

# The Societal and Environmental Impacts of Cyclone Zoë and the Effectiveness of the Tropical Cyclone Warning Systems in Tikopia and Anuta Solomon Islands

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### Summary

When the full fury of Severe Category 5 Tropical Cyclone Zoë was unleashed on Tikopia and Anuta, two of the world's smallest and most remote islands, between December 27 and 29, 2002 there was a world-wide up-welling of concern for the combined populations of less than 1800 village dwellers. Communities on the islands had been without two-way radio communication since early November and their ability to receive short-wave radio transmissions, particularly those from national and international weather services delivering tropical cyclone warning messages, was unknown. There was a very real possibility that the people had been un-warned and unprepared for Tropical Cyclone Zoë and it was feared that loss of life and property in its wake must have been significant. However, with no viable communications and limited capacity within the Solomon Islands to mount a reconnaissance mission, there was no easy way to immediately find out. When news of the fate of the islanders began to trickle out, more than a week later, it emerged that both islands had been devastated but, miraculously, everyone had survived. This paper provides a brief overview of the environmental and societal impacts of Tropical Cyclone Zoë, the efficiency of the national and international response and relief efforts, the resilience of the Tikopians and Anutans and finally, their capacity to rebuild and restore their devastated communities.

### Tikopia and Anuta

Tikopia and Anuta are in the Solomon Islands eastern province of Temotu. They are 1025 kilometres SSE and 1110 kilometres SE of Honiara respectively, and are 75 kilometres apart. Tikopia is an almost circular 4.5 square kilometre volcanic Island with steep hilly terrain surrounding an essentially fresh water crater lake and a small flat coastal plain that supports almost half of its 1446 residents. Anuta is much smaller with an area of just 1.2 square kilometres and a population of 232. Both are surrounded by coral reefs. The people are Polynesian and their primary languages are Tikopian, Anutan and Solomon Island Pijin. There are four principal kinship groups on Tikopia and two on Anuta. Each is headed by an hereditary chief. The islanders practice Christianity and all belong to various parishes of the Church of Melanesia. However, they also continue to acknowledge the authority of their chiefs and adhere strongly to many customary practices and beliefs. They have an enduring sense of cultural identity and even those who have lived away from the region for many years continue to feel strong attachment to their island and their society. Villagers follow a traditional substance life style, typically harvesting food from gardens, rearing chickens and catching and collecting seafood. There is virtually no cash economy. Some cash income is generated with the sale of marine products such as trochus shells, beche-de-mer and shark fin and a small, but significant, amount of money is sent from wontoks (relatives) working in other parts of the Solomon Islands or overseas. Most of this money passes through the economy as it is spent on educating a small number of students who have been fortunate enough



*Tikopia is a volcanic island with steep hilly terrain surrounding a fresh water crater lake*

to win places in secondary schools in Honiara. The traditional currency, which is used primarily for payment of bride-price and compensation, is a rope made of feathers collected from the near-by island of Fatutaka.

### **Tropical Cyclone Zoë**

The storm that was to become Tropical Cyclone Zoë was first detected on December 22 between Tuvalu and Tokelau as a slowly westward-moving tropical low-pressure system. It drifted towards the Solomon Islands and intensified to a Category 2 Tropical Cyclone and on December 25 was named Zoë by the Nadi Tropical Cyclone Warning Centre. The Queensland Tropical Cyclone Warning Centre sent the first Tropical Cyclone Advisory to the Solomon Island Broadcasting Commission (SIBC) via the Australian High Commission in Honiara on December 26. Receipt of the warning was confirmed and three hourly warnings commenced and continued throughout the life of the storm. The SIBC then broadcast the warnings through its network—however receipt of the re-transmitted warning messages was never confirmed from settlements within the threat area. On December 27 news presenters at Radio Australia were contacted and arrangements were made for them to also receive and transmit the warnings. By then Zoë was a Category 4 storm and destructive

hurricane force winds had begun to lash Tikopia and Anuta. By December 28 Zoë was a Category 5 Tropical Cyclone with average winds in excess of 213 kilometres per hour and satellite imagery showed Tikopia to be under the eye wall cloud where the strongest winds are expected and Anuta just on the edge of the eye wall. Village communities were relentlessly pounded with cyclonic winds, storm surge and wind-driven waves for almost three days. When the storm finally subsided and villagers emerged from their flimsy shelters they discovered that destruction to the physical environment was almost total, but amazingly there had been no loss of life or serious injury. The ‘shattered’ populations were totally on their own, without any contact with the world beyond their own islands. International political protocols and failing national infrastructure delayed any early emergency response and outside assistance resulting in the medical relief assessment team not arriving on Tikopia until Sunday January 5, 2003—nine days after the storm began. The combined NDO<sup>1</sup>/OCHA<sup>2</sup> assessment team, along with emergency food and shelter relief supplies arrived the next day. Assistance finally reached Anuta on Tuesday January 7.

