



# **Vanuatu Klaemet Infomesen Blong Redy, Adapt Mo Protekt (Van-KIRAP)**

**Fisheries and Climate Information Services (CIS):  
Policy Review, Action and Communication Plan**





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Cover photograph: Village children intertidal net fishing, Espiritu Santo, Vanuatu. Photo Credit: Mitchell Kanashkevich.

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## Acronyms

APCC	APEC Climate Centre
AWS	Automatic Weather Station
BoM	[Australian] Bureau of Meteorology
CDMS	Climate Data Management System
CLEWS	Climate Early Warning System
ClIDE	Climate Data for the Environment
ClIDEsc	Climate Data for the Environment Services Application Client
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
EEZ	Exclusive Economic Zone
FAD	Fish Aggregation Device
FAO	Food and Agricultural Organization (of the United Nations)
GCF	Green Climate Fund
GEF-LDCF	Global Environment Facility-Least Developed Countries Fund
GFCS	Global Framework for Climate Services
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (Germany)
NAPA	[Vanuatu] National Adaptation Programme of Action
NCOF	National Climate Outlook Forum
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
NOAA	National Oceanographic and Atmospheric Administration (USA)
NOP	National Ocean Policy (2016)
PRSCS	Pacific Roadmap for Strengthened Climate Services
SDP	[National] Sustainable Development Plan 2016—2030
SNC	[Republic of Vanuatu] Second National Communication to the UNFCC
SPCZ	South Pacific Convergences Zone
SPC	The Pacific Community

SPREP	Secretariat of the Pacific Regional Environment Programme
UNDP	United Nations Development Programme
Van-KIRAP	Vanuatu Klaemet Infomesen blong Redy, Adapt mo Protekt (formerly known as Climate Information Services for Resilient Development [CISRD] in Vanuatu Project)
VCU	Vanuatu Climate Update
VMGD	Vanuatu Meteorology and Geohazards Department



## Executive Summary

The Vanuatu Klaemet Infomesen blong Redy, Adapt mo Protekt (Van-KIRAP) Project is delivering climate science to support decision makers and communities in Vanuatu to prepare for and adapt to climate variability and change. Although Vanuatu has been identified as a carbon sink, it is significantly affected already by changing weather patterns and the start of slow-onset climate change, such as warming oceans.

Assessments of vulnerability to climate change undertaken over the last two decades have identified Vanuatu as highly exposed to climate variability and change, and at risk of impacts, with the country ranked 9th globally under the Climate Risk Index for 1998–2017<sup>1</sup>. The Government of Vanuatu and development partners have developed policies and strategies to improve access to reliable climate information and to ensure it is used effectively to minimise impacts. Both these objectives are expensive and difficult to achieve, and so the integration of climate information into planning processes has been slow.

Van-KIRAP will support Vanuatu Meteorology and Geohazards Department (VMGD). to provide five target sectors, including the Department of Fisheries and its stakeholders, with climate information ready to be used in current and planned activities. A sector coordinator in the Department of Fisheries will co-ordinate implementation of the Fisheries and Climate Action and Communication Plan to advance the mainstreaming of climate information services into fisheries policy, planning, design and delivery.

This document reviews existing information on climate variability and change as they affect Vanuatu's fisheries sector and summarises current policies, strategies and frameworks. It provides the Fisheries Climate Action Plan and Communication Plan developed through a collaboration between the Department of Fisheries and the VMGD.

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<sup>1</sup> German Watch (2019) Global Climate Risk Index 2019: Who Suffers Most from Extreme Weather Events? Weather-related loss events in 2017 and 1998 to 2017. Authors: David Eckstein, Marie-Lena Hufils and Maik Winges, Munich, Germany.



## 1. Background

The VMGD, in partnership with the Secretariat of the Pacific Regional Environment Programme (SPREP) and funded by the Green Climate Fund (GCF) is leading the Vanuatu Kilaemet Infomesen blong redy, adapt mo protekt (Van-KIRAP) Project.

Van-KIRAP “will increase the ability of decision makers, communities and individuals across five target sectors (agriculture, fisheries, infrastructure, tourism and water) to plan for and respond to the long- and short-term impacts of climate variability and change”.

The project is building capacity to harness and manage climate data, develop and deliver practical Climate Information Services (CIS) tools, support the coordination and dissemination of tailored information, enhance CIS related information technology and infrastructure, improve the accessibility of CIS to sectors and communities, and support the application of CIS through real-time processes.

CIS provides people and organisations with timely, tailored climate-related information and tools that can be used to minimise the impacts of climate variability and change on lives, livelihoods, natural resources, property and infrastructure. CIS supports better policy, planning, and decision-making across sectors, and at national and community scales for both long- and short-term timeframes.

The Project is responding to priorities identified in the Vanuatu Framework for Climate Services (2016) and the VMGD Strategic Development Plan 2014–2023, developed through a national consultation and design process.

