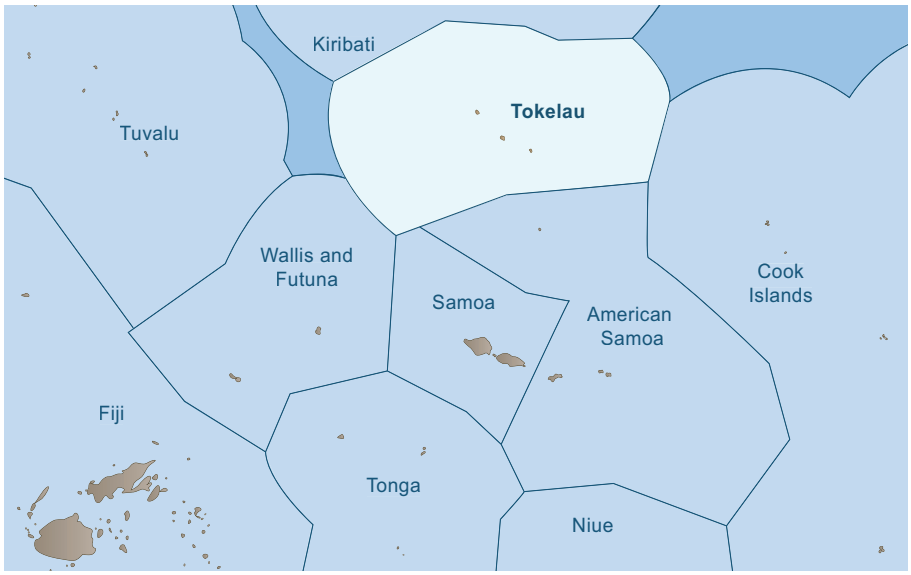
2.18 Tokelau



Key features

Population

Year	2010	2035	2050	2100
Population (x 1000)[a]	1.2	1.2	1.2	1.2
Population growth rate[a]	-0.2	-0.1	0	0

a = Data from SPC Statistics for Development Programme (www.spc.int/sdp).

EEZ area (km²) 318,990

Land area (km²) 10

Land as % of EEZ 0.003

Fisheries and aquaculture activities: Oceanic fisheries and coastal fisheries.

Membership of regional fisheries management arrangements: Forum Fisheries Agency; Western and Central Pacific Fisheries Commission (participating territory); Te Vaka Moana Arrangement; South Pacific Tuna and Billfish Subcommittee.

Surface climate and the ocean

Existing features

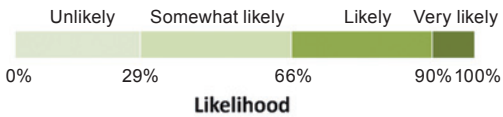
Tokelau has a tropical climate {Chapter 2}. Recent air temperatures in Pukapuka have averaged 24.4°C and average rainfall is 2925 mm per year. Tokelau lies within the Pacific Equatorial Divergence Province (PEQD) {Chapter 4, Figure 4.6}. The PEQD Province is generated by the effects of the earth's rotation on the South Equatorial Current, which results in significant upwelling of nutrients {Figure 4.3}. These conditions create the richest surface waters in the region.

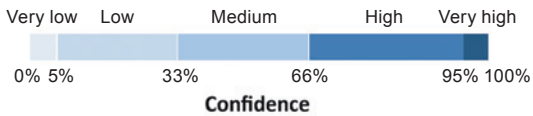
Projected changes to surface climate

Air temperatures and rainfall in Tokelau are projected to increase due to climate change under the low (B1) and high (A2) emissions scenarios in 2035 and 2100 {see Chapter 1, Section 1.3 for definition of scenarios} relative to long-term averages {Chapter 2, Section 2.5, Table 2.6}.