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1. Solomon Islands National Disaster Office  
2. United Nations Office for the Coordination of Humanitarian Affairs

## Preparations and response to warnings

Field assessment teams restored communications with and between the islands and Honiara. It was discovered that some of the warning messages transmitted via SIBC and Radio Australia had, in fact, been received when short-wave reception was available in the early mornings and evenings until Friday December 27, when severe weather caused radio reception to be finally lost. Those who had not heard the messages directly, or had not understood Radio Australia's (delivered in English only) were generally advised by runners that went hut-to-hut and to churches where people were gathering and preparing feasts for New Year celebrations. People generally began preparations immediately, cutting palm fronds and banana trunks and laying them on roofs to support and strengthen roofs and walls and confining chickens to their coups. Celebrations were cancelled, or moved into communal huts and people sheltered indoors. There was no attempt to pick ripe fruit and store food in huts and nobody tried to evacuate to higher ground or areas of safety until the storm had become so intense that dwellings were threatened with imminent inundation or had begun to break up. Many villagers had some experience of intense cyclones – but never one of this duration – and most felt well protected in their traditional style huts with low walls and sloping thatched roofs, even though many were located on the near-shore beach areas and were exposed and unprotected from both wind and surge effects. In Anuta a 3 metre sea-wall along the eastern edge of the beach constructed from unmortared coral provided an effective barrier that protected dwellings from the force of the powerful storm surge. The waves that over-topped the wall however, spread sand and salt water through the villages and gardens.

## Environmental impact

Cyclone Zoë had a devastating impact on the landscape and physical environment of both Tikopia and Anuta with the eastern side of both islands being the most severely affected. While Tikopia was more severely impacted, high winds stripped vegetation and salt and sand spray-dried and 'burned' all vegetation not directly affected by storm surge and waves, on both islands. Damage to flora was almost total. Many of the larger trees, including coconut palms were twisted, snapped or uprooted. In some places the ground was scoured down to bare rock by the rain and storm surge, and several medium sized landslips were clearly visible on the steeper slopes. With the humus layer, topsoil and shade cover removed, and the delicate ecological balance of the islands' flora and fauna disrupted by the loss of many of the local seed-dispersing flying foxes and birds, it seems unlikely that vegetation will fully recover, except in the very long term.



Figure 1. Hillslopes are stripped of vegetation and topsoil; landslides are evident; sand ridge in front of the lake has been completely removed

In Tikopia the storm surge, in what people described as a series of three giant waves, removed a 2.5–4 metre high sand ridge that had extended along the coast between the shoreline and the lake on the eastern side of the island. The swamp area behind the ridge was also washed away and the area left covered with sand and coral debris. The 70 village huts that were built along the ridge were also swept away. A 'new' shoreline was created approximately 50 metres inland of its previous position. Sand, swamp mud, coral debris and seawater washed into the central lake that had previously contained only very slightly brackish water supporting freshwater fish populations, raising the salinity and substantially filling it in (up to 30 metres into the lake on the seaward side). Additionally, erosion of the sand spit that separated the lake from the sea created a permanently open channel that allowed fresh water to flow out of the lake and tidal seawater to flow in.

## Societal Impact

The ferocity and duration of Cyclone Zoë were such that it is a 'miracle' that there were no casualties and only very few injuries. Tikopian villagers on the eastern/south-eastern side of their island gave detailed accounts of scurrying up the hillslopes and sheltering in craggy rocky overhangs (not caves), as the surrounding vegetation was being torn and washed away by the storm, and staying there exposed to the elements, for up to three days. Overall it was estimated that in Tikopia 70% of the total village housing was severely damaged or destroyed with the remaining 30% being somewhat damaged. In addition most community buildings, constructed with both traditional materials and sawn timber with corrugated iron roofs were also damaged or destroyed. Three of the islands seven churches were washed away, one was destroyed and three sustained moderate damage. Both of the primary schools were destroyed with all educational materials lost. The clinic building was damaged but was still able to be used by the medical assessment team. In Anuta, where the sea-wall mitigated severe damage from storm surge, only five dwellings were destroyed, 24 were badly damaged,

and several more were somewhat damaged. The primary school was undamaged. The vast majority of all buildings are traditional structures constructed with local materials. The normal life span of sago palm roof thatch is just two years, therefore all surviving structures on the islands will need new roofs within the next 12–18 months. Almost all traditional housing materials on the islands were lost. It will take 6–12 years for sago palms to regenerate and even longer for structural timber. Tikopia and Anuta will therefore not be able to approach self-sufficiency in building materials for at least 12 years.

The isolation of these islands and lack of infrastructure is hard for 'westerners' to comprehend. There are no jetties or airstrips. Canoes and outriggers launch from the beach and the inter-island ships anchor offshore with cargo and passengers being transferred to shore in canoes or dinghys. There is a small area on Tikopia suitable for landing a long-range helicopter at low tide. There are no roads, just well-defined walking tracks, the only available power source is battery or (when working) generators, there are no phones and radio reception is intermittent and unreliable. Travel by canoe between the islands, through 75 kilometres of ocean, is often treacherous. Ships to the islands are irregular, averaging one every five months.