Without timely and tailored information about the impacts of climate variability and change, development sectors, governments and communities risk significant losses and damage from extreme events such as drought, heat waves, cyclones and flooding, and from slow onset changes, such as rising temperatures, sea-level rise and ocean acidification.<sup>2</sup>

In support of these objectives, Van-KIRAP commissioned the development of sector specific Climate Information Services (CIS) Action and Communication Plans. This document reflects the requirements of the fisheries sector as it relates to CIS in Vanuatu.

## 2. Climate in Vanuatu

Vanuatu is one of the world’s most vulnerable countries to natural disasters. It experiences droughts, floods, cyclones, volcanic eruptions, landslides, tsunami and coastal inundation. Its location in the ‘warm pool’ of the South Pacific Convergence Zone (SPCZ) means its population is highly exposed to tropical cyclone activity.

The landscape is characterised by six island groups (Provinces), of mostly mountainous volcanic origin; steep catchments lead to narrow coastal plains vulnerable to flooding. It has a tropical climate, moderated by southeast trade winds from May to October, and moderate rainfall from November to April, often affected by cyclones from December to April. Vanuatu has a population of approximately

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<sup>2</sup> SPREP, RFT: Climate Information Services Policy Review, Sector-Action and Communications Plan Consultancy, 2018

278,000 that is concentrated along the coastal environment that plays a vital role in the subsistence and commercial life of ni-Vanuatu.

Increased human activity in this coastal environment is placing greater pressure on sensitive areas such as beaches, coral reefs, seagrass and mangroves. Atolls, low-lying islands, and low-lying coastal areas of Vanuatu are particularly vulnerable to climate change consequences. Some of these climate related risks include the following:

- by 2040, daily temperatures will increase from 1995 levels by 1.2°C;
- sea level rise will continue and accelerate, so risks of coastal inundation will be high when combined with storm surges and high seas;
- ocean acidification may degrade 80% of coral reefs within 20 years;
- extreme temperatures will reach higher levels and become more frequent;
- extreme weather events, including cyclones and storms, will increase in intensity but not necessarily in frequency; and
- dry periods will last longer and extreme rainfall will be more frequent and intense, so Vanuatu will be susceptible to intensified erosion and flooding.

The economy is based primarily on small-scale agriculture, which provides a living for about two-thirds of the population (and is a particular source of income and livelihood for women). Fishing, offshore financial services, and tourism (with nearly 197,000 visitors in 2008), are other mainstays of the economy. Most of the population does not have access to a reliable supply of potable water, though 94.5% has access to 'improved' water sources, and deforestation exists as a major environmental challenge.

The main climate hazards for Vanuatu include tropical cyclones with high winds and wave energy, heavy rainfall resulting in flooding, extended periods without rain causing drought, rising sea levels threatening coastal environments and property, as well as sea temperature increase and ocean acidification impacting highly valuable coastal ecosystems and resources (including coral reefs, seagrass and fisheries). Pacific region adaptation costs across all vulnerable sectors are estimated to be between US\$158 – 775 million per annum until 2050 to prepare for best to worst case future scenarios (with US\$447 million under business-as-usual) (ADB 2013).<sup>3</sup>

### **3. Climate Services in Vanuatu**

#### **3.1 Vanuatu Meteorology and Geohazards Department (VMGD)**

The mandate of VMGD is decreed by the Meteorology, Geological Hazards and Climate Change Act (2016) – Act No.25 of 2016. The Act gives the VMGD wide ranging powers with respect to the execution of meteorological, geological and climate change related services.

VMGD is headed by the Director of VMGD, who is accountable to the Director General of the Ministry of Climate Change, Meteorology, Geohazards, Energy, Environment and Disaster Management. The Director General is also co-chair of the National Advisory Board on Climate Change and Disaster Risk

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<sup>3</sup> SPREP, GCF Funding Proposal: Climate Information Services for Resilient Development in Vanuatu, 2016

Reduction (NAB) which facilitates and endorses the development of new DRR and CC programs, projects, initiatives and activities, acts as a focal point for information-sharing and coordination on CC/DRR, and guides and coordinates the development of national climate finance processes.<sup>4</sup>

VMGD is responsible for the collection, quality control, processing, storage and retrieval of meteorological and climatological data so that it may be utilised by a wide variety of stakeholders. One of its primary responsibilities is the preparation and publication of seasonal climate forecasts and long-term climate change predictions. VMGD provides technical expertise to the National Disaster Management Office (NDMO) and various climate-sensitive sectors during ENSO events, and disseminates advisories on significant climate events such as El Niño and La Niña. It also pursues climate variability and climate change research in support of national development strategies. In addition, VMGD has an active focus on community engagement, which includes raising awareness of its climate information and services, and how these might be utilised by various end-users.<sup>2</sup>

