COOK ISLANDS
STATE OF ENVIRONMENT REPORT
2018

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

UN environment programme

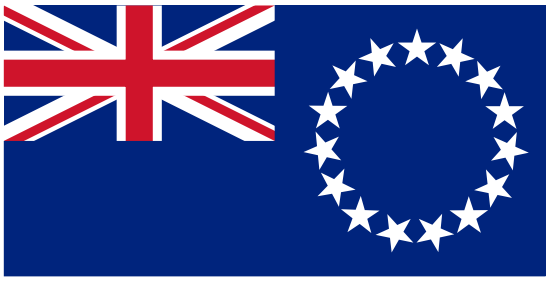
SPREP
Secretariat of the Pacific Regional Environment Programme

An initiative of the African, Caribbean and Pacific Group of States funded by the European Union

ACP MEAs 2

COOK ISLANDS STATE OF ENVIRONMENT REPORT

2018



NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

This document is approved by the Cabinet of the Cook Islands Government on 6 March 2020 (CM (20) 060).

SPREP Library Cataloguing-in-Publication Data

Cook Islands: State of Environment Report 2018.
Apia, Samoa : SPREP, 2018.

198 p. 29cm.

ISBN: 978-982-04-0666-7 (print)
978-982-04-0667-4 (e-copy)

1. Human ecology – Cook Islands.
2. Cook Islands – Environmental conditions.
3. Environmental protection – Cook Islands.
4. Environmental policy – Cook Islands.
I. Pacific Regional Environment Programme (SPREP).
II. Title

333.7209623

Cover photo: Rarotonga © David Kirkland
Other photos: Unless otherwise acknowledged, all photographs were taken by SPREP staff.

Designed by: The Little Design Company, Wellington, New Zealand.

An initiative of the African, Caribbean and Pacific Group of States funded by the European Union.

This document has been produced with the financial assistance of the European Union and the United Nations Environment Programme. The views expressed herein can in no way be taken to reflect the official opinion of the European Union or the United Nations Environment Programme.

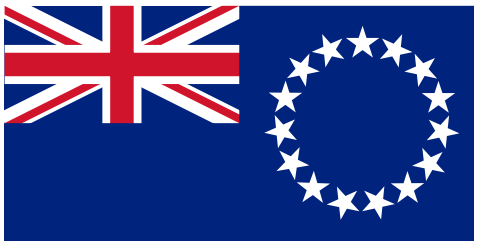
SPREP
Secretariat of the Pacific Regional Environment Programme

PO Box 240, Apia, Samoa
+685 21929
sprep@sprep.org
www.sprep.org

Our vision: *The Pacific environment, sustaining our livelihoods and natural heritage in harmony with our cultures.*

COOK ISLANDS STATE OF ENVIRONMENT REPORT

2018



NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

An initiative of the African, Caribbean and Pacific Group of States funded by the European Union

UN environment programme

SPREP
Secretariat of the Pacific Regional Environment Programme

ACP MEAs 2

MESSAGE FROM THE DIRECTOR GENERAL OF SPREP

The natural environment has always been part of Pacific island cultures. It has shaped and influenced our way of life over the centuries and as the primary source providing for our Pacific communities, it has fed, clothed and kept us safe over the years.

Despite its immense value, our environment is under growing pressure due to economic development, tourism expansion and the threat of global climate change. Therefore, it is important that we continue monitoring and maintaining the quality of our environment for future generations.

The 2018 Cook Islands State of Environment (SOE) report updates the last report completed in 1993. The report assesses seven themes as well as the baseline information for new and emerging environmental challenges.

Four new themes are introduced in this report: Atmosphere and Climate, Biodiversity, Culture and Heritage, and Inland Waters. Other themes include Land, Built Environment and the Marine environment. Improving on the 1993 Cook Islands SOE, this report places the emphasis on data-based conclusions and presents supporting evidence for all indicators.

The 2018 SOE is a new baseline for future reports and can help the Cook Islands with national, regional and international reporting obligations including multi-lateral environmental agreements. This report has already informed environmental planning and decision making, and has guided the development of the National Environmental Management Strategy.

SPREP is pleased to have partnered with the Cooks Islands' National Environment Service in developing this document, as well as the many other agencies and Civil Society Organisations that contributed to the consultative process.

I would like to sincerely thank the individuals and all the government ministries and departments for their contributions. It is important that regular updates to this SOE are conducted to assess Cook Islands' environmental conditions. I encourage you all to use this report to help track, manage, plan and report on its natural resources and environment.

Kosi Latu

Director General
Secretariat of the Pacific Regional Environment Programme

FOREWORD FROM THE MINISTER OF NATIONAL ENVIRONMENT SERVICE, COOK ISLANDS

We have been blessed in the Cook Islands with an abundance of natural resources upon which our economy and way of life is sustained, and ensuring we continue to use these resources sustainably is what underpins our National Sustainable Development Plan and the future direction for the Cook Islands.

I am pleased to present Cook Islands State of Environment Report 2018, a measure and record of our environment, our heritage and our legacy. The State of Environment Report represents the first integrated account of the Cook Islands natural resources since the publication of the Cook Islands National Environmental Management Strategies report in 1993. This report updates the 1993 baseline with the latest findings supported by scientific data from the Cook Islands and presents it in a form that is easily understood.

To gather the information that formed this report was only possible through the collective effort of national stakeholders under the lead of the National Environment Service in partnership with the Secretariat of the Pacific Regional Environment Programme (SPREP).

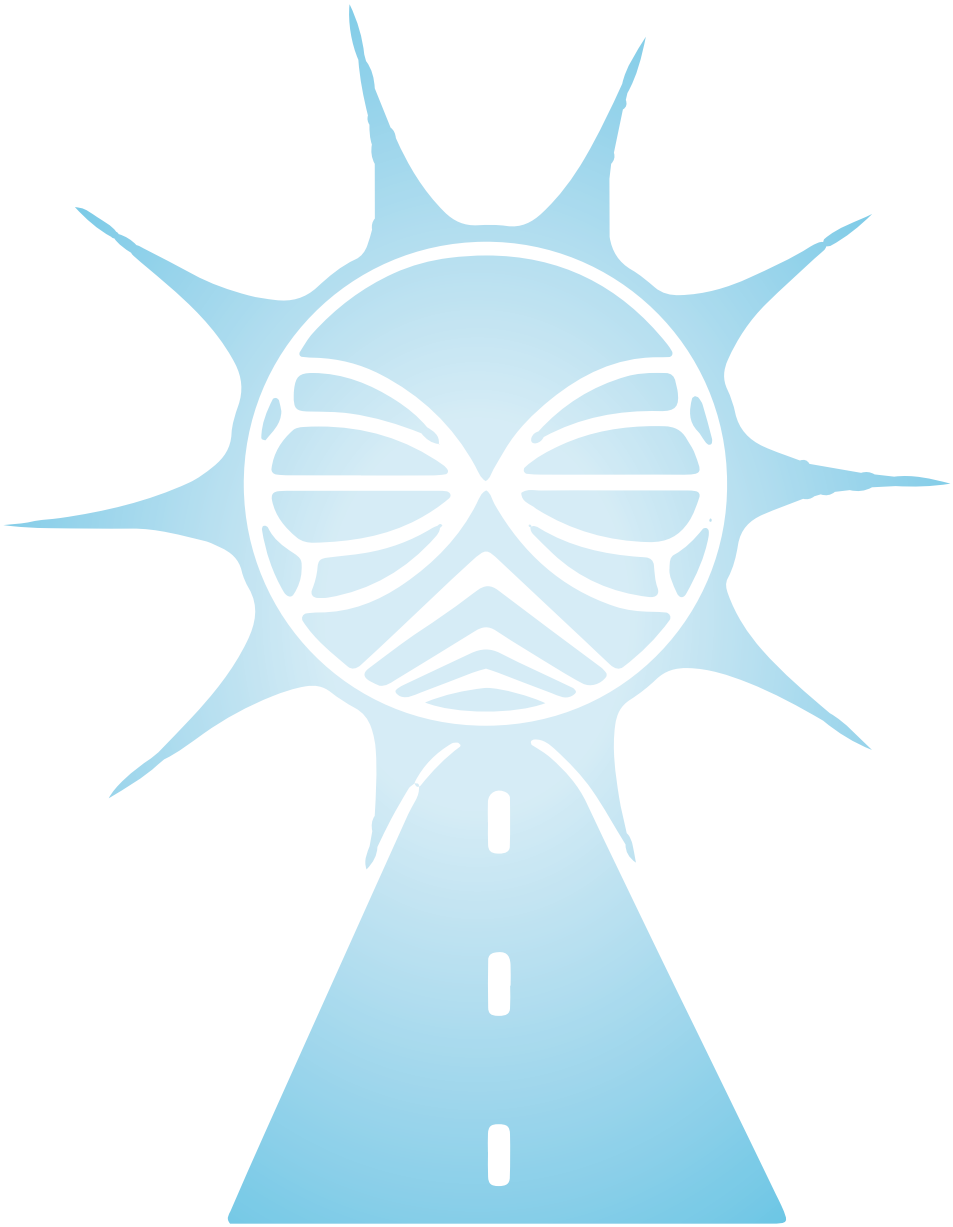
The Cook Islands, like the rest of the world, is developing fast and changes are happening quickly. We still face some of the old challenges such as the spread of invasive species and inadequate waste management infrastructure but we are also facing new challenges, specifically the threat of climate change. The unprecedented effects of climate change coupled with short term gains from unsustainable use of natural resources only puts us on a path towards a grim future.

The challenge is before us, the contest is arduous but we are a resilient and ambitious people. We are reclaiming our stewardship of the ocean and asserting our place on this planet to ensure that the future we want for our children is the future we will leave behind.

If we ignore the environment now, we risk our own development as a strong and independent nation. I recommend that all government agencies, all our development partners and donors, and civil society representatives use this State of Environment Report 2018 to inform their actions related to the seven areas covered in this document: Atmosphere and Climate, Inland Waters, Land, Marine, Biodiversity, Culture and Heritage and Built Environment. I invite you to help us address the challenges that have been identified, thereby bringing us one step closer to a more sustainable future.

Hon. Robert Tapaitau

Minister for Environment
Cook Islands Government



EXECUTIVE SUMMARY

The 2018 State of Environment (SOE) Report for Cook Islands updates the 1993 SOE report, and uses the Drivers, Pressures, State, Impact and Response (DPSIR) model of reporting. The main aims of this report are to:

- Identify the key drivers and pressures behind the changing environment in Cook Islands;
- Update the assessment of the Cook Islands environment since the 1993 SOE through use of the best available information for seven key thematic areas: Atmosphere and Climate, Inland Waters, Land, Marine, Biodiversity, Culture and Heritage and the Built Environment;
- Document the social, economic and environmental impacts that result from changes in the state of the environment;
- Document current responses by Cook Islands to address changes in the state of the environment that better protect and manage resources; and
- Provide recommendations for Cook Islands to address key challenges and build on existing strengths, which are linked actions outlined by the National Environmental Strategy (NEMS).

This report is comprised of three discussions:

1. Drivers and Pressures in Cook Islands: A summary of the main points discussed in the Pressures and Drivers section of the report.
2. The State of Environment and Impacts on the Society, Economy and Environment: Key findings for each of the seven themes.
3. Responses and Recommendations – Challenges in Moving from Policy to Action: This presents key responses, opportunities, challenges and recommendations.

DRIVERS AND PRESSURES IN COOK ISLANDS

Cook Islands is rapidly changing and so is the environment. The changes are driven by broader social, economic, technological and cultural forces referred to as 'drivers'. These include population growth, urbanisation, tourism, increased access to external markets, a growing middle class, the clash of traditional and contemporary values and greater access to technology. The drivers are a source of further pressure on the environment but they can also offer potential solutions to problems. Climate change is one driver that poses the greatest threat to the Cook Islands' environment, particularly in areas vulnerable to extreme weather events like flooding and cyclones.

The pressures on the environment fall into three categories for the SOE:

- Land Development (urban, agricultural and coastal),
- Resource Extraction (commercial fishing and mining/ quarrying), and
- Consumption and Waste (energy, solid and liquid waste and water).

Most of these pressures have increased, except for large scale agriculture which has declined over 20 years. New pressures on the environment are being seen, such as the expansion of commercial fishing. These pressures are linked, and the rise or fall in one pressure type can lead to changes in another.

THE STATE OF ENVIRONMENT IN COOK ISLANDS AND IMPACTS ON THE ENVIRONMENT, SOCIETY AND ECONOMY

Information was gathered from local stakeholders and experts on the seven major themes to provide a summary of the state, impact and response to 24 topics. A brief synopsis is included at the beginning of each theme for a quick review. The following provides a summary of each major topic covered in the SOE:

Atmosphere and Climate

GREENHOUSE GAS: Greenhouse gases (GHGs) have increased over the past 20 years particularly in the energy sector. From 1994 to 2006, total national GHG emissions increased by 26,424 tonnes of CO_2. GHG emissions from the energy sector increased by 91.53 per cent in that same timeframe. Within the energy sector GHG emissions from electricity generation increased by 35.29 per cent and from road transport 35.88 per cent – these two areas had the biggest increase over the 12 years. However, the phase out of HCFCs as a refrigerant should substantially reduce GHG emissions from the industrial products sector. Efforts to introduce renewable sources of energy may also slow GHG emissions.

OZONE DEPLETING SUBSTANCES: Ozone depleting substances have been slowly phased out since 1995. Cook Islands phased out Chlorofluorocarbons (CFCs) in 2010, and Hydrochlorofluorcarbons (HCFCs) in 2015.

PHYSICAL CLIMATE AND CLIMATE TRENDS: Mean and extreme temperatures, and rainfall are higher in the northern Cook Islands than in the south. A trend of increasing warm nights can be observed and it is

predicted that temperatures will increase in the Cook Islands. Environmental impacts such as coral bleaching will continue due to increased sea level and ocean acidification. Extreme weather events can have impacts on the environment but also on health and livelihoods. Cook Islands treats climate change preparations and impacts seriously and is taking part in programmes addressing data collection and disaster preparedness.

CLIMATE ADAPTATION: Cook Islands sees climate change adaptation as a priority and has developed activities to adapt to impacts on different levels. Water Security, Food Security, Heath, Land Use and Infrastructure are the five priority areas to address issues related to climate change. Vulnerability assessments are underway. However, data availability is very limited especially for health, land and infrastructure.

Inland Waters

STREAMS: Streams in Cook Islands are not in good condition. Data from Rarotonga and Aitutaki show a high contamination of bacteria and high level of nutrients. Data for Pa Enua (Outer Islands) is very limited or not available.

Land

FORESTS: Cook Islands has about 67 per cent total forest cover, which includes *Makatea* atoll forest, littoral forest, and montane and cloud forest. These forest ecosystems are in good to fair condition and are ranked as one of the highest in the Pacific Islands for percentage of intact natural forest. The greatest pressures are from development, agriculture and invasive species.

AGRICULTURE – LAND UNDER CULTIVATION: Land used for agricultural activities has reduced by more than half from 1988 to 2011. The number of Cook Islanders involved in commercial or subsistence agriculture has declined dramatically. Farmers are getting older and not many young ones follow. This is mainly due to changes in lifestyle and increased dependence on imported food.

WETLANDS: The wetlands in the Cook Islands include freshwater marshes and swamps, freshwater lakes, mountain streams and a tidal salt marsh. Wetlands provide important ecosystem services and are threatened by several human impacts.

Marine

OFFSHORE ENVIRONMENT: The tuna fishery has experienced an increase in total tuna catch, thereby putting more pressure on this natural resource. Albacore and Skipjack remain vulnerable even though catches are within maximum sustainable yield (MSY). Bigeye tuna is considered overfished and Yellowfin tuna is considered fully exploited. The Ministry of Marine Resources (MMR) increased their effort for data collection and fisheries observers on long liners. In 2012 Cook Islands introduced a ban on the harvest and retention of shark products and declared a nearly two million sq. km area as a shark sanctuary.

INSHORE ENVIRONMENT: The inshore environment is subdivided into five themes: Live coral cover; Reef fish and urchin density and biomass; Reef Fisheries; Marine Managed Areas, ***Ra'ui**** on Rarotonga and Pa Enua; and Lagoon Water Quality.

LIVE CORAL COVER: The inshore reef ecosystem and coral cover are relatively healthy although widespread coral bleaching, impacts from cyclones and Crown of Thorns Starfish are visible. Corals are improving slowly around Rarotonga after a decline in recent years but are still exposed to pressures from development, waste and agriculture. Coral reefs in the less populated islands are in better heath.

REEF FISH AND URCHIN DENSITY AND BIOMASS: The biomass of reef fish and other reef invertebrates are an indicator for the reef condition. Rarotonga has more surgeon fish and sea urchins but fewer damsel fish and less hard coral cover compared to other islands. This reflects the poorer and deteriorating reef conditions in Rarotonga.

REEF FISHERIES: Reef fish and invertebrates are targeted by reef fisheries. The reef fishery has declined dramatically in the last 25 years due to better incomes through other occupations, an increase in the occurrence of ciguatera and demographic changes.

MARINE MANAGED AREAS, *RA'UI* ON RAROTONGA AND PA ENUA: *Ra'ui* is a customary form of resource management, used by local communities to ensure food security. Ten islands have one to several *Ra'ui* and it can be showed that invertebrate density is higher within *Ra'ui* than outside.

Cook Islands declared its whole EEZ as a reserve, known as the Marae Moana, which is one of the largest marine managed areas in the world. Its management regime is under discussion.

LAGOON WATER QUALITY: Lagoons in Cook Islands are not in good condition and water tests show high amounts of bacteria and nitrates. The water quality has a negative influence on the environment as well as social and economic impacts. There is very limited data available for the Pa Enua.

TURTLES AND CETACEANS: Turtles and whales play an important part in the Cook Islands culture, ecosystem and tourism sector. Four sea turtles are known to the Cook Islands, all of which are globally endangered. Cetaceans are protected in the Cook Islands Whale Sanctuary which was declared in 2001 and 14 different species can be observed in local waters, 11 more commonly. Turtles are nesting from September to April. July to October are the months for the seasonal migration of whales.

* *Ra'ui*: A form of tapu (taboo) restricting access to an area or resource.

Biodiversity

ENDEMIC, NATIVE AND THREATENED SPECIES: Over 4000 species have been identified in the Cook Islands of which 62 per cent are native species. Two percent are endemic and four percent are threatened or endangered. Nearly all marine species are native to the Cook Islands but only 34 per cent of terrestrial species are native, which shows a higher introduction of land based species. Native species often have a very important part in culture and traditions. The loss of these endemic and native species can have social, economic and environmental impacts.

ENVIRONMENTAL INVASIVE SPECIES: Invasive Species are one of the biggest threats to biodiversity in the Cook Islands. Impacts can be economic, e.g. lower crop productivity, reduced export potential, and habitat change. Social impacts include increased human labour costs, and a reduced aesthetic value. Loss of culturally important species can impact on the use of traditional medicines. Environmental impacts include increased erosion and the threat to native and endemic species through predation.

KEY SPECIES OF CONCERN. CASE STUDIES KĀKERŌRI, TAMANU AND PA'UA: Cook Islands has many endangered and endemic species. Three threatened species were chosen as examples of their functional group. Management plans developed for these species can be used for best practice and, where possible, joint management plans or habitat management plans should be developed.

TERRESTRIAL PROTECTED AREA: There are 14 Terrestrial Protected Areas declared in the Cook Islands with a total area of approximately 1407 hectares. Terrestrial Protected Areas are important to allow the ecosystems to recover from human impacts but also to prevent ongoing loss of biodiversity. The protection of a whole area has the advantage of protecting several species as well as sensitive habitats and rare ecosystems. Protected areas can include private nature reserves, conservation areas, entire island and motu PAs, a wildlife sanctuary, National Parks and Reserves, as well as community managed areas.

Culture and Heritage

BUILT HERITAGE AND INDIGENOUS SITES: There are 181 sites identified in the Cook Islands. The national historic site register is inactive. Most of the sites are in poor condition and many *Marae** sites were destroyed with the arrival of Christianity. Some *Marae* sites have been reconstructed and less than ten percent are actively maintained. *Marae* and historic sites provide a direct link between place, environment, spirituality, history and culture and therefore have a high value for Cook Islanders.

LANGUAGE: Cook Islands Maori is still widely spoken but it has declined and about 2000 people living in the Cook Islands are not able to speak the native language. Higher education requires English which is why many young islanders prefer to learn English. Cook Islands Maori and English are recognised as official languages in the Te Reo Maori Act 2003.

TRADITIONAL PRODUCTION AND CONSUMPTION OF FOOD: Tradition agriculture, fishing and food production has declined in the Cook Islands while food imports are increasing. This is partly due to changing lifestyles and traditional production not being as lucrative as other jobs. The shift in food choices also impacts body size and the health of locals negatively, while less agriculture leads to shifts in land use. There is a rise in the promotion of local food in the Cook Islands.

TRADITIONAL ENVIRONMENTAL KNOWLEDGE: Development and the wider use of cheaper imported products to replace local material is placing pressure on traditional knowledge and its use. Local products are also overharvested and fewer people know how to work with these resources. The change in lifestyle and the ability to get cheaper products from overseas affects the traditional and cultural aspects of Cook Islanders.

Built Environment

ENERGY: Access to energy is becoming a bigger issue in the Cook Islands. The remote location and small size makes access more difficult. High numbers of visiting tourists increases the consumption of energy. Cook Islands is widely promoting the use of renewable energy sources and the government fulfilled its aim to have 50 per cent of islands powered by renewable energy by 2015. It is planned to have all islands on renewable energy by 2020.

DISTRICT SOLID WASTE: Nearly all households have access to rubbish collection but only Rarotonga and Aitutaki have access to sanitary engineered landfills. The newly developed Solid Waste Management Strategy 2013–2016 is helping to minimise the volume of waste, and reduce environmental impacts such as leachate from landfills, littering and poor air quality. The strategy is also raising awareness to make waste management everyone's responsibility.

HAZARDOUS WASTES: E-waste, white goods, health care waste, asbestos, batteries and other household toxics are categorised as hazardous waste. Bulky items as well as e-waste are very difficult to recycle in the Cook Islands due to the high cost of shipping them off islands to be recycled properly. The treatment of health care waste is good in Rarotonga but still a problem in Aitutaki. Cook Islands has also started to remove asbestos from priority sites on some islands.

POTABLE WATER: Groundwater, rainwater and water from streams are the main water sources. Access to improved drinking water has improved. The majority in Rarotonga (96%) and the southern islands (84%) have access to water through the public system, but the northern islands depend mainly on their private rainwater tanks. One third of water is used for agriculture and another third is lost though leakages.

* *Marae*: A structure to commemorate an event of importance to society.

SEWAGE AND SANITATION: In Cook Islands most households have a septic system with flush toilets. However, access to sanitation in some rural areas remains an issue in addition to broken and old septic systems. Leaking sewage impacts the water quality and has associated health, social, environmental and economic impacts.

Responses and Recommendations Challenges in Moving from Policy to Action

While gaps exist, Cook Islands has many strong laws, policies and regulations that promote sustainable use and protection of its environmental resources. Since the 1993 SOE report, Cook Islands has had many assessment reports which recommend actions on biodiversity, agriculture, water, marine management, climate change, and other focal areas. However, the national implementation and enforcement of these efforts is inconsistent and, in some cases, non-existent. Activities and initiatives are largely dependent on external funding from donors and international sources, many of which are short-term and determined by changing international priorities.

Successful implementation of conservation objectives can be achieved through public, civil society, and/or private partnerships. A good example is the case of endangered species management. Through a partnership of government and civil society the population of an endangered bird, *Kākerōri* (Rarotongan Flycatcher), increased. This is a result of effective management of the Takitumu Conservation Area (TCA) through the TCA Committee who took over the management and the recovery programme for this endangered bird. It also highlights the importance of the involvement of civil society for the survival of endangered species and in conservation programmes.

The Cook Islands Biodiversity Database is one of the best in the region. It provides excellent information for decision makers, researchers and civil society. This is helpful when information is needed for management plans, assessments, or reports, but also as general information for interested citizens.

Traditional practices such as *Ra'ui* areas are implemented in the Cook Islands but are insufficient on their own to protect the environment from modern day pressures, such as high fishing demand, deep sea mining, and whole-scale resource extraction and population growth. Traditional practices of environmental management need to be integrated into, and supported by, a strong legislative framework of environmental protection, Environmental Impact Assessments and Climate Change Adaptation programmes, for overall success.

The Cook Islands government has ample policies and regulations to support the sustainable use and protection of the environment. Some are in draft format and should be updated and endorsed. The challenge for the next five years will be implementing these policies while balancing development pressures with sustainable use and conservation.

The State of Environment Report can be used to gather information about progress and achievements, collect environmental information and data, and identify needs and recommendations which will help the National Environment Service to inform cabinet on the progress of implementation and necessary next steps.

CONTENTS

ACKNOWLEDGEMENTS

The Cook Islands 2018 State of Environment report was developed by the Cook Islands National Environment Service (NES), and the Secretariat of the Pacific Regional Environment Programme (SPREP). Content contributions were made by numerous representatives from government, universities and NGOs listed below. There are many others not listed who also helped in the data gathering, analysis and design whom without their assistance, it would not have been possible to develop a report of this complexity and scope. Their contribution is greatly appreciated. We apologise for any omissions.

THEMATIC AREA	THEMATIC LEAD
Atmosphere and Climate	Ministry of the Prime Minister
Inland Waters	Ministry of Marine Resources
Land	National Environment Service
Marine	Ministry of Marine Resources
Biodiversity	National Environment Service
Culture and Heritage	Ministry of Cultural Development
Built Environment	National Environment Service

COORDINATION AND PLANNING

National Environment Service
Joseph Brider (Director)
Louisa Karika

SPREP
Mark Graham
Paul Anderson

WRITING, ANALYSIS, DESIGN AND COMPILATION
Mark Graham – SPREP
Paul Anderson – SPREP
Anna Bertram – SPREP
Kelsey Richardson – SPREP
Kilom Ishiguro – SPREP

KEY CONTRIBUTORS

National Environment Service
Joseph Brider – (Director)
Louisa Karika
Elizabeth Munro
Olaf Rasmussen
Muraai Herman

Cook Islands Tourism Corporation
Metua Vaiimene

Ministry of Cultural Development
Mahiriki Tangaroa
Elizabeth Ponga

Ministry of Agriculture
Matairangi Purea
William Wigmore
Tiria Rere
Maja Poeschko

Office of the Prime Minister
Ana Tiraa
Tangi Tereapii
Alex Henry
Celine Dyer
Roger DeBray

Ministry of Marine Resources
Koroa Raumea
Dorothy Solomona
Georgina Langdon
Ngereteina George

Ministry of Infrastructure Cook Islands
Jaime Short

Ministry of Internal Affairs
Ngatuaine Maui

Natural Heritage Trust
Gerald McCormack

Other Offices and Organisations

Offices
Ministry of Health
Ministry of Finance and Economic Management
Ministry of Transport

Institutions and Organisations
University of the South Pacific
House of Ariki
Koutu Nui
Muri Environment Care
Te Ipukarea Society
Titikaveka Growers Association
Takitumu Conservation Area Committee
John Hay

SPREP Staff
Amanda Wheatley
Audrey Brown-Pereira
David Moverley
Diane McFadzien
Easter Galuvao
Elizabeth Vanderburg
Espen Ronneberg
Ma Bella Guinto
Makelesi Gonelevu
Michael Donoghue
Nanette Woonton
Ryan Wright
Tommy Moore
Vaiunuupo Jungblut

ACRONYMS

ADB	Asian Development Bank
AFB	Adaptation Fund Board
AIACC	Assessment of Impacts and Adaptation to Climate Change
ANZECC	Australia and New Zealand Environment and Conservation Council
AusAID	Australian Agency for International Development
CBD	Convention on Biological Diversity
CBDAMPIC	Capacity Building for the Development of Adaptation Measures in Pacific Island Countries
CCRC	Center for Cetacean Research and Conservation
CFC	Chlorofluorocarbon
CH4	Methane
CHARM	Comprehensive Hazard and Risk Management
CLIMAP	Climate Change Adaptation Programme for the Pacific
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CO_2	Carbon dioxide
COTs	Crown of Thorns (starfish)
DO	Dissolved Oxygen
DPR	Daily Pollution Release
DPSIR	Drivers, Pressures, State, Impact and Response
DRM	Disaster Risk Management
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EbA	Ecosystem-based Adaption
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSSLP	Food Security for Sustainable Livelihoods Programme
GCRMN	Global Coral Reef Monitoring Network
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gases
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
IBA	Important Bird Areas
ICI	Ministry of Infrastructure Cook Islands
INDC	Intended Nationally Determined Contribution
IPPC	International Plant Protection Convention
JNAP	Joint National Action Plan
KBA	Key Biodiversity Areas
KPAF-SRIC	Kyoto Protocol Adaptation Fund Project Proposal Strengthening Resilience of Our Islands and Communities
MEA	Multilateral Environment Agreement
MFEM	Ministry of Finance and Economic Management
MMA	Marine Managed Area
MOA	Ministry of Agriculture
MOIF	Ministry of Infrastructure and Planning
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
NA	Nesting Aggregation
NBSAP	National Biodiversity Strategic Action Plan
NEMS	National Environmental Strategy
NESAF	National Environment Strategic Action Framework
NGO	Non-Governmental Organisation
NH_4	Ammonium
NISSAP	National Invasive Species Strategy Action Plan
NMDI	National Minimum Development Indicator
N_20	Nitrous Oxide
NO_3	Nitrate
NSDP	National Sustainable Development Plan
NZAid	New Zealand Agency for International Development
NZD	New Zealand Dollar
ODS	Ozone Depleting Substances
OPM	Office of the Prime Minister
PACC	Pacific Adaptation to Climate Change
Pa Enua	Outer Islands
PASAP	Pacific Adaptation Strategy Assistance Programme
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PFC	Perfluorocarbons
PIC	Pacific Island Countries
PROCFish	Pacific Regional Oceanic and Coastal Fisheries Programme
SF_6	Sulphur hexafluoride
SOE	State of Environment Report
SOPAC	Pacific Islands Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPCZ	South Pacific Convergence Zone
SPREP	Secretariat of the Pacific Regional Environment Programme
SST	Sea Surface Temperature
SUP	Sanitation Upgrade Project
SWOT	State of Worlds Sea Turtles
TREDS	Turtle Research and Monitoring Database System
TSS	Total Suspended Solids
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
UVC	Underwater Visual Census (survey method)
VCA	Vulnerability and Capacity Assessment
WATSAN	Water Waste and Sanitation Unit of ICI
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WWF	World Wildlife Fund

INTRODUCTION AND BACKGROUND

Cook Islands National Environment Service

INTRODUCTION AND BACKGROUND

ENVIRONMENTAL REPORTING IN THE COOK ISLANDS

The Environment Act 2003 requires annual reports of work undertaken by NES. In addition periodic SOEs should be conducted – many countries in the Pacific are using a five year period. The last comprehensive SOE report was completed in 1993. Cook Islands has produced thematic reports on Biodiversity, Climate Change and Land degradation in 2007; the national report to the UNFCCC in 2008 and 2011; the NBSAP in 2002, and four national communications to the CBD – the most recent in 2011.

This SOE updates the 1993 SOE and provides a quantitative numerical baseline for future environmental monitoring and reporting.

PURPOSE OF THE STATE OF ENVIRONMENT REPORT

The purpose of the Cook Islands SOE is to present the best available information about the current state of the environment as the basis for effective environmental management and planning (Figure 1). The SOE examines the major drivers of change to the environment that emerge from global, regional and national factors. The SOE evaluates the main environmental pressures created by these drivers, and examines their social, economic and environmental impacts.

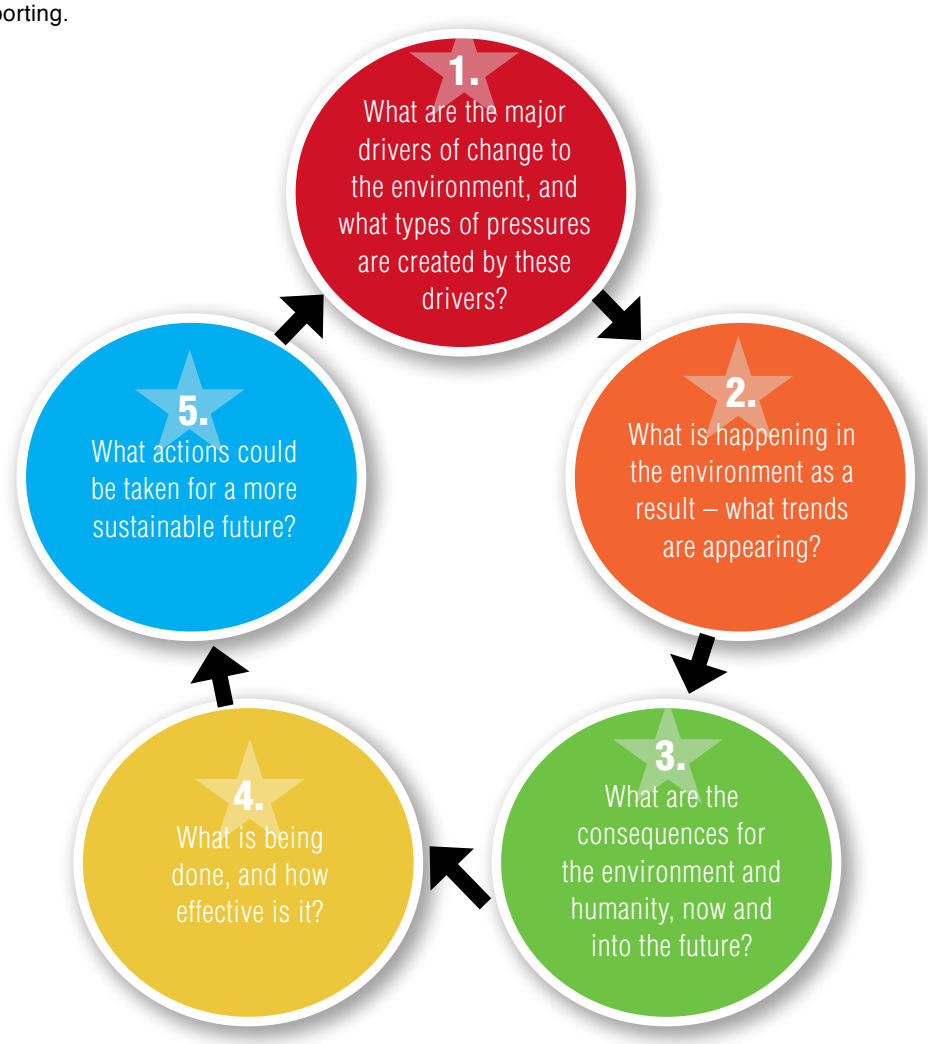


FIGURE 1. Objectives of SOE reporting.

State of Environment (SOE) reporting is an internationally accepted reporting method that analyses the condition of a geographic area or jurisdiction's ecosystems, and associated natural resources. SOE reports compile and analyse quantitative and qualitative data from a variety of local, national, regional and international sources to provide a holistic picture of a location's current state of the environment. SOE reports also identify environmental trends including anthropogenic impacts to natural environments.

SOE reports prioritise the most important environmental attributes of a given location, and identify issues that impact the state of the location's environment. The reports have included the condition of flora and fauna species as well as habitats such as native forests, marine and inland water bodies, soils, and vegetation cover. The reports also address key aspects of highly modified agricultural and built environments.

Many SOE reports predict a location's future state which is often related to problems within that environment. These predictions can help to address growing concerns about the impacts of climate change by offering an idea of the future state of the environment under 'business as usual' scenarios. This can inspire climate change adaptation and mitigation strategies that address emerging issues and threats. SOE reports can also provide well-researched information for local, district and national planners and managers in areas such as natural resource management, town and urban planning, tourism and resource development.

AUDIENCES

The main audiences for the Cook Islands SOE are:

- Cook Islands government personnel, particularly in areas relating to the environment, planning and infrastructure, health and education
- Citizens and community groups
- Donor organisations
- Non-governmental organisations e.g. Te Ipukarea Society
- Research institutions and universities, and researchers with interests specific to the SOE report's thematic areas.

FIGURE 2. SOE Planning Workshop, 2014. (Paul Anderson, SPREP)

COMPARING THE 1993 AND 2018 STATE OF ENVIRONMENT (SOE) REPORTS

The 2018 State of Environment Report (SOE) updates the 1993 SOE, with a focus on data collected in the interim between the reports. Many of the problems identified in 1993 remain, and some new ones have emerged. The collection of better data has helped to clarify some of these problems.

Beyond an observation of similar issues, it is difficult to make quantitative comparisons between the two reports. In 1993 there was little data available to determine baselines or trends. Much of the 1993 assessment was done by expert opinion, some of whom have contributed to this report. The 2018 SOE contains a summary of the state of environment and recommended actions, as well as a summary of the best available data and information on each thematic area. This provides an environmental baseline and assessment for future reporting.

Significant data gaps remain. The 2018 SOE used a pragmatic approach to data collection by identifying the best data available to determine state and trends. If important issues still contained data gaps, this approach then investigated and identified proxy data that provided a 'clue' to the state of the indicator. In the example of air quality, vehicle emission data was taken as proxy data for the state of urban air quality. To account for existing data gaps and the use of proxy data, a confidence level was developed. Typically, indicators which use proxy data to fill data gaps have lower confidence levels compared to indicators that use more specific data.

APPROACH TO THE 2018 COOK ISLANDS SOE

THE DRIVERS, PRESSURES, STATE, IMPACT AND RESPONSE (DPSIR) MODEL IN SOE REPORTING

The Drivers, Pressures, State, Impact and Response (DPSIR) model (Figure 3) is used in SOE reporting. It includes the social, political, economic and technological factors that affect the state of a given environment, in addition to natural forces, such as climate variability. These factors overlap. Climate change is one example, where a 'natural' driver, climate, is linked to other economic and social drivers, political and policy regimes. Such drivers result in pressures which bring about changes in the natural environment. These impact on the social, economic and environmental conditions that influenced the change in the first place, thus worsening the changes.

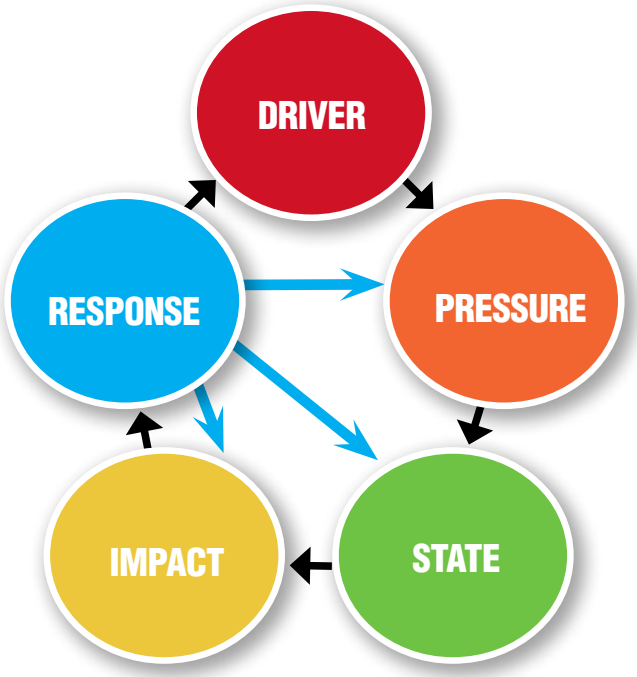


FIGURE 3. DPSIR model for SOE reporting.

THEMES FOR THE 2018 COOK ISLANDS SOE

The 2018 SOE includes seven thematic areas with important ecosystems and environmental issues addressed under each theme. Themes were divided into habitats or sub-topics, and indicators were developed for each one. For example, the Marine Environment theme is divided into three sub-topics: the Offshore Environment, Inshore Environment, and Turtles and Cetaceans.

The indicators for each habitat or sub-topic are used to assess the state of that specific habitat or sub-topic (Table 1). For example, the sub-topic Inshore Environment has four key indicators: Coral Cover, Marine Water Quality, Reef Fisheries, and Fish and Urchin Biomass and Density. The indicators are individually rated for State (Good, Fair, Poor), Trend (Deteriorating, Stable, Mixed, Improving) and Confidence in the Data (Low, Medium, High). The indicators are then integrated into the sub-topics under each theme (highlights section), and a similar rating for State, Trend and Confidence is assigned to each theme. For more information, refer to *A Guide to Interpreting State, Trend and Confidence Symbols (*page 8).

TABLE 1. Themes, sub-topics and indicators for the 2018 Cook Islands SOE

THEME	SUB-TOPIC OR AREA	INDICATOR (S)
Atmosphere and Climate	Greenhouse Gas (GHG) Emissions	GHG emission trends and mitigation efforts to date
	Ozone Depleting Substances	ODS consumption trends and reduction efforts to date
	Physical Climate and Climate Trends	Mean, Max and Min Temperature trends
		Mean, Max and Min Precipitation trends
		Sea Level Rise over time
		Cyclone frequency and intensity
		Flood and drought occurrence over time
	Climate Adaptation	Water Security Adaptation Actions
		Food Security Adaptation Actions
		Health Adaptation Actions
		Land Use Polices
		Climate Proofing Infrastructure and Buildings
Inland Waters	Streams	Stream water quality and flow
Land	Forests: Natural and Plantation Forests	Forest area, and types naturally vegetated areas and trends over time
	Agriculture: Land under cultivation	Per cent of Land under cultivation or other agricultural use
	Wetlands	Wetland areas and trends over time
Marine	Offshore Environment	Tuna, Sharks and other targeted species
	Inshore Environment	Live coral cover
		Reef fish and urchin density and biomass
		Reef fisheries
		Marine Managed Areas, *Ra'ui* on Rarotonga and Pa Enua
		Lagoon water quality
	Turtles and Cetaceans	Turtle movement and nesting
		Cetacean movement and abundance
Biodiversity	Endemic, native and threatened species	Status of endemic and native species
	Environmental Invasive Species	Status of spread and control of environmental invasive species
	Key species of concern. Case studies Kākerōrī, Tamanu and Pa'ua	Status of species from case studies
	Terrestrial Protected Area	Status of terrestrial protected areas
Culture and Heritage	Built Heritage and Indigenous Sites	Historical and *Marae* sites status and protection
	Language	Traditional spoken language
	Traditional Production and Consumption of Food	Consumption and Production of Traditional Foods
	Traditional environmental knowledge	Practice and Production of Traditional Medicines, Knowledge and Crafts
Built Environment	ENERGY	Access, Sustainability and Efficiency Energy Consumption, Availability and Renewables
	DISTRICT SOLID WASTE	Collection, Recycling and Waste Separation
	HAZARDOUS WASTES	Management and Collection of HAZARDOUS WASTES: E-waste and Bulky Items, Health Care Waste and Asbestos.
	Potable Water	Access and quality of drinking water
	Sewage and Sanitation	Access and quality of sewage treatment

A READER'S GUIDE TO THE 2018 STATE OF ENVIRONMENT REPORT

HOW TO READ THE REPORT

A State of Environment report condenses a large amount of information on various aspects of the environment into a readable and actionable report. Given the broad spectrum of topics covered, the report has been broken into themes. The report can be read as a whole, or according to different themes, noting that most of the themes are connected to each other and to the pressures and drivers behind them.

Symbols were designed for each indicator to summarise the State, Trend and Confidence in each assessment. Symbols were also designed for groups of indicators that describe a habitat or sub-topic within a theme. For example, the Land theme is broken into Naturally Vegetated Areas and Agriculture. Symbols were not designed for each theme because the variety of potential states limits a meaningful summary statement.

A GUIDE TO THE SYMBOLS USED

SOE assessments integrate many data sources and expert opinions. For the Cook Islands SOE, while there is more data available since the 1993 SOE, there is not enough information available to make quantitative assessments of the state of an environment using, for example, an index of 1 -10, or a quantitative threshold figure, that could be compared across themes. Consequently, a generic index was developed that used expert opinions and best available data to inform 'Status' ratings of either 'Good', 'Fair', and 'Poor'.

Assessment symbols (Figure 4) summarise the 'State' of each indicator. The assessment symbols establish baselines to compare the state of each indicator for future assessments, including SOE Reports. The symbol includes ratings for 'Status', 'Trend' and 'Confidence'. Table 2 provides a guide to interpret the symbols, and explains how the symbols were derived.

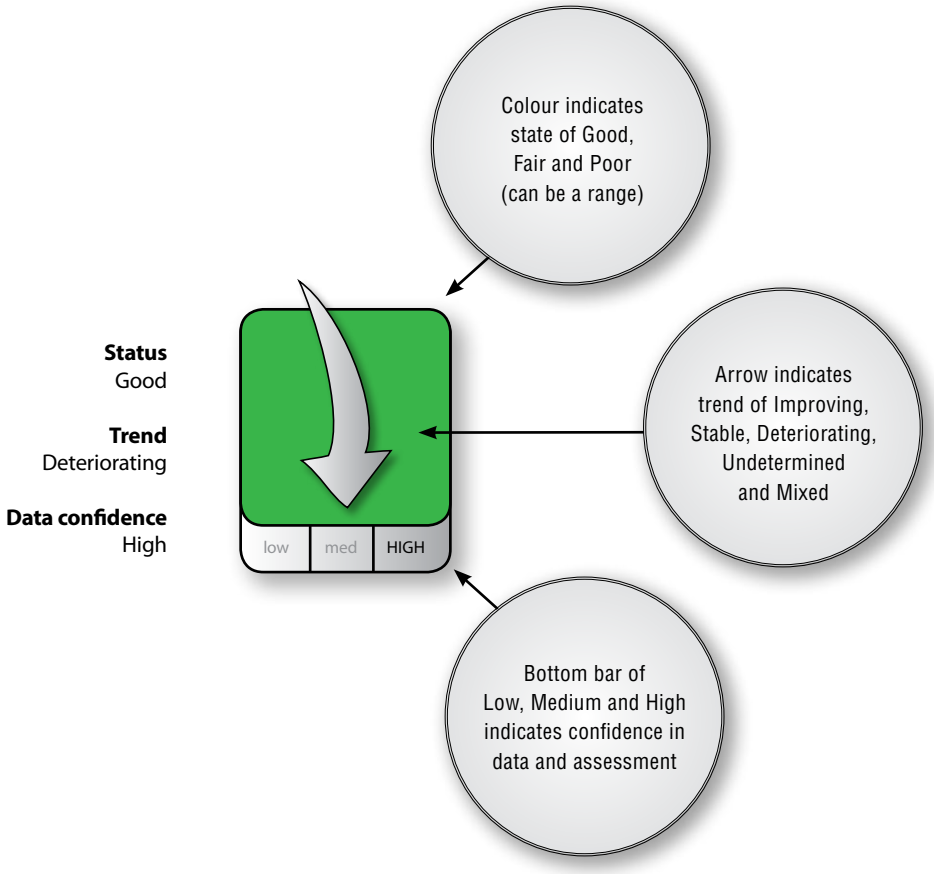
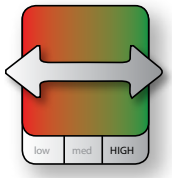
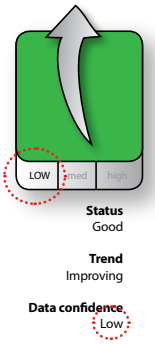


FIGURE 4. Explanation of the Indicator symbol.

TABLE 2. A guide to interpreting the symbols

	CATEGORY	DESCRIPTION	HOW IS IT DERIVED?	EXAMPLE
STATE (CAN BE A RANGE)	**GOOD** **FAIR** **POOR**	The level to which the indicator meets or exceeds (good), is close to meeting (fair) or is well below (poor) a given standard for healthy ecosystems, habitats, species, airsheds, watersheds or an urban environment.	Assessment is based on : • recent trends; • comparison with similar jurisdictions; and • comparison with "healthy" habitats and systems. Where limited data exists to make an assessment based on these criteria, expert opinion is used.	
TREND	**IMPROVING**	The state of the environment related to this indicator is getting better.	Trends show a significant increase, or based on weight of evidence that indicators are improving.	
	DETERIORATING	The state of the environment related to this indicator is getting worse.	Trends show a significant decrease, or based on weight of evidence that indicators are worsening.	
	STABLE	The state of the environment related to this indicator shows there is no detectable change.	Trends show no significant increase or decrease, or, based on weight of evidence that indicators are stable.	
	MIXED	The state of the environment related to this indicator shows a mixed **TREND:** sometimes the state is getting better, worse, or there is no change.	Used primarily for sub-topics with multiple indicators, or in cases where data shows two distinct trends.	
	UNDETERMINED	Not enough data exists to determine trend.	Insufficient data available to generate trend.	
CONFIDENCE	**HIGH**	Data is of high quality and provides good spatial and temporal representation.	Trusted and comprehensive time series and/or national level data sources are used to determine confidence trend.	
	MEDIUM	Data is either lower quality, geographically sparse or limited temporally.	Data is derived from many sources, and is not always consistent, with some extrapolation necessary.	
	LOW	Data does not meet any of the above criteria.	Data is very coarse and outdated, and limited to single country sites.	

ADDITIONAL SYMBOLS USED

AICHI BIODIVERSITY TARGETS

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	
 **TARGET 1** By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	**OBJECTIVE 1** People are aware of the value of biodiversity and the steps they can take to conserve and use it sustainably
 **TARGET 2** By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations
 **TARGET 3** By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations
 **TARGET 4** By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	
 **TARGET 5** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 6** By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 7** By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 8** By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 9** By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 10** By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	**OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	
 **TARGET 11** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites
 **TARGET 12** By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance
 **TARGET 13** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	
 **TARGET 14** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 15** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites
 **TARGET 16** By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
 **TARGET 17** By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	**OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5
 **TARGET 18** By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance **OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5
 **TARGET 19** By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	**OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5
 **TARGET 20** By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011–2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	**OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5

SDG – SUSTAINABLE DEVELOPMENT GOALS

THE COOK ISLANDS NATIONAL DEVELOPMENT GOALS

1. Improve welfare, reduce inequity and economic hardship
2. Expand economic opportunities, improve economic resilience and productive employment to ensure decent work for all
3. Promote sustainable practices and effectively manage solid and hazardous waste
4. Sustainable management of water and sanitation
5. Build resilient infrastructure and Information Communication Technologies to improve our standard of living
6. Improve access to affordable, reliable, sustainable, modern energy and transport
7. Improve health and promote healthy lifestyles
8. Ensure inclusive and equitable quality education and promote life-long learning opportunities
9. Accelerate gender equality, empower all women and girls, and advance the rights of youth, the elderly and disabled
10. Achieve food security and improved nutrition, and increase sustainable agriculture
11. Promote sustainable land use, management of terrestrial ecosystems, and protect biodiversity
12. Sustainable management of oceans, lagoons and marine resources
13. Strengthen resilience to combat the impacts of climate change and natural disasters
14. Preserve our heritage and history, protect our traditional knowledge, and develop our language, creative and cultural endeavours
15. Ensure a sustainable population engaged in development by Cook Islanders for Cook Islanders
16. Promote a peaceful and just society and practice good governance with transparency and accountability

DRIVERS AND PRESSURES ON THE COOK ISLANDS' ENVIRONMENT

Anna Bertram

WHAT ARE THE DRIVERS OF ENVIRONMENTAL CHANGE IN THE COOK ISLANDS?

Human activities such as urban development and overfishing are placing pressures on the natural environments of Pacific islands and their exclusive economic zones (EEZs). These activities are driven by broad social, economic, technological and cultural forces. These drivers interact to produce changes in the environment which impact the livelihoods and well-being of individuals, communities and nations. The 2018 Cook Islands State of Environment Report (SOE) identifies five broad level drivers of environmental change (Table 3):

- Population demographics and migration;
- Globalisation and geography;
- Economic and technological development;
- Traditional and contemporary values, attitudes, lifestyles and governance; and
- Climate change and variability.

TABLE 3. Cook Islands environmental drivers and key indicators used in the SOE

DRIVERS	**Population Demographics and Migration**	**Globalisation and Geography**	**Economic and Technological Development**	**Traditional and Contemporary Values, Attitudes, Lifestyles and Governance**	**Climate Change and Variability**
KEY INDICATORS	Regional and national population changes	Shipping patterns and connectivity	Access to internet and cell phones	Trends in traditional cooking	Global CO_2 emissions
	Migration trends	Tourism arrivals in Cook Islands and regional tourism comparisons	Global and national economic trends.	Trends in access to foreign and national education	Global average air temperatures and sea surface temperature
	Household Composition		GDP per capita and income distribution – the Pacific and Cook Islands		

Drivers can have diverse social, economic and environmental impacts; are not exclusively negative or positive, and should be viewed objectively with respect to their various management contexts.

DRIVER 1: POPULATION DEMOGRAPHICS AND MIGRATION

Population growth is a major driver of changes to the environment with pressures on both the built and natural environment. Figure 5 shows the historic, current and projected populations for the Pacific region from 1970 to 2050. Polynesia and Micronesia have lower historic and projected growth rates compared to Melanesia, in particular Papua New Guinea.

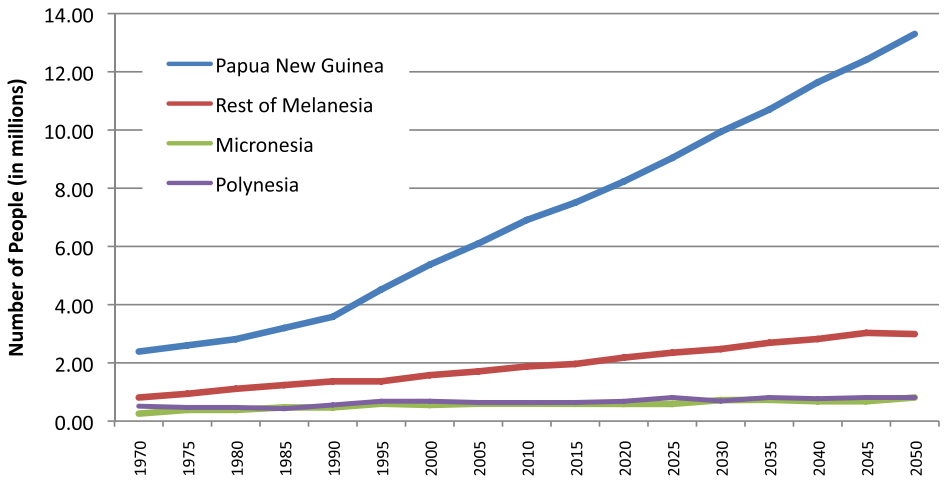


FIGURE 5. Pacific Islands Past, Current and Projected Populations.
(Adapted from the Pacific Environment and Climate Change Outlook – PECCO, 2012)

The Cook Islands is one of four Pacific island countries (plus Federated States of Micronesia, Niue and Tokelau) experiencing population decline. The population of Cook Islands fell from around 21,000 in 1971, at its peak, to around 17,700, as of 2011 (Figure 6). Cook Islands census figures include all people, including tourists, on the night of the census, so the actual residential population (the magenta line in Figure 6) is even less, at around 15,000. Rarotonga's population decreased for five years from 1971 to 1976, then rose again for twenty years until 1996, when it began to decline. The northern and southern Pa Enua have been in steady decline since 1971.

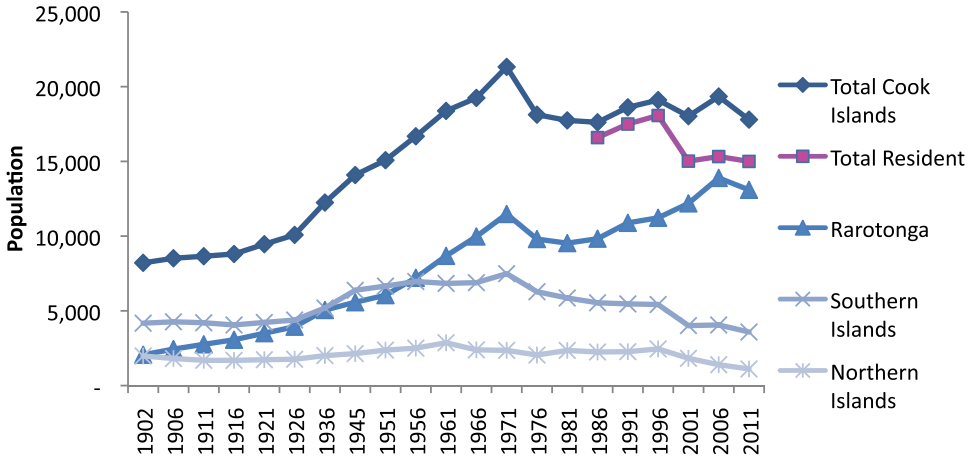


FIGURE 6. Cook Islands population 1902–2011. (Cook Islands Census)

Cook Islands is self-governing in free association with New Zealand . All citizens carry New Zealand passports and can freely migrate between the two countries. Much of the population loss is related to emigration to New Zealand and Australia. Migration has occurred in waves since 1971. One major period of emigration was in the early 1970s with the opening of the Rarotonga International Airport (1973), which allowed thousands of people to more freely enter and leave the country. After a period of population growth in the late 1980s to early 1990s, in 1996 the government dramatically downsized its public sector. As a result, large numbers of those laid off emigrated to New Zealand and Australia for employment. From 1996 to 2012, there has been steady emigration out of Cook Islands, with the sharpest decline in population between 1996 and 2001. Figure 7 shows the excess resident departures and arrivals annually since 1971.

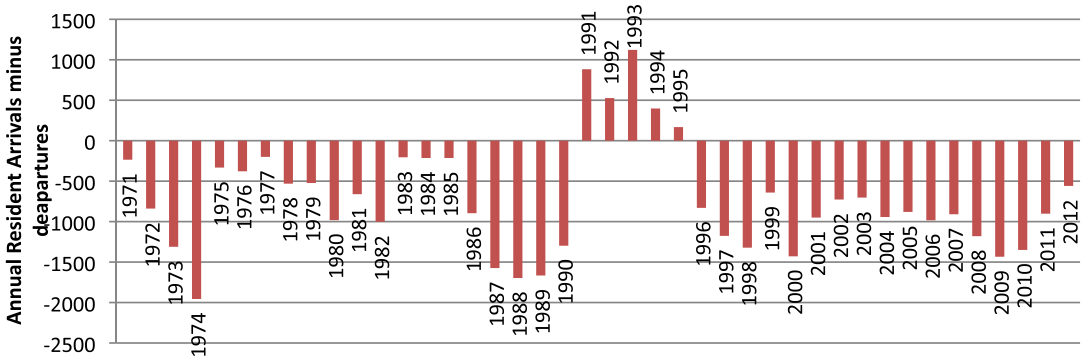


FIGURE 7. Excess resident departures and arrivals by year, 1971–2012 (negative = more departures than arrivals). (Cook Islands Statistics Office)

In general, Rarotonga's population has not declined at the same pace as the Pa Enua. In fact, with the exception of the 1971 migration, prior to 1996 Rarotonga's population was steadily increasing. This reflects the general pattern of Cook Islands migration, where Pa Enua residents migrate to Rarotonga, and then to other countries. Figure 8 shows the migration patterns from the 2001, 2006 and 2011 censuses of net migration to and from Pa Enua and Rarotonga, based on residency one year prior to the census dates.

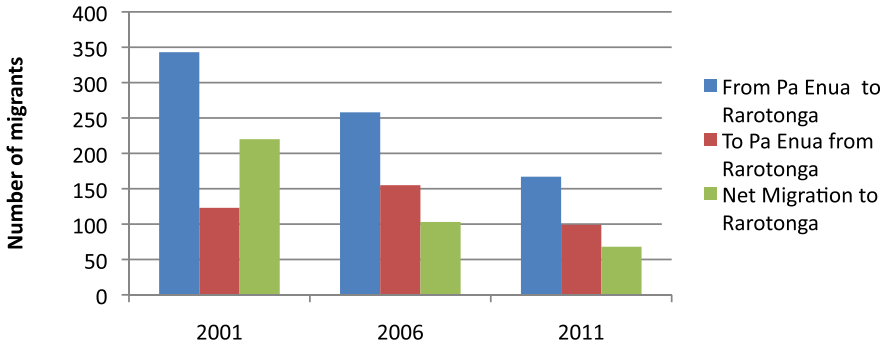


FIGURE 8. Net migration of Pa Enua and Rarotongan residents. (Cook Islands Statistics Office)

The trend to smaller family sizes is another indicator of declining populations which occurs globally across both developing and developed countries. Cook Islands family size is large compared to New Zealand (an average of four in 2006 for Cook Islands versus 2.6 for New Zealand (http://www.stats.govt.nz/). However, family sizes have declined since 1996, as women aged 15 and over are having fewer children (Figure 9). In 1996 women aged 45–49 had an average of 4.5 children, whereas in 2011, the same demographic had 3.2 children (Figure 9).

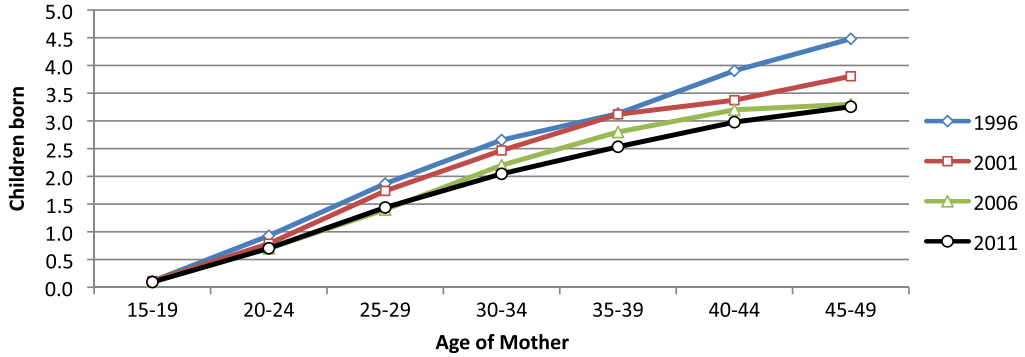


FIGURE 9. Female population aged 15 to 49 by average number of children born alive by age of mother in 1996, 2001, 2006 and 2011. (Cook Islands Statistics Office)

The drivers of population decline, emigration and declining family size have mixed social, economic and environmental consequences. One major social consequence is the dramatic fall in the proportion of younger populations compared to older populations. Between 1986 and 2011 (Figure 10), the proportion of the population aged 0–29 was considerably higher compared to 2014 (Figure 11).

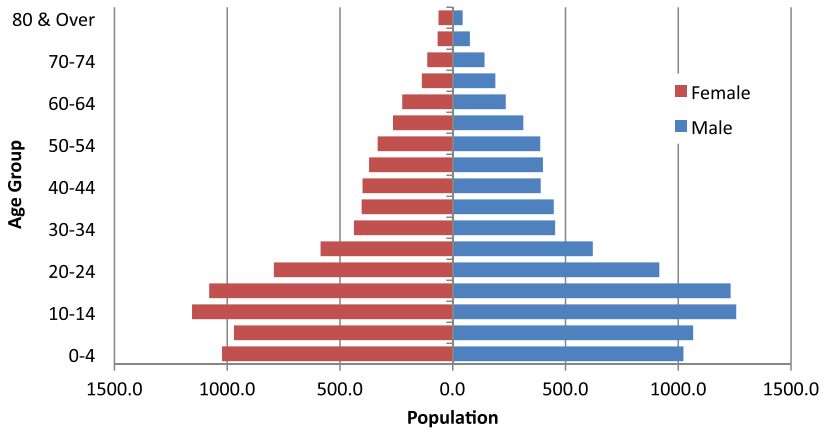


FIGURE 10. Cook Islands population pyramid, 1986. (Cook Islands Statistics, 2011)

This suggests a major loss in the 25–45 age range (also shown in Figure 11). Compared to French Polynesia (Figure 12), a territory with high levels of tourism and strong links to a metropolitan country (France), the gap is significant. Much of this population decline in younger generations is due to the emigration of younger people and families who leave Cook Islands looking for work opportunities.

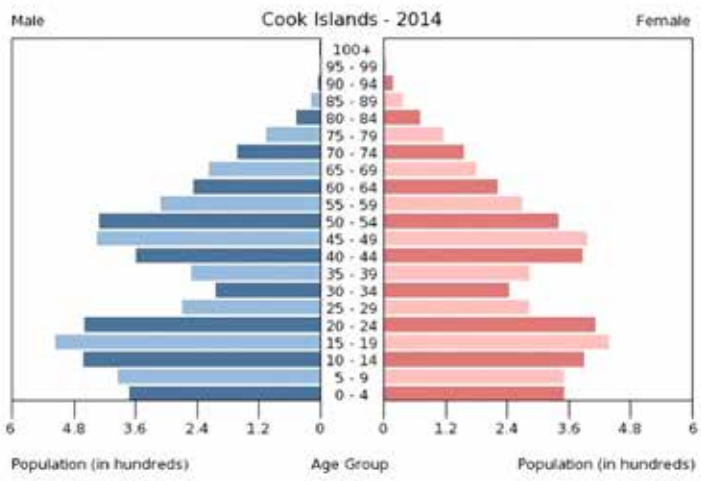


FIGURE 11. Cook Islands Population Pyramid 2014 (Cook Islands Statistics)

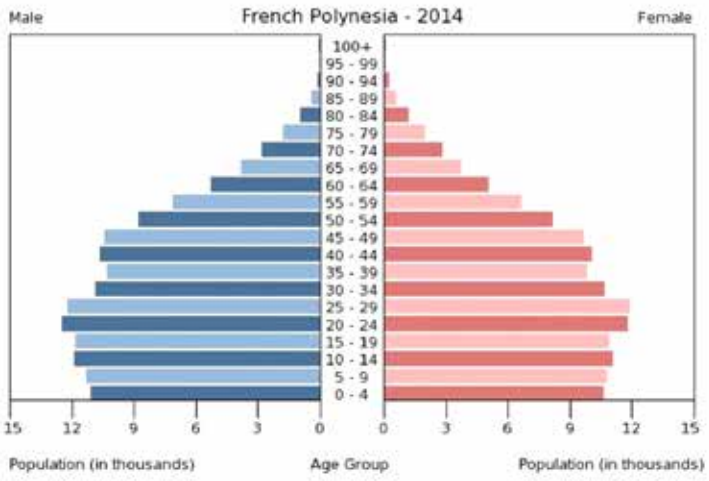


FIGURE 12. French Polynesia Population Pyramid (Cook Islands Statistics)

Some suggest that this emigration of younger professionals, particularly during the 1996 government lay off, has led to a loss of skills and a deterioration in the quality of services, especially in the health and education sectors (Kanhaiya 2008). Such a loss in skills and quality of services has implications for the availability and quality of sound environmental governance and leadership. Another consequence of emigration is the declining population in the Pa Enua, which has reduced certain environmental pressures, such as fishing. Emigration has also created new pressures, such as the decline in the agricultural sector, which in turn reduces food security for the Pa Enua. This results in greater reliance on imported foods and remittances as sources of income, from both Rarotonga and overseas. These and other implications are explored in the Pressures section.

DRIVER 2: GEOGRAPHY AND GLOBALISATION

Connectivity to markets

As a small island country, Cook Islands has physical limits on growth and infrastructure. These limits can create serious pressures on the environment, such as lack of space for waste management and agriculture, and high transport costs for imports and exports. The relative isolation from other countries has meant a reduced capacity for cheap, imported goods and access to international markets.

With expansion of international trade and exports, small islands are linked to global markets. This delivers many opportunities and challenges, including better access to consumer goods, education, new economies and healthcare. However, the limited physical space can mean less capacity to support new goods and opportunities. The relative isolation of the Pa Enua from the administrative headquarters in Rarotonga make it harder to provide consistent standards, services and regulatory protections for the environment. On the Pa Enua, authority for environmental protection is given to the Island Environment Authorities, under the Environmental Act 2003. Several islands, however, have not acceded to the Act. As a result, national environmental policies are not applied consistently across the country.

Shipping patterns and connectivity

Overall, shipping traffic has increased. The number of container ships arriving in Cook Islands has peaked at about one ship per week (Figure 13). Compared to the larger Pacific region, this amount of ship traffic is high, especially given Cook Islands' small geographic size.

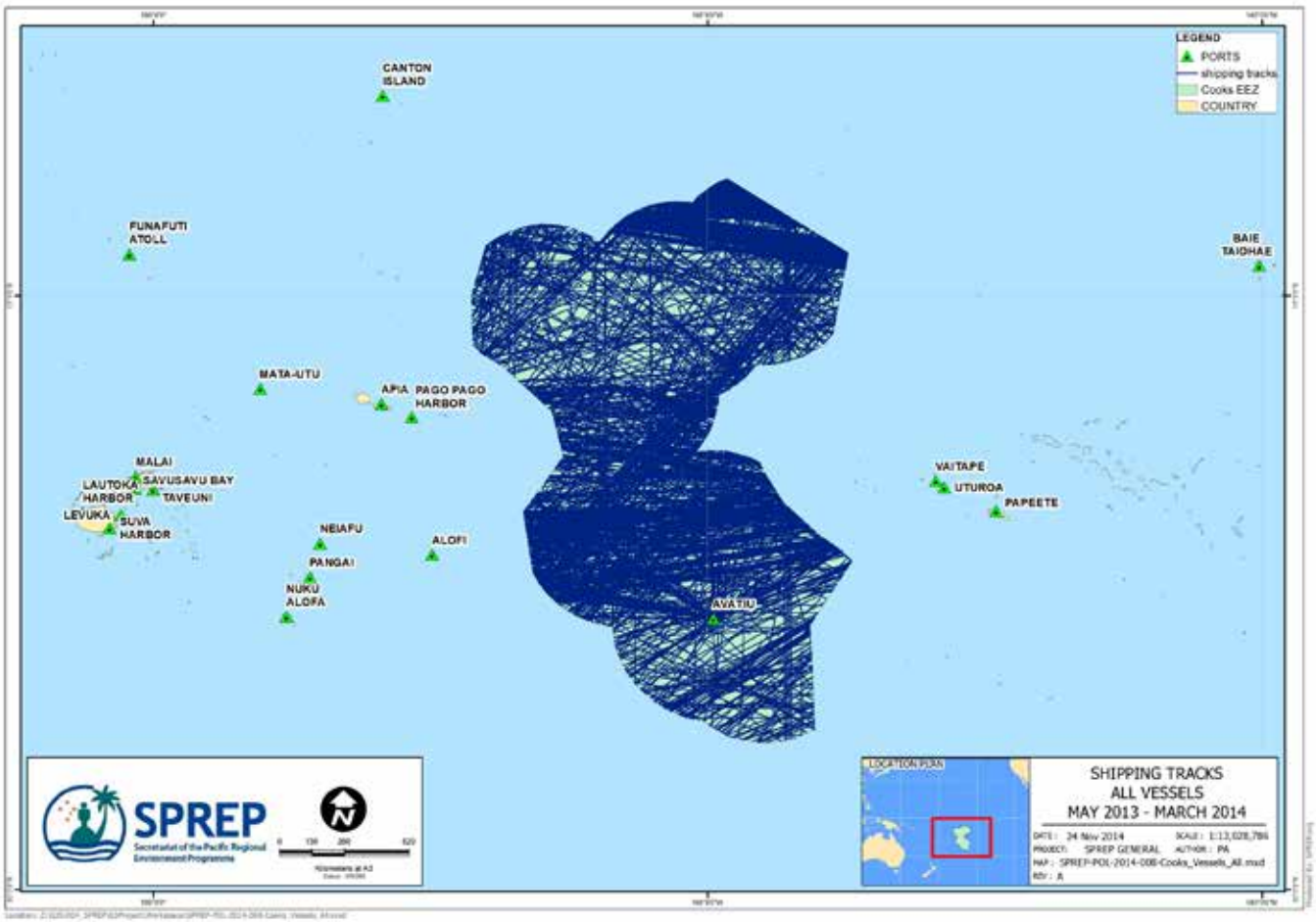


FIGURE 13. Shipping traffic in the Cook Islands EEZ May 2013 to March 2014 (Ships over 35 meters in length). 54 Ships destined for Avarua (SPREP, Data from AIS 2014)

Tourism arrivals in Cook Islands and regional tourism comparisons

Tourism is the largest driver behind better links to international markets in Cook Islands. Tourist arrivals have grown steadily from around 1500 in 1971 to 121,000 in 2012 (Figure 14). The largest period of steady growth began in 1999, when tourist numbers more than doubled from 53,000 to around 121,000 as of 2012.

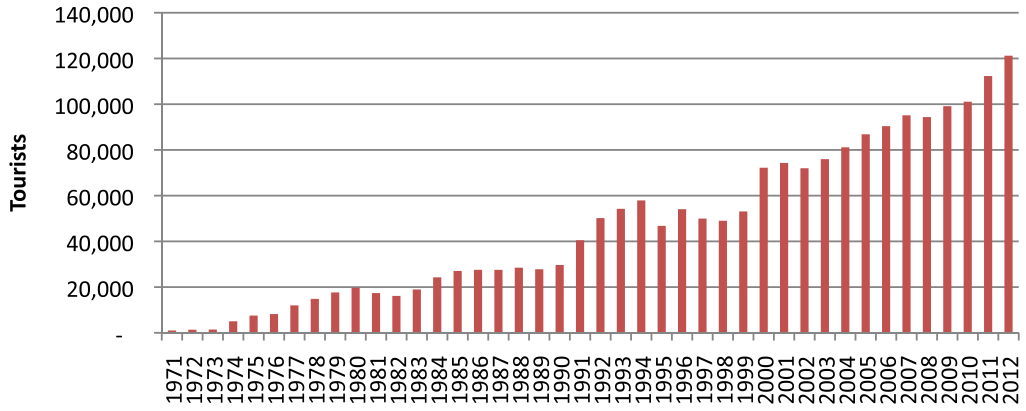


FIGURE 14. Tourist arrivals to Cook Islands, 1971–2012. (Cook Islands Statistics Office, 2014)

Tourism presents opportunities and challenges. Tourism is a relatively stable driver for economic growth; provides jobs for locals, and generates revenue for government services. However, tourism is also the source of several social and environmental pressures, including more solid and liquid waste, more development, and greater pressure on coastal resources.

A recent study on the decline of coral reefs in the Caribbean Islands by the Global Coral Reef Monitoring Network (GCRMN) narrowed the main causes of reef degradation to two major elements: 1) the decline of algae grazers (urchins declined due to white band disease in the 1970s and parrotfish (*Scarus forsteni)* have declined due to overfishing), and 2) impacts from 'too many people', which include water pollution, development and reef access (Jackson et al. 2014). Generally, Caribbean islands with less fishing and development had healthier coral reefs.

This study has important lessons for Pacific island countries. The Caribbean is significantly more developed than most of its Pacific counterparts, and reef condition is generally better in the Pacific than the Caribbean (Chin 2011). Population density and related development is increasing in the Pacific, along with associated pressures on the surrounding ecosystems, as more island nations invest in tourism as a source of revenue.

Figure 15 shows the density of overnight (i.e. non-cruising) tourists per square kilometre in both the Pacific Islands and the Caribbean in 2012. With the exception of Guam, which has a highly developed tourist sector for the Asian market, Cook Islands has the highest annual density of tourists in the Pacific (500 tourists per square km). Rarotonga, which hosts at least 80% of those tourists, is even higher (1500 tourists per square km). Rarotonga's tourist density is approaching similar levels of high density islands in the Caribbean, many of which have heavily degraded reefs. The only Caribbean island with high tourism densities and healthy reef systems is Bermuda, which the authors attribute to a highly regulated fishing and tourist development framework. Based on Rarotonga's seriously declining inner coral reef over the past decade, which corresponds with a steep increase in tourists, it seems that Rarotonga may be reaching, or has already reached, capacity for tourism without any major restrictions.
Note: *This figure does not include cruise tourism, which is highly developed in the Caribbean.*

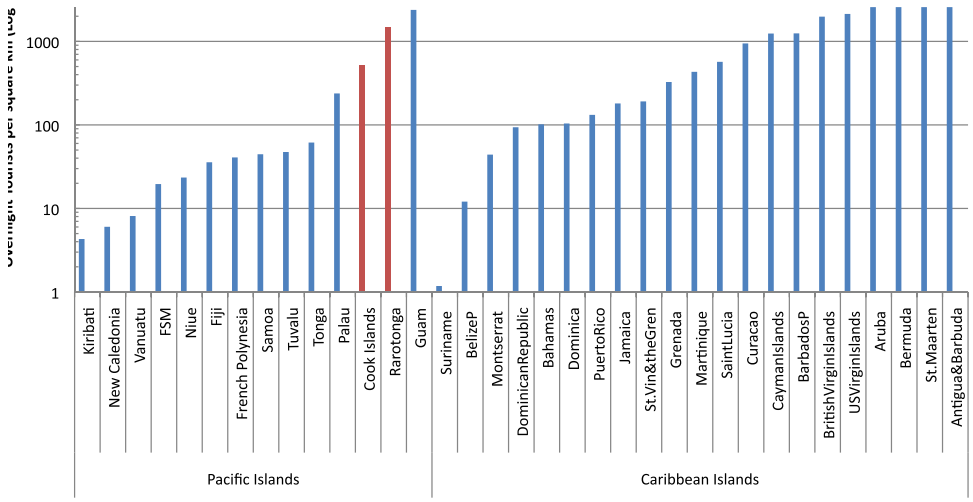


FIGURE 15. Overnight Tourists per square km in selected Pacific and Caribbean Islands, 2012. (Pacific Island Statistics Offices and the Caribbean Tourism Organization: Latest Statistics 2012)

DRIVER 3: ECONOMIC AND TECHNOLOGICAL DEVELOPMENT

ECONOMIC GROWTH AND INCREASED ACCESS TO INCOMES

With growth in the Cook Islands' tourism sector and greater access to global markets, the economic drivers have changed. Globally, from 1970 to 2010, there has been a rise in the contribution of the service industry sector to GDP, and a fall in the contribution of the industrial and agricultural sectors to GDP (Figure 16). This is also the case for Cook Islands.

