ANNEX 1

EXPERT REPORT FOR THE GOVERNMENT OF THE KINGDOM OF TONGA

PREPARED BY THE PACIFIC COMMUNITY (SPC)

Pacific Community
Communauté du Pacifique

INTERNATIONAL COURT OF JUSTICE

Request for an Advisory Opinion on Obligations of States in respect of Climate Change

Expert Report for the Government of the Kingdom of Tonga
prepared by the Pacific Community (SPC)

18 March 2024

Acknowledgements

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We acknowledge the scientific and technical support from Pacific Community (SPC) staff, including teams within SPC's Human Rights and Social Development (HRSD) division, Geoscience Energy and Maritime (GEM) division, Fisheries, Aquaculture and Marine Ecosystems (FAME) division, Land Resources Division (LRD), Climate Change and Environmentally Sustainability (CCES) programme and Corporate Communications Office (CCO).

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I. INTRODUCTION AND EXPERTISE

The Pacific Community (SPC) supports Pacific countries and territories with scientific and technical solutions to address the region's greatest challenge, climate change. SPC is one of the Pacific region's scientific and technical intergovernmental organisations working alongside its Pacific Island country and territory (PICT) members[1] to understand and develop effective solutions to the challenges they face. In this case, SPC's core technical abilities to provide the objective science behind observed impacts of the adverse effects of climate change experienced by Tonga will further substantiate its state submission.

SPC's mandate and work programme addresses the many facets of climate change and its impacts on the region, including but not limited to, marine ecosystems, fisheries,[2] coastal hazards, and human rights protections.[3] Additionally, SPC is the regional lead for the implementation of many climate change mitigation and adaptation programmes, including on sea level rise as well as loss and damage, and it sustainably manages Pacific maritime zones, ecosystems, and resources from 'ridge to reef' for current and future generations.[4] Its expertise in global and regional analyses of the impacts of climate change on the marine environment led to its inclusion in the advisory opinion proceedings at the International Tribunal for the Law of the Sea in Case No. 31.[5]

SPC is also a consultative and advisory body to participating governments in matters affecting the economic and social development of its members within its scope, and the welfare and advancement of their peoples.[6] SPC sustainably manages social and environmental risks and impacts of all its activities in an inclusive manner, with a people-centred approach to maximise whole-of-society benefits. SPC is committed to openness and transparency, maintaining the highest ethical standards, and, as such, the statements contained in this report are factually correct and materially complete.

II. METHODOLOGY

Tonga requested this expert report to include the full scope of climate-related losses and damages experienced, including environmental, human health, socio-economic, and cultural impacts. From this request, several of SPC's largest and most relevant divisions provided the necessary science to put

[1] SPC has 27 members, including 22 PICTs: American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Wallis and Futuna.

[2] Note that, under the United Nations Convention on the Law of the Sea (UNCLOS), fishing is singled out among the legitimate uses of the sea that are negatively affected by pollution ('pollution of the marine environment means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities), UNCLOS, 10 December 1982, 1833 United Nations Treaties Series (U.N.T.S.) 397 (entered into force 1 November 1994) at Article 1(1)(4).

[3] Article IV, §§ 6-10, of the Canberra Agreement establishing the South Pacific Commission (U.N.T.S., vol. 97, p. 227).

[4] For the full range of SPC's implementation for mitigation and adaptation programming, *see* Pacific Community Strategic Plan 2022–2031 (available at: https://purl.org/spc/digilib/doc/uzzya).

[5] *See* Request for an Advisory Opinion submitted by the Commission of Small Island States on Climate Change and International Law (Request for an Advisory Opinion submitted to the Tribunal).

[6] See note 3 at para. 6.

together this report, compiled by an international lawyer with a scientific background to ensure proper competencies.[7]

The science captured in this expert report builds upon the best available science, including the Sixth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC).[8] It covers climate impacts that have already been observed as well as those currently occurring, like cyclones and other natural disasters, extreme weather events, marine environment degradation, and others.

It concludes that (i) PICTs like Tonga are highly vulnerable to the impacts of anthropogenic climate change, (ii) Tonga has already experienced significant harm as a result of anthropogenic climate change, and (iii) future losses and damages are bound to occur, with the extent of future harm depending on actions taken to avert, minimise, and address such losses and damages.

III. CLIMATE CHANGE–RELATED IMPACTS

Small island developing states, due to their geographical circumstances and level of development, are specially affected and particularly vulnerable to the adverse effects of climate change. For Tonga, these well-documented harms include, but are not limited to, extreme weather events (heat drought, precipitation, etc.); sea-level rise, shoreline change, and coastal inundation (waves); extreme weather events; ocean warming, acidification, and deoxygenation; water security; food security; displacement; and cultural loss.[9] These impacts are described under the progression of time and corresponding increased temperature projections, and where possible, the climate impacts likely to occur at 2.8°C—the level of warming projected to occur if nationally determined contributions (NDCs) submitted under the Paris Agreement are fully implemented.[10]

Tonga is extremely vulnerable to the adverse effects of climate change because of its geographical, geological, and socio-economic features. Tonga is also sensitive to severe natural events (volcanic eruption, seismic activity, etc.) which are likely to become worse with the ongoing climate crisis. Of particular concern are climate change impacts of increasing sea-level rise and associated coastal inundation and erosion; increasing intensity of extreme weather events such as tropical cyclones; and sea surface temperature effects on coral reefs.

Sea-level rise

Climate change–induced sea level rise is an existential threat to archipelagos such as Tonga, which include high volcanic islands, elevated limestone islands, and low-lying atolls. Tonga consists of 176 islands, of which 36 are inhabited, with approximately 85% of the population living in rural areas. The sea-level rise near Tonga as measured by satellite altimeters has been over 6 millimetres (mm) per year since 1993, which is double the global average of 3.2 ± 0.4 mm per year, with even higher estimates in

[7] SPC's relevant divisions include Human Rights and Social Development (HRSD), Geoscience Energy and Maritime (GEM), Fisheries, Aquaculture and Marine Ecosystems (FAME), Land Resources Division (LRD), and Climate Change and Environmentally Sustainability (CCES) programme.

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

[9] *See mainly*, McGree, Simon, Grant Smith, Elise Chandler, Nicholas Herold, Zulfikar Begg, Yuriy Kuleshov, Philip Malsale and Mathilde Rittman, SPC. *Climate Change in the Pacific 2022: Historical and recent variability, extremes and change.* Chapter 14 'Tonga'; and Gillett, Robert and Fong, Merelesita 2023. Fisheries in the economies of Pacific Island countries and territories (Benefish Study 4). Noumea, New Caledonia: Pacific Community. 704 p. https://purl.org/spc/digilib/doc/ppizh. SPC also received further data from experts at the Secretariat of the Pacific Regional Environment Programme (SPREP) in consultation with the Government of Tonga.

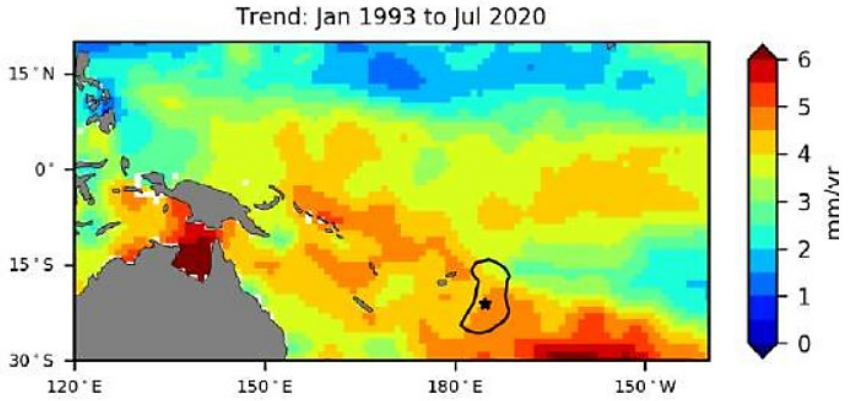
[10] Additional information on historical climate trends for Tonga can be found in the Pacific Climate Change Data Portal, available at http://www.bom.gov.au/climate/pccsp.

the south (see Table 1).[11] For Nuku'alofa, the trend is even higher at 6.6 mm per year, significantly higher than altimetry trends shown in Figure 1. This difference is largely attributed to subsidence (land sinking) occurring at Nuku'alofa.[12]

Table 1. Decadal increments for projections of sea level rise in metres (m) for Tonga relative to the 1995–2014 mean sea level.[13]

Year	*Low* SSP1–2.6	*Intermediate* SSP2–4.5	*High* SSP3–7.0	*Very High* SSP5–8.5	*Very High – Low* SSP5–8.5 H+
1995–2014	0.00	0.00	0.00	0.00	0.00
2020	0.07 (0.05–0.10)	0.07 (0.04–0.10)	0.07 (0.04–0.10)	0.07 (0.05–0.10)	0.08 (0.05–0.11)
2030	0.14 (0.10–0.18)	0.13 (0.10–0.17)	0.13 (0.09–0.18)	0.14 (0.11–0.19)	0.15 (0.10–0.22)
2040	0.19 (0.14–0.25)	0.20 (0.15–0.25)	0.20 (0.15–0.27)	0.22 (0.17–0.28)	0.22 (0.16–0.35)
2050	0.26 (0.20–0.34)	0.28 (0.22–0.36)	0.29 (0.23–0.38)	0.31 (0.24–0.40)	0.32 (0.24–0.51)
2060	0.33 (0.25–0.43)	0.35 (0.28–0.46)	0.38 (0.30–0.49)	0.41 (0.33–0.53)	0.43 (0.32–0.71)
2070	0.40 (0.31–0.53)	0.44 (0.35–0.58)	0.49 (0.38–0.63)	0.53 (0.41–0.69)	0.56 (0.41–0.96)
2080	0.46 (0.35–0.62)	0.54 (0.42–0.71)	0.60 (0.47–0.79)	0.66 (0.52–0.87)	0.72 (0.52–1.25)
2090	0.53 (0.40–0.72)	0.63 (0.49–0.84)	0.73 (0.57–0.96)	0.81 (0.64–1.07)	0.90 (0.64–1.59)
2100	0.60 (0.44–0.83)	0.73 (0.54–0.99)	0.88 (0.66–1.17)	0.97 (0.76–1.29)	1.11 (0.76–1.93)
2110	0.69 (0.49–0.96)	0.83 (0.59–1.15)	0.99 (0.69–1.35)	1.10 (0.80–1.50)	1.31 (0.80–2.28)
2120	0.76 (0.53–1.06)	0.93 (0.66–1.29)	1.13 (0.79–1.54)	1.25 (0.91–1.71)	1.55 (0.91–2.60)
2130	0.82 (0.57–1.16)	1.02 (0.72–1.43)	1.26 (0.88–1.73)	1.39 (1.01–1.92)	1.81 (1.01–3.38)
2140	0.89 (0.61–1.26)	1.11 (0.78–1.57)	1.40 (0.97–1.92)	1.53 (1.11–2.12)	2.09 (1.11–4.46)
2150	0.95 (0.65–1.36)	1.21 (0.84–1.70)	1.53 (1.06–2.11)	1.66 (1.20–2.32)	2.41 (1.20–5.63)

Figure 1. Satellite altimetry annual trend for the Pacific from 1993 to 2020 with Tonga's exclusive economic zone (EEZ) highlighted in black.[14]



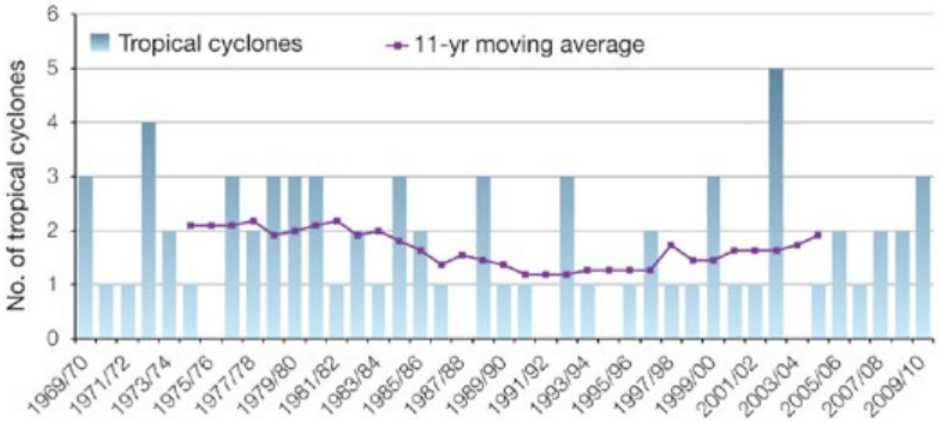
Pacific Island countries are experiencing sea-level change that exceeds that of global rates, particularly for Tonga, which is subject to seismic activity. Consistent with the AR6 assessment, rates for Tonga are high, dominated by rapid short-term changes during seismic events followed by a period of readjustment.[15] The highest sea levels typically occur in the months of December to April. Additionally,

[11] McGree et al., *Climate Change in the Pacific 2022.* Chapter 14 'Tonga'.
[12] Brown, N. J., Lal, A., Thomas, B., McClusky, S., Dawson, J., Hu, G., and Jia, M. 2020. Vertical motion of Pacific Island tide gauges: combined analysis from GNSS and levelling. Record 2020/03. Geoscience Australia, Canberra. http://dx.doi.org/10.11636/Record.2020.003.
[13] Graphic taken from *Pacific Regional Infrastructure Facility (PRIF) (2021): Guidance for managing Sea Level Rise Infrastructure Risk in Pacific Island Countries*, 2021. Projections based on IPCC (2021) sourced from AR6 and interpolated to nearest decade and adjusted for the upper bound of the most *likely* vertical land movement defined by Fox-Kemper et al. (2021).
[14] Figure from McGree et al., *Climate Change in the Pacific 2022.* Chapter 14.8.2 'Trends', 182. The star symbol indicates the location of the Nuku'alofa tide-gauge.