#### National Climate products from VMGD

1. Vanuatu Climate Update (VCU) – the VCU is produced monthly and is an outlook of expected climate for the upcoming three months. It includes information on seasonal rainfall, tropical cyclones and sea surface temperature. The VCU is disseminated via the VMGD website and email and comes in both English and Bislama.<sup>5</sup> (Figure 1)
2. ENSO (El Niño–Southern Oscillation) update
3. Climate Services: Report for Agriculture – produced from AWS data at a site and available via the VMGD website
4. Media release – El Niño, or La Niña, TC outlook
5. Tropical Cyclone Outlook – usually released early November
6. Klaod Nausara Animation – explains the impacts of El Niño and La Niña in Bislama
7. Brochures – La Niña and El Niño in English
8. ENSO handbook (DVD, brochures and a games toolkit)
9. Vanuatu Ocean Outlook – in trial (Figure 2)
10. Early Alert Rainfall Watch – in trial
11. Rainfall data request – rainfall, temperature, etc.

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4 World Meteorological Organization (WMO), Enhancing Early Warning Systems to build greater resilience to hydrological and meteorological hazards in Pacific Small Island Developing States (SIDS): National consultation report, January 2018

5 SPREP, Vanuatu Framework for Climate Services, 2016

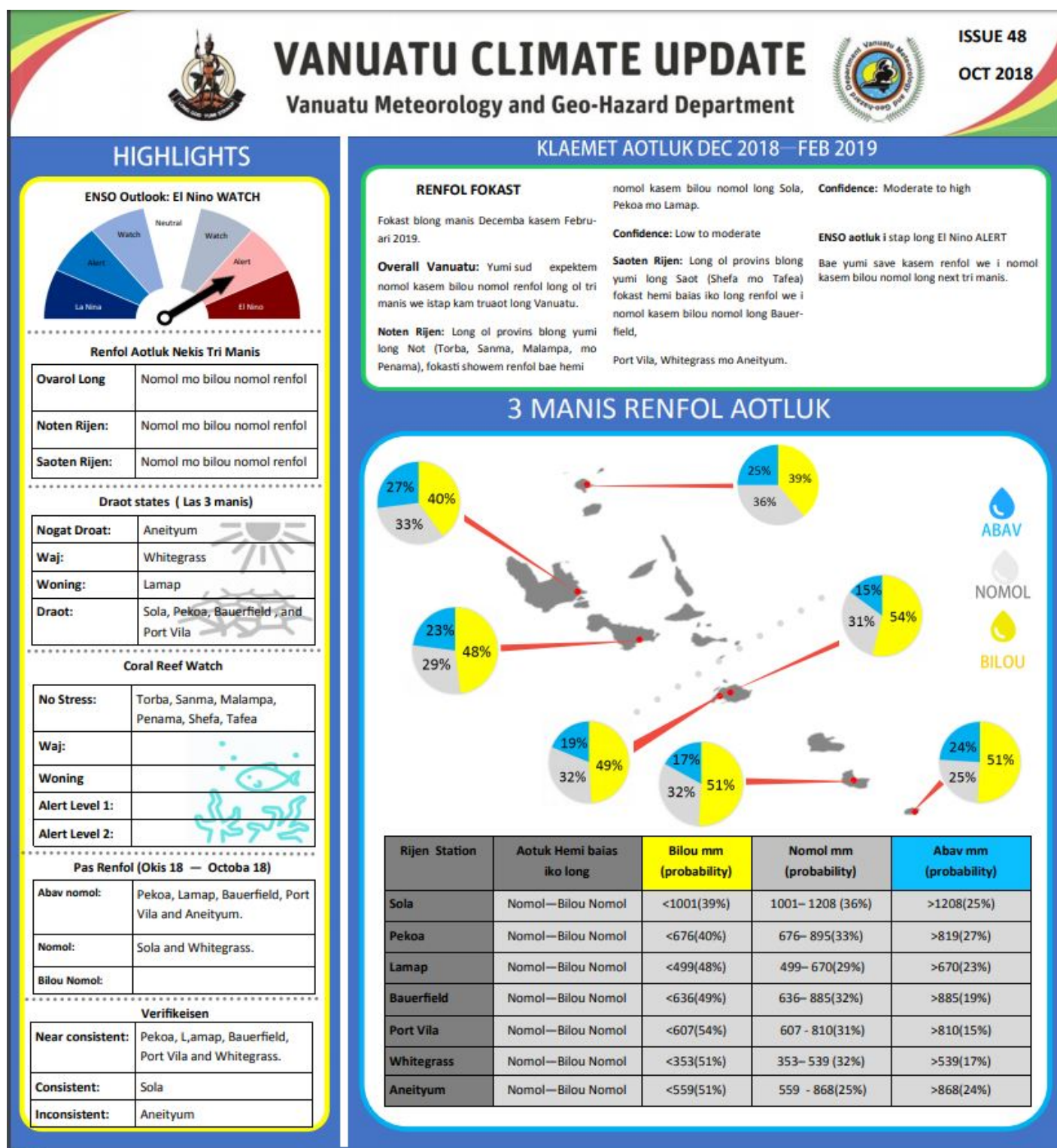


Figure 1: Vanuatu Climate Update (Source: VMGD)



