PUKAPUKA – TE ULU O TE WATU

A community case study from the Cook Islands

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1. Research Context

Climate change is intensifying with a wide range of challenges to the sustainable development and resilience of all Pacific Island countries. Pacific political leaders collectively and individually continue to underscore that climate change remains the single greatest threat to the livelihoods, security, and wellbeing of the peoples of the Pacific. Community leaders also emphasise the need to mitigate and adapt to the effects of climate change because communities want to continue living in their own countries, for as long as possible.

Mobility has always been a part of Pacific ways of living and is part of our resilience. This means that mobility is a measure of last resort when other options for the ongoing flourishing of life have been exhausted. In the context of climate change, mobility includes a broad range of responses influenced by individual, family, and community circumstances. It can include temporary movement of people within and between countries to support community resilience (e.g., via internal recruitment for work and international labour mobility schemes), relocation of people and communities within a country (whether voluntary or not, including in response to climate-related hazards), and permanent migration across the Pacific or further afield.

Consideration of climate-related (im)mobility also needs to account for other common forms of human mobility such as displacement, where people are forced to leave home to save their lives, and immobility, where people and communities adapt and respond to climate change without everyone moving, whether that 'immobility' is voluntary or not.

Climate change is adding to existing drivers of mobility, especially economic mobility, in the Pacific and elsewhere. Attributing current mobility decisions to the direct effects of climate change can be difficult, but climate change-related hazards will impact Pacific Island peoples' wellbeing including their heritage, culture, language, and ancestral connections to land; security, including water shortages, the actual loss of land and increased risk to life from intensifying extreme weather events; and livelihoods, including salt-water intrusion affecting agricultural production.

This case study is one of 17 undertaken as part of a comprehensive research project, funded by the New Zealand Ministry of Foreign Affairs and Trade (MFAT), known as Climate Immobility Research in the Pacific. The overall goal of the research is to "enhance Pacific resilience and well-being and ensure the livelihoods, security and well-being of the peoples of the Pacific are protected in the context of climate change" (MFAT, 2021, p. 25). Underpinning the overall goal is acknowledgement of Pacific values, knowledge and culture, and Te Tiriti o Waitangi. Each case study explores climate and hazard risk factors, resilience and decision-making practices, mobility patterns, land and marine tenure, understandings of wellbeing, and climate mobility-associated loss.

This case study was undertaken in Pukapuka in the Cook Islands, an island country in the South Pacific consisting of 15 islands. About 400 people live on Pukapuka, all of whom are Cook Island Māori. The population of the Cook Islands is 14,987 (Cook Islands Statistics Office, 2022), with over 60,000 Cook Islanders living in Aotearoa New Zealand and Australia.

2. Pukapuka

Pukapuka (Te Ulu o te Watu) is an atoll in the Northern Cook Islands with cultural influences from nearby western Polynesia. From a mobility perspective, Pukapuka embodies a community that primarily desires to remain rooted in its location. Paradoxically, this includes its transnational community.

The place

Pukapuka is situated on the western margin of the Manihiki Plateau, 527 km west-southwest of Rakahanga, its nearest Cook Island neighbour, making it one of most isolated atolls in the Cook Islands. It is 1,140 km northwest of Rarotonga. The atoll's shape resembles a blunt-nosed stingray, with truncated north and south ends and a tail. It measures 8.4 km north–south across the 'wings,' and 4.7 km east–west, excluding the

5 km tail. The total platform area is 29.5 km^2, including the tail, with about 5 km^2 of exposed land.[1]

Figure 1: Map of Pukapuka, Cook Islands

The reef rim has three small islands:

1. Pukapuka, in the north-west, is helmet shaped with an area of 1.4 km^2 and is where everyone lives.
2. Motu Ko, to the south, has an area of about 1.5 km^2 and is the site of an airstrip. The distance between Pukapuka and Motu Ko is 4.6 km and includes a 400 m-wide reef flat with scattered motu (small islands) flanked by gravel bars.

[1] Other features of Pukakuka are the outer reefs surrounding the atoll, which are best developed to the south and west including the southern part of the tail where they are up to 250 m wide. The western tip of the tail features a sand cay, primarily composed of rock and rubble, with a reef flat covered in sand. A reef, roughly 150 m wide, continues along the northern and eastern sides of the island. The atoll is encircled by a spur and groove system which is most prominent to the northeast and southeast and extends over 450 m seaward and descends approximately 50 m into the deep water.

3. Motu Kotawa, on the westernmost rim apex, is a triangular-shaped island about 2.1 km^2 that points toward the west-lying tail. This 'tail' is a submerged unbroken reef, which is ~3–9 m deep and terminates with a ~36 ha sand cay.

Just south of Pukapuka Island, on a reef flat, an artificial channel approximately 20 m wide has been excavated to provide barge access to anchored vessels beyond the reef.

The lagoon is 8.3 km^2 with coral patches and overlaps with the inner reef flat to the southwest and northeast. The lagoon is ~50 m deep and features at least 12 reticulated basins, with some near Motu Ko being shallow, rubbly, and reef covered.

The physical geography of this area, which included rocks, breakers, heavy surf, and no safe anchorage, greeted Admiral John Byron in 1765 when he happened upon Pukapuka thinking he was in the Solomon Islands (Byron & Gallagher, 1964). He named this atoll the Isles of Danger before moving on.

From a meteorological perspective, there is a noticeable distinction between the Southern Cook Islands and Northern Cook Islands. Pukapuka, in the Northern Cook Islands, is exposed to more severe weather events and climate-related environmental hazards like rising water tables and soil salination. Like most Pacific countries, the options of relocating or adapting are part of the same conversations.

The people

It has been estimated that Pukapuka was first settled around 1300. Local traditions say that the island was formed when the god Tamayei raised a rock from the ocean and, from this rock, Mataliki, a god and founding ancestor of Pukapuka, was born (emerged).

Today, Pukapuka has a population of just over 400 living in one area, with an estimated 10,000 living outside Pukapuka (Borofsky, 2012). Pukapuka stands out culturally and linguistically from its neighbouring islands, with Te Leo Wale (the language) being spoken by over 3,000 people worldwide (Solomon, 2022). The Pukapuka atoll community has close kinship ties to Nassau, a small low-lying 1.3 km^2 island about 88 km away. The atoll has a wharf, high school, hospital, solar farm, community hall, and three churches.

With the absence of job opportunities outside government roles, many individuals have migrated abroad to reunite with family and seek employment. People from Pukapuka can

be found throughout Aotearoa New Zealand. There is a sizable South Auckland community that is divided into two community groups. The original group, the Pukapuka Community of Aotearoa New Zealand, has its headquarters in Mangere. Another group, Ulu o te Watu Incorporated Society, with headquarters in Otahuhu, was established in 2012 because of dissatisfaction with leadership of the Pukapuka Community of Aotearoa New Zealand. Both groups are active, with programmes in place to bring the community together to advance the people of Pukapuka in Aotearoa New Zealand. Participants from the Pukapuka population in South Auckland participated of this case study.

There is also a small translocal Pukapuka community based in Rarotonga, Cook Islands.