[15] *PRIF*, 47.

the top ten sea-level events on record occurred from December to March and at least half of these were associated with tropical cyclones, indicating the importance of weather events in contributing to sea-level extremes (see Graph 1).

Graph 1. Number of tropical cyclones passing within 400 km of Nuku'alofa per season.[16]



Shoreline change and coastal inundation (waves)

King tides, which typically occur a few times a year, are generally considered a proxy for the extent of permanent exposure to sea-level variation. For Tonga, the land and infrastructure near the coastal margin are highly susceptible to the impacts of sea-level rise and will feel its impacts earlier than other PICTs.[17] In 2015, the eastern areas of Tongatapu Island were already identified as harmed and vulnerable to coastal erosion and inundation, with several villages in need of extra protections. The Trialling Coastal Protection Measures in Eastern Tongatapu project used different engineering methods to protect coastal areas, including through construction of offshore breakwaters, beach replenishment, and coastal planting. These measures served to protect nearly 4000 people living in the adjacent coastal area from storms and storm surges.[18]

Tonga experiences a semidiurnal tidal cycle, meaning two high and two low tides per day. The highest predicted tides of the year typically occur during the wet season months of December to February. Projected climate change and sea-level rise also affects the groundwater via saltwater intrusion and loss of land from coastal erosion or flooding associated with climate extremes.[19] Extreme wave analysis completed for Nuku'alofa was done by defining a severe height threshold and fitting what is known as a generalized Pareto distribution (GPD)—a two-parameter distribution that is often used to model the tail of a distribution beyond a certain threshold; it is particularly useful to show that an individual extreme event (such as a severe wave) can be quantified by an observable measure (such as sustained wave height over intervals). The optimum threshold selected was 2.95 m. In the 42-year wave hindcast, 169 wave events reached or exceeded this threshold, averaging four waves per year.[20] The GPD was

[16] Figure adapted from McGree et al., *Climate Change in the Pacific 2022.* Chapter 14.6.1 'Tropical cyclones', 179. The 11-year average is presented as a purple line and considers all years.
[17] *PRIF*, 49.
[18] Kingdom of Tonga, Voluntary National Review (VNR) 2019 at 49, available at https://sustainabledevelopment.un.org/content/documents/23588Kingdom_of_Tonga_Voluntary_National_Review_2019_Report_web.pdf.
[19] Pacific Adaptation to Climate Change, Kingdom of Tonga Report of In-country Consultations, para. 62, p. 21, available at https://www.sprep.org/attachments/Climate_Change/PACC_Report_of_in-country_consultations_Tonga.pdf.
[20] Extreme wave analysis is a useful tool but is not always accurate because the analysis is sensitive to the data available, the type of distribution used, and the threshold to which it is fitted. For example, the analysis does not accurately account for tropical cyclone waves that reach greater heights and over shorter intervals.

fitted to the largest wave height reached during each of these events (Table 2). Modelling such as this is useful for designing coastal infrastructure and hazard planning.

Table 2. Summary of the results from extreme wave analysis in Nuku'alofa of wave events that have occurred since 1979.[21]

Large wave height (90th percentile)	1.90 m
Severe wave height (99th percentile)	2.97 m
1-year ARI wave height	4.46 m
10-year ARI wave height	8.80 m
20-year ARI wave height	10.76 m
50-year ARI wave height	14.02 m
100-year ARI wave height	17.11 m

Extreme weather events

On average, Nuku'alofa experiences 17 tropical cyclones per decade (recall Graph 1 and see also Graph 2), with the majority occurring between November and April—Tonga's wet season. The high interannual variability in the tropical cyclone numbers makes it difficult to identify long-term trends in frequency.[22] Nevertheless, global evidence shows that the economic damage caused by cyclones is long-lasting and cumulative.[23] For example, Tropical Cyclone Gita, a Category 5 cyclone that hit Tonga in February 2018, caused widespread damage to basic public infrastructure, livelihoods, and living facilities, many of which are still under reconstruction and recovery to this day.[24]

Communities in Tonga also face varying and increasing threats from natural disasters and climate change, including an increase in the strength and frequency of tropical cyclones.[25] Ha'apai and Tongatapu both experienced multiple Category 4 (and above) cyclones within the past ten years, with increasing impacts from storm surges.[26] These direct impacts to communities not only damage infrastructure and increase risks to safety, and to human life, but also weaken the health of marine habitats and marine resources, threatening the food security and subsistence of families living in coastal areas, reducing their resilience.

For example, Special Management Areas (SMAs) are part of a community-based fishery programme in Tonga, where designated communities are granted legal rights to manage their coastal fishery resources. Findings from the household survey conducted in SMA communities from February to March 2021 were collected and evaluated for socio-economic impacts and community perception of SMAs. In total, 275 household surveys were conducted that provide insights into community-focused, socio-economic impacts of climate change (see Table 3). This data also shows community perception of climate change impacts, how often they occur, and the degree to which they feel prepared to handle climate-related

[21] Table from McGree et al., *Climate Change in the Pacific 2022*, Chapter 14.1.1 'Current Climate', 216.
[22] McGree et al., *Climate Change in the Pacific 2022*, Chapter 14.9.3 'Extreme waves', 184.
[23] United Nations Capital Development Fund (2020), Economic impacts of natural hazards on vulnerable populations in Tonga, available at https://www.uncdf.org/article/6318/climate-risk-insurance-literature-reviews, 5.
[24] Voluntary National Review, 49.
[25] Tropical cyclone data and historical tracks starting from the 1969/1970 season are available from the Southern Hemisphere Tropical Cyclone (SHTC) Data Portal, http://www.bom.gov.au/cyclone/tropical-cyclone-knowledge-centre/history/tracks/.
[26] Household survey of Special Management Area communities in Tonga: Assessment for the monitoring and evaluation of the SMA programme, 2, available at https://purl.org/spc/digilib/doc/zj35s.

hazards. It shows that these harms are occurring now, are observable, and that the loss and damage communities feel have long-lasting consequences.

Table 3. Households that have experienced natural and climate-related hazards and the coping ability of the household.[27]

Climate-related hazard	No. of households that have experienced impacts in last five years	No. of # house-holds with little or no ability to cope	Percentage of households that have experienced hazards
Cyclones	187	118	63
Drought	149	86	58
Changes in rainy/dry season	133	81	61
Coastal erosion	101	74	73
Saltwater intrusion	82	67	82
Sea level rise	84	64	76
Flooding	78	57	73
Coral bleaching	56	46	82
Increased sea surface temperature	44	29	66

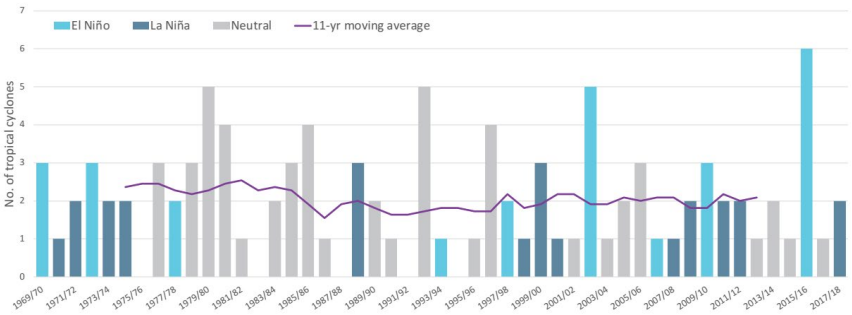
Tropical cyclones usually affect Tonga during the southern hemisphere tropical cyclone season, which is from November to April, but they also occasionally occur outside the tropical cyclone season. The Southern Hemisphere Tropical Cyclone archive indicates that between the 1969/1970 and 2017/2018 seasons, 101 tropical cyclones passed within Tonga's EEZ (refer to Graph 1).[28] This represents an average of 21 cyclones per decade. Tropical cyclones were most frequent in neutral years (23 cyclones per decade, shaded in grey), followed by El Niño years (20 per decade, shaded in light blue), and least frequent in La Niña years (17 cyclones per decade, shaded in dark blue).[29] Gross domestic product loss due to the frequency and intensity of cyclones occurring will certainly increase and adversely affect vulnerable aspects of nature and community into the future.

Interannual variability in the number of tropical cyclones in the EEZ is large, ranging from zero in some seasons to six in 2015/2016 and five in 1979/1980, 1992/1993, and 2002/2003 (see Graph 2 and Map 1). High interannual variability and the small number of tropical cyclones occurring in the EEZ make reliable identification of long-term trends challenging.[30] However, extensive data does exist for the loss and damages caused by previous extreme weather events that have had lasting impacts on Tonga. For example, severe Tropical Cyclone Gita damaged over 4000 homes and destroyed over 800, causing the evacuations of over 4500 people and left more than 80% of homes without power. The economic damages alone were estimated at US$164 million, equivalent to 38% of Tonga's total gross domestic

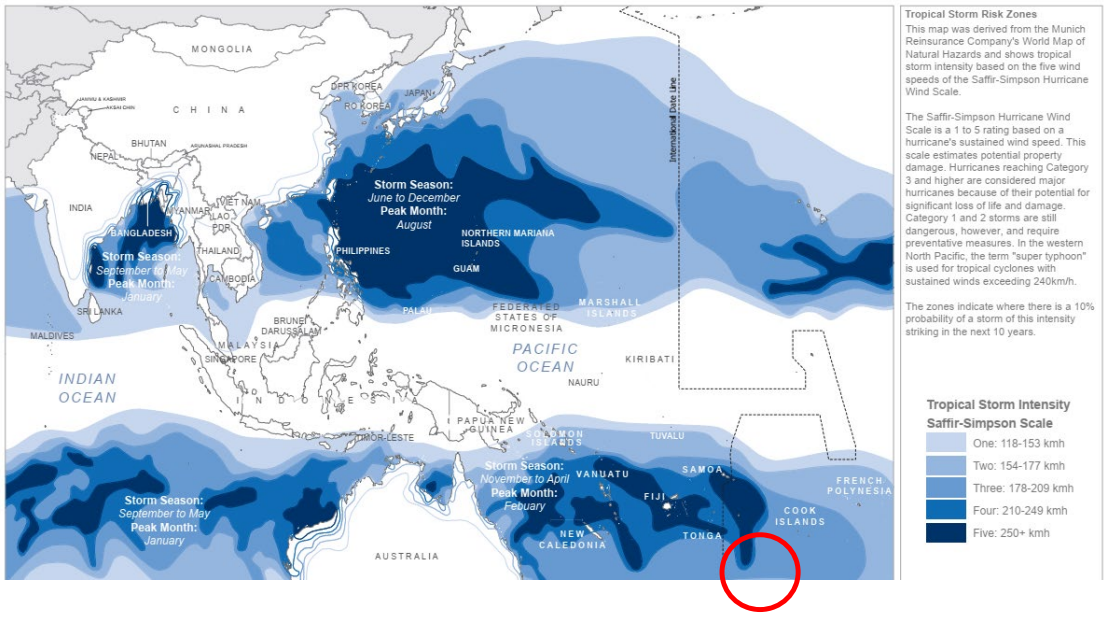
[27] Table from the Household survey of Special Management Area communities in Tonga, note 26, 24.
[28] McGree et al. *Climate Change in the Pacific 2022.* Chapter 14.6 'Tropical cyclones', 179.
[29] *Ibid*., Chapter 14.6.1 'Seasonal cycle'.
[30] Records of tropical cyclones exist from the late 1800s in some countries in the Southwest Pacific, but trends in tropical cyclones have only been presented from 1981/1982. Satellite-based observations began in the Southwest Pacific in the early 1970s, but consistent coverage and reliable intensity estimates have only been available since the early 1980s. Confidence in tropical cyclone trends is moderate as the definition of a tropical cyclone has changed, and satellite observation methods have continued to improve over the last 40 years. Tropical cyclone data and historical tracks starting from the 1969/1970 season are available from the SHTC Data Portal http://www.bom.gov.au/cyclone/history/tracks/index.shtml.

product (GDP).[31] Dealing with the damage of even a single cyclone—whether labelled as severe or not—puts a lot of strain on small island developing states like Tonga. Additionally, after severe storms, governments are often still recovering when other storms hit. This cycle makes even the smallest storms feel severe as people are still rebuilding homes, fixing power, and recovering from previous damages—particularly in Tonga where they have had to deal with volcanic eruptions as well as cyclones. This cycle can be endless and difficult to manage when GDPs are consistently redirected towards disaster relief.