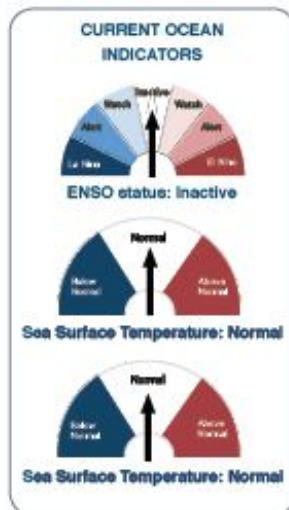


# VANUATU OCEAN OUTLOOK

Vanuatu Meteorology and Geo-Hazard Department



May 2018



## April Ocean Summary:

- The El Niño Southern Oscillation (ENSO) remains neutral -neither El Niño nor La Niña. All climate models indicate the tropical Pacific Ocean will continue to warm slowly.
- Sea Surface Temperatures (SST) anomalies were slightly cooler than average in the central and eastern tropical Pacific Ocean. Warm anomalies were present across most of South Pacific, which includes Vanuatu.

## Ocean Outlook (June - August):

- Normal to below normal Sea Surface temperatures (SST) is expected over Vanuatu waters over the coming months.
- Weak or modest positive anomalies (raised sea level) over areas close to equator. Negative anomalies forecast further away from the equator. Weaker negative anomalies (lower sea level) over Vanuatu and Fiji.
- Trade winds over Equatorial Pacific will continue to weaken.
- In June highest tide will be on the 24th at 0500hrs - height of 1.55m. Lowest tide of the month and also lowest for the year on the 25th at 1245hrs, height of 0.04m.

## Sea Surface Temperature

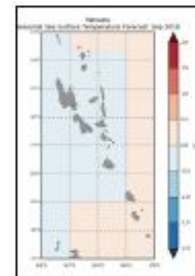
Weak warm to near normal Sea Surface Temperatures(SST)anomalies in April for Vanuatu. The outlook for Jun to August shows weak warm anomalies slowly cooling, but remaining near normal SSTs.

## Application

- Different species of fish are sometimes known to be found at certain temperature ranges

Common name	Species	All occurrences (C)	Abundant occurrences (C)
Skipjack	<i>Katsuwonus pelamis</i>	17-30	20-29
Yellowfin	<i>Thunnus albacares</i>	18-31	20-30
Bigeye	<i>T. obesus</i>	11-29	13-27
Albacore	<i>T. alalunga</i>	13-25	15-21
Southern	bluefin <i>T. maccoyii</i>	10.5-21	17-20

Figure 2: Ranges of sea surface temperature that different species of tuna present in the Pacific (Blackburn & Williams)

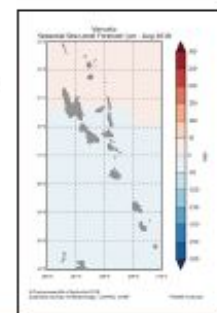


## Sea level

The sea level for month of April has been near normal over Vanuatu. The outlook for the next three months (Jun-Aug), sea-level will be moving toward lower than normal over Central and Southern islands. While the islands in the North will experience positively near normal( a little rise in the sea level).

## Application

- Extremely low tides exposes reefs to sunlight may affect reef population and food chain, especially if duration of low tides are longer than normal.....
- .....



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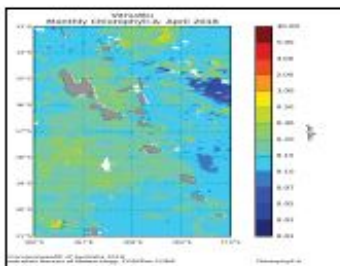


#### Coral Reef Watch

This Coral Reef watch for the month of April has been on No Stress Level. The outlook for the months (Jun-Aug) throughout Vanuatu is maintained at No Stress Level.

#### Application

- When combined with the implementation of a management plan, advanced knowledge of potential bleaching events can reduce the severity of the bleaching event and aid in recovery.
- Following a bleaching event, coral recovery can be inhibited by opportunistic algae growth.
- Limiting fishing in the region can increase fish populations, which in turn maximises the consumption of plant growth and limits their impact on the corals. (Marshall and Schuttenberg, 2006).

