

INTERNATIONAL TRIBUNAL FOR THE LAW OF THE SEA

**REQUEST FOR AN ADVISORY OPINION SUBMITTED BY
THE COMMISSION OF SMALL ISLAND STATES ON
CLIMATE CHANGE AND INTERNATIONAL LAW**

(Request for Advisory Opinion submitted to the Tribunal)

WRITTEN SUBMISSION FROM THE PACIFIC COMMUNITY

16 JUNE 2023

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WRITTEN SUBMISSION OF THE PACIFIC COMMUNITY

I. INTRODUCTION

1. The present written submission is provided by the Pacific Community in accordance with the Order of the Tribunal of 15 February 2023, and the decision of the President of the Tribunal to consider the Pacific Community (SPC) as an intergovernmental organization likely to be able to furnish information on the questions submitted to the Tribunal for an advisory opinion, dated 8 June 2023.

2. As the Pacific region's oldest (76 years), largest, and primary scientific and technical intergovernmental organization, SPC's mandate and work programme have addressed issues relating to climate change, fisheries, marine ecosystems, and coastal geoscience for decades. SPC has a wealth of knowledge and expertise in global and regional analysis of the impacts of climate change, global warming and sea level rise on the marine and coastal environment and subsequent implications for Pacific countries and communities. This includes a broad range of data, observed impacts, and studies linked directly to the issues raised by the advisory proceeding. In addition, SPC leads the implementation of numerous programmes aimed at climate change mitigation and adaptation, including sea level rise, loss and damage, and sustainably managing maritime zones, ecosystems and resources in the Pacific region for current and future generations,¹ through its different divisions.² Particularly, the Climate Change and Environmental Sustainability Programme (CCES) leads support for reinforcing technical assistance, as well as strategic coordination to design and implement climate change adaptation and mitigation projects in the region.

3. SPC is also an active member of the Council of Regional Organizations in the Pacific (CROP), an essential committee for coordinating policy advice and providing technical expertise, assistance and support to Pacific countries. CROP as a regional architecture is guided by priorities espoused by Pacific Island Forum Leaders and the governing councils of respective organizations. Most recently, these are broadly captured under the 2050 Strategy for the Blue Pacific Continent,³ in which climate change and disasters, ocean and environment and security are featured prominently.⁴

¹ See Pacific Community, Strategic Plan 2022-2031 (Annex 1).

² Fisheries, Aquaculture and Marine Ecosystems (FAME); Geoscience, Energy and Maritime Division (GEM); Climate Change and Environmental Sustainability (CCES); Land Resources Division; Statistics for Development Division (SDD); Public Health Division (PHD); Education, Quality and Assessment Programme (EQAP) and Human Rights and Social Development (HRSD).

³ 2050 Strategy for the Blue Pacific Continent, Pacific Islands Forum Secretariat, 2022 (Annex 2).

⁴ The CROP was founded in 1988 under the name of "South Pacific Organisations' Coordinating Committee". CROP membership consists of the following Pacific regional inter-governmental organisations: Pacific Aviation Safety Office (PASO); Pacific Community (SPC); Pacific Islands Forum Fisheries Agency (FFA); Pacific Islands Development Program (PIDP); Pacific Islands Forum Secretariat (CROP Chair); Pacific Power Association (PPA); Secretariat of the Pacific Regional Environment Programme (SPREP); South Pacific Tourism Organisation

4. In accordance with the SPC’s mandate,⁵ the present submission focuses on the obligations related to preventing, reducing, and controlling pollution of the marine environment in relation to climate change and protecting and preserving the marine environment in light of climate change impacts.

II. CURRENT STATUS

5. In 2022, Pacific Leaders reaffirmed that climate change remains the region’s single greatest security threat when launching the 2050 Strategy for the Blue Pacific Continent. Leaders again prioritised addressing climate change in March 2023 when launching the Pacific Security Outlook Report 2022-2023. In 2019 Kainaki II Declaration, Pacific Leaders called on all parties to the Paris Agreement to meet or exceed their Nationally Determined Contributions (NDCs) to pursue global efforts to limit global warming to 1.5°C above pre-industrial levels, recognising that this is critical to the security of the Blue Pacific.⁶ In the Ocean Statement of 2021, Leaders reiterated calls “for urgent action to reduce and prevent the irreversible impacts of climate change on our Ocean reiterating that climate change is the single greatest threat to the livelihoods, security and wellbeing of the peoples of the Blue Pacific.” They further stressed with concern that unless urgent action is taken, there would be significant adverse impacts on the Ocean with “[t]he recognition of the ocean-climate-biodiversity nexus entails that the protection of one cannot be at the expense of the other, and that radical ambition is required.”⁷

6. Recent scientific analysis of the impact of existing and new NDCs compared to the “emissions gap”⁸ shows that the gap has only been narrowed by 11-14 %.⁹ Globally, States are on track for 2.4 degrees of warming and an optimistic scenario would indicate a 2-degree warming if all net zero targets are implemented.¹⁰ These developments are still insufficient. A recent report by the International Energy Agency (IEA) states there is an immediate need to halt subsidies toward fossil fuel supply, new unabated coal plans, new oil and gas fields and new coal mines.¹¹

(SPTO); and The University of the South Pacific (USP). See online: <https://www.spc.int/updates/blog/2018/08/council-of-regional-organisations-of-the-pacific-crop-turns-30>; and <https://www.spc.int/sites/default/files/wordpresscontent/wp-content/uploads/2017/01/Response-to-Climate-Change.pdf>.

⁵ See Article IV, §§ 6-10, of the Canberra Agreement establishing the South Pacific Commission (*United Nations Treaties Series*, vol. 97, p. 227).

⁶ Kainaki II Declaration for Urgent Climate Action Now, 2019 (Annex 3).

⁷ Pacific Islands Forum Leaders Ocean Statement 2021 (Annex 4).

⁸ See also <https://www.unep.org/resources/emissions-gap-report-2022>.

⁹ Climate Action Tracker, Global Update, Climate Summit, May 2021 (Annex 5).

¹⁰ Ibid.

¹¹ IEA, *Fossil Fuels Consumption Subsidies 2022*, IEA, Paris, 2023 (available at: <https://www.iea.org/reports/fossil-fuels-consumption-subsidies-2022>).

7. The Pacific Ocean is the largest ocean area of the world, and which absorbs a very large amount of heat from global warming as well as CO₂. Without healthy oceans, this vital function could be jeopardized. Pacific Small Island Developing States (PSIDS) manage over 10 % of the world's ocean and 20 % of the global marine jurisdictions in their Exclusive Economic Zone (EEZ).

8. The most recent Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6 Report) shows ocean warming, ocean acidification & deoxygenation will continue to increase in the 21st century at rates dependent on future emissions of carbon dioxide and greenhouse gases (GHG).¹²

9. The IPCC AR6 states with high confidence that ocean warming, and ocean acidification have already affected food production including shellfish aquaculture and fisheries in some regions.¹³ The capacity of oceans to absorb carbon dioxide will also be diminished under higher warming scenarios. The IPCC consistently reports impacts and risks to ocean ecosystems from climate change under various warming scenarios.

10. Despite dire warnings from the IPCC, the impacts of ongoing ocean warming, acidification, and deoxygenation caused by increased carbon dioxide and GHG emissions are often misunderstood or not reflected across mainstream climate mitigation or adaptation priorities across the United Nations Framework Convention on Climate Change (UNFCCC). The ocean and climate change dialogues agreed to at the 27th Conference of the Parties to the UNFCCC has only commenced to facilitate discussions on these issues in June 2023.

11. The lack of specific responses to ocean warming, acidification and deoxygenation across the UNFCCC poses a substantial and currently unaccounted for risk to coastal community resources, well-functioning marine ecosystems, seafood security and economies.

12. The lack of specific responses to ocean warming, acidification and deoxygenation also risks undermining the effectiveness of more mainstream mitigation and conservation tools like blue carbon ecosystems and habitat restoration efforts, marine protected areas, nature-based solutions, and climate-resilient fisheries and aquaculture.

13. Finally, lack of recognition of acidification and deoxygenation by the UNFCCC risks exacerbating these effects through ocean-based climate interventions that seek mitigation through enhanced primary production or carbon disposal in the deep ocean, as well as geo-engineering proposals that would alter ocean chemistry with uncertain consequences.

¹² Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2022 (also available at: https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf).

¹³ *Ibid.*

III. IMPACTS RELEVANT TO THE PACIFIC ISLANDS REGION

A. Pelagic fisheries

14. Around 55 % of the world’s tuna landings come from Western and Central Pacific waters¹⁴ while 47 % of Pacific households list fishing as either a primary or secondary source of income with national fish consumption in the Pacific islands being three to four times the global average. Pacific Ocean-based shipping and tourism provides USD 3.3 billion each year to the national economies of Pacific Island Countries and Territories.¹⁵

15. Recent science in a published study called *Pathways to sustaining tuna-dependent Pacific Island economies during climate change*¹⁶ highlights the impacts of climate change on tuna in the region under different scenarios. Climate change is driving tuna further to the east and into the high seas, threatening the economic and food security of PSIDS:

- (a) Climate-driven redistribution of tuna threatens not only to disrupt PSIDS economies, but the sustainable management of the world’s largest tuna fishery.
- (b) By 2050, under a high greenhouse gas emissions scenario (RCP 8.5), the total biomass of three tuna species in the waters of ten PSIDS could decline by an average of 13 % (range = –5 % to –20 %), due to a greater proportion of fish occurring in the high seas.
- (c) The potential implications for Pacific Island economies in 2050 include an average decline in purse-seine catch of 20 % (range = –10 % to –30 %), an average annual loss in regional tuna-fishing access fees of USD 90 million (range = –USD 40 million to –USD 140 million) and reductions in government revenue of up to 13 % (range = –8 % to –17 %) for individual PSIDS.
- (d) Redistribution of tuna under a lower-emissions scenario (RCP 4.5) is projected to reduce the purse-seine catch from the waters of PSIDS by an average of only 3 % (range = –12 % to +9 %), indicating that even greater reductions in greenhouse gas emissions, in line with the Paris Agreement, would provide a pathway to sustainability for tuna-dependent Pacific Island economies.

¹⁴ S. R. Hare *et al.*, *The western and central Pacific tuna fishery: 2021 overview and status of stocks*. *Tuna Fisheries Assessment Report no. 22*, Pacific Community, Noumea, 2022 (available at: <https://purl.org/spc/digilib/doc/8izba>).

¹⁵ H. Seidel and P. N. Lal, *Economic value of the Pacific Ocean to the Pacific Island Countries and Territories*, IUCN, Gland, 2010 (available at: https://www.iucn.org/sites/default/files/import/downloads/economic_value_of_the_pacific_ocean_to_the_pacific_island_countries_and_territories_p.pdf).

¹⁶ J. D. Bell *et al.*, “Pathways to sustaining tuna-dependent Pacific Island economies during climate change”, *Nature sustainability*, Vol. 4, 2021, p. 900-910 (Annex 6) (also available at: <https://www.nature.com/articles/s41893-021-00745-z>).

B. Impacts on Coastal Fisheries

16. The decline in warm-water coral reefs is projected to greatly compromise the services they provide to society, such as food provision (high confidence). Increases in the risks for seafood security (medium confidence) associated with decreases in seafood availability are projected to elevate the risk to nutritional health in some communities highly dependent on seafood (medium confidence). Such impacts compound any risks from other shifts in diets and food systems caused by social and economic changes and climate change over land (medium confidence).¹⁷

17. Climate change impacts on marine ecosystems and their services put key cultural dimensions of lives and livelihoods at risk (medium confidence), including through shifts in the distribution or abundance of harvested species and diminished access to fishing or areas. This includes potentially rapid and irreversible loss of culture and local knowledge and Indigenous knowledge, and negative impacts on traditional diets and food security (medium confidence).¹⁸

C. Coral Reef Systems

18. The ocean warming trend documented in the IPCC Fifth Assessment Report (AR5) has continued, and this has been documented in AR6.¹⁹ Since 1993, the rate of ocean warming and thus heat uptake has more than doubled (likely) and is attributed to anthropogenic forcing (very likely).

19. The ocean will continue to warm throughout the 21st century (virtually certain). By 2100, the top 2000 m of the ocean are projected to take up 2-7 times more heat (depending on the emission scenario) than the observed accumulated ocean heat uptake since 1970 (very likely).

20. Warm-water coral reefs are currently impacted by extreme temperatures and ocean acidification (high confidence). Marine heatwaves have already resulted in large-scale coral bleaching events at increasing frequency (very high confidence) causing worldwide reef degradation since 1997, and recovery is slow (more than 15 years) if it occurs (high confidence).

21. Globally, marine heatwaves have doubled in frequency and have become longer-lasting, more intense and more extensive (very likely). It is very likely that between 84-90 % of marine

¹⁷ Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2023*. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Geneva, 2023, 5.3 (“IPCC AR6”).

¹⁸ *Ibid.*

¹⁹ Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Synthesis Report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Geneva, Switzerland, 2014 (also available at: https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf).

heatwaves that occurred between 2006 and 2015 are attributable to the anthropogenic temperature increase.

22. Marine heatwaves are projected to further increase in frequency, duration, spatial extent and intensity (maximum temperature) (very high confidence). Climate models project increases in the frequency of marine heatwaves by 2081-2100, relative to 1850-1900, by 20 to 50 times (depending on the emission scenario). The tropical region is a region where this increase will be the largest. The intensity of marine heatwaves is projected to increase about 10-fold under the high emission scenario by 2081-2100, relative to 1850-1900 (medium confidence).

23. Almost all warm-water coral reefs are projected to suffer significant losses of area and local extinctions, even if global warming is limited to 1.5° C (high confidence). The species composition and diversity of remaining reef communities is projected to differ from present-day reefs (very high confidence).

D. Ocean Acidification

24. The ocean has taken up between 20-30% (very likely) of total anthropogenic CO₂ emissions since the 1980s causing further ocean acidification. Open ocean surface pH has declined by a very likely range of 0.017-0.027 pH units per decade since the late 1980s, with the decline in surface ocean pH very likely to have already emerged from background natural variability for more than 95 % of the ocean surface area.

25. Continued carbon uptake by the ocean by 2100 is virtually certain to exacerbate ocean acidification. Open ocean surface pH is projected to decrease by around 0.3 pH units by 2081-2100, relative to 2006-2015 (virtually certain).

E. Sea level and coastal changes

26. Global mean sea level (GMSL) is rising (virtually certain) and accelerating (high confidence). GMSL will rise between 0.43 m and 0.84 m (depending on emission scenarios) by 2100 (medium confidence) relative to 1986-2005. There is a 17 % chance that GMSL will exceed 1.10 m under the highest emission scenario in 2100.

27. Under the highest emission scenario, the rate of sea level rise will be 15 mm per year (10–20 mm per year, likely range) in 2100, and could exceed several cm per year in the 22nd century.²⁰ For Pacific Islands, GMSL is compounded by the vertical movement of the islands themselves, due to tectonic or human activities, which can increase the impact of GMSL rise.

²⁰ Intergovernmental Panel on Climate Change (IPCC), *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*, Cambridge University Press, 2022, p. 321-445 (Chapter 4) (also available at: https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/SROCC_FullReport_FINAL.pdf).

28. Due to projected GMSL rise, extreme sea level events that are historically rare (for example, today's hundred-year event) will become common by 2100 under all emission scenarios. More recent science presented at the UNFCCC meetings in June 2023 noted a growing body of research that confirms 2°C warming above pre-industrial is insufficient to slow rates of global sea level rise. Only SSP1-1.9, with temperatures peaking around 1.6°C and levelling off below 1.5°C, avoids long-term acceleration of sea level rise. Sea level continues to accelerate even after rate of warming slows.²¹

29. Well-designed coastal protection is very effective in reducing expected impacts from extreme sea level events, but generally unaffordable for rural and poorer areas (high confidence). The IPCC 6AR also states that “[a]daptation options that are feasible and effective today will become constrained and less effective with increasing global warming. With increasing global warming, losses and damages will increase and additional human and natural systems will reach adaptation limits. Maladaptation can be avoided by flexible, multi-sectoral, inclusive, long-term planning and implementation of adaptation actions, with co-benefits to many sectors and systems (high confidence).”²²

30. Risk related to rise in GMSL (including erosion, flooding and salinisation) is expected to significantly increase by the end of this century along all low-lying coasts in the absence of major additional adaptation efforts (very high confidence).²³

31. Coastal communities in the Pacific region have been significantly affected by the range of climate change impacts to date including those that have manifested in the ocean – such as wave inundation, and coastal erosion, deterioration of coastal food systems and fresh water sources. These climate change-exacerbated environmental impacts have forced many communities to abandon their ancestral lands and important traditional food sources, and relocate to safer areas, often resulting in the loss of cultural heritage, cultural identity, cultural practices, social cohesion, and economic stability and insecurity. The displacement of these communities poses significant challenges in terms of safeguarding human rights, ensuring access to basic services, and maintaining community structures. There are also many implications for receiving communities and the ability of nations to effectively relocate communities where there are limited land resources and highly complex land tenure systems.

IV. DISPLACEMENT OF COASTAL COMMUNITIES IN THE CONTEXT OF CLIMATE CHANGE

32. SPC would like to draw attention to the observed and experienced displacement of coastal communities in the context of climate change. The impacts of climate change, including ocean warming, sea level rise, and ocean acidification, have had profound effects on the marine environment (see points 14 - 31), resulting in adverse consequences for the livelihoods and

²¹ Estimates based on IPCC AR6 and DeConto et al. (2021), Stokes et al. (2022) and Park et al. (2023).

²² IPCC 6AR, Summary for Policymakers, p. 19, para. B.4 (also available at: https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf).

²³ IPCC 6AR, Summary for Policymakers.

well-being of coastal communities, including their very security and survival. It is well documented and appreciated that climate change is an existential threat for many PSIDS.²⁴ The subsequent consequences that follow displacement also go beyond impacts on coastal communities, particularly as the climate crisis expands.²⁵

V. LEGAL ASPECTS TO THE REFERENCED SCIENTIFIC STUDIES

A. Displacement of Coastal Communities in Relation to Climate Change Impacts

33. Coastal communities in the Pacific region have been significantly affected by the displacement caused by wave inundation, coastal erosion and sea level rise. These environmental changes have forced communities to abandon their ancestral lands and relocate to safer areas, often resulting in the loss of cultural heritage, cultural identity, cultural practices, social cohesion, and economic stability. The displacement of these communities poses significant challenges in terms of safeguarding human rights, ensuring access to basic services, and maintaining community structures.²⁶

B. Obligations under UNCLOS

34. **Prevention, Reduction, and Control of Pollution:**²⁷ State Parties to UNCLOS have an obligation to prevent, reduce, and control pollution of the marine **environment** resulting from anthropogenic greenhouse gas emissions into the atmosphere, which contribute to climate change impacts. In the context of coastal communities' displacement, this obligation requires proactive measures to mitigate the effects of climate change, including the implementation of sustainable development practices, the reduction of greenhouse gas emissions, and the promotion of climate change adaptation strategies that prioritize the protection of vulnerable communities.

35. **Protection and Preservation of the Marine Environment:**²⁸ State Parties have a duty to protect and preserve the marine environment, taking into account the impacts of climate change such as ocean warming, sea level rise, and ocean **acidification**. This obligation extends to safeguarding the rights and well-being of coastal communities, in particular indigenous

²⁴ Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2022*, op. cit. (fn 12), Chapter 15 (Small Islands), p. 2043 ff.

²⁵ See IPCC AR6, Summary for Policymakers, p. 13, para. B.1.4, and p. 15, para. B.2.1 (also available at: https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf).

²⁶ See e.g., Ian Fry (Special Rapporteur on the promotion and protection of human rights in the context of climate change) *Providing legal options to protect the human rights of persons displaced across international borders due to climate change*, A/HRC/53/34, 18 April 2023; and Cecilia Jimenez-Damary (Special Rapporteur on the human rights of internally displaced persons), *Human rights of internally displaced persons*, A/75/207, 21 July 2020. See also SPREP: CBDAMPIC final reports www.sprep.org.

²⁷ United Nations Convention on the Law of the Sea (UNCLOS), Part XII (Protection and Preservation of the Marine Environment), Article 194.

²⁸ *Ibid.*, Article 192.

communities, especially in light of global and regional cooperation requirements for formulating and elaborating international rules, standards and recommended practices and procedures consistent with the Convention, for the protection and preservation of the marine environment.²⁹ To reduce the negative economic and cultural impacts on PSIDS coastal communities, it is important to recognize the critical contribution the marine environment has on community economies and livelihoods, particularly as regards the redistribution of fish stocks and other losses of natural resources from the effects of climate and ocean change.

C. Relevance to ITLOS Advisory Proceedings

36. While the development of the Regional Framework on Climate Mobility Framework is still in progress through the Pacific Island Forum process, evidence gathered to date on displaced communities in the Pacific region can serve as valuable supporting evidence to showcase the impact of wave inundation and coastal erosion.³⁰ The regional dialogue is facilitated through the Pacific Islands Forum Secretariat (PIFS), led by the International Organization for Migration (IOM) and Economic and Social Commission for Asia and the Pacific (ESCAP) alongside the international Labour Organization (ILO), Office of the High Commissioner for Human Rights (OHCHR), and the Platform on Disaster Displacement (PDD). All together, this forms the joint-agency Pacific Climate Change Migration and Human Security (PCCMHS) programme. All participants reviewed and provided inputs into the draft Pacific Regional Framework on Climate Mobility that aims to guide governments in addressing the legal, policy and practical issues that arise from the four main types of climate mobility: displacement, migration, evacuations and planned relocation.³¹ The testimonies, case studies, and data collected from affected communities provide compelling evidence of the need for stronger legal frameworks and coordinated international efforts to address the challenges faced by coastal communities in the face of climate change-induced displacement.³²

37. Furthermore, the specific obligations of State Parties under UNCLOS in addressing the impacts of climate change on coastal communities are closely linked to the concept of loss and damage. Loss and damage refers to the adverse effects experienced by countries, particularly PSIDS, that are unable to cope with the economic, social, and cultural losses resulting from the impacts of climate change. The displacement of coastal communities due to wave inundation and coastal erosion represents a significant aspect of loss and damage, as it entails the loss of land, property, livelihoods, food sources, and cultural heritage. By acknowledging the linkages between state obligations under UNCLOS and the concept of loss and damage, the advisory

²⁹ *Ibid.*, Article 197 on cooperation on a global or regional basis.

³⁰ See Pacific climate change migration and human security (PCCMHS) programme, *Regional policy dialogue. Summary Report*, 2022 (available at <https://www.preventionweb.net/publication/pacific-climate-change-migration-and-human-security-pccmhs-programme-regional-policy>).

³¹ *Ibid.*

³² See also 2023 Pacific Island Forum Regional Conference on Statehood and the Protection of Persons Affected by Sea Level Rise, Summary and Outcomes, Nadi, Fiji, 30 March 2023 (available at: <https://www.forumsec.org/2023-regional-conference-on-statehood-and-the-protection-of-persons-affected-by-sea-level-rise/>).

opinion can shed light on the nature of these obligations, especially as regards international cooperation.

VI. CONCLUSION

In conclusion, the Pacific Community (SPC) respectfully requests that the advisory opinion on the specific obligations of State Parties to UNCLOS includes the aforementioned dimensions on the observed effects of climate-related ocean-changes on coastal ecosystems and communities. By recognizing the impacts on people and communities, the advisory opinion can better emphasize the urgent need for collective action to fulfill the obligations of State Parties under UNCLOS and ensure the protection and preservation of the marine environment in the face of climate change.

Noumea, 16 June 2023



Dr. Stuart Minchin
Director-General of the Pacific Community

Annexes to the Written Statement of the Pacific Community

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- Annex 5. Climate Action Tracker, Global Update, Climate Summit (May 2021)
- Annex 6. J. D. Bell *et al.*, “Pathways to sustaining tuna-dependent Pacific Island economies during climate change”, *Nature sustainability*, Vol. 4, 2021, p. 900-910

Annex 1

Pacific Community, Strategic Plan 2022 2031

(available at: <https://purl.org/spc/digilib/doc/uzzya>)



Pacific
Community
Communauté
du Pacifique

STRATEGIC PLAN 2022–2031

*Sustainable Pacific development
through science, knowledge
and innovation*

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FOREWORD

CHAIR OF THE TWELTH CONFERENCE OF THE PACIFIC COMMUNITY

On behalf of the Pacific Community's (SPC) governing council, it gives me great pleasure to present the Pacific Community's Strategic Plan 2022 to 2031.

It has been a privilege to chair the consultations amongst SPC members and stakeholders in endorsing this Plan. I thank the Subcommittee for their work on the Strategic Plan and SPC's Secretariat for their commitment to ensuring a member-driven, inclusive and consultative approach, despite the challenges caused by the COVID-19 pandemic. The Plan's completion and endorsement is testament of our shared stewardship towards developing and transforming our Blue Pacific Continent.

'Blue Prosperity and Pacific Well-Being' is the thematic session of the Twelfth Conference of the Pacific Community, reflecting our new Strategic Plan's vision: A peaceful and prosperous region committed to a people-centred approach to sustainable development that is unique to the Blue Pacific, and that defines our progress and ambitions through our own interpretation of 'Well-Being' and success, beyond traditional measures like GDP. We acknowledge the centrality of our blue resources and our shared custodianship for the Ocean, as set out in the long-term vision for prosperity in the 2050 Strategy for the Blue Pacific Continent.

The Plan reflects a commitment to resourcing and transforming the Pacific Community's interventions, serving its members as 'One SPC' and holding itself accountable through professional development, institutional effectiveness, good governance and equitable partnerships in its application of Pacific science, knowledge and innovation for sustainable development. The strategic results framework combined with the values enshrined in the Plan, will ensure that our indicators of success are anchored in a Pacific context and measured in an accountable and constructive manner.

I encourage all SPC members and partners to use this Strategic Plan as a navigational tool to support our efforts and aspirations over the coming decade as we embark together on this collective journey.

We are stronger together, as one Blue Pacific.



Honourable Johnny Koanapo Rasou, MP

Minister of Finance and Economic Management of the Vanuatu Government, and Chair of the 12th Conference of the Pacific Community

DIRECTOR-GENERAL OF THE PACIFIC COMMUNITY

On our 75th anniversary, we the Pacific Community have our eyes firmly fixed on the future. With millennia of cultural wisdom, science and learning filling our sails, our course is charted for 2031. I am pleased to present the Pacific Community's Strategic Plan 2022 to 2031, outlining our ten-year commitment to developing a resilient Blue Pacific: a region of peace, harmony and prosperity for all.

As the premier scientific and technical intergovernmental organisation in the Pacific, SPC is proud to be applying our collective capabilities in science, knowledge and innovation to serve the people of the Pacific in reaching their sustainable development goals and aspirations. By placing Pacific people at the centre of our approaches, and with our deep understanding of Blue Pacific contexts and worldviews, we embark on the journey to implement the Strategic Plan that encompasses the insights and foresight of our members, staff and key stakeholders. It builds on learning from our previous plans and aligns with the 2050 Strategy for the Blue Pacific Continent.

We hold ourselves accountable to the Pacific values enshrined in this Strategic Plan and to serving our Blue Pacific region in progressing our four development goals:

Goal 1: All Pacific people benefit from sustainable development

Goal 2: All Pacific communities and cultures are empowered and resilient

Goal 3: All Pacific people reach their full potential and live long and healthy lives

Goal 4: One SPC delivers integrated programmes through streamlined services

As a member-owned organisation, SPC commits to transforming and adapting as an institution to respond to our members' unique and evolving priorities, including the ongoing impacts of the COVID-19 pandemic. In doing so, we draw on the strength of our diversity, including the vast interdisciplinary expertise and multi-cultural backgrounds of our 650+ staff located across the region.

SPC has proudly served its members for 75 years. Guided by this new Strategic Plan, we begin our voyage into the next decade with the confidence and determination to support all Pacific peoples to meet the many challenges and opportunities ahead.

We welcome all those who wish to join our vaka as we begin this journey.



Dr Stuart Minchin,
Director-General of the Pacific Community



INTRODUCTION

Pacific people have been wayfinders and stewards of our region for centuries, using knowledge to sustain life, livelihoods and well-being. The Pacific Community Strategic Plan 2022–2031 guides the Pacific Community in developing and transforming our Blue Pacific Continent.

The Pacific Community (SPC) is the principal scientific and technical organisation supporting development in the Pacific region. We are an international organisation with a mandate articulated in [Article IV of the Canberra Agreement](#); and one of nine member agencies of the Council of Regional Organisations of the Pacific (CROP).

As a Pacific organisation, we interweave science, technology and innovation with cultural wisdom and indigenous knowledge for our region's collective betterment. We serve the people of the Blue Pacific. Across the 27 members of our Pacific Community, the region's unique and vibrant cultures are 'the breath that blows the conch shell of a nation's identity, intellectual, moral and spiritual life'¹. We support SPC staff well-being and build trusted partnerships, secure in our shared identity and worldview.

This plan is shaped by foresight, evidence and analysis generated by SPC members, staff and partners. The participatory approach was inclusive of diverse perspectives, creating ownership and identifying pathways of action toward our shared future visions.

Setting course through to 2031, we build on previous strategies, COVID-19 recovery efforts, sustainable development commitments and the onward voyage to the Blue Pacific of 2050. We will continue to collaborate, mobilise resources and capabilities to strengthen and complement existing regional mechanisms. Through our convening power, we will amplify Pacific voices across regional and international forums. With a focus on learning and adaptation, as well as results to impact, this strategy will be reviewed at the third, fifth and eighth year milestones to remain relevant, responsive and coherent with other regional strategies.

¹ SPC. 2010. [Regional Culture Strategy: Investing in Pacific Cultures 2010 – 2020](#).

VISION

We are voyaging towards a resilient Pacific. A region of peace, harmony and prosperity, where all our people and communities live safe, free, healthy sustainable and productive lives. As wayfinders, our paths are intertwined with the culture, environment and resources of our Blue Pacific Continent. We recognise our role as stewards of our Pacific Ocean and are responding with urgent collective action to the threat of climate change.