Graph 2. Number of tropical cyclones passing within Tonga's EEZ per season as defined by El Niño–Southern Oscillation (ENSO) status.[32]



Map 1. Tropical storm risk for Tonga showing it sits in the highest intensity pathway for the Southern Pacific.[33]



[31] Australian Department of Foreign Affairs and Trade, Crisis Hub, *Tropical Cyclone Gita*, 19 June 2018 (accessed 4 February 2024) available at: https://www.dfat.gov.au/crisis-hub/cyclone-gita.
[32] A light blue line indicates an El Niño year, dark blue a La Niña year, and grey a neutral ENSO year. The 11-year moving average is presented as the purple line and considers all years.
[33] Map from the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), *Asia-Pacific: Tropical Storm Risk,* available at: https://reliefweb.int/map/world/asia-pacific-regional-hazard-map-tropical-storm-risk.

Ocean warming, acidification, and deoxygenation

Monthly average ocean temperature, as measured by the Nuku'alofa tide-gauge, ranges from 23°C in August to 27.5°C in the months of February/March.[34] However, there are individual months in January to March that can reach as high as almost 30°C (see Figure 2). Hourly temperatures can be up to 3°C higher or lower than these monthly averages, although 50% of hourly observations fall within 1.5°C of the average. Altogether, the sea surface temperature (SST), as per satellite observations, is increasing by 0.27°C per decade (Figure 3).

Figure 2. Annual temperatures measured at the Nuku'alofa tide-gauge.[35]

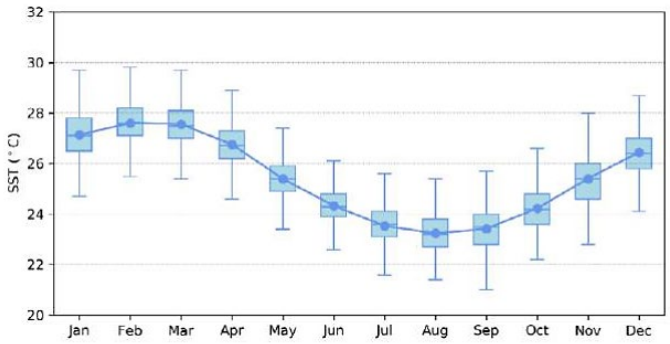
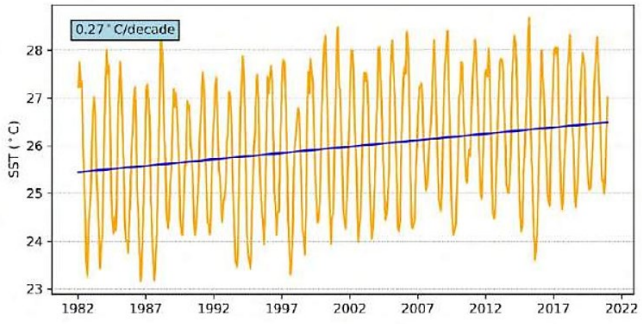


Figure 3. Sea surface temperature from satellite observations averaged across Tonga's EEZ.[36]



The long-term averages are expected to result in sustained increases in SST and ocean acidification (see Table 4). Under climate change, variations due to the ENSO will have a major influence on the abundance of tuna in Tonga's EEZ. The projected changes to the key features of the tropical Pacific Ocean surrounding Tonga relative to the long-term averages are expected to result in increases to SST, sea level, and ocean acidification (see Table 4). Changes to ocean currents and reductions in nutrient supply are also expected to occur.[37]

[34] Tide-gauge data were sourced from the Nuku'alofa tide-gauge station, which dates back to 1988 at hourly intervals.

[35] Figure from McGree et al., *Climate Change in the Pacific 2022*, 14.7.1 'Sea surface temperature', 180. Blue dots show the monthly average and shaded boxes show the middle 50% of hourly observations. Lines show the top and bottom 25% of hourly observations.

[36] *Ibid*. The orange line depicts the averages, and the blue line indicates the linear regression trend (average temperature rise since 1982).

[37] Bell J.D., Johnson J.E., Ganachaud A.S., Gehrke P.C., Hobday A.J., Hoegh-Guldberg O., Le Borgne R., Lehodey P., Lough J.M., Pickering T., Pratchett M.S., Waycott M. 2011. *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change: Summary for Pacific Island Countries and Territories*. Chapter 2.19. Secretariat of the Pacific Community, Noumea, New Caledonia (2017). https://purl.org/spc/digilib/doc/tns8k.

Table 4. Projected changes to key ocean features surrounding Tonga over time.[38]

Ocean feature	1980–1999 average	Projected change			
		B1 2035	A2 2035	B1 2100*	A2 2100
Sea surface temperature (°C)	25.9[a]	+0.6 to +0.8	+0.7 to +0.8	+1.2 to +1.6	+2.2 to +2.7
Sea level (cm)	+6 since 1960				
IPCC **		+8	+8	+18 to +38	+23 to +51
Empirical models ***		+20 to +30	+20 to +30	+70 to +110	+90 to +140
Ocean pH (units)	8.08	-0.1	-0.1	-0.2	-0.3
Currents	Increase in South Pacific gyre	Continued increase in strength of South Pacific gyre			
Nutrient supply	Decreased slightly	Decrease due to increased stratification and shallower mixed layer			< -20%

* Approximates A2 in 2050; ** projections from the IPCC-AR4; *** projections from recent empirical models {Chapter 3, Section 3.3.8}; a = average for EEZ derived from the HadISST dataset.

Food security: Coastal fisheries

In Tonga, coastal fisheries annual catch was estimated to be 6500 tonnes, worth US$17.5 million. The projected change to coastal fisheries catch reflects the very high reliance on demersal fish—or fish that live and feed on or near the bottom of seas and occupy the ocean floors. Additionally, existing coastal fish habitats in Tonga are vulnerable to climate change impacts. Tonga has more than 5800 km^2 of coral reefs that support many important fisheries species as well as mangrove and seagrass. Climate change is expected to add to the existing local threats to coral reefs, mangroves, seagrasses and intertidal flats, resulting in declines in the quality and area of all habitats. According to projections (A2—conservative estimates), by 2050, the progressive declines in productivity in demersal fish and intertidal/subtidal invertebrates are due to both direct effects (e.g., increased SST) and indirect effects (e.g., changes to fish habitats) of climate change (see Table 5).

Table 5. Projected changes to coastal fish habitat.[39]

Habitat feature[a]	Projected change (%)		
	B1/A2 2035	B1 2100*	A2 2100
Coral cover[b]	-25 to -65	-50 to -75	> -90
Mangrove area	-30	-70	-80
Seagrass area	-5 to -10	-5 to -20	-10 to -20

* Approximates A2 in 2050; a = no estimates in reduction of intertidal flats available; b = assumes there is strong management of coral reefs.

[38] Table from *Ibid*. 239. Updates to AR6 expected later this year.
[39] *Ibid*. 242.

Tonga's fishing industry is a key sector for economic growth, so protecting it from the adverse effects of climate change is critical to sustainability. Coastal communities continue to rely on subsistence fishing. Both inshore and offshore fishing are in fair and stable condition. However, climate change in Tonga poses a severe threat to coastal fisheries and aquaculture sectors, in turn affecting food and nutrition security, local livelihoods and the national economy. More severe extreme weather events, rising sea levels, increasing water temperature, and ocean acidification, are expected to have profoundly negative effects on the status and distribution of coastal habitats, and the fish and invertebrates they support. As a result, the productivity of coastal fisheries and aquaculture will decline**.**

Coastal fisheries in Tonga are already impacted by climate variability and change. Recent sea temperature increases around Tonga's coastal waters have caused widespread coral bleaching and increased algal blooms.[40] The variability of fishing yields and fish stocks has already increased as a consequence of extreme climatic events. When rain falls intensively over a short period, increased overland flow and runoffs smother and poison intertidal and subtidal areas, affecting ecosystem health, fisheries productivity, and threatening important food sources.[41] In fact, an assessment of the vulnerability of reef-dependent communities to the effects of ocean acidification on food security and livelihoods from fishing, aquaculture and tourism found that communities in Tonga were among the most vulnerable in the Pacific.[42]

Food security: Pelagic fisheries

Tuna is greatly impacted by climate change for a range of reasons. Shifts in biogeographical distribution indicate a loss of suitability of habitats due to changes in the biophysical environment such as increases in water temperature and a decrease in oxygen concentration. Since tuna are migratory species, they are widely distributed throughout the world's ocean for feeding and spawning purposes; however, the largest portion of the world's tuna catch—upwards of 80%—is found within the western central Pacific Ocean (WCPO). More importantly, the largest portion of this catch is taken within EEZs of PICTs in WCPO, including Tonga.[43] Of this, the most economically important tuna species for Tonga are albacore (*Thunnus alalunga*), bigeye (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*), and yellowfin (*Thunnus albacares*), which account for over 95% of all Tonga's tuna fisheries annual catch.[44]

In relation to food security, fewer than 10% of Tonga's farmers and fishers are commercial producers, meaning that most of Tonga's fisheries are still based on traditional/subsistence fishing systems.[45] Fish is identified as the primary food source for Tongans, and fresh fish consumption in Tonga is one of the highest in the Pacific (80% nationally, 87% for coastal communities).[46] Thus, fishing is critical to household food security in Tonga, not only through subsistence production and income generation

[40] Food and Agriculture Organization of the United Nations, Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management (JNAP), 2; Tonga Fisheries Sector Plan 2016-2024, available from https://www.fao.org/faolex/results/details/en/c/LEX-FAOC170089/
[41] *Ibid*., 2.
[42] Johnson, Johanna, Johann Bell, and Alex Sen Gupta. (2016) Pacific Islands ocean acidification vulnerability assessment. SPREP, Apia, Samoa, 40.
[43] Vaihola, S., Kininmonth, S., 'Climate Change Potential Impacts on the Tuna Fisheries in the Exclusive Economic Zones of Tonga', *Diversity* 2023, 15(7), 844: 10 July 2023 (accessed 11 February 2024) available at https://www.mdpi.com/1424-2818/15/7/844.
[44] All species data and extracted predictor variables are available in Vaihola, Siosaia (2023), Tonga tuna, Dryad, Dataset available at https://datadryad.org/stash/dataset/doi:10.5061/dryad.nk98sf7xs
[45] Tonga Strategic Development Framework (2015-2025), available at https://policy.asiapacificenergy.org/sites/default/files/TSDF%20II.pdf
[46] Karen E. Charlton, Joanna Russell, Emma Gorman, Quentin Hanich, Aurélie Delisle, Brooke Campbell, and Johann Bell, Fish, food security and health in Pacific Island countries and territories: a systematic literature review. BMC Public Health. 2016,16:285. https://doi.org/10.1186/s12889-016-2953-9.