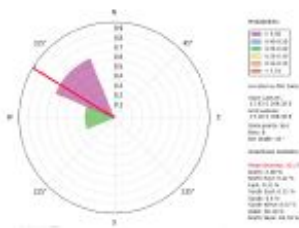


#### Monthly Chlorophyll

Last month's map shows a higher concentration of chlorophyll in the central and southern parts of Vanuatu group. The outlook for the next three months Jun - Aug is

#### Application

- Fishermen targeting smaller pelagic (open sea) fish may be interested in the chlorophyll concentration in the ocean, because smaller fish are closer to phytoplankton on the food chain.
- Chlorophyll is present in algae and small marine plants and these areas tend to be rich areas for fishing. Chlorophyll-a is the principal photosynthetic pigment chain.



#### Monthly Wave Direction

Port Vila wave climate for the month of April show majority of the waves coming from the (north/ west/south east) going toward the north west direction. This has been the average direction for the past 30 years.

#### Application

- Estimates of the frequency and severity of extreme waves can inform planning decisions such as appropriate zoning for residential buildings.
- Wave climatology information can be valuable to determine safe and efficient shipping routes.
- Construction works, naval architecture, equipment maintenance, and any other development occurring near the ocean require knowledge of the typical wave climate that a region is likely to experience.

#### Tidal Predictions for 2018

2018 Tidal predictions show the highest tides of the year for Port Vila. The next highest tide coming up on the 14th of May with a height of 1.81m. The lowest tide in Port Vila is on the 15th with a height of 0.09m.

Port Vila highest and lowest tides for 2018						
Highest tide per month			Lowest tide per month			
Date	Time	Height	Date	Time	Height	
Jan						
Feb						
Mar						
Apr						
May						
Jun						
July						
Aug						
Sep						
Oct						

Lagunville highest and lowest tides for 2018						
Highest tide per month			Lowest tide per month			
Date	Time	Height	Date	Time	Height	
Jan						
Feb						
Mar						
Apr						
May						
Jun						
July						
Aug						
Sep						
Oct						

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Figure 2: Vanuatu Ocean Outlook (Source: VMGD)

#### National Climate stakeholder liaison by VMGD

1. VMGD Monthly climate briefings – presentation on the climate summary and outlook information
2. VMGD 3-Monthly climate briefings – presentation on the climate summary and outlook information
3. VMGD National Climate Outlook Forum (NCOF)
4. Media briefings – Radio talkback monthly

### 3.2 Regional climate products supported by partners

#### *SPREP*

1. Early Action Rainfall (EAR) Watch (see VMGD website)
2. Traditional Knowledge program (housed at VMGD) – survey form, database system
3. Climate Information Toolkit for the Pacific (<http://clikp.sprep.org/>) (supported by APCC)
4. Pacific Island Countries Advanced Seasonal Outlook (PICASO) – rainfall threshold predictions (<http://clikp.sprep.org/>) (supported by APCC)
5. SCOPIC/Seasonal Forecasting (in partnership with BoM) – 3 month prediction (<https://www.pacificmet.net/products-and-services/climate-bulletin>)

#### *Australian Bureau of Meteorology (BoM)*

1. COSPPac Bulletin (<https://www.pacificmet.net/products-and-services/climate-bulletin>)
2. SCOPIC/Seasonal Forecasting - 3 months (<https://www.pacificmet.net/products-and-services/climate-bulletin>)
3. Drought Monitoring Tool (allows VMGD meteorologists to set thresholds for different water requirements)
4. ENSO Wrap-up (<http://www.bom.gov.au/climate/enso/>)
5. CliDE (climate data for the environment) (and CliDEsc which is supported by NIWA)
6. Sea-level information products (real time data monitoring and tide calendars)
7. Pacific Climate Change Data Portal (<http://www.bom.gov.au/climate/pccsp/>)
8. TC portal (<http://www.bom.gov.au/cyclone/history/tracks/>)
9. ACCESS-S dynamic model (in development) – outlook for season, month, fortnight and week
10. POAMA dynamic model – 3 to 9-month forecasts (SST+, hot spots, bleaching risk etc.)
11. ReefTemp Next Gen – 1 to 14 days (SST, SST+, hot spots and bleaching risk maps)

#### *Commonwealth Scientific and Industrial Research Organisation (CSIRO)*

1. Climatology of Vanuatu: Past, present and future
2. Technical Report and non-technical country brochure
3. Regional Climate Consortium in Asia-Pacific (RCCAP) Portal
4. Websites and portals:
  - [www.pacificclimatechangescience.org](http://www.pacificclimatechangescience.org)
  - [www.pacificclimatefutures.net](http://www.pacificclimatefutures.net)
  - [www.pacificmet.net/rcc](http://www.pacificmet.net/rcc)
  - [www.rccap.org](http://www.rccap.org)



