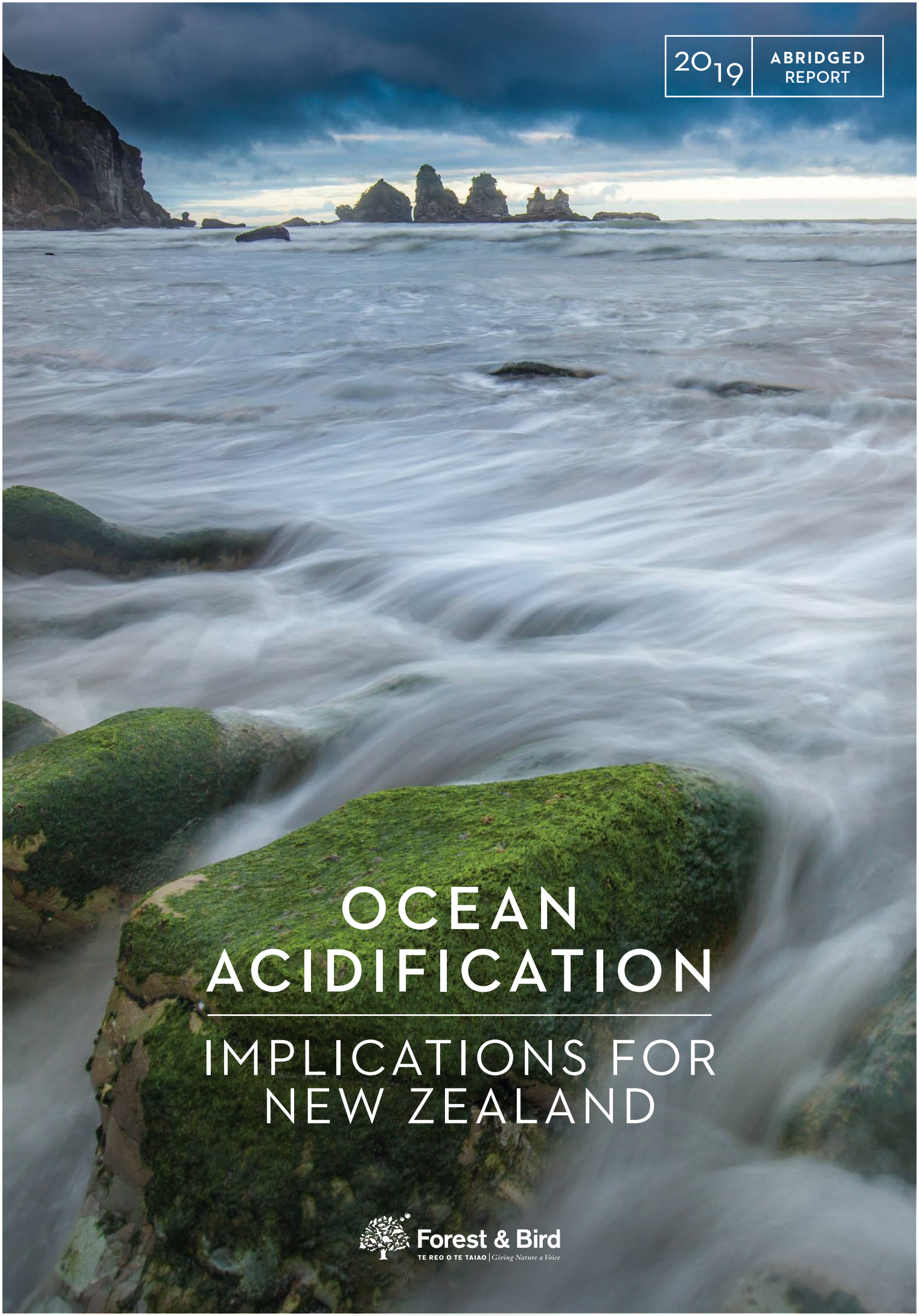

2019 ABRIDGED REPORT

OCEAN ACIDIFICATION

IMPLICATIONS FOR NEW ZEALAND

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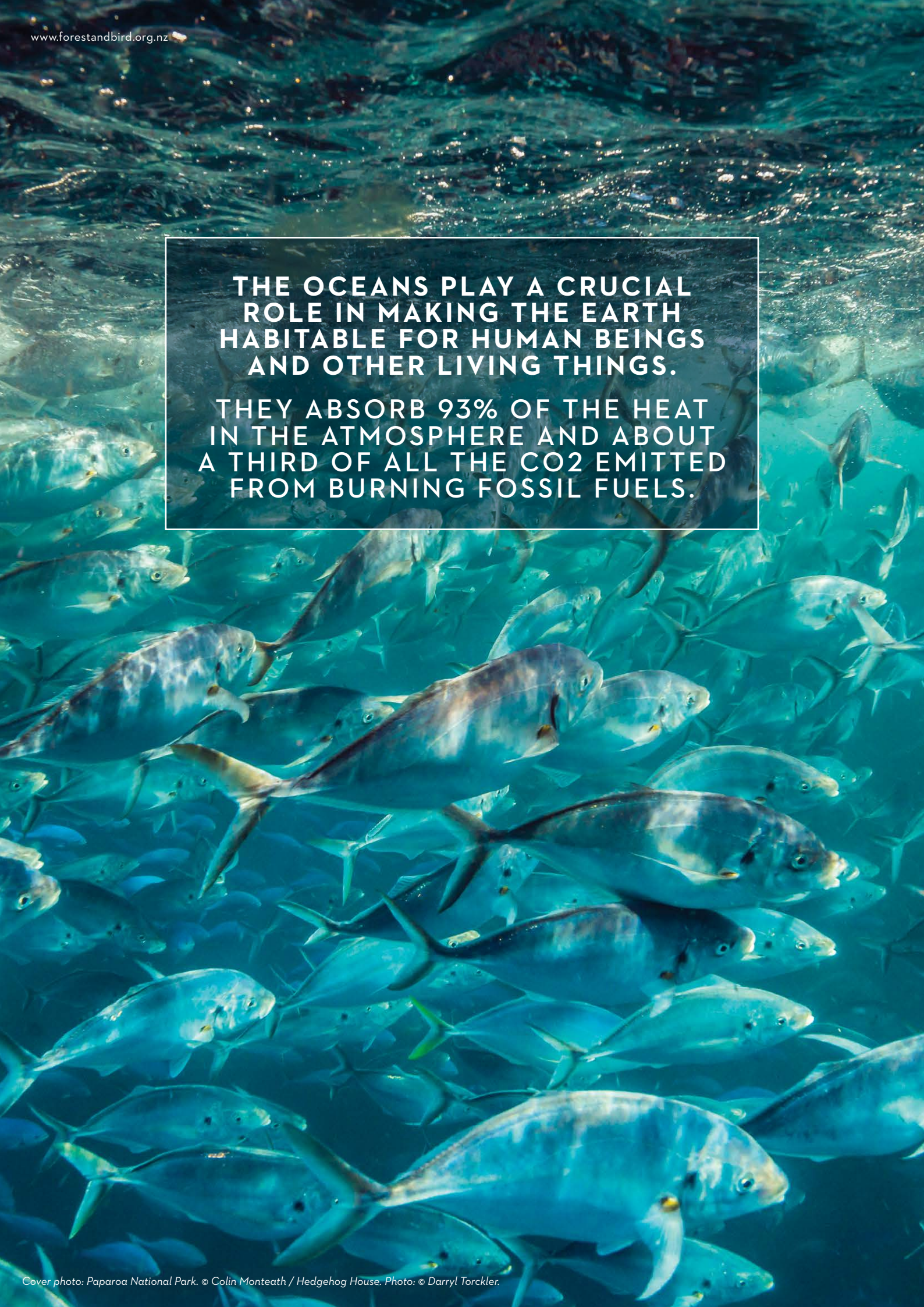


THE OCEANS PLAY A CRUCIAL ROLE IN MAKING THE EARTH HABITABLE FOR HUMAN BEINGS AND OTHER LIVING THINGS.

THEY ABSORB 93% OF THE HEAT IN THE ATMOSPHERE AND ABOUT A THIRD OF ALL THE CO2 EMITTED FROM BURNING FOSSIL FUELS.

Cover photo: Paparoa National Park. © Colin Monteath / Hedgehog House. Photo: © Darryl Torckler.

EXECUTIVE SUMMARY

Since the industrial revolution started in the mid-18th century, the burning of fossil fuels and deforestation have caused levels of CO_2 in the atmosphere to rise from about 285 parts per million to more than 400. As CO_2 concentrations in the atmosphere have grown to levels never before seen in human history, the quantity absorbed by the world's oceans has also risen.

Oceans have absorbed about a third of all the CO_2 released into the atmosphere by human activities. This has changed their chemical balance in a process known as ocean acidification. The average pH, which measures the acidity or alkalinity of a solution, of the oceans has fallen from 8.2 units to 8.1 since pre-industrial times. Because pH is measured on a logarithmic scale, like earthquakes, this represents an increase in acidity of 26%.

If greenhouse gas emissions continue to rise in a "business as usual" scenario, the average pH level of New Zealand waters is projected to fall to 7.77 by the end of this century, a 116% increase in acidity since pre-industrial times. This would be the fastest rate of change for millions of years.