Mission

To progress all Pacific peoples' rights and well-being through science and knowledge, guided by our deep understanding of Blue Pacific contexts and cultures.

Value Proposition

The Pacific Community supports sustainable development by applying a people-centred approach to science, research and technology across all of the Sustainable Development Goals (SDGs). We serve our members by interweaving and harnessing the nexus of climate, ocean, land, culture, rights and good governance; through trusted partnerships; investing in Pacific people; and understanding Pacific contexts.

Values

Our Pacific values² guide us - respect, solidarity and mutuality - in navigating towards our collective well-being and prosperity. Voyaging together as we serve our Blue Pacific, we embrace:



Enginkelap | Generosity

*We provide for each other.
We work together towards
our shared mission valuing
all contributions.*



Kaitiakitanga | Stewardship

*We are the stewards of our
Blue Pacific. Our history,
knowledge and science
hold the solutions for
contemporary challenges.*



Gida Gaituvwa | Unity

*We progress together.
Leaving no one behind, we
harness the richness of our
history and culture across
generations.*



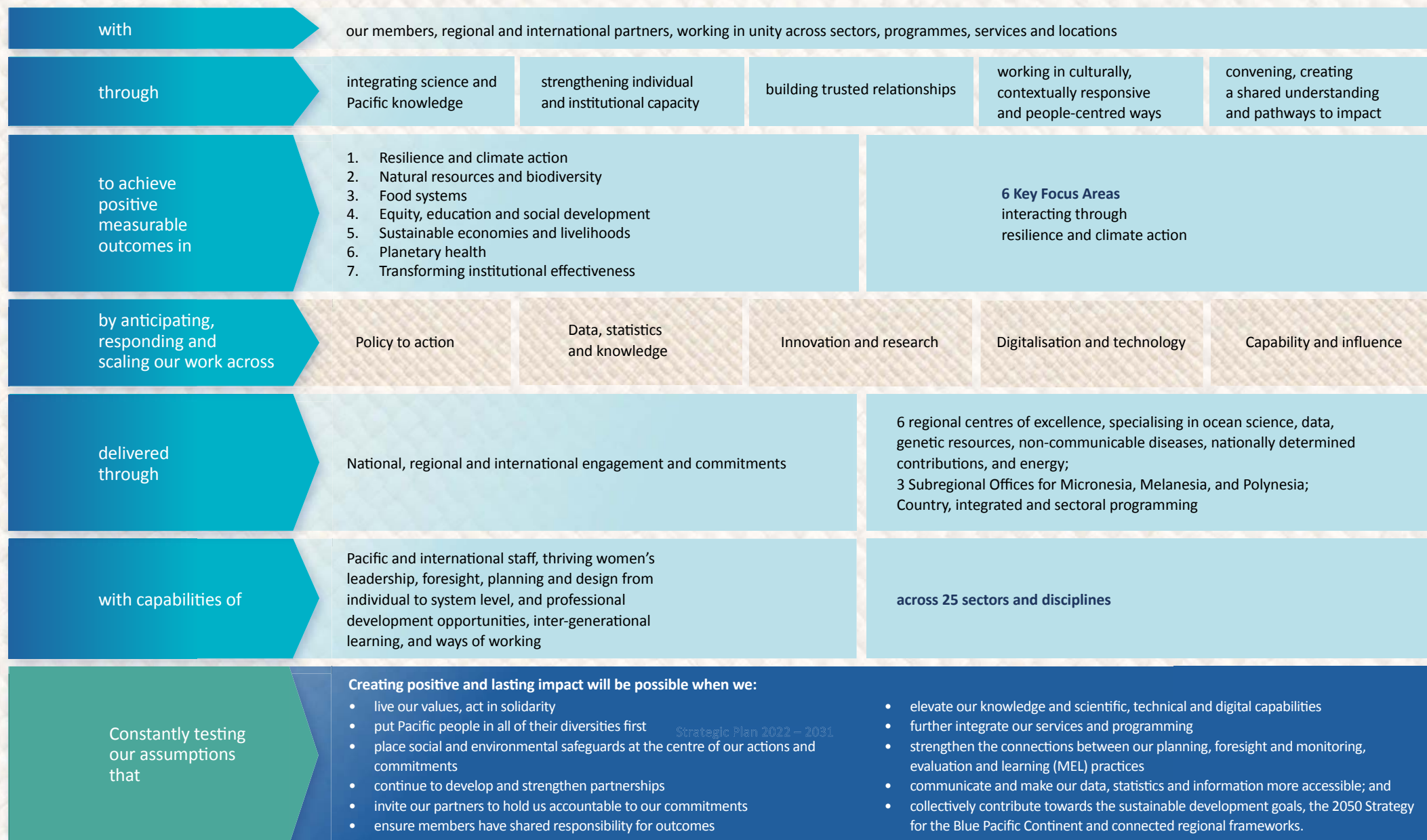
Aroha | Care

*We care for each other.
The well-being of our
people and places are at
the centre of our efforts.*

These values are SPC's navigational markers, steering us as an organisation that transforms and adapts to our region's realities in serving our members' evolving needs and priorities.

² Our shared values emphasise the connection between language and identity and highlight the rich linguistic diversity of Pacific people. *Aroha* and *Kaitiakitanga* share Polynesian origins, *Gida Gaituvwa* comes from Pentecost Island in Vanuatu and *Enginkelap* from Pohnpei State in the Federated States of Micronesia.

OUR THEORY OF CHANGE



Strategic Plan 2022 – 2031

OUR GOALS AND KEY FOCUS AREAS

GOAL 1:

All Pacific people benefit from sustainable development.

GOAL 2:

All Pacific communities and cultures are empowered and resilient.

GOAL 3:

All Pacific people reach their full potential and live long and healthy lives.

GOAL 4:

One SPC delivers integrated programmes through streamlined services.

The Pacific Community contributes to four development goals for a unified, safe, just, equitable and resilient Blue Pacific. It is cognisant of the science, data and digital assets, statistics and analytics that connect to the strategy and provide the evidence to underpin products and services for the region. These goals are further shaped by the transformations required for institutional effectiveness and good governance of SPC's regional commitments, members' national priorities and global commitments.



Five pathways guide the high-level actions towards our goals across SPC's key focus areas. These pathways are: Policy to action; data, statistics, and knowledge; innovation and research; digitilisation and technology; and capability and influence. We weave the delivery of regional public goods through Pacific centres of excellence, frameworks, networks, and partnerships across our key focus areas.

Through our connections between culture, traditional and indigenous knowledge, and the land and sea of the region, to the Pacific people, their rights and aspirations, we give meaning to our key focus areas.

Our sectors and disciplines

- Sustainable agriculture
- Biosecurity
- Culture
- Coastal, oceanic fisheries and aquaculture
- Earth and marine observation
- Economic and social statistics collection, analysis and dissemination
- Education quality
- Energy security

- Food systems
- Gender equality and social inclusion
- Genetic resources (plant, fish, livestock)
- Governance
- Institutional strengthening
- Health system strengthening
- Human rights
- Integrated disaster risk reduction and climate resilience
- Sustainable livelihoods

- Maritime safety
- Sustainable fisheries
- Public health governance, NCDs and health security
- Ocean science
- Regional micro-qualifications
- Sustainable georesources
- Sustainable forests and landscapes
- Water and sanitation



KEY FOCUS AREAS (KFAs)

KFA 1

Resilience and Climate Action

CURRENT STATE 2021

The climate crisis is the greatest challenge facing our vibrant Blue Pacific Continent.

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

PATHWAYS

Climate, disaster risk information, indigenous knowledge and the rights and needs of the most vulnerable inform decision making, management and response.

Coherent and accessible data collection and analysis inform the development of decision-ready products for oceans, land, water and people.

Pacific-led developments in adaptation and mitigation actions and technologies scale from small to large system-level solutions.

Data integration and innovation support better decisions and technology adoption including for low carbon transition; water and sanitation; and climate and disaster resilience.

Transdisciplinary programme design, engagement in international dialogue, pathways for young professionals and Pacific women in scientific and technical leadership influences regional and international action.

FUTURE STATE 2031

Pacific people are thriving, with enhanced resilience from better informed decision making and necessary resources that also enable the achievement of low carbon, climate resilient sustainable development.



The Pacific Community continues to strengthen its organisation-wide capabilities in climate change and resilience building, including through the deployment of a flagship programme on climate change as well as multi-sectoral approaches through regional public goods, including [the Pacific Nationally Determined Contribution \(NDC\) Hub](#), the Maritime Technology Cooperation Centre in the Pacific (MTCC-Pacific) and the Framework for Resilient Development in the Pacific (FRDP). SPC's accreditation to the Green Climate Fund and Adaptation Fund supports members to access and manage climate finance.

Natural Resources and Biodiversity

CURRENT STATE 2021

Natural systems, biodiversity and ecosystems underpin community livelihoods and security. Increasing pressures on and modification of ecosystems threaten the health of the region’s natural resources and biodiversity.

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

PATHWAYS

Pacific science and knowledge inform international and bilateral treaty negotiations, legislation and natural resource policy, genetic resource management and integrated management of natural resources.

Applied science in ecological and resource assessments, surveys and mapping; generates evidence and informs monitoring for sustainable management.

Cutting-edge scientific capacity and Pacific traditional knowledge improves biosecurity, management of diverse land, water and ocean natural resources, ecosystems, the conservation and utilisation of Pacific genetic and renewable resources.

Through earth, water and marine observations, integrated data supports natural resources management, ecosystem restoration and evidence informed decision making.

Multiple pathways for growing scientific and technical capabilities that incorporate traditional knowledge, fosters Pacific scientists, professionals and future leaders.

FUTURE STATE 2031

Thriving, productive and resilient ecosystems and communities, responsibly harnessing our natural resources and biodiversity for security and prosperity.



The Pacific Community leads on Pacific applied science, and research interrogation that enables Pacific voice and agency. Through regional public goods, including the Pacific Community Centre of

Ocean Science (PCCOS), the Centre for Pacific Crops and Trees (CePACT), the Pacific Geospatial and Surveying Council, the Pacific Marine Specimen Bank and the Pacific Partnership for Atoll Water Security.

Food Systems

CURRENT STATE 2021

The key food systems in the region are the coastal food system and the regional tuna food system. The Pacific faces the combined challenges of an eroding resource base, climate change, a reliance on food imports and a crisis of non-communicable diseases (NCDs).

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

The Pacific Community leads on transdisciplinary approaches to integrated programming. Through regional public goods, including the Pacific Monitoring Alliance for NCD Action (MANA) dashboard, the Pacific Nutrient Database, Organic

PATHWAYS

Pacific knowledge and stewardship are combined with cutting-edge science and inclusive governance for the holistic sustainable management of food systems, inland, coastal and marine.

Data collection and analysis support evidence-based policy making across the food- water-health-trade nexus to create healthier, more equitable food systems.

Pacific-led food systems, innovation and research inform climate resilient and sustainable production and consumption, enhanced biosecurity and nutritious food consumption.

Testing and developing appropriate technologies regenerates and revitalises the environment, contributes to more productive farms and fisheries, healthier communities and economies.

Global awareness of the role of the Pacific Ocean in the global food system and shared responsibility for stewardship is championed by Pacific Food Systems leaders, who drive local and global transition to nutritious and sustainable food systems.

Pasifika and the New Song for Coastal Fisheries Strategy, SPC assists Pacific Island countries and territories (PICTs) to conserve and utilise the region's diverse genetic resources for health and nutrition.

FUTURE STATE 2031

Pacific food systems are accessible, regenerative, biodiverse, equitable and resilient to shocks. They provide access to safe and nutritious food and contribute to healthy people, ecosystems, vibrant cultures, and prosperity for all.



Equity, education and social development

CURRENT STATE 2021

Current investment in socio-development systems, including education, cultural industries and institutions, is inadequate and has created inequities that are exacerbated by the impact of climate change and COVID-19, particularly for women, youth and people with disability.

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

PATHWAYS

Progress toward regional goals on education, training, culture, human rights, gender equality and social inclusion, through mainstreaming and concrete investments strengthens good governance.

Collection and dissemination of robust and accessible social, economic, education and cultural statistics and information informs decision making, measuring progress and improving accountability of policy outcomes.

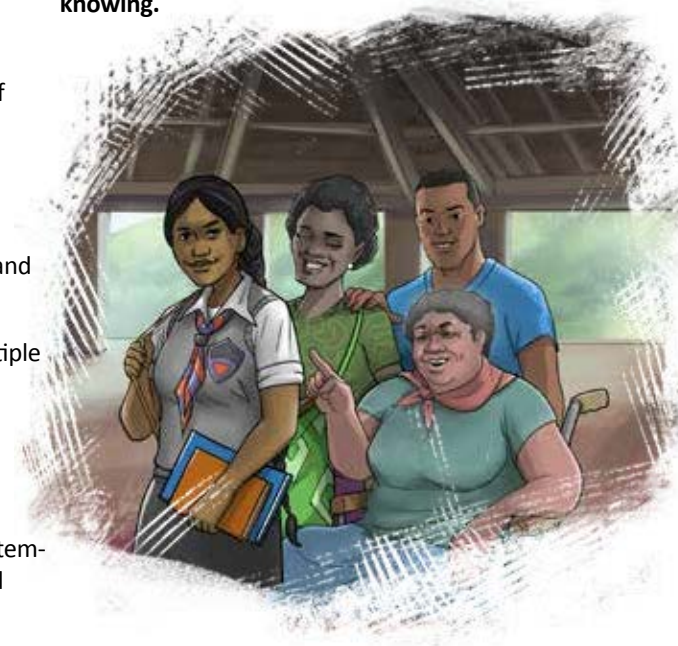
Research in education and training, human rights, gender equality and social inclusion, informs investments in legislative reform, curriculum development, and opportunities for young people and emerging professionals.

Appropriate technology is harnessed to design multiple learning pathways (formal and informal education training) supporting equity in benefits from the digital economy.

Strengthened individual and institutional capacity, leadership development and advocacy, embeds system-level inclusion of human rights; gender equality and social inclusion; and improves governance.

FUTURE STATE 2031

Social development systems result in real gains for education, gender equality and social inclusion through a contextualised approach to human rights and good governance that incorporates Pacific cultures and ways of knowing.



SPC leads efforts to improve the quality of learning pathways, regional and national education ([Pacific Regional Education Framework](#)) and works to advance human rights, and good governance, equality and social inclusion for all Pacific people ([the Pacific Youth Development Framework](#)),

grounded in cultural values and principles ([Pacific Regional Culture Strategy](#)). SPC leads the Pacific Islands Literacy and Numeracy Assessment (PILNA) and is the [statistical systems lead](#) for the Pacific and is a key partner to the Pacific Platform for Action on Gender Equality.

Sustainable Economies and Livelihoods

CURRENT STATE 2021

COVID-19 has exacerbated existing vulnerabilities and had far-reaching effects across nearly all services, economic and social activities. Growing interest in partnerships for strengthening capabilities that support improved market access and protects the region from transboundary pests and diseases.

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

SPC leads resource analysis to inform opportunities and decision making for economies and livelihoods. Through regional public goods, including the Regional Maritime Boundaries Consortium of Partners and the Pacific Biosecurity Information Facility,

PATHWAYS

Development of roadmaps and strategies that use systems approaches and Pacific science and knowledge, are inclusive and targeted increases the potential to realise sustainable economies, livelihoods and well-being.

Social research and the integration of e-monitoring and e-reporting enables live information sharing, targeted responses and robust sustainable resource management practices.

Investment in strategic research assets and facilities, sustainable maritime transport and ports, emerging technologies, advanced modelling, biosecurity and capabilities enables research, monitoring, modelling and uptake of science.

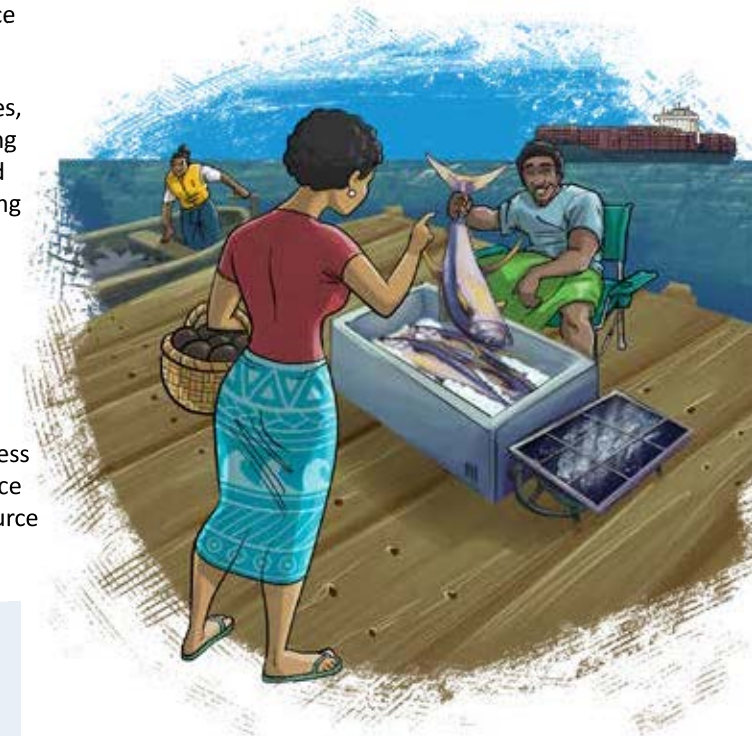
Technology availability and uptake encourages Pacific digital entrepreneurs and supports efforts for the diversification of economies and livelihood opportunities.

Equitable and inclusive learning pathways and access to formal qualifications strengthens national science capability and collaboration on scientific and resource use and planning.

the [Pacific Centre for Renewable Energy and Energy Efficiencies \(PCREEE\)](#) and the [Framework for Energy Security and Resilience](#), SPC assists strengthening sustainable and secure energy markets, industries and innovation.

FUTURE STATE 2031

The Blue Pacific is a well-being economy through a balance of sustainable economic growth, protection and inclusive distribution of resources, energy secure, healthy and resilient communities with livelihoods sustained through trade, maritime connectivity and harmonious relationships with the land and the sea.



Planetary Health

CURRENT STATE 2021

Pacific people face a triple disease burden: An epidemic of NCDs, outbreaks of infectious and zoonotic diseases, compounded by low levels of access to safe water, sanitation and hygiene facilities and the health impacts of climate change and COVID-19.

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

SPC thought and capability leadership at the nexus of human, animal and environmental health is underpinned by regional public goods, including

PATHWAYS

A regional well-being framework integrates human, animal, environmental and ecosystem health into transdisciplinary policy and practice. Cross-sectoral partnerships accelerate the action needed to secure universal access to safe water, sanitation and hygiene.

The collection, analysis and use of a regional set of health, nutrition and well-being indicators inform planning, investment and policy decision making.

Dedicated planetary health research and innovation hubs with transdisciplinary Pacific researchers inform investments in stronger systems.

Digital planetary health services including telehealth, e-diagnostics and reporting, complement access to improved physical services and enables integration across human, animal and environmental systems.

The promotion and incorporation of planetary health curricula strengthens individual and institutional capacity.

the Pacific Public Health Surveillance Network, the Plant Health Laboratory and the Pacific Health Information Network (PHIN).

FUTURE STATE 2031

Collaboration and stewardship of our Blue Pacific for healthy islands; where children and vulnerable groups are nurtured in body and mind; environments invite healthy lifestyles learning and leisure; people work and age with dignity; ecological balance is a source of pride; people maintain their cultures and traditions with the land; water and oceans are protected.



Transforming Institutional Effectiveness

CURRENT STATE 2021

SPC serves the region through scientific and technical expertise, capabilities and assets. Innovative partnerships based on shared values are demonstrating genuine collaboration with members and between partners for impact.

Policy to action

Data, statistics and knowledge

Innovation and research

Digitilisation and technology

Capability and influence

PATHWAYS

Coordinated strategy and planning improves integrated governance across the Blue Pacific architecture, shifting toward a OneCROP approach.

Regional data ecosystems and improved data governance enable greater data sharing and empower members to use evidence for decision making.

Strengthened cross-SPC planning and communication, innovations in our business systems and funding for internal innovation, drives necessary transformation.

Appropriate technology and digital investments provide evidence and enable effective engagement for shared and inclusive decision making, networking and learning.

SPC invests in staff and member capabilities and develops gender sensitive systems supported by appropriate facilities and by communities of practice with deep sectoral capabilities and leadership skills.

SPC leads information sharing through the [Pacific Data Hub \(PDH\)](#), the central repository of open data and knowledge products about the Pacific region. [Digital Earth Pacific](#), data, information and decision-ready products will strengthen planning, decision making and reporting.

FUTURE STATE 2031

One SPC is values-based and working with members and partners to provide coherent, social and environmental responsible learning for enhanced representation of Pacific people and gender equality across the organisation and at all levels of decision making.



IMPLEMENTING OUR STRATEGIC PLAN

Our strategic efforts will be guided by our business plans and we will continue to grow our flexible multi-year programmatic and outcomes-based funding for financial sustainability. Our pursuit of resource mobilisation will continue through strategic partnerships and accreditations.

Staff expertise, capabilities and organisational sustainability underpin the implementation of the strategic plan. The governance, structures and policies of the organisation will support the strategic plan's culture, values and goals.

By ensuring a connected approach, supported by our regional offices and embedding Blue Pacific contexts and values in our work, SPC will collaborate more closely with CROP agencies and partners to optimise resources, networks and assets for our region's benefit. We will actively work together across disciplines within our focus areas to deliver on agreed outcomes through continued investments in integrated and country programmes.

Our strategic planning process has embedded shared ownership and collective responsibility for implementation and performance. To navigate forward together, we will work through mutual partnerships to monitor our progress, identify changes in direction and achieve collective impact.

Our commitment to accountability is guided by our values and embedded in our annual results reporting. The Audit and Risk Committee will continue to oversee internal audit and risk management processes. The Subcommittee for the Strategic Plan will continue to oversee the progress of implementation and necessary course corrections. Our communication and engagement with members and partners will foster transparency and sharing of information for learning and exchange.



STRATEGIC RESULTS FRAMEWORK

As we navigate toward our shared vision, we remain committed to measuring our progress to understand where we are on the journey, where we have come from, where we need to be and how to correct our course as needed. The Strategic Results Framework (SRF) is our critical navigational tool for SPC's strategic journey of the coming decade.

SPC's results reporting and learning will build on our current strengths and further improve our approaches to monitoring, evaluation and learning (MEL) to support development effectiveness, transparency and accountability. Reporting on strategic plan implementation will continue through annual results reporting and supporting mechanisms, as guided by our Planning, Evaluation, Accountability, Reflection and Learning (PEARL) policy, which outlines a holistic approach to planning, monitoring, reporting and learning.

Detailed results frameworks nest under this high-level SRF at KFA, division and programme levels, including indicators and targets, enabling SPC to demonstrate the combined outcomes, contributions and impact of our sectoral, country programme and integrated work, from PICTs to regional level.

SPC is committed to strengthening the use of Pacific MEL approaches, both within SPC, with our members, and supporting Pacific-led MEL across the region. This will also support greater external monitoring and validation of our results with members and partners. We will continue to review and refine our approach to MEL throughout the life of the strategic plan, to support ongoing relevance and strengthen SPC as a learning organisation.



IMPACT MEASURES

Shared regional impact evidenced through SDG indicators, 2050 Strategy levels of ambition². While our work contributes to multiple SDG indicators across all KFAs, below are key selected SRF indicators:

Resilience and climate action	Natural resources & biodiversity	Food systems	Equity, education & social development	Sustainable economies & livelihoods	Planetary health	Transforming institutional effectiveness
11 13 14	6 14 15	2 3 14	4 5 16	1 7 8 9 10 12 14	3 6	13 16 17
SDG 11.5.2	SDG 6.1.1	SDG 2.1.1, 2.1.2, 2.5.1	SDG 4.1.1, 4.2.2, 4.7.1, 4. C.1	SDG 1.2.1, 1.2.2	SDG 3.8.1, 3.c.1, 3.d.1, 3.3.5	SDG 13. a. 1
SDG 13.1.2, 13.2.1, 13. b.1	SDG 14.4.1, 14.5.1	SDG 3.4.1	SDG 5.1.1, 5.2.1, 5.2.2	SDG 7.2.1, 7.a.1, 7.b.1 SDG 8.6.1, SDG 9. a.1	SDG 6.2.1	SDG 16.9.1
SDG 14.2.1	SDG 15.1.1, 15.5.1	SDG 14. b.1	SDG 16.1.3, 16.7.2	SDG 10.2.1, 12. b.1 SDG 14.6.1, 14.7.1		SDG 17.18.2, 17.18.3, 17.19.1, 17.19.2

OUTCOME MEASURES

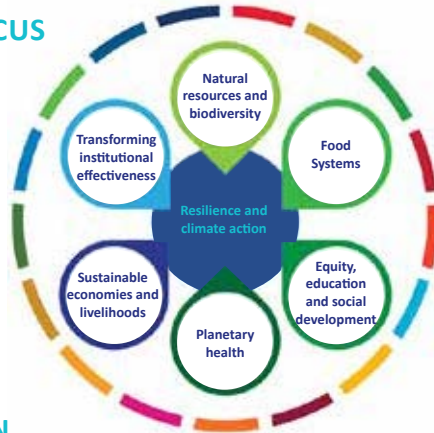
SPC's shared contributions by "pathways" across key focus area outcomes
SPC's results and direct contributions by "pathways" across all key focus areas

VISION

We are voyaging towards a resilient Pacific. A region of peace, harmony and prosperity, where all our people and communities live safe, free, healthy sustainable and productive lives. As wayfinders, our paths are intertwined with the culture, environment and resources of our Blue Pacific Continent. We recognise our role as stewards of our Pacific Ocean and are responding with urgent collective action to the threat of climate change.

GOAL 1	GOAL 2	GOAL 3
All Pacific people benefit from sustainable development.	All Pacific communities and cultures are empowered and resilient.	All Pacific people reach their full potential and live long and healthy lives.

KEY FOCUS AREAS



MISSION

To progress all Pacific peoples' rights and well-being through science and knowledge, guided by our deep understanding of Blue Pacific contexts and cultures.

GOAL 4

One SPC delivering integrated programmes through streamlined services.

VALUES

- | | | | |
|---|--|---|---|
| Aroha:
We care for each other | Kaitiakitanga:
We lead together in the stewardship of our Blue Pacific | Engkelap:
We provide for each other and value all contributions | Gida Gaituvwa:
We progress together |
|---|--|---|---|

Pathway	Output indicator summary ^{1,2,3}	Outcome indicator summary ^{1,2,3}
Policy to action	Number of legislation/regulations/policies developed or reviewed	Number of laws/regulations/policies adopted & implementation
	Stakeholder engagement by gender, age, traditional knowledge holders, other relevant target groups	Mechanisms to promote active participation by gender, age, traditional knowledge holders, other relevant target groups
	Number of SPC initiatives supporting legislative/regulation/policy strengthening	Legislative/regulation/policy frameworks guided by evidence and good governance criteria
Data, statistics and knowledge	Number of data/knowledge products and services that are accessible	Number of Pacific Data Hub visits and downloads. Pacific Development Indicators up-to-date and accessible
	Tools developed to guide use, governance and sharing of data products	Use and uptake of data in decision-making, reporting, and other applications
	Number of SPC's collaborations and partnerships to support data and statistics	Adherence to data governance standards
Innovation and research	Number of research outputs published/made available	Use and uptake of innovation and research in practice, decision-making and other applications.
	Number of collaborations and partnerships to support innovation and research	Research and innovation hubs for Pacific research and capability
Digitilisation and technology	Number of SPC initiatives supporting innovation, culture in research and creative industries. Stakeholder engagement by gender, age, traditional knowledge holders, other relevant target groups	Initiatives promoting participation in cultural and creative industries, by gender, age, traditional knowledge holders, other relevant target groups
	Number of people trained on digital infrastructure and technology by gender, age, traditional knowledge holders, other relevant target groups	Use and uptake of digital technology initiatives by gender, age, traditional knowledge holders, other relevant target groups
	Number of SPC initiatives supporting digital infrastructure and digitilisation	Employment and entrepreneurship participation among Pacific young people, women and other relevant target groups through digitilisation and technology
	Stakeholder engagement by gender, age, traditional knowledge holders, other relevant target groups	Mechanisms to promote active participation by gender, age, traditional knowledge holders, other relevant target groups
Capability and influence	Number of initiatives supporting technology for low carbon transition and climate resilience	Adoption of technology for climate resilience and low carbon transition
	Number of people accessing capacity building activities by gender, age, traditional knowledge holders, other relevant target groups	Proportion of people accessing capacity building activities demonstrating increased knowledge/skills
	Number and type of capacity building initiatives	Evidence of changes in ways of working or application of learning among those accessing capacity building initiatives
	Number and type of SPC initiatives supporting civic participation, influence or leadership, by gender, age, traditional knowledge holders, other relevant groups	Evidence of young people, women, traditional knowledge holders and producers, and other key groups engaged as influencers/having influence
	Number and % of SPC staff participating in learning by gender and age	Reach and influence through SPC's online platforms, including social media

APPROACH LEVEL

Approach measures:

- Relevance, responsiveness, and effectiveness of what SPC's delivers, given member contexts, needs and priorities.
- Adaptations in how SPC works to respond to changes in context and key learning, including review and adjustments to planning and budgets.
- The extent to which the way SPC works, systems and processes aligns with SPC's vision, mission, goals, values, including consideration of cross-cutting issues, internal good governance, diversity and inclusion in decision-making, women in leadership.

Footnotes:

1. This is a 1-page summary of the high level SRF. For a full version please contact planning@spc.int.
2. All indicators will be disaggregated by PICT to enable both regional and national level results reporting.
3. Specific indicators across each key focus area are found in the results frameworks for each KFA and SPC's Divisions and Operations which will nest under this Strategic Results Framework.