### Other Organisations

1. Pacific Ocean Portal (formerly BoM and now supported by SPC)
2. Tide Predictions Calendar (<http://www.bom.gov.au/pacific/projects/pslm/>) (SPC)
3. RiskScape – Land-use planning tool that includes sea level, rainfall, elevation (NIWA)
4. Coral Reef Watch – 9-month SST+ and bleaching projections (NOAA & used by VMGD) (<https://coralreefwatch.noaa.gov/satellite/baa.php>)
5. Bleaching Futures – downscaled coral bleaching return interval projections to 2100 for Vanuatu (NOAA/Symbioseas)<sup>6</sup>

## 4. Fisheries in Vanuatu

Vanuatu's fisheries sector is an important provider of employment, food and income. Fisheries resources are exploited at the subsistence, artisanal and industrial levels and have always been considered secondary to agriculture. As is the case in many Pacific Islands, fish resources provide the principal source of animal protein for ni-Vanuatu communities, especially those living in the country's many remote islands.<sup>7</sup>

Vanuatu's fisheries resources are divided into three main groups: 1) various species of tuna, 2) deep-water bottom fish generically referred to as “poulet” and made up of primarily of snapper and related species, and 3) reef fish that inhabit the coastal waters inside the reefs. Current fishing activities in Vanuatu can be classified into the following broad categories:

- *Subsistence*: nearshore reef fishing activities that target reef associated and lagoon fish, shellfish and small pelagic fish, reef gleaning, and shell collecting;
- *Artisanal*: small-scale commercial fishing activities that principally target shallow and deep-water bottom snapper (poulet) species, and FAD associated pelagics using trolling and longlining techniques. Also includes collection of sessile organisms such as trochus, green snails, and beche-de-mer;
- *Big game/sports fishing*: commercial charter boat sport fishing for tourists. This fishing activity targets billfish, tunas and large coastal pelagic fish species. Some vertical droplining for deep-water bottom fish is also included;
- *Locally based longliners*: pelagic longline fishing for albacore and yellowfin tuna, plus some bottom set longlining for snapper and groupers; and,
- *Foreign access industrial fishing*: which is primarily longlining, but also some multilateral purse-seining.<sup>6</sup>

Vanuatu has a large locally-based longline fishery for tuna that operates both within and outside its exclusive economic zone (EEZ), and a purse-seine fishery that operates only outside the EEZ. Recent average catches (2004–2008) by these fisheries totalled more than 72,000 tonnes per year, worth more than USD 130 million. Vanuatu also licenses foreign longline fleets to fish for tuna in its EEZ.

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<sup>6</sup> Maynard, J., Heron, S., van Hooidek, R., Tracey, D. 2018; Past and projected future impacts of coral bleaching on the reefs of Vanuatu. Report to the Secretariat of the Pacific Regional Environment Programme (SPREP), Apia, Samoa (19 pp).

<sup>7</sup> Amos, J.A, 2007; Vanuatu Fisheries Resource Profile – International Water Project Pacific Technical Report, 2007.

These fleets made average annual catches of > 4200 tonnes, worth ~ USD 10 million between 1999 and 2008 <sup>8</sup> (Figure 3).

Local oceanic fisheries	Average annual catch (tonnes) 2004–2008	Average annual catch value (USD million)* 2004–2008
Tuna		
Purse-seine	59,787	70.8
Longline	11,233	58.2
Other oceanic fish <sup>a</sup>	1265	1.3
<b>Total</b>	<b>72,285</b>	<b>130.3</b>

\* Calculated using market value per tonne for 2004–2008; a = billfish catch only, valued at USD 1000 per tonne.

Figure 3: Recent Catch and Value (Source: Bell et al. 2011)

[A] village subsistence fishing survey conducted in 1983 indicated that over 50% of the country's rural population engaged in fishing and 93% was for subsistence consumption. Most fishing within the reefs and lagoons has been at the subsistence and artisanal levels. Reef and lagoon fish, as well as non-fish marine animals such as lobsters, are becoming increasingly important at the artisanal level. <sup>9</sup>

Traditional management practices have been used to conserve stocks, although with advances in fishing techniques and equipment, and increasing pressure for financial rewards from fishing, customary methods of fishing have declined in some areas. Although in some communities, village level management methods are reportedly making a comeback. <sup>10</sup>

## 4.1 Fisheries services in Vanuatu

### 4.1.1 Fisheries institutional arrangements relating to climate

The Department of Fisheries is the key agency for VMGD to work with. An MOU between the two Departments with Standard Operating Procedures (SOPs) and Service Level Agreements (SLAs) is desirable. The National Oceanic and Atmospheric Administration (NOAA), Pacific Community (SPC) and Secretariat of Pacific Regional Environmental Programme (SPREP) are also key regional partners.

### 4.1.2 Current use of climate information by the fisheries sector

There is currently limited use of climate data or information by the fishing industry in Vanuatu, but VMGD and the Ministry of Fisheries have a close relationship. A NOAA-funded workshop entitled “Technical Exchange in support of Climate Early Warning for the Marine Sector” (May 2016) has identified several key steps to strengthening the relationship.