(which allows food purchases), but also for communities that have limited opportunity to engage in other agricultural or economic sectors to produce food and/or income.

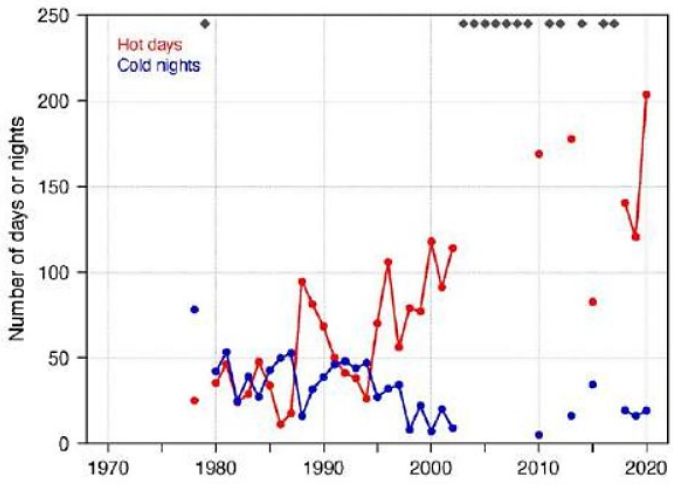
Variabilities in climate, such as global warming and the ENSO, threaten global fisheries production and have negative climate change–related impacts such as increasing regional temperature, changing weather patterns, rising sea levels, ocean acidification, cycling nutrient loads in ocean circulations, increasing stratification of water columns, and changing precipitation patterns. Under these extreme circumstances, environmental stress on primary producers, including changes in tuna spatial and temporal distribution and abundance is acute, resulting in decreased tuna catch over time. Within this context, climate change has serious negative impacts on pelagic fisheries (tuna catch in open ocean) and consequently economic outcomes for Tonga and other PICTs.[47]

Temperature rise

Air temperatures in Tonga are driven by surrounding ocean temperatures. Average annual and seasonal temperatures have increased significantly at Nuku'alofa. Daily minimum temperatures are increasing faster than daily maximum temperatures and November–April temperatures are increasing faster than May–October temperatures.[48] In other words, there has been warming across all months at Nuku'alofa for both maximum and minimum air temperatures between the 1991–2020 and 1961–1990 climatology periods.

Numerous gaps exist in the daily temperature record for Nuku'alofa, which prevents the robust calculation of trends in temperature extremes. Nevertheless, Figure 4 shows that several years since 2010 experienced more than three times as many hot days than at the beginning of the record. This is consistent with the increases in average temperatures and trends in temperature extremes in neighbouring PICTs.

Figure 4. Annual number of hot days and cold nights in Nuku'alofa.[49]



Drought and water security

Tonga relies heavily on groundwater and rainfall as its primary source of freshwater. Droughts caused by the intensification of ENSO events pose significant challenges to Tonga's freshwater supply. With limited rainfall, the replenishment of groundwater slows, making overuse of this vital resource

[47] Note that analysis of the tuna longline fisheries data was double verified by government officials and considered a true representation of catch data in Tonga. SST, sea surface salinity, and sea surface current data were also used as variables within this data set.
[48] McGree et al., Climate Change in the Pacific 2022, Tonga, 14.5.1 'Air temperature', 178.
[49] *Ibid*. Diamonds indicate years with insufficient data for one or both variables.

unsustainable. When extended and severe droughts become more frequent, water scarcity becomes a pressing concern. The 2022 Hunga Tonga–Hunga Haʻapai eruption also affected clean drinking water supplies and caused water restrictions resulting from volcanic ash.

The Tonga Meteorological Services declared a drought for the islands of Tongatapu and ʻEua, with alerts for Niuafoʻou and Niuatoputapu, and warnings for Haʻapai and Vavaʻu just in November of last year.[50] Findings suggest that 90% of the population in remote islands in the Niuas group (Haʻapai, Vavaʻu, etc.) depend on rainwater for drinking,[51] making water security a dire issue for this island group.

Coral reefs and biodiversity

As with many other South Pacific nations, coral reefs in Tonga are increasingly threatened. In the past decade alone, five severe tropical cyclones (Category 4–5) have affected Tonga (Wilma 2011, Evan 2012, Ian 2014, Winston 2015 and Gita 2018), and coral bleaching events were reported in 2012, 2014 and 2016 (personal communication, Vavaʻu Environmental Protection Association [VEPA]). Concerns about overfishing and destructive fishing practices have also been raised for decades, with multiple management strategies employed with varying degrees of success.[52]

Coral reef resources are very important to Tonga for income and food security. The coral reefs for each of the islands are impacted as follows:

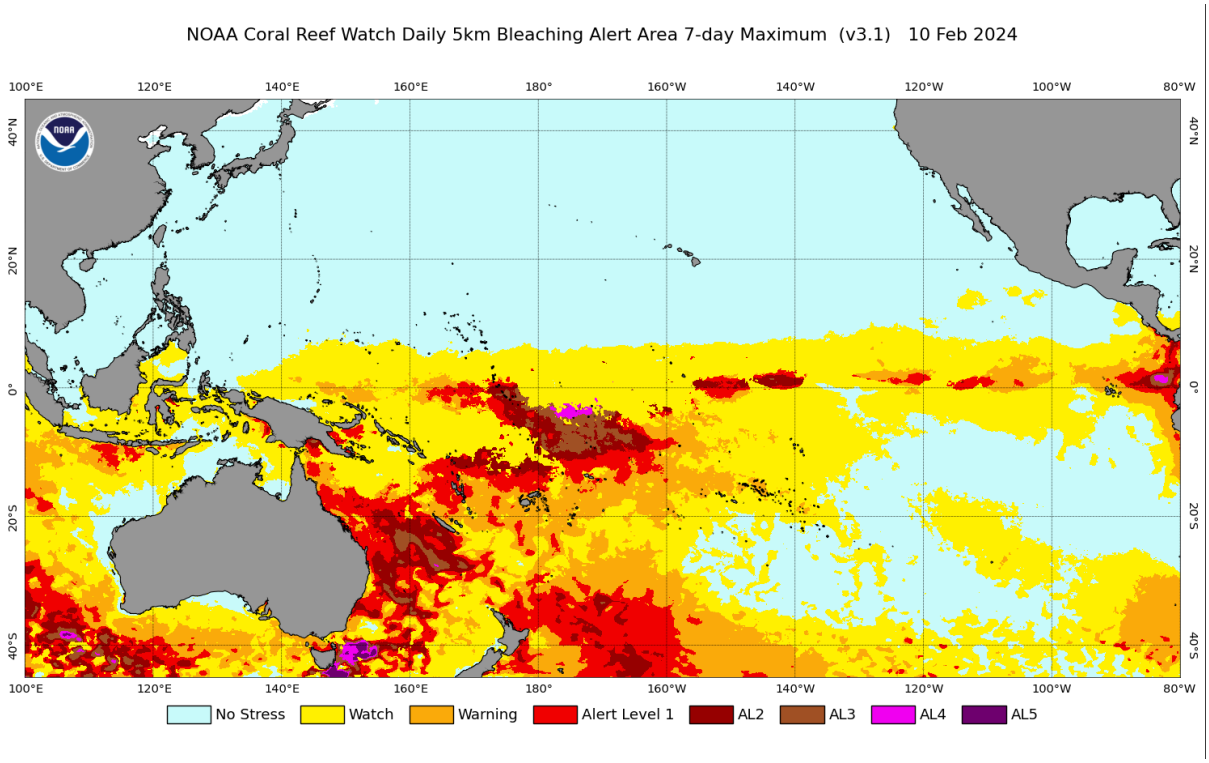
- Vavaʻu – the reefs of Vavaʻu are generally sheltered, narrow fringing reefs below limestone cliffs and adjacent to deep (60–100 m) water. Most reefs are likely to have very little current flow and are sheltered from the open ocean and prevailing weather conditions. Reefs in Vavaʻu might therefore be more susceptible to impacts from both coral bleaching and local pollution. When reefs are subjected to heatwaves, coral bleaching in more open areas could be limited by flushing from cool oceanic waters, while the geography of Vavaʻu would limit flushing and result in pockets of warm water persisting for much longer. Likewise, pollutants from local sources are unlikely to wash away readily given the topography of the islands and instead might persist at greater concentrations. However, limited data are available on current regimes around Vavaʻu to investigate this hypothesis.[53]

- Haʻapai – Many of the sites in northern Haʻapai are sheltered from the east by the main islands and therefore could also trap pockets of warm water, exacerbating bleaching at a local scale. Conversely, the reefs of Southern Haʻapai are much more exposed, which might therefore promote flushing by prevailing winds, waves and currents.[54]

- Tongatapu – The reefs in Tongatapu were overall in better condition than anticipated. Coral cover within the main bay was higher than assessed elsewhere, and reef fish richness and density were moderate. These results could be due to the cooler waters in Tongatapu, which might buffer against the large bleaching events which appear to have impacted Vavaʻu and northern Haʻapai (Figure 5).[55]

[50] Kingdom of Tonga, Meteorological Services 2023, https://met.gov.to/.
[51] Kingdom of Tonga, Voluntary National Review 2019, available at https://purl.org/spc/digilib/doc/ffz9t.
[52] Smallhorn-West Patrick, Sophie Gordon, Karen Stone, Daniella Ceccarelli, Siolaʻa Malimali, Tu'ikolongahau Halafihi, et al., (2020*), Biophysical and anthropogenic influences on the status of Tonga's coral reefs and reef fish fishery*. PLoS ONE 15(11). doi:10.1371/journal.pone.0241146
[53] *Ibid*.
[54] *Ibid*.
[55] *Ibid*.

Figure 5. Coral Reef Watch 5 km Bleaching Alert Area



Impacts on marine mammals (particularly humpback whales and turtles)

Tonga's EEZ has a total area of about 700,000 km². There have been 38 species identified as pelagic fish found in both deep sea and coastal zones. Also recorded were 12 species of whales and six species of marine turtles. Humpback whales and bottlenose whales are considered endangered and together with hawksbill turtles are all protected under Tongan legislation.[56]

One of Tonga's most precious marine mammals is the humpback whale: the waters surrounding Tonga are an important mating, birthing and nursing area for a population of around 2000 humpback whales. Each austral winter the whales migrate to the warm waters around Tonga, which is one of the most important overwintering areas for humpback whales in Oceania.[57] Humpback whale populations are still recovering since whaling was banned in the southern hemisphere in 1966 and the species is listed as Least Concern on the IUCN Red List.[58] Vava'u in particular is a humpback whale hotspot and whale watching and swimming with whales has become an important component of Tonga's tourist industry, contributing an estimated US$700,000 to the economy in 2002.[59]

Global warming is predicted to impact habitat suitability in a great part of current breeding grounds in Oceania (including Tonga), based on shifting isotherms toward higher latitudes. Studies suggests that a great part of the currently occupied breeding sites in Oceania might become unsuitably warm for humpback whales by the end of the 21st century. The thermal tolerance displayed by humpback whales

[56] Tonga State of Environment Report 2018, 89, available at https://tonga-data.sprep.org/dataset/tonga-state-environment-report-2018.
[57] Constantine, Rochelle, Jennifer A. Jackson, Debbie Steel, C. Scott Baker, Lyndon Brooks, Daniel Burns, Phillip Clapham et al., "Abundance of humpback whales in Oceania using photo-identification and microsatellite genotyping." Marine Ecology Progress Series 453 (2012): 249-261, available at https://www.int-res.com/articles/meps2012/453/m453p249.pdf.
[58] Cooke, J. G. "Megaptera novaeangliae." The IUCN Red List of Threatened Species (2018). https://www.iucnredlist.org/species/13006/50362794
[59] See note 56, 117.

in Oceania, combined with flexible patterns of habitat use and the great extent of available suitable habitats, suggests an adaptive capacity of these subpopulations on their breeding grounds. In response to global warming, humpback whales risk relocating to areas where other threats are currently unidentified and deserve investigation.[60]

Figure 6: Humpback whales breeding grounds in the Pacific region (including Vava'u, Tonga)[61]