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Annex 2

2050 Strategy for the Blue Pacific Continent, Pacific Islands Forum Secretariat, 2022

(available at: <https://www.forumsec.org/wp-content/uploads/2022/08/PIFS-2050-Strategy-Blue-Pacific-Continent-WEB-5Aug2022.pdf>)



2050 Strategy for the Blue Pacific Continent





PACIFIC ISLANDS FORUM

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Foreword

Securing the future of the Pacific cannot be left to chance, but requires a long-term vision, strategy and commitment – Pacific Islands Forum Leaders, 2019 Communique

The Blue Pacific Continent is our home, ocean, lands and common heritage.

As Pacific Leaders, we are strongly committed to ensuring the health and wellbeing of our people, and to human rights and equity for all. We place great value on our ocean and land, and celebrate a deep connection to our community, natural environment, resources, livelihoods, faiths, cultural values and traditional knowledge.

We work with our people to deliver on a vision that they will help to nurture. We welcome the support of our national and regional institutions in these efforts. We have often taken on challenges much bigger than ourselves. Many of our nations have gained political independence and have set new paths for their future. Our governance is maturing, and our people have much higher expectations of transparency and accountability. Our public services are supporting a gradual improvement of our wellbeing and quality of life. Much work remains, yet we are confident of success.

The establishment of the Pacific Islands Forum in 1971 strengthened our collective voice and revealed our commitment to political and economic cooperation. The *2050 Strategy for the Blue Pacific Continent* builds on this long history of working together.

In this context, the 2050 Strategy sets out our long-term approach to working together as a region, and as countries and territories, communities, and people of the Pacific. It frames our regional cooperation and broader action around seven key thematic areas which are designed and developed to support the achievement of our vision. These thematic areas include Political Leadership and Regionalism; People-Centred Development; Peace and Security; Resource and Economic Development; Climate Change and Disasters; Ocean and Environment; and Technology and Connectivity. They will require a whole-of-region approach, the inclusion of all key stakeholders in supporting and delivering on our shared priorities, and engaging as the Blue Pacific Continent in strategically beneficial partnerships at the regional, multilateral and global level.

These efforts will require the contribution of all stakeholders, including CROP and other regional agencies; the private sector; civil society; media; academia; community, cultural and faith-based organisations; development partners; and other equally valuable constituencies. Further, we acknowledge the need to listen to and respond to the voices and aspirations of all Pacific peoples, including most importantly, our young people and children as they will inherit what we leave behind.

The success of the 2050 Strategy depends on enhanced cooperation, strong leadership and the continued participation at all levels of society in its implementation. We seek the broadest support possible across our region to ensure full ownership and accountability in delivering on our shared objectives. Through this Strategy we pledge our support to your voices, actions and decisions to build a brighter future for our Blue Pacific. This is our 2050 Strategy, and we will drive and deliver it together for the benefit of all Pacific peoples.



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Leaders' Vision for 2050

All Pacific peoples have an undeniable connection to their natural environment, resources, livelihoods, faiths, cultural values and traditional knowledge. Given our shared stewardship of the Blue Pacific Continent, we have a deep concern for and commitment to the need for urgent, immediate and appropriate action to combat the threat and impacts of climate change; biodiversity and habitat loss; waste and pollution; and other threats. We support our young people to develop their full potential, empower women to be active participants in economic, political and social life and recognise the importance of creating accessible services and infrastructure to enable all Pacific peoples to participate in and benefit from development outcomes. Therefore:



As Pacific Leaders, our vision is for a resilient Pacific Region of peace, harmony, security, social inclusion and prosperity, that ensures all Pacific peoples can lead free, healthy and productive lives.



Our Values

As Pacific peoples, our values will guide our collective action in delivering the 2050 Strategy:

- ◇ We recognise **regional cooperation** and our **shared commitment** to work together, as an important platform for achieving the greatest benefits for our people.
- ◇ We value and depend upon our vast ocean and our island resources and the **integrity** of our natural environment.
- ◇ We treasure the **diversity and heritage** of the Pacific and seek an inclusive future in which our faiths, cultural values, and traditional knowledge are respected, honoured and protected.
- ◇ We embrace **good governance**, the full **observance of democratic principles and values**, the rule of law, the defence and promotion of all human rights, gender equality, and commitment to just societies.
- ◇ We ensure **peaceful, safe, and stable communities** and countries, ensuring robust **security and wellbeing** for the peoples of the Pacific.
- ◇ We encourage **innovation and creativity** and respect our **cultural values and traditional knowledge**.
- ◇ We support full **inclusivity, equity and equality** for all peoples of the Pacific.
- ◇ We strive for effective, **open and honest relationships** and **inclusive and enduring partnerships**—based on mutual accountability and respect—with each other, within our sub-regions, within our region, and beyond.
- ◇ We recognise the **importance of a regional architecture** that includes the Pacific Islands Forum at the apex, and that works closely with regional, multilateral, and global partners.

Leaders' Commitments to 2050

Strategic Context: The Influences that Shape Our Region

As large oceanic countries and territories, we are the custodians of nearly 20 percent of the earth's surface, and we place great cultural and spiritual value on our ocean and land, as our common heritage.

We occupy a vitally significant place in global strategic terms. As a consequence, heightened geopolitical competition impacts our Member countries. Further, there is increasing commercial and state-sponsored interest in our region's ecological and natural resources. This is reflected in the global community's present interest in the "Blue Economy" and suggests that there will be growing demand for our resources over the years to come.

Under current trends global temperature rise will exceed 1.5°C before 2040 and 2°C between 2041 and 2060 unless there are rapid, deep and sustained reductions in global greenhouse gas emissions¹. To avert and manage the worst-case scenarios requires urgent, robust and transformative action globally, regionally and nationally. While collective greenhouse gas emissions from the Blue Pacific Continent is just over 1%² of global emissions, we are at the frontline of the adverse impacts of climate change. Harnessing untapped potential for policy interventions to enhance carbon sequestration of the ecosystems and Exclusive Economic Zones of the Blue Pacific Continent could generate substantial climate benefits. The Blue Pacific Continent continues to experience damaging impacts of climate change and requires timely access to scaled-up, effective and sustainable climate finance.

¹ Reference is based on the Intergovernmental Panel on Climate Change Sixth Assessment Report as welcomed in the Glasgow Climate Pact^[1].

² CSIRO, New Zealand Ministry for the Environment, Casella (2019)



2050 Strategy: The Opportunity to Shape our Future

To leverage this strategic and economic value and at the same time address our most significant threats, including climate change, we are deeply committed to working together whilst ensuring that our regional efforts complement the national interests of our Members. As the Blue Pacific Continent we engage with our partners from a position of strength, unity and solidarity on matters of collective interest.

We will prepare and position ourselves through technology, scientifically-based research, cultural values and traditional knowledge, and equitable partnerships to secure our ocean and derive economic benefits from its resources in a manner that will maintain environmental integrity and drive sustainable economic prosperity and development for all Pacific peoples.

We will continue to collectively support each other in our shared responsibilities through both positive and challenging times. Furthermore, it is vital to our Blue Pacific Identity that we resolve any challenges or disputes in our own unique *Pacific Way* involving consensus-based decision making, whilst respecting sovereignty and the principle of non-interference in national affairs. Above all, our efforts must always lead and contribute to the security, prosperity and wellbeing of our people.

The 2050 Strategy is our opportunity to engage with and shape the most significant dynamics and influences on our region, in order to secure our long-term wellbeing and prosperity. Through the Strategy, we will ensure we are resilient and 'future-ready' by being able to anticipate, prepare for and respond to hazardous climate events, geopolitical and security trends, and other unanticipated shocks.



Leaders' Commitments to 2050

To secure our Blue Pacific Continent by 2050, and building on existing priorities, we commit ourselves as Leaders of the Blue Pacific to do as follows:

- i. **To nurture collective political will and deepen regionalism and solidarity**, we will invest in leadership development, diplomatic capacity and relationship building at all levels and pursue our national interests mindful of our agreed collective regional priorities. We will also endeavour to resolve our challenges and disputes in our own unique *Pacific Way*.
- ii. **To collectively deliver for our people**, we will ensure that the Pacific Islands Forum and wider regional architecture is coherent and effective, and that they deliver on our collective strategic priorities. Further, we will ensure that they allow for the inclusion and engagement of the private sector; civil society; media; academia; community; cultural and faith-based organisations; development partners; and other equally valuable constituencies.
- iii. **To embed our Blue Pacific identity**, we will embrace our cultural diversities, respect our national sovereignties, and protect our collective interests. We will honour and reflect our rich values and traditions by acting as the Blue Pacific Continent to position our region with our partners as well as in global negotiations and processes.
- iv. **To secure the wellbeing of our people**, we will work together to strengthen national and regional efforts to ensure all Pacific peoples benefit from enhanced provision of education, health and other services. To achieve this, we will place emphasis on learning from each other, drawing on scientifically-based research and traditional knowledge as well as promoting human rights, gender equality and the empowerment of all people.
- v. **To protect our people and our place** we will have a more flexible and responsive regional security system that acknowledges the breadth of issues impacting peace and security in our region, and the contribution the region makes in international fora to progressing global peace and security.
- vi. **To accelerate our economic growth aspirations**, we will invest our shared expertise to quantify and determine the full value of our people, oceanic and land-based natural resources. Where appropriate, we will use this value as the basis of our negotiations regarding access to these resources.
- vii. **To guarantee the future of our children**, we will urgently advocate as a collective to reduce and prevent the causes and impacts of climate change and sea level rise; we will call for stronger global commitment to combat climate change; we will continue to pursue innovative measures to address climate change impacts and disaster risk; and with the support of our partners, we commit to ensuring net zero carbon emissions by 2050.
- viii. **To secure a future for our people**, we will deepen our collective responsibility and accountability for the stewardship of the Blue Pacific Continent and protect our sovereignty and jurisdiction over our maritime zones and resources, including in response to climate change induced sea level rise, and strengthen our ownership and management of our resources.
- ix. **To protect our ocean and environment**, we commit to safeguarding the integrity of our natural systems and biodiversity through conservation action and by minimising activities that degrade, pollute, overexploit, or undermine our ocean and natural environment.
- x. **To ensure a well-connected region**, we commit to invest in and strengthen our partnerships and regional regulatory arrangements to support transport and information, communication and technology services and infrastructure.

Strategic Context

The 2050 Strategy emphasises that the Blue Pacific is about Pacific peoples, their faiths, cultural values, and traditional knowledge. People who know their needs and potential; plan and own their development agenda; and act collectively for the good of all.

The global COVID-19 pandemic and global security challenges placed tremendous social and economic stress on the people of the Pacific, who already contend with the impacts of climate change, frequency of disasters and the increasing number of people suffering from non-communicable diseases. While the region continues to face challenges related to the sustainability and security of its ocean and land-based resources, these other issues are creating widening fiscal deficits.

The Strategy is shaped by the region's historical, current and evolving context and identifies where and how the countries and territories of the region will work together as the Blue Pacific Continent and in partnership with all regional stakeholders. It builds on a number of regional agreements and declarations such as the Pacific Plan (2003), Framework for a Pacific Oceanscape (2010), The Pacific Leaders Gender Equality Declaration (2012), The Framework for Pacific Regionalism (2014), The Regional Roadmap for Sustainable Fisheries (2015), The Blue Pacific Narrative (2017), The Boe Declaration (2018), and The Pacific Regional Culture Strategy (2022).

In the current context, there is an increased urgency for the region to act collectively to progress issues of significance, including health epidemics, climate change and disaster risk, gender equality, regional security, ocean governance, and economic and trade development.

The Strategy is a living document which has been developed through comprehensive consultations at both the national and regional level with Members, CROP agencies, Non-State Actors and specialists from within and beyond the region. It is supported by an implementation planning process that recognises unforeseen events. It will be supported by a policy brief and implementation plan which will capture details of sequenced collective actions and a detailed monitoring and reporting framework.

Overarching Approach

The 2050 Strategy features **10 commitments** that Leaders have made to strengthen their collective action and deepen regionalism to realise the vision. In support of these commitments, the Strategy brings together seven interconnected **thematic areas** that are based on comprehensive consultation with Members, CROP and other regional organisations, Non-State Actors, and regional experts.

The thematic areas are:

- » Political Leadership and Regionalism
- » People-Centered Development
- » Peace and Security
- » Resource and Economic Development
- » Climate Change and Disasters
- » Ocean and Environment
- » Technology and Connectivity

Each thematic area contains a **level of ambition** that represents the transformational change that is sought by 2050 in that area. Together, the achievement of all levels of ambition will support the realisation of the vision.

To drive this, each thematic area contains a number of **strategic pathways** which focus on governance; inclusion and equity; education, research and technology; resilience and wellbeing; and partnerships and cooperation. The strategic pathways align to our values and have been developed in a way that reflect the interlinkages that exist across the thematic areas. The strategic pathways, which also align to the Leaders' commitments, will guide the identification and development of collective actions as part of the Strategy's **implementation plan**. An overview of the strategic pathways is as follows:

Strategic Pathway Definitions

- The **Governance Strategic Pathway** emphasises the importance of effective leadership, shared commitment and accountability of the Pacific Islands Forum, together with strong and sustained policies and processes that ensure cooperation, coordination and engagement between the various entities, making up the regional architecture.
- The **Inclusion and Equity Strategic Pathway** recognises the diversity and heritage of Pacific cultural values and ensures that all Pacific peoples are protected and have the right to live in societies in which all can participate and prosper.
- The **Education, Research and Technology Strategic Pathway** is designed to encourage scientifically based research, innovation and creativity while taking account of the best of our traditions and cultural practices.
- The **Resilience and Wellbeing Strategic Pathway** underlines the importance of continuing to strengthen the capacity of the Pacific, her peoples, communities and nations to respond effectively in times of adversity, including in relation to the environment, while building and sustaining free, healthy and productive livelihoods.
- The **Partnership and Cooperation Strategic Pathway** highlights the importance of the region working together, and of working with a wide range of regional and international stakeholders, where all respect the region's faiths, cultural values, and traditional knowledge, and genuine and durable partnerships are based on principles of national and/or regional ownership, mutual trust, transparency and accountability.

LOTOKAYA

White t-shirt, blue goggles on forehead

Dark long-sleeved shirt, black goggles on forehead

White t-shirt with "TAMANUKU" printed on the chest, yellow goggles on forehead

White t-shirt with "en...is" printed on the chest, blue goggles on forehead

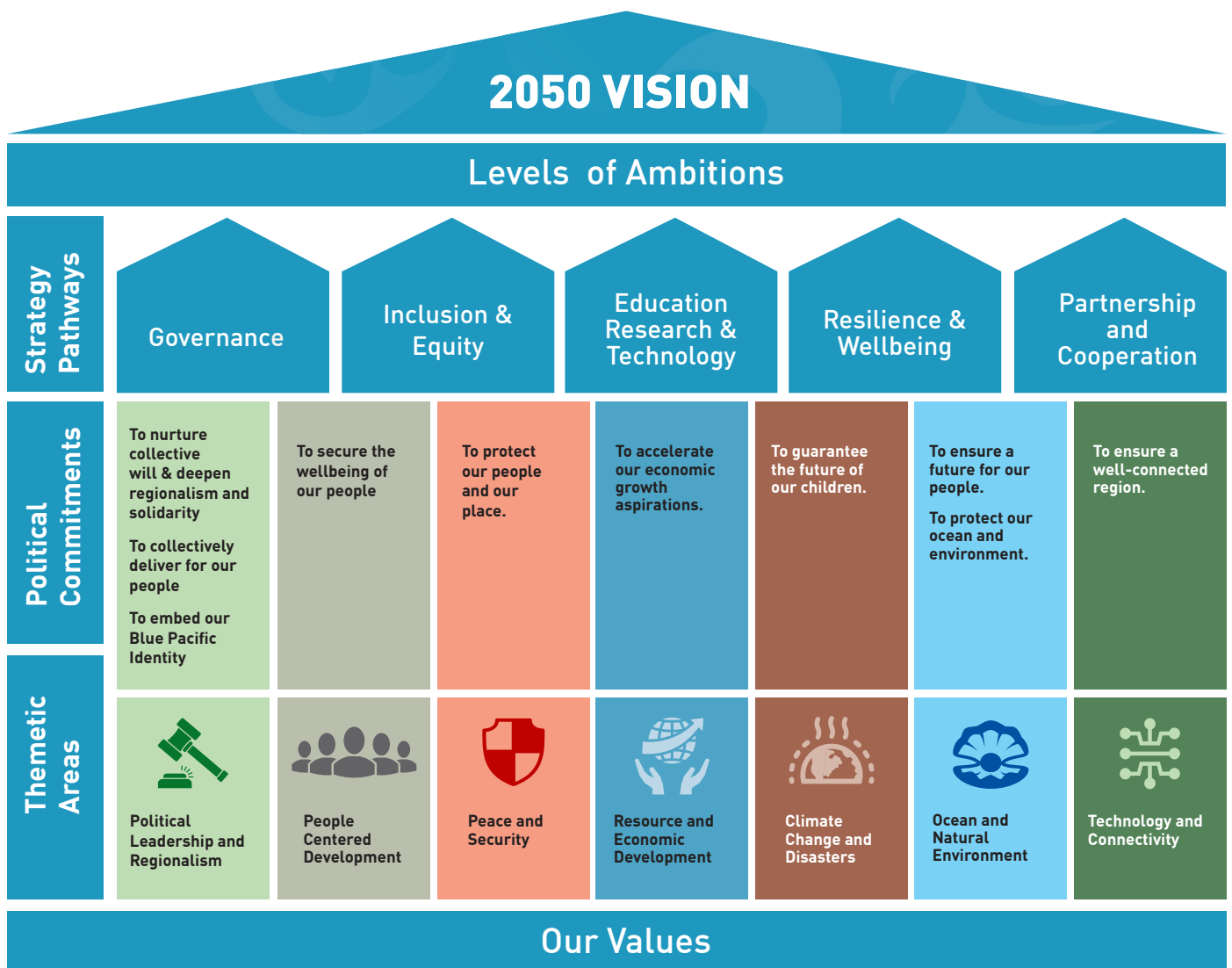
Black wetsuit, black goggles on forehead

White t-shirt with a crown logo and "1st" above a vertical graphic. Text below reads: "JAMES... UNFINISHED BUSINESS... THE LORD AND HE WILL... LIFT YOU UP". Blue shorts.

White t-shirt with text: "FUH NI TAU MAMA" and "KIA MAI OI TUAA". Black goggles on forehead.



Thematic Areas



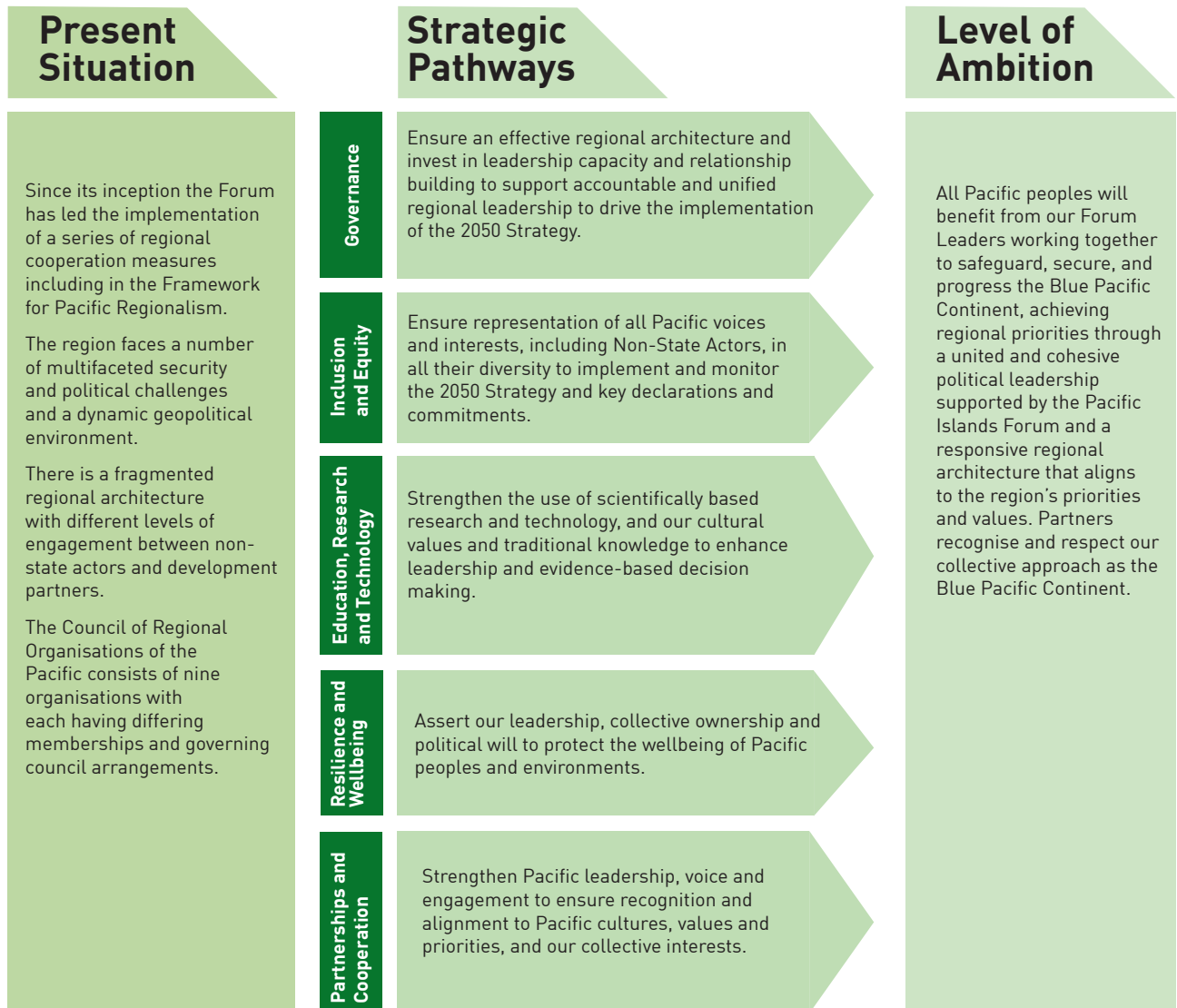




Thematic Area – Political Leadership And Regionalism

The history of Pacific regionalism demonstrates the importance of strong and enduring leadership and political will to address the increasingly complex geopolitical environment and to respond to emerging issues. The delivery of collective actions will be driven by effective governance, inclusivity and ownership that will build leadership and diplomatic capacity and commitment to regionalism.

Success under this thematic area depends on the region working together, including with Non-State Actors, through a regional system that complements national efforts, and drives our joint aspirations and priorities as the Blue Pacific Continent. While respecting national sovereignty and in order to protect our collective interests, the region will act in unity and solidarity in its engagement and advocacy with partners.



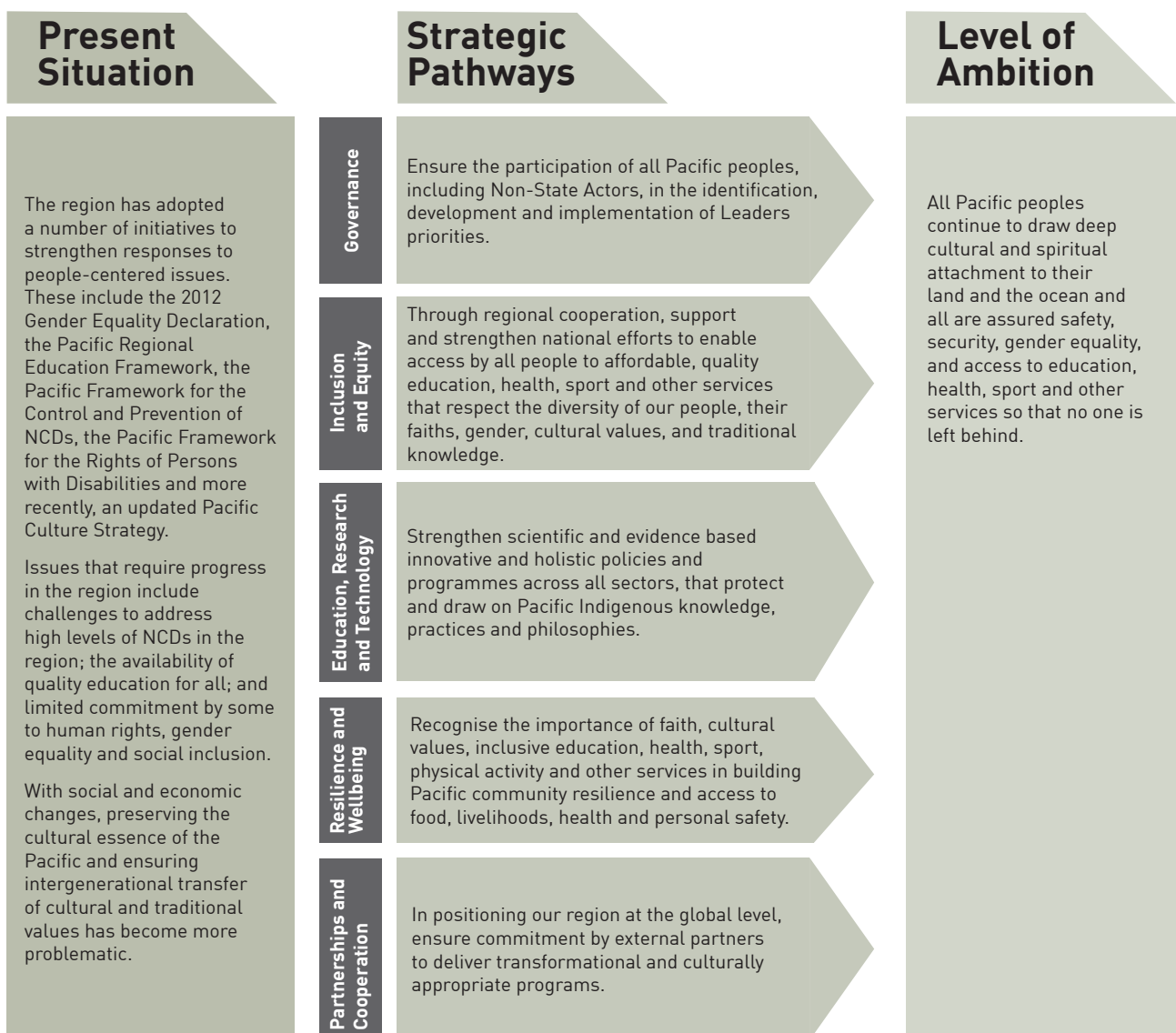




Thematic Area – People-Centered Development

This thematic area recognises that Pacific peoples draw their identity and inspiration from their cultural diversity and deep cultural and spiritual attachments to their land and the ocean. Despite a range of initiatives in the Pacific to promote improved health and education outcomes, much more needs to be done. There is a need to address issues of exclusion and inequality, including gender inequality, marginalised groups, and the importance of protecting human rights and environmental rights.

People-centered development includes youth and cultural development, cultural wellbeing, and participation in sport and physical education. Adaptation and preservation of our indigenous knowledge, social inclusion and social protection are important elements for a people-centered approach to development, and in positioning our region at the global level.



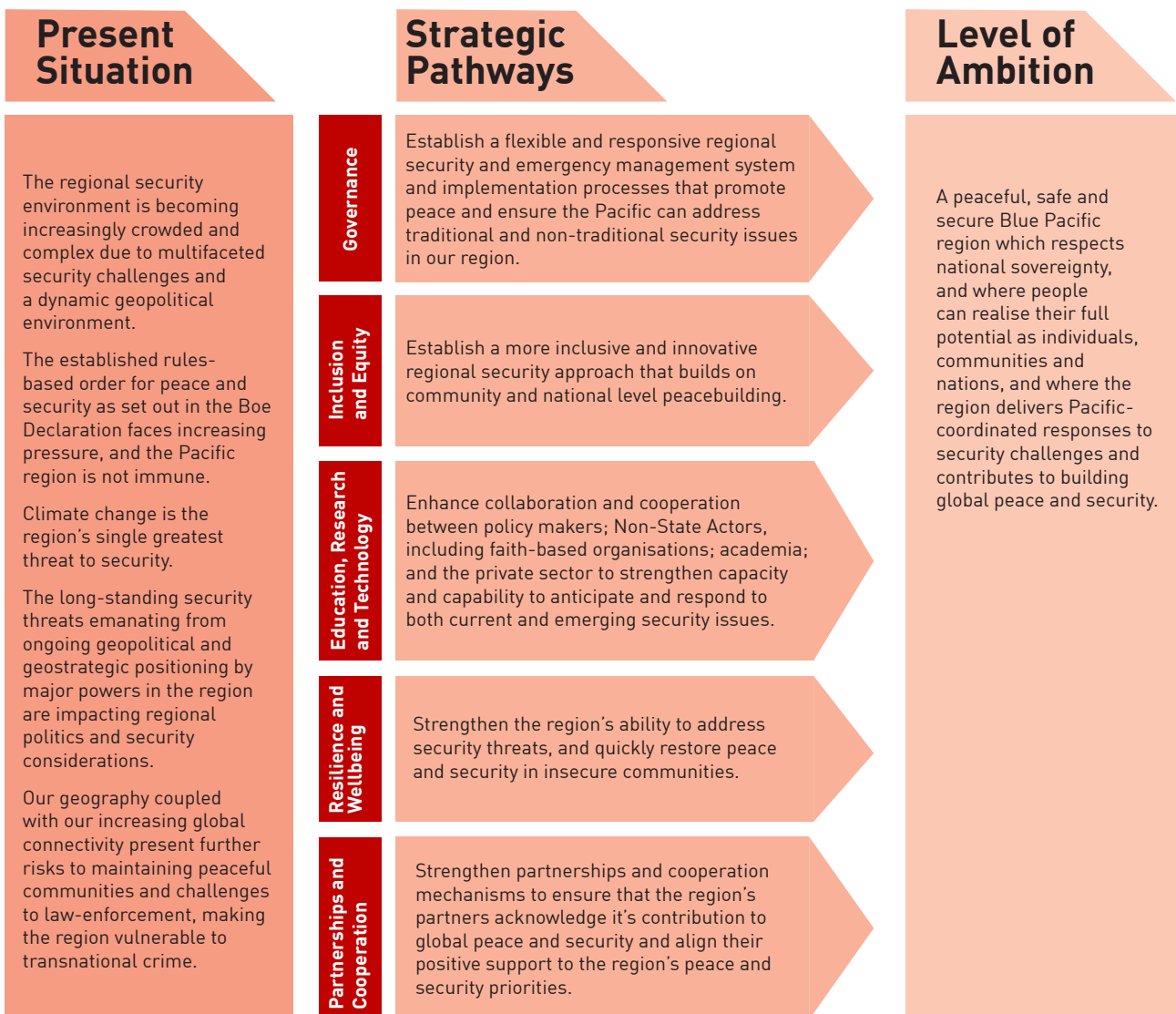




Thematic Area – Peace And Security

This thematic area highlights the central role that peace and security play in ensuring that our countries and territories are able to realise a safe, secure and prosperous region. While recognising the importance to Member countries of collective threats to their peace and security, the Blue Pacific Continent remains committed to principles of democracy, good governance, and non-interference in national affairs.