A reliable supply of fresh water is available on both islands via gravity fed water systems with tanks being continuously replenished from natural springs. During the cyclone, tanks and piping were badly damaged and the intakes blocked. Spring water was still available and could be collected at its source and carried to the villages. There is no sanitation the only toilet is the inter-tidal zone. After the cyclone there was a noticeable increase in flies, mosquitoes and possibly other vectors, making this practice a possible threat to health, especially for children. Tikopia has a (barely) functioning clinic, but there has been no clinic on Anuta since 1995. The chiefs refused to support its existence and demanded its removal, arguing that modern medicine brought illness and that customary healing practices promoted health. In the wake of the cyclone there was an increase in diarrhoea and various skin diseases, particularly among children and a (cyclone unrelated) epidemic of Chicken Pox in Anuta.

Arguably the most serious impact of Cyclone Zoë was the devastation to gardens and food supply. Agricultural productivity on both islands was almost totally wiped out and with much of the ground left stripped of vegetation, humus and topsoil, it was dry, hard, exposed and unsuitable for planting—even if any seedling stock were locally available. All gardens on the hill slopes were destroyed by high winds, sand and salt spray. Those on lower ground were affected by wind and/or storm surge. Large fruit trees such as local avocado and breadfruit were stripped and broken—any that survived will not

produce fruit for 2–3 years. Some chickens survived the cyclone but stocks will take some time to rebuild. Ocean fish and seafood remain plentiful however the ability of Tikopians to catch fish was seriously limited with the loss of most of their canoes and other fishing equipment. New canoes can be built in 2–4 weeks depending on the availability of manpower and tools such as axes and adzes. Some large logs are locally available from uprooted trees however, given the large number required many will have to be imported from other parts of the Solomon Islands

## Response, Recovery and Resilience

Official response to the Cyclone Zoë disaster was delayed and relatively disorganised—despite the best efforts of the National Disaster Management Office and its Central Control Group to co-ordinate and facilitate an effective response. The near-total collapse of the national infrastructure meant that national disaster managers were trying to operate without adequate resources and without reliable communication networks. Support from over-seas, notably Australia, was available but 'on-hold' until all political protocols of 'waiting for an official request for assistance' had been satisfied and until the resources (including the human resources) necessary to launch the response, had been paid for. At a local level Solomon Islanders and NGO's rallied to provide what-ever supplies they could for a relief effort. Thirty Tikopian and Anutan members of the Solomon Islands Police Force formed a volunteer task force go to their islands and help rebuild huts and replant gardens. When the international media began to focus world attention on the plight of the people of Tikopia and Anuta donations began to flood in. However, these were often inappropriate (such as black plastic sheeting for shelter) and some were given with conditions attached, making organising the distribution of resupply goods to match needs a near impossible task. In the months following Zoë several boatloads of supplies have bypassed the central organizing groups in Honiara and have taken goods directly to the islands. While these donors are well-intentioned and are merely concerned about corruption in the national capital and the possibility of goods and money being siphoned off before they reach the cyclone victims, they run the risk of introducing plant disease and insect pests in seedling stock and used tools.

Despite overwhelming difficulties, the on-going recovery effort is enjoying some success. Many of the people are slowly beginning to rebuild their lives and although the emergency food supplies may be nutritionally unbalanced (mainly rice) no-one is hungry. Life however, will necessarily change for these people. Long-term existence on the islands will be difficult. It will be many years before there will be any guaranteed food security and it is just not within the capacity of the Solomon

Islands government to provide on-going support for the Tikopian and Anutan communities.

Tikopians and Anutans are often described locally in the Solomon's as "having strong kastom (culture)". They typically enjoy strong cohesive family and societal networks that are based on a long history of adherence to customary practices and belief systems, and acceptance of a common worldview that has incorporated Christian values and practices. This has probably been maintained in part because of the relative isolation of the communities. It certainly supported the initial resilience that was demonstrated by the affected population during, and in the wake of, Cyclone Zoë. However, as the months have passed many seem to be finding life increasingly difficult. There are reports of debilitating depression among older people and there has been an alarming increase in the death rate—four elderly villagers died in the six weeks after the cyclone, the expect death rate is about one per year. It is possible that many are suffering from some form of post-trauma distress. A dance troupe from the province of Makira was sent to perform and entertain the villagers. This reportedly 'lifted the peoples spirits' for a short time. There is increased movement between the islands and Honiara with ships going to the area every couple of months, many people appear to be travelling but few have actually moved away from the area.

How the Tikopians and Anutans will fare in the medium and long term will depend very much on their desire and ability to recover and on the availability of long-term support. Currently the Solomon Islands is in a state of political chaos and economic collapse. The tensions and civil unrest that are affecting Guadalcanal, Malaita and the Western Province only spill over into the Temotu region very minimally, nevertheless they undermine the national capacity to respond to, and recover from, this, and any other natural disaster that affects the people of the Solomon Islands.

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