From a climate change-mobility perspective, Pukapuka represents a 'staying in place' community that has experienced both gradual- and sudden-onset impacts of climate change. With a significant population in Aotearoa New Zealand, the Pukapuka population has been, or continues to be, mobile, with those staying at home making it possible for others to leave.

3. Methodology

The research project *Climate (Im)mobility in the Pacific* was co-designed to generate knowledge using formal and informal Indigenous qualitative social science methods. For each country, the research approach was informed by methodological contributions from Indigenous scholars. This was to ensure consistency with Indigenous research principles.

Relationship building, ethics and community approval

During 2022, the research team undertook co-design consultations with Cook Islands representatives to agree on the design of the research, its approach, and its alignment with government and local priorities and needs.

The University of Auckland Human Participants Ethics Committee approved the Cook Islands country ethics application on 29 March 2023.

The Cook Islands issued a research permit in April 2023 in accordance with the National Research Policy and Guidelines. Letters of support from key community and government leaders were supplied as part of this process.

The research took place amongst the Pukapuka Community in Auckland on May 14 and 25, 2023. The research in Pukapuka took place from August 10–12, 2023.

The research team

A key prerequisite of the study design was to engage experienced and emerging Cook Islands researchers who are fluent in the local languages of the sites in which we held our workshops, including Te Leo Wale in Pukapuka. The in-county researcher, Elizabeth Koteka-Wright, is from Pukapuka, wrote her MA thesis on migration in the Cook Islands and has held high government posts such at the Cook Island High Commissioner to New Zealand and the head of Office of the Prime Minister. Rima Moekaa, also an in-country researcher, is a well-qualified education specialist and researcher and speaks fluent Rarotongan Māori. Overall research co-lead Dr Christina (Tina) Newport is also a Cook Islander and lives in Vaimaanga.

Engaging a team with ancestral connections to the Cook Islands, who are well respected and speak the language, generated nuanced understandings of the entangled themes of mobility and the impacts of climate change over generations and is a unique feature of this study design.

Recruitment of participants

Both the Pukapuka community in the Cook Islands and in South Auckland, Aotearoa New Zealand, were involved in the research. In South Auckland, community members were invited to two separate community meetings by Elizabeth Koteka-Wright – one on the 14th and one on the 25th of May 2023. The meeting on the 14th was also attended by Dr Christina Newport, Professor Yvonne Underhill-Sem and Melina Tuiravakai (project co-ordinator at the time)

We recruited 144 Pukapuka community participants overall. There was a particularly large turnout in Pukapuka because our in-country researcher, Elizabeth, is well respected on the island and was visiting for only 3 days.

Elizabeth facilitated all workshops on the atoll and in Auckland.

Overall, 120 participants from Pukapuka atoll contributed to the study, and 24 from Auckland, Aotearoa New Zealand. The research activities and numbers were as follows:

- 115 in community workshops in Pukapuka; 24 in community workshops in Auckland
- 4 key informant interviews in Pukapuka
- 1 'walk-the-land' observation and conversational interview with a community leader in Pukapuka

In the May 2023 workshops we held in South Auckland, 24 people participated in two workshops: one for men and the other for women. In August 2023, Elizabeth Koteka-Wright travelled by chartered flight to talk with the Pukapuka atoll community. There were two workshops there – one for young people and another for adult and older generations. Both workshops were grouped by three village groups with a mix of males and females.

See **Appendix 1** for a breakdown of the participants from both Pukapuka atoll and South Auckland, including gender, age, and employment.

Figure 2: Pukapuka South Auckland community workshop men and women participants

South Auckland, 14 May 2023. Photographer: Melina Tuiravakai

Methods

The methodology for this research was informed by the scholarship of Herman (2013), Futter-Puati and Maua-Hodges (2019), Newport (2019), Te Ava and Page (2020), and Wright-Koteka (2006).

Three research methods were used to collect data.

1. Key informant interviews

Key informant interviews were one-on-one conversations with village elders. The interviews were audio recorded and conducted by Elizabeth. Each interview took about 60 minutes.

2. Community workshops

Elizabeth used conversational discussion in the community workshops. One workshop in New Zealand included groups of men and women. One workshop in Pukapuka included mixed groups of men and women in Pukapuka. A Youth workshop of mixed men and womens groups was held separately in Pukapuka.

During each group workshop, Elizabeth posed questions relating to five themes: environmental challenges and movements; resilience and wellbeing; decisions and peace; land and marine tenure, use and planning; and climate mobility-associated loss. Community members were invited to share their insights, stories, and experiences in relation to these themes. Each session lasted for up to 1 hour, then each workshop group took turns to share their thoughts to the whole group.

3. Walk-the-land method

One elder walked with Elizabeth around Pukapuka atoll. Observations relating to environmental, social, and cultural changes were recorded, as were stories and experiences relating to the impacts of climate change in Pukapuka.

Figure 3: Pukapuka community workshop men and women participants

Pukapuka, 2023. Photographer: Elizabeth Wright-Koteka

Data transcription, analysis and sensemaking

All conversations, interviews, workshop data, and researcher reflections were translated into English and coded using NVivo 14 data analysis software. Photographs and video clips were also gathered.

All material, including previous research publications, were shared with the wider research team and discussed so that everyone could share their insights. The research team undertook sensemaking sessions and debriefed during and on the completion of formal research activities. These sessions provided opportunities for more contextual and nuanced analysis because members of the leadership team had relevant previous research experience in the Cook Islands.

In the next sections, we present historical information about mobility relevant to the people of Pukapuka. This is followed by feedback and findings from the community on a range of topics that demonstrate how the community continues to maintain strong connections to land, ocean, and cultural traditions as climate change threatens their traditional ways of living and being.

4. History of Mobility

As described earlier, Pukapuka has histories of mobility both within the country, translocally, to Rarotonga, and transnationally to Aotearoa New Zealand and Australia.

Pukapuka has also recently become home to a small I-Kiribati community (Etches, 2022). We did not have the time to interview this group, although these dynamics are important to understand, especially in terms of land tenure and conflict resolution.

Historical settlement and mobilities (ancestral time/ancient memory)

Pukapuka's resilience is reflected in the preservation of its cultural stories and traditions. Stories reflect a history of a seafaring people, survival, exploration, cultural richness, and links to other islands including Tonga, Niue, and Samoa. Reference to more than one god is often made.

> *Our origins are that we are descendants of Mataliki. The story goes that the God Tamayei was flying over the ocean and needed a place to rest and so commanded a rock to rise from the ocean floor, and, when it did, our ancestor Mataliki was in that rock. He later sailed to a land called Tongaleleva and found a wife, and from their children we became a people. We still tell that story today to our children. (Key informant)*

The later voyage to Tongaleleva mentioned in this quote was directed by another god, *Vaelua*. The wife Mataliki found was named Vaopupu and he brought her to Pukapuka – *Te Ulu o te Watu* ('the head of the rock'). This legend is the origin story of Pukapuka and its people.

Pukapuka oral traditions describe a long history of voyaging and movement across the Pacific. This includes the story of Muliwutu where 10 canoes set sail in search of new land, but from this fleet only one canoe returned bearing tales of hardship and survival.