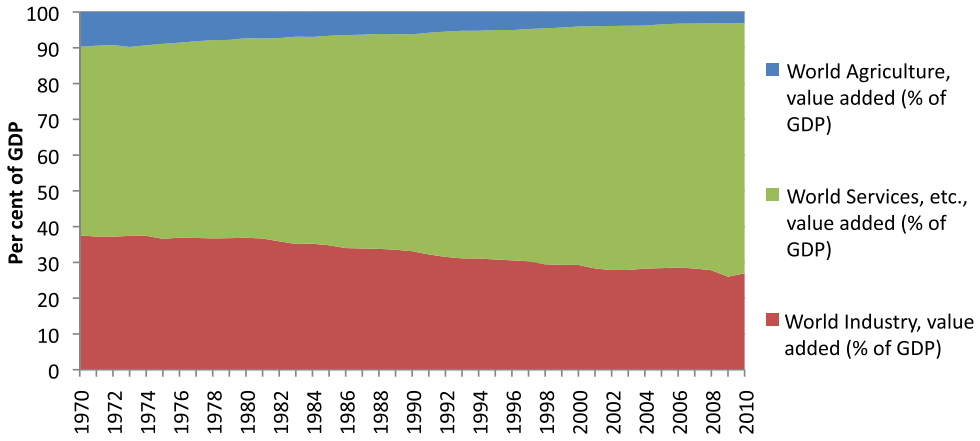


FIGURE 16. Major Global Economic Sectors as per cent of GDP from 1970 to 2010. (World Bank, 2013)

Tourism related services, which accounted for 25% of Cook Islands' GDP in 1995, were 40% of GDP in 2012 (Figure 17). Similar to global trends, the contribution of the agricultural and fisheries sectors halved from ten per cent of GDP in 1995 to five per cent in 2012, and government services fell from 25% of GDP in 1995 to 15% in 2012.

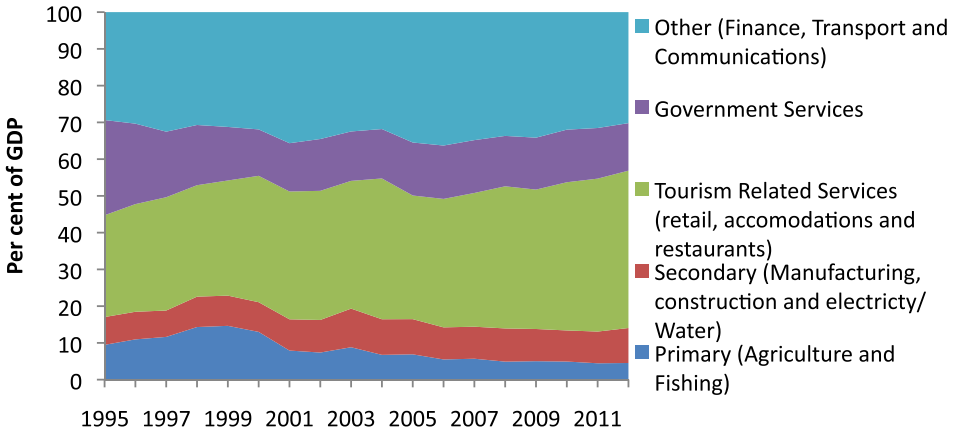


FIGURE 17. Cook Islands: Per cent of GDP by sector. (Cook Islands Statistics Office)

This marked change in the economic drivers of the Cook Islands has economic, social and environmental implications. While the changes have eased some pressures, such as poverty, and have improved access to health care and goods, they have also created new pressures from the higher national consumption, more waste, and cultural changes. The Cook Islands has the highest per capita incomes of the independent Pacific island countries (Figure 18).

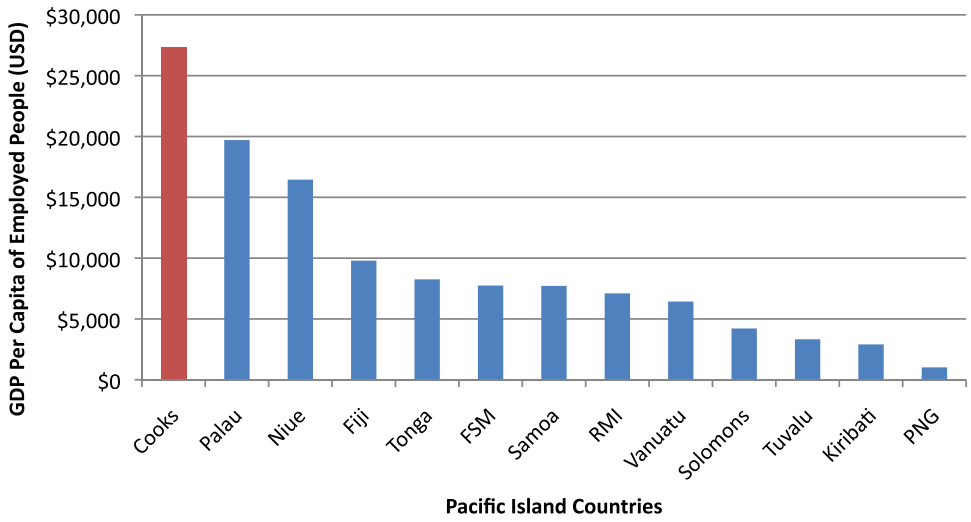


FIGURE 18. GDP per capita of employed people by Pacific island country. (NMDI, SPC 2014)

Based on a comparison between 2001 and 2011, per capita income levels for the Cook Islands have grown (Figure 19). The percentage of persons aged 15 and up without any source of income has declined from 25% in 2001 to 17% in 2011, while the percentage of people with incomes higher than NZD10,000 and above has increased.

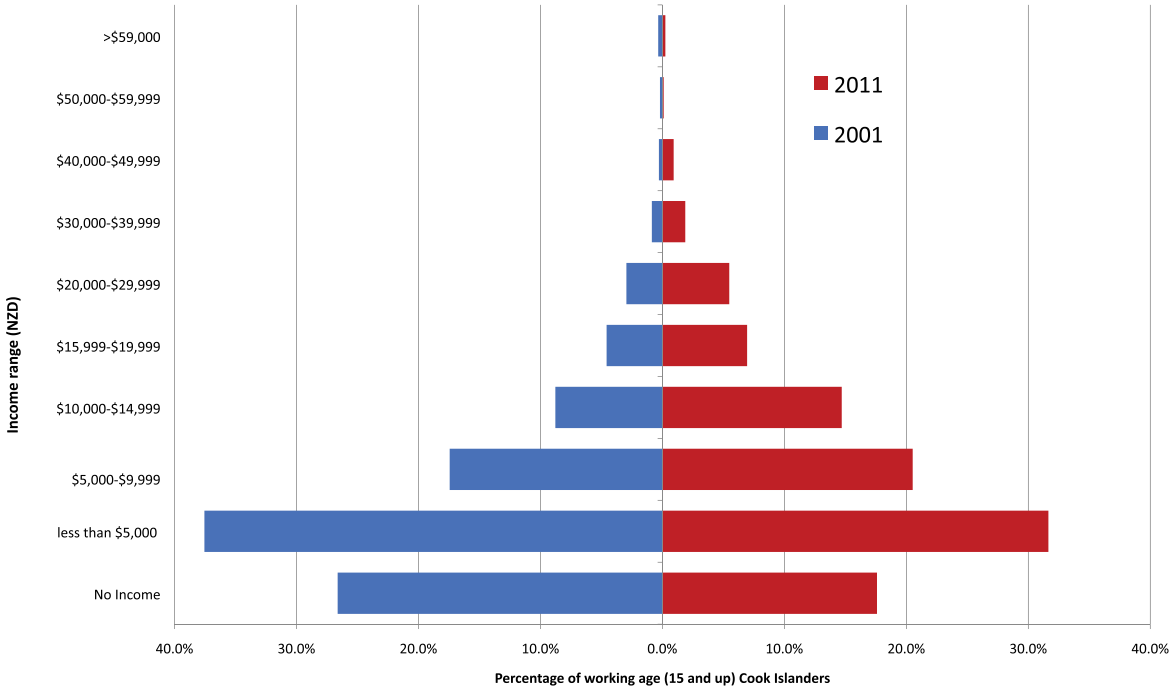


FIGURE 19. Comparison of the percentages of working age (15 and up) Cook Islanders at different income levels, between 2001 and 2011. (Cook Islands Statistics Office)

Economic growth and a declining primary sector have mixed impacts on the environment and society. As economic drivers have shifted from a largely resource-based economy to an increasingly service and trade oriented economy, there has been an increase in the urban-centric economy, with most services now based in developed areas. The underperforming rural economy translates to key differences between 'urban' Rarotonga and the 'rural' Pa Enua. In general, Rarotonga has more high income earners compared to Pa Enua, and fewer employable people with no income (18% vs. 12%) (Figure 20).

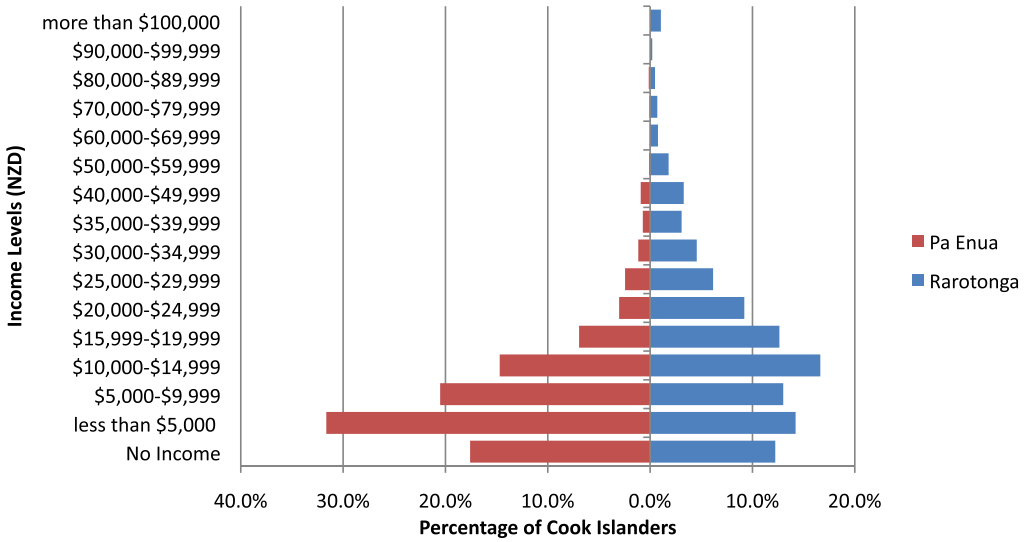


FIGURE 20. Comparison of income distribution between Rarotonga and Pa Enua, 2011. (Cook Islands Census data 2011)

There are several reasons for the differences in income and employment levels between urban Rarotonga and rural Pa Enua. Most tourist-based income is generated in Rarotonga, with a smaller portion in Aitutaki. The decline in primary industries (besides offshore fishing) has a greater effect on Pa Enua residents, who are heavily reliant on agriculture and fishing, whereas Rarotonga has a more diversified economic sector. The cost of subsistence living is higher in Pa Enua than in Rarotonga, while lower incomes and fewer jobs drive Pa Enua residents to migrate to Rarotonga.

TECHNOLOGICAL DEVELOPMENT

The 'Technological development' driver is closely related to the 'globalisation' and 'increased access to incomes' drivers. Increased access to technology has many positive and negative social, economic and environmental impacts for the Cook Islands. Improvements in technology can lead to more extensive resource extraction. For example, the wider use of power boats over canoes has allowed bigger catches over larger areas, for less time and energy. Improved technology can inspire the adoption of more environmentally sensitive and efficient resource extraction, shipping and processing methods. Technological development also influences society through exposure to a global culture, via television and the internet. The growing use of electronics brings with it electronic waste, or 'e-waste', which adds to the already challenging waste management situation in the Cook Islands.

The adoption of the internet is an important example of technological change across the Pacific (Figure 21). The Cook Islands has the second-highest household internet usage in the Pacific islands, at 42 users per 100 people.

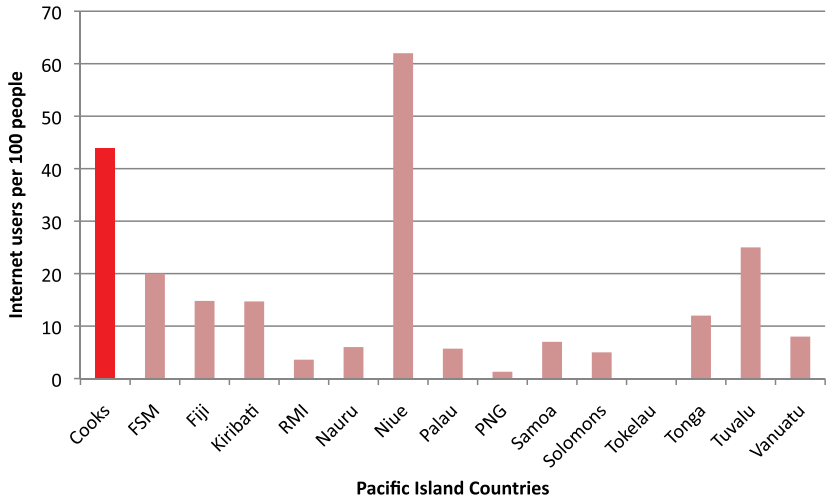


FIGURE 21. Internet users per 100 people in Pacific Island Countries, 2009–2011. (NMDI, SPC)

With the increasing use of cellular phones with internet access, this high number of internet users is likely to grow (Figure 22).

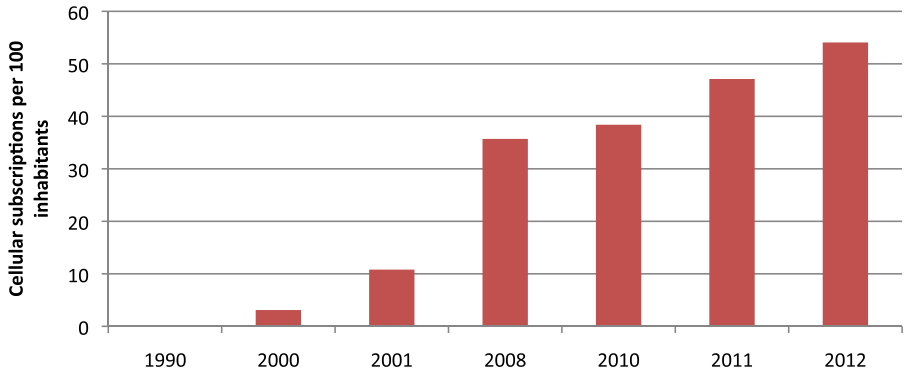


FIGURE 22. Cook Islands Cellular Subscriptions per 100 inhabitants, 1990–2012. (Telecom Cook Islands)

DRIVER 4: TRADITIONAL AND CONTEMPORARY VALUES, ATTITUDES AND LIFESTYLES

Lifestyle, behaviour and values are important drivers of environmental change, and are often strongly linked to other drivers, such as income and globalisation. Increases in Cook Islands incomes, coupled with a globalised transport sector, has allowed for better access to imported items. Cheaper goods can increase the reliance on imports, which can change traditional cultural values and behaviours.

One example is a change in Cook Islands cooking methods over 30 years. Traditional cooking methods, *umukai*, which use wood and earth, declined from 25% of households in 1986 to less than ten per cent in 2011. These methods were replaced by faster, modern alternatives and the gas stove is now the main cooking method (Figure 23).

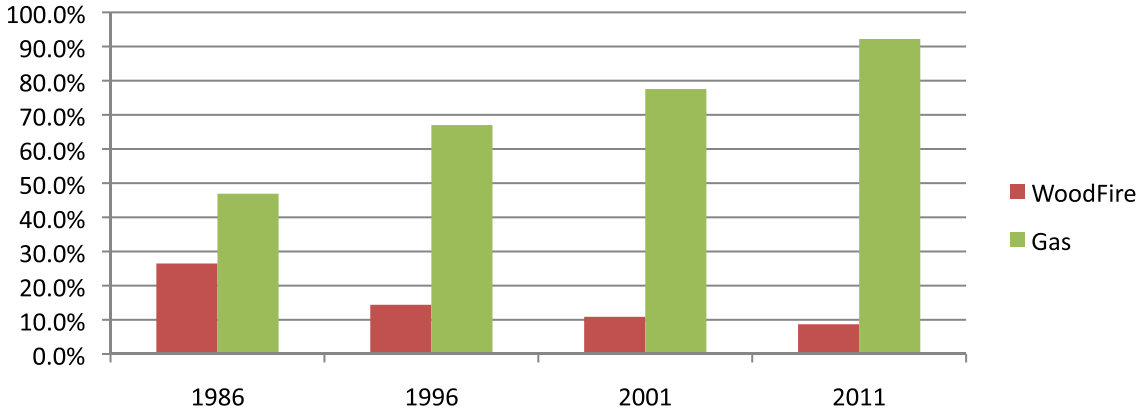


FIGURE 23. Principal Source of Cooking 1986–2011. (Cook Islands Statistics Office)

Education is another important indicator of the cultural change driver. Access to education, particularly secondary and post-secondary, can have profound impacts on the environment through a change from subsistence to a service-based economy, greater environmental awareness, and increased adoption of contemporary values and lifestyles over traditional ones. Between 1986 and 2011, the percentage of Cook Islanders over 15 with Cook Islands secondary education certificates increased from 28% to 58% while tertiary education increased from six per cent to 23% (Figure 24). Another 30% of Cook Islanders aged 15 and over are educated in New Zealand or elsewhere.

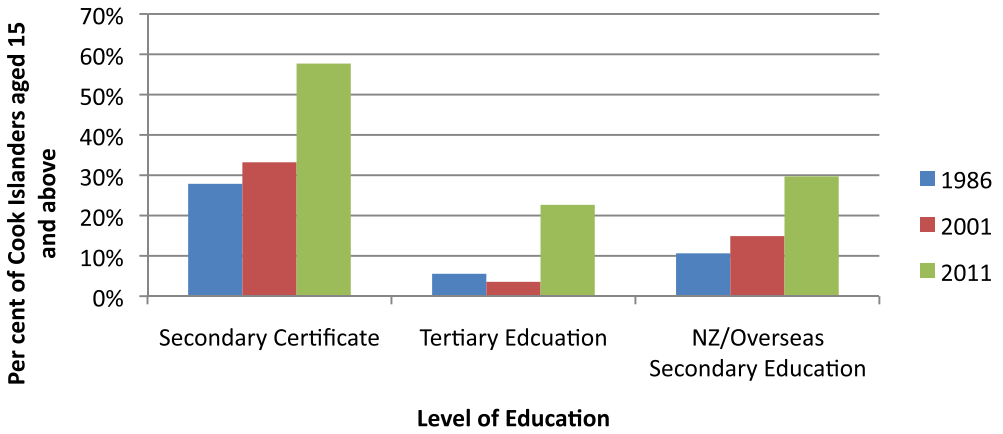


FIGURE 24. Per cent of Cook Islanders over 15 with a) local secondary certificate, b) tertiary education and c) New Zealand or other overseas secondary education, 1986, 2001 and 2011. (Cook Islands Statistics Office)

DRIVER 5: CLIMATE CHANGE

Climate change refers to a change of climate attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, and which is, in addition to natural climate variability, observed over comparable time periods (UNFCCC 1992). It is now widely recognised that climate change is occurring globally as a result of human activity, in particular from the burning of fossil fuels. Figure 25 shows the historical trend for mean global CO_2 concentrations since 1980.

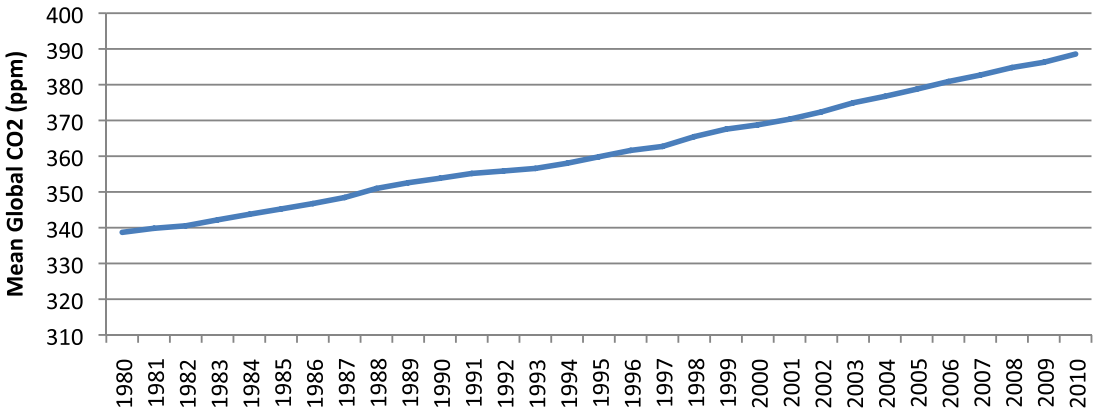


FIGURE 25. CO_2 emissions worldwide. (UNEP Live, 2013)

Climate variability refers to variations in the mean state and other climate statistics such as standard deviations, and the occurrence of extreme weather events. The effects of these variations may be experienced well beyond the timing and scale of the initial weather event. Variability may result from natural internal processes within the climate system (internal variability) or from variations in natural or anthropogenic external forces (external variability).

The effects of climate change and climate variability are being felt in Cook Islands, and elsewhere, as a key driver of environmental change. Geographic location, topography and other factors influence the rate and intensity of changes in climatic conditions. Thus, the level of vulnerability across the Cook Islands can vary. Figure 26 shows historical average temperatures in the Cook Islands have risen steadily since the late 1800s. Cook Islands is vulnerable to climate change impacts. These can include sea level rise, warming ocean temperatures, ocean acidification and associated adverse impacts to already vulnerable coral reefs, changing migration routes especially for highly migratory species, increased intensity of storm and weather events, and the introduction of invasive species, among others.

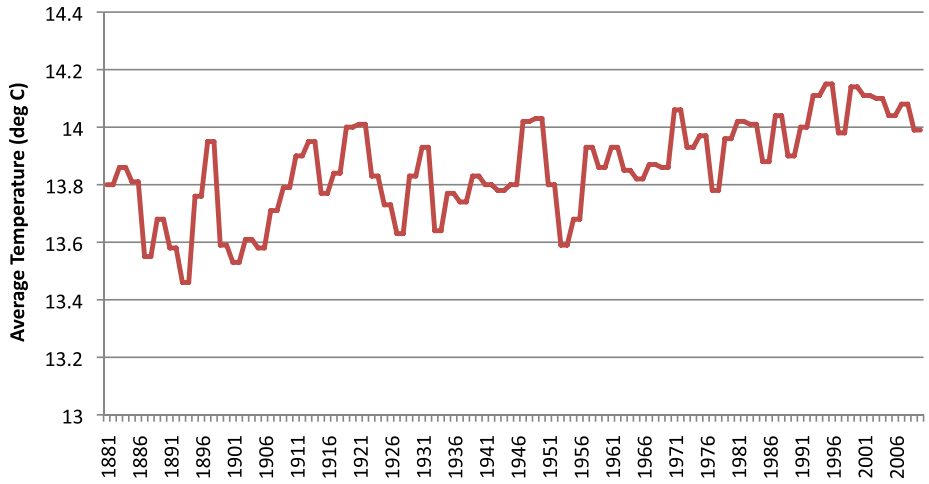


FIGURE 26. Average Global Temperatures, 1881–2006. (UNEP Live, 2013)

WHAT ENVIRONMENTAL PRESSURES ARE THE DRIVERS CREATING?

This section highlights the key pressures on the Cook Islands' environment and society created by the overarching drivers identified in the previous section. Pressure indicators present data about the main human activities that could adversely affect the environment, and each indicator is linked to at least one of the drivers. Pressure indicators are organised using three classifications: land development, resource extraction and consumption and waste (Table 4). Some pressures will be covered in the 'State' section.

TABLE 4. Key environmental pressures in the Cook Islands

	PRESSURES		
	LAND DEVELOPMENT	RESOURCE EXTRACTION	CONSUMPTION AND WASTE
KEY INDICATORS	Formal Urban Development	Land use and forestry	Energy consumption
	Agriculture	Fishing	Vehicle ownership
	Invasive Species	Aquaculture	Solid and Liquid Waste Generation
			Water consumption

PRESSURE 1: LAND DEVELOPMENT

Formal Urban Development

Urban development creates environmental pressures through increased removal and fragmentation of sensitive habitats. Urban development can also increase waste discharge to the natural environment, particularly sewage and solid waste. In the case of formal developments which follow strict building codes, the lack of proper monitoring and enforcement of these codes can result in poorly designed and improperly managed waste and sanitation infrastructure. In the Cook Islands, many resorts have sanitation systems originally built to handle a small number of guests. Over time, with a growing tourist economy, some resorts have expanded without upgrading their sanitation systems. This can lead to overload. Proper planning for waste management is especially important to address this problem.

Urban development is one of the biggest pressures on the Cook Islands environment. Despite a declining residential population, private dwellings (including resorts) have increased from 3296 in 1986 to 4372 in 2011 (Table 5).

TABLE 5. Family size and number of private dwellings, 1986 to 2011. (2011 Census)

CENSUS YEAR	HOUSEHOLD SIZE	RESIDENT POPULATION	PRIVATE DWELLINGS
1986	5.0	16,593	3296
1991	4.8	17,500	3677
1996	4.4	18,071	4153
2001	3.9	15,017	3880
2006	3.6	15,324	4237
2011	3.4	14,998	4372

Growth in the tourism and service industry sectors, and decreasing family size, all affect development trends in the Cook Islands. As family sizes reduce, even with overall population decline, the numbers of houses required for a family are increasing. Private buildings, which include resorts and service facilities (restaurants, stores, offices) are also increasing, and often depend upon unreliable external influences, such as changes in demand for tourism and fluctuating market prices. Figure 27 shows the general pattern of volatility in building development between 2002 and 2013. There is a weak relationship between residential and commercial building growth and decline, which suggests that similar market forces and investment environments influence both types of development.

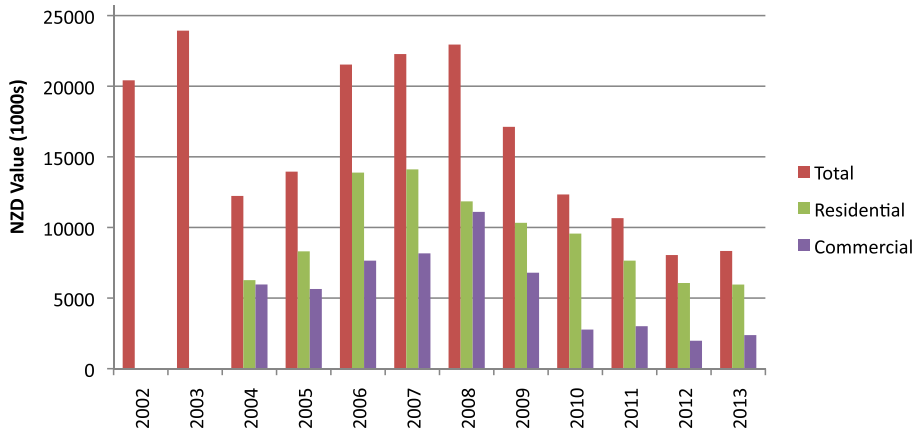


FIGURE 27. Cook Islands Investments (NZD) in Commercial and Residential building, 2002–2013. (Cook Islands Statistics Office) *Only total investments available for 2002 and 2003

Urban development has mainly impacted Rarotonga, the most populated area of the country and location for most of the country's tourist and administrative services. Much of the fringing coastline of Rarotonga, which previously supported a significant amount of agricultural land, is now replaced with modern development. Figure 28 shows land use in Rarotonga as of 2011, which is largely split between 'Urban' spaces (larger contiguous developed areas such as resorts, commercial and administrative buildings, and urban parks) and 'Residential' spaces (individual homes and owned lots). 'Other' areas are largely agricultural land, both fallow and productive. Modern development has impacts upon Rarotonga's inshore environment, inland waters, sanitation, waste, drinking water and biodiversity. These impacts are explored later in the report.

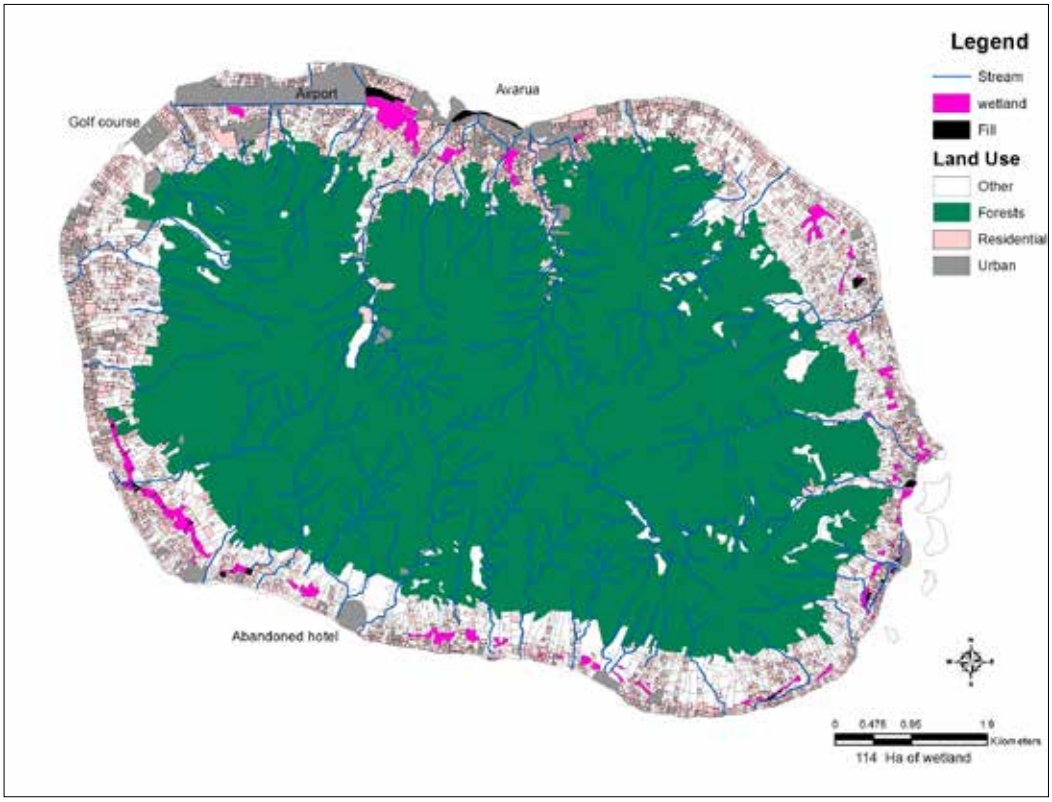


FIGURE 28. Land use in Rarotonga, 2011. (SPREP)

AGRICULTURAL DEVELOPMENT

From the 1950s to the 1980s the Cook Islands had an extensive agricultural economy that included subsistence farming. Much of the agriculture was dominated by citrus, banana *(Musa cavendishii)* and copra export industries on Rarotonga, Atiu and Mangaia. The Cook Islands were also a major producer of fruit juices. By the late 1980s, much of this had disappeared due to global market competition.

The significant decline in agriculture began in 1988 (Figure 29). Total land used for agriculture in Rarotonga declined from 12% in 1988 to less than four per cent in 2011. In the northern Pa Enua, total land used for agriculture declined from almost ten per cent in 1988 to less than one per cent in 2011. The main reasons were a drop in subsistence farming, and the loss of the export fruit and vegetable industries.

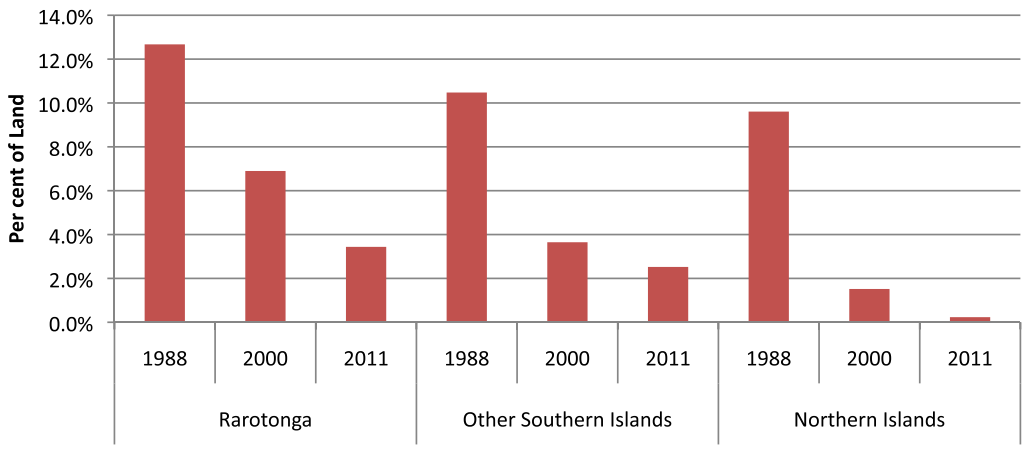


FIGURE 29. Per cent of total land used for agriculture in the Cook Islands. (1998, 2000 and 2011 Agricultural Censuses, MOA)

Unsustainable agricultural practices can create environmental pressures through soil and nutrient loss, pesticide and nutrient pollution to ground and surface water, habitat fragmentation, air pollution from crop burning, diminished biodiversity and the spread of invasive species. The eroding pineapple *(Ananas comosus)* fields in Mangaia, which were planted with pine *(Pinus caribaea)* plantations to prevent further erosion, provide an example of how large scale agriculture has negatively impacted the environment. Another example is the use of agricultural chemicals and fertilisers. Between 2000 and 2011, despite population declines and an overall decline in the agricultural sector, Cook Islands households increased their use of agricultural chemicals such as pesticides and herbicides. The number of households using inorganic fertilisers remained relatively stable, and the number of households using organic fertilisers fell sharply (Figure 30).

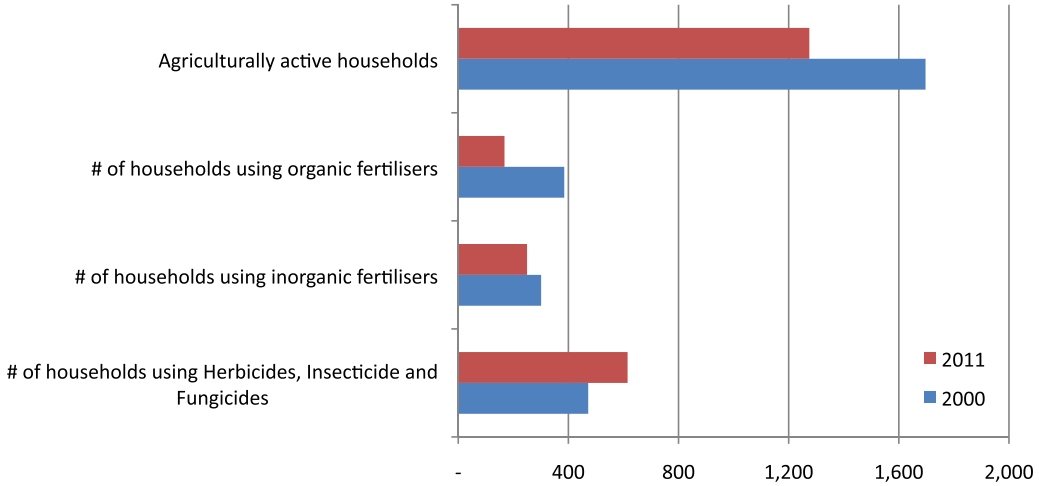


FIGURE 30. Cook Islands agriculturally active households using fertilisers and chemicals, 2000 and 2011. (Agricultural Censuses, 2000 and 2011, MOA)

Despite some problems with historically unsustainable agricultural practices, the recent decline in agriculture is of great concern, with far reaching social and environmental impacts, for several reasons. Firstly, a serious agricultural decline can create food insecurity, especially in vulnerable small island nations. Figure 31 shows an example of the reliance on food imports. While the Cook Islands was once a major exporter of oranges *(Citrus sinensis)*, the country now imports citrus, but on a much smaller scale. There was a single export in 2005 which was not repeated. Secondly, a reliance on imported foods and goods introduces more waste packaging to an overburdened waste management system. Thirdly, the agricultural decline contributes to emigration from more rural areas and the country as a whole. Larger numbers of younger, employable Cook Islanders are moving away from farming and into the service industry in either Rarotonga, or overseas. This reduces the already few agricultural opportunities within the country, and causes more outward migration, especially for the Pa Enua. More details are explored in the Land section of this report.

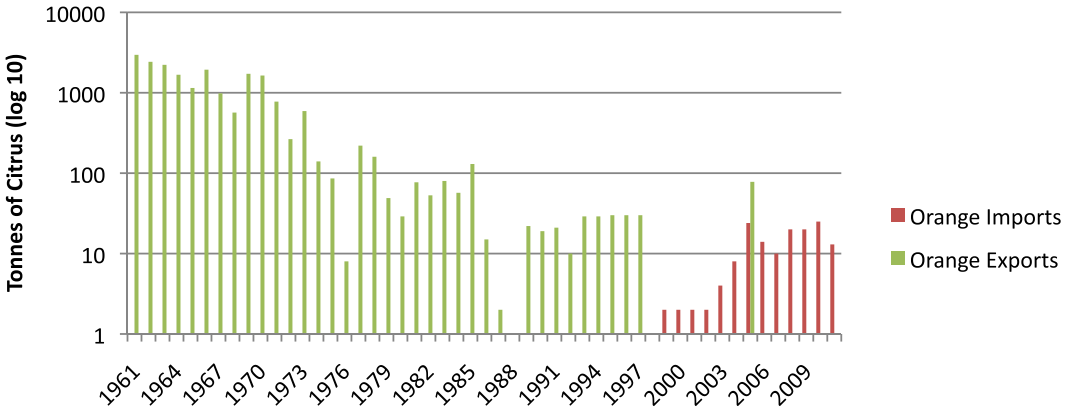


FIGURE 31. Orange imports and exports in the Cook Islands, 1961–2011. (FAOSTAT, 2014)

Invasive Species

Invasive species are introduced plants, animals and other organisms that cause harm to the environment, economy or human livelihoods. This report focuses on Environmental Invasive Species which excludes Invasive Species from agriculture. However, many environmental invasive species may impact upon agriculture.

Increased globalisation and connectivity to the world bring more invasive species to the Cook Islands. However, the main pathway for spread is infrastructure related to development such as roads, urban expansion and agriculture. Natural disasters such as cyclones give invasive plants more resources, such as space and sunlight, and can result in a long-term domination of biomass.

Invasive species pressure the environment by competing with indigenous species and habitats, with little or no natural predation. Most commonly, invasive species arrive through air or sea transport and are one of the biggest threats to the flora and fauna of Cook Islands. The spread of invasive species is a serious problem for many Pacific islands countries and territories. A national database has been developed for invasive species, their distribution and impact. This is important for monitoring invasive species (Figure 32). Cook Islands has been successful in some eradication activities, however, many invasive species are unmanaged.

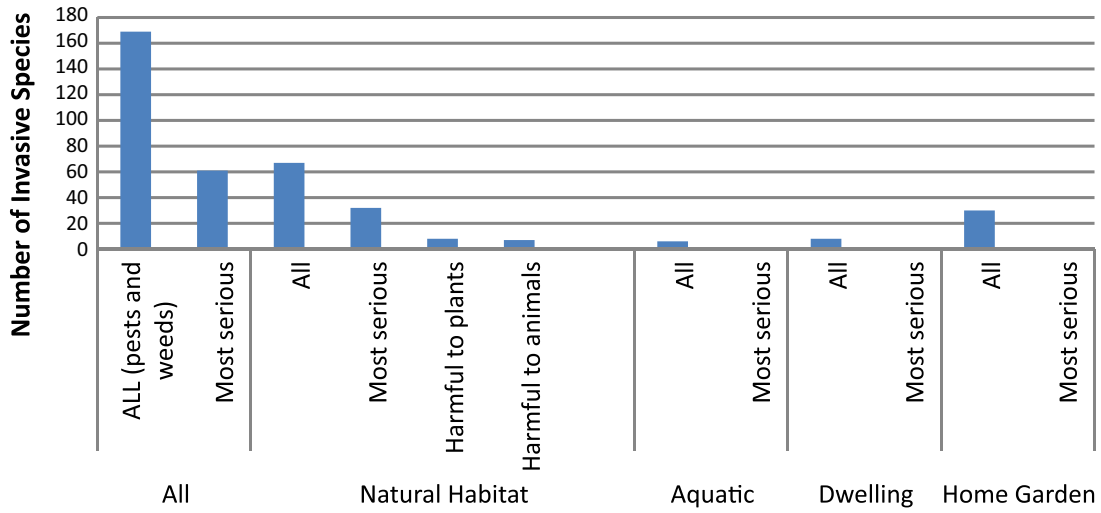


FIGURE 32. Types and numbers of Cook Islands invasive species, by habitats and impacts. (Cook Islands Biodiversity Database)

Resource Extraction: Fishing

Fishing places numerous pressures on both inshore and offshore marine biodiversity and habitats, particularly if harvest levels are unsustainable or unregulated.

INSHORE FISHING

For this report, inshore fishing includes subsistence and commercial harvest of reef fish such as parrotfish, invertebrates such as beche-de-mer (sea cucumber, *Thelenota ananas)* and trochus *(Tectus niloticus)*, and a small catch of pelagic stocks for local subsistence and commercial markets. Data on inshore fishing harvests is limited for reef and pelagic stocks, with the exception of the trochus, which is heavily regulated. Based on census data, inshore fishing pressure has declined over 20 years, particularly in Rarotonga. Figure 33 shows the proportion of households engaged in commercial and subsistence fishing activities. Since 2001, Rarotonga has seen a fall in subsistence fishing from half of households in 2001 to only 25% in 2011. Ciguatera poisoning in Rarotonga, as well as general lifestyle changes, account for most of the decline in subsistence fishing.

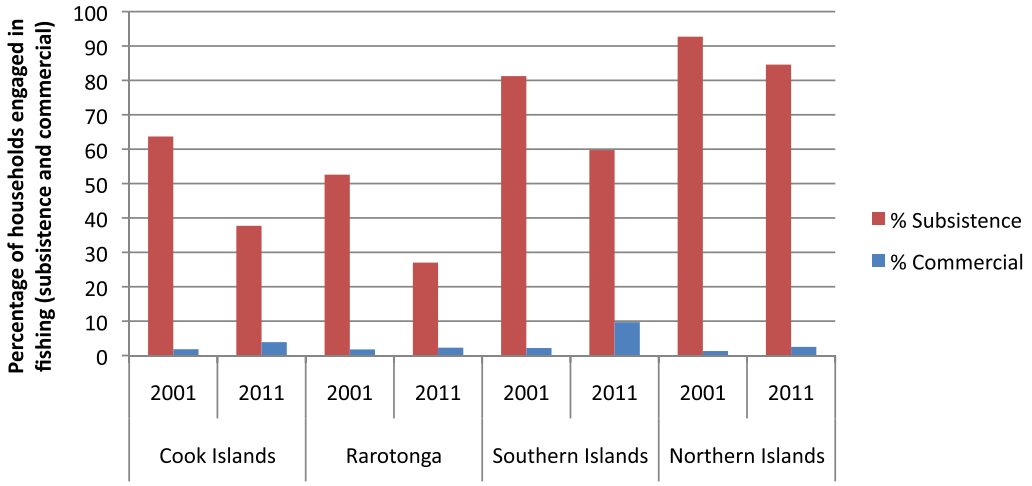


FIGURE 33. Percentage of households engaged in subsistence and commercial fishing, 2001 and 2011. (Cook Islands Department of Statistics)

Data collected from the 2007 Secretariat of the Pacific Community (SPC) Pacific Regional Oceanic and Coastal Fisheries Development Programme (PROCFish) report confirms this decline. Despite a high proportion of subsistence fishing in the southern and northern Pa Enua, relative to the rest of the Cook Islands, these islands also show a decline in levels of subsistence fishing. It is important to note that recreational fishing associated with tourism is not covered. Inshore fishing is discussed further in the Marine section.

OFFSHORE FISHING

For this report, offshore fishing is limited to commercial harvest of pelagic (deep-water) fish, including tuna, tuna-like species and by-catch. The number of households engaged in commercial fishing (mostly offshore) doubled from two to four percent overall, and in the southern Pa Enua, from two to ten per cent, between 2001 and 2011 (Figure 33). There has been an increase in the commercial harvest, particularly in the last ten years, which began with the nationalisation of the Cook Islands' fishing fleet in 2000.

Figure 34 shows estimates of total tuna harvest since 1954, including the rapid increase in harvest since 2000. Much of the tuna fishing between the 1950s and 1980s was from foreign flagged vessels from Japan, South Korea and Taiwan. After a period of instability and low harvest, a moratorium was imposed in 2000 on the licensing of all foreign fishing vessels and the tuna harvest increased. In 2008 the moratorium on non-nationalised fleets was removed – the tuna harvest doubled in 2010, and nearly doubled again in 2012. Most of the tuna harvest in the Cook Islands uses the long-line method of fishing for Albacore tuna (*Thunnus alalunga*), with occasional purse-seine fishing for Skipjack tuna (*Katsuwonus pelamis*).

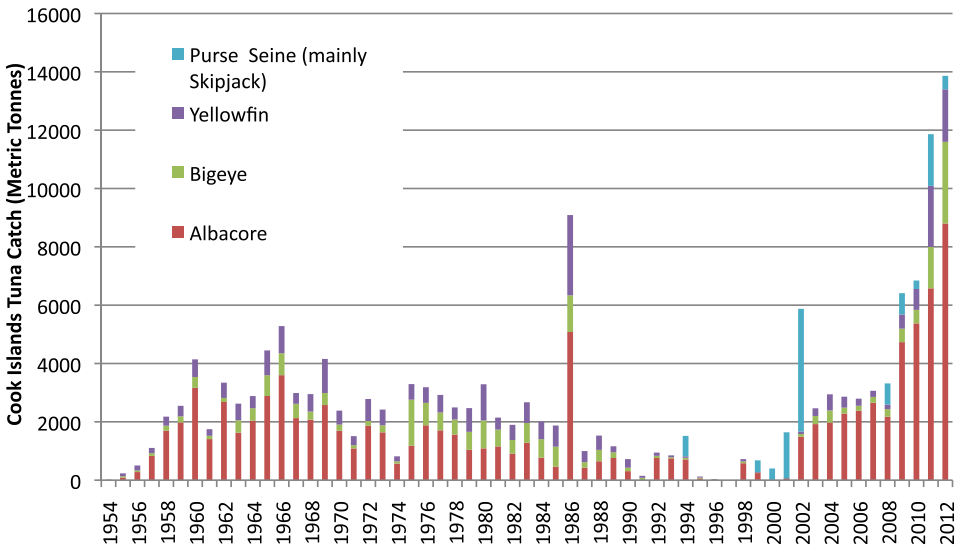


FIGURE 34. Cook Islands Tuna Catch, Longline 1954–1999, Longline and Purse Seine, 1994–2012. (Reconstructed from Molony, 2006, SPC 2011 and MMR, 2009 and 2013)

Unsustainable levels of tuna fishing can reduce stock size and biomass, and have unintended impacts on by-catch species such as sharks. In the Western Pacific, Skipjack, Yellowfin (*Thunnus albacares*) and Albacore tuna are all listed by SPC as 'vulnerable' to overfishing, and Bigeye tuna (*Thunnus obesus*) is considered overfished. Harvest of all tuna stocks continues to increase and Bigeye tuna harvests have more than doubled every year since 2010 (Figure 34). The State, Impact and Responses for Offshore fishing are discussed further in the Marine section.

PEARL FARMING

Farming of the black-lipped pearl oyster (*Pinctada margaritifera)* began in the mid-1980s on Manihiki, Rakahanga and Tongareva (also known as Penrhyn) islands in the northern Pa Enua. With the assistance of international aid donors, pearl farming expanded in the 1990s and, by 2000, there were over 182 pearl farms, largely on Manihiki. Since 2000, the industry has declined to only 35 farms, all on Manihiki. In 2001 about five per cent of all households in the Cook Islands were involved in pearl farming (Census of Agriculture 2000), which dropped to just over one per cent in 2011 (Census of Agriculture 2011). The decline in pearl farming was largely due to the outbreak of vibrio disease in 2000 and 2001, which affected as much as 60% of the stock, and falling prices due to the higher production of black pearls in world markets. There has been some consolidation in the pearl farming industry, and average farm sizes have increased. The average farm in 2000 had nine farm lines and three spat collector lines; in 2011 this increased to 41 farm lines and 13 spat collector lines (Census of Agriculture, 2011).

Pearl farming can impact the quality of lagoon water and sediments. Organic debris and by-products from oyster processing and oyster lines falls to the seafloor and creates an excess of decomposing organic material and anaerobic (low oxygen) environments. This effect is enhanced in lagoons with low flow, such as the Manihiki lagoon. A 1995 study by SPC on the Manihiki pearl farms showed that for high density oyster farms, water quality was impacted up to 100 metres in depth. Deeper water levels can be especially impacted by these farms because nutrients and organics accumulate deeper in the water column. The study recommended a 200 metre buffer zone between farms. This would provide optimum conditions for the oysters and prevent negative water quality impacts from the farming (Anderson 1998).

Recent water quality monitoring of the Manihiki lagoon showed no obvious increases in the levels of nutrients or suspended solids (MMR 2009). A 2008 comparison in water quality monitoring showed that median bacterial levels were higher in the Manihiki lagoon compared to other lagoons, including lagoons in Rarotonga and Aitutaki (Figure 35). Maximum bacterial levels in the Manihiki lagoon were much lower than the other islands. However, it is difficult to determine if these higher median levels are due to human and animal effluents, oyster farming, or a combination of both, without further testing.

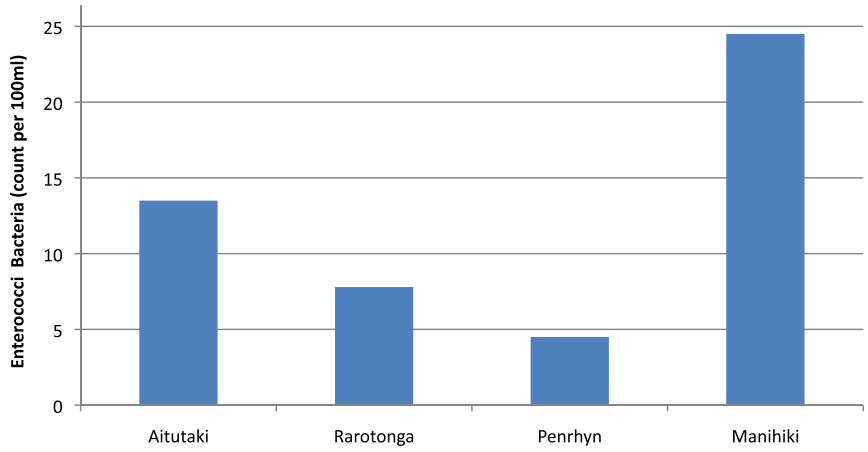


FIGURE 35. Median Enterococci bacteria levels in 2008 for selected islands in Cook Islands. (MMR water quality data report Manihiki, 2009)

DEEP SEA MINING – MANGANESE NODULES

Deep sea mining is an emerging opportunity for Pacific island countries. Cook Islands established a Seabed Mineral Authority which is supported by the Seabed Minerals Act 2009. While cost benefit analysis indicates that mineral values in some locations can be economical to exploit (Figure 36), the environmental impact of such exploration is unknown. As with mining on land, the potential for serious environmental impacts is high. Developing countries in the Pacific, including the Cook Islands, will likely be among the first in the world to explore the potential economic benefits of deep sea mining, while grappling with the impacts on the environment, biodiversity and physical oceanography.

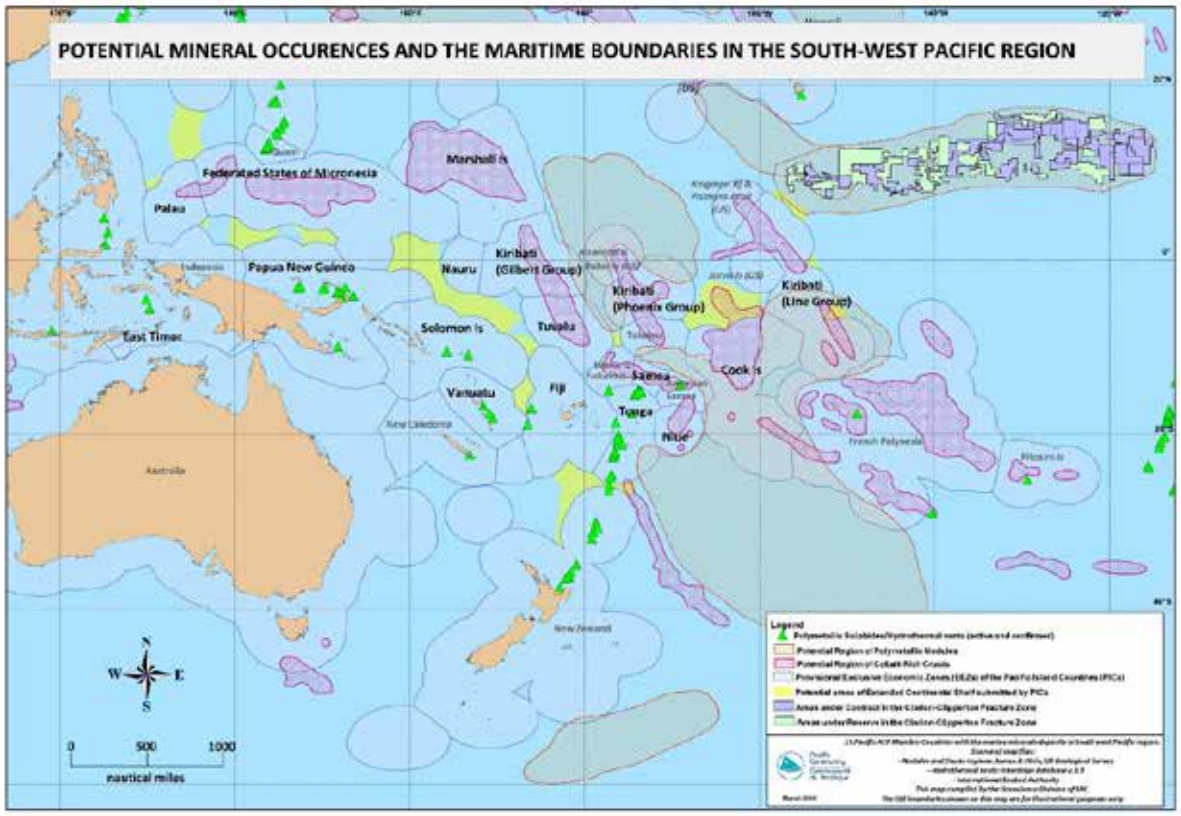


FIGURE 36. Potential minerals occurrences and maritime boundaries in the south-west Pacific region. (SPC, 2016)
*Detailed country seabed mining potential is not publically available.

Consumption and Waste

DEMAND FOR CONSUMER GOODS AND INCREASED ENERGY CONSUMPTION

With the growth in household incomes and a globalised transport sector, demand for imported goods has increased, particularly for consumer and electronic goods. The dramatic increase in household ownership of white goods and televisions is an example of this higher demand for imported consumer goods and electronics (Figure 37).

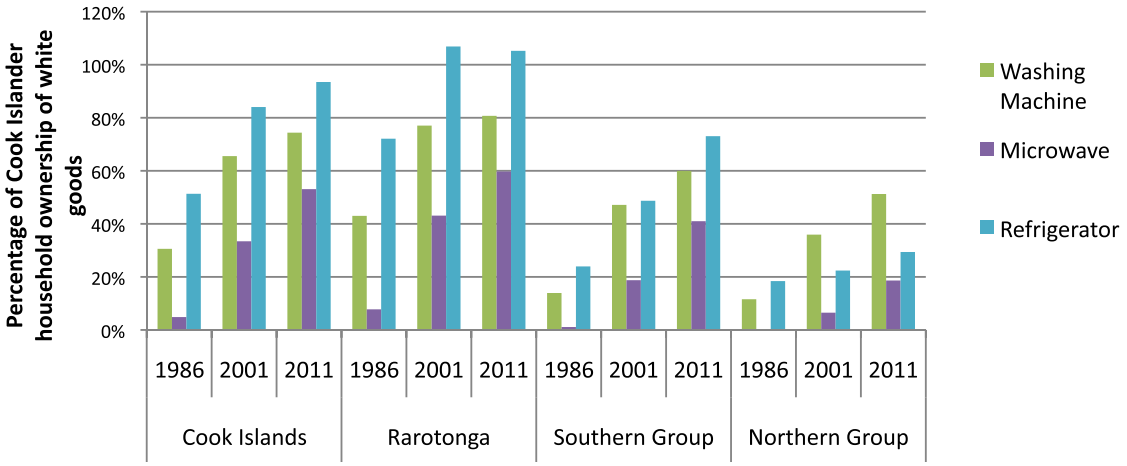


FIGURE 37. White goods owned in Cook Islands households. (Cook Islands Statistics Office)

From 1986 to 2011, household ownership of washing machines rose from 30% to 75%, microwaves from five per cent to 53% and refrigerators from 51% to 93%. Households from all islands lifted their ownership of white goods, with the largest share held by households in Rarotonga.

The higher demand for consumer goods over the last two decades is reflected in energy consumption patterns. In 2009, Cook Islands was the third highest consumer per capita of electricity in the Pacific region, next to Palau and Niue (Figure 38).

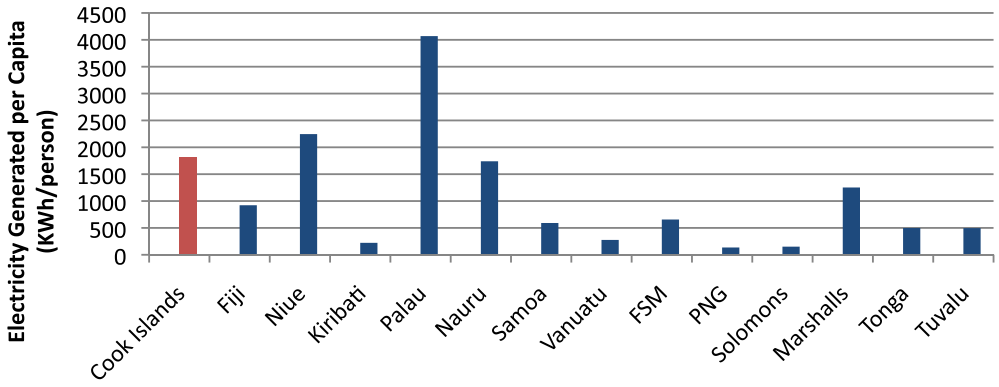


FIGURE 38. Electricity generated per capita across Pacific island countries, 2009. (SPC Energy)

From 2005 to 2013, energy consumption rose from 1500 KWh per person to about 1800 KWh (Figure 39). The more developed islands of Rarotonga and Aitutaki have the highest per capita energy consumption rates. Per capita electrical consumption on Aitutaki, Manihiki and Rakahanga more than doubled from 2005 to 2013, due to improved access to electricity.

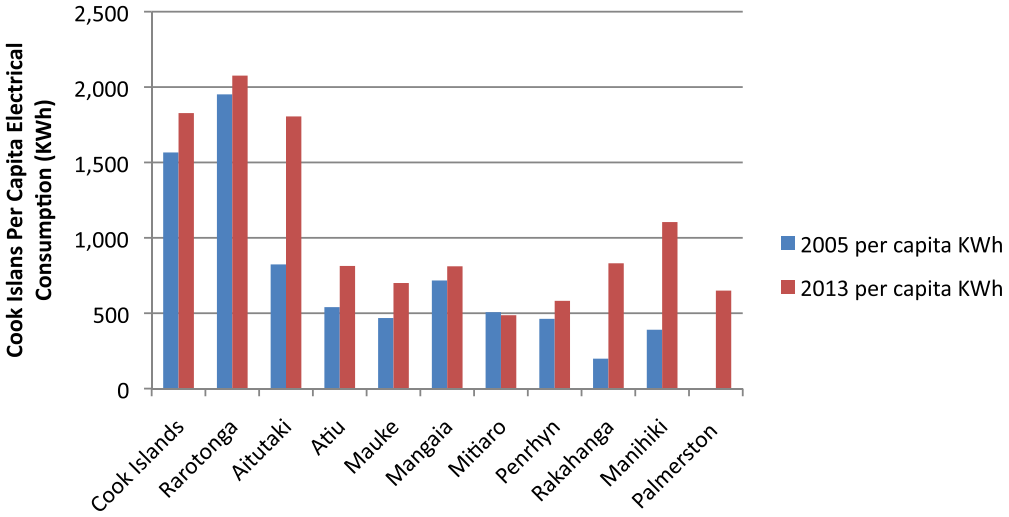


FIGURE 39. Cook Islands per Capita Electrical Consumption, 2005 and 2013. (Cook Islands Statistics Office)

In the Cook Islands, along with many other Pacific island countries, energy and electricity are largely supplied by diesel generators. This diesel dependence increases the vulnerability of these island countries to the market volatility of fuel prices. Many Pacific island countries and territories, including the Cook Islands, are working to develop sustainable and more independent sources of energy. This topic is covered further in the section on Built Environment.

VEHICLE OWNERSHIP

Vehicle ownership is another environmental pressure for the Cook Islands. It directly impacts the air quality, through vehicle emissions, and levels of waste from the disposal of old cars. Indirect environmental impacts include the expansion of roads to support more vehicles. Paved roads increase the amount of impervious surfaces, and creates greater risks of flooding, habitat fragmentation, and the spread of invasive species.

Figure 40 shows vehicle ownership per 100 Cook Islander households, including motorcycles and scooters, from 1986, 2001 and 2011. Car ownership increased from ten cars per 100 households in 1986 to 40 cars per 100 households in 2001. Motorcycle ownership increased from 50 motorcycles per 100 households in 1986, to 140 motorcycles per 100 households in 2011, or more than one motorcycle or scooter per household.

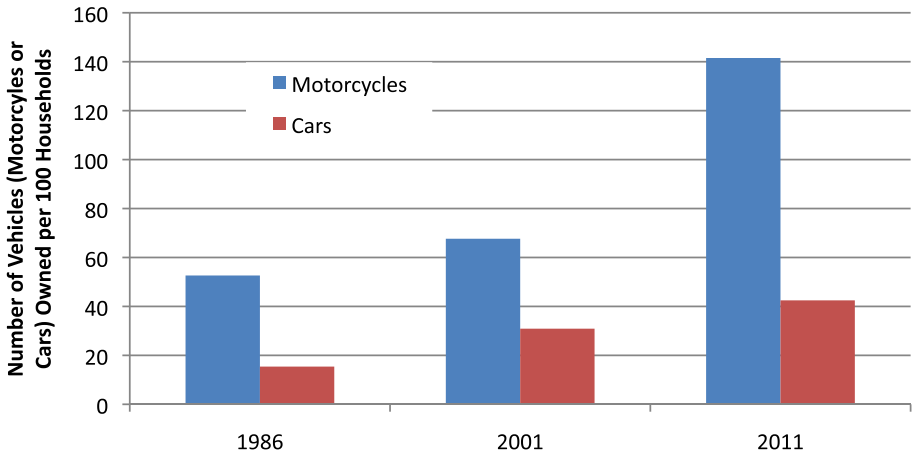


FIGURE 40. Vehicle registration in Cook Islands, 1986–2011. (Cook Islands Statistics office)

WATER CONSUMPTION

Water consumption for drinking and agricultural and industrial uses is another environmental pressure in the Cook Islands. Water availability can be scarce, particularly in the atoll islands during droughts. Lack of adequate water resources and associated management, and substandard water infrastructure, can further limit the supply and quality of water. In volcanic, raised islands with surface water sources, such as Rarotonga, water withdrawals can place pressure on the inland water ecosystem by lowering water levels. This can raise air and atmospheric temperatures, increase airborne pollutants and adversely impact human health.

2013 water consumption estimates show that most water in Rarotonga is used by the agricultural sector, followed by residential and industrial users (Figure 41). Alarmingly, 29% of Rarotonga's water is lost through leakages in the existing water system, which is more than the combined water consumption by residential and industrial users. Planned upgrades in 2014 and onwards are expected to reduce these leakages (Te Mato Vai 2013; MFEM 2014). Water availability and water quality is further discussed in the Inland Waters and Built Environment theme.

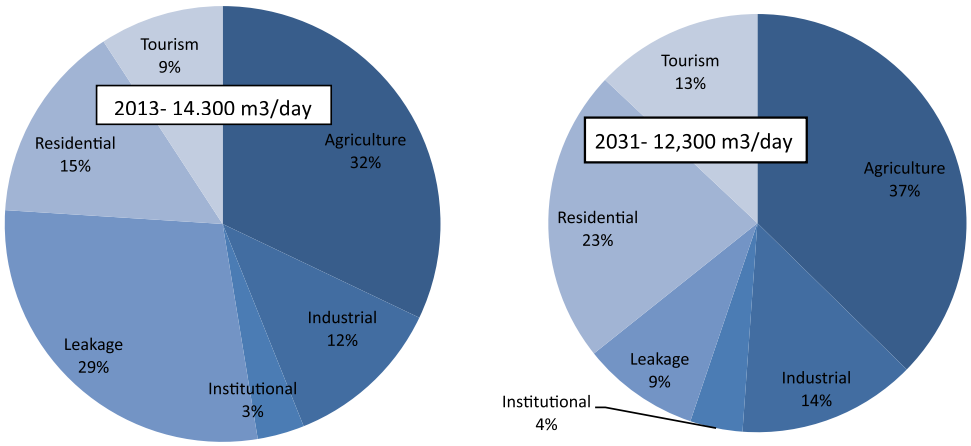


FIGURE 41. Cook Islands water withdrawal estimates for 2013 and projected estimates for 2031. (Water Supply Master Plan for Rarotonga, 2014)

WASTE GENERATION

Waste is a serious and growing problem in the Cook Islands. The rising demand for imported goods, as a result of more disposable income, is worsening the waste problem as more goods are introduced without adequate waste management infrastructure to support their waste streams. This report explores the pressures from both Liquid Waste (sewage) and Solid Waste. Both pressures are discussed in greater detail in the Built Environment section.

LIQUID WASTE

Management of sewage is a significant challenge for the Cook Islands, especially in the more populated islands of Rarotonga and Aitutaki. All sewage is managed through septic systems, most of which are very old and at, or over, capacity. A 2011 audit on septic systems in Rarotonga estimated that over 80% of the systems installed did not adequately manage sewage wastes (Figure 42).

Poor sewage management creates numerous pressures on environmental and human health. Human and animal wastes are the biggest threats to lagoon health in the Cook Islands, particularly on Rarotonga, and increasingly on Aitutaki. Human and animal wastes introduce high levels of bacteria and nutrients to lagoons, which are typically small, and have low water exchange relative to those in many other Pacific island countries. Excess nutrients and bacteria adversely impact water quality, and cause algal growth, which can smother corals and pose health dangers to people using the lagoon areas. Pressures from sewage and human and animal wastes are further discussed in the Built Environment theme.

SOLID WASTE

More non-organic waste products are entering the Cook Islands. Solid waste items including plastics and glass are a particular problem, as there is limited room for land-filling and storage of the waste items. The tourism industry is one source of introduced waste products. A 2005 household survey estimated that around 86% to 91% of imported beer bottles are for tourist consumption (Figure 43).

Hazardous wastes, such as electronic wastes (e-waste), and bulky goods have also increased in the Cook Islands. In general, the waste management regimes within many Pacific island countries, including the Cook Islands, struggle to keep up with the rising consumption and associated waste patterns of their citizens, and their industrial and tourism sectors. This is largely due to limited physical space for the waste products, and a lack of financial and human resources to meet the growing waste management challenges. Solid and hazardous waste management are explored further in the Waste subtopic in the Built Environment Theme.

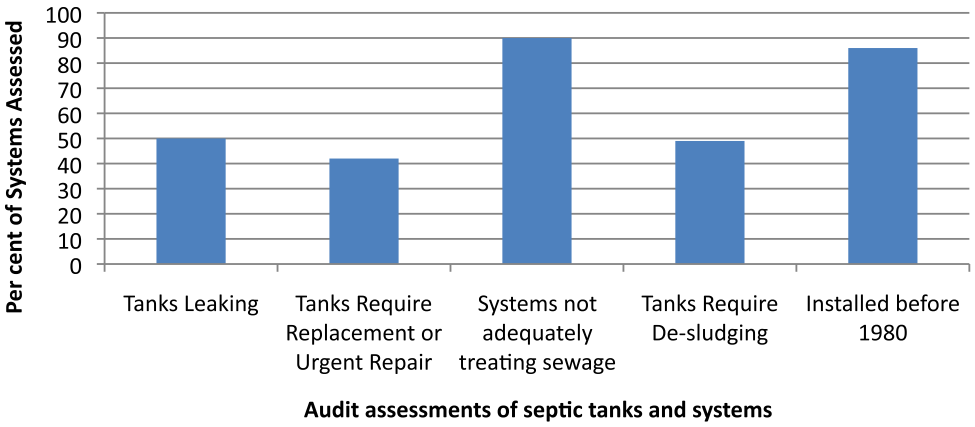


FIGURE 42. Results of 2011 audit on Rarotonga septic tanks and systems.
(Audit of Rarotonga's Domestic Sanitation Systems, Cook Islands Ministry of Health, 2011)

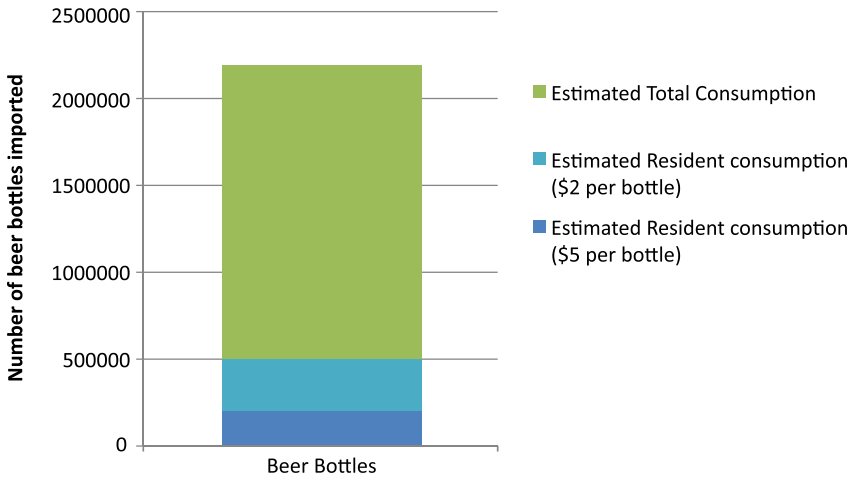
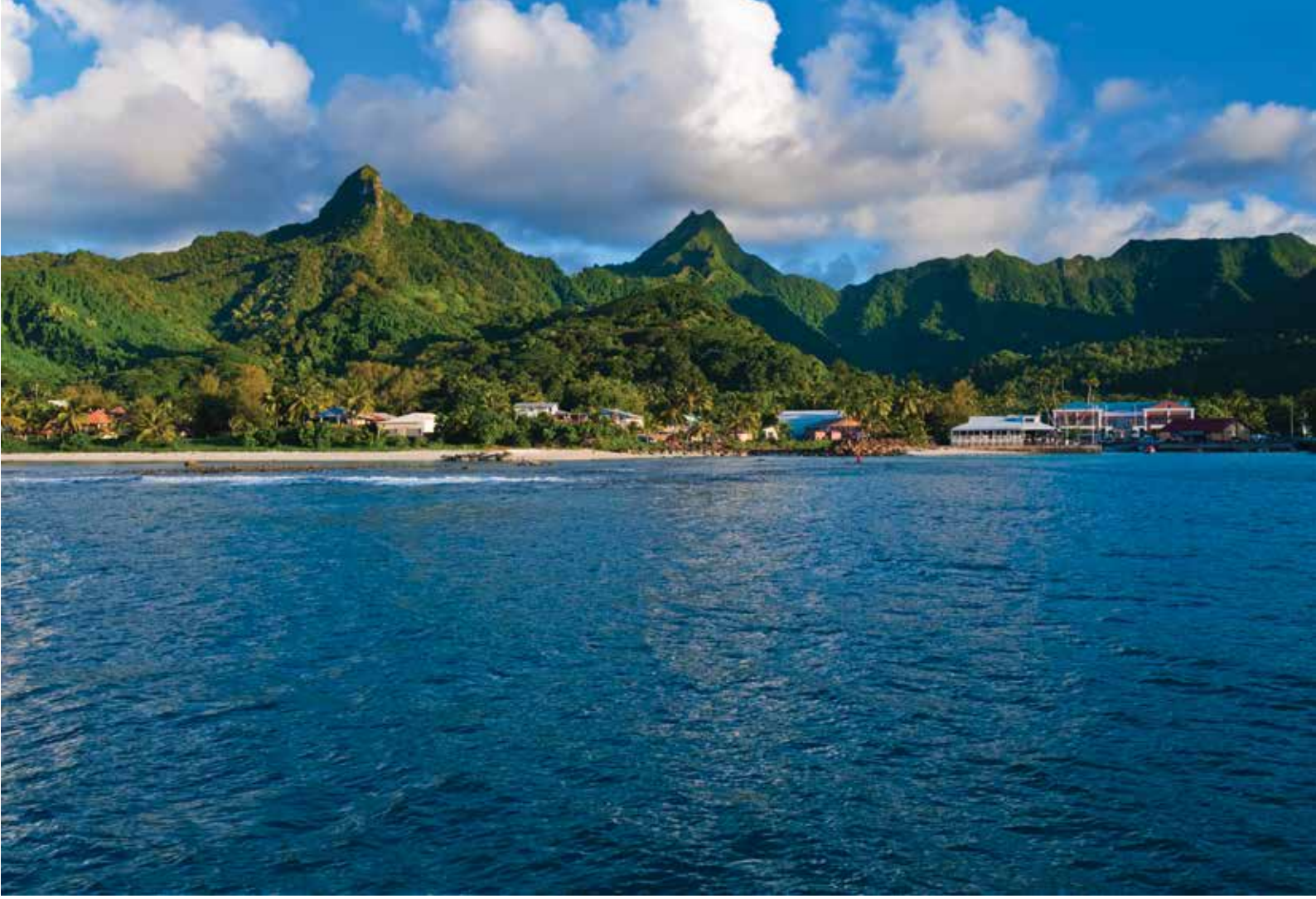


FIGURE 43. Cook Islands estimated beer bottle imports for consumption, 2013. (WATSAN, based on beer imports by 3 major distributors compared to average resident consumption (by expenditure) of beer by citizens in the 2005 Household survey)



© David Kirkland

SOURCES

Anderson, M. 1998. The ecological sustainability of pearl farming in Manihiki lagoon, northern Cook Islands. SPC Pearl Oyster Information Bulletin #11).

Chin, A., Lison De Loma, T., Reytar, K., Planes, S., Gerhardt, K., Clua, E., and Burke, L., Wilkinson, C. (2011). Status of Coral Reefs of the Pacific and Outlook: 2011. Publishers Global Coral Reef Monitoring Network. 260 P.

Food and Agriculture Organization of the United Nations (FAO). 2000. Agriculture and Fisheries Census and Statistics Cook Islands Census

Government of Cook Islands. 2003. Environment Act.

Jackson, J.B.C., Donovan, M.K., Cramer, K.L., Lam, V.V. (eds). 2014. Status and Trends of Caribbean Coral Reefs: 1970–2012. Global Coral Reef Monitoring Network, IUCN, Gland, Switzerland.

Kanhaiya, L. 2008. *Public sector downsizing in the Cook Islands: some experience and* lessons. South Pacific Studies, 28 (2). pp. 69–85. ISSN 0916–0752

Ministry of Agriculture and Statistics Office. Cook Islands Census of Agriculture 1988. Rarotonga, Cook Islands.