The region continues to make valuable contributions to the advancement of global peace and security. In doing so, it recognises the expanded concept of security that includes human security, economic security, humanitarian assistance, environmental security, cyber security and transnational crime, and regional cooperation to build resilience to disasters and climate change. Peacebuilding that ensures safety and security at the community level is supported by faith-based and non-governmental organisations. Forum Members continue to work cooperatively to uphold regional peace and security, and support international peace and security efforts, in the face of complex global challenges and relationships.



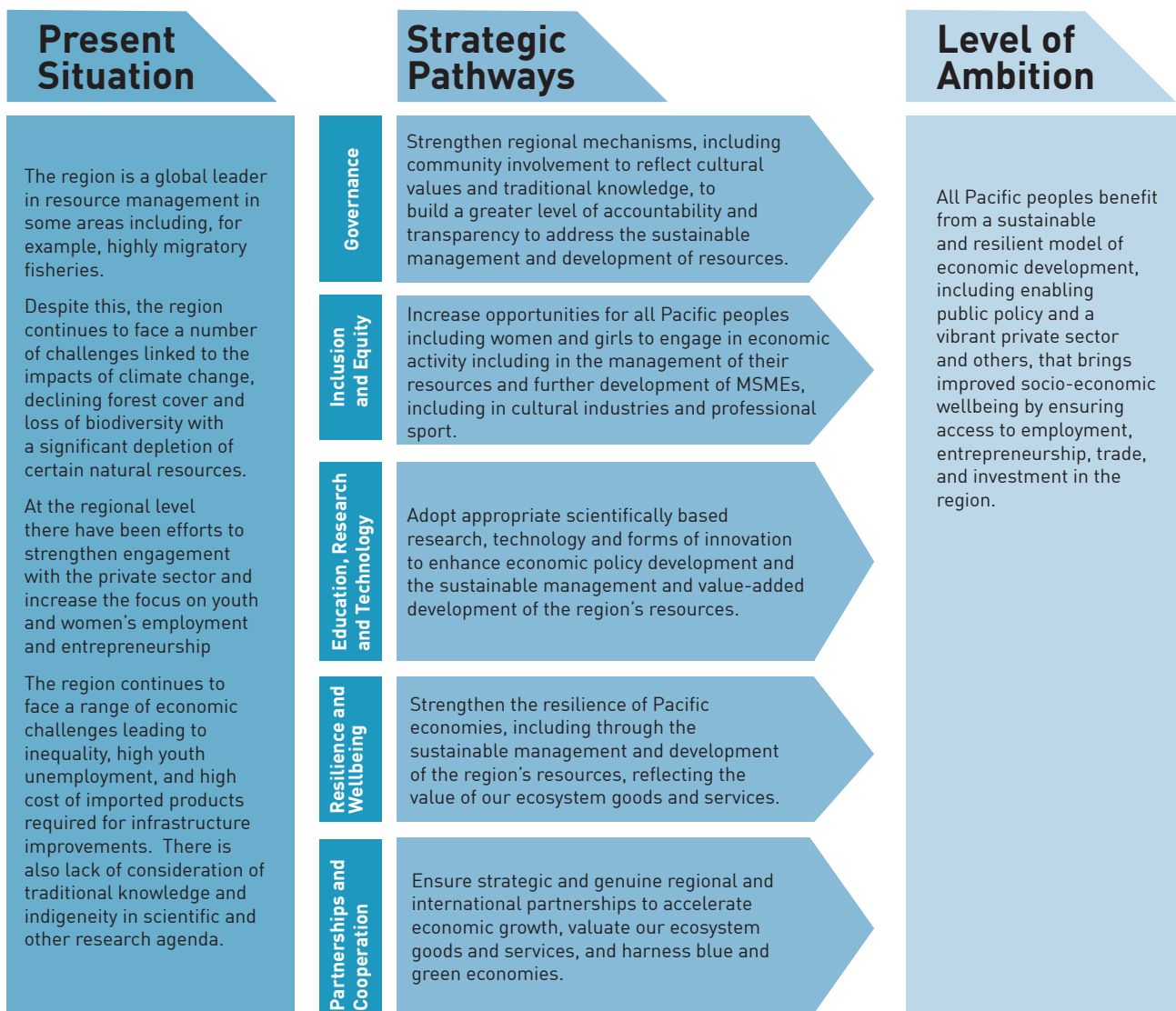




Thematic Area – Resources And Economic Development

This thematic area highlights the importance of accelerating the region’s economic growth aspirations through strengthened ownership, and by ensuring the sustainable management and development of the region’s natural and human resources. The sustainable management of resources will require the development of control measures; environmental, social and cultural impact assessments; and by identifying and valuing the region’s ecosystem goods and services. This is critical for building the region’s resilience and ensuring sustained economic development and growth.

The region already faces the dual challenge of fiscal sustainability risks in the short term and financing shortfalls in critical areas, especially in the fight against climate change, increasing the urgency to consider innovative financing instruments and mechanisms. Diversifying our investment portfolios, increasing the role of the private sector in important areas such as fisheries, agriculture, forestry, mining and tourism, and cultural industries and creating employment and entrepreneurial activity in the micro, small and medium-sized enterprises (MSMEs) are vital for improving and expanding wellbeing opportunities for Pacific peoples. The region continues to benefit from labour mobility schemes and professional sport that promotes skills development and remittances.



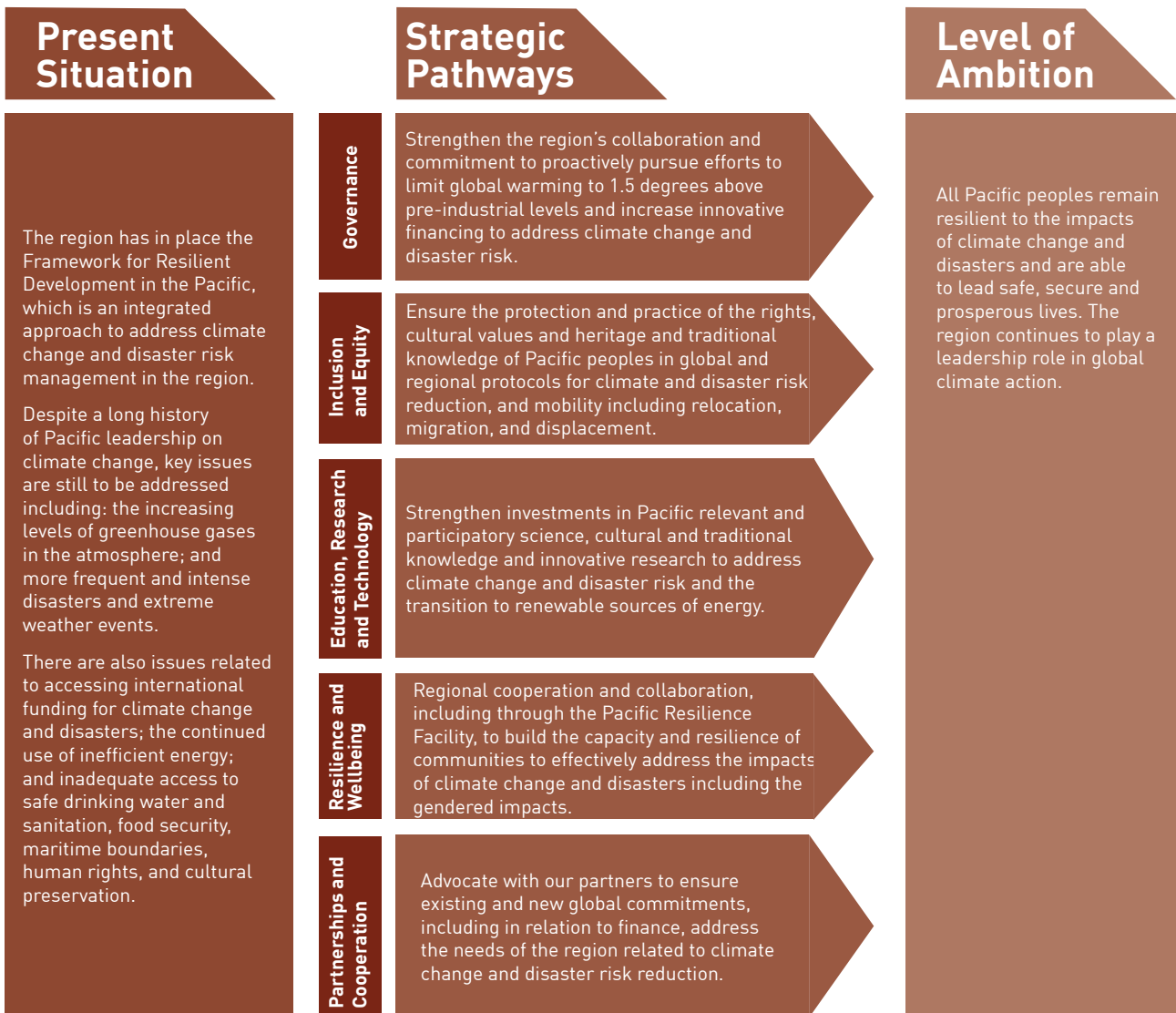




Thematic Area – Climate Change And Disasters

This thematic area highlights the many impacts of climate change and disasters and their threats to the future of the region’s people and the statehood of many Pacific nations. It is important to implement agreed measures that proactively, collectively, and in a culturally appropriate manner, address climate change and current and future disaster impacts including extreme weather events, cyclones, drought, flooding and sea level rise and ocean acidification.

Other important issues include climate finance, disaster risk reduction mechanisms, loss and damage, the nexus between climate change and the ocean, maritime boundaries, human rights, the rights of women and girls, the rights of persons affected by climate change, food and water security, disasters as well as climate change and disaster related mobility including relocation, migration, and displacement.



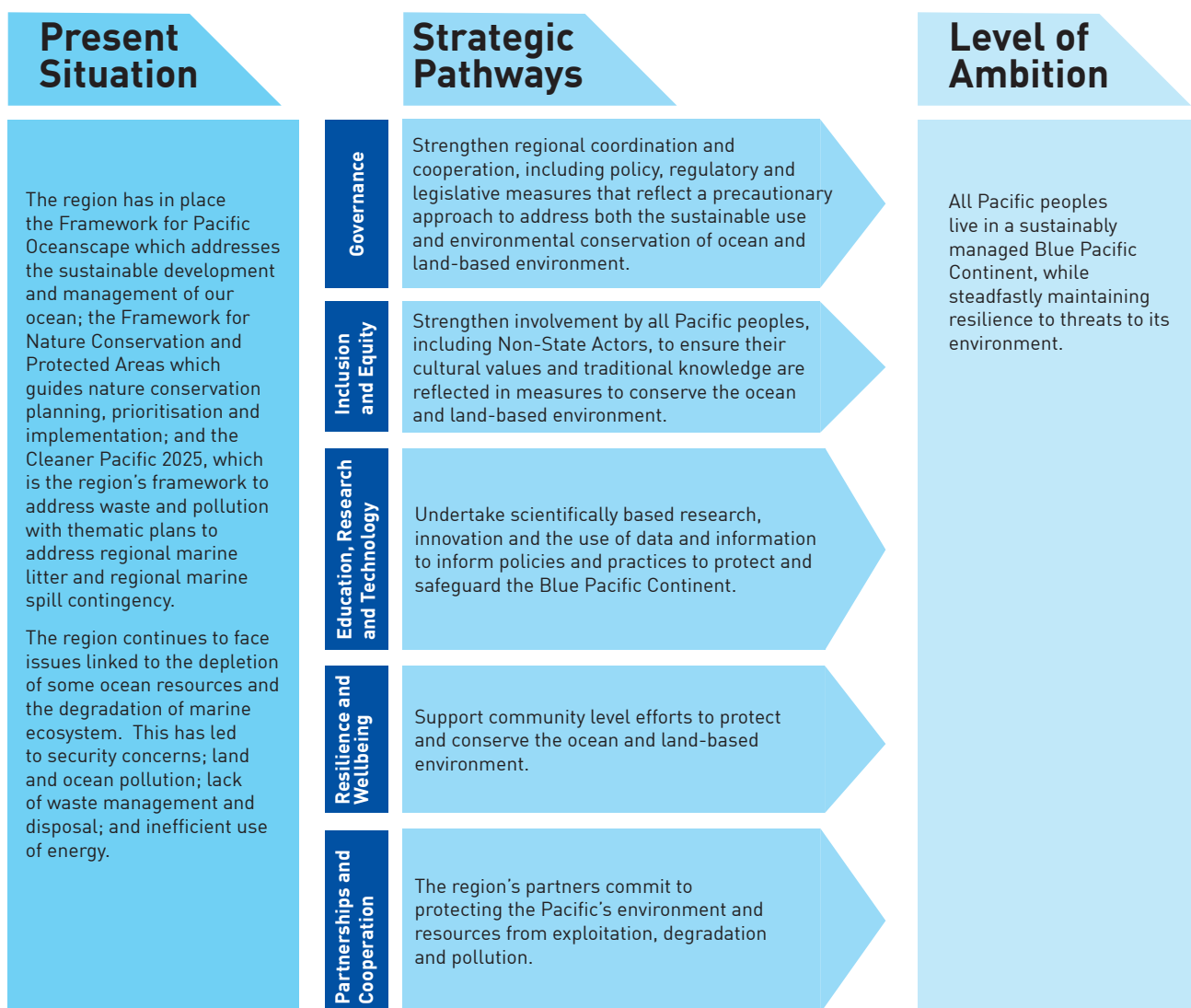




Thematic Area – Ocean And Environment

This thematic area focuses on the region’s stewardship of the Blue Pacific Continent through collective responsibility, commitment and investment in its ocean and lands. This includes to invest in the region’s sovereignty and sovereign rights over its maritime zones and lands, such as to support its continental shelf claims.

Recognising the significant environmental and ecosystem-based services that the Blue Pacific provides to the planet, the region’s ability to benefit from its ocean and environment depends on its capacity to make the right policy choices, partnerships and investments, including by adopting a precautionary and forward looking approach to protect the region’s biodiversity, its environment and resources from exploitation, degradation, nuclear contamination, waste, pollution, and health threats.



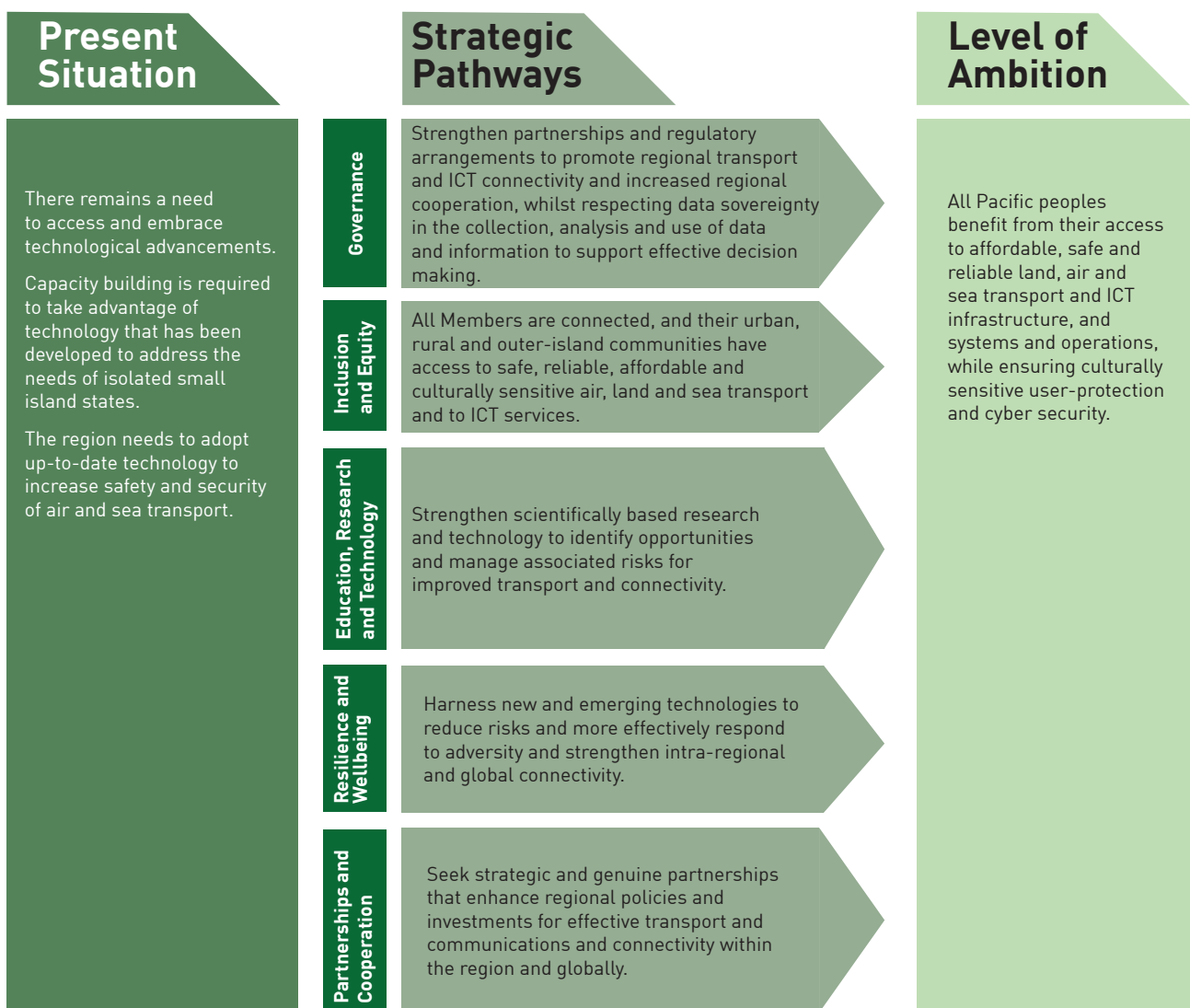




Thematic Area - Technology And Connectivity

This thematic area highlights the need for a well-connected region that ensures inclusive, affordable and accessible air, sea and land transport and ICT technology infrastructure and services. Technology and infrastructure is often unaffordable, inaccessible, and difficult to maintain. The adoption of new and emerging sustainable digital technologies requires effective partnerships and appropriate regional regulatory arrangements that respect the region’s shared values.

The thematic area also draws attention to the importance of disaggregated data and data sovereignty and more detailed information for improved decision-making while ensuring safeguard measures are in place.



Implementation Approach

To ensure the effective delivery of the 2050 Strategy and the achievement of the Leaders Vision, a comprehensive implementation and monitoring plan will be developed. It will set out in detail the collective actions required to meet the levels of ambition for each thematic area to support the achievement of the 2050 vision.

The implementation plan will identify the interlinkages across all thematic areas and ensure coordination with timelines, resourcing and involvement of key stakeholders and relevant technical agencies. It will be the basis for monitoring and measuring progress under each thematic area and in doing so, identify risks, implementation issues/constraints that may impede progress. It will draw on the enabling aspects of the region's cultural values and traditional knowledge and reflect how activities will be designed and implemented. It will also highlight the roles and responsibilities of partners in supporting the collective actions.

To ensure accountability and commitment to the implementation of the 2050 Strategy, it will be important to develop a strong monitoring and reporting framework that uses quantifiable data and qualifiable information to monitor the performance and delivery of expected outcomes under each of the Strategic Pathways. As a starting point, the regional SDGs indicator set will be used to monitor the implementation of each of the thematic areas. It will also be important to consider the need for other Pacific-relevant targets and indicators that monitor the success of partnerships as well as progress made to deepen regionalism in the terms defined in the Framework for Pacific Regionalism.

Guiding Principles

The implementation approach will be framed by the following principles:

- **The Implementation approach and collective actions will be developed in a manner which respects national sovereignty and the principle of non-interference in national affairs.**
- **Collective actions developed under the 2050 Strategy should be responsive, aligned and complementary to national actions and policy positions:** The Framework for Pacific Regionalism identifies collective actions which support national priorities and objectives such as those where there is a shared norm, standard or common position on an issue; delivers a public or quasi-public good; overcomes national capacity constraints; realizes economies of scale or facilitates economic or political integration.
- **Builds from existing national and regional policy frameworks, declarations and decisions of Leaders** and collective actions such as the pooling of services, streamlining of policies, resource mobilization, technical assistance, and the creation of public goods in areas such as health, education, trade, and sustainable development leadership in collective diplomacy.
- **Adopts an effective governance and reporting process** that is Member-led and driven, to build accountability for implementation by Member countries and relevant regional agencies in meeting the commitments of Leaders as outlined in the 2050 Strategy. A governance structure for the development of the implementation plan, yet to be developed, will be finalised for Leaders' consideration in due course.
- **Includes an inclusive and integrated approach**, with the full participation of Member states, CROP agencies, Non-State Actor groups, faith-based organisations in the development of the implementation plan and monitoring and reporting framework.
- **Ensure collective actions are developed in a robust and flexible** way based on evidence and including comprehensive risk assessment.





Annex 3

Kainaki II Declaration for Urgent Climate Action Now, 2019

(available at: <https://www.forumsec.org/2020/11/11/kainaki/>)

Kainaki II Declaration for Urgent Climate Change Action Now

Securing the Future of our Blue Pacific

1. We, the Leaders of the Pacific Islands Forum, meeting in Tuvalu see first-hand the impacts and implications of the climate change crisis facing our Pacific Island Nations.
2. Right now, climate change and disasters are impacting all our countries. Our seas are rising, oceans are warming, and extreme events such as cyclones and typhoons, flooding, drought and king tides are frequently more intense, inflicting damage and destruction to our communities and ecosystems and putting the health of our peoples at risk. All around the world, people affected by disaster and climate change-induced displacement are losing their homes and livelihoods, particularly the most vulnerable atoll nations.
3. As Leaders, we reflect and acknowledge the substantial work and investment over two and half decades of climate change negotiations, commitments, and scientific advancements, all intended to avert the crisis we now face. However, we are concerned that progress within the United Nations Framework Convention on Climate Change (UNFCCC) must keep pace with the challenges we face today and in the future, in line with the *Boe Declaration on Regional Security*.
4. We hear the voices of our youth and the most vulnerable within our societies, having a loud and resounding impact. In amplifying the alarm we have been sounding for decades, including the youth of Tuvalu who called for the preservation of their homeland and culture. We welcome the Republic of the Marshall Islands' role as co-lead on the United Nations Secretary General (UNSG) Climate Action Summit's Youth and Public Mobilisation track, including through promoting the "Kwon Gesh" Youth Climate Pledge.
5. We welcome the work of the Intergovernmental Panel on Climate Change (IPCC), which remains the authoritative scientific body on climate change and is regarded as providing governments the best available science on climate change. The *IPCC Special Report on Global Warming of 1.5°C* indicates that in model pathways with no or limited overshoots of 1.5°C above pre-industrial levels, global net anthropogenic carbon dioxide emissions decline by about 45% from 2010 levels by 2030, reaching net zero around 2050.
6. We note with grave concern and fear for our collective future that global greenhouse gas emissions continue to rise, reaching record levels; and based on current trends, without urgent action, we will exceed 1.5°C by as early as 2030 and reach 3°C or more by the end of this century.
7. We are of the conviction that the shared prosperity and security of our Blue Pacific can only safely exist if the international community pursue efforts to limit global warming to 1.5°C above pre-industrial levels, as set out in the Paris Agreement. The science is non-negotiable. Urgent action by the international community to reduce greenhouse gas emissions is critical to keep us on the 1.5°C pathway.

8. Urgent action is needed to ensure our shared needs and interests, potential and survival of our Blue Pacific and this great Blue Planet.

9. It is clear that to overcome the climate change crisis facing our Pacific Island Nations, we must increase our global solidarity and align our actions with our common concerns. Any failure to act will impact not just us, but our children and all generations to come. The time to act is now.

10. The Pacific Ocean is at the heart of our Blue Pacific narrative and critical for our future. As Leaders of the Pacific Islands Forum, custodians of the world's largest ocean and carbon sink, and representatives of our Pacific peoples, we call for immediate action and not just discussion of ambition. Action must be taken in our region, and internationally, to support clean, healthy, and productive oceans, the sustainable management, use and conservation of marine resources, growth in the blue economy and address the impacts of climate change on ocean health.

Our Commitment to Bold Regional Climate Change Action

11. As Leaders of the Pacific Islands Forum, we recognise that to lead is to act and acknowledge the action being taken by all our Members, but we know more needs to be done. To secure the future of our Blue Pacific, we have pursued and must continue to pursue, bold and innovative regional solutions recognising that each of our nation's futures, as well as the actions we choose to take, are interconnected.

12. Our actions and voices must be consistent with a collective vision and we have committed to developing a regional 2050 Strategy to secure the future of the Blue Pacific. Further, the *Boe Declaration on Regional Security* recognises climate change as the region's single greatest security threat and through its expanded concept of security, we are increasing our ability to respond and manage threats to our security.

13. We have established the *Framework for Resilient Development in the Pacific (FRDP)* and its inclusive *Pacific Resilience Partnership (PRP)* as an integrated approach to address climate change adaptation and disaster risk management and will continue to collaborate to build regional resilience. In this spirit, we direct the *PRP Taskforce* to further elaborate the *FRDP* in line with the Paris Agreement and finalise the Monitoring & Evaluation framework by the end of 2021, with a progress update in 2020.

14. We are committed to a collective effort, including to develop international law, with the aim to ensure that once a Forum Member's maritime zones are delineated in accordance with the *1982 United Nations Convention on the Law of the Sea (UNCLOS)*, that the Member's maritime zones could not be challenged or reduced as a result of sea level rise and climate change.

15. We are taking action to protect our fisheries resources, and to conserve and restore our marine ecosystems and biodiversity. We are working to protect our ocean from harmful plastics through our *Pacific Regional Action Plan on Marine Litter 2018-2025* and call on Pacific Rim countries to join and commit to action on addressing marine pollution and marine debris.

16. As a region, we are also creating innovative regional platforms, financial instruments, and services to build our resilience and secure our future. We welcome the substantial investment and technical support provided to date, and request further financial and technical support to elaborate our emerging initiatives.

The Blue Pacific's Calls for Urgent, Transformational Global Climate Change Action

17. This December marks the twenty fifth meeting of the Conference of the Parties (COP 25) to the United Nations Framework Convention on Climate Change (UNFCCC), and is a key opportunity for countries to highlight and increase their pre-2020 ambition and action before the Paris Agreement is fully operational in 2020.

18. We firmly believe that the UNSG Climate Action Summit, the SAMOA Pathway Review, and COP 25 are global turning points to ensure meaningful, measurable and effective climate change action. As Leaders, we commit to act as one family, with mutual respect and responsibilities, to empower our people and secure a shared, bright future for our Blue Pacific. We reinforce the need for transformational change at scale, and for courageous and committed leaders prepared to urgently deliver on real, tangible outcomes.

19. We, the Leaders of the Pacific Islands Forum, call for:

- (i) As we approach the 2020 milestone, all parties to the Paris Agreement to meet or exceed their Nationally Determined Contributions (NDCs) in order to pursue global efforts to limit global warming to 1.5°C above pre-industrial levels, recognising that this is critical to the security of our Blue Pacific. For those that are not a Party to the Paris Agreement, we believe they should take similar steps to pursue efforts to limit global warming to 1.5°C above pre-industrial levels;
- (ii) All Parties to the Paris Agreement to formulate and communicate mid-century long-term low greenhouse gas emissions development strategies by 2020. This may include commitments and strategies to achieve net zero carbon by 2050, taking into account the urgency highlighted by the *IPCC Special Report on Global Warming of 1.5°C*, and establish the necessary policy, financing and governance mechanisms required to achieve this;
- (iii) All countries to recall the United Nations Secretary General's opening remarks at the *Pacific Islands Forum Leaders-UNSG High-level Dialogue*² in May 2019 regarding carbon pricing, fossil fuel subsidies, and just transition from fossil fuels, and invite all Parties to the Paris Agreement to reflect on these views when updating their NDCs and formulating Low Emissions Development Strategies (LEDS);
- (iv) The members of G7 and G20 to rapidly implement their commitment to phase out inefficient fossil fuel subsidies, acknowledging the priorities of the United Nations Secretary General for the upcoming Climate Action Summit;

² The UN Secretary General's opening remarks made at the *Pacific Islands Forum Leaders-UNSG High-level Dialogue*² held at the PIF Secretariat in Suva, Fiji on 15 May 2019, can be found at <https://www.un.org/press/en/2019/sgsm19579.doc.htm>.