Climate feature[a]	1980–1999 average	Projected change			
		B1 2035	A2 2035	B1 2100*	A2 2100
Air temperature (°C)	24.4[b]	+0.5 to +1.0	+0.5 to +1.0	+1.0 to +1.5	+2.5 to +3.0
Rainfall (mm)	2925[c]	+5 to +15%	+5 to +20%	+10 to +20%	+10 to +20%
		More extreme wet and dry periods			
Cyclones (no. per year)	0.6	➢ Total number of tropical cyclones may decrease ➢ Cyclones are likely to be more intense			

* Approximates A2 in 2050; a = for more detailed projections of rainfall, air temperature and cyclones in the vicinity of Tokelau, see www.cawcr.gov.au/projects/PCCSP; b = 1985–1999 data from Pukapuka in Cook Islands used as a surrogate for Tokelau; c = 1975–1999 data from Pukapuka in Cook Islands.





Projected changes to the ocean

The projected changes to the key features of the tropical Pacific Ocean surrounding Tokelau relative to the long-term averages are expected to result in increases in sea surface temperature (SST), sea level and ocean acidification. Changes to ocean currents, such as the South Equatorial Current, and the area and location of the PEQD Province, are also expected to occur {Chapter 3, Sections 3.3 and 3.4, Tables 3.1 and 3.2}.

Ocean feature	1980–1999 average	Projected change			
		B1 2035	A2 2035	B1 2100*	A2 2100
Sea surface temperature (°C)	29.3[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	SEC decreases at equator; EUC becomes shallower; SECC decreases and retracts westward			
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; SEC = South Equatorial Current; EUC = Equatorial Undercurrent; SECC = South Equatorial Counter Current.

Oceanic fisheries

Recent catch and value

Tokelau has only a very small local fishery for tuna within its exclusive economic zone (EEZ), with recent average catches (2004–2008) of ~ 6 tonnes per year, worth > USD 14,000. Tokelau also licenses foreign purse-seine fleets to fish in its EEZ. The average annual catch by these fleets between 1999 and 2008 was 2665 tonnes, worth USD 2 million. See 'Coastal Fisheries' below for contributions of tuna to nearshore artisanal and small-scale commercial fisheries.

Local oceanic fisheries	Average annual catch (tonnes) 2004–2008	Average annual catch value (USD)* 2004–2008
Tuna		
Troll	6.2	14,385
Total	**6.2**	**14,385**

* Calculated using market value per tonne for 2004–2008.

Existing oceanic fish habitat

The waters of the PEQD Province are characterised by high-salinity, nutrient-rich waters, and an abundance of phytoplankton {Chapter 4, Figure 4.7}. However, primary production in PEQD is limited by low iron concentrations {Chapter 4, Figure 4.9}. The prime feeding areas for tuna are located to the northwest of Tokelau at the convergence of PEQD and the Warm Pool {Chapters 4 and 8}.

Projected changes to oceanic fish habitat

Under climate change, the surface area of the PEQD Province is projected to contract and the convergence zone with the Warm Pool is expected to move eastward. However, there are likely to be only minor changes in the key components of the food web for tuna (e.g. net primary production and zooplankton biomass) in PEQD {Chapter 4, Table 4.3}.

PEQD feature	Projected change (%)			
	B1 2035	A2 2035	B1 2100*	A2 2100
Surface area[a]	-20	-27	-30	-50
Location		Eastwards		
Net primary production	0	0	+2	+4
Zooplankton biomass	-2	-2	-3	-6

* Approximates A2 in 2050; a = area derived from modelling of nutrients and salinity {Chapter 4, Table 4.3}.

Projected changes in oceanic fisheries production

Preliminary modelling suggests that under the B1 and A2 emissions scenarios, catches of skipjack tuna in the EEZ of Tokelau are expected to increase by > 60% in 2035 and 2100, relative to the 20-year average (1980–2000). However, catches of bigeye tuna are projected to decrease progressively under both scenarios in 2035 and 2100 {Chapter 8, Section 8.7}. Modelling for yellowfin tuna is now in progress. The trends for yellowfin tuna are expected to be similar to those for skipjack tuna.

