

SOPAC



COUNTRY PROFILE



TONGA

SOPAC



Our Vision

*The improved health,
well being and safety
of the Pacific and its peoples*

The South Pacific Applied Geoscience Commission (SOPAC) is an independent, intergovernmental, regional organisation established by South Pacific nations in 1972, and dedicated to providing geotechnical services to the countries it serves. Its Secretariat is located in Suva, Fiji, and has about 40 professional and support staff.

SOPAC's work for its member countries focusses on three key areas; resource development; environmental geoscience; and national capacity development in the geosciences. To effectively deliver these services SOPAC maintains a regional data centre, provides information services, and offers technical and field services for specific project work.

THIS COUNTRY PROFILE WAS PRODUCED TO PROVIDE A SNAPSHOT OF THE CURRENT ISSUES FACED BY THE COUNTRY AND SOPAC'S ROLE IN ASSISTING COUNTRIES TO ACHIEVE SUSTAINABLE DEVELOPMENT



TONGA COUNTRY PROFILE



Tonga: Our Future

"... The Government of Tonga is committed to a course of action which will ensure that the Tongan way of life is environmentally sound and sustainable for all generations."

Late-Hon. Dr S. Ma'afu Tupou
Minister of Ministry of Lands,
Survey and Natural Resources. (1993)

Capital:	Nuku'alofa
Population:	100 000 (1999 est.)
Land Area:	649 sq. km
Max. Height above Sea-level:	1 030 m (Extinct volcano, Kao)
Geography:	Consists of about 150 islands (36 inhabited); archipelago of coralline and volcanic islands; 3 main island groups comprising the southern Tongatapu group, the central Ha'apai group and the northern Va'vau group
EEZ:	700 000 sq. km
Climate:	Tropical; modified by trade winds; wetter months (December to March) and cooler months (June to September)
Rainfall:	Varies from 1 500 – 2 500 mm per annum
Mean Temperature:	27°C
Economy:	Dependent on aid, remittances, agriculture, forestry, fishing and tourism; exports include squash, banana, copra, vanilla, vegetables and fish products
GDP per Capita:	US\$ 1 868 (1998 est.)
Currency:	Pa'anga
Energy Sources:	Biomass, solar, wind and wave
Freshwater Sources:	Groundwater, rainwater, surface water
Natural Hazards:	Cyclone, storm surge, coastal flooding, drought, earthquake, tsunami, volcanic eruption, river flooding and landslide
Mineral Potential:	On-land – unknown; Offshore – polymetallic sulphides (gold, silver, copper, lead and zinc), hydrocarbons
Languages:	Tongan and English
Government:	Independent kingdom and member of Commonwealth
SOPAC Membership:	Full member since 1971
Country Representative:	Secretary. Ministry of Lands, Surveys and Natural Resources
	PO Box 5. Nuku'alofa
	Tel: (676) 23 210. Fax: (676) 23 216
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profile



Tonga

The Kingdom of Tonga is an archipelago of about 150 islands (of which 36 are inhabited) within an Exclusive Economic Zone (EEZ) of over 700 000 sq km. Its total land area is approximately 649 sq km with a maximum height of 1 030 m above sea-level.

There are three principal groups of islands that make up the coralline and volcanic islands of Tonga. To the south is the Tongatapu group, named after the largest island in Tonga, on which the capital Nuku'alofa is located. The Ha'apai group is in the centre, the Vava'u group in the north and the small Niua group in the far north. The total population of the country in 1999¹ stood at about 100 000.

The Tongan economy is dependent considerably on development aid and remittances from Tongans working abroad. Other mainstays of the economy include agriculture, forestry, fishing and tourism.

There are several resource and environmental issues, common to island nations, affecting sustainable development in the Kingdom of Tonga. These include an array of issues from climate and sea-level variability, environmental degradation and pollution to resource

management. More specific challenges to sustainable development include coastal erosion, water quality, water availability and sanitation. Sustainable management of resources such as aggregate, offshore minerals and

renewable energy are other issues in Tonga's quest for development.