Ministry of Agriculture and Statistics Office. Cook Islands Census of Agriculture and Fisheries 2011. March, 2014.

Ministry of Finance and Economic Management (MFEM). 2014. Te Mato Vai – Water Supply Master Plan for Rarotonga.

Molony, B. 2006. SPC Oceanic Fisheries Programme, Cook Islands National Tuna Fishery Status report No. 11, Aug 2006.

Ministry of Marine Resources, Cook Islands. 2009. Cook Islands Longline Fishery Annual Reports 2009.

Ministry of Marine Resources. 2009. Water quality reports.

Ministry of Marine Resources, Cook Islands. 2013. Cook Islands Longline Fishery Annual Reports 2012.

National Millennium Development Indicators (NMDI). Online Database. Pacific Community. Version 2.0.

Pacific Community (SPC). 2012. Country Energy Security Indicator Profile 2009. Prepared by the Energy Programme, Economic Development Division, Secretariat of the Pacific Community.

SPC Oceanic Fisheries Programme. 2013. The potential for interactions between commercial tuna fisheries and Cook Islands artisanal fisheries: Issue-Specific National Report 5.2, 2013.

Cook Islands Statistics Office. 2012. Cook Islands 2011 Census of Population and Dwellings.

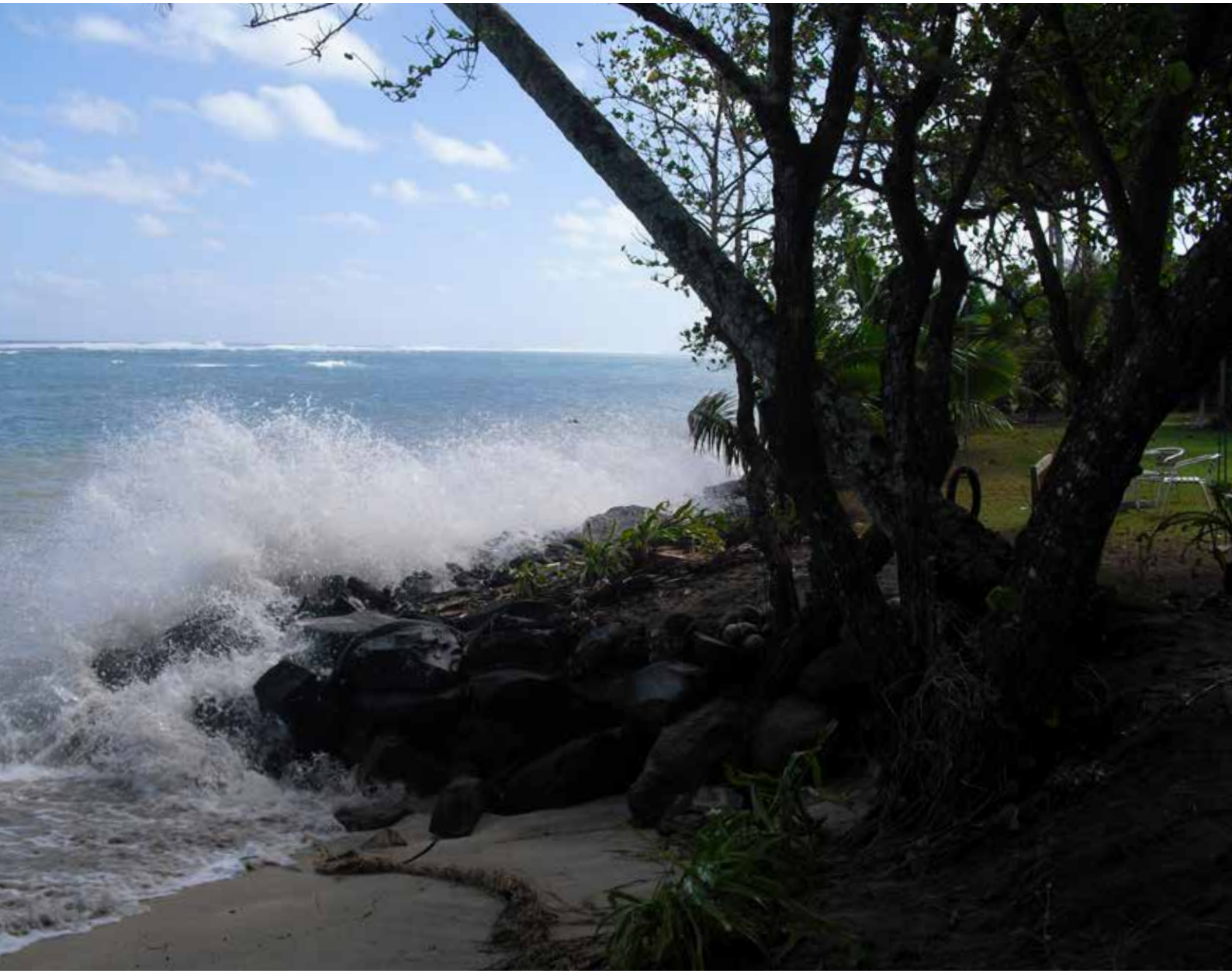
Te Mato Vai. 2013: Te Mato Vai Draft Master Plan – Consultation Summary.

United Nations Framework Convention on Climate Change (UNFCCC). 1992. United Nations.

United Nations Environment Programme (UNEP) Live. 2013. Online Database (uneplive.unep.org).

MAP: Pacific Community (SPC): Potential minerals occurrences and maritime boundaries in the south-west Pacific region. Geoscience Division of SPC. March 2016.

STATE OF THE ENVIRONMENT, IMPACT AND CURRENT AND RECOMMENDED RESPONSES



U.Wragg

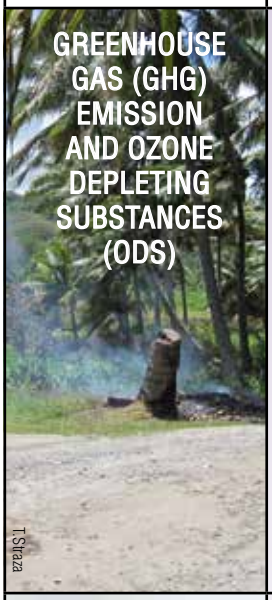
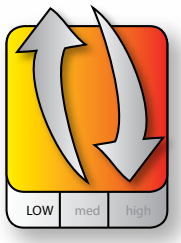
OVERVIEW

This chapter on the state of Cook Islands' Atmosphere and Climate focuses on four areas: Greenhouse gases (GHGs), Ozone Depleting Substances (ODS), Physical Climate and Climate trends (air temperature, precipitation, and extreme climatic events) and Climate Adaptation (food security, water security, health and flood risks).

Through the greenhouse effect, the increase in concentration of GHGs in the atmosphere has been shown to influence climate change, which results in more intense storms and droughts, and higher sea level and temperatures. The Cook Islands National Energy Policy seeks to achieve 100% renewable energy by 2020.

As of 2014, five per cent of the country's energy comes from renewable sources, thus it is necessary to prioritise the development of the renewable energy sector. Cook Islands phased out ODS over the last decade and has fully complied with the Montreal Protocol. Chlorofluorocarbons (CFCs) were phased out in 2010 and Cook Islands is ahead of schedule in phasing out hydrochlorofluorocarbons (HCFCs) by 2030, with a current import level of 0.3 metric tonnes in the third quarter of 2014. Climate adaptation is recognised as a priority and Cook Islands is assessing the vulnerability of each of its islands.

ATMOSPHERE AND CLIMATE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
	**ODS** **Status** Fair **Trend** Improving **Data confidence** Medium  **GHGs** **Status** Fair **Trend** Deteriorating **Data confidence** High 	Ozone depleting substances (ODS) have been greatly reduced; CFCs phased out in 2010 and HCFCs in 2015. GHGs have increased over the past 20 years. Most GHG emissions are from the energy sector, with domestic aviation, solid and liquid waste management, agriculture and industrial coolants and solvents also significant sources of GHGs.	Cook Islands should maintain its strong response to reducing ODS, particularly HCFCs, and build on its past successes. Cook Islands should offer regular refresher training courses for technicians under the National Ozone Unit's training course, and should keep records of ODS imports and exports. The Renewable Energy Chart aims to reach 100% renewable sources of electricity by 2020. Programmes should be developed to reduce GHG sources from other sectors including road transport, domestic aviation and shipping. This includes investments in public transport and restrictions on certain vehicle types.
	 **Status** Good to Fair **Trend** Deteriorating **Data confidence** High	Mean and extreme temperatures and rainfall are usually higher in the northern Cook Islands, with little seasonal variation in temperature in both island groups. Cook Islands has a wet season and a dry season, and its climate is strongly affected by the South Pacific Convergence Zone (SPCZ), and by El Niño /La Niña events. Climate change projections include warming temperatures, sea level rise, ocean acidification, increased rainfall and changes in wind patterns, all of which have various environmental, social and economic impacts.	Cook Islands is committed to addressing, preparing for and mitigating climate change impacts, such as through its role as a signatory in international climate change treaties. Cook Islands should expand data collection of climate related indicators, expand disaster preparedness programmes particularly for tropical cyclones, and increase natural, ecosystem-based adaptation projects. Integration of climate change information into cross-sectoral planning and management regimes is essential to prepare for climate impacts into the future.
	 **Status** Fair to Poor **Trend** Mixed **Data confidence** Low	Climate adaptation is recognised as a high priority, and it is being addressed by all sectors from government to NGOs and youth. This report focuses on the state and need for climate adaptation in the areas of water security, food security, health, land use and infrastructure. Climate adaptation activities can range within each of these areas. Cook Islands has made good progress in integrating climate adaptation into national and international policies, and undertaking a range of partnership projects. However, due to the many vulnerabilities and risks associated with climate change, adaptation efforts will need to remain a high priority into the future, with greater investment into adaptation projects.	Cook Islands should continue to prioritise climate adaptation projects, and should further integrate climate proofing into future infrastructure development and policy requirements such as EIAs. There is good progress with vulnerability assessments across the country. Many climate adaptation options are likely to vary from island to island. Where possible, Ecosystem-based Adaptation (EbA) approaches should be prioritised to ensure long term adaptive, financial and environmental sustainability of adaptation projects.

ATMOSPHERE AND CLIMATE – GREENHOUSE GAS (GHG) EMISSIONS

Introduction

The six greenhouse gases (GHGs) reported under the United Nations Framework Convention on Climate Change (UNFCCC) are carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), sulphur hexafluoride (SF6), Perfluorocarbons (PFCs) and Hydrofluorocarbons (HFCs). Through the greenhouse effect, the increase in concentration of these gases in the atmosphere enhances climatic changes. These include, among others, increased intensity of storm events, droughts, and an overall increase in sea level and temperatures. Figures 44 and 45 show how the Cook Islands is vulnerable to the effects of greenhouse gases. It is important to track emissions of these gases both to understand national contributions to global levels of GHGs and to track national progress in GHG reduction as part of the UNFCCC framework.

The first Cook Islands GHG inventory for the UNFCCC took place in 1999, and covered 1994 GHG emissions. The Cook Islands Second National Communication under the United Nations Framework Convention for Climate Change was completed in 2011 and covered GHG inventories for 2000–2006. Both inventories estimated the tonnes of GHGs emitted by the Cook Islands' four most energy intensive sectors: Industry, Energy, Waste and Agriculture/ Forestry. The 2000–2006 inventories examined each sector's sources of GHG emissions in detail. An example is the comparison undertaken between GHG emissions from both road transport and domestic aviation.

For this report, GHG emissions by sector and year are based on the first and second National Communications inventories, from 1994 and 2001–2006, respectively. All GHGs are converted to tonnes of CO_2 equivalents for ease of comparison.

Status
Fair

Trend
Deteriorating

Data confidence
High

Status: Fair Trend: Deteriorating Data Confidence: High

The Cook Islands Second National Communication under the UNFCCC revealed that per capita GHG emissions rose by 56% between 1994 and 2006 (3.6 t CO_2 per capita). This largely resulted from the increased availability and use of electricity, higher national consumption of energy-reliant products such as air conditioners, vehicles, white goods and other electronics, and a dramatic increase in tourism.

The relative contribution of GHG emissions by sector and the overall trends in GHG emissions from 1994 to 2006 have risen 62% (Figure 46). The energy sector is the biggest contributor to GHG emissions. Between the 1st to the 2nd National Communications the procedures and accounting improved, thereby increasing the GHG number by fully accounting for the production of GHGs. There is a possibility that the 1st National Communication actually under-counted emissions, and therefore the increase is due to better accounting. In 2006, electricity generation comprised 34% of total GHG emissions, and road transport comprised 33% of total GHG emissions (Figure 47). The remaining sources of emissions were dominated by domestic aviation, solid and liquid waste management, agriculture and industrial coolants and solvents.

FIGURE 44. Squall at Tongareva Atoll.

FIGURE 45. Water coming ashore during Cyclone in 2005 (Pitt Media Group)

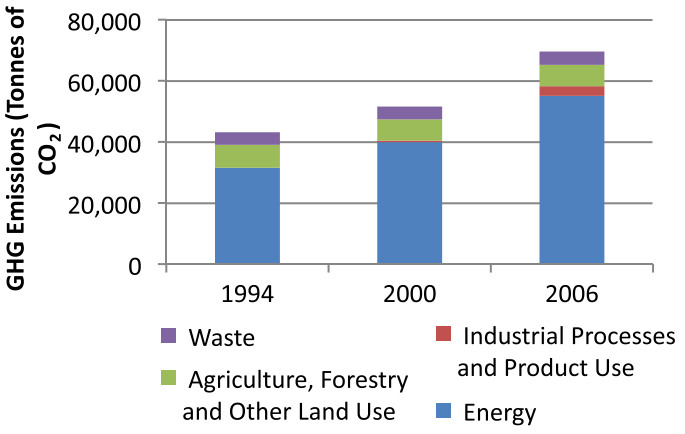


FIGURE 46. National trends in Cook Islands GHG emissions by sector, 1994, 2000 and 2006. (Cook Islands Second National Communication under the UNFCCC, 2011)

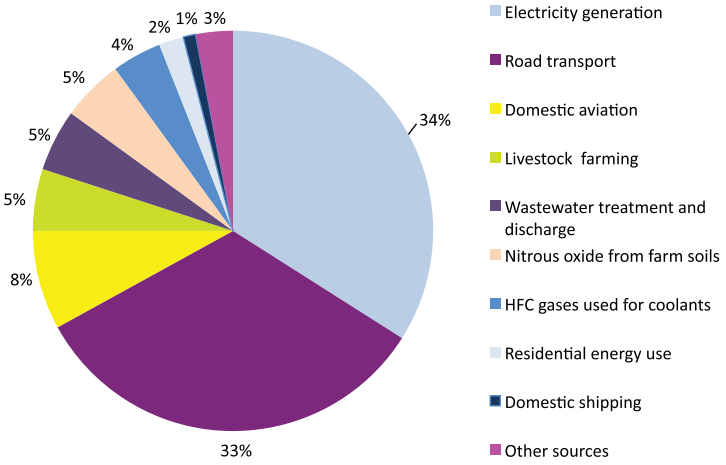


FIGURE 47. Dominant sources of GHGs in the Cook Islands, 2006. (Cook Islands Second National Communication under the UNFCCC, 2011)

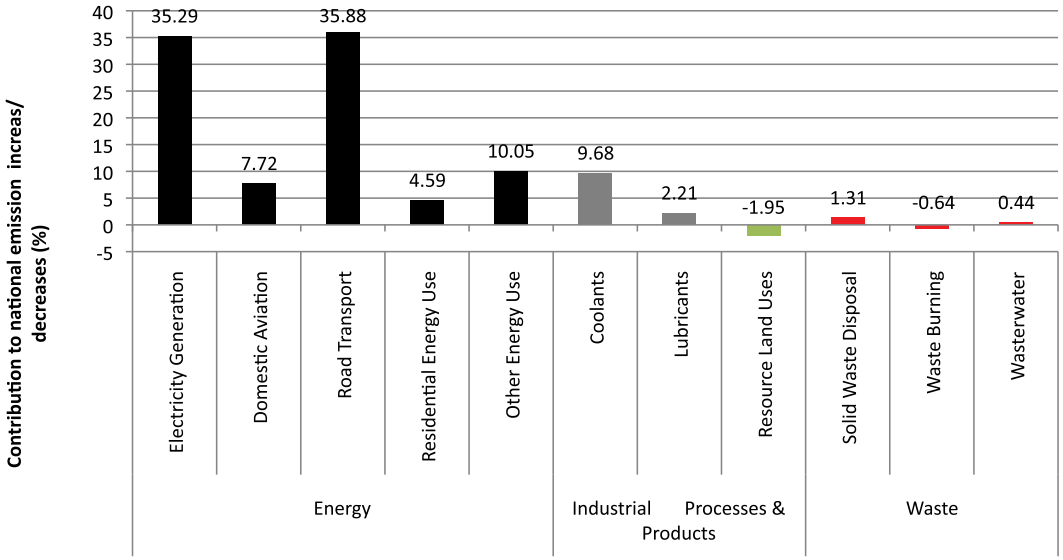


FIGURE 48. Relative change in contribution to Cook Islands GHG emissions between 1994 and 2006. (Cook Islands Second National Communication under the UNFCCC, 2011)

International aviation is not included in this analysis, as foreign operated airlines report their emissions to their respective countries, and not the countries they fly to.

The energy sector was the biggest contributor to increasing amounts of GHG emissions from 1994–2006, and accounted for over 90% of increased GHG emissions during this time (Figure 48). The use of coolants in air conditioning and lubricants for industrial processes and products added more than ten per cent of the increases in Cook Islands' GHG emissions from 1994–2006. As shown in the agricultural census dating back to 1986, the agriculture and forestry sector (resource land uses) has declined. This is consistent with the decline in the agricultural sector (MOA 1986, 2000 and 2011).

While forests in the Cook Islands add little to GHG emissions or sequestration, they do represent a 'carbon sink' and are an important buffer. Based on increased GHG emission per capita, and the relatively low per capita rate in comparison to developed countries, the GHG emissions indicator 'Status' is considered 'fair' but 'deteriorating' (trend) with 'high' confidence in the data. Efforts to introduce renewable sources of energy in the Cook Islands may slow this trend, although it is still too early to tell (Figure 49). Renewable energy sources are discussed further in the response section.

Impact

GHG emissions have several impacts globally and locally. Firstly, increased GHG emissions cause far reaching climate impacts. These were discussed in the Drivers section five. Secondly, with energy production and road transport reliant on fossil fuels, there are several local impacts including reduced air quality from fossil fuel burning and reduced energy security from volatile world fuel prices and shipping disruptions. Both high and fluctuating fuel prices have a destabilising effect on the local economy and households and limit economic growth, particularly in isolated and vulnerable areas.
Fuel shortages for road transport occur from time to time (Figure 50).

FIGURE 49. Micro Wind turbine behind Muri beach.

FIGURE 50. Lining up for petrol during a fuel shortage in Rarotonga, May 2014. (Mark Graham, SPREP)

Responses and Recommendations

The Cook Islands' first National Energy Policy was enacted in 2003. This policy was replaced by the 2009 National Renewable Energy Policy, and again by the 2011 Renewable Energy Chart. The Government policy proposed specific policies, measures and actions in six areas:

1. Harnessing renewable energy;
2. Clean and green transportation;
3. Being energy smart;
4. Having the right infrastructure;
5. Awareness that prompts change; and
6. Building our capacity.

(from the Cook Islands Second National Communication under the UNFCCC, 2011).

The Customs Tariff Act 2012 set duty rates on the import of motor vehicles as the transport sector is the highest GHG emitter. Cook Islands is looking to embrace proven low carbon transport technologies. Incentives for promoting clean energy transportation are currently being explored (INDC to the UNFCCC, 2015).

The Cook Islands 2011 Renewable Energy chart has an ambitious goal of '50/15 and 100/20' or 50% of islands powered by renewable electricity by 2015, and 100% by 2020. As of 2014 the Cook Islands generates five per cent of its electricity from renewable energy, up from one per cent in 2009. Cook Islands has achieved its 50% target of having half of their islands shifting from diesel to renewable electricity (Figure 51), and is on track to achieving the 2020 target (INDC to the UNFCCC, 2015). Cook Islands submitted their Intended Nationally Determined Contribution (INDC) to the UNFCCC in 2015 which shows their commitment towards the outcome of the UN climate conference in Paris (INDC to the UNFCCC, 2015). Energy efficient light bulb and appliance programmes have helped to reduce energy demand. More information on renewable energy can be found in the Built Environment Theme.

The phase out of HCFCs as a coolant should substantially reduce GHG emissions from the industrial products sector.

It is recommended that Cook Islands prioritise energy efficiency, self-sufficiency and security to reducing greenhouse gas emissions and mitigating their impacts by switching to renewable electricity sources. This includes other sectors responsible for large GHG emissions such as road transport, domestic aviation and shipping. These programmes and policies could include investments in public transport at the same time to create incentives for improvements.

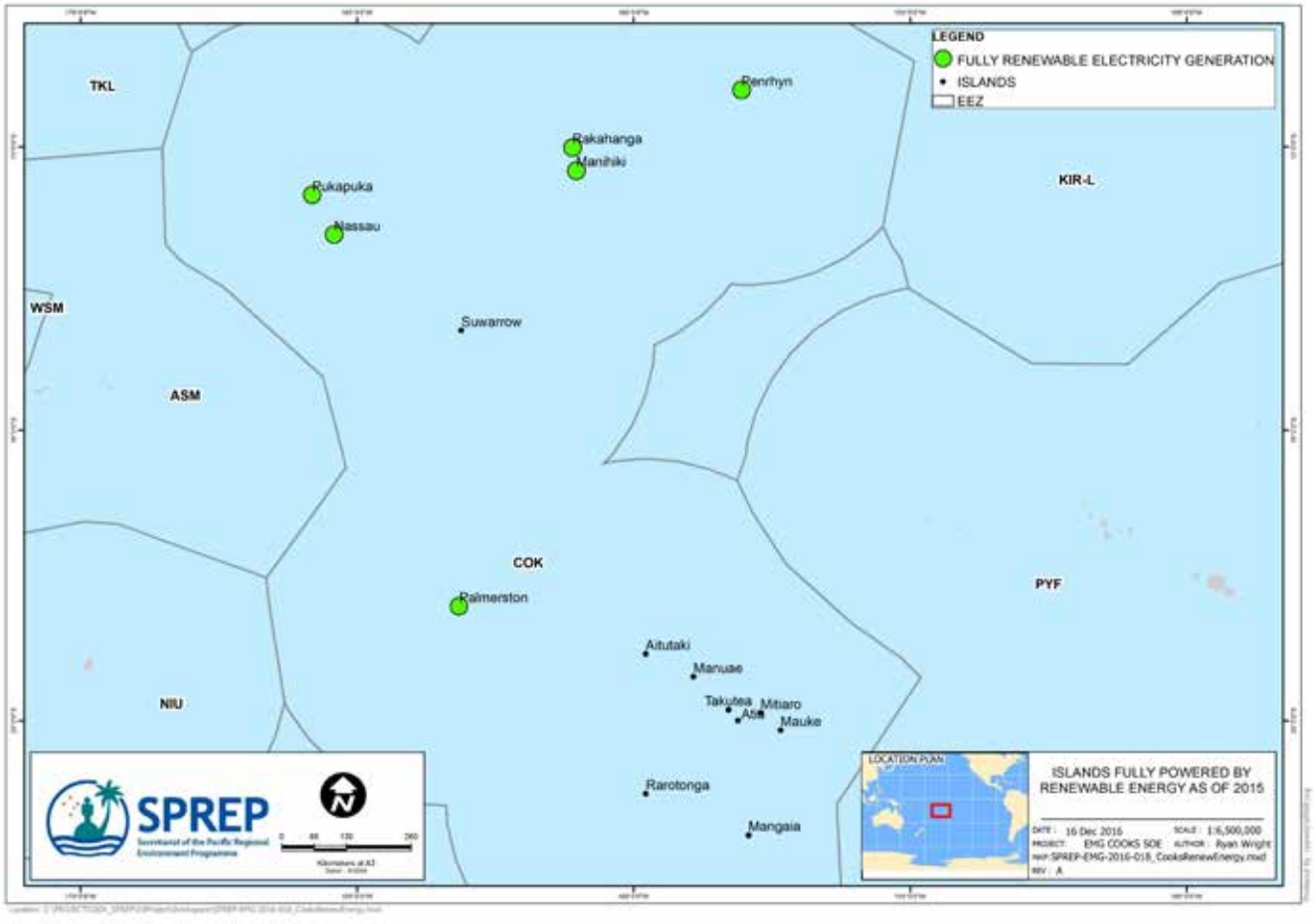


FIGURE 51. Islands with full renewable electricity generation. (SPREP 2016. Data source: Government of Cook Islands)

SOURCES

Government of Cook Islands. 2012. Customs Tariff Act 2012.

Government of Cook Islands. 2016. UPDATED: Cook Islands Renewable Energy Chart – June 2016.

Intended Nationally Determined Contributions to the UNCCC from Cook Islands. Submitted 20.11.2015.

National Environment Service (NES) of the Government of the Cook Islands. *Cook Islands Second National Communication under the United Nations Framework Convention for Climate Change*, National Environment Service, Tu'anga Taporoporo, Cook Islands, December 2011.

National Environment Service (NES), Tu'anga Taporoporo, Cook Islands. http://nescookislands.com/ 07.10.2016.

Ministry of Agriculture and Statistics Office. *Cook Islands Census of Agriculture 1988*. Rarotonga, Cook Islands.

Ministry of Agriculture. *Cook Islands Census of Agriculture and Fisheries 2000*. September, 2001.

Ministry of Agriculture. *Cook Islands Census of Agriculture and Fisheries 2011*. March, 2014.

Secretariat of the Pacific Regional Environment Programme (SPREP). 2014. Environmental Monitoring and Governance (EMG) Division, photo by Mark Graham.

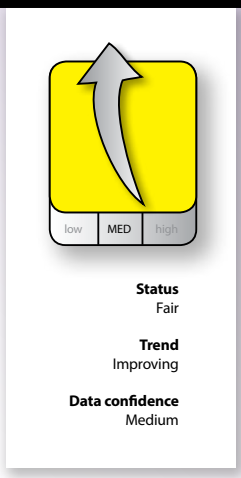
ATMOSPHERE AND CLIMATE – OZONE DEPLETING SUBSTANCES

Introduction

Stratospheric ozone is naturally generated at high altitudes (15–50km above the earth's surface), and protects humans and other life forms from harmful ultraviolet energy from the sun. Chlorofluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs) and other Ozone Depleting Substances (ODS) deplete stratospheric ozone by reacting with it, and breaking it down. ODS are found in many products and household items, and have a number of applications, including for refrigeration, air conditioning, solvents and fire extinguishers.

The Montreal Protocol is an international agreement designed to eliminate the production and consumption of ODS. The Montreal Protocol was adopted in 1987, and has since been revised and amended. The Cook Islands became party to the Montreal Protocol on 22 December, 2003.

This indicator reviews Cook Islands' consumption of CFCs and HCFCs since 1995, based on data provided to the United Nations Environment Programme (UNEP). Values are given in ozone depleting potential (ODP) units, which is a measure of the relative amount of degradation to the ozone layer that ODS chemicals can cause. Depending on their makeup, CFCs have anywhere from five to 200 times more ODP compared to HCFCs.



Status: Fair Trend: Improving Data Confidence: Medium

Since the 1980s it is estimated that four types of ozone depleting substances have been imported into Cook Islands in bulk form. These are: chlorofluorocarbons (CFCs), Hydrochlorofluorcarbons (HCFCs), methyl bromide and halons. CFCs and HCFCs are used for refrigeration and air conditioning, methyl bromide was used for quarantine fumigation and halons are used for fire protection. The consumption of ozone depleting substances in Cook Islands is exclusively in the refrigeration and air conditioning sector (NES, 2016). Due to international and national efforts, CFCs declined rapidly in Cook Islands from 1995 onward, and as of 2010 CFCs have been phased out. Data collection on HCFCs began in 2008 and shows a decline from 2010 to 2013 (Figure 52). No ODS data was collected for the Cook Islands between 1999 and 2008.

The Cook Islands is working to phase out all of its HCFCs. A baseline for the import of HCFCs was based on an average of 2009 and 2010 data at 1.2 metric tonnes. In 2012 the import of HCFCs was 0.75 metric tonnes, down 39% on the 2009/2010 average. It dropped again in 2013 by 30.5% to 0.37 metric tonnes. By 2015 no HCFCs were imported. This means that Cook Islands is 15 years ahead of the phase out schedule set by the Montreal Protocol, whose goal was 2030 to phase out 97.5% of all HCFCs (Figure 53).

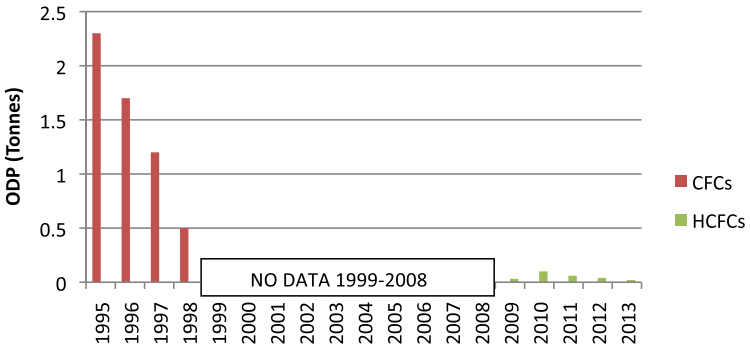


FIGURE 52. Cook Islands CFC and HCFC consumption, 1995–2013. (UNEP)

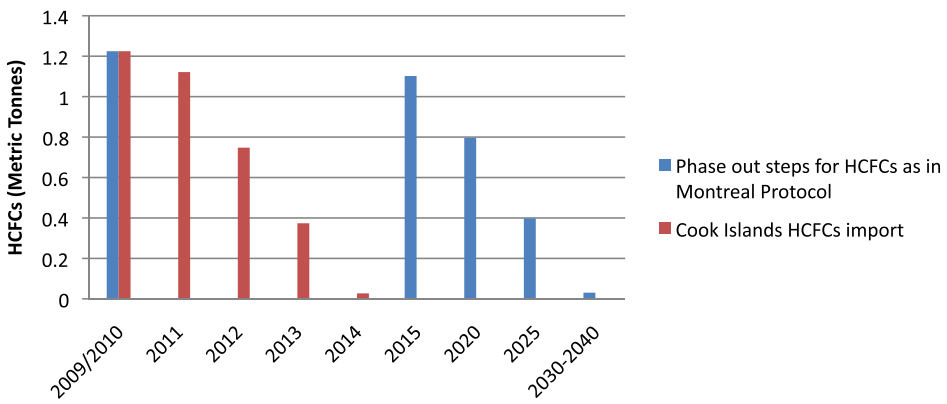


FIGURE 53. Comparison of Cook Islands phase out steps for HCFCs as in the Montreal Protocol (blue) with and actual imports of HCFCs (red) up to third quarter of 2014. (Montreal Protocol and UNEP and pers. comm. NES)

Impact

ODS are not only harmful to the ozone layer, they are also a potent source of Greenhouse Gases (GHGs). HCFCs have 2000–3000 times greater global warming potential than does CO_2, although amounts in the atmosphere are much less. Phasing out of ODS not only helps to protect the ozone layer, but also benefits climate change mitigation through reduction of GHGs emissions. Figure 54 shows empty canisters of an HCFC.

As a signatory to the Montreal Protocol, there are trade implications if the Cook Islands accepts, or illegally trades, in ODS. The phase out of ODS is important for the Cook Islands' environment, but also for its economy to protect against adverse trade implication and ensure compliance and good global standing as a signatory to the Montreal Protocol.

FIGURE 54. Disposed R22 Canister and HCFC refrigerant. (swa.org)

Response and Recommendations

Cooks Islands has phased out CFCs, and is ahead of schedule to phase out HCFCs. The National Ozone Unit (NOU) updated the Environment Act to provide an ODS import quota system and include a Technicians Licence to legally service equipment containing ODS. This includes a requirement for technicians to attend training in 'Good Practices in Refrigeration' as well as refresher courses. The training covers the proper handling of ODS and educates the technicians about the importance of avoiding any gas leakages or discharges of ODS into the atmosphere. Between 2010 and 2013 the number of certified ODS recovery technicians increased from 16 to 24. A Memorandum of Understanding (MOU) between the NOU and Customs provides training to customs officials to identify and report illegally imported ODS.

Data collection and monitoring of ODS imports improved after 2008. ODS recovery equipment is available for Rarotonga, including recovery cylinders. ODS recovery and re-use is growing across Rarotonga. CusPac Customs system software helps to track and detect tariff codes for ODS, which assists with monitoring and management measures.

Currently records are not kept for ODS exports for disposal from Cook Islands. Recording ODS exports, as well as imports of ODS alternatives such as HCs and HFCs, would assist in the overall monitoring and management of ODS. Regular refresher training courses for the National Ozone Unit's technicians would ensure their skills are up to date.

SOURCES

United Nations Environment Programme (UNEP). 2000. The Montreal Protocol on Substances that Deplete the Ozone Layer

National Environment Service (NES), Tu'anga Taporoporo, Cook Islands. *Ozone Depleting Substances (ODS) phase out in the Cook Islands.* http://nescookislands.com/advisory-compliance-division/ozone-depleting-substances/. 07.10.2016.

United Nations Environment Programme (UNEP). Ozone Secretariat. *ODS Database. http://ozone.unep.org/. ODS Consumption in ODP Tonnes, data retrieved from database when last updated 23 September 2014.*

Introduction

Climate plays an integral role in the regulation of the environment and the services it provides. This section considers the climate trends in the northern and southern Cook Islands trends. It also assesses the state of various climate parameters including temperature, rainfall, cyclone frequency and waves. The main influences on the climate of the Cook Islands are the South Pacific Convergence Zone (SPCZ), the El Niño-Southern Oscillation (ENSO) and its counterpart La Niña. This section also presents climate change projections to 2100 for Cook Islands and related impacts. Most data comes from the Cook Islands Meteorological Service, along with a number of national climate related reports.

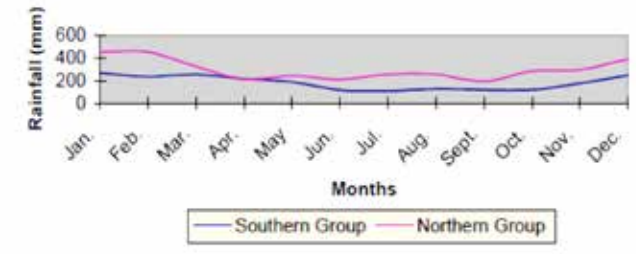


FIGURE 55. Cook Islands monthly average rainfall. (Australian Bureau of Meteorology and CSIRO. 2014)

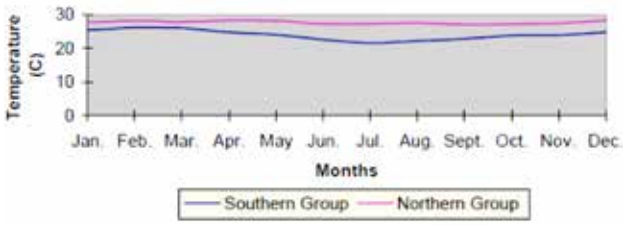


FIGURE 56. Cook Islands monthly average temperature. (Australian Bureau of Meteorology and CSIRO. 2014)

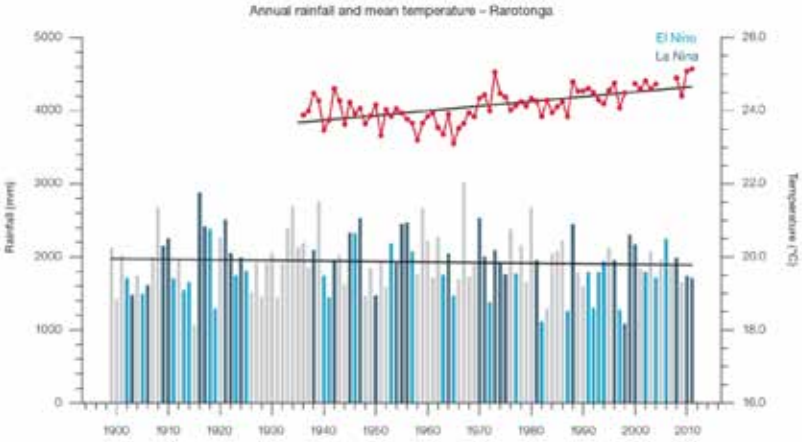


FIGURE 57. Annual rainfall and mean temperature – Rarotonga. (Australian Bureau of Meteorology and CSIRO. 2014)

Status
Good to Fair

Trend
Deteriorating

Data confidence
High

CLIMATE TRENDS

Status: Good to Fair Trend: Deteriorating Data Confidence: High

There are significant differences in climate, including variability and trends, between the northern and southern Cook Islands. For this reason, this report often differentiates between the two. Mean and extreme temperatures, and rainfall, are usually higher in the northern group. There is little seasonal variation for temperature in the two island groups (Figures 55 and 56).

The climate is strongly affected by the South Pacific Convergence Zone (SPCZ), which lies to the west and south of the northern Cook Islands, and to the north of the southern Cook Islands. There is a wet season (November-April) when the SPCZ is more active, and a dry season (May to October) when the SPCZ is generally to the north of the southern Cook Islands. This island group is more affected by the dry southeast trade winds. The SPCZ's inter-annual variability is strongly affected by El Niño and La Niña events, which in turn strongly influence the climate. El Niño years bring above average rainfall to the northern Cook Islands and drier conditions to the southern Cook Islands. Figure 57 shows that Rarotonga has an average annual rainfall of 2000 mm, with average annual temperature of about 20° C from the late 1800s. Conversely, La Niña years bring below average rainfall to the northern Cook Islands and above average rainfall to the southern Cook Islands. Data for Rarotonga shows that the annual number of warm nights are increasing, while the number of cold nights are decreasing (Figure 58). Table 6 summarises the physical climate and climate trends.

TABLE 6. Southern and northern Cook Islands climate trends. (Australian Bureau of Meteorology and CSIRO. 2014)

Trend	Southern Cook Islands (Rarotonga station)	Northern Cook Islands (Tongareva station)
WARMING	Warming trends are evident. The annual number of warm nights has increased, and the number of cold nights has decreased, for 1934–2011 (Figure 54).	No trend in annual mean temperatures, for 1941–1991.
RAINFALL (general trend for Cook Islands)	Little change in annual and half-year rainfall trends, since 1899. Little change in extreme daily rainfall since the 1930s.	
TROPICAL CYCLONES (general trend of Cook Islands)	Occur mainly between November and April within the Exclusive Economic zone (EEZ), with an average of 18 cyclones per decade (1969/1970–2010/2011 seasons). Most frequent during El Niño years (average 28/decade) and least frequent during La Niña years (average six cyclones per decade). Seventeen of the 53 tropical cyclones within the Cook Islands EEZ from 1981/1982–2010/2011 were considered 'severe' events (Category 3 and higher).	
WAVES	Larger storm waves can be found in the southern Cook Islands compared to the northern Cook Islands. Wind waves are influenced by trade winds as well as the South Pacific Convergence Zone (SPCZ) seasonally and the El Niño-Southern Oscillation (ENSO) and Southern Annular Mode (SAM) inter-annually.	

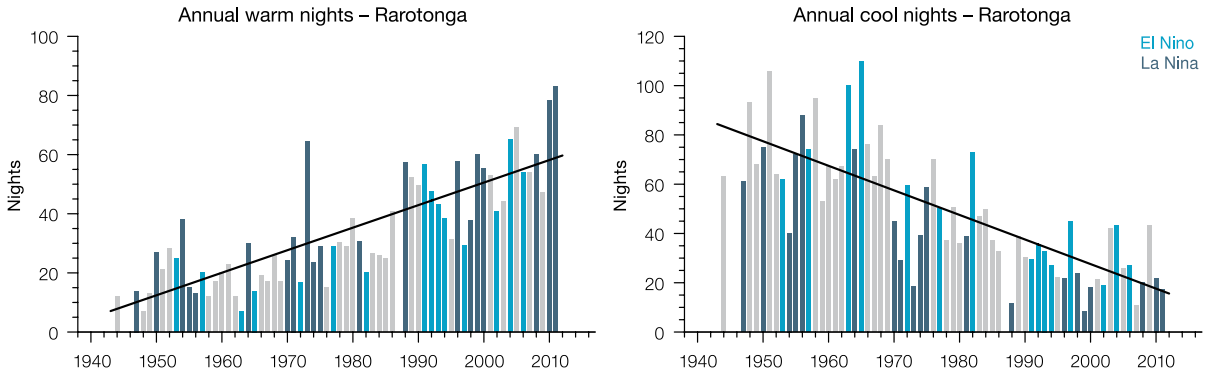


FIGURE 58. Annual warm and cool nights in Rarotonga (Australian Bureau of Meteorology and CSIRO. 2014)

TROPICAL CYCLONES

Tropical cyclones (TCs) are the most extreme climate events that affect Cook Islands. The most serious and powerful TCs usually occur between November to April, and increase in frequency and intensity during El Niño years. The two cyclone seasons, 2004/2005, and 2009/2010 impacted the Cook Islands heavily. Six TCs crossed during the 2004/2005 season, three of which were Category 5, devastating Pukapuka, Rarotonga and Mangaia. TC Pat, a Category 4 cyclone during the 2009/2010 season devastated Aitutaki. Other major TCs in recent years include TC Sally (1986), TC Peni (1990), TC Martin (1997) and TC Pam (1997). Figure 59 shows the number of TCs which crossed the Exclusive Economic Zone (EEZ) between 1969 and 2009. There were three major cyclones in the early 1980s, late 1990s and mid 2000s.

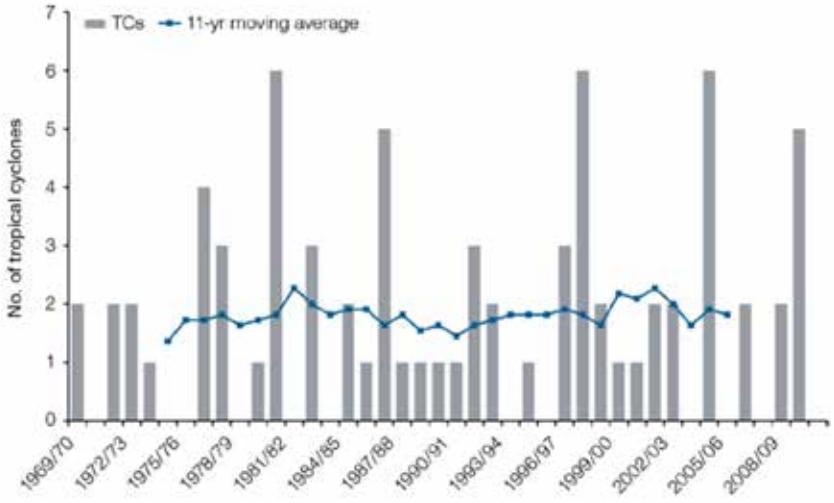


FIGURE 59. Tropical cyclones crossing the Cook Islands Exclusive Economic Zone, 1969–2009. (Australian Bureau of Meteorology and CSIRO. 2014)

CLIMATE PROJECTIONS

Temperatures will increase in the Cook Islands (Table 7). Maximum air temperature increases in the northern Cook Islands (Tongareva station) will be larger than in the southern Cook Islands, with warming by 2090 projected to be between 0.6°C and 4.2°C, compared to 0.7°C to 3.9°C for the southern Cook Islands (Rarotonga station). Climate models predict an increase in prevailing southeast trade winds, with increasing easterlies for the southern Cook Islands and increasing southerlies for the northern Cook Islands. It is predicted that sea level rise and ocean acidification will continue with more events of coral bleaching. The average rainfall will stay similar to the current climate patterns but with higher frequency and intensity of extreme rainfall. This can be explained as a warmer atmosphere (increase in mean temperature) holding moisture which leads to more extreme rainfall. Under the high emission scenario it is predicted that northern Cook Islands will have less annual rainfall, but more extreme rain events and more droughts. There are no predictions that droughts will increase in the southern Cook Islands (Australian Bureau of Meteorology and CSIRO. 2014).

TABLE 7. Cook Islands long-term climate projections. (Australian Bureau of Meteorology and CSIRO. 2014)

Climate trend	Climate Projection	Confidence Level (Very High, High, Medium, Low)
El Niño and La Niña events	Will continue into the future, with little consensus regarding frequency or intensity.	Very High
Warming/ Temperatures	Annual mean and extreme high daily temperatures will continue to rise.	Very High
Rainfall	Average annual rainfall projected to remain similar to the current climate, with more extreme rain events, and a small decrease in northern Cook Islands from May-October (under the high emission scenario).	More extreme rain events: High Small decrease in northern Cook Islands: Medium
Waves	Not projected to change significantly, with the exception of potentially more intense cyclones.	Low
Wind	Overall increase in prevailing southeast trade winds, with increasing easterlies for the southern Cook Islands and increasing southerlies for the northern Cook Islands.	Unavailable
Droughts	Southern Cook Islands: projected to remain similar to current climate. Northern Cook Islands: increase slightly (under the high emission scenario).	Medium
Ocean acidification	Will continue.	Very High
Coral bleaching	Increase.	Very High
Sea level	Will continue to rise.	Very High

Impact

Physical climate, climate trends and climate change have many environmental, social and economic impacts, especially in small islands. Climate change impacts in Cook Islands include sea level rise, warming ocean and atmospheric temperatures, potential for changes in migratory species routes, ocean acidification, coral bleaching and droughts. There is the potential for relocation in some cases due to impacts from sea level rise, such as salt water intrusion, and loss of crops and access to freshwater. As the climate changes, traditional signs and methods used to predict weather events are becoming less reliable and less accurate. Poor information on cyclones and disaster planning can result in large scale environmental degradation and greater social and economic impacts, as communities are ill prepared for large scale natural disasters.

Many low lying islands and atolls are particularly vulnerable to extreme weather events and sea level rise. Sea surges and king tides are more common and damaging to crops and water sources, particularly from saltwater intrusion. Some land areas have been scoured and undermined by increasing wave action, or completely reclaimed by the ocean. Extreme weather events can result in loss of habitat, food and water for local wildlife. Foreshore protection may not withstand extreme weather events: for example, many seawalls (often made from rocks) are able to withstand a Category 3 tropical cyclone, but not a Category 5.

Changes in the physical climate and climate trends can also result in more health problems such as dengue fever, gastrointestinal illnesses, heat related illnesses, and the flu. Such illnesses and disease outbreaks can adversely impact the tourism sector, through international travel advisories recommending against travel to Cook Islands.

Recent anecdotal evidence indicates that changes in climate may have resulted in mangoes growing in July instead of September to November, or in the case of Aitutaki, mangoes and breadfruit fruiting all year round. Warmer lagoon water can lead to certain algal blooms which affect fish and other marine life, but also make the water unattractive for tourists. Bad weather and storm events can compromise interisland travel, particularly freight and other shipments, including imported goods. Most islands depend upon rainwater collection for drinking water, and droughts as a result of climatic changes can result in the need to import water, or even to invest in desalination units.

Response and Recommendations

Cook Islands is taking climate change preparations and impacts seriously. Programmes to address the issue include data collection to improve weather forecasting and enable advance climate and disaster preparedness, tide gauge upgrades, collection of local, traditional knowledge on climate and weather predictions, and better collation and dissemination of information about its physical climate and climate change. The commitment to international treaties and partnerships to address climate change is evidenced through Cook Islands' membership in the Alliance of Small Island States (AOSIS), and its position as a signatory to the UNFCCC (1992), the Kyoto Protocol (2001) and the Paris agreement (2016).

The Climate and Disaster Compatible Development Policy (2013–2016) has three strategic areas to address the adverse impacts of climate change: strengthen resilience, low carbon development and an enabling environment. The policy provides a roadmap to address vulnerabilities and mitigation in the Cook Islands. The Joint National Action Plan on Disaster Risk Management and Climate Change Adaptation (2011–2015) maps the implementation plan of action for disaster risk management and climate change (currently under review). The aim of the plan is that everyone has a role to play in strengthening resilience to reduce vulnerabilities. Mitigation efforts are focussed on Renewable Energy (RE), a priority under the NAMA. The work is guided by the Renewable Energy Charter (2016–2020) to achieve the government's target of 100 per cent renewable energy by 2020. All these policies and plans fall under the National Sustainable Development Plan (NSDP 2016–2020).

Under the Adaptation Fund, the Cook Islands now has direct access status for up to $3 million per project and is on the fast track process to be an accredited entity under the Green Climate Fund (GCF). This will recognise that the country frameworks and upgraded financial systems satisfy international standards, while being tailored to national capability, strengths and special circumstances.

Climate change activities in the Cook Islands under the Strengthening the Resilience of our Islands and Communities to climate change (SRIC) is aimed at the Pa Enua, funded by the Adaptation Fund.

These activities include:

- Tablet training targeting seniors, student proposal writing workshop targeting years 9 and 10, coastal and turtle habitat protection, and reforestation with indigenous trees on Tongareva.
- Food security through bio-farming practices in Mangaia, hydroponics in Manihiki and Pukapuka, worm farming in Palmerston, students agriculture in Nassau, protection through provision of fencing and for drainage of agriculture land in Pukapuka affected by salt water intrusion and flooding, eradication of invasive species and planting coconut trees on Mauke.
- Water security through the provision of household water tanks to the southern islands of Atiu, Aitutaki, Mangaia and Palmerston. Provision of community filtered water stations on Mitiaro for clean drinking water. In partnership with GIZ to improve community water access and storage capacity in the northern group islands.
- Sustainable traditional fishing practices through the provision of light weight fabricated canoes for Mitiaro Island. Safety and protection of residents from cyclones and unpredictable severe climate conditions through the provision of lifejackets for the residents of Palmerston Island and the tie-down of residential homes in preparation for severe weather conditions.
- In partnership with the Ministry of Health to prevent the outbreak of vector-borne diseases through the provision of environmentally friendly equipment, sprays and training.
- Ongoing community awareness through cooking workshops promoting the use of locally grown produce and wild plants for better health.
- Coral reef monitoring to verify the health of the reef in Rarotonga and the state of marine ecosystems and bio-diversity.

Data collection, management and dissemination are crucial to address impacts from climate change and climate trends. Data collection programmes can include parameters such as mercury and ocean acidification, mapping and collection of information about health-related impacts from climate events such as dengue fever outbreaks, information about the impacts of cyclone and other major storm events (including impacts on agriculture, biodiversity and local communities), and dissemination of better information for cyclone preparedness.

Communication and collaboration between agencies, NGOs and other support groups involved in climate related emergency responses should be improved. Climate data should be integrated into other sectors such as agriculture, health and social welfare for better preparation and planning. For example, such information could be used in the marine and environmental resources sector to prepare for impacts from coral bleaching and species and habitat losses. The data can assist the agricultural sector to integrate more drought and saltwater resistant crops, the water resources sector to improve water storage, and the energy and tourism sectors to integrate climate information into their planning and management of coastal infrastructure.

Cook Islands should continue to address the vulnerability of coastal infrastructure. Better controls and oversight of development should be established, particularly around streams and wetlands that might have adverse impacts in the case of flooding. The environmental impact assessment process is an important tool to ensure climate resilient design is used in appropriate locations. Climate change planning should include response plans for vulnerable groups such as children, elderly and disabled people. Cyclone shelters and resources should be improved for future cyclone events.

Bleached coral. Photo: E.Torea-Allan

SOURCES

Australian Bureau of Meteorology and CSIRO (2014). Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports. Pacific-Australia Climate Change Science and Adaptation Planning Program Technical Report, Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation, Melbourne, Australia.

Baldi, M., Brett M., Salinger, J., and Hosking, D. 2009. Module 3: The Cook Islands Climate – Variation and Change. 27 May 2009. Prepared for Cook Islands National Environment Service and Cook Islands Meteorological Service. National Institute of Water and Atmospheric Research (NIWA) Ltd. NIWA Client Report: AKL2009–032.

Cook islands Red Cross Society and the International Federation of Red Cross and Red Crescent Societies, Geneva, 2012. International Disaster Response Law (IDRL) in the Cook Islands

Gero, A., Fletcher, S., Thiessen, J., Willetts, J., Rumsey, M., Daly, J., Buchan, J. and Kuruppu, N. 2013. Understanding the Pacific's adaptive capacity to emergencies in the context of climate change: Country Report – Cook Islands. Report prepared for NCCARF by the Institute for Sustainable Futures, and WHO Collaborating Centre, University of Technology, Sydney.

Global Climate Change Alliance: Pacific Small Island States (GCCA: PSIS). 2014. Review of mainstreaming of climate change into national plans and policies: Cook Islands November 2013. Based on a consultancy report by Planning four Sustainable Development and The Four Assist Network of Experts, commissioned by the Secretariat of the Pacific Community (SPC) through the project, funded by the European Union.

Walter, G., Hunnam, P., Pratt, C. and Hay, J.. 2013. Australian Support for Climate Change, Environment and Disaster Risk Management in the Pacific. Findings and Recommendations of an Independent Review and Needs Assessment. August 2013

Island Friends Ltd. 2004. Cook Islands priority environmental problems (PEC) report: a review and assessment of the priority environmental concerns. Apia, Samoa: SPREP, 2004.

Vaiimene, M., Maihia, D. and Bates, N. Climate, climate variability and change of Cook Islands. Pacific Climate Change Science Program. International Climate Change Adaptation Initiative. Poster.

Rongo, T. and Dyer, C. 2014. Using local knowledge to understand climate variability in the Cook Islands. Government of the Cook Islands. 55 pp.

Australian Government Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education; AusAID, Geoscience Australia, 2013: Preparing a nation for the impacts of climate change: Implementing national plans and policies in the Cook Islands

Fes A. de Scally. Evaluation of storm surge risk: A case study from Rarotonga, Cook Islands. International Journal of Disaster Risk Reduction 7 (2014) 9–27

Blacka M.J., Flocard, F., P.F., Rayner, D.S. and Parakoti, B.. 2014. Coastal Adaptation Needs for Extreme Events and Climate Change, Avarua, Rarotonga, Cook Islands, Water Research Laboratory, School of Civil and Environmental Engineering, UNSW Australia, Manly Vale, NSW, 2093, WRL Technical Report, WRL TR2013/13

N.Woonton

© Pitt Media Group

Nikao Maori School struck during the cyclone season in 2005. © Pitt Media Group

Introduction

Climate adaptation refers to activities that protect or safeguard infrastructure, people and resources against climatic variability and events such as rising sea levels, floods, droughts, heat stress and storms.

Climate adaptation is recognised as a priority by the Cook Islands. Plans and activities to adapt to climate change impacts have been developed at all levels including communities, government and on a regional scale across the Pacific. Climate adaptation programmes and planning often overlap with other development activities that address energy, drinking water, natural resources, infrastructure development and land use.

In Cook Islands, climate change mostly impacts water and food security, health, land use and infrastructure. Climate change adaptation projects focus on these areas. The slow onset of rising sea levels and temperatures is a major concern for Cook Islands. However, since many of these impacts develop slowly it is often hard to attract funding and a higher priority.

This report rates the state of effort and investment into each of the five priority adaptation areas:

1. Water security – based on households having regular access to potable water that can be used in an emergency;
2. Food security – based on the food balance between exported and imported foods and the efforts in planting crop varieties resistant to drought, pests and disease;
3. Health – based on efforts to reduce vector borne diseases such as dengue fever;
4. Land use – based on the development of policies and regulations around land use, particularly in areas sensitive to climate change impacts; and
5. Infrastructure – based on the level of investment in climate proofing buildings, roads and other infrastructure to withstand climatic change.

These indicators only evaluate the level of effort or completion – not the level of effectiveness of the activity itself in reducing climate change risks.

Status
Fair to Poor

Trend
Mixed

Data confidence
Low

Status: Fair to poor **Trend: Mixed** **Data Confidence: Low**

The various adaptation sub indicators have been amalgamated into one status due to the lack of data available for each sub-indicators below:

WATER SECURITY

Overall, access to water is high across Cook Islands, with most water access from untreated reticulated systems on Rarotonga and Aitutaki (Figure 60). However, given the vulnerability of reticulated systems to shut down during storms, floods and droughts, and the fact that only 40% of households have access to rainwater catchment tanks or similar catchment systems, water security is considered fair to poor. Water security is improving, and access to rainwater tanks by households has doubled from 20% in 1986 to 40% in 2011. The vulnerable northern islands have almost 100% rainwater catchment through access to rainwater tanks, while only 23% of Rarotongan households have rainwater tanks (Figure 61).

FIGURE 60. Rainwater catchment, Aitutaki (T. Nakalevu)

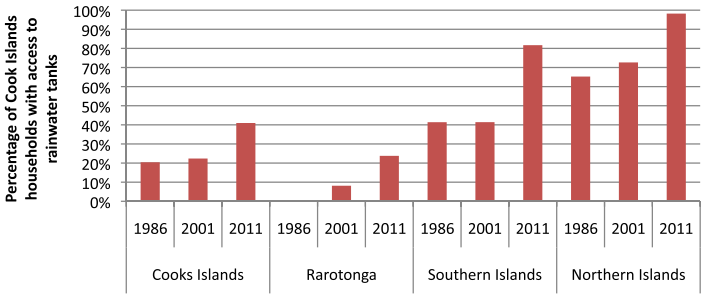


FIGURE 61. Percentage of Cook Islands households with access to rainwater tanks, 1986, 2001 and 2011 (Cook Islands Statistics)

FOOD SECURITY

Food security is one of the biggest climate change issues for the Cook Islands. Agriculture is in serious decline, particularly subsistence and minor activities. In 1988, half of all households engaged in some form of subsistence agriculture (NES, 1988), compared to only 20% in 2011. The agricultural decline is reflected in the growing reliance on food imports (Figure 62). In 2013, food imports were three times the value of food exports. About 97% of the exports were from fish, not including crops. There is very little aquaculture activity in Cook Islands, and inshore fishing activity has declined, leading to a loss of subsistence fishing knowledge and skills. Very few of the remaining agriculturally active households are planting improved and climate change resilient crop species, such as drought resistant and/or saltwater tolerant crops (Figure 63).

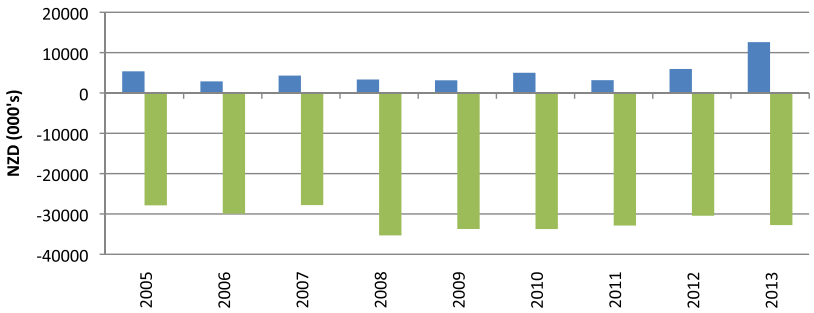


FIGURE 62. Income expenses from import and export for Cook Islands food and live animals. Import expenses (green) and export incomes (blue) (NZD), 2005–2013. (Cook Islands Statistics)

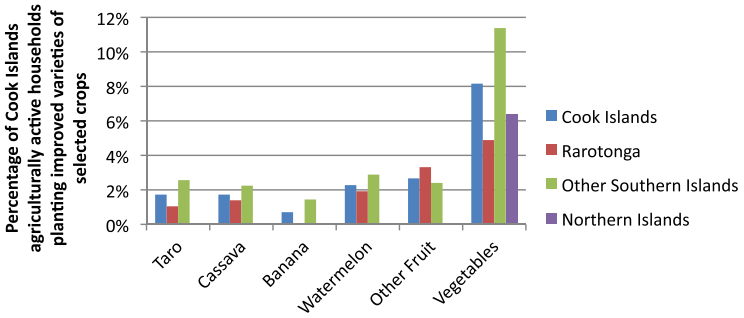


FIGURE 63. Percentage of Cook Islands agriculturally active households planting improved varieties of selected crops (Cook Islands Statistics)

HEALTH

Climate change-related health issues are a concern for most countries. Loss of a clean water supply can result in water contamination, which has significant medical concerns. An increase in atmosphere and sea temperatures could intensify the risks of water and vector-borne diseases, such as diarrhoea, dengue fever, disaster-related fatalities, injuries and illnesses, heat stress and conjunctivitis (pink-eye). The Cook Islands monitors for outbreaks such as dengue fever to allow rapid spraying of mosquito-ridden areas when required.

LAND USE

Generally, land use planning is not practised in Cook Islands. Agricultural, coastal and forest land loss due to development is not addressed or monitored. Figure 64 shows the most vulnerable low lying areas in Rarotonga.

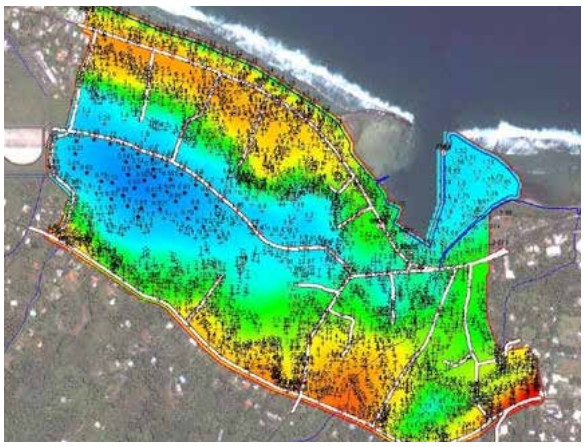


FIGURE 64. Elevation map for Avatiu showing areas (in blue) most vulnerable to sea level rise. (Cook Islands 2nd National Communication)

INFRASTRUCTURE

Although some climate proofing activities in infrastructure have been developed, many older buildings are not covered. However, the trend for the Infrastructure indicator is improving as most new buildings are required to meet a climate-proof code (Figure 65).

FIGURE 65. Climate proofing – coping strategies already in use in the Avatiu-Rarotonga study area. (Source: A Risk-based Approach to Adaptation, Hays et al, 2005)

Impact

Climate change adaptation measures can strengthen the resilience to negative impacts from climate change, and build the capacity to better adapt to changing climates. The costs of adaptation can be expensive, especially for many hard infrastructure measures like large seawalls (Figure 66). Soft measures such as the protection and sustainable management of at risk coral reef habitats, replanting of native trees and plants in riparian areas, and investing in rainwater catchment tanks for households or local communities, are cheaper options. Climate change adaptation measures are designed to allow communities to handle a changing climate, and reduce the negative impacts of doing nothing, or very little.

FIGURE 66. Seawall in Rarotonga (UNDP)

Response and Recommendations

The Cook Islands is undertaking vulnerability assessments for each of its islands to prepare for impacts from climate change, and to implement the most suitable adaptation projects from island to island. The Cook Islands Second National Communication to the UNFCCC explores the adaptation options and responses for several thematic areas. These include coastal zones, coral reefs and coastal infrastructure; marine resources and fisheries; water resources; agriculture, food security and diet; biodiversity (terrestrial and marine); human health; and other cross-cutting socioeconomic considerations including community well-being, tourism, energy demand, disaster risk management, and integration of gender perspectives into decision making.

A Technology Needs Assessment (TNA) led to the publication of the report *Technology Needs Assessment for Adaptation to Climate Change for the Cook Islands*. This identified technology needs for adaptation in the areas of health, water, agriculture, coastal zone, and cross sectoral areas, as well as barriers to implementation. This will help to set priorities for adaptation projects. Cook Islands has been active in education and awareness raising activities, so that its citizens can respond to climate changes as they occur, with support from the government.

The Cook Islands' National Sustainable Development Plan (NSDP), situated under the national vision framework Te Kaveinga Nui 2020, is the key socioeconomic document with all sector and government agency planning aligned to its priorities. Although its strategic goals do not directly address climate change, the NSDP can still be used to support climate adaptation measures, especially with its stated objective "*to build a sustainable future that meets our economic management, environment integrity, social stability, and our Cook Islands Maori culture, and the needs of our future generations*" (Cook Islands Second National Communication under the UNFCCC, 2011).

Other important policies with implications for climate adaptation include: the National Environment Strategic Action Framework (NESAF) whose third goal is "to increase resilience by strengthening national capacities for climate change, variability, adaptation and mitigation"; the Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (CI JNAP DRM CCA), and international involvement in the UNFCCC and the Kyoto Protocol (Cook Islands Second National Communication under the UNFCCC 2011).

Due to the priority that Cook Islands places on climate change, a large number of projects have been undertaken from Rarotonga to the Pa Enua to address national adaptation efforts. Table 8 summarises some of the adaptation activities.

Table 8. Cook Islands Climate Adaptation Projects. (Source: Cook Islands Second National Communication under the UNFCCC, 2011)

Name	Short Description
Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC)	$2.2 million, Canadian funded (Cook Islands pilot project USD 250,000), SPREP executed project, 2002–2005. Aim: to increase ability of Pacific island people to cope with climate change with four countries total. Cook Islands: focus on Aitutaki to address rainwater harvesting for drinking water (identified as main community concern).
Assessment of Impacts and Adaptation to Climate Change (AIACC)	GEF project implemented by UNEP, 2002–2005. Aim: to enhance technical and human capacity of Pacific island countries to handle climate change and variability. Cook Islands: research included community awareness of climate change survey and evaluation of CBDAMPIC project.
Climate Change Adaptation Programme for the Pacific (CLIMAP)	2002–2005, ADB programme: to assist Pacific developing member countries to enhance their adaptive capacities and resilience to climate change, climate variability and extreme events. Included risk assessment, adaptation planning and 'climate proofing'. Cook Islands: 2003 assisted with climate proofing the design of Avatiu Harbour and the breakwater for the Western Basin in Rarotonga (USD $800,000).
Comprehensive Hazard and Risk Management (CHARM)	1998 initiative by the Pacific Islands Applied Geoscience Commission (SOPAC) to provide a consistent approach to risk management across the Pacific region. Shifts focus from recovery and response to preparedness and risk reduction, recognised the isolation of the Pa Enua, transportation limitations, and increased vulnerabilities to disaster risk, some funding was provided for technical assistance and training.
Strengthening Disaster Management and Mitigation	*Component 1: Strengthening Disaster Risk Management*, 2005–2006, funded by SOPAC, designed to strengthen disaster mitigation and preparedness. *Component 2: Preventative Infrastructure Master Plan*, 2007 ADB support for the review, prioritisation and design of infrastructure projects on Rarotonga and the Pa Enua; focus on economic growth and climate proofing; review of Building Code, development of a Climate Risk Profile for the Cook Islands, 111 project briefs were developed and 44 were prioritised for the first five years, projects at risk from climate change and associated adaptation measures identified and process for further research to test feasibility.
Development of Sustainable Agriculture in the Pacific	2007–2009, Food and Agriculture Organization (FAO) case study report on climate change and food security in Cook Islands. Following the study's recommendations, the Ministry of Agriculture trial tested recommended crops.
Food Security for Sustainable Livelihoods Programme (FSSLP)	2010 FAO food security assessment for the southern group of islands.
Pacific Adaptation to Climate Change (PACC)	2009–2013, regional Special Climate Change Fund of GEF supported/funded project, executed by SPREP. NES facilitated the national coastal infrastructure project preparation, with the Ministry of Infrastructure and Planning (MOIF) as the national implementing agency. USD $800,000. Regional focus to build PIC capacity to adapt to climate change in key sectors, through policy and mainstream climate issues on a project basis, with the project focus on climate proofing the new Mangaia harbour.
Red Cross Preparedness for Climate Change Programme and Vulnerability and Capacity Assessment (VCA)	Documenting traditional methods of food preparation in the Pa Enua since 2009, Vulnerability and Capacity Community Assessments are being undertaken in the Pa Enua to carry out disaster preparedness and risk reduction community driven programmes such as work on emergency road access and emergency water supplies.
WWF South Pacific	Workshops, meeting participation, negotiation training and resource publications were funded by WWF to enhance participation in international climate change policy.
Managing Climate Risks in the Cook Islands' Vulnerable Communities (ADB-SGA-WWF) Community-Based Climate Vulnerability Assessment and Adaptation Planning	USD $100,000 from ADB, in partnership with WWF and Cook Islands Government to pilot a participatory approach to Protecting Island Biodiversity and Traditional Culture through Community based Risk Management, with development of community vulnerability and risk atlases to inform government planning and decision making processes.
Kyoto Protocol Adaptation Fund Project Proposal Strengthening Resilience of Our Islands and Communities (KPAF-SRIC) Akamatutu'anga I Te Iti Tangata No Te Tuatau Manakokoreia E Te Taui'anga Reva	NES with UNDP Samoa and OPM, Central Policy and Planning Division, project submitted to Adaptation Fund Board (AFB) with USD $5 million approved, awaiting approval of full project proposal. Aim: adaptation and disaster risk reduction interventions in identified priority vulnerable sectors including agriculture, water, coastal protection and health. Seven different islands, proposed benefits to more than 1500 households, addresses gender issues and builds adaptive capacities.
Pacific Adaptation Strategy Assistance Programme (PASAP)	Aim: to develop adequate capacity for 14 Pacific island countries and East Timor to adapt to adverse impacts of climate change. Components include: synthesis of current knowledge and experience of climate change and mainstreaming climate change adaptation into national planning and budget processes.
Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)	Joint initiative between SPC/SOPAC, the World Bank and the ADB with financial support from the Government of Japan and the Global Facility for Disaster Reduction and Recovery (GFDRR) for 14 Pacific countries. Developed a Pacific Risk Information System with a regional geospatial database and country specific catastrophe risk models, provides technical tools for the development of sustainable and affordable disaster risk financing and insurance solutions.
Pacific Disaster Risk Financing and Insurance Program	Application to PCRAFI to develop risk management and urban infrastructure/planning. Aim: to increase the financial resilience of Pacific island countries against natural disasters, improve their post-disaster funding needs and assist in macroeconomic planning.
Pukapuka Cyclone Safety Shelter	2011, Government of Cook Islands and European Union (EU) construction of Pukapuka emergency cyclone shelter, designed to withstand Category 4 cyclone, built on community land at the highest point on the island.

Cook Islands submitted their Intended Nationally Determined Contribution (INDC) to the UNFCCC in 2015 which shows their commitment towards the outcome of the UN climate conference in Paris (INDC to the UNFCCC, 2015).

The Cook Islands' Second National Communication identified the high priority needed for more climate proofing in climate adaptation projects, which this report further recommends. This is not only important for long term infrastructure sustainability, but many donor infrastructure projects now require that climate proofing be included within project proposals. Cook Islands should continue its work on vulnerability and adaptation assessments for every island, to better identify and prioritise future projects. Where possible, it should improve climate monitoring efforts to provide better information to national policy and decision makers.

Cook Islands should continue to invest in disaster planning and management programmes, including drought management and bio-agriculture. Cook Islands should further invest in programmes to assist small scale farmers and local communities to grow saltwater and drought resistant crop varieties, which provide the added benefit of reducing the reliance upon imported foods.

Recommendations and actions from national and international policies with implications for climate adaptation – such as NESAF and international involvement in the UNFCCC and the Kyoto Protocol – should be implemented.

Locally suitable adaptation measures and technologies should be standardised into building codes. Current building codes should be amended to require all future infrastructure projects to include climate proofing. These are reflected in many EIA procedures, but could be strengthened. This could include the formal adoption of the foreshore, wetland and sloping land policies which are still in draft form. Where possible, ecosystem-based adaptation (EbA) programmes and infrastructure should be developed for Cook Islands communities, because these are more cost effective and have fewer adverse environmental impacts. Traditional knowledge should be integrated into climate adaptation measures, especially EbA measures and in the development of climate proofing designs.

Data for heath, land and infrastructure is very limited. Data needs to be collected and made available to ensure problems can be addressed.

Mauke Harbour. Photo: Maureen H., NZHC, 2013

Cyclone Meena, 2005. Photo © Pitt Media Group

Mangaia Harbour, 2016. Photo: UNDP

SOURCES

Government of the Cook Islands. 2012. Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (JNAP) 2011- 2015.

Hay, J. E., Warrick, R., Cheatham, C., Manarangi-Trott, T., Konno, J., Hartley, P. 2005. *Climate Proofing: A Risk-based Approach to Adaptation*. Asian Development Bank (ADB), The Philippines.

Ministry of Agriculture and Statistics Office. *Cook Islands Census of Agriculture 1988*. Rarotonga, Cook Islands.

Ministry of Agriculture. *Cook Islands Census of Agriculture and Fisheries 2011*. March, 2014.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 1986 Census of Population and Dwellings*. 1991.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 2001 Census of Population and Dwellings*. December, 2003.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 2011 Census of Population and Dwellings*. December, 2012.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Overseas Trade Statistics*.

National Environment Service (NES) of the Government of the Cook Islands. *Cook Islands Second National Communication under the United Nations Framework Convention for Climate Change*, National Environment Service, Tu'anga Taporoporo, Cook Islands, December 2011.

THEME 2 INLAND WATERS

A.Bertram

THEME 2 INLAND WATERS

OVERVIEW

This theme on the state of inland waters, focuses on streams that connect inland watersheds with the lagoon.

Data was collected by the Ministry of Marine Resources on eight streams in Rarotonga and four streams in Aitutaki. This chapter looks at the outcomes of the research.

J.Brider, Cook Islands National Environment Service

INLAND WATERS HIGHLIGHTS

TOPIC	STATUS AND TREND	JUSTIFICATION	RESPONSE AND RECOMMENDATIONS
STREAMS  Lake Tiriara, Mangaia © NES	 **Status** Poor **Trend** Deteriorating **Data confidence** Low	Streams in Rarotonga show a high contamination of bacteria (such as Faecal Coliforms) and a high level of nutrients. The cause of the poor water quality is based on human sewage, animal manure and inorganic fertilisers. Streams in Aitutaki show poor water quality. However, there is insufficient data available to determine a trend.	Cook Islands has water quality regulations which govern the construction and installation of sewage and sanitation systems. A Water, Waste and Sanitation Unit was developed to address sewage, sanitation and drinking water problems in Rarotonga and Aitutaki. More research data and resources are needed to support existing water quality data and to identify sources of inland water pollution.

There is limited to no data available for Pa Enua, therefore a status and trend cannot be determined. This represents a data gap which should be filled.

INLAND WATERS: STREAM WATER QUALITY

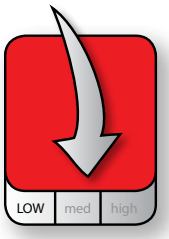
RAROTONGA AND AITUTAKI

Status: Poor Trend: Deteriorating Confidence medium

In Cook Islands, streams connect the inland watersheds and the lagoon. Stream health impacts on general lagoon health and the coral reefs, fish and people that rely on them for subsistence and income. Streams are also habitats for freshwater fish and invertebrates.

Cook Islands streams are small and short. The flow is typically low and only flushes during high periods of rainfall. Many Rarotongan stream flows have altered over time through human intervention, mainly to satisfy public consumption. Data shows that lower stream flows tend to concentrate pollutants.

This indicator measures the annual quality of stream water through an examination of stream clarity, nutrients, dissolved oxygen and bacteria. Stream clarity is measured by the presence of 'Total Suspended Solids' (TSS), which are fine suspended particles such as clay, silts or organic matter that reduce visibility and increase temperature. Nutrients sampled in Cook Islands streams include phosphate, nitrogen and ammonia from human and organic waste products, and fertilisers. Dissolved Oxygen (DO) levels indicate how much oxygen is in the water. Low DO levels indicate an abnormal disturbance in the ecosystem, such as an algal bloom. This report examines the bacteria Enterococci as a measure of stream quality. Enterococci are a subgroup within the faecal streptococcus group, which can survive in salt water, and are thus a suitable faecal coliform measure for Cook Islands streams and lagoons.



Status
Poor

Trend
Deteriorating

Data confidence
Medium

FIGURE 67. Aitutaki stream water quality sampling sites by MMR. (MMR)

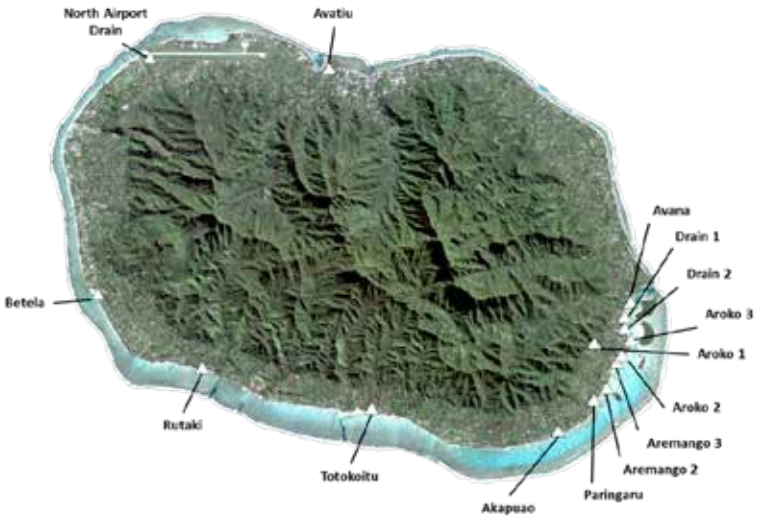


FIGURE 68. Rarotonga stream water quality sampling sites by MMR. (MMR)

Information is collected at stream mouths by the Ministry of Marine Resources (MMR) on a monthly basis for four regular, long term sites on Aitutaki (Figure 67) and eight on Rarotonga (Figure 68). These sampling sites are then assigned an average report card score, A through F, which identifies the stream water quality for each location (Figures 69 and 70).