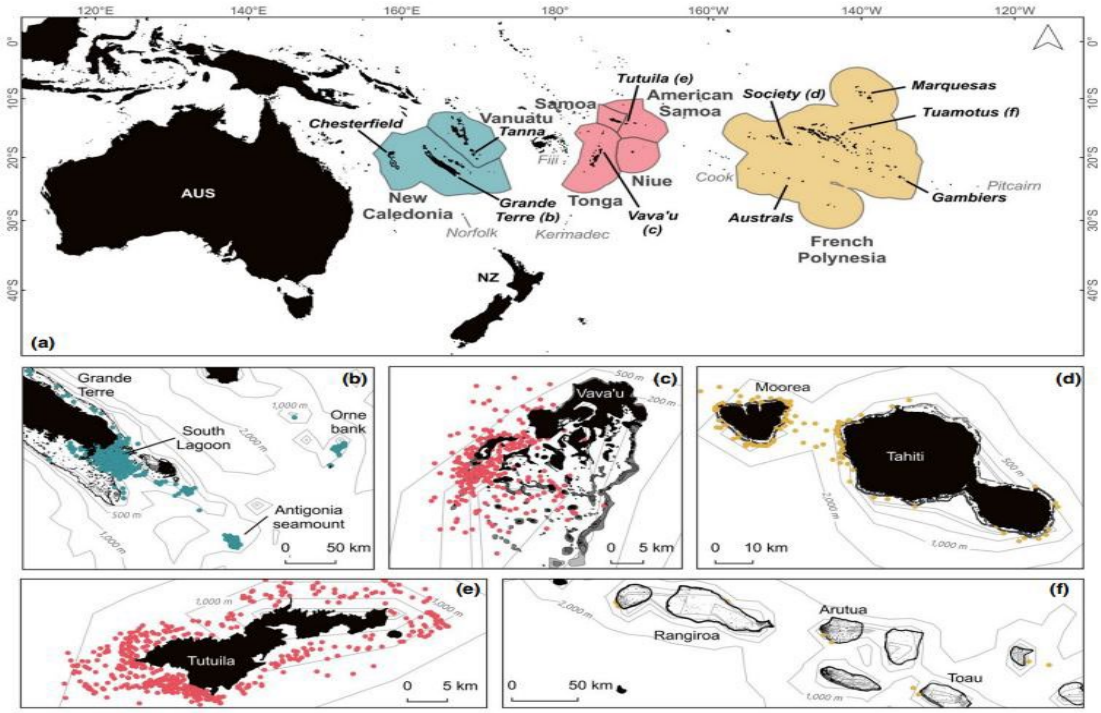


FIGURE 1 Humpback whale breeding grounds and study sites of Oceania. (a) Overview of Oceania with EEZs included in the study represented by colored polygons (from left to right: western, central, and eastern regions). Country names are shown in bold, localities are shown in italics. Other panels zoom in on specific study sites, with land in black, reefs in gray, and presence locations in color: (b) the southern New Caledonia area; (c) Vava'u archipelago in Tonga; (d) Tahiti and Moorea Islands in the Society archipelago of French Polynesia; (e) Tutuila island in American Samoa; (f) Rangiroa atoll in the Tuamotu archipelago of French Polynesia. Isobaths are represented with gray lines [Colour figure can be viewed at wileyonlinelibrary.com]

Turtles are also of particular importance. Turtles live throughout Tonga but the island groups of Ha'apai and Vava'u support the largest populations.[62] All marine turtles recorded from Tonga are listed as threatened on the IUCN Red List.[63]

Climate change affects species and ecosystems around the globe. The impacts of rising temperature are particularly pertinent in species with temperature-dependent sex determination (TSD), where the sex of an individual is determined by incubation temperature during embryonic development. In sea turtles, the proportion of female hatchlings increases with the incubation temperature. With average global temperature predicted to increase by 2.6°C by 2100, many sea turtle populations are in danger of high egg mortality and female-only offspring production. Furthermore, extreme incubation temperatures not only produce female-only hatchlings but also cause high mortality of developing clutches. With rising

[60] Derville, Solène, Leigh G. Torres, Renee Albertson, Olive Andrews, C. Scott Baker, Pamela Carzon et al., Whales in warming water: Assessing breeding habitat diversity and adaptability in Oceania's changing climate, (2018), available at https://library.sprep.org/sites/default/files/2021-07/whales-warning-habitat-diversity.pdf, 10.
[61] Derville et al., Whales in warming water, 4.
[62] Atherton, J. N., S.A. McKenna, and A. Wheatley, 2014. Rapid Biodiversity Assessment of the Vava'u Archipelago, Kingdom of Tonga, https://evols.library.manoa.hawaii.edu/bitstreams/ccc5c85c-3ec0-4687-91ce-c19722c98e43/download
[63] Jensen, Michael P., Camryn D. Allen, Tomoharu Eguchi, Ian P. Bell, Erin L. LaCasella, William A. Hilton, et al., Environmental Warming and Feminization of One of the Largest Sea Turtle Populations in the World, (2018), https://doi.org/10.1016/j.cub.2017.11.057.

global temperatures and most sea turtle populations naturally producing offspring above the pivotal temperature, it is clear that climate change poses a serious threat to the persistence of these populations.

Economic and cultural impacts

Tonga's economy is highly dependent on climate-sensitive sectors like agriculture, fisheries, and tourism, with a limited resource base that is sensitive to external shocks. Vulnerability to extreme weather events not only damages infrastructure, but it also contributes to a population's health challenges. One example of relocation is the original Nuiʻui Hospital on Lifuka, located about 18 m from the coastline with an elevation of five m. The hospital was damaged by Tropical Cyclone Ian in 2014 and a new hospital was built inland 1907 m from the coastline at an elevation of 61 m. Renamed the Princess Fusipala Hospital, it serves the population of Lifuka and Foa Islands, approximately 6470 people.

Additionally, the Hunga Tonga–Hunga Haʻapai volcanic eruption and subsequent tsunami waves of 15 January 2022 resulted in the displacement of about 2390 people and 564 households based on data collected to date. About 54.41% of affected households were located in Tongatapu, 30.54% in Haʻapai Islands, and 15.05% in ʻEua.

IV. CONCLUSION

Climate change is causing significant harm to Pacific Island countries, with archipelagic nations such as Tonga being injured and/or specially affected by the adverse effects of climate change. This harm is seen in increasing sea-level rise and ocean temperatures, ocean acidification, coastal erosion, extreme weather events, prolonged drought, and other impacts.[64] Projections indicate that these impacts are bound to intensify with climate change. The extent to which this existential threat materialises will heavily depend on actions taken to curb anthropogenic greenhouse gas emissions—the vast majority of which are generated outside its borders—as well as measures to adapt to climate change and respond to the loss and damage it causes.

[64] *See* SPC, written submission to the Tribunal for the Law of the Sea, 16 June 2023, available at https://www.itlos.org/fileadmin/itlos/documents/cases/31/written_statements/2/C31-WS-2-5-SPC.pdf.

ANNEX 2

WITNESS EVIDENCE

1. WITNESS STATEMENT OF LATIUME KAUFUSI

2. WITNESS STATEMENT OF PATELISIO FE'AO

3. WITNESS STATEMENT OF SIOKA NOA

4. WITNESS STATEMENT OF 'ETMONI PALU

5. WITNESS STATEMENT OF PULOTU MA'U

6. WITNESS STATEMENT OF SEMISI TONGIA

7. WITNESS STATEMENT OF LAITIA FIFITA

Witness statement of Latiume Kaufusi of Tongaleka, Ha'apai

I, Latiume Kaufusi, of Tongoleleka, Ha'apai, state as follows:

1. I am a businessowner and have previously worked as an electrician. I make this statement to the International Court of Justice as part of the submissions for the advisory opinion on the *Obligations of States in respect of climate change*.

2. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true.

3. I was born and raised in the village of Haveluloto on Tongatapu, the main island of Tonga. At the time of making this statement, I am 62 years of age. I moved to Ha'apai in 1994 when I married my wife and I have lived here ever since. I currently live in the village of Tongoleleka, which is located along the Western Coast of the main island, Lifuka, just South of the capital village Pangai. My wife and I have four children, one who lives abroad in New Zealand and the other three are still in Tonga.

4. I used to work as an electrician for the government-owned electricity company. However, in 2002 the generation and distribution of electricity in Tonga was taken over by a private company. I was asked to move to Vava'u, another island group, but decided to stay in Ha'apai and stopped working as an electrician. Today, I now run an oil trading business, providing petrol and diesel to people and businesses in Ha'apai. There is no fuel depot on Ha'apai so I get the fuel from the capital Nuku'alofa on Tongatapu and bring it back to Ha'apai to sell.

5. While some families live inland, the farthest being a quarter mile from the shore, most families here in Tongoleleka, including my family, live by the sea and have relied on the sea for food. The people of Tongoleleka have lived by the sea for generations.

6. When I first moved to Ha'apai, I lived with my wife and her parents in a shack by the sea. Our livelihood relied upon the resources of the ocean, even though both my wife and I had jobs. I would often walk out to sea when it was low tide and collect clams, sea urchins, and crabs. Our family would then gather on the beach and be served fresh seafood. On hot sunny days we would walk and lay by the sea under wild hibiscus trees and feel the satisfying cool breeze from the sea.

7. In the time that I have lived in Ha'apai I have witnessed the devastating impacts of climate change in my community, including the rising of the sea level, destructive tropical cyclones, and extended hot, dry periods. As a result, many families have moved away and relocated for the first time in generations, leaving behind their family history and inheritance.

Changing realities in Ha'apai

Sea-level rise

8. Along the western coast of Lifuka island, the rising of the sea-level has brought great deterioration and erosion to coastal areas. In the time I have been living here, I have seen sea-level rise of almost 30 metres in some places. These lands where people had once made homes now sit underwater. I understand that the rising of the sea will not stop, it will gradually increase.

9. The impact of rising sea-level is particularly evident when the sea is at high tide and a cyclone falls simultaneously. The combination causes high, strong waves to thrash onto the shore, damaging our homes and defences. We have tried to protect ourselves against the encroaching tide, by building walls, trying to create blockages with sand and planting strong trees and vegetation along the coasts.

10. Unfortunately, these efforts take a long time, and we cannot work fast enough. The seawall along the coast at Pangai – the main village on Lifuka - now sits at the ocean floor, and the wild hibiscus trees and pine trees that we once relied on as a shield from the ocean have been badly damaged or broken by the power of the ocean.

11. I feel deeply the horror of these impacts, as it brings great difficulty for me living by the sea knowing that our coastal areas, homes and families are unprotected from disastrous waves. Today, my family and I have no other choice but to rely on the trees that remain along the shore to keep us and our home safe from the waves.

Tropical cyclones

12. In 2014, we encountered Tropical Cyclone Ian, a category 5 cyclone. In my recollection, this was the most devastating cyclone Ha'apai has experienced since Tropical Cyclone Isaac in 1982. It caused great destruction. Our shack where my family and I lived was shattered into scraps. For the first time I have ever witnessed a

cyclone being able to uplift a 1 Tonne pick-up truck a few inches above the ground. The impacts of this cyclone were terrible all over Tonga, but the Ha'apai islands are especially vulnerable to extreme weather. Out here, we live on long, thin islands so the sea is a constant threat, and we are isolated, making it hard to get support. I recall that after one cyclone, there was a blackout for almost three months before we had power back. This had a serious impact on people's lives, we just had to survive. My family and I built a shelter with the materials we could find, and lived there until power was restored and we could start to rebuild our lives.

13. Here, people are ready for cyclones; they know what to do. When a cyclone falls, families evacuate, and they do not return until after it has passed. However, as the cyclones have become more severe, they increasingly return to their homes to find them wrecked by the waves. These homes are then rebuilt only to be destroyed again by the next cyclone. It's a vicious cycle.

Drought

14. Recently, we have experienced long periods of drought as the hot season gets hotter than it ever was. I witness plantations perish, the grass has now become a hot layer of dirt and dust and it is impossible for the crops to survive during this season. Whenever it rains, we are thankful. Yet, once the rain passes, it gets hot again. These extremes are exacerbated by the effects of El Niño. I can no longer rely on plantations to yield crops as I used to.

15. Drought also contributes to water scarcity in Ha'apai. Here, the people depend on rain fall for all our water as the ground water is very salty and unusable. During these seasons, water is our main import from the main island of Tongatapu. Without importing water, the people are at risk of various illnesses, and we are unable to water our crops or feed our livestock.

