



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

RECENT SHIFTS, FUTURE SIGNALS

PAINTING A PICTURE OF TONGA/NS, SAMOA/NS TO **2050**

RESEARCH ON PACIFIC CLIMATE CHANGE MOBILITY

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PRODUCT OVERVIEW

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PRODUCT INTENT

PURPOSE

This report is the first of many products being delivered as part of a research program on the future of climate change mobility in the Pacific. The University of Waikato's research specifically is focused on Tonga (and Tongan people) as well as Samoa (and Samoan people). This research is funded with New Zealand's climate finance through the International Development Cooperation (IDC) Programme. The purpose of this document is to provide a useful set of baseline figures and analysis across a range of data fields (population, economy etc.) to refer to in future research activities and analysis in this project. The data leveraged for analysis is all existing, publicly available data. Insights have been drawn from the comparison of data across time, the comparison of analysis done for Tonga and Samoa, as well as through the consideration of relevant context from New Zealand. The projections, with their known limitations, will also be used as a reference for future research activities on the project. The goal of this product is to draw out a number of 'signals' of the future, in order to push the scope of conversations with research participants engaged on this project, supporting engagement that considers a range of change drivers that could influence the future of mobility for Tongan and Samoan people in the medium term, as well as the potential impact of that mobility. Some of the analysis will provide practical guidance in terms of populations or sub-populations to target for research based on their e.g., inundation risk exposure.

APPLICATION

Key applications of this analysis include as pre-read material for participants in the future scenario workshops to be held in Tonga and Samoa between July – September 2023. The projections, though with their known limitations, will be helpful inputs to provoke thought and discussion for these workshops. The analysis also provides guidance to target participant engagement (e.g., from environmental exposure mapping), and some useful insights to share with stakeholders in the research, including those we engage for in-depth talanoa, as part of a process of reciprocity with our research participants (the joint sharing of knowledge).

SCOPE

The document covers analysis of key features of population (age, sex, marital status, employment, household land tenure), economy, some migration data where available, and the environment, where that data is available. The incorporation of data/analysis from New Zealand was included where it provided helpful counterpoints (e.g., in comparing labour force participation levels of Tongan and Samoan people in Tonga/Samoa as well as in New Zealand).

AUDIENCE

The main purpose of this document is to serve as an internal resource to guide researchers and research activities for this project. An additional audience could be decision-makers and leadership in Tonga, Samoa and New Zealand who may find the presentation of this data and analysis helpful, particularly in bringing together, and comparing key 'features' of Tonga and Samoa, as well as their people. A summarised version of some 'future signals' will be shared with some research participants ahead of research activities.

ACKNOWLEDGEMENTS

Thanks to Boston Consulting Group (Auckland) for their generous support in the development of this product.

SUMMARY OF RECENT SHIFTS AND FUTURE SIGNALS

further details in respective sections

POPULATION

- Projections for populations in Tonga and Samoa (based off UN population division assumptions) have Tonga's population at ~130,000 in 2050, and Samoa's population at 320,000. Unlike Tonga, Samoa's population is expected to continue to boom through to 2100.
- There's been a slight drop in population in Tonga in recent years, with the drop in the number of males driving this. Depending on drivers we could see a further gender imbalance in the population by 2050
- If the Tongan population in New Zealand continues to grow at the same rate as it has in the time period 2013 - 2021, the population could reach over 200,000 by 2050. If the Samoan population also increases as it has in the same timeframe, there could mean over 370,000 Samoans in New Zealand by 2050
- The median age in Tonga and Samoa will increase by 2050 (27 and 25 respectively) but will still be younger than New Zealand's current median age
- The proportion of Tongan and Samoan people (living in Tonga/Samoa) with tertiary qualifications may continue to rise as it has recently
- The proportion of households residing on customary land has reduced while those residing on freehold land has increased, depending on drivers this pattern could continue into the future.

ECONOMY

- Samoa's economy is approximately twice the size of Tonga's. For both Tonga and Samoa, GDP growth in the coming years is projected (World Bank assumptions) to be positive, but muted
- Tonga's formal economy is highly reliant on agriculture, and both Tonga and Samoa have a strong informal economy centred around agriculture which could be increasingly exposed to climate change by 2050
- Since 2003, females have increased their share of employment in Tonga, and depending on drivers, this pattern could continue to 2050
- For both Tonga and Samoa, over half of the population are not engaged in the formal labour workforce and the proportion not participating may continue to increase as we have seen in recent years, particularly if GDP growth remains slow.

MIGRATION

- Both Tonga and Samoa have had net negative migration over the last ~decade. Tonga's negative net migration has accelerated in recent years and could impact population levels by 2050.
- In Samoa, North-West Upolu has seen the highest intake of migrants, and Savai'i has seen the most out-migrants. By 2050, if these patterns continue, we could see significant shifts in population distribution between Savai'i and Upolu.
- For both Tongans and Samoans leaving home to live in New Zealand, Australia or the United States, New Zealand is the most common destination of choice, followed by Australia. The USA is an increasingly less popular destination of choice for Tongan migrants.

ENVIRONMENT

- There is a medium to high level of confidence that both Tonga and Samoa will face reduced Tropical Cyclone frequency in future, but that Tropical Cyclones when they do occur will be more intense, with higher rainfall rates
- Tonga and Samoa will increase in average temperature by 2050, with upper ranges of 1.1deg higher (Samoa) and 2deg higher (Tonga)
- Both Nuku'alofa and Apia face significant inundation risk under most sea level rise scenarios, particularly when paired with high tide events and/or storm surges

OPPORTUNITIES, KEY GAPS

UN Population Division assumptions for population projections apply fixed levels of negative net migration for Tonga and Samoa, and both significantly undershoot actual averages over the last ~decade. These assumptions should be revisited to ensure projections are using the best available data.

Intra-island (Tonga) and intra-district (Samoa) mobility data capture could offer a richer view of current levels of internal mobility at a family and village level. At an island level, 2016 data from Tonga showed very little overall movement - in and out - over the course of the year. More mobility was apparent at the equivalent level in Samoa, though noting there was a 'lifetime approach' to that analysis. Talanoa, and survey engagement through this research will aim to capture data that can deepen the picture of people mobility, including mobility drivers.

Based on recent conversations (late 2023) with the relevant organisations, the researchers understand that further LiDar mapping has occurred for Tonga and Samoa, and that efforts are now underway to use that data to update e.g., exposure maps. Having this data provides the critical springboard for the level of analysis and modelling needed for government through to community-level planning. Work will need to happen to ensure easier and broader access to these insights, with translation of messages where indicated.

POPULATION

INSIGHTS SUMMARY

2050 SIGNALS



The population in Tonga has dropped slightly in recent years, with population reductions shared unevenly across the islands (Ha'apai has seen the largest drop with 14% reduction in the last decade). Looking forward however, projections for Tonga's population suggest an increase from ~100,000 in 2021, to ~131,000 by 2050¹. By 2070 population peaks at 139,000 and by 2100 is back to ~130,000.

Unlike Tonga, Samoa's population projections suggest continual growth; from 206,000 in 2021 to 320,000 in 2050 and 441,000 by 2100. The UN Population Division fixed assumption of net migration at -1500 annually is lower than actual average annual net migration for Samoa, in the last 18 years it has been nearly three times that. This could create downwards pressure on population projections for 2050.

Anecdotal reports in Tonga suggest there are 'less men to do the work'. Between 2011–2021, the number of males in Tonga dropped by about 6%. Digging deeper we note a loss of nearly 2700 males in the 20–44 year age bracket. The count of females in Tonga in the same time period was stable. If this continues we could see an increasing imbalance between males and females in Tonga. In the same timeframe, total males and females increased in Samoa.

Tonga and Samoa's median age may increase by 2050, but will still be relatively young, 27 years old and 25 years old respectively by 2050.

A higher proportion of those in Tonga/Samoa (c.f. Tongans/Samoans in New Zealand) have tertiary as their highest education level. For those in Tonga and Samoa, there has been a slight increase in tertiary level education recently. It is unclear if the 'tertiary gap' between those in Tonga/Samoa and those in New Zealand will continue.

In Samoa, most households still reside on 'customary land' and in Tonga, 'owned (without mortgage)'. In Samoa, there has been a reduction in the proportion of households on customary land, and in that same time period there was an increase in households on freehold land. If this trend continues, we could see further households residing on freehold land in Samoa by 2050.

If the Tongan population in New Zealand continues to grow at the same rate as it has in the time period 2013 - 2021, the population could reach over 200,000 by 2050. If the Samoan population also increases as it has in the same timeframe, there could mean over 370,000 Samoans in New Zealand by 2050.

1. Using UN Population Division Medium Projections.

TO EXPLORE IN RESEARCH ACTIVITIES

Based on census data, in Tonga, the numbers of males 20–44 years has reduced in Tonga in the last decade - how does this impact family, the community and Tonga more broadly? What is lost? What is gained? If this trend continued to 2050, how could this impact the lives and roles of those who remain – both male and female?

If we believe the projections, the population in Tonga could reach 130,000 by 2050. If the population does increase by 30% by 2050, how might this impact choices around mobility? What would be the main challenges or risks? Are there opportunities in such a shift? If however numbers continue to drop, like we've seen in the last decade, what could be the mobility-related risks/challenges and opportunities, including to those remaining in Tonga?

How does the type of household land tenure impact mobility options, choices or vulnerability – and is this different for different people i.e., leading to differential vulnerability for e.g., different genders, people in different positions within the family etc.?

In Samoa, population projections for the future suggest continual growth through to 2100 and could reach 320,000 or more by 2050 (medium growth projection) – an increase of over 50% in the population. How might this impact choices around mobility? What would be the main challenges or risks? Are there opportunities in such a shift?

In Samoa there's been a shift from customary land tenure type to freehold. What could be causing this? And what are the impacts, for whom? How could this shift influence the future of internal mobility in Samoa? Are there other important land trends emerging?

What could continued growth of the Tongan and Samoan population in New Zealand mean for Tongan and Samoan people in New Zealand, and those who remain in Tonga and Samoa (including in terms of adaptation capacity, economic and social resilience, cultural and social impacts etc.)?

POPULATION TONGA

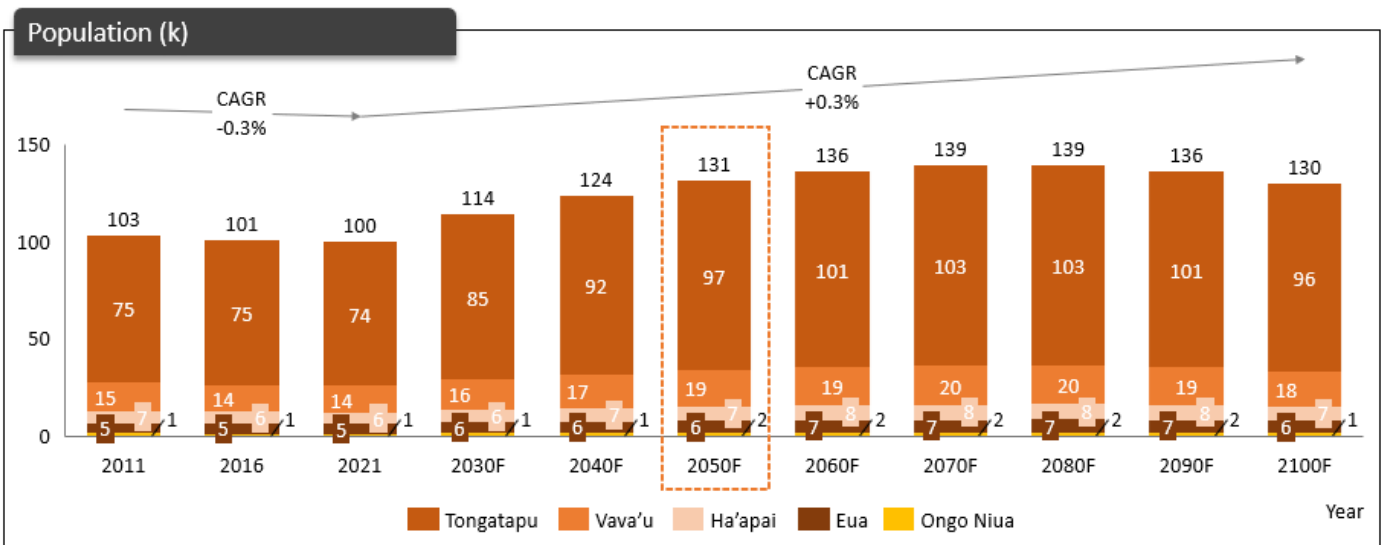
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POPULATION (BY REGION) - MEDIUM PROJECTION

In the decade 2011 - 2021, the total population of Tonga dropped, with decreases seen across all major island groups. Breaking down the numbers however, Tongatapu saw a ~3% reduction in total population, Vava'u saw a ~5% reduction in total population and Ha'apai saw the most significant change, an approximate 14% reduction in population in that decade.

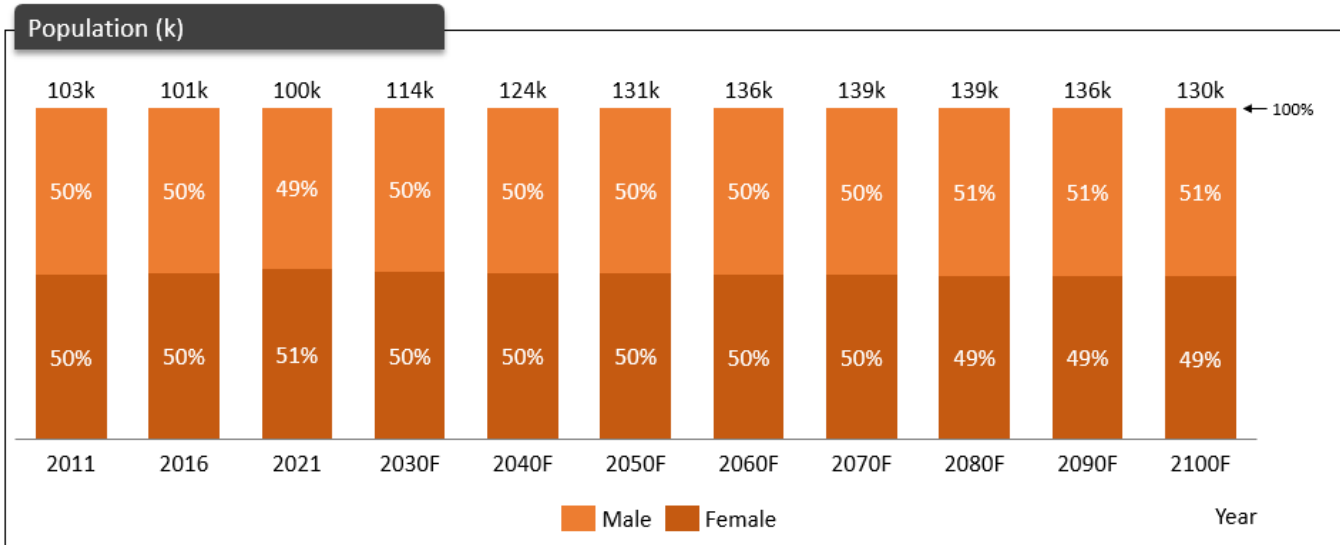
Projecting out using UN population assumptions (medium projection), Tonga sees a bump in population, reaching 131,000 in 2050, and peaking at just under 140,000 in 2070. The underpinning assumptions in UN projections need to be examined, including fixed assumptions on net migration which do not reflect recent historical data (see further in the report). Future scenarios for mobility should consider a range of possible population changes, including an ongoing drop in numbers and/or divergent patterns of population loss between islands.



Note: 2011,2016,2021 data from census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each sub-region growing at same rate as overall population
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs

TOTAL POPULATION: MALE/FEMALE SPLIT (%) – MEDIUM PROJECTION

At a high-level, the overall balance of male to female has remained stable. UN projections modelled out show this remaining true to 2050 and beyond. Digging deeper into the data provides an interesting view into recent changes in the male population (see following graphs).

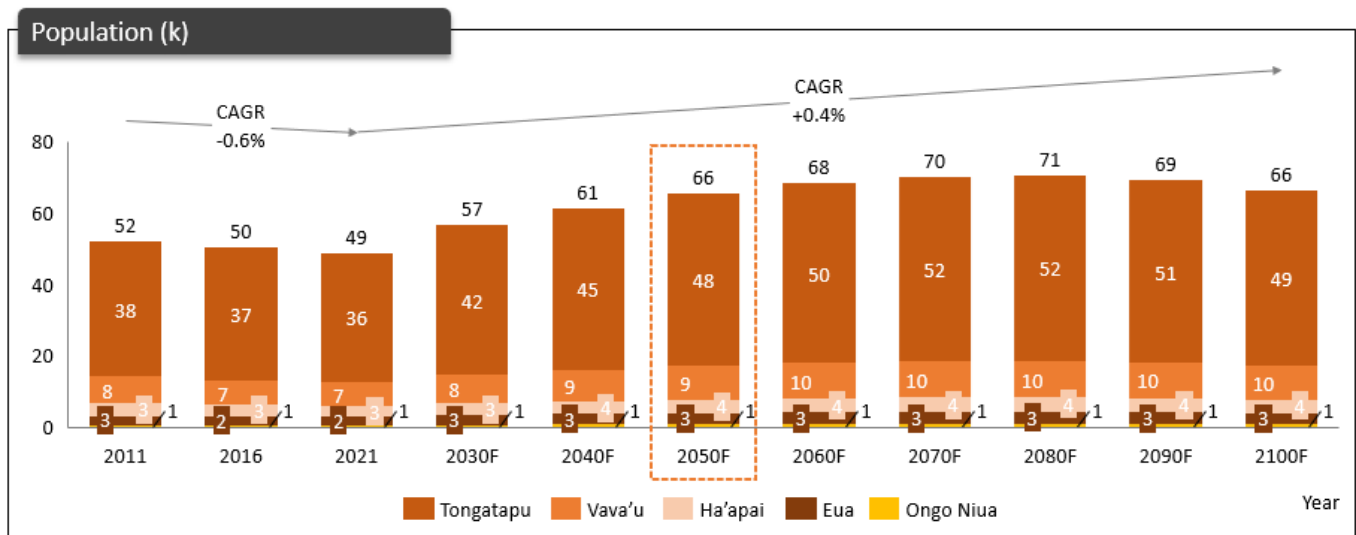


Note: 2011, 2016, 2021 Data from Census; Projections 2030-2100 from UN Population Division (Medium Projections)
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs

POPULATION: MALE (BY REGION) – MEDIUM PROJECTION

In the last decade, the total number of men in Tonga has dropped by ~3,000. On the population base, this could be seen as a meaningful change and does help validate anecdotal data collected in Tonga recently about the lack of men available to do typically 'male' activities, now being filled by women (e.g., electrical line work, captaining cargo ships etc.).

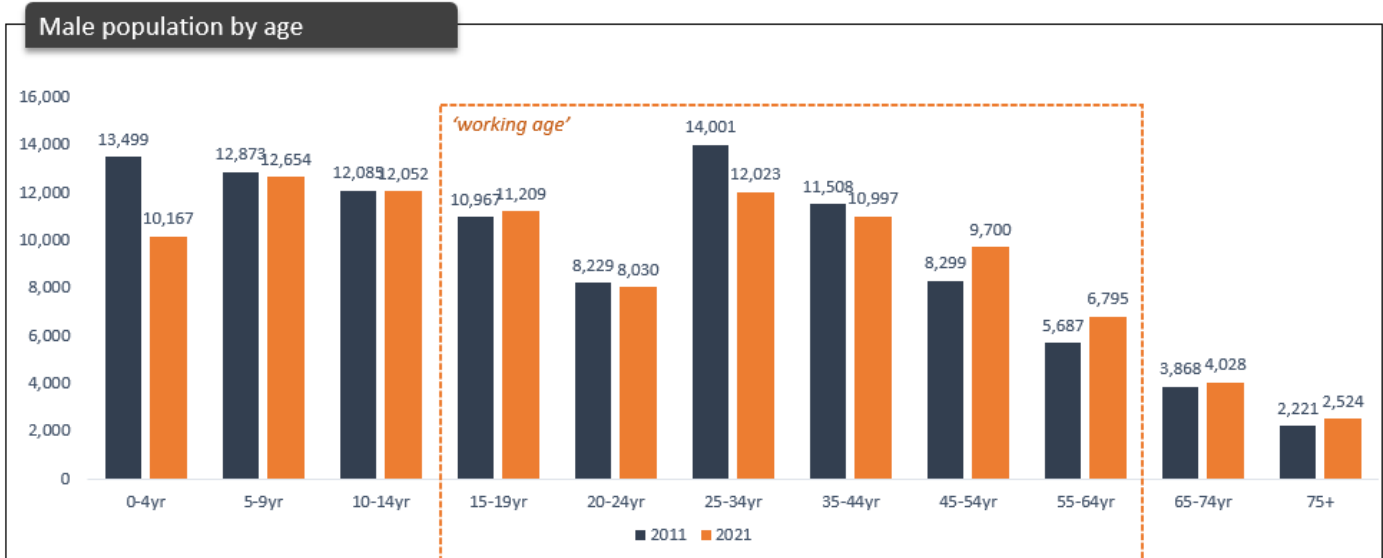
The next set of analysis disaggregates the data by age to dig into the total change in numbers seen here.



Note: 2011, 2016, 2021 Data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each sub-region growing at same rate as overall population
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs

POPULATION: MALE POPULATION BY AGE 2011 - 2021

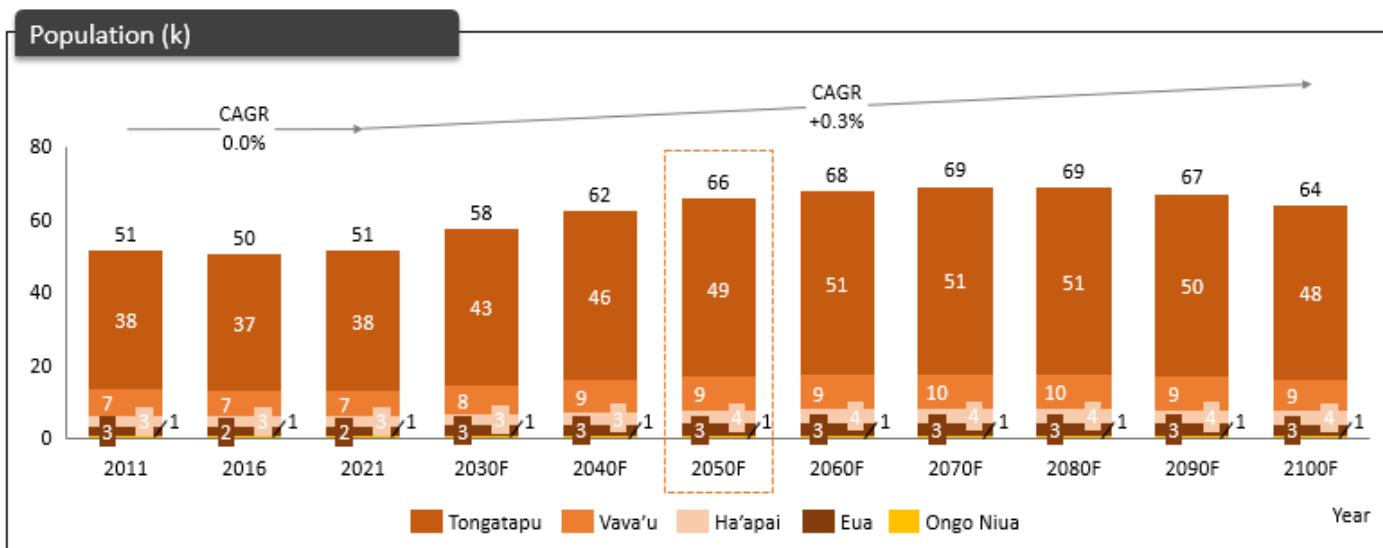
Building off the previous analysis, and responding to anecdotal reports of less 'working age men' remaining in Tonga, we drew out the age ranges of those captured in the 2011 and 2021 census to see if we could identify where the main 'loss' of males was happening in that decade. Other than the drop in numbers in the 0-4-year age group, the most significant drop off for males was seen in the 25-34-year age bracket. This was balanced out by gains in numbers in the 'older' working age ranges of 45-64 years which meant the overall 'working age' population didn't show a material drop. The drop in 0-4-years is of interest too in considering what contribution the drop in 25-34-year old males could be having on births.