Rarotongan streams are generally in poor condition due to bacteria and nutrients levels that far exceed guidelines for most streams, for most months (Figure 71). The trend is 'deteriorating' due to declining dissolved oxygen levels and decreasing stream-water clarity. Aitutaki appears to have a similar 'poor' status as Rarotonga, however there is not enough data collected to determine a trend.

The main causes of impaired water quality in Rarotongan streams are faecal bacteria from human and animal sewage, and nitrogen (NO_3 and NH_4) from sewage, animal manure and inorganic fertilisers. Most of this contamination is anthropogenic and not natural. The Avatiu stream areas are an example of these anthropogenic influences, where 2013 sampling showed that the Avatiu intake area upstream had far lower levels of bacterial contamination compared to the stream mouth (Figure 72).

Figures 73 and 74 show the level of impairment for the eight major streams sampled in Rarotonga from 2006–2009. Paringaru has the highest nitrate levels, while Akapuao has the highest bacterial levels.

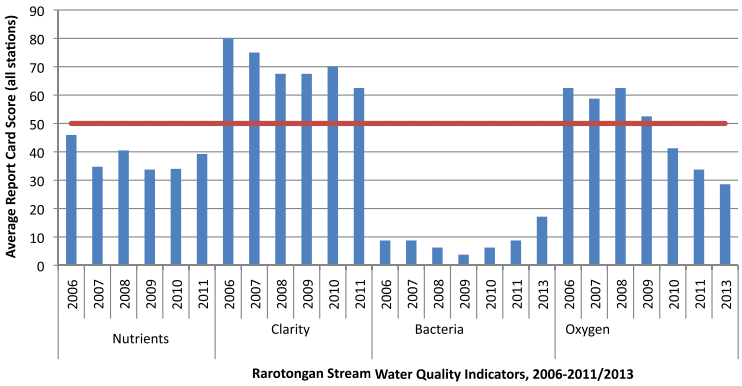


FIGURE 69. Annual Report Card Summaries for All Rarotonga Streams, 2006–2013. (*MMR; "Note: Values above the red line are within guidelines, and values below the red line fail guidelines. The average Report Card Summary is based on yearly median values for Nutrients (NO3, NH4 and DPR), Clarity (TSS), Bacteria (Enterococci) and Oxygen (percent Dissolved O2 saturated). No 2012 data for all sites and no 2013 data for Nutrients and Clarity)*

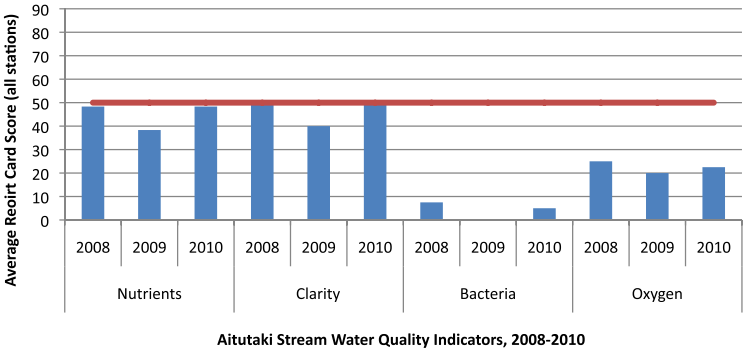


FIGURE 70. Annual Report Card Summaries for All Aitutaki Streams, 2008–2010. *(MMR; *Note: Values above the red line are within guidelines, and values below the red line fail guidelines. The Average Report Card Summary is based on yearly median values for Nutrients (NO3, NH4 and DPR), Clarity (TSS), Bacteria (Enterococci) and Oxygen (percent Dissolved O2 saturated))*

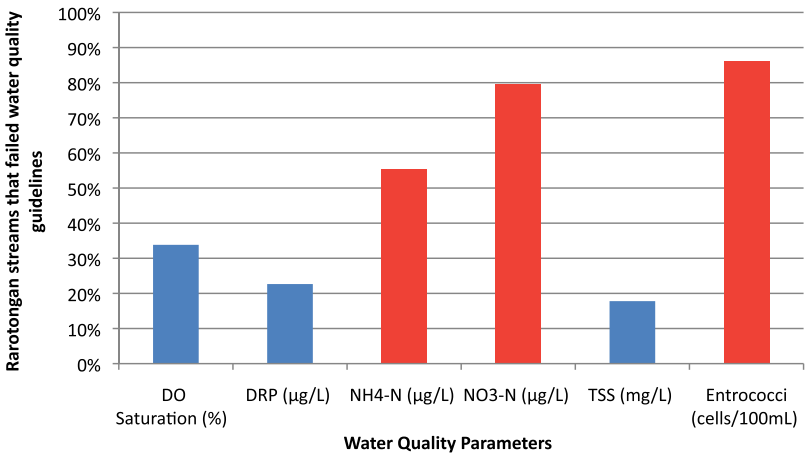


FIGURE 71. Per cent of total water samples from Rarotongan streams that failed guidelines for each parameter, 2006–2009. (MMR)

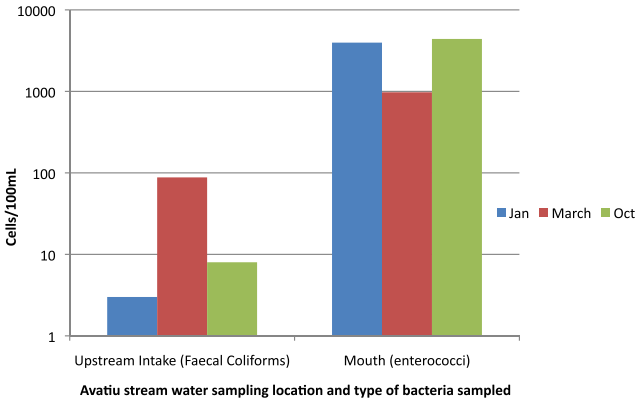


FIGURE 72. Water samples from Avatiu Stream at the drinking water intake upstream and the stream mouth, 2013. (MMR *Enterococci is a subset of faecal coliforms, and is a conservative estimate of faecal coliforms)

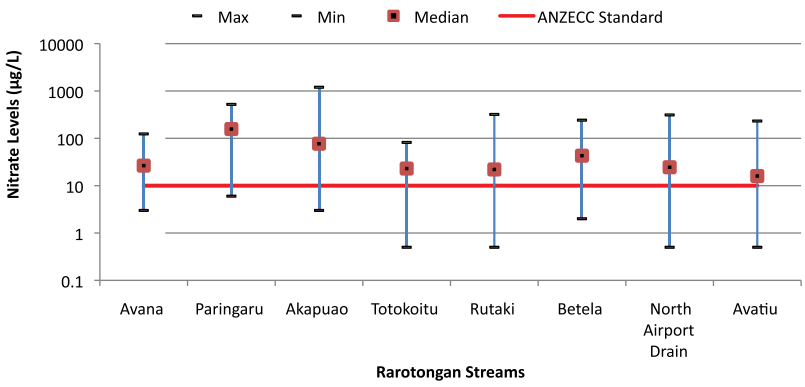


FIGURE 73. Nitrate levels for eight Rarotongan streams, 2006–2009. (MMR)

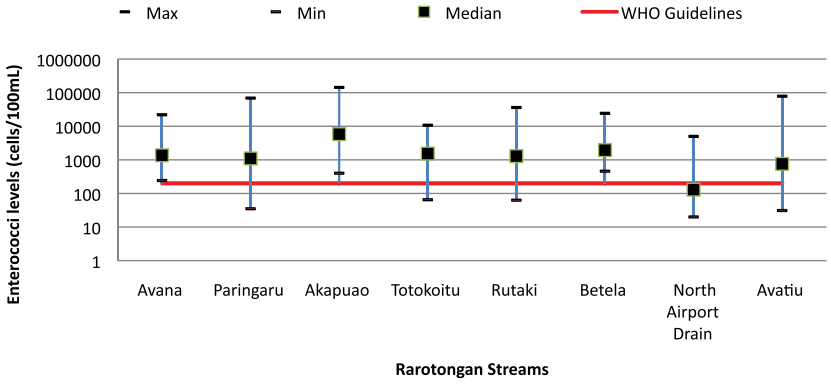


FIGURE 74. Enterococci levels for eight Rarotongan streams, 2006–2009. (MMR)

Response and Recommendations

Cook Islands has water quality regulations which govern the construction and installation of sewage and sanitation systems. In partnership with NZAid, the Ministry of Infrastructure developed the Water, Waste and Sanitation Unit (WATSAN) to address sewage, sanitation and drinking water issues in Rarotonga and Aitutaki. WATSAN's Te Mato Vai project addresses leakages in public water mains and creates more storage capacity, which is expected to reduce the demand on water extraction from freshwater intake areas.

Development in riparian zones and wetlands is managed under local and national environmental legislation. Communities and schools have helped to replant vegetation on stream banks.

More research and resources are needed to support water quality data collection in Cook Islands, and to identify sources of inland water pollution. Public areas with poor water quality should have proper signage installed to inform the public about the risks of using these areas for drinking, fishing and recreation. Citizens should be advised about the variety of public health, economic and environmental impacts associated with poor water quality. Strengthening the institutional environment through a stronger water resources authority would provide a more focused response to problems surrounding poor water quality. It is very important that existing EIA regulations are used and enforced to reduce additional impacts.

The WATSAN project's research suggests that around 15% of pollution entering lagoon areas is caused by animal wastes, via streams and other freshwater sources. On Rarotonga, most of these animal wastes are from pigs, cows and goats, which are kept too close to streams and riparian areas. Set-back distances for activities in riparian zones should be increased, with appropriate resource monitoring and enforcement programmes.

Cook Islands has 15 islands. Monitoring of water quality issues on the Pa Enua would help to address public health problems and fill a data gap.

PA ENUA

Water quality data for Pa Enua is largely unavailable thereby preventing any analysis, state or trends. This gap should be filled by prioritising islands with surface water, which include Atiu and Mangaia.

Impact

Lower freshwater quality has direct impacts on freshwater ecology and contributes to higher lagoon algal and bacteria levels, including ciguatera. Poor water quality can result in eutrophication and anaerobic conditions, which reduces freshwater and lagoon productivity.

Poor water quality has negative impacts to human health and can adversely affect livelihoods, recreational activities and tourism development.

SOURCES

Ministry of Marine Resources (MMR). Water quality repots.

Ministry of Marine Resources (MMR). Trends in Rarotonga streams' water quality from 2007 to 2011

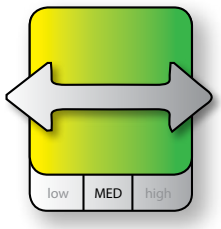
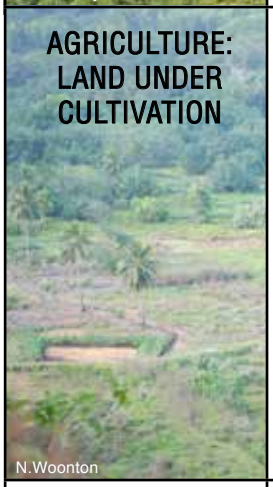
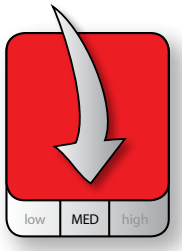
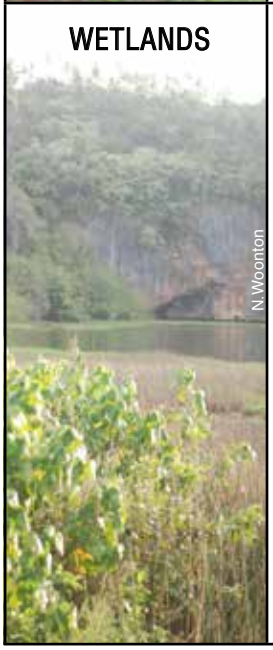
WATSAN project: http://ici.gov.ck/watsan (2016)

Zhang Da Qiang

OVERVIEW

The land ecosystem of Cook Islands is made up of forests, agricultural lands and wetlands which have been shaped by local land management practices. This theme addresses the status and management of these critical resources and looks at the main use of forest, agricultural lands and wetlands and its impacts through development, food security, Invasive species and climate.

FORESTS HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
	 **Status** Good to Fair **Trend** Stable **Data confidence** Medium	About 67% of Cook Islands' land is covered by forests, with 62% covered by natural forests. The forests are mainly made up of *Makatea*, littoral, montane and cloud forests and provide important ecosystem functions as well as biodiversity habitat, particularly for endemic and native birds. While pressures from development, agricultural and invasive species continue to threaten the forests, they are mostly in good to fair condition, and Cook Islands ranks as one of the highest in the Pacific islands for percentage of intact natural forests.	The Cook Islands recognises its forests as an important habitat for endangered species. Regular surveys are recommended to maintain a database and monitoring programme on the forests, which should include invasive species. The public profile of the forests should be raised through awareness activities and communities should be mobilised to harvest native trees sustainably and replant them. Community-based protected areas could be established to protect the forests. It is recommended that genetic resources from threatened trees are conserved to get important forest areas acknowledged in government policy.
	 **Status** Poor **Trend** Deteriorating **Data confidence** Medium	Agricultural activity has dramatically declined since 1988, especially subsistence agriculture. This reflects the national shift from a resource-based economy to a service-based economy. Most farmers are now aged 65 and above. The declining agricultural activity can result in the spread of invasive species to fallow lands, more reliance on imported foods, less food security, and reduced public health.	Cook Islands should continue to support its farmers in order to encourage growth in the agricultural sector, increase national food security and decrease dependence upon imported foods. Particular emphasis should be placed upon training and development of Cook Islander youth agricultural programmes, especially with most of the country's farmers currently aged 65 and above. 'Go Local' campaigns, with support for local agricultural development and integration across all sectors would also help to strengthen agricultural development.
	 **Status** Poor **Trend** Deteriorating **Data confidence** Low	Wetlands provide important ecosystem services including water filtration and storm buffering, and are important habitats for taro (*Colocasia esculenta*) cultivation and a rich biodiversity of freshwater species. There are four main types of wetlands in the Cook Islands: freshwater marshes and swamps, freshwater lakes, mountain streams and a tidal salt marsh. While already limited in number and an important component of freshwater habitats, wetlands are under threat from development pressures, invasive species, climate change pressures (saltwater inundation and cyclone-caused flooding) and illegal solid waste disposal. Focused stewardship is needed to maintain the habitat diversity and services that they provide.	Cook Islands should continue to strengthen its oversight of development on and around fragile wetland ecosystems, and should educate people about the importance of wetlands across social and political sectors. There is limited information about wetlands outside of Rarotonga. More investment could be applied to research national wetland habitat health and biodiversity, as well as ongoing monitoring programmes to establish stronger references for wetland health over time. The draft wetland policy should be revised and finalised.

FORESTS: NATURAL AND PLANTATION FOREST

Introduction

Forested areas in Cook Islands consist of three main forest types: 1) Makatea atoll forests, which are established on raised fossilised corals in Mangaia, Atiu, Mauke and Mitiaro, 2) littoral forests, which are found in coastal areas 3) montane and cloud forests. Figure 75 shows the montane forest of Rarotonga.

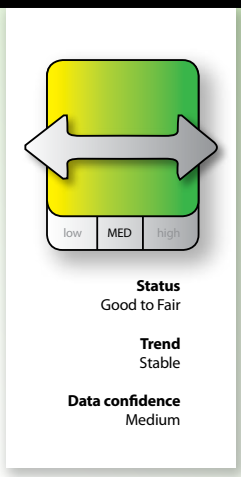
Historically, forestry in Cook Islands has been for conservation and local cottage-type industry use, such as hand crafts, firewood, and land management in areas prone to erosion. Historical pressures on forests include agricultural clearing and residential development, largely prior to 1990.

The key sources of information for this indicator are forest cover assessments from 1992, 1998, 2005 and 2010.

FIGURE 75. The montane forest of Rarotonga. (Paul Anderson, SPREP)

There are also plantations of Caribbean Pine and Acacia *(Acacia mangium*) species on Mangaia, Rarotonga, Mauke and Atiu, and small plots of sandalwood have been established on these islands. The largest pine plantation in Mangaia was established as an erosion control method on fallow pineapple plantations in the 1990s.

FIGURE 76. Pine plantation on Mangaia. (Cook Islands News)



Status: Good to Fair Trend: Stable Data Confidence: Medium

About 62% of Cook Islands' land area is under natural forest cover with five per cent comprised of plantations (Figure 77). Natural forests are about one third littoral, one third montane and one third *Makatea* forests (Figure 78). Figure 79 shows a map of forest and other types of land on Rarotonga.

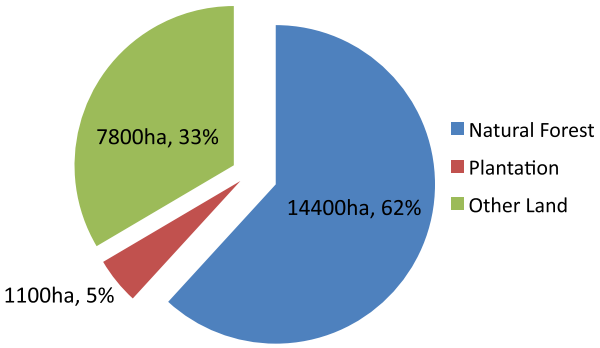


FIGURE 77. Area (ha) and percentage of forests and other land types for all of Cook Islands, 1998. (Oliver, W. 1999 in FAO Global Forest Resource Assessment 2010, Cook Islands.)

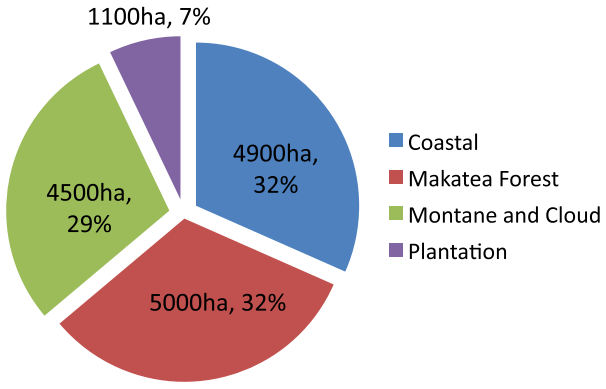


FIGURE 78. Area (ha) and percentage of forest types for all of Cook Islands, 1998. (Oliver, W. 1999 in FAO Global Forest Resource Assessment 2010, Cook Islands.)

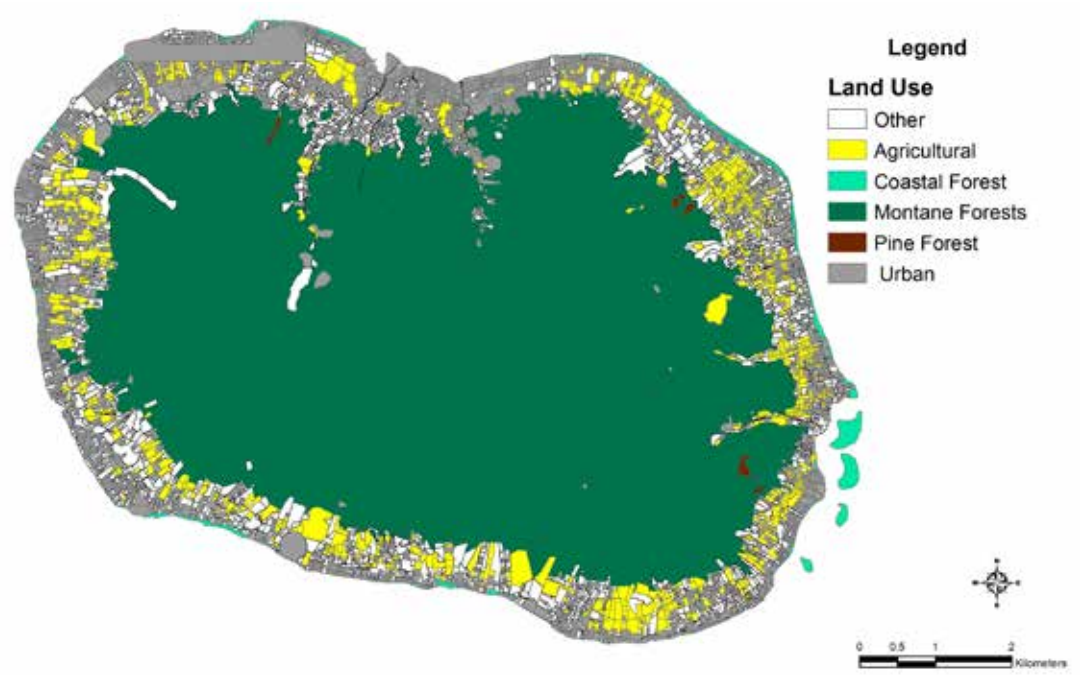


FIGURE 79. Forest and other land types in Rarotonga, 2011. (SPREP, 2014; Data courtesy of NES)

The status of Cook Islands' forests is 'Good to Fair,' with very little change since the 1992 assessment. Due to the lack of information, the size of forest in 2000, 2005 and 2010 were assumed to be the same as the reported values for 1998 (FAO 2010). Cook Islands has one of the highest proportions of intact natural forests in the Pacific region, and ranks third in the highest proportion of intact natural forests for all Polynesian countries (Figure 80).

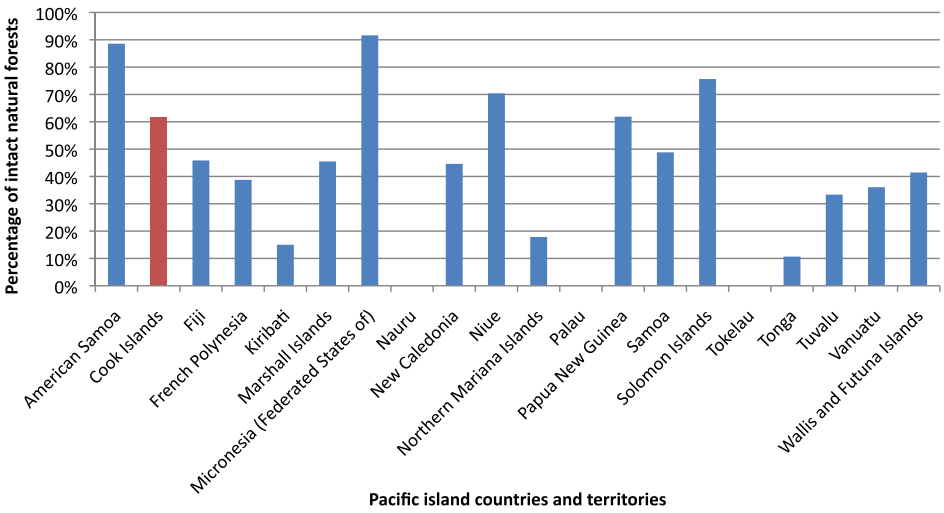


FIGURE 80. Proportion of natural forest cover to land base for all Pacific island countries and territories. (FAO Forestry (http://countrystat.org/home.aspx?c=FORandtr=1)

The main reasons for this stability in intact natural forest cover are: 1) the vegetation of *Makatea* forests is generally well preserved because the rough ground surface is unsuitable for cultivation or human habitation, 2) most development since 1990 occurred on fallow agricultural land near the coast, which alleviated development pressures on the inland forests, and 3) there is no commercial forestry industry within Cook Islands.

Key pressures on forests are mainly: 1) urban and tourism development on coastal vegetation, and 2) the spread of forest invasive species such as Merremia *(Merremia peltata)* and Balloon Vine (*Cardiospermum grandiflorum*) from abandoned agricultural lands and free range domesticated animals. Direct and indirect threats for the *Makatea* forest and the cloud forest of Rarotonga were listed in the NBSAP and shown in Table 9 (NES 2011).

TABLE 9. Threats to Cook Islands' Forest Ecosystems Source: NES, 2011

Ecosystem	Threats		Key changes/capacity to address the threats
	Indirect	Direct	
Makatea forests (Atiu, Mauke, Mitiaro and Mangaia)	Depopulation of these islands meant farmed animals such as pigs and goats have gone wild and feed on *Makatea* forest vegetation. This is a threat to medicinal and income-generating plants, e.g. maire *(Microsorum commutatum)* especially the lower vegetation.	Wandering animals (goats and pigs) Invasive species, e.g. Acacia spp. and Java Plum (*Syzygium cumini*)	No data is available, but spread of weeds are observed key changes; Increased acreage covered by Acacia spp. and Java Plum
Cloud forest of Rarotonga	Changing Climate	Increased use of area by visitors; Biosecurity risks through invasive species	No data available

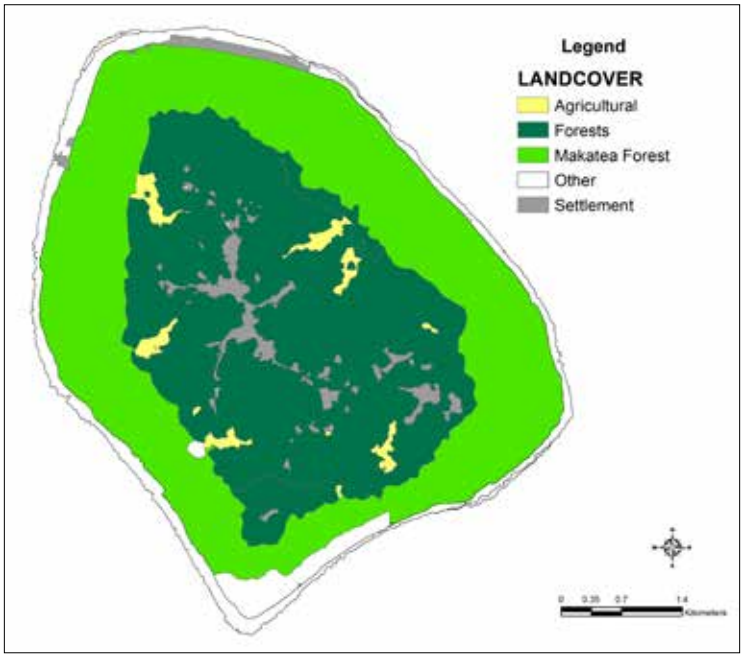


FIGURE 81. Forest and other land types in Atiu, 2011. (SPREP, 2014; Data courtesy of NES)

Impact

Natural forest cover is important for the preservation of biodiversity in forest habitats, particularly for endemic and native bird species such as the *Kākerōri*, and a diversity of birds on Atiu (Figure 81). In addition, natural forests provide important ecosystem services and aid in erosion control, climate moderation, water balance, shelter for native plant and animal species, and as sources of firewood for local communities. It can also provide important natural environments for the development of ecotourism and recreation, especially for activities such as bird watching and trekking.

Response and Recommendations

Forests are recognised as important ecosystems in the 4th National Report to the Convention of Biological Diversity in 2011 which stated the progress Cook Islands made under the CBD.

Cook Islands has established terrestrial protected areas. The cloud forest survey in 2015 provides a good insight into this unique ecosystem.

Cook Islands recognises invasive species as a threat to the forests and native birds. The draft National Invasive Species Strategy and Action plan (NISSAP 2016) points out that monitoring and data collection are necessary. The Cook Islands Land Use Policy (2008 Draft) identifies pests and weeds along with the adverse environmental effects of poorly planned land use. The NISSAP proposes a policy element of 'Coordination and processes to protect agricultural systems and forests from weeds, pests and pathogens'. As a signatory to the International Plant Protection Convention (IPPC), which is an international agreement on plant health developed in 1951 and overseen by the Food and Agriculture Organization (FAO), one of the objectives includes the protection of the environment, forests and biodiversity from plant pests.

The forests provide important habitat for endangered species which are recognised in the Cook Islands National Biodiversity Strategy and Action Plan (NBSAP). But survey data especially for the cloud forest is limited, thus long-term trends are hard to access. Regular surveys and monitoring programmes are recommended to build on the existing Cook Islands Biodiversity Database (http://cookislands.bishopmuseum.org/search.asp), especially for the *Makatea f*orest and the cloud forest. This would assess the impact of threats and any management actions. The cloud forest has a low public profile and all forests in the Cook Islands would benefit from awareness raising in local communities. The Cook Islands NBSAP in 2002 and the 4th National Report to the CBD in 2011 recommended a national system of community-based protected areas to protect important terrestrial ecosystems. There are further actions in the 4th National Report to the CBD to survey and conserve rare plants which would also benefit the forest (NES 2002 and 2011; Wildlands 2016).

Invasive species have a significant impact on forests through the predation of all taxonomic groups and competition for resources. This is even more apparent after disturbances such as cyclones where invasive plants are able to capitalise on the increase in resources such as space and sunlight, and maintain a long-term domination of biomass. The Cook Islands has begun a programme of biological control to address some of these widespread weeds, and this should be continued. Predators have been eradicated from some high value biodiversity islands. More mainland control sites should be established to safeguard the survival of species. In the long term, the total eradication of rats *(Rattus exulans)* will most probably be a realistic goal. The recently developed National Invasive Species Strategy and Action Plan should be implemented. The Cook Islands should maintain regional links to invasive teams and may consider joining the Pacific Invasive Learning Network Team to share lessons, case-studies and skills with other Pacific islands (NES 2002 and 2011, NISSAP 2016).

The Cook Islands Agriculture Department supports the conservation of genetic resources, especially for the most important and threatened trees, while communities should be mobilised to harvest native trees sustainably and replant them (Tokari 2010).

The report from Wildlands seeks to ensure that the risk to cloud forests from climate change is acknowledged in government policy (Wildlands 2016).

SOURCES

Food and Agriculture Organization of the United Nations. 2010. Global Forest Resource Assessment, Cook Islands.

National Environment Service. 2002. Cook Islands National Biodiversity Strategy and Action Plan (NBSAP).

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

National Environment Service. 2016. Draft National Invasive Species Strategy and Action Plan (NISSAP)

Oliver, W. 1999. FAO Global Forest Resource Assessment 2010, Cook Islands.

Tokari, N. 2010. Country Reports for the State of the World's Forest Genetic Resources.

Wildlands. 2016. Catchment Management and Restoration Plan for Rarotonga Cloud Forest Ecosystems, Cook Islands.

Cook Islands Biodiversity Database http://cookislands.bishopmuseum.org/search.asp

ONLINE SOURCE:

FAO Forestry (http://countrystat.org/home.aspx?c=FORandtr=1)

AGRIDULTURE: LAND UNDER CULTIVATION

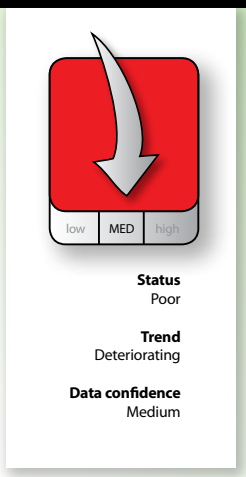
Introduction

Agriculture is an important part of Cook Islands' culture and economy, particularly for crops such as taro, coconut, citrus, banana and papaya, and livestock such as goats, pigs and chickens. Figure 82 shows a taro plantation.

From the 1940s to the 1980s, agriculture was dominated by plantation products for export including pineapples, oranges, coconuts *(cocos nucifera)*, and fruit juices. Citrus crops were found extensively in Aitutaki, Rarotonga, Atiu and Mangaia. By 1989, citrus and banana exports had dropped sharply and by 1993 the main fruit cannery in Rarotonga had shut down. Exports of root crops remained strong through these years of transition, and are still an important part of Cook Islands agriculture today.

This indicator begins the analysis of Cook Islands agriculture with the decline of the commercial citrus industry in 1988. It uses information from the agricultural censuses over the years through to the most recent one in 2011. The 1993 SOE recommended reviving the agricultural economy and stimulating subsistence agriculture (Syed 1993).

Key indicators are: Land under cultivation or active agricultural use, farming demographics, status of key crops and households involved in agriculture.



Status: Poor Trend: Deteriorating Confidence: Medium

10.1
10.3

7

Agricultural activity has dropped sharply in Cook Islands since 1988, particularly subsistence farming. Farming had already slowed from the 1950s through the late 1980s, with the decline of the coconut and citrus industries. Some commercial agricultural activity and export markets of fruits and vegetable grew in the mid-2000s, but have since declined.

Figure 83 shows the decline in the amount of land used for agricultural activities in Cook Islands, with the biggest drop in the northern Pa Enua. From 1988 to 2011, there has been a significant decrease in the number of households engaging in subsistence agriculture, while commercial agriculture has stabilised since 2000 (Figure 84). As Cook Islands has shifted from a resource-based to service-based economy, fewer young people are participating in the agricultural or fishing industries. The age range of Cook Islands farmers is now 65 and above (Figure 85).

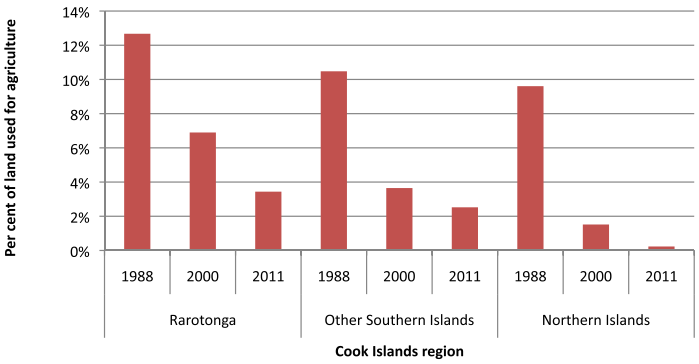


FIGURE 83. Per cent of land used for agriculture in Cook Islands by region, 1988, 2000 and 2011. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

FIGURE 82. Wet taro fields (flooded). (Paul Anderson, SPREP)

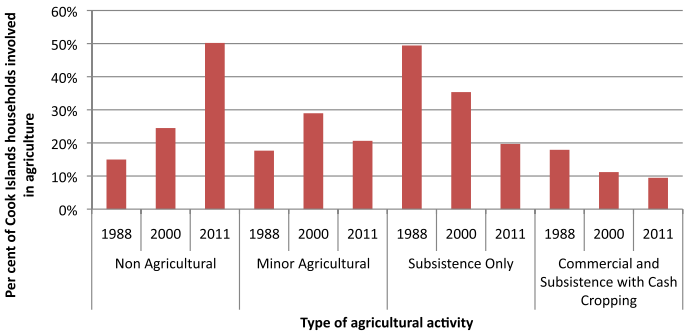


FIGURE 84. Per cent of Cook Islands households involved in agriculture. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

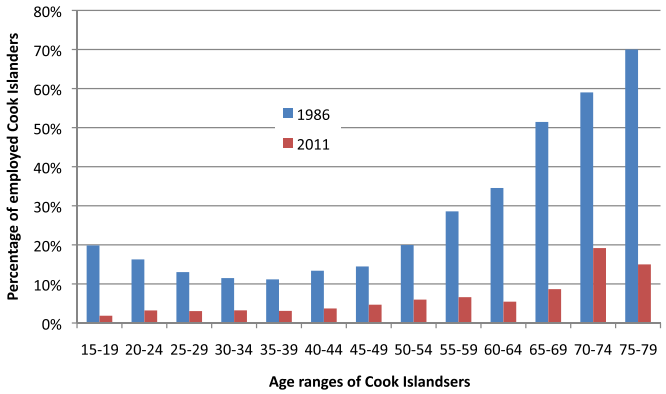


FIGURE 85. Per cent of employed male and female Cook Islanders, aged 15 and above, involved in the agricultural or fishing industries, 1986 and 2011. (MFEM and MoA: Cook Islands Censuses 1986, 2011)

Almost all crops farmed in the Cook Islands have declined from 1988 to 2011, especially bananas, coconuts, cassava (*Manihot sculenta*) and kumara *(Ipomoea batatas)* (Figure 86, 87 and 88). The biggest falls occurred in the Pa Enua, with a large loss in single use crop area in the southern islands and virtually no single use cropping in the northern islands (Figures 86 and 87). Figure 88 shows a summary of all cropping areas, including mixed and scattered crops and minor agricultural households. While not as large as the crop decline, there has also been a drop in livestock keeping (Figure 89).

Over the last few decades, agricultural land has largely been left fallow or converted to residential or commercial properties, especially in Rarotonga and Aitutaki. The main reasons are 1) a shift to a service-based economy that is increasingly reliant on tourism income, 2) out migration of farmers from the Pa Enua to Rarotonga and outside Cook Islands, 3) changing lifestyles, diets and an increasing reliance on imported foods, 4) competition from outside markets and high costs of transportation for agricultural exports with decreasing costs for agricultural imports, and 5) quarantine restrictions due to agricultural pests and introduced species such as the common fruit fly *(Bactrocera melanotus).*

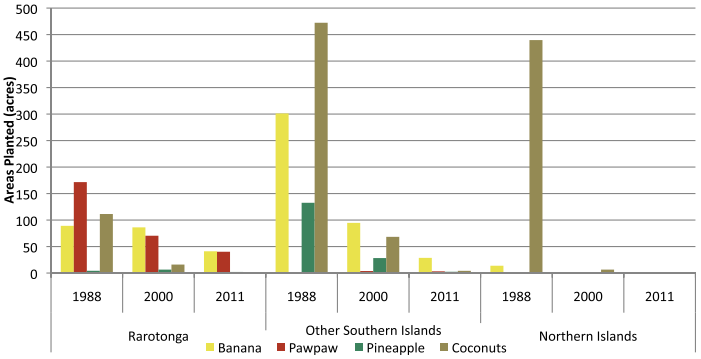


FIGURE 86. Acres of single plantation fruit products. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

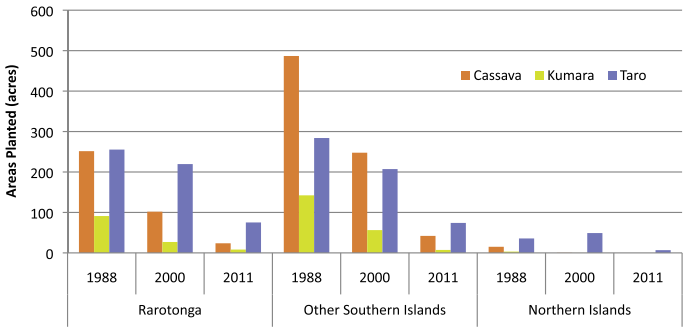


FIGURE 87. Acres of single plantation root crop products. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

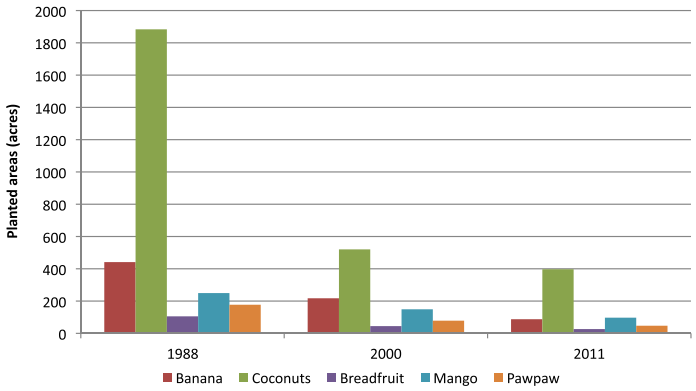


FIGURE 88. Acres of major fruit products in single, mixed and minor agricultural households. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

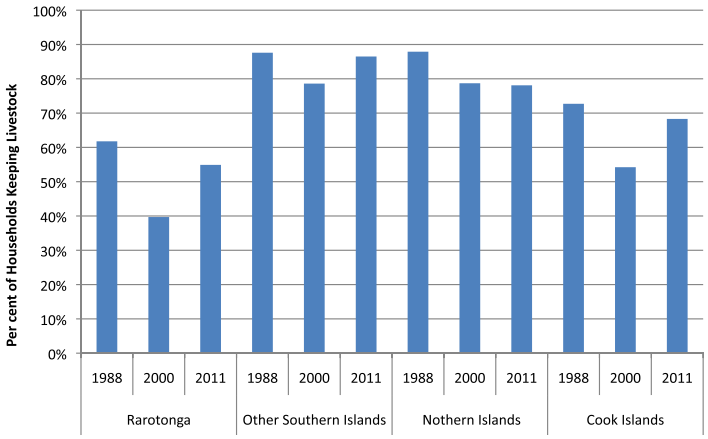


FIGURE 89. Per cent of households keeping livestock by region. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

FIGURE 90. Coconut plantation covered with Merremia *(Merremia peltata)* vine. (Paul Anderson, SPREP)

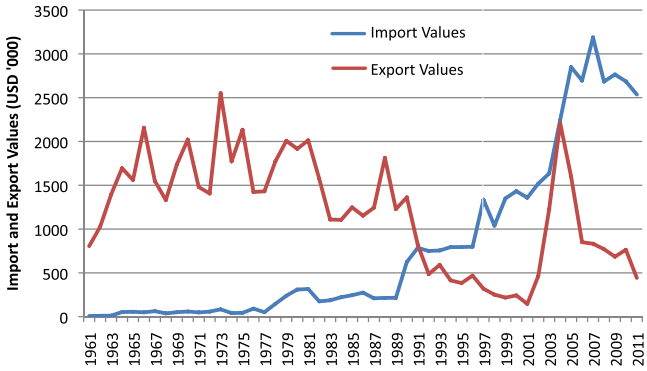


FIGURE 91. Import and Export Values (USD '000) for vegetables, 1961–2011. (FAO)

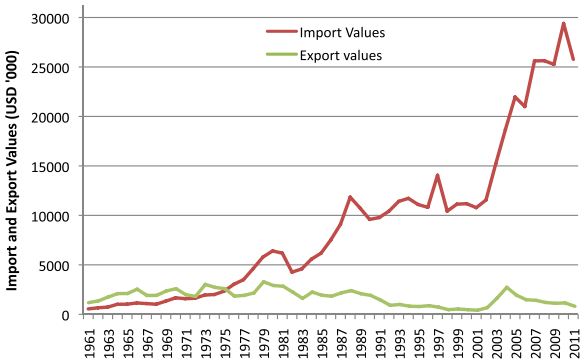


FIGURE 92. Import and Export Values (USD '000) for crops and livestock, 1961–2011. (FAO)

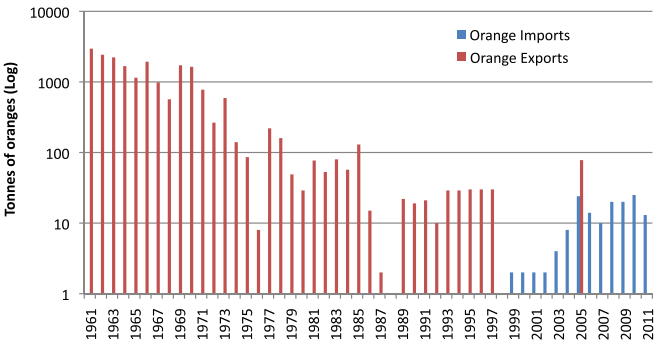


FIGURE 93. Tonnes of exported/imported oranges. (Cook Islands Agricultural Censuses 1988, 2000, 2011)

Impact

The agricultural decline has several environmental and social impacts. Firstly, invasive species often move into untended, fallow land, leading to further intrusion of invasive species into native forests, which threatens native and endemic species (Figure 90). Secondly, prime arable land that has been converted to urban use frequently loses its capacity to be converted back to healthy land for agriculture, which prevents the possibility of any future agricultural activity or growth in those areas. Thirdly, a decline in agriculture seriously affects the nation's food security and leads to greater reliance on imported food products, along with more reliance on shipping and expensive fossil fuels (Figure 91). This becomes more important when looking at crops and livestock (Figure 92). Cook Islands was a big exporter of oranges from 1961 to 1970 (Figure 93), which then declined to no orange exports from 1998. Instead, Cook Islands began to import oranges. This has an impact on food security especially for Pa Enua which is more vulnerable to supply disruptions than Rarotonga. It also leads to higher costs of local goods and further vulnerability for low income families. Finally, a reliance on imported foods, and a loss of locally grown foods, has serious health implications as diets shift to pre-packaged, processed food instead of local, fresh food.

Response and Recommendations

There has been government support to local farmers through fertiliser subsidies, and farming equipment sourced from China. Greater support to farmers is needed, especially to new farmers who have barriers to access through restricted financial capacity and access to markets. Farming practices are also complicated in Cook Islands as some farmers attempt to grow high value crops outside of their natural environments, such as growing *Maire* under shade cloth. Care should be taken that methods are sustainable. Taro shoots that have tested positive to resistance to known pests by the Ministry of Agriculture have been shared between farmers. Guidelines were developed by the Ministry of Agriculture to manage agricultural invasive species. Climate change adaptation plans for agriculture include identification of crops resistant to climate change impacts. It is recommended that there be a focus on goals in the 4th National report to the CBD as it would assist the agriculture of Cook Islands (NES 2011).

Some bio-agriculture and soil schools have been established to support farmers in the development of sustainable agricultural practices, but more training and support for farmers is needed.

As most farmers are in their seventies (Census 2011), there is a further need to attract and train younger people to become farmers. The provision of agricultural schools and training programmes would help to make this area more attractive for young people. Another option is to integrate agriculture and horticulture science into the school curriculum.

Local food should be supplemented with imported food and not the other way around. One initiative is the 'Go Local' campaign where local shops, restaurants and tourist resorts contribute to a 'Go Local' initiative through buying locally grown food, and advertising this to their clientele. There is also high value in growing uncommon local crops, such as noni *(Morinda citrifolia)*, chillies *(Capsicum frutescens)*, or the production of coconut oil, which can be sold within the country or exported for their unique values.

Finally, local and national land use policy should promote the value of arable land for agriculture rather than commercial and urban development. There is great potential for agricultural development in Pa Enua, however the challenge is to transport products to Rarotongan markets. Subsidies and government incentives to introduce food from the Pa Enua to more urban centres would help to support agricultural development and growth in these areas, and increase food security.

Photos: Anna Bertram

SOURCES

Food and Agriculture Organization of the United Nations (FAO). 2000. Agriculture and Fisheries Census and Statistics – Cook Islands.

Food and Agriculture Organization of the United Nations (FAO). Data sheet Import and Export values for Agriculture products, 1961 to 2011.

Ministry of Agriculture. 1988. Cook Islands Census of Agriculture 1988.

Ministry of Agriculture. 2011. Cook Islands 2011 Census of Agriculture and Fisheries.

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

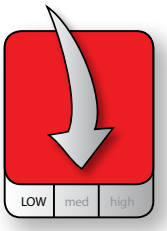
Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 1986 Census of Population and Dwellings*. 1991.

Syed, S. 1993. Agriculture in the Cook Islands: New Directions.

WETLANDS

Introduction

Rarotonga has 114.4 hectares of wetlands and 190.9 hectares of swamps. The four main types of wetlands in the Cook Islands include freshwater marshes and swamps on Rarotonga, Mangaia, Atiu, Mitiaro and Mauke; permanent freshwater lakes with Lake Tiriara on Mangaia, Lake Tiroto on Atiu, and Lake Rotonui and Rotoiti on Mitiaro; a tidal salt marsh at Ngatangiia Harbour on Rarotonga and mountain streams on Rarotonga. However, there is very little data including area matrix for these sites. Freshwater bodies and freshwater biodiversity are extremely limited, with no large freshwater lakes or streams. The wetlands comprise almost all of the country's freshwater areas and its biodiversity. Terrestrial freshwater swamps and bogs make up the largest portion of wetland areas, and it is extremely important to manage these sustainably. Wetlands provide important ecosystem services including acting as storm buffers and water filters, especially from pollution. They are also important for food resources and as biodiversity reservoirs. The wetlands are often used for taro and *mauku (Stylosanthes guianensis)* cultivation, and for traditional purposes such as to colour and harden wooden handicrafts. Increased development and infill to wetland ecosystems are the largest threats to the wetlands, as well as illegal dumping of solid waste in these areas or the introduction of invasive species. Examples are the opening of areas for development and wetland modification for agriculture (taro farming) with associated modifications to the natural water flow and drainage (summarised in Table 8) (Tiraa 1986; NES 2011).



Status
Poor

Trend
Deteriorating

Data confidence
Low

Status: Poor **Trend: Deteriorating** **Confidence: low**

11.1

There is strong pressure from wetland landowners to in-fill the areas for residential and commercial development, as this results in greater personal income through rental fees. Such infilling or construction in freshwater intake areas in the wetlands and along streams alters the water flow and natural drainage. This can cause period flooding, which can affect surrounding areas. In many cases, artificial drainage systems have been developed which further alters natural wetland function, natural drainage, and stream water flow. The wetlands are important places for taro cultivation which provides food security, while altering the natural habitat and drainage systems. Figures 94 and 95 show the types of land in Rarotonga and Figure 96 sums up the types of land in the country.

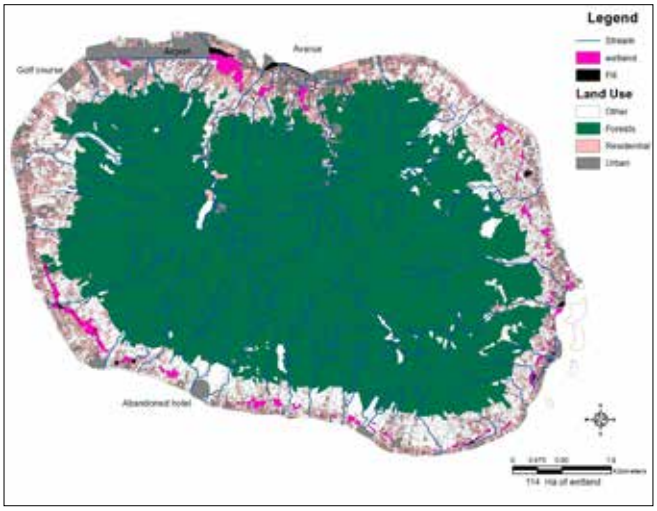


FIGURE 94. Rarotonga's wetlands, with in-fill areas of wetlands, and other types of land-use. (SPREP, 2015; Data source NES)

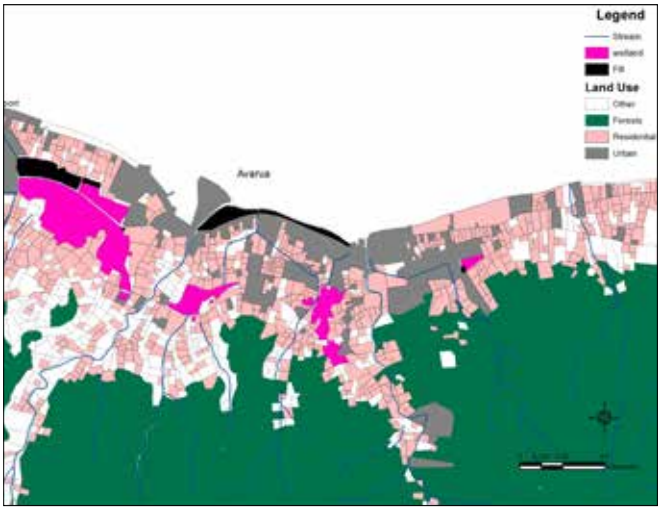


FIGURE 95. Rarotonga's wetlands near Avarua. (SPREP, 2015, Data source NES)

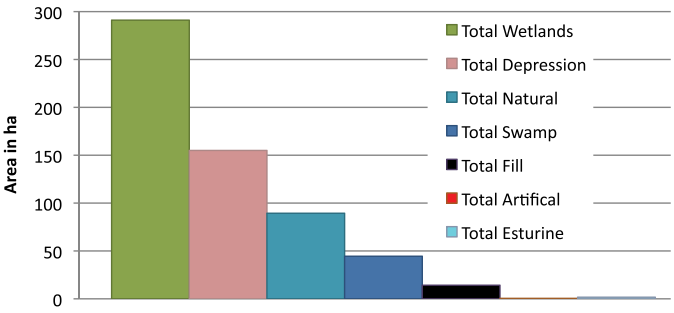


FIGURE 96. Total Wetland area (NES, 2014)

Solid waste disposal is a serious problem for wetlands. Waste is frequently disposed of in the rugged terrain and limestone pits of the *Makatea* islands of Mauke, Mitiaro, Atiu and Mangaia and in the lagoon sides, pits and holes of foreshore areas in the northern group of islands, especially Tongareva. The waste can result in lower water flows, flooding and changes to natural drainage, as well as attract mosquitoes and other public health hazards. Another serious threat to wetlands are invasive species which often enter from in-fill and development, or when the habitat is damaged by tropical cyclones or other storm events.

On Rarotonga coral sand mining near wetland areas can be very destructive, especially through sedimentation from the infill of soils and/or solid wastes. These can disrupt natural wetland habitats and interrupt the natural drainage systems. Some wetlands have been impacted from pesticide spraying and fertiliser applications, such as in Aitutaki, where banana growers used to clean their equipment at the stream outlet at Nikaupara (NES 2011).

Pa Enua wetlands are decreasing overall, specifically on the island of Mangaia where erosion from past agricultural activities have caused siltation and damage to the wetlands. In the 1970s pineapple plantations on Mangaia caused serious erosion on the slopes, and siltation of surrounding wetlands where taro cultivation took place. Nothing was done until the 1980s when these sloping lands were replanted with pine (*Pinus caribaea)* and Acacia *(Acacia mangium*). The *Acacia mangium* has since become a pest on the island. Landowners are reluctant to use the land in many areas where it grows, as it is expensive and labour intensive to remove these trees. Many people believe that the planted pine trees have caused the surrounding wetland and water catchment areas to dry up, thus worsening the problem from what was originally a solution to the erosion. The Mangaia wetlands are slowly drying up, and their condition is declining. Despite this, Mangaia's Lake Tiriara is still in good condition, and remains abundant with local tilapia and eels. It is considered an important tourist attraction for the region, thus highlighting the importance of wetland stewardship for biodiversity, food resources and tourism.

Impact

Wetlands provide important ecosystem services such as storm buffers and water filtration systems. They are important for livelihoods and food security, especially for taro cultivation. Flooding of wetlands both from natural causes such as tropical cyclones and major storm events, and human causes such as interference with natural drainage systems, can result in aesthetic, economic and human health problems. Disease carrying mosquitoes are attracted to flooded areas, and flooding can damage small scale taro plantations which are important food sources for many people.

Impacts of development such as infill and siltation to wetlands can disrupt the natural drainage and water flow, and may result in periodic flooding of these environments, as well as damage to local species and ecosystem functions. A taro replanting programme in Atiu mitigated some of the negative impacts to the taro crops there. Locally grown taro can reduce dependence on imported foods while strengthening the local food resource.
The lakes in the southern group of islands experience occasional saltwater intrusion, which has negative impacts on taro crops, the freshwater wetland ecosystem, and freshwater plants and animals.

Impacts from climate change such as intense storms or cyclones can cause flooding which may be more common and stronger in areas that are artificially altered. These events can also cause saltwater intrusion into wetland ecosystems which can threaten these fragile areas.

A *Ra'ui* (a form of tapu restricting access to an area or resource) in Mitiaro for its eels is an example of a positive measure that has helped to boost the freshwater eel population in the wetland habitat. However, *Ra'ui* can also have some financial costs, such as the rules for no-take of eels and other fish species that might otherwise be financially lucrative. Table 10 summarises threats and associated impacts to the wetland ecosystems.

Response and Recommendations

The Cook Islands Environment Act 2003 has a specific section on the protection of wetlands (section 58) with restrictions, requirements and fines for development-related activities to wetlands, and other activities which might harm wetlands. This expands the environmental progress made by the Rarotonga Environment Act of 1994–1995 to the entire country, including important environmental regulations and provisions that apply to the Pa Enua as well as Rarotonga. NES also has a draft Wetlands Policy which includes more specific protections and provisions for development around these areas.

There is a close working relationship between the Ministry of Agriculture (MOA) and the National Environment Service (NES) on proper wetland management practices, which is essential as so many Cook Islanders actively farm taro in the wetland areas. A NES GIS project carried out scientific

Table 10. Threats to Wetland Ecosystems in the Cook Islands. (National Environment Service, 2011)

Island/Island region	Threats		Key changes/capacity to address the threats
	Indirect	Direct	
Rarotonga	• Demand on land for housing and commercial development; • Land development on the sloping lands and in the catchments impact strongly on the wetland through siltation and also affect seaward water flow. • Poor drainage for road developments; • Climate change; • Abandonment of use resulting in significant vegetation change and ecosystem functioning.	• Filling and claiming of wetlands; • Siltation through surface runoff; • Modification of wetlands through taro planting and modified drainage systems and water flows; • Dumping of solid waste and refuse; • Cyclones; • Extreme high seas; and • Clearing of wetland land and vegetation.	• Decreasing wetland area through land reclamation and infill of wetlands. There is no data available to show these changes.
Pa Enua	• Land development on the sloping lands and in the catchments impact strongly on the wetland through siltation and also affect seaward water flow. • Poor drainage for road developments; • Climate change; • Abandonment of use resulting in significant vegetation change and ecosystem functioning; • Aitutaki: tourism impacts on O'otu wetland; • Other islands, particularly the low-lying northern group, are threatened by rising sea levels and associated salt-water intrusion.	• Cyclones; • Extreme high seas; and • Clearing of wetland land and vegetation.	• Fewer people are using wetlands; • The capacity to utilise the wetlands for the benefit of people depends on imported technologies, e.g. innovative methods for soil creation after a cyclone has caused wetlands flooding; and • Pumping of sea water away from wetland areas to assist in taro plant recovery.

mapping of all the taro areas within Rarotonga and Avatiu, for a better understanding of local agriculture within wetland habitats.

Given the importance of wetlands, and the poor status and declining trend of these important ecosystems, Cook Islands should review and strengthen its Environment Act. Furthermore, it is recommended that the 2005 draft Wetland policy is reviewed and finalised. If support is required, regional organisations should be asked for assistance.

Cook Islands should develop stronger guidelines and standards for development around the wetlands associated with construction, excavation, clearing, planting and reclaiming. It should fund education and awareness programmes to implement these guidelines and standards, and create monitoring programmes that ensure the standards are being met. Broad compliance, education, awareness and monitoring programmes are important to ensure that people understand the value of wetland ecosystems, and how best to mitigate their own impacts to these areas. While social studies classes cover land-use and agriculture, a specific section on the importance of wetlands management should be included so that students more fully understand how land-use and agriculture relates to the environments where they take place. NES monitoring programmes should include a specific focus on wetland health monitoring, including stream monitoring, and ongoing monitoring programmes should be re-examined to determine how a wetlands focus might best be incorporated. Environmental education of local ministries and politicians will help to ensure that policy and decision makers better understand the importance of wetland conservation and the ecosystems and services that these areas provide. Finally, the Cook Islands should support more national research into wetlands and should use the science to inform policy decisions.

The national report from 2011 includes Cook Islands goals under the Convention on Biological Diversity (page: 47–62 and 79–92) in relation to plants, wetlands, invasive species, community based protected areas, traditional knowledge, mainstreaming of biodiversity and waste (NES 2011).

SOURCES

Ellison, J. 2009. Wetlands of the Pacific Island region. Wetlands Ecol Manage. 17:169–206.

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

Tiraa, A. 1986. Cook Islands Wetland Situation.

ONLINE RESOURCES

http://www.ramsar.org/

http://www.cookislandsnews.com/item/35889-protect-our-precious-wetlands/35889-protect-our-precious-wetlands

MAPS

SPREP, 2015 with data from NES

T.Straza

OVERVIEW

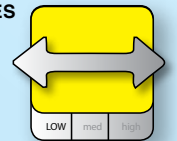
This theme on the state of Cook Islands' marine environment focuses on the offshore and inshore environment. It includes the tuna fishery, the status of the coral reef, reef fish and sea urchin density and biomass, reef fisheries, marine protected areas and *Ra'ui*, lagoon water quality, marine turtles, whales and other marine mammals.

The status of the marine environment is fair but more data is needed to make a more accurate statement. The offshore and inshore fishery is impacting on the marine life and it is important for Cook Islands to look after the marine resources.

Cook Islands entire EEZ has been declared a Marae Moana, established under the Marae Moana Act 2017, to protect and conserve the ecological, biodiversity, and heritage values of the Cook Islands marine environment. Marae Moana is one of the largest multiple-use marine protected area in the world, an important steps towards the protection of a unique marine environment.

© Michael F. Donoghue

MARINE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
OFFSHORE MARINE ENVIRONMENT	**TUNA, SHARKS AND OTHER TARGETED SPECIES:**  **Status** Fair **Trend** Deteriorating **Data confidence** Medium	Catches of most tuna species in the Western and Central Pacific Ocean (WCPO) have increased dramatically over the past decade. The biomass of tuna stocks in subregional waters around Cook Islands have declined significantly. Albacore, Yellowfin and Skipjack tuna are all being fished within Maximum Sustainable Yield (MSY) levels, but still remain vulnerable. Bigeye tuna is considered overfished well above MSY, and Yellowfin tuna is considered fully exploited with no room for expansion. Around half of the licensed longline fishing vessels in Cook Islands are foreign fishing vessels. Bycatch of non-target fish species and sharks is of major concern, especially in the longline fishery. Overfishing and bycatch can result in serious economic and biological losses, and can threaten the sustainability and future of entire fisheries and ecosystems.	The Ministry for Marine Resources increased data collection and introduced new measures to monitor the catches of long liners. The observer programme was introduced and offshore fishing is now managed under the regional tuna vessel day plan scheme. A shark sanctuary was declared. Half of the Cook Islands EEZ was declared to be part of the new Marine Park Marae Moana. It is recommended that data collection is increased as well as the number of observers on board of fishing vessels. This information will be shared with Marae Moana, other government authorities and the wider public.
INSHORE MARINE ENVIRONMENT	**LIVE CORAL COVER:** **REEF FISH AND URCHIN DENSITY AND BIOMASS:** **REEF FISHERIES:**  **Status** Fair **Trend** Mixed **Data confidence** Medium **MARINE MANAGED AREAS, RA'UI ON RAROTONGA AND PA ENUA**  **Status** Fair **Trend** Stable **Data confidence** Medium **LAGOON WATER QUALITY, RAROTONGA**  **Status** Poor **Trend** Deteriorating **Data confidence** Low	LIVE CORAL COVER: Live coral cover is relatively healthy across the southern Cook Islands where reefs usually undergo cyclic declines and recoveries from cyclones and Crown of Thorns Starfish (COTs). While Rarotonga had a large fall in live coral cover over the last decade, coral cover is improving slowly, although shallow inshore reef areas are declining or stable at best. Coral cover is under pressure from development, waste and agriculture. Stringent management is required to ensure continued recovery and growth of live coral cover into the future. REEF FISH AND URCHIN DENSITY AND BIOMASS: Rarotonga has more herbivores and fewer damselfish in its reefs. This reflects poor and deteriorating reef conditions there, compared to the outer southern islands which have much higher numbers of damselfish, and fewer herbivores. Reef fish and urchin density and biomass vary across the Cook Islands depending upon the island habitat, and existing anthropogenic pressures such as fishing and development. REEF FISHERIES: Since 1986 the number of people employed in the fishing sector has dropped and most people fish for subsistence. From 2001 to 2011 more people started to fish inside the reef. MARINE MANAGED AREAS, RA'UI ON RAROTONGA AND PA ENUA: Communities can benefit through *Ra'ui* as they protect sensitive areas and re-establish populations outside the protected area. More resources are available for subsistence and commercial activities. The tourism sector is benefiting from community-based managed areas. *Ra'ui* have become less common and control and enforcement is lacking. The issue of the legal status of *Ra'ui* needs to be solved. LAGOON WATER QUALITY: Water quality monitoring started in 2004 to provide baseline data for Rarotonga, as it was noticed that people got sick when they swam in certain areas. Some sites in Rarotonga have high levels of nitrates and enterococci, and similar results are observed for Aitutaki. The other islands have generally good water quality but not much data is available.	Cook Islands should continue to use whole ecosystem reef to ridge management to address and manage land-based impacts to live coral cover. It should better engage the tourism industry to provide financial capacity for coral protection and management, which is a major tourist attraction. The WATSAN Unit was established to improve water quality and to reduce negative impacts on the coral reef. The establishment of the Marae Moana and the support from the WATSAN Unit will help improve the reef fish and sea urchin density and biomass in the lagoons. Data collection is recommended to get a better understanding and to advise the public accordingly. Cook Islands responded with a bonefish management project due to the falling numbers of reef fish. It is hoped this fishery will provide a new tourism market. Some Pa Enua islands have established *Ra'ui* for *Pa'ua* (clams) (*Tridacna maxima*) and prohibit *Pa'ua* from being taken off the island. To enforce these actions the national legislation should be strengthened and enforced. Minimum catch sizes are recommended. Data should continue to be monitored and collected. Impacts from land also impact on marine protected areas. It is important to include traditional knowledge into the establishment of *Ra'ui* and to integrate traditional knowledge into national law. The establishment of Marae Moana showed the desire by local communities to have the area extended to cover the whole EEZ. Cook Islands established the WATSAN Unit to address lagoon water quality. Health regulations also regulate sewage systems and land based activities. There is not much data available, thus data sampling of lagoon water should be increased, especially in the Pa Enua. Programmes to mitigate pollution should be considered and a waste management system developed for piggeries.
TURTLES AND CETACEANS	**TURTLES**  **Status** Fair **Trend** Unknown **Data confidence** Low **WHALES**  **Status** Fair **Trend** Stable **Data confidence** Low	Turtles and whales play an important part in the Cook Islands ecosystem and tourism sector. These highly migratory species are vulnerable to pollution and threatened by solid waste and toxic chemicals. Four sea turtle species and eleven cetacean species are likely to be seen in Cook Islands waters. Sea turtles nest in the Cook Islands from September to April but there is little information available. Whales come through from July to October on their seasonal migration. In 2001 Cook Islands declared its waters as a Whale Sanctuary.	In 2006 Cook Islands became a signatory to the Convention on the Conservation of Migratory Species of Wild Animals (CMS). Different educational programmes for turtles were implemented and data collected through TREDS. Regulations for long line vessels were implemented to prevent sea turtle bycatch. An MOU was signed with SPREP and CMS for whale and dolphin conservation and action plans. A whale sanctuary was established. Research is carried out at the Center for Cetacean Research and Conservation (CCRC). It is recommended that longer term research is conducted for turtles to help plan conservation measures, and to continue the data collection and research done by the CCRC.

Introduction

Offshore fisheries production is an important indicator of pelagic (deep water) fish stock health. It provides a measure of the state of fisheries and management, as well as the general state of commercial species and bycatch fish populations, including sharks and other species. This indicator is a basic data type for most fisheries.

From 1953 to 1984, the historic tuna fishery in the Cook Islands was dominated by foreign longline fleets from Japan, South Korea and Taiwan that targeted Albacore, Yellowfin and Bigeye tuna species (Molony, 2006). From the mid-1980s to late-1990s a small, domestic fleet dominated the fishery. In order to develop the domestic fishery, a moratorium was imposed in 2000 on the licensing of all foreign fishing vessels. During this time the national fleet expanded significantly. In 2008, however, the moratorium was reversed as it had partially achieved its goal. As of 2012 around half of the 70 licensed longline ships (36) are licensed foreign ships, while 34 are the national fleet. Of them, 17 are of Cook Islands origin and 17 are Chinese ships licensed to fish nationally (MMR 2012).

Since 2001 two distinct fisheries have developed within the Exclusive Economic Zone (EEZ), which is delineated into north and south by the 15°S latitude line (Figure 97). The northern fishery targets Albacore tuna and uses longline vessels which operate out of Pago Pago, American Samoa. Purse seining of Skipjack tuna has historically been only a minor component of the fishery, and all of the limited purse seining activity occurs in the northern EEZ. The southern fishery is comprised of two small, locally based vessels which operate domestically out of Rarotonga and target a range of species to cater mainly to local demand (MMR 2012).

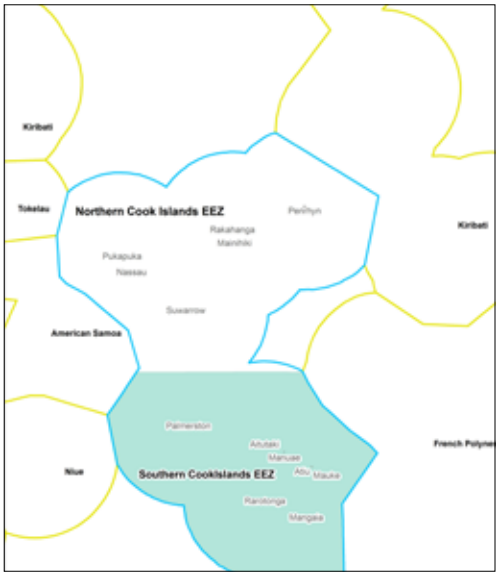
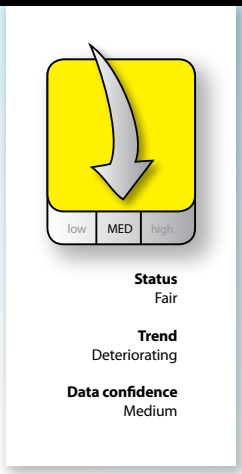


FIGURE 97. Cook Islands' Exclusive Economic Zone (EEZ), divided between the northern and southern fishery zones. (SPREP)



TUNA, SHARKS AND OTHER TARGETED SPECIES

Status: Fair Trend: Deteriorating Confidence: Medium

Catches of most tuna species in the Western and Central Pacific Ocean (WCPO) have increased dramatically over the past decade. Regional stock assessments in 2010 indicate that key tuna stocks in subregional waters around the Cook Islands have declined in biomass by up to 58% (Yellowfin) from a 1980 baseline, or by up to 40% (Skipjack) from a 2000 baseline (SPC 2013). Recent stock assessments by the Secretariat of the Pacific Community (SPC) for the Western Pacific report that Albacore and Skipjack fisheries are within maximum sustained yields (MSY) and are not currently overfished, but remain vulnerable to being overfished especially as longline catch continues to increase. WCPFC estimates a 19% chance of Albacore being overfished by 2033 under current levels of exploitation. Longline fishing effort for Albacore tuna in both EEZs and on the high seas south of 10 degrees increased steadily between 2010 and 2014. This caused the Catch Per Unit Effort for Pacific Islands Small Island Developing States, including the Cook Islands, to decline, which affected profitability. Bigeye tuna is a species of particular concern and the 2014 stock assessment reported that Bigeye catch is well above MSY, and is considered overfished. Bigeye catches in the region in 2015 were the lowest since 1996, despite increased fishing effort (WCPFC 2016). Yellowfin tuna is considered fully exploited with no room for expansion.

While data is limited for shark populations the condition of shark stocks in the Cook Islands and in the Pacific is more dire than that of tuna species.

Figure 98 shows the national and foreign fleet catch of tuna species in Cook Islands since 1954. The fishery is dominated by Albacore tuna, followed by Bigeye and Yellowfin tuna. Skipjack tuna has been caught and recorded since 1993, and the biggest single catch was 4000 tonnes in 2002. The longline tuna fishery has grown rapidly since 2002, and 2012 represented the single highest recorded catch

for Albacore (8800 tonnes) and Bigeye (2800 tonnes) tuna. The total amount of tuna caught in 2012 was almost 14,000 tonnes, which doubled the total catch recorded in 2009 and 2010. Based on export data of fresh fish from the Cook Islands Statistics Office, there is evidence that this number was still rising rapidly in 2013 and 2014. Figure 99 shows the values of fresh fish exports from 2009 to the first and second quarters of 2014. Similar to the catch doubling seen in 2009/2010 and 2012, the value of exports also doubled. The 2013 fresh fish export values increased by more than double compared with 2012. The same can be observed for the first two quarters of 2014 which already has the same value of exports as all of 2013. Without catch volume data for 2013/2014 it is not possible to say if the increase in value is due to an increase in price per tonne or increase in volume caught. In either case, tuna is an important and increasing economic driver for the Cook Islands.

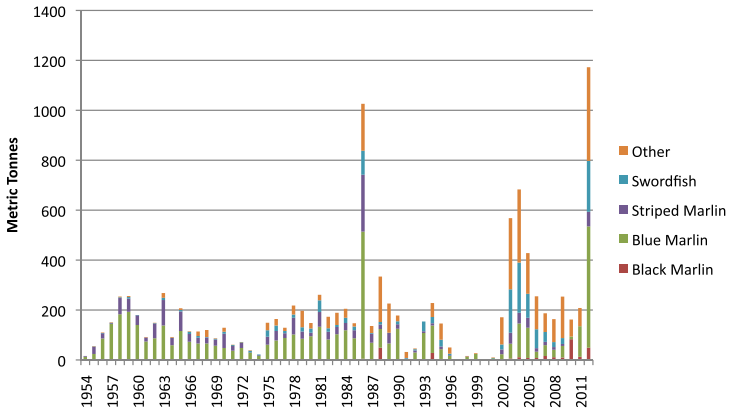


FIGURE 100. Other fish species harvested from bycatch and targeted fisheries in the Cook Islands. (Reconstructed from Molony, 2006, SPC 2011 and MMR, 2009 and 2012) **excludes wahoo and sharks*

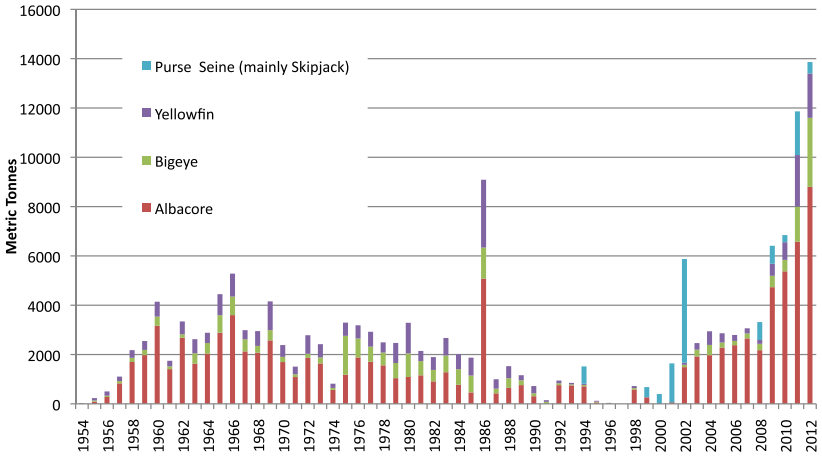


FIGURE 98. Cook Islands Tuna Catch (Longline: 1954–1999, Longline and Purse Seine: 2000–2012). (Reconstructed from Molony, 2006, SPC 2011 and MMR, 2009 and 2012)

FIGURE 101. Oceanic white tip shark (*Triaenodon obesus*) *(Sean Havas)*

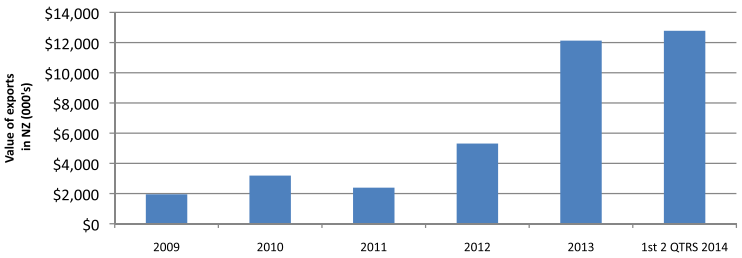


FIGURE 99. Value of Cook Islands' fresh fish exports, 2009–2014. (STATS)

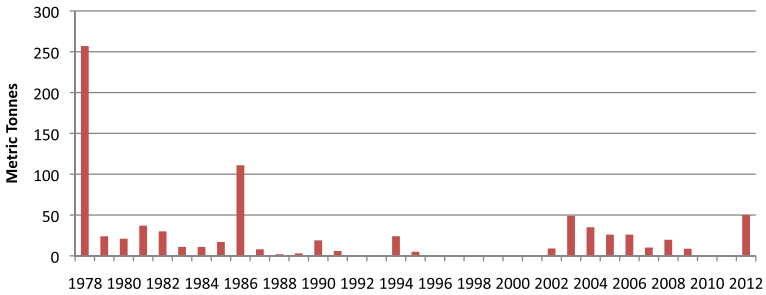


FIGURE 102. Shark bycatch in Cook Islands Exclusive Economic Zone (EEZ), 1978–2012. (Reconstructed from Molony, 2006, SPC 2011 and MMR, 2009 and 2012) *Note: numbers not available for 2010 and 2011

Other species of fish harvested from 1954 to 2011 (Figure 100) are dominated by marlin *(Makaira indica)* and swordfish *(Xiphias gladius)*. The bycatch of non-targeted species harvested from tuna fishing is dominated by wahoo (*Acanthocybium solandri)*, swordfish and marlin. A particular concern across the Pacific is bycatch and targeted fishing of shark species (Figure 101), with the fins sold to the increasingly lucrative shark-fin market. Cook Islands' fisheries have recorded incidental bycatch of shark species since the late 1970s (Figure 102). A complete ban on the harvest and retention of shark products was introduced in the Cook Islands in 2012, although it is too early to see if this ban has impacted shark harvest numbers.