- (v) The international community to continue efforts towards meeting their global climate finance commitment of USD 100 billion per year by 2020 from a variety of sources in the context of meaningful mitigation actions and transparency on implementation, through bilateral, regional or global mechanisms, including the replenishment of the Green Climate Fund; and to complete work required to enable the Adaptation Fund to serve the Paris Agreement;
- (vi) The international community to immediately increase support and assistance for Pacific-led science-based initiatives intended to improve our understanding of risk and vulnerability, including through support for modelling and risk mapping capabilities, the development of methodologies for understanding, projecting and responding to climate change-related economic and infrastructure impacts, and capacity building support for evidence-based decision-making and project development;
- (vii) The international community to welcome the work of the IPCC and consider in relevant decision-making the findings of the *Special Report on Global Warming of 1.5°C*, the *Special Report on Climate Change and Land* and the upcoming *Special Report on Oceans and Cryosphere in a Changing Climate*;
- (viii) All parties attending COP 25 to welcome the focus on oceans, and consider developing a work programme on oceans within the United Nations Framework Convention on Climate Change process and convene a workshop on the climate-ocean nexus in 2020;
- (ix) All countries to accelerate support for the work of the *Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts* and ensure that efforts to avert, minimise and address loss and damage are key elements of the financial support needed to meet climate change and development challenges in the Pacific region; and,
- (x) The United Nations Secretary General to urgently appoint a Special Adviser on climate change and security and the United Nations Security Council to appoint a special rapporteur to produce a regular review of global, regional and national security threats caused by climate change, in recognition that climate change is the single greatest threat to the Blue Pacific region as reaffirmed in the *Boe Declaration on Regional Security* and is a growing global security threat.

20. We call on all countries and non-state actors to join with the Blue Pacific in taking bold, decisive and transformative action to address the ever-present challenges of climate change.

Annex 4

Pacific Islands Forum Leaders Ocean Statement 2021

(available at: https://www.forumsec.org/wp-content/uploads/2021/03/Oceans-Statement_v8.pdf)

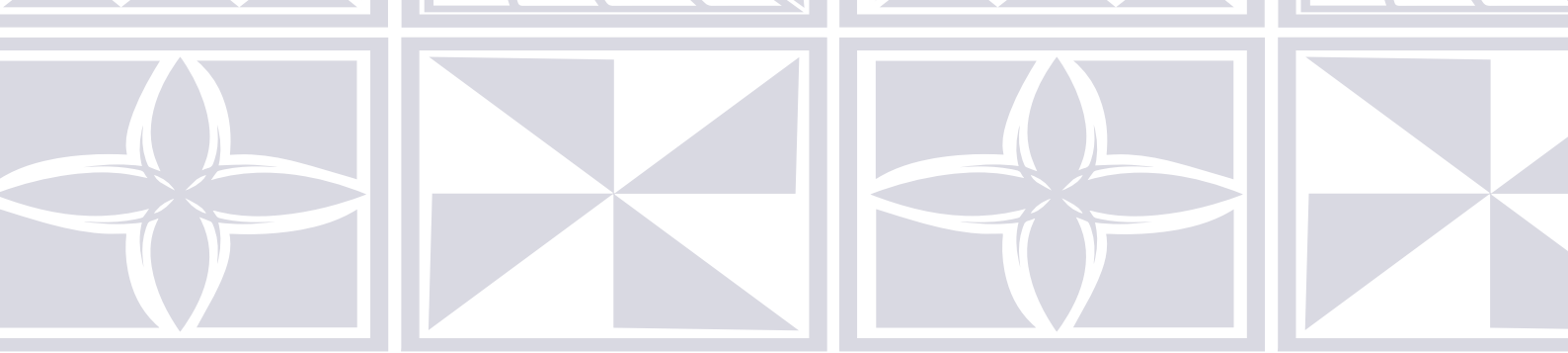


PACIFIC ISLANDS FORUM

Pacific Islands Forum Leaders Ocean Statement 2021



PICTURE: SPC



1. We, the Pacific Island Forum Leaders, representing the Blue Pacific and its peoples, are committed to strong regional action, harnessing shared stewardship of the Pacific Ocean and acting as one Blue Pacific Continent. With 96 per cent of our region being Ocean, the Ocean is at the heart of our geography, our cultures and our economies.
2. Starting in 2021, we will be guided by a new *2050 Strategy for the Blue Pacific Continent* in order to protect people, place and prospects of the *Blue Pacific*. It is envisaged that this new strategy will reinforce the prioritisation of ocean and climate change considerations into all regional and national policies and plans, both public and private.
3. We recognise the impacts and ongoing challenges that COVID-19 has imposed on our region and its Ocean-driven economic sectors. The pandemic has led to major disruptions, reinforcing the need for the Blue Pacific and the international community to renew ambition and action on the Ocean at national, regional and global levels, including towards recovery from the impacts of COVID-19 that advances the goals of the Paris Agreement.
4. The potential of the Ocean to meet sustainable development needs is enormous; but only if our oceans can be restored and maintained to a healthy and productive state. Ongoing trends of exploitation and degradation of marine ecosystems show that not only have endeavors to date been insufficient, but risks are increasing every day. More must be done to protect our Ocean as it provides solutions to some of our existential challenges such as climate change.
5. As custodians of the Blue Pacific, we have demonstrated our leadership and collective resolve to protect the Pacific Ocean. It is our endowment fund, inherited from our ancestors and which we share with future generations. We must care for, invest in and nurture the Ocean to continue to benefit from it.

Recommitting to our regional ocean policies

6. We reaffirm our commitment to sustainably manage, use and conserve our Ocean and its resources, as one Blue Pacific, guided by our regional commitments and policy instruments.¹

1 Namely: Vemööre Declaration: Commitments to Nature Conservation Action in the Pacific Islands region, 2021 – 2025; 2019 Kainaki II Declaration for Urgent Climate Change Action Now; 2018 Boe Declaration for Regional Security; 2016 Pohnpei Ocean Statement: A Course to Sustainability; and 2014 Palau Declaration on The Ocean: Life and Future and regional policy instruments: 2010 Framework for Pacific Oceanscape; 2002 Pacific Islands Regional Ocean Framework for Integrated Strategic Action Policy; the Pacific Islands Framework for Nature Conservation and Protected Areas, 2021 – 2025; Regional Action Plan: Marine Litter; Cleaner Pacific 2025 Strategy; Framework for Pacific Regionalism; Framework for Resilient Development in the Pacific; and Regional Roadmap for Sustainable Pacific Fisheries.

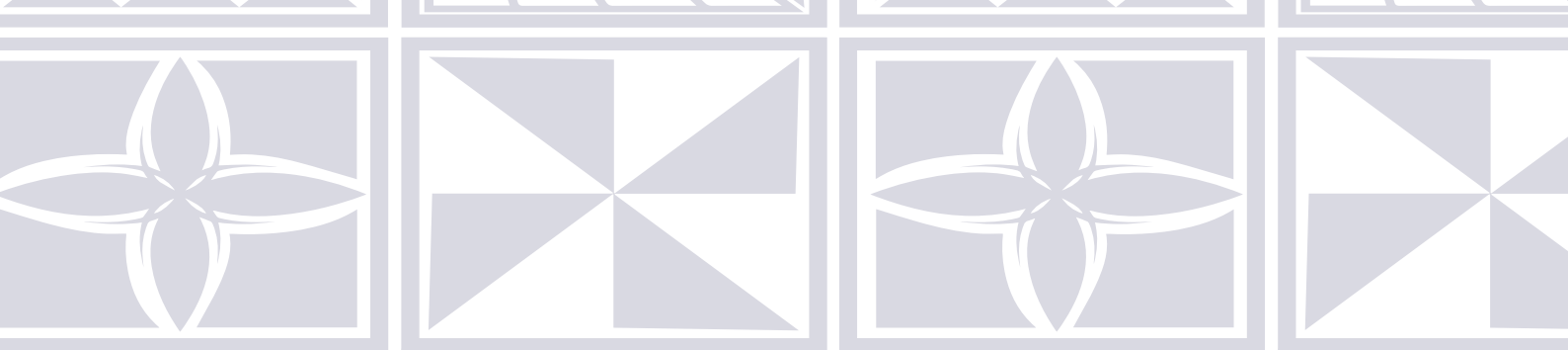
Ocean advocacy and engagement

7. We affirm Forum Foreign Ministers' decision to prioritise sustainable ocean management, use and conservation for the Forum's international engagement and advocacy. As we come together for the 2nd UN Ocean Conference (2UNOC), the 15th Conference of the Parties to the Convention on Biological Diversity (CBD COP15), the Our Ocean Conference, and 26th Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC COP26), and as we enter the UN Decade of Ocean Science for Sustainable Development 2021 – 2030 and the UN Decade on Ecosystems Restoration 2021 - 2030, we must collectively enhance our understanding of the ocean; strengthen the ocean science and policy interface, and focus on effective implementation of all commitments made and go further, to ensure a thriving Ocean now, and for the future. We note the important role of the Pacific Ocean Commissioner on advocacy and attention to Ocean priorities, decisions and processes, including to monitor and report on progress in the implementation of regional Ocean commitments.
8. We acknowledge Palau's role as host of the 7th Our Ocean Conference in 2021, and recognise that hosting this conference and other international events in our Blue Pacific region provides a critical opportunity to showcase regional leadership, build partnerships and raise ambitious action-oriented solutions.



Biodiversity

9. We note the global biodiversity crisis and emphasise the importance of having strong Ocean governance in place both within, and beyond, national jurisdictions of countries of the Blue Pacific, to ensure the holistic and sustainable management of the Ocean.



10. We support global action to develop and implement the post-2020 Global Biodiversity Framework. This framework, along with the 2050 Strategy for the Blue Pacific Continent, will provide further momentum to holistically safeguard our rich biodiversity.



PICTURE: SPC


11. We strive for the expeditious finalisation, adoption and entry into force of an international legally binding instrument for the conservation and sustainable use of marine biodiversity of areas beyond national jurisdictions (BBNJ) that establishes a robust and ambitious framework to conserve and sustainably use our marine biodiversity. This framework must be based on the best available scientific information and relevant traditional knowledge of indigenous peoples and local communities; taking into account the precautionary approach; recognising the special circumstances of Small Island Developing States; recognising the special interests and roles of coastal states; and taking into account cumulative impacts of activities, as well as of climate change, without undermining existing relevant legal instruments and frameworks and relevant global, regional and sectoral bodies.

Urgent climate change action

12. We call for urgent action to reduce and prevent the irreversible impacts of climate change on our Ocean, reiterating that climate change is the single greatest threat to the livelihoods, security and wellbeing of the peoples of the Blue Pacific.

We also note with significant concern, that based on current trends we will exceed 1.5 degrees Celsius as early as 2030 unless urgent action is taken, with significant adverse impacts on the Ocean. The recognition of the ocean-climate-biodiversity nexus entails that the protection of one cannot be at the expense of the other, and that radical ambition is required. This should include meeting or exceeding nationally determined contributions (NDCs), formulating mid-century low emissions development strategies in 2020 and may include commitment and strategies to achieve net zero carbon by 2050.

13. We welcome the convening of the Ocean and Climate Change Dialogue, which considered how to strengthen mitigation and adaptation action in this context, including through consideration of developing a work program on Ocean within the UNFCCC.

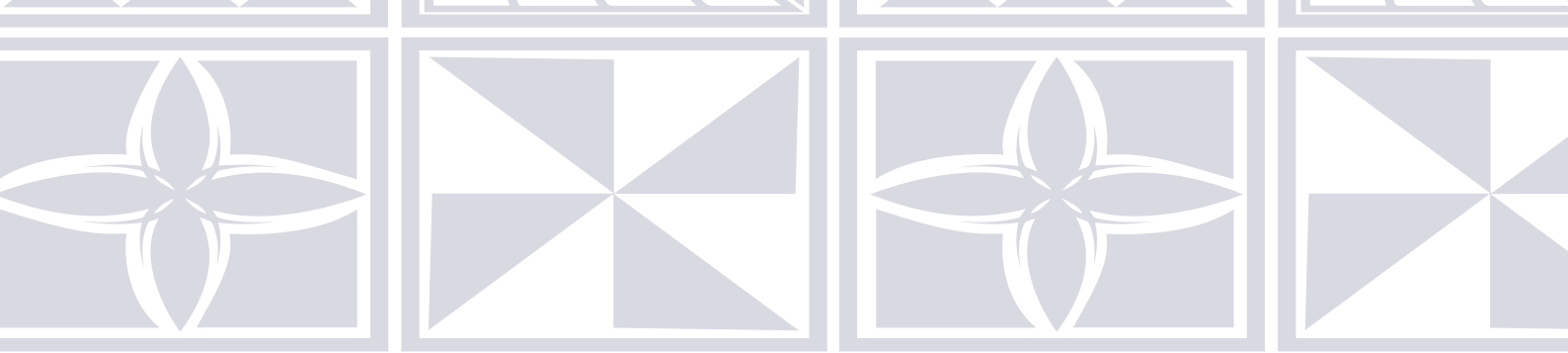
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14. We call for increased investment for the establishment of observation systems, to understand impacts of climate change on the Ocean, blue carbon protection and restoration initiatives for climate mitigation and adaptation, as well as monitoring and prediction to strengthen natural disaster response and risk reduction strategies for our islands. The international community must meet the global climate finance commitment of at least USD 100 billion per year by 2020 from a variety of sources to invest in climate action in developing countries. This investment should be transparently accounted for in its provision and implementation. This should also include exploring innovative financing options and mechanisms for the Ocean.

Securing the Blue Pacific

15. Recognising the strategic importance and value of the Ocean and its peaceful use, we reaffirm our commitment to the rules-based international order founded on the UN Charter, adherence to the UN Convention on the Law of the Sea and resolution of international disputes by peaceful means.
16. Securing the limits of the Blue Pacific Continent against the threats of sea-level rise and climate change is the defining issue underpinning the full realisation of the Blue Pacific Continent. We are committed to concluding outstanding maritime boundaries claims and zones, including related treaties and legal frameworks to support the sustainable development and ensure the peace and security of our Blue Pacific Continent not only from environment threats but also from external geo-strategic interests. We are also committed to a collective effort, including to develop international law, with that aim of ensuring that once a Forum Member's maritime zones are delineated in accordance with the 1982 *UN Convention on the Law of the Sea*, the Member's maritime zones cannot be challenged or reduced as a result of sea-level rise and climate change.

Conservation and sustainable management of the ocean and its resources

17. We commit to responsibly and effectively manage 100% of the Blue Pacific Ocean within and beyond national jurisdiction to ensure its health, productivity, resilience and safety, based on the best available scientific information and traditional knowledge. This includes taking into account ecological and cultural connectivity when designating and establishing conservation and management measures and areas-based management measures including marine protected areas.
18. We are committed to ensuring the long-term sustainability and viability of the *Blue Pacific's* fisheries resources currently being compromised by Illegal, Unreported and Unregulated (IUU) fishing, harmful fisheries subsidies, climate change, low level of value-adding of tuna in the region and marine pollution recognising its centrality to the wellbeing of communities and economies, and as guided by our *Regional Fisheries Roadmap*. Revenues from tuna fisheries provide much needed income for Forum Island members. The industry also provides over 22,000 jobs across the region. COVID-19 and its impact on sectors such



as tourism, has increased the importance of fisheries resources for Forum Island members, both in terms of economic returns and for food security.

19. We call for the increased use of technology, to address threats to the long-term sustainability of fisheries resources and the associated impacts on the social and economic well-being of our people. We call for increased investment in coastal and marine ecosystem restoration and management capacities, sustainable aquaculture development and research activities. Investment is needed for the future of sustainable coastal and marine tourism, economic resilience of fisheries, and community-level economic uplift and food security. We call for focused investment and capacity building towards retaining the traditional knowledge of sustainable fishing practices for future generations of Pacific people.

Maritime connectivity and renewable energy

20. Recognising that the Blue Pacific's maritime transport industry plays a critical role, we call for the sustainable and resilient development of the maritime industry, including investment in new technology and operations, to ensure safe, accessible, efficient and affordable maritime transport which contributes to the International Maritime Organizations decarbonisation strategy and a quieter maritime sector.
21. We are committed to promote partnerships that provide incentives for investment in sustainable ocean-based renewable energy – for new economic opportunities and energy security.

Combatting marine pollution

22. Marine pollution, of all kinds, produces negative ecological and socio-economic impacts including plastics; nuclear waste, radioactive and other contaminants; World War II wrecks and other shipwrecks; and unexploded ordnances. Marine pollution puts entire ecosystems and species at risk in addition to the people who depend on them for livelihood and economic development. Plastic pollution is a planetary threat affecting nearly every marine and freshwater ecosystem globally. Members contribute less than 1.3 percent of the mismanaged plastics in the world's oceans but are one of the main recipients.
23. As the Blue Pacific, we have developed and implemented a regional action plan on marine litter (2018-2025) as part of the *Cleaner Pacific 2025* strategy. However, we recognise the interconnectivity of the world's oceans means that marine pollution requires the involvement of all countries and people to be effectively addressed. We call on Pacific Rim countries to expeditiously implement relevant measures to prevent and effectively manage marine pollution and litter, including through land-based sources, in accordance with international law. The most effective control measures remain prevention and avoiding waste generation. We further call on governments to ensure that appropriate global mechanisms are in place to enable the transformation of the global plastics economy.

Access to development finance and blue recovery

24. Achieving the objectives of the Blue Pacific requires increased levels of development and other sources of finance for the Ocean. It also requires strengthening of enabling environments at all levels, including institutional and human capacity building at the national level and promoting access to science, knowledge, infrastructure, technology and innovation that is open and responsive to the specificities and challenges of our region.

25. We call on greater collaboration with development partners to improve economic recovery efforts and the formation of a sustainable ocean economy in response to COVID-19 pandemic challenges. We call for the development of innovative financing mechanisms, to mobilise financial resources to improve the amount and efficacy of finance to effectively implement ocean governance objectives in the region.

26. We call on global financing institutions, including the Green Climate Fund, Global Environment Facility and Adaptation Fund, to increase investments on oceans and climate change. Further, we call on the international community to identify innovative start-ups as champions to help address development challenges; and promote sustainable and innovative solutions, including implementing ecosystem-based adaptation to climate change, to further develop and advance regional COVID-19 recovery efforts.

27. The Ocean is our past, our present, our future. By deepening collective responsibility and accountability for the stewardship of the Ocean, we can protect our people, place and prospects and secure the future of our Blue Pacific Continent.

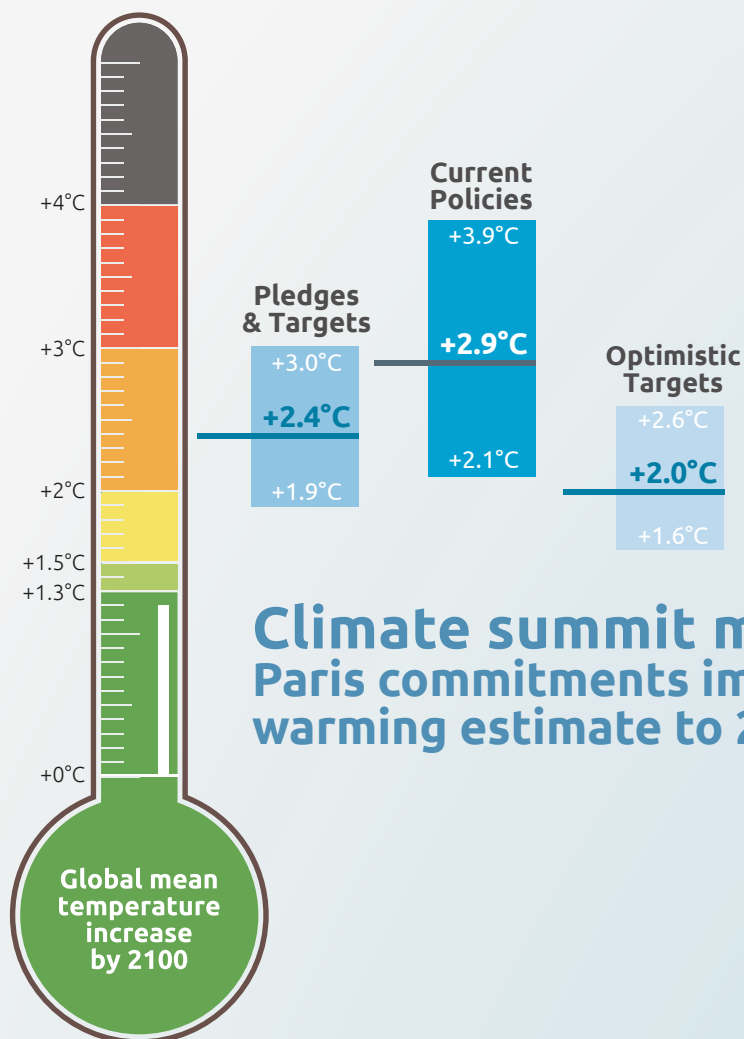


PICTURE: PIFS

Annex 5

Climate Action Tracker, Global Update, Climate Summit (May 2021)

(available at: https://climateactiontracker.org/documents/853/CAT_2021-05-04_Briefing_Global-Update_Climate-Summit-Momentum.pdf)



Climate summit momentum: Paris commitments improved warming estimate to 2.4°C

Climate Action Tracker

Warming Projections Global Update

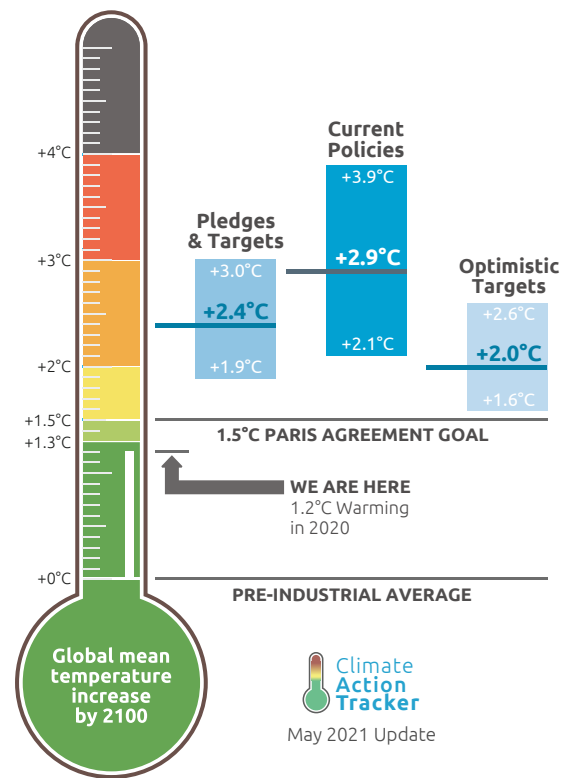
May 2021



Summary

▶ Climate action announcements at US President Biden's Leaders Summit on Climate, together with those announced since September last year have improved the Climate Action Tracker's warming estimate by 0.2°C. End of century warming from these Paris Agreement pledges and targets is now estimated to be 2.4°C.

▶ Assuming full implementation of the net zero targets by the US, China and other countries that have announced or are considering such targets, but have not yet submitted them to the UNFCCC, global warming by 2100 could be as low as 2.0°C ('Optimistic Targets' scenario). 131 countries, covering 73% of global GHG emissions, have adopted or are considering net zero targets (up by four since [our last assessment](#)). However, it is the updated 2030 NDC targets, rather than the additional countries, that contribute the most to the drop in projected warming compared to our last estimate, highlighting the importance of stronger near-term targets.



▶ While all of these developments are welcome, warming based on the targets and pledges, even under the most optimistic assumptions, is still well above the Paris Agreement's 1.5°C temperature limit.

▶ The emissions gap in 2030 between Paris pledges and targets and pathways compatible with 1.5°C has narrowed by around 11-14% (2.6-3.9 GtCO₂e). The largest contributions came from the US, the EU27, China and Japan.

▶ This emissions gap needs to be closed with further NDC target updates this year.

▶ NDC updates need to continue in advance of the COP in Glasgow. Those countries that have not improved their targets need to rethink: Australia, Mexico, Brazil, Russia, Indonesia, Turkey, and Saudi Arabia.

▶ All targets have yet to be supported by ambitious policies. Our temperature estimate of all adopted national policies ('current policies' scenario) is 2.9°C.¹

¹ This estimate is based on our [September 2020 assessment](#) and has not been updated.



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At the end of April, President Biden invited 40 world leaders to participate in a climate change summit, demonstrating that world leaders are again turning their attention to the climate crisis.

The **US, Japan and Canada** announced new 2030 nationally determined contribution (NDC) targets. The [US target](#) of 50-52% below 2005 levels is a significant step forward, but falls short of the [57-63% below 2005 levels](#) needed to be compatible with the Paris Agreement's 1.5°C temperature limit. The [Japanese target](#) of 46% below 2013 levels fell short of expectations that the country would announce halving emissions in 2030, let alone adopt the [more than 60%](#) needed to be Paris compatible. [Canada](#) would only improve its CAT rating if it ditched the less ambitious end of its newly-announced target range of 40-45% below 2005 levels by 2030.

Argentina announced a further strengthening of its target by 2.7% (excl. LULUCF). The announcement builds on the country's [December 2020](#) update where it essentially made its previous conditional target, unconditional.

China announced plans to strictly control coal consumption over the next 14th Five-year Plan period (FYP 2021-2025) and to start gradually phasing out coal during the 15th FYP (2026-2030). While restraining the coal industry is a continuation of current policy priorities, this is the first time China has announced a timeframe for the peaking of coal, planned for 2025. This should be considered a significant milestone. Importantly, however, the commitment does not include placing an absolute limit on coal growth in the next five years, or an actual date for a complete coal phase-out, nor ending financing of fossil fuel infrastructure abroad. It is also reflected in [our assessment](#) of President Xi's announced NDC update made during the Climate Action Summit in December, as this gradual phase out would be needed to achieve peaking emissions before 2030.

The **UK** announced a new 2035 target, having previously submitted its [updated NDC](#) in December 2020, while **South Korea, New Zealand, Bhutan and Bangladesh** all committed to submitting more ambitious NDC this year. **South Korea** also committed to ending all public financing for coal-fired power plants overseas. **South Africa** discussed its [draft NDC update](#), currently undergoing public consultation.

Brazil's President Bolsonaro brought forward the country's climate neutrality goal by 10 years from 2060 to 2050. However, the commitment is dubious as changes in Brazil's 2030 baseline as part of its [NDC update](#) last December, effectively weakened its NDC target. Likewise, **Australia** promised to reach to net zero emissions, at an unspecified date depending upon technology development, but [failed](#) to announce stronger 2030 targets.

While the leaders of **India, Indonesia, Mexico, Russia, Saudi Arabia and Turkey** all spoke, none announced stronger NDCs.

2

Number of NDC updates is on the rise, but more and stronger targets are still needed

The new NDC announcements at the Summit build on the [wave of submissions](#) made at the end of last year. Progress is being made, but there is still a long way to go.

Just over 40% of the countries that have ratified the Paris Agreement, representing about half global emissions and about a third of the global population have submitted updated NDCs (Figure 1).

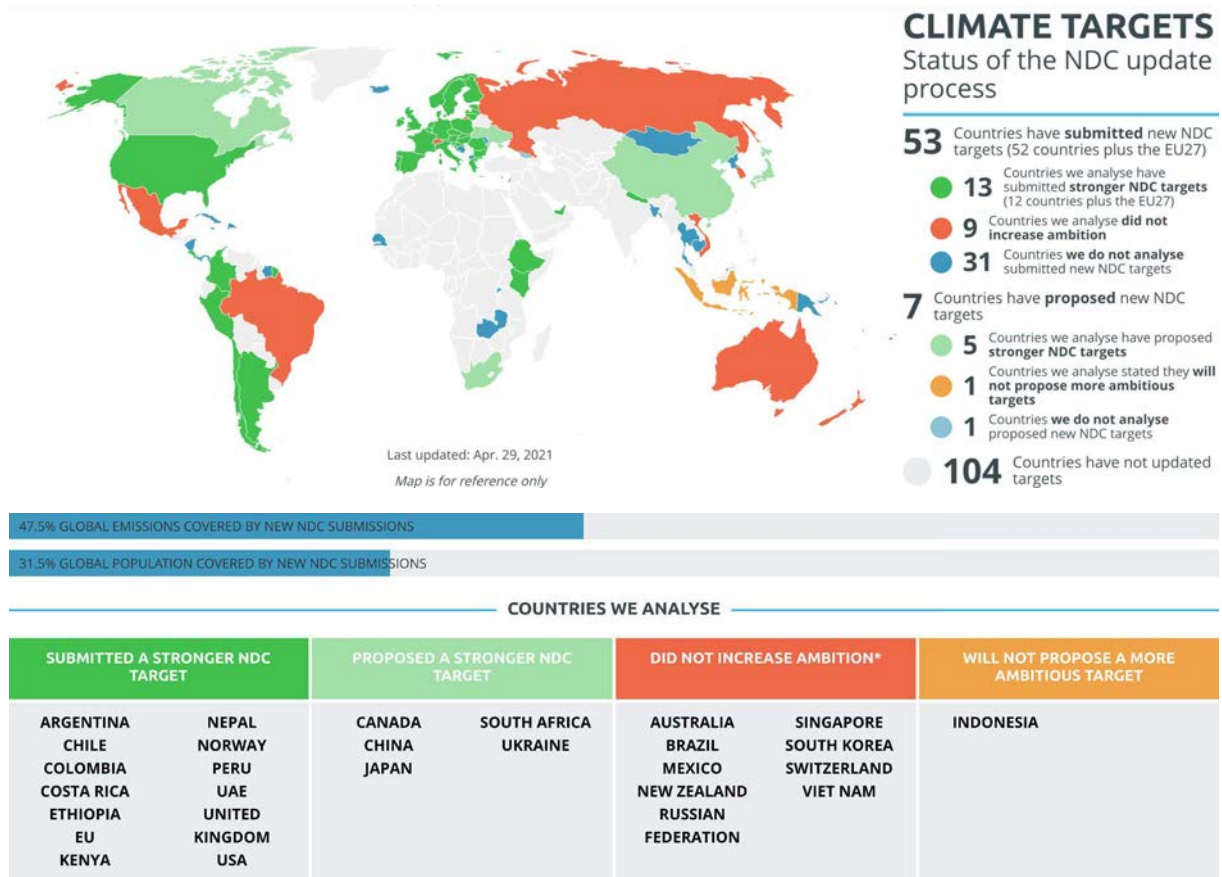


Figure 1 Status of NDC updates as of 30 April 2021. See our [Climate Target Update Tracker page](#) for further details.