The Kingdom of Tonga is a founding member of the South Pacific Applied Geoscience Commission (SOPAC) since 1971. SOPAC is an independent, intergovernmental,

regional organisation, which provides expert technical assistance, policy advice and information on the sustainable management of these non-living resources.

SOPAC also contributes to a variety of geoscientific training and educational opportunities at all levels to increase the country's capacity in science and resource management. Additional assistance is made by SOPAC through technical support for the establishment and maintenance of database information systems and for electronic

exchange of information. Expertise in hazard assessment, disaster preparedness, mitigation and management is also provided.



Tongan cultural performers

Resource Development & Management

For Small Island Developing States (SIDS), natural resource development and management holds the key to rapid economic development. Unwise exploitation of non-renewable resources and exploitation of renewable resources at a pace higher than the natural rate of replenishment could prove detrimental to the sustainable development plans of the country.

MINERALS

Offshore exploration is still at a nascent stage in Tonga. Exploratory surveys have, however, revealed the extensive presence of polymetallic sulphides (rich in copper, lead, zinc, gold and silver) in the Exclusive Economic Zone (EEZ) of the country. Tonga also has a great hydrocarbon potential with natural oil seeps occurring in its waters.

The future exploitation of these minerals has the potential to provide great economic benefits to the country. Several exploration companies and research organisations have expressed interest in these findings and have applied for exploration licenses to assess the scope and potential for development. There is also potential for hydrocarbons in Tonga.



Blowhole

¹SPC Demography Programme

ENERGY

Energy is an essential pre-requisite for economic development and thus for raising the quality of life of the rural and urban populations. Tonga depends heavily on imported petroleum products and liquid petroleum gas (LPG) to supply its commercial, industrial, and domestic energy needs. Currently, petroleum imports account for 30-40 per cent of the total energy consumption and diesel-powered generators produce the electricity. However, in the outer island groups, there are still a number of households that do not have access to electricity.

For domestic purposes such as cooking, biomass is widely used. This includes firewood and coconut husks. However, due to the over-exploitation of these resources, natural biomass is becoming scarce in Tonga.

Tonga also has relatively good solar, wind and wave/ocean energy potential. Owing to the high cost of imported fuel and increased consumption in the energy sector, these alternative energy sources are valuable for future development. The most promising of these is solar energy. As with all frontier technologies, there is a need to monitor and plan the exploitation of these resources. Currently, there is a strong need to collect and analyse energy-sector data to facilitate better management and control in the future.



Installation of solar photovoltaic cell

WATER & SANITATION

Fresh water is a critical resource for the small, widely scattered islands of the Kingdom. Most development plans are pivotal on the availability of fresh water. Clean water and proper sanitation enhance the health and productivity of the work force and therefore have particular implications for the children and future generations.



Water catchment tank

An estimate by the Department of Health is that 85 per cent of the population uses groundwater while 15 per cent rely on rainwater catchments. Tonga is faced with an increasing demand for safe potable water in both rural and urban districts. In many areas of Tonga, brackish groundwater is used for domestic purposes while rainwater is reserved for drinking only. It has also been recorded that during extensive periods of drought, as in 1987, some outer islands depend heavily on coconuts, which in some instances provide the only liquid for refreshment.

The main problems concerning groundwater in Tonga are the quantity and quality of the water. Together with its limited availability, groundwater is also prone to contamination from saltwater intrusion and human or animal waste. Also faced are problems of collection and storage of rainwater.

The recent increase in demand for water has led the Government of Tonga to identify various areas in the Kingdom in which to develop reticulated water systems. The largest of these systems is in the capital, Nuku'alofa, and is run by the Tonga Water Board. Leakage from this system is substantial, with estimates ranging from 60 to 70%. No water treatment is provided to this water supply.

On the sanitation side, only 40 per cent of the population have access to proper sanitation facilities.

Challenges to Sustainable Development and SOPAC's role in Tonga

MINERALS

SOPAC has been assisting Tonga in addressing issues related to the development of mineral resources. Assistance has included field surveys, assessment studies, training, workshops and policy formulation.