Figure 103 shows the drastic increase of hooks used, and therefore fishing effort, in fisheries from 2001 to 2012. This has gone from 3082 hooks up to 394,500 hooks in 2012 which correlates to the increased longline fishing of Albacore from 2001.

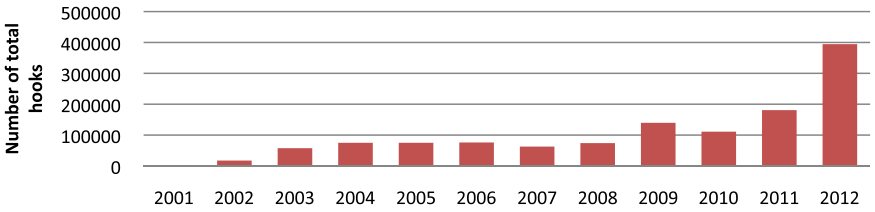


FIGURE 103. Total number of hooks from 2001 to 2012. (MMR 2013)

Impact

Overfishing has a big impact on the economy and on ecosystems. Unsustainable fishing leads to the collapse of key stocks, and disruption of trophic relationships and food webs. Management and control is crucial to support the livelihoods of both commercial and artisanal fishers. Although most of these stocks are not yet fished beyond MSY levels, the availability of these fish to artisanal fisherman has significantly declined, and continues to decline (SPC 2013). A recent survey by SPC on the impact of commercial fishing on artisanal fishing communities shows that pelagic fish biomass and availability is decreasing for coastal communities in the Cook Islands. Surveys of artisanal catch effort (kg of fish caught per hour of effort expended) on islands where commercial fishing was within 100km of the coastal zone showed a large drop in catch per unit effort from 2000 to 2010 (Figure 104).

The removal of key biological species like sharks, which maintain the trophic balance, can have wide-reaching impacts for both inshore and offshore ecosystems. Based on community consultations through the House of Ariki, local communities on Pa Enua report that they have witnessed a fall in catches and also a decrease in the size of the fish they are catching. Whether this smaller fish size is due to commercial exploitation requires more study. The communities reported that they compete with the sharks for the fish and that sharks get the fish from their lines. Depredation is a well-known phenomenon and has been happening for as long as fishing has been going on. But as catches decline, the taking of hooked fish by sharks becomes more obvious and is perceived as an economic problem.

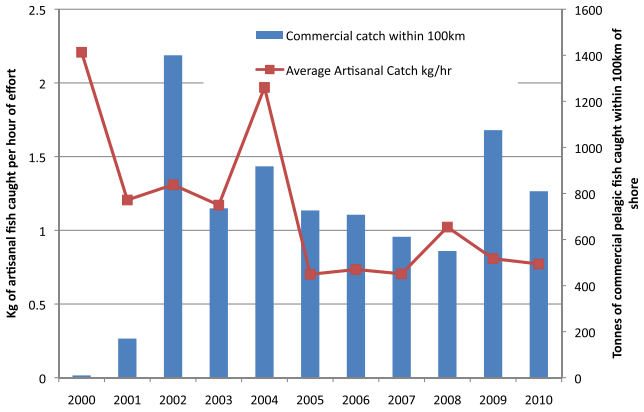


FIGURE 104. Relationship between artisanal fish catch effort averaged from all Cook Islands and commercial pelagic fish catch with 100km of islands. (SPC, 2013)

Response and Recommendations

The Ministry of Marine Resources (MMR) is increasing efforts to enhance data collection as well as enforcement and control of total catch for long liners. In 2005 two new forms were introduced to the industry, a vessel unloading form and a vessel trip/port activity log. The intention is to record more accurately the volume of fish unloaded to markets by all vessels as well as the record of time spent at sea, fishing and transiting for scientific purposes (MMR 2006).

The Marine Resources (Longline Fishery) Regulations 2008 were reviewed in 2010 and a Marine Resources (Longline Fishery) Amendment Regulations 2010 was endorsed.

In 2010 Cook Islands introduced Fisheries observers to longline fishing vessels who monitor and record activities and operations on board. In 2010, ten observers covered about two per cent of fishing days, these increased to 18 observers and seven per cent of fishing days in 2011, and 30 observers covering eight to ten per cent of fishing days in 2012 (MMR 2010, 2011 and 2012).

Offshore fishing is managed by the Ministry of Marine Resources. Recently (2015) an eight year Sustainable Fisheries Partnership Agreement between the European Union and Cook Islands was ratified. This agreement includes a four-year protocol which allows up to four EU purse seine vessels into the Cook Islands Exclusive Economic Zone (EEZ) to fish up to 7000 tonnes per year, mainly Skipjack and Yellowfin tuna, for which the EU will provide 2.9 million Euro (European Parliament 2016; Cook Islands News 2016).

The House of Ariki has proposed the extension of the 12 nautical mile ban for foreign fishing fleets around islands to 50NM, to support local fishing. Current proposed legislation includes both the 50NM and a compromise 24NM foreign fishing ban which includes both long liners and purse seiner fishing vessels. A decision is pending.

In 2009 the Forum Fisheries Agency (FFA), SPC and SPREP developed a Regional Action Plan for Sharks. Cook Islands developed regulations banning the commercial take of sharks. These regulations prohibit the possession of sharks on board commercial vessels.

Furthermore, on 12 December 2012, the Cook Islands declared a 1.997 million sq.km area as Shark Sanctuary. All sharks and ray species are protected under the Marine Resources Act and regulation.

Also in 2012 Cook Islands declared 1.1 million sq. km of the southern half of the Cook Islands EEZ as a marine park called Marae Moana, the second largest in the world. Due to requests from communities and stakeholders, it was decided to also include the northern Cook Islands. The draft policy of Marae Moana has been amended to cover the entire EEZ. The size of the full protection area is still under discussion with stakeholders. Zones of use and protection are currently under development (Rongo et al. 2013; Maraemoana.gov.ck).

Despite these efforts, more control and oversight is required, particularly over the harvest of catches of long liners and management of the pelagic fishery. The expansion of the observer programme is to be commended.

Cook Islands should collect more data on the offshore fishery. Information on marine biodiversity, including bycatch, from the observer programme should be shared with Marae Moana, NES and relevant government authorities. Data derived from the fishing industry has particular relevance for the management of the Marae Moana, and the work of NES and civil society, and needs to be made available to key partners.

Public awareness of the use and management of marine resources is an important output of the government mandate. Therefore, marine resource ministries are encouraged to engage with the public and communicate their activities and plans. Data should be transparent and information should be made available and used for conservation, tourism and biodiversity.

© WWF SSI

SOURCES

European Parliament. 2016. Expanding the network of EU tuna fisheries agreements.

SPC, 2011. Oceanic Fisheries Programme: Issue-Specific National Report 5.2 – Figure 1b

SPC, 2013. Oceanic Fisheries Programme. The potential for interactions between commercial tuna fisheries and Cook Islands artisanal fisheries: Issue-Specific National Report 5.2

Ministry of Marine Resources. 2009. Cook Islands Longline Fishery Annual Reports 2009.

Ministry of Marine Resources. 2013. Cook Islands Longline Fishery Annual Reports 2012.

Molony, B. 2006. SPC Oceanic Fisheries Programme. 2006. Cook Islands National Tuna Fishery Status report No. 11, Aug 2006

Harley, S., Williams, P. Nicol, S. and Hampton, J. 2011. SPC Oceanic Fisheries Programme. 2011. The Western and Central Pacific Tuna Fishery: 2011 Overview and Status of Stocks, 2011

Harley, S., Davies, N., Hampton, J. and McKechnie, S. 2014. SPC Oceanic Fisheries Programme. 2014. Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean. Report to the Scientific Committee, Tenth Regular Session, Majuro, Marshall Islands, 2014.

Cook Islands Statistics Office. 2014. Overseas Trade Statistics June 2014

Rongo, T., Evans, J., Passfield, K., Cramp, J., Sudek, M., Tautu, B., McDonald, G., Rongo, T.C., and B. Hanchard.. 2013. Cook Islands Marine Park: coral reef survey of Aitutaki, Manuae, Mitiaro, Takutea, and Atiu in the southern Cook Islands. Government of the Cook Islands. 64 p.

Western and Central Pacific Fisheries Commission (WCPFC) 2016. 13t Regular Session of the Commission.

ONLINE SOURCES

www.Maraemoana.gov.ck – 22.10.2016

MMR responds to EU fishing questions: http://www.cookislandsnews.com/national/local/item/58975-mmr-responds-to-eu-fishing-questions/58975-mmr-responds-to-eu-fishing-questions – 16 June 2016

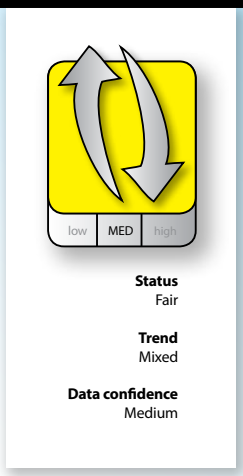
INSHORE MARINE ENVIRONMENT PERCENT LIVE CORAL COVER

Introduction

Live coral reef cover is a good indicator of the overall state of the inshore ecosystems in the Cook Islands. For this indicator, live coral cover is defined as the area covered with living coral either in mono-species or multi-species colonies, and includes both hard and soft corals.

Coral cover provides a measure of land-use impacts and erosion, fishing pressures, relative sea surface temperature (SST), presence of disease and predators such as the Crown of Thorns (*Acanthaster planci*) (COTs) starfish, and mechanical damage from anthropogenic sources such as development or agriculture, or natural phenomena such as cyclones. This indicator is a basic data type for most surveys and information is widely available in both Cook Islands and the wider Pacific region.

This indicator assesses the amount of live coral reef and algal communities at sites in Rarotonga from 1994 to 2011. Coral and algae cover is also provided for the southern Pa Enua from a recent survey in 2013. With the exception of Palmerston, not enough data exists at the time of publication for the northern islands (Figure 105).



Status: Fair **Trend: Mixed** **Confidence: Medium**

Across the southern Cook Islands, coral cover is relatively healthy, and is at or above the Indo-Pacific average of 22.1% (Figures 106). For example, Manuae and Mitiaro recovered from low levels of 10–20% coral cover in 2002 and 2005 to over 30% in 2013. However, added pressures on the environment from water pollution, fishing and coastal development have slowed recovery in Rarotonga and Aitutaki. Coral reefs in Cook Islands generally undergo a cyclic phenomenon of decline and recovery from Crown of Thorns Starfish (COTs) or cyclones. Aitutaki has experienced a substantial decrease in coral cover on the leeward side from 34% and 14% at two sites in 2008, to less than one per cent at the same sites in 2013 (Figure 107). This is largely due to the impact from cyclone Pat in 2010 and the ongoing COTs outbreaks there (Rongo et al. 2013).

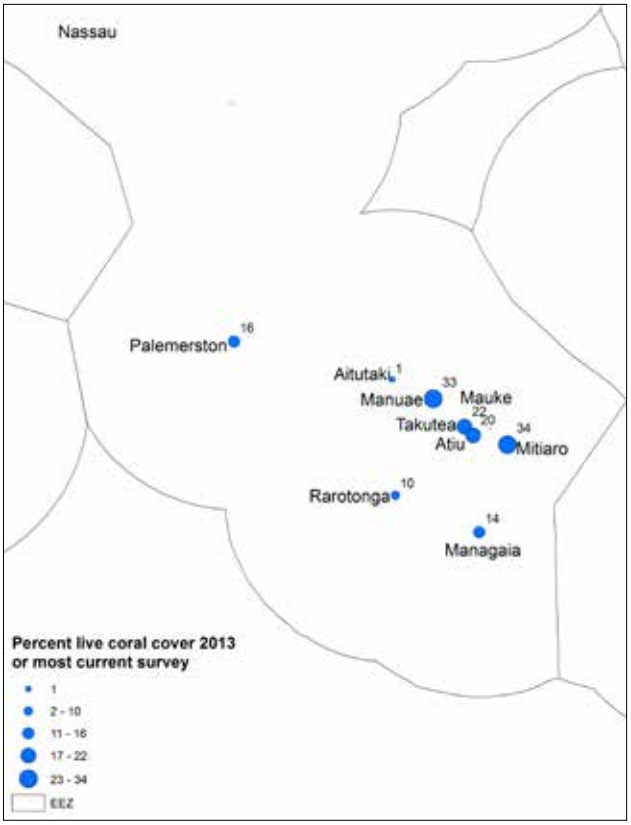


FIGURE 105. Per cent live coral cover from southern Cook Islands and Palmerston. (Rongo and van Woesik, 2013; Rongo T. et al. 2013, SPREP Summary)

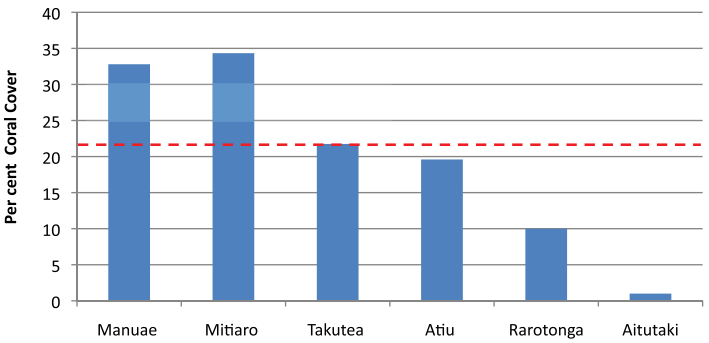


FIGURE 106. Southern Cook Islands percent hard and soft coral cover, all sites, 2013 (Rongo T. et al. 2014)

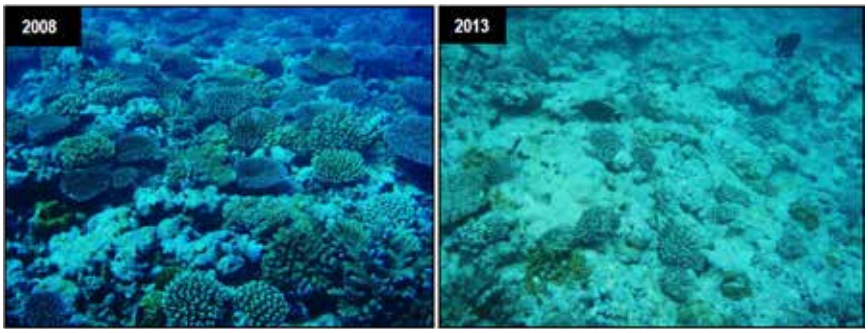


FIGURE 107. Pacific Resort Forereef Aitutaki: depicting general decrease in coral cover 2008–2013 believed to be from Cyclone Pat in 2010 and ongoing Crown of Thorns (COTs) outbreaks. (Source: Rongo T. et al. 2013)

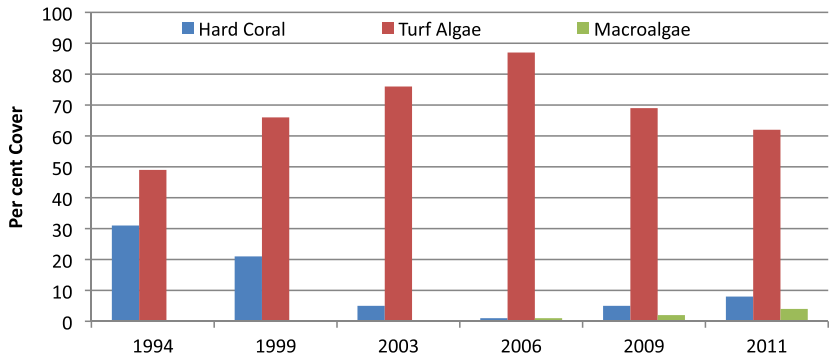


FIGURE 108. Per cent hard coral cover on Rarotonga reefs, 1994–2011. (Rongo and van Woesik, 2013)

Rarotonga experienced a big drop in hard coral cover from 31% in the mid-1990s to less than one per cent in the mid-2000s (Figure 108). This was likely due to combined effects from a major COTs outbreak which began in the mid-1990s, followed by a series of destructive cyclones in the mid-2000s.

The north coast of Rarotonga recovered faster than the south and east coasts from a COTs outbreak and cyclone in 2005. The overall increase in coral cover matches a decline in turf algae (Figure 108). Since 2006, however, overall soft and hard coral cover on Rarotonga has increased (Table 11) and is now around ten per cent.

TABLE 11. Rarotonga Hard Coral, Turf Algae and Macro Algae Cover in per cent. (Rongo and van Woesik, 2013)

YEAR	1994	1999	2003	2006	2009	2011
Number of Sites	3	6	?	11	10	?
Hard Coral Cover	31	21	5	1	5	8
Turf Algae	49	66	76	87	69	62
Macro Algae	-	-	-	1	2	4

Mean hard coral cover has been slowly increasing since 2006 on Rarotonga's fore-reef at an average of 1.4% per year. Although the reefs appear to be recovering, the shallow areas inside the reef are declining or stable at best, and it is likely that local pressures like development and water quality are impeding the pace of recovery there.

Warming oceans due to climate change impacts the coral reefs and coral bleaching events are taking place. Long periods of stress due to warming water can damage corals and bleach whole colonies. A recent study showed that in 2016 60% of corals in the atoll islands of Tongareva, Rakahanga, Manihiki, and Pukapuka in the northern Cook Islands had been affected by bleaching (Rongo 2016).

Impact

Tourism is the largest generator of overseas income in Cook Islands and the largest non-extractive user of reef resources, with most visitors involved in marine activities. Healthy coral reefs will continue to attract tourists and have major impacts on visitors who consider their reef interactions as part of a genuine environmental experience. Degraded coral reefs can result in a loss of tourism dollars and investment in that sector of the economy.

The condition of Cook Islands reefs, particularly in the less populated islands, has a major impact on sustainable livelihoods as many communities rely upon the reefs for food. Poor reef quality and low live coral cover can have negative impacts on biodiversity, result in very few to no shellfish in some areas, an increase in the incidence of ciguatera, and other negative health impacts as locals move from fresh and healthy reef fish diets to imported food. The loss of live coral reef cover can also result in negative cultural impacts as communities forget traditional biodiversity and knowledge of areas that have changed.

Response and Recommendations

In order to protect and enhance the natural resilience of coral reefs, the Cook Islands Ministry of Infrastructure is running the Water, Waste and Sanitation Unit (WATSAN) to improve water quality discharge and reduce the negative effects on coral reefs. WATSAN aims to improve water delivery, waste and sanitation services. It has a pilot project in Muri and Avana to improve water quality in the Muri lagoon through pollution prevention and replacement of all non-compliant residential septic systems in the surrounding areas. This pilot, in partnership with New Zealand and Australian aid programmes, recognises that the Muri lagoon is an important area for tourism, and helps to protect economic interests at the same time as improving public and environmental health in the area.

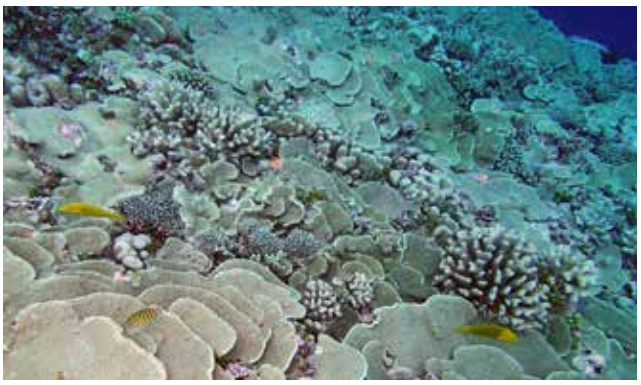
Cook Islands has taken steps to stop imports of phosphate-based detergents, which harm coral reefs by increasing eutrophication. WATSAN's Sanitation Upgrade Programme (SUP) also worked to upgrade domestic sanitation systems and improve overall water quality, thus easing pressure on the surrounding lagoons and coral reefs.

NES and others are conducting coral reef monitoring in several locations to track coral health, coral bleaching and coral cover. This should be expanded in future.

Cook Islands should continue to address threats to its coral reefs through ridge to reef programmes. These recognise the links of entire ecosystems from mountains and communities to surrounding reefs and lagoons, and the impacts that land-based activities can have upon coral reefs, particularly from waste, sewage, development, and agriculture. While coral planting activities do occur in some areas, the impact made by such programmes is often minimal, and should be coupled with longer term, more sustainable management projects.

Coral reefs are a major tourist attraction, and deliver a substantial amount of money and investment to the country. Cook Islands Tourism has been successful in setting up a lagoon monitoring programme in Aitutaki, and a coral garden project. More emphasis should be placed on the role that tourism can play in improving coral reefs, such as through tourist taxes or green fees to provide specific money for coral and environmental restoration. One example could be in the form of a tourist departure tax, or through a tourism accreditation programme that requires properties and resorts to comply with certain waste management standards, such as septic standards to be phosphate free and to provide proper solid waste management and recycling in order to receive environmental endorsement on a national level.

Crown of Thorns starfish (COTs) was identified by communities as a 'most serious' invasive species during public consultations, but more recently COTs have been less of an issue. Coral monitoring should include COTs in addition to coral bleaching and coral disease. MMR has a coral monitoring programme and cooperation between relevant agencies would help to coordinate an integrated coral monitoring approach and resourcing.



Photos: T.Rongo

SOURCES

Miller, I., Thompson, A. and Loo, M. 1994. Report on the Baseline Surveys for Monitoring the Fringing Reef of Rarotonga, Cook Islands

Ponia, B., Raumea, K., Turua, T. and Clippingdale, M. 1999. Rarotonga Fringing Reef Fish and Coral Monitoring Survey. Prep. for MMR.

Lyon, S.J. 2003. Rarotonga Fringing Reef Survey (prep. for NES).

Rongo, T., J. Holbrook and T. C. Rongo. 2006. Reef Survey for Rarotonga.

Rongo T. 2008. Coral Reef Survey for Aitutaki. For the Cook Islands National Environment Service.

Rongo, T., Rongo, T.C., Rongo, J. 2009. Rarotonga Fore Reef Community Survey 2009. For the Cook Islands National Environment Service.

Rongo T. 2011. Marine survey analysis for the proposed cruise ship landing jetty site in Arorangi.

Rongo, T. and von Woesik, 2013. The effects of natural disturbances, reef state, and herbivorous fish densities on ciguatera poisoning in Rarotonga, southern Cook Islands. Toxicon 64:87–95

Rongo, T., Evans, J., Passfield, K., Cramp, J., Sudek, M., Tautu, B., McDonald, G., Rongo, T.C. and Hanchard, B. 2013. Cook Islands Marine Park: coral reef survey of Aitutaki, Manuae, Mitiaro, Takutea, and Atiu in the southern Cook Islands. Government of the Cook Islands. 64 p.

Rongo, T., Tautu, B., McDonald, G., Hanchard, B. and Rongo, T.C. 2015. Rarotonga fore reef community survey for 2014. Government of the Cook Islands. 36 pp.

Rongo, T. 2016. Impacts of the 2015/2016 El Niño event in the Northern Cook Islands. Government of the Cook Islands. 27 pp.

INSHORE MARINE ENVIRONMENT REEF FISH AND SEA URCHIN DENSITY AND BIOMASS

Introduction

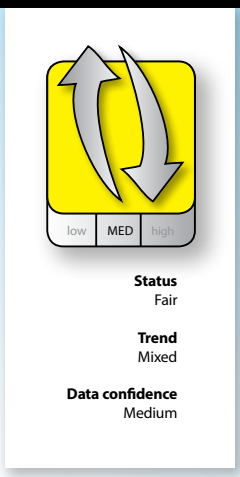
Reefs and inshore species exist in mutually supportive relationships, where reefs support fish and invertebrates with food and shelter, and fish and invertebrates help maintain and establish reef systems. The density of reef fish and urchins provides a good insight into the health of the inshore environment in addition to anthropogenic pressures such as fishing and development. Reef condition, particularly coral cover and algal cover, can impact the relative density, species and size of fish, sea cucumbers and urchins. For example, reefs in a state of heavy algae cover favour algae-eating herbivores, like parrotfish and surgeonfish *(Acanthurus achilles)* and urchins, which can facilitate coral recovery. Conversely, high coral cover supports a diverse array of fish, who use coral structures for shelter and feeding.

Inshore fishing typically targets larger reef fish such as goat fish (*Mulloidichthys flavolineatus*), parrotfish and surgeonfish (Figure 109), and can impact the health of reefs by removing important grazers from the ecosystem. In Cook Islands, fishing pressure is determined by socioeconomic factors and ciguatera.

A study from the Caribbean in 2014 suggested that the decline of reefs there over the past 30 years is in part due to the decline of algal grazing urchins and fish such as parrotfish which help keep algae growth in check and aid in the re-generation of coral. This, coupled with pressures from over-development and tourism, has reduced coral cover level to extremely low levels which have not recovered (Jackson et al. 2014).

Inshore fish density is measured in numbers per area and/or in estimated weight per area. Urchin species are grouped under the two dominant genera *Echinothrix* and *Echinometra*, and averaged in numbers per area. Fish and urchins are counted using the Underwater Visual Census (UVC) method. The UVC method uses survey dives to measure species, size and abundance along replicate transects at deep and shallow depths. Both density and biomass are extrapolated mathematically using results from the survey.

Results are summarised from three major projects: 1) annual benthic and fish community surveys on Rarotonga from 1999, 2006 and 2009, 2) the SPC 2007 Pacific Regional Oceanic and Coastal Fisheries Programme (PROCFish) finfish survey for Mangaia, Palmerston, Rarotonga and Aitutaki islands, and 3) the 2013 Benthic and fish survey for the southern Cook Islands.



Status: Fair **Trend: Mixed** **Confidence: Medium**

The status of inshore fish and urchins in Cook Islands is fair, and the trends are mixed, with the status and trends based on the unique characteristics and diversity of the various islands. Some islands are pristine, some have low fishing pressure but high development, and some islands have high fishing pressure but low development.

Data collected since 1999 at several stations around Rarotonga reveals the relationship between reef condition and fish and marine invertebrate populations. Generally speaking, as the reefs deteriorated and algae increased from 1999 to 2006, the number of herbivores increased and numbers of damselfish (*Chromis bami)* decreased (Figure 110 and 111). Data from 1999 to 2009 show that the reef is gradually regenerating, and that damselfish populations have increased and herbivores have decreased. In addition, urchin numbers in Rarotonga are the highest in the Cooks Islands compared to the other seven islands, likely due to the high level of algae still present (Figure 112).

This trend in reef deterioration with more herbivores and fewer damselfish is shown by the comparison of reef populations in Rarotonga with the outer southern Cook Islands. Rarotonga has up to eight times the density of surgeonfish and ten times the density of parrotfish (herbivores) compared to other islands in Cook Islands (Figures 112 and 113). Conversely, it only has about one fifth of the density of damselfish, which rely on coral cover for food and shelter, compared to other islands. Table 12 show the comparison of types of pressures on the marine environment for each islands.

FIGURE 109. School of surgeon fish during the PROCFish surveys. (Rongo et al, 2009)

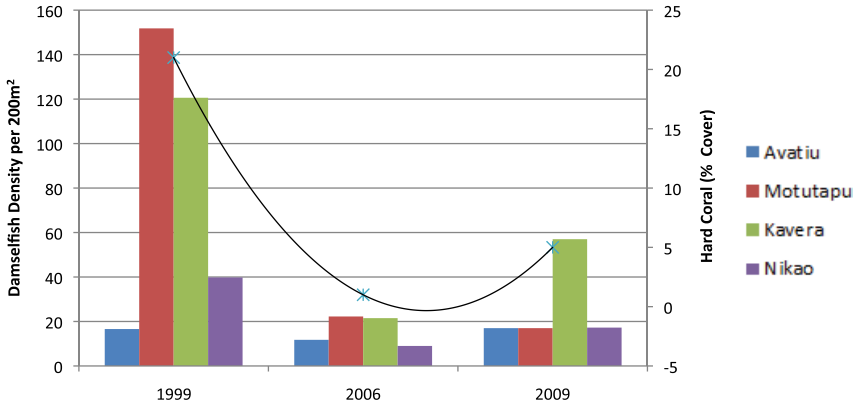


FIGURE 110. Rarotonga's damsel fish (*Chromis bami)* densities and percent hard coral cover, 1999–2009. (Rongo et al. 2009 (Including data from Ponia et al. 1999)

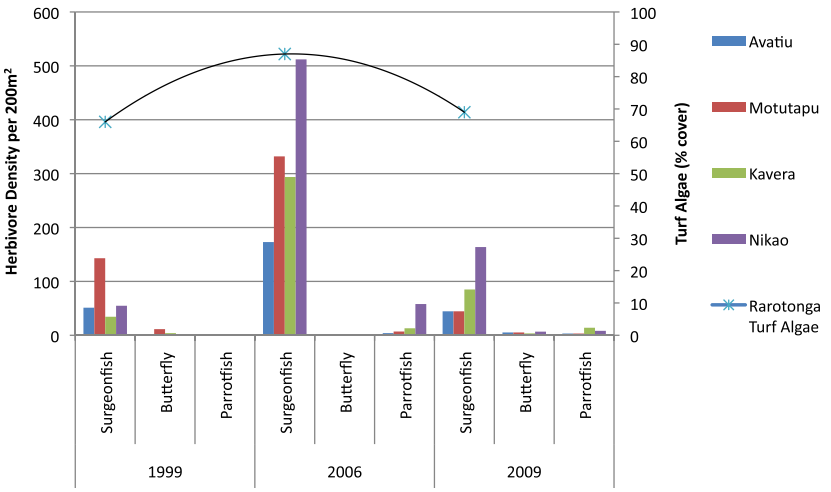


FIGURE 111. Rarotonga's major herbivore fish densities and percent turf algae cover, 1999–2009. (Rongo et al. 2009. Including data from Ponia et al. 1999)

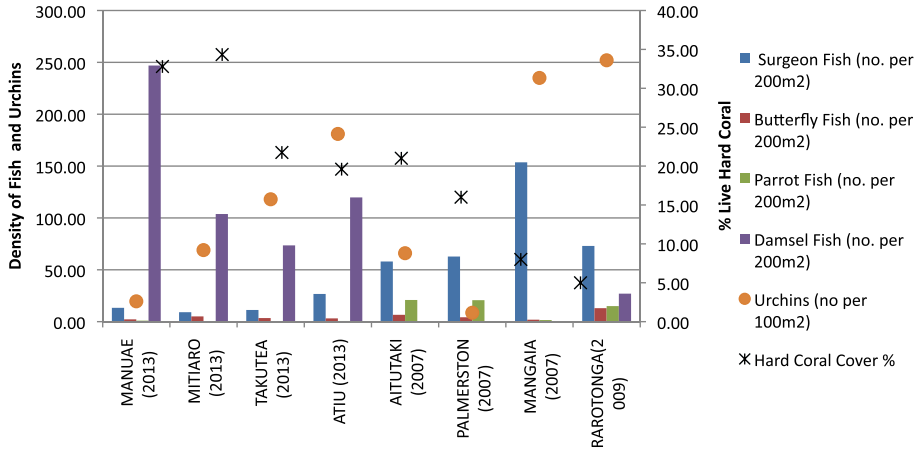


FIGURE 112. Comparison of coral cover, fish and urchin populations in southern Cook Islands and Palmerston. (Rongo et al. 2009 and 2013 and PROCFish 2009); *Note: Damselfish not collected for 2007 PROCFISH report

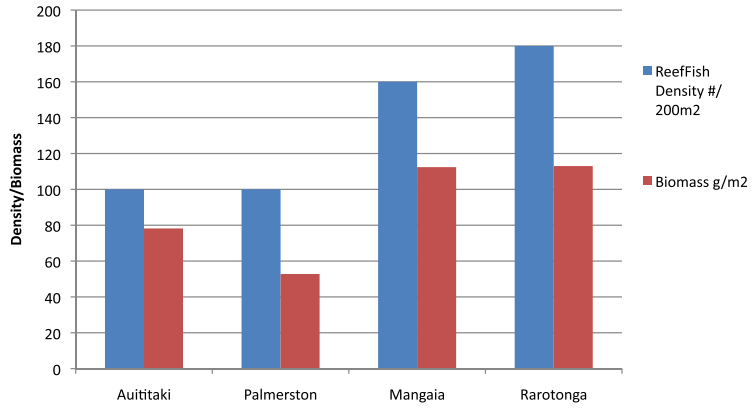


FIGURE 113. Total finfish density inside reef, 2007. (PROCFish 2009)

TABLE 12. Comparison of key reef impact types in the Cook Islands. (SPREP Summary)

Primary Impact Types	Fishing Pressure	Coral Cover	Biomass/ Density of Planktivore	Biomass/ Density of Herbivores	Biodiversity of reef	Examples
Developed Island	Lower (ciguatera keeps fishing pressure lower in Rarotonga)	Lower	Lower	Higher	Lower	Rarotonga (Aitutaki moving towards)
Island with fishing pressure	Higher	Moderate	Moderate	Lower	Moderate	Palmerston and Aitutaki
Pristine Island	Lower	V. High	V. High	Lower	High	Manuae

Impacts

When considering additional anthropogenic pressures such as fishing and development, analysis shows that the Cook Islands are in three scenarios in regards to their inshore urchin and fish populations. These scenarios are: (1) 'Reef dominated' where the status of the reef is the largest factor, with low coral cover and high algae cover. Combined with low fishing pressure and high development, this results in fewer damselfish and more large herbivores such as surgeon fish, parrotfish and urchins (e.g. Rarotonga), and ciguatera can be a major influence here as well; 2) 'Fishing dominated' where the status of the fishing pressure is dominant with moderate coral cover and moderate to high fishing pressure, which impacts the biomass of herbivores (e.g. Palmerston), and 3) 'Pristine' where there is low fishing pressure and high coral cover such as the uninhabited islands (e.g. Manuae). This provides very high levels of damselfish and fewer herbivores. Despite low anthropogenic pressures, pristine reefs are still sensitive to natural events such as cyclones and COTs outbreaks.

The results of the studies show that the reefs with a low percentage of hard corals have a high abundance of sea urchins and a different mix of reef fish – damselfish are absent in areas with low hard coral and sea urchins, but more surgeon fish are present. Changes in the reef environment can affect the resilience of the reef which also impacts on the surrounding areas.

Response and Recommendations

As discussed in the 'Live Coral Cover' indicator of this theme, Cook Islands responded to the water quality issues with a Water, Waste and Sanitation Unit (WATSAN) to improve water quality discharge and to reduce the negative effects upon coral reefs.

The declared marine park Marae Moana and other community protected areas provide some areas that fish and other marine animals can use as a refuge and nurseries. This improves the fish populations and makes the reef more resilient.

The coral reef, reef fish and the reef fishery are highly connected. Communities should be involved in the management and ownership of protected areas, to help with the enforcement and data collection.

Further data collection and analysis of coral reefs and reef fish is critical for data management. The development and use of simple, standardised monitoring protocols for the condition of reefs would be useful, particularly with several agencies gathering data.

Fisheries management strategies that lead to the restoration of parrotfish, damselfish and other reef fish populations is encouraged. Specifically, the 2009 PROCFish report recommends that Aitutaki controls spearfishing and gillnet use, and states that spearfishing during the night should be banned. A monitoring system should be in place to detect further changes.

It is important to manage the reef ecosystem as a whole and to address threats through ridge to reef programmes, and to work together with tourism to improve the reefs.

SOURCES

Jackson, J.B.C., Donovan, M.K., Cramer, K.L., Lam, V.V. (eds). (2014) Status and Trends of Caribbean Coral Reefs: 1970–2012. Global Coral Reef Monitoring Network, IUCN, Gland, Switzerland.

Ponia, B., Raumea, K., Turua, T. and Clippingdale, M.. 1999. Rarotonga Fringing Reef Fish and Coral Monitoring Survey. Prep. for MMR.

Pinca, S., Awira, R., Kronen, M., Chapman, L., Lasi, F., Pakoa, K., Boblin, P., Friedman, K., Magron, F. and Tardy, E. 2009. PROCFish, Secretariat of the Pacific Community 2009. Cook Islands country report: Profiles and results from survey work at Aitutaki, Palmerston, Mangaia and Rarotonga (February and October 2007).

Rongo, T., J. Holbrook and T. C. Rongo. 2006. Reef Survey for Rarotonga.

Rongo, T., Rongo, T.C. and Rongo, J. 2009. Rarotonga Fore Reef Community Survey 2009. For the Cook Islands National Environment Service.

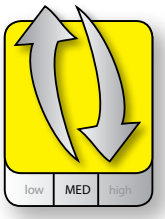
Rongo, T. and von Woesik, 2013. The effects of natural disturbances, reef state, and herbivorous fish densities on ciguatera poisoning in Rarotonga, southern Cook Islands. Toxicon 64:87–95

Rongo, T., Evans, J., Passfield, K., Cramp, J., Sudek, M., Tautu, B., McDonald, G., Rongo, T.C. and Hanchard, B.. 2013. Cook Islands Marine Park: coral reef survey of Aitutaki, Manuae, Mitiaro, Takutea, and Atiu in the southern Cook Islands. Government of the Cook Islands. 64 p.

Introduction

Reef fisheries target both reef fish (Figure 114) and invertebrates such as urchins, clams, sea cucumbers and trochus. Cook Islanders have traditionally relied on reef fishing for subsistence. There is a small commercial market for reef fish which are sold locally or to other islands. The main indicators used to assess reef fisheries are fish consumption trends (kg/person/per day), fishing pressure (either in tonnes per year or tonnes per area) and fish/invertebrate densities and biodiversity.

The key source of information used for reef fisheries is the SPC 2009 Pacific Regional Oceanic and Coastal Fisheries Programme (PROCFish) report, which undertook a full socioeconomic analysis of four fishing communities from Aitutaki, Palmerston, Mangaia and Rarotonga, and surveyed fish and invertebrate populations inside and outside the reef. Additional census surveys on sea cucumbers are used here to provide a synopsis of the state of sea cucumbers.



Status
Fair

Trend
Mixed

Data confidence
Medium

Status: Fair **Trend: Mixed** **Confidence: Medium**

Subsistence reef fishing has fallen sharply from 1986 to 2011 for most of the population. This is in large part due to:

1) Changing socioeconomic values, higher wages and more reliance on tourism in Aitutaki and Rarotonga, coupled with a big drop in consumption of fresh fish and marine invertebrate products (Figure 115);

2) Ciguatera in both Rarotonga and Aitutaki, where high ciguatera rates have hindered fishing of major reef fish species such as parrotfish; and

3) Demographic changes, where many populations are ageing and moving away from the more rural Pa Enua to the more urban Rarotonga.

However, there is evidence of a rejuvenation of subsistence and artisanal fishing in Rarotonga due to an increase in Pa Enua migrants (Figure 116), non-Cook Islanders and families engaging in casual fishing. Recreational fishing appears to be increasing. In addition, although there is only anecdotal evidence, there may be overfishing of species that do not have ciguatera such as the unicorn fish.

FIGURE 114. Big eye trevally *(Caranx sexfasciatus)* at Manuae. (Rongo et. al., 2014)

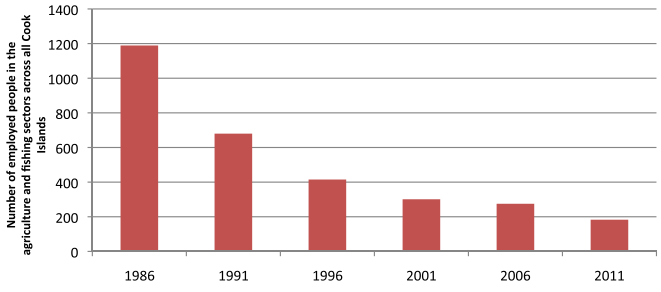


FIGURE 115. Number of employed people in the agriculture and fishing sectors across all Cook Islands, 1986–2011. (Cook Islands Statistics Office)

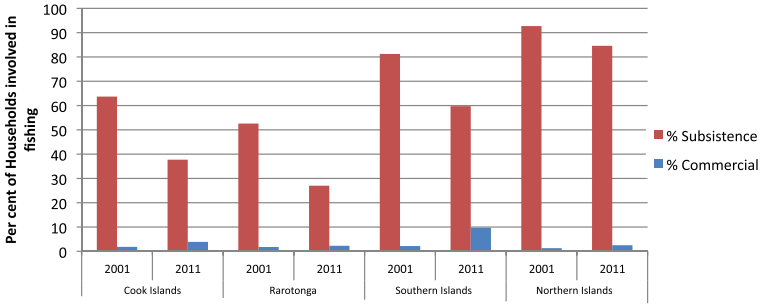


FIGURE 116. Per cent of Cook Islands households involved in subsistence and commercial fishing by region. (Cooks Islands Statistics Office)

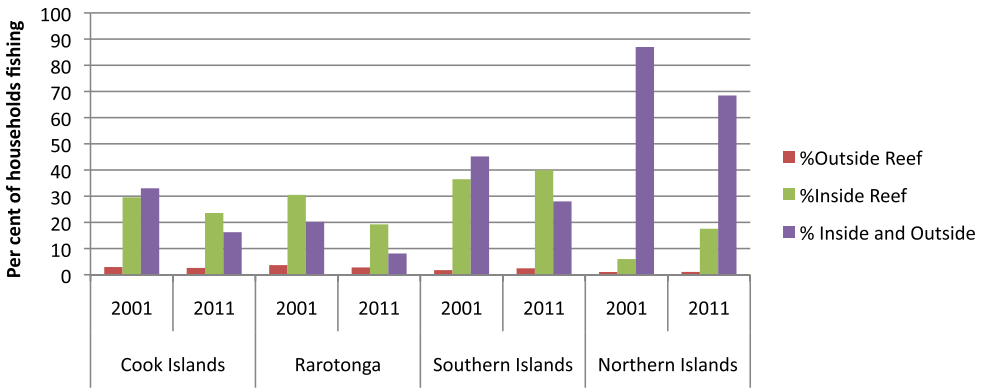


FIGURE 117. Percentage of Cook Islands households fishing inside and outside local reefs. (Cooks Islands Statistics Office)

Data for the southern and northern Pa Enua show that the proportion of households involved in inside reef fishing has risen since 2001 (Figure 117). This is partly due to the fact that as the population there has declined, the remaining households were typically subsistence fishing based, so the proportion of households participating inside reef fishing for subsistence purposes has increased with a decreasing population. However, in places like Palmerston, the increase in inside reef fishing may be due to a growing commercial demand from Rarotonga for the export of reef fish.

Table 13 shows the key results of the PROCFish survey for the status of finfish resources and fishing pressures. In Palmerston and Mangaia, finfish resources have deteriorated due to the switch from the traditional *Ra'ui* system to more effective fishing methods (gillnetting), longer storage times aided by freezers, and greater access to fishing grounds with power boats. Growing fishing pressure in Palmerston to supply the Rarotongan market has affected Palmerston reef fish, as shown by the decline in the parrotfish size between 1988 and 2007 (Figure 118). This is corroborated by local observations. Rarotonga has generally higher finfish biomass and density but the lowest biodiversity of all the islands due to the poor condition of its reefs.

TABLE 13. Key findings from the PROCFish resource and reef environment survey for Rarotonga, Palmerston, Aitutaki and Mangaia Islands, 2009. (Preston et al, 1995)

	Rarotonga	Palmerston	Aitutaki	Mangaia
Fishing Pressure	Low	High commercial, Low subsistence	Moderate	High
Status of reef fish resources (PROCFish)	Good but low biodiversity	Poor to average	Poor to average	Poor
Consumption of fish and invertebrates (kg/person/year)	Fish: 32 Invertebrates: 1.5	Fish: 111 Invertebrates: 4.25	Fish: 58 (100 in 1988) Invertebrates: 2.5	Fish: 66 Invertebrates: 7.5
Biodiversity (species per transect)	27	29	34	36
Biomass (g/m^2)	114	53	78	112
Size (cm FL)	16	12	17	17
Size Ratio (fish size/max reported)	59%	38%	53%	48%
Main findings:	Ciguatera and lifestyle changes behind big fall in fishing pressure. Poor reef condition leads to low biodiversity values.	Very reliant on subsistence fishing but low impact due to small population numbers. Commercial export to Rarotonga and elsewhere having larger impact. Gillnetting has replaced traditional fishing methods and fish sizes are observed to be smaller now.	Fishing pressure has decreased due to tourism influence, ciguatera and changing socioeconomic patterns.	Local consumption already having an impact on reef fish populations. Natural reef habitat is not conducive to supporting a large fishery resource.

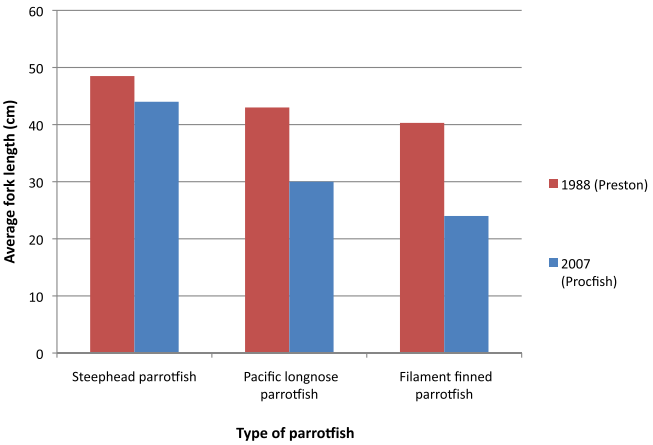


FIGURE 118. Palmerston average parrotfish fork lengths, 1998 and 2007. (Preston et al 1998 and 2007 PROCFish)

A survey in 2013 across four islands in Cook Islands showed that Aitutaki and Rarotonga have high total sea cucumber densities, whereas Mangaia and Palmerston have lower densities, likely due to less suitable habitat availability and higher harvest rates (Figure 119). Most of the cucumber species counts are at or above the regional reference population. This data shows that sea cucumber fishing pressure is generally low across Cook Islands.

Impact

Overall, people are eating fewer reef fish and invertebrates. Employment in agriculture and fishing, and households involved in fishing, have dropped sharply in much of the southern Cooks, especially Rarotonga and Aitutaki. This has mixed impacts. On the one hand, inshore reef fishing pressure is decreasing in some areas, which has good implications for coral reefs which rely on surrounding fish and invertebrate population to keep the reef healthy. This is important, especially in areas of high coastal development and water pollution.

However, less reef fishing also means that diets are changing and that there are less communal fishing methods practiced. This means that communal fishing traditions are lost, many of which were practiced sustainably. These methods are being replaced by extremely efficient fishing methods such as spear fishing and gillnetting. Thus, while there has been a reduction in the number of fishers, this reduction is tiny compared to the higher catch from new methods.

Response and Recommendations

Cook Islands' Ministry of Marine Resources (MMR) responded to concerns about decreases in reef and subsistence fishing through the introduction of a bonefishing management project that includes the designation of certain reef areas on Aitutaki specifically for bonefishing. A tourism focused market for bonefishing, aimed at recreational fishers internationally was developed. Net fishers were converted to bonefish guides within the Cook Islands. The goal is to sustainably manage and support the new fishery to support subsistence fishing, while providing a new tourism market and source of revenue.

Cook Islands also has an export ban on *Pa´ua* (giant clams) in Aitutaki, Tongareva and Manihiki; a strong trochus management plans, and research on sea cucumber populations. This will ensure that all of these sensitive reef fishery populations are maintained and managed sustainably. Aitutaki has also established *Ra'ui* management areas for no-catch zones to ensure that at risk and vulnerable reef fish are not overexploited and able to maintain their populations to allow subsistence reef fishing catch into the future.

Developing stronger national legislation to support *Ra'ui* areas, including enhanced enforcement from MMR, can provide large gains in reef fisheries management by local communities. Best practices for reef fisheries should be promoted including integrated management plans, island bylaws, and reporting mechanisms for coastal fisheries to report catch. There is a need for more information on fishing in the northern Cook Islands, as well as a need to monitor potential anthropogenic and other contaminates in reef invertebrates. Minimum catch size and net size limits should be established in collaboration with island councils, for example, coconut crab *(Phaethon lepturus)* minimum size and enhanced support for *Ra'ui* areas. Strengthened monitoring and management of reef fisheries would help to ensure sustainable growth of this important food source.

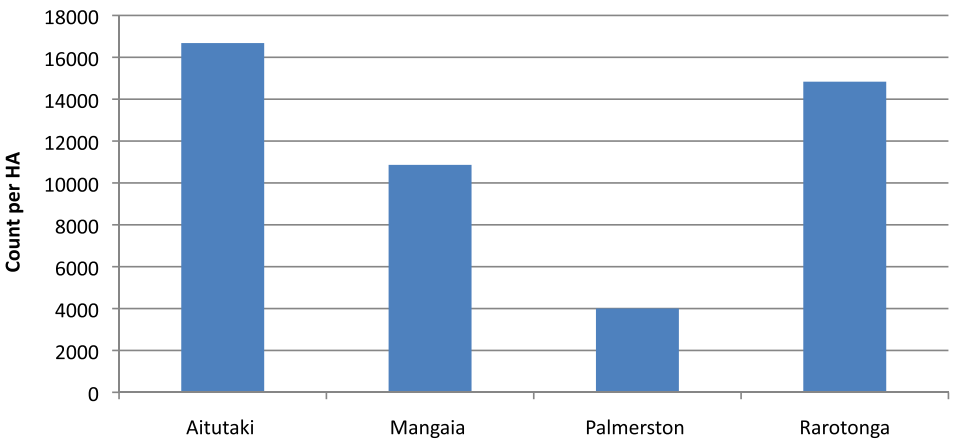


FIGURE 119. Sea cucumber densities (count per area) from four islands in Cook Islands, 2013. (Rongo et al, 2013)

Milkfish catch and release fishing in Aitutaki. David Kirkland ©Kirklandphotos

SOURCES

Cook Islands Statistics Office. Cook Islands Census reports.

Preston, G.L.; Lewis, A.D.; Sims, N.; Bertram, I.; Howard, N. 1998. The marine resources of Palmerston Island, Cook Islands. Inshore Fisheries Research Project, Technical Document No. 10. South Pacific Commission, Noumea, New Caledonia. 61 p.

Pinca, S., Awira, R., Kronen, M., Chapman, L., Lasi, F., Pakoa, K., Boblin, P., Friedman, K., Magron, F. and Tardy, E.. 2009. PROCFish, Secretariat of the Pacific Community 2009. Cook Islands country report: Profiles and results from survey work at Aitutaki, Palmerston, Mangaia and Rarotonga (February and October 2007)

Rongo, T., Evans, J., Passfield, K., Cramp, J., Sudek, M., Tautu, B., McDonald, G., Rongo, T.C., and B. Hanchard. 2013. Cook Islands Marine Park: coral reef survey of Aitutaki, Manuae, Mitiaro, Takutea, and Atiu in the southern Cook Islands. Government of the Cook Islands. 64 p.

ONLINE SOURCE:

http://www.cookislandsnews.com/item/32951-new-bonefishery-creates-livelihoods/32951-new-bonefishery-creates-livelihoods

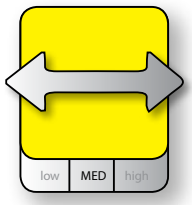
INSHORE MARINE ENVIRONMENT MARINE MANAGED AREAS, *RA'UI* IN RAROTONGA AND PA ENUA

Introduction

A *Ra'ui* is a customary form of prohibition imposed in Cook Islands by chiefs or landowners to restrict the use of resources and land areas (Figure 120). Historically, these included streams, beaches, trees, crops and other resources. Traditionally, a sign, was set in place by the owner near the resource reserving it for a special use or to protect it (Hoffman 2002). As land laws changed under the Cook Islands Act 1915, this system weakened and by the 1970s, the *Ra'ui* system was no longer in use on Rarotonga. Article 66A of the Cook Islands Constitution makes customary law 'recognised'. There are many *Ra'ui* across the Cook Islands, which are managed for different purposes including freshwater and marine resources. As various forms of customary law, they are in theory all recognised by the Constitution (Table 14).

Inshore marine resource protection has been driven by traditional and local management regimes i.e. *Ra'ui*. The *Ra'ui* are established by the traditional leaders of each island, and supported by local communities. This means the *Ra'ui* on each island can differ significantly based on the needs of each community. The government supports the *Ra'ui* by providing technical guidance, monitoring, education and awareness programmes. The recent announcement of the Marae Moana aims to empower the traditional leaders and Island Councils and promotes the connections between island communities.

Five *Ra'ui* were established around Rarotonga in 1998 as a response to concerns that the local marine environment had degraded (Figure 121). The *Ra'ui* were declared to assist in the protection of the marine environment and a complete ban on the taking of marine life and materials was set up by the local communities, while recreational activities were allowed in these areas. The acceptance of the *Ra'ui* by the local people was a result of a number of factors. These included a sudden increase in ciguatera cases, a decline in the health of the reef environment, and fewer people relying on lagoon-based resources for their livelihoods, so the impacts of a closure were minimal.



Status
Fair

Trend
Stable

Data confidence
Medium

Status: Fair **Trend: Stable** **Confidence: Medium**

This indicator examines the effectiveness of *Ra'ui* in Rarotonga and other islands to protect and improve marine fish and invertebrate population health. As most of the survey data is available for Rarotonga, the focus of this indicator is based on data collected between 1998 and 2002, when four separate surveys were undertaken by the Ministry of Marine Resources (MMR). Invertebrate densities (populations per 100m^2) were compared across all sites for all years as well as inside and outside the *Ra'ui*.

FIGURE 120. *Ra'ui* sign at Edgewater Resort, Cook Islands. (diveplanit.com)

FIGURE 121. Map of *Ra'ui* marine areas in Rarotonga. (SPREP, 2017)

TABLE 14. *Ra'ui* across Cook Islands, 2014. (NES)

ISLAND	NAME(S)	COMMENTS
Rarotonga	Aroko, Aroa, Akapuao, Pouara, and Nikao	Rules vary but generally no take of coral, fish or invertebrates, recreational use allowed
Aitutaki/Manuae	Maina Reef, Maina Lagoon, O'otu, Motikitiu, Akaiami and several bonefish sites	No take of marine species
Suwarrow		No take
Atiu/Takutea	Landowner (Ngamaru Ariki)	No take (Trust Management)
Pukapuka	Three motu, Ko, Motu Kotawa, Roto	
Tongareva	Lagoon	No take of *Pa´ua*
Manihiki	Lake Porea, Tepuka, Pearl zonation sites	No take of *Pa´ua* in pearl zonation sites, no take of eels in Lake Porea
Rakahanga		No take of Crayfish
Mitiaro	Roto Nui Lake	No take of eels

Ra'ui can be an effective management tool to protect invertebrate and fish populations. The *Ra'ui* in 1998 led to higher densities of invertebrates at all sites between 1998 and 2002 (Figures 122). A comparative study of invertebrate surveys inside and next to the *Ra'ui* showed that four out of five of the *Ra'ui* sites had much higher invertebrate densities. Follow-up surveys in 2009 at Akapuao and Nikao showed that the number of invertebrates in the reef areas adjacent to the *Ra'ui* also increased when compared to 2002 numbers (Figure 123). This is likely due to the benefit of a nearby protected area, which allows populations to regenerate. It is likely that all of Rarotongan marine resources have benefitted from the *Ra'ui* system.

Despite evidence that they work, there have been some problems with the management of *Ra'ui* in Rarotonga. Over the past decade, community consultations, which were common at the onset in 1998, have become less common. Insufficient monitoring, control, and surveillance capacity are still major constraints in enforcing the *Ra'ui*. Poaching has occurred in some areas due to a gradual lack of awareness and reduced support by communities (Tiraa 2006). Some of this is due to cultural changes in Rarotonga, as behaviours and attitudes are increasingly influenced by outside cultures and locals are less reliant on marine resources for subsistence.

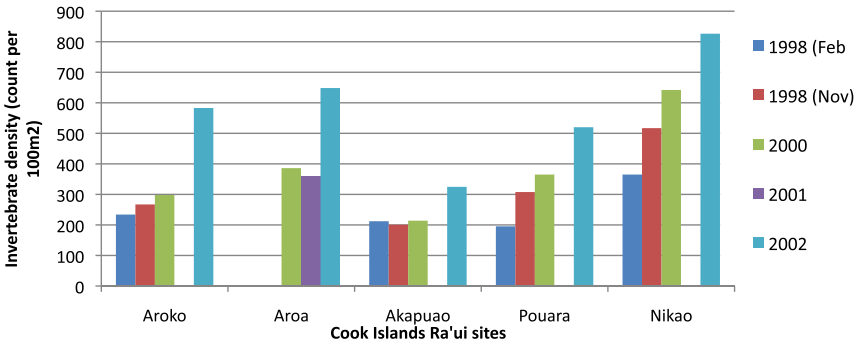


FIGURE 122. Invertebrate densities at five Cook Islands *Ra'ui* sites, 1998–2002. (MMR, 2003)

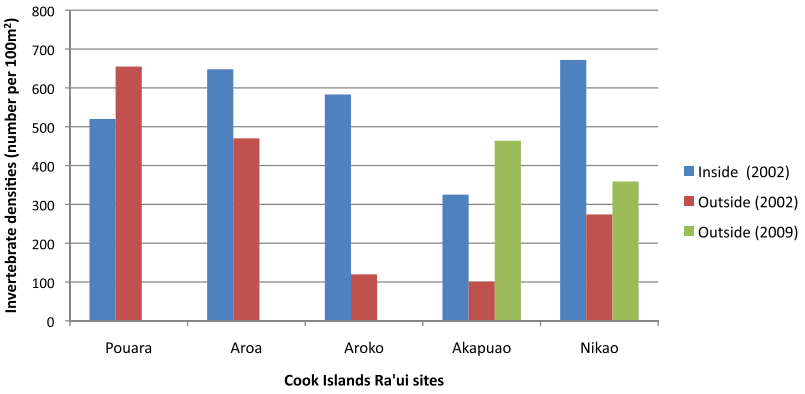


FIGURE 123. Invertebrate densities inside and outside of Cook Islands *Ra'ui* sites in 2002, and outside the *Ra'ui* sites of Akapuao and Nikao in 2009. (MMR 2002 and 2009)

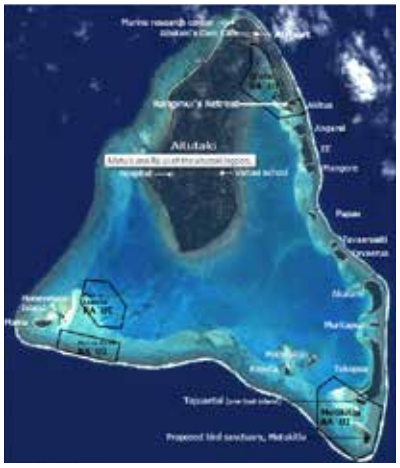


FIGURE 124. Ra'ui sites in Aitutaki. (*www.ranginuisretreat.com and MMR)*

Not all *Ra'ui* work in the same ways. For example, the *Ra'ui* in Aitutaki (Figure 124) was implemented to protect all marine species, whereas the *Ra'ui* in Ō'otu was to protect an important spawning ground for a lagoon fish species. The Akaiami *Ra'ui*, recognised a habitat for introduced trochus spawning and juvenile development to support commercial ventures. On Mitiaro, paramount chief of Mitiaro, Tou Ariki, declared a *Ra'ui* in October 2014, on the freshwater lake Roto Nui for the protection of freshwater eels. The protection was for two years and was a food and economic security measure for the Mitiaro people ahead of large public events in 2016.

It is generally acknowledged that the *Ra'ui* are stronger and enforced more frequently on the Pa Enua than in Rarotonga. Efforts are being made on Rarotonga to strengthen the management of the *Ra'ui* there, but traditional leaders still have not resolved the legal status of *Ra'ui*. Many leaders wish to keep *Ra'ui* management out of the formal legal framework and within traditional *Ra'ui* practices.

The first National Park in the Cook Islands was the Suwarrow Atoll in 1978, to protect the wildlife and marine resources. Suwarrow is the largest national park in the Cook Islands with a lagoon of about 10km diameter and a landmass of 0.4sq km. This national park is an important sea-bird breeding site. There have been no in-depth marine surveys undertaken but it is believed to contain a range of marine life as it is unexploited. The main threat to the atoll and the sea birds are rats (http://nescookislands.com/). Figure 125 shows a map of all the Marine Managed Areas (MMAs) in the in the Cook Islands.

Impact

Reserve areas protect sensitive areas and also help to re-establish populations outside of the reserve by allowing for a safe area for species to reproduce and grow. Communities can benefit from these areas through more resources for subsistence and commercial activities, as well as enhanced tourism values for recreational activities such as snorkelling and kayaking. In Rarotonga, amidst declining subsistence fishing, *Ra'ui* are still important, and as other pressures on the reef continue to mount they may be the key to preserving reef resources.

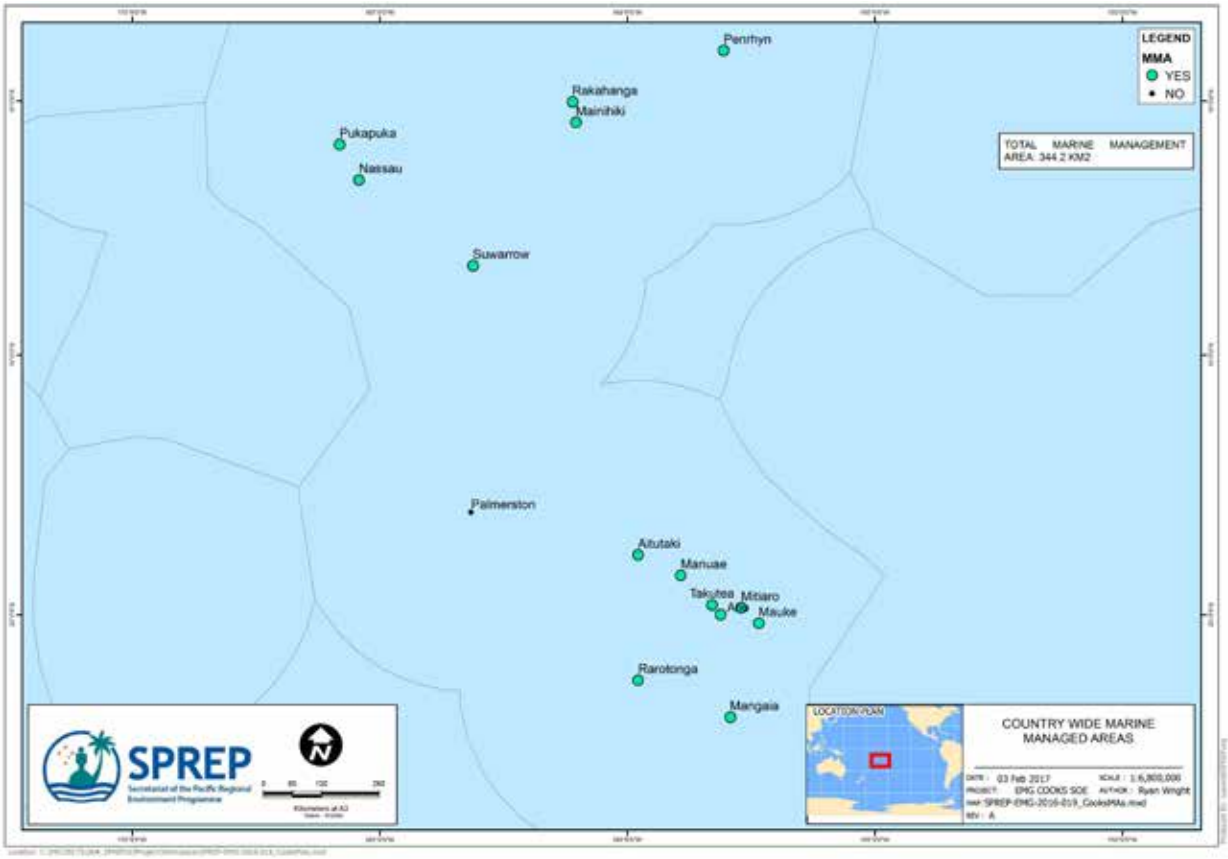


FIGURE 125. Marine Managed Areas in Cook Islands (SPREP)

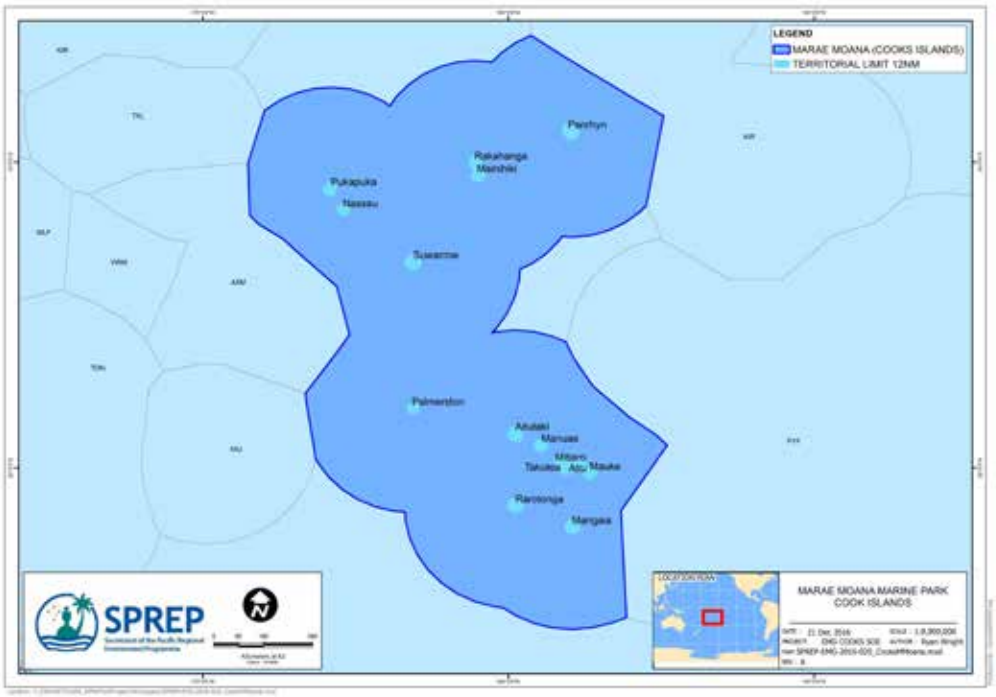


FIGURE 126. Marae Moana boundaries (SPREP)

Response and Recommendations

The establishment of the Marae Moana reserve (Figure 126) is a response to sustainable development of marine resources issues, and it is one of the largest marine managed areas in the world. Following a request from communities and stakeholders, it was decided to also include the northern Cook Islands – the draft policy of Marae Moana has been amended to cover the entire EEZ. However, the management regime of the area is under discussion with stakeholders and some zoning will be used (Rongo et al. 2013; Maraemoana.gov.ck). In the 1990s, *Ra'ui* were a forgotten tool on Rarotonga but actively used on other islands. In 1998 it was revived in Rarotonga as a traditional management tool. This has resulted in many *Ra'ui* being developed.

Given that land-based activities affect the marine areas and many communities rely upon healthy marine ecosystems for basic livelihoods and subsistence, the Cook Islands government, NGOs and local community partners should continue to monitor both marine and terrestrial areas, using a whole of island, ridge to reef, and integrated ecosystem-based approach. Where available, traditional knowledge should be used in the creation of new *Ra'ui* and other marine and coastal reserve areas.

While customary practices and marine management are recognised by the Cook Islands Constitution, there is a need to strengthen the implementation of *Ra'ui* and traditional management tools. These include codifying traditional management measures into national law, to ensure that these areas are recognised, supported and managed, especially with greater urbanisation, more changes from a more global economy, and changing political environments.

SOURCES

Government of Cook Islands. 2016. Marae Moana Policy.

Hoffmann, T. 2002. The Reimplementation of the Ra'ui: Coral Reef Management in Rarotonga, Cook Islands. The Coral Reef Alliance (CORAL). *Coastal Management,* 30:401–418

Pinca, S., Awira, R., Kronen, M., Chapman, L., Lasi, F., Pakoa, K., Boblin, P., Friedman, K., Magron, F. and Tardy, E. 2009. PROCFish, Secretariat of the Pacific Community 2009. Cook Islands country report: Profiles and results from survey work at Aitutaki, Palmerston, Mangaia and Rarotonga (February and October 2007)

Raumea, K., Turua, T., Makikiriti, N., Rongo, T., Nooroa, R. and Ponia, B. 2000. 2nd Monitoring survey of the Rarotonga Ra'ui. Ministry of Marine Resources.

Rongo, T., Rongo, T.C., Rongo, J. 2009. Rarotonga Fore Reef Community Survey 2009. For the Cook Islands National Environment Service.

Rongo, T., Evans, J., Passfield, K., Cramp, J., Sudek, M., Tautu, B.,

McDonald, G., Rongo, T.C. and Hanchard, B. 2013. Cook Islands Marine Park: coral reef survey of Aitutaki, Manuae, Mitiaro, Takutea, and Atiu in the southern Cook Islands. Government of the Cook Islands. 64 p.

Saywood, A., Turua, T., Makikiriti, N. 2002. 3rd Monitoring survey of the Rarotonga Ra'ui. Ministry of Marine Resources.

Solomon, D. 2012. Traditional fishing methods, *raui* and gender roles in Arorangi village, Rarotonga, Cook Islands. SPC Women in Fisheries Information Bulletin #22 – July 2012

Tiraa, A. 2006. Ra'ui in the Cook Islands – today's context in Rarotonga. SPC Traditional Marine Resource Management and Knowledge Information Bulletin #19 – April 2006.

Ministry of Marine Resources (MMR). 1998. Reports

ONLINE SOURCES

http://nescookislands.com/, 27.10.2016
http://www.ranginuisretreat.com

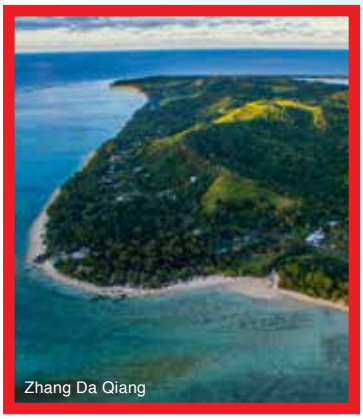
INSHORE MARINE ENVIRONMENT LAGOON WATER QUALITY

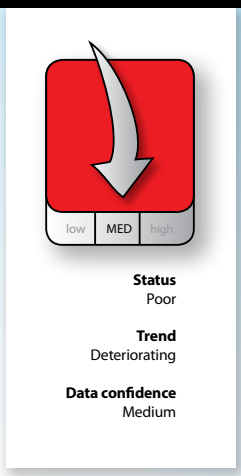
Introduction

Cook Islands' lagoons are some of the most important natural assets. They supply food, provide storm protection and habitats, and are tourist attractions. Most lagoons are small with low-flushing rates, and are particularly sensitive to water quality impacts. These are largely from freshwater, groundwater and stream runoff, but can linked to activities in the lagoon itself, such as recreational use, pearl farming and other aquaculture. The quality of the lagoon water is an important indicator of anthropogenic stress on the marine environment.

Water quality monitoring began in 2004, and was expanded in 2006. The programme was started to provide baseline water quality data for Rarotonga. Initially the Takitumu area was a concern because of a sickness that affected people who swam in the Titikaveka lagoon at the end of 2003. Common symptoms included irritations in the eye, nose, throat and skin. The water quality monitoring programme was undertaken by MMR, in partnership with NES, and has expanded to long term monitoring on Aitutaki. Water quality has also been assessed on Tongareva and Manihiki to determine water quality threats linked to pearl farming there.

For this report, water quality is based on three main parameters sampled from 2006–2009. These are: 1) Nutrients, including Ammonia (NH4), Nitrate (NO3) and Dissolved Reactive Phosphate (DRP) associated with sewage waste and fertilisers, 2) Faecal Bacteria from sewage, based on enterococci bacteria, which is able to survive in salt water, and 3) Total Suspended Solids (TSS). Data past 2009 is not available for this report from MMR, except for enterococci data for Rarotonga in 2013. Due to geographic variety, status is provided for the three areas of Rarotonga, Aitutaki and the outer Pa Enua (Manihiki and Tongareva).





Status: Poor **Trend: Deteriorating** **Confidence: Medium**

The median levels of nutrients and TSS for all sites on Rarotonga, Aitutaki, Tongareva and Manihiki for the available sampling years (Figure 127). Figure 128 shows enterococci results for the same islands and years.

Rarotonga: Rarotonga has the highest median levels of nitrates of all islands tested, with 41% of water quality samples above nitrate guidelines for marine inshore environments. Of 894 enterococci samples, 66 or seven per cent of samples, were above the standard for human use of marine waters.

Aitutaki: Aitutaki has the highest ammonia and TSS levels of all sampled islands, and significantly high median bacteria levels with exceptionally high occasional results. Of 535 nutrient samples, 214 (40%) were above guidelines for NH4, and 30 out of 537 samples (5.5%) were above guidelines for enterococci. The TSS has 263 out of the 540 total samples over the marine guideline of 4.5mg/L (49%). There is anecdotal evidence from residents that water clarity is deteriorating in the lagoon, however, further data and analysis is required to assess this. Overall, the state is poor, the trend is uncertain, and the 2010–2013 dataset is required to determine with greater certainty the trend and to clarify uncertainties.

Pa Enua: The less inhabited Pa Enua have generally good water quality, although there is not enough data currently available to determine trends with any certainty. Manihiki has high median bacteria levels, possibly due to a higher population and pressures from oyster farming, but overall, there are few maximum bacterial events compared to Aitutaki and Rarotonga. All other parameters tend to be within guidelines.

In most cases for Rarotonga and Aitutaki, poor lagoon water quality is associated with poor stream water quality. High pollution events often occur after heavy rainfall as chemicals and bacteria are flushed into the lagoon. The nutrient trend appears to be deteriorating for four long term sites (Figure 129). Bacterial counts appear to be stable at some sites and deteriorating at others (Figure 130). For these reasons, the state is determined to be fair to poor, with a deteriorating trend. Figure 131 shows all the sampling sites on Rarotonga.