Some of these ‘updates’ have done little to actually address emissions.

- ▶ [Brazil](#) and [Mexico](#)’s submitted the same numerical targets; however, changes to their baseline assumptions mean that these are actually weaker overall.
- ▶ [Russia](#) and [Viet Nam](#)’s updates appear stronger on paper but do not constitute a change as they can easily be met with current policies.
- ▶ [Australia](#) simply recommunicated its original NDC. Last year, media reports suggested that [Indonesia](#) intended to resubmit its original NDC target. We heard nothing at the Summit that changes that. The CAT has calculated that [Indonesia could cut its emissions by 30%](#) below its 2030 target if it were to address its burgeoning coal issue, by retiring old plants and cutting back its huge coal plant pipeline.
- ▶ [Singapore](#) and [South Korea](#) improved on the architecture of their targets, but not the ambition. However, as noted above, South Korea has committed to making a further NDC update this year.
- ▶ [Switzerland](#) increased the domestic component of its NDC, but not the overall target.
- ▶ [New Zealand](#) submitted its original NDC target, but, like South Korea, has committed to submitting a stronger NDC this year.

3 We have begun to narrow the gap, but only just

All of the NDC updates since September last year, have narrowed the 2030 emissions gap by around 11-14% (2.6-3.9 GtCO₂e).

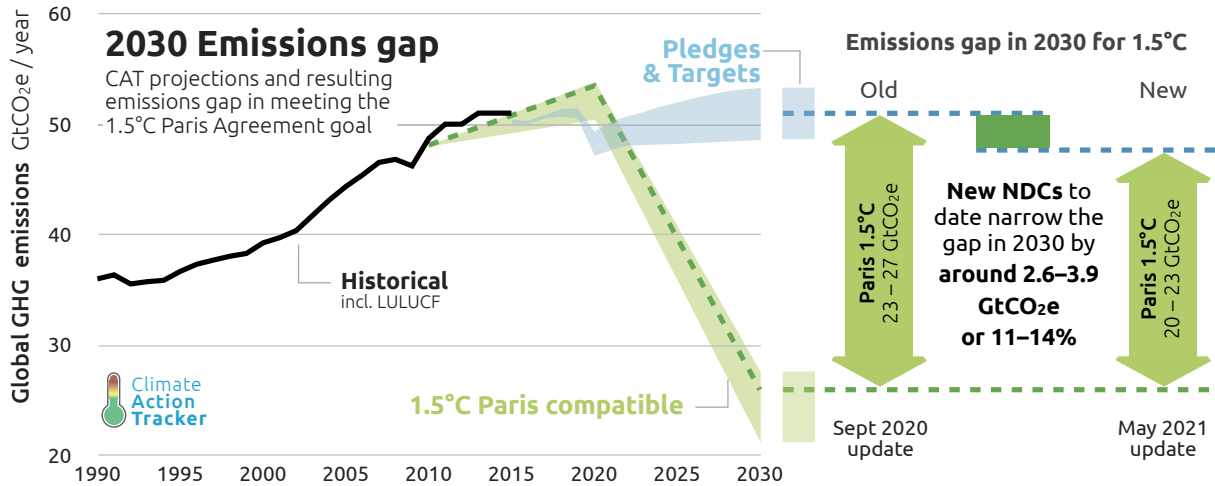


Figure 2 Comparison of emissions gap in 2030 for 1.5°C compatible scenario based on CAT analysis in September 2020 and May 2021.

The largest contributions came from the US, the EU27, China, and Japan.

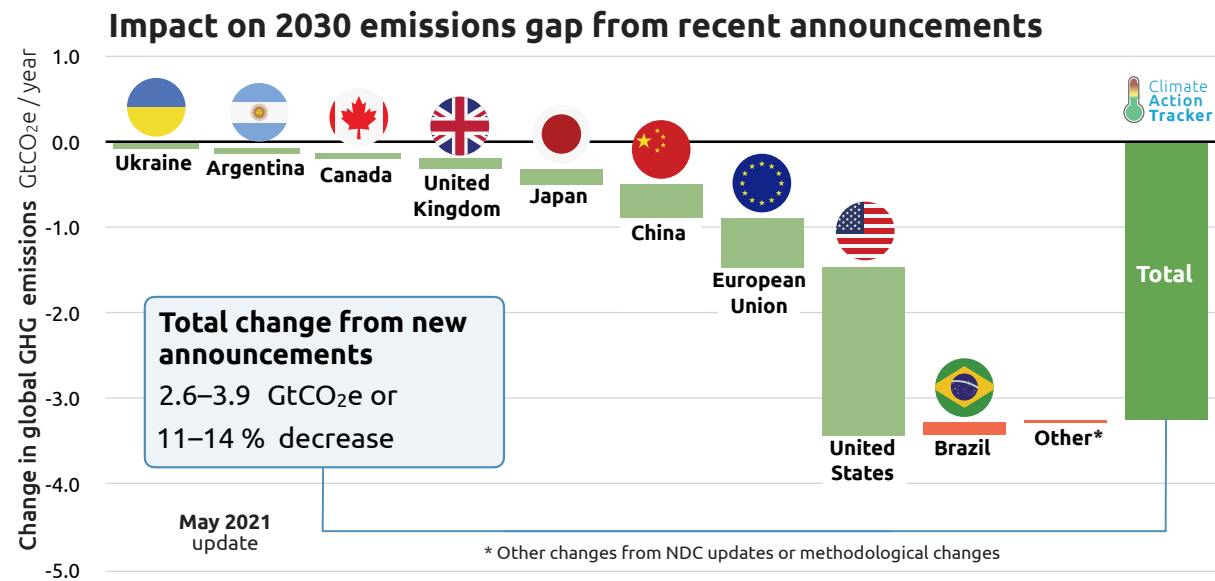


Figure 3 Impact of recent NDC announcements and submissions since September 2020 on the reduction in the 2030 emissions gap.

NDCs updates still put end-of-century warming far above Paris 1.5°C limit

NDC announcements and updated submissions since September 2020 have brought down our temperature estimate of all Paris Agreement pledges and targets to 2.4°C - a drop of 0.2°C.²

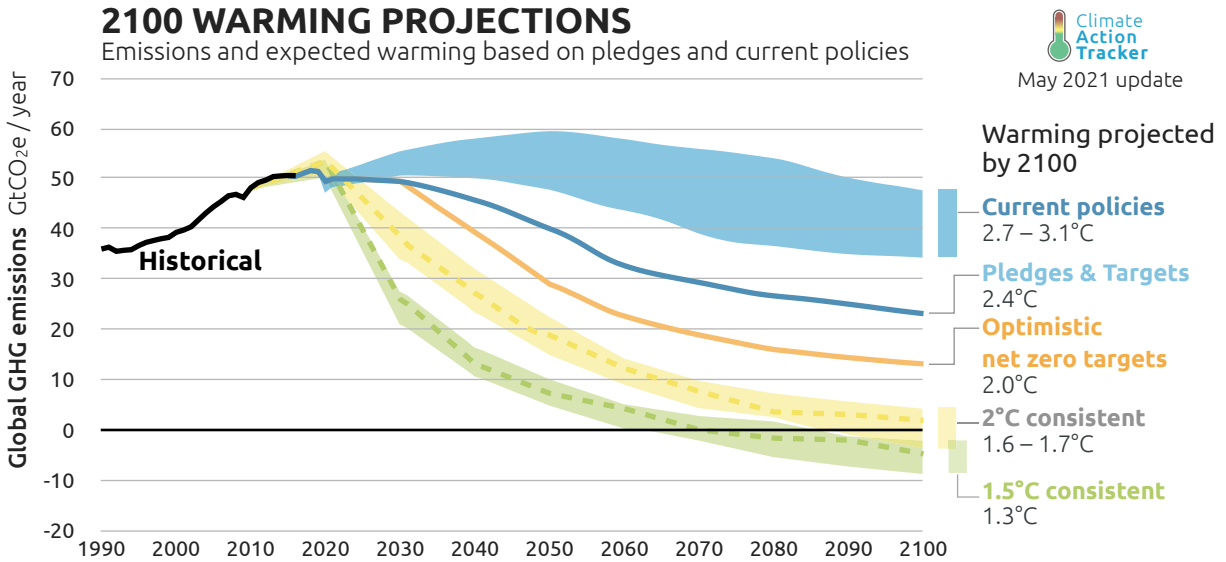


Figure 4 Global greenhouse gas emissions from Pledges and Targets, Current Policies and the Optimistic Targets scenarios and the Climate Action Tracker thermometer showing projected impact on temperature increases by 2100. This estimate for the Current Policies scenario is based on our September 2020 assessment.

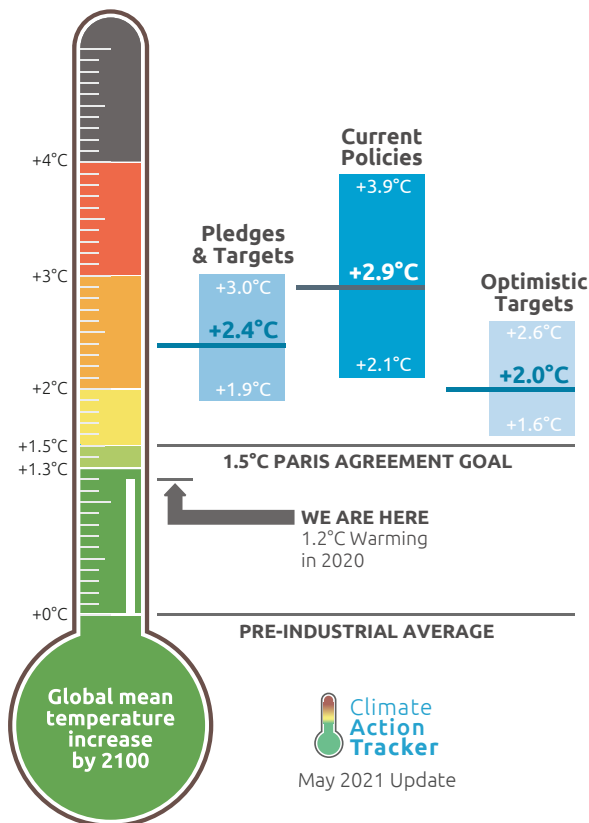


Figure 5 The Climate Action Tracker thermometer showing projected impact on temperature increases by 2100 based on Pledges and Targets, Current Policies and the Optimistic Targets scenarios.

² We also include long-term or net zero targets that are included in countries' long-term strategies submitted to the UNFCCC or adopted in law in our pledges and targets scenario, though occasionally we will remove long-term targets that we deem are no longer valid. This run includes the long-term or net zero targets of: Canada, Chile, Costa Rica, the EU27, Japan, Norway Singapore, South Africa, South Korea, Switzerland and the UK. Normally, we only consider NDCs that have been officially submitted; however, to fully assess the impact of the latest updates we have also included NDC announcements from: Canada, China, Japan, South Africa and Ukraine as we assume that NDCs of, at least, this level of ambition will be submitted to the UNFCCC this year.

Stronger 2030 targets, rather than new net zero targets, have improved our most optimistic scenario

Our most optimistic targets scenario global warming by 2100 could be as low as 2.0°C, which is a slight drop compared to our [December 2020 analysis](#).³ This scenario assumes the full implementation of the net zero targets announced by the US and China and 129 other countries with similar targets or announcements, covering 73% of global emissions. Four more countries have announced net zero since our last assessment: Andorra, Brazil, Kazakhstan, and Panama.⁴

Net zero emissions target announcements

agreed in law, as part of an initiative, or under discussion

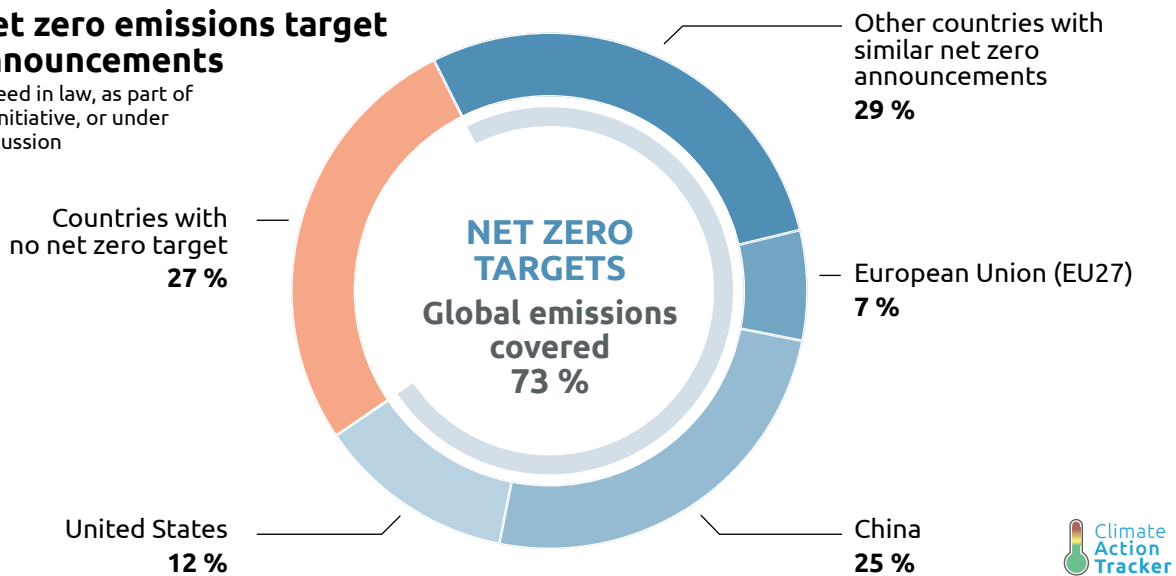


Figure 6 Share of GHG emissions covered by countries that have adopted or announced net zero emission targets (agreed in law, as part of an initiative, or under discussion). Compilation based on ECIU (2021) as of 29 April 2021 complemented by CAT analysis. Emissions data for 2017 taken from EDGAR emissions database.

Stronger 2030 targets, and not these additional countries, contributed the most to this drop in temperature of the optimistic scenario, as it lowers the cumulative emissions pathway to meet the long-term goals. China's and the EU's lower 2030 targets contributed the most here and should reinforce the necessity of having strong 2030 targets.

Reaching the 2.0°C level is an important milestone, but there is only a 50 / 50 chance that it is indeed 2.0°C. This means that there is a 50% chance that the calculated temperature would be exceeded if the given emissions pathway were followed. In probabilistic terms, warming is likely⁵ below 2.2°C.

³ This drop between our December 2020 2.1°C estimate and this estimate is smaller than 0.1°C, with the change driven principally by NDC improvements. The reported 0.1°C difference is due to rounding of the temperature results.

⁴ We have quantified the Brazil and Kazakhstan targets. The approach for Andorra and Panama is the same as that outlined in our [December 2020 briefing](#). For Brazil, we assume that in 2050, CO₂ emissions excluding LULUCF balance projected net removals from LULUCF taken from [a decarbonisation strategy](#) for Brazil produced by the Fórum Brasileiro de Mudança do Clima. Non-CO₂ emissions are assumed to fall linearly to zero in 2070. For Kazakhstan's net-zero GHG target, we assumed that LULUCF sinks will contribute as much as the largest sink recorded in [Kazakhstan's inventory data](#) (i.e., Kazakhstan's GHG emissions in 2060 are assumed to equal the minimum LULUCF emissions between 1990 and 2018). This assumption was based on the reforestation plan [as announced](#) by the Kazakh government, accompanying their net-zero target.

⁵ A 66% or greater chance.

6 The Paris Agreement continues to drive climate action

Since we began tracking the temperature impact of climate targets more than a decade ago, our temperature estimate has decreased 1.1°C (3.5°C to 2.4°C) taking all Paris Agreement pledges and targets or by 1.5°C (3.5°C to 2.0°C) if one takes into account all of the net-zero announcements.⁶ The Paris Agreement is responsible for this drop and has spurred governments to adopt more ambitious targets.

Not only the good intentions, also the national policies implementation has improved over time, driven by new pledges and in particular falling prices of renewable energy. Our temperature effect of climate policies has also decreased by 0.7°C (from 3.6°C to 2.9°C).⁷

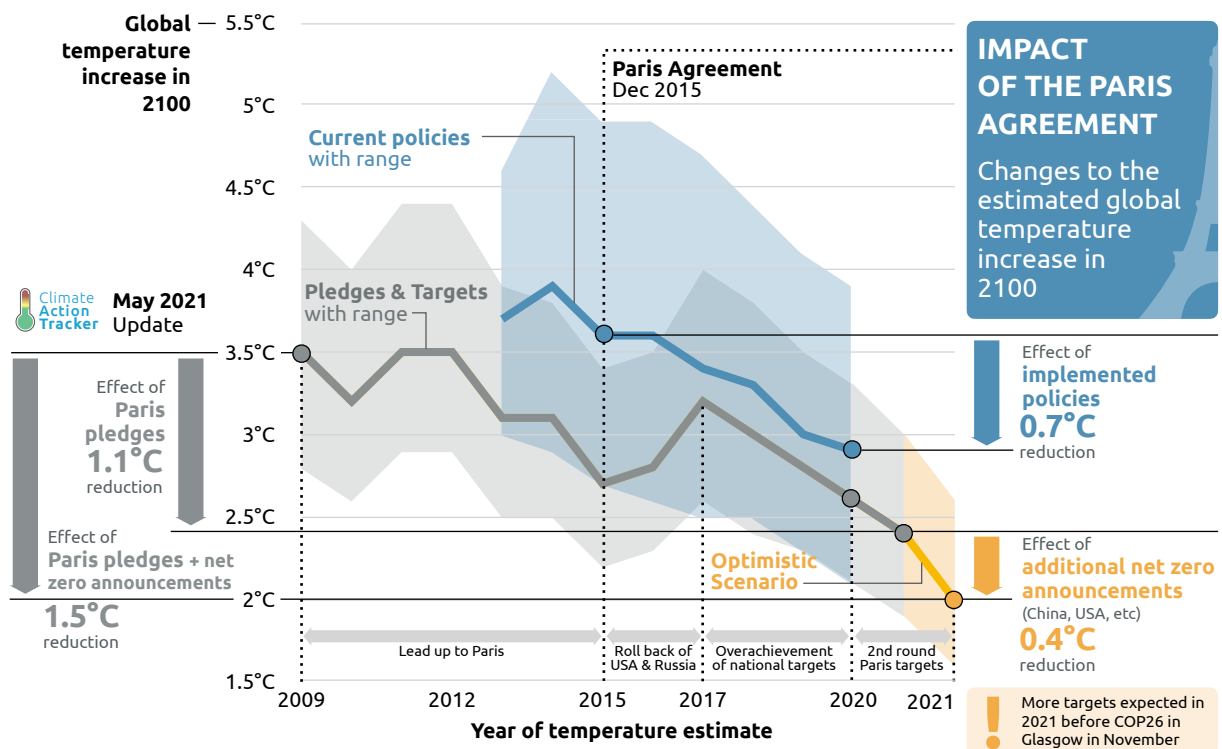


Figure 7 Impact of the Paris Agreement on the estimated global temperature increase in 2100. Figure shows the estimates of the Climate Action Tracker from 2009-2021 for its “pledges and targets” and “current policies” scenarios.

While we are moving in the right direction, even under the most optimistic target assumptions, we are still far from the 1.5°C limit. The fact that [current global warming](#) is now at 1.2°C above pre-industrial levels only serves to reinforce the urgency of further NDC updates.

Moreover, governments have yet to adopt sufficient policies to actually meet the targets they have set. In September 2020, [we estimated](#) that currently implemented policies, including the effect of the pandemic, will lead to a temperature rise of 2.9°C by the end of the century.⁸

6 The Climate Action Tracker is continuously updating and refining its methodology. As a result, the temperature estimates in figure 7 cannot solely be attributed to target improvements or real-world action; however, the figure does show the overall progression of our estimates.

7 This estimate is based on our [September 2020 assessment](#) and has not been updated.

8 We will update our current policies scenario later this year.

7 What needs to happen by Glasgow?

Our analysis shows that while progress is being made, the emissions gap in 2030 has only narrowed by 11% to 14%. There is still much work to be done by the time of the COP in Glasgow to keep the window to limiting warming to 1.5°C open.

There are several key steps to narrow the remaining gap:

- ▶ **Countries that have already updated** their targets that are not 1.5°C aligned need either reconsider or overachieve them. All targets submitted should be viewed as the floor: emissions reductions should be “at least” below the stated amount.
- ▶ **All those that have announced**, but not submitted, have an opportunity to consider revising their targets further in light of the new momentum.
 - ▷ China, the world’s largest emitter, has not yet officially updated its NDC.
- ▶ **Countries that have promised to submit an updated NDC** should do so as soon as possible in order to continue to build momentum.
 - ▷ South Korea and New Zealand are in this category.
- ▶ **The 100+ countries that have not submitted** an update, covering about half of global emissions, need to do so, by submitting much more ambitious targets.
 - ▷ This list includes India, Turkey and Saudi Arabia
- ▶ **Countries that already submitted the same targets, targets that are easily met** with current policies, or that **are less ambitious** than the first NDC, must reconsider and resubmit:
 - ▷ This includes Australia, Mexico, Brazil, Russia, Singapore, Switzerland and Viet Nam. Japan and Argentina, who announced second, more ambitious submissions, are positive examples.
- ▶ **Countries with targets that are less ambitious than their current emission trajectory** could easily update their targets.
 - ▷ For countries like India, Indonesia, Russia (even with its November 2020 [updated NDC target](#)), Saudi Arabia, Singapore, Turkey, and Viet Nam, we already do not consider their targets in our global calculations, but take the current policy trajectory, as it is more ambitious than the target.
- ▶ **Developed countries also need to significantly scale up their climate finance.** Many developing countries will only be able to meet ambitious 1.5°C compatible pathways with significant support from developed countries.
- ▶ Beyond NDC updates, **countries also need to both tighten their policies and urgently implement them.** This scaling up of action is necessary to achieve these targets would put the world on a 1.5°C pathway.

What action do we have to take in individual sectors in order to cut emissions in half in the next ten years and reach net zero by 2050? Sector-specific pathways compatible with the goals of the Paris Agreement can support governments in designing ambitious NDCs. These can also serve as useful benchmarks for assessing the adequacy of interventions planned by governments to decarbonise sectors and economies. This section highlights developments required in key sectors, based on a [Climate Action Tracker report](#) from August 2020.

Climate action up to today has not yet been fast and deep enough to put most sectors onto a Paris-compatible path. Two areas with promising trends in recent years are renewable electricity technologies and electric vehicles. While innovative approaches either exist or are emerging for the buildings and industry sectors, their development is still far too slow. Of great concern are the persisting plans of some governments to build new infrastructure not compatible with Paris goals, such as new coal-fired power plants, increasing uptake of natural gas as a source of electricity and that there are large inefficient personal vehicles in some countries.



Power sector

Action in the electricity sector has a high priority as it directly enables the successful decarbonisation of all other sectors that can move from fossil fuels to electricity. In all countries, emissions per unit of electricity need to rapidly decrease to reach zero, ideally by 2040, latest by 2050.

For this transition, a fast ramp up of CO₂-free technologies to practically 100% is required. From all CO₂-free options, renewables seem to be the most viable. Variable renewable energy sources can be backed with a variety of approaches including storage, flexible gas turbines powered with synthetic gas or green hydrogen and smart grid developments.⁹

Coal, the most emissions-intensive electricity generation, needs to be phased out by 2030 in developed countries and 2040 in developing countries and emerging economies. Renewables will be important in the displacement of coal, reaching 75-100% share electricity generation by 2040.



Transport sector

For the total of transport (all modes and passenger/freight), low carbon fuels (electricity, hydrogen or biomass) need to enter the energy mix rapidly: around 15 to 20% by 2030 and towards 100% in 2050. Electric passenger vehicles (or other zero emission vehicles) need to reach a very high market share by 2030 (95% for developed countries) and close to 100% by 2040, so that the global passenger car fleet will be almost 100% emission free by 2050. Despite challenges to full decarbonisation, multiple mitigation strategies should be pursued to decrease the emissions intensity of aviation and shipping.

⁹ We do not see fossil gas with carbon capture and storage (CCS) as an option because CCS itself is not emissions free and would require non-trivial negative emissions to compensate. The current generation of nuclear is not flexible enough to provide cost-effective backup power.



Industry

Industry is a large emitter which needs very specific solutions to decarbonisation based on the solutions available in each subsector. Where possible, industrial energy supply should be electrified, with the objective of around 50% of final energy in 2050 being met with electricity.

Cement and steel production emit a large share of the non-energy emissions of the industry sector, but decarbonisation by 2050 is possible:

- ▶ In the cement industry, emissions intensity needs to be reduced by 30% to 40% by 2030 and 90% by 2050 compared to today. Key measures to reduce emissions are reducing the share of the emissions-intensive cement clinker, transitioning to alternative fuels for thermal energy and novel cements that have low process emissions through incorporation of CCS and CCU. With additional efforts in material substitution and material efficiency, the cement sector as a whole could achieve zero emissions by 2050.
- ▶ The steel industry needs to reduce emissions intensity by 25% to 30% by 2030 and to zero by 2050. The best route for decarbonisation depends heavily on the country context. Recycling of scrap steel will play a key role in many countries; the maximum share of future production varies between 7-80% based on availability.
- ▶ No new conventional primary steel plants (BF-BOF) should be built. In the short term, partial fuel switch to charcoal and/or hydrogen or biogas should be considered in existing conventional plants. The hydrogen production route should reach between at least 15-30% market share by 2050, requiring investments in large-scale demonstration projects today to support maturing of the technology.



Buildings

Emissions intensity of the building stock in kgCO_2/m^2 converges close to zero by 2040, and 2050 at the latest. This target can be reached through either lowering energy demand or zero carbon energy, or both. The transition to get to zero varies by country and depends on both current emissions and the energy needs of the country, particularly their climatic zone.

Given the long lifetime of the building stock, from now on, all new buildings in all countries need to be of a high standard and equipped with heating and cooling technologies that either are or can be zero emissions, such as heat pumps, solar thermal water heaters and high thermal building standards. For existing buildings, renovation rates need to increase to the order of 3.5% per year and also transition to zero carbon heating and cooling technologies.



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The Climate Action Tracker (CAT) is an independent scientific analysis produced by two research organisations tracking climate action since 2009. We track progress towards the globally agreed aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C.

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Climate Analytics is a non-profit climate science and policy institute based in Berlin, Germany with offices in New York, USA, Lomé, Togo and Perth, Australia, which brings together interdisciplinary expertise in the scientific and policy aspects of climate change. Climate Analytics aims to synthesise and advance scientific knowledge in the area of climate, and by linking scientific and policy analysis provide state-of-the-art solutions to global and national climate change policy challenges.

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NewClimate Institute is a non-profit institute established in 2014. NewClimate Institute supports research and implementation of action against climate change around the globe, covering the topics international climate negotiations, tracking climate action, climate and development, climate finance and carbon market mechanisms. NewClimate Institute aims at connecting up-to-date research with the real world decision making processes.

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Annex 6

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Pathways to sustaining tuna-dependent Pacific Island economies during climate change

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Climate-driven redistribution of tuna threatens to disrupt the economies of Pacific Small Island Developing States (SIDS) and sustainable management of the world's largest tuna fishery. Here we show that by 2050, under a high greenhouse gas emissions scenario (RCP 8.5), the total biomass of three tuna species in the waters of ten Pacific SIDS could decline by an average of 13% (range = -5% to -20%) due to a greater proportion of fish occurring in the high seas. The potential implications for Pacific Island economies in 2050 include an average decline in purse-seine catch of 20% (range = -10% to -30%), an average annual loss in regional tuna-fishing access fees of US\$90 million (range = -US\$40 million to -US\$140 million) and reductions in government revenue of up to 13% (range = -8% to -17%) for individual Pacific SIDS. Redistribution of tuna under a lower-emissions scenario (RCP 4.5) is projected to reduce the purse-seine catch from the waters of Pacific SIDS by an average of only 3% (range = -12% to +9%), indicating that even greater reductions in greenhouse gas emissions, in line with the Paris Agreement, would provide a pathway to sustainability for tuna-dependent Pacific Island economies. An additional pathway involves Pacific SIDS negotiating within the regional fisheries management organization to maintain the present-day benefits they receive from tuna, regardless of the effects of climate change on the distribution of the fish.

Fishing for tuna plays a vital role in the economic development and/or food security of most of the 22 Pacific Island countries and territories^{1,2}. However, in the case of ten of these Pacific Small Island Developing States (SIDS), the contributions of tuna to the economy are so substantial that these SIDS are 'tuna-dependent' (Fig. 1 and Supplementary Note 1). More than 95% of all tuna caught from the jurisdictions of the 22 Pacific Island countries and territories comes from the combined exclusive economic zones (EEZs) of these 10 SIDS (Supplementary Table 1), and access fees paid by industrial fishing fleets provide an average of 37% (range = 4–84%) of their government revenue (excluding grants) (Supplementary Table 2). These extraordinary benefits have been secured mainly through cooperative management of the purse-seine fishery within the combined EEZs of nine of the ten Pacific SIDS under the Parties to the Nauru Agreement (PNA) Vessel Day Scheme (VDS) (Box 1). Longline and pole-and-line fishing also occur within the waters

of tuna-dependent Pacific SIDS but generally make minor contributions to these economies compared with purse-seine fishing (Supplementary Note 1).