> *It was the canoe of Nookaulava who told the people of Pukapuka what had happened to their fleet. They landed in Tonga and the entire fleet were killed by the Tongans except Nookaulava, who the chief of that place had taken a fancy too. She had a son with the Tongan chief and named him Moko. She asked Moko to go back to Pukapuka and let them know of what had happened, and to avenge the death of her people. (Key informant)*

Recent settlement and mobilities (living memory time)

There was increased migration from Pukapuka in the aftermath of Cyclones. A cyclone in the 1940s saw some move to Rarotonga. At that time, landowners from Pue, in Rarotonga, gifted land to those affected from Pukapuka. More recently, Cyclone Percy in 2005 caused significant damage. The cyclone destroyed nearly all homes and buildings and salt-water intrusion devastated local swamps and boreholes, thus impacting food and freshwater sources (Terry & Falkland, 2009). At the time, the government considered the temporary relocation of people to Aitutaki in response to an offer made to host them. However, based on the devastating experience of Cyclone Martin in 1997, which hit Manihiki (150 km east of Pukapuka) in the Northern Cook Islands, an alternative approach was taken. In 1997, lives were lost, and survivors were evacuated from the island. This time the Pukapuka community was supported to remain in place while recovery and reconstruction efforts took place (C. Newport, personal communication 4 June 2023). However, the precarious and hazardous post cyclone conditions drove an acceleration of departures from the island to more populated islands in the south, such as Rarotonga, and Aotearoa New Zealand (Rongo & Dyer, 2014).

> *I think that the intention of those who left [following Cyclone Percy], was to go overseas and work to build up their lives again. To repair their houses and get a bit of money to start again. I think that's why they left. But they haven't come back. (Key informant)*

Community members migrated with the intention to return; however, there is uncertainty about when and if that will happen.

5. Challenges and Movements

In Pukapuka, the intricate interdependence of the people, their environment, and their semisubsistence livelihood is strikingly evident. The natural environment forms the backbone of their livelihoods as it is the primary source of sustenance, with local diets heavily reliant on the bounty of the land and sea. This semisubsistence livelihood is complemented by imported cargo supplies, which typically include basic staples such as flour, sugar, and canned meats.

Recognising the fundamental role of Pukapuka's natural environment in sustaining livelihoods and way of life prompts a deeper reflection on the challenges that face this relatively isolated community in the face of a global economy. One interviewee illustrated the challenge of sustaining a traditional lifestyle in Wale:

> *Transportation from the outside is an issue and the cost of living is outrageous. Here in Wale [the name people from Pukapuka call their island], everything cost 3 or 4 times more than Rarotonga for imported food. But we manage to live on our own local food. But the question is, will we always be able to live on our local food? (Key informant)*

Unfortunately, the impacts of climate change loom as the most significant threat to the delicate ecosystem on Pukapuka, food, and water security. Sea-level rise and coastal erosion have become increasingly pronounced, threatening the physical integrity of the island and its ability to support its inhabitants. Many of the participants in this research emphasised their observations and concerns, for example the following participant articulated the threat to a key staple crop:

> *All the uwi[meeting] had wawa [taro] and they were flourishing. Now this is not the case. Growing wawa is not the same. We can't grow wawa anymore in some of our uwi. It seems easier for the sea to come onto the land, whether it be over the surface or underground, the sea is reaching our uwi. (Key informant)*

> *The seawater has come under the land, through the ground. The wawa at Uta can't be planted anymore. The ground will not allow it to grow. (Key informant)*

Community members also identified that while land is disappearing due to coastal erosion on the ocean side of the atoll, land area is increasing via sediment deposits on the lagoon side. This is causing the lagoon to become shallower and warmer, thereby negatively affecting the marine life including paua (clams).

Changes to the flora and arable land were noted at a community workshop in South Auckland. The men's group noted that these changes had a knock-on effect on the local population's diets and dependence on imported goods:

The loss of planting lands and the complete change of diets. People's diets have already changed to increased imported food. This will further change due to loss of planting lands. (Member of men's community workshop)

It was a common concern among key informants and all community workshop participants that, should these trends continue, people will have no choice but to move. Further still, when asked "Should people be forced to leave the atolls?", the women's group in South Auckland stated that they worried they would be faced with returning to a land that had become "barren."

The Pukapuka community in South Auckland are well established as a transnational community, having migrated and settled there for a variety of reasons over a long period of time. They are regarded as a vital part of Pukapukan life, providing help and support by way of remittances, which can be used to buy goods, and services, and provide fresh ideas to help the community. They also provide hospitality and care for those who travel temporarily to Aotearoa New Zealand for transit, social, health, or other reasons.

It is our way to help our families and look after those who have no place here. (Member of women's community workshop)

We have customs in welcoming people and making them feel at home. We have to help them look for work, shelter, accommodation, homes for themselves, financial assistance. (Member of men's community workshop)

The nature of their kinship ties also means that their role is vital in providing longer term substantive assistance and advocacy for those who travel for the longer term or permanently. This includes providing a place to live. Community members in both the men's and women's groups identified access to adequate and appropriate housing as a key concern in meeting their familial obligations.

It's like us when we moved here. We had to stay with family until we get our own place if we are able to. Some people can't get their own place and still staying with family. It's okay if that's their own family's house. But if it's not, if they are renting, then it is a problem, because you only allowed a certain number of people in the house. If you break the rules of your rental house, you will get kicked out and then

where are you going to go. It takes a long time to get a house from the Housing. (Member of women's community workshop)

This is particularly pertinent given the current housing challenges faced by families in Aotearoa New Zealand and in determining what support transnational communities can provide to fulfil their responsibilities to their kin from Pukapuka. This includes both those who come temporarily and those who stay longer term due to climate change impacts and other driving factors.

There is a strong correlation between the impacts of climate-related changes in Pukapuka and the mobility of the population. The impact of climate change on the environment (e.g., the erosion of shorelines, warming of the lagoon, and salinisation of freshwater sources) poses grave risks to the infrastructure and safety of the population: a population fully aware of, and concerned about, these risks and challenges.

Figure 4: Ground is damaged from rising sea levels and unable to grow crops

Pukapuka, 2023. Photographer: Elizabeth Wright-Koteka

6. Decisions and Peace

Oral traditions are the foundations of the emergence of Pukapukan social structures, as demonstrated in the story of Mate o Wanguna, a time named after a devastating cyclone

that left only 21 survivors. Of these survivors, Te Kula became the *Aliki* (chief) of Pukapuka, and his six children became the founders of the island's chiefly lines. Among these chiefly lines there are three chiefs from Ngake, two from Yato, and one from Loto (villages on the three islets that make up Pukapuka – see map, Figure 1). The Aliki is always selected from Loto's lineage. Other chiefs make up the rest of the *Matai'apo* (subchief) and *Te Kau Wowolo* (leaders). There is also another title called the *yula* that has a similar standing to that of a *Rangatira*. The yula is a title bestowed by the village, and it is held by those who have special expertise or skill. There are two yula of Yato, one in Loto and one in Ngake.

Pukapuka is unique in its enduring adherence to traditional decision-making structures, where village and church authorities play a central role in planning and implementing projects. Each of the three villages (Loto, Yato, Ngake) has their own secretary, chairman, two island councillor representatives, treasurer, committee members, and women's group.