Diminishing resources

16. As we try to adapt to the worsening weather and rising sea levels, it seems that we are no longer able to rely on resources from the sea in the same way that we used to.

17. North of the island of Lifuka, there is a small island located between the islands of Foa and Ha'ano named Nukunamo. I used to take my family to this island where we

would collect all sorts of shellfish from the beach. Throughout the years, I have noticed that shellfish are starting to be very scarce. What was normally collected in 20 minutes, now takes more than 2 hours to be gathered. I no longer visit Nukunamo as nothing can be found in its waters.

Moving away from Ha'apai

18. Migration away from Ha'apai is already happening, it is evident when you look around. Today there are large amounts of unoccupied land in Ha'apai where people used to live or have previously grown crops. In my view, a big part of the reason people move is due to the changing climate and weather, which makes life so much harder than it used to be here. We can no longer rely on the ocean as a regular source of food, growing crops is more difficult and water scarcity is a persistent problem.

19. In addition, the cost of living is only increasing. Without being able to catch or grow enough food, many people need to buy fish to feed their families but, as the fishermen are able to catch less, the cost of buying fish is high. Many families can no longer afford to buy fresh fish and have to rely on tinned foods. This is completely different to how I remember life on Ha'apai when I first moved here.

20. Between the uncertainty of the future and the economic difficulties on Ha'apai, a lot of young people move away from Tonga to countries like New Zealand or Australia on temporary work schemes, and, if they can, they will stay there. One of my own children moved to New Zealand temporarily and has stayed there. There are simply more opportunities there for him. Many young people who move overseas provide money to their families back in Tonga. It's this money – rather than people's incomes – that means that many people here are able to have cars, houses and even afford the price of fish today.

21. In Ha'apai, we have always cared for the environment; we feel a strong relationship with this environment. Whenever my family and I were in want, it would cater. We ensured our environment was clean, we made sure to give back to the land before we took. Nature was perfect back then but now it is suffering, and we are suffering too. If my family and I were to move away from Ha'apai, it would cause me great sadness. But the reality is that it is only going to become more difficult to stay.

I believe that the facts stated in this witness statement are true.

Signed.....

LATIUME KAUFUSI

Date 15.03.2024

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.

Date this 15 day of March 2024

(5) pages

Lavemai

Madeleine K E Lavemai
Law Practitioner
Nuku'alofa,Tongatapu

Statement of Patelisio Fe'ao of Ha'ato'u, Ha'apai

I, Patelisio Fe'ao, of Ha'ato'u, Ha'apai, Tonga, state as follows:

1. I am a teacher at St Joseph Catholic High School in Ha'apai. I make this statement to the International Court of Justice as part of the submissions for the advisory opinion on the *Obligations of States in respect of climate change.*

2. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true.

3. I was born and raised in the village of Ha'ato'u on the Island of Lifuka in the Ha'apai group, which is north of the main island of Tongatapu.

4. I started teaching in 1994 and have been teaching ever since, other than a short break I took in 1998. I have taught in both Tongatapu and Ha'apai, and today I teach at St Joseph Catholic High School in Ha'apai. I predominantly teach mathematics but over my career I have taught some English, science, computer science and religious education. In addition to my teaching responsibilities, I am the sports master and coach rugby at the school. This is a role I also held at a previous teaching post in Tongatapu.

Memories of childhood in Ha'apai

5. Growing up in my village, our family relied on the ocean as our daily source of food. We would sometimes rely on growing crops in the bush, but mostly we relied on the ocean.

6. When the tide was low and the seas were calm it was very easy to go out to the rocks and fish, even as children. I remember that some types of fish would come to the shoreline in shoals and almost everyone in the community would go into the sea using woven coconut leaves as nets. We would catch so many fish that we could feast for months.

7. My home island of Lifuka is very close to another island in the Ha'apai group, Uoleva; they are only about one kilometre apart. Growing up, I recall that when it was low tide, a long flat slab of coral limestone would elevate above the sea-level which

connects Lifuka and Uoleva. I remember fondly that I would be able to walk with my friends and family over to Uoleva where we would collect coconuts and different types of shellfish from the shoreline to bring home. You could walk down and just pick and choose whatever meal you wanted for the day whether it is; Kaloa'a (Blood Clams), Tukumisi (Sea urchin), To'o (Little Neck Clams), Ngou'a, Muli'one, Kolukalu (Jellyfish), Limu (Sea Grapes), and many other sorts of seafood. Sometimes, we would split into two groups, one group would walk down to the sea and collect shellfish, while the other group would take a boat a bit further out to the sea and catch fish. I remember the boat would come back with different varieties of fish. In those days, the sea was very abundant with its resources and made our livelihood very simple and easy.

The impacts of climate change

8. In my capacity as a teacher and having grown up here in Ha'apai, I have lived through and witnessed the impacts of climate change on many elements of our life in Ha'apai and seen the changes people here have had to make to adapt.

Physical damage

9. In my role as a teacher, I see the impacts of natural disasters and extreme weather on students and school life. We are no strangers to bad weather in Tonga, but the severity of weather events and natural disasters has increased over the decades. Regularly the school is impacted by weather, whether that is water coming into the building or structural damage. For example, during the Hunga Tonga-Hunga Ha'apai eruption and tsunami in January 2022, waves came all the way up to and into the school building, and during the Tonga earthquake in 2006, one side of the school building was entirely destroyed.

10. When the school is affected by a serious weather event like a tropical cyclone, we normally have to close the school for a period of time, although how long this is will depend on the severity of the weather. We try to make sure we open the school again as quickly as possible but normally the school is closed for at least three days. Even when the school is reopened, some students aren't able to return to school immediately. This might be because their homes have been damaged or even because their families are scared about them leaving shelter to attend school.

11. Although people here are used to hurricanes and tropical cyclones, part of my role as a teacher is ensuring that the students are prepared for extreme weather events. Together with the other staff, I share advice with the students on how to prepare and stay safe. This has become more important as cyclones and hurricanes seem to get more severe.

12. In the past when the school has been damaged, there has been very limited public money available to repair it. When the school was damaged significantly in 2006, we had to undertake major fundraising efforts with the students to be able to repair and strengthen the school building. Some of the students even travelled to Australia - where there is a strong Tongan community – to raise funds for the repair.

13. In addition to extreme weather, people's homes in Ha'apai are threatened by sea-level rise. Families that live along the shore have been forced to relocate themselves in-land. In some cases, they have nowhere else to relocate to and have had to modify their homes or move them slightly to deal with the rising tides. I have seen communities plant more trees along the shores to protect them from the sea but that still does not stop the sea from reaching inland.

Fear and uncertainty

14. In addition to the physical damage caused by increasingly bad weather, I notice that the people in Ha'apai are becoming fearful and uncertain about their futures. The tsunami in 2022 was devastating for the community and caused lots of destruction. It has left the people here with a sense of foreboding. Even though it is my understanding that tsunamis cannot be predicted or forecasted a long time before they occur, we have had instances here where town officers have announced that another tsunami is coming. So far, this has not turned out to be true, but people are so scared that they are waiting for something similar to happen all the time.

15. It is not just the possibility of a further tsunami that people are worried about. These days it's hard to predict when tropical cyclones and hurricanes will come; they seem to come out of season now, and we don't know when to expect them. The damage that they cause builds on the damage of previous disasters and threat of rising sea levels.

16. As a teacher, I try to be calm and rational with my students, even in the face of changing weather conditions. But when we speak about climate change and its impacts in Tonga, I can see in their faces that they are scared, worrying about what will happen and what their futures will look like.

Our environment

17. I have noticed a major change in the environment; this is far from the Ha'apai that I remember as a child. For instance, the sea that we heavily relied on no longer has abundant resources. Throughout the years we started to notice a decrease in the population size of different species of shellfish that we would normally collect. Walking down to the sea to collect clams and sea urchins is now a challenge; they are nowhere to be found and it is as if they have all vanished. A specific part of the sea where we were in the habit of catching many fish, no longer had any fish at all. The fishermen of the island bring back their catch to the Fanga-'i-he-si market and sell them at a very high price. Confused by the price increase, I thought initially that it might be overfishing but realised that would be near impossible with the small population of Ha'apai. The reality is that it is harder to catch fish, there are fewer of them these days.

18. The long flat slab of coral limestone that we used to walk on to Uoleva has started to be covered with sand. Throughout the years, I have noticed the rising of the sea. At first, the stone was covered with dried sand while at low tide. After a few years, we could still walk on the sand to Uoleva, but the sea level was at our ankle. Today, the long flat slab of coral limestone is fully covered with sand, and the sea level is now at your knees at low tide. Not only that, but the sea now comes with strong currents, making it impossible to cross between the islands on foot.

The future in Ha'apai

19. Today, life in Ha'apai is very different to what I experienced growing up. With the ongoing scarcity of the sea's resources and the rising sea-level, most of the families in my village have relocated to the main island of Tongatapu.

20. At the school, there are fewer students. I recall 20 years ago, the total number of students in Ha'apai High School was over 500. Today, there are approximately only 200 students in Ha'apai High School.

21. The Ha'apai islands are the lowest lying islands in Tonga. My people consider the ocean as part of our life, it gives me the identity of who I am. My father passed away when I was 5 years old, my mother then took the role of teaching us how to live from the ocean. I took pride in fishing and collecting shellfish just from off the shore. Unfortunately, the impacts that I see affect me deeply, as the fond experience of catching fish and collecting shellfish has now become a memory that I can no longer relive. We wanted our children to experience what we experienced when we were young. We wanted to teach our children how to live from the ocean and to feel pride and joy in doing so. The fact that we can't causes great distress and sorrow to our community.

I believe that the facts stated in this witness statement are true.

Signed .....

PATELISIO FE'AO

Date15.03.24.....

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.
Date this 15 day of March 2024

5) pages

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Madeleine K E Lavemai
Law Practitioner
Nuku'alofa,Tongatapu

Statement by Sioka Noa, of Kolonga, Tongatapu

I, Sioka Noa, of Kolonga, Tongatapu, state as follows:

1. I am a fisherwoman, farmer, and businesswoman by trade. I am also involved in the community, where I am the Secretary for Kolonga's fisheries group, and a member of the Kolonga's women's group.

2. I make this statement to the International Court of Justice as part of the submissions for the advisory opinion on the *Obligations of States in respect of climate change.*

3. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true.

Changing conditions in Tonga

4. I live in the coastal village of Kolonga which is in the east of Tonga's main island, Tongatapu. I have been subsistence fishing since 1990 when my husband and I started catching hulihuli in the outer islands. It was our main source of livelihood. Over time, we shifted to fishing by nets and after saving up enough money, we purchased a boat that we rent out to fishermen who fish at night.

5. In the decades that I have been fishing or involved in fishing in Kolonga, I have noticed changes in the species of fish available. In the early 1990s, it was possible to catch various fish and marine species, especially when the tides were low, and the seas are calm. We would usually fish at the small islands off the coast of Kolonga, namely, Motutapu, Fukave, Tau, and Sikatoka. The main types of fish we would catch are 'ume, ma'ave and hulihuli, all of which had good quality, and we would sell them for cheap prices.

6. However, in the last five to 10 years I have seen a decrease in the catch. The perfect conditions for fishing of calm seas are hard to come by. The seas are rougher than they are calm, and it is rare for fishermen to experience a week of calm seas. This has prevented local fishermen from fishing. I would often see them in groups, sitting on the seaside, hoping for the seas to be calm. As fishing becomes harder, some fishermen have transitioned from fishing to agriculture practices to make an additional form of income.

Keeping the community safe and prepared

7. Women play an important role in Tongan society, they are involved in almost everything that happens in the community. They are the watchers and the carers for the community, working hard to keep families and others safe.

8. For example, whenever I notice that the sea is getting rough or that there has been a high tide, I encourage the men in the village to pull their boats to shore so that they are not damaged. During times when catch is not good, I look out for the families who are heavily dependent on fishing, and I try to assist them either by providing food or money. Community is integral to Tongan society, and women are important to maintaining and safeguarding community.

9. It has also always been a priority for me to involve women in community activities. I am currently the chair of the Hahake Women's Civil Society group and I encourage the women to be involved in the initiatives of the Civil Society Forum of Tonga. The women in the group are involved in a range of community-based activities, including traditional practices like weaving mats, and maintaining the village. We call the latter 'green practices' because the women – divided into three groups – are responsible for keeping allocated sections of the village clean and in good order.