Associated with the fall in pH is a decline in calcium carbonate availability in the oceans. This is expected to affect the ability of shellfish, corals, and other calcifying organisms to form and maintain their shells and carbonate structures.

Parts of the ocean – including most of our neighbouring Southern Ocean – are projected to be undersaturated in aragonite, the more soluble form of carbonate, by the end of this century.

In undersaturated conditions, the unprotected aragonite shells and skeletons of corals and some molluscs can start to dissolve.

Studies have also shown that acidification disrupts the sensory system of some fish species and that they change their behaviour in response. Some tropical species lose their wariness of predators and awareness of their surroundings when exposed to pH levels expected in the future. A small number of studies of temperate climate fish have shown similar sensory disruption and lower survival rates for larvae, although research in this area is at an early stage. Acidification is not the only disruption related to climate change occurring in the oceans and coastal waters. Rising sea temperatures will also likely have a profound impact, and already some fish and plankton species have been recorded as shifting towards the poles.

Other warming impacts will include an expansion of low oxygen waters and changes to nutrient availability, currents, and weather patterns. Taken together with the impacts of acidification, these are expected to have far-reaching consequences for ecosystem communities and food webs, from phytoplankton at the base of the food chain to predators, such as marine mammals, sharks, and seabirds.

The world's oceans and coastal waters are already changing because of rising CO_2 levels, and some degree of further acidification and warming is inevitable because of the levels of CO_2 and heat already in the oceans and atmosphere. But those changes will be far more far-reaching and potentially devastating if we allow CO_2 emissions to continue rising through this century. Cutting emissions is the single most important thing we can do.

RECOMMENDATIONS

New Zealanders should take action at all levels to reduce the risks from ocean acidification. We all have a role in cutting CO_2 emissions. Central government, local government, marine industries, and Parliament all have a role to play. This report's recommendations are:

TO THE MINISTER FOR CLIMATE CHANGE

Ensure rapid reduction of CO_2 emissions consistent with a fair contribution towards achieving atmospheric levels of 450ppm of CO_2.

TO PARLIAMENT

Amend the Climate Change Response (Zero Carbon) Amendment Bill to include ocean acidification in all governmental risk assessment and planning for climate change-related adaptation.

TO THE MINISTER FOR THE ENVIRONMENT

Reform the Resource Management Act to include safeguarding the climate and minimising ocean acidification as matters of national importance and to ensure that the CO_2 emissions of an activity are expressly required to be taken into account in decision-making about resource management.

Prepare a national policy statement on climate change that addresses ocean acidification and that includes policies on CO_2 emissions, other activities that contribute to ocean acidification, activities that reduce carbon sequestration, activities that exacerbate ocean acidification (such as mangrove clearance), and activities that promote resilience in the face of unavoidable acidification.

Reform the Exclusive Economic Zone Act to allow for direct and indirect CO_2 emissions to be taken into account when assessing an activity.

TO THE MINISTER OF FISHERIES

Reform the Fisheries Act to adopt ecosystem-based fisheries management that takes into account the risks posed by ocean acidification.

Amend the information principles in the Fisheries Act so that uncertainties about the effects of ocean acidification are not used as a reason to delay action when setting Total Allowable Catches and Total Allowable Commercial Catches.

Support new Marine Protected Areas legislation that has a clear goal of fully protecting (no take) 30% of each bioregion within New Zealand's territorial sea and New Zealand's Exclusive Economic Zone in a meaningful and representative way that builds ocean resilience.

Photo: Cape Reinga, New Zealand. © Mathew Waters, Unsplash.

TO THE MINISTER OF CONSERVATION

Adopt new Marine Protected Areas legislation that has a clear goal of fully protecting (no take) 30% of each bioregion within New Zealand's territorial sea and Exclusive Economic Zone in a meaningful and representative way that builds ocean resilience.

Advocate for and protect biodiversity that helps mitigate the impacts of ocean acidification, such as coastal mangrove and kelp forests, coastal wetlands, and seagrass beds.

TO THE MINISTER OF RESEARCH, SCIENCE AND INNOVATION

Fund a comprehensive programme of research into the likely impacts and implications of acidification and warming, and ways of addressing those impacts.

Fund research into the risks to New Zealand native migratory fish species from ocean acidification.

TO REGIONAL COUNCILS AND TERRITORIAL AUTHORITIES

Ensure that regional policies and plans established under the Resource Management Act mitigate the effects of acidification, including by preventing the removal of mangroves and by reducing run-off, sewage, and other contaminants into coastal waters.