The socioeconomic importance of tuna has been recognized by Pacific Islands Leaders in their *Regional Roadmap for Sustainable Pacific Fisheries*³, which aims to sustain harvests, add value to catches, increase employment associated with tuna fishing and processing, and allocate more tuna for local food security. The *Roadmap's* sustainability goal is being achieved; over the past decade, annual purse-seine catches from the EEZs of the ten Pacific SIDS have deviated little from the ten-year average of 1.4 million tonnes (Supplementary Table 3) (coefficient of variation = 9%) and are approximately half as variable as catches from high-seas areas (Supplementary Table 4) (coefficient of variation = 17%). In addition, none of the tuna species caught by purse-seine in the region are overfished or subject to overfishing⁴, due largely to cooperative

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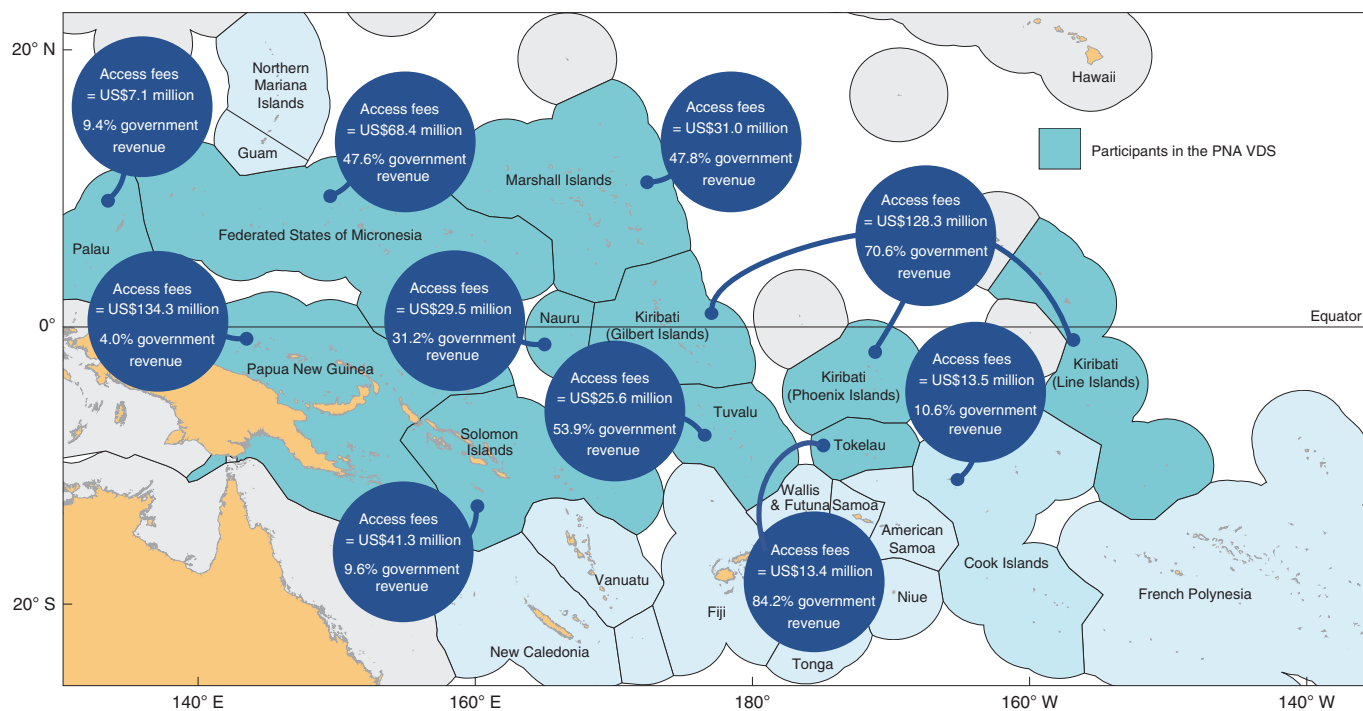


Fig. 1 | Tuna-dependent Pacific SIDS in the western and central Pacific Ocean. Average annual tuna-fishing access fees (US\$) for the period 2015–2018 earned by the ten Pacific SIDS, together with the average percentage contributions of access fees to total government revenue (excluding grants). The nine Pacific SIDS participating in the PNA VDS (Box 1) are also shown. Access fee and government revenue data sourced from ref.¹ and the Pacific Islands Forum Fisheries Agency.

management by PNA members (Box 1) (Supplementary Notes 3 and 4) under the auspices of the Western and Central Pacific Fisheries Commission (WCPFC).

Cooperative management of the purse-seine fishery has also enabled tuna-dependent economies to adapt to the profound effects of the El Niño–Southern Oscillation (ENSO) on the extent of the western Pacific warm pool (‘warm pool’) and the associated distribution of the abundant skipjack tuna^{5,6} (Box 1). However, the realization that climate change will alter the tropical Pacific Ocean, and cause further modifications to ENSO^{7,8} and the warm pool (Supplementary Note 5), has prompted the regional organizations assisting Pacific SIDS to manage their tuna resources, the Pacific Community, Pacific Islands Forum Fisheries Agency and WCPFC, to support modelling of the effects of climate change on tuna biomass^{9–12}. This modelling, which focused mainly on the EEZs of Pacific SIDS, projected progressive redistribution of tuna biomass in equatorial waters to the east and, to a more modest extent, to higher latitudes. Provided tuna biomass remains high within the combined EEZs of PNA participants, the provisions of the VDS (Box 1) are expected to limit the implications of climate-driven tuna redistribution for tuna-dependent economies and the goals of the *Roadmap*.

However, many Pacific SIDS are increasingly concerned that redistribution to the east could lead to decreases in tuna biomass within their EEZs, and increases in high-seas areas, undermining the socioeconomic benefits they derive from tuna fishing (Supplementary Note 6) and the strong management of tropical Pacific tuna resources. Preliminary analyses justify these concerns^{13,14}. Here, we evaluate the risks to the sustainability of the ten tuna-dependent Pacific Island economies by simulating changes to tuna biomass in their EEZs and in high-seas areas in the western and central Pacific Ocean (WCPO) and eastern Pacific Ocean (EPO) under different greenhouse gas (GHG) emissions scenarios

by 2050, using a more-robust modelling approach than in previous studies. Our analysis then cascades the results of the biomass modelling to assess the potential implications for future purse-seine catches within the EEZs of the ten Pacific SIDS and for the vital government revenue flowing to these highly vulnerable states from purse-seine fishing. Finally, the projected patterns of tuna redistribution are used to identify the most promising pathways for enabling tuna-dependent economies to retain the socioeconomic benefits they now receive from tuna.

Projected changes in tuna biomass

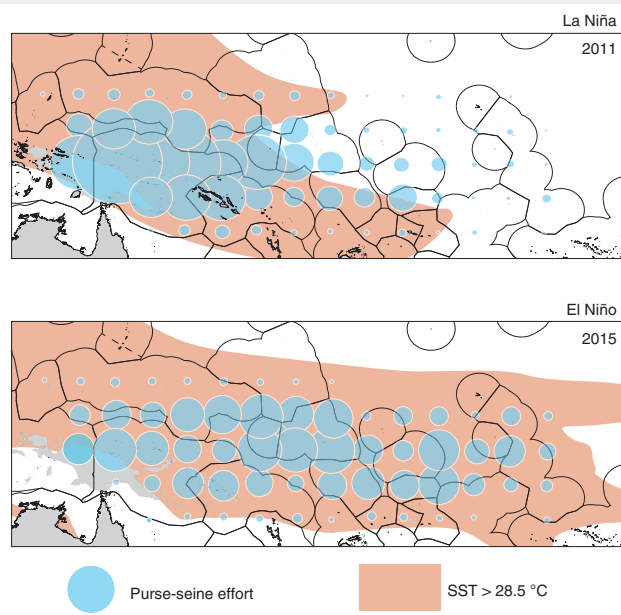
We used the Spatial Ecosystem and Population Dynamics Model (SEAPODYM)^{15–17}, informed by projected changes to the tropical Pacific Ocean derived from four Earth system models (ESMs), to simulate the responses of tuna species caught by purse-seine fishing (skipjack, yellowfin and bigeye tuna) to climate change. SEAPODYM simulates the spatial dynamics of tuna under the effects of fishing and key environmental variables (temperature, primary production, oceanic currents and dissolved oxygen) and the predicted distributions of tuna prey in three layers of the water column between the surface and a depth of ~1,000 m (Methods). This modelling framework synthesises current knowledge on the biology, ecology and population dynamics of the key life stages of tuna species (from larvae to mature fish) in their oceanic ecosystem and has been validated against a large set of observations (Methods and Supplementary Note 7). We assume that the relationships and mechanisms inherent in SEAPODYM will remain valid over the next few decades.

We modelled the responses of tuna biomass to the Intergovernmental Panel on Climate Change (IPCC) representative concentration pathway (RCP) 8.5, RCP 4.5 and RCP 2.6 emissions scenarios for 2050 in the EEZs of Pacific SIDS, focusing on the ten tuna-dependent SIDS (Fig. 1), and in high-seas areas

Box 1 | The PNA VDS

Pacific SIDS that are the PNA (Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu) have developed a system for jointly managing the purse-seine fishery targeting skipjack tuna within their combined EEZs. It is called the Vessel Day Scheme (VDS)⁶⁹ (Supplementary Note 4). Tokelau also participates in the VDS under a memorandum of understanding with PNA.

The ‘cap and trade’ VDS sets the total annual purse-seine fishing effort within the combined EEZs of PNA members at ~45,000 fishing days and allocates these days to members on the basis of individual EEZ areas and their past 8–10 years of fishing effort history. The VDS provides a trading mechanism among PNA members^{70,71}, allowing them to respond to the profound effects of ENSO on the warm pool and the prime fishing grounds for skipjack tuna^{5,6}. During La Niña events, the best catches of skipjack tuna are made in the west of the region (see top panel in the following diagram), whereas during El Niño events fishing is most efficient up to 4,000 km to the east (see bottom panel). During La Niña events, the VDS enables countries in the west to buy fishing days from members in the east, enabling fleets to keep fishing in the west. The reverse occurs during El Niño events. Therefore, regardless of where the tuna are caught, all PNA members receive access fees every year. In this way, the VDS evens out the previously high interannual variability in access fees received by PNA members and helps stabilize government revenue for tuna-dependent economies.



The various provisions of the VDS—transferability of fishing days among PNA members, ‘pooling’ of days by groups of members, and ‘roaming’ of vessels from PNA member countries among their collective EEZs⁷⁰—also provide non-confrontational adaptations to the progressive redistribution of skipjack tuna within the combined EEZs of PNA members due to ocean warming^{70,71} (Supplementary Note 4). However, the VDS does not encompass adaptations for the redistribution of tuna from the EEZs of PNA members to high-seas areas.

(Supplementary Fig. 1) (Methods). Projections for RCP 4.5 and RCP 2.6 were estimated on the basis of examining changes in the RCP 8.5 simulation at the times when CO₂ concentrations reach those

equivalent to RCP 4.5 and RCP 2.6 in 2050 (Methods). Estimating the effects of the lower-emissions scenarios in this way was necessary because appropriate ocean forcings, with bias-corrected physical and biogeochemical variables, do not yet exist for RCP 4.5 and RCP 2.6.

Our modelling of climate-driven redistribution of tuna under RCP 8.5 by 2050 (Fig. 2 and Supplementary Fig. 2) indicates that total biomass of the three species (tuna biomass) in the combined jurisdictions of the 10 Pacific SIDS would decrease by an average of 13% (range = –5% to –20%) (Fig. 3a) and by up to ~30% in 10 of the 12 individual EEZ areas (noting that Kiribati has three separate EEZ areas) (Supplementary Table 5). Conversely, tuna biomass is projected to increase by an average of 23% (range = 13% to 32%) in the central EPO (EPO-C, Fig. 3a), the high-seas area where most tuna are caught (Supplementary Table 4). Tuna biomass is also projected to increase by an average of up to ~20% in nine other high-seas areas (Supplementary Table 6) and by an average of 12% in all high-seas areas combined (Supplementary Fig. 5). These projected changes in tuna biomass by 2050 generally reflect the contrasting responses of sea surface temperature (SST), primary production and the prey organisms of tuna to RCP 8.5 in the WCPO and EPO (Supplementary Figs. 3 and 4).

The projected effects of the more moderate, surrogate RCP 4.5 emissions scenario (RCP 4.5) on redistribution of tuna biomass (Fig. 2) are far less pronounced (Fig. 3a). Under this scenario, total biomass of tuna in the combined EEZs of the ten Pacific SIDS decreases by an average of only 1% (range = –9% to +8%), and decreases occur on average in only three EEZ areas (Supplementary Table 7). By contrast, the projected effects of RCP 4.5 on tuna biomass in high-seas areas are similar to those for RCP 8.5; that is, there is an average increase of 18% (range = +9% to +32%) in EPO-C (Fig. 3a), an average increase of up to 19% in 11 of the other high-seas areas (Supplementary Table 8) and an average increase of 11% in all high-seas areas combined (Supplementary Fig. 5). A possible explanation for the substantial increases in tuna biomass in high-seas areas under RCP 4.5 by 2050 is the stronger response to increased GHG emissions by the food web supporting tuna in the EPO than in the WCPO (Supplementary Fig. 4).

On average, the biomass of tuna in the combined EEZs of all other Pacific SIDS (which occur mainly in sub-equatorial waters) also increased under RCP 8.5 and RCP 4.5 (Supplementary Tables 9 and 10). However, this increase was less than 20% of the increase in EPO-C (Supplementary Fig. 5), indicating that most redistribution of tuna biomass within the Pacific Ocean is projected to occur in equatorial areas.

Results for the strong mitigation RCP 2.6 simulations are not presented because the uncertainty associated with using RCP 8.5 forcings to estimate RCP 2.6 is too high to have reasonable confidence in the results (Methods).

Implications for tuna catches

The projected changes in tuna biomass due to increased GHG emissions are expected to affect purse-seine catches of tuna from the EEZs and high-seas areas (Methods). By 2050 under RCP 8.5, the total purse-seine catch from the combined EEZs of the ten tuna-dependent Pacific SIDS is estimated to decrease by an average of 20% (range = –30% to –10%), that is, 284,000 tonnes (range = –428,000 to –143,000 tonnes); it is estimated to increase by an average of 27% (range = +15% to +37%), that is, 125,000 tonnes (range = +69,000 to +169,000 tonnes), in EPO-C (Table 1, Fig. 3b and Supplementary Tables 11 and 12).

The projected changes in purse-seine catch by 2050 under RCP 4.5 also follow the patterns in tuna biomass, decreasing by an average of 3% (range = –12% to +9%), that is, 47,000 tonnes (range = –165,000 to +124,000 tonnes), in the combined EEZs of the ten Pacific SIDS and increasing in EPO-C by an average of 18%

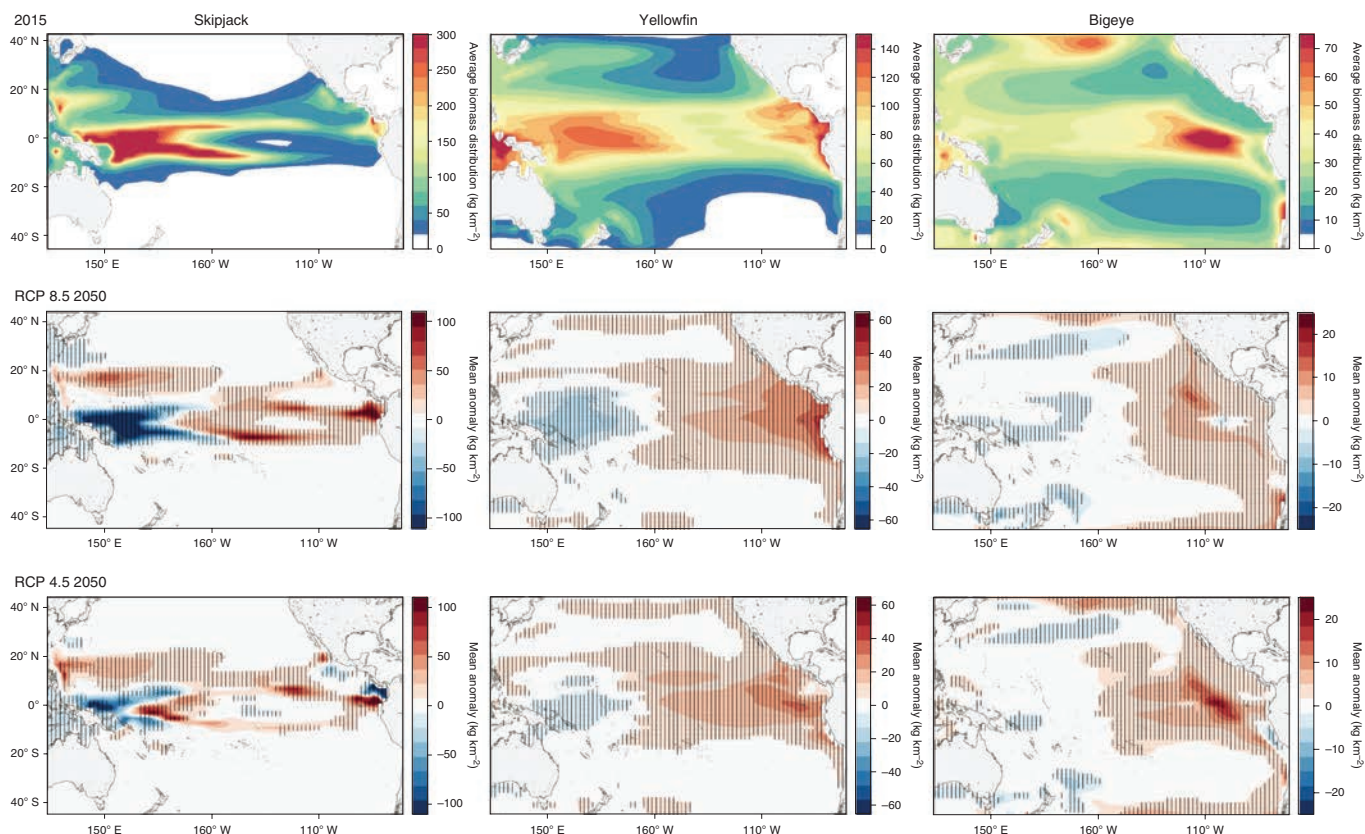


Fig. 2 | Projected effects of climate change on the distributions of the three tuna species caught by purse-seine fishing in the Pacific Ocean. Average biomass distributions (kg km^{-2}) of skipjack, yellowfin and bigeye tuna in the Pacific Ocean basin for 2015 (2011–2020) (top row) and mean anomalies (kg km^{-2}) from the average 2015 biomass distribution of each tuna species projected to occur by 2050 (2044–2053) under two emissions scenarios, RCP 8.5 (middle row) and RCP 4.5 (bottom row). Shading indicates areas where projections from all four ESMs (Methods) agree in the sign of change, excluding near-zero changes (white zones).

(range = +7% to +34%), that is, 84,000 tonnes (range = +32,000 to +154,000 tonnes) (Table 1, Fig. 3b and Supplementary Tables 13 and 14).

Effects on tuna-dependent economies

The estimated changes in purse-seine catch under RCP 8.5 could reduce total annual fishing access fees earned by the ten Pacific SIDS by an average of US\$90 million (range = –US\$40 million to –US\$140 million) per year compared with the average annual revenue received between 2015 and 2018 (Table 2 and Supplementary Table 15). Losses in access fees are estimated to occur in all ten Pacific SIDS under RCP 8.5, and reduce total government revenue by up to 13% (range = –8% to –17%) for individual Pacific SIDS, by 2050 (Table 2 and Supplementary Table 15).

Under RCP 4.5, the average change in access fees for all ten Pacific SIDS represents a loss of US\$12 million (range = –US\$54 million to +US\$48 million) per year (Table 2 and Supplementary Table 16). Due to the more-limited loss of access fees under RCP 4.5, total government revenue in 2050 is estimated to decrease by an average of 1% or less in only three of the ten Pacific SIDS (Table 2 and Supplementary Table 16).

The estimates of reduced access fees, and flow-on losses in government revenue, due to climate-driven redistribution of tuna include a number of assumptions (Methods) but, overall, are probably conservative because they do not account for the control that the ten Pacific SIDS exert in the marketplace. At present, these Pacific SIDS command high access fees because ~90% of the catch from the purse-seine fishing grounds within the Pacific Island region

of the WCPO comes from their combined EEZs (Supplementary Note 1). However, if there is substantial movement of fish from the EEZs to high-seas areas, the ten Pacific SIDS would be unlikely to obtain the same daily rates for fees. Any such effects are also likely to occur to some extent under RCP 4.5, which is projected to reduce catches in the combined EEZs of the ten Pacific SIDS by ~50,000 tonnes and increase catches in high-seas areas by more than 100,000 tonnes (Table 1).

Even at conservative levels, the estimated losses in fishing access fees are expected to have substantial implications for economic development. They would coincide with the need for increased financial resources and flexibility to adapt to climate change, including sustained government facilitation of community-based initiatives¹⁸. The projected reductions in tuna biomass and catch are also expected to affect the ability of many of the ten Pacific SIDS to harmonize the employment, value-adding and food security goals of the *Roadmap*³ and achieve sustainable development^{19,20}. With a lower biomass of tuna within their EEZs, several of the ten Pacific SIDS may need to use a greater proportion of their tuna resources for local consumption², further limiting the scope for earning access fees and potentially reducing the supply of tuna that supports employment in national canneries.

Implications for fisheries management

The projected climate-driven redistribution of tuna biomass and purse-seine catches also has potential implications for sustainable management of the world's largest tuna fishery. In a scenario where

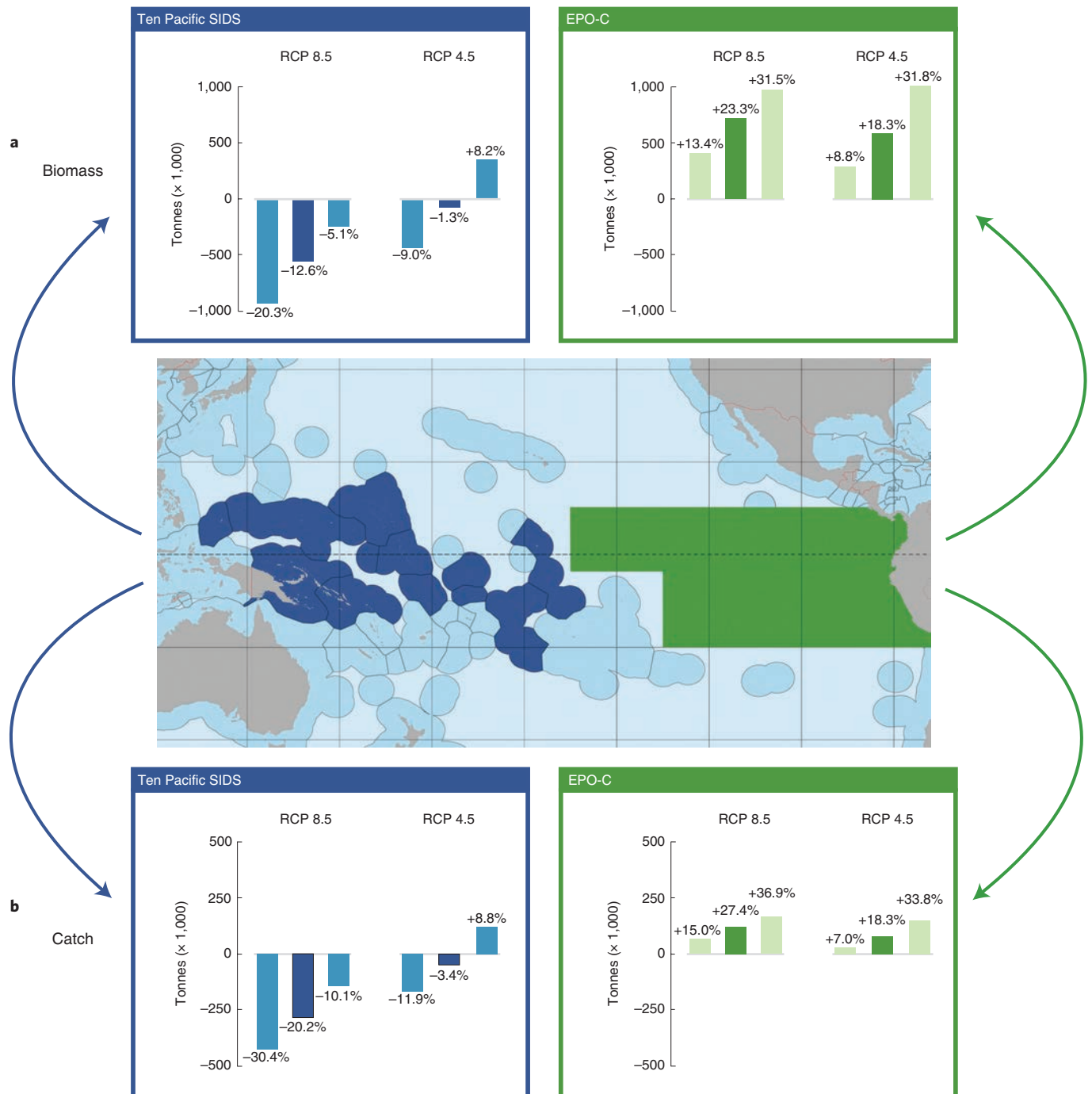


Fig. 3 | Redistribution of tuna biomass and purse-seine catch from the combined EEZs of the ten tuna-dependent Pacific SIDS to the central eastern Pacific Ocean. a, Projected changes in total biomass of skipjack, yellowfin and bigeye tuna in the combined EEZs of the ten Pacific SIDS and EPO-C under the RCP 8.5 and RCP 4.5 emissions scenarios in 2050 relative to the average biomass from these areas in 2009–2018. **b**, Projected changes in total purse-seine catch in the EEZs of the ten Pacific SIDS and EPO-C under the RCP 8.5 and RCP 4.5 emissions scenarios in 2050 relative to the average catch from these areas in 2009–2018. The dark column in each histogram represents the average change from the four ESMs. The columns on either side of the average represent the maximum and minimum changes projected by the range of ESMs. See Supplementary Tables 5–8 for further details of changes in biomass and Supplementary Tables 11–14 for details of changes in purse-seine catch. Projected changes in biomass and catch for all high-seas areas combined are presented in Supplementary Fig. 5.

a lower proportion of tuna resources is under the jurisdiction of the PNA VDS (Box 1), the sustainability of tuna catches could be at greater risk because the monitoring, control and surveillance required to combat illegal, unreported and unregulated fishing, and impose penalties for non-compliance, are more difficult in high-seas areas²¹. This is because responsibility for compliance with

fishing regulations on the high seas rests with the states that ‘flag’ fishing vessels (often resulting in self-regulation), whereas compliance within EEZs is under the purview of coastal states. With continued GHG emissions, the onus will be on WCPFC to implement tighter controls on fishing for tropical tuna species by all vessels operating in high-seas areas of the WCPO.

Table 1 | Average projected changes in purse-seine catch from the EEZs of tuna-dependent Pacific SIDS and high-seas areas

Area	Average catch (t)	RCP 8.5 2050			RCP 4.5 2050		
		Catch (t)	Change (t)	Change (%)	Catch (t)	Change (t)	Change (%)
EEZs of Pacific SIDS							
Cook Islands	11,080	10,640	−440	−4.0	12,065	+985	+8.9
FSM	178,587	155,407	−23,180	−13.0	173,773	−4,815	−2.7
Kiribati	396,048	363,520	−32,528	−8.2	423,251	+27,202	+6.9
Gilbert Islands ^a	(260,073)	(225,177)	(−34,896)	(−13.4)	(278,023)	(+17,950)	(+6.9)
Phoenix Islands ^a	(94,696)	(92,140)	(−2,557)	(−2.7)	(101,132)	(+6,435)	(+6.8)
Line Islands ^a	(41,279)	(46,203)	(+4,924)	(+11.9)	(44,096)	(+2,817)	(+6.8)
Marshall Islands	37,003	36,728	−275	−0.7	37,778	+775	+2.1
Nauru	110,794	86,886	−23,908	−21.6	117,059	+6,266	+5.7
Palau	2,655	2,646	−9	−0.3	2,738	+82	+3.1
Papua New Guinea	461,032	308,404	−152,628	−33.1	389,654	−71,378	−15.5
Solomon Islands	116,877	86,399	−30,477	−26.1	106,740	−10,137	−8.7
Tokelau	21,392	17,954	−3,438	−16.1	22,610	+1,218	+5.7
Tuvalu	73,080	55,992	−17,088	−23.4	75,589	+2,509	+3.4
Total EEZs	1,408,548	1,124,577	−283,971	−20.2	1,361,257	−47,291	−3.4
High-seas areas							
I1	15,330	11,396	−3,934	−25.7	13,541	−1,790	−11.7
I2	23,083	16,413	−6,670	−28.9	20,738	−2,345	−10.2
I3	47	60	+13	+27.8	61	+14	+29.8
I4	21,443	21,773	+330	+1.5	22,727	+1,284	+6.0
I5	23,231	28,021	+4,790	+20.6	26,194	+2,963	+12.8
I6	16,211	16,868	+657	+4.1	17,800	+1,589	+9.8
I7	16.7	18	+1.3	+9.0	17	+0.2	+1.3
I8	2.2	3	+0.8	+15.5	3	+0.4	+20.2
I9	33.2	41	+7.8	+24.7	36	+3	+8.9
H4	20,893	17,796	−3,097	−14.8	23,308	+2,415	+11.6
H5	46,517	49,502	+2,985	+6.4	48,360	+1,842	+4.0
EPO-N	84,175	100,443	+16,268	+19.3	98,130	+13,955	+16.6
EPO-C	457,664	583,082	+125,418	+27.4	541,194	+83,530	+18.3
EPO-S	3,293	4,339	+1,046	+31.8	3,747	+454	+13.8
Total high seas	711,939	849,755	+137,816	+19.4	815,856	+103,917	+14.6

Ten-year (2009–2018) average purse-seine tuna catches in tonnes (t) from the EEZs of ten Pacific SIDS and high-seas areas together with average projected changes to these catches by 2050 in tonnes and percentage terms under the RCP 8.5 and RCP 4.5 emissions scenarios (see Supplementary Fig. 6 and Supplementary Tables 11–14 for ranges of projected changes in catch). ^aThe three EEZ areas of Kiribati, which have been integrated to produce the total for Kiribati. FSM, Federated States of Micronesia; see Supplementary Fig. 1 for locations and definitions of all high-seas areas.