<sup>8</sup> Bell, J.D., Johnson, J.E., Hobday, A.J. 2011; Vulnerability of tropical Pacific fisheries and aquaculture to climate change, Secretariat of the Pacific Community (SPC), Noumea, New Caledonia.

<sup>9</sup> Government of Vanuatu; Vanuatu National Fisheries Sector Policy – 2016-2031

<sup>10</sup> Amos, J.A., 2007; Vanuatu Fisheries Resource Profile – International Water Project Pacific Technical Report, 2007.

The Vanuatu Climate Update and the monthly climate summary are sent to the Department of Fisheries, and the Department takes part in the annual NCOF. VMGD has recently tailor-made a fisheries bulletin—the Ocean Outlook—which is currently in trial.

## 4.2 Main climate impacts on fisheries

Ni-Vanuatu depend heavily on subsistence fisheries for their food security. Seafood comprises a very high percentage of the animal protein consumed by Pacific Islanders, much higher than the world average of 17 percent. If the subsistence fisheries ceased to exist, Vanuatu may have to spend US\$7–\$15 million a year for substitutes with similar protein content (World Bank, 2000).

The impact of long-term trends in climate change, in particular related to global warming, is less well-understood in fisheries but is beginning to receive attention (FAO, 2007a). Climate change and rising sea levels are likely to impact on marine resources through their effects on corals and reef ecosystems. Coral bleaching could increase as a result of increased temperatures and there are concerns about the possible increase in ciguatera poisoning due to increased temperatures of the oceans, marine pollution from land-based activities and sedimentation of the coastal areas and water run-off.

Changes in ocean circulation patterns, may affect fish populations and the aquatic food web as species seek conditions suitable for their lifecycle. Higher ocean acidity (resulting from carbon dioxide absorption from the atmosphere) could affect the marine environment through deficiencies in forming calcium carbonate, affecting shelled organisms and coral reefs.

The damage to coral reefs from cyclone events can be considerable as was the case with reefs around Efate from Tropical Cyclone (TC) Ivy in 2003. Several outbreaks of the coral-destructive Crown of Thorns starfish have been reported since the cyclone, but it is difficult to say if this was directly related to the cyclone damage.<sup>11</sup>

## 5. Stakeholder Consultations Relating to Climate and Water

### 5.1 VMGD consultation

VMGD regularly interact with the Fisheries sector through their 3 monthly climate stakeholder engagement and their annual national climate outlook forum (NCOF). VMGD have also undertaken engagements specifically with the Fisheries sector over the last few years including through the development of the Vanuatu Framework for Climate Services, the Vanuatu Coastal Inundation Project and most recently through the Van-KIRAP project. The outcomes of these interactions are incorporated into this document.

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<sup>11</sup> FAO; An Assessment of The Impact of Climate Change on Agriculture and Food Security - A Case Study In Vanuatu

## 5.2 Vanuatu Coastal Adaptation Project<sup>12</sup>

The Vanuatu Coastal Adaptation Project (VCAP), is a UNDP supported, GEF-LDCF led project which is working to build resilience and improve the quality of life in targeted vulnerable areas in the coastal zone through increased food production, improved infrastructure and sustainable livelihoods.

## 5.3 Van-KIRAP sector consultation

From January to December 2018, several workshops and consultations were held with the Van-KIRAP team and the Fisheries sector in which recommendations, actions and communication plans were iterated. The summary section below articulates the outcomes.

### 5.3.1 Van-KIRAP Inception Workshop – January 2018<sup>13</sup>

The Technical Inception Workshop for Van-KIRAP, funded by the Green Climate Fund (GCF), was held on 22 February 2018 at the Holiday Inn in Port Vila. “Its purpose was to officially launch and commence the project, refresh awareness of the stakeholders about the project, and review project activities, and implementation arrangements.”<sup>14</sup>

One of the outcomes of the workshop was to identify the key project priorities for each sector. The priorities identified by the Fisheries Department are listed below:

- Establish community based marine protected areas as food reserves for use during natural disasters or special occasions.
- Develop community based Integrated Coastal Zone Management (ICZM) Plans to manage inland and marine resources.
- Conduct baseline habitat surveys: mangrove, seagrass and coral reef (mapping).
- Establish mini facilities for freshwater cultured species in provincial centres for restocking after disasters.
- Promote gender inclusion through integrated aquaculture and agriculture system.
- Identify new commercially viable strains of aquatic species tolerant to poor water quality.
- Encourage and promote diversification of fisheries activities to promote livelihoods, food security and income sources, which includes non-fisheries related activities.
- Rehabilitate coastal ecosystems that provide coastline protection (e.g. mangrove replanting).
- Collaboration with stakeholders to address climate resilience in coastal communities.

