). The average pH of global ocean surface waters has fallen by about 0.1 units since the beginning of the industrial era (IPCC, 2013). While this may not seem much, the pH scale is logarithmic – so a decrease of 0.1 pH units is equivalent to a 26 percent increase in acidity (IPCC, 2013).

Ocean acidification will continue for centuries if emissions continue

In 2014, the Intergovernmental Panel on Climate Change (IPCC) concluded, with high confidence, that ocean acidification will increase for centuries if substantial carbon dioxide emissions from human activities continue, and will strongly affect marine ecosystems (IPCC, 2014). Scientists who wrote the oceans chapter within the same IPCC assessment round were less conservative. They concluded that ocean acidification is effectively irreversible in any reasonable human time scale as it will take tens of thousands of years to reverse this chemical change to the world's oceans (Hoegh-Guldberg et al, 2014).

Ocean acidification may cause widespread harm to ecosystems

While there is uncertainty about the full implications of ocean acidification for New Zealand's marine environment, ocean acidification could cause widespread changes to marine ecosystems. In a 2012 assessment of human-based threats to New Zealand's marine habitats, marine experts ranked ocean acidification as the most serious threat to New Zealand's marine habitats (MacDiarmid et al, 2012a).

Ocean researchers around the world are investigating the impacts of ocean acidification and are treating the issue as a matter of urgency (Secretariat of the Convention on Biological Diversity, 2014). Of particular concern is the growth and reproduction of organisms with shells composed of calcium carbonate, because a more acidic ocean makes it harder for them to build their shells. This covers a diverse range of organisms, including plankton, corals, crustaceans, and molluscs such as shellfish. Plankton form the base of the food chain and are

a direct or indirect source of food for almost all marine animals, so any disruption to these organisms may have widespread effects on marine ecosystems (Fabry et al, 2008).

Many overseas studies show that acidification reduces the growth and survival rates of corals, molluscs, and echinoderms (such as sea urchins and starfish), although the responses of different species are variable. Studies also show acidification changes the sensory systems and behaviour of some fish and invertebrates (Secretariat of the Convention on Biological Diversity, 2014).

In New Zealand, ocean acidification may affect some of the species we harvest for customary, commercial, or recreational purposes, such as pāua, mussels, and oysters.

For more detail see *Environmental indicators Te taiao Aotearoa: Ocean acidification*.

Our oceans are warming

Alongside their role as a carbon sink, oceans also have a critical role in regulating global temperature. The vast mass of the world's oceans can store huge amounts of heat. In addition, regional climates are strongly influenced by huge ocean currents that transport enormous amounts of heat around the world.

High concentrations of greenhouse gases in the atmosphere are leading to warmer oceans around the world, although this warming is neither constant nor uniform. More than 90 percent of the heat associated with global warming from 1971 to 2010 has been absorbed by the world's oceans (IPCC, 2013).

Natural variability in sea-surface temperature

New Zealand's annual average sea-surface temperatures measured by satellite have not shown a statistically significant trend over the past 20 years. This is not surprising given the short time series of these data and expected natural variability of sea-surface temperatures.

Sea-surface temperatures naturally fluctuate with the seasons and from decade to decade, in part due to climate oscillations – persistent atmospheric patterns and variations in ocean currents. During certain phases, climate oscillations can lead to warmer seas or more stormy weather.

The El Niño Southern Oscillation is one of the main climate oscillations over the Pacific region, and influences weather patterns across New Zealand. The warmer El Niño phase can lead to more winds from the south in the winter, causing colder climate patterns in New Zealand and lower sea-surface temperatures in the surrounding ocean (Salinger & Mullan, 1999).

New Zealand's long-term data indicate rising sea-surface temperatures

Other long-term New Zealand data show a statistically significant trend. Long-term sea-surface temperature measurements taken around New Zealand's coastline using ships, buoys, and satellites indicate an increase of about 0.71 degrees Celsius over the period 1909–2009 (Mullan et al, 2010). This is consistent with a widely accepted record of global average sea

surface temperature showing an increase of 0.067 degrees Celsius per decade for the period 1909–2012 (Hartmann et al, 2013).

The huge heat capacity of the world's oceans means they will be slow to adjust to any changes in greenhouse gas concentrations. Scientists project that even if greenhouse gas concentrations could be held at present levels, the deep-ocean temperature will continue to warm for centuries to millennia (IPCC, 2013).

The full implications of ocean warming for marine ecosystems are not clear

Change and variability in ocean temperatures, along with other climate changes, can affect ocean currents, marine processes, habitats, and species.

Depending on their tolerance for changing environmental conditions, some species may find it hard to survive in areas where waters are warming. Other species are expected to extend their range as ocean temperatures increase (Willis et al, 2007; Molinos et al, 2015). For example, climate change may strengthen the East Auckland ocean current in northern New Zealand, promoting the establishment of tropical or subtropical species that currently occur as occasional visitors (vagrants) in warm La Niña years (Willis et al, 2007).

These shifts in the range of some species may change the distribution of wild fisheries and aquaculture species (Norman-Lopez et al, 2011), with both challenges and opportunities for fishing and aquaculture industries. There is no conclusive evidence of climate change impact on fish abundance in New Zealand waters (Reisinger, 2014).

In a 2012 assessment of human-based threats to New Zealand's marine habitats, marine experts ranked warming sea temperature as the second-greatest serious threat to New Zealand's marine habitats, after ocean acidification (MacDiarmid et al, 2012a).

For more detail see *Environmental indicators Te taiao Aotearoa: Oceanic sea-surface temperature*, *Coastal sea-surface temperature*, and *Climate oscillations*.

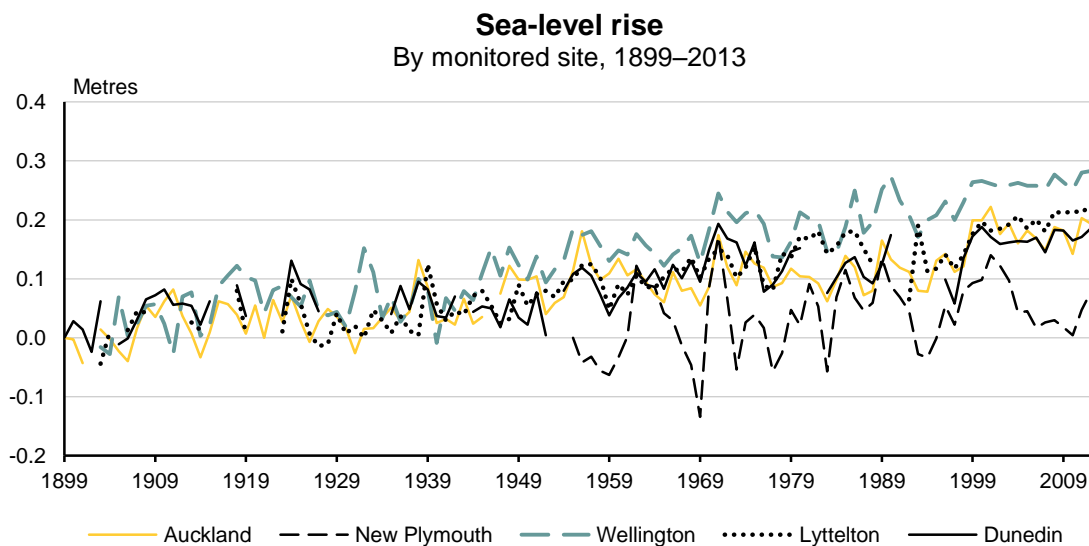
Sea level is rising

Anthropogenic (human-induced) climate change is causing sea levels to rise around the world. During the 20th century, sea-level rise was mainly due to melting glaciers releasing water into the oceans, and the expansion of warming sea water (IPCC, 2013).

Between 1900 and 2013, sea levels rose (relative to land) between 1.31 millimetres and 2.14 millimetres a year on average at observation sites around New Zealand (see figure 4). These changes are consistent with sea-level rise observed worldwide (Church & White, 2011). Globally, sea level has risen an average of about 20 centimetres since the beginning of the 20th century (IPCC, 2013).

Sea-level rise associated with climate change is not uniform around the world, and is unlikely to be uniform along New Zealand's coastline. This is because sea level on any coastline is influenced by a range of factors, including the rising or sinking of land relative to the sea, and regional variations in ocean temperatures and circulation.

Figure 4



Source: School of Surveying, University of Otago

Note: No information is available for New Plymouth before 1955.

Sea-level rise is already having an impact on coastlines and will continue to do so

Sea-level rise is set to continue for many centuries, even if global greenhouse gas emissions are stabilised. The amount and rate of rise depends on future emissions. The IPCC (2013) projected that by the end of the century, likely global average sea-level rise will be between 26 and 98 centimetres, based on scenarios of varying global responses to climate change. While New Zealand's sea-level rise has been in line with the global average so far, at least one study projected that our sea-level may rise a little faster than the global average in the future (Ackerley et al, 2013).

In New Zealand, an 80-centimetre sea-level rise will mean the current 1-in-100-year high-tide level will be exceeded almost daily (Royal Society of New Zealand, 2016). Rising sea levels and increased heavy rainfall associated with climate change are projected to increase coastal flooding and erosion, which may in turn cause damage to coastal ecosystems and infrastructure (Reisinger et al, 2014). Extreme coastal flooding, usually due to storm surges coinciding with very high tides, already causes disruption and damage in some places around New Zealand's coastline. Rising sea levels will mean these once very rare flooding events will occur more often.

The implications of sea-level rise for New Zealand are discussed in the Parliamentary Commissioner for the Environment's 2015 report, [Preparing New Zealand for rising seas: Certainty and uncertainty](#).

For more detail see *Environmental indicators Te taiao Aotearoa: Coastal sea-level rise*.

Ocean storms and extreme waves are highly variable

Ocean storms and extreme wave events can damage marine ecosystems and affect coastal infrastructure, marine-based industries, and other human activities. At a global level, we have a poor understanding of the likely impact of climate change on ocean storms. Climate change could alter the frequency of storms, with variability between regions. Our knowledge of the impact climate change has on wave height is limited (Hoegh-Guldberg et al, 2014).

Data on the number of days when ocean wind speeds exceed gale force and storm force in New Zealand waters are available from 1979, and show high variability around the country and from year to year. Data on extreme waves are only available from 2008. We need a much longer time series for both measures to assess any statistically significant trend.

For more detail see *Environmental indicators Te taiao Aotearoa*: [Ocean storms](#) and [Oceanic and coastal extreme waves](#).