In the last two decades SOPAC has carried out various exploration work within the Tonga EEZ. These surveys have given room for optimism as the Tonga EEZ has shown the extensive presence of polymetallic sulphides and cobalt-rich crusts², precious corals³, and potential areas of hydrocarbons⁴.

Surveys in 1993⁵ have also produced preliminary evaluations of the petroleum potential in the Tonga basin. This has greatly enhanced the knowledge of the country's petroleum geology and promoted exploration opportunities for oil companies by identifying potential resource levels. SOPAC also established at the Secretariat a comprehensive Oil Company Database in 1993⁶ to assist the member countries in their dealings with oil companies. This was a follow up to the consultancy that SOPAC offered in 1992⁷, to promote the hydrocarbon potential of the South Pacific nations to the Oil Industry.

Capacity development in the member states is one of the top priorities of SOPAC. Training in the field for technical personnel from the member countries is an ongoing process with the aim of enhancing in-country capacity to undertake assessment studies and field surveys. This training is carried out through workshops and seminars

and through the courses in the Earth Science and Marine Geology Certificate Programme, which has been undertaken for 21 years. In-country seminars concentrating on



Tongan ESMG students

geology, hydrology and hydrogeology were held in Apia in September 1999 for staff from departments of several ministries including those based at the Apia Observatory and also for school principals and lecturers.

ENERGY

Electricity in Tonga is generated by diesel powered generators, which depend on imported petroleum products. The Tonga Electric Power Board provides the diesel-generated electricity service.

SOPAC has assisted the Kingdom in the identification and monitoring of renewable energy sources to reduce the dependence on imported fossil fuels. These include solar, wind, wave and biomass energy.

Assistance was also provided to the country in the development of rural electrification and appropriate energy supply policies⁸. The supply of conventional energy to rural areas by urban-based energy utilities is generally uneconomical. For the rural dwellers, energy is often their only hope for improving their standard of living. There is an abundant supply of energy in the rural areas. Wind, solar radiation and biomass are examples of these abundant energy sources. The rural dwellers must work together as a community to address their energy needs. Experience in the region has shown that community and rural-based "energy utilities" can be sustainable if proper business management practices are observed and the appropriate institutional and policy frameworks are in place. Unfortunately this is currently

²SOPAC Cruise Report 17

³SOPAC Cruise Report 32

⁴SOPAC Technical Report 108

⁵SOPAC Miscellaneous Report 158

⁶SOPAC Miscellaneous Report 146

⁷SOPAC Miscellaneous Report 141

⁸Task Profile TO 99.004



Installation of photovoltaic cells

not the case, and it has been identified that assistance in the design and development of a regionally acceptable system will help enhance these rurally focused energy sector initiatives and activities.

SOPAC has assisted the Government of Tonga with the development of a Solar Rural Electrification Program (TSREP)⁹. The aim of this project has been to provide reliable

energy services to outer islands, encourage the use of low-emission technologies and native energy resources, and provide energy services based on the least cost. Through this programme, SOPAC has been able to demonstrate that solar photovoltaic technology is appropriate for deployment in Tonga.

In addition to this, SOPAC has also conducted training workshops for technical personnel to strengthen their capacity in evaluating new and renewable energy sources¹⁰, and manage the database¹¹ as well as the energy sector as a whole¹².

SOPAC realises the need to assist Tonga in:

- encouraging the use of low-emission technologies and native energy sources;
- providing reliable energy services based on the least-cost strategy and technically proven technologies;
- guaranteeing full cost recovery from customers for the provisions of energy; and
- providing training to enable users to install and maintain their solar photovoltaic systems.

⁹SOPAC Miscellaneous Report 3

¹⁰SOPAC Training Report 54

¹¹SOPAC Technical Report 11

¹²SOPAC Technical Report 185

WATER & SANITATION

Since 1992, SOPAC has assisted the Kingdom of Tonga with its water- and sanitation-related issues.