> *The Aronga Mana [customary leaders' group] definitely influences what happens on the island. The island council usually seeks the Aronga Mana's permission and input into their deliberations. There is still that respect for the views of the Aronga Mana and I think that this is a positive thing, especially since on our other islands the mana of the Aronga is not what it used to be. They have, in many respects, lost that authority and it's been taken up by the member of parliament or the island council. Not in Wale, the Aronga Mana are still mana. (Key informant)*

Each of the three church denominations (Cooks Islands Christian Church, Catholic, and Seventh Day Adventist) operates its own committees and distinct events such as sports days. Additionally, there is a unified village-wide youth group, Lopa Tamawine o Mataaliki, complete with a chairman, secretary, treasurer, and committee members. All these groups convene every fortnight at a uwingapule (community meeting). These fortnightly meetings lay out the concerns for the village, upcoming events, and news from the island councillors and projects.

During these meetings, villagers are also able to raise their concerns or any problems they have been having at the village level (e.g., a neighbour's pig going into their taro

patch). These meetings also serve as a time to rotate and update the village on the pule: working groups that clean and protect each motu and the ecological food reserves. These meetings have also, at various times, discussed the possibility of mobility:

> *Some years back, with the previous council, we spoke about where we could possibly move to. Maybe to our other higher islands, like Rarotonga, Ngaputoru [Southern Island grouping of Atiu, Mauke, Mitiaro and Takutea] or Mangaia, where it is higher ground. This was just a bit of brainstorming just in case the sea-level rises and our land will be covered by the sea, we will request to Rarotonga, Ngaputoru, or Mangaia to take us. At that time, we didn't think of New Zealand, but I think New Zealand would be better for us, our people are there, and everything is there. (Key informant)*

While this does indicate that there is community-level discussion around mobility, the ultimate decision to move typically resides with each individual family.

Decision making on Pukapuka is a collective process where everyone, including women, contribute to discussions from which decisions are made:

> *The island is involved in the decision-making process. The kau wowolo and council bring their deliberations to the island meeting and then the island discusses. From those discussions, they will consider what they will do and the direction that they will give to the island. ...everyone at the meeting has a chance to say their views. Both men and women. (Key informant)*

Despite the egalitarian character of these decision-making processes, participants also emphasised that these processes are not immune from interpersonal conflicts and tensions. As such, the community's perception of their leaders' rapport and trustworthiness plays a critical role in engendering the community's cooperation, particularly in the face of disagreements within the community:

> *The leaders of the community must be those that can be trusted. The community needs to be nurtured to grow and to focus on the young people coming through. From my perspective, that's the important thing for us in this group. (Member of women's community workshop)*

Pukapuka also retains traditional conflict-resolution processes, where conflicts are resolved within the community rather than through the (Westernised) court system:

> *The Aliki [chief] and Kauwowolo (mataiapo) [sub-chief] are responsible for resolving the conflict. In modern times, the council serves as the witness to this process of conflict resolution. Usually, they will tell the parties to work out their differences and come to an agreement. If the parties cannot agree, the Kauwowolo and the Aliki will give a resolution because they are ultimately the rulers of the land. Very rarely does the situation reach a stage that the Kauwowolo and Aliki have to step in and the people agree to this process of conflict resolution. (Key informant)*

While conflicts arise for many reasons, particularly around land disputes, one participant noted that land disputes have become less of an issue:

> *Usually on every island there are land issues. I think that in the copra days there used to be land disputes. The main driver for these disputes was money. People could earn money from the coconut trees on the land. Nowadays, land disputes is not much of an issue. There is no monetary value derived from land and so there is no need for a dispute. (Key informant)*

However, climate change impacts exacerbate land availability for uses such as crops and housing due to coastal inundation and erosion. Having less land increases the pressure to access land set aside for other purposes and other community members' entitlements.

7. Land and Marine Tenure, Use, and Planning

The political and decision-making structure across Pukapuka allows each village to have its own autonomy, particularly around land use. Ngake village looks after Motu Ko, Yato village looks after Motu Kotawa, and Loto village looks after Motu Uta. Each village has its own rules for the motu. Fines are handed out for those who break these rules:

> *Some people have broken the rules on the motu. They've gone to the motu when it's been closed. They have been dealt with by the leaders. (Key informant)*

The rules are grounded in traditional protocols that serve to ensure communities have sustainable access to local food sources (Tiraa, 2006):

> *We have our traditions, values, tapenga wenua, tikanga Pukapuka, protocols. We have conservation even with manuiri [visitors]coming on island, we have tribal customs in place. The villages, we have them in place. Even our yolonga – where you will be buried. Not on top of your husband, you go back to your village, to your father's side. All those things – when you want land, when you go to Tua and get thirsty, you will ask for permission to pick the coconuts. (Member of women's community workshop)*

> *There are no boundaries in the sea, except around the motu. There are reserved sea areas for conservation purposes. (Key informant)*

de Scally and Doberstein (2022) discussed integration of local/traditional knowledge (including 'bottom-up' decision-making processes) and adaptation approaches and strategies. They argued that an integrated approach includes many benefits that may help inform and ensure future policy directions are culturally appropriate and sustainable (p. 361). However, in practice, an integrated approach to climate change is also faced with the challenge of the gradual loss of cultural knowledge (Rongo & Dyer, 2014). A case study participant articulated the challenges of maintaining traditional practices in a climate change affected environment:

> *We are trying to maintain our traditional and cultural practices. But they have been affected. For example, we have broken our traditional conservation practices at times because of food shortages. We have harvested kaveu [coconut crab], uto [spongy mass in a sprouting coconut], drinking coconuts, outside of the prescribed timeframes for laui[conservation]. Because the areas that have been dedicated for communal harvesting are not bearing the food. (Key informant)*

Intergenerational ways of strengthening connections as a people by maintaining the practices of social interactions and transfer of stories, traditions, conservation, community structures and cultural practices will assist in maintaining Pukapuka and its special characteristics on island and abroad, despite the challenges that the homeland faces.

Figure 5: Coconut fields and sand build up in lagoon foreshore, 2023

Photographer: Elizabeth Wright-Koteka

8. Resilience and Wellbeing

One of the greatest strengths of Pukapuka is the preservation of traditional knowledge and practices because of the region's relative isolation. Of note, is the continued preservation of ecological and traditional knowledge designed to conserve and sustain the region's cache of rich natural resources.

All men, including boys, know how to fish. All women, including girls, know how to work the taro plantations. All three motu and the main island of Wale have rich taro and pulaka (swamp taro) beds. The women tend the taro, with the matrilineal rights of taro plots passing from mother to daughter. The Pukapuka diet consists primarily of many kinds of fish and taro. There are over 25 different ways of cooking taro.

There are abundant reef and deep-sea fish. Men fish with rods, nets, or spears, and use other styles of fishing unique to Pukapuka. The warming of the lagoon, which impacts the extent and types of seafood available for harvest, was also noted.

Coconuts are abundant and considered the tree of life, with uto, coconut milk, and coconut water consumed daily. Coconut fronds are used for thatching the houses on the motu; all parts of the coconut tree have a practical use.