Coastal erosion, such as that pictured here in Haumoana, Hawke's Bay, occurs when waves, wind, or storms erode the coastal environment. Coastal erosion will become more widespread as sea levels rise this century. (Photo: Alan Blacklock, NIWA)

Summary and implications

Increasing concentrations of atmospheric carbon dioxide and other greenhouse gases are a serious threat to New Zealand's marine ecosystems, and the benefits we receive from the marine environment. New Zealand's subantarctic waters have become increasingly acidic since measurements were first taken in 1998, and long-term data show sea-surface temperatures in New Zealand's waters have been increasing over the last century. Sea levels around New Zealand's coastline have risen since reliable measurements began in 1900, at a rate consistent with sea-level rise worldwide.

Ocean acidification and ocean warming have the potential to cause widespread changes to ecosystems and biophysical processes – often through complex interactions with other

environmental stressors and climate change impacts. Increased storminess and changes in ocean currents – and other pressures – such as sedimentation, algal blooms, and marine pests – may have compounding effects. These changes will bring challenges and opportunities to industries such as aquaculture and fisheries, and changes to recreational fishing and Māori harvesting of mahinga kai (traditional food). Sea-level rise is already affecting our coastline and will continue to do so.

These changes to our marine environment are evidence of human beings' profound impact on Earth's natural systems. Ocean acidification will continue for generations if substantial carbon dioxide emissions from human activities continue. Ocean warming and sea-level rise are set to continue for centuries to millennia even if global greenhouse gas concentrations are stabilised. While these future changes to the state of our marine environment are largely inevitable, the rate, and extent of change, will depend on whether, and how fast, human societies reduce greenhouse gas emissions on a global scale.

Extracting fossil fuels and other resources from under the sea has a localised impact

The burning of fossil fuels is a major cause of anthropogenic (human-induced) global warming and ocean acidification. On a local scale, the extraction of fossil fuels such as oil and gas from ocean-based wells can have environmental impacts.

In 2012, about 197 offshore oil and gas wells were drilled in New Zealand waters, 176 of which are in the Taranaki region (Petroleum Exploration and Production Association New Zealand, 2015).

Oil and gas extraction can adversely affect the marine environment, although the effects are localised. Offshore and deep-sea oil and gas extraction and transport always carry the risk (however small) of a major oil spill, which, based on overseas events, can cause devastating and widespread harm to the marine environment.

Potential sites for mineral extraction are being surveyed and explored. Sediment plumes produced by the extraction process can affect an extensive area, as the suspended sediment spreads. The plumes reduce food availability for some species, smother seabed species such as corals, and reduce light availability for photosynthesis. Discharge of tailings (residues from extraction) and effluent can harm plankton and fish species (Chung et al, 2002; MacDiarmid et al, 2012b).

For international comparability of the marine economy, 'offshore minerals' includes oil, gas and minerals, but in practice this grouping is primarily oil and gas. In 2013, offshore minerals contributed \$1.95 billion to New Zealand's gross domestic product; it made up 48 percent of the marine economy and 0.9 percent of the national economy (Statistics NZ, 2016a). Most of the oil and gas used by New Zealanders is imported from overseas.

For more detail see *Environmental indicators Te taiao Aotearoa: Occurrence of oil and gas and minerals extraction*.

Our marine birds and mammals

New Zealand has a diverse range of species and subspecies of marine birds and mammals that have established naturally here, and raise their young along our coastlines.

New Zealand is recognised globally as providing important habitat for seabirds. Nearly one-quarter of the world's seabird species breed here and we have more endemic seabird species than any other country (Croxall et al, 2012).

Of the world's marine mammals, New Zealand has species and subspecies of seals, sea lions, fur seals, whales, dolphins, and porpoises. Nearly half the world's whale, dolphin, and porpoise species are found in New Zealand's waters (Gordon et al, 2010; Taylor, 2000).

In this chapter we discuss the pressures on our marine birds and mammals. We report on 'bycatch' – when animals are unintentionally caught and killed during commercial and recreational fishing operations.

We also report on the conservation status of New Zealand's indigenous seabirds, shorebirds, and marine mammals and whether that status has improved or worsened in recent years. The conservation status of a species or subspecies indicates its risk of extinction, based on the size of the population of mature individuals, and the stability of that population over time (see [Appendix 1: New Zealand Threat Classification System](#)).

Top issue

Native marine birds and mammals are threatened with extinction

What is happening?

Many native marine animals that breed in New Zealand are threatened with extinction:

- 35 percent of seabird species and subspecies – including albatrosses, petrels, penguins, shags, and terns
- 57 percent of shorebird species and subspecies – including herons and dotterels
- 28 percent of marine mammal species and subspecies – including dolphins, whales, and New Zealand sea lions.

Why does it matter?

These species are tāonga (treasures) to Māori and can inspire and delight us with their unique, natural beauty.

The extinction of species may have consequential impacts on other species and the resilience of ecosystems – particularly if the extinction extended to a high proportion of one animal group such as seabirds.

Most of our marine bird species are threatened with or at risk of extinction

While most of New Zealand's seabirds and shorebirds are now legally protected species, this has not always been the case. Today's populations of seabirds and shorebirds are a remnant of the seabird life before New Zealand's human settlement.

Early Polynesian settlers harvested seabirds – such as petrels, penguins, shags, and albatrosses – for food, to trade, and for feathers and down. They later developed customary practices – which some iwi and hapū continue to use today – to ensure future harvests.

Early European settlers largely viewed seabirds and shorebirds as pests (shags) or game (pied stilts, dotterel) (Hutching & Walrond, 2015). Waves of European settlement brought predators, such as pigs, cats, and dogs, and rural and urban coastal development that destroyed breeding habitats.

The loss or modification of breeding habitats due to coastal development or from browsing mammals is still a pressure on seabirds and shorebirds. Introduced predators – such as pigs, cats, dogs, stoats, rats, and mice – eat eggs and young birds. Nesting sites can be damaged by livestock, people, vehicles, and severe weather events.

Ocean storms can be devastating for seabirds. In July 2011, for example, thousands of dead and stranded prions (a type of sea petrel) were found along New Zealand's coastline and further inland as a result of an ocean storm. This caused a large dent in New Zealand's broad-billed prion population (Miskelly, 2011). Ocean storms may become more intense to the south of New Zealand during winter due to climate change (Mullan et al, 2011).

At sea, the main human-related pressures on seabirds are bycatch from commercial and recreational fishing and marine pollution. We report below on bycatch from commercial fishing.

Bycatch of seabirds is decreasing but is still a major cause of death for some species

Bycatch occurs when marine animals are unintentionally caught during fishing operations. Some examples of how bycatch occurs during commercial fishing in New Zealand include:

- longline – seabirds attempt to consume hooked bait and become caught by hooks or in fishing lines
- trawling – seabirds collide with trawling equipment, leading to death, or injury that later results in death
- set nets – seabirds become entangled and drown in nets while diving for food (Ministry for Primary Industries, 2013).

Estimated seabird commercial bycatch numbers decreased, from about 9,000 birds in 2003 to 5,000 in 2014. This is likely due in part to mitigation measures, such as bird-scaring devices deployed on fishing vessels (Ministry for Primary Industries, 2016a). We do not have data on the bycatch from recreational fishing.



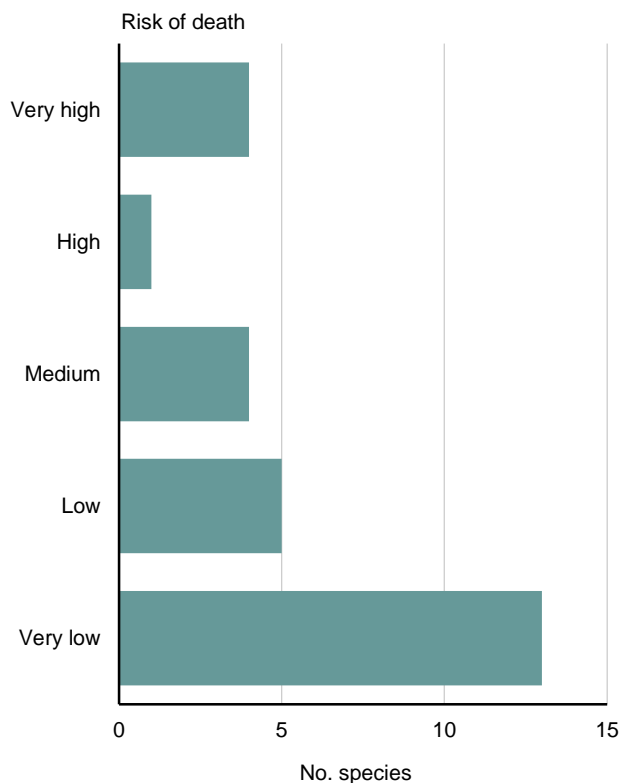
The Antipodean albatross is classified as nationally critical and has a high risk of dying as a result of becoming caught in commercial fishing gear. Its conservation status has worsened in recent years. (Photo: Neil Fitzgerald)

Some bird species are more vulnerable to bycatch than others, depending on a range of factors such as their foraging behaviour, and the extent their hunting range coincides with commercial and recreational fisheries (see figure 5).

Between 2007 and 2013, five species of seabirds classified as **threatened** with extinction had a high or very high risk of dying as a result of becoming caught in commercial fishing gear.

Figure 5

Risk of fishing-related seabird deaths For threatened species, 2007–13 fishing years



Source: Ministry for Primary Industries

For more detail see *Environmental indicators Te taiao Aotearoa: Bycatch of protected species: seabirds*.

Most of our indigenous seabird species are threatened with or are at risk of extinction

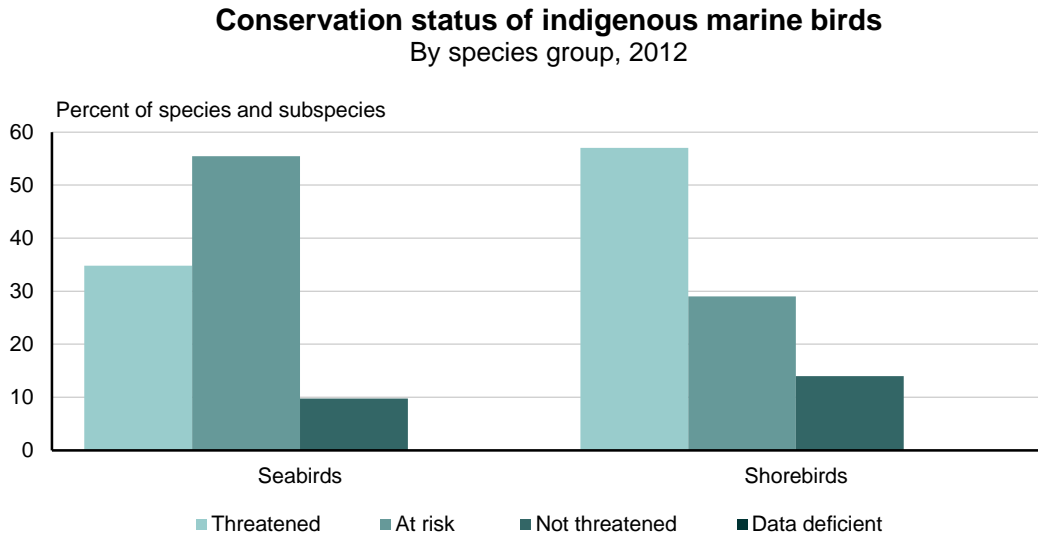
New Zealand has 92 resident indigenous seabird species and subspecies that established naturally and breed in New Zealand. Of these, 35 percent (32 of 92) are **threatened** with extinction (see [Appendix 1: New Zealand Threat Classification System](#)), giving New Zealand the highest number of threatened seabird species in the world.