Various projects have been conducted by SOPAC and these are:

- Identification of appropriate waste-water treatment technologies for selected villages, and the conditions under which a certain number of toilets can be connected to a single small-scale waste-water treatment plant. These included the economic, technical and social viability of the project¹³.
- Assistance in the assessment of water resources and water supply of outer islands, some of which have potential for tourism development. Through this project the potential amount of available water in Tonga was determined. Therefore, developers in the future will know what is available and thus plan accordingly¹⁴.



Sewage plant in Tonga

- Increasing the Tonga Water Board (TWB) capabilities in hydraulic network modelling by providing in-country training¹⁵.
- Conducting a fellowship attachment for TWB Planning Engineer and producing a calibrated numerical model of the Nuku'alofa water distribution system¹⁶.
- Providing the TWB with comprehensive information on PVC-pipe detection technology to enable it to purchase cost-effective and appropriate equipment¹⁷.

The lack of sustainable fresh water and increasing

¹³Task Profile TO 99.007

¹⁴Task Profile TO 99.001

¹⁵Task Profile TO 99.032

¹⁶Task Profile 99.037

¹⁷Task Profile TO 99.033

demands on freshwater resources have been identified as amongst some of the primary constraints to development of the South Pacific. Through efficient demand management and conservation of water supplies, pressure on freshwater resources will reduce, thus making more water available for other development or for future use. The actual savings to the operational budgets of small-island economies will also be significant. By taking less out of the already stressed water sources, the environment benefits as well.

SOPAC continues to provide training on freshwater demand, management and conservation in Tonga¹⁸. This would in turn make more water available for environment enhancement and for future generations.

Assistance was likewise provided by SOPAC in the final stages of the UNESCO-funded groundwater pollution study on Lifuka Island¹⁹. Recently, too, a series of visits have been made to Tonga to review ongoing sanitation projects and identify current waste-water disposal and treatment options²⁰.



Blowhole

During the 1999 World Water Day, SOPAC organised an Essay and Poster Competition for schools. The theme 'Everybody Lives Downstream' helped raise public awareness of the flow-on effects of water pollution and mismanagement. The day also highlighted the need in island nations to manage freshwater resources wisely, and a public forum was organised as well.

In addition to these, SOPAC has been running an Earth Science and Marine Geology Certificate Programme for technicians from Tonga and the region since 1979. Since 1995, when the Water and Sanitation Programme was first attached to SOPAC, a module relating to water issues has been added to the certificate course at the University of the South Pacific.

HAZARDS & DISASTERS

Natural hazards have a disastrous impact on human lives, property, investments, agricultural land, and marine ecology. Consequently, socio-economic development may be impeded, increasing poverty, reducing investment confidence and disrupting family life. Most urban centres of Pacific Island nations are situated on the coast and thus are highly vulnerable to the devastating effects of natural hazards.

Tonga falls in a tropical cyclone belt with an average of one cyclone passing through Tongan waters every year.

Cyclones usually develop in Tonga in the period November to April. Global climate change has triggered more-frequent and more-severe storms, interspersed with scorching droughts. The impact of this unpredictable climate has been harsh on the ecosystems, coastlines, terrestrial and marine biodiversity. Economically, the

impact has translated into decreased agricultural yield, death of livestock and variable marine productivity. As the majority of the people are economically dependent on these resources, the risk of poverty is high.

The El Niño Southern Oscillation (ENSO) event caused by regional atmospheric variations can bring about changes in precipitation and climate patterns. In Tonga, the impact of ENSO is widely believed to have caused an extended drought event in 1987. This had an adverse effect on the economy and the people of Tonga. The estimated monetary loss incurred by the Kingdom during this event totalled several million dollars.

Nuku'alofa, as Tonga's major urban centre, is vulnerable to many hazards, especially earthquakes, cyclones, coastal erosion, storm surge and tsunamis. Nuku'alofa lies in the seismogenic zone that results from the convergence of the Pacific Plate with the Indo-Australian Plate. Thus, strong earthquakes have to be expected due to the city's geographical location with respect to the Tonga Trench (the zone of convergence). The last big earthquake, in 1977, caused extensive structural damage to buildings, Queen Salote wharf and lifelines in

¹⁸SOPAC Technical Report 264

¹⁹SOPAC Technical Report 286

²⁰SOPAC Preliminary Report 109



Aerial view of Tonga's coast

Nuku'alofa. With the current rate of development essentially driving larger numbers of the community into vulnerable urban living conditions, an earthquake of the same magnitude may have a more devastating effect on the city and its populace.

