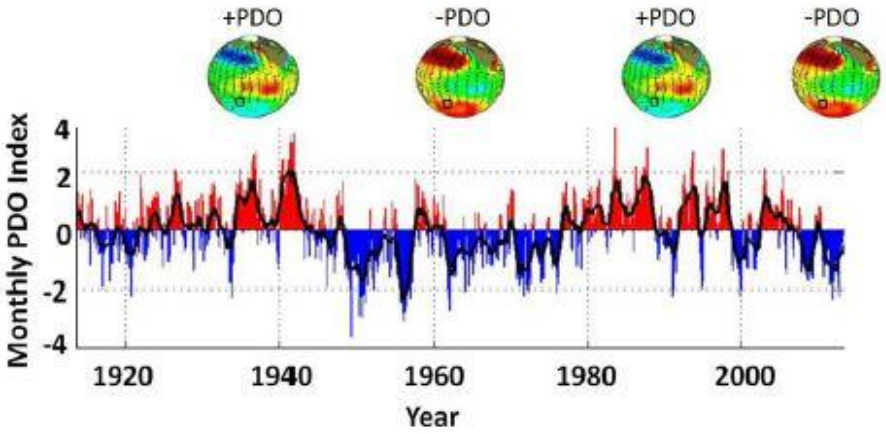
Using local knowledge to understand climate variability in the Cook Islands

Climate Change Cook Islands, Office of the Prime Minister

Climate change has been the topic of much research in the last few decades, however information on its impacts – particularly on remote small island nations – remain scant. Yet, through centuries of observation of their natural environment, Pacific islanders hold a wealth of knowledge of the sky, land and sea. Sadly, with a shift towards a more western lifestyle on some of these islands in recent decades, this local knowledge is at risk of being lost. Recognising the importance of documenting this before it is gone, a team of Climate Change Cook Islands of the Office of the Prime Minister conducted a questionnaire survey on selected islands throughout the Cook Islands from January to April 2014, to examine changes in various biological and physical systems over the last several decades.

The survey was carried out in five islands - Aitutaki, Atiu, Mangaia, Mauke and Mitiaro – and consisted of video interviews and questionnaire surveys with at least 10% of the population on each island. The target age group for the questionnaire was 20 – 59 years, while those interviewed on video were 60 years and older. The interviewees/respondents were asked to share observed changes in their environment. They were encouraged to talk freely about variations in their daily routine as a result of environmental changes. The interview outline is attached as Appendix 1.

Indeed the causal factors for some changes seem complex and difficult to explain with the limited information available. Nevertheless, it appeared that a large number of changes were linked to hydroclimatic shifts associated with the movement of the South Pacific Convergence Zone (SPCZ) that is influenced by climate oscillations. Most importantly, the well-documented phase shift of the decadal oscillation (i.e. inter-decadal Pacific Oscillation/Pacific Decadal Oscillation) in 1967/77 that affected rainfall distribution in the region was evident in the Cook Islands. For example, wet conditions were prevalent in the southern group for much of the 1950s to the 1970s during a predominantly negative phase of the decadal cycle, while drought conditions dominated from the 1980s to the 2000s during a predominantly positive phase. This hydroclimatic shift coincided with the loss or the decline of many important floral and faunal species on the islands in both the terrestrial and marine environment.



Monthly values for the Pacific Decadal Oscillation from 1910 to 2013. Boxed areas in globes indicate the southern Cook Islands region. Blue region on +PDO globe (red on plot) indicate cool and dry periods in the southern Cook Islands, while the red region on –PDO globe (blue in plot) indicate warm and wet periods. The opposite is true for the northern Cook Islands in the respective PDO phases. Figures modified from http://jisao.washington.edu/pdo/.

Left: Photo taken in Mangaia stream in 1957, during a predominantly wet period (between the 1940s and 1980s) in the southern group associated with the negative phase of the Pacific Decadal Oscillation. During this period, water was flowing through the taro swamp areas in many southern Cook Islands and was teaming with fishes and other freshwater fauna (photo by Don Marshall provided by the Mangaia Heritage Society). *Right:* Photo of the same location taken in 2014 during a dry period, which has been the state of this area for much of the 1980s and the 2000s. During this predominantly dry period, most of the taro swamp areas throughout the southern group dried up, resulting in the loss of many species that normally thrive in these wetland habitats (photo by Teina Rongo).