Note: 2011, 2021 Data from Census.
Source: Tonga Statistics Department

POPULATION: FEMALE (BY REGION) - MEDIUM PROJECTION

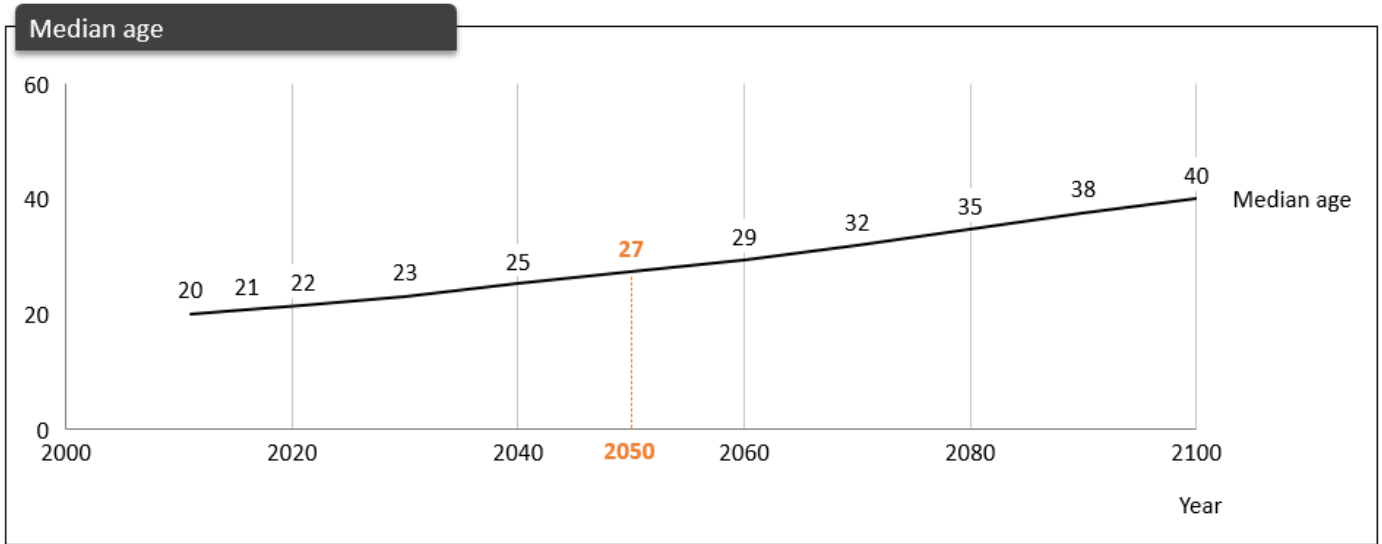
Contrasted with an overall drop in numbers of males, the number of females captured in the census data in the decade to 2021 was stable. UN projections indicate a total of ~66,000 females in 2050.



Note: 2011, 2016, 2021 Data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each sub-region growing at same rate as overall population.
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs

TOTAL POPULATION - MEDIAN AGE

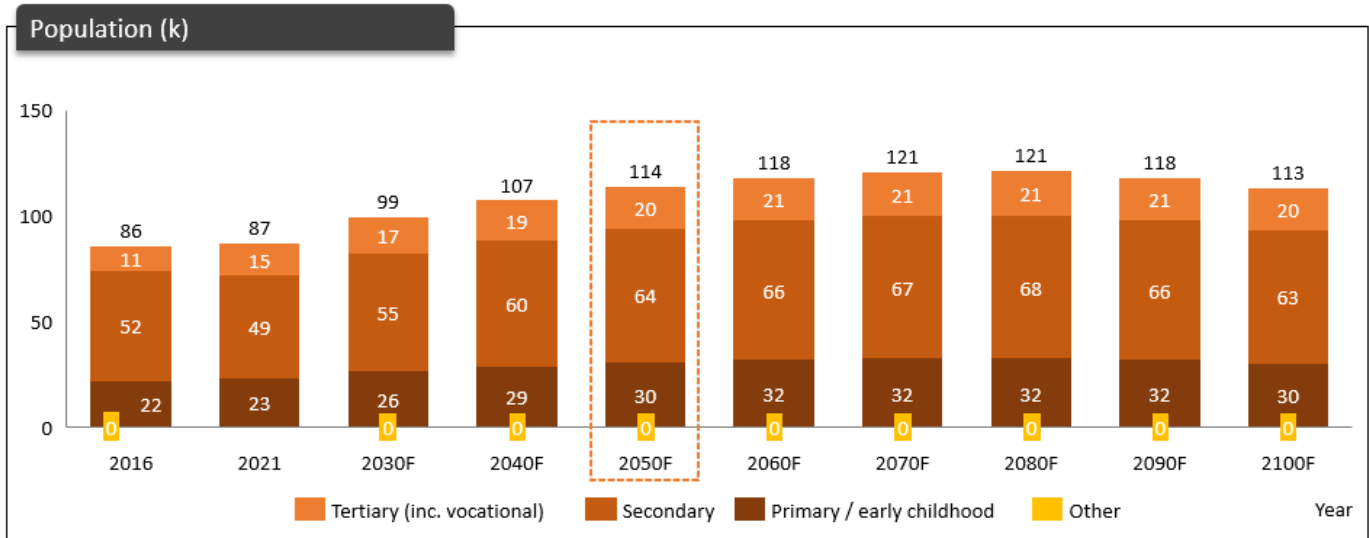
The median age of those in Tonga is increasing and UN projections expect that to continue - with the median age increasing from 22 years (current) to 27 years old by 2050. By 2100 this will be closer to 40. In New Zealand, the current median age for males is 37 and females is 39 (Statistics NZ). The median age of Tonga's population has relevance to labour income, consumption levels, as well as the populations relative age to other countries (including countries like New Zealand). By 2030, one in five people in New Zealand will be over 65, by 2050, this could be closer to one in four people.



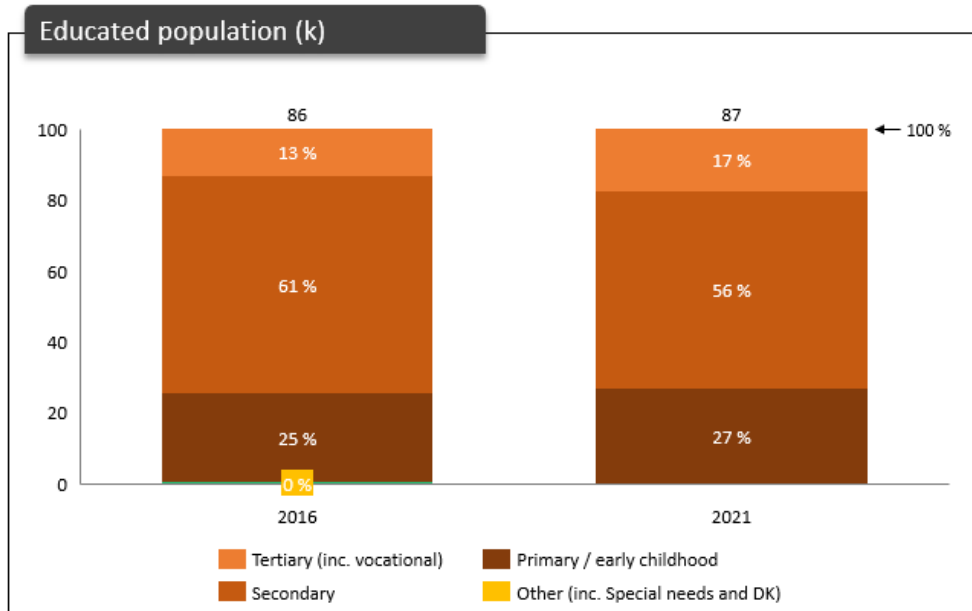
Source: UN Department of Economic and Social Affairs

POPULATION BY HIGHEST EDUCATION LEVEL

Education remains a high priority among Tongan families. Between 2016 and 2021, the absolute numbers of people with tertiary qualifications increased by nearly 4000 people and the proportion of people whose highest qualification was at a tertiary level (including technical and vocational training) increased from 13% to 17%. UN projections suggest a near doubling of tertiary educated folk by 2050 from 2016 levels. Note, applying UN projections to this data includes the assumption that the population in each education category is growing at same rate as the overall population.



Note: Includes only those >3 who have ever attended school. 2016,2021 data from census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each education category growing at same rate as overall population
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs



Note: Includes only those >3 who have ever attended school. 2016, 2021 data from census. 2011 data not available.
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs

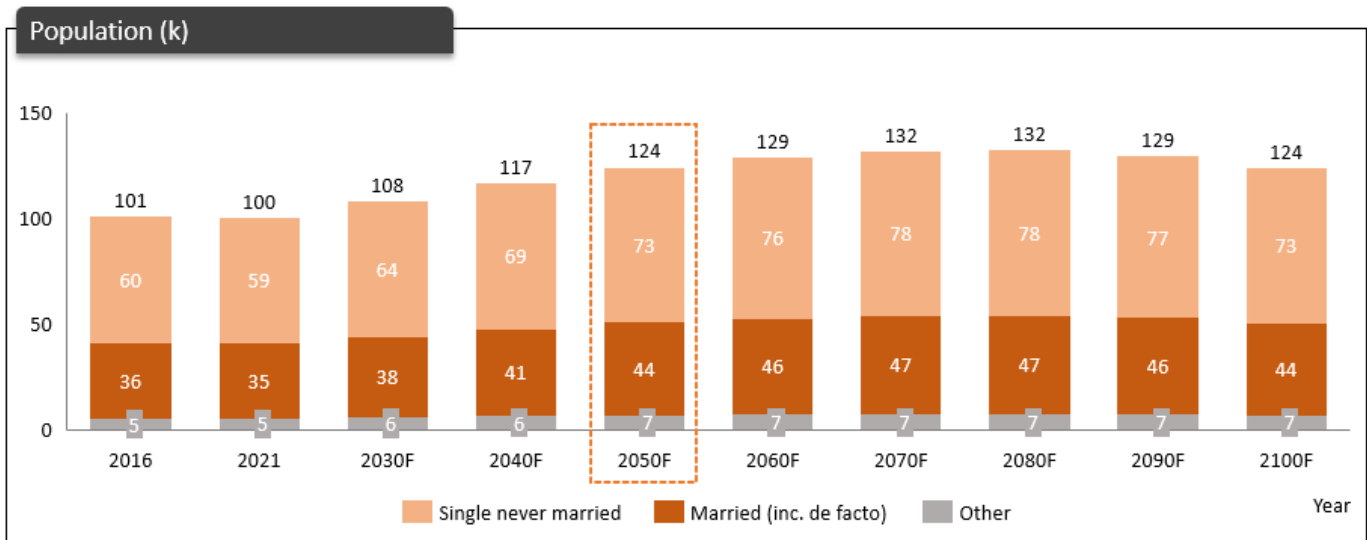
Education level, % split

Those within the tertiary qualifications bracket here includes technical/vocational and tertiary education. The increase seen from 2016 to 2021 was nearly all due to increased numbers completing tertiary education. In 2016, 4774 reported technical/vocational training was their highest qualification, this number increased slightly to 4805 in 2021. In contrast, those with tertiary qualifications increased from 6666 in 2016 to 10,318 in 2021. Regarding those in the disability and 'special needs' category, anecdotal data suggests that the official count of those with disability/'special needs' is not as high as one would expect for the population of Tonga.

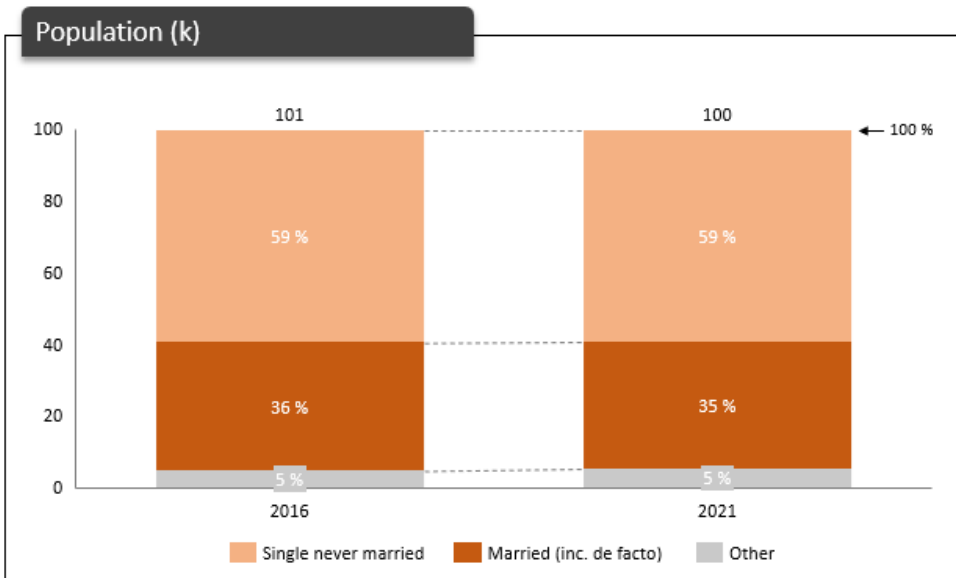
POPULATION BY MARITAL STATUS

Marital status can have relevance to people's, particularly women's, land tenure rights in Tonga, as well as mobility decision-making. Analysis from the 2016 census showed 55% of males (17,099) and 55% of females (18,139) 15 years and older were married. The discrepancy in absolute numbers was put down to the fact that a number of male spouses were working overseas at the time of the census. The impacts on married women whose spouses are working overseas, including in New Zealand, for long periods of the year has been an area of study that continues to warrant attention.

The data below captures the total population of Tonga and projections, as in others, are based on a set of UN Population Division assumptions (provided at the end of the document).



Note: Data from Tonga 2016 and 2021 Census; 2011 data not available; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each marital category growing at same rate as overall population. Other category includes widowed, divorced and separated.
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs



Note: 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Other category includes widowed, divorced and separated.
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs

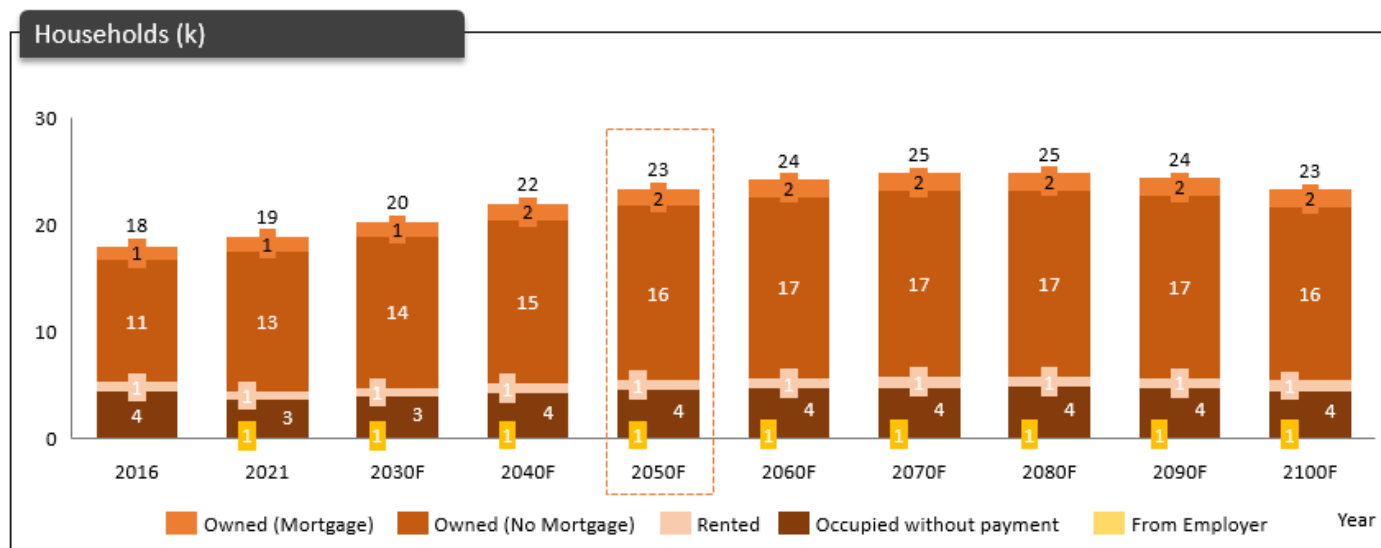
Marital status, % split

The overall balance of married to never married to 'other' remained stable between 2016 - 2021. Similar to the discrepancy between married males and married females, in 2016 there were 407 divorced females to 262 divorced males.

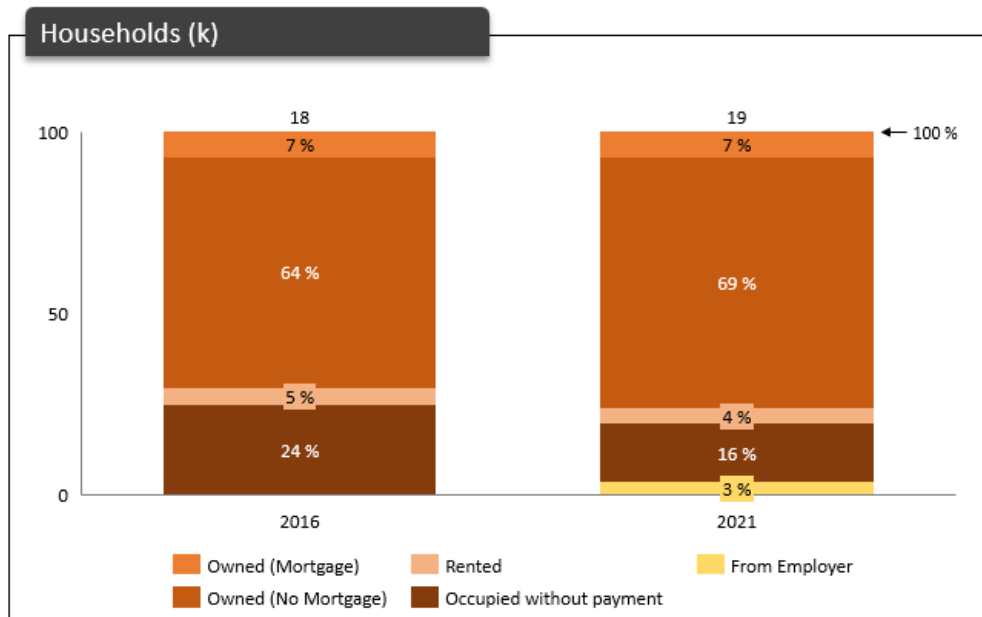
Anecdotal reports suggest that seasonal work arrangements (e.g., the Recognised Seasonal Employment scheme) is contributing to higher separation and divorce rates. Between 2016 and 2021, there was an increase from 669 divorced persons to 854. Total separation numbers actually went down from 731 to 718 (which could be explained by separations in 2016 progressing to divorce by 2021).

HOUSEHOLDS BY LAND TENURE TYPE

Land tenure type and signals of changes in land tenure type is a significant consideration in the future of internal mobility in Tonga. Categories were described in the census as 'owned by you or someone in this household with a mortgage or a loan' (owned (mortgage)), 'owned by you or someone in this household free and clear' (owned, no mortgage), 'rented with any payments' (rented), and 'occupied without payment'. In 2021 the definitions changed slightly to include households residing on employer's land. When considering the future of mobility and the options people may or may not have access to, it will be important to understand the next level of detail - namely who within households has legal ownership, who can and does make decisions on the occupation and use of the land, and what options the land tenure type households have access to in terms of how it may support or represent barriers to current or future mobility. It is important to note that a number of households in Tonga have two pieces of land - a plot for a household residence and a 'tax allotment' for growing produce. Early anecdotal evidence suggests a possible growing trend of households leasing productive land to non-ethnic Tongans, something that will be further tested through research activities. This particular data set would not provide this nuanced picture.



Note: Data from Tonga 2016 and 2021 Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes number of households in each land tenure category growing at same rate as overall population. 2016 data does not include "From Employer" category.
 Source: Tonga Statistics Department; UN Department of Economic and Social Affairs



Note: 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). 2016 data does not distinguish Occupied without Payment and From Employer categories
 Source: Tonga Statistics Department

Household tenure type, % split

Between 2016 and 2021 there was a slight increase in the proportion of land households held under the category of 'owned (no mortgage)' and a corresponding slight decrease in those identifying under the categories 'occupied without payment', 'from employer' and 'rented'. Those owning property through purchase remained relatively constant.

POPULATION SAMOA

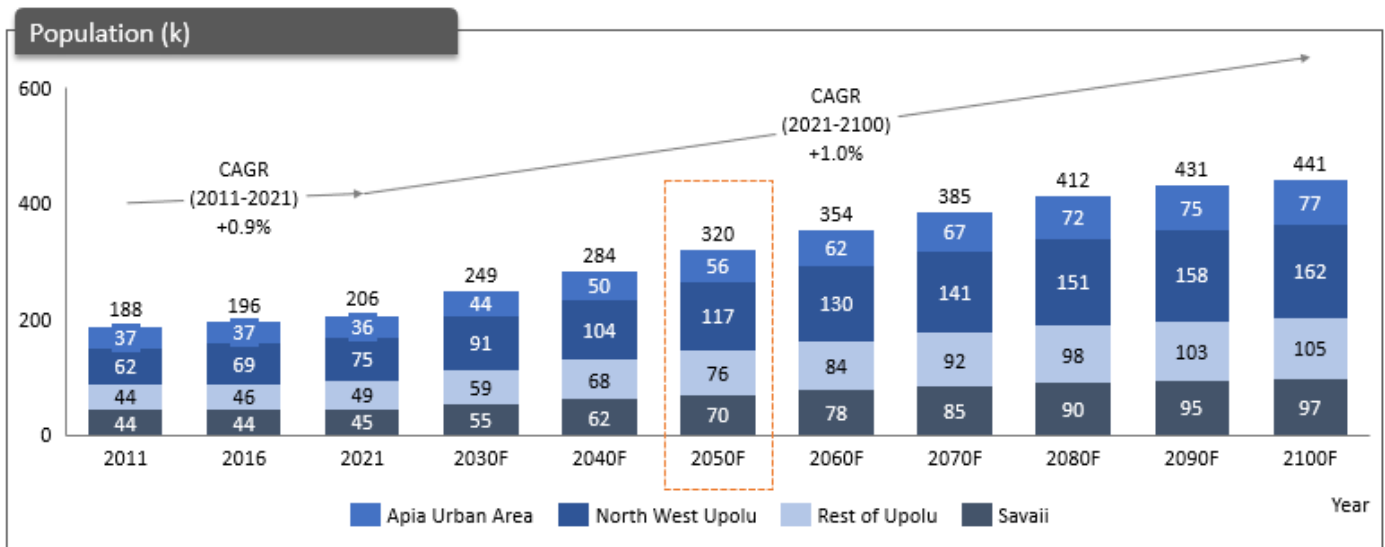
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- HOUSEHOLDS BY LAND TENURE TYPE (% SPLIT)

POPULATION (BY REGION) - MEDIUM PROJECTION

In the decade 2011 - 2021, the population in Samoa increased by ~18,000 people, with the majority of this growth happening in Upolu, outside of the Apia urban area. UN population projections suggest that this trend will continue, with the total population reaching 320,000 by 2050 - a more than 50% jump on 2021 population numbers. In reality, this figure of 320,000 by 2050 may be moderated by a higher negative net migration than the assumptions used by the UN (see net migration figures later in the report). Indeed, if these projections factored in the mean actual negative net migration from the last one and a half decades, there could be downward pressure on this projection of 320,000 (e.g., could be reduced by ~82,000 to a figure closer to 238,000).

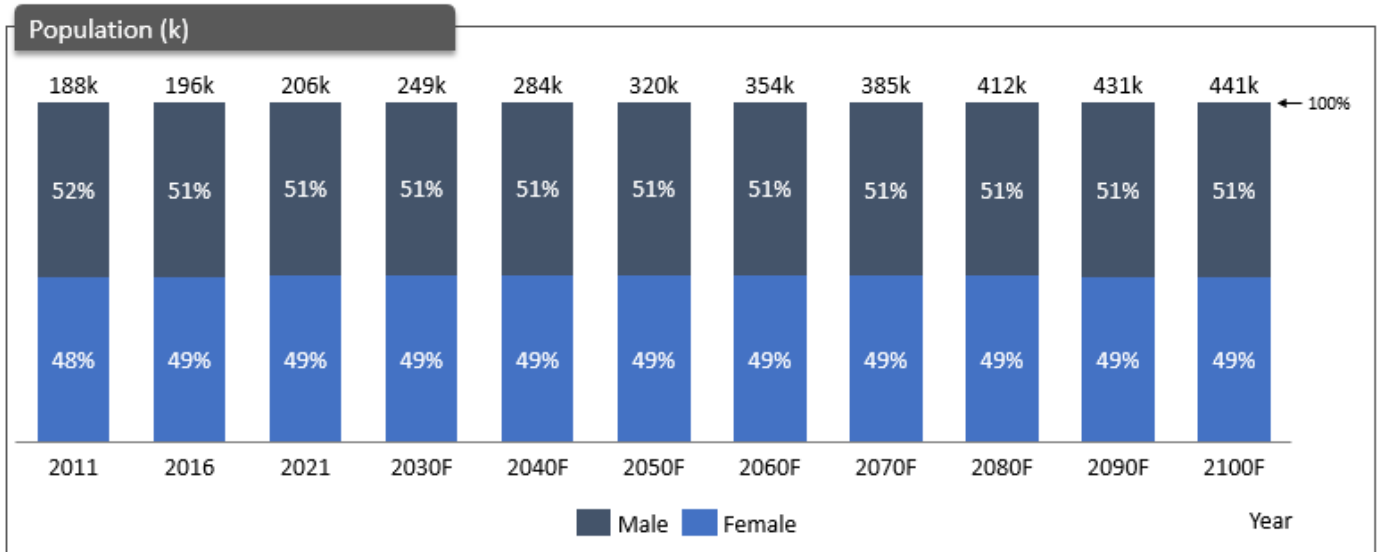
As with other extrapolations, an underpinning assumption is that the population in each sub-region will grow at the same rate as the overall population.



Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each sub-region growing at same rate as overall population
 Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs

TOTAL POPULATION: MALE/FEMALE SPLIT (%) – MEDIUM PROJECTION

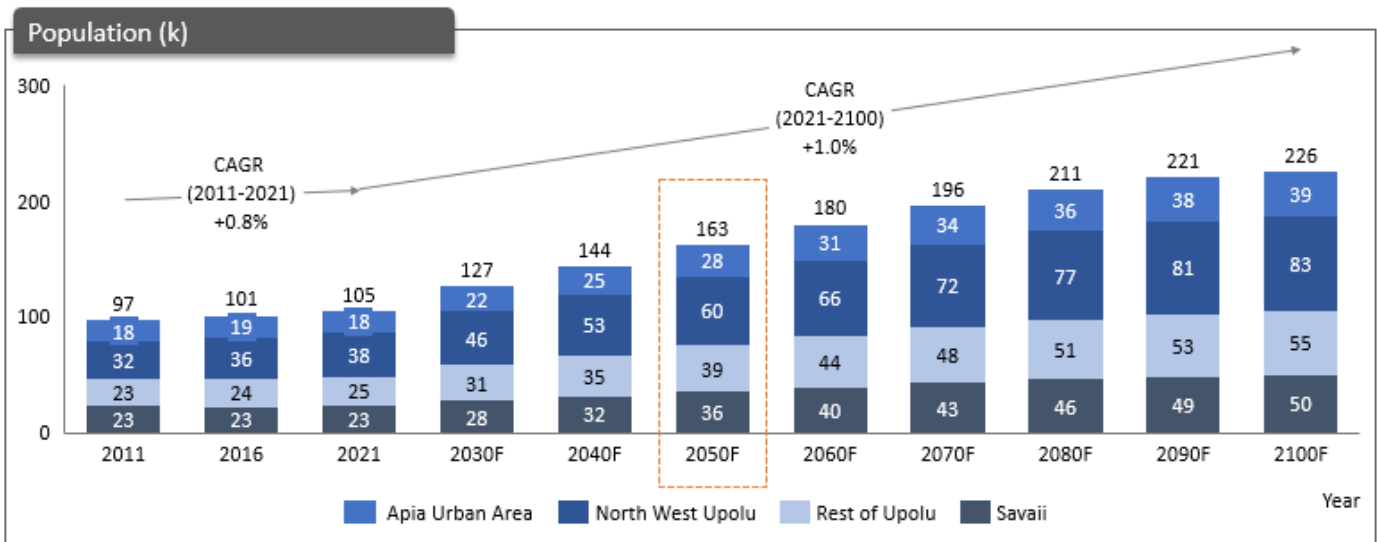
In Samoa there has remained a slight difference in numbers of males to females, in 2016 the census counted 100,892 males and 95,097 females. In 2021 the counts went up to 104,853 males and 100,704 females with a small but persistent gap remaining of ~5,000-6,000 less females. UN projections assume a relative continuance of a 51% to 49% split male to female.



Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Sex ratio at birth held constant.
Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs

POPULATION: MALE (BY REGION) – MEDIUM PROJECTION

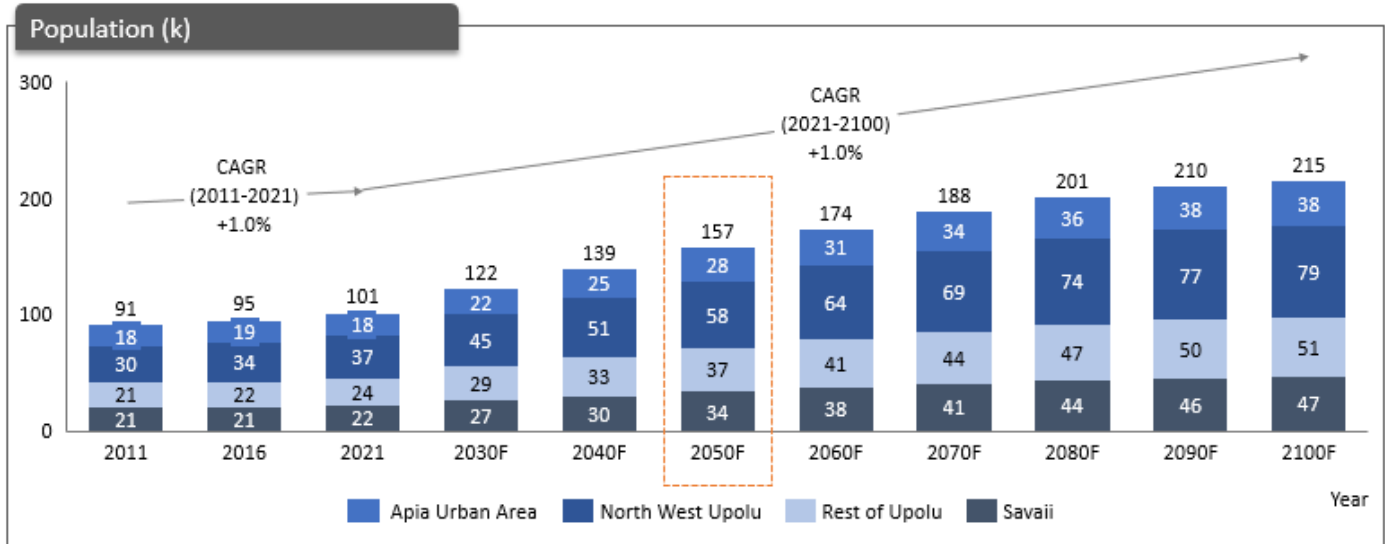
Unlike in Tonga, the total male population increased in Samoa, reflecting as well an overall increase in population in the decade to 2021. The most significant jump in male numbers was noted in North West Upolu. The total number of males in Savai'i remained relatively stagnant in the decade to 2021. UN projections assume an increase in total male population by over 50% on 2021 numbers by 2050 (though per previous comments, the underpinning assumptions, including of net migration, gives cause for pause).



Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each sub-region growing at same rate as overall population
Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs

POPULATION: FEMALE (BY REGION) - MEDIUM PROJECTION

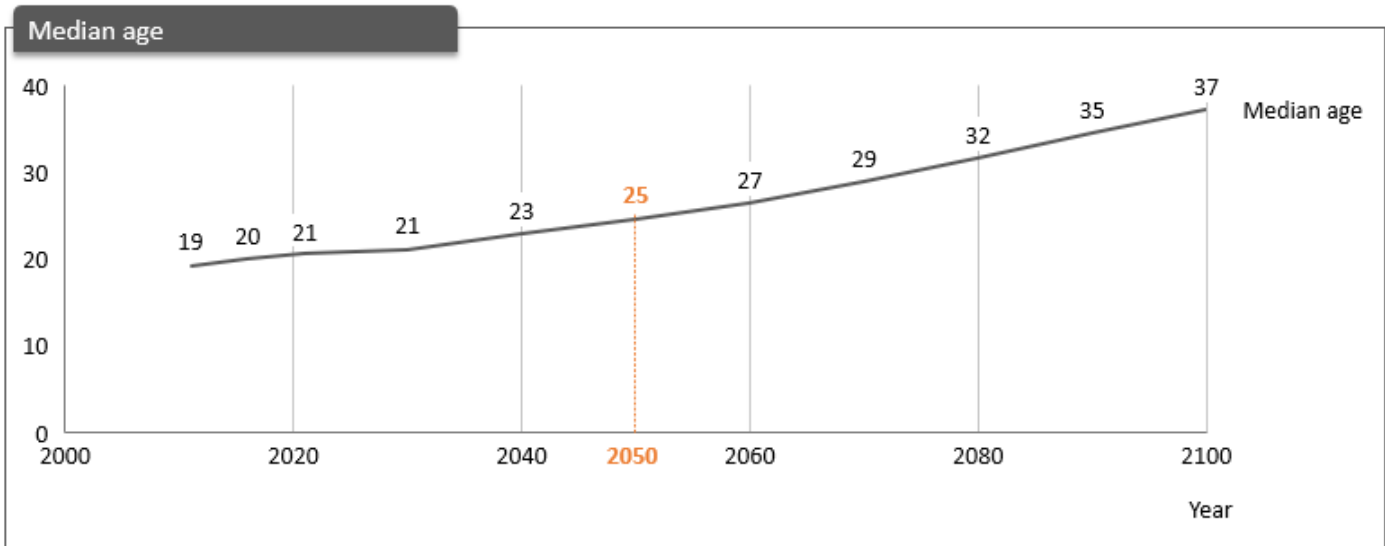
There was a slightly faster increase in total females (versus males) in the decade to 2021. This growth is projected by the UN to continue, increasing by over 50% on 2021 numbers to ~157,000 in 2050. Similar to the growth seen in the male population (in the decade to 2021), the growth in female numbers was seen most concentrated in North West Upolu. Total numbers of females in Savai'i did increase slightly between 2016 and 2021.



Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each sub-region growing at same rate as overall population
 Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs

TOTAL POPULATION - MEDIAN AGE

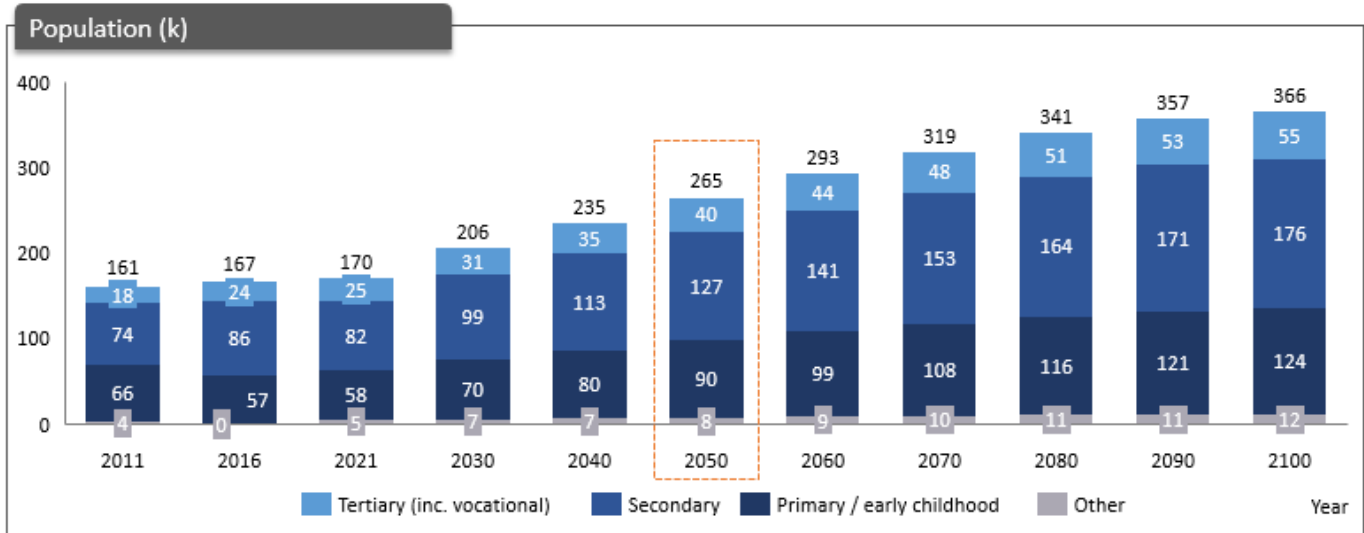
The median age of those in Samoa is slightly younger than in Tonga - currently ~21 years old, and projected to increase to 25 years by 2050. This is still a lot younger relative to New Zealand's median age, currently 37 for males and 39 for females. This median age is projected to be reached in Samoa by 2100.



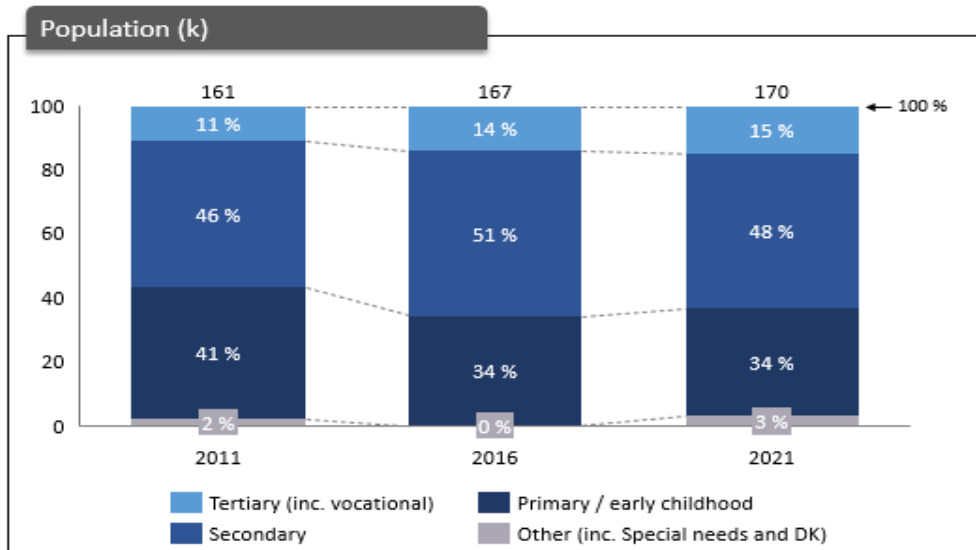
Note: Median age projections based on UN medium fertility variant population projections
 Source: UN Department of Economic and Social Affairs

POPULATION BY HIGHEST EDUCATION LEVEL

Similar to Tonga, Samoa saw a bump in total numbers and overall proportion of the population with tertiary education as their highest education level. The data included in this analysis changed necessarily due to changes in definitions and categorisations at each census, e.g., data from 2011 includes over 5s, from 2016 includes over 3s, from 2021 includes 'ever attended school'.



Note: Includes only those who have ever attended school. 2011, 2021 Data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each education category growing at same rate as overall population. Other category includes special needs, 'don't know' and in 2011 'never been to school'. Data from 2011 includes over 5's; from 2016 includes over 3's, from 2021 includes 'ever attended school'
 Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs



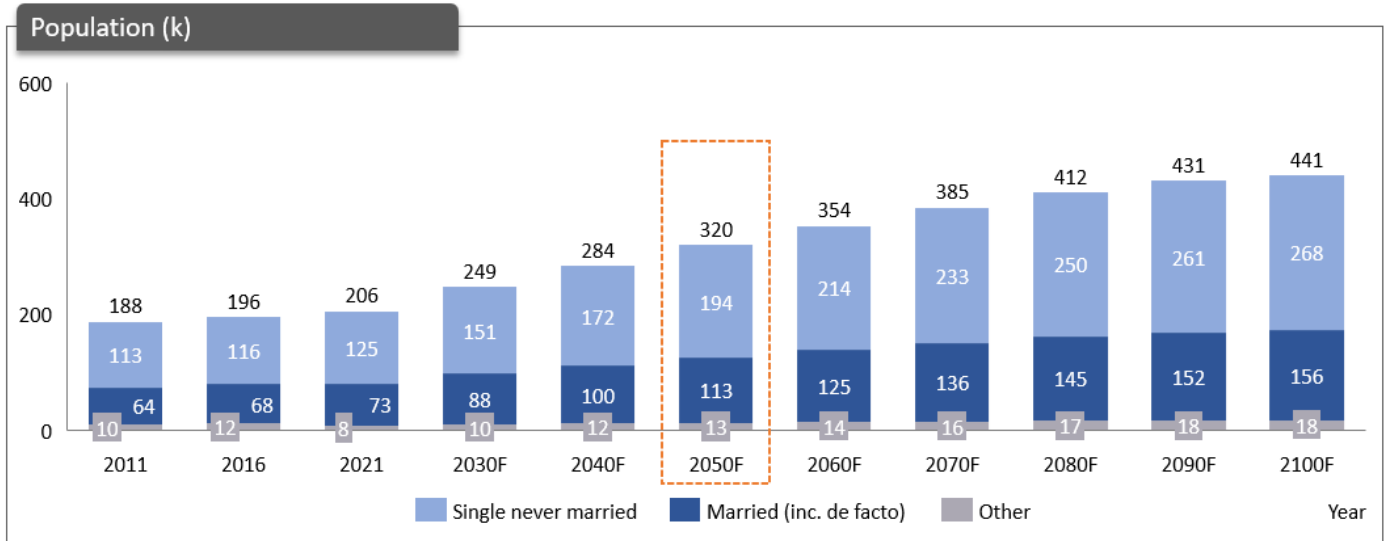
Education level, % split

Between 2011 and 2021, there appears to be a material shift from the proportion with primary level education as their highest education level and those with higher achievement. Contrasted with Tonga data, there appears to be slightly higher representation of those with a disability or 'special needs' in the data from Samoa.

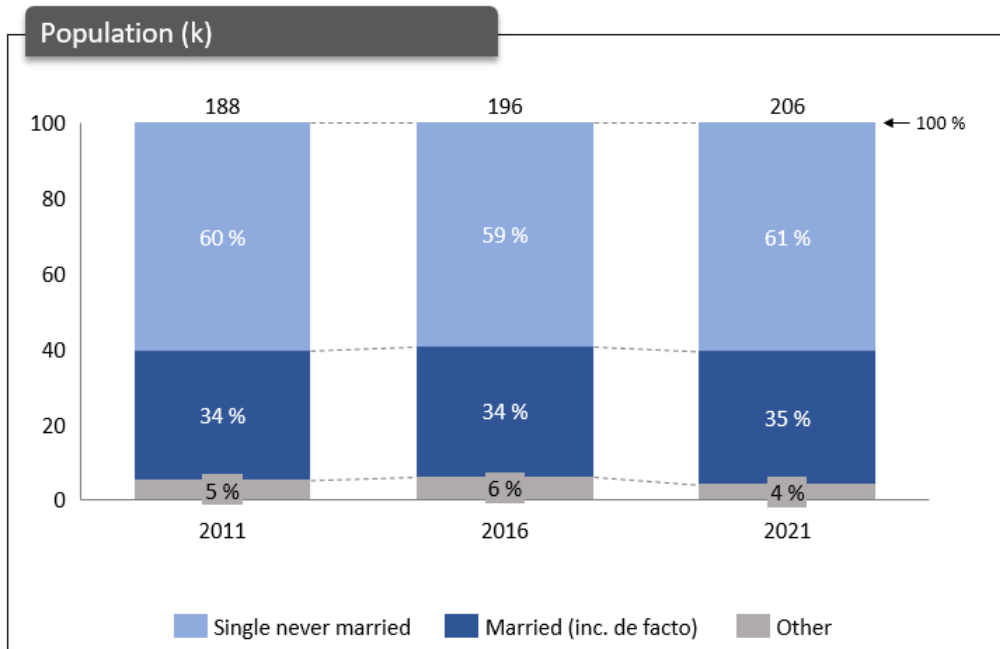
Note: Includes only those who have ever attended school. 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each education category growing at same rate as overall population. Other category includes special needs, 'don't know' and in 2011 'never been to school'. Data from 2011 includes over 5's; from 2016 includes over 3's, from 2021 includes 'ever attended school'
 Source: Samoa Bureau of Statistics

POPULATION BY MARITAL STATUS

In Samoa, similar to Tonga, a higher number of married females were counted in 2021 than married males (32,419 and 29,892). One could assume this is due in part to male spouses working overseas at the time. There was also a higher number of divorced females than divorced males in Samoa in 2021. Marital status, depending on the context, can have implications for decision-making and decision-making rights of married females within the family, as well as land/property security for married females if for example a male partner passes away.



Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each marital category growing at same rate as overall population. Other category includes widowed, divorced and separated.
 Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs



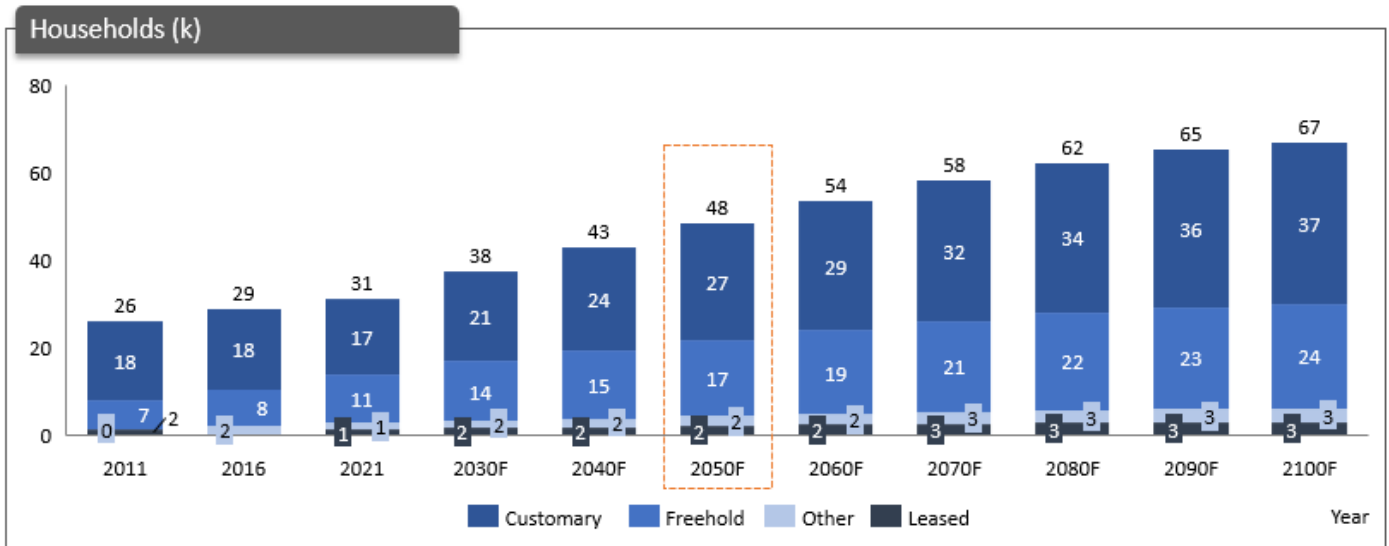
Marital status, % split

The overall proportion of married to never married to 'other' remained stable in Samoa between 2016 - 2021. The overall proportion of those in the 'other' category (which includes divorced, separated and widowed) dropped slightly in 2021. There was a shift in data collection categories between 2016 and 2021 where divorced and separated were counted together in 2016 and separated in 2021.

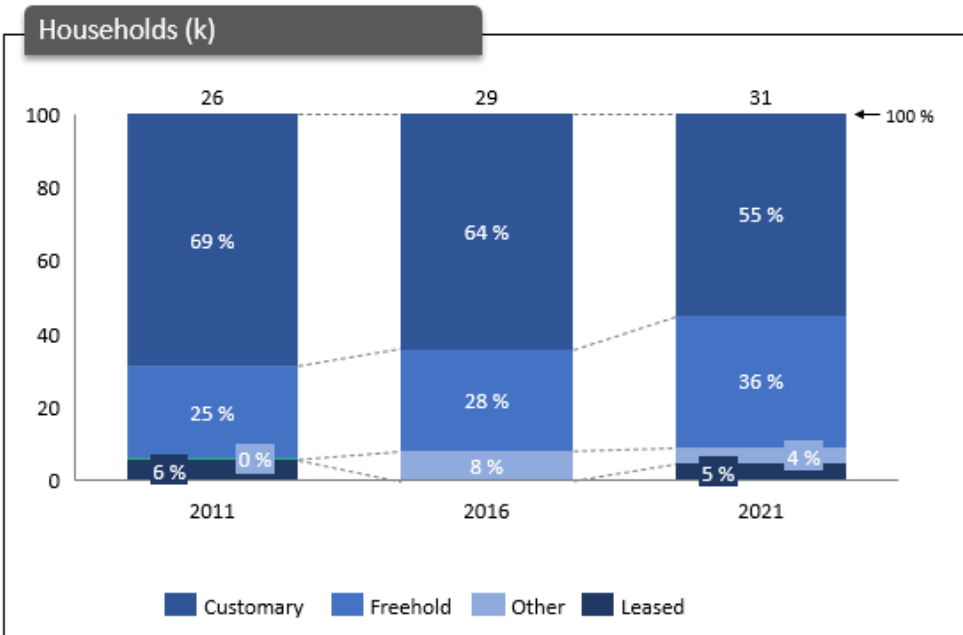
Note: 2011, 2016, 2021 data from Census; Other category includes widowed, divorced and separated.
 Source: Samoa Bureau of Statistics

HOUSEHOLDS BY LAND TENURE TYPE

The data below shows the number of households by the land tenure type they are living on. Breaking down some of these figures we see a near halving of households living on government land between 2016 and 2021, from 408 to 238 households. There was a slight reduction in households residing on church land (from 945 to 873) from 2016 to 2021. There was a reduction in households residing on customary land, and a significant increase in the number of households residing on freehold land. Interestingly, 272 households in 2021 reported they did not know the tenure type of the land their household resided on. Note, there was a change in data categories in 2016 where 'leased' was not included. Note also, as previously, the projections assume the number of households in each category will grow at the same rate as the overall populations.



Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes number of households in each land tenure category growing at same rate as overall population. Other category includes Church and Government land and 'don't know'. Leased includes leased customary, leased government, leased freehold and leased church. 2016 data does not include 'leased' category.
Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs



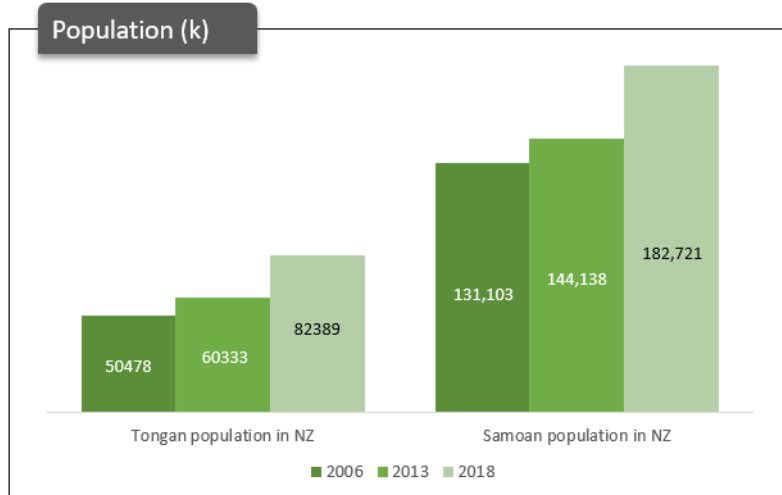
Note: 2011, 2016, 2021 data from Census; Projections 2030-2100 from UN Population Division (Medium Projections). Other category includes Church and Government land and 'don't know'. Leased includes leased customary, leased government, leased freehold and leased church. 2016 data does not include 'leased' category.
Source: Samoa Bureau of Statistics

Household tenure type, % split

Households residing on customary land decreased in number between 2016 and 2021, from 18,497 households to 17,106 households, a change of nearly 8%. In the same time period, households residing on freehold land increased by 3,195.

TONGAN AND SAMOAN POPULATIONS IN NEW ZEALAND

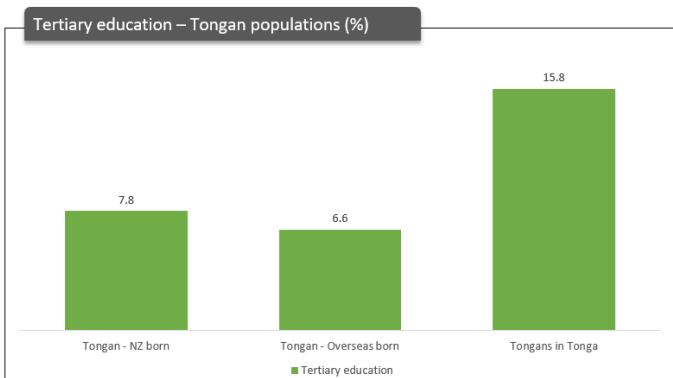
The Tongan population in New Zealand has been the fastest growing Pacific ethnic group in recent years. Between 1986 and 2006, the population grew threefold (Stats NZ, 2023). Between 2013 and 2021, the number of Tongans increased nearly 37%. In the same time period, the Samoan population in New Zealand grew ~27%. Samoans represent the largest Pacific ethnic group in New Zealand. In 2018, there was a balance of Samoan males and females in NZ, whereas there were ~4% more Tongan males than Tongan females in New Zealand (in Tonga, the most recent census there shows more females than males).



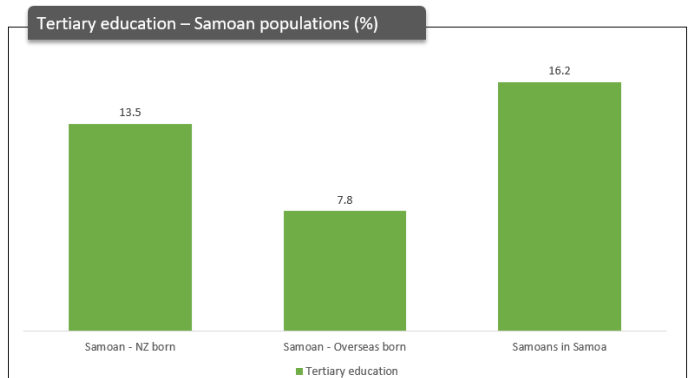
HIGHEST EDUCATION LEVELS TONGAN AND SAMOAN PEOPLE IN NEW ZEALAND

Data from the 2021 censuses in both Tonga and Samoa were analysed to provide a counter point to the analysis presented for 2018 data captured by Statistics New Zealand. NZ-born and overseas-born Tongan and Samoan people, over the age of 15 in New Zealand have a notably lower proportion of the population that has achieved tertiary education compared to those living in Tonga or Samoa. Nearly 16% of Tongans in Tonga, over the age of 15, have tertiary level education as their highest qualification level. Comparing that with 'NZ-born' Tongans, that drops to just under 8%, looking also at 'overseas-born' Tongans in New Zealand that proportion drops to further to 6.6%. For Samoa, just over 16% of the total population over the age of 15 has tertiary education as their highest level of education. Comparing that to NZ-born Samoans and overseas-born Samoans, that drops to 13.5% and 7.8% respectively.

This could have relevance and/or implications for those in New Zealand being able to e.g., remit to their potential if those moving to New Zealand (or being born in New Zealand) are more likely to reach a wage or salary ceiling given their education level. Interesting to connect this data with that seen on page 31 - though Tongan and Samoan people in New Zealand who were born in Tonga/Samoa have a lower education level than those who remain in Tonga/Samoa or were born in New Zealand, they also have the highest wage (Tonga) or are on par (Samoa) with those born in New Zealand, suggesting a relatively good capacity to support family at home, potentially sponsor family etc. Per the notes on page 31, this is 'relatively' good capacity as while overseas born Tongans and Samoans in New Zealand have higher average wages than those born in New Zealand, Tongan and Samoan people's median wages in New Zealand are far below the New Zealand median wage.



Note: Available data for Tongans in NZ was from 2018. The data for Tongans in Tonga was from the 2021 census. Tertiary education does not include vocational or technical training data. Proportions of the population with tertiary education calculated off population base of 15 years and older to be consistent with the approach of Stats NZ. Source: Stats NZ, Tonga Statistics Department



Note: Available data for Samoans in NZ was from 2018. The data for Samoans in Samoa was from the 2021 census. Tertiary education does not include vocational or technical training data. Proportions of the population with tertiary education calculated off population base of 15 years and older to be consistent with the approach of Stats NZ. Source: Stats NZ, Samoa Bureau Statistics

ECONOMY

INSIGHTS SUMMARY

2050 SIGNALS



GDP growth has been modest in both Tonga and Samoa in recent years and growth into the future may remain muted

While males hold more of the balance of employment in Tonga, in recent years, there was an increase in the female share of employment. By 2050, this shift towards female employment could continue, particularly if we continue to see the loss of males (likely out-migration) in the 20-44 year age bracket.

In recent years, an increased proportion of people 15 years and older in both Tonga and Samoa are not participating in the formal labour workforce - over half of the population over 15 years old in Tonga and Samoa. With GDP growth trends, this picture may not improve/change dramatically by 2050. Important to note that compared to those in Tonga and Samoa, workforce participation of Tongan and Samoan people in New Zealand is higher.

The Samoan economy is largely driven by commerce, financial services, public administration and agriculture. The Tongan economy is particularly exposed to the direct impacts of climate change, with agriculture being the single largest contributor to the economy (~14% in 2018). As climate change progresses, there may be increased vulnerability of the Tongan formal economy by 2050. The informal economy in both countries is large, with agriculture being the main employer in the informal economy in Samoa.

In 2018, the median wage of Tongan (NZD\$21,000) and Samoan (NZD\$25,000) people in New Zealand was significantly lower than the median wage of (total) New Zealanders (~NZD\$52,000), and the median wage of Samoans in New Zealand, both NZ-born and overseas-born, is higher than Tongans in New Zealand. Out of NZ-born and overseas born Tongans and Samoans, NZ-born Tongans had the lowest median wage at NZD \$16,600.

Total remittance sending continues to grow in both Tonga and Samoa, and if trends continue, will remain a significant economic feature in 2050.

TO EXPLORE IN RESEARCH ACTIVITIES

If the economies in Tonga and Samoa continue to grow at a slow pace (or go backwards like we saw during the COVID 19 pandemic), what could that mean for the future of mobility in the coming decades?

If the economy weakens in future, how could that increase vulnerability to climate change hazards (e.g., how has or would the economy interact with hazards to cause displacement)? Also, who might be most affected economically by the progressive impacts of climate change? Is it the same country-wide or will we see differential vulnerability?

How will the large number of people operating in the informal (particularly agricultural and fisheries) economy be impacted by the effects of climate change? What could be the impact on mobility for these people and what are some ways to support or build resilience in that group?

How is current or recent mobility patterns affecting employment for females? If females continue to take up more of the total share of employment (like in Tonga) in the coming decades, what could be the impact (including social and cultural impacts, resilience, adaptation capacity, and future employability for women e.g., overseas)?

How might significantly lower median wages for Tongans and Samoans in New Zealand (compared to the New Zealand median wage) impact resilience and adaptation capacity, including for family members who remain in Tonga and Samoa?

If remittance sending continues to grow in future, what could be some of the impacts on the future of Tonga and Samoa? How could remittance levels be impacted in a future of increasing climate change impacts? How could higher or lower mobility impact remittance levels? Conversely, how could higher or lower remittance sending impact mobility?

ECONOMY TONGA

CONTENT

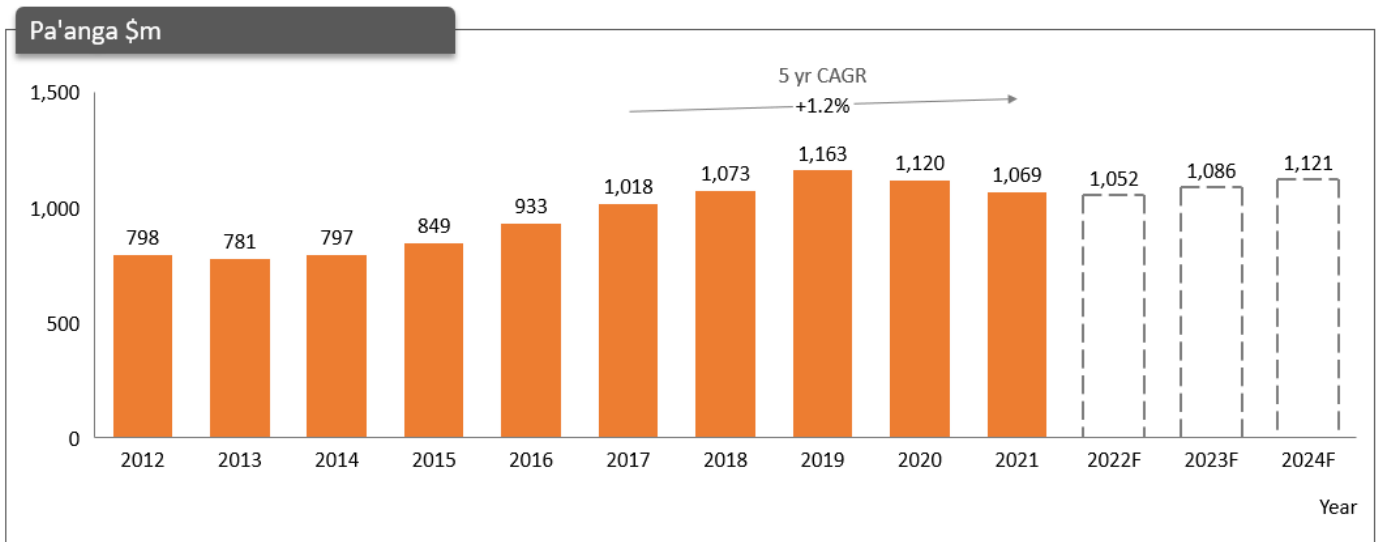
TOTAL GROSS DOMESTIC PRODUCT (GDP)
GDP CONTRIBUTION BY INDUSTRY (2021)
REMITTANCE SENDING - CURRENT NET TRANSFERS
POPULATION BY EMPLOYMENT TYPE
POPULATION BY EMPLOYMENT TYPE (% SPLIT)
EMPLOYMENT BY GENDER (2003, 2018)
EMPLOYMENT BY INDUSTRY (2018)
MONTHLY WAGES BY INDUSTRY SECTOR (2018)
MONTHLY WAGES BY OCCUPATION (2018)

TOTAL GROSS DOMESTIC PRODUCT (GDP)

In the lead up to the impact of COVID-19, Tonga's GDP growth had been positive, yet contracted in 2020 and 2021. In the five years to 2021, Tonga's GDP delivered a CAGR of +1.2%. At the population level of 2021, this put GDP per capita at approximately TOP\$10,690. Comparing this with New Zealand, with a current economy size of NZD\$385b, and a current population of 5,200,000, the GDP per capita in New Zealand is approximately NZD\$74,000.

Tonga's economy relies heavily on agricultural production. Remittances from family overseas continues to be a significant contributor to the national economy, and international aid represents a significant portion of the government's budget at about 40% (MFAT, 2021).

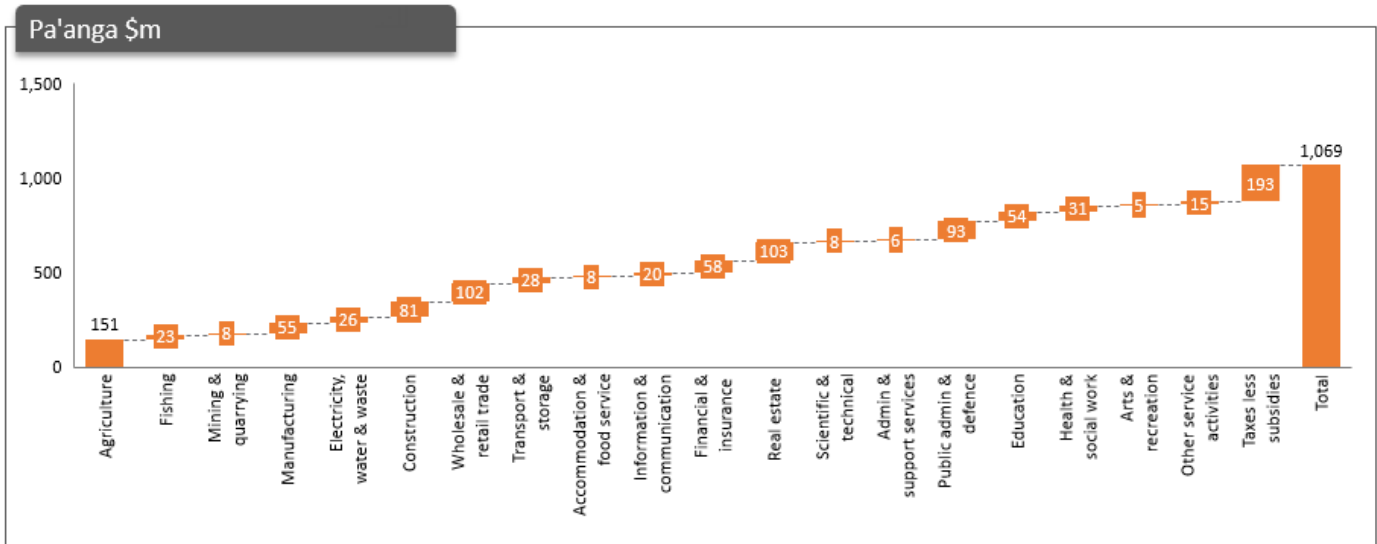
The 'projections' for the following three years are based off 2021 actual GDP with World Bank growth rate assumptions applied.



Note: GDP is at nominal (current) prices. Forecast GDP is based off 2021 actual GDP grown by World Bank estimated GDP growth rates
Source: Tonga Statistics Department; World Bank Global Economic Prospects

GDP CONTRIBUTION BY INDUSTRY

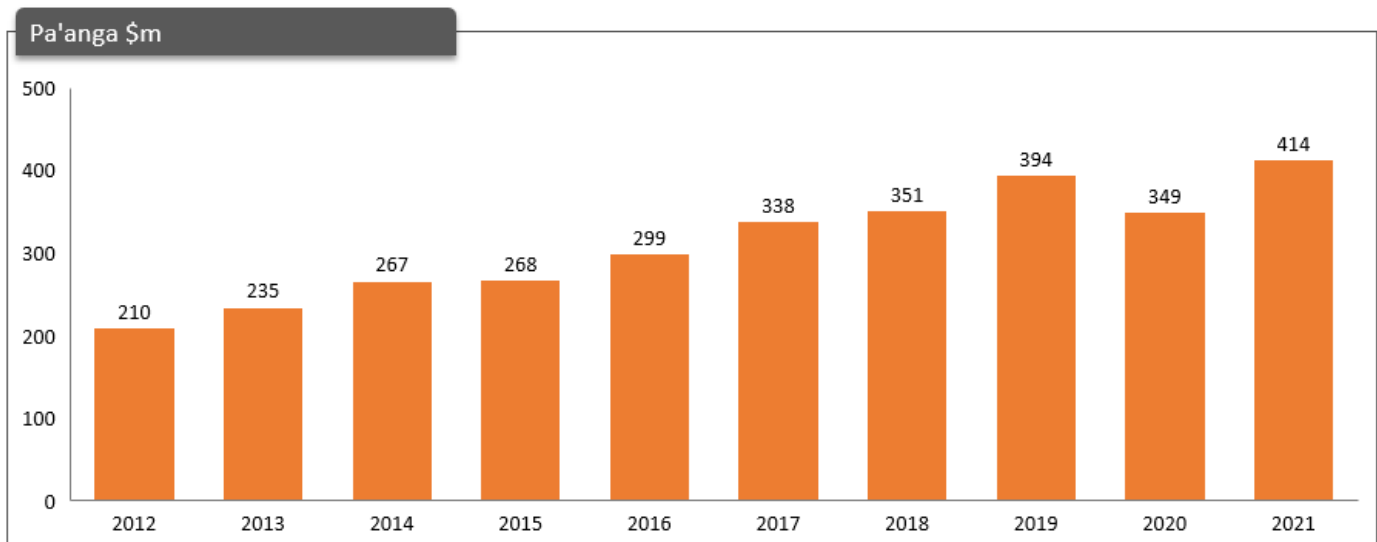
Agriculture is the strongest contributor to GDP of all industries in Tonga, representing 14% of total GDP and delivering TOP\$151m to the economy in 2021. Overall the picture remains quite fragmented, with real estate, wholesale and retail trade, and public administration/defence contributing at similar levels. 'Tourism' is not called out as a discrete industry in the data provided, rather providing data for contributing industries such as accommodation and food service (which contributed just TOP\$8m in 2021). Fishing contributed less than transport and storage to the [official] economy.



Note: GDP at current (2021) prices.
Source: Tonga Statistics Department

REMITTANCE SENDING - RECENT NET TRANSFERS

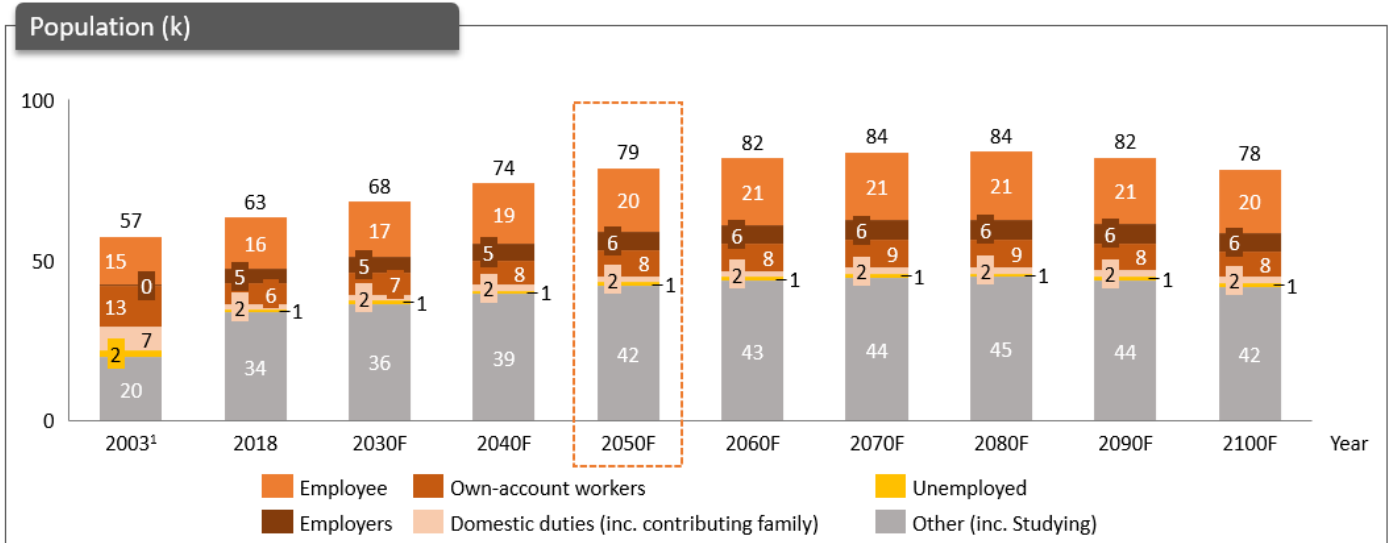
It is widely recognised that remittance sending is significant within the Tongan international community. Remittance sending represents a significant component of gross national income in Tonga, and remittance sending levels continue to grow (save an initial dip in the first year of the pandemic). In the last ten years, remittance levels have nearly doubled and in 2021, remittance levels represented nearly 40% of the value of Tonga's GDP that year.



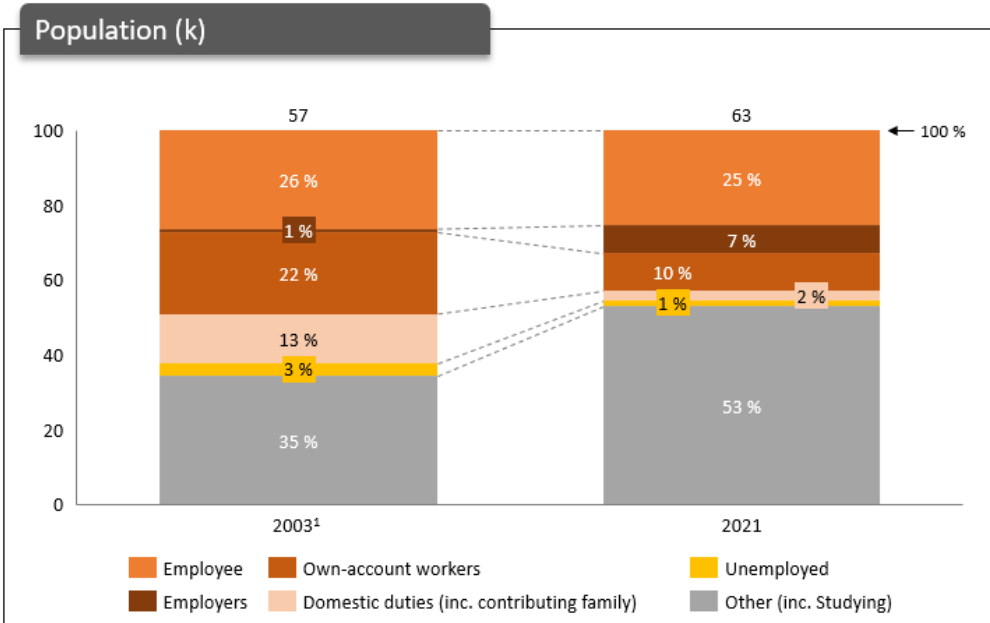
Note: Current net transfers includes remittances. Current net transfers are added to Gross National Income to give Gross National Disposable income
Source: Tonga Statistics Department

POPULATION BY EMPLOYMENT TYPE

The below graph shows some recent historical data (taken from labour force surveys in 2003 and 2018) on population by employment type. 'Projections' from 2030 onwards are taken from UN Population Division assumptions and growth in the categories assumes each are growing at the same rate as the overall population. Based on these projections, absolute numbers in 'official' unemployment would remain low, though around 45,000 people 15 years and older would not be participants in the labour force.