Projected change in skipjack tuna catch (%)			Projected change in bigeye tuna catch (%)		
B1/A2 2035	B1 2100*	A2 2100	B1/A2 2035	B1 2100*	A2 2100
+61	+69	+63	-3	-6	-16

* Approximates A2 in 2050.

Coastal fisheries

Recent catch and value

The coastal fisheries of Tokelau are made up mainly of three components: demersal fish (bottom-dwelling fish associated with coral reef habitat), nearshore pelagic fish (including tuna, rainbow runner, wahoo and mahi-mahi), and invertebrates gleaned from intertidal and subtidal areas {Chapter 9, Section 9.2.1}. The total annual catch was estimated to be 375 tonnes in 2007, worth > USD 710,000. There was no commercial catch. Demersal fish are estimated to make up ~ 50% of the total catch.

Feature	Coastal fisheries category				Total	Total value (USD m)*
	Demersal fish	Nearshore pelagic fish[b]	Targeted invertebrates	Inter/subtidal invertebrates		
Catch (tonnes)*	182	150	0	43	375	0.7
Contribution (%)[a]	48	40	0	12	100	

* Estimated total catch and value in 2007 (Gillett 2009)[1]; a = method for calculating disaggregated catch data for each category is outlined in Chapter 9 {Appendix 9.2, Supplementary Table 9.1}; b = catch dominated by tuna species.

Existing coastal fish habitat

Tokelau has 204 km^2 of coral reef habitat that supports many coastal fisheries species {Chapter 5}. There are no mangroves or seagrasses in Tokelau and the area of intertidal sand flats within lagoons has not been documented {Chapter 6}.

Projected changes to coastal fish habitat

Climate change is expected to add to the existing local threats to coral reefs in Tokelau, resulting in significant declines in coral cover in the medium and long term {Chapters 5 and 6}.

Habitat feature[a]	Projected change (%)		
	B1/A2 2035	B1 2100*	A2 2100
Coral cover[b]	-25 to -65	-50 to -75	> -90

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

Projected changes in coastal fisheries production

Fisheries for demersal fish and intertidal and subtidal invertebrates in Tokelau are projected to show progressive declines in productivity due to both the direct effects (e.g. increased SST) and indirect effects (changes to fish habitats) of climate change

{Chapter 9, Section 9.5}. On the other hand, the nearshore pelagic fishery component of coastal fisheries is projected to increase in productivity due to the redistribution of tuna to the east {Chapter 8}.

Coastal fisheries category	Projected change (%)			Main effects
	B1/A2 2035	B1 2100*	A2 2100	
Demersal fish	-2 to -5	-20	-20 to -50	Habitat loss and reduced recruitment (due to increasing SST and reduced currents)
Nearshore pelagic fish[a]	+15 to +20	+20	+10	Changes in distribution of tuna
Inter/subtidal invertebrates	0	-5	-10	Declines in aragonite saturation due to ocean acidification

* Approximates A2 in 2050; a = tuna dominate the nearshore pelagic fishery {Chapter 9, Tables 9.8 and 9.10}.

The overall projected change to coastal fisheries catch reflects the relative importance of demersal fish and the projected increase in productivity of nearshore pelagic fish. As a result, potential catches from coastal fisheries in Tokelau are expected to increase under both scenarios in 2035, decrease under B1 in 2100 (A2 in 2050), and decrease further under A2 in 2100.

Coastal fisheries category	Contrib. (%)**	Projected change in productivity (P) and catch (%)					
		B1/A2 2035		B1 2100*		A2 2100	
		P***	Catch	P***	Catch	P***	Catch
Demersal fish	48	-3.5	-2	-20	-10	-35	-17
Nearshore pelagic fish	40	+17.5	+7	+20	+8	+10	+4
Inter/subtidal invertebrates	12	0	0	-5	-0.5	-10	-1
Total catch[a]			**+5**		**-2**		**-14**

* Approximates A2 in 2050; ** contribution of each component to total coastal fisheries catch in Tokelau; *** median projected change in productivity based on range in Chapter 9; a = assumes that proportion of each category remains constant.