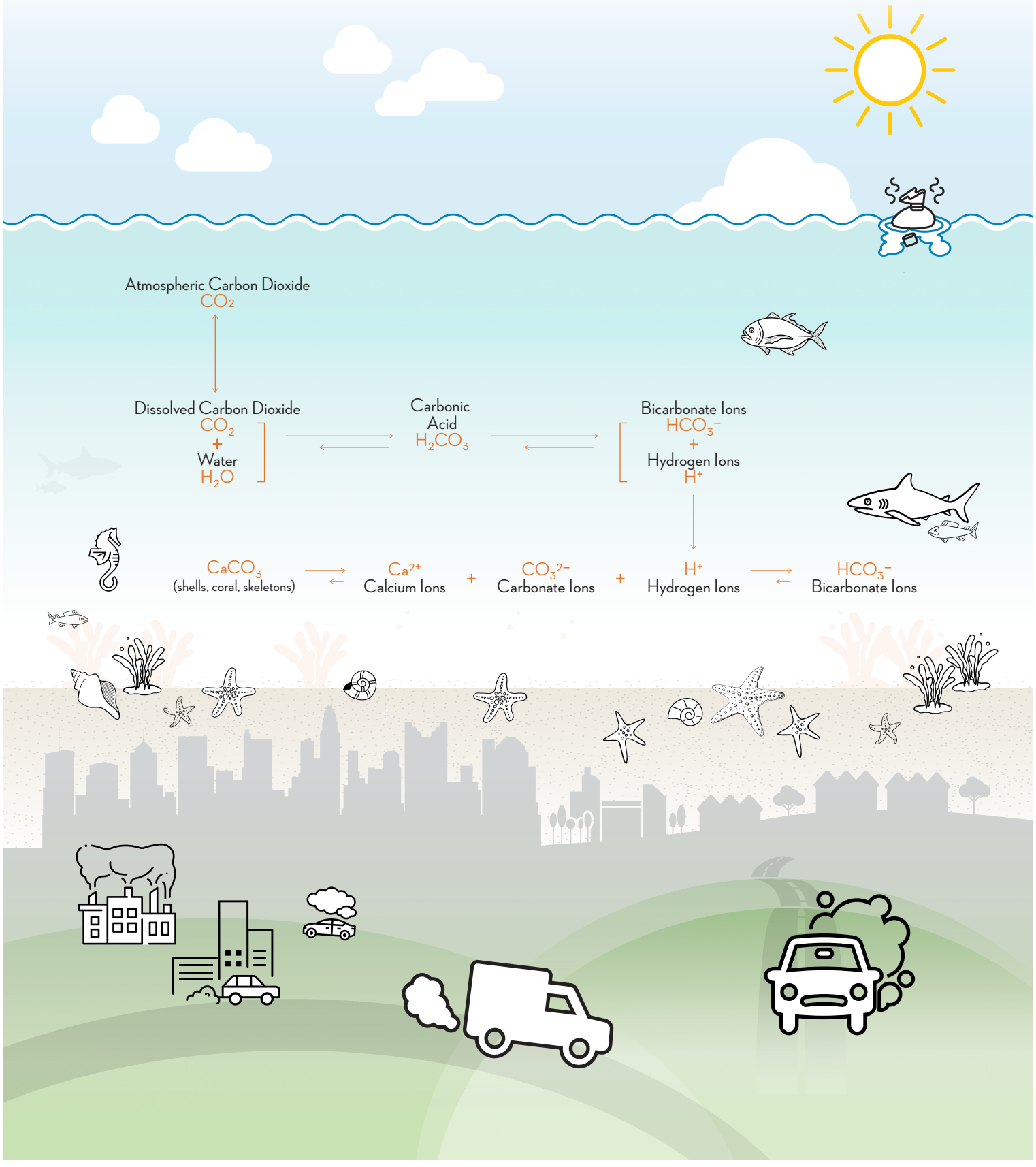
TO MARINE FISHING AND FARMING INDUSTRIES, AND TO UNIONS REPRESENTING WORKERS IN THESE INDUSTRIES

Advocate for rapid and substantial cuts in global CO_2 emissions to reduce risks to marine fishing and farming industries from ocean acidification.

Strongly advocate for domestic legislation that rapidly reduces CO_2 emissions and promotes adaptation to reduce risks to marine fishing and farming industries from ocean acidification.

Support reforming the Fisheries Act and Marine Protected Areas legislation to increase the resilience of our oceans to cope with unavoidable ocean acidification.

OCEAN ACIDIFICATION CHEMISTRY



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Dr Wendy Nelson, NIWA principal scientist – marine biology, specialising in macro-algae, seaweeds

Ms Di Tracey, NIWA fisheries scientist, specialising in deep-sea corals

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Dr Darren Parsons, NIWA marine ecologist, specialising in fish ecology

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