Note: Includes only those aged 15 years and over. Data from Tonga 2003 and 2018 Labour Force Surveys; Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each employment category growing at same rate as overall population. Other category includes the population outside the labour force is defined as people who are neither in employment nor in unemployment, including students, elderly and those engaged in unpaid domestic duties. 1. 2003 indicative only, due to differences in survey methodology
Source: Tonga Statistics Department; UN Department of Economic and Social Affairs



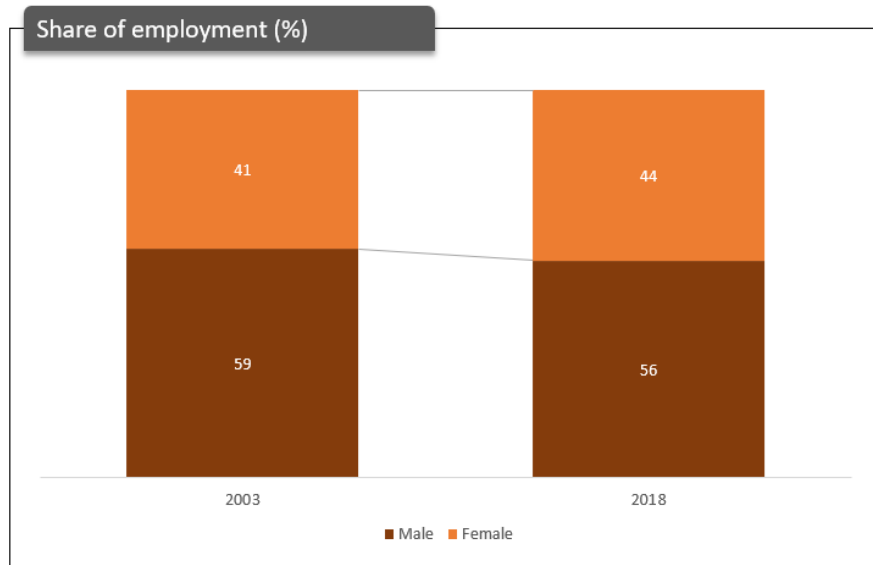
Employment type, % split

Though there are limitations to comparing these two data sets (including survey methodology differences in 2003), there are interesting shifts to highlight, particularly in the increase of those identifying as 'employers', a reduction in 'own-account workers' and those in the 'domestic duties' category, and significant growth in the 'other' category. The overarching picture shows a significant proportion of the population in Tonga 15 years and over were not active in the labour force in 2021 (from 35% in 2003 to over half in 2021).

Note: Includes only those aged 15 years and over 2003, 2021 data from Labor Force Surveys. Other category includes the population outside the labour force is defined as people who are neither in employment nor in unemployment, including students, elderly and those engaged in unpaid domestic duties. 1. 2003 indicative only, due to differences in survey methodology
Source: Tonga Statistics Department

EMPLOYMENT BY GENDER (2003, 2018 DATA)

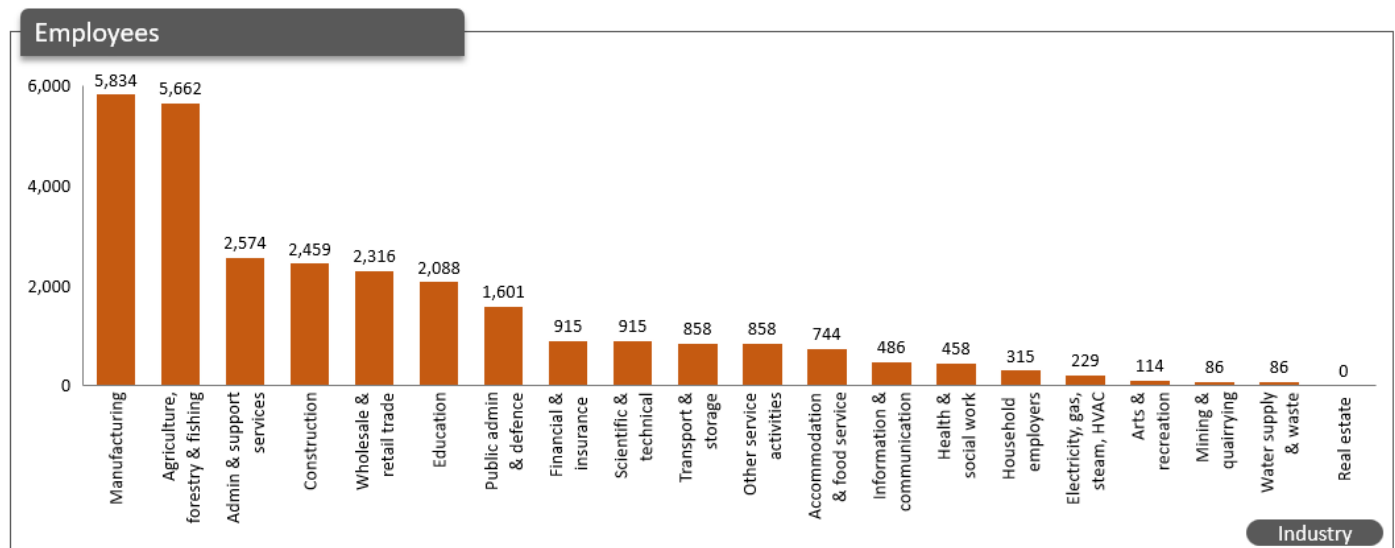
More formal employment of those 15 years and older is held by males in Tonga, however between 2003 and 2018, the share of total employment in Tonga shifted slightly towards females. Breaking down employment by sector in 2018 provides some interesting insights - 40% of females in employment are in craft and other trade work. 30% of employed males are in skilled agriculture/forestry/fishing work. Interestingly, as we see in subsequent graphs, the average monthly wage for those employed in 'craft and other trade work' is slightly higher than those in 'skilled agriculture/forestry/fishing work'.



Note: Includes only those aged 15 years and over, from Labor Force Surveys (2003, 2018).
Source: Tonga Statistics Department

EMPLOYMENT BY INDUSTRY (2018 DATA)

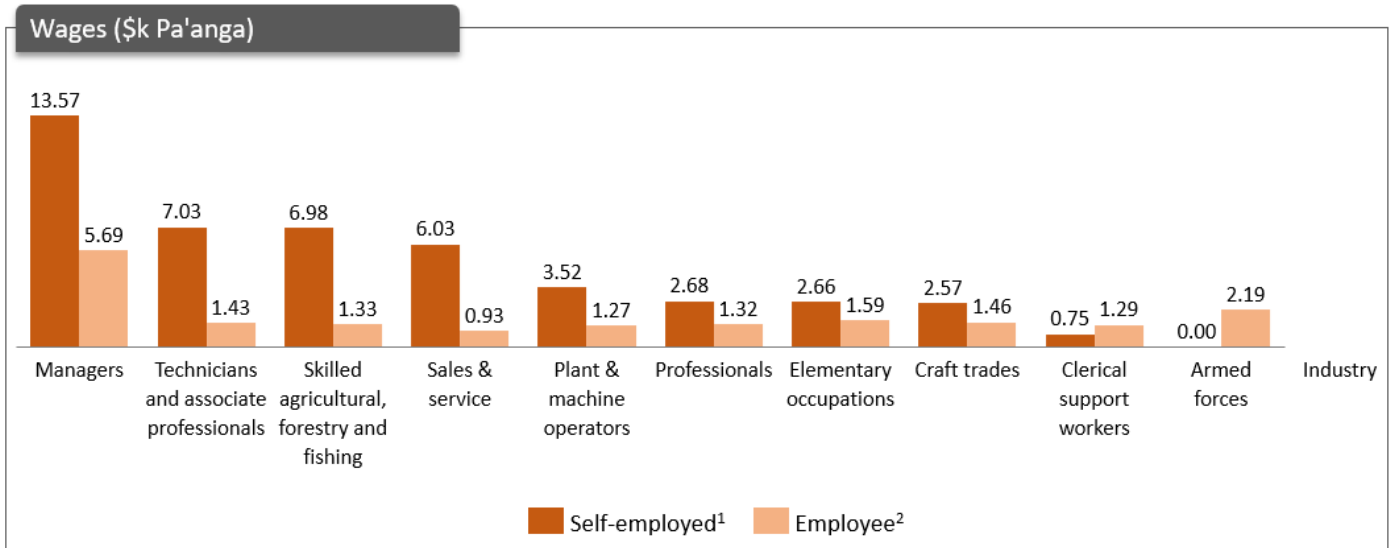
Manufacturing topped the table in 2018 as the industry with the highest number of employees in Tonga, just surpassing agriculture, forestry and fishing. Interestingly, when comparing this data with GDP data (2021), manufacturing contributed TOP\$55m to Tonga's economy in 2021, whereas agriculture and fishing combined contributed TOP\$174m. Five other industries showed employee numbers of over 1,000 - administration and support services, construction, wholesale and retail trade, education and public administration and defence.



Note: Wholesale & retail trade includes vehicle repairs; Informal employment included in data; Subsistence work is not included as it overlaps with this view as a different filter
Source: Tonga Statistics Department

MONTHLY WAGES BY OCCUPATION (2018 DATA)

Managerial wages were highest for both self-employed and employed. A significant proportion of male workers work in agriculture and agriculture is the single highest contributor to GDP in Tonga. One of the starkest differences between the average wages for self-employed vs. employed are in that sector.



Note: Wages displayed are monthly, per person; n=2,644 households; 1. Self-employed n = 360 households (estimate) 2. Employee n = 885 households (estimate)
 Source: Tonga Statistics Department

ECONOMY

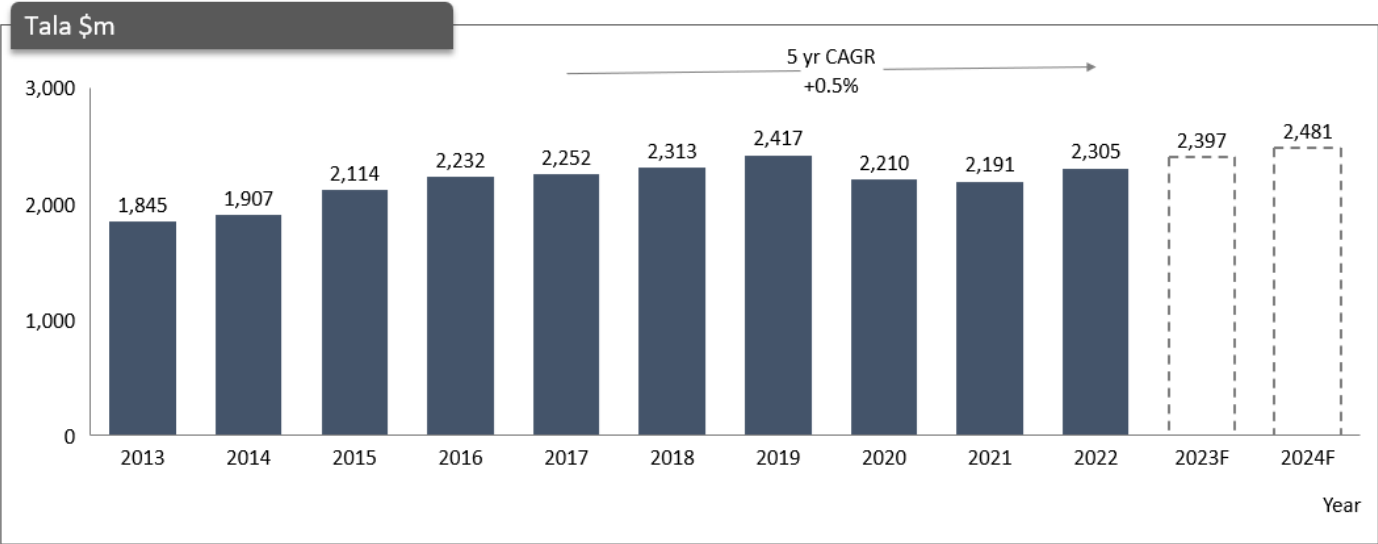
SAMOA

CONTENT

- TOTAL GROSS DOMESTIC PRODUCT (GDP)
- GDP CONTRIBUTION BY INDUSTRY (2022)
- REMITTANCE SENDING - CURRENT NET TRANSFERS
- POPULATION BY EMPLOYMENT TYPE
- POPULATION BY EMPLOYMENT TYPE (% SPLIT)
- REGISTERED EMPLOYEES BY INDUSTRY (2022)
- TOTAL WAGES OF REGISTERED EMPLOYEES BY INDUSTRY (2022)
- WAGES PER EMPLOYEE BY INDUSTRY (2022)

TOTAL GROSS DOMESTIC PRODUCT (GDP)

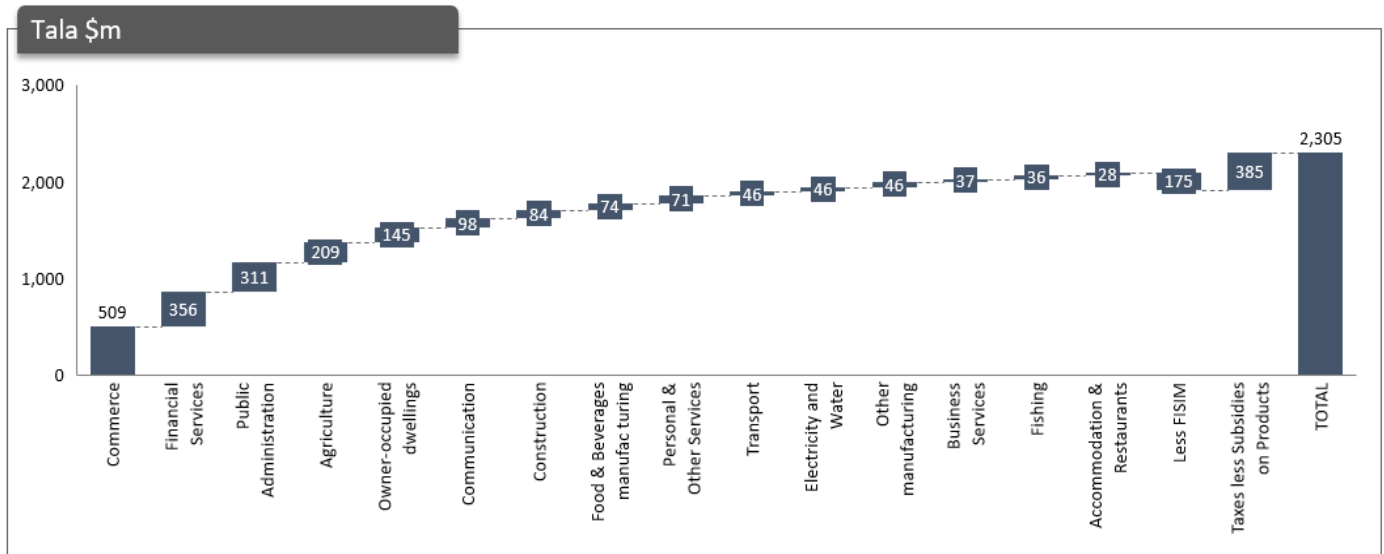
In the lead up to the impact of COVID-19, Samoa's GDP growth had been steady, yet contracted in 2020 and 2021, showing a slight recovery in 2022. In the five years to 2022, Samoa's GDP delivered a modest CAGR of +0.5%. The 'projections' for the following two years, showing further modest growth in the economy are based off 2022 actual GDP with World Bank growth rate assumptions applied.



Note: GDP is at nominal (current) prices. Forecast GDP is based off 2022 actual GDP grown by World Bank estimated GDP growth rates
 Source: Samoa Bureau of Statistics; World Bank Global Economic Prospects

GDP CONTRIBUTION BY INDUSTRY (2022)

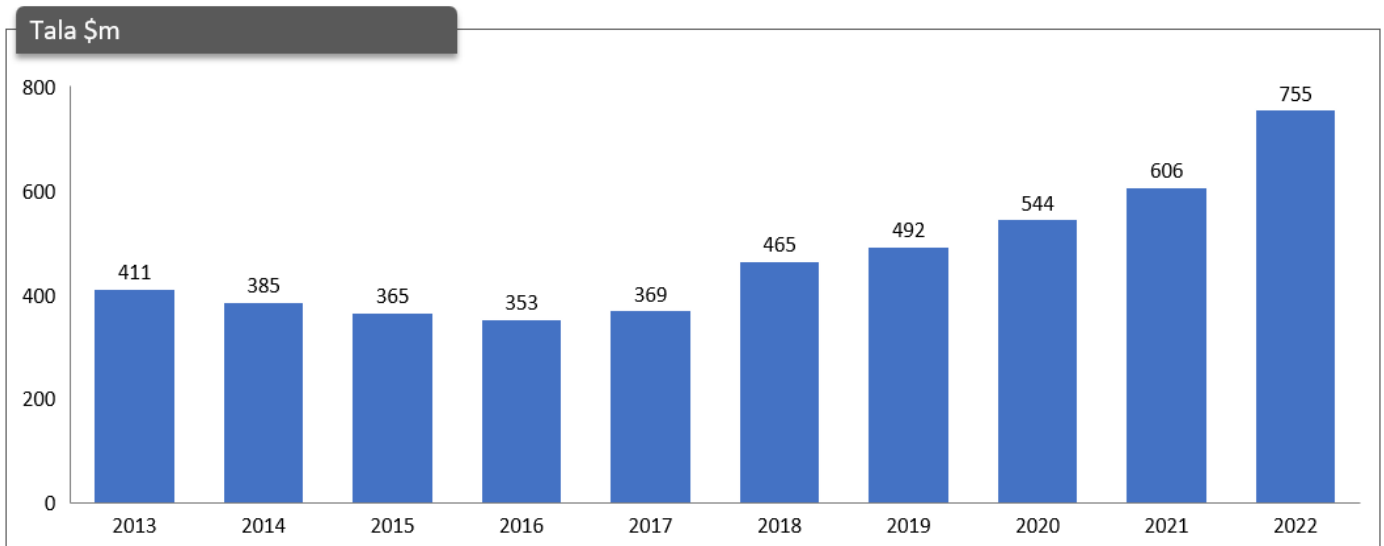
Commerce activities are the highest single contributor to the Samoan economy (22% of total) followed by financial services and public administration. Agriculture contributed ~9% to the total GDP in 2022 (note this does not include the significant informal agricultural economy). The overall size of the economy (WST\$2.3b) is approximately double that of Tonga's economy, yet still significantly smaller than New Zealand's.



Note: GDP excludes current net transfers (which makes up part of gross national disposable income). GDP at current (2022) prices. FISIM = Financial intermediation services indirectly measured
 Source: Samoa Bureau of Statistics

REMITTANCE SENDING - RECENT NET TRANSFERS

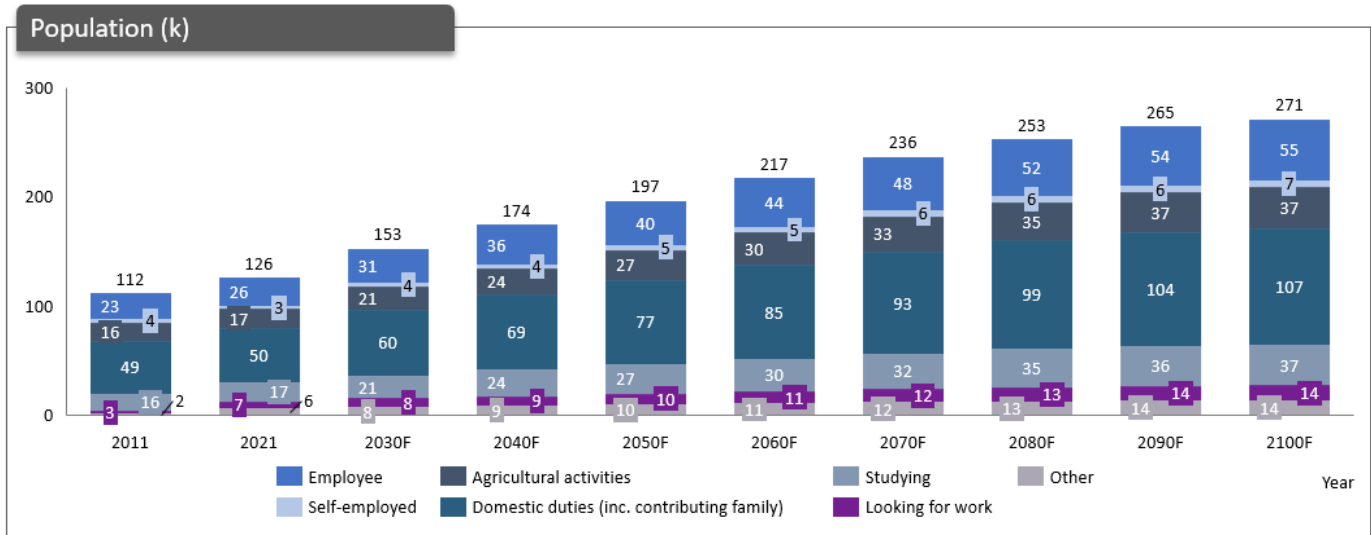
Remittance sending continues to grow and topped WST\$755m in 2022. In 2022, remittances represented nearly one third of the value of Samoa's GDP that year.



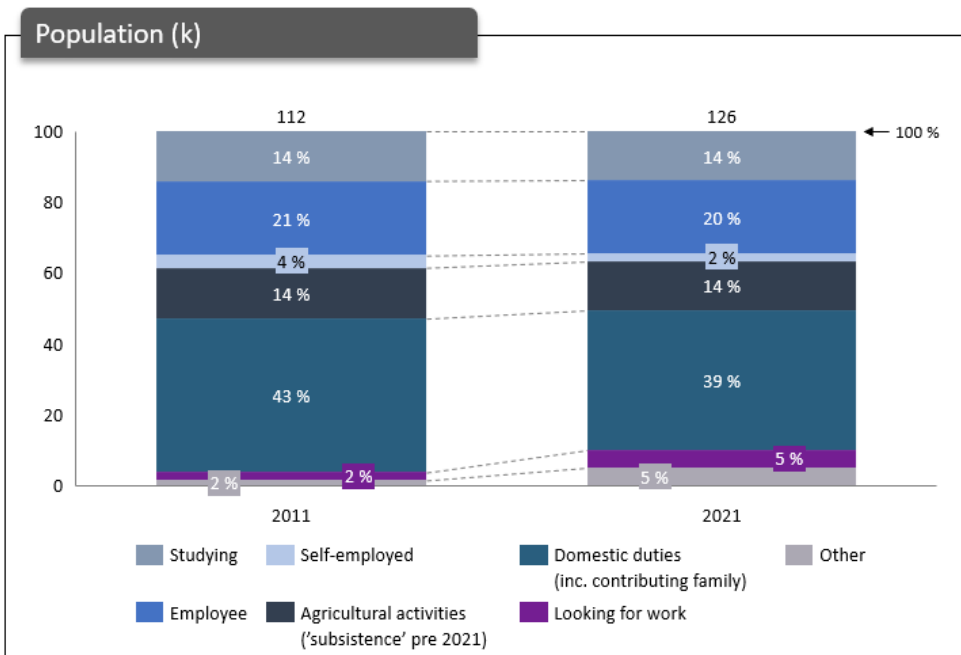
Note: Recent net transfers includes remittances. Current net transfers are added to Gross National Income to give Gross National Disposable income
 Source: Samoa Bureau of Statistics

POPULATION BY EMPLOYMENT TYPE

The below graph shows some recent historical census data on population by employment type. 'Projections' from 2030 onwards are taken from UN Population Division assumptions and growth in the categories assumes each are growing at the same rate as the overall population. There was an uptick in the overall numbers of people looking for work in 2021. If the share of total continued to 2050, there would be approximately 10,000 people looking for work in 2050. Note, higher rates of official unemployment have been provided for Samoa than what is shown here (here, those 'looking for work' equates to ~5% of those 15 years and older).