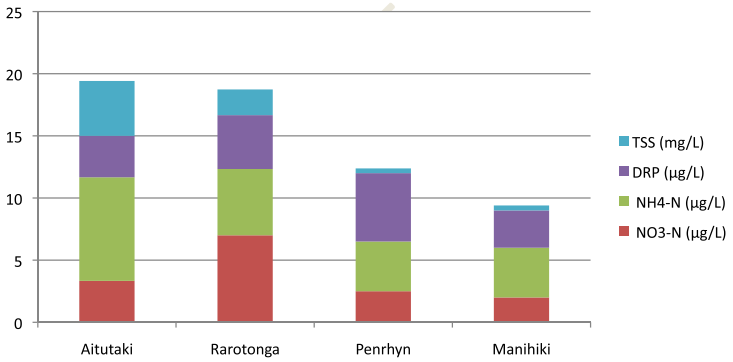


FIGURE 127. Median nutrient and TSS levels at all sampling sites for Rarotonga (2006–2013), Aitutaki (2008 -2010) Tongareva (2008) and Manihiki (2009). (Ministry of Marine Resources)

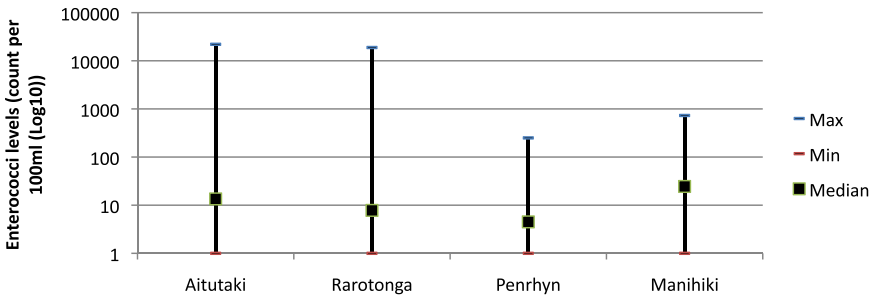


FIGURE 128. Minimum, median and maximum enterococci levels (log 10) at all sampling sites for Rarotonga (2006–2013), Aitutaki (2008–2010), Tongareva 2008 and Manihiki 2009. (Ministry of Marine Resources)

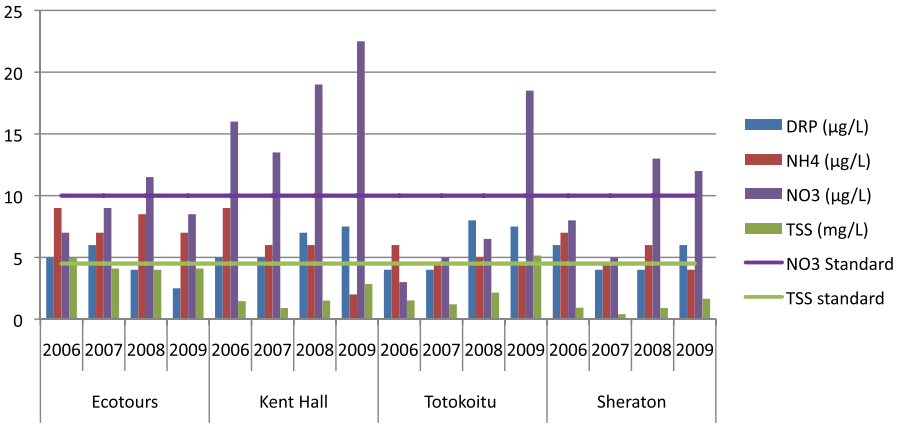


FIGURE 129. Annual median nutrient and TSS levels for four long term sites in Rarotonga, 2006–2009. (Ministry of Marine Resources) **Standards based on ANZECC water quality guidelines.*

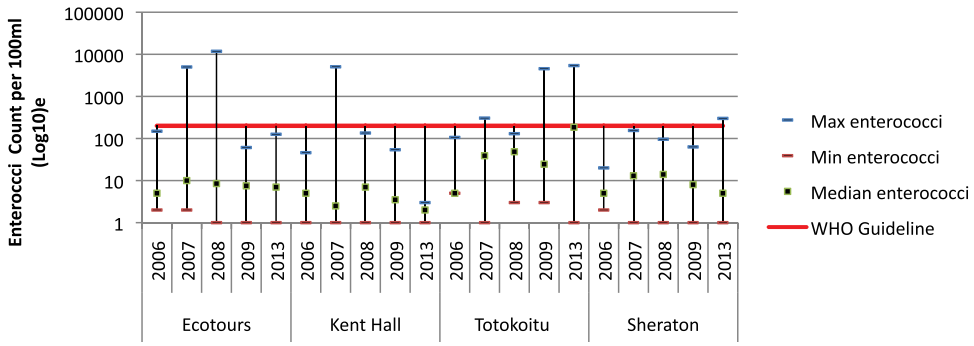


FIGURE 130. Annual minimum, median and maximum enterococci levels at four long term sampling sites in Rarotonga, 2006–2009 and 2013. (Ministry of Marine Resources)

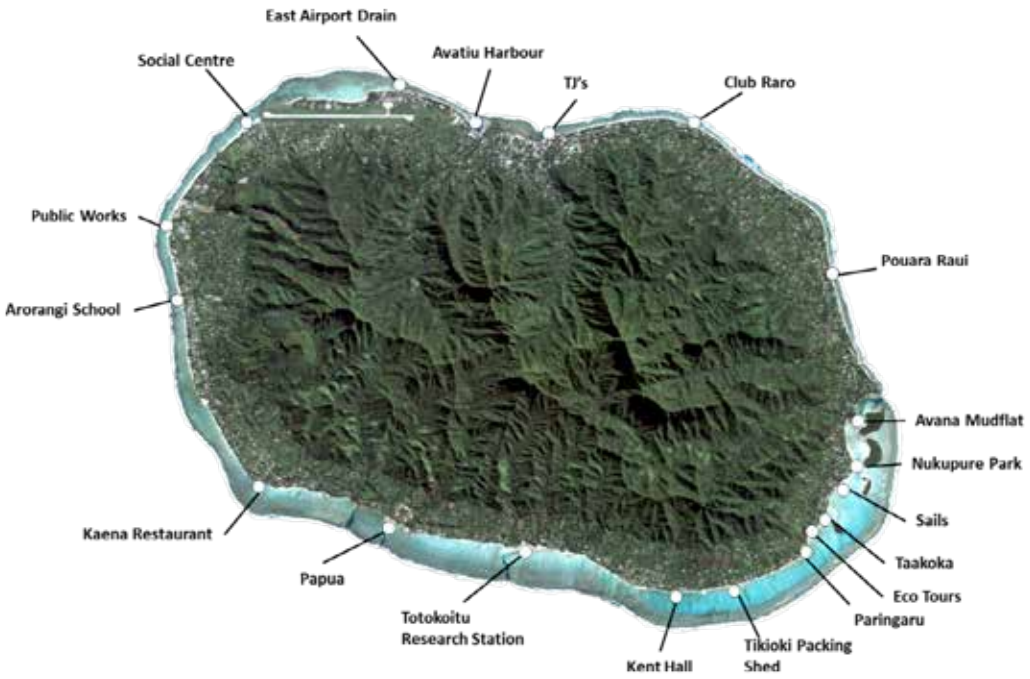


FIGURE 131. 2013 Rarotonga Lagoon sampling sites. (MMR, Water Quality Report for Rarotonga, 2014)

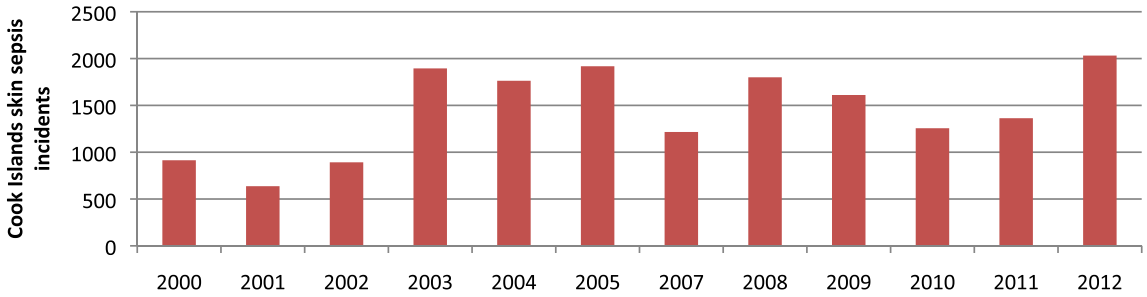


Figure 132: Skin sepsis incidents reported to the Ministry of Health, 2000–2012. (MOH Annual Report)

Impacts

Poor lagoon water quality has environmental, social and economic impacts. Reef habitats in lagoons are susceptible to smothering from algal growth which is often stimulated by excess organic and nutrient matter. Economically, impaired lagoons can lead to a decline in tourism and reduced visitor enjoyment. The degradation of lagoon habitats can also negatively impact people who rely on the inshore marine environment for subsistence and income. Health impacts are also associated with lagoon water quality. Water quality monitoring started in Rarotonga because of reported irritations and infections from exposure to high bacteria levels in lagoon water. Since 2006 there is little improvement. Figure 132 shows the rise of skin sepsis (infections) reported by the Ministry of Health from 2000–2012, which includes incidences of skin sepsis caused by exposure to bacteria in the air, soil and water. It is uncertain how much marine pollution is linked to this increase, but it is very likely one route of exposure.

Responses and Recommendations

A significant response by Cook Islands to address lagoon water quality is the Ministry of Infrastructure's Water, Waste and Sanitation Unit's (WATSAN) donor aided programme. The WATSAN programme is upgrading septic systems in the Muri area, and now extends to all of Rarotonga. There are some lessons learned from the WATSAN project that include a reticulated system and off-site disposal. Cook Islands also has public health regulations to regulate sewage systems and land-based activities such as piggeries.

Lagoon water quality monitoring to date has been useful in Rarotonga, however it would be useful to expand this to Pa Enua and more key sites. Detailed source monitoring, such as through the use of isotope or trace signature chemicals to rank relative pollution source contributions, may help to ensure that mitigation activities are within project scopes.

Once more is known about the contributing sources of lagoon pollution, a range of mitigation options should be considered under a cost-benefit analysis plan. Reticulation of sewage waste may need to be considered for sensitive coastal foreshore areas.

A reticulated system for sewage should be started in Muri and extended to the rest of Rarotonga. Care should be taken to ensure that the outlet travels sub-reef to prevent breakage at the reef crest.

Cook Islands should also invest in the development of effective waste management of commercial piggeries and poultry farms. One option is the development of community piggeries with established waste management systems. Under a community piggery system, members would be allocated space for their pigs and would share the facility under community oversight following appropriate environmental regulations.

Citizens should be kept informed. Awareness programmes such as the report card programme could be expanded and would help to make sure people are aware of the lagoon water quality and the associated health, economic and environmental impacts associated with poor water quality.

SOURCES

Ministry of Health. 2011. Health statistical tables 2008–2010.

George, N., Tuatai, T., Turua, T. and Solomon, D. 2007. Rarotonga water quality annual report 2006. Ministry of Marine Resources.

George, N., Tuatai, T., Turua, T. and Solomon, D. 2009. Rarotonga water quality annual report 2007. Ministry of Marine Resources.

Ministry of Marine Resources. Rarotonga Annual Water Quality Report 2014.

Turua, T., Tuatai, T., George, N. and Solomon, D. 2010. Water Quality Data Report Rarotonga 2009. Ministry of Marine Resources.

Tuatai, T., George, N., Solomon, D. 2010. Aitutaki Water Quality Data Report 2009. Ministry of Marine Resources.

Solomon, D., Turua, T., George, N. and Tuatai, T. 2009. Water Quality Data Report Aitutaki 2008. Ministry of Marine Resources.

Solomon, D., Tuatai, T., Turua, T. and George, N. 2009. Water Quality Data Report Manihiki 2008. Ministry of Marine Resources.

Solomon, D., Tuatai, T., Turua, T. and George, N. 2009. Water Quality Data Report Penrhyn 2008. Ministry of Marine Resources.

Solomon, D., George, N., Tuatai, T. and Turua, T. 2009. Water Quality Data Report Rarotonga 2008. Ministry of Marine Resources.

Sea turtle on a beach. © Juney Ward

ENDANGERED MARINE SPECIES TURTLES AND CETACEANS

Introduction

Marine mammals and turtles are important components of Cook Islands' biodiversity, culture and intrinsic natural heritage. These species have a place in national customs as a traditional totem of various clans and tribes. Interactions between people and these species have changed over time from consumption and commercial whaling to scientific research and the promotion of conservation.

This indicator examines the stability of marine mammal and turtle populations and uses data collected over the past decade about turtle nesting and whale migrations.

Status
Fair

Trend
Unknown

Data confidence
Low

© Michael F. Donoghue

TURTLES

Status: Fair **Trend: Unknown** **Confidence: Low**

There is limited information and few scientific reports about sea turtles in Cook Islands. The absence of regular surveys mean that there is limited to no baseline information from which to compare sea turtle populations in Cook Islands over time. Nor is there reliable information as to when and where sea turtle nesting occurs in Cook Islands.

Four sea turtle species are known to use Cook Islands waters: the green turtle (*Chelonia mydas*), the hawksbill turtle (Eretmochelys imbricata), the leatherback turtle (Dermochelys coriacea) and the loggerhead turtle (Caretta caretta). The green and loggerhead turtles are found throughout the year. The green turtle is the most common with all life stages observed in Cook Islands. Leatherback turtles have been reported by offshore industrialised fisheries (White, 2012) and satellite tracking has shown leatherbacks transiting through Cook Islands' EEZ from French Polynesia on their way to Fiji (MMR). Loggerhead turtles have been reported on Palmerston Island.

SEA TURTLE NESTING IN COOK ISLANDS

Tongareva is considered the most important nesting site for green turtles (estimated 500 nests per annum), followed by Palmerston (estimated 100 nests per annum). Most of the egg-laying occurs on the nearby uninhabited and rarely visited motu. The green turtle nests in the sparsely populated Pa Enua (MMR), and nesting sites have been confirmed for ten of the 15 islands in Cook Islands (White 2012). As of 2012, 866 nests were reported in the databases of State of Worlds Sea Turtle (SWOT) and the Turtle Research and Monitoring Database System (TREDS). Egg laying by green turtles has been confirmed at Aitutaki, Manihiki, Manuae, Nassau, Palmerston, Pukapuka, Rakahanga, Suwarrow and Tongareva, with some nesting emergences also reported at Mauke. The nesting locations of loggerhead turtles in Cook Islands are unknown.

While the hawksbill turtle has been known to nest in some areas of Cook Islands (MMR), they have not been found nesting recently, and juveniles represent the largest portion of individuals found so far (White 2012). Hawksbill turtles have historically been heavily exploited for meat, eggs and tortoiseshell in the Pacific. However, the lack of long term population data means that there is no information available on status and trends for this species in Cook Islands and the South Pacific region, despite the likelihood that nesting populations are declining or near total depletion, and that more than 80% of hawksbills have declined globally over the last 100 years (White 2012).

Cook Islands' sea turtle nesting likely occurs seasonally between September and April, with differences between species and northern and southern group islands, although there is little information about nesting in Cook Islands. The start of the egg-laying period has been confirmed in reports for Palmerston and Rakahanga, with most nests laid in the back-beach forest and vegetation areas (with higher likelihood of male turtles, high nest success rates (95%) and low predation), with few mid-beach nests (White 2012). Based on limited nesting data, nesting stocks have been grouped into 'Nesting Aggregations' (NAs), which link areas within 500 km of one another. Cook Islands' sea turtles fit within three designated NAs: Western Polynesia which includes Pukapuka, Samoa and American Samoa; northern Cook Islands with Manihiki, Nassau, Rakahanga, Suwarrow and Tongareva; and southern Cook Islands with Aitutaki, Atiu, Manuae, Mauke, Mitiaro, Palmerston, Rarotonga and Takutea (White, 2012). Given the lack of data, only green turtles have been included in these NAs. These have been grouped into 25–100 females for the southern group, with Palmerston estimated to have at least 55 nesting female green turtles; and 100–500 females in the northern group, with Tongareva estimated at 139 nesting female green turtles (White 2012). These numbers are cited from White's 2012 report, and as not all atolls have been assessed, are likely to increase.

SEA TURTLE MOVEMENT THROUGH COOK ISLANDS

There is little information about sea turtle movement around Cook Islands. Table 15 summarises what is documented about sea turtles passing through from 1993 to 2012. Figures 133 and 134 show both satellite tracking and flipper tagging of sea turtle migrations regionally.

TABLE 15. Summary of documented sea turtles passing through Cook Islands as of October, 2012. (information modified and adapted from White, 2012 report)

Flipper-tag returns	Satellite tracking
Green turtle (*Chelonia mydas*) tagged at Scilly Atoll, French Polynesia, was captured in Cook Islands (Balaz, 1995).	Green turtle (*Chelonia mydas*) was tagged (ID 25695) while nesting (November 2000) at Palmerston Atoll, Cook Islands and migrated westward to the south of Fiji (NOAA).
Green turtle (*Chelonia mydas*) tagged at Rangiroa, French Polynesia, was recaptured in Solomon Islands, and may have traversed Cook Islands waters (SPREP, 1993).	Green turtle (*Chelonia mydas*) was tagged (ID 50159) at Tetiaroa, French Polynesia (released 18 November 2010) and migrated to the west of Fiji (NOAA).
Two green turtles (*Chelonia mydas*) tagged at Scilly Atoll, French Polynesia, were found at Palmerston Atoll (Tag #P841, applied 21 June 1993, recaptured 14 October 1994; Tag #S757, applied 1 October 1993, recaptured 11 September 1995. Note: this may include the Balaz 1995 tag).	Green turtle (*Chelonia mydas*) was tagged (ID 53765) at Tetiaroa, French Polynesia (released 14 February 2011) and migrated to the east of Fiji (NOAA).
	Green turtle (*Chelonia mydas*) was tagged (ID 53762) at Tetiaroa, French Polynesia (released 2 March 2011) and migrated to the east of Fiji (NOAA).
	Hawksbill turtle (*Eretmochelys imbricata*) was tagged (ID 60061) while nesting at Tutuila, American Samoa, and migrated southeast toward Aitutaki, Cook Islands (Tagarino et al., 2008).
	Juvenile hawksbill turtle (*Eretmochelys imbricate*) was tagged (ID 60069) at Tutuila, American Samoa, and migrated southeast toward Aitutaki and the eastern atolls, Cook Islands (Tagarino et al., 2008).

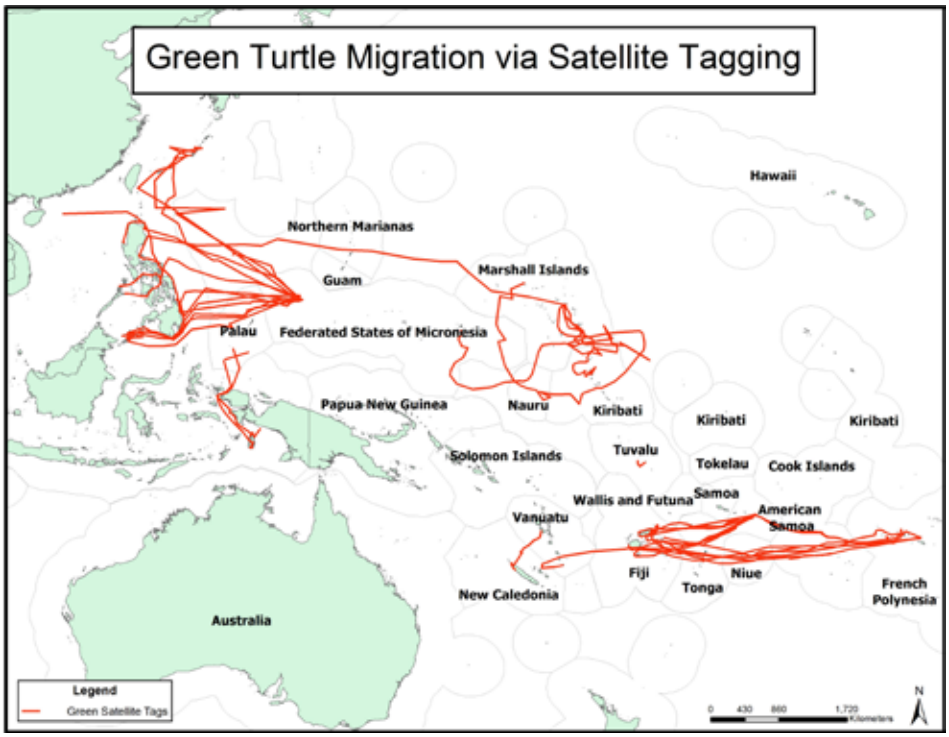


FIGURE 133. Green turtle migration in the Pacific region via satellite tagging. (SPREP, 2015. Aggregated NOAA data of satellite tracks of green turtle)

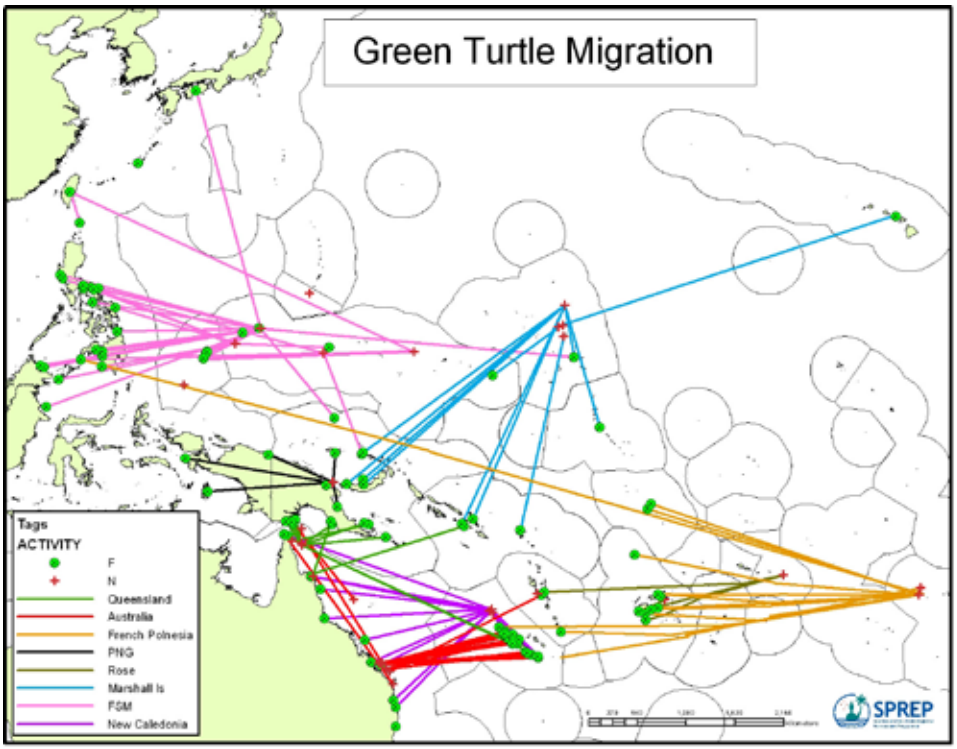


FIGURE 134. Green turtle migration and nesting to foraging in the Pacific region via flipper tagging. (TREDS/SPREP, 2015)

Whales

Status: Fair **Trend: Stable** **Confidence: Low**

On 19 September 2001 Cook Islands declared all of its territorial waters as the Cook Islands Whale Sanctuary (CIWS), with regulations to protect cetaceans within CIWS waters, and prohibitions against killing, injuring or harassment of any whales or other cetaceans within the sanctuary. There are 14 different cetacean species known to exist within the CIWS, with around 11 more different cetacean species likely to occur within Cook Islands' territorial waters based on either local reports or knowledge of distribution and range across the South Pacific Ocean (Table 16 and 17).

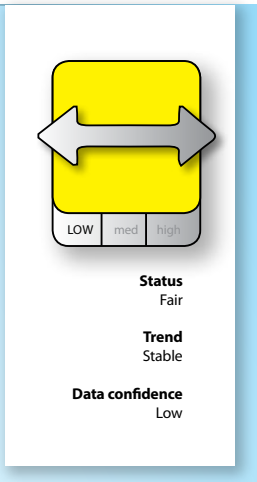


TABLE 16. Cetacean species known from confirmed scientific observations to occur in the Cook Islands Whale Sanctuary (Nan Hauser)

Scientific name	Common name	Remarks
Megaptera novaeangliae	Humpback whale	Hauser et al. (2000). Seasonal occurrence in austral winter; likely breeds and calves in the region.
Balaenoptera borealis	Sei whale	
Balaenoptera musculus	Blue whale	Probably *B. m. Brevicauda*
Balaenoptera bonaerensis or Balaenoptera acutorostrata sp.	Antarctic minke whale or Dwarf common minke whale	Species uncertain.
Physeter macrocephalus	Sperm whale	
Orcinus orca	Killer whale	
Globicephala macrorhynchus	Short-finned pilot whale	
Lagenorhynchus australis	Peale's dolphin	Leatherwood *et al.* (1991).
Ziphius cavirostris	Cuvier's beaked whale	Observed both alive and stranded.
Mesoplodon densirostris	Blainville's beaked whale	Observed both alive and stranded.
Delphinus delphis/ frontalis	Common dolphin	
Stenella longirostris	Spinner dolphin	
Stenella attenuata	Striped dolphin	
Lagenodelphis hosei	Fraser's dolphin	Stranding in Rarotonga in 2001.

TABLE 17. Cetacean species likely to occur in the Cook Islands Whale Sanctuary, based on either equivocal local reports or knowledge of their distribution and range in the South Pacific Ocean (Nan Hauser)

Scientific name	Common name
Balaenoptera edeni	Bryde's whale
Balaenoptera physalus	Fin whale
Pseudorca crassidens	False killer whale
Feresa attenuata	Pygmy killer whale
Grampus griseus	Risso's dolphin
Steno bredanensis	Rough-toothed dolphin
Peponocephala electra	Melon-headed whale
Tursiops truncatus	Bottlenose dolphin
Stenella attenuata	Spotted dolphin
Kogia breviceps	Pygmy sperm whale
Kogia simus	Dwarf sperm whale

Most of the current knowledge and research about whales in Cook Islands comes from Nan Hauser and her team at the Centre for Cetacean Research and Conservation (CCRC). The CCRC research includes humpback whales in the South Pacific through satellite tagging, acoustics, photo-identification, genetics, toxicology and surveys; beaked whales through surveys, conservation of critical habitats and examination of impacts from acoustic pollution; conservation and awareness raising initiatives for cetaceans in both Cook Islands and the larger region; participation in the *A pattern of dolphins* (A-POD) survey about dolphin distribution, connectivity and relatedness regionally; and collaboration with the South Pacific Whale Research Consortium (SPWRC).

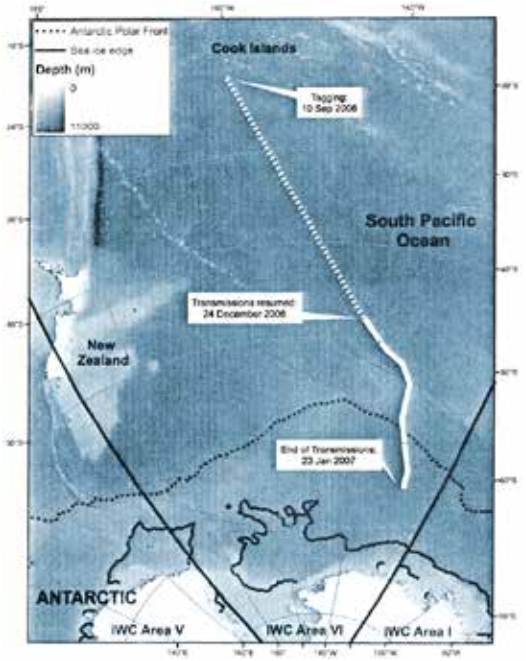


FIGURE 135. Satellite-monitored track of humpback whale number 22854 tagged off Rarotonga in 2006 and travelling from the Cook Islands to the Antarctic in 2006/2007 (Nan Hauser).

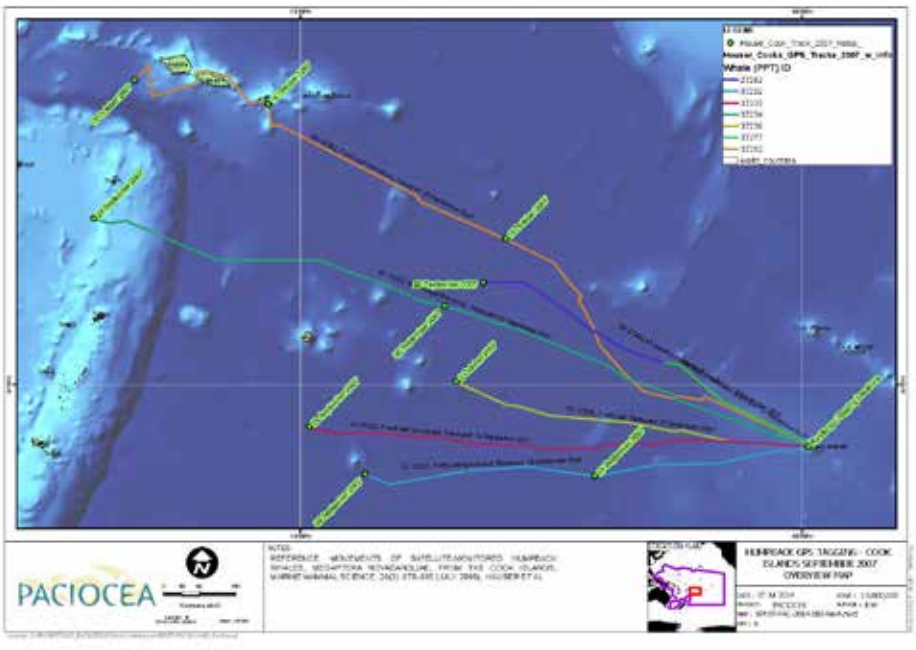


FIGURE 136. Satellite monitored tracks of humpback whales tagged off Rarotonga, 2007. (SPREP; Data: Hauser et al. 2010)

HUMPBACK WHALES IN COOK ISLANDS

The Oceania subpopulation of humpback whales found in Cook Islands, Megaptera novaeangliae, is classified as endangered under the IUCN's Red List of Threatened Species. Humpback whales are present in the CIWS waters from July through October, on their seasonal migration from Antarctic waters where they feed during the summer, to warmer tropical waters during the austral winter to mate and calve. There are no current estimates of Cook Islands humpback whales, but their populations are generally considered to be small and transient. Photo identification of Cook Islands humpback whale populations have shown exchange among major island groups in New Caledonia, Tonga, Vanuatu and French Polynesia, based on 2006 and 2007 satellite tag studies. It is believed that the humpbacks in Cook Islands are transiting from Antarctic waters in the south and east, and continuing in a west or northwest direction toward Tonga, Samoa and American Samoa to breed and calve (Figure 135) before returning to Antarctica at the end of the winter. Given the relatively small numbers of humpback whales in Cook Islands compared to countries such as Tonga, it is believed that while some mating and calving does occur in Cook Islands waters, this is likely opportunistic, and occurs while on the migration west and northwest.

The International Whaling Commission (IWC) classified seven distinct populations of humpback whales in the southern hemisphere ('classified Breeding stocks A-F'), with migratory connections to six distinct areas in Antarctic feeding waters ('Areas I-VI'). While based on limited research and information, Cook Islands humpback whale populations are classified under 'Breeding stock F,' and, based on a 2006/2007 satellite tag of a whale from the Cook Islands that had migrated to Antarctic waters in the wintertime to feed, it is now generally believed that the humpback whales in Cook Islands are part of the 'Area VI' population (Figure 136). Besides the satellite tag of this individual, very little information exists about the route taken back to Antarctic waters by the humpback whales found in Cook Islands, and no information exists about where they are feeding in Antarctic waters.

It is likely that the Cook Islands' population of humpback whales hasn't fully recovered from overexploitation from whaling and illegal catches by the USSR in the 1959/60 season, when almost 13,000 humpbacks were killed from Areas V and VI. Despite the past overexploitation of humpback whales in the southern hemisphere (over 200,000 were killed in a seven decade period during the 20th century) and the illegal humpback kill by the USSR in Antarctic waters, historically it appears that Cook Islands was never a major whaling site, especially compared to other areas in the southwest Pacific. There are only three historic records of humpback whales taken opportunistically by vessels on their way to other major whaling waters. There are some historic local reports of whales taken by native Cook Islanders on Rarotonga. These were likely humpback whales because of a local tradition that used the flowering of the Ngatae (Indian Coral, *Erythrina variegata*) tree as a sign for local whalers to prepare their boats and equipment for the arrival of the first whales. Since this tree usually flowers in July, many believe the whales that locals were hunting were humpback whales because the timing matched, with the only other candidate being sperm whales, although this is less likely as their migration routes are not as seasonal.

Most humpback whales in Cook Islands have been studied by Nan Hauser and her research team beginning in 1998, with most of the humpback whale research conducted in three locations: Rarotonga, Aitutaki and Palmerston Atoll. Nan Hauser, along with the Center for Cetacean Research and Conservation (CCRC) have expanded their research focus throughout the region, together with the South Pacific Whale Research Consortium (SPWRC), in order to better understand the distribution and links of the humpback whales found in Cook Islands with the region. Nan Hauser and the CCRC humpback whale research in Cook Islands includes satellite tagging, acoustics, photo identification, genetics, toxicology and surveys.

Impact

Turtles and whales are important parts of Cook Islands' marine ecosystems, as iconic, charismatic, and in some cases totem species. They are also highly migratory and vulnerable species of concern, and important symbols of traditional Cook Islands culture. Both whales and turtles attract tourists who want to see these animals in their natural environments and, for some turtle species, to swim with them. Whale watching is a particularly important tourist attraction in Cook Islands during July to October. While there are no dedicated whale watching operators, during the whale season many dive companies and game fishing vessels take tourists for whale watching. The Cook Islands also has land-based whale watching platforms. In 2015 a company started advertising their services for whale watching. The decrease and loss of these species in Cook Islands has negative economic, social and environmental impacts. These include negative impacts to sources of revenue through tourism, particularly ecotourism; a loss of cultural identity, tradition and connection, particularly in some cultures where these animals might be important traditional totem species; and an alteration of natural ecosystems and food webs, especially where turtles and whales play important roles in ecosystem balance and food web dynamics. For example, turtles play an important role as macro herbivores, grazing in marine reef systems, regulating algal and other plant growth, and helping to keep the entire ecosystem in balance.

Threats and Associated Impacts

Primary threats to sea turtles in Cook Islands include pollution, predation, algal blooms, fisheries and impacts from bycatch and climate change impacts. Pollution threats to sea turtles include solid waste, particularly plastics in the marine environment which turtles can mistake as food and ingest with the potential for not only false satiation, strangulation and starvation, but also toxic chemical transfers. Sea turtles can become entangled in lost or discarded fishing gear which can lead to injuries or death. Some people catch and eat turtles in Cook Islands, usually by turning nesting females upside down and returning later to collect them. There have been reports of intentional or opportunistic hunting at Tongareva Atoll, and opportunistic hunting at Palmerston. While turtle take and predation, especially for eating, is rare now compared to the past, it does exist. The loss of nesting females can have serious adverse impacts on already declining and vulnerable sea turtle populations in the country. Crabs, seabirds, fish, dogs and wild pigs are all known to predate upon sea turtles, especially when they are hatching and entering the ocean. Algal blooms can lead to eutrophication events and loss of habitats and food sources for the turtles. Industrial fishing, especially longline fishing, can result in the bycatch of already vulnerable sea turtle species. Measures have been put in place by MMR to minimise sea turtle bycatch which is discussed in greater detail in the following response section. Climate change impacts including warming ocean temperatures, mean sea level rise, and more intense storm events, can result in disrupted and changing migration routes for sea turtles, as well as decreasing and changing food, habitat and nesting areas around the country. There is very little information specifically for Cook Islands about climate change impacts to sea turtles.

Whale populations are vulnerable to pollution impacts including ingestion and strangulation, entanglement with fishing nets and lines which can lead to injury, stranding and death. Big shipping vessels can be a threat to whales as these cross the migratory routes of whales. Adverse impacts from climate change such as warming ocean temperatures and changing food web dynamics can change migration routes, habitats and breeding and calving grounds.

Juney Ward

Response and Recommendations

Cook Islands is party to the Convention on the Conservation of Migratory Species of Wild Animals (CMS) as of 2006, which covers whales and turtles as highly migratory species within the country and the region.

The Prime Minister of Cook Islands declared a marine park, Marae Moana, one of the largest in the world, which is an excellent measure to protect migratory species such as whales and turtles. The inclusion of the northern Cook Islands has led to the draft policy of Marae Moana being amended to cover the entire EEZ. Zones of use and protection are still under development (Rongo et al. 2013. Maraemoana.gov.ck).

Educational activities around sea turtles have been carried out in Pukapuka (Niua school), Manihiki (Tauhunu and Tukao schools), Tongareva (Omoka and Tetautua schools), Palmerston (Lucky school) and Rarotonga (Tereora College) through sea turtle education modules to school student and staff; at the LifeSkills Expo in Manihiki in 2011; in collaboration with international universities; and in collaboration with Nan Hauser and the Whale Research Centre with information about turtles at the Whale and Wildlife Centre. Community presentations about turtles have been given at Palmerston, Rakahanga and Tongareva. Turtle projects that involve the community have been initiated at these islands and atolls, and will later be led by the communities.

In 2012 Dr David White and partners established the first 'Index Beach' at Mangarongaro *motu* in Tongareva atoll. The Index Beach is designed to monitor nesting sea turtles to better understand turtle populations and conditions for nesting, raise environmental awareness in the greater area and establish baseline data to compare nesting turtle populations over time. The Mangarongaro index beach is part of a three year monitoring project, and includes a nesting census with tagging and genetics sampling of any turtles encountered. Tongareva's other beaches are also monitored for nesting to better understand marine habitat use by the turtles. This index beach is one of three in the Cook Islands to monitor sea turtle nesting habitats over time; the other two are at Rakahanga. The five most important nesting sites at Palmerston are also being monitored. Dr White has noted that as most turtles do not nest every year and many migrate very long distances, it will also be important to understand with long term monitoring efforts the inter-annual variability of nesting abundance, as well as whether there is any correlation in nesting abundance with El Niño events. He notes that while long term monitoring is important, nesting habitats likely don't reflect current changes in entire populations such as decline in entire species with smaller and fewer females nesting, reduced egg success, lower fecundity and longer intervals between nesting times (White 2012).

SPREP houses the Turtle Research and Monitoring Database System (TREDS) which compiles data from turtle stranding, tagging, nesting, emergence and beach surveys from Pacific island countries and territories. This is a valuable resource to understand the state of Cook Islands' sea turtles locally, nationally and regionally. However sparse, limited and irregular data inputs limit the effectiveness and value of this database. As of 2012, 646 in-water sightings of sea turtles in Cook Islands have been reported to the TREDS database (White 2012).

Cook Islands has acted to prevent and mitigate sea turtle bycatch through pelagic longline regulations. Some of the regulations around handling and bycatch of turtles include: reporting requirements for all turtles caught, both retained and discarded; a requirement for captains to attend a protected species workshop when required; for vessels to possess all MMR-required equipment for handling and releasing sea turtles such as a long handled dipnet, line-cutter, dehooker, and bolt cutter; to possess MMR-approved handling and release guides for turtles; to employ best-practice handling and release methods described in MMR-provided guidelines if a turtle is caught alive; and other specific regulations related to gear types and prohibited fishing areas.

In 2006, in collaboration with SPREP and the CMS Secretariat, Cook Islands signed a Memorandum of Understanding (MOU) for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region. This MOU is important regionally, as Cook Islands is able to work with 11 other countries on whale and dolphin conservation and action plans.

As discussed in the status section, the Cook Islands Whale Sanctuary (CIWS) was declared on 19 September 2001. The CIWS is around one million square nautical miles (all of Cook Islands' territorial waters). Nan Hauser and her team at the Centre for Cetacean Research and Conservation (CCRC) carry out important research about cetaceans within the CIWS, which is discussed at greater length in the status section. The CCRC also provides public outreach and education on the history of whales in Cooks Islands and their conservation status. The CIWS has regulations to protect cetacean populations, and it is forbidden to kill, injure or harass cetaceans within the CIWS.

Nan Hauser and CCRC are also involved with conservation and awareness raising initiatives that use science to inform conservation, such as providing government officials and national policy-makers information about whale migration routes, habitats and behaviour to help manage national marine sanctuaries and marine protected areas. CCRC also works with schools, local communities, fishermen, businesses including the tourism sector, national and international media to share information about the importance of whales within Cook Islands. In 2000 Nan Hauser along with Joan Daeschler and Helen Jordan built the Cook Islands Whale Education Centre, which is now the Cook Islands Whale and Wildlife Centre. The centre educates people about Cook Islands' ocean environment including its whales, dolphins, sharks and turtles, and the importance of ongoing research, conservation and stewardship.

In August, 2014 Nan Hauser and CCRC, in collaboration with the University of Canberra and the United States National Oceanic and Atmospheric Association (NOAA) tagged ten more humpback whales in Rarotonga, the first tagging activity since the 2006/2007 studies discussed in the status section. This will provide more information about the little known migration routes of the humpback whales.

While Cook Islands is not a CITES member and therefore does not have the additional reporting burden of members, it does fulfil the non-party obligations to CITES for turtles and whales and all other CITES listed species in the Cook Islands.

Dr White provides a series of recommendations in his 2012 paper, including a management approach for sea turtles in Cook Islands to 'undertake long-term research, provide appropriate education, build capacity and plan appropriate conservation measures, and, where necessary, implement legislation,' which are summarised in Table 18 (White 2012).

Research, conservation, capacity building and education activities can be held at the same time, especially in the Pa Enua where entire communities may involve with projects. It is important to work closely with communities in any turtle-related projects, especially in the case of the Pa Enua, as communities have been strong supporters and actors in implementing projects and assisting with research and monitoring efforts, but also raising awareness about the importance of turtles.

Cook Islands can refine its turtle conservation regulations and legislation to protect these vulnerable species, especially through the Precautionary Principle where little information exists. Turtles have been recognised in island-level regulations for Mitiaro and Atiu, with the opportunity to expand these elsewhere. Cook Islands can also explore traditional management such as through the *Ra'ui* system and the turtle *Ra'ui* on Aitutaki. Best management practices should be developed for turtle conservation and communities. A focus should be placed on protection of mature females as they maintain species numbers, especially with such low numbers observed around the country. As NGOs have largely driven turtle management actions in the past, further support should be given to individuals and groups working on this topic. One example is $1 from Onu shirt sales to go toward supporting turtle conservation efforts around the country.

Cook Islands should work with SPREP and other partners around the region to promote sustainable, environmentally and community friendly approaches to whale watching and tourism, especially with the significant economic contribution from tourism. In collaboration with Nan Hauser and CCRC, Cook Islands should continue to work with regional organisations such as SPREP, and global organisations such as the World Cetacean Alliance (WCA), to better define the important role of whales in the country and identify other actions such as the designation of Whale Heritage Sites or the promotion of sustainable whale watching certification programmes.

TABLE 18. 'A Workable Approach for Managing Sea Turtles in the Cook Islands'. (Summarised and adapted from White, 2012)

Research	Determine present status, abundance and distribution of sea turtles throughout the archipelago
	Identify critical habitats
	Establish ongoing surveys on Index Beaches at various atolls to determine trends
	Identify and quantify threats and impacts (a) fishery bycatch (b) direct take of meat and eggs (c) pollution (d) loss of critical habitats (e) climate change
Education	Deliver environmental and marine education: (a) teach a turtle module in each school, especially at senior student level (b) give community presentations (c) teach the *Turtle Rangers* programme (d) provide training courses to science teachers (e) use Life-skills and other non-academic approaches to student development (f) identify potential tertiary level students (g) facilitate post-graduate research
Conservation and capacity-building	Build capacity at local grassroots level (a) initiate a turtle monitoring programme in each atoll (b) advise Island Councils on specific monitoring programmes for their unique environment (c) assist community efforts toward sustainable resource use
	Build capacity at government level (a) assist MMR and NES to develop sea turtle management options (b) assist MMR and NES to report relevant findings to regional bodies (c) design suitable training modules for government workers
Legislation	Advise National Government and Island Councils on legislative needs (a) assist with Parliamentary committees (b) provide background information for *Ra'ui* decision making

Anna Bertram

SOURCES

Hauser, N., Zerbini, A., Geyer, Y., Heide-Jorgensen, M. and Clapman, P. 2010. Movements of satellite-monitored humpback whales, Megaptera novaeangliae, from the Cook Islands. Marine Mammal Science, 26(3): 679–685 (July 2010)

Hauser, N. and Clapham, P. The Cook Islands Whale Sanctuary.

Hauser, N., Zerbini, A., Geyer, Y., Heide-Jorgensen, M. and Clapman, P. Migratory destination of a humpback whale satellite-tagged in the Cook Islands.

White. M,. 2012. Sea Turtles in the Cook Islands. Volume One: 2009–2012.

ONLINE SOURCES

http://www.cookislandswildlifecentre.com/rarotonga-cook-islands-about-us/

http://www.cookislands.org.uk/whale-watching#.VlkFwKOhdy0

http://www.doc.govt.nz/documents/conservation/native-animals/marine-mammals/whales-in-the-south-pacific.pdf

http://nanhauser.com/#research

http://www.iucnredlist.org/details/132832/0

http://www.cookislandsnews.com/item/48150-scientists-risk-lives-tagging-whales/48150-scientists-risk-lives-tagging-whales

http://www.cms.int/en/legalinstrument/cms

https://www.sprep.org/thetreds (TREDS)

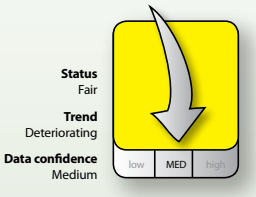
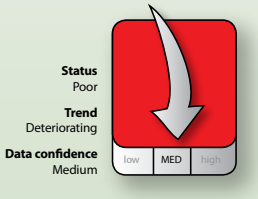
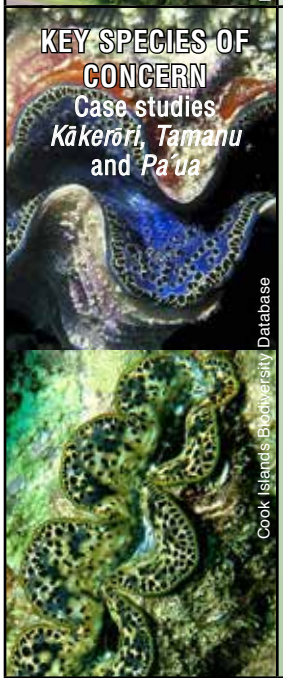
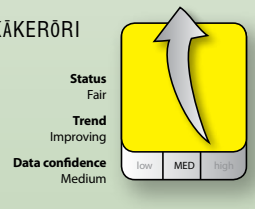
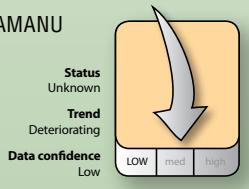
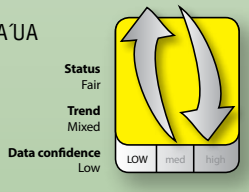
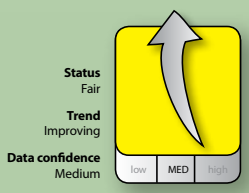
Zhang Da Qiang

OVERVIEW

This chapter covers the theme of Biodiversity reviewing the state of endemic, native and threatened species, invasive species, key species of concern as well as terrestrial protected areas (marine protected areas are addressed in the Marine Section). This section describes what the Cook Islands government is doing, and needs to do, to protect its unique species and ecosystems from further degradation.

Cook Islands has a very small landmass of 240 km^2 compared to its exclusive economic zone of 1,800,000 km^2. Unfortunately, many unique species are threatened through development and invasive species. The general status is fair but efforts need to be continued to implement management plans to protect endemic and native species and prevent the establishment of new invasive species. Cook Islands has 14 terrestrial protected areas. More work is needed to fulfil the 2020 goal of 17% of landmass being conserved as protected areas.

BIODIVERSITY HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
		4213 existing species are identified under the Cook Islands Biodiversity Database. Only 34% of terrestrial species are native to Cook Islands, compared to the 98% of native marine species. Terrestrial species are under serious threats from anthropogenic pressures such as impacts from development, population growth and pollution, with higher percentages of terrestrial species groups identified as threatened or endangered. 26% of all species endemic to the Cook Islands are classified as threatened or endangered.	Cook Islands should continue to educate citizens, especially younger generations and schoolchildren, about the importance of biodiversity and species conservation and should integrate local biodiversity education into primary and secondary school curricula. Taxonomic changes should be updated where relevant to national biodiversity databases including the Cook Islands Biodiversity Database and the country's National Report to the CBD. Ridge to reef and other whole of island integrated ecosystem-based management should be used and practised by planners and managers, especially when considering potential impacts from coastal development.
		Invasive species are one of the biggest threats to biodiversity. There are 440 invasive species recorded in Cook Islands, or 10% of all existing species. Agricultural invasive species comprise 62% of total invasive species, and 50% of these (135) are considered harmful to plants. Fourteen per cent of all invasive species are considered 'most serious'. Invasive species threaten native and endemic species and have long-lasting negative social, economic and environmental impacts.	To prevent the introduction of invasive species, Cook Islands needs to expand border control and biosecurity measures through more financial and personnel resources, as well as more oversight and evaluation of the effectiveness of existing programmes. Cook Islands should expand its public education initiatives about the impacts of invasive species, as well as monitoring and enforcement of undeclared plant and animal introductions. More focused investment into prevention and eradication of current invasive species, plus more support to programmes that address invasive species are essential.
	KĀKERŌRI  TAMANU  PA'UA 	Many of the threatened species are endemic and inhabit the terrestrial environment. Information is available to make a sound statement about their state for only a few species. Development and natural disasters pose two of the main threats to threatened species. Some management and recovery plans exist including several successful interventions.	With 26% of endemic species listed as threatened there is a need for more ecosystem management to achieve species specific conservation goals. Recommendations include strengthening and reviewing management plans. Data collection should be improved to make better statements about the condition of threatened species. It is important to continue to involve NGOs and local communities.
		Cook Islands has 14 terrestrial protected areas which are six per cent of the total land mass. The PAs include private nature reserves, conservation areas, entire island and motu PAs, a wildlife sanctuary, National Parks and Reserves, and community managed areas. However most PAs are not covered by legislation. KBA and IBA provide a guide for conservation.	Cook Islands needs to establish more terrestrial protected areas with suitable management plans to fulfil the Aichi target of having 17% of the land mass protected. It is important to collect data for future decisions. An holistic ridge to reef approach is needed when developing protected areas. It is important to involve communities in the establishment of new protected areas.

ENDEMIC, NATIVE AND THREATENED SPECIES

Introduction

Due to its small landmass and relative isolation, Cook Islands' biodiversity is limited compared to other areas of the Pacific, and is relatively understudied. Larger, charismatic species including flowering plants, birds and mammals have been studied in greater detail and estimates presented in this report are fairly accurate. However, much less is known about smaller less charismatic species including insects, as well as marine species more broadly. Estimates presented here are based on the best available knowledge.

Cook Islands has been actively involved in efforts to better identify, understand, and sustainably conserve and preserve its limited species, especially those which are endemic. About 62% of all species are native to the Cook Islands, and two per cent are endemic. While only four per cent of existing species are classified as threatened or endangered, 26% of the endemic species are in this category. Cook Islands is taking these threats to its biodiversity very seriously.

Almost all (98%) of marine species, and 34% of terrestrial species, are native to the country. Terrestrial species are under serious threat from largely anthropogenic pressures such as impacts from development, population growth and pollution, with higher percentages of terrestrial species groups identified as threatened or endangered.

This indicator used the Cook Islands' Biodiversity Database to identify and catalogue numbers of endemic, native, introduced and threatened species, and links the status of these species to different terrestrial and marine habitats.

Status
Fair

Trend
Deteriorating

Data confidence
Medium

Status: Fair Trend: Deteriorating Data Confidence: Medium

Data confidence in Rarotonga is high but low in the Pa Enua.

There are 4213 existing species identified under the Cook Islands Biodiversity Database (Table 19). More than half (57%) are identified as terrestrial species which includes freshwater and land-based aquatic species, and 43% are identified as marine species. About 62% of all of the species are native (two per cent are endemic), and 38% were introduced either pre- or post-Polynesian contact to the Cook Islands. Almost all of the identified existing marine species are native (98%), and one per cent species are endemic), while only 32 marine species are identified as introduced species (two per cent of total marine species). By contrast, 34% of all terrestrial species are native to Cook Islands (three per cent are endemic), and 66% of all terrestrial species classified as introduced species.

TABLE 19. Total terrestrial and marine existing, introduced, native, endemic and threatened or endangered species. (Cook Islands Biodiversity Database, Nov 2014)

GROUP	TOTAL NUMBER OF KNOWN LIVING SPECIES	NUMBER OF INTRODUCED SPECIES	NUMBER OF KNOWN, LIVING NATIVE SPECIES	NUMBER OF NATIVE SPECIES ENDEMIC TO COOK ISLANDS	NUMBER CURRENTLY THREATENED OR ENDANGERED
Terrestrial					
Plants	1445	1013	432	33 (2%)	90
Invertebrates	883	585	327	37 (4%)	9
Reptiles, Frogs	19	15	4	0	4
Birds	83	13	70	6 (7%)	21
Mammals	15	11	4	0	1
Marine					
Plants	81	7	74	1 (1%)	0
Invertebrates	1063	18	1045	4 (<1%)	20
Fish, sharks, rays	651	4	647	12 (2%)	0
Reptiles	6	2	4	0	3
Birds	45	1	44	0	12
Mammals	23	0	23	0	6

THREATENED OR ENDANGERED SPECIES (TOTAL EXISTING, ENDEMIC AND NATIVE)

When considering all species in Cook Islands (endemic, native and introduced), a few (four per cent) are threatened or endangered. If divided into terrestrial and marine species, then five per cent of all terrestrial species and two per cent of all marine species are classified as threatened or endangered. However, this figure is increasing. A quarter (26%) of all species endemic to the Cook Islands are classified as threatened or endangered – this consists of 36% of endemic plant species, 13% of endemic vertebrates, and all (100%) of the six endemic bird species. About 80% of Cook Islands' total native reptile species are threatened or endangered, as are 31% of native trees (excluding tree ferns), 29% of all native bird species, and 28% of all mammal species.

TERRESTRIAL SPECIES

Most terrestrial species are identified in lowland habitat areas, followed by the mountainous habitat of Rarotonga, and wetland habitats across the country. Most terrestrial species in the lowland and wetland habitats are introduced, while most of the species in the mountains of Rarotonga are native (Figure 137). The majority of terrestrial plants and invertebrates are introduced (70% and 67%, respectively), while 84% of Cook Islands' terrestrial bird species are native (Figure 138). Of the terrestrial vertebrates 25% are classified as threatened or endangered, which is largely comprised of reptiles and frogs (37%) and birds (25%) (Cook Islands Biodiversity Database, Nov 2014). The Cook Islands' cloud forest is of international importance and is a key biodiversity areas (KBAs). The cloud forest has eight vascular plant species that are globally threatened, and supports several land snail species and two vascular plant species. It is one of the largest remaining areas of small-islands low latitude cloud forest which retains almost the full suite of plants restricted to cloud forest habitats of tropical Pacific Islands (NES, 2015).

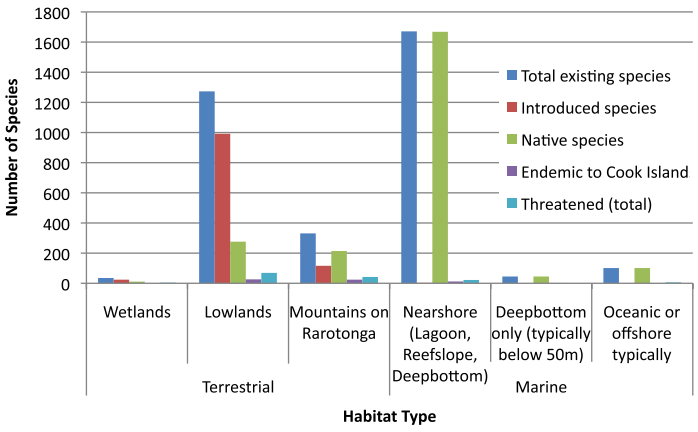


FIGURE 137. Total existing, introduced, native, endemic and threatened species by habitat type. (Cook Islands Biodiversity Database, Nov 2014)

MARINE SPECIES

Almost all of Cook Islands' marine species are native to the country as discussed above; with most species identified (92%) located in near shore (lagoon, reef slope, deep bottom) environments as shown in Figure 137. Most of the marine species that have been identified are animals (96%) which are mainly invertebrates (57%) and fish, sharks and rays (35%) (Figure 138). The remaining mammals, reptiles, frogs and birds have only a few species but these are iconic such as whales, sea turtles and sea birds (Figure 138). Reef surveys haven been conducted in Rarotonga on a regular basis and it is notable that Crown of Thorns starfish (COTs) outbreaks, storms (including cyclones) and bleaching events are the main cause of the decline of Rarotonga's reef communities in the past 16 years (Rongo et al. 2015).

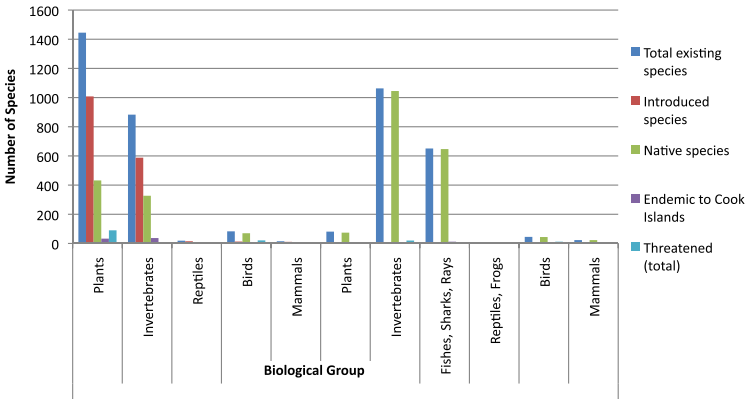


FIGURE 138. Total existing, introduced, native, endemic and threatened or endangered species by biological group. (Cook Islands Biodiversity Database, Nov 2014)

BIRDS

Cook Islands' bird species are well researched compared to other groups. The southern Cook Islands group supports mostly land birds (11 native birds with six endemic), while the northern group mainly supports seabirds, with only one resident land-bird, the *Rupe*, found on Manihiki, Palmerston and Pukapuka. The island and national park of Suwarrow is an important sea-bird breeding site for both Cook Islands and the Pacific region; eleven seabird species breed on the island, and it supports significant colonies of the *Kota'a Iti (Fregata ariel)* (nine per cent of the world's population) and the *Tavake (Phaethon lepturus)* (three per cent of the world's population) (NES 2011). During the cloud forest survey in 2015 four indigenous birds were seen or heard (NES 2015).

Impact

Losses in biodiversity and native and endemic species have social, economic and environmental impacts. Species endemic to Cook Islands can be a link to cultural history and traditions, such as through costume making, medicines, and traditional environmental knowledge systems, as well as a source of national pride. Native and endemic species, particularly many of the seabirds and fish, can be a source of economic revenue through tourism and fishing.

Increased development in Cook Islands, particularly through the jump in tourism, can result in more threats and pressures to the endemic and native species whose habitats are in the path of the development. Even progressive development measures, such as proposals for solar energy or bicycle paths across the islands, can threaten at-risk species if environmental and species impact assessments are not undertaken. Land-based impacts from development such as sedimentation, nutrient and wastewater runoff, and pollution, not only affects terrestrial biodiversity in these areas, but can also impact on biodiversity in the lagoon and near shore areas, particularly shellfish species.

Marine turtles are under pressure from unregulated harvests and fewer nesting sites on Rarotonga and Aitutaki through development in beach areas. More light from hotels and houses in coastal areas can also disturb the already stressed turtle populations.

In many cases, the value of a certain species may be unknown or not communicated. As a result, certain threats or pressures to biodiversity from development, for example, might be allowed due to a lack of knowledge and/or communication about unintended consequences. One mechanism to address these threats is the Environmental Impacts Assessment which provides site-specific opportunities to mitigate impacts. In these cases, the precautionary principle might be applied until more is known about the impacts to species biodiversity. Traditional and cultural knowledge related to biodiversity has declined over the last few decades. However, with greater political and public interest in environmental issues, which are increasingly taught in schools, there is growing use of traditional cultural knowledge. This can be seen clearly in the new Marae Moana protecting over half of the Cook Islands' EEZ.

Invasive species, particularly terrestrial invasive species, can put more pressure on species health and diversity in some areas, which is discussed in the next section of this theme.

Response and Recommendations

The Cook Islands government and civil society have made significant progress in conserving important species. Efforts to protect threatened and endangered species include management plans for a number of key species. One of the best known is the recovery and sustainable management programme for the *Kākerōri* (Rarotongan flycatcher, *Pomarea dimidiata*) in the Takitumu Conservation Area (TCA) of southeast Rarotonga. Another example is the management plan on Atiu for bird species in response to pressures from tourism. A species specific action includes the development of management plans for seabirds in the northern Cook Islands. Cook Islands has ongoing management plans for turtles and coral gardening. A recent report by the Pacific Islands Conservation Initiative (PICI) recommended human impact assessment of suitable beaches on Rarotonga to determine if human habitat changes have influenced nest-site selection (Ischer et al. 2015).

While all of the EEZ is a whale sanctuary, there are no specific management plans for whales. With the significant investment in species driven conservation, it may be worth considering habitat specific conservation. An assessment of the coconut crab, *Unga*, in Mauke showed that it is necessary to conserve and manage this important species. The Mauke community is very supportive – it has established an *Unga Ra'ui* area and is developing regulations. This is a very good example for a community engagement project and shows that Cook Islanders are conscious of the environment and natural resources (Matamaki et al. 2016).

The use of traditional knowledge in biodiversity management is codified in a Traditional Knowledge Act (TK Act), endorsed in 2013, that maintains a register of all traditional knowledge for the Cook Islands. Environmental regulations and by-laws for species of concern on the islands of Atiu and neighbouring Takutea and Mitiaro were developed. More information can be found in the Culture theme.

Civil society is very active in biodiversity management. For example, Te Ipukarea Society (TIS) is a non-governmental organisation formed in 1996 to look after natural heritage after the downsizing of the Environment service. TIS is involved in many biodiversity projects, including a coral reef campaign, working with conservation areas, eradication of invasive species and several bird programmes. This is an important step towards the protection of endemic species and helps to raise awareness with the local community. It also provides leadership on key environmental problems and provides a voice for local communities.

The establishment of the Shark Sanctuary and other protected areas is an important step towards the safeguard of threatened native and endemic species in the Cook Islands.

The GEFPAS project 'Implementing the Island Biodiversity Programme of Work by integrating the conservation management of Island Biodiversity' conducted a cloud forest survey which successfully developed a management and restoration plan. This is a prime example of habitat-based conservation. Under the IIB project a turtle component raised public awareness about the importance of turtles, and carried out monitoring, and surveys. Building on the importance of traditional knowledge, a home nursery was built to grow medicinal plants that are of traditional importance.

Regular outreach about Cook Islands' biodiversity and important habitats is conducted by the NES, other government agencies and civil society to build awareness in local communities.

With over 150 species classified as vulnerable and threatened, a more systematic approach of ecosystem management is required in a timely and cost effective manner. For example, implementing the findings of the cloud forest survey would be an important step in increasing the use of habitat management.

About half (48%) of Cook Islands' terrestrial endemic

species are located in Rarotonga's unique cloud forest, which is the only island in the country with such a habitat. Efforts should be made to protect, conserve and preserve endemic species, especially as relocation of these species to another island is not an option. Recommendations in the Cloud Forest Management and Restoration plan (Wildlands 2016) and in the 4th National Report to the CBD (NES 2011) should be implemented.

To preserve Cook Islands' biodiversity, it is essential that everyone from local communities to businesses and government leaders, understands the importance of species and ecosystem protection, and the associated cultural, heritage, economic and environmental benefits and services. Cook Islands should invest in economic incentives for species and ecosystem conservation driven by government policies, as a means to ensure biodiversity protection, especially for threatened native and endemic species. There is a need for conservation by future generations. Cook Islands should continue to educate children in schools about biodiversity values, traditional knowledge related to biodiversity in the local context, and the country's native and endemic species. Management of the growing pressure from development and overharvest of sensitive species will be critically important. The Marae Moana presents a national opportunity to engage with all stakeholders in this process.

The Cook Islands National Biodiversity Database is the regional goal standard for taxonomic data. However, taxonomic identifications of many Cook Islands species have changed, but are not updated in the database. These biodiversity sources should be updated to provide the most current information. The database should also be promoted.

As discussed in the status section above, Cook Islands' terrestrial species are under great threat and therefore require constant management. While Marae Moana is an important marine protected area, planners and managers should include ridge to reef, and other whole of island/ whole of atoll management systems, that address land-based impacts and links with marine ecosystems. Such integrated management approaches should address important terrestrial biodiversity concerns.

NES

SOURCES

Ischer, T., Weeks, E., Lyon, S. 2015. Nesting Suitability Survey of Rarotonga, Cook Islands. Pacific Islands Conservation Initiative.

Matamaki, T., Munro, E., Helagi, N., Bertram, I. and Samue, R. 2016. Assessment of the coconut crab (Birgus latro) in Mauke, Cook Islands. Pacific Community.

National Environment Service. 2002. Cook Islands National Biodiversity Strategy and Action Plan (NBSAP).

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

National Environment Service. 2015. Rarotonga Cloud Forest Ecosystems. Synthesis report, key findings and recommendations.

Rongo, T., Tautu, B., McDonald, G., Hanchard, B. and Rongo, T.C. 2015. Rarotonga fore reef community survey for 2014. Government of the Cook Islands. 36 pp.

Wildlands. 2016. Catchment Management and Restoration Plan for Rarotonga Cloud Forest Ecosystems, Cook Islands.

ONLINE SOURCE:

Cook Islands Biodiversity Database http://cookislands.bishopmuseum.org/search.asp

ENVIRONMENTAL INVASIVE SPECIES ESTABLISHED AND NEW INVASIVES

Introduction

Invasive species are introduced plants, animals and other organisms that can harm the environment, economy or human livelihoods. They are mostly spread through human activity, deliberately or unintentionally. The introduction and spread of invasive species is a serious problem for many Pacific island countries and territories as it threatens their environment, and is one of the biggest threats to biodiversity in the Cook Islands.

This indicator focuses on the environmental and economic impacts through invasive species that have direct negative impacts through food losses, disruption of trade, commerce and tourism, and damage to agricultural crops, marine food species and the environment. The focus on environmental invasive species, as distinct from agricultural invasive species, does not include the many diseases, pests and viruses that affect agriculture, although many environmental invasive species may have impacts on Cook Islands' agriculture.

This report uses the Cook Islands Biodiversity Database as its main source of information about invasive species, as it is the best source of available data. For comparison, the next best resource is the Global Invasive Alien Species Information Partnership (GIASI Partnership). The GIASI Partnership includes data from three main sources, the Invasive Species Compendium (ISC), the Global Invasive Species Database (GISD) and the Global Biodiversity Information Facility (GBIF). It records only 170 total invasive species for Cook Islands.

To determine the state and trend of Cook Islands' invasive species, the number and distribution of established invasive species, and the infrastructure to control them, was used.

Status
Poor

Trend
Deteriorating

Data confidence
Medium

Status: Poor Trend: Deteriorating Data Confidence: Medium

Invasive species are considered the biggest threat to flora and fauna, and will remain so with the growth of air and sea transport. According to the Cook Islands Biodiversity Database, there are 440 invasive species recorded in the country, including pests and weeds (Figure 139). These 440 invasive species make up ten per cent of the total recorded 4213 Cook Islands species.

Cook Islands made great progress on rat eradication on Suwarrow. Together with Te Ipukarea Society and BirdLife International, NES eradicated the ship rat from Suwarrow in 2013 and there have been no more sightings (NES 2015). This has had great benefits for the bird colonies on Suwarrow. Starburst *(Clerodendrum quadriloculare)* was eradicated from Mauke. A biodiversity workforce have intercepted and eradicated the Giant African Snail (*Achatina fulica*), the Coconut Rhinoceros Beetle (*Orcytes rhinoceros*) and the Queensland Fruitfly (*Bactrocera tryoni*).

Cook Islands is active in the management of Beach Burr (*Cenchrus Echinatus*), Red Passion fruit (Passiflora rubra) and Cuscuta (*Cuscuta campestris*). Three biocontrol agents are in place and it is planned to release three more. Ongoing management of invasive species is very time-consuming and has to be taken into account when calculating costs.

Cook Islands has been successful in some eradication efforts. However many invasive species are unmanaged hence the status is declining.

The largest amount of invasive species is found in agriculture with 62% (271 recorded), and half of these (135) are considered harmful to agricultural and domestic plants. While there are more agricultural invasive species considered harmful to plants compared to animals (135 compared to 13), the numbers are nearly even for natural habitat invasive species (eight recorded harmful to plants, compared to seven recorded harmful to animals).

Figure 139 provides a summary of the number of Cook Islands invasive species by habitat and level of impact.

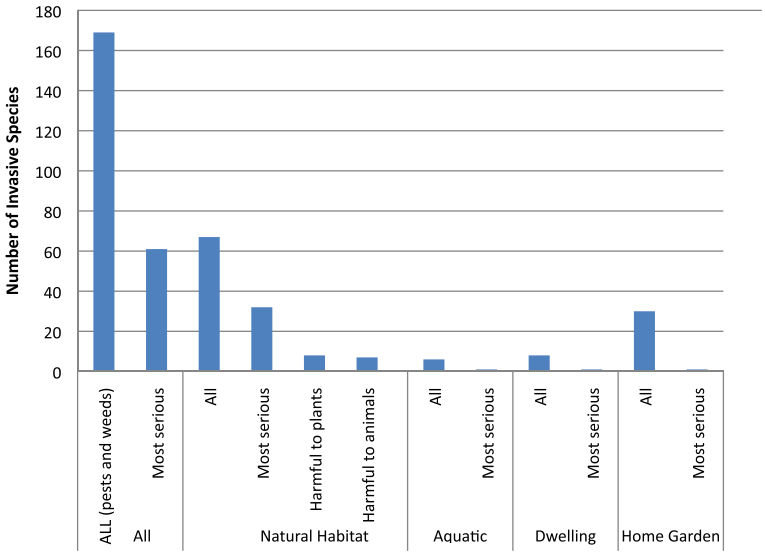


FIGURE 139. Types and numbers of Cook Islands invasive species, by habitats and impacts. (Cook Islands Biodiversity Database)

Of 169 total invasive species (excluding invasive species in agriculture), 61 are considered 'most serious' invasive species. Almost half (48%) of the invasive species that occur in natural habitats are considered as 'most serious' (32 of the total 67). Six invasive species are recorded in aquatic habitats and only one of these, the Crown of Thorns (COTs) starfish, is considered as 'most serious'.

Native habitats can be opened up to invasive species through natural disasters and storm events as well as through human development. Tropical cyclones can destroy existing native species which then makes room for other new (invasive) species to establish. This was the case for the Balloon Vine (*Cardiospermum grandiflorum*) in Rarotonga and the Mile-a-minute (*Mikania micrantha*). Numbers of the endemic tree *Mato* (*Homalium acuminatum*) have declined as a result of these introductions, even amidst strong coping abilities to cyclonic impacts. Climate change impacts such as more intense storm events, king tides and coastal flooding can worsen these storm impacts, thus creating more opportunities for invasive species to be established in affected areas.

The development of the interior – including lowlands, foothills and mountainous areas – as residential areas and access roads creates disturbance and new spaces for invasive species to establish themselves. For example, construction machinery can act as a transport vector for these species between sites.

Impact

Invasive species are one of the biggest threats to biodiversity in the Cook Islands, and can have negative economic, social and environmental impacts. Economic impacts include loss of economic revenue through export restrictions from other countries, damage to infrastructure and food production and agriculture, lower crop productivity, and economic losses from eradication and control programmes. Social impacts include higher labour costs, reduced aesthetic value, potential adverse impacts to marine and terrestrial ecosystem health and human health, and loss of culturally important species such as those used for traditional medicines. Environmental impacts from invasive species can include more competition between endemic and native species and invasive species, loss of natural habitats, and more erosion which can disrupt water supply.

Invasive species are one of the biggest causes of loss of native birds and invertebrates. When invasive plant species smother and kill native forest canopies, the habitat for native birds such as the *Kākerōri* (Rarotonga Flycatcher) (*Pomarea dimidiata*), the *ʻĪʻoi* (Rarotongan Starling) (*Aplonis cinerascens*), the *Kurāmoʻo* (Blue Lorikeet) (*Vini peruviana*) and endemic land snails is also destroyed. These already sensitive and often threatened native species are made even more vulnerable. Rats, cats and pigs can have a big impact on birds through habitat distraction and the eating of bird eggs.

Response and Recommendations

In 2000 Cook Islands started to prepare its National Biodiversity Strategy and Action Plan (NBSAP). A national biodiversity steering committee was established to coordinate the project and ensure input from stakeholders (NES 2002). The 2002 NBSAP committed to control invasive species and reduce future invasions.

Cook Islands introduced biosecurity legislation in 2008, with a biosecurity plan under development for Suwarrow. A biodiversity workforce has intercepted and eradicated the Giant African Snail (*Achatina fulica*), the Coconut Rhinoceros Beetle (*Orcytes rhinoceros*), and the Queensland Fruitfly (*Bactrocera tryoni*). Rats and Starburst were eradicated from Suwarrow and Mauke respectively.

Border control measures cover a wide range of air and sea passengers as well as cargo movement and transport, along with associated wastes and ballasts. Given this broad cover, Cook Islands remains seriously under-resourced to prevent invasive species at the national level.

The Ministry of Agriculture also monitors and manages some invasive species such as the Glassy-winged Sharpshooter (*Homalodisca coagulata*) and the Cuban Laurel Thrip (*Gynaikothrips ficorum*). It is working on a biocontrol programme for priority invasive plants. The Ministry of Agriculture also has invasive species prevention and eradication programmes that target the Coconut Flat Moth *(Agonoxena argaula),* white fly *(Dialeuropora decempuncta)* and Giant Sensitive weed *(Mimosa invisa).*

Successful invasive species management on Atiu has reduced the Myna *(Acridotheres tristis)* bird population from 5000 to less than 300 in only three years. While there are public education initiatives about the risks involved in undeclared plant transport and smuggling from overseas, more support is needed. Ongoing monitoring, management and expansion of current invasive species programmes and mechanisms is essential to prevent negative impacts to Cook Islands.

From 2011 to 2016 Cook Islands implemented a Global Environment Facility project in partnership with SPREP 'Prevention, control and management of invasive alien species in the Pacific Islands'. This included work to raise awareness, write a National Strategy and Action Plan for invasive species, develop an early detection rapid response plan, ship rat monitoring and control, implement best management practices to control Dodder (*Cuscuta campestris*) and Beach Burr (*Cenchrus Echinatus*), the Belkin's Biting midge (*Culicoides belkini*) locally known as "sandflies" and red passion fruit (Passiflora rubra), and the rearing and release of a bioagent for Giant Sensitive Weed (*Mimosa invisa*).

The 4th National Report to the Convention on Biological Diversity shows that several of the invasive management actions in the NBSAP have been completed and the remainder are ongoing.

Harmful effects of invasive species should be reduced and further invasions prevented. The recently developed

draft National Invasive Species Strategy and Action Plan (NISSAP) should be approved and implemented. A list of the species at risk can be found in the National Biodiversity Strategy and Action Plan and the 4th national report to the Convention on Biological Diversity (CBD) 2011, page 105, where it is clear that invasive species are a major threat to Cooks Islands. This report includes a list of key invasive species (Figure 140).

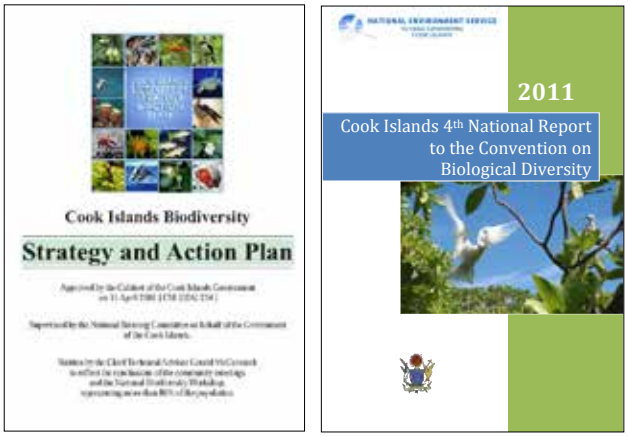


FIGURE 140. Cook Islands National Biodiversity Strategy and Action Plan and the 4th National Report to the Convention on Biological Diversity (NES).

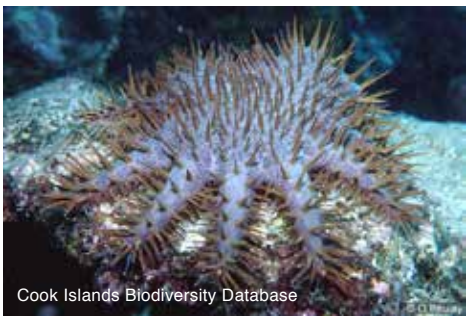
Efforts to prioritise invasive related activities took place in 2011 and more recently in the draft NISSAP. Both documents, the 4th National Report to the CBD 2011 and the draft NISSAP, include recommendations. Building on these efforts is the next step to implement the NISSAP.

Despite attempts to eradicate invasive weeds in Mangaia, Mauke, and Mitiaro, these have not been successful. The total areas are likely to have increased since the NBSAP project was prepared. These efforts should be continued and monitored.

Predators have been eradicated from some high value biodiversity islands but more mainland control sites should be established. This will safeguard important species. In the long term the total eradication of rats will most probably be a realistic goal and Cook Islands should work towards this.

A monitoring and control programme for Crown of Thorns (COTs) starfish is recommended to detect COTs outbreaks early and allow a quick response.

The Cook Islands should maintain regional links to invasive teams and may consider joining the Pacific Invasive Learning Network Team to share lessons, case-studies and skills with other Pacific islands.



SOURCES

Cook Islands Biodiversity Database http://cookislands.bishopmuseum.org/search.asp

National Environment Service. 2002. Cook Islands National Biodiversity Strategy and Action Plan (NBSAP).

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

National Environment Service 2016. Draft National Invasive Species Strategy and Action Plan.

National Environment Service. 2015. Rat Eradication on the Island of Suwarrow.

Ground and building covered with invasive plant species. (Olly Burn)

KEY SPECIES OF CONCERN CASE STUDIES: KĀKERŌRI, TAMANU AND PA´UA

Introduction

The number and variety of threatened species in Cook Islands makes it difficult to report comprehensively on the state of each species in this report. There is very little information available on many species to allow for a full assessment. For the purpose of this report, three species were chosen as examples of their functional group that had reasonable information available, established recovery plans, and were native and/or endemic to Cook Islands.

The estimated number by the IUCN Red List of species described in the Cook Islands is 1621. Of these, 312 were assessed as critical endangered, endangered, vulnerable, near threatened, least concern, data deficient or extinct.