The villages work together to feed everyone. After sports games, the losing village has to fish for the winning village. The subsistence lifestyle and the protection of these natural resources have allowed people to survive here for thousands of years.

The communal aspects that are evident in the handing down of traditional ecological knowledge, and the management and distribution of food, reflect a form of resiliency. A key informant in Pukapuka shared:

> *I think in planting and fishing we can draw on traditional knowledge to adapt. When you look at our history our people dug out the centre of the island and composted it for generations to turn to swamp and grow taro.*
>
> *This is resilience, people on an atoll growing a crop that doesn't usually grow on atolls. I think that if we draw on this historic fact, we can find some ways to help us grow food despite climate change. The same goes for fishing, we can look back at history and change to suit our needs. We have adapted in terms of improving efficiencies. Change is good, if it is needed. (Key informant)*

Community dynamics are further complicated by considerations of those living with disability and complex health needs, where individuals migrate to New Zealand to access healthcare services and infrastructure that is otherwise unavailable on Pukapuka.

The Pukapuka people are resilient. Their strong foundation of traditional knowledge and practices helps them to adapt to change and maintain a sense of wellbeing.

9. Climate Mobility-Associated Loss

It is recognised that the differentiated impacts of climate change compounds inequities, with greater losses accruing for communities where those least responsible for climate change are at most risk. (Calliari & Vanhala, 2022; Nayna Schwerdtle et al., 2020). This is true for Pukapuka as a 'staying in place' atoll community that is experiencing interconnected dimensions of loss on a significant scale: ways of being now and future ways of being (McNamara et al., 2021).

> *It will be a pity for the land to disappear. Because for us born in New Zealand, we have a physical reference point to home. If it disappears, it will be but a mystical homeland that used to exist in times past. Even though I was disappointed when I*

went there, I was still glad that I was able to see the physical Pukapuka – the place of my origin. (Member of women's community workshop)

At a national level, the movement of people out of the Cook Islands and the outer islands especially has been framed by "depopulation as a major issue" (Puna, 2015). This expands global debates on 'loss and damage' but is a key feature of climate mobility-associated loss in Pukapuka, Responses from community members also indicate a community-level awareness of the correlations between mobility, population, local economies, and infrastructure. Participants stated that Wale needed more income-generating opportunities to attract and retain youth, and that without such opportunities this would be a barrier to resilience and the lifestyle they aspire to.

Community members reflected on the importance of their songs and chants that record their genealogies, Indigenous knowledge, and histories that are held by their elders. Without the means to retain these artefacts, they risk losing crucial cultural heritage.

One aspect of these generational dimensions is visible in the shared familial and community apprehensions regarding the prospect of immobility in later years, and the sense of loss associated with this:

I have heard so many of our old people in New Zealand and Australia say that they would like to go home one more time, to be buried where they were supposed to be buried. I feel sad for them that they never made it back and that's why when my dad said he wanted to come home. We made sure that we brought him back. (Key informant)

At my father's last birthday, his wish was to come home and so my wife and I brought him back and it gave us a chance to do some more work on our house. Our father, of course, has passed, and I am so happy that we granted him his wish to see his homeland one more time. (Key informant)

In this context, the concern around returning later in life transcends individual concerns among the elderly but is a collective familial issue that includes younger generations as they wish to support their elders.

These extracts emphasise a strong sense of relationality and interconnectedness between people, land and sea, and the spiritual elements of Pukapuka. They also emphasise deep concern should these connections be broken. This is a critical aspect that needs to be addressed in relation to associated losses of climate change and (im)mobility.

10. Conclusion

As the Pukapuka community remains in place, it continues to maintain a strong holistic community centredness that is interconnected to land, ocean, culture, and wellbeing; even as climate change threatens their traditional ways of living and being.

The role of their transnational kinship relationships in facilitating support in multiple locations of home are a multidimensional strength now and into the future. Nevertheless, generational apprehensions about being able to remain in place prevail due to the direct impacts of climate change as well as its exacerbating effect on other socioeconomic factors at play.

Intergenerational ways of strengthening connections as a people by maintaining the practices of social interactions and transfer of stories, traditions, conservation, and community structures will assist in maintaining Pukapuka and its special characteristics on island and abroad, despite the challenges that the homeland faces. The community will need to adapt to the challenges of climate change while remaining in place.

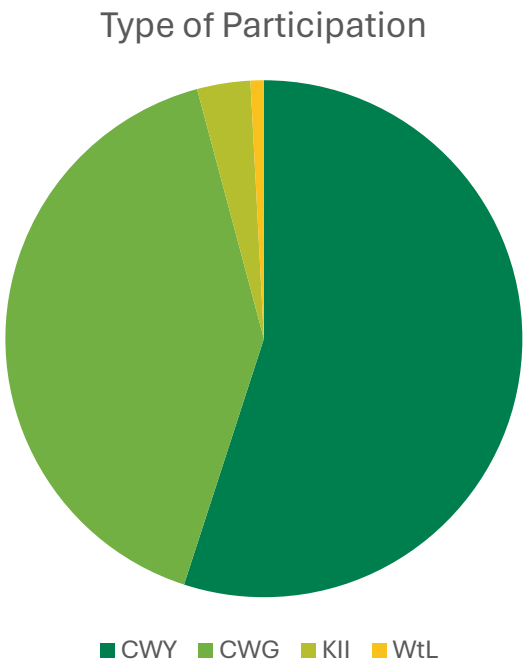
Communities indicated that the national government could strengthen their resilience by, for instance, continually upgrading infrastructure like the port, airport, communications, and water supply. For those who move, assistance is needed to support the hosting communities in Aotearoa New Zealand. Some of the areas identified for support include access to housing, income (employment), and social services, as well as maintaining hubs for the community to congregate and provide services, preserve language, and ensure the continuation of their culture.

Appendix 1: Research Participants

Pukapuka, Cook Islands

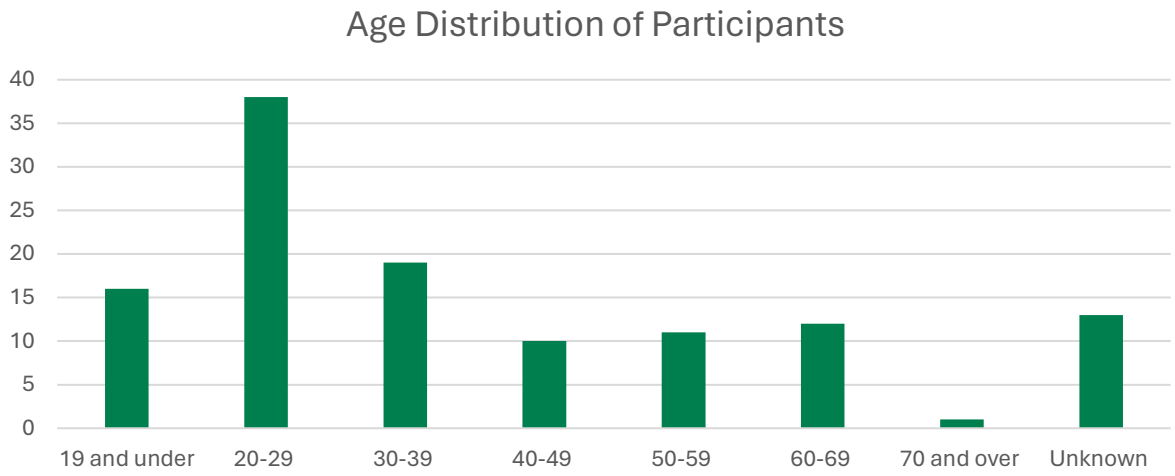
In Pukapuka, Cook Islands, there was a strong turnout for community workshops over a 3-day period from August 10–12, 2023. A total of 120 participants contributed to this study. Four participated in key informant interviews (KII) and one in a walk-the-land (WtL) interview. The remaining participants were divided between community workshops for youth (CWY) and the general public (CWG) (see Figure 6).