Note: Includes only those aged 15 years and over. 2011, 2021 data from Census (2016 census excluded as numbers include all over 10 years old); Projections 2030-2100 from UN Population Division (Medium Projections). Assumes population in each employment category growing at same rate as overall population. Other category includes employees, unpaid volunteers and incapable (due to elderly)
 Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs



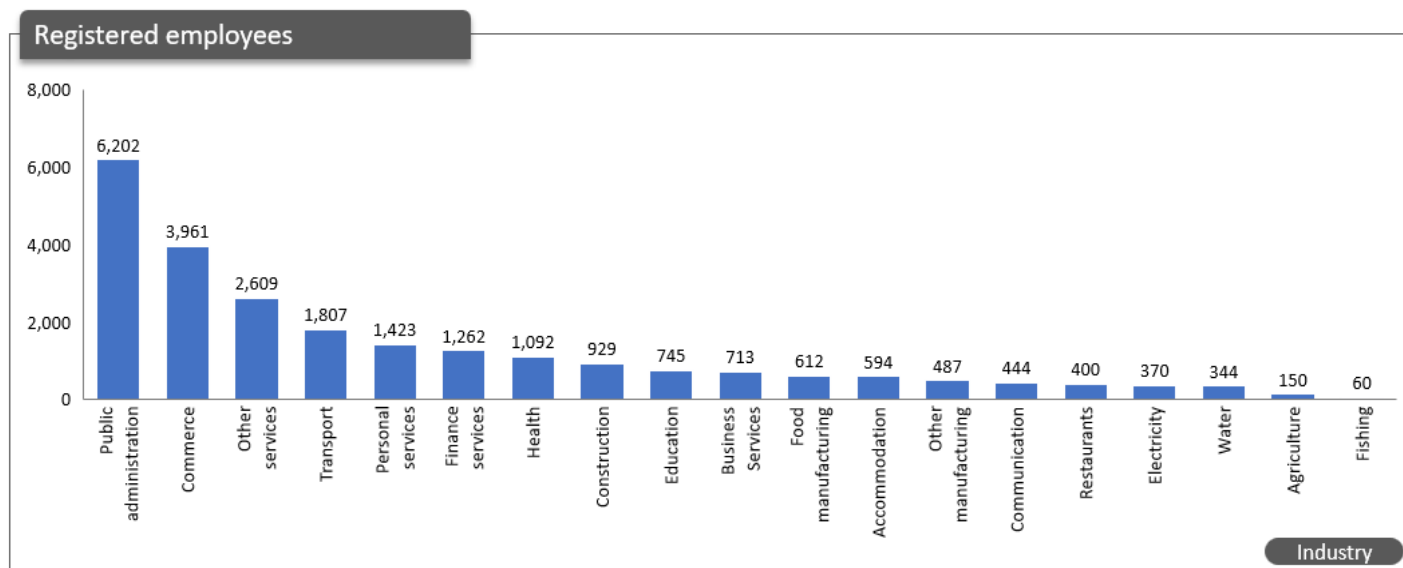
Note: Includes only those aged 15 years and over 2011, 2021 data from Census (2016 census excluded as numbers include all over 10 years old). Other category includes employees, unpaid volunteers and incapable (due to elderly). 2016 census excluded as numbers include all over 10 years old, skewing results.
 Source: Samoa Bureau of Statistics

Employment type, % split

In the decade to 2021, the proportion of the population 15 years and older who are looking for work increased. Those engaged in domestic duties reduced slightly. Overall, a significant proportion - over half - of those 15 years and older are not participating in the *formal* labour workforce.

REGISTERED EMPLOYEES BY INDUSTRY

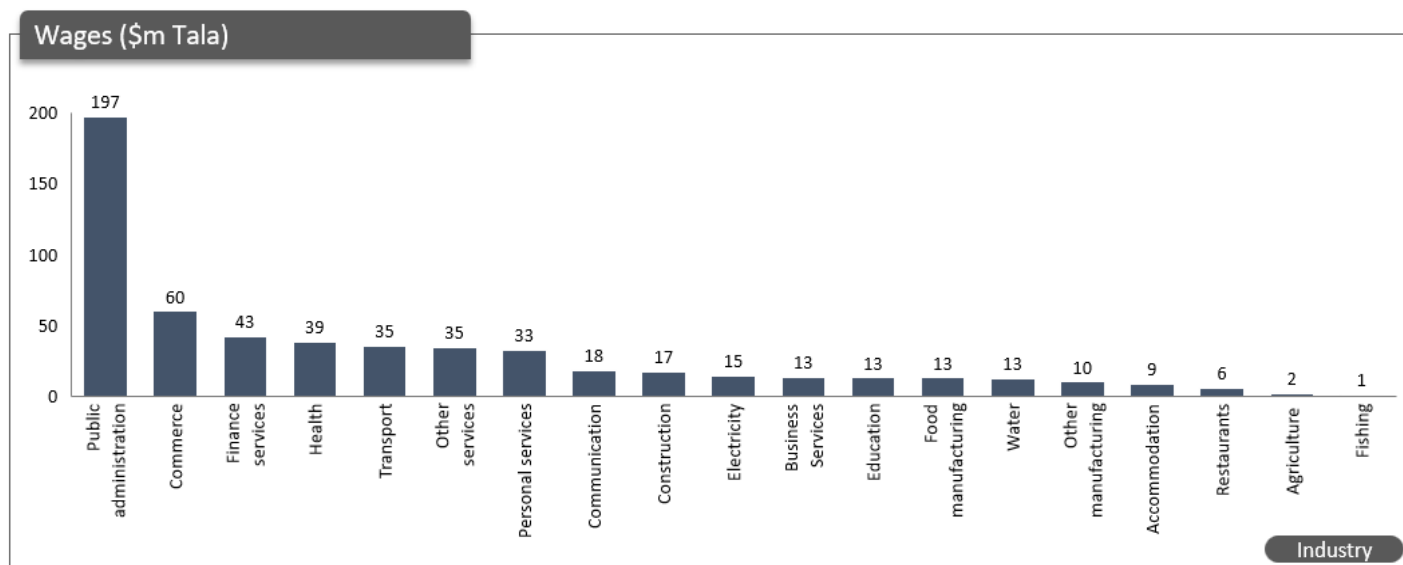
By far, the most registered employees in Samoa are in public administration. With commerce being the single highest contributor to the Samoa economy in 2022, it is the second highest employer. Important to note that this data set of 'registered employees' does not include the many who are engaged in agricultural activities (those formally registered in agriculture is shown as just 150 people, with fishing only counting 60). The majority of informal workers in Samoa are employed in the agricultural sector.



Note: Includes only registered employees. Does not include self-employed or 'agricultural activities'
Source: Samoa Bureau of Statistics

TOTAL WAGES OF REGISTERED EMPLOYEES BY INDUSTRY

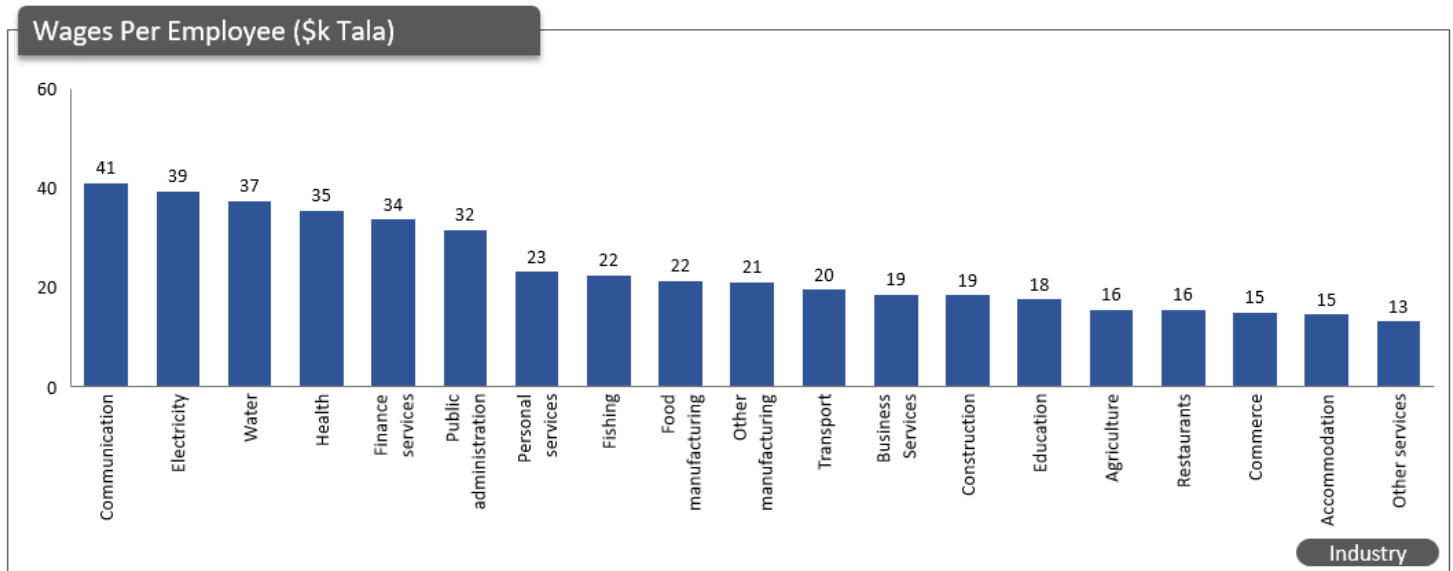
Total wages mirrors the high employment levels in public administration. The slight reordering of categories here in considering total wages suggests a relatively higher wage level for health and finance service workers versus transport, 'other services' and personal services as shown in the next graph.



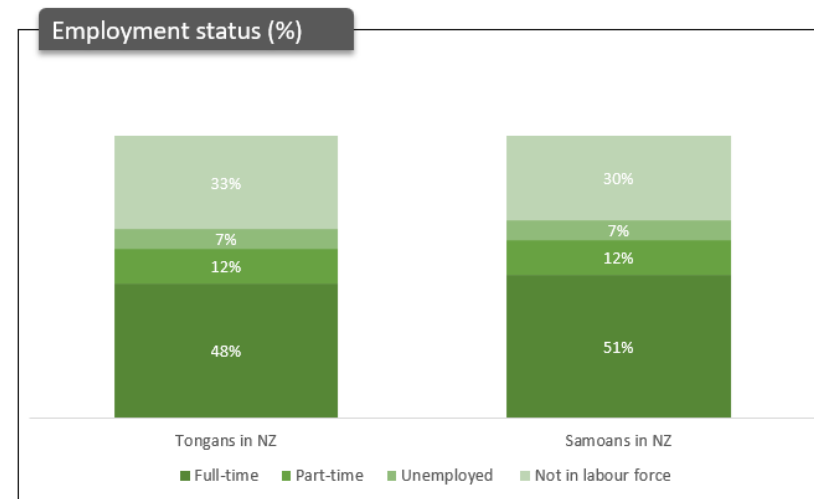
Note: Includes only registered employees. Does not include self-employed or 'agricultural activities'
Source: Samoa Bureau of Statistics

WAGES PER EMPLOYEE BY INDUSTRY

Despite being the largest employer, and contributor to the Samoa economy in 2022, those working in commerce take home some of the lowest annual wages. Communication, utilities like electricity and water, health, finance and public administration all earn above WST\$30,000 annually.



Source: Samoa Bureau of Statistics



Source: Stats New Zealand (2018)

EMPLOYMENT STATUS OF TONGAN AND SAMOAN PEOPLE IN NEW ZEALAND (2018)

Reflecting on data captured in 2018, Tongans and Samoans in New Zealand have an unemployment rate of approximately 7%. Non participation in the labour force in New Zealand for Tongans and Samoans is 33% and 30% respectively.

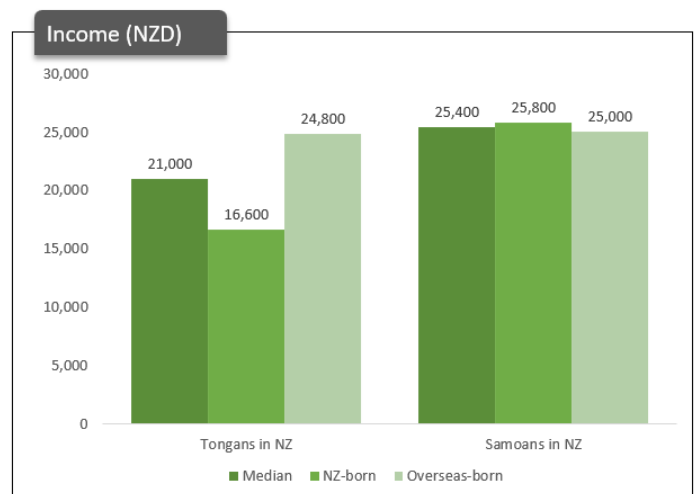
Compared with Tongans in Tonga and Samoans in Samoa, labour force participation is higher in New Zealand (e.g., over half of Tongans in Tonga 15 years and older are not active in the labour force). This needs to be filtered through context (not being formally employed in Tonga or Samoa does not equate to not working or contributing to the family/village/community), however there are considerations in terms of resilience, adaptation capacity and choice offered through [formal] employment.

INCOME OF TONGAN AND SAMOAN PEOPLE IN NEW ZEALAND (2018)

The average income of Samoans in New Zealand, whether New Zealand or overseas born is higher than the average income of Tongans in New Zealand.

The median income (2018) sat at ~\$21,000 for Tongans in New Zealand, and \$25,400 for Samoans in New Zealand. This compared with a median income in New Zealand of just under NZD\$52,000 in 2018.

As noted on page 20, though Tongan and Samoan people in New Zealand who were born outside of New Zealand have lower average educational levels, they are either earning more than those who are New Zealand born (Tonga) or are ~on par with those who are New Zealand born (Samoa).



Source: Stats New Zealand (2018)

MIGRATION

INSIGHTS SUMMARY

2050 SIGNALS



On average, both Tonga and Samoa have had net negative migration over the last ~decade, with actual negative migration levels a lot higher than the UN Population Division assumptions. Tonga's negative net migration has accelerated in recent years and could impact current 2050 population projections.

In terms of internal movement in Samoa, North-West Upolu has seen the highest intake of migrants, and Savai'i has seen the most out-migrants. By 2050, if these patterns continue, we could see significant shifts in population distribution between Savai'i and Upolu.

In 2009, the year of the September tsunami, Samoa saw a rare year where migration was net positive. It took nearly 10 years for negative net migration to reach the levels it was immediately prior to the tsunami. On years where there were particularly destructive natural disasters, like tsunami and tropical cyclones, there seems to be a pattern of positive migration or reduced negative net migration relative to adjacent years for Samoa. For Tonga, positive net migration was seen in 2014 (Tropical Cyclone Ian), then strongly negative in 2018-2020 (years of Tropical Cyclone Gita and Harold). It is unclear how populations will respond to in future, to future disasters in terms of mobility, and whether we can assume that past behaviours or patterns will continue.

For both Tongans and Samoans leaving home to live in New Zealand, Australia or the United States, New Zealand is the most common destination of choice, followed by Australia¹.

For Tonga, USA is less and less common as a destination for 'intended permanence' and if trends continue could no-longer be in the top three destinations for Tongan people in 2050. The proportion of those moving from Samoa to live in the USA (inclusive of American Samoa) has stayed relatively stable.

TO EXPLORE IN RESEARCH ACTIVITIES

We noted some interesting features in the net migration data following major environmental events (e.g., a shift from regular net negative migration to net positive in the year of the 2009 tsunami in Samoa). After a major environmental disaster, what is the short, medium and longer term mobility response - do people talk about relocating within the island or country, or overseas, or staying and continuing to rebuild? Are these responses changing over time or could they (e.g., in a future where environmental events become more destructive)? How might people respond in future?

The available internal migration data is at 'division' level (Samoa) or island level (Tonga) and doesn't show the next level down of migration or mobility happening (e.g., at a village level or even within households' own land, though noting Tonga does capture loss of a family member at household level). Do you see any changes in the way people are moving (e.g., direction, destination, reasons for moving)? What could this lead to in 20-30 years' time?

Less is known about how people will respond to sea level rise and other 'slow' onset hazards. Is 'slower' climate change causing mobility at a family or community/village level? If yes, what could this mean for the community/village or the country in terms of social, economic, cultural impacts in 20-30 years' time?

Tonga and Samoa continue to lose people to migration overseas - who is most commonly leaving (age groups, gender, education level/work experience) and what could this mean for Tonga/Samoa if this continues to 2050?

In the last decade, New Zealand has most commonly received the most Tongan and Samoan migrants annually. What drives this pattern? Will it continue or do we see a shift to other countries (e.g., Australia) in future? What role do family overseas play in destination preferences and is this changing?

What could be the impact on Savai'i and other parts of Samoa in future if Savai'i continues to see the highest levels of out-migration?

1. Excluding data from 2020 and 2021 due to the impacts of the pandemic on travel.

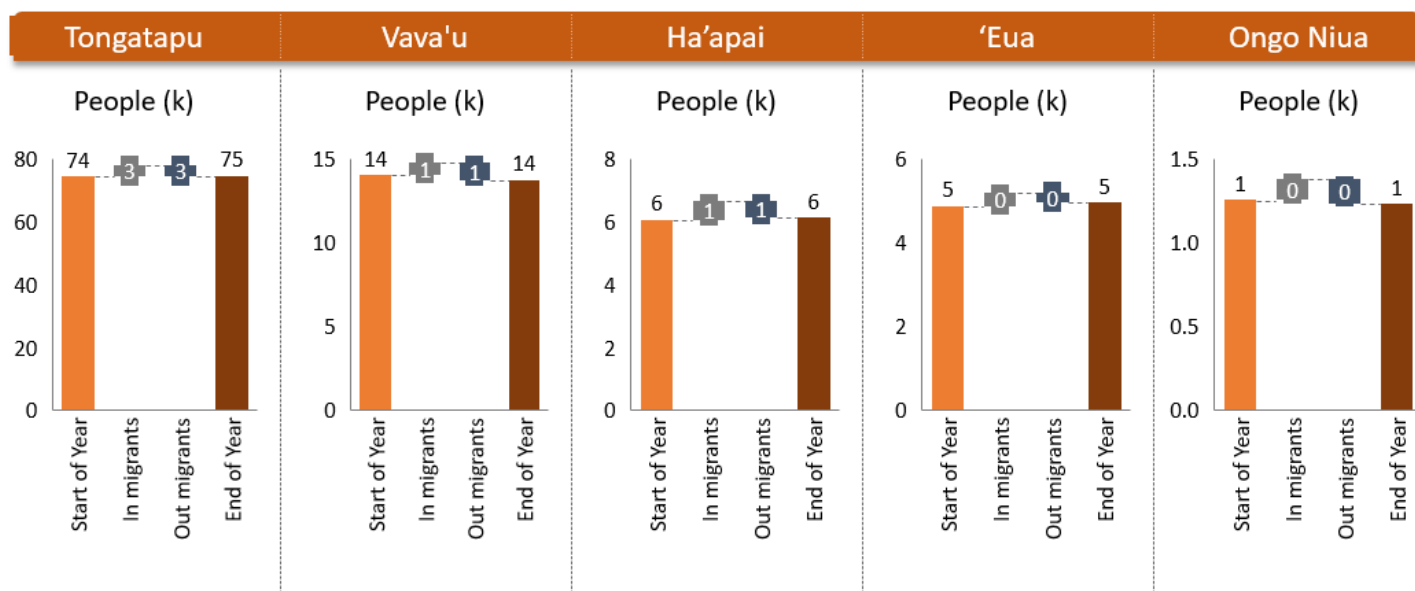
MIGRATION TONGA

CONTENT

- INTERNAL (INTER-ISLAND) MIGRATION PATTERNS (MIGRATION OVER 2016)
- EXTERNAL MIGRATION: NET MIGRATION
- TONGA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA
- TONGA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA (% SPLIT)

INTERNAL MIGRATION PATTERNS (MIGRATION OVER 2016)

Internal (inter-island) migration records for 2016 show start and end of year figures being relatively static (excepting a small change in numbers into Tongatapu). Important to note that this does not capture intra-island internal mobility. 2021 records were not available at the time of writing though we note that data on internal mobility was captured as part of the 2021 census (the questions asked suggest there could be data available on inter-village mobility in the last one and five years).

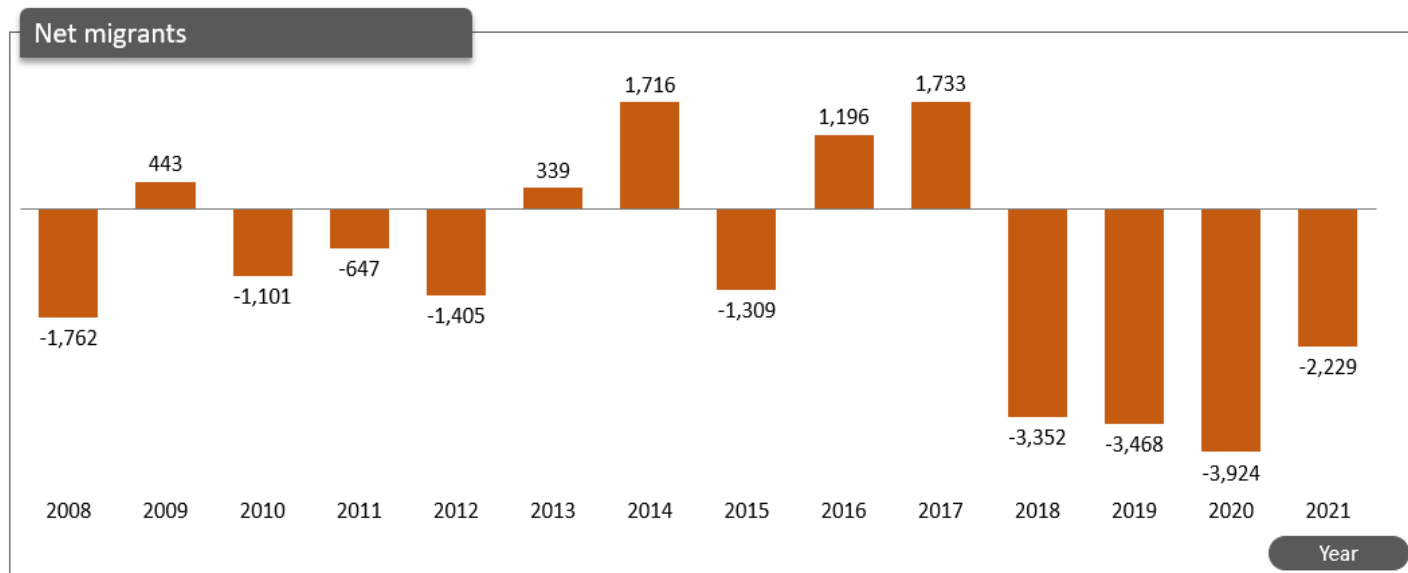


Note: Data is internal migration at Division level over one year (2016), sourced from 2016 Census; Start of Year population does not indicate population born in Division; 2021 Census Internal Migration data not yet available
Source: Tonga Statistics Department

EXTERNAL MIGRATION - NET MIGRATION

Tonga's annual average (mean) net migration over the last 14 years is -984. This has accelerated more recently, with an annual average negative net migration of -3200 in the last four years of records. It is important to contrast these actual figures with the UN Population Division fixed assumption of -800 annually (Medium Projection).

Between 2018 and 2020, where we saw some of the largest annual negative net migration figures, Tonga was impacted by Tropical Cyclone Gita (February 2018) and Tropical Cyclone Harold (April 2020). Without claiming correlation, it provides context for reflection. In contrast, in 2014 Tonga (particularly Ha'apai) was hit by Tropical Cyclone Ian - the most powerful storm recorded in Tonga at the time - and yet that year, positive net migration was recorded. And while the Recognised Seasonal Employment scheme commenced in 2007 (data not shown) and the Seasonal Worker Program (Australia) started in 2012, the annual stocktake should not in theory show these cyclical movements.

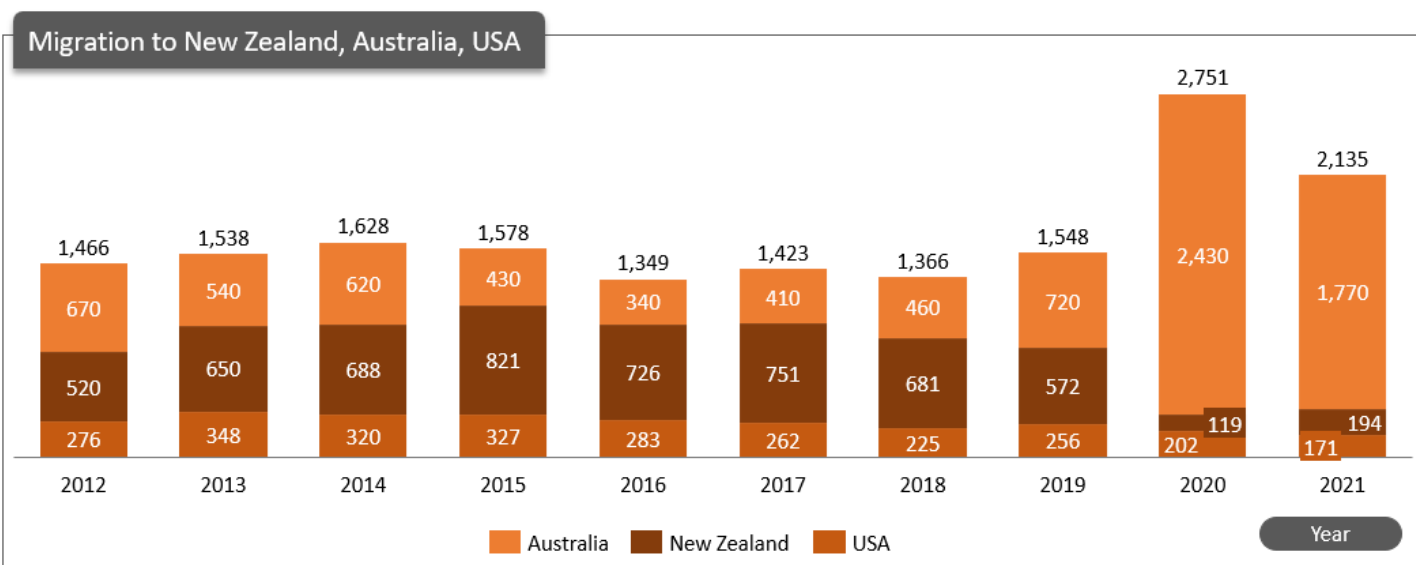


Note: Net migration = total arrivals minus total departures
Source: Tonga Statistics Department

TONGA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA

The data below provides interesting insights into the destination of travel for those leaving Tonga with intended permanence. Between 2012-2021, if we discount 2020 and 2021 for the impacts of the pandemic on travel, in six out of eight years, more Tongans moved to New Zealand than Australia or the USA. In some years (e.g., 2015-2017), nearly double the number of Tongans moved to New Zealand than Australia. Since 2013, the number of Tongans moving to the USA with intended permanence has continued to drop.