SOPAC has been trying to assist Tonga come to terms with these threats through numerous field investigation projects, workshops and training programmes. Some of the key field surveys SOPAC has focused on:

- Investigations into the likelihood of a major earthquake in Nuku'alofa. It is plain that building height and foundation are key determinants of the amount of damage that might occur.
- The development of a comprehensive multi-hazard risk-management geographic information system (GIS) database under the Pacific Cities Project. Under this, zonation of all hazards, their distribution frequency and likely impact on the city are being done. The database is vast in its coverage and even information on all buildings in high-disaster-risk areas is included to prepare the response structure to a wide range of hazards like cyclone, earthquake and sea-level change. Training of technical personnel in risk analysis, disaster mitigation and civil protection measures is also being undertaken as part of the project.

All these contribute towards SOPAC's vision of strengthening Tonga's capability to assess natural and man-made hazards and improve post disaster rehabilitation.

COASTAL MANAGEMENT

In Tonga, coastal-management issues are acute in the urban centre of the capital, Nuku'alofa, which is adjacent to a partially enclosed lagoon. Because of an increase in population and migration to urban centres, the mining of sand for infrastructure construction and the reclaiming of

land are also on the rise.

Rapid changes in the coastal geography of Tonga have occurred associated with ad-hoc fill land reclamation and aggregate mining caused by burgeoning urbanisation. To protect reclaimed land from the onslaught of the sea, various protection systems such as concrete sea walls have been constructed haphazardly. However, the success of these protection structures has been minimal owing to a lack of understanding of the wave and current pattern around the islands, and the misconception that coasts are inherently and eternally stable. Poor construction and development practices, indiscriminate reclamation and aggregate mining in the reef areas cause coastal instability and beach erosion.

Sand aggregate is a critical resource for infrastructure development throughout Tonga. Urban development is concentrated on the island Tongatapu, where the capital Nuku'alofa is located. Historically, sand has been mined from beaches for use in the building industry and for traditional covering of graves in public cemeteries.



Sandmining

For the last few decades, a large amount of calcareous sand has been mined from beaches at a rate that is far in excess of the natural replenishment rate. The current primary source of sand aggregate is from the foreshore zone. This indiscriminate mining of beach sand has contributed to extensive beach erosion and in some cases has resulted in beaches being stripped to the bare rock substrate. The flow-on effect is the loss of coastal lands and infrastructure through chronic erosion, which is further exacerbated during storms and cyclones. In addition, coastal pollution damages and destroys reef biota.

SOPAC has been assisting Tonga in addressing the coastal erosion issue through coastal-zone field surveys and assessment studies. Some of the key projects undertaken in Tonga include the assessment of the impacts associated with current aggregate source areas, mapping of the extent of sub-surface deposits and investigations



Beach in Tonga

into the rates of sand production and loss²¹. Baseline data of potential resource areas have also been collected and advice given on alternative resources²².

More recently, SOPAC undertook a survey of aggregate at Vava'u. About 300 000 m³ of sand was identified during that study in the northern part of Koloa Island²³. In another study²⁴ the rate of sand production and loss has been investigated by SOPAC. Further studies on coastal aggregate resources are planned for Vava'u²⁵. These will examine additional sources of aggregate for construction purposes.

Baseline studies of inshore areas for coastal development programmes have been undertaken by SOPAC as well²⁶, together with evaluations of appropriate shore-protection measures in the Tongatapu region²⁷. In the near future, based on a request from the Kingdom of Tonga, SOPAC will undertake an assessment of erosion problems in Atata (Vava'u Group). A new task will be developed for this activity.