10. I am also a member of a church group that works with the Ministry of Internal affairs. Part of my work in this group is to help ensure the preparedness of the community against natural disasters or bad weather. I help members of my community to identify what they may need when disasters come and encourage them to be prepared by packing their essentials and necessities. I also share guidance with my community from international organisations like the Red Cross to make sure they know what to do if there is a disaster or emergency.

11. In addition to my work with women's groups and the church, I try to work with young people to teach them skills which are important in Tonga, such as fishing for subsistence and income. My husband and I take some young people, free of charge, on our night fishing trips so that they can observe our methods and learn how to catch fish. Some have even begun fishing and make a modest wage from their catch. To increase prosperity in Kolonga, I have been involved in constructing a local fish market stand, which opened earlier this year. This will enable fishermen to sell their produce in Kolonga, and it is located by the seafront for convenience.

12. This work – preparing the community to be safe and able to look after each other – is important to me, as I have seen the impacts of climate change and how they can hurt my community. I know many people who have been affected and increasingly struggle to depend on the sea and the land for their livelihoods. Over the past few years, I have been trying to build on the foreshore where my home is situated to protect it from storm surges. Other members of the village have had no choice but to relocate. This means leaving everything behind, including the cultural traditions that they have been practicing their whole lives. We are resilient here in Kolonga, and we continue to find ways to support ourselves, despite our limited resources and the difficulties we face.

I believe that the facts stated in this witness statement are true.

Signed.....Malia Peata Sioka Noa.....

SIOKA NOA

Date..13/03/2024.....

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.
Date this 14 day of March 2024
(3) pages
Lavemai
Madeleine K E Lavemai
Law Practitioner
Nuku'alofa,Tongatapu

Statement by Etimoni Palu, of Nuku'alofa, Tongatapu

I, 'Etimoni Palu, of Nuku'alofa, Tongatapu, Tonga, state as follows:

1. I am an offshore fisherman and the owner of Pacific Sunrise Fishing, a fishing company based in Nuku'alofa, on Tonga's main island of Tongatapu. I make this statement to the International Court of Justice as part of the submissions for the advisory opinion on the *Obligations of States in respect of climate change*.

2. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true. Where I refer to information supplied by others, the source of the information is identified; facts and matters derived from other sources are true to the best of my knowledge and belief.

Pacific Sunrise Fishing

3. I was born and grew up on one of Tonga's outer islands. When I got older, I moved to Australia where I started my professional career. One of my early jobs was as a fisheries researcher for the South Pacific Community (researching tuna). After six years, I began fishing - originally catching lobsters in Tasmania, Australia, before moving into tuna fishing. In 1999, my wife and I returned to Tonga and commenced operations as Pacific Sunrise Fishing (**PSF**).

4. When I first registered the company, I had purchased a 55-foot boat from New Zealand. I brought it back to Tonga for the first year to get a feel for the waters and the catch rate. I soon realised that the boat was not going to be big enough, so I sold it and built a boat designed specifically for tuna fishing. At first the company was small; I hired five crew and my mother would then sell our catch on the shoreline. This is how we operated for the first three years. As we grew and had more money coming in, we started using a third party to outsource the processing of our fish. We bought more boats and began leasing a facility from the Department of Fisheries.

5. Our principal catch is tuna and tuna-like species. We also catch a few other species including marlin. We had reached our peak in business operations in 2018, and in one week, we would pack around 140 boxes of tuna for export. We had gone from using one boat to using six boats by 2018, with seven crew on each boat. However, since then, my business has taken a downturn.

Natural disasters and climate change

6. In 2022, we suffered the devastating impacts of the Hunga Tonga-Hunga Ha'apai volcanic eruption and tsunami. During the tsunami, some of our boats were damaged and they are yet to be repaired today. This has a direct impact on the number of fish we can catch and also the amount of people we can employ. We are now down to four working boats, the number of people we employee has reduced from around 75 to 55 people, and recently there have been some weeks where we have packed as few as five boxes of tuna for export. If not for the effects of the tsunami, PSF would have continued to thrive, and we might have even needed to invest in more boats.

7. In my view, the effects of climate change have also contributed to the decline of PSF's business. From conversations I've had with colleagues and fellow fishermen, they share the same view.

8. In the 25 years that I have been operating PSF, I have seen a progression of the weather getting worse and sea temperatures getting warmer. When fishing for tuna, the temperature of the sea is a key element to consider. We have sea temperature monitors on all our vessels. I recently went through my logbooks, dating back to when I started PSF, to look at the temperatures over time in the areas where we usually fish. Over the course of the last 20 years, I can see that sea temperatures are about 2-3°C warmer than what they used to be. I am certain that this has had an impact on our catch rate. For example, our catch rate is 30-40 percent lower than what it used to be when I first started PSF. There are some areas where I used to fish, but I would hardly catch any now. Our options are becoming more limited.

9. The increasing severity of tropical cyclones is another factor that impacts my work. The fishing season runs from December to March each year, which overlaps with the most likely time of year for tropical cyclones in Tonga. As tropical cyclones get worse, there are increased safety risks for our vessels and crew. There are potentially more disruptions to marine ecosystems which are impacted. In Tonga we are used to tropical cyclones, but I have noticed that they have become more severe over time. In the first years of fishing in Tonga, I don't recall experiencing a cyclone beyond Category 3. However, in the past 10 years, I have seen Category 4 and Category 5 cyclones, which have been devastating to Tonga and its natural environment. Because of this, there is a downward trend in the quantity of fish stock in our waters.

10. The economy in Tonga is heavily reliant on fishing, but if these trends – ocean warming, severe, unpredictable weather, rising cost of operations, decreasing catch rates – continue there will be a major change in the way we fish here. We might have to multi-fish for various species during the year. This will mean an overhaul of current fishing practices. We may have to turn to trawlers or deep-water netting. Otherwise, we will have to start importing seafood which would be damaging to jobs and the local economy.

Future of PSF

11. The future of PSF is uncertain. Recently, it has been a challenge trying to generate revenue and cover our costs over recent years. Over the past two or three years, my wife and I have put all of our savings into trying to keep the company afloat, and we have had to borrow money to fix our damaged vessels. The banks in Tonga only permit small borrowings, with high levels of security required to get a loan. What I can borrow is not enough to fully repair the damaged boats. It is very disheartening. In the next six months, if operations have not improved, we may have to close down PSF.

12. If I have no option but to close down PSF, I am worried about what my employees will do for work. We are one of the larger employers here compared to most fishing businesses. I have found it hard to explain to my crew what is happening and how it will directly affect the amount of money that they take home to their families. It is hard for them to understand that we at PSF have not done anything wrong and it is something much bigger than us, the harmful effects of climate change, that directly impact the success of our business and their jobs.

13. I have thought about going back to Australia where the economy is better than here in Tonga and there are more work opportunities. I would find it too hard to leave my employees here in Tonga. PSF pays their salaries, but we also provide financial support to some of the employees' children so they can attend school. I am concerned what my employees will do if we close the business down and move away. They are trained up specifically for this type of work and would likely find it difficult to get work locally if the business closed. Without training to do other jobs, they may need to move overseas to find employment. Even if I have to reduce the capacity of the business down to 50 percent, I would try to keep going so that I could at least help half of my employees. It would be heart-wrenching to just leave, but I might have no choice in the future.

I believe that the facts stated in this witness statement are true.

Signed.....

'ETIMONI PALU

Date.....13 March 2024.....

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.
Date this 14 day of March 2024
(4) pages .
Lavemai

Madeleine K E Lavemai
Law Practitioner
Nuku'alofa,Tongatapu

Statement by Pulotu Ma'u, of Nuku'alofa

I, Pulotu Ma'u, of Nuku'alofa, Tonga, state as follows:

1. I work in the Culture and Heritage Division of the Ministry of Tourism of the Government of the Kingdom of Tonga (**Tonga**). I make this statement to the International Court of Justice as part of the submissions for the advisory opinion on the *Obligations of States in respect of climate change*.

2. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true.

3. The Culture and Heritage Division of the Ministry of Tourism is concerned with the protection of both tangible cultural heritage (**TCH**) and intangible cultural heritage (**ICH**). I understand that my colleague, Mr. Semisi Tongia is providing a witness statement concerning TCH. My role in the Ministry of Tourism is focused on the protection of ICH, and that is what I shall address in this statement.

Intangible Cultural Heritage

4. There are five domains of ICH. These include:

   i. Oral tradition and expressions including language as a vehicle of ICH;

   ii. Performing arts;

   iii. Social practices, rituals and festive events;

   iv. Knowledge and practices concerning nature and the universe;

   v. Traditional craftmanship.

5. Each of these components is kept alive by the knowledge and practice of people in Tonga. In Tongan culture, traditional practices pertain to the 'people' and 'space'. The 'people' are custodians of the land, practitioners of ICH, transmitting our culture and sharing stories, and the 'space' refers to the land where culture is practiced. However, when the people are impacted by extreme weather and natural disasters, the way that they live is forced to change. When the land is damaged, the practice of traditions may no longer be transmissible.

6. My role at in the Culture and Heritage Division is to safeguard ICH through designing and implementing projects which protect and share knowledge of ICH. Recently, Tonga has become one of the beneficiaries of an UNESCO project to safeguard intangible cultural heritage in times of emergency in Small Island Developing States. This project aims to integrate ICH into disaster risk reduction strategies and help communities to prepare for and respond to emergencies.

The impacts of a changing climate on ICH in Tonga

Importance of community and settlements

7. Whenever there is a natural disaster or extreme weather event in Tonga, it affects the way that Tongan people live and how, or if, they perform their daily norms. This is especially true when people are forced to relocate from their homes, away from the ancestral grounds where cultural heritage is practiced and physically belonging to a different place that does not have the same cultural significance to them.

8. During the Hunga-Tonga Hunga-Ha'apai volcanic eruption and tsunami in January 2022, a number of coastal settlements were damaged. People were forced to move - both temporarily and permanently - away from their homes. This is true when severe tropic cyclones occur too. Additionally, the rising sea-levels are a constant threat to the people of Tonga, and it is likely that many people will need to resettle in the years to come.

9. Resettlement away from the ancestral grounds can impact the way that Tongan people culturally identify themselves. For example, if a community is relocated from one island to another, a question arises as to whether they identify themselves as part of their original or their new settlement. Tongan people share a deep connection to the land that they and their ancestors grew up in. When they are forced to leave that place, they risk losing a sense of belonging, cultural identity and heritage.

10. As the impacts of climate change affect the people and the land of Tonga, more people are moving away to find opportunities abroad. The voluntary and forced movement of people, contributes to the loss of ICH. Fewer young people are in Tonga to learn cultural knowledge and practices, which means they will be unable to transmit it on to future generations.

Lack of traditional resources

11. ICH and TCH are closely connected to each other. Whilst ICH is focused on traditional knowledge and transmission of cultural heritage, in some cases it depends on the existence of traditional instruments, resources, and places. When those resources are lost, it is harder for the people to practice ICH.

12. For example, where a specific fishing ground is changed or damaged by rising sea-levels or ocean warming, people can no longer practice traditional fishing methods in that place. Further, where native plants that are used in traditional medicines are damaged in natural disasters, submerged by the sea, or no longer grow because of warmer temperatures, they can no longer be used in traditional remedies or rituals.

13. If these resources are not available, it means that young people have fewer opportunities to practice Tongan traditions. It is difficult to teach without the right equipment. There is a real risk that some if not all ICH will be lost if we do not find a way to preserve it for future generations.

Preserving ICH in Tonga

14. Due to the changing weather, growing lack of resources and movement of people that I have described, we have experienced the slow demise of certain aspects of Tongan culture including the use of the Tongan language, the act of wearing our Tongan attire, and passing down our tradition to our children and grandchildren. In the face of the impacts of climate change, we have a responsibility to safeguard and protect our Tongan cultural practices. The programmes created and implemented by the Ministry of Tourism go some way to achieving this but require more funding to be most effective. The safeguarding of ICH is also key to the preservation of cultural authenticity for visitors.

I believe that the facts stated in this witness statement are true.

Signed.....

PULOTU MA'U

Date....13/03/24.....