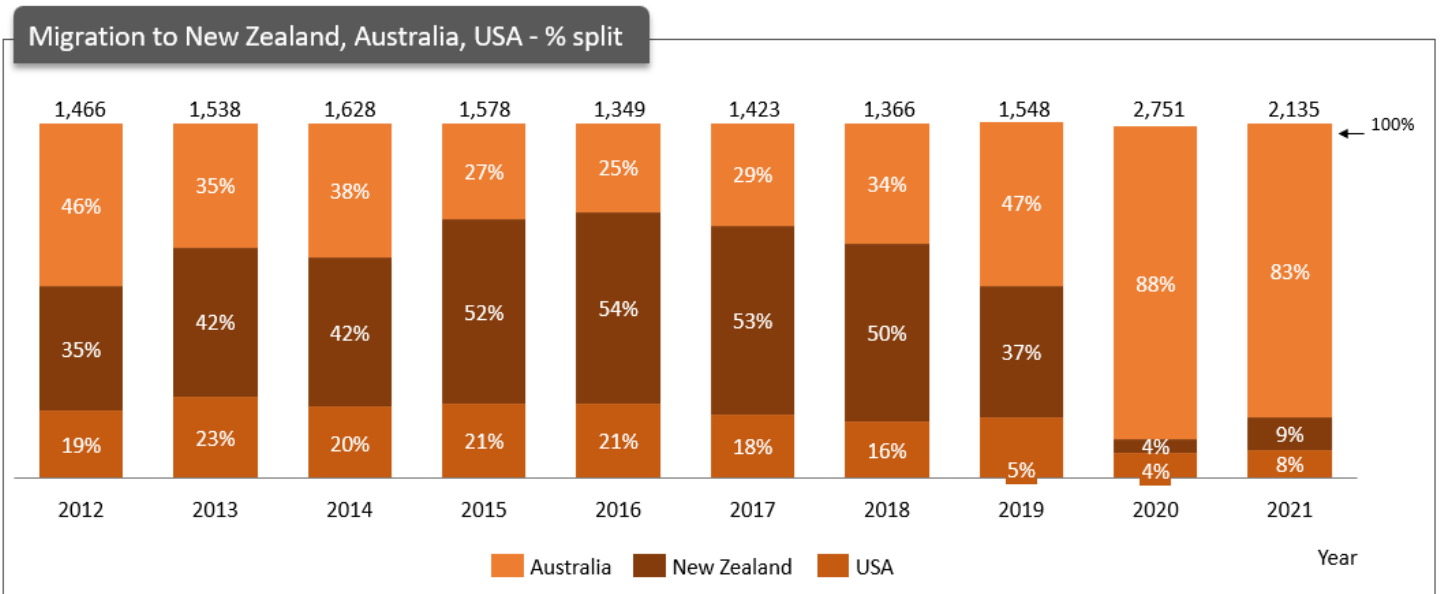
Those counted below were those arriving as 'permanent and long-term migration arrivals' (New Zealand), those 'obtaining lawful permanent residence' (United States of America), and 'net overseas migration based on the 12/16 month rule' i.e., 12 of the next 16 months spent in country (Australia). Those arriving in American Samoa were counted here under the USA.



Note: Permanent long-term migrants by country of birth = Tonga. Excludes countries other than NZ, Australia, USA. NZ numbers include permanent and long-term migration arrivals; USA includes American Samoa, includes those obtaining lawful permanent residence; Australia includes net overseas migration based on the 12/16 month rule (12 of the next 16 months being spent in the country)
Source: Statistics New Zealand, Australian Bureau of Statistics, DHS Office of Immigration Statistics

TONGA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA (% SPLIT)

Presenting the same data as a proportion of total 'permanent' movement further shows how New Zealand was more commonly chosen as a migration destination over Australia and the USA. The trend down in permanent migration to the USA is also more clearly depicted through this view of the data.



Note: Permanent long-term migrants by country of birth = Tonga. Excludes countries other than NZ, Australia, USA. NZ numbers include permanent and long-term migration arrivals; USA includes American Samoa, includes those obtaining lawful permanent residence; Australia includes net overseas migration based on the 12/16 month rule (12 of the next 16 months being spent in the country)
 Source: Statistics New Zealand, Australian Bureau of Statistics, DHS Office of Immigration Statistics

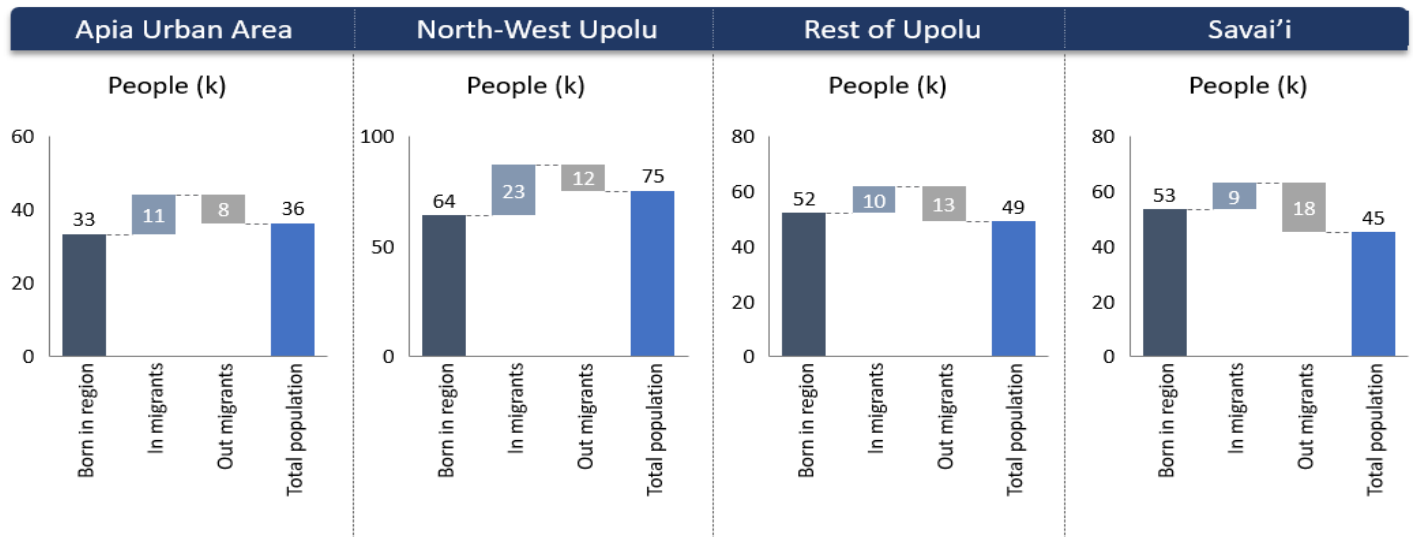
MIGRATION SAMOA

CONTENT

- INTERNAL MIGRATION PATTERNS (LIFETIME MIGRATION)
- EXTERNAL MIGRATION: NET MIGRATION
- SAMOA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA
- SAMOA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA (% SPLIT)

INTERNAL MIGRATION PATTERNS (LIFETIME MIGRATION)

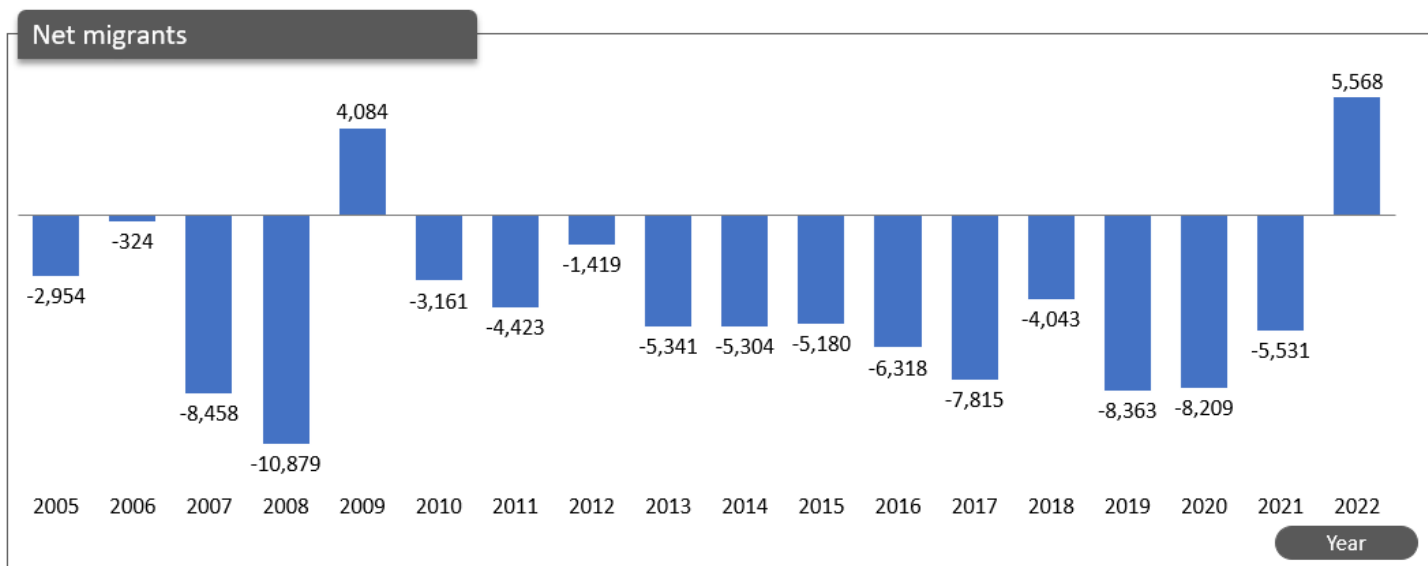
The way internal migration data is recorded and presented in Samoa differs to Tonga. Instead of taking an annual view, and a start and end count, a 'lifetime' migration view is taken - considering who was born in the area, who has entered who was not born there, and how many have left to give an end total count. This provides a unique view of the population in the context of mobility, and shows North-West Upolu as a top receiver of 'in migrants', and Savai'i as the top generator of 'out migrants'. This view aligns with the shifts in population we saw over time in the different divisions of Samoa (e.g., North-West Upolu seeing the strongest population growth of all divisions in the decade to 2021) and may provide a further signal as to how populations within and between divisions may continue to change in future.



Source: Samoa Bureau of Statistics

EXTERNAL MIGRATION: NET MIGRATION

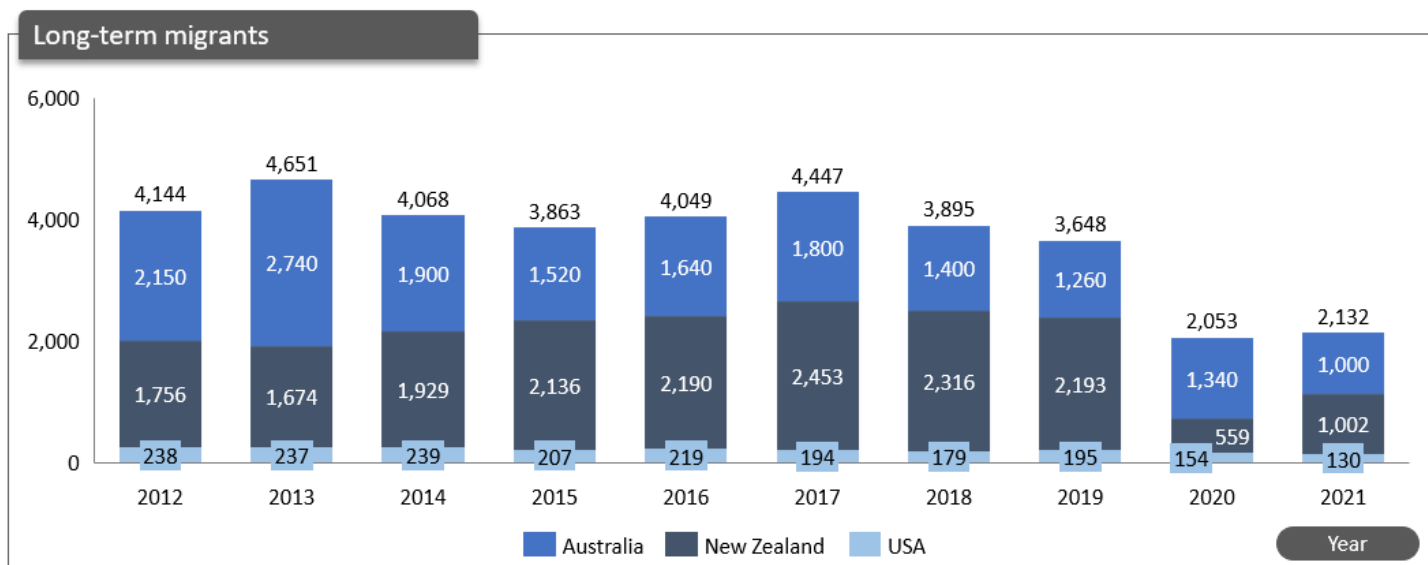
The annual average (mean) net migration for Samoa over the last 18 years is -4337. These actual numbers are important to contrast with the UN Population Division fixed assumption of negative net migration of -1500 annually. A slightly longer view of the data was taken here to capture any mobility responses to the 2009 tsunami. Interesting to note that in 2009, the year of the Samoa tsunami (September 2009), positive net migration was recorded. One could posit the bump could be arrivals to support rebuild efforts. Interesting also to note the incremental increase in negative net migration, taking 10 years to return to the levels seen immediately prior to 2009. Other than 2009, the only other positive net migration for the time period was recorded in 2022, likely owing in part to Samoa's borders reopening in August 2022. In 2012 and 2018, Tropical Cyclone Evan and Tropical Cyclone Gita hit. Without claiming correlation, in those same years we note a pull back in net negative migration.



Note: Net migration = total arrivals minus total departures
Source: Samoa Bureau of Statistics

SAMOA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA

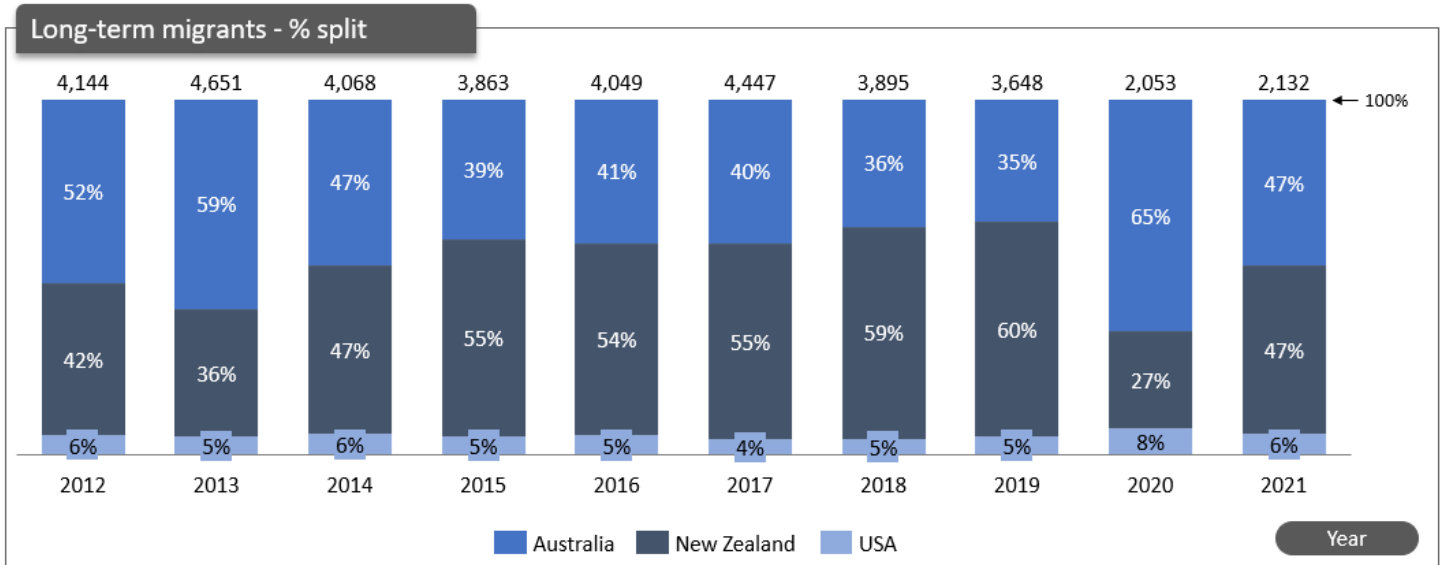
For those leaving Samoa to reside 'long term' elsewhere, there are similarities with what we see in the data for those leaving Tonga. Discounting 2020 and 2021 figures due to the impact of the pandemic on travel, we note that more Samoans moved to New Zealand than Australia in six out of eight years.



Note: Permanent long-term migrants by country of birth = Samoa. Excludes countries other than NZ, Australia, USA (including American Samoa). NZ numbers include permanent and long-term migration arrivals (net numbers may be lower); USA includes American Samoa, includes those obtaining lawful permanent residence (net numbers may be lower); Australia includes net overseas migration based on the 12/16 month rule (12 of the next 16 months being spent in the country)
Source: Statistics New Zealand, Australian Bureau of Statistics, DHS Office of Immigration Statistics

SAMOA-BORN MIGRATION TO NEW ZEALAND, AUSTRALIA AND USA - % SPLIT

Presenting the same data as a proportion of total 'permanent' movement further shows how New Zealand was more commonly chosen as a migration destination over Australia and the USA. For Samoa, the proportion of those moving who move to the USA has stayed relatively steady in the last decade. There could be range of reasons for this, but the steadiness could be owing to the connection of American Samoa (counted in this data under USA) and Samoa.



Note: Permanent long-term migrants by country of birth = Samoa. Excludes countries other than NZ, Australia, USA (including American Samoa). NZ numbers include permanent and long-term migration (net numbers may be lower); USA includes American Samoa, includes those obtaining lawful permanent residence (net numbers may be lower); Australia includes net overseas migration based on the 12/16 month rule (12 of the next 16 months being spent in the country)
 Source: Statistics New Zealand, Australian Bureau of Statistics, DHS Office of Immigration Statistics

ENVIRONMENT

INSIGHTS SUMMARY

2050 SIGNALS



While there remain many unknowns, there is a medium to high level of confidence that both Tonga and Samoa will face reduced Tropical Cyclone frequency in future, but that Tropical Cyclones when they do occur will be more intense, with higher rainfall rates.

Both Tonga and Samoa will increase in average temperature by 2050, with upper ranges of 1.1 degrees higher (Samoa) and 2 degrees higher (Tonga).

Rainfall ranges are broad (from less annual rain to more annual rain), though we know with increasing sea level, flooding will hang around longer in the future.

In specific geographies in Tonga, particular villages across the wider Nuku'alofa area have been identified as particularly at risk of future inundation, with the highest risk areas under 0.5 - 2m SLR scenarios including Tukutonga, Popua, Nukumotu, the north west of Kolomatu'a and south eastern Ma'ufanga. A number of key infrastructure in Nuku'alofa face discrete to moderate inundation under 1m SLR scenarios. Under a 0.5m SLR scenario - close to projections for 2050, the Popua Power Plant faces minor inundation.

Lifuka, Ha'apai faces sea-flooding inundation risk, with significant shoreline erosion already seen in the administrative capital of Pangai. The shoreline could retreat a further 30-40m (or more) by 2050 given historical rates and 14% of those living within 120m of the shoreline report annual sea water flooding.

In Samoa, detailed and recent modelling has been done for Apia, including of the Vaisigano river catchment area. Building, vehicle and human life risk has been mapped with some residential areas along the banks of the Vaisigano showing high risk exposure in a 1 in 100 year event.

Modelling was also done ~a decade ago to assess Apia's storm surge exposure. Using this work as a guide, by 2050, the entire Mulinu'u Peninsula (currently hosting the Parliament of Samoa, a number of hotels and restaurants as well as housing) would be completely inundated with a sea level at approximately the current projection for 2050, in a 1 in 50 year tropical cyclone storm tide.

TO EXPLORE IN RESEARCH ACTIVITIES

What are the impacts of a hotter Samoa or hotter Tonga? On people, on infrastructure, on animals and crops? Other? How could higher temperatures impact the future of mobility in Tonga/Samoa?

FOR TONGA

For those living in villages in Nuku'alofa highlighted as most at risk in future climate change scenarios (e.g., Tukutonga, Popua), what could be the consequences of these changes for these families? Who might be more negatively affected than others? What choice do these people have (or not have) in terms of responding to this risk?

What planning is happening or could be happening to face possible future scenarios where key infrastructure (e.g., Vaiola Hospital) is threatened? What opportunities exist in having this knowledge?

What about 'safe places' identified through some of this modelling - what should be considered, or what planning could be happening at family, village or national level to reduce risk and grasp opportunities?

FOR SAMOA

Though efforts continue on the Vaisigano catchment to manage flood risk, risks do remain. What responses have we seen by those affected by flash flooding in the past? What options or choices do those people most at risk have in terms of mobility? What could be some challenges in terms of planning around mobility in the future?

Areas of high storm surge risk in Apia have been identified - including where the New Parliament House is and a number of hotels and restaurants. What options do businesses have in mobility planning? What examples do we have of business relocation (or rebuild) in the past, and what can we learn from that?

CONTENT

CONTEXT AND LIMITATIONS

NATIONAL LEVEL VIEW

NUKU'ALOFA, TONGATAPU - INUNDATION RISK - SEA LEVEL RISE, PLUVIAL FLOODING AND THE INTERACTION OF THESE RISKS

LIFUKA, HA'APAI - EROSION, SEA WATER FLOODING AND FRESH WATER SECURITY

CONTEXT AND LIMITATIONS

The intention of this section is not to collate all data on climate change hazards relevant to Tonga (or Samoa), nor small island states in general, but to highlight recent and targeted studies that are more geographically-specific and provide analysis that can guide research engagement to geographies and populations of relatively higher exposure.

Sea level rise poses a significant risk to Pacific Island states. A rising sea level will increase the impact of storm surges and coastal flooding. In terms of coastal exposure, CSIRO and SPREP note that in Samoa and Tonga, 61% and 84% of the population live within 1 km of the coast respectively. And while Global Mean Sea Level (GMSL) rise scenarios are widely available, the relative Sea Level Rise (SLR) felt by those in Tonga and Samoa is the critical consideration. The IPCC (2019) confirm that thermal expansion, ocean dynamics and ice loss can create 'regional departures (from GMSL) of +/- 30%' (Oppenheimer et al, 2019).

Having up-to-date, comprehensive topographic data is necessary to support modelling of specific exposure risk. In Tonga, LiDAR mapping has been limited to Nuku'alofa and Lifuka (Ha'apai) only, and data is over a decade old now. Researchers have noted that there are opportunities to improve other data collection to support mapping and planning, including more consistent capture of coastal erosion, rainwater measurement, and peak flood measurement.

Given the availability of topographic mapping in Nuku'alofa and Lifuka, the focus of content for Tonga in this section is on these two areas. Samoa has been fully LiDAR mapped and this difference is apparent in the amount of risk modelling done for Samoa versus Tonga. Even so, this data is also aging.

While it is generally projected that tropical cyclone frequency will decrease and intensity (including rainfall and other impacts) will increase globally, the influence of climate change on tropical storms in the Pacific is not well understood, and 'there is particularly low confidence levels in quantifying these influences' (ADB, 2021). 'NextGen' climate projections done by CSIRO and SPREP state that for both Samoa and Tonga, there is medium to high confidence there will be an increase in both average cyclone intensity (wind speed), and cyclone rainfall rates. While progress is happening in terms of understanding the impact of climate change on tropical cyclones and 'storminess', it was noted that some modelling on inundation risk for example does not factor in future changes in storminess for Tonga and Samoa.

Both Tonga and Samoa are affected by the South Pacific Convergence Zone (SPCZ) which makes future projections for Samoa particularly difficult (Doug Ramsey, personal communication, June 2023).