Of the 32 species and subspecies threatened with extinction:

- 12 are **nationally critical**, facing an extremely high risk of extinction (see [Appendix 2: Conservation status of New Zealand’s resident indigenous seabirds, shorebirds, and marine mammals](#))
- eight are **nationally endangered** and 12 are **nationally vulnerable**, facing a high risk of extinction.

Fifty-five percent of our resident indigenous seabirds (51 of 92) are **at risk** of extinction (see figure 6). This is a lower risk than that for **threatened** species and includes 26 of 51 species that are **naturally uncommon**. Only 10 percent (9 of 92) of seabird species or subspecies are **not threatened**.

Figure 6



Source: Department of Conservation

Note: There were no species of marine birds for which data was deficient.

The conservation status of eight seabird species and subspecies worsened between the 2008–11 and 2012–14 assessment periods. The conservation status of one seabird species, Bounty Island shag, improved over this period, but is still classified as nationally endangered.

Over half our indigenous shorebird species are threatened with extinction

New Zealand has 14 resident indigenous shorebird species and subspecies. Of these, eight (57 percent) are **threatened** with extinction, four (29 percent) are **at risk**, and two (14 percent) are **not threatened** (see figure 6).

Of the eight species and subspecies **threatened** with extinction:

- four are **nationally critical**, facing an extremely high risk of extinction (see [Appendix 2: Conservation status of New Zealand’s resident indigenous seabirds, shorebirds, and marine mammals](#))
- one is **nationally endangered**, and three are **nationally vulnerable**, facing a high risk of extinction.

There was no change in conservation status of shorebirds between the 2008–11 and 2012–14 assessment periods.

For more detail see *Environmental indicators Te taiao Aotearoa: Conservation status of seabirds and shorebirds* and *Changes in the conservation status of indigenous marine species*.

Some of our iconic marine mammals are threatened with extinction

New Zealanders' relationship with our marine mammals has changed profoundly during our human history. For example, Europeans and Māori hunted seals and whales around New Zealand in massive numbers until the late 1800s. The last harpooning of a whale by a New Zealand vessel in our waters was in 1964. This was along the Kaikoura coast – now the location of a well-established whale-watching industry. All whales, and other marine mammals, are now totally protected (Hutching & Walrond, 2015).

Today, the main pressures on marine mammals are entanglement in fishing lines and nets, ship strike (when whales are hit by ships or boats), marine pollution, and habitat degradation (eg, from dredging and blasting) (Department of Conservation, nd; Whitehead et al, 2000).

Bycatch from commercial and recreational fishing is the main identified cause of death of Hector's and Māui dolphins

Data on bycatch of Hector's and Māui dolphins come from members of the public, fisheries' observers, and fishers. Along with reports on dolphins washed up dead on beaches or found floating dead at sea, there are reports on dolphins caught during commercial or recreational fishing.

Between 1921 and 2015, entanglement in fishing gear accounted for 71 percent of the 301 Hector's and Māui dolphin deaths for which a cause of death was determined. Of the 174 deaths where the type of fishing gear was recorded, 86 percent were caused by commercial and recreational set nets.

Bycatch of Hector's and Māui dolphins has decreased over the last decade. However, limitations to the data mean we cannot estimate the size of this decrease. In addition, numbers of Māui dolphins are now so low that the probability of a dolphin being caught has also diminished.



Hector's dolphins caught in a recreational set net. Hector's dolphins are small coastal dolphins at risk of dying from being caught in fishing gear. Their conservation status is nationally endangered. (Photo: Department of Conservation)

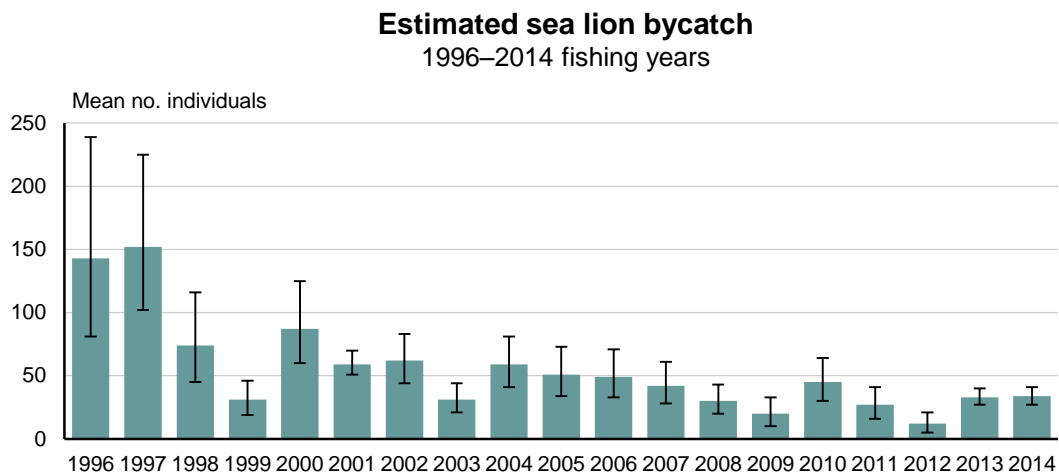
For more detail see *Environmental indicators Te taiao Aotearoa: Bycatch of protected species: sea lion and fur seal* and *Bycatch of protected species: Hector's and Māui dolphins*.

Bycatch of New Zealand sea lions and fur seals is decreasing but still a major cause of death

The estimated number of New Zealand sea lions and fur seals injured or killed as commercial bycatch has decreased since the late 1990s. However, we cannot confidently estimate the size of the decrease as there is a large probability of error for estimates for some years.

Our data on New Zealand sea lion bycatch goes back to 1996, when the estimated bycatch was 143 individual sea lions. This decreased to 43 individuals in 2014 (see figure 7). The New Zealand sea lion is classified as **nationally critical** with a declining population (see [Twenty-eight percent of our marine mammal species are threatened with extinction](#)).

Figure 7



Source: Ministry for Primary Industries

Note: The vertical line that sits on a column is an error bar – the longer the line, the greater the margin of error of the mean (average) number of individuals. Where error lines overlap in any two years, then the data between those years is unlikely to be significantly different.

Our data on estimated fur seal bycatch goes back to 1999, when the average estimated bycatch was 1,729 individual fur seals. This decreased to 490 individuals in 2014.

As with seabirds, these decreases are thought to be partly due to increased use of mitigation measures (Ministry for Primary Industries, 2016a). Reliable data on the bycatch of New Zealand sea lions and fur seals from recreational fishing are not available.

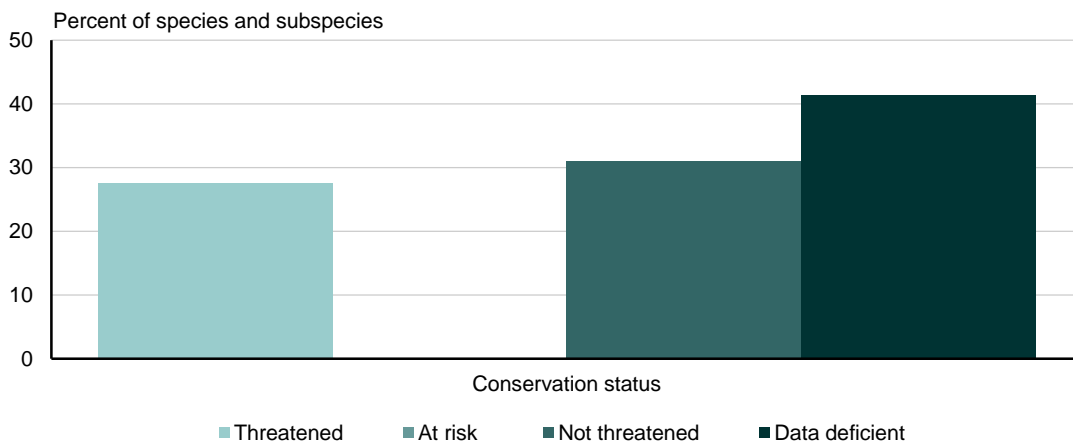
Twenty-eight percent of our marine mammal species are threatened with extinction

New Zealand has 29 species and subspecies of resident indigenous marine mammals – species and subspecies that established naturally and breed in New Zealand. Of these, eight (28 percent) are classified as **threatened** with extinction and nine (31 percent) are **not**

threatened (see Appendix 2: Conservation status of New Zealand’s resident indigenous seabirds, shorebirds, and marine mammals). The status of the remaining 12 species or subspecies (41 percent) cannot be assessed because of lack of information about their distribution and abundance – these are reported as **data deficient** (see figure 8).

Figure 8

Conservation status of indigenous marine mammals 2013



Source: Department of Conservation

Note: No marine mammals were classified as at risk – which is a lower threat assessment than threatened.

Of the eight species and subspecies classified as threatened with extinction, five (17 percent) are classified as **nationally critical**, facing an extremely high risk of extinction in the wild, including the New Zealand sea lion and Māui dolphin, which are endemic to New Zealand.

Before human settlement, the New Zealand sea lion was often found around the coast of New Zealand’s main islands, but is now only rarely seen in Otago, Southland, and Stewart Island. It has a stronghold population of about 12,000 in the subantarctic Auckland Islands (Breen et al, 2010). Since 1996, the population in the Auckland Islands is estimated to have declined by about 25 percent – although the latest population size estimate is for 2009 (Breen et al, 2010; Ministry for Primary Industries, 2016a). Along with bycatch, competition for food from commercial fishing and disease may also play a role in this decline (Robertson & Chilvers, 2011).

The latest survey in 2010/11 estimated that 55 individual Māui dolphin over a year old were left in the wild, making it one of the rarest marine mammals in the world (Ministry for Primary Industries, 2016a).

The conservation status of one marine mammal species, southern right whale, improved between the 2008–11 and 2012–14 assessment periods. This was due to a population increase associated with the slow reestablishment of former wintering grounds around New Zealand. However, southern right whale is still classified as **nationally vulnerable** (Carroll et al, 2014) and its distribution may be pushed further south as sea temperatures increase over the next century (Torres et al, 2013).