Figure 6: Type of participation – Pukapuka, Cook Islands



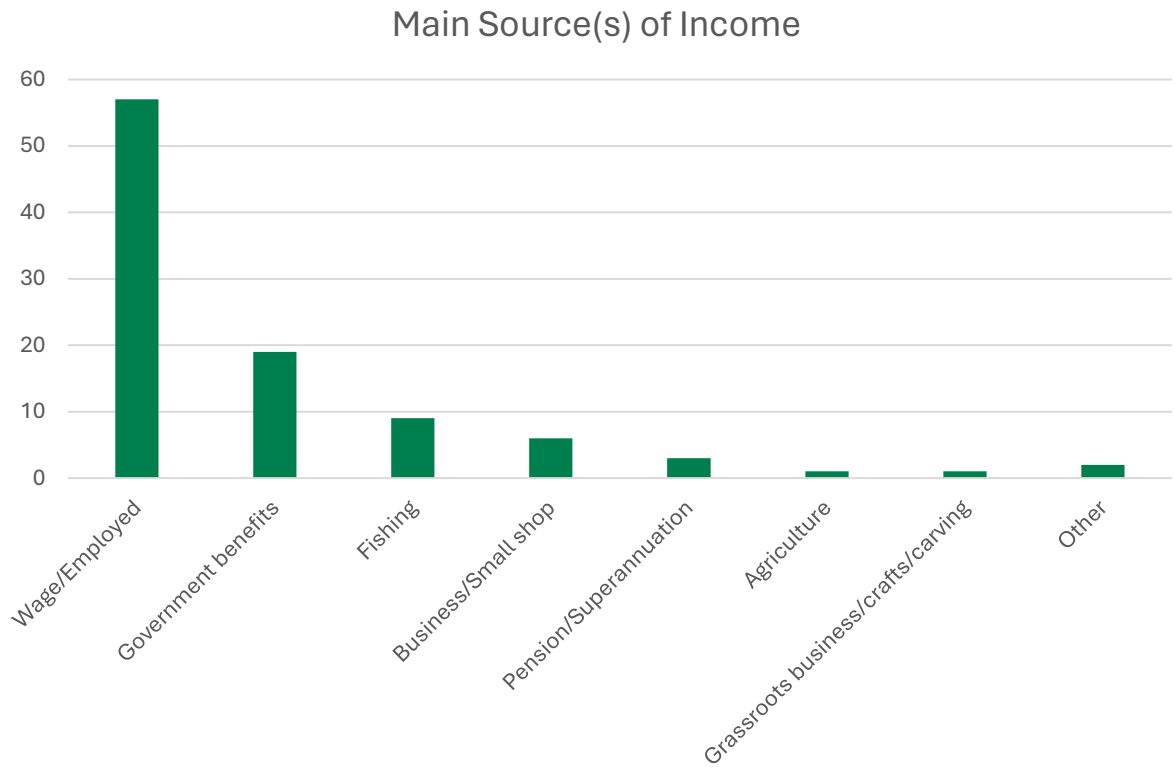
These workshops and interviews involved participants across a wide set of ages from under 19 to 70 or older. The most represented age group was 20–29-year-olds, with 38 participants. Of the 120 community members, 107 have a recorded age (see Figure 7). There were 61 men, 45 women, and one gender nonbinary.

Figure 7: Age distribution of participants – Pukapuka, Cook Islands



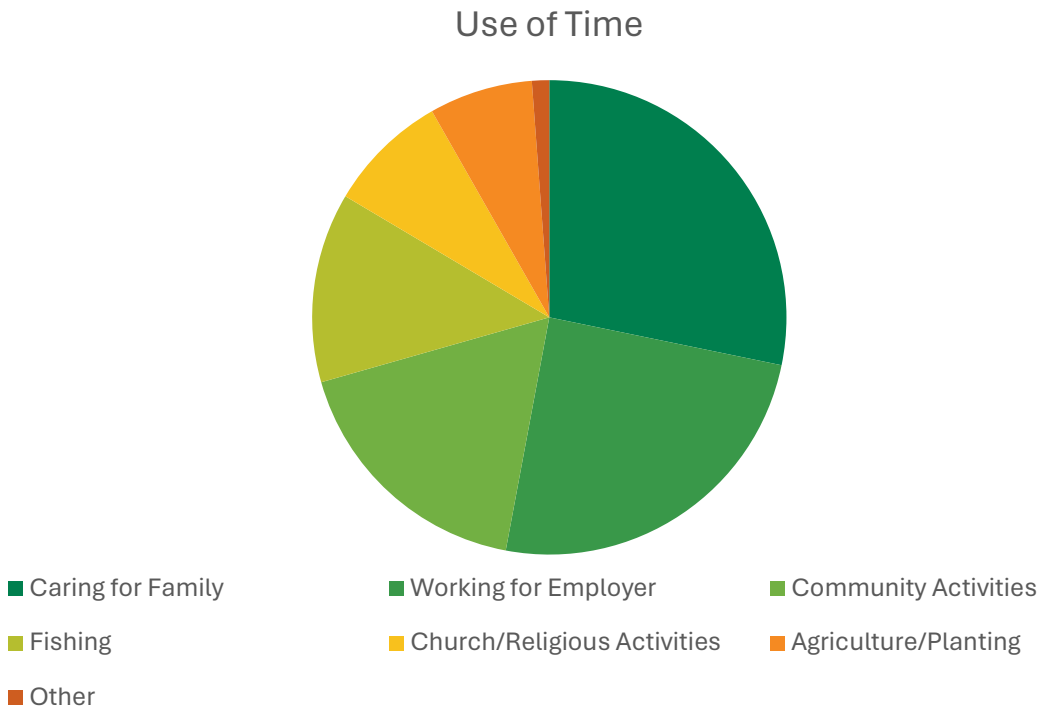
Ninety-two of 120 participants responded to the question "What is highest level of education?" The majority, of 71, had high school as their highest level of education. Two out of every three participants answered the question "What is your main source of income?" Of those 80 who did respond, 12 listed multiple sources of income. The most common form of income was wage/employment, followed by government benefits and fishing (see Figure 8).

Figure 8: Main source of income, Pukapuka, Cook Islands



Of the 120 participants, 50 answered the question “What do you spend most of your time doing each day?”, a 41.6% response rate. Of those 50 who answered, only 12 selected multiple ways in which they spend their time daily. The three most common ways of spending their time were caring for family, working for employers, and community activities (see Figure 9).