NATIONAL LEVEL VIEW: Pacific 'NextGen' environmental projections for Tonga (CSIRO and SPREP, 2021)

BY ~2050

- Annual rainfall could change by -5% to +12% (low emission scenario) to -10% to +15% (high emission scenario)
- Temperatures could be between +0.4 degrees celcius (lower range of low emission scenario) to +2 degrees celcius higher (high range high emissions scenario)
- High-intensity rainfall causes flooding and prolonged ponding of water (driven in part by sea level rise - see lower soil infiltration next page), which is associated with health risks such as waterborne and vector-borne diseases, including dengue fever
- Sea level rise will cause coastal inundation, erosion and saltwater intrusion into aquifers
- Coastal communities are highly exposed because 84% of the population live within 1 km of the coast and infrastructure within 500 m of the coast accounts for 51% of the total asset number and 57% of the total infrastructure replacement value
- Severe coral bleaching may occur on an annual basis by 2045 (under high emissions scenario)
- Maximum fisheries catch potential under RCP8.5 is projected to decline 20% by 2050

Nuku'alofa, Tongatapu

IPCC suggest with medium confidence that Global Mean Sea Level will rise between 0.43 m (0.29–0.59 m, likely range; RCP2.6) and 0.84 m (0.61–1.10 m, likely range; RCP8.5) by 2100 relative to 1986–2005 (Oppenheimer, 2019). CSIRO and SPREP (2021) suggested more conservative figures of 0.23m and 0.28m by 2050 (low and high emissions scenarios respectively). The United States National Oceanic and Atmospheric Administration (NOAA) has modelled global SLR scenarios out to 2100 (Sweet et al 2017) and an extract was prepared for Nuku'alofa, showing scenarios of a <0.5m ('low' scenario) – 1.2m rise ('extreme' scenario).

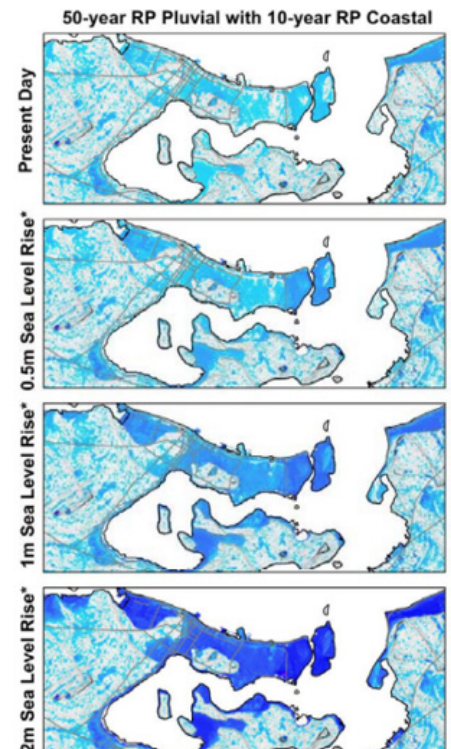
Scenarios chosen by a recent report commissioned by the Asian Development Bank (ADB) chose to align with a 'precautionary approach', considering higher-end scenarios, meaning consideration of 0.5m, 1m and 2m SLR. For time horizons of 2050, the authors recommended that SLR of 0.5m should be considered, as should 1m for comparison. They also suggested that a rise of 2m was 'plausible by 2100' and should be considered in projects with a time horizons of greater than 30 years.

Inundation risk modelling done for Nuku'alofa considered SLR scenarios and pluvial flooding of differing return periods.

In summary, the findings showed that large portions of the urban development of Nuku'alofa are exposed to pluvial flooding, coastal inundation and SLR. Critically, with rises in sea level, it was stated that areas affected by coastal inundation will be affected for greater durations due to decreased soil infiltration rates due to the higher sea levels.

Key observations from the modelling include:

1. Climate change drove **increased rainfall intensities, with an increase in pluvial flooding**. Areas affected by this **flooding will also be affected for greater durations** due to decreased infiltration rates experienced due to the higher sea levels
2. The **increase in pluvial flooding due to increased rainfall intensities is minor in comparison to inundation due to SLR**, and **SLR scenarios were noted as having a permanent impact on the inhabitability of the region**.
3. The **majority of existing sea defences along the northern coast of Nuku'alofa are overwhelmed** by most storm tide events when considering SLR scenarios.
4. **With 2.0m of SLR**, at 'High Astronomical Tide' and average meteorological conditions, the **majority of the northern coastline of Nuku'alofa from the western extent of Vuna Road to the eastern extent of Popua is inundated**.
5. **With 1.0m of SLR and a 10-year return period coastal inundation event**, the **majority of the northern coastline of Nuku'alofa is inundated from approx. 600m west of the Royal Palace through to the eastern extent of Popua and Tukutonga**.
6. Under general atmospheric and climatic conditions, **the effects of SLR alone, without consideration of storm tide events will inundate areas of the built environment**.
7. Minor SLR scenarios will result in **extended durations of inundation**, whilst **larger SLR scenarios combined with High Astronomical Tide will completely inundate significant areas of Nuku'alofa**



The figure above shows the extent of inundation of Nuku'alofa under three different SLR scenarios and pluvial flooding (50-year return period) Source: ADB (2021)

Observations from modelling of the highest astronomical tide plus different sea level rise scenarios for Greater Nuku'alofa, including villages of greatest risk exposure, and impacts on key infrastructure.

SLR scenario	Greater Nuku'alofa	Key infrastructure
0.5m	Tukutonga: majority inundated with maximum depth 1.5m Popua: south-eastern extents inundated with maximum depth of 1.2m	Popua Power Station: minor inundation
1m	Tukutonga: all inundated with maximum depth 2m Popua: majority inundated with maximum depth of 1.7m Ma'ufanga: south-eastern and northern extents inundated with maximum depth of 1.8m Kolofo'ou: south-eastern extents inundated with maximum depth of 1.8m Kolomotu'a: western extent inundated with maximum depth of 1.8m	Popua Power Station: majority inundation Royal Palace and adjacent to the Nuku'alofa Passenger Terminal: discreet inundation Vaiola Hospital and New Parliament House: moderate inundation
2m	The majority of Greater Nuku'alofa is inundated	Popua Power Station, Royal Palace, Nuku'alofa Passenger Terminal, Vaiola Hospital and New Parliament House

Source: ADB (2021)

Lifuka, Ha'apai - erosion and sea-water flooding

A recent study by SPC (2021) examined coastal erosion, inundation risks and water security around Lifuka, Ha'apai, and they undertook community engagement to understand residents perceptions of risks and beliefs regarding possible solutions and approaches to risk reduction.

In the past 40 years, Lifuka has experienced coastal erosion of between 2m and 43m in locations along the western shoreline. With erosion most notable in Pangai (the administrative capital village of Ha'apai). A significant earthquake in 2006 resulted in subsidence of the island of 23cm. The study notes that a number of homes, a church, a broadcasting tower, and the hospital are at risk from inundation during periods of heightened wave energy. During daily high tides, many homes are within two metres of the water and face inundation in strong onshore winds (SPC, 2021).

The report notes that most of Lifuka's infrastructure is inland. When engagement was focused to land within 120m of Lifuka's coast, 29% reported flooding in the past, and 14% reported annual flooding. The King's Palace, the hospital, and island council offices are among the infrastructure within 120 m of the coast. In Pangai, nearly 40% of households within 120m of the coast reported flooding in the past and 30% reported annual flooding.

Interesting to note that when residents were asked how coastal erosion could best be managed, respondents showed little enthusiasm for relocation. However, when asked about sea-level rise, people commonly suggested relocation as a viable option. The authors of the study concluded that it appeared Lifuka's people perceive coastal erosion as something local and visible that can be dealt with through structural means, but that sea-level rise causes fear.

The maps to the right and below show inundation modelling applied to Lifuka (right), and zoomed into Pangai (below).

The map below of Pangai shows inundation scenarios at different SLR by 2100. 'Intermediate-high' shows inundation at 1.4m relative sea level rise, and 'Highest' shows the level of inundation at 2.9m relative sea level rise.

The map to the right shows Lifuka risk zones under an equivalent Category 5 Tropical Cyclone event - much of the built up areas would be subject to inundation +/- 'damaging wave activity', particularly around Pangai.

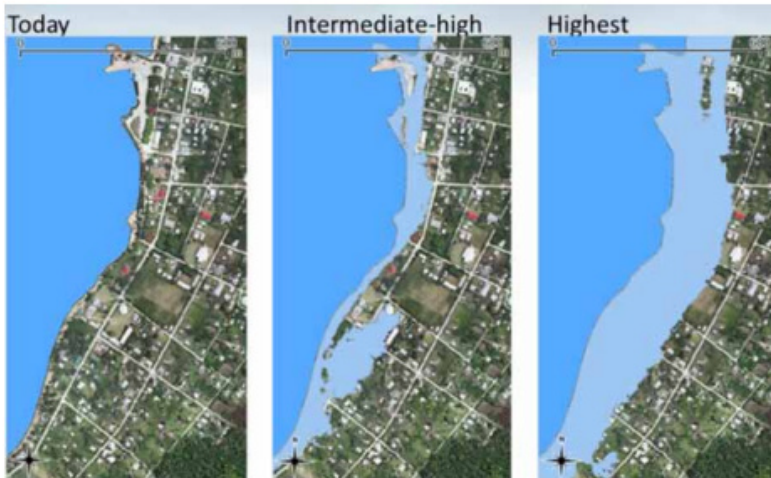


Figure 25: Sea-level scenario in Pangai in 2100

Source: SPC (2021)

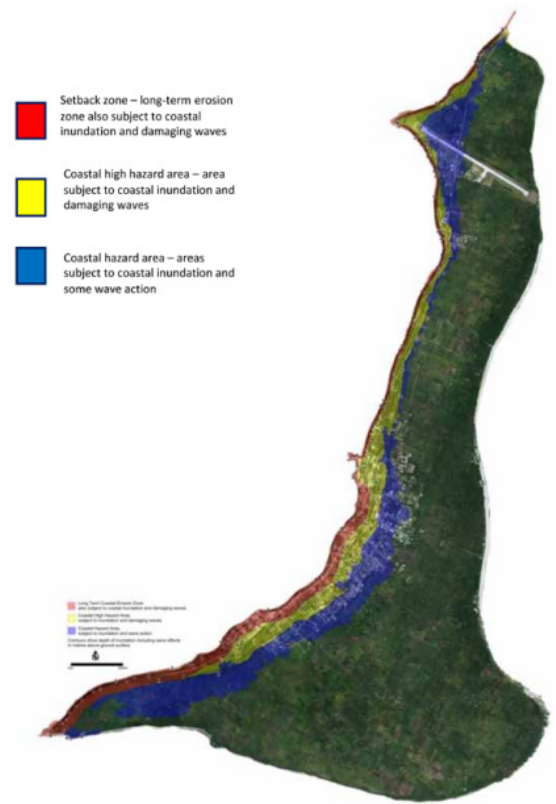


Figure 32: Hazardous zones in Lifuka in a 1:100 year storm event (equivalent to a category 5 tropical cyclone). See the report C.1.0 Coastal hazards for methodology.

Source: SPC (2021)

Lifuka, Ha'apai - fresh water security

The study also investigated the fresh water lens in Lifuka which was noted to be both fragile, at risk by rising sea levels, and highly-sensitive to rain levels - thinning out quickly during dry spells. Records from the last 30 years shows Lifuka has one of the lowest average monthly rainfalls in Tonga meaning those relying on rainwater stores will continue to have some dependence on ground water in future. Assessment of the thickness of the freshwater lens found it to be thickest near Hihifo (9m thick at the time), and just 3m thick in other areas.

ENVIRONMENT

SAMOA

CONTENT

NATIONAL LEVEL VIEW

APIA, UPOLU - VAISIGANO RIVER FLOOD RISK MAPPING

APIA, UPOLU - STORM SURGE RISK ANALYSIS

NATIONAL LEVEL VIEW: Pacific 'NextGen' environmental projections for Samoa (CSIRO and SPREP, 2021)

BY ~2050

- Annual rainfall could change by -7% to +8% (low emission scenario) to -8% to +5% (high emission scenario). There is a range of future possibilities, with the median projection of little change in annual and November-April rainfall, and a small decrease in May-October
- Temperatures could be between +0.4 degrees celcius to +1.1 degrees celcius higher (both low and high emissions scenario)
- Cyclone damage has risen due to extreme winds and rainfall, coupled with sea-level rise, destructive waves, storm surges and coastal flooding
- Sea level rise will cause coastal inundation, erosion and saltwater intrusion into aquifers. Median sea-level projections for Samoa for 2050 were provided at 0.22m (low emissions scenario) to 0.27m (high emissions scenario)
- Coastal communities are highly exposed with 61% of the population living within 1 km of the coast
- Infrastructure within 500 m of the coast accounts for 47% of the total asset number and 48% of the total infrastructure replacement value

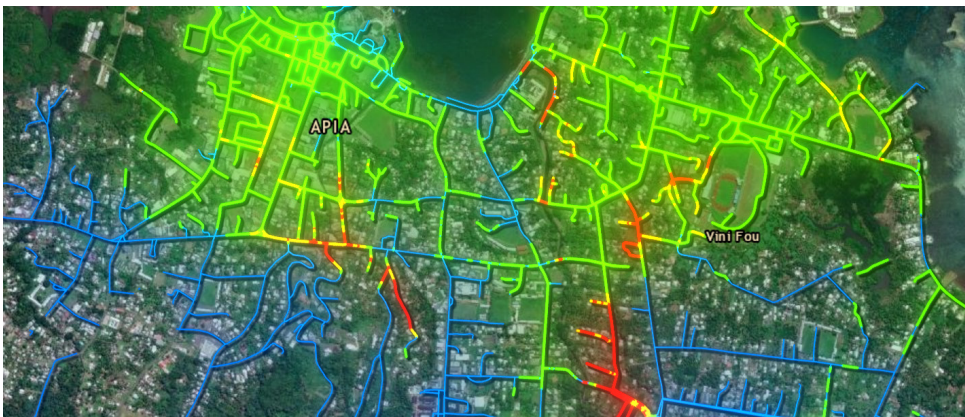
As stated in the 'context and limitations' section, there is medium to high confidence that Tropical Cyclone frequency will drop in the coming century, but that Tropical Cyclone intensity and rainfall rate will increase (CSIRO and SPREP, 2021).

Apia, Upolu - Vaisignano river flood risk mapping

Apia generally sits about on metre above sea level and was developed in what was originally a wetland environment. The Vaisigano catchment passes through the urban centre of Apia and can 'favour rapidly rising floods during periods of intense rainfall', likely to be exacerbated by progressive climate change (MNRE, NIWA, 2022).

Due to a number of successive and destructive flash flooding events, e.g., 2012, 2020, investments have been made in river monitoring and alert systems, and flood risks have been modelled.

The following maps highlight flood exposure and relative risk areas for human safety and building damage in Apia in a 1 in 100 year event.



Vehicle Human Safety Threat (left)
Red = extreme threat to human safety
Yellow = medium threat
Green = low threat

Source: MNRE and NIWA (2022)



Building Human Safety Threat (below)

- Red = extreme threat to human safety
- Yellow = medium threat to human safety
- Green = low threat to human safety

Source: MNRE and NIWA (2022)

In the map above, particular human safety 'hot spots' seen south of Apia's centre (note red shading of ~15 buildings and yellow shading for ~15 more towards the bottom of the map) in a 1 in 100 year event.



Building Damage. Medium level threat (yellow) is seen for almost half of the buildings mapped above in a 1 in 100 year event.

Source: MNRE and NIWA (2022)

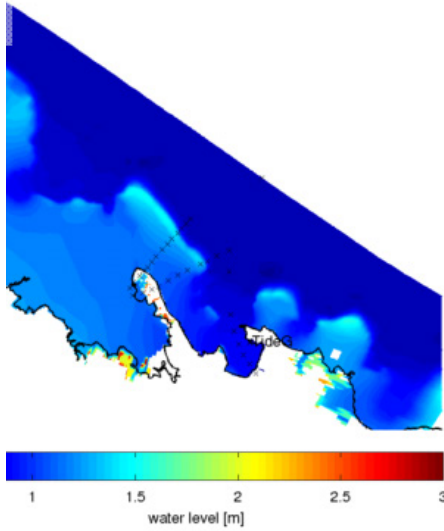
Apia, Upolu - storm surge risk analysis

Modelling done in 2014 under The Centre for Australian Weather and Climate Research mapped out different scenarios of sea-water flooding in 1 in 20 year, 1 in 50 year and 1 in 100 year events.

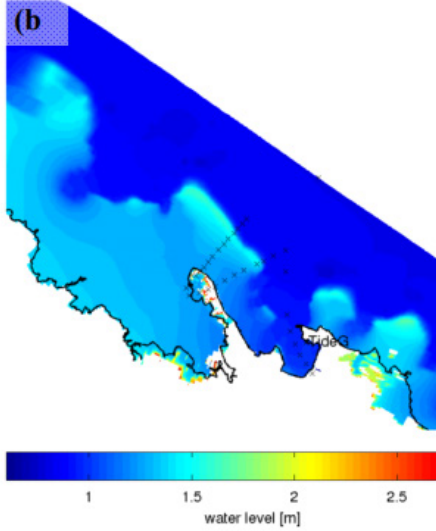
The maps below show four scenarios for Apia in a 1 in 50 year event on different sea level rise scenarios.

the entire northern end of Mulinu'u Peninsula in Apia becomes inundated under water level conditions associated with 20-year and 50-year tropical cyclone storm tides (Hoeke et al, 2014)

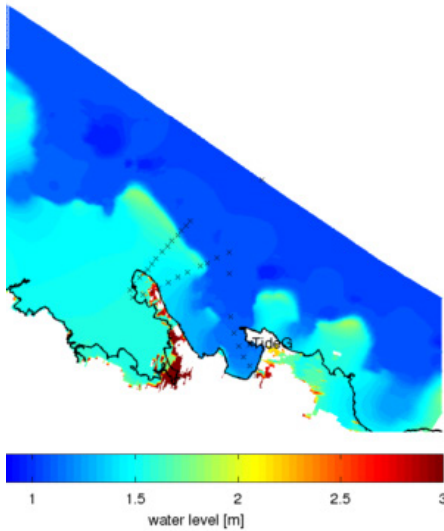
a, Median water level, Return Period 50 years, Scenario 0 cm



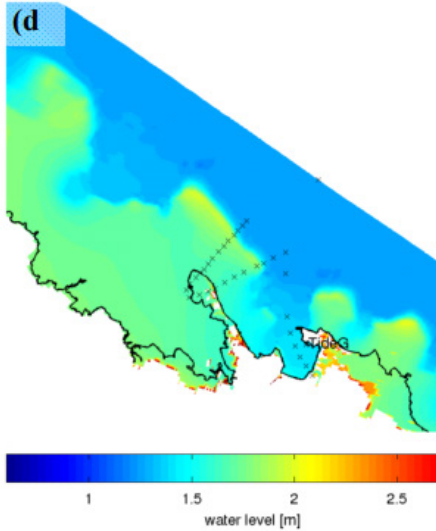
Apia, Median water level, Return Period 50 years, Scenario 14



c, Median water level, Return Period 50 years, Scenario 30 cm



Apia, Median water level, Return Period 50 years, Scenario 57



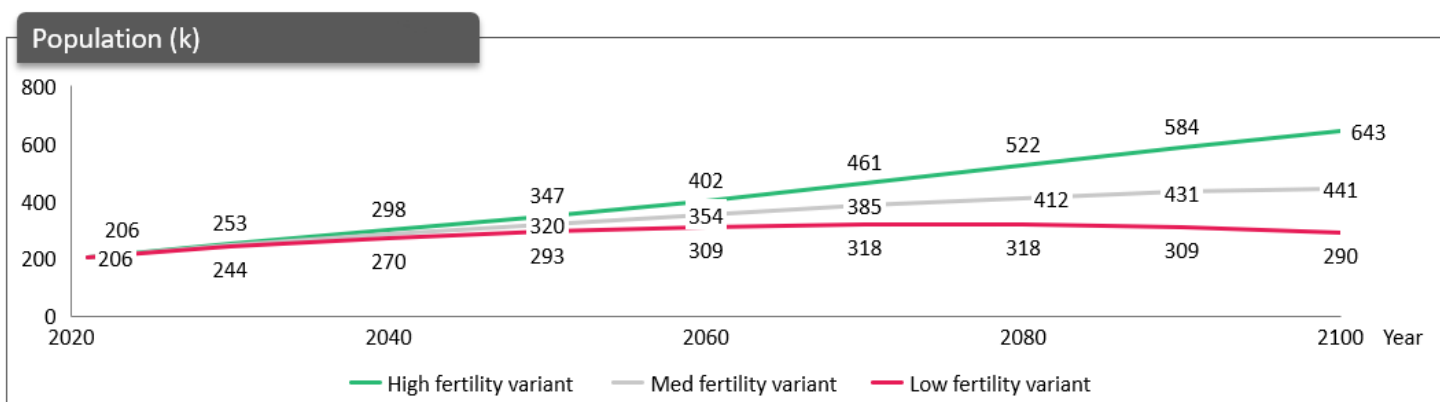
Source: Hoeke et al (2014)

APPENDIX

CONTENT

UN POPULATION DIVISION PROJECTIONS
ASSUMPTIONS TABLES (ALL PROJECTIONS)

UN POPULATION SCENARIOS: SAMOA



Fertility rate assumptions:

Scenario	2021	2030	2040	2050	2060	2070	2080	2090	2100
High	3.93	3.91	3.63	3.33	3.11	2.90	2.73	2.60	2.51
Med	3.93	3.51	3.13	2.83	2.61	2.40	2.23	2.10	2.01
Low	3.93	3.11	2.63	2.33	2.11	1.90	1.73	1.60	1.51

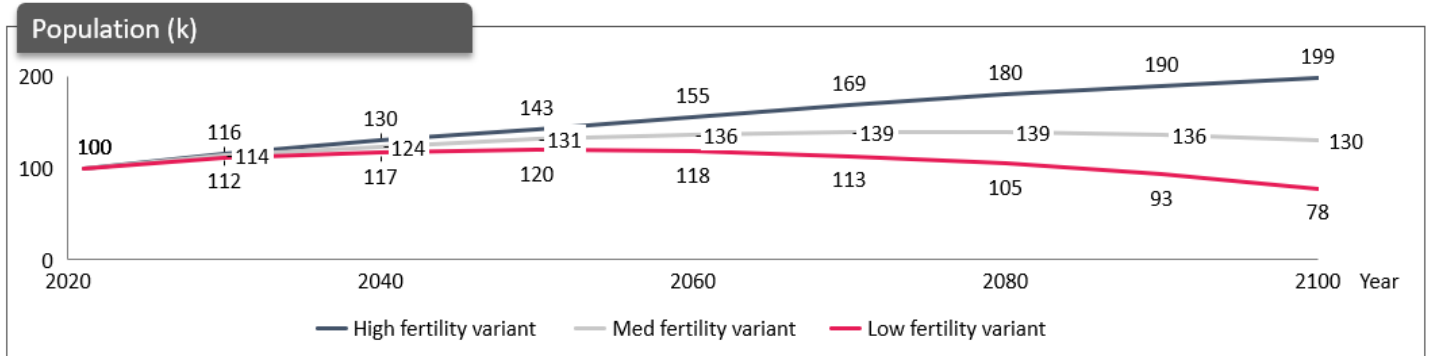
Note: Fertility rate = live births per woman. Population scenarios have identical assumptions on life expectancy, sex ratio at birth, mortality rates, absolute migration numbers
Source: Samoa Bureau of Statistics; UN Department of Economic and Social Affairs

OTHER KEY ASSUMPTIONS IN UN POPULATION PROJECTIONS (ALL SCENARIOS): SAMOA

Dimension	2021	2030	2040	2050	2060	2070	2080	2090	2100
Sex ratio at birth	108	108	108	108	108	108	108	108	108
Life expectancy at birth	72.8	73.8	75.3	76.9	78.4	79.9	81.4	82.9	84.2
Infant mortality rate	14.1	12.1	9.1	6.8	5.4	4.4	3.6	3.0	2.6
Net migration (thousands)	(1.1)	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)

Note: Sex ratio at birth = males per 100 females at birth; infant mortality rate at birth = infant deaths per 100 live births
Source: UN Department of Economic and Social Affairs

UN POPULATION SCENARIOS: TONGA



Fertility rate assumptions:

Scenario	2021	2030	2040	2050	2060	2070	2080	2090	2100
High	3.24	3.34	3.21	3.02	2.85	2.71	2.59	2.49	2.44
Med	3.24	2.94	2.71	2.52	2.35	2.21	2.09	1.99	1.94
Low	3.24	2.54	2.21	2.02	1.85	1.71	1.59	1.49	1.44

Note: Fertility rate = live births per woman. Population scenarios have identical assumptions on life expectancy, sex ratio at birth, mortality rates, absolute migration numbers
Source: UN Department of Economic and Social Affairs

OTHER KEY ASSUMPTIONS IN UN POPULATION PROJECTIONS (ALL SCENARIOS): TONGA

Dimension	2021	2030	2040	2050	2060	2070	2080	2090	2100
Sex ratio at birth	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1
Life expectancy at birth	73.7	72.4	73.7	75.1	76.4	77.7	79.1	80.5	81.9
Infant mortality rate	9.6	7.3	5.8	4.7	3.8	3.1	2.7	2.3	2.0
Net migration (thousands)	(0.9)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)

Note: Sex ratio at birth = males per 100 females at birth; infant mortality rate at birth = infant deaths per 100 live births
Source: UN Department of Economic and Social Affairs

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