For more detail see *Environmental indicators Te taiao Aotearoa: Conservation status of marine mammals* and *Changes in the conservation status of indigenous marine species*.

Summary and implications

The populations of many of New Zealand's marine birds and mammals have declined because of multiple past and present-day pressures including historic exploitation, predation, habitat loss and modification, and disease. Fishing bycatch is still an important cause of death for some rare species. While attribution of pressures from climate change will always be difficult, climate change may exacerbate existing pressures, for example, through more intense winter storms in the south of New Zealand.

Over the past 50 years or so we have become better at recognising that our marine birds and mammals are an important part of our cultural heritage. Their extinction is a permanent change in the state of the marine environment. Some seabird species continue to be an important source of sustainable harvest for hapū and iwi, supporting Māori cultural values. New Zealanders and overseas visitors enjoy interacting with marine wildlife, through both recreation and commercial tourism.

The future of our marine birds and mammals, most of which are at or near the top of the food chain (apex species), is of international interest and has importance for global biodiversity. The extinction of these species may have consequential impacts on other species and the resilience of ecosystems. However, the specific potential impacts of losing these species on New Zealand's wider marine environment are poorly understood.

Our coastal waters, harbours, and estuaries

The marine habitats in our coastal waters, harbours, and estuaries provide many benefits to New Zealanders. Some readily come to mind – swimming off our beaches, fishing and diving, and harvesting shellfish.

Other benefits are more subtle and involve complex functions of natural marine systems – also known as ecosystem services. Many people are unaware of these coastal marine ecosystem services. They include recycling nutrients and human wastes, trapping and stabilising sediments, producing oxygen that supports other marine life, and providing nursery grounds for fish.

Coastal marine habitats are particularly vulnerable to pressure from human activities because of their proximity to urban centres and ease of access to people and industry. Scientists who have assessed the human threats to New Zealand’s marine environment found that reef, sand, and mud habitats in harbours and estuaries and along our coastlines were the most highly threatened of the marine habitats in the EEZ and territorial sea (MacDiarmid et al, 2012a).

In this chapter we outline some of the main pressures on coastal marine habitats that come from land- and marine-based human activities and plastic and oil-based pollution, which come from activities on land and at sea.

Top issue

Coastal marine habitats and ecosystems are degraded

What’s happening?

Of all marine environments, our coastal environment is under the most pressure from humans because it is closest to where we live, work, and play. Over decades, coastal habitats have been destroyed or degraded – losing the abundance and diversity of marine life usually found in a natural ecosystem.

Why does it matter?

Biodiversity and the health of the ocean ecosystem depend on the functioning of coastal marine habitats – for example, as nurseries for fish. The degradation of coastal waters limits opportunities for recreation and compromises marine-based industries.

What are the big coastal pressures?

- Ocean acidification and climate change impacts (see [Our oceans and the climate](#))
- Excess sedimentation
- Seabed trawling and dredging for fish and shellfish (see [Our fisheries and the impact of fishing on marine ecosystems](#))
- Marine pests
- Excess nutrients carried down waterways.

Land-based activities that put pressure on coastal marine habitats

Land-based pressures on coastal marine habitats come from water catchments – such as streams, rivers, and stormwater pipes. These waterways carry sediment and pollution from the land into the sea. In this section we describe the pressures from water catchments: sedimentation; run-off from roads, urban development, and agriculture (including heavy metal concentrations in estuaries); and wastewater pollution.

Other land-based pressures on coastal marine habitats come from various types of coastal engineering, such as infilling of estuaries and harbours to get rid of ‘clean’ fill or for building coastal infrastructure (reclamation), removal of sand and gravel for building roads and infrastructure, and building of raised roads, paths, and access ways for boats (causeways). We do not have the data on these pressures for this report.

Excess sediment in waterways can damage marine habitats

The transfer of sediment from land into waterways, and ultimately out to sea, is a natural process. It brings sand to our beaches and sediment to estuaries, creating habitats for wildlife. However, changes in land use such as harvesting forests and clearing land for farming and urban subdivisions can disrupt this natural process, causing excess sediment to enter waterways and eventually our harbours and estuaries.



A plume of suspended sediment in the Hoteo River flows into Kaipara Harbour. Increased sedimentation is a threat to coastal marine habitats. (Photo: Mark Pritchard, NIWA)

Sediment plumes can often be seen from the air at river and harbour mouths following heavy rain. New Zealand loses about 192 million tonnes of soil into waterways and the ocean every year. This is estimated to contribute about 1.5 percent to global sediment loss, despite New Zealand making up only 0.2 percent of the global land area (Syvitski et al, 2005; Walling, 2008).

In a 2012 assessment of human-based threats to New Zealand's marine habitats, marine experts ranked increasing sedimentation as one of the top four threats to New Zealand's marine habitats, on a par with seabed trawling, and outranked only by ocean acidification and warming (MacDiarmid et al, 2012a).

While it continues to be a present-day pressure, excess sedimentation is an outcome of fine sediments accumulating over decades in estuaries and coastal bays. Emerging evidence supports the following impacts from increased sedimentation of coastal waters:

- direct effects on shellfish species such as cockles, pipi, and scallops, for example, by clogging their gills and reducing their filtering ability
- reduction in survival rates of shellfish, for example, young pāua and kina
- reduction in foraging abilities of finfish, for example, juvenile snapper
- loss of important nursery habitats, for example, seagrass meadows and mussel beds (Morrison et al, 2009).

These effects on species and habitats do not occur in isolation from other pressures such as excess nutrients and pollution. The impact of sedimentation has implications for recreational and commercial fishing and Māori harvesting of traditional marine-based foods.

Run-off from urban development and agriculture can harm coastal ecosystems

Land-based activities, particularly agriculture, can cause excess nutrients to wash down waterways into estuaries and coastal waters. Having too many nutrients in the sea promotes the growth of algae and can lead to harmful algal blooms that can affect habitats and species (Ministry for Primary Industries, nd). An increase in nutrients can lead to a reduction of oxygen in water, which in turn can affect fish and other marine animals that depend on dissolved oxygen to survive.

The two main nutrients of concern are nitrogen and phosphorus. While data are available for some regions these are not comparable as a national dataset. Available data show levels of nitrogen and phosphorus that are highly variable across sites and from year to year. This is partly because the levels of nutrients are affected by the weather, for example, high rainfall and flooding flushes nutrients through waterways into the marine environment.

Improving these data as part of an overall indicator for coastal water quality is a priority for future reports (see [Future reporting](#)). For more information on water quality in local marine environments please refer to regional council websites.

For more detail see *Environmental indicators Te taiao Aotearoa*: [Coastal and estuarine water quality](#), [River water quality trends: phosphorous](#), and [River water quality trends: nitrogen](#).

Heavy metals wash into waterways, estuaries, and harbours

Run-off from roads and other sources contains heavy metals such as lead, zinc, copper, and cadmium. Heavy metals are toxic to both animals and humans, even at low concentrations. They wash into waterways, estuaries, and harbours, especially at times of heavy rain. Cadmium is also a component of some fertilisers, and can be present in run-off from farms.

Heavy metals from run-off accumulate in the sediments of estuaries and can be taken up by organisms living in the sediment. They also build up in higher concentrations in species further up the food chain (bio-accumulate).

Regional and unitary councils monitor the concentrations of lead, cadmium, copper, and zinc in sediment in coastal environments and estuaries around New Zealand. Our data cover 10 of 16 regions: Auckland, Bay of Plenty, Canterbury, Gisborne, Hawke's Bay, Marlborough, Northland, Otago, Waikato, and Wellington.

In the five years from 2010 to 2014:

- 89 percent (copper), 92 percent (zinc), 94 percent (lead), and 95 percent (cadmium) of sites had concentrations of these heavy metals at levels that were **unlikely** to cause harm to seabed species
- between 3 and 11 percent of sites had concentrations of at least one heavy metal at levels that **can** cause harm to seabed species – these sites were in estuaries or waterways in the regions of Auckland, Bay of Plenty, Gisborne, Marlborough, Northland, Waikato, and Wellington.
- 1 percent of sites had concentrations of cadmium or zinc at levels where **harm frequently occurs** to seabed species – these sites were in estuaries or waterways in the regions of Auckland and Bay of Plenty for cadmium, and Gisborne and Northland for zinc.

A contributing factor to the low heavy-metal concentrations from 2010 to 2014 may be the low concentrations found at Canterbury sites. Liquefaction and other effects of the 2010 and 2011 Canterbury earthquakes shifted sediments around during this time, for example, overlaying existing sediment with new sediment. Heavy-metal concentrations decreased in many estuary sites in the Canterbury region over this period. None of the 18 Canterbury sites had heavy-metal concentrations above the threshold level at which harm can occur to seabed species.

For more detail see *Environmental indicators Te taiao Aotearoa*: [Heavy metal load in sediment](#).

Pollution from sewage has improved since the 1990s

New Zealand's sewage treatment improved in the 1990s. A small proportion (less than 10 percent) of sewage from households and industries still receives only basic treatment to remove solid, suspended waste before it is discharged directly into the ocean (Water New Zealand, 2016). Heavy rain events can overload sewage systems causing untreated sewage to leak into coastal seas.

Wastewater in stormwater pipes drains untreated into the sea, and can include pollutants such as plastic litter, animal excrement, cleaning products, corrosives such as battery acid, and heavy metals.

When people immerse themselves in seawater during activities such as swimming, diving, and surfing, they can risk ingesting pathogens (disease-causing microorganisms) through the mouth, nasal passages, or ears. Pathogens generally enter waterways through contaminated animal or human faecal matter.

Regional councils monitor popular swimming sites to assess the level of health risk for recreational activities such as swimming. However, the data are not included in this report as they are not intended to be nationally representative of the state of New Zealand's coastal water quality, and are not comparable across all regions.

For information about your local swimming spots, see [Land, Air, Water Aotearoa](#).

Marine-based activities that put pressure on coastal marine habitats

Some of the marine-based activities that put pressure on our coastal marine habitats include:

- competition from invasive species (marine pests) accidentally introduced from boats and ships
- dredging to clear shipping and access channels and dumping of dredge spoils
- plastic and oil-based pollution
- accumulation of shells, feed, and faeces on the seabed from aquaculture
- anchoring of ships and boats, particularly on reef habitats (MacDiarmid et al, 2012a).

In this section we report on pressures from non-indigenous species, which can become marine pests. Commercial and recreational fishing are also important pressures in coastal waters, and are discussed in [Our fisheries and the impact of fishing on marine ecosystems](#).

Non-indigenous species in our marine environment are increasing

Non-indigenous (exotic) species are generally introduced into New Zealand waters attached to boat or ship hulls or in ballast water. Some have little impact or cannot survive in New Zealand waters; others can become pests.