SOPAC recently undertook a coastal change monitoring project in Tongatapu. This study examined the causes of recent coastal changes, both natural and human induced. From this study, recommendations were made for a viable monitoring programme in support of the Integrated Coastal Zone Management initiative²⁸.

Several recommendations have been made by SOPAC to tackle coastal erosion and manage sand and gravel extraction:

- implementation of appropriate environmental policies and legislation;

- use of advanced technology for shoreline protection;
- better monitored reclamation and shorefront development; and
- identification of alternative coastal resources using remote sensing and ground surveys.

Given the critical importance of sustainable development to Tonga, SOPAC will continue to play an important role in coastal preservation and the development of sound policies to ensure better management of coastal resources.

STEPS INTO THE FUTURE: INFORMATION TECHNOLOGY & COMMUNICATION

For effective resource management and planning, the storage and processing of timely and accurate scientific data is critical. Island nations face the fundamental crisis of geographic isolation and high cost of communication between the various islands. Given the small size of these nations, technology providers are reluctant to supply cutting-edge technology because of poor economies of scale and difficulties in monitoring. Low human capital endowment further complicates the situation. These problems are a constraint in Tonga's pursuit of rapid growth.

SOPAC has been assisting Tonga to improve its management systems and train personnel in Information Technology. This assistance includes:

- Development of relevant and effective information technology systems²⁹.
- Support for Geographical Information System (GIS) and remote sensing (RS) capacity development³⁰.
- Production and organisation of coastal data³¹.

Several training attachments and workshops have been conducted by SOPAC. A regional Power Utilities workshop was held in Tonga in 1997 to train participants in MapInfo and GIS. In addition to this, SOPAC provided

²¹Task Profile TO 97.019

²²Task Profile TO 98.003

²³SOPAC Technical Report 277

²⁴Task Profile TO 97.014

²⁵Task Profile TO 98.003

²⁶SOPAC Cruise Report 88

²⁷SOPAC Technical Report 32

²⁸SOPAC Technical Report 218

²⁹Task Profile TO 98.008

³⁰Task Profile TO 98.015

³¹Task Profile TO 98.012

assistance in the installation of GIS in the Tonga Electric Power Board in 1998, funded by the European Union and the Pacific Regional Energy Programme. Training on-site and at the Secretariat was also a part of this project.

A computing unit for GIS and remote sensing work was provided by SOPAC to Tonga in 1993 through funding under Lome III. Technical assistance, hardware and support continue to be an integral part of SOPAC's workplan for Tonga.

As a regional data centre, SOPAC has been compiling geographic data on Tonga.

By performing its functions as the specialised scientific organisation that it is, SOPAC has been addressing some of the fundamental factors that have impeded the development process.

Reference Materials

SOPAC provides access to a variety of information relating to the Kingdom of Tonga. This can be accessed through the library database, PIMRIS or the Internet. SOPAC holds at its Secretariat:

- Maps of Tonga
- Project Reports
- Videos
- Geological samples
- Deep-sea mineral database
- General reference material

Please refer to the Tonga Bibliography for SOPAC's full reference and material listing.

Future directions in Tonga

In future, SOPAC will continue its partnership with Tonga, to overcome the hurdles in the path of sustainable development. SOPAC will use its key 'ownership advantage' - the expertise in applied sciences - to help Tonga manage and develop its non-living resources sustainably.

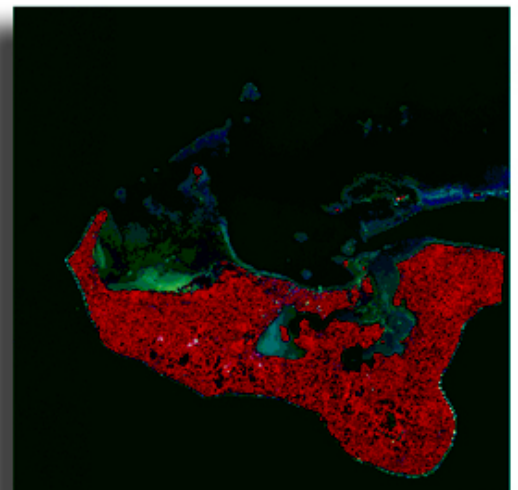
SOPAC will further its partnership with Tonga in developing offshore resources. Policy formulation will be a key area that SOPAC will develop as its core professional activity.