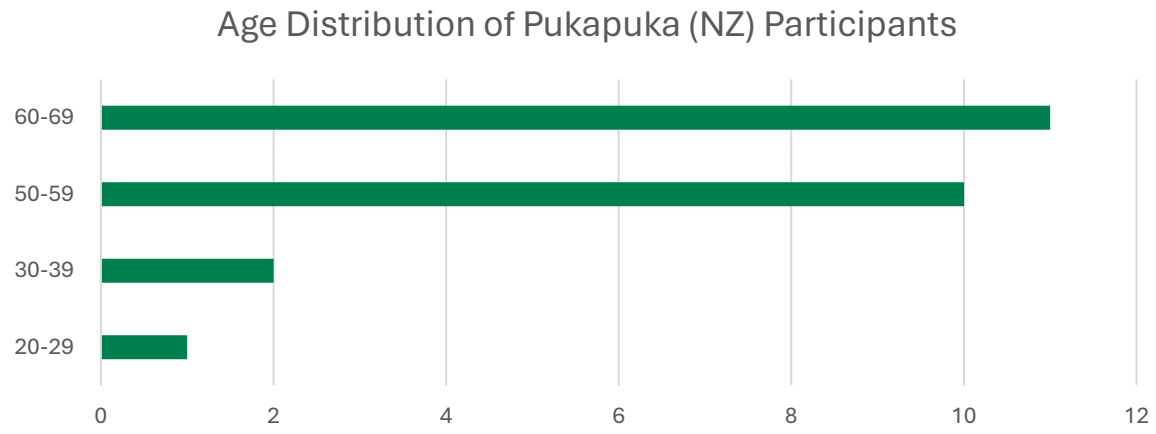
Figure 9: Use of time, Pukapuka, Cook Islands



Pukapuka, South Auckland

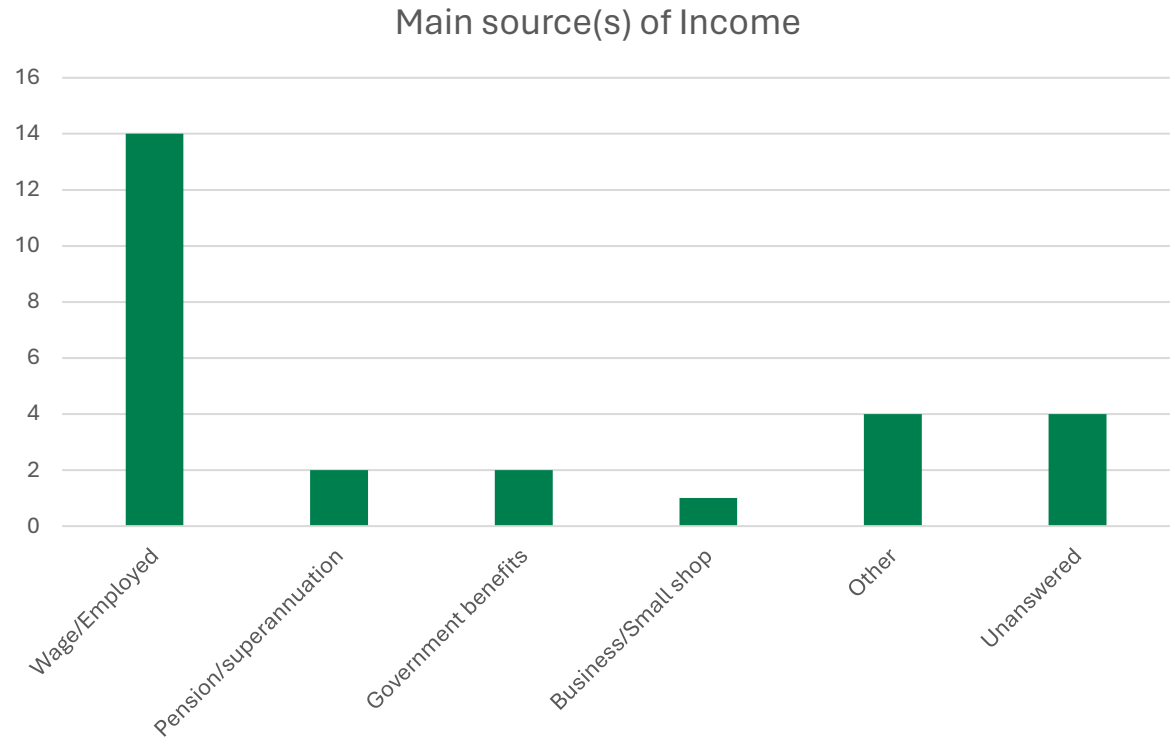
Members of the Pukapuka community in South Auckland presented their perspectives on climate mobility. Participants were involved in two general workshops. The first occurred on May 14, 2023, and the second on May 25, 2023. By gender, participants were well-distributed, with 13 women and 11 men. Of the 24 participants, all but three were aged 50–69 years. Those three remaining were 20–39 years old (see Figure 10).

Figure 10: Age of participants in Pukapuka, South Auckland



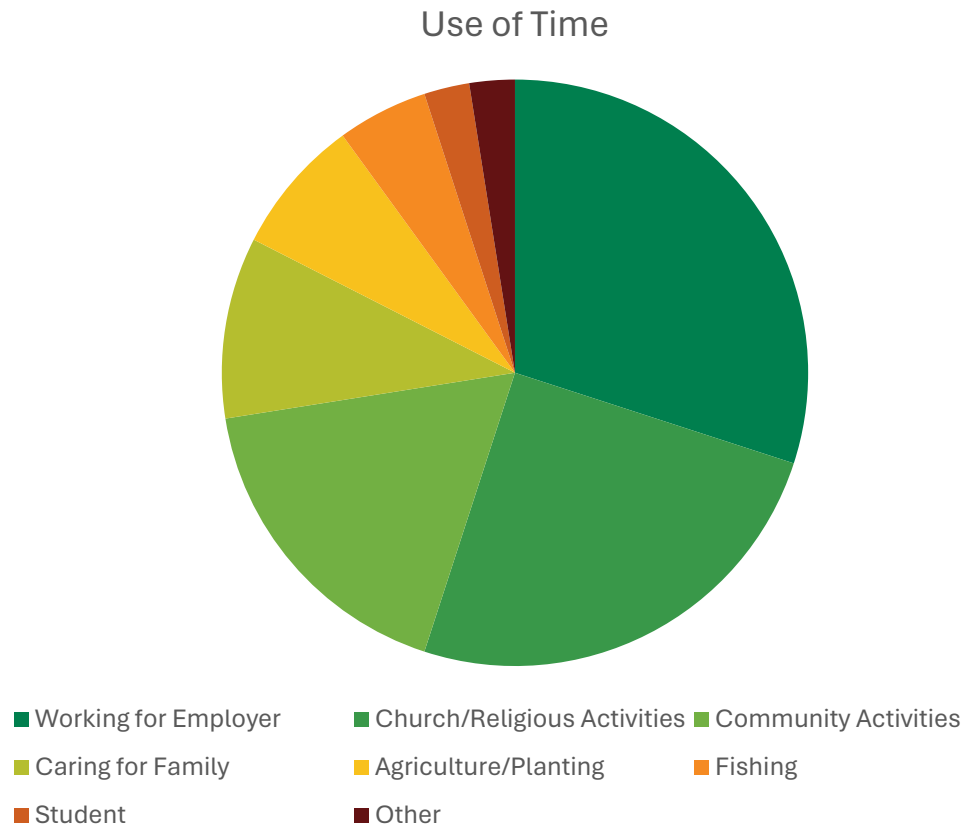
When asked "What is your highest level of education?", participants' responses varied. The greatest number of participants (9) responded that high school was their highest level of education. Fourteen of the 24 Pukapuka community members who participated in this research listed wage/employment as their main source of income. Following this, "other sources" was listed as a main form of income for four participants. Pension/superannuation, government benefits, and business/small shop all had one to two responses (see Figure 11).