Sustainable management of tropical Pacific tuna resources will also be challenged by the substantial projected increases in average tuna biomass in the EPO-C high-seas area, particularly under RCP 8.5 (Fig. 3a and Table 1). This will necessitate closer collaboration between WCPFC and the regional fisheries management organization for the EPO, the Inter-American Tropical Tuna Commission (IATTC). The shared governance arrangements between WCPFC and IATTC that are already in place for the overlap in their convention areas (Supplementary Fig. 1) will need to be expanded and strengthened to avoid the problems that have accompanied management of climate-driven shifts in fish distribution in other jurisdictions^{22,23} and to address the economic impacts that reductions in access fees would have on tuna-dependent Pacific SIDS.

Increased tuna biomass in high-seas areas will also need to be considered during the application of the emerging instrument for conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (BBNJ Agreement) under the

United Nations Convention on the Law of the Sea²⁴ (Supplementary Note 8). Although the BBNJ Agreement has been designed to avoid undermining existing governance regimes in high-seas areas^{25,26}, questions remain regarding interactions between fisheries management and components of the agreement related to area-based management, transfer of technology and capacity building^{27,28}. Accordingly, WCPFC and IATTC will need to develop transparent systems for information exchange and cooperation with the BBNJ institutional framework and manage any new impacts between fisheries and high-seas biodiversity caused by climate change.

Pathways to sustaining tuna-dependent economies

Development of responsible systems for the sustainable management of tropical tuna resources and maintenance of high-seas biodiversity are not the only challenges as the Pacific Ocean is transformed by GHG emissions. The projected declines in government revenue for tuna-dependent Pacific Island economies due to tuna

Table 2 | Projected changes in tuna-fishing access fees and government revenue for the ten tuna-dependent Pacific SIDS

Pacific SIDS	Average 2015–2018			Change by 2050 (RCP 8.5)			Change by 2050 (RCP 4.5)		
	Government revenue (million US\$)	Access fees (million US\$)	Access fees as % of government revenue	Purse-seine tuna catch (%) ^a	Access fees (million US\$)	Government revenue (%)	Purse-seine tuna catch (%) ^a	Access fees (million US\$)	Government revenue (%)
Cook Islands	126.1	13.5	10.6	-4.0	-0.5	-0.4	+8.9	+1.2	+1.0
FSM	150.6	68.4	47.6	-13.0	-8.9	-5.9	-2.7	-1.8	-1.2
Kiribati	181.7	128.3	70.6	-8.2	-10.5	-5.8	+6.9	+8.9	+4.9
Marshall Islands	66.1	31.0	47.8	-0.7	-0.2	-0.3	+2.1	+0.7	+1.0
Nauru	98.6	29.5	31.1	-21.6	-6.4	-6.5	+5.7	+1.7	+1.7
Palau	75.2	7.1	9.4	-0.3	-0.02	-0.03	+3.1	+0.2	+0.3
PNG	3,360.8	134.3	4.0	-33.1	-44.4	-1.3	-15.5	-20.8	-0.6
Solomon Islands	429.0	41.3	9.6	-26.1	-10.8	-2.5	-8.7	-3.6	-0.8
Tokelau	16.0	13.4	84.2	-16.1	-2.1	-13.4	+5.7	+0.8	+4.8
Tuvalu	47.4	25.6	53.9	-23.4	-6.0	-12.6	+3.4	+0.9	+1.9
Total		492.4			-89.9			-12.0	

Average government revenue (excluding grants), tuna-fishing access fees and the percentage of government revenue derived from access fees for ten tuna-dependent Pacific SIDS between 2015 and 2018, together with estimated changes in purse-seine tuna catch, access fees and government revenue, by 2050 under the RCP 8.5 and RCP 4.5 emissions scenarios. See Supplementary Tables 15 and 16 for ranges of estimated percentage changes in access fees and government revenue by 2050, and details of the calculations summarized here. PNG, Papua New Guinea. ^aProjected change in average total purse-seine catch due to climate-driven redistribution of total tuna biomass (Supplementary Tables 17 and 18).

redistribution also highlight the need to identify pathways to sustain these economies and secure climate justice²⁹ for these Pacific SIDS (Supplementary Note 9).

The United Nations Convention on the Law of the Sea is silent on climate change. However, the most important pathway to sustaining Pacific Island economies is common to all climate justice action—reduction of GHG emissions to limit global temperature rise to 1.5°C by the end of the century³⁰. Although the effects of RCP 2.6 (which limits warming to ~2°C by 2100, approximating the aspirations of the Paris Agreement) could not be assessed effectively during this study, the marked difference between projected tuna catches across the tropical Pacific Ocean under RCP 8.5 and RCP 4.5 (Table 1 and Fig. 3) indicates that further reductions to GHG emissions to achieve the goals of the Paris Agreement should substantially reduce the potential impacts of climate change for tuna-dependent economies. This conclusion is supported by modelling for other fisheries³¹.

However, another pathway based on a regional approach is also essential for sustaining the economies of tuna-dependent Pacific SIDS in case there is inadequate progress in attaining the goals of the Paris Agreement. This pathway involves negotiation, through the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC Convention)³², to enable Pacific SIDS to retain the socioeconomic benefits they now receive from tuna, regardless of climate-driven redistribution of the fish (Supplementary Note 10). The WCPFC Convention is the appropriate vehicle for these negotiations because it is based on the important principles of international cooperation and long-term sustainability established under the 1995 United Nations Fish Stocks Agreement³³. The conservation and management measures within the WCPFC provide the framework for negotiations to ensure that catches are consistent with the objective of long-term conservation of tuna resources, conservation and management measures consider the special requirements of developing States and do not place a disproportionate burden of conservation action on such States, and the respective dependence on fish resources by members of the WCPFC Convention, including Pacific SIDS, are taken into account. Such negotiations should

recognize the injustice of climate-driven tuna redistribution for Pacific SIDS, be guided by WCPFC Resolution 2019-01 on Climate Change (Supplementary Note 6) and consider conferring more responsibility for management of tuna in high-seas areas of the WCPO to Pacific SIDS.

On the basis of its existing conservation and management measures, WCPFC agreed in 2017 to begin a process for adopting hard limits for the high-seas purse-seine fishery for tropical tuna and allocating access rights³⁴ (Supplementary Note 11). This process will be compatible with the existing limits that apply to EEZs and provide a mechanism for WCPFC to ensure that the benefits of rights that presently accrue to Pacific SIDS are locked in for the long term³⁵. Allocation of long-term rights would substantially mitigate the projected effects of tuna biomass declines within the EEZs of the ten tuna-dependent Pacific SIDS and maintain the revenues they derive from industrial fishing. A member of WCPFC (South Korea) has already suggested exploring the possibility of making PNA vessel days (Box 1) transferable to high-seas areas, under present-day conditions when fish are more abundant there, in ways that do not jeopardize the sovereign rights or aspirations of PNA members³⁶. Such an arrangement could lay the foundation for enabling distant-water fishing fleets to continue paying revenue to PNA members for access to their EEZs but use the vessel days to fish on the high seas when catch rates are better there. It is a prime example of a possible equitable solution within the ‘negotiation’ pathway.

In the event that negotiations within the WCPFC are unsuccessful, Pacific SIDS could use a conciliation commission, based on the dispute settlement mechanism under the WCPFC Convention and international law, to identify a lasting solution that incorporates an appropriate level of flexibility and stability. Other possible mechanisms available to the tuna-dependent Pacific SIDS include the United Nations Framework Convention on Climate Change Warsaw International Mechanism for Loss and Damage (Supplementary Note 12) and the Climate Security Mechanism of the United Nations (Supplementary Note 13).

Although the rationale for the negotiations outlined here is based on the projected redistribution of tuna, we recognize that there are also systemic and procedural issues associated with the prevailing

circumstances^{37–39}. These issues should also be examined to identify the full dimensions of justice and equity for tuna-dependent Pacific SIDS.

Discussion

This analysis demonstrates that sustainable development of tuna-dependent economies in the Pacific Island region is likely to be at substantial risk from continued high GHG emissions. Although considerable uncertainty remains, our modelling provides sufficient information to indicate that it is not a question of ‘if’ tuna biomass will shift from the combined EEZs of the ten Pacific SIDS but ‘when, how quickly and to what extent’. It is important that this risk be recognized by the United Nations Framework Convention on Climate Change and included in the rationale for limiting global warming in line with the Paris Agreement.

The process to identify a mechanism to eliminate or substantially reduce this risk for tuna-dependent Pacific SIDS, based on the principles of cooperation and long-term sustainability through the WCPFC Convention, should also begin immediately. Ultimately, the necessary international negotiations will be facilitated by reducing uncertainty in the timing and extent of tuna redistribution and the associated impacts on catch, access fees and government revenue.

Reducing the remaining uncertainty in redistribution of tuna biomass will depend on improving tuna modelling to increase the spatial resolution (for example, up to 0.5°), incorporating ocean forcings for all emissions scenarios considered in the Coupled Model Intercomparison Project Phase 6 (CMIP6), integrating additional and enhanced biogeochemical models into the simulation ensemble for the impacts of ocean warming and acidification on the food webs that support tuna, and assessing the effects of the Interdecadal Pacific Oscillation⁴⁰ on the onset of accelerated ocean warming. Preliminary genetic research, showing that some tropical tuna species are composed of multiple, self-replenishing populations (‘stocks’)^{41–44}, indicates that efforts to reduce uncertainty in redistribution of tuna biomass will also be strengthened by identifying the stock structure of each species. This would enable the response of each stock to climate change to be modelled separately and then aggregated to produce a more accurate understanding of tuna redistribution from EEZs to high-seas areas.

Once improved estimates of biomass redistribution are available, and policy alternatives have been developed to limit the vulnerability of Pacific SIDS, bio-economic modelling will be needed to help reduce uncertainty in future purse-seine catches and the associated contributions to tuna-dependent economies. Such modelling should explore the effects of different fleet-dynamics and market-force scenarios on catch rates and government revenue derived from access fees. It should also examine the extent to which various proposed policies and regional fisheries management arrangements empower the ten Pacific SIDS to maintain control over their historical levels of purse-seine catch.

These investments will not only enable tuna-dependent Pacific SIDS to negotiate more effectively for the international agreements and management actions required to sustain their economies, they will also provide WCPFC and IATTC with the information needed to identify shared stocks, improve stock assessments and harmonize their conservation and management measures—information that is essential for minimizing the impact of climate change on the sustainability of tuna resources⁴⁵.

Methods

Ocean forcings. The Nucleus for European Modelling of the Ocean (NEMO) ocean framework⁴⁶, which includes an online coupling with the biogeochemical component PISCES in a 2° latitude × 2° longitude configuration^{47,48}, was used to simulate the historical oceanic environment (hindcast simulation). This historical simulation was forced by the Drakkar Forcing Sets 5.2 (DFS5.2)⁴⁹ on the basis of a corrected set of the European Centre for Medium-Range Weather Forecasts (ECMWF) Reanalysis - Interim (ERA-Interim) over the period 1979–2011.

Salinity, temperature and biogeochemical tracer concentrations (nitrate, phosphate, iron, silicate, alkalinity, dissolved oxygen and dissolved organic and inorganic carbon) were initialized from the World Ocean Atlas climatology (WOA09)⁵⁰ and previous model climatology for iron and dissolved organic carbon⁵¹. To minimize any substantial numerical drift in the simulations related to a non-equilibrated initial state, we applied a spin-up of the ocean model and biogeochemical model for 66 years, cycling twice over the DFS5.2 forcing sets⁴⁸.

Overall, the model simulates basin-scale, historical SST and salinity distribution, together with seasonal and interannual (ENSO) variability with good fidelity⁵². Classical biases are associated with the coarse (2°) resolution, for example, the latitudinal position of the Kuroshio Current. In the tropical Pacific, there is a cold bias of –1 °C in the central equatorial zone (between 170° W and 100° W) and a warm bias of +1 °C in the eastern part of the basin (east of 90° W). Despite some local discrepancy between simulation outputs and satellite-derived chlorophyll concentration around islands and near the American coasts, simulated mean chlorophyll in the equatorial Pacific Ocean is close to observed values^{51,52}.

For future ocean projections, we first selected several ESMs from the CMIP5 intercomparison project⁵³ on the basis of the ability of the models to produce accurate ENSO variability in the Pacific⁵⁴. The four ESMs selected were IPSL-CM5A⁵⁵, MIROC⁵⁶, GFDL-ESM2G⁵⁷ and MPI-MR⁵⁸. We then extracted atmospheric fields from these models for the period 2011–2100 under RCP 8.5 to simulate ‘business-as-usual’ climate anomalies to build forcing sets for the NEMO–PISCES ocean model.

All ESMs display large biases in their representation of Pacific climate, including the important South Pacific Convergence Zone^{59,60}. These atmospheric biases propagated uncertainties associated with future atmospheres into the coupled, dynamical-biogeochemical oceanic framework. For example, they result in prominent distortions in the extension and position of the warm pool⁶¹ and can be expected to affect modelling of the open ocean ecosystem up to the higher trophic levels¹².

To mitigate the mean state model biases in the selected ESMs, we used a ‘pseudo-warming’ anomaly approach to force the ocean model. To do this, we extracted monthly anomalies (relative to 2010) of surface atmospheric temperature, zonal and meridional wind speeds, radiative heat fluxes, relative humidity and precipitation from the ESM models over the 2010–2100 period and applied a 31-year-wide Hanning filter to remove variability on timescales less than 15 years.

Each ESM-filtered timeseries was superimposed onto the repeating 30-year historical forcing (that is, repeated three times to span the twenty-first century) to provide the forcing for the NEMO–PISCES projections. This procedure enabled us to retain a realistic climatology and high-frequency variability from observations subject to long-term trends due to climate change based on the ESMs (Supplementary Fig. 7).

For consistency, the control simulation of NEMO–PISCES was forced using the same three, repeated, 30-year historical periods to correct any long-term drift generated internally without climate change forcing.

It is important to note that use of all ESM acronyms (for example, IPSL) in the following text refers to NEMO–PISCES or SEAPODYM simulations derived from the ESM anomaly forcing, and not to the ESM models themselves.

The four NEMO–PISCES simulations of future ocean conditions produced contrasting results in terms of dynamics and biogeochemistry (Supplementary Fig. 8). In particular, there was strong warming in the IPSL and MIROC simulations and weaker warming for GFDL and especially MPI. Spatial patterns in ocean warming produced by the NEMO–PISCES simulations differed mostly in intensity rather than spatial structure.

Using NEMO–PISCES outputs to produce SEAPODYM forcings. The outputs of NEMO–PISCES were used to provide environmental forcing variables for SEAPODYM, the model used to project the responses of the key life stages of skipjack, yellowfin and bigeye tuna to climate change (Supplementary Note 7). The following physical and biochemical forcing variables were used in SEAPODYM applications: three-dimensional (3D) temperature, dissolved oxygen (O₂) concentration, zonal/meridional currents and primary production, and 2D euphotic depth. Before running SEAPODYM, these forcing variables were interpolated to a regular 2° Arakawa A grid and placed in the centre of the grid cells. Primary production was then vertically integrated throughout the water column, whereas the other 3D variables were integrated within three pelagic layers, defined according to the euphotic depth to provide the mean 2D fields for each variable per layer. Selected environmental variables from the historical ocean reanalysis and from four climate-driven ocean outputs are shown in Supplementary Fig. 3.

These integrated variables were then used to force the SEAPODYM-LMTL (lower and mid-trophic level) sub-model. SEAPODYM-LMTL relies on primary production, temperature and ocean currents to simulate the biomass of six functional groups of micronekton—mid-trophic-level prey organisms of tunas (Supplementary Fig. 4)—residing or migrating through three pelagic layers within the upper 1,000 m of the water column (the epipelagic layer and the upper and lower mesopelagic layers), with depths linked to the depth of euphotic layer Z as 1.5Z, 4.5Z and 10Z (with 10Z limited to 1,000 m). The definition of these pelagic layers is derived from the diurnal vertical distributions of micronekton species⁶².

Optimal parameterization of SEAPODYM during historical period. The parameterization of SEAPODYM for each tuna species is highly sensitive to ocean forcing; that is, in its average state it is free from systematic biases, and it represents interannual variability and ENSO correctly. This sensitivity enables the model to reproduce observed variability within large, geo-referenced datasets of tuna catches and length distributions reflecting changes in fish abundance¹². The environmental forcings in this study were obtained from the historical NEMO–PISCES reference simulations using a realistic atmospheric reanalysis based on a consistent set of atmospheric observations. Historical fishing datasets used to achieve model optimal parameterizations were compiled from the combination of data provided by the Pacific Community for the WCPO and by IATTC for the EPO. The model spatial resolution was 2° × 2°, and the resolution for time and age dimensions was one month. The skipjack tuna reference model was obtained by integrating all available geo-referenced data—catch, length–frequency of catch and tagging release–recapture data—into a likelihood function and obtaining the solution using the maximum likelihood estimation (MLE) approach (Supplementary Note 7). The initial habitat and movement parameters for bigeye and yellowfin tuna were also estimated by integrating tagging data into the model; however, the final parameterizations of the reference models for these two species were based mainly on fisheries data. The methodology and optimal reference solutions obtained for skipjack, yellowfin and bigeye tuna, and model validations with statistical metrics, are described in other publications documenting the use of SEAPODYM^{13,63–65}.

The structures of the populations of the three tuna species in December 2010 (the last time-step of the reanalysis) were used to set the initial conditions for the projections starting in 2011. A second historical simulation was run to remove the effects of fishing mortality (Supplementary Figs. 9 and 10) to establish the initial conditions for the unfished tuna populations (Supplementary Fig. 10). In these latter simulations, the stocks increase and reach an equilibrium state in a time that is defined by the lifespan of the species and the estimated stock–recruitment relationship. We assume that at the end of the 30-year reanalysis (December 2010), stocks of all three tropical tuna species are at their virgin (unfished) state and influenced by environmental variability and demographic processes only.

Projections of climate change impacts on tuna. Previous studies on the impact of climate change on tropical tuna species in the Pacific Ocean produced projections based on the full-field NEMO–PISCES output from a single ESM (IPSL) under the IPCC business-as-usual scenario^{6,10,12,66,67}. These projections were subject to biases, resulting in poor coherence between historical and projected environmental forcings and abrupt changes and biases when switching from a historical reanalysis to a projected time series¹². To reduce this problem, we used an approach based on the four, bias-corrected, projected climates from NEMO–PISCES outputs (Supplementary Methods).

Simulations of the SEAPODYM tuna model were run with parameters from the reference MLE models for the three tuna species, with forcings from the four NEMO–PISCES and mid-trophic simulations, under the RCP 8.5 scenario to project tuna population dynamics until mid-century. We estimated the virgin biomass of each species in the decade 2011–2020 and computed the relative change in biomass by 2050 (2044–2053) as follows:

$$\delta_B(2050) = \frac{1}{N} \sum_{t=2011}^{2020} \left(\frac{B(t + \Delta t)}{B(t)} - 1 \right) \quad (1)$$

where Δt is the time interval corresponding to 33 years and N is the number of monthly time steps in the selected time period (120 months between 2011 and 2020). We chose to average over 10 years at 33-year intervals to compare two distant periods with the same atmospheric variability, thus removing the possible effects of interannual variation and allowing better detection of the climate change signal.

The relative biomass change $\delta_B(2050)$ was computed for the EEZs of Pacific SIDS and all high-seas areas in the WCPO and EPO (Supplementary Fig. 1).

Sensitivity analyses to explore uncertainty. We analysed the impacts of climate change on skipjack, yellowfin and bigeye tuna with an ensemble of simulations focusing on the greatest sources of uncertainty in the NEMO–PISCES variables and in SEAPODYM (Supplementary Fig. 11 and Supplementary Table 21). The methods used to explore these uncertainties, and the rationale for these analyses, are explained in the Supplementary Methods.

Modelling tuna distribution under lower-emissions scenarios. The simulations based on RCP 8.5 project a redistribution of tuna biomass by 2050 as globally averaged surface temperature rises to 2°C above pre-industrial levels by mid-century. To evaluate possible effects of a lower GHG emission scenario on tuna redistribution, we also estimated the responses of tropical tuna species to conditions similar to RCP 4.5 and RCP 2.6 by 2050.

In the absence of ocean forcings and SEAPODYM outputs for RCP 4.5 and RCP 2.6, we used estimates based on the RCP 8.5 simulations using a ‘time-shift’ approach⁶⁸. This method consists of identifying the time segment in RCP 8.5 in which a key variable (for example, CO₂-equivalent (CO₂e)) matches the value expected for the selected RCP in 2050. Accordingly, we selected the periods in the

RCP 8.5 curve when total CO₂e concentrations in the atmosphere reached those projected for RCP 4.5 and RCP 2.6 in 2050 (Supplementary Fig. 12). On the basis of this method, the equivalent of RCP 4.5 in 2050 is reached in 2037 under RCP 8.5, and the equivalent for RCP 2.6 in 2050 is reached in 2026.

An important assumption of this method is that the dynamical pattern corresponding to a given change of global temperature is independent of the rate of change. This assumption is expected to be met for key features of the tropical Pacific Ocean because the upper ocean generally responds rapidly to changes in atmospheric forcing. However, this assumption is unlikely to hold for tuna population dynamics because interannual variability of tuna biomass is driven by demographic processes (recruitment and mortality), which are in turn influenced by environmental variability. Furthermore, due to the slow nature of demographic processes, the repercussions of environmental variability on tuna population dynamics are time lagged. For example, there is a time lag of 8 months between the Southern Oscillation Index and the biomass of young skipjack tuna (aged from 3 to 9 months)¹⁷, and a time lag of 12 months between the Southern Oscillation Index and total biomass of skipjack tuna (Supplementary Fig. 13). When combined with the effects of stock–recruitment relationships, and different generation times between tuna species, the speed and duration of climate change processes may have a profound effect on tuna biomass. Therefore, due to the rapidly changing ocean conditions in the RCP 8.5 scenario, the population status of a tuna species in the second and third decade cannot be assumed to be equivalent to that under a scenario with lower emissions by mid-century.

To address the complications associated with the population dynamics of tuna in a changing environment, we generated synthetic RCP 4.5 and RCP 2.6 2011–2050 time series by recycling the years from RCP 8.5 simulations. Note that recycling the ‘equivalent’ years from RCP 8.5 simulations to imitate those projected for the RCP 4.5 and RCP 2.6 scenarios involves re-using the same years multiple times because of their lower rate of change. To avoid looping the forcings over the same year multiple times, we selected several years around the equivalent RCP 8.5 year while enlarging the temporal window with increasing differences in the rates of GHG change between the two scenarios and ensuring that the mean CO₂e within this window was equal to those in the target RCP 4.5 or RCP 2.6 scenario. The inverse mapping of the RCP 8.5 curve from arrays of CO₂e values to the equivalent years in the RCP 8.5 simulation (Supplementary Fig. 14) provided the selected range of RCP 8.5 years to imitate the RCP 4.5 and RCP 2.6 scenarios. The NEMO–PISCES model variables from those years were then used to compute monthly climatology for each year of the surrogate RCP 4.5 or RCP 2.6 forcing to provide smoothed time series of forcing variables over the complete time range. The temporal evolution of epipelagic ocean temperature is compared for four climate models and three RCP scenarios in Supplementary Fig. 14.

The biomass changes projected for the three tuna species in 2050 under RCP 8.5 and under the lower surrogate emissions scenarios were then computed for all Pacific Island EEZs (Supplementary Fig. 15) following equation (1) (Supplementary Methods). The biomass changes projected under the RCP 4.5 forcing are smaller in magnitude than those for RCP 8.5, demonstrating that the effect of climate change is less pronounced in the simulations under this lower-emissions scenario.

The simulations under the surrogate RCP 2.6 forcing did not follow the expected pattern and were deemed to be too unreliable for use in this study (Supplementary Methods).

Estimating changes in tuna biomass in EEZs and the high seas. For this analysis, we produced reference biomasses for skipjack, yellowfin and bigeye tuna for the period 1979–2010 from quantitative assessment studies using SEAPODYM, which estimates population dynamics, habitats, movements and fisheries parameters with an MLE approach (Supplementary Note 7). The fit between observations and predictions (for catch and catch size frequencies) was used to validate the optimal solutions of the models within and outside the time window for the model parameter estimates. The fit was analysed spatially by fishery to ensure that there were no regional biases. Once the optimal solution was achieved, a final simulation was made with the same set of parameter estimates but without considering any fishing, to obtain the unfished biomass dynamics during both the historical period and the projection for the twenty-first century. The differences in unfished biomass between the historical period (2001–2010) and projections in 2050 (mean of 2046–2050) for each species were used to compute the weighted mean change in total tuna biomass in the EEZs of the ten Pacific SIDS, the high-seas areas shown in Supplementary Fig. 1 and the EEZs of the other Pacific SIDS listed in Supplementary Table 1 for the RCP 8.5 and RCP 4.5 emission scenarios by 2050.

Estimating changes in catch in EEZs and the high seas. To evaluate the impacts of climate change scenarios on purse-seine fisheries, comparisons were restricted to the EEZs of the ten tuna-dependent Pacific SIDS and the high-seas areas, particularly EPO-C (Supplementary Fig. 1).

To estimate the effects of projected changes in biomass of skipjack, yellowfin and bigeye tuna due to RCP 8.5 and RCP 4.5 on purse-seine catches in the EEZs of Pacific SIDS and in high-seas areas by 2050, in the absence of management interventions to reallocate catch entitlements to maintain historical access rights for Pacific SIDS, we assumed that there would be a direct relationship between

projected changes in biomass and catch. Because purse-seine catches are composed of different proportions of the three tuna species, and because each species is projected to have a different response to climate change (Fig. 2), changes in purse-seine catches by 2050 were estimated using the weighted mean response of the three tuna species to RCP 8.5 and to RCP 4.5. These estimates were derived from the average relative abundance of each species in purse-seine catches in the EEZs of the ten Pacific SIDS (Supplementary Table 3) and in high-seas areas (Supplementary Table 4) and the projected percentage change in biomass of each species under each emission scenario (Supplementary Tables 17 and 18).

The weighted average percentage changes in biomass of all tuna species combined were then applied to the 10-year average (2009–2018) purse-seine catches from the EEZs of the ten Pacific SIDS and high-seas areas (Supplementary Tables 3 and 4) to estimate the changes in purse-seine catches for these jurisdictions by 2050 under RCP 8.5 and RCP 4.5. In the case of Kiribati, which has three separate EEZ areas (Fig. 1), we estimated the change in catch for each EEZ area and amalgamated the results to produce the overall estimated change in purse-seine catch for the country.

The projected percentage change in total purse-seine catch differs from the percentage change in total tuna biomass due to variation in the relative contributions of the three tuna species to total catch and to total biomass.

Estimating the effects of tuna redistribution on economies. To assess the effects of climate-driven redistribution of tuna on the economies of the 10 Pacific SIDS, we assumed that estimated changes in purse-seine catch within their EEZs due to the redistribution of tuna biomass described above would result in a proportional change in access fees earned from purse-seine fishing and associated operations.

To estimate the effects of RCP 8.5 and RCP 4.5 on the capacity of Pacific Island governments to earn access fees from industrial tuna fishing, and the contributions of these access fees to total government revenue excluding grants ('government revenue'), we used annual averages of government revenue, tuna-fishing access fees earned by the ten Pacific SIDS and the percentage contribution of access fees to government revenue for the period 2015–2018 (Supplementary Table 2) as a baseline. We applied the projected average percentage changes in total purse-seine catch in each EEZ for RCP 8.5 and RCP 4.5 (summarized in Supplementary Tables 17 and 18) to the average annual access fees received in 2015–2018 by each of the Pacific SIDS to estimate the change in value of their access fees by 2050 under each emissions scenario. The change in value of access fees was used to estimate decreases or increases in government revenue in 2050 relative to 2015–2018 under both emissions scenarios in US\$ and percentage terms, assuming that the relative contributions of other sources of government revenue remain the same.

The estimated percentage changes in government revenue for each Pacific SIDS do not account for (1) management responses; (2) variation in the value of access to particular EEZs and the willingness of fleets to pay for this access due to the effects of changes in tuna biomass on catchability of each species, levels of fishing effort/catch rates, the price of tuna or cost of landing tuna; and (3) the impact of tuna redistribution on the degree of control that Pacific SIDS exert over fisheries targeting tuna. The third factor is expected to be particularly important. For example, substantial movement of tuna from the EEZs of PNA countries into high-seas areas would be expected to limit the effectiveness of the VDS⁶⁹ by reducing the degree of control over the fishery exerted by PNA members.

Overall, it is important to note that the simple approach used to assess the potential effects of tuna redistribution on government revenue is intended only to provide indicative information on the magnitude of these impacts. To obtain robust estimates of climate-driven changes in government revenue, more complex bio-economic analyses will be required, beginning with, for example, a fleet-dynamics analysis to investigate the potential response of purse-seine vessels to redistribution of tuna and the flow-on effects on access fees.

Reporting Summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

The 3D ocean data from the ESMs in netcdf format used to inform the SEAPODYM modelling are available at <http://data.umar-lops.fr/pub/AFCM85/>. All analysed data on tuna catch and government revenue are included in the published Analysis and the Supplementary Information files.

Code availability

The executable files for SEAPODYM, together with the input files, the outputs and the SEAPODYM manual, are available on a repository at <https://osf.io/qa8w4/>.

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Author contributions

J.D.B., T.A., Q.H., H.H.-D., G.H., W.M., C.P., Y.O., K.L.S., N.S., S.T. and M.T. designed the study during a workshop at the University of Wollongong. O.A., B.C., M.D., M.G., T.G., M.L. and C.M. produced the ocean forcings, and I.S. and P.L. modelled the responses of tuna to ocean warming with SEAPODYM. J.D.B. compiled the main text and Supplementary Information on the basis of contributions from all authors.

Competing interests

The authors declare no competing interests.

Additional information

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