Marine pests compete with, and prey on, indigenous species, modify natural habitats, affect marine industries, and alter ecosystem processes. They are largely a threat to coastal marine habitats rather than the deeper ocean (MacDiarmid et al, 2012a). Their impact on native species and habitats means they pose a risk to our natural and cultural heritage and to commercial and recreational fishing, shellfish harvesting, and aquaculture.

In 2015, 351 non-indigenous species were identified in New Zealand's coastal waters, of which more than half (187) had established a breeding population in our marine environment. Since 2009, the number of non-indigenous species in New Zealand has risen by 10 percent, with 33 new species recorded between 2010 and 2015.

Data on eight species can demonstrate how the threat of marine pests is changing

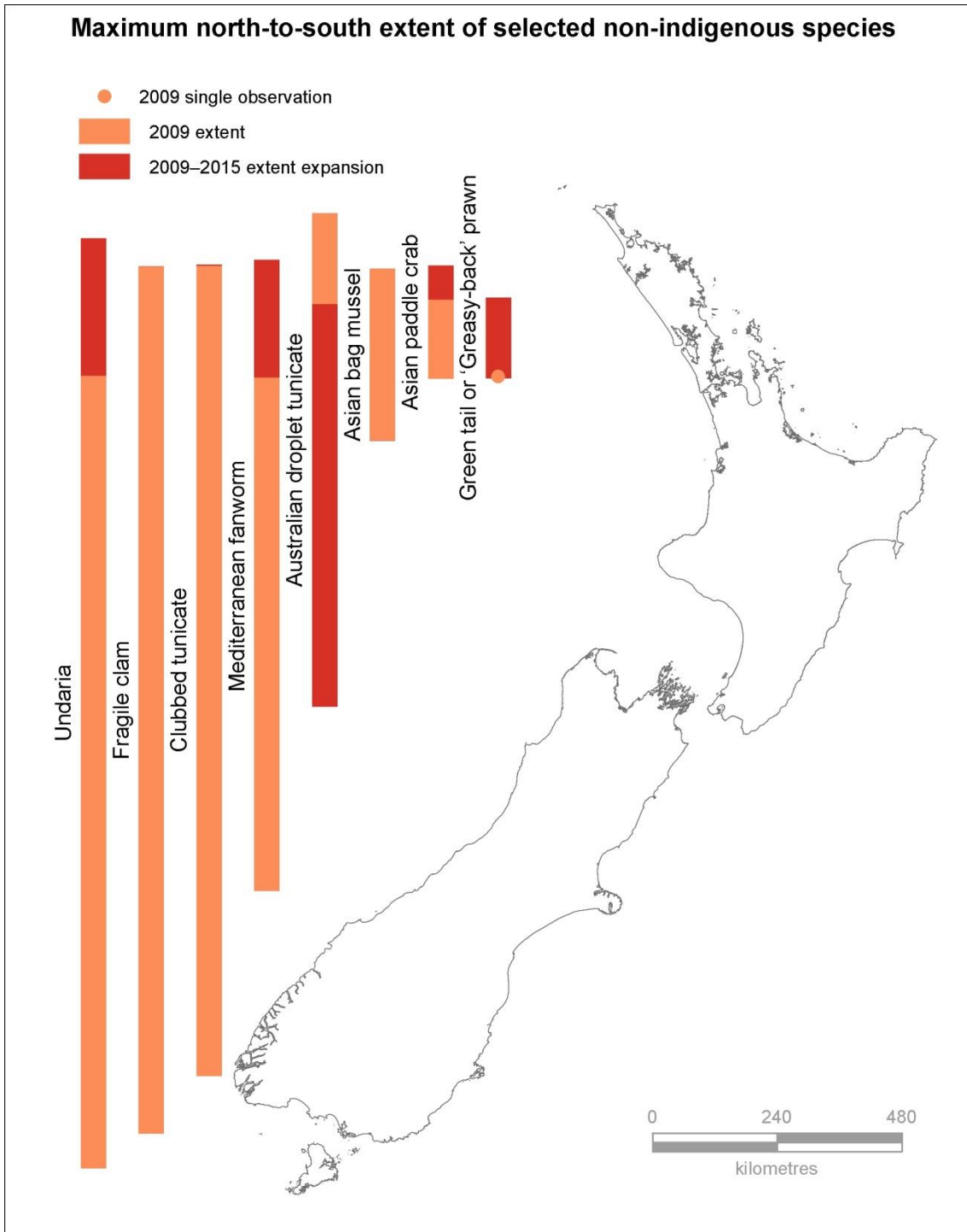
In the absence of certainty about the future impact of any particular non-indigenous species, we chose eight species to represent the threat of non-indigenous species to our marine environment (see figure 9).

The species occur in a variety of different marine environments, and represent species across a range of scientific classes of organisms, that established at various dates in New Zealand waters (see table 1).



The Australian droplet tunicate (a sea squirt) in Rangaunu Harbour in the far north of the North Island. The tunicate smothers beaches, rocks, and tide pools and is a pest of aquaculture (Photo: Crispin Middleton, NIWA)

Figure 9



Source: Ministry for Primary Industries; NIWA

Note: Undaria has been found as far south as the subantarctic Snares Islands.

Table 1

Eight marine species representing the threat of marine pests to our marine environment		
Marine species	Description	Impact and history
Asian bag (or date) mussel <i>Arcuatula senhousia</i>	Small, thin-shelled mussel that lives in estuaries	<ul style="list-style-type: none"> • Modifies native habitats • Established in Auckland in the 1970s
Asian paddle crab <i>Charybdis japonica</i>	Large, aggressive swimming crab	<ul style="list-style-type: none"> • Predator of native species • First recorded in the Auckland region in 2000
Australian droplet tunicate <i>Eudistoma elongatum</i>	Sea squirt that forms long, white cylindrical tubes	<ul style="list-style-type: none"> • Smothers beaches, rocks, and tide pools and a pest of aquaculture • First reported in Northland in 2005
Greentail (greasy back) prawn <i>Metapenaeus bennettiae</i>	Prawn that grows to about 13cm in length	<ul style="list-style-type: none"> • Estuarine deposit feeder • First recorded in Waitemata harbour in 2009
Mediterranean fanworm <i>Sabella spallanzanii</i>	Very large, fast-growing worm that builds long, flexible tubes up to 1 metre in length	<ul style="list-style-type: none"> • Pest of aquaculture and other industries • Modifies natural habitats • Affects cycling of nutrients within natural ecosystems • Establishment date not reported
Clubbed tunicate <i>Styela clava</i>	Rapid growing sea squirt that forms dense colonies	<ul style="list-style-type: none"> • Pest of aquaculture and other industries • Establishment date not reported
Fragile clam <i>Theora lubrica</i>	Small bivalve (shellfish with two hinged shells)	<ul style="list-style-type: none"> • An indicator of marine pollution • Present since at least the 1970s
Undaria <i>Undaria pinnatifida</i>	Fast-growing brown kelp	<ul style="list-style-type: none"> • Pest of aquaculture and other industries • First reported in New Zealand in 1987

Source: Inglis and Seaward (2016)

There is limited research on the economic and non-market costs of pests in the marine environment. Biosecurity New Zealand's 2009 study estimated the economic output loss from marine pests at \$15 million a year – this did not include ongoing expenditure on restricting pests. Another report estimated the initial one-off costs of responding to incursions of the clubbed tunicate and Mediterranean fanworm to be \$2.2 million and \$1 million, respectively (Biosecurity NZ, 2010). Non-market costs from pest invasions could include losing shellfish beds for harvesting and children being unable to paddle at the water's edge (Bell & Yap, 2008; Royal Society of New Zealand, 2014).

For more detail see *Environmental indicators Te taiao Aotearoa: Marine non-indigenous species*.

Marine pollution from land and sea

Oil and plastic pollution and sewage can come from both marine- and land-based activities. Large amounts of waste, mainly from urban centres, are carried along waterways and washed out to sea. Other waste can come from recreational boating, fishing boats, shipping, and oil and gas operations.

Habitats in coastal waters, and harbours, estuaries, and reefs along exposed coasts, are particularly vulnerable to the effects of plastic pollution (MacDiarmid et al, 2012a). While some waste collects on beaches, most remains in the ocean.

Marine debris

Some of the effects of build-up of debris in the marine environment include:

- marine animals and seabirds can become entangled in it and be injured or killed
- fish, seabirds, and turtles can swallow plastic debris they mistake for food
- debris drifting in the ocean can damage fragile marine habitats
- plastics can remain in the ocean for hundreds of years
- when plastics eventually break down into small particles they can enter the food chain (Derraik, 2002; World Economic Forum, 2016).

The data on marine waste in New Zealand's marine environment are limited. One New Zealand study identified that between 1995 and 2005, the incidence of fur seals and sea lions being entangled in plastic and other debris in Kaikoura was one of the highest rates reported in the world (Boren et al, 2006).

Globally, it is estimated that at least 8 million tonnes of plastic waste enters the ocean each year (Jambeck et al, 2015), with packaging comprising more than half this waste (World Economic Forum, 2016). Some of this waste forms huge drifting patches, such as the Great Pacific garbage patch in the North Pacific Ocean (Turgeon, 2014).

By 2050, there may be more plastic than fish in the ocean, by weight, based on the current estimated rate of global plastic entering the ocean (World Economic Forum, 2016).

For more detail see *Environmental indicators Te taiao Aotearoa: Effects of marine debris on marine life*.

Summary and implications

Our coastal waters, harbours, and estuaries are the marine habitats New Zealanders are most likely to visit for recreation, fishing, and shellfish harvesting. However, there are limited national data available with which to confidently quantify how the pressures discussed in this chapter are changing the state of this important part of our marine environment.

Increased sedimentation from changes in land use can have substantial impacts on nursery habitats and shellfish species but we have not been able to assess the extent to which this is

changing our coastal environment on a national scale. We cannot yet quantify the impact of excess nutrients on marine ecosystems and species. Heavy metal concentrations in estuaries and harbours are mostly at levels unlikely to cause harm to seabed species in the 10 of 16 regions around the country for which we have data.

We know that a greater number of non-indigenous marine species are entering our waters, increasing the threat these species pose to natural ecosystems, aquaculture, and fisheries. The economic costs of marine pests are not well quantified, but are likely to amount to millions of dollars a year.

These pressures on coastal habitats can be cumulative and will not occur in isolation from ocean acidification and warming, or pressures from commercial and recreational fishing, which we discuss in the next chapter, [Our fisheries and the impact of fishing on marine ecosystems](#).

For Māori, the degradation of coastal waters, harbours, and estuaries has been a significant source of grievance since early European settlement. [Ngāti Whātua Ōrākei, Ōkahu Bay – aligning mātauranga and science to restore mauri](#) aptly demonstrates the cumulative nature of human pressures on a coastal marine environment. It tells a compelling story of how the degradation of a bay in the Hauraki Gulf affected the local hapū's health and undermined their customary values, including the traditional harvesting of pipi and other kaimoana.