The three species chosen as examples are:

Kākerōri

The *Kākerōri (*Rarotongan flycatcher, *Pomarea dimidiata)* is endemic to Rarotonga and was classified as 'critically endangered' under the IUCN classification system in 1989. Only 29 individuals were documented during that time and the species were under threat from the invasive ship rats which invaded the *Kākerōri* nests. Without any intervention, it was projected that the species would be extinct by 1999.

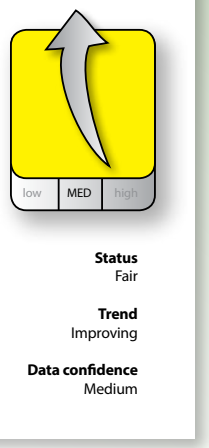
Tamanu

The *Tamanu* (Polynesian mahogany, *Calophyllum inophyllum*) tree is native to Cook Islands and is locally endangered. This low-branching, slow growing tree can grow between 8–20 metres in height, and is sometimes used as an ornamental plant due to its fragrant flowers and decorative leaves. Various parts of these trees have been used in traditional and modern medicines, boatbuilding, and oils used in skin and hair products.

Pa´ua

The *Pa´ua* (small giant clam) is native to the Cook Islands, and is both nationally and globally endangered. It can be found in near-shore marine environments, and is common in the northern and southern islands. These clams can grow up to 20 cm and they have single-celled algae which live inside their tissues and are responsible for their striking colours. *Pa´ua* are used for food, medicinal purposes, and in some cases for the aquarium trade.

The state of these species is assessed based on the current population trend and the efficacy of management and recovery plans.



KĀKERŌRI (RAROTONGAN FLYCATCHER, *POMAREA DIMIDIATA*)

Status: Fair **Trend: Improving** **Confidence: Medium**

CURRENT POPULATION: The latest count in 2015 of the *Kākerōri* (Figure 141) showed 414+ individuals in Rarotonga and 156 individuals in Atiu.

TREND: Increasing, due to focused conservation efforts from the Takitumu Conservation Area (TCA).

MAIN THREATS: Rats and other invasive species such as cats, *Karavia* (long-tailed Cuckoo, *(Eudynamis taitensis)* or Myna birds; land development; more people in Kākerōri habitats; natural disasters with associated habitat destruction, particularly tropical cyclones; and dependence upon continued habitat protection with limited financial capacity.

RECOVERY PLAN: The Cook Islands Conservation Service (CICS), with support from the New Zealand Department of Scientific and Industrial Research (DSIR), developed a species recovery plan which began with rat poisoning and nest protection in 1989. The Takitumu Conservation Area (TCA) Committee took over the *Kākerōri* management and the recovery programme proved successful over ten years.

LEVEL OF MANAGEMENT SUCCESS: By 2001 the population of 29 *Kākerōri* in 1989 had recovered to 255 individuals. A sustainable management programme was established to maintain population numbers above 250, and 30 birds were introduced to Atiu as a geographic 'insurance policy' should the Rarotongan population be significantly threatened again. A 2009 census of the birds recorded 330 individuals on Rarotonga and 93 on Atiu. Conservation and management of the *Kākerōri* is continuing. Threats remain, however, and continued management for both species and habitat is necessary to maintain and increase population numbers.

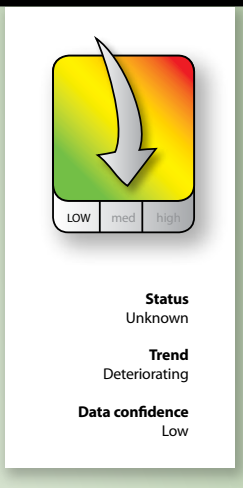
FIGURE 141. Rarotongan Flycatcher

TAMANU (POLYNESIAN MAHOGANY, *CALOPHYLLUM INOPHYLLUM*)

Status: Unknown **Trend: Deteriorating** **Confidence: Low**

CURRENT POPULATION: uncommon to common

TREND: Undetermined to deteriorating. It is difficult to determine the trend as very limited data is available. The *Tamanu* (Figure 142) has low absolute numbers in the Cook Islands, where it is in decline on Rarotonga, and numbers are low and declining on Mitiaro, Aitutaki and Atiu. The population in the northern Islands is good and stable.



MAIN THREATS: Threats to the *Tamanu* include land development, cutting of the trees for power lines, timber (for carving and canoes), and building code requirements (trees must be at least five metres away from buildings).

FIGURE 142. *Tamanu*

RECOVERY PLANS: Increasing replacement of traditional *Tamanu* uses for medicines, arts and crafts and building materials with modern, cheaper imported alternatives reduces the pressure on the tree. A management plan for Mangaia was developed to replace the pine forests there with native species such as the *Tamanu*. Schools in partnership with the Ministry of Agriculture have *Tamanu* replanting programs in the Pa Enua and along the coast of Rarotonga. A survey of native plants in Arorangi including the *Tamanu* was conducted, as well as greater promotion of the *Tamanu* for economic uses such as oil production for export.

LEVEL OF MANAGEMENT SUCCESS: Promotion of *Tamanu* oil for export is assisting in maintenance and preservation of the species in Cook Islands, in addition to replanting programmes by schools in Rarotonga and the Pa Enua, and replacement as a native species on Mangaia. Pressures from urban development, especially as these large trees require large, open areas, and decreasing use of the trees for traditional products continue to threaten this species. Continued management will be required to ensure that the numbers stabilise.

KEY SPECIES OF CONCERN CASE STUDIES: KĀKERŌRI, TAMANU AND PA´UA

PA'UA (SMALL GIANT-CLAM)

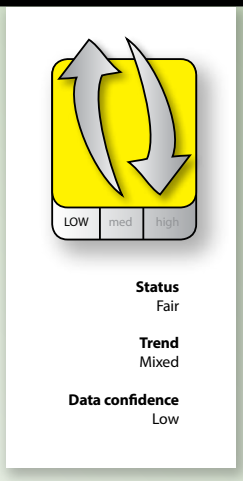
Status: Fair **Trend: Mixed** **Confidence: Low**

CURRENT POPULATION: Unknown

TREND: The trend is mixed as the population varies within the different islands. Some islands such as Takutea, Atiu, Aitutaki, Rarotonga, Manihiki and Tongareva have estimated population records for the giant clams but there is little data about the *Pa´ua* (Figure 143) population in Cook Islands. The IUCN lists the *Pa´ua* on their Red List, under 'lower risk, conservation dependent'. It is assumed that the population in the northern group is improving and in the southern group is either deteriorating or stable. *Pa´ua* can live in the wild over 100 years with a growth rate of 2.5cm per year (Anthony et al. 1998). These slow-growing iconic species have been important to Cook Islands for hundreds of years and require continued management.

MAIN THREATS: They are threatened by several issues such as overharvesting, change in sea temperature, pollution, sedimentation and change in nutrient level, and Rarotongan demand for clams from the northern group of islands.

RECOVERY PLAN: Surveys are being carried out by MMR. Aitutaki, Rakahanga, Manihiki and Tongareva have developed management plans which are being implemented. For example, Manihiki and Tongareva have harvesting bans in response to the reduced *Pa´ua* stocks. On Mauke the *Pa´ua* is managed through the *Ra'ui* system



and harvesting is carried out every three years. Atiu and Mangaia have proposals to allocate sections of their reefs in their *Ra'ui* to allow for *Pa´ua* stock improvements. Aitutaki has a clam hatchery and nursery to breed and raise *Pa´ua* for exports (some for the aquarium trade) and lagoon restocking. Such controlled harvesting can allow islands to sustain giant clam population numbers as well as benefit economically from these recovery and management practices.

LEVEL OF MANAGEMENT SUCCESS: Management success is mixed, and largely depends upon the specific island context. Management in the northern group of islands appears to be good and improving, while management in the southern group of islands is either poor to stable, depending upon the location. More information is needed to determine the management success of the *Pa´ua* in Cook Islands. Focused management is essential to recover and maintain numbers of this species in the country.

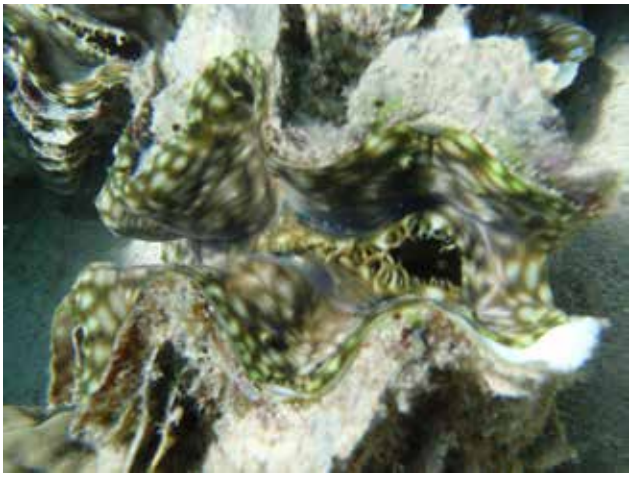


FIGURE 143. *Tridacna maxima*

Response and Recommendations

There has been good progress in species management and recovery plans in the Cook Islands. These three examples highlight the resources required by government agencies to support species based conservation. Much work is needed to address other valuable and threatened species.

Endangered and threatened species are considered in the NBSAP and recommendations and management actions were developed. All threatened endemic and native plants and animals are listed in the 4th National report to CBD (NES 2002, 2011). The next step is to prioritise species for action and where possible develop joint management plans or habitat management plans.

Management plans should be improved for these three species and other threatened species in Cook Islands. Where possible, multiple species should be considered in management planning. A good example of success is the growing *Kākerōri* population.

Quantification of results is critical if management action is successful or needs to be adjusted. More data is needed for the *Tamanu*, *Pa´ua* and other threatened species to provide managers with the baseline they need.

Where management plans have been successful it is important to build on this where possible. There has been significant investment in species management, invasive species and protected area development in the Cook Islands.

It is important that the government and non-governmental organisations continue to work together and share leadership on threatened species management. Without this, it is very difficult to implement management plans effectively. In particular, government leadership is required in the enforcement of both recovery plans and legislation, to protect species and habitats.

Community awareness work, training and local solutions should ensure that people understand the value of the endangered species.

SOURCES

Hart, A.M., Bell, J.D. and Foyle, T.P. 1998. Growth and survival of the giant clams, Tridacna derasa, T. maxima and T. crocea, at village farms in the Solomon Islands. Aquaculture 165 1998 203–220.

National Environment Service. 2002. Cook Islands National Biodiversity Strategy and Action Plan (NBSAP).

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

Takitumu Conservation Area – Ed Saul. 2016. Kākerōri Fact Sheet.

ONLINE SOURCE:

Cook Islands Biodiversity Database: http://cookislands.bishopmuseum.org/search.asp

Tridacna Maxima: http://www.picionline.org/weblog/?p=567

Introduction

The International Union for the Conservation of Nature (IUCN) defines Protected Areas (PAs) as "regions set aside primarily for nature and biodiversity conservation. They are a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values" (www.iucn.org/about/work/programmes/gpap_home).

The Cook Islands' Programme of Work for Protected Areas (PoWPA) falls under the Convention for Biological Diversity (CBD), under which Cook Islands committed to conserve 17% of terrestrial habitat by 2020. The country is also committed to protect ten per cent of marine habitat. More information on Marine Protected Areas can be found in the Marine section in the subtheme 'Marine Managed Areas, *Ra'ui* in Rarotonga and Pa Enua'.

Based on the 4th National Report to the CBD, the Cook Islands identified 14 total terrestrial PAs (Figure 144). This represents the official count of terrestrial PAs, however, numbers vary depending upon the source. While traditional management methods contribute in practice to international protected areas and conservation targets, they are often not reported to international conventions as part of national reporting processes, nor are they recognised in international protected area databases. As a result, more effective PAs may exist in the Cook Islands which are not nationally represented. The type of Cook Islands terrestrial PAs examined by this indicator vary. They include nature reserves, conservation areas, a wildlife sanctuary and community managed areas.

This indicator quantifies the number and extent of terrestrial PAs in Cook Islands, and describes their status, management plans and protection of biodiversity and important species.

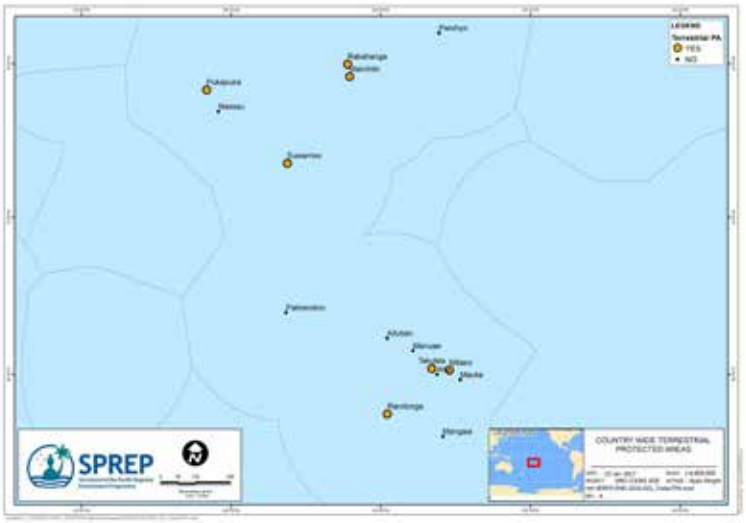
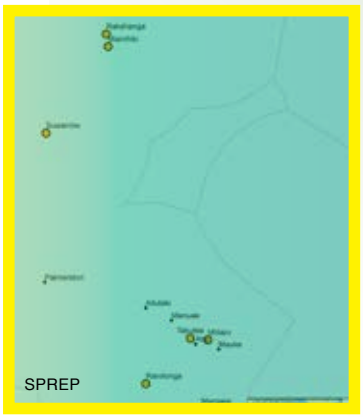
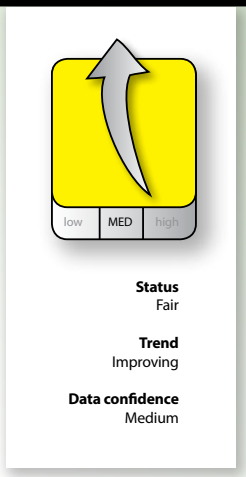


FIGURE 144. Cook Islands Country wide Terrestrial Protected Areas (SPREP)





TERRESTRIAL PROTECTED AREAS

Status: Fair **Trend: Improving** **Confidence: Medium**

The SOE uses the 2011 report by Cook Islands to the Convention on Biological Diversity (CBD) to identify the country's terrestrial protected areas, which is summarised in Table 20. There are 14 terrestrial PAs, which total at least 1407.2 hectares (five PAs are uncalculated), or about six per cent of the Cook Islands' total 240 km^2 land mass. Terrestrial PA are concentrated in a few locations. Three of the 15 islands in Cook Islands are wildlife reserves (Suwarrow, Takutea and Manuae), almost 40% of the terrestrial PAs are represented by four *motu* on Pukapuka, and three of Rarotonga's four PAs make up 36% of total terrestrial PAs. The PAs include private nature reserves, conservation areas, entire island and *motu* PAs (Suwarrow Island and Pukapuka's *motu*), a wildlife sanctuary (Takutea Wildlife Sanctuary), National Parks and Reserves, and community managed areas (Table 20). Many of these PAs are represented by a single example.

Traditional leaders, Island Councils, communities and government have all contributed to the establishment and management of PAs. Most Cook Islands PAs are not covered by legislation, and the few that are legislated vary in their levels of protection. Only three of the 14 terrestrial PAs are covered by formal government-based legislations and regulations, which include the Suwarrow National Park Declaration, Takutea Island Regulations and Takuvaine Water Catchment Regulations.

TABLE 20. Currently recorded Cook Islands Terrestrial Protected Areas. (NES 2011)

Island	Type	Name of Area	Total Area	Comments
Takutea	Wildlife Sanctuary	Takutea Wildlife Sanctuary	120 ha	Established 1903, re-established in 1950 by Takutea Island Trust. Endorsed as a Community Conserved Area under the Atiu and Takutea Environment Regulation 2008. Inclusion of lagoon not determined.
Suwarrow	National Park	Suwarrow National Park	160 ha	Established in 1978 under the Prime Minister's Office. Inclusion of the lagoon not determined.
Rarotonga	Nature Conserved Area	Takitumu Conservation Area (TCA)	155 ha	Established in 1996 under landowner committee to protect endangered native birds and their habitat.
	Nature Reserve	Highland Paradise	32.5 ha	Family operated reserve containing natural features of cultural significance.
	National Park Reserve (Terrestrial)	Nikao Social Centre	2.5ha	Established in 2000 for public recreation.
	Community Managed Area	Takuvaine Water Catchment	229 ha	Established in 2006 under the Environment (Takuvaine Water Catchment) Regulations for species and habitat protection.
Pukapuka	Marine and Terrestrial Reserve	*Motu* Kotawa	90 ha	Reserved for Yato Village, inclusive of entire islet and surrounding lagoon.
	Marine and Terrestrial Reserve	*Motu* Ko	300 ha	Reserved for Ngake Village, inclusive of entire islet and surrounding lagoon.
	Marine and Terrestrial Reserve	*Motu* Uta	50 ha	Reserved for Loto Village, on Wale islet, inclusive of 30% of the islet.
	Marine and Terrestrial Reserve	*Motu* Niua	10 ha	Reserved for Yato Village, on Wale islet.
Mitiaro	Wetland	Te Roto Nui	321.7 ha	Reserved for habitat protection and rejuvenation of freshwater eels (*Anguilla obscura*).
Rakahanga	Lagoon	Te Taha ki Raro	104 ha	Total PA is marine and terrestrial (343 ha total). The terrestrial specific portion of the lagoon protected area is 104 ha, as indicated in total area.
	Marine and Terrestrial Reserve	Te Kainga Island	8.83 ha	Terrestrial PA including the beach. Te Kainga was setup by Island Council.
Manihiki	Salt-marsh lakes	Lake Porea	25.8 ha	Traditional breeding and raising ground for Milkfish (Chanos chanos) to supplement food supply during rough seas. The site was set up by the local island government, and is also called the Konitara in the local language.
	Salt-marsh lakes	Tepuka Roto	15.4 ha	Traditional breeding and raising ground for Milkfish (Chanos chanos) to supplement food supply during rough seas. The site was setup by the local island government, and is also called the Konitara in the local language.

Rarotonga

The 155 ha Takitumu Conservation Area (TCA) was established in 1996 under a landowner committee to protect endangered native birds and their habitat, and is also designated under Birdlife International's system as a globally recognised Important Bird and Biodiversity Area (IBA). The 229 ha Takuvaine Water Catchment was established in 2006 with strong regulation and management plans to protect the water catchment and its surrounding habitat and species (Figure 145).

The 32.5 ha family-operated Highland Paradise reserve differs from other PAs in Rarotonga through its specific focus on protection of areas with particular cultural significance. Rarotonga is home to the country's only cloud forest, which provides critical habitat for many species native to the Cook Islands, including 24 endemic species. Figure 146 gives us an idea of different types of land formation and ecosystems in Rarotonga.

FIGURE 145. Taro patches in the Takuvaine Water Catchment Area. (J. Brider)

MANGAIA

The volcanic, raised limestone island of Mangaia is home to many native bird species including the *Tangaeo*, the endemic Kingfisher (Todirhampus ruficollaris), which lives in Mangaia's Makatea forests. To protect these birds, a management plan has been proposed but the status of this is uncertain.

ATIU

The raised limestone island of Atiu is covered by volcanic slopes, wetlands and *Makatea* forests, and contains many important endemic and native flora and fauna. The Makatea forests are home to the endemic Kopeka (Aerodramus sawtelli), or Atiu Swiftlet, and the native Coconut crab (*Birgus latro*, commonly known as *Kaveu*), which both live in caves within the forests. A population of the endemic Rarotongan flycatcher, the *Kākerōri* (*Pomarea dimidiate*), was also established on Atiu as an 'insurance policy' after a successful re-introduction to Rarotonga (discussed further in the Key Species of Concern section, which precedes this section), in case the Rarotongan population should decline. The Atiu forests are rat free, which is still a problem in other islands. The island supports a healthy population of the endemic Cook Islands fruit dove *Kukupa* (*Ptilinopus rarotongensis*) along with the *Kura* (Rimatara Lorikeet, *Vini kuhlii*), which was relocated to Atiu from Rimatara, French Polynesia to rebuild its population. Due to the variety of native and endemic flora and fauna, there are a number of sites proposed for extra protective measures on Atiu.

TAKUTEA

Takutea has a 120 ha wildlife sanctuary which was first set up in 1903 and re-established in 1950 by the Takutea Island Trust. It is endorsed as a Community Conserved Area under the Atiu and Takutea Environment Regulation 2008. The five metre high sand cay of Takutea is situated offshore of Atiu and is an important seabird nesting area for the *Kota'a Nui* (Greater Frigatebird, *Fregata minor*) and the Toroa (Red-footed Booby, *Sula sula*). It is also home to the Kena (*Sula leucogaster*) and the *Teue* (Bristle-thighed Curlew, *Numenius tahitiensis*). While its neighbouring island Atiu was declared both a Key Biodiversity Area (KBA) and Important Bird Area (IBA), Takutea was considered for KBA status but not formally declared. Takutea is protected by the Atiu Island Trust. The Trust's management plan is written in Maori, which makes this plan and associated protection measures more readily communicated to Cook Islanders who either do not speak English, or for whom English is not their first language. The Atiu/Takutea Environment Regulations support protection on this small sandy cay.

MITIARO

The wetland lake of Te Roto Nui on the island of Mitiaro was declared a protected area to conserve the habitat and help to rejuvenate the island's *Tuna Maori* (freshwater eels, *Anguilla obscura*). The lake's peat deposits provide habitat for these eels. The protective measures serve to maintain the habitat for wetland vegetation birds and other inhabitants.

SUWARROW

The first formally established National Park in the Cook Islands was Suwarrow Island in 1978. It was set up to protect the wildlife and marine resources. Suwarrow is the largest national park in the Cook Islands with a lagoon of about 10km diameter and a landmass of 0.4sq km. This national park is an important sea-bird breeding site. There have been no in-depth marine surveys undertaken but it is believed to contain a range of marine life as it is unexploited. The main threat to the atoll and the sea birds are rats (http://nescookislands.com/).

There is a need for more integrated terrestrial protective measures across Cook Islands that benefit the many species.

FIGURE 146. Reef, lagoon, coastal and mountain ecosystems on Rarotonga (©Kirklandphotos)

Despite the variety of protective measures in place, many created for birds, there is a need for greater protection of wetland habitats and Rarotonga's cloud forest. While Marine Protected Areas (MPAs) provide regulations and management measures for entire ecosystems under the Cook Islands' Marine Resources Act 2005, terrestrial protected areas are managed by the National Environment Service (NES) regulations and by-laws, which focus on species of concern in the country. A more integrated approach to terrestrial PAs that included broad habitat types, as opposed to island-specific species protection, would result in stronger and more sustainable terrestrial PAs over time. The MPAs serve as a general example in this regard.

Impact

Protected areas allow ecosystems to recover relatively free from human exploitation, directly prevent ongoing loss of biodiversity, replenish species populations and encourage better stewardship by landowners. Protection of natural forests, particularly the *Makatea* forests, has resulted in more protection of the habitats for endemic and native bat and bird species.

Rarotonga's Takitumu Conservation Area (TCA) is a good example of a protected area with focused management regimes for the preservation of endangered and vulnerable species. The TCA was established in 1996 under a landowner committee to protect endangered native birds and their habitat. In 1989 the endemic *Kākerōri (*Rarotongan flycatcher, *Pomarea dimidiata)* was considered one of the ten rarest bird species in the world, with only 29 birds in the TCA. With focused protection efforts through the TCA in 1996, the population recovered to 255 individuals in 2001, 291 individuals in 2006, and 330 individuals in 2009 on Rarotonga.

While the 32.5 ha Highland Paradise is a popular nature reserve with tourists and locals, large numbers of visitors can have mixed and sometimes negative impacts upon the very environments that the reserve works to protect. Increased tourism can result in the clearing and removal of native plants and, as a result, the reserve will need to use more protective measures for important native plants as it welcomes more visitors. Highland Paradise is an example to other PAs about the unintended consequences with PA designation and the rise in visitor numbers, especially with growing tourism.

Six per cent of the Cook Islands land mass is protected. A further 11% would need to be declared as PA to fulfil the goal under the CBD Aichi Targets by 2020 of 17% terrestrial protected areas.

Response and Recommendations

Cook Islands has made good progress in establishing protected areas to contribute their national commitment under the Convention for Biological Diversity of declaring 17% of their terrestrial areas as PA by 2020. However, more declared PAs or terrestrial management plans are needed. The existing five PA need to be formally mapped, which will increase the committed area under the PA status. Protected area data should be entered into a database. Cook Islands may consider using the Pacific Islands Protected Area Portal (PIPAP). Communities should continue to be involved in the establishment of protected areas and their participation could be linked to alternative livelihood projects.

The declaration of Marae Moana is an important achievement, especially for the marine area, and with a ridge to reef approach it would provide an opportunity for a holistic approach and the inclusion of terrestrial management areas.

A field survey was conducted over three weeks in 2015 in the cloud forest on Rarotonga and the data was used to develop a management and restoration plan for the cloud forest. This is a good opportunity to increase active management and protect some of the rarest habitat in the Cook Islands.

Key Biodiversity Areas (KBA) and Important Bird Areas (IBA) have been identified which provide a guide for conservation. Some high priority areas include developing regulations for Suwarrow, and regulations and management plans for Takuvaine.

It would be worth having a terrestrial PA committee made up of stakeholders from relevant sectors including environment, agriculture, tourism and civil society. This could be a subcommittee to one of the existing working groups such as the NBSAP working group. Recommendations from the cloud forest management plan and the 4th national report to the CBD in regards to protected areas should be implemented. It is important to prioritise and resource PA monitoring to ensure good management practices and proper record keeping takes place.

SOURCES

National Environment Service. 2011. Cook Islands 4th National Report to the Convention on Biological Biodiversity.

Takitumu Conservation Area – Ian Karika and Ed Saul

House of Ariki and Koutu Nui

KBA and IBA – Kelvin Passfield and Jacqui Evans

NHT – Gerald McCormack

ONLINE SOURCES

http://nescookislands.com/

www.iucn.org/about/work/programmes/gpap_home

Clockwise from top left: masked booby (*Sula dactylatra*), tern (*Sterna lunata)*, Iniao (*Pritchardia mitiaroana*), A'i (*Santalum insulare*)

Nanette Woonton

OVERVIEW

Cook Islands has a rich cultural heritage dating from the arrival of Tahitian settlers between 1200 and 1800 years. This has been infused with other influences over time, with the Portuguese explorer, Pedro Fernandes de Queirós, making the first recorded European landing in the 17th century, followed by several British landings in the 18th century. The most significant influence on Cook Islands culture came with the arrival of Christianity in the early 19th century and annexation under the British Commonwealth and New Zealand administration. Christian practices and beliefs were accepted over traditional religious customs and social hierarchy. Order was infused with Westminster systems of governance. In more recent times, Cook Islands is seeing an increase in Asia-Pacific influence, with Filipino, Fijian, Samoan, New Zealand and Tongan populations residing in Cook Islands for employment opportunities.

There is growing recognition that cultural heritage and its conservation is a shared responsibility, and that cultural heritage should be more than just an inventory of historical resources, but rather an integrated part of Cook Islands identity now, and for the future.

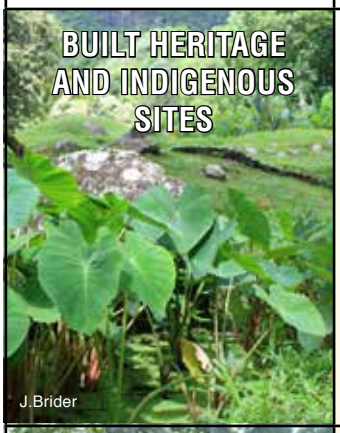
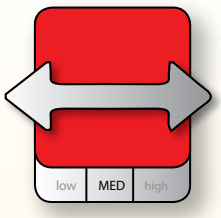
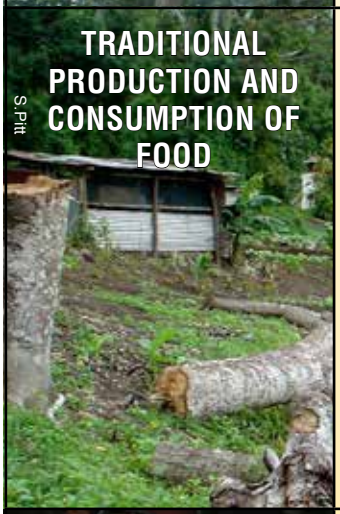
Conservation of tradition and culture has been a challenge for government and society, with varying levels of success and failure. The House of Ariki (*Are Ariki*) is a parliamentary body composed of high chiefs (*Ariki*) with the function to:

> "Consider such matters relative to the welfare of the people of the Cook Islands as may be submitted to it by Parliament for its consideration, and it shall express its opinion and make recommendations thereon to Parliament" *(The Constitution of the Cook Islands)*

The success of cultural heritage protection hinges on three important factors: 1) Social factors which enhance national image leading to residential pride and the integration of cultural values into day-to-day living, 2) Politico-economic factors and the role that culture can play in the economy, and 3) Planning factors which consider cultural heritage and integration into national development frameworks.

In light of these factors, it is important to enshrine cultural heritage conservation within national development and show its links with other issues including tourism, revitalisation of local economies, local governance and community resource management.

CULTURE AND HERITAGE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
	 **Status** Poor **Trend** Stable **Data confidence** Medium	Historical and *Marae* Sites are the direct link between Cook Islanders and their land. Documentation is lacking as the register is inactive. Many of the *Marae* sites today are reconstructed as the original sites were destroyed. Some prehistoric sites are in good condition but most are in poor condition.	Historical sites should be protected and maintained as they are culturally, environmentally and economically important for the Cook Islands. A campaign may help to raise the profile of traditional knowledge with Cook Islanders and tourists. A register should be established under the Cultural and Historic Places Trust. The Cultural and Historic Places Act could be strengthened.
	 **Status** Fair **Trend** Deteriorating **Data confidence** Medium	Cook Islands Maori has a very strong connection to the environment as the language evolved in part to describe nature. Since the first English speaking settlers moved to Cook Islands in 1827 the number of people that speak Cook Islands Maori has decreased 15.6%.	To protect Cook Islands Maori and to ensure that certain knowledge is passed on, youth should be motivated to learn their mother tongue. Traditional songs, chants and other important knowledge should continue to be documented and preserved.
	 **Status** Poor **Trend** Deteriorating **Data confidence** Medium	Cook Islanders supplement their food with imported goods. Traditional agriculture and fishing has declined especially on Rarotonga with youth being less interested in traditional food production. The shift in food impacts the body size of Cook Islanders which has grown since 1952. Home gardens are being replaced by private and commercial development. Imported food also increased the amounts of single use plastic which adds pressure to the limited landfill space on Cook Islands.	Cook Islands developed programmes to promote local, traditional and healthy food consumption. A 'Go Local' campaign encourages people to buy and grow local food. These programmes and campaigns should be supported. Cook Islands may want to invest in more education programmes including the public health sector.
	 **Status** Fair **Trend** Deteriorating **Data confidence** Medium	Traditional knowledge is facing pressure from modernisation and social change. The use of traditional ecological products is in decline as are traditional farming and medicinal use. *Ra'ui* are being used more often but still has its challenges. The decline of traditional knowledge can have severe impacts on Cook Islands culture and its authenticity.	The GEFPAS IIB project focused on a database for medicinal plants and on ways to ensure rare plants can be protected. It is recommended to continue formal relationships with MoH. Data collection as well as the involvement of local community is important in regards to *Ra'ui*. Traditional ecological products should be promoted and tree planting activities encouraged.

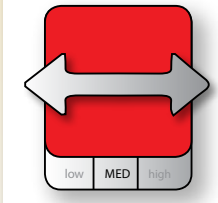
Introduction

The Cook Islands people and their culture arise from a long tradition of ocean navigation and exploration, in search of new land, new homes and an evolving sense of place and belonging. Despite this migratory nature, Cook Islanders, and Pacific Islanders, centre their cultural heritage on land. It is in this 'space' that everyday life plays out and the spiritual and physical environments interplay with socio-cultural traditions and practices. The concept of land transcends the physical and geographical definitions of 'soil', but rather signifies relationships, kinships and connections between people, the environment and their heritage. The significance of land and place is critical to the conservation of cultural heritage, the values that Cook Islanders place on culture and how they define themselves.

This indicator looks at the state of historical and *Marae* sites and measures cultural landscapes formed through interaction between culture and environment, or by Cook Islands imposition of traditional meanings onto the environment. Historical and *Marae* sites provide a direct link between Cook Islanders and their land.

Marae have been defined simplistically as the traditional 'court' of the Polynesian, particularly the Eastern Polynesian elite, but it is more complex than this. A more accurate definition would be '*a structure to commemorate an event of importance to society'*. Given this definition, the purpose differs for each *Marae* depending on how the people of that area define the importance of an event. *Marae* could signify important economic, social, political, ideological and cosmological factors. With the segmentary nature of prehistoric Cook Islands life, a *Marae* could be linked to a particular socio-political hierarchy ranging from households to atolls to island groups or, in the case of *Orongo* and *Taputapuatea*, demonstrate transboundary and possibly spiritual connectivity.

While there is a national historical sites register, it is inactive and no sites are included. A Cultural and Historic Places Trust was established in 1994. However, while 181 sites have been identified, none have been shared publicly through an online database. In the absence of an active historical sites registry, this indicator utilises stakeholder perceptions, consensus and agreement to identify these places, and ethnographic literature to support these perceptions, where available. Historical sites cover prehistoric places of importance including burial caves, roads, places of significance, and contemporary sites such as churches, post-colonisation buildings, and sites of modern national importance.



Status
Poor

Trend
Stable

Data confidence
Medium

Status: Poor **Trend: Stable** **Data Confidence: Medium**

14.2
14.3

MARAE SITES

With the arrival of Christianity and its rapid acceptance by Cook Islanders, most *Marae* were destroyed, and built upon with churches or discarded by those who once revered them. Many *Marae* today are reconstructions of old discarded sites or recent creations, however, original installations exist in the form of *Vaerota* at Avana Passage and *Maungaroa ki Tai i te Opuanga o te Ra* in Puaikura. With the value placed on land in the Cook Islands, under customary practice, *Marae* have always been regarded as the responsibility of *Kopu Tangata* (Familial Clan).

The *Marae* sites that exist today are in a poor state, with less than ten percent of the known *Marae* actively maintained. Many of the negative drivers of change are a result of lower value given to *Marae* by the Kopu Tangata, which leads to neglect and deterioration of these sites. Conflicts in ownership between different Kopu Tangata have resulted in site neglect and, in some cases, creation of new *Marae*.

All *Marae* sites, whether known or not, are considered vulnerable to future development pressures. Some sites have been destroyed as a result of development or the authenticity of the site has been diminished by nearby development. *Arai te Tonga*, the most well-known and most visited *Marae* site has a driveway cutting through the middle of the site.

Prehistoric Sites

ARA NUI O TOI (THE GREAT ROAD OF TOI) – a pre-contact paved road that encircled the island of Rarotonga, possibly built around AD 1500. Paved mostly with basaltic and coral rock, the *Ara Nui* is the largest archaeology site on Rarotonga, and one of the largest in Polynesia. The *Ara Nui* preserves the path taken by the ancient ancestor, and one of the first settlers to Rarotonga, *Tangi'ia Nui*,

where he established 46 *Marae* sites around Rarotonga in commemoration of his arrival. The *Ara Nui* may have facilitated lowland settlement and the movement of people and commodities around the island, instigating a local economy of trade between villages.

Today, the ancient road is discontinuous and largely destroyed or buried by the modern road, and while some remnants are still visible in a few locations, the general status is poor.

TUORO (BLACKROCK) – an assemblage of felsic lava flows, which flowed to the sea, Tuoro is the final remnant of this lava flow where it meets the ocean. Tuoro is located on the western side of Rarotonga and signifies the boundary between Puaikura and Te Au o Tonga. It also signifies the point where the spirits of the Rarotongan deceased departed the physical world for the journey to the afterlife in *Avaiki*. Tuoro is a popular place to swim, view migrating humpback whales during the calving season and take wedding photographs with the setting sun as a backdrop.

Tuoro is in a poor state as a result of maintenance neglect and suffers from social problems (littering and alcohol consumption) due to its popularity.

TOKATARAVA – a sentinel outpost in Puaikura where the ancient warrior *Kapu* stood guard, protecting the entrance to Maungaroa, the traditional settlement of the people of Puaikura, from invading forces. Legend says that the only way to get past *Kapu*, was to watch the leaves of the *I'i* (Polynesian Chestnut) tree; if the leaves were still *Kapu* was on guard, and when the leaves were rustling *Kapu* was asleep.

The site has been buried under the modern back road and the site is now identified by an *I'i* tree growing in the vicinity of the site. Knowledge of the site and the associated legend is decreasing amongst the community, which contributes to its state designation of 'poor'.

VAI-O-KURA – a stream that flows through Puaikura, the name means the "Red River" and is in reference to the blood that flowed down the stream when the Puaikura people vanquished the invading forces of the neighbouring Takitumu tribe. In peaceful times, the stream was used for bathing and drinking water.

Vai-o-Kura, the stream, is in a 'good' state. The knowledge of the site's significance persists amongst older people in Puaikura and is shared as part of a tourism experience at the Highland Paradise Cultural Centre.

TOKA URI (PUNISHMENT ROCK) – located in the village of Puaikura, this site represents a form of traditional punishment. Those convicted of a crime and punished to serve time at Toka Uri where required to stand upon the rock on one leg from sunrise to sunset. This small site is well maintained and has been protected from disturbance because the site is said to be cursed.

AVANA – the site commemorates an ancient migration, where it is said that a 'great fleet' of seven ocean voyaging canoes; *Aotea*, *Kurahaupo*, *Mataatua*, *Tainui*, *Tokomaru*, *Te Arawa* and *Takitumu* departed the shores of Rarotonga around 1350 AD and discovered New Zealand.

The site is considered to be in a 'poor' state, relative to the value that people attribute to the significance of the event that took place there, particularly for visitors from New Zealand seeking connectivity to the past and a sense of belonging. Controls have been put in place to manage littering and alcohol consumption in the area although enforcement of these controls is limited.

TAU ARE O RORI (HOME OF RORI) – a site on the island of Mangaia, situated deep in the inaccessible *Makatea*. *Rori* was the son of *Rongo-ariki*, an acclaimed carver on Mangaia, who possessed the knowledge to carve images of the gods. War came to *Rori's* village and *Rongo-ariki* was fatally wounded, before his passing he told *Rori* to flee into the *Makatea* in order to protect the knowledge of god carving. The *Makatea* is a harsh limestone karst environment with sharp jagged rocks, limited water and very few sources of food. In the *Makatea Rori* used *kiriau* to create footwear (*tamaka kiriau*) to protect his feet from the sharp *Makatea* and fashioned tools to create a gravel path through the *Makatea*. This allowed him to move quickly through the *Makatea* if the invading forces tried to capture him. Over time *Rori* would sneak into his former village to collect food, and was always careful to replace the food he took with rotten food he found in the *Makatea*, so that the villages would not know of his coming. As time passed *Rori* was forgotten by the people and eventually the knowledge of god carving was lost to the people. However, from time to time the villagers would see an old man running quickly through the *Makatea*, so fast that they could never catch him (because they did not know where his gravel path was in the *Makatea* labyrinth). When *Rori* was an old man, the invading forces had left Mangaia. An old man named *Manaune*, who was *Rori's* friend as a child, realised that this old man in the *Makatea* was *Rori* and sought him out to bring back the knowledge of god carving. When *Manaune* called out to his friend, they reunited and *Rori* returned to his village to share his knowledge of god carving.

The site is said to be the home of *Rori* and the gravel path in the *Makatea*. The site is considered to be in a good state and is part of the Mangaia tourism experience package.

Historical Sites

These sites occupy prominent locations. They represent important cultural gathering places for generations and a connection between Cook Islanders, nature and the use of local materials.

Para o Tane Palace – the palatial home of the reigning *Makea Ariki*, situated in Avarua, Rarotonga on the sacred grounds of *Taputapuatea Marae*. The palace is made from coral stone and plastered with limestone. The site is important due to the land upon which it sits and its status as home of the reigning *Makea*. It is also the location where *Makea Takau* signed the treaty making the Cook Islands a British protectorate in October 1888.

The site fell into disrepair for many years and was renovated in the early 1990s by Auckland University students and local volunteers. The property is currently

unoccupied and has been for many years, as the rightful *Makea* is yet to be determined. The site is considered to be in an 'average' state.

Takamoa Theological College – established in 1839 – is one of the first of its type in the Pacific region. Takamoa is owned by the Cook Islands Christian Church and offers study in a Diploma of Theology and a Certificate of Bible Studies. The College produced many pioneering Pacific missionaries. One noteworthy missionary to emerge from Takamoa in the late 19th century was Ruatoka from Mangaia. He was a successful evangelist in Papua New Guinea and served as a guide, interpreter and advisor to the English missionaries based there. His exploits were commemorated by having Ruatoka College in Rigo named after him as well as Ruatoka Road in Port Moresby. His portrait also featured on a 1972 Papua New Guinea postage stamp.

The College is well maintained and was recently renovated in 2008 and 2009. Its status is considered 'high.'

Cook Islands Christian Church – Founded by the London Missionary Society in 1821, the Cook Islands Christian Church (CICC) is the largest religious denomination in Cook Islands, with 18,000 members in Cook Islands and congregations in Australia and New Zealand. The church buildings are instantly recognisable structures on all islands, with 23 branches nationally, for their size and scale. Constructed from coral stone and plastered with limestone, the churches are central to community life. They are a physical connection with the past and the acceptance of Christianity, and also social and political spaces where relationships interweave. The Church buildings are very well maintained and considered 'high' in status.

Impact

Marae and historic sites have intrinsic value for Cook Islanders, providing a direct link between place, the environment, spirituality, history and culture. Many sites, particularly *Marae* sites, are at risk from pressures from development. In some cases, such as in the northern group of Cook Islands, modern perceptions of heathenism are associated with *Marae* titles, which have led to the abandonment of some *Marae* sites. Loss of *Marae* and historic sites results in loss of culture, history and tradition, whereas strengthening the conservation and preservation of these sites can strengthen traditional cultures, cultural memory, integrate history and traditional values among citizens, and provide places that people can visit for a cultural experience and the environment around them.

Marae and historic sites have additional value as tourist attractions and sources of revenue. Clear economic potential and value associated with *Marae* and historic sites can motivate families and communities to maintain such sites – the Highland Paradise reserve is a good example.

Response and Recommendations

Cook Islands historical sites are important culturally, environmentally and economically and therefore the maintenance and preservation of these sites has been prioritised. A public campaign to raise the profile of traditional knowledge about cultural *Marae* and historic sites around the country could be linked to tourism development. This can be done through partnerships with tourist operators, school education and awareness programmes about traditional knowledge, and associated cultural sites. Local and community *Marae* sites should also be identified across the country, as not every family actually knows about the importance or location of *Marae* sites.

While action has been taken to establish a Cook Islands Cultural and Historic Places Trust, the general consensus is that the trust will not take ownership of *Marae* and historic sites, but that ownership and management will remain with site owners, families and community members. The trust will simply maintain the register of sites. The Cook Islands Cultural and Historic Places Trust should be activated, with locations identified, mapped and information shared with communities and nationally, through an active, online database. The Cultural and Historic Places Act can also be strengthened to reflect the importance of these places, and protect them in the face of changing cultural attitudes, and threats and pressures from increasing development.

Dylan Harrison

SOURCES

The Constitution of the Cook Islands – Functions of House of Ariki

Duff, R. (ed.). 1969. No Sort of Iron. Culture of Cook's Polynesians, Christchurch.

Bellwood, P. 1969. Archaeology on Rarotonga and Aitutaki, Cook Islands: A Preliminary Report. University of Auckland.

ONLINE SOURCES

http://www.culture.gov.ck/index.php/te-runanga-pakau/anthropology-heritage/93-oo.html

http://www.webcentral.co.ck/asiteseeing.htm

Aorangi

Peu Maori

Kopu Tangata

A'u

Pu rakau

Manu

Moana

Oire

Reo

Kuki Airani

Aroa

Introduction

Language and action are used to describe an individual and establish their heritage, credentials and connection. Cook Islanders traditionally expressed themselves in relation to their Harbour, Water Source, Mountain, *Marae*, or other place of local importance. This personal expression was typically accompanied by a chant that described a person's place of belonging, which resulted in even stronger interest in and sense of that place as belonging, and as an interactive part of the surrounding environment.

Cook Islands has two native languages, Maori and Pukapukan, with dialect variations among the islands which speak Maori. In addition, there are colloquial forms of the language which use a high number of 'coined' terminologies.

There is an observed decline in the numbers of Maori speakers, particularly amongst younger people. The typical language of business is English and Maori is spoken more commonly in homes or communal settings. Maori vocabulary is quite limited in today's society, and, as a result, the use of coined words is becoming common practice. There are plans, however, to re-establish a Maori Language commission to promote, safeguard and strengthen the use of Cook Islands Maori.

Information for the language sub-topic was collected through the National Census, and reflects the number of people who indicated that they can speak Cook Islands Maori, amongst other spoken languages in the Cook Islands.

Status
Fair

Trend
Deteriorating

Data confidence
Medium

Status: Fair Trend: Deteriorating Data Confidence: Medium

14.1

Cook Islands Maori is still widely spoken but over the years there has been a decline. The census in 2011 states that of 12,180 Cook Islands Maori, 10,274 are speaking the native language (Figure 147). This shows a decline of 15.6% since 1827 when the first English speakers moved to the Cook Islands (Frances, 2016). Previous censuses have not documented the proportion of Maori speakers. However based on historical observations this report estimates that nearly 100% of Cook Islanders spoke Cook Islands Maori 100 years ago. If other nationalities that are living in Cook Islands are included the number of people not speaking Cook Islands Maori increases to 27.8% from a total population of 14,974.

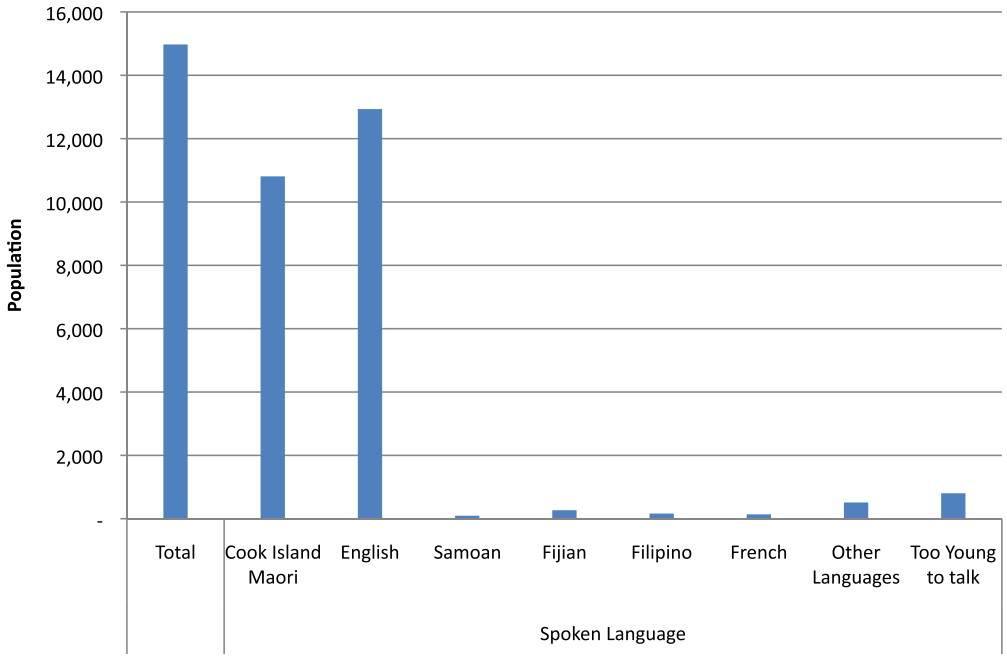


FIGURE 147. Spoken Languages in Cook Islands in 2011. (National Census report 2011)

Cook Islands is a small country with a rich oral history. English is used widely in Rarotonga, but for most of those living in the Pa Enua, their own Cook Islands Maori is preferred to English. Cook Islands Maori evolved in part to describe important parts of the environment such as names for fish, trees, medicinal plants, navigation terms and sacred sites. The connection between Cook Islands Maori and the environment is very strong and language is a major component of this interaction.

As English is required to access higher qualifications, which improves chances for employment, many young Cook Islanders prefer learning English over Maori. Literacy in Cook Islands Maori is also rated as less important for the youth (Frances 2016). The legislation of the Te Reo Maori Act in 2003 stated that Cook Islands Maori and English are both recognised as official languages. According to Frances (2016) young people should learn both languages in school as per the Cook Islands Curriculum Framework 2002 but it is questionable how effective this is as many teachers do not have training in speaking Cook island Maori themselves (Frances 2016).

N.Woonton

Impact

Most Indigenous people identify strongly with their traditional language. Cultural heritage and knowledge is passed on from generation to generation by language rather than in writing. With fewer people able to speak Cook Islands Maori there is a risk that certain knowledge (cultural knowledge, kinship, song lines and stories) will be lost as the older generation is not able to pass this on to the next generation.

Indigenous languages keep people connected to culture and environment and this strengthens feelings of pride and self-worth.

Response and Recommendations

Cook Islands Maori is still widely spoken through the Cook Islands and is also important in New Zealand. The Ministry of Education of New Zealand has established a national Maori Language week *Te epetoma o te reo Maori Kuki Airani.* They provide resources and ideas to help celebrate Cook Islands Maori with schools and communities.

As the number who speak Cook Islands Maori is declining the efforts in the school system to foster its use should be continued. Youth programmes should include language components where possible. Traditional songs, chants and other important knowledge should continue to be documented to ensure it is preserved and the effort with Maori language week should be continued.

SOURCES

Frances, E., 2016: Tracing Language Use and Policy in Cook Islands' Schools: 1827–2003. South Pacific Studies Vol.36, No.2, 2016.

House of Representatives Standing Committee on Aboriginal and Torres Strait Islander Affairs. 2012: Our Land Our Languages Language Learning in Indigenous Communities.

CULTURE AND HERITAGE TRADITIONAL PRODUCTION AND CONSUMPTION OF FOOD

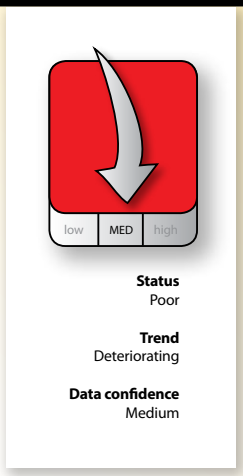
Introduction

One component of cultural identity is diet. Like many aspects of traditional culture, today's diets reflect the clash and merging of traditional patterns with modern trends.

Traditional food production in Cook Islands occurs on small pieces of land between 0.25–0.5 acres, mainly for home consumption and some surplus for cash sales. There is less land available for agriculture, and the Cook Islands government is supporting the growth of small farms in the Pa Enua. Traditional agriculture and food production included taro (*Colocasia esculenta*), cassava (*Manihot sculenta*), sweet potatoes (*Ipomoea batatas)* and *Tarua (Xanthosoma sagittifolium*), yams (*Dioscorea spp.*), breadfruit (*Artocarpus altililis*), bananas, *(Musa cavendishii),* coconuts *(Cocos nucifera)* and other important foods, medicinal plants and trees (FAO 2008).

Some traditional agricultural and land use practices include the use of green leaves from trees, excluding coconut palm fronds, to contribute to greater soil health, and taro cultivation as a food source and sustainable method of wetland preservation. Green leaves from trees are sometimes put under *Ra'ui* protection, such as *puka* (*Hernandia nymphaeifolia*) trees, or they can be stripped for their high nutrient values. Taro farmers often use a practice known as *uri-pa'i* where different taro varieties are planted in varying raised water levels, with the taro patches turned over regularly to provide the wet soils with nutrient rich leaf and vegetation. These traditional taro practices are common in Rarotonga, Atiu, Mauke, Mitiaro, Mangaia, Pukapuka, Manihiki, Rakahanga and Nassau. Wetland taro is commonly found in the valleys of Rarotonga and Mangaia. However, many traditional wetland taro patches have been abandoned in recent years in Rarotonga's valleys due to encroaching development and streambeds which have dried up. The *uri-pa'i* taro practices also contribute to overall water flow, and help to maintain natural wetland drainage systems.

The *arapo* moon calendar is another example of a traditional food production practice that has declined in recent years, however, many growers still practice *arapo*. The *arapo* uses moon cycles and seasons to inform traditional planters and growers when to plant and clear their lands. For example, preparation for land planting should take place before the full moon and the new moon, so that by the time the rains of the full and new moons arrive, the plants are ready to receive the water. During the dry season, *arapo* farmers clear their lands for new planting, which, if cleared during the wet season, would cause flooding and crop loss.



Status: Poor Trend: Deteriorating Data Confidence: Medium

10.1 10.2

Traditional fishing has declined in recent years due to ciguatera outbreaks in the Rarotonga lagoons. Arapo is also used by fishermen, who use the cycles of the moon and seasonal cycles, to determine when to harvest certain types of fish. While some subsistence fishing is still practiced, it is in decline (due to impacts from ciguatera outbreaks and more food imports among other factors), with a rise in recreational fishing. The ability to freeze and store foods has also resulted in a shift from subsistence to commercialisation of food production.

Traditional Cook Islands diets have changed in recent decades from traditional agriculture and fish to more high fat, processed diets from increased imported foods. This is reflected in the high levels of Non-Communicable Diseases (NCDs) and serious obesity concerns.

Historically there was some traditional consumption of sea turtles, but only under special circumstances such as by chiefs, priests (Tongareva and Rarotonga), or by whole communities for special ceremonies, in the case of Pukapuka. This traditional consumption was largely historical though, and while sea turtles are considered a delicacy in many areas throughout Polynesia, there is limited information about this type of consumption occurring today.

Fifty years ago traditional cooking methods were used through the use of open fires for cooking. In the last 20 years since the improvement in supplies of electricity and gas and the introduction of cooking appliances, traditional cooking has declined and there is more reliance on electricity and modern appliances.

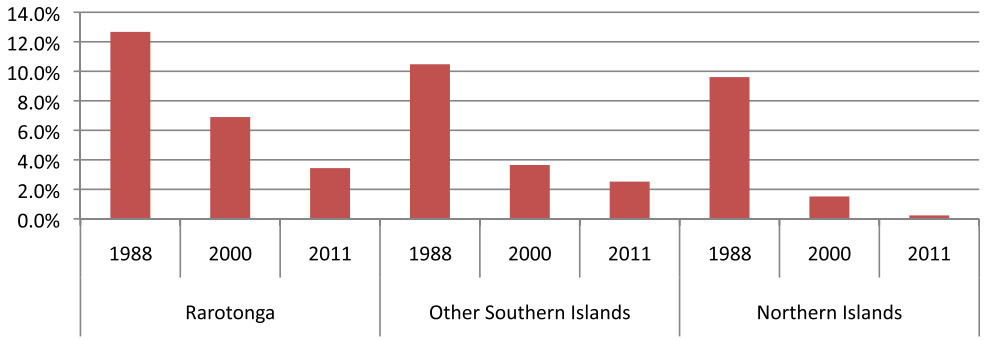


FIGURE 148. Total land used for Agriculture. (MOA, 2012)

Only 4.3% of all Cook Islands land is adequate for agriculture (Figure 148), but even this is not fully used. Traditional agriculture has declined over time across all islands, especially on Rarotonga (Table 21). Traditional and subsistence fishing, including gleaning from reefs, have also declined significantly in recent decades. As traditional food production in Cook Islands has declined, there has been a big rise in food imports.

TABLE 21. Cook Islands land availability* (Cook Islands environmental issues report. *Includes land used for residential and commercial uses, and marginal lands such as sloping lands and wetlands.)

Islands	Lad Areas (acres):	Makatea area (acres):	Area used for agriculture (acres):	Others* (acres):
Rarotonga	16,598.4	0	1143.00	15,455.4
Mangaia	12,794.6	4322.5	373.3	8098.8
Atiu	6644.3	3334.5	152.6	3157.2
Mitiaro	5508.1	496.6	52.5	1059.0
Mauke	4544.8	3428.7	271.8	790.3
Aitutaki	4470.7	0	458	4012.7
Manuae	1704.3	0	0	1704.3
Palmerston	494	0	0	494
Takutea	296.4	0	0	296.4
Tongareva	2420.6	0	0	2420.6
Manihiki	1333.8	0	18	1315.8
Pukapuka	1062.1	0	56.9	1005.2
Rakahanga	1012.7	0	12.7	1000.0
Nassau	296.4	0	3.9	292.5
Suwarrow	98.8	0	0	98.8
Total	59,280.0	15,536.3	2542.7	41,201.0

Prior to missionary contact, many land developments including for traditional food production were site specific and dependent upon the natural ecosystems and environments. For example, water wells were sited where there was water, and banana and taro crops were only cultivated where they grew naturally. Post-missionary contact, the introduction of modern agriculture and new technology have changed the location of land areas for food production. Food is now grown using modern technologies, with a growing loss in traditional knowledge about food production (Table 22).

TABLE 22. Proportion of families consuming different food categories, Rarotonga, Cook Islands: across a 7–10 day period, per family, 1952; during the previous day, adults, 1996. *(Ulijaszek, 2003)*

Food categories	Percentage families, 1952	Percentage adults, 1996
Traditional staples (tubers)	100	91
Coconut	100	39
Fresh fish	95	37
Bread and rice	100	94
Tinned meat	83	62

There has been an observed change in land use patterns resulting in the conversion of arable land to residential and commercial properties.

Younger generations are less interested in traditional food production (Figure 149), and with ageing farmers and growing house sizes, land use is increasingly shifting from home gardens to larger homes and increased development. As a result a large amount of food has to be imported to meet the needs of Cook Islands.

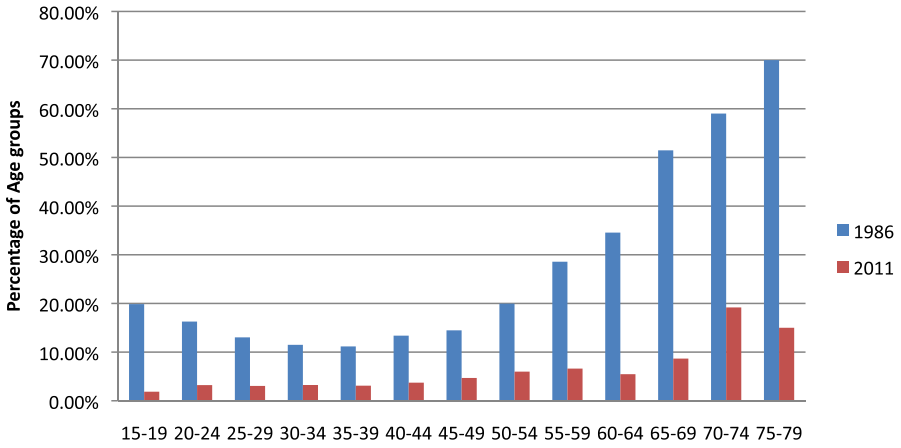


FIGURE 149. Percentage of age groups involved in agriculture. (MOA, 2012)

Impact

A 2003 study showed that the body sizes of Cook Islanders on Rarotonga increased from 1952–1996 (Figure 150). The study linked the decline in traditional food staples, such as fish, and higher consumption of meat and imported goods to the increasing body sizes, NCD and obesity concerns of Cook Islanders. In 2010, 81% of Cook Islands adult deaths were related to NCDs, and according to Cook Islands' director of public health, Dr Rangi Fariu, between 80–90% of men are obese, due to high cholesterol levels, diabetes, heart disease and high blood pressure (McCormack, 2014).

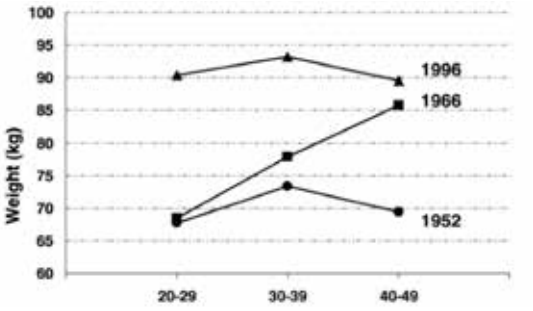


FIGURE 150. Mean weight of females by age group (sample size adjusted means, 1952; age adjusted means, 1966, 1996). (Ulijaszek, 2003)

With such high percentages of NCDs and related health problems due to the transition from healthier, traditional diets to unhealthy, imported foods, there is greater pressure on families and communities to take care of family members and pensioners.

With the decrease in traditional agriculture and fishing, there is an associated change in land use. As homes are getting larger (despite decreasing family sizes), home gardens are being replaced by both private and commercial developments, and the agricultural lands are being replaced and threatened from development pressures. Imported food products also introduce new waste streams, especially from single use, throwaway plastic packaging. This increases waste management pressures which are already strained due to limited landfill space on small islands, and high costs to ship waste off the islands.

Response and Recommendations

In response to the shift from traditional foods to modern diets that are high fat, high cholesterol, and high sugar food imports. The national government is promoting local, traditional, healthy food consumption across the public health, education and agricultural sectors. Cook Islands also has a 'Go Local' campaign that encourages people to buy locally grown produce, particularly hotels and restaurants in the tourism sector, and works with local farmers to build capacity to meet growing local and traditional food market demands.

The Titikaveka Growers Association is one of the key groups in Cook Islands for the promotion of organic agriculture, much of which helps to support traditional food production and natural biological controls. The Ministry of Agriculture is also supporting family gardening and hydroponics, especially in the northern group of the Cook Islands.

Cook Islands should promote and support traditional agriculture and fishing methods where possible, such as through subsidies to small scale, traditional and organic farmers, and campaigns such as the 'Go Local' campaign. More investment is needed in education programmes around traditional food production, as well as public health and education campaigns that link traditional foods to organic and local agriculture and small-scale fishing methods.

SOURCES

Food and Agriculture Organization of the United Nations (FAO). 2008. State of Plant Genetic Resources for food and agriculture in the Cook Islands. Country Report.

Ulijaszek, S. 2003. Trends in body size, diet and food availability in the Cook Islands in the second half of the 20th century. Economics and Human Biology 1 (2003) 123–137.

ONLINE SOURCES

http://www.fao.org/docrep/013/i1500e/Cook%20Islands.pdf

http://www.theguardian.com/global-development/2014/sep/02/cook-islands-obesity-imported-food

Young women in farming. © UNDP

CULTURE AND HERITAGE TRADITIONAL ENVIRONMENTAL KNOWLEDGE

Introduction

Traditional knowledge means the knowledge, know-how, skills and practices that are developed and sustained within a cultural community and passed on from generation to generation, forming parts of its cultural identity. Traditional knowledge provides a link with our ethnic group and country. It is also a living heritage that through interactions with the environment, can improve human responses to environmental changes. In many cases it maintains a healthy and sustainable relationship between people and the environment.

For the State of Environment Report, traditional knowledge is analysed from its interactions with the environment. For this indicator, we look at the status of three traditional practices that exist today:

- The traditional use of natural products for social and economic benefits
- The use of traditional *Ra'ui* areas for management of coastal fisheries
- Traditional agriculture and medicinal plants


Dylan Harrison

Status
Fair

Trend
Deteriorating

Data confidence
Low

Status: Fair Trend: Deteriorating Data Confidence: Medium

14.2

Traditional knowledge is facing pressures from modernisation and social change. The House of Ariki, traditional healers, and local conservation groups are all working to preserve traditional knowledge and its ties to the environment. They face the same pressures as other Pacific island countries with more trade, quick and cheap solutions and changing values. That appears to be a trend with more pressures being asserted in urban areas and more resilience in Pa Enua due to their remoteness.

TRADITIONAL ECOLOGICAL PRODUCTS

The traditional use of ecological products has declined as local products are overharvested or modern products are easier to find. Fewer people are working with traditional resources. Younger generations no longer practise traditional methods nor do they know the best time to collect the materials.

For example, the traditional craftwork has changed over the years especially for the use of natural fibres as synthetic fibres are available. In the more northern Pa Enua the use of *rito* remains strong compared to those in the southern Cook Islands. Only a few people still know which trees to use for building voyaging canoes and how to construct the hulls, as the traditional canoe building is seldom practised and much of this knowledge is not being passed on (Figure 151). Another example is *aute (Broussonetia papyrifera)* a tree that is used for tapa making. This tree does not naturally propagate and disappeared from Mauke and Mangaia but is in low numbers in Rarotonga due to replanting efforts. Other trees such as M*iro (Thespesia populnea), Tamanu* and *Tou (Cordia subcordata)* used traditionally for buildings, canoes and music instruments. Their timber is of high value, for which they have been harvested, and as they need a long time to mature they are now rare. Also the feather removal for traditional costumes has declined, as birds, such as *Kura* (Rimatara Lorikeet, *Vini kuhlii*) and *Tavake (Phaethon lepturus)*, are overharvested. *Kura* have been successfully reintroduced.


NES


NES

Nowadays, Cook Islanders are seeking overseas options for the supply of feathers and *kiriau* (*Au*) for their traditional costumes and collections. This does not deplete local species but also reduces the use of traditional practices.

FIGURE 151. Examples of traditional craftwork. Top to bottom: Small Miro Tangaroa statues at Island Craft in Avarua; Inside of Mauke's first church, built in the 1870s – Ziona, in Oiretumu – the ceiling and roof is supported by Tamanu poles; Paiere made out of Tamanu log at Mauke harbour. (T. Rongo)

Ra'ui

Ra'ui is the traditional way of fisheries management and is usually put in place by a person of high rank. It can also be enforced when an important occasion is planned such as weddings and feasts, or when the fish stock is depleted. If a *Ra'ui* is in place the whole village is informed of the area and closure period. Breaching of *Ra'ui* is punished. As chiefs began losing their authority, these sites were not declared as often. However, there has been a revival of *Ra'ui* as they are seen as an option to boost marine life and conservation efforts. This also leads to more chiefs taking an active role in fisheries management (Solomona and Vuki 2012).

There have been some changes in attitude towards the traditional fisheries management compared to the past where *Ra'ui* were highly respected. This can reduce the respect for the closure and leads to poaching within the *Ra'ui*. Some islands have adopted a modern approach in declaring *Ra'ui* to provide food for festivities whereas, traditionally, the *Ra'ui* was used to protect resources. *Ra'ui* in Rarotonga (Figure 152) require additional management techniques as the population is of mixed cultures and nationalities who do not understand or fully respect the traditional concept. Table 23 shows a list of types of MMAs.

Table 23. *Ra'ui* across Cook Islands, 2014. (NES)

Island	Name(s)	Comments
Rarotonga	Aroko, Aroa, Akapuao, Pouara, and Nikao	Rules vary but generally no take of coral, fish or invertebrates, recreational use allowed
Aitutaki/ Manuae	Maina Reef, Maina Lagoon, O'otu, Motikitiu, Akaiami and several bonefish sites	No take of marine species
Suwarrow		No take
Atiu/Takutea	Landowner (Ngamaru Ariki)	No take (Trust Management)
Pukapuka	Three *motu* – Ko, Motu Kotawa, Roto	
Tongareva	Lagoon	No take of *Pa´ua*
Manihiki	Lake Porea, Tepuka, Pearl zonation sites	No take of *Pa´ua* in pearl zonation sites, no take of eels in Lake Porea
Rakahanga		No take of crayfish
Mitiaro	Roto Nui Lake	No take of eels

FIGURE 152. *Ra'ui* marine areas in Rarotonga. (SPREP, 2017)

TRADITIONAL FARMING AND MEDICINAL USE/ MAKING

The shortage of young farmers (see Land theme) means fewer people to grow traditional crops. Some traditional farming practices are still in use but are under increased pressure due to 1) few Cook Islanders taking up farming, 2) low commercial value of local products, and 3) the easy access to imported products. This affects agriculture and the use of traditional medicinal plants. Knowledge about the plants and how to use them is not passed on, important sites are not cultivated, habitats are getting destroyed due to development, and some plants are only available in certain seasons.

One activity under the GEFPAS IIB project was to protect and conserve rare *Vairakau** Maori (traditional medicine) plants. The project established a database of important plants and their status, as well as a list of traditional healers that still have the knowledge. Nurseries will help to grow rare but important plants. There are 1125 plants of traditional importance for Cook Islanders, either as medicinal plants, food, material or agriculture (Table 24). Of the medicinal plants 11.6% are listed as rare (Table 25).

TABLE 24. Number of species in the database as having positive social significance (Cook Islands Biodiversity Database). Notes: * denotes species listed as mildly-seriously endangered, this list may be incomplete. (Source: NES – IIB project outcome activity 1)

Use	Listed	Non-Plants	Plants
Food Plants	369	166	203
Medicinal Plants	176	12	164
*(Mildly–Seriously Endangered medicinal plants)	(21)	(2)	(19)
Ornamental Plants	599	8	591
Material Plants, e.g. timber, dye, etc.	225	122	103
Agricultural Use e.g. for plant material and for crops	125	61	64
Total	1494	369	1125

TABLE 25. Complete List of rare and uncommon *vairaka*u (traditional medicinal) plants (NES – IIB project)

Medicinal Plant Name:	Island where their level of rarity gives them a rare rating:
Stalked Adder's-tongue Fern or *Tiapito*	Rarotonga, Mangaia, Atiu and Mauke
Polynesian Sandalwood or *Ai* of Mitiaro	Mitiaro
Garland Berry or *Poroiti*	Rarotonga, Mangaia, Mauke and Aitutaki
Medicine Daisy or *Takatakaiara*	Atiu
Native Burr-grass or *Parango Maori*	Mitiaro and Rarotonga
Medicinal Vitex or *Rara*	Rarotonga and Mitiaro
Perfume Tree or *Mata'oi*	Rarotonga, Atiu, Mangaia and Mauke
Yellow Crown-head or *Kamika*	Rarotonga, Mangaia, Atiu, Mauke Mitiaro
Liminophila or *Mapua*	Atiu and Aitutaki
Kava Shrub or *Kava Maori*	Rarotonga and Mangaia

* *Vairakau*: Taditional medicinal plants.

The use of important plants for medicine, ornaments, food, etc. puts more pressure on them (Figure 153). Invasive species compete with these plants so it is important that the invasive species are identified and controlled. Mechanical weed controls are another threat to small medicinal plants growing between weeds (Figure 154).

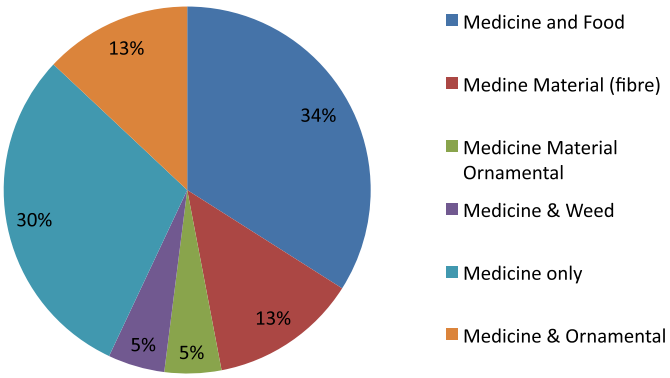


FIGURE 153. Use of plants (IIB report from Activity 1: Output 3)

FIGURE 154. Tiapito or Stalk Adder's tongue fern. Note the small size of this plant. In Mangaia it is not rare, but you need to know where to look (T. Rongo)

A study from Rongo T. and Rongo J. (2004) who interviewed *Taunga* on Mangaia and Mitiaro showed that most *Taunga* are women. Most learned on island and passed it on to relatives, usually their children (Figure 155). The report shows that *Taunga* are still practising and knowledge is passed on. However some knowledge has been lost and plants have become rare and most probably there would be no medicinal plants without the *Taunga* (Rongo and Rongo 2004).

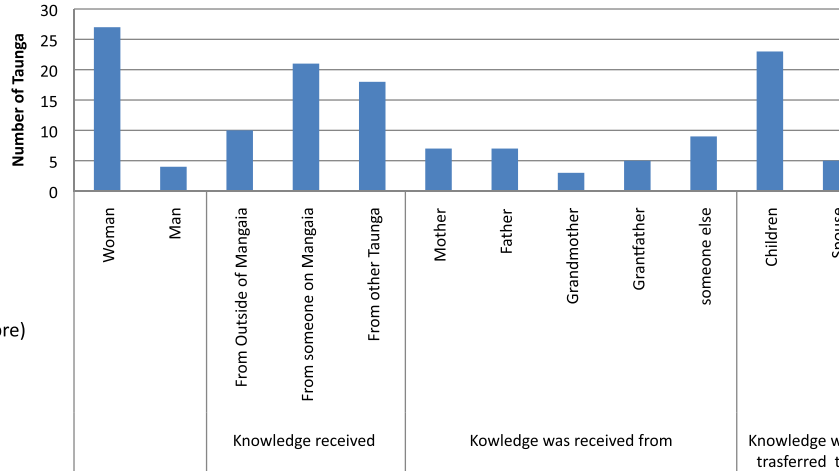


FIGURE 155. Taunga on Mangaia and Mitiaro (Rongo T. and Rongo J. 2004)

Impact

The decline and loss of traditional knowledge and culture practices can have severe impacts as an important part of the culture could vanish. This would mean a loss of authenticity for the image of Cook Islanders.

Traditional practices such as making medicine is part of the customs from the ancestors and must be taught in Cook Islands Maori (IIB Report). The *Taunga* want to keep this custom but with fewer people speaking Cook Islands Maori this could impact the transfer of knowledge. There are *Taunga* who are still passing on the knowledge (Rongo and Rongo 2004). Plants and herbs are very rare and knowledge about them is limited, which makes it difficult to identify where they occur (IIB Report).

Traditional products are still produced and used but it often difficult to find the right material and Cook Islanders have to rely on new modern products from overseas. Nowadays, some products are even preferred over the traditional item as it involves less work to acquire them. The traditional costume making by youth often chooses artificial material in place of natural materials.

The revival of the *Ra'ui* sites has had a positive impact as there is more interest in local traditional management plans. However poaching is still a problem due to a lack of respect for the old system of managing marine resources, especially among people who are not familiar with the traditional way of preserving resources.

Response and Recommendations

Several measures support the preservation of traditional environmental knowledge and customs. *Ra'ui* areas, for example, are being established by local communities and government. The island of Mangaia has revived tapa-making, sennit (ka'a) making, and traditional basket weaving. The GEFPAS IIB project has conducted school tree planting events for Tamanu and Miro to help to increase their population and availability for traditional ecological products.

The National Environment Service with support from SPREP has developed a programme for medicinal plants and has set up nurseries in Mauke, Atiu, Mangaia and Rarotonga (pueikao). A database was established for rare *Vairakau* Maori plants. There is also a database of practitioners. Traditional and rare plants for medicine were added to the National Biodiversity Strategy and Action Plan (NBSAP) to give it wider coverage.

A draft policy has been developed to protect traditional knowledge and promote traditional skills.

More research is needed on the use of traditional knowledge in preserving ecosystems. The involvement of local communities in the establishment of Ra'ui is essential for their commitment and support.

Traditional ecological products could be more widely marketed. School and education programmes could be developed to raise awareness and interest among youth to learn the traditional ecological products. Replanting of trees and plants and conservation programmes for native birds will help to conserve the material used for their traditional craftwork, costumes and tapa.

The work on the medicinal plants has some recommendations which should be implemented. This includes an arrangement for the Taunga Vairakau Maori and a formal relationship with the Ministry of Health, awareness work and development of school programmes. The NES should continue to work closely with the Ministry of Culture to support the draft traditional knowledge policy.

Dylan Harrison

SOURCES

Solomona, D. M. and Vuki, V. C. 2012: Traditional fishing methods, *Ra'ui* and gender roles in Arorangi village, Rarotonga, Cook Islands. SPC Women in Fisheries Information Bulletin #22.

National Environment Service. GEF PAS Integrated Island Biodiversity (IIB) Project outcome reports 2014.

National Environment Service. 2002. Cook Islands National Biodiversity Strategy and Action Plan (NBSAP).

Rongo T. and Rongo J. 2004: A report on the implementation and analysis of the state of capacity and future needs to survey and conserve rare *vairakau* plants. Prepared for the Cook Islands NBSAP Add-On Project, National Environment Service.