Figure 11: Main source of income, Pukapuka, South Auckland



When asked “What do you spend most of your time doing each day?” most participants selected working for an employer (12), church or religious activities (10), and community activities (7). Other responses included caring for family, agriculture, fishing, student, and other (see Figure 12).

Figure 12: Use of time, Pukapuka, South Auckland



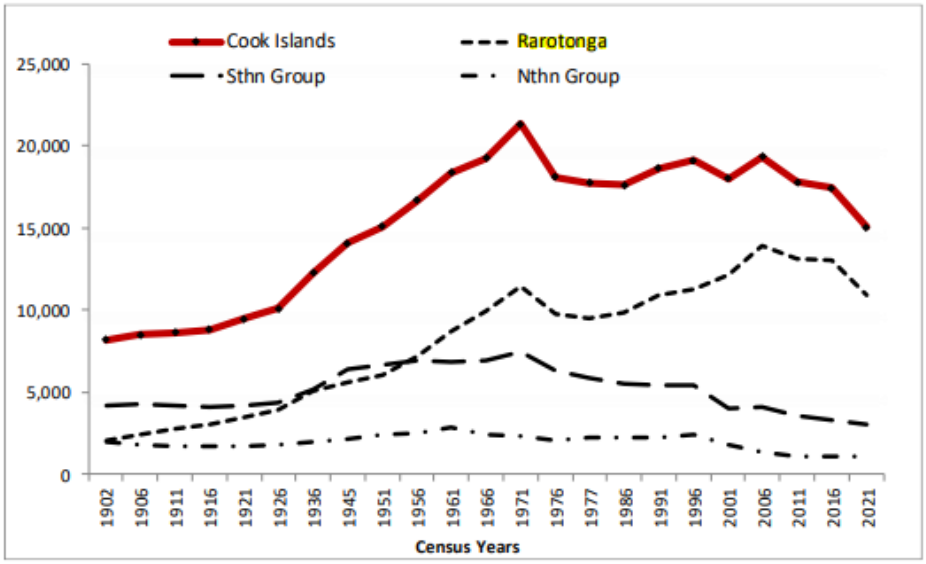
Appendix 2: Cook Islands National Population, and Climate Change-Related Policies

Population context: Cook Islands

In the Cook Islands, there are continued concerns about population size (estimated population 2021 is 14,658), and composition (aging) and that is mostly resident in Rarotonga (Hayes, 2022). More recent concerns are related to the health and wellbeing of its citizens and economic recovery after the COVID pandemic. In addition, long-standing debates continue around the nature of political sovereignty for the Cook Islands vis à vis Aotearoa New Zealand and the Cook Island's sense of self-determination. The Cook Islands has one of the highest GDPs per capita in the Pacific, but like other tourism dependant economies, it is still recovering from the impacts of COVID border closures. Overseas development assistance remains high (NZD98million in 2023; Cook Islands Government, 2023, p. 81).

Population decline is anticipated to continue due to declining fertility and projected net migration of 50–70 young people per year. The annual population loss in the Cook Islands will be evident by 2050 (see Figure 13). However, in-country depopulation will be balanced by the growth of people with Cook Islands ancestry in Aotearoa New Zealand and Australia. It is estimated that only 11% of all Cook Islanders live in the Cook Islands (Hayes, 2022, p. 31) meaning most people with Cook Islands ancestry live outside the country. The nature and scale of Cook Islanders' mobility as it relates to maintaining connection with their 'home country' requires further research and analysis.

Figure 13: Cook Islands total population from 1902 to 2021 (Cook Islands Statistics Office, 2022)



Climate context: Cook Islands

Figure 14: Map of the Cook Islands

There is a noticeable distinction between the Southern Cook Islands and Northern Cook Islands. Mean and extreme temperatures, and rainfall, are higher in the Northern Cook

Islands than in the south. A trend of increasing warm nights can be observed and it is predicted that temperatures will increase in the Cook Islands.

Natural hazard exposures in the Cook Islands are due to variations in temperature, rainfall (drought, flooding), extreme weather events (tropical cyclones, storm surges) and sea-level rise as well as ocean acidification. The number of cyclones varies greatly from year to year with none in some seasons and as many as six in some years. The sea-level rise near the Cook Islands, measured by satellite altimeters since 1993, is about 4 mm per year, similar to the global average of 3.2 ± 0.4 mm per year. This rise is partly linked to a pattern related to annual and decadal climate variability. Maximum tides tend to occur between March and April in Rarotonga, and February and March in Penrhyn. These higher tides and short-term raised water levels combine to produce the highest likelihood of extreme water levels between January and April, peaking in March, in both locations. Environmental impacts such as coral bleaching will continue due to increased sea level and ocean acidification. Extreme weather events can have impacts on the environment, health, and livelihoods. (Government of the Cook Islands, 2019; Secretariat of the Pacific Regional Environment Programme, 2018).

Climate change policy context

The Cook Islands is considered highly vulnerable to climate change impacts and the government is actively securing resources to "ensure reliable, timely and actionable information and early warning on local weather, climate and ocean environments as well as science-based advice on adaptation planning and early action for longer term climate change impacts" (Government of the Cook Islands, 2023, p. 89)

This research on climate-related mobility aligns with the Government of the Cook Islands' (2021) Goals 12 and 15 in *Te Ara Akapapa'anga Nui – National Sustainable Development Agenda (NSDA) 2020+, 2021-2121*. "Goal 12, To Tatou Kite Pakari – Our Knowledge and Innovation," aims for a "world class education and research system that is fully supported and encouraged. A system which incorporates our language and culture and which perpetuates our history" (p. 16). "Goal 15, To Tatou Akamatutu'anga Ora'anga e te Akateateamamao – Our Resilience and Preparedness," speaks to being "prepared with

the threat of climate change through planning towards adaptation and mitigation and technologies that will enable this to happen" (p. 17).

This research also aligns with both the *Cook Islands Climate Change Policy 2018–2028* and the adaptation measures of the *Cook Islands Third National Communication Under the United Nations Framework Convention on Climate Change*, with policy attention given to

> examining how climate change impacts threaten the sustainable habitability of islands and coastal areas for human settlement. Examining the implications such as land availability, ownership, protection and maintenance of important sites and graves, as well as losses associated with culture, sense of identity, traditional knowledge, and the ties of people to land and ocean. (Government of the Cook Islands, 2019, p. 69)

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