Ngāti Whātua Ōrākei, Ōkahu Bay – aligning mātauranga and science to restore mauri

In the 1980s, kuia and kaumatua (elders) of the Hauraki Gulf hapū, Ngāti Whātua Ōrākei, noticed a disturbing change in their ancestral Ōkahu Bay. The beach had become noticeably empty of whānau (family) collecting pipi and other kaimoana (seafood) from their ancestral pataka (food cupboard). Whānau noticed the bay ‘filling in’ and wondered where the sand had gone.

These changes were likely the result of a surge of housing development from the 1950s to the 1970s. Land clearing and the engineering of rock walls and marinas changed the flushing ability of the bay. This led to large quantities of sediment flowing into the bay but not out, altering the underwater landscape of the bay and smothering the habitat of shellfish such as pipi.

Human actions had been affecting the health of the Ōkahu Bay for some time. In 1914, against the wishes of Ngāti Whātua Ōrākei, a two-metre high sewer pipe was built along the beachfront to carry raw sewage from Auckland into the bay.



A sewer pipe under construction at Ōkahu Bay in 1910, in front of the ancestral village of Ngāti Whātua (buildings on left). Source: 7-A2929 Sir George Grey Special Collections, Auckland Libraries

Offensive from a cultural and spiritual perspective, the sewage also polluted shellfish beds, leading to a surge in illness and death from cholera and other water-borne diseases. In the mid-1930s, all streams in the catchment were piped underground, destroying stream and estuarine habitat, including inanga (whitebait) spawning grounds. In 1960, sewage was diverted to the Mangere Wastewater treatment plant, but a new road (Tamaki Drive) was constructed over the line of the old sewer pipe. The road created a permanent physical barrier between the sea and land and further dislocated Ngāti Whātua Ōrākei from the bay.

In 2005, Ngāti Whātua Ōrākei decided it wanted to better understand what was happening to the bay. The hapū commissioned the development of a model aligning mātauranga Māori (Māori knowledge) with empirical science. Central to this model is an annual kaimoana monitoring survey. Recent results from the survey found that the entire bay had only about 180 cockles, concentrated in isolated pockets. A healthy bay environment would expect to have abundant and widely dispersed populations.

Before urban development and intensification from the 1950s, the seabed of Ōkahu Bay was mainly sand, with sandbars throughout. However, a report commissioned by the hapū estimated that about 10,000 cubic metres of sediment enters the bay from the surrounding catchment every year (Kahui-McConnell, 2007). Stormwater also carries heavy metals and other contaminants that are harmful to the marine ecosystem. The report estimated that about 56 kilograms of zinc, 11 kilograms of copper, and 23 kilograms of petroleum hydrocarbons make their way into the bay through stormwater pipes every year (Kahui-McConnell, 2007).

Ngāti Whātua Ōrākei's cultural health indicators for Ōkahu Bay reflect the hapū's vision of restoring their cultural and spiritual relationship with the bay and strengthening mātauranga (indigenous knowledge). This would include: harvesting and eating kaimoana such as pipi, cockles, and crabs without fear of illness; swimming, diving, and boating in the bay; and maintaining access throughout the bay and into the wider Waitemata Harbour. Ngāti Whātua Ōrākei, in partnership with Auckland Council, will continue to monitor the bay and the wider catchment to track progress towards their goal of restoring the mauri (life force) of the moana (ocean).

This case study is based on interviews with Ngāti Whātua Ōrākei on 22 March 2016, and a report commissioned by the hapū (Kahui-McConnell, 2007). We thank Ngāti Whātua Ōrākei for sharing their stories and research with us.

Our fisheries and the impact of fishing on marine ecosystems

Throughout New Zealand's human history, the bounty of the sea has provided people with food and goods for trade. When Polynesian settlers first arrived 700–800 years ago, New Zealand's coasts and oceans provided an abundance of food and resources. Over time, Māori developed practices to conserve these resources and fishing became a source of economic and cultural wealth for iwi and hapū.

The marine environment continues to be important in the Māori economy. Kaimoana (fish, crustaceans, and molluscs) was the top export commodity of Māori authorities in 2015, accounting for \$304 million or 63 percent of all merchandise exports. It was an important commodity for Māori small and medium-sized enterprises (Statistics NZ, 2016b). A number of coastal areas are set up as mātaihai (reserves) and taiāpure (local fisheries) for customary Māori fishing.

Fishing and aquaculture industries contributed \$896 million (0.4 percent) to New Zealand's gross domestic product in 2013, providing over 47,000 jobs (Statistics NZ, 2016a). The marine environment also supports an informal economy for perhaps as many as one-third of New Zealand adults who recreationally fish, dive, or harvest shellfish to feed family and friends (Ministry of Fisheries, 2008).

This report has already discussed some threats to fisheries and aquaculture – such as ocean acidification and warming, sedimentation, and marine pests. However, fishing has its own impact on fish species and marine ecosystems. This chapter is primarily about the impact of fishing on the environment.

A cross-cutting issue

Fishing is both a highly valued human activity and a pressure on marine species and ecosystems.

Commercial fishing

Of New Zealand's commercial fish stocks, 17 percent were assessed as overfished in 2015, comparing favourably to about 29 percent of overfished fish stocks worldwide.

Seabed trawling and dredging

Seabed trawling and dredging cause widespread harm to seabed habitats. These methods mostly occur in coastal waters – the part of our marine environment under the most pressure from human activities. Commercial trawl and dredge tows have decreased since the late 1990s.

Bycatch

Most fishing methods can result in the accidental death of non-target species (bycatch). Bycatch has been decreasing over the past 15–20 years but is still an important cause of death for rare species of seabirds and marine mammals.

Ecological sustainability

To draw firm conclusions about the ecological sustainability of fishing our reporting programme would need data on the impact of commercial, recreational, and customary fishing on a wider range of non-target species and marine ecosystems.

Fishing pressures on the marine environment

Fishing can have an adverse effect on other species and the wider marine environment. For example:

- some fishing methods can cause widespread harm to extensive areas of marine habitat, notably seabed (bottom) trawling and dredging
- most fishing methods result in the accidental death of non-target species (bycatch) including other fish species, sharks, rays, seabirds, fur seals, sea lions, and dolphins (see [Our marine birds and mammals](#))
- removing too many target and non-target species can disrupt the natural balance of species within the wider marine ecosystem.

Our reporting programme's data provide a partial picture of fishing pressures

Of the pressures listed above, we report in this chapter on commercial seabed trawling and dredging, the status of commercial fish stocks, and the marine trophic index for the Chatham Rise. These data provide a partial picture of the pressure from fishing on marine ecosystems. A fuller picture would include data and analysis on the impact of commercial, customary, and recreational fishing on a greater range of non-target species and wider marine ecosystems.

New Zealand's most destructive commercial fishing methods have decreased

Seabed (bottom) trawling and dredging are fishing methods where large nets (bottom trawling) or heavy metal baskets (dredging) are towed near or along the ocean floor. Trawling is carried out in both shallow and deep waters and is used to catch a range of species, for example, hoki and squid. Dredging is carried out on the seabed in shallow waters and often targets shellfish species such as scallops and oysters.

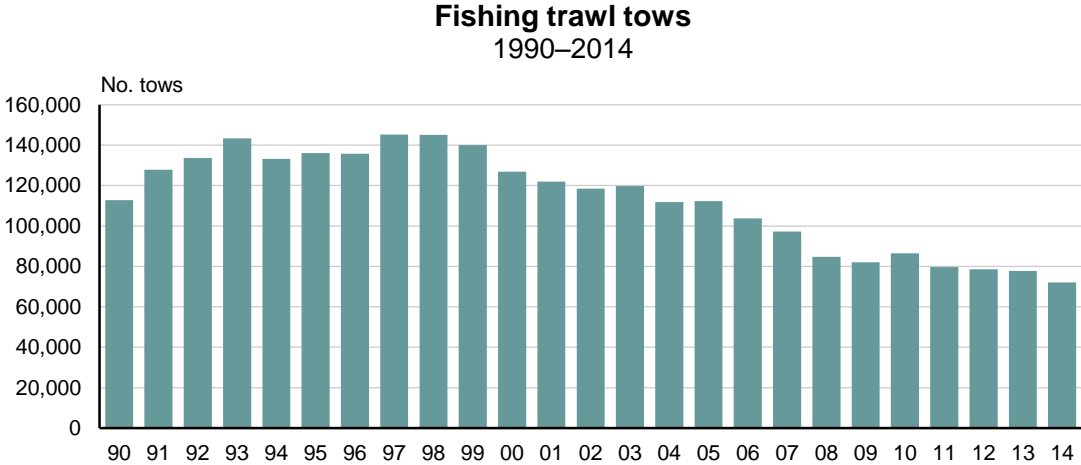
Seabed trawling and dredging can have a major impact on seabed habitats and species, and are the two most destructive fishing methods used in New Zealand. When trawls and dredges are dragged along the seabed, they disturb sediment, damage corals, and scoop up seabed species such as crustaceans and brittle stars. The extent of damage will depend on a number of factors, including the type, weight, and size of equipment, its towing speed, and the nature of the seabed habitat.

Commercial seabed trawl and dredge tows have decreased

The number of commercial fishing trawl tows and dredge tows in New Zealand waters has fallen (Ministry for Primary Industries, 2016a; Black & Tilney, 2015), reducing pressure on seabed habitats and species. The number of trawl tows decreased 50 percent from a peak of over 145,000 tows in 1997 to over 72,000 in 2014 (see figure 10). The number of dredge tows reported in New Zealand waters decreased 83 percent from a peak of over 260,000 tows in 1996 to over 43,000 in 2014.

The extent of seabed trawled for the first time, where the potential for damage is greatest, has been decreasing each year since 2007. Similarly, the overall area trawled each year has generally decreased since 2003 (Black & Tilney, 2015).

Figure 10



Source: Ministry for Primary Industries

Trawling occurs mostly in shallower waters less than 1,500 metres. Table 2 shows the percentage of seabed in our EEZ and territorial sea that was trawled at least once between 1990 and 2011, at different depths. As shown, 44 percent of the seabed up to 400 metres in depth was trawled at least once.

Table 2

Percentage of seabed in the EEZ and territorial sea trawled at least once from 1990 to 2011	
Depth of seabed (metres)	Seabed trawled at least once (percent)
0-400	44
400-800	31
800-1,200	12
1,200+	Less than 1 percent

Source: Ministry for Primary Industries

Recovery of seabed habitats

There is limited research in New Zealand on the recovery rates of seabed habitats that have been subject to trawl and dredge tows. Overseas studies indicate that recovery time can take from months to years depending on the nature of the seabed (Ministry for Primary Industries, 2016a).