Freshwater and estuarine fisheries

Tokelau has no freshwater or estuarine fisheries.

Aquaculture

Tokelau has no aquaculture production.

Economic and social implications

Economic development and government revenue

Current contributions

Licence fees from foreign surface fishery vessels contributed 11.4% to government revenue (GR) in 2007. Estimates of the gross domestic product (GDP) of Tokelau were not available {Chapter 12}.

Industrial fishery	Contribution to GR*	
	USD m	GR (%)
Surface	1.5	11.4

* Information for 2007, when total government revenue was USD 13 million.

Projected effects of climate change

The effects of climate change on the distribution and abundance of tuna are projected to increase the contribution of tuna licence fees to government revenue in the medium and long term. Potentially, contributions to GR could increase from ~ 11% to up to ~ 20% (assuming total GR remained constant) {Chapter 12}.

Projected changes to GR (%)		
B1/A2 2035	B1 2100*	A2 2100
+1 to +9	+1 to +10	+1 to +9

* Approximates A2 in 2050.

Food security

Tokelau is among the group of PICTs (Group 1) where the estimated sustainable production of fish and invertebrates from coastal habitats will be more than enough to supply the national population with the 35 kg of fish per person per year recommended for good nutrition[i] {Chapter 12, Section 12.7.1}.

Current contributions of fish to food security

Average national fish consumption in Tokelau is estimated to be ~ 200 kg per person per year[1], well above the recommended levels for good nutrition. At present, coral reefs in Tokelau are estimated to be able to supply > 500 kg of fish per person per year.

i Based on fish contributing 50% of dietary protein as recommended by the SPC Public Health Programme (SPC 2008)[25].

Effects of population growth

The population in Tokelau is projected to remain stable over this century and coastal fisheries are expected to continue to easily meet the demand for fish for food security. The current estimated fish surplus of > 400 kg is expected to continue in 2035, 2050 and 2100.

Variable	2010	2035	2050	2100
Population	1200	1200	1150	1150
Fish available per person (kg/year)[a]	510	510	532	532
Surplus (kg/person/year)[b]	475	475	497	497

a = Based on 3 tonnes of fish per km^2 of coral reef habitat {Chapter 9}; b = relative to recommended consumption of 35 kg per person per year.

Additional effects of climate change

The projected decline in coastal fisheries in Tokelau due to climate change is not expected to have any significant effect on the fish available per person for food security. The large area of coral reef relative to population size will continue to supply enough fish to meet the traditional demand.

Livelihoods

Current contributions

There are no estimates of the number of jobs supported by the small local tuna fishery in Tokelau. There are no commercial coastal fishing activities and no information was available on possible opportunities to gain income from coastal fisheries.

Adaptations and suggested policies

The plans Tokelau has to derive greater socio-economic benefits from fisheries will depend heavily on interventions to:

1. improve access of foreign fleets to tuna with in its EEZ, and manage coastal fish habitats and fish stocks to ensure that these resources continue to provide a surplus of fish for food security.

The adaptations and suggested policies to achieve these plans under a changing climate are summarised below (see Section 3 for details).

Economic development and government revenue

Adaptation no. (Section 3.2)	Summary of adaptation	Supporting policy no. (Section 3.3)
E1	Full implementation of sustainable fishing effort schemes	E1, E2, E4–E6
E3	Immediate conservation management measures for bigeye tuna	E8
E7	Safety at sea	E10
E9	Pan-Pacific tuna management	E2

Food security

Adaptation no. (Section 3.4)	Summary of adaptation	Supporting policy no. (Section 3.5)
F2	Foster the care of coastal fish habitats	F1–F3, F18
F6	Diversify catches of coastal demersal fish	F6, F13, F18
F11	Improve post-harvest methods	F17, F18

Sustainable livelihoods

Adaptation no. (Section 3.6)	Summary of adaptation	Supporting policy no. (Section 3.7)
L1	Improve technical and business skills of communities	L1, L2