Development of appropriate legislation to manage coastal erosion and regulate aggregate mining will be a priority in the near future.

Sustainable development, conservation and management will be the guiding principles in the water and energy sectors. Policy development will be an activity in both these areas as well. Training programmes, workshops and seminars will be organised regularly to assist Tonga in creating a national capacity in geo-science. SOPAC will continue its work to reduce Tonga's vulnerability to natural disasters and improve preparedness.

Island systems management will be a future area of focus given its ability to improve database management and the decision-making processes. SOPAC intends to support the development of information technology and communication infrastructure in Tonga to achieve this.

Spot image

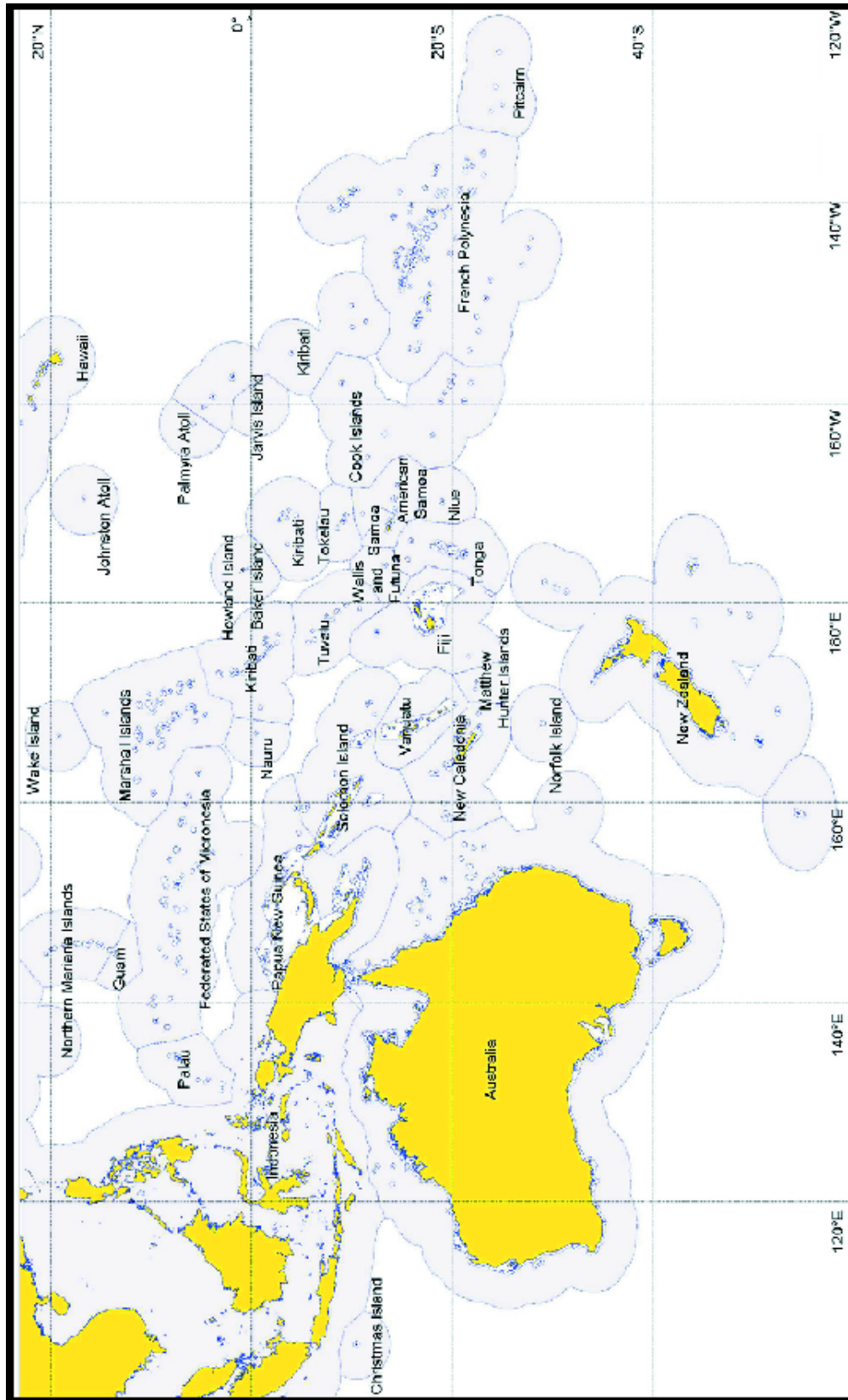


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Issues and SOPAC's Responses for Further Development

ISSUES	CONSTRAINTS	RESPONSES FOR FURTHER DEVELOPMENT
Water & Sanitation	<ul style="list-style-type: none"> · Demand exceeds the supply for water · Saltwater intrusion into groundwater · Inadequate water catchment and storage facilities · Water wastage and unaccounted for water loss · Insufficient sewerage systems for the entire population · Lack of public awareness on safe sanitation practices · Insufficient wastewater treatment · Development of resource policy and legislation 	<ul style="list-style-type: none"> · Assessing and upgrading water-supply systems and infrastructure · Increasing public awareness on sustainable water management through training and workshops · Development of policy and legislation · Carrying out research and feasibility studies · Educating the public on safe sanitation and waste-disposal practices at all levels · Improvement of infrastructure within sanitation sector
Coastal Management	<ul style="list-style-type: none"> · Unmanaged sand mining · Lack of implementation of coastal-zone management plan · Insufficient environmental knowledge on coastal issues · Unplanned development in coastal areas 	<ul style="list-style-type: none"> · Development and implementation of appropriate policies and legislation · Identifying alternative potential aggregate resources · Increasing public awareness on coastal issues through workshops, training, etc. · Dialogue with the government and private sector on sustainable development