For more detail see *Environmental indicators Te taiao Aotearoa*: [Commercial seabed trawling and dredging](#) and [Commercial coastal seabed trawling and dredging](#).

Recreational dredging

While local fishing rules vary around the country, recreational fishers can use a dredge – usually to collect scallops. This causes damage to seabed habitats, although on a much smaller scale than a commercial operation. There are daily limits to the number and size of shellfish that can be taken per person.

We are not aware of any data on the extent of recreational dredging around the country and how this may be changing coastal marine habitats. Recreational dredging is prohibited in the Fiordland (Te Moana o Atawhenua) marine area, the internal waters of Fiordland, and Paterson's Inlet in Stewart Island (Rakiura).

Our commercial fish stocks are managed with the aim of ensuring future harvests

Since 1986, New Zealand has managed its commercial fisheries under a quota management system (QMS). QMS gives quota holders a property right to harvest a fish stock up to a maximum level, known as the total allowable commercial catch. QMS controls the total allowable commercial catch of almost all the main fish stocks within New Zealand's EEZ.

The total allowable commercial catch is established separately for each fish stock, with the aim of ensuring future harvests. It includes adjustments for recreational and customary fishing and other fish-related mortality.

Fisheries managers define a fish stock as overfished when the fish stock:

- is depleted and needs to be actively rebuilt
- has collapsed and closure should be considered to rebuild the stock as fast as possible (Ministry for Primary Industries, 2016c).

In 2015, 17 percent of New Zealand's fish stocks were assessed as being overfished, requiring active management intervention to rebuild stock. This included stocks of southern bluefin tuna, Pacific bluefin tuna, orange roughy, snapper, John dory, and scallops.

The 17 percent of New Zealand's fish stocks overfished in 2015 compares with an estimated 29 percent of fish stocks overfished worldwide (based on a 2011 assessment) (Food and Agriculture Organization of the United Nations, 2014).

In 2015, 78 percent of the total landings of fish by weight and value came from stock of known status (Ministry for Primary Industries, 2016).

Information on the status of the main commercial species has markedly improved over the last decade. In 2015, of 344 fish stocks which cover most of the main commercial species, we knew the status of 157 stocks for assessing stocks against the soft limit – the management limit when fish stocks are assessed as depleted and need to be actively rebuilt. The 2015 stock was an increase in known status of fish stock of 65 percent since 2009.

One of the roles of our reporting programme is to assess the ecological impacts of fishing on marine ecosystems. The fisheries management data we reported on above was not designed for this purpose – a limitation of this report.

For more detail see *Environmental indicators Te taiao Aotearoa: State of fish stocks*.



A net full of lookdown dory, ling, and hoki. Hoki are widely distributed throughout New Zealand waters and the species is an important commercial fishery. The fishery poses a particular risk of bycatch for Southern Buller's albatross and Salvin's albatross (Ministry for Primary Industries, 2016b). (Photo: Peter Marriot, NIWA)

Marine trophic index indicates no determinable impact of commercial fishing on demersal fish in the Chatham Rise

The trophic level is the position of an organism within a food web – for example, phytoplankton are at level 1 at the base of the food web, omnivores are generally at level 2 or 3, and predatory species have levels greater than 3. The marine trophic index (MTI) is the mean (average) trophic level of fisheries landings (fish species caught and landed). It is used internationally to measure changes in marine ecosystems associated with fishing and climate variability.

A gradual decline in MTI indicates the structure of fish populations is changing, with a relative increase in populations of smaller fish and invertebrates lower in the food web and fewer of the larger, predatory fish populations. This can indicate that predatory fish – the main commercial fish species – are being overexploited by fishing or are being affected by other pressures, such as climate variability.

Our reporting programme has used MTI to measure the abundance and diversity of demersal fish in the Chatham Rise, one of the most productive fishing grounds in our EEZ. Demersal fish populations include the main commercial species of hoki, hake, ling, oreo, and orange roughy.

Data from 1992 to 2014 showed no statistically significant long-term change in the demersal fish community, with a mean MTI of 3.9 indicating a predatory fish community for the area. This supports the view that fishing and other pressures, such as climate variability, have not caused a determinable change in populations of large demersal fish in the Chatham Rise over this period. MTI for the Chatham Rise is not representative of the wider EEZ.

For more detail see *Environmental indicators Te taiao Aotearoa*: [Marine trophic index: Chatham Rise](#).

Summary and implications

Understanding the impact of fishing on the marine environment is a complex science. As yet, our reporting programme cannot draw firm conclusions about the full ecological impact of fishing on wider marine ecosystems.

The data we reported in this chapter provide a partial picture of fishing pressures. While it is good news that commercial dredging and bottom trawling are decreasing, there were still more than 72,000 trawl tows in 2014. Knowledge on the ecological implications of trawling and dredging and the consequences for the productivity of fish stock for New Zealand is incomplete.

The 17 percent of New Zealand's commercial fish stock assessed as overfished in 2015 compares favourably to international data on overfished fish stocks. However, the purpose of the fish stock data are to inform good management decisions within QMS; the data are not intended for environmental reporting on the ecological sustainability of fisheries or wider ecosystems.

MTI indicates no determinable change in the abundance of demersal fish in the Chatham Rise over the past few decades. Having similar data across other fishing grounds in the wider EEZ would provide more information on the impact of fishing and other pressures on marine ecosystems.

Data on commercial bycatch of seabirds and marine mammals reported in the chapter [Our marine birds and mammals](#) show that while bycatch is decreasing, it is still an important cause of death for some threatened seabird and marine mammal species.

To provide a fuller picture of the impact of fishing, future reports would need to include data on the bycatch of other non-target species, and pressures on fisheries and marine ecosystems from recreational and customary fishing.

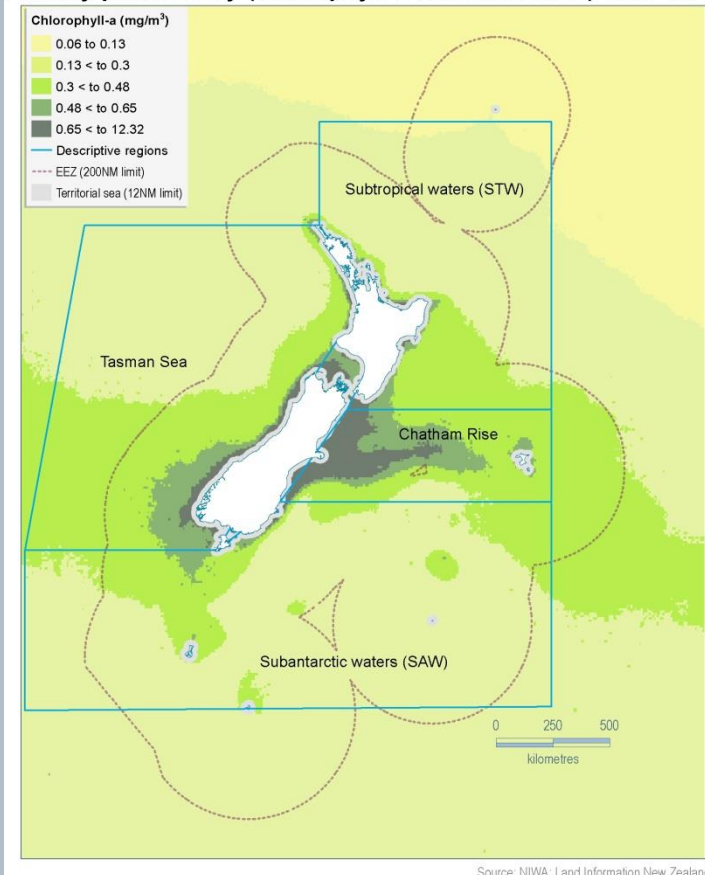
The role of phytoplankton in supporting marine life and our fisheries

Phytoplankton, microscopic organisms at the base of the food chain, use a pigment called chlorophyll-a to capture energy and grow via photosynthesis. These phytoplankton then become food for other marine organisms, including commercial fish species. As the marine environment's primary producers, phytoplankton are critical for the productivity and abundance of other marine life, and the overall health of the marine ecosystem. They also influence other important aspects such as carbon dioxide uptake by the ocean.

Primary productivity is the synthesis of new organic material from nutrients and sunlight by phytoplankton, and can be measured by satellite observations of concentrations of chlorophyll-a. Primary productivity is often high along coastlines and in underwater continental shelf areas – one reason these areas are also productive fishing grounds. Figure 11 shows the relatively high primary productivity of the Chatham Rise, one of the most important commercial fishing grounds in New Zealand's EEZ.

Figure 11

Primary productivity (chlorophyll-a concentrations) 1997–2016



For more detail see: [Environmental indicators Te taiao Aotearoa: Primary productivity.](#)

Future reporting

Through our Environmental Reporting Programme we will continue to work with data providers to improve on existing data and expand our range of indicators for future reports.

Our strategic intentions for supporting mātauranga Māori are set out in the Ministry for the Environment's (2016) [Reporting environmental impacts on te ao Māori: A strategic scoping document](#).

Initiatives under way

We have a data improvement project under way to provide national coastal-water-quality data across a range of physical, chemical, and microbiological variables. Data should be available for reporting by 2019. The Ministry for the Environment is also looking into a project to monitor beach litter, using citizen science.

Medium- to long-term reporting improvements

Reporting improvements we have identified by theme, in no particular order, include:

Mātauranga Māori

- use of marine cultural health indexes

Oceans and the climate

- ocean currents

Biodiversity

- population data across more marine plant and animal groups

Coastal habitats and ecosystems

- health of shellfish and emerging contaminants of coastal waters
- the ecology of coastal and estuarine environments
- sedimentation of open coasts, harbours, and estuaries from land and rivers
- nutrient loading on estuaries and the coastal zone
- algal blooms and other indications of eutrophication

Fishing

- ecosystem effects such as marine trophic index across the EEZ
- recreational fishing
- wider information on fish species populations

Other

- marine mining.