Pacific Island Migration and Loss Of Traditional Knowledge. A presentation by Imogen Pua Ingram (Te Pa Mataiapo)

ONLINE SOURCE:

The Cook Islands Herald Online Edition: http://www.ciherald.co.ck/articles/h560d.htm (25.11.2016)

N.Woonton

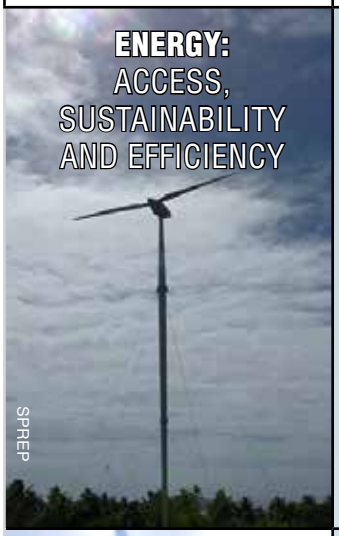
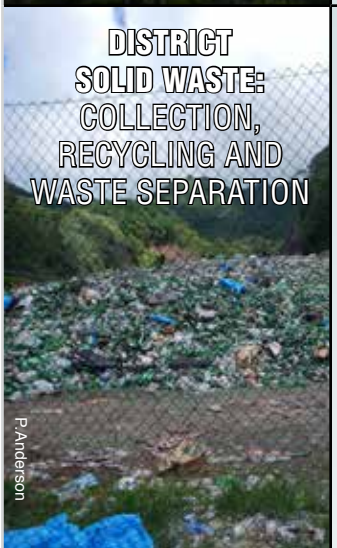
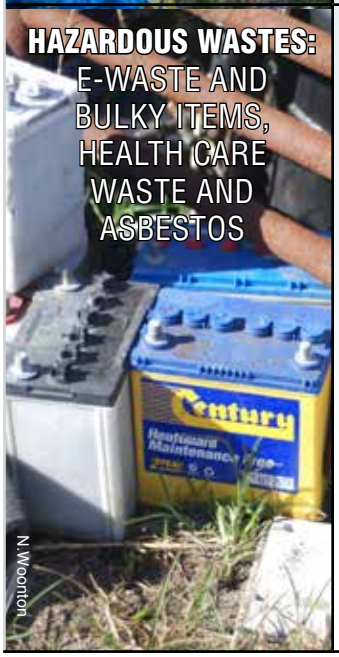
OVERVIEW

Like most countries the Cook Islands is urbanising, especially Rarotonga. The last census in 2011 showed 74% of Cook Islanders live in Rarotonga, 20% in the southern group and six per cent in the northern group.

The main environmental impact of urbanisation is that the population is outpacing the ability of urban services to meet demand. With more people comes more rubbish and the rubbish dump needs to keep up. Drinking water and access to electricity have improved but the management of solid waste is challenging. Although per capita consumption of energy is rising, renewable sources such as solar are improving energy efficiency and 50% of the islands are already powered by renewable energy. The plan is for the rest to join by 2020. Solid (household) and liquid (sewage) waste are having a huge negative impact on the environment. Most people have flush toilets but their septic tanks are very old and not in good condition. Access to drinking water is good but tap water quality is often poor and needs treatment.

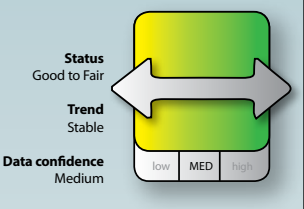
N.Woonton

BUILT ENVIRONMENT HIGHLIGHTS

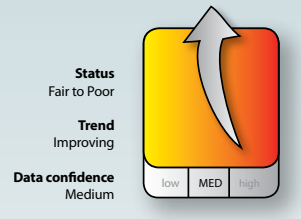
TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
	Access to Energy **Status** Good **Trend** Stable **Data confidence** High low med HIGH Sustainable Energy **Status** Fair to Poor **Trend** Improving **Data confidence** Medium low MED high	Most islands depend on imports of fossil fuel. Cook Islands has a very high energy consumption per capita, partly due to high numbers of tourists and more electrical products. Cook Islands has one of the most efficient electrification systems in the Pacific and plans to greatly expand the renewable energy sector.	Cook Islands has greatly increased the solar panel installations. The government target is to be 100% renewable electricity by 2020. Nevertheless, energy consumption campaigns should be promoted as the higher energy consumption may not be sustainable, even if it is sourced from solar panels.
	Rarotonga and Aitutaki **Status** Fair **Trend** Improving **Data confidence** Medium low MED high Other Pa Enua **Status** Poor **Trend** Stable **Data confidence** Medium low MED high	Solid waste is a key problem and the small land area worsens the impacts of growing waste. Most waste is collected in 93% of Cook Islands but burning does take place on Pa Enua where there is no roadside pickups. The landfill on Rarotonga separates glass, steel, plastic PET 1 and 2 and aluminium cans, but segregation at the household level is not widely practised.	Tourism operators agreed voluntarily to improve their waste management and some deliver their green waste to the composting site. Cook Islands improved their data capture for the landfill in Rarotonga and also organised bulky waste drop off events. As the waste management system is still underdeveloped it is recommended to assess and improve the current system through cost-benefit analyses and to explore advanced disposal methods.
	E-Waste and Bulky Items **Status** Poor **Trend** Deteriorating **Data confidence** Medium low MED high Health Care Waste **Status** Good to Poor **Trend** Stable **Data confidence** High low med HIGH Asbestos **Status** Fair **Trend** Stable **Data confidence** Low LOW med high	Cook Islands has difficulty dealing with hazardous waste as it cannot be recycled locally and has to be shipped to New Zealand. This includes whiteware, bulky items and asbestos. Solid waste can have big impacts on human and environmental health and must be handled properly.	Cook Islands could implement many activities through the PacWaste project which is funded by the European Union to help with medical waste and asbestos. Hazardous waste is a big problem. The recommendation is for an Audit to be conducted and to segregate components of hazardous waste. Cook Islands may also want to develop disposal site maps for the local community.

BUILT ENVIRONMENT HIGHLIGHTS

Access to improved water



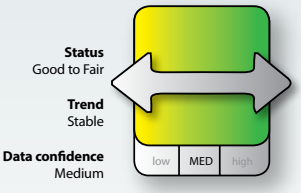
Drinking water quality



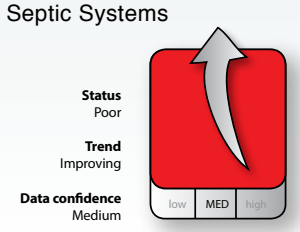
Water for drinking, bathing and washing comes from three sources: groundwater, rainfall harvesting, and streams or springs. Almost 100% of the population has access to improved water and 80% of households in the southern islands have their own water tanks. Northern Islands have nearly no access to public water mains and get almost 100% of their water supply through rain tanks. Water needs to be boiled before drinking to avoid illnesses such as diarrhea or skin sepsis.

The draft Water Policy should be endorsed by the government. This will help to guarantee that the public will have access to safe drinking water. Many water tanks were installed to improve water security. It is recommended that Pa Enua be provided with water stations to secure clear drinking water. Another recommendation is to test water regularly for pollutants and pesticides.

Access to Improved Sanitation



Septic Systems



Septic tanks are the most common sewage treatment system. Almost everyone has access to flush or pour toilets. Pit holes and lagoon toilets are very rarely found in the Pa Enua. Limited space and porous soil combined with heavy rainfall makes sewage management a major problem. Poor access to sanitation causes health problems and has also a negative impact on the environment.

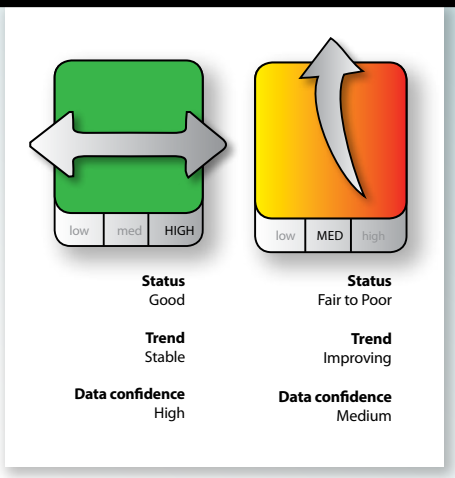
Composting toilets are actively promoted by the government. This effort should be continued and options for commercial level systems should be explored. The sanitation systems of 214 households were upgraded. In 2014 the Ministry of Health developed sanitation regulations which should be implemented. The recommendation is to monitor and prioritise areas that are major sources for septic pollution.

Introduction

In Cook Islands and across much of the Pacific, energy is a serious and growing problem. The country's small size and relative isolation makes it challenging to access cheap energy for all citizens, and most islands are highly dependent on fossil fuels for their energy needs, including electricity and transport. These islands are extremely vulnerable to fluctuating world fossil fuel prices. In 2009, Cook Islands spent 28% of its GDP on fossil fuels imports alone, which was the highest proportion of GDP spent on fossil fuel imports of all Pacific island countries (Figure 156).

Cook Islands also has some of the highest per capita energy consumption in the Pacific, at about 1800 KWh per person as of 2013 (Figure 157). The high proportion of tourism and energy using facilities, the high access to energy across the islands, a rise in household incomes and more electrical products such as white goods, computers, phones and power tools all account for this high per capita national energy consumption.

For this indicator, both access to energy and the sustainable quality of the energy supply are analysed to provide an overall status of energy in the Cook Islands. Access to energy is determined by census surveys. Energy quality is determined by the proportion of renewable sources of energy, the efficiency of the current electrification system and the CO_2 emissions per capita, all based on recent national energy surveys.



ACCESS TO ENERGY

Status: Good **Trend: Stable** **Confidence: High**

SUSTAINABLE ENERGY

Status: Fair to Poor **Trend: Improving** **Confidence: Medium**

Energy consumption is increasing across Cook Islands, particularly in the Pa Enua. The positive development has been the doubling of production and consumption between 2005 and 2013 on islands such as Rakahanga and Manihiki, largely through a recent influx in household solar panel installations (Figure 158). This is reflected in more electrification in the Pa Enua, where access doubled between 1986 and 2011 in the north, and rose 20% in the south (Figure 159). This increase is a combination of traditional diesel generation and renewable energy sources. As of 2011, access is almost at 100% across the islands.

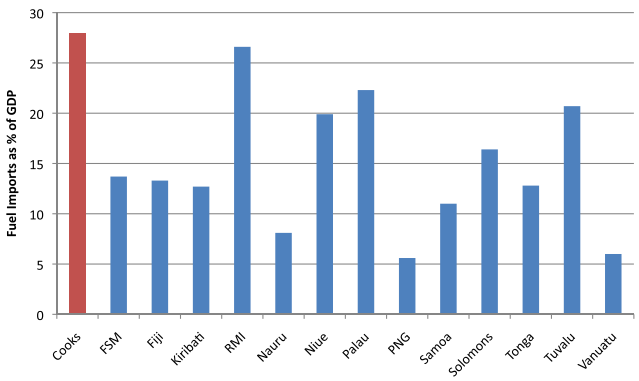


FIGURE 156. Fuel imports as per cent of GDP across Pacific island countries, 2009. (NMDI, SPC)

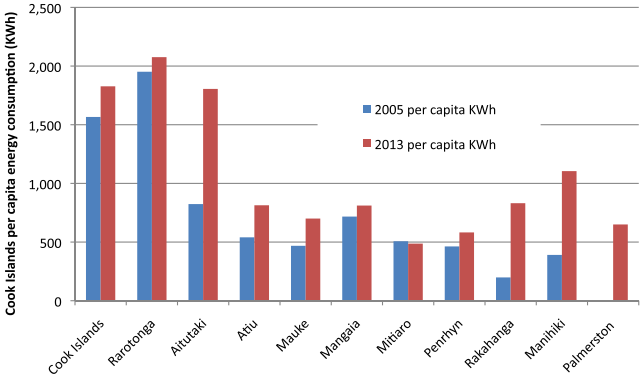


FIGURE 157. Cook Islands per capita energy consumption by island, 2005 and 2013. (Cook Islands Statistics Office, Misc Statistics)

FIGURE 158. Solar panels (Amber Carvan)

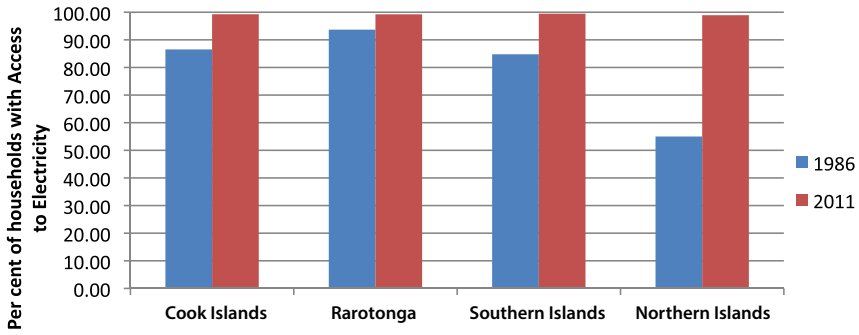


FIGURE 159. Proportion of Cook Islands households with access to electricity by region, 1986 and 2011. (Cook Islands Statistics Office)

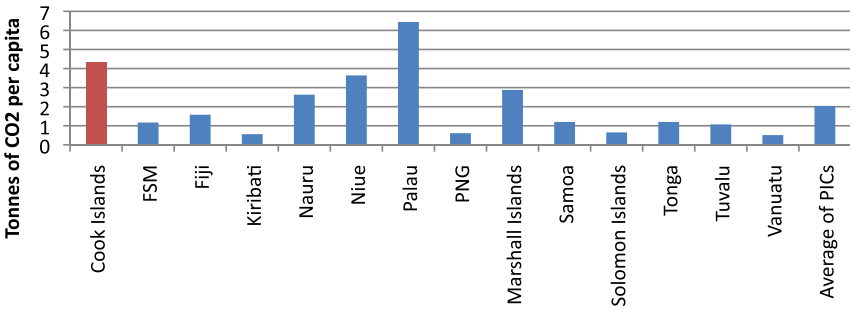


FIGURE 160. Estimated tonnes of CO_2 per capita across independent Pacific Island Countries (PICs), 2009. (SPC Energy Profiles)

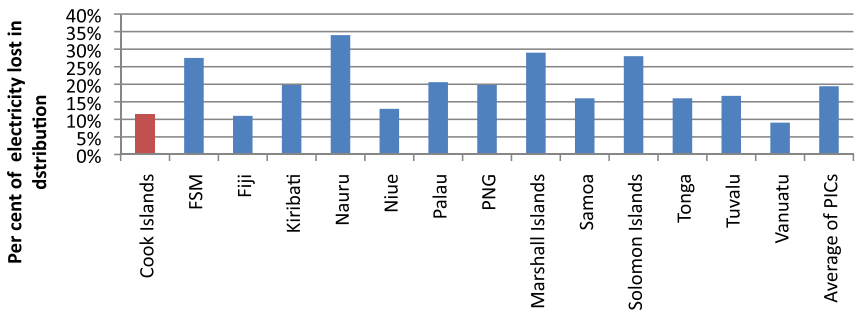


FIGURE 161. Energy losses from the distribution system across independent Pacific Island Countries (PICs), 2009. (Source: SPC Energy Profiles)

Historically, energy sustainability in Cook Islands has been low, with a reliance on fossil fuels. Most (60%) of northern Pa Enua uses renewable energy sources, but it is an insignificant compared to overall Cook Islands energy supply. Based on a 2009 energy survey, only 0.29% of the national electricity supplied is renewable and 0.03% of energy sources (i.e. electrification and transport) are renewable (SPC, 2009). This is reflected in the country's per capita CO_2 emissions, which in 2009 were the second highest in the Pacific (Figure 160).

The proportion of renewable energy sources is expected to greatly increase over the next five years, and they have improved since 2009 (see response section below). The 50% target of having half of their islands shifting from diesel to renewable electricity has been achieved (Figure 51, page 44), and the government is on track to achieving the 2020 target of 100% renewable electricity (INDC to the UNFCCC, 2015). Cook Islands has one of the most efficient electrification systems in the Pacific with the second lowest energy distribution loss percentage in the region (Figure 161).

Impact

Access to energy has traditionally been a key factor in improving health, education and quality of life in developing countries. Energy development and energy access for vulnerable, isolated populations such as the Pa Enua has immediate benefits, such as refrigeration for medicines and foods. However, in areas like Rarotonga that already have high levels of energy access, more access has drawbacks and creates further pressures on the environment, society and economy. These include a rise in sedentary lifestyles, a loss of cultural activities and more use of energy consumptive products. This raises the demand for more energy, produces more waste and increases household energy expenditures.

Higher energy consumption in Cook Islands may not be sustainable, even if it is sourced from solar panels. Many Pacific island countries are working to reduce their reliance on fossil fuels and to lower their energy costs. However, more access, consumption and maintenance costs of renewable sources may negate these improvements. As the Cook Islands increases its renewable energy sources, the importance of energy conservation is also stressed. Excess consumption is not justified by the fact that the energy sources available are renewable.

Response and Recommendations

Cook Islands is promoting renewable energy use at the household level, and the government has taken leadership by setting national renewable energy targets to have 50% of its islands powered by renewable electricity by 2015, and 100% by 2020. The Renewable Energy Chart Te Atamoa o Te Uira Natura outlines how the country will achieve these ambitious goals, through projects and partnerships (Table 26). Access to international donor funds from New Zealand and Japan as well as intergovernmental organizations and international donors all contribute financial capacity to realize these goals. They also support other programmes such as the installation of energy efficient light bulbs, and education and awareness campaigns.

The Rarotonga International Airport, with support from New Zealand and the European Union, installed the largest solar array in the country (Figure 158), named Te Mana o te Ra (Power from the Sun), which provides Cook Islands with around five per cent of its total electricity needs. For the private sector, the Cook Islands Trading Corporation (CITC) has taken a leading role in renewable energy by installing a large solar array to supply its own energy, in addition to providing solar hot water systems and lighting and energy efficient household appliances. Muri Beach Resort in Ta'akoka became the first resort in Cook Islands to run off 100% renewable energy, through installation of solar panels at the resort.

The national government should continue to work toward its ambitious goals to provide renewable electricity across the country, both as an important source of energy, and also as an example of the importance of sustainable and renewable sources of energy for SIDS. Local households should be encouraged to work with reputable solar power suppliers so that proper maintenance can occur, as historically some individual purchases have suffered from poor maintenance. The country should also promote and finance energy consumption awareness campaigns through activities such as energy efficiency audits of residences and businesses, the promotion and supply of energy efficient products such as light bulbs or solar panels. It should also promote meters in homes and businesses so that individuals can raise their awareness of their own energy consumption patterns. Particular attention should be paid to the new waste streams which solar arrays produce, including used batteries and old panels.

TABLE 26. Renewable Electricity Chart – Cook Islands Renewable plan by 2020. (Renewable Energy Development Division, 2011)

Region	Island	Proposed Technology	Estimated Cost (NZ$M)
Northern Pa Enua	Rakahanga	Solar (PV) with diesel backup	1.1
	Pukapuka	Solar (PV) with diesel backup	2.4
	Nassau	Solar (PV) with diesel backup	0.35
	Suwarrow	Solar (PV) with diesel backup	0.04
	Manihiki	Solar (PV) with diesel backup	2.5
	Tongareva	Solar (PV) with diesel backup	2.5
Southern Pa Enua	Palmerston	Solar (PV) with diesel backup	0.35
	Mitiaro	Solar (PV) with diesel backup	1.5
	Mangaia	Wind, Solar (PV), biomass, with diesel backup	3.5
	Atiu	Solar (PV), biomass with diesel backup	3.2
	Mauke	Solar (PV) with diesel backup	4
	Aitutaki	Solar (PV) with diesel backup	8
	Rarotonga	Solar (PV), wind, waste to energy, grid storage and bio diesel backup	200
	Total		229.44

SOURCES

Cook Islands Statistics Office. 2012. Cook Islands 2011 Census of Population and Dwellings.

National Millennium Development Indicators (NMDI). Online Database. Pacific Community. Version 2.0

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 1986 Census of Population and Dwellings*. 1991.

Te Atamoa o te Uira Natura, Cook Islands Renewable Electricity Chart, 2011. Renewable Energy Development Division.

ONLINE SOURCES

http://www.stuff.co.nz/timaru-herald/news/10645412/Solar-panels-light-up-the-Cook-Islands

http://www.spc.int/edd/section-01/energy-overview

N.Woonton

DISTRICT SOLID WASTE COLLECTION, RECYCLING AND WASTE SEPARATION

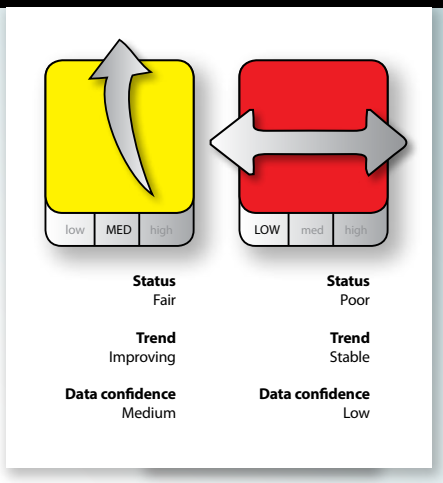
Introduction

Management of solid waste is an important issue in the Cook Islands and across the Pacific. Physical resource and human capacity limitations make the management of solid waste a key challenge. Due to their small size, Pacific Island nations experience the impacts of waste accumulation much more intensely than larger metropolitan countries.

This indicator looks into solid waste (or district solid waste) which includes household and commercial waste such as paper, plastics, metals and garden/kitchen organic wastes. Hazardous wastes (e.g. asbestos, PCBs, paint and other special wastes) are discussed separately as the Hazardous Waste indicator.

The state of solid waste management in the Cook Islands is analysed here using three measures: 1) access to waste collection, 2) the level of household recycling (Refuse, Reduce, Reuse, Recycle), and 3) the sanitary quality of landfills including the extent of waste separation. A distinction is made between Rarotonga and certain southern islands and the remaining northern islands.

Data used for this analysis is gathered from census surveys and information provided by WATSAN, Infrastructure Cooks Islands.



RAROTONGA AND AITUTAKI

Status: Fair **Trend: Improving** **Confidence: Medium**

OTHER PA ENUA

Status: Poor **Trend: Stable** **Confidence: Low**

A Solid Waste Management Strategy 2013–2016 was developed to take responsibility for sustainable waste management, with an aspiration towards Zero Waste. The objectives are to minimise the volume of waste that goes into landfills, develop infrastructure, increase education and awareness around waste management to make this everyone's responsibility, and to have clear and robust institutional and legislative frameworks.

Figure 162 shows that, at the household level, collection and recycling have risen between 2001 and 2011, from 73% to 93% for collection and from 13% to 22% for recycling. Rarotonga and the southern Pa Enua have close to 100% collection with a big increase in recycling by households. Both Rarotonga and Aitutaki have roadside pick-up. In other islands household waste is typically burned (Figure 163), buried or recycled at the household level or disposed in non-sanitary landfills. The northern Pa Enua show little change between 2001 and 2011, in fact a slight decrease is seen in collection/disposal at landfills. Across the Cook Islands green waste is ether buried, composted or burnt on site.

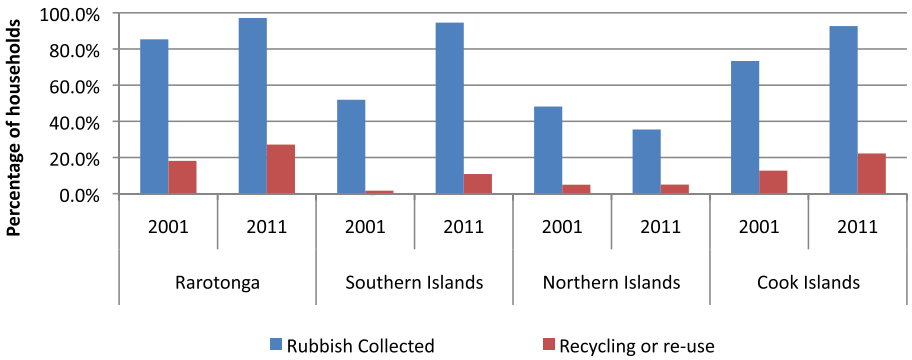


FIGURE 162. Access to rubbish collection and percentage of households practising recycling. 2001 vs 2011. (Cook Islands Statistics Office Census).

FIGURE 163. Backyard burning of non-organic solid wastes. (Paul Anderson, SPREP)

Rarotonga and Aitutaki are the only islands with sanitary engineered landfills. Across Rarotonga, segregation of solid waste at source is encouraged by the government, but this is not widely practised by the community. Figure 164 shows the tonnes of rubbish and recyclable plastics received at the Rarotonga landfill. Glass, steel, plastic PET 1 and 2 and aluminium cans are separated at the landfill. Aluminium and plastic is baled and shipped off island throughout the year based on volume (Figure 165). Glass is crushed but not shipped off for recycling as of 2014. Paper and cardboard are also shipped for recycling. However, despite the waste separation at the landfill, only a very small fraction of recyclables (Figure 166) or other waste could be diverted from the landfill for other purposes. (Cook Islands Solid Waste Management Strategy 2013–2016).

FIGURE 164. Waste separation at the Rarotonga landfill. (Paul Anderson, SPREP)

FIGURE 165. Plastic bales ready for shipment at the Rarotonga landfill. (Paul Anderson, SPREP)

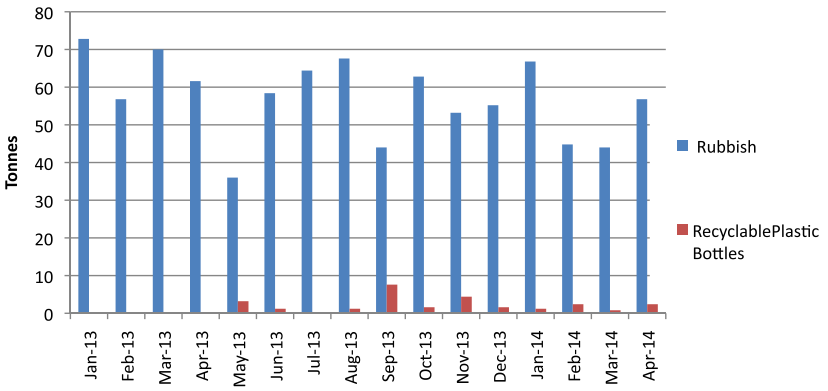


FIGURE 166. Tonnes of rubbish (baled) and recyclable plastic at the Rarotonga landfill by month 2013–2014. (WATSAN, Infrastructure Cook Islands)

Impact

Impacts from solid waste include leachate from landfills, diminished enjoyment of the environment from littering, poor air quality due to burning, and rising costs due to lack of landfill space.

Waste management in the Cook Islands involves several government agencies, including the National Environment Service (who regulate litter, location of waste management sites, and toxics), the Ministry of Health (who regulate disposal and burning of wastes, including toxics, transport and removal of hazardous waste), the Ministry of Agriculture (who regulate biosecurity and pesticides), the Ministry of Infrastructure Cook Islands (who operate waste management services in Rarotonga and Aitutaki) and the Outer Islands Governments (who regulate and operate Pa Enua waste management services). In addition, several private sector agencies deal with collection and hazardous waste management. The many players and responsibilities in waste management can pose a significant challenge in cohesively managing waste across the islands and integrating policies and operations.

SOURCES

Wichman. J., 2014. Eco Reset Pasifika, personal communication.

Government of Cook Islands. 2013. Cook Islands Solid Waste Management Strategy 2013-2016

Ministry of Finance and Economic Management (MFEM). Statistics Office. Cook Islands Census 2001 *Census of Population and Dwellings*. December, 2003.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 2011 Census of Population and Dwellings*. December, 2012.

Response and Recommendations

There are several initiatives to improve waste management in the Cook Islands. Tourism operators have agreed to improve their waste management voluntarily (e.g. Muri and Titikaveka resorts delivering green waste to the TGA composting site). The Rarotonga landfill data capture has improved and bulky waste drop off events have been organised. Aitutaki has received assistance in crushing its metal waste.

The waste management system is still under development (Wichman 2014). With the exception of some Pa Enua, the waste sector has effective collection, compaction and some recycling but not full disposal of rubbish off-island. In the long run, off-island disposal may be required in some islands as consumption patterns increase and landfill space becomes limited. The true costs of waste may not be factored into the management system. Therefore, a material flow cycle and cost-benefit analysis is needed to plan for processing and disposal, and to fully address the costs of waste management. Options could include the development of an advanced disposal method and process. This includes:

REGULATED INCINERATION

Complete shipping of all Rarotonga waste to an approved waste management centre off-island

A USER PAYS SYSTEM

The inclusion of green waste into the waste management system (including composting incentives and/or collection)

Improving waste audits at all landfills to track tonnage and waste separation at household level, and at major landfills across the Pa Enua, would be beneficial.




FIGURE 167. Clockwise from top left: Asbestos roofing (PacWaste); E-waste dumping in the Cook Islands (David Haynes); Waste disposal pit at Aitutaki Hospital (SPREP); Rarotonga Hospital Incinerator for treating medical waste (SPREP).

HAZARDOUS WASTE E-WASTE AND BULKY ITEMS, HEALTH CARE WASTE AND ASBESTOS

Introduction

Hazardous waste consists of solid, gas or liquid waste types that pose a significant risk to public health or the environment. Effective transport, storage and end-of-life management of hazardous waste is extremely critical to preventing disease bearing materials and toxic chemicals from entering the environment. For the purpose of this indicator, hazardous wastes include:

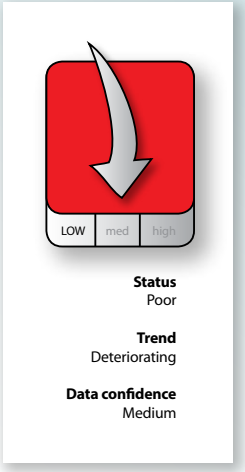
1) E-waste and Bulky Items from disposed computers, phones and other electronics that contain heavy metals or other toxics that can harm the environment. As well as items such as cars, tyres and refrigerators that are difficult to dispose of and/or contain hazardous chemicals.

2) Health Care Waste: including needles (sharps), bottles, blood and body tissues, and materials that have come into contact with them. These items carry a significant health risk to anyone exposed.

3) Asbestos: a fibrous, fire-proof building material used in the 1900s in roofs, paint, walls, stucco and other materials. Fibres released during handling and destruction of materials cause 'asbestosis', a serious lung disease.

Batteries and household toxins are part of hazardous waste but due to lack of sufficient data they are not reflected as part of the indicator in this report.

The main indicators used to measure the state of hazardous waste management (Figure 167) in the Cook Islands are 1) consumption trends, and 2) the presence or absence of environmentally sound management and disposal of hazardous waste, for each of the above categories. These are measured through import and export data and waste management audits. Much of the information is for Rarotonga with less information on Pa Enua.



Status: Poor Trend: Deteriorating Data Confidence: Medium

3.1 3.2

E-WASTE AND BULKY ITEMS

White ware and bulky items: Private contractors offer recycling and off-island shipment of white ware and bulky metals. Cook Islands has trialled a one-time incentive programme to swap out old fridges and light bulbs for newer energy efficient ones. However, like e-waste, it can be assumed that this situation is deteriorating because consumption is overtaking management. As disposal is based on a user pays system, most bulky items remain at the household, including vehicles.

CONSUMER TRENDS: Figures 168 and 169 show consumption trends for products that end up as bulky items or e-waste. Since 1986, Cook Islands households have seen a five-fold increase in TV ownership and a two to three-fold increase in washing machines, refrigerators and microwaves. Motorcycle and vehicle ownership has nearly tripled since 1986.

E-WASTE: E-waste is not currently collected. However, e-waste was taken off the island of Aitutaki in 2012 and partially in Rarotonga in 2010 during a New Zealand funded e-day. On that day, 238 vehicles and 5154 electronic items (no TVs) were exported to New Zealand. Cook Islands residents are advised to stockpile their e-waste until another shipment can be arranged. Based on the rapid rise in e-products it can be assumed with medium confidence that this situation is deteriorating.

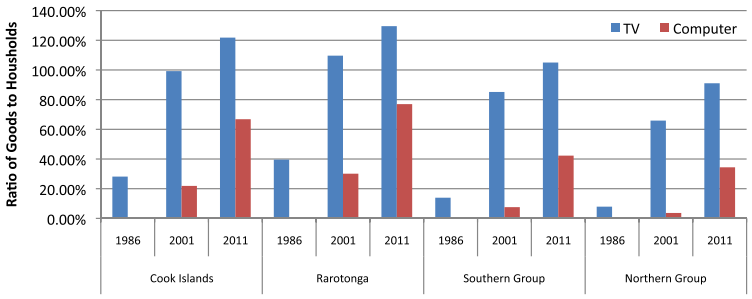


FIGURE 168. Ratio of e-goods to households in the Cook Islands. (Cook Islands Census 1986, 2001, 2011)

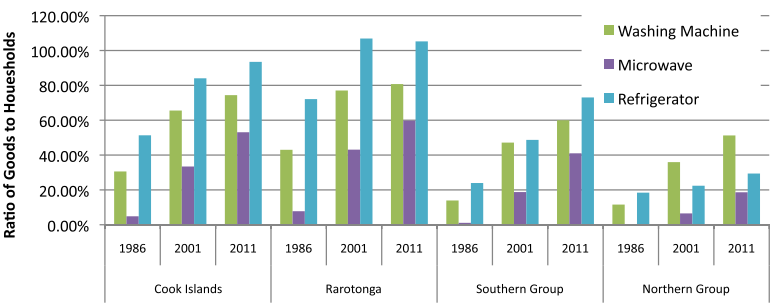
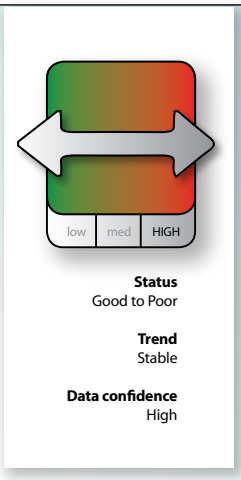


FIGURE 169. Ratio of White goods to households in the Cook Islands. (Cook Islands Census 1986, 2001, 2011)

HEALTH CARE WASTE

Table 27 shows the results of a 2014 waste audit at the Rarotonga and Aitutaki hospitals. Rarotonga hospital meets most criteria for treating hospital waste, whereas Aitutaki does not meet any, and a particular problem is the lack of a treatment system for both sharps (e.g. needles) and non-sharps waste. The trend is unknown as this is the first audit.



Status: Good to Poor Trend: Stable Data Confidence: High

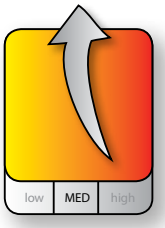
TABLE 27. Health Care Waste Audit Results: Key Issues for Rarotonga and Aitutaki Hospitals. (Baseline Study for the Pacific Hazardous Waste Management – Healthcare Waste: Cook Islands Report, SPREP)

Scale	Category	Minimum Standard Criterion	Rarotonga General Hospital	Aitutaki District Hospital	Cook Islands – overall
Health Care Facility	Policy	Has been developed by the hospital and is based on a review of healthcare waste management and is current (within five years).			
Health Care Facility	Signage	Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types.			
Health Care Facility	Segregation	Wastes are correctly segregated in all wards/departments with containers that are colour-coded for the different waste types.			
Health Care Facility	Containers	All areas have dedicated waste containers suitable for the types of waste generated. All waste containers are colour-coded and have correct wording on them. Sharps are deposited into containers that reduce potential for needle-stick injury.			
Health Care Facility	Internal Handling	A dedicated trolley is used for waste transport. The trolley is designed so that any spills are contained.			
Health Care Facility	Training	A structured waste management education programme has been developed with a clear delivery structure.			
Health Care Facility	Waste Audits	A programme has been implemented to ensure waste audits are conducted of all waste materials/systems in all wards/departments on an annual basis. Reports are provided to the waste management committee. Effective systems are in place to ensure that any non-conformance (with the hospital waste management strategy) is remedied.			
Health Care Facility	Treatment	The method for treating healthcare waste is in accordance with required standards – this includes operating parameters and location of the treatment unit.			
Health Care Facility	Healthcare waste management emergencies	Spill kits are provided for all types of healthcare waste in all wards/departments, storage areas and on trolleys and vehicles. Staff are trained in the use of spill kits. All incidents of spills of healthcare waste are investigated and where appropriate remedial actions implemented.			

Meets minimum standards assessment criteria.
Partially meets minimum standards assessment criteria.
Does not meet minimum standards assessment criteria.

ASBESTOS

A 2014 survey of asbestos funded by the European Union identified priority areas for asbestos removal so there is a good understanding of where the asbestos is located (Figure 170). Between 2012 and 2014, Rarotonga and Aitutaki shipped about 70 tonnes of asbestos to New Zealand and have begun removing it from priority sites, such as schools. In 2008 the Cook Islands sunk about 250 tonnes in a ship, *Miss Mataroa*, off the coast of Rarotonga (Wichman, pers. comm.). Most of the Pa Enua are burying asbestos, rendering it inert unless dug up again. Overall, given the state of knowledge and recent actions to remove it or render it inert, it is assumed that the status is improving.



Status
Fair to Poor

Trend
Improving

Data confidence
Medium

Status: Fair to Poor Trend: Improving Data Confidence: Medium

3.2

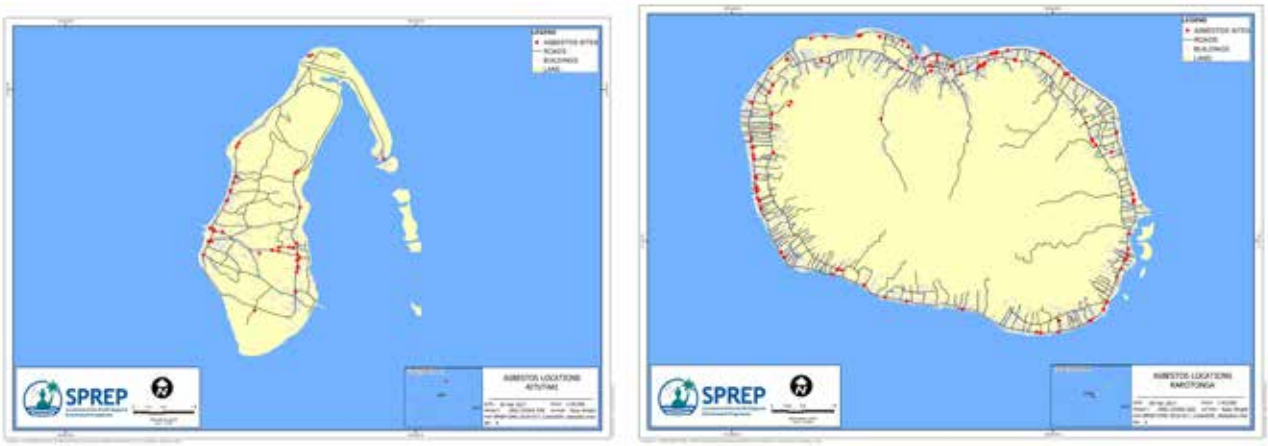


FIGURE 170. Asbestos sites in Rarotonga and Aitutaki. (SPREP, 2016)

Impact

Solid waste can have big impacts on human and environmental health and economy. With a growing population, a better economy and more imported products, the waste increases. This causes more pressure and negative impacts to the environment, society and economy. Solid and hazardous waste must be handled properly to protect the environment, the health of citizens, and for sustainable development. The impacts of solid waste include:

- The leaching of pollutants into the surrounding land, sea and ground-water environments.
- The increase in greenhouse gas emissions from waste decomposition.
- The spread of diseases through unsanitary waste management methods.
- Degraded amenity through more litter and odours.

Response and Recommendations

Educational awareness programmes have been conducted. A rubbish separation system was developed on Rarotonga.

A healthcare waste management baseline survey was conducted in April 2014 and information was collected from ward-level waste generation through to treatment and disposal. Audits were conducted in Rarotonga General Hospital (Rarotonga) and Aitutaki District Hospital (Aitutaki). These activities were under the EU-funded PacWaste project which Cook Islands is implementing together with SPREP. Based on the results of the assessment, the project is providing a high temperature healthcare waste incinerator for the Aitutaki District Hospital, incinerator training, and healthcare waste management training for staff at the two facilities that were audited.

Through the PacWaste project a baseline asbestos survey in 2014 was used to determine the prevalence of asbestos, assess risks associated with the material, and identify best

practice options. After the surveys the project committed to safely dispose of around 4000m^2 of asbestos from 22 sites across Rarotonga, Aitutaki, Atiu, Mangaia, Mauke and Mitiaro.

There are few disposal options for solid waste and no option for e-waste, so TVs and radios are haphazardly disposed of in unauthorised sites. This situation should be improved with proper disposal facilities. The promotion of mercury-free products will help with the eventual phase-out.

Hazardous waste is a significant problem nationally and acknowledging it as a priority in waste management and conducting a proper audit would be beneficial. The recommendation is to segregate precious metal components of hazardous waste. It would be helpful to improve the customs tariff codes to specifically identify hazardous wastes and develop a user pays fee on all hazardous e-waste. A first step would be another analysis on developing and implementing this plan – a previous analysis was not implemented.

For the national management of waste it is necessary to map all disposal and dump sites, especially for hazardous waste for the local communities. It is important to clarify and identify which departments are responsible for the different tasks to make sure processes are followed through and tasks are implemented. Outstanding activities of the PacWaste project should be implemented.

Developing a green procurement policy, including preferred manufacturers that are EPR (extended product responsibility) for government agencies, would be a step in the right direction as they are some of the largest consumers of e-waste and other hazardous products.

SOURCES

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 1986 Census of Population and Dwellings*. 1991.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 2001 Census of Population and Dwellings*. December, 2003.

Ministry of Finance and Economic Management (MFEM). Statistics Office. *Cook Islands Census 2011 Census of Population and Dwellings*. December, 2012.

SPREP. 2011. An Asbestos-Free Pacific: A Regional Strategy and Action Plan. Secretariat of the Pacific Regional Environment Programme, Apia, Samoa.

SPREP. 2013. Review Of Regional E-Waste Recycling Including a Model Product Stewardship Approach for Pacific Island Nations. Secretariat of the Pacific Regional Environment Programme, Apia, Samoa.

SPREP. 2014.Baseline Study for the Pacific Hazardous Waste Management Project – Healthcare Waste. Secretariat of the Pacific Regional Environment Programme, Apia, Samoa.

Wichman, J. Personal communication.

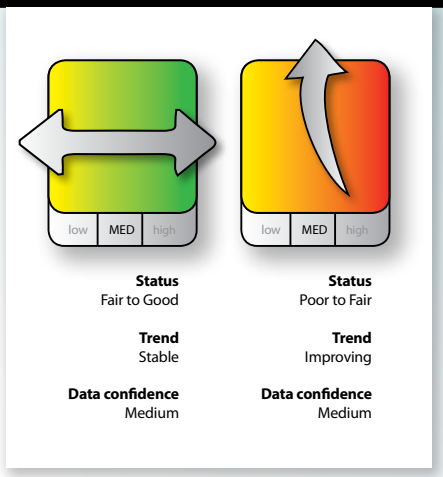
POTABLE WATER

Introduction

Water used for drinking, bathing and washing in the Cook Islands comes from three sources: groundwater, direct rainfall harvesting, and streams or springs (Figure 171). In the southern islands, water is largely sourced from springs and streams within catchment valleys, for example, Rarotonga with 14 intakes (Figure 172). In the northern islands (coral atolls), water is mainly sourced from rainwater and groundwater.

For this indicator, potable water is assessed using two primary indicators: 1) the proportion of the population with access to improved drinking water (i.e. water that has either gone through at least one stage of treatment or is from relatively clean sources), and 2) drinking water quality (i.e. the levels of bacterial contamination in the drinking water).

Access to improved water is assessed using Cook Islands Census data for all islands from 1986 to 2011. Drinking water quality is only available for Rarotonga and is assessed using the Ministry of Health bacterial sampling at drinking water intakes and houses around Rarotonga from 2008 to 2013.



ACCESS TO IMPROVED WATER

Status: Fair to Good Trend: Stable Confidence: Medium

DRINKING WATER QUALITY

Status: Poor to Fair Trend: Improving Confidence: Medium

Overall, access to improved potable water is fair to good, with almost 100% of the population having access to improved water. The southern islands are dominated by public water mains (Figure 173). Currently, Rarotonga's gravity-fed water system is the most comprehensive water supply infrastructure in the country and water is treated using coarse gravel filters. More recently, households have been installing private rainfall tanks with over 80% of the southern islands (excluding Rarotonga) having their own rain tank. The northern islands are almost 100% supplied by rain tanks with some community water catchment from ground-water boreholes or rainfall.

FIGURE 171. Water supply Intake in Rarotonga
(Water Supply Master Plan for Rarotonga)

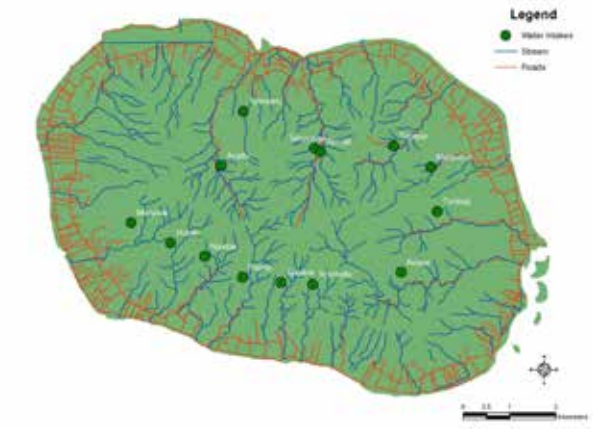


FIGURE 172. Public Water main intakes in Rarotonga.
(Data source NES, map prepared by SPREP)

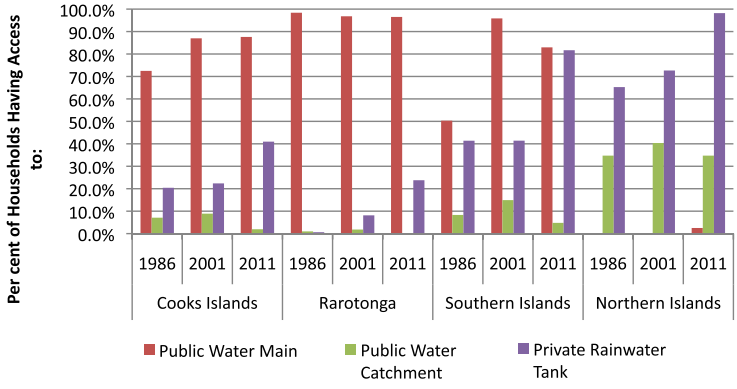


FIGURE 173. Per cent of households with access and types of drinking water sources by region.
(Cook Islands Census 1986, 2001 and 2011)

On islands with public mains, water losses are high due to the ageing infrastructure. In Rarotonga, estimates for 2013 reveal that up to 29% of treated public water is lost due to leakage (Figure 174). Water quality is not as good as access, with most tap water requiring boiling. Sources are prone to contamination from animal and human pollutants at the source and within the system itself and the current treatment of public sources does not remove bacteria effectively. In Rarotonga, most hotels have their own advanced treatment systems.

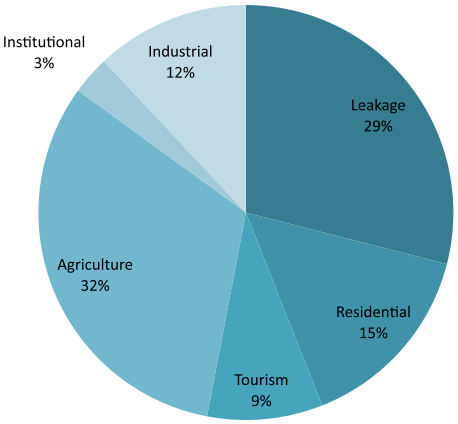


FIGURE 174. 2013 Water demand estimates for Rarotonga. (Water Supply Master plan for Rarotonga, 2014)

Between 2008 and 2013, most public water intakes in Rarotonga were regularly over the WHO standard of 0 Faecal Coliforms/100ml (see Figures 175 and 176) but often within the Cook Islands the standard is 50 per 100ml. No trend is detectable at this point. However, with the installation of public treated water filling stations in Rarotonga and Aitutaki, and more rainwater tanks, drinking water quality is likely improving overall.

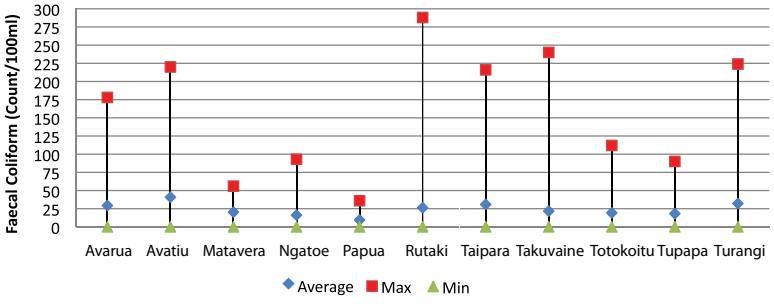


FIGURE 175. Average, Minimum and Maximum Faecal Coliform counts per 100ml at standpipes in 11 water districts in Rarotonga (2008–2013) (Cook Islands Standard = 50 count/100ml). (Ministry of Health)

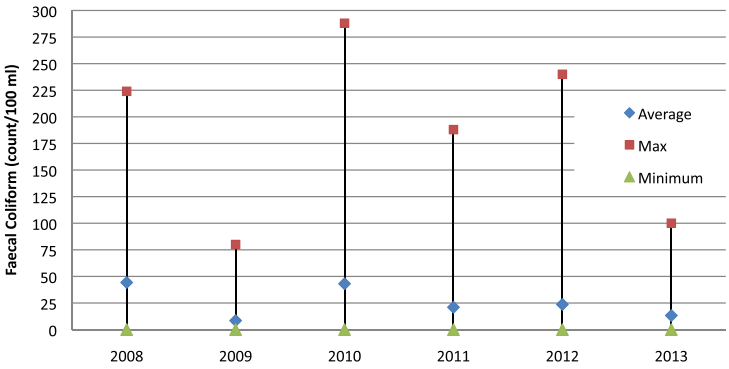


FIGURE 176. Average, Maximum and Minimum Faecal Coliforms values at all standpipes in Rarotonga 2008 to 2013. (Ministry of Health)

Impact

Poor drinking water can be responsible for a number of illnesses, including diarrhoea and skin sepsis. Figure 177 shows the reported cases of diarrhoea and skin sepsis from 2000 to 2012. A marked decrease in diarrhoea cases may show that, in regards to consumption, people are increasingly boiling their own water or finding other sources of clean drinking water. However, skin sepsis cases are still high, and may reflect continued exposure to untreated water from the households or polluted ambient environment (e.g. streams and lagoons).

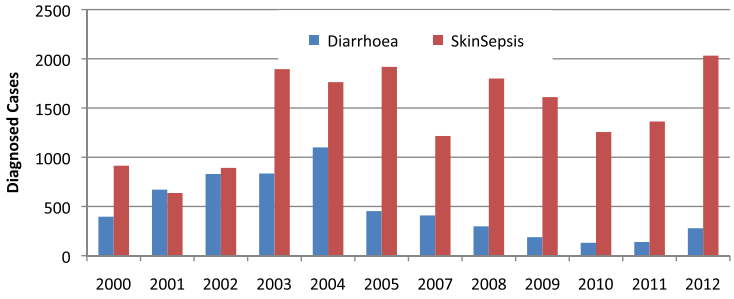


FIGURE 177. Reported and Diagnosed cases (by year) of water quality related diseases in Cook Islands. (Ministry of Health – Statistical Bulletins 2000 to 2013)

Aside from health impacts, water quality can have secondary impacts on the economy and environment. Health costs associated with water-borne illness can be costly to the medical systems but may also impact on tourist enjoyment. The establishment of drinking water filling stations can also be costly. A heavy dependence on bottled water by tourists and citizens is not only costly but adds to an already burdened waste management system.

Response and Recommendations

Cook Islands is providing clean public water to 87% of its citizens while the rest use private catchments. One example is the Aitutaki Lagoon Resort, which installed their own desalination equipment.

Over the recent years many water tanks were installed to improve water security in the Cook Islands. These initiatives took place under the Strengthening the Resilience of our Islands and Communities (SRIC) Project, Rarotonga Water Tank Subsidy Scheme, the Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC), NZ Aid Cyclone Pat Recovery, Community Tanks and others.

The Te Mato Vai planned to further treat water in Rarotonga by adding chlorine and fluoride, and to also address the leakage problems. The Ministry of Health developed a draft National Water Policy in 2015.

The government should endorse the draft national water policy and implement the eleven key objectives. This is to ensure all national water resources are protected from contamination and managed in an integrated, equitable and sustainable way. Everyone should continue to have access to safe drinking-water; all public health risks associated with unsafe drinking water are identified and managed in a timely manner, and all sanitation requirements to ensure the above are implemented (Draft national water policy, 2015).

P.Webb, Cook Islands News

SOURCES

Ministry of Health – Medical Record Unit. 2013. Statistical Bulletin 2012.

Ministry of Finance and Economic Management (MFEM). 1991. Statistics Office. *Cook Islands Census 1986 Census of Population and Dwellings*.

Ministry of Finance and Economic Management (MFEM). 2003. Statistics Office. *Cook Islands Census 2001 Census of Population and Dwellings*.

Ministry of Finance and Economic Management (MFEM). 2012. Statistics Office. *Cook Islands Census 2011 Census of Population and Dwellings*.

Government of the Cook Islands – Ministry of Finance and Economic Management. 2014. Mato Vai Water Supply Master Plan for Rarotonga.

Government of Cook Islands. 2015. National water policy.

Compacted aluminium cans. (N.Woonton)

Waste materials at the landfill. (N.Woonton)

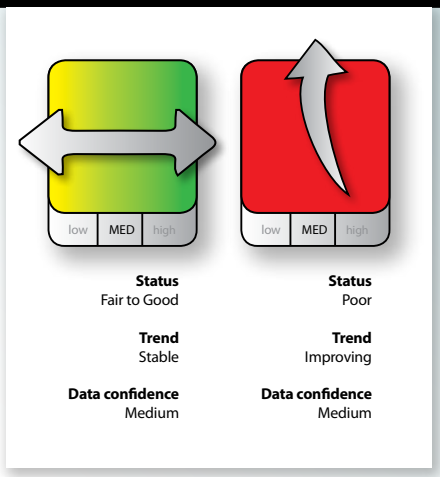
SEWERAGE AND SANITATION

Introduction

In the Cook Islands, the major sewage treatment systems are household septic systems (including flush and pour toilets), pit toilets and the rare, traditional lagoon toilet. Management of sewage waste is a major problem, in part, due to limited space, porous soils and heavy rainfall. This quickly flushes contaminants into the environment (Figure 178). These challenges are compounded by scarce resources to develop an extensive sewage infrastructure, including a lack of compliance and poor enforcement of regulations.

For this indicator, two criteria are used to assess the state of sanitation and sewage in the Cook Islands. These are 1) access to "improved" sanitation, defined in the Cook Islands as the percentage of households with access to flush toilet systems, and 2) an assessment of the state of septic systems in Rarotonga. Access to information is derived from the 1986, 2001 and 2011 national census. The Rarotonga septic system assessment is derived from a septic audit study by Evans and Dakers in 2011.

FIGURE 178. Muri/Avana Septic Upgrade Work, 2012. (WATSAN Website)



ACCESS TO IMPROVED SANITATION

Ststus: Fair to Good **Trend: Stable** **Confidence: Medium**

SEPTIC SYSTEMS

Status: Poor **Trend: Improving** **Confidence: Medium**

Overall, access to improved sanitation is fair to good with almost 97% of households having access to flush or pour toilets (Figure 179). Nearly all (99%) Rarotonga residents have access to flush toilets. In the southern Pa Enua, access to toilets has more than doubled since 1986 to 87% of households. In the northern Pa Enua, most households have access to flush toilets but some places still use pit latrines and a handful of lagoon toilets exist. These are known to contribute towards sewage pollution in the Pa Enua.

All properties on Rarotonga have an on-site wastewater sanitation system of varying degree. Septic tank systems are widely used throughout Rarotonga and Aitutaki and septic disposal is the responsibility of each owner. In 2013, 1,460,000 litres of sewage were collected from tanks in Rarotonga and disposed of at a treatment facility.

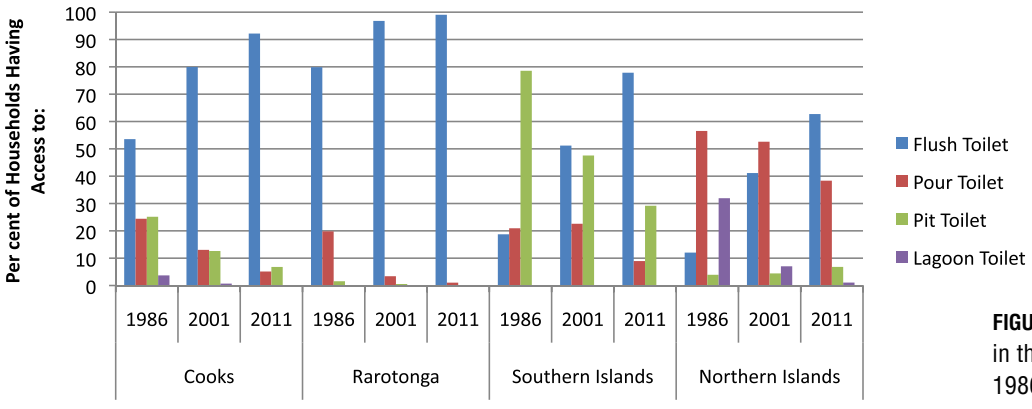


FIGURE 179. Access to toilet systems in the Cook Islands and regions 1986–2011. (Cook Islands Census)

Most sanitation systems in the Cook Islands are not treating effluent properly. The results of an audit of septic systems in Rarotonga (2011) revealed that up to 90% of septic systems are not functioning effectively and were either poorly designed, undersized for the number of users (e.g. resort developments) or suffered from a lack of maintenance. Figure 180 shows that of the assessed systems, 86% were installed prior to 1980, 50% of tanks leaked, 42% of tanks required immediate repair or replacement and 48% of tanks required desludging.

Impact

The main impact from poor access to sanitation is health related and includes gastrointestinal diseases and associated serious diseases such as typhoid, dysentery and hepatitis. These have profound impacts on social development, the economy and tourism. In addition, environmental impacts include eutrophication of rivers and marine waters, increased algal growth, smothering of coral reefs and reduced visibility. These affect fish, people's livelihoods and tourism operators.

Sanitation systems need to be improved but this also means higher maintenance costs. Cook Islands is making great efforts to find which systems are best for different areas as new systems may still result in high nitrate levels.

Response and Recommendations

The national government is actively promoting and installing composting toilets in households as well as public and tourist facilities. The Ministry of Health developed sanitation regulations in 2014. The established Water, Waste and Sanitation Unit (WATSAN) and NZAid programme upgraded 214 sanitation systems in Muri, Rarotonga and Aitutaki (Table 28).

TABLE 28. Total number of houses upgraded

Year	Total Septic Upgrades
2012	136
2013	63
2014	4
Total Houses upgraded (some houses share one system)	214

Cluster systems and piping sewage out of the lagoon with a deep ocean outfall is being discussed, but it is also thought that composting toilets may be part of the solution.

Resources should be used to monitor areas that are major sources for septic pollution. The access to improved sanitation systems (improved from current septic systems) should be collected through the next census.

The government promotion of composting toilets should be continued and options for commercial level systems, or systems specifically for the coastal berm e.g. reticulated, should be investigated.

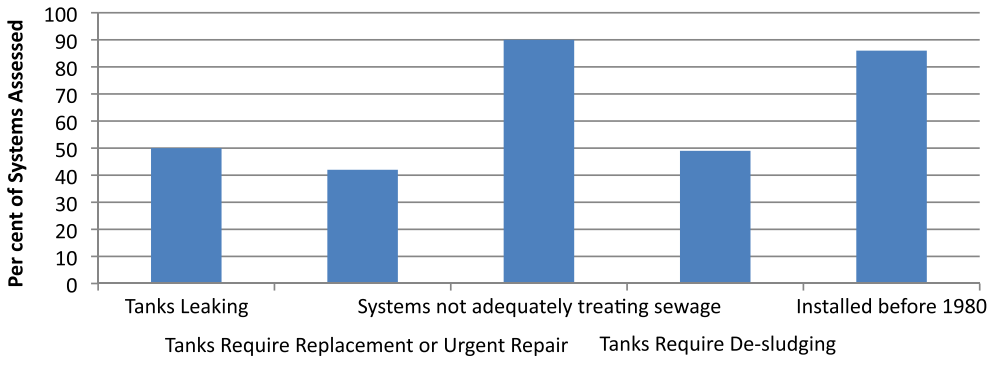


FIGURE 180. Audit results of Rarotonga septic systems. (Evans, J. and Dakers, A. 2011, Ministry of Health).

SOURCES

Asian Development Bank (ADB). 2009. Final Report TA 7022-C00: Preparing the Infrastructure Development Project. Volume 3: Water Supply and Sanitation Sector.

Cook Islands Statistics Office. Ministry of Finance and Economic Management. Cook Islands

Census Of Population and Dwellings. 1986.

Cook Islands Statistics Office. Ministry of Finance and Economic Management. Cook Islands

Census Of Population and Dwellings. 2001.

Cook Islands Statistics Office. Ministry of Finance and Economic Management. Cook Islands

Census Of Population and Dwellings. 2011.

Evans, J. and Dakers, A. 2011. Audit of Rarotonga's Domestic Sanitation Systems. Ministry of Health, Rarotonga.

Government of Cook Islands: DRAFT National Water, Sanitation and Climate Outlook, 2014

N.Woonton


Keep Aitutaki Clean
RECYCLE
RECYCLE
PLASTIC BOTTLES
Keep Aitutaki Clean
Keep Aitutaki Clean

N.Woonton

CONCLUSION AND RECOMMENDATIONS

U.Wragg

CONCLUSION AND RECOMMENDATIONS

Several global and regional drivers are altering the environment in Cook Islands. They include globalisation and exposure to world markets, rising incomes and population, urbanisation, rapid expansion and growth of technologies, new and existing cultural norms and global climate change. In turn, these drivers are creating pressures on the land, marine, freshwater, atmosphere and built up ecosystems. These pressures include land development, overcrowding of urban centres, waste generation and energy consumption and resource extraction.

These pressures are, in varying degrees, affecting the environment. This effect has been measured in this report by evaluating the state of key habitats, ecosystems, climate variables, and species.

Although gaps exist, Cook Islands is a leading nation in the Pacific in terms of addressing biodiversity loss, threats of climate change and integrating ecosystem health with sustainable tourism. While much work remains to be done there have been impressive achievements over the last decade. Twenty six per cent of "state" conditions in this report are rated as poor, sixteen per cent as good and over half of them (55%) are rated as fair (Figure 181).

Good progress was made toward the 2020 goal of 100% renewable energy generation for electricity. This is particularly important because the two largest sources of CO_2 emissions are from land transport and electricity generation and these two sources have also risen by the greatest percentage. Efforts to meet the 2020 goal for renewable electricity generation should continue, while also increasing efforts to reduce energy consumption in the road transport sector. There is a significant opportunity to reduce CO_2 emissions, lower fuel costs and improve human health by increasing access to public transportation, adding bicycle lines and increasing energy efficiency standards for imported vehicles.

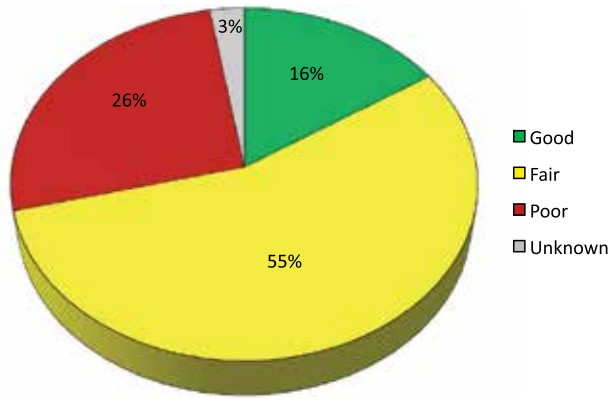


FIGURE 181. Percentage of Indicators that are Good, Fair, Poor and Unknown.

Cook Islands is doing extremely well in the handling of Ozone Depleting Substances (ODS) under the Montreal Protocol. The ODS includes CFCs and HCFCs, of which the first one was successfully phased out in 2010. Under the Montreal Protocol, HCFCs are to be phased out in 2030. However, Cook Islands have reduced their HCFC imports significantly and there were no imports in 2015. This success should be continued – it is important that technicians attend training and that refresher courses are offered. Data collection is very good but could be improved by also recording data for ODS exports from Cook Islands for disposal.

The excellent progress in meeting Montreal Protocol commitments and tracking progress sets the standard for managing MEA implementation. This should be replicated where possible.

The progress towards integrating climatic data and climate change prediction into national and sectoral policy and projects is a high priority for the Cook Islands, and should continue. Cook Islands has effectively shown the environment and economy-wide impacts of climate change. The next steps include ensuring that problems such as ocean acidification, dengue fever outbreaks, impacts of cyclones or other major storm events which impact agriculture, biodiversity and local communities are monitored and clearly linked to climate change. Climate data should continue to be integrated into other sectors such as agriculture, health and social welfare to better inform and enable preparation and planning.

Climate change, as identified in numerous national policy documents, impacts nearly every aspect of daily life and the environment. It is important to insure the environmental management and conservation factors in climate change and to build resilience to address climate change. The Cook Islands' Second National Communication under the UNFCCC is a useful document for exploring adaptation options for different thematic areas. Several national and international policies address climate adaptation and the Cook Islands is implementing many climate change adaptation projects. There is still a need to improve climate proofing which should be included in future adaption projects. Adaptation assessments on all islands could identify priority areas. Monitoring efforts should continue to have the best available data. Other important areas are disaster planning and management, drought management and bio-agriculture. Building codes should be amended to include climate proofing. Data related to health, land and infrastructure is limited and should be improved. Information to national policy and decision makers should be made available using existing platforms such as the Pacific Climate Change Portal (PCCP). If required a Climate Change Portal for the Cook Islands should be developed. Recommendations from national and international policies such as NESAF, UNFCCC and Kyoto Protocol should be implemented.

Cook Islands has an excellent biodiversity database and a solid track record of managing species of national concern. Species management plans are important but need to be part of a habitat management process to ensure that many species profit from a single action. For example, rat eradication in specific areas reduces pressures on many bird species and insects. It also increases the regeneration of important plants and can potentially restore balance to a stressed ecosystem.

Balancing economic development through increased tourism, with the maintenance of the national systems that make the Cook Islands a desired tourist destination, is a key development challenge.

Biodiversity, economic development and environmental planning must be considered together for the best outcome. For example, tourist development in the coastal area is often designed without consideration for marine wildlife, such as seawalls and night time lighting. Through proper planning with developers and government agencies, biodiversity values can be enhanced while also adding value to potential ecotourism. For example, turtle friendly coastal development with healthy turtle nesting populations have successfully promoted themselves as ecotourism destinations. This process can benefit from a robust EIA process.

The Cook Islands made significant progress in controlling some very damaging invasive species. This work is critical for biodiversity and for human health and safety. Natural disasters such as cyclones, which may become more extreme due to climate change, create gaps in the forest canopy and denude riverbanks. These openings provide pathways for invasive species to spread and dominate the new spaces. On high islands, invasive species can block rivers and, during high rainfall events, worsen flooding. The shallow root systems of invasive trees make them prone to wind-throw which cases extensive erosion and, during cyclones, a large amount of green waste.

Where species management plans have been successful it is important to build on their success and replicate where possible. There has been significant investment in species management, invasive species and protected area development in the Cook Islands. The most successful should be replicated. In the case of the *Tamanu* tree, effective species recovery will benefit several sectors including traditional knowledge and cultural preservation, as well as coastal protection and potential economic benefits from *Tamanu* oil. This is an example of many benefits linked to conservation.

Protected areas are a tool to manage habitats which the Cook Islands is using to protect many species. The Cook Islands committed under the CBD to have 17 per cent of its terrestrial area, and ten per cent of its coastal and marine area, protected by 2020. Currently, Cook Islands has declared six per cent of its land area as protected, and is in the process of zoning its EEZ under the Marae Moana marine park.

Protected areas benefit many stakeholders including the people of the Cook Islands, the tourist sector, pearl farmers, local fishermen and the biodiversity of the Cook Islands. Dedicated management of the protected areas can be very time consuming and costly, so this responsibility should be shared by relevant stakeholders. The Marae Moana has significant social and economic benefits. Some of the main social benefits include the empowerment of local leaders and community members to co-manage natural assets and protect their natural heritage.

Cook Islands makes a significant investment in the protection of migratory species such as turtles and whales. Anecdotal evidence suggests there is high community appreciation and understanding of the importance of marine mammals and reptiles to both the ecosystem, tourism and culture.

Tourists are attracted by walking tracks within protected areas and reserves, healthy reefs and pristine waters. Local fishermen will maintain their catch if no-take zones exist and are effective within the reef area and the critical megafauna, including shark populations, may stabilise in the future if the current regulations are fully enforced.

The efforts to prioritise important areas for management are well underway and include the use of Key Biodiversity Areas (KBA) and Important Bird Areas (IBA). The next steps are stakeholder buy-in and consultations with the NBSAP committee. This will be followed by planning which needs to consider all threatened species but also traditionally important plants such as herbs, food used for traditional medicine, or plants used for traditional costumes. This requires a holistic habitat management plan.

Forests are important ecosystems, providing clean water, biodiversity and habitats, sustainable forest products, and ecotourism opportunities. A 2015 study of the Rarotonga cloud forest supports this and showed its particular uniqueness. A major threat comes from invasive species and their management is a high priority. With the limited land base and generally intact forests, there is a high priority for monitoring, conservation and planning for this ecosystem. External threats including climate change require action now to bolster the resilience of the forest. A newly drafted National Invasive Species Strategy and Action Plan (2016) presents an opportunity to increase the resiliency of the forest and should be implemented.

Cook Islands was agriculturally sustainable for much of its history and was once an important foreign exchange earner, especially from oranges. Over time a $2 million dollar trade deficit has developed between imports and exports in vegetables. This shows changing agricultural production, consumption patterns and less food security. Declining agricultural production has led to more invasive species due to abandoned fields, and fewer local products available. Increasing the use of locally grown produce can have a positive impact on NCDs and overall health while supporting local business and farmers. As Cook Islands looks to diversify its livelihood opportunities in the face of climate change, the agriculture sector is well positioned for investment.

Rare ecosystem types require attention. Cloud forests are rare and particularly important for biodiversity. Wetlands are vital for agriculture, water quality functions and biodiversity. They act as a sink for water as well as waste products such as sediment, pesticides and herbicides. Wetlands also represent traditionally important sites for taro production. Wetlands are increasingly uncommon due to development pressures and the impacts of climate change. Since the main threats to wetlands are from development pressures, environmental impact assessments and proper enforcement of regulations will be critical in protecting these key ecosystems.

The offshore marine ecosystem, its biodiversity and specifically its healthy tuna population is critical for the health of the Cook Islands economy. With Bigeye and Bluefin *(Thunnus orientalis)* Tuna at their lowest levels ever, it is clear that more management efforts are required to protect this valuable resource which made up 79% of exports in 2007 (Gillett 2011). The Marae Moana is the best current opportunity to integrate pelagic biodiversity management with conservation planning. This zoning exercise provides space for local communities to ensure their values are taken into account, and to make explicit links between land, lagoon and the deep sea in relation to biodiversity.

Cook Islands is known for its pristine water and coral reefs which attract tourists, protect coastlines, provide habitat for marine species and provide livelihoods for local communities. Therefore it is important to keep the impacts on reefs low and to improve water management and sewage treatment. Available nutrients in the water and changes in the water quality can increase the algae cover. This can change the mix of reef fish, unbalance the reef and reduce resiliency. With the benefits and values coral reefs provide so clearly identified, it is important to redouble efforts to address the impacts from tourism, fishing, thermal stress and ocean acidification. There have been some very successful fishery management practices implemented at the site level in the Cook Islands. These practices include *Ra'ui* areas and species protection which should be replicated widely.

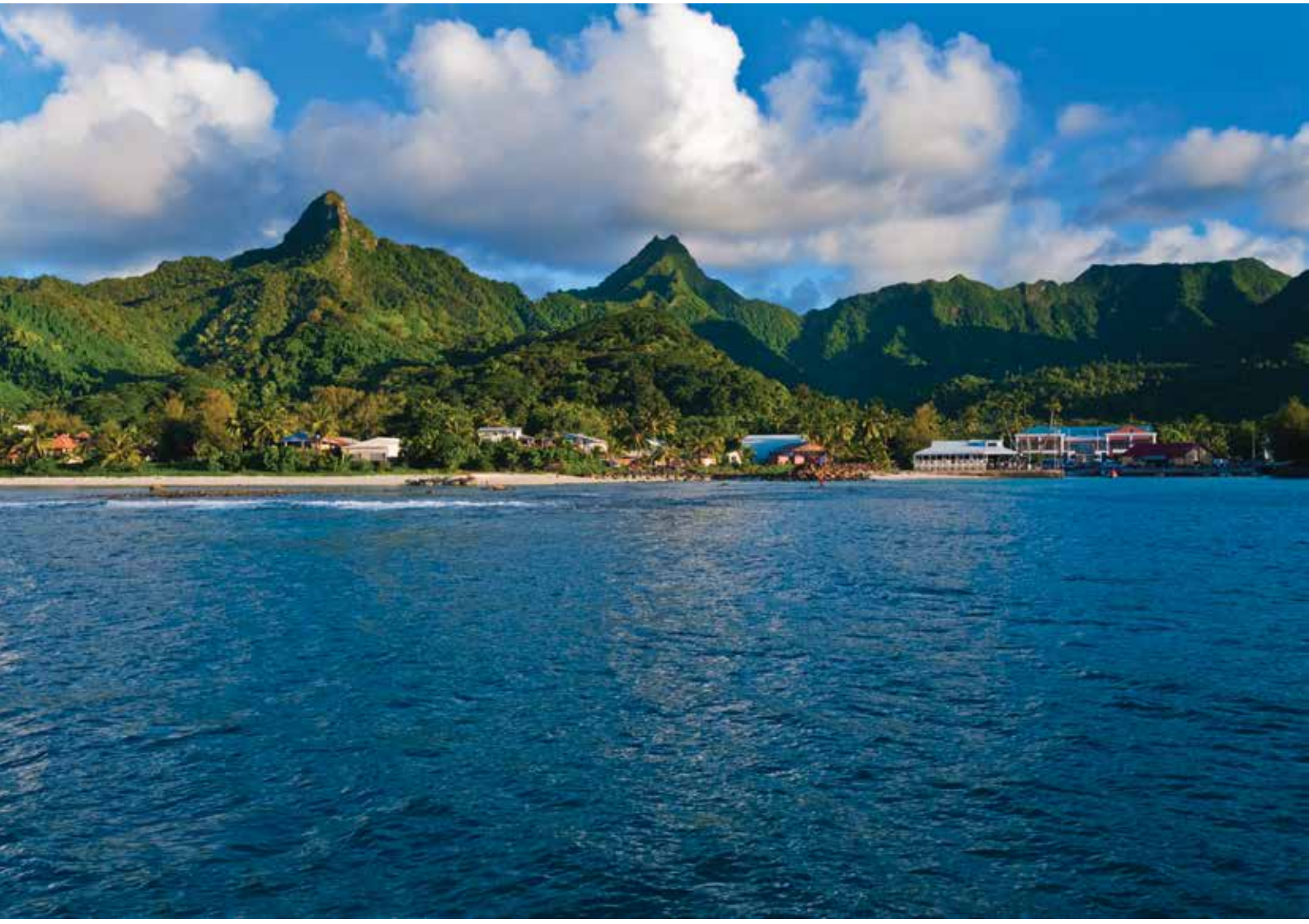
Many cultural sites and Marae are an integral part of the environment. Improved management and awareness of these sites will enhance the environment, cultural practices and values. The strong connection between culture and the environment benefits locals and the tourism sector, as the people and place draw tourists to the Cook Islands. Enhancement of local resources and traditional practices such as tapa making, basket weaving or costume making are examples of this mutual benefit.

Waste management is an important part of the management of natural resources as it impacts terrestrial, fresh water and marine ecosystems. Good waste management practices benefit human health, the environment and tourism sectors. The asbestos removal programme should be paired with an import ban due to serious health risks such as lung cancer.

Sewage and other pollutants have a serious impact on inland water and lagoon quality. Cook Islands in partnership with NZAid has established a Water, Waste and Sanitation Unit (WATSAN) to address water quality in inland waters and lagoons. The work of WATSAN is significant because improving water quality affects many key development areas including human health, biodiversity, coral reef health, tourism and waste management. As so much of the economy depends on tourism, enhancing lagoon water quality is essential for both reef and human health. While threats like climate change have to be mitigated on the global level, water quality is an issue that affects many sectors and can be addressed at the national and local level. Improved water quality will lead to more resilient ecosystems to help mitigate the impacts of global phenomena like climate change.

REFERENCES:

Gillett, R. (2011). Fisheries of the Pacific Islands: Regional and national information. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2011/03, 279 pages.



NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

UN environment programme

SPREP
Secretariat of the Pacific Regional Environment Programme

An initiative of the African, Caribbean and Pacific Group of States funded by the European Union

ACP MEAs 2