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.
Date this 14 day of March 2024
(3) pages
Lavemai
Madeleine K E Lavemai
Law Practitioner
Nuku'alofa,Tongatapu

Statement by Semisi Tongia, of Nuku'alofa

I, Semisi Tongia, of Nuku'alofa, state as follows:

1. I am the Principal Programme Officer for the Culture and Heritage Division at the Ministry of Tourism of the Government of the Kingdom of Tonga (**Tonga**). I make this statement to the International Court of Justice as part of the submissions for the advisory opinion on the *Obligations of States in respect of climate change*.

2. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true.

3. The Culture and Heritage Division of the Ministry of Tourism is concerned with the protection of both tangible cultural heritage (**TCH**) and intangible cultural heritage (**ICH**). I understand that my colleague Mr. Pulotu Ma'u is providing a witness statement concerning ICH. My role in the Ministry of Tourism is focused on the protection of TCH, and that is what I shall address in this statement.

Tangible Cultural Heritage

4. TCH refers to objects, artefacts, structures, and things that we can physically touch which have traditional or cultural use or significance. It includes both natural and cultural such as historical sites, buildings, monuments, artwork, traditional items such as clothing, instruments and handicrafts, and traditional flora which is native to the area. In my role as Principal Programme Officer, I am concerned with the protection, preservation, conservation and promotion of Tongan TCH.

5. By far, the greatest threat to TCH in Tonga is the changing weather, climate and natural disasters which have become more frequent over time because of climate change. The paragraphs that follow provide more detail of TCH which is under threat.

Historical sites, buildings and monuments

6. One of my responsibilities is to make submissions to UNESCO World Heritage for the protection of Tongan heritage sites. At present, Tonga has two sites included on its tentative list, which is an inventory of sites that it intends to consider for nomination:

   6.1 Lapita Pottery Archaeological Sites, submitted on 9 August 2007; and

   6.2 The Ancient Capitals of the Kingdom of Tonga, submitted on 9 August 2007.

7. Within the last decade, Tonga has been the victim of devastating tropical cyclones, volcanic eruptions, and a tsunami. As many heritage sites are located in coastal areas, they are disproportionately impacted by hazards such as these.

8. In February 2018, Cyclone Gita, a Category 5 Tropical Cyclone, destroyed the Parliament Building in the capital city of Nuku'alofa. At the time of the cyclone, the building was over 100 years old. The original Parliament Building has still not been repaired or rebuilt today. The destruction of the Parliament building represents not only the destruction of a physical building, but also the loss of a place of cultural significance. Whilst stories of the Parliament, its people, and its history will continue to be told, we no longer have the place which people can see and visit. This impacts both the people of Tonga and also tourists who can no longer visit this important building.

Settlements and villages

9. In Tonga, the majority of people live in coastal villages and settlements. The coast forms the basis of many livelihoods in Tonga. It is the place where resources are, and it is also where people have lived for generations. Tongan people were navigators and depended on the ocean for their way of life. Our ancestors were closely connected to the coastal environment. They built traditional Tongan canoes from the natural resources available to them and relied on traditional navigation knowledge – of tides, currents, and the stars – to voyage and to fish.

10. It is common for people to stay in the same villages and areas as their ancestors, and even if people move away for education or work, they often return to their village later in life. Even today, when fewer people use traditional methods of fishing and navigation, Tongan people often live in the same coastal settlements as their ancestors. As property rights usually pass through the eldest son, generations of families are likely to live in the same village and even the same property over time. This feeds into the importance of family and kinship in Tongan culture, where ancestry is an integral part of the Tongan way of life.

11. Another reason that Tongan people tend to settle in the same places as their ancestors is because their ancestors are buried close to that settlement. It is important to be able to visit the graves of ancestors and pay respects to the people who once lived and practiced the Tongan way of life and traditional culture.

12. Due to the coastal location of many settlements and cultural sites, they are vulnerable to extreme weather events and natural disasters. During the Hunga Tonga-Hunga Ha'apai volcanic eruption and tsunami in January 2022, large numbers of coastal settlements across Tonga were wiped out completely. Three communities had to be entirely relocated, two of which were moved to different islands and the other was moved in-land from a coastal location on the same island.

13. Disasters like this are more and more common in Tonga, and compound the effects of rising sea-levels which threaten communities and damage or wash away cemeteries. Where Tongan people are forced to move, they may be unable to ever return to their ancestral homes and the places where their ancestors are buried. Of course, they continue to tell stories of the people who came before them and their practices, but they cannot visit their graves anymore. In my view, this makes it harder to pass cultural knowledge down to the younger generations. Without TCH, it is more abstract and there is nothing physical to refer to.

Traditional flora

14. Another element of TCH which is impacted by changes in weather and climate is the growth and use of traditional plants. For many generations, traditional plants have been used by our ancestors to create medicine and natural remedies. Today, rising sea-levels, natural disasters, and changing temperatures damage native vegetation and impact how and when it grows. The traditional plants that our ancestors relied upon are no longer abundant or available.

15. As a result, fewer Tongan people practice traditional Tongan medicine and the younger generations do not have the traditional knowledge that has, until this point, been passed down generation-to-generation.

Cultural heritage and tourism in Tonga

16. Tourism in Tonga is an important part of the economy, accounting for about 20 percent of Tonga's gross domestic product. In order to maintain and grow the tourism industry, it is important for the Ministry of Tourism to protect and clean up existing natural and cultural heritage properties as much as possible.

17. For a long time, heritage properties in Tonga were neglected. They were hard to access or in overgrown areas. In the past 15 years or so, the Ministry of Tourism has been

working hard to improve this by restoring and reinstalling monuments in original locations and doing landscaping work to improve access. This work has had a positive impact on tourism in Tonga and we have seen a growing number of visitors.

18. The severity of weather events and natural disasters threatens this progress. Like the Parliament Building, we have had heritage properties damaged by tropical cyclones and other natural disasters. If this level of damage continues or gets worse, I am concerned that, in addition to the cultural loss I have described above, it will have a negative impact on the level of tourism we can attract to Tonga and the Tongan economy more generally.

I believe that the facts stated in this witness statement are true.

Signed.....

SEMISI TONGIA

Date.....13/3/24.....

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.
Date this 14 day of March 2024
(4) pages
Lavemai
Madeleine K E Lavemai
Law Practitioner
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Statement by Laitia Fifita, of Nuku'alofa

I, Laitia Fifita, of Nuku'alofa, state as follows:

1. I am the Deputy Director of the Tonga Meteorological Service, which is part of the Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (**MEIDECC**). I make this statement to the International Court of Justice as part of the Kingdom of Tonga's (**Tonga**) submissions on the *Obligations of States in respect of climate change.*

2. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true.

Tonga Meteorological Service

3. The Tonga Meteorological Service (the **Service**) is one of several departments comprising the MEIDECC. The other departments include climate change, energy, disaster and rescue management, corporate services, and communications. Each department has cross-cutting functions and interrelated mandates. For example, the analysis and predictions of the Service will inform the work of other departments in MEIDECC.

4. I have worked in the Service for approximately 10 years. I have held my current position of Deputy Director of the Service for around four years. Prior to this, I held the position of Chief Meteorologist in the same department. In 2017-2018, I took a short break from the Service to complete a postgraduate Master's Degree in Applied Meteorology and Climate at Reading University, United Kingdom.

5. As Deputy Director, I have a range of responsibilities, including:

   5.1 supporting the Director of the Service with administrative tasks;

   5.2 overseeing Service operations;

   5.3 advising on policy documents;

   5.4 making submissions to Cabinet;

   5.5 leading on strategic planning, monitoring and evaluation for the Service; and

5.6 providing information and analysis to cross-department groups and committees.

6. Day-to-day, I am confronted with the reality of changing weather patterns in Tonga, whether through the frequency of weather events or through projects carried out by the Service which identify variations and changes.

Changing weather patterns in Tonga

7. It is important to distinguish between 'weather' and 'climate', which in my view are related but not the same. 'Weather' occurs in the short term; we can make predictions about the weather and weather events on a two-to-three-week timescale. As the applicable timescale moves into months and longer and we can notice patterns or trends; this is 'climate'. At the Service, we have records dating back to the 1940s, and we are therefore able to review weather events to identify climate trends over time.

8. In Tonga, we have two seasons: the wet season between November and April and the dry season between May and March. During the wet season, it is usual for there to be tropical cyclones and increased rainfall. The global fluctuations of El Niño and La Niña feed into these seasons in Tonga and the South Pacific region.

9. There are certain types of weather that we have come to expect, which can be related to El Niño and La Niña. Historically, during El Niño rain shifts away from the Pacific Islands and we have come to expect drought in Tonga as a result. These weather patterns are well known in Tonga and the people of Tonga have come to know the indicators of changing or severe weather. In the more remote islands of Tonga, people rely on this traditional knowledge – recognising strong winds in a particular direction, and changes in ocean temperatures and currents – to make decisions about agriculture, fishing, and personal safety.

10. In the time that I have worked at the Service, I have seen changes in weather patterns. More frequently, we do not see the weather that we would normally expect at different times of the year. In recent years, instead of drought during El Niño, we have had increased rainfall. It is becoming harder to predict changes in the weather, beyond predictions in the short term, and traditional indicators of weather events are becoming less reliable.

11. Over the course of 2021 and 2022, the Service carried out a project to gather anecdotal data on the changes in weather and potential impacts of climate change over a long-term

period from people living on Tonga's remote islands. As Deputy Director, I have had oversight of this project and its findings. During the life of the project, inhabitants of a range of remote islands were surveyed. They reported that they have seen significant sea-level rise over time, with some responding that they have seen the seashore move between 50 and 100 metres inland over the past 30 years. Respondents also reported that their traditional knowledge of weather and climate, including understanding the indicators of upcoming weather, was no longer sufficient to identify incoming weather. In fact, in some cases, these indicators can no longer be seen or heard by local people, which means they are less prepared for changes in the weather. In many instances, local people directly attribute these variabilities and changes to climate change.

12. This is the first survey of this kind that we have done in the Service, and we would like to do this work year-on-year to better our understanding of climate trends over time in the most remote parts of the country. Unfortunately, the Service does not have the budget to carry out this work on a regular basis.

13. In my view, climate change is happening and Tonga is at the forefront of the effects of it. This is evident in the increased anomalies and abnormalities in weather and climate patterns in Tonga and the surrounding region. There is also evidence to suggest that sea-level rise in Tonga is caused, at least in part, by global warming. What is certain though is that Tonga needs the financial, technical and human resources to carry out this research and understand the changes in the climate, weather and environment which impact the lives of the Tongan people.

Increasing preparedness in Tonga

14. In September 2023, I attended a workshop in Nadi, Fiji on impact-based forecasting. At the workshop, which was also attended by representatives from the Samoa Meteorological Service, I gained operational experience of the impact-based forecasting early warning system which we now use in Tonga. The benefit of impact-based forecasting is that we can now report not only what the weather or hazard will be, but also what the impact of a hazard will be for the community. This helps people to make decisions about their work and their safety, based on a better understanding of the likely impacts of a natural hazard.

15. We had been working to develop models and research covering key hazards since 2020, and it was during this phase of our work that the Hunga Tonga-Hunga Ha'apai volcanic

eruption and tsunami took place in January 2022. Such a devastating event served as a reminder of Tonga's vulnerability to natural hazards. Later that year, we started using the impact-based forecast system. It is too early to report on the impact of the new forecast system, but I am confident that it will contribute to increased preparedness in Tonga, in the context of increasing weather variability.

Disaster and emergency management

16. As noted at paragraph 5, part of my role is to represent the Service on certain cross-departmental committees. One of these is the National Emergency Management Committee (**NEMC**), formed under the mandate of the National Emergency Management Office which was established under the Emergency Management Act 2007.

17. The role of the NEMC, amongst other things, is coordinate the development and implementation of emergency management responses in communities before, during, and after the impact of an event. As the representative of the Service, I brief the NEMC on incoming hazards and the potential impacts of hazards. I also assist the NEMC in making decisions on the appropriate emergency response, such as distribution of assistance and allocation of recovery funds. The functions of the NEMC have increased over the time I have been involved, based on the frequency and severity of natural disasters.

I believe that the facts stated in this witness statement are true.

Signed.....

LAITIA FIFITA

Date.....**15 March 2024**.....

CERTIFICATE

I have this day compared the following with the orignal copy and hereby certify it to be a true and exact copy thereof.
Date this 15 day of March 2024
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