Minerals	<ul style="list-style-type: none"> · Inadequate scientific research to define full potential of resources 	<ul style="list-style-type: none"> · Assessing the potential of polymetallic sulphides, cobalt-rich crusts and potential hydrocarbon areas in the Tongan EEZ · Assisting in the development of resource policies · Advising on the management and development of hydrocarbon and mineral resources · Encourage further research
Energy	<ul style="list-style-type: none"> · Heavy reliance on imported fossil fuels putting increasing strain on the economy · Inadequate public knowledge on renewable energy sources and management 	<ul style="list-style-type: none"> · Assisting in identification of viable renewable energy sources · Development of rural electrification · Development and implementation of appropriate energy policies · Undertaking training workshops to strengthen human resource capacity within energy sector
Hazards & Disasters	<ul style="list-style-type: none"> · Prone to natural disasters such as cyclones, drought and climate change including ENSO related hazard impacts 	<ul style="list-style-type: none"> · Conduct training workshops and disaster management and response for disaster managers and the wider community · Raise awareness of hazards and assist with preparedness and mitigation actions of vulnerable communities
Information Technology & Communication	<ul style="list-style-type: none"> · Limited availability and poor access to information · Lack of skilled people to manage IT sector · Lack of relevant regional and local data · High cost of technology 	<ul style="list-style-type: none"> · Development of relevant and effective IT systems · Providing support for database development · Helping with development of Internet and Intranet · Training of local staff in information technology and GIS systems · Coordination, compilation and creation of standardised geographic data sets
Human Resource Development	<ul style="list-style-type: none"> · Weak human resource base · Limited financial and institutional resources · Limited expertise 	<ul style="list-style-type: none"> · Conducting workshops and technical training programmes to improve national capacity in the geosciences · Running the Earth Science and Marine Geology course to improve the human resource base · Fellowship attachments



South Pacific Region Maritime Limits

SOPAC Member Countries: Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, Guam, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Kingdom of Tonga, Tuvalu, and Vanuatu. French Polynesia and New Caledonia are Associate Members.