Dragonflies are commonly found in taro swamp areas in the southern group; however the hydroclimatic shifts that occurred in the late 1970s that resulted in frequent drought periods saw a decline in the dragonfly population on all the southern group of islands. Dragonflies are important predators for mosquitoes and sandflies in the southern group, and their decline may have human health implications regarding vector-borne diseases; photo by Teina Rongo. Other changes in these swamp areas include the loss of tilapia (*tirapia*), Gambusia (*ika namu*) and Dusky sleeper (*kokopu*) on most islands in the southern group.

Ūmoemoe (*Leptoscarus vaigiensis*) is a type of parrotfish, which used to be an important food fish that are caught on the reef flats of islands in the southern group. This fish is normally found in dense mats of the seaweed *Sargassum*. According to fishers, the decline in *Sargassum* cover on all islands in the southern group appear to be linked to the loss of the *ūmoemoe*. Photo taken from Randall, 2005.

It was difficult to link observed changes recorded in this survey to the effects of the anthropogenic-driven climate change. However, some observed changes recorded may support the well-documented global sea level rise phenomenon, such as the loss of salt crystals on reef flats and shorter low tide durations. The latter has negative repercussions in the outer islands of the southern group because it limits people's access to marine resources, especially when most subsistence fishing is carried out during low tides. Rougher sea conditions and stronger ocean currents that are observed by fishers may explain the decline in the *ika tauira* (new recruits of reef fishes) throughout the Cook Islands in recent years. These changes also contributed to noted shifts in fishing methods from using traditional canoes towards powered vessels that are costly because they require the use of fuel. In addition, stronger currents associated with the

intensification of the regional trade winds reported in recent years may explain the shallowing and the formation of sand banks in many lagoons and foreshore areas that were noted in this survey.

Decline in the seasonal recruitments of juvenile reef fish, or *ika tauira* as it is locally known, is perhaps a concern considering the critical role this plays in replenishing fish stocks on reefs. In the last few decades, people have noticed that large recruitment events are becoming infrequent. For example, *pipiriri*, which is the juvenile of *Siganus argenteus* (inset) and is one of the most common recruits during the months of March and April, has not been observed in the last decade or soon the island of Rarotonga and Mangaia.

Other changes may be influenced by human activities. It was noted that observations on the general decline in abundance and size of pelagic fishes caught in recent years throughout the Cook Islands may be the result of heavy fishing pressure, considering the increase of foreign fishing vessels licensed to fish within the Cook Islands' Exclusive Economic Zone over time.

A decline in pelagic species was consistently noted throughout the Cook Islands. Smaller yellow-fin tuna are frequently caught in recent years, which is atypical when compared with the past. In addition, fishers are going out further and spending more time fishing, which can be costly considering the price and availability of fuel in the outer islands. Photo taken by Teina Rongo in Manihiki in 2014.

The findings of this survey are consistent with the meteorological literature regarding decade-long climate variability within SPCZ-influenced regions. The information from this survey will be critical in developing strategies for infrastructure and resource management, and could provide the basis for future climate change research in this region. We recognise that local knowledge is at risk of being lost because, for the most part, the transmission of this information to younger generations in the Cook Island is compromised. Continuous documentation of such knowledge is critical for understanding the influence of climate variability on remote small island nations.

Appendix 1: Interview outline

1. Have you heard of climate change?
2. Rank your understanding of climate change on a scale of 1-10 (10 being good).
3. Do you think that we are vulnerable to climate change impacts (e.g. cyclones, droughts)?
4. Do you feel that outside assistance, such as financial support, is critical for us to cope with the impacts of climate change?
5. Is there a need to increase the awareness of climate change?
6. What seasonal resources on your island have you noticed have changed (e.g. fruiting season, spatial distribution) and how?
7. Do you know of any plant or animal on both land and sea that have declined or increased in abundance? (Indicate a time period when this happened.)
    - Marine
    - Land
8. Have you noticed any climatic changes (e.g. rainfall, temperature, etc) on your island
    - pre-1980?
    - post-1980?
9. Have you noticed any hydrodynamic (e.g. currents) or tidal changes in the marine environment
    - pre-1980?
    - post-1980?