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Glossary

aquaculture	The practice of farming aquatic organisms such as fish, crustaceans, or molluscs in marine and freshwater environments.
at risk	Species assessed according to the New Zealand Threat Classification System . Includes four subcategories: declining, recovering, relict, and naturally uncommon.
ballast water	Fresh or salt water held in tanks and cargo holds of ships to increase stability and manoeuvrability during a voyage, and which can include a multitude of small marine organisms.
biodiversity	The variability among living organisms, and the ecological systems they are part of. Includes the diversity within species, between species, and of ecosystems.
bycatch	Species not targeted by a fishery but caught accidentally during fishing operations. Once caught, they are either landed, discarded, or released.
carbon sink	A forest, ocean, soil, or other natural feature of the environment that accumulates and stores carbon, including carbon dioxide emitted into the atmosphere from human activities.
climate change	Change in global or regional climate patterns, evident over an extended period (typically decades or longer). May be due to natural factors or human activities.
continental shelf	Seabed and subsoil of submarine areas extending out to the continental margin (the zone of the ocean floor that separates the thin oceanic crust from the thick continental crust).
dredge tow	Process of dragging a dredge along the seabed behind a fishing vessel (usually to harvest oysters or scallops).
echinoderms	Bottom-dwelling marine invertebrates with various feeding habits such as star fish, sea cucumbers, and sea urchins.
emission	The release of a substance into the atmosphere; its concentration in the air will depend on how it disperses in the atmosphere.
endemic	An organism that occurs naturally only in one place or region.

exclusive economic zone (EEZ)	Area of ocean extending from 12 to 200 nautical miles from shore, including the seabed and subsoil. New Zealand has jurisdiction over exploration and extraction of marine resources in its EEZ. The notion of the EEZ was established by the 1982 United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS provides each coastal state with exclusive rights over resources in its EEZ while clarifying access and navigational rights of foreign vessels.
extended continental shelf	The part of the continental shelf beyond the EEZ. The rights of each coastal state to resources in its extended continental shelf was provided for by the United Nations Convention on the Law of the Sea, subject to some limitations.
extinction	The loss of a species. The moment of extinction is generally considered to be marked by the death of the last individual of that species.
greenhouse gases	Carbon dioxide, nitrous oxide, methane, ozone, water vapour, and chlorofluorocarbons occurring naturally and resulting from human (production and consumption) activities, and contributing to the greenhouse effect (global warming).
heavy metal	Subset of elements that exhibit metallic properties and have relatively high atomic weight. Heavy metals can be emitted from human activities, such as vehicle tyre/brake wear and battery and steelmaking facilities, but also occur naturally.
indigenous	An organism belonging naturally to a given region or ecosystem, as opposed to one that is introduced or exotic. Also referred to as 'native'.
Intergovernmental Panel on Climate Change (IPCC)	An international body that assesses the science related to climate change. IPCC assessments are written by hundreds of leading scientists from around the world. The assessments draw attention to areas of well-established knowledge on climate change, as well as to where multiple perspectives exist in the literature. The IPCC's fifth assessment report was completed in November 2014.
invertebrate	An animal without a backbone or spinal column. Corals, sponges, and jellyfish are examples of marine invertebrates. Land examples are insects, spiders, and slaters.

mātauranga Māori	The knowledge, comprehension, or understanding of everything visible and invisible existing in the universe, and often used to mean ‘wisdom’. Often includes present-day, historic, local, and traditional knowledge; systems for transferring and storing knowledge; and goals, aspirations, and issues from an indigenous perspective.
marine mammal	A warm-blooded animal that breathes through lungs, gives birth to live young, nurses its young with milk from mammary glands, and has adapted to living all or part of their life in the ocean. For example, seals, sea lions, whales, dolphins, sea otters, walruses, and polar bears.
overfishing	Rate of fishing that exceeds the rate at which the stock is naturally replenished and will lead to a stock falling below management targets and/or limits.
pH	Measure of acidity/alkalinity, with measures below 7 being acid and above 7 being alkaline.
quota management system	System established in 1986 to control the total commercial catch for most of the main fish stocks in New Zealand’s exclusive economic zone.
resident	Species that breed in New Zealand.
relict	Species or subspecies that have undergone a documented decline within the past 1,000 years and now occupy less than 10 percent of their former range, and that meet criteria set out in the New Zealand Threat Classification System .
seamount	A mountain under the sea.
species	A basic unit of biological classification, comprising individual organisms very similar in appearance, anatomy, physiology, and genetics, due to having relatively recent common ancestors. Species can interbreed.
statistically significant	When a finding is likely to be due to something other than random chance. A statistically significant finding is determined by tests based on the 95 percent confidence interval. This interval shows the range of values that would include the estimate 95 percent of the time if the test was repeated multiple times.
subspecies	A subdivision of a species, usually as a consequence of geographic isolation. A subspecies is genetically distinguishable from other populations of the same species.
territorial sea	Area of sea extending from the coast to the 12 nautical mile limit.

threatened species

Species assessed according to the [New Zealand Threat Classification System](#) as being threatened with extinction. Includes three subcategories: nationally critical, nationally endangered, and nationally vulnerable.

trawl tow

Process of dragging a trawl net behind a fishing vessel, along or just above the seabed.

Appendix 1: New Zealand Threat Classification System

Extinct		A species for which there is no reasonable doubt that the last individual has died.
Threatened species	Nationally critical	Fewer than 250 mature individuals (natural or unnatural); or 250–1,000 mature individuals and 50–70 percent decline over 10 years or three generations; or Any population size with a greater than 70 percent population decline over 10 years or three generations, whichever is longer.
	Nationally endangered	250–1,000 mature individuals (natural or unnatural) with a 10–50 percent population decline; or 250–1,000 mature individuals (unnatural) with a stable population; or 1,000–5,000 mature individuals with a 50–70 percent population decline.
	Nationally vulnerable	250–1,000 mature individuals (unnatural) with a population increase of more than 10 percent; or 1,000–5,000 mature individuals (unnatural) with a stable population; or 1,000–5,000 mature individuals with a 10–50 percent population decline; or 5,000–20,000 mature individuals with a 30–70 percent population decline; or 20,000–100,000 mature individuals with a 50–70 percent population decline.
At risk	Declining	5,000–20,000 mature individuals with a 10–30 percent population decline; or 20,000–100,000 mature individuals with a 10–50 percent population decline; or >100,000 mature individuals with a 10–70 percent population decline.
	Recovering	1,000–20,000 mature individuals with a population increase of more than 10 percent.
	Relict	5,000–20,000 mature individuals with a stable population; or More than 20,000 mature individuals with a stable or increasing population; or All relict species occupy less than 10 percent of their original range.
	Naturally uncommon	Species or subspecies whose distribution is naturally confined to specific habitats or geographic areas (eg subantarctic islands), or that occur within naturally small and widely scattered populations. This distribution is not the result of past or recent human disturbance. Populations may be stable or increasing.
Not threatened		Species or subspecies that are assessed and do not fit any of the other categories are listed in the 'not threatened' category.

Source: Department of Conservation

Appendix 2: Conservation status of New Zealand’s resident indigenous seabirds, shorebirds, and marine mammals

Table A2.1

Seabirds – threatened		
Nationally critical	Nationally endangered	Nationally vulnerable
Antipodean albatross ↓ ☒	Black-fronted tern	Auckland Island shag
Black-billed gull ↓	Bounty Island shag ↑	Black petrel ☒
Chatham Island shag ↓	Fiordland created penguin ↓	Caspian tern
Chatham Island taiko	King shag	Chatham Island petrel
Codfish Island diving petrel	Masked (blue-faced) booby	Flesh-footed shearwater ☒
Eastern rockhopper penguin	New Zealand storm petrel	Grey-headed mollymawk
Gibson's wandering albatross ↓ ☒	Red-tailed tropicbird	Pied shag
Kermadec white-faced storm petrel	White-bellied storm petrel	Red-billed gull
New Zealand fairy tern		Southern white-fronted tern
Pacific white tern		Stewart Island shag
Pitt Island shag ↓		White-flipped blue penguin
Salvin's mollymawk ↓ ☒		Yellow-eyed penguin

↓ worsened or ↑ improved status between the 2008–11 and 2012–14 assessment periods

☒ high or very high risk of bycatch

Source: Robertson et al (2013)

Table A2.2

Seabirds – at risk		
Declining	Relict	Naturally uncommon
Erect-crested penguin ↓	Broad-billed prion	Antarctic prion
Hutton’s shearwater	Cook’s petrel	Black shag
Light-mantled sooty albatross	Fairy prion	Blue shag
NZ white-capped mollymawk	Fluttering shearwater	Brown skua
Northern blue penguin	Grey-backed storm petrel	Buller’s shearwater
Sooty shearwater	Kermadec little shearwater	Campbell Island mollymawk
Southern blue penguin	Kermadec petrel	Campbell Island shag
White-chinned petrel	Mottled petrel	Chatham fulmar prion
White-fronted tern	NZ white-faced storm petrel	Chatham Island blue penguin
	Northern diving petrel	Chatham Island mollymawk
Recovering	Southern diving petrel	Fulmar prion
Antarctic tern	Wedge-tailed shearwater	Grey petrel
North Island little shearwater	White napped petrel	Grey ternlet
Pycroft’s petrel		Lesser fulmar prion
		Little black shag
		Northern Buller’s mollymawk
		Northern giant petrel
		Northern royal albatross
		Snares Cape pigeon
		Snares crested penguin
		Sooty tern
		Southern Buller’s mollymawk
		Southern royal albatross
		Subantarctic little shearwater
		Westland petrel
		White-capped noddy

↓ worsened status between the 2008–11 and 2012–14 assessment periods

Source: Robertson et al (2013)

Table A2.3

Seabirds – not threatened
Australasian gannet
Black-bellied storm petrel
Black-winged petrel
Grey-faced petrel
Little shag
Southern black-backed gull
Spotted shag
Subantarctic diving petrel
White-headed petrel

Source: Robertson et al (2013)

Table A2.4

Shorebirds		
Threatened	At risk	Not threatened
Nationally critical	Declining	White-faced heron
Chatham Island oystercatcher	New Zealand pied oystercatcher	Spur winged plover
New Zealand shore plover	Pied stilt	
Southern New Zealand dotterel		
White heron	Recovering	
	Variable oystercatcher	
Nationally endangered		
Reef heron	Naturally uncommon	
	Auckland Island banded dotterel	
Nationally vulnerable		
Banded dotterel		
Northern New Zealand dotterel		
Wrybill		

Source: Robertson et al (2013)

Table A2.5

Marine mammals		
Threatened	Not threatened	Data deficient
Nationally critical	Antarctic minke whale	Andrews' beaked whale
Bryde's whale	Common dolphin	Cuvier's beaked whale
Māui dolphin	False killer whale	Dense-beaked whale
New Zealand sea lion	Gray's beaked whale	Hector's beaked whale
Orca (killer whale)	Long-finned pilot whale	Hourglass dolphin
Southern elephant seal	New Zealand fur seal	Pygmy right whale
	Pygmy sperm whale	Shepherd's beaked whale
Nationally endangered	Southern right whale dolphin	Southern bottlenose whale
Bottlenose dolphin	Sperm whale	Spade-toothed whale
Hector's dolphin		Spectacled porpoise
		Strap-toothed whale
Nationally vulnerable		True's beaked whale
Southern right whale ↑		

↑ improved status between the 2008–11 and 2012–14 assessment periods

Source: Baker et al (2016)

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