### 5.3.2 Van-KIRAP Sector Workshops – October 2018

The VMGD “with funding support from the GCF and the Secretariat of the Pacific Regional Environment Programme (SPREP), organised a Sector Consultation Workshop for Developing Climate

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<sup>12</sup> GEF, Vanuatu Coastal Adaptation Project: Climate Information and Services, Summary Sector tables, 2017

<sup>13</sup> SPREP, Inception Report: Climate Information Services for Resilient Development Planning in Vanuatu (Van-CIS-RDP), 2018

<sup>14</sup> SPREP, Inception Report: Climate Information Services for Resilient Development Planning in Vanuatu (Van-CIS-RDP), 2018

Action and Communication Plans from 23 October to 2 November 2018.”<sup>15</sup> Pacific Science Solutions (PSS) facilitated and led the consultations with the workshop participants.

The workshop was structured in three parts. The first part was held in Port Vila, attended by the Project Delivery Partners, sectors and other science organisations. Sector representatives were supported to draft Action and Communication Plans relating to their use of climate information. The second part of the workshop was held in Santo where provincial sector representatives were asked to review the draft sector Action and Communication Plans written by their Port Vila colleagues. The last part of the workshop was held in Port Vila, where senior sector representatives reviewed and finalised their draft Action and Communication Plans.

See the Workshop Report for more information.

### **5.3.3 Van-KIRAP Follow-up Sector Consultation – December 2018**

From 3 to 7 December, Pacific Science Solutions and SPREP conducted follow-up consultations with representatives from four sectors (agriculture, tourism, fisheries and water) to discuss their draft sector plans and seek their respective Directors’ preliminary endorsements. The draft plans incorporated the outcomes of the consultation workshops (Section 5.3.1). Further changes and inputs were provided during the follow-up meetings and these have been incorporated in this document.

## **6. Summary of Outcomes for Fisheries**

The following information comes directly from the policy review and consultations with VMGD and the Department of Fisheries. The tables outline the proposed recommendations for the Fisheries sector’s use of climate services. The proposed actions should be undertaken in conjunction with a communication plan to ensure effective communication between the Fisheries sector, its primary stakeholders and VMGD.

### **6.1 Recommendations**

The recommendations from the VFCS and priorities identified at the Van-KIRAP Inception Workshop were reviewed, updated and prioritised by the Fisheries sector at the Van-KIRAP Sector Consultation Workshops (Table 1). Participants added information and clarity to the recommendations.

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<sup>15</sup> SPREP, Van-KIRAP sector consultation workshop report, 2018

Table 1: The final list of Recommendations

RANK	LEAD GFCS PILLAR	RECOMMENDATION
1	Climate Services Information System	Tailor climate information services for fisheries & aquaculture (freshwater, coastal, offshore)
2	User Interface	Make weather and marine climate data accessible on Aqua-Tails tablets
3	User Interface	Enable additional resource (area council - in remote areas and fishers' associations) to support a marine climate early warning system for Vanuatu
4	Climate Services Information System	Incorporate traditional knowledge relating to Fisheries into the Fisheries sector
5	Climate Services Information System	Climate related impact information available for fisheries and aquaculture
6	User Interface	Expand communities using marine monitoring toolkit and add climate information
7	Research, Modeling and Prediction	Climate change maps for fisheries and aquaculture (freshwater, coastal, offshore)
8	Climate Services Information System	An update to the ENSO Handbook (Klaud Nasara) for marine resource management is required and poster distribution
9	Climate Services Information System	Development of a Climate-Freshwater bulletin in partnership with the Department of Fisheries

## 6.2 Alignment of recommendations with National and Regional policies and plans

A review of the top national and regional policies and plans associated with Fisheries and Climate were assessed for alignment with the recommendations. The documents reviewed were: Vanuatu's National Ocean Policy 2016 (NOP), Vanuatu National Fisheries Sector Policy 2016-2023 (NFSP), Vanuatu Framework for Climate Services (VFCS), Vanuatu Meteorology and Geohazards Departments Strategic Development Plan 2014—2023 (VMGD SDP), National Sustainable Development Plan (NSDP) 2016-2030, Republic of Vanuatu Second National Communication to the UNFCCC (SNC); and the Pacific Roadmap for Strengthened Climate Services (PRSCS) (Table 2).

In some cases where recommendations are quite specific there was no alignment to policies. As such these recommendations were not included in Table 2.



Table 2: Recommendations aligned with National and Regional policies and plans

Number	Recommendation	Policy & Plan Alignment
1	Tailor climate information services for fisheries & aquaculture (freshwater, coastal, offshore)	<b>VMGD SDP:</b> KO 4 Monthly to seasonal climate information, forecasts, services and warning are continually developed and routinely improved. It is noted that Climate Division's growth in service in recent years has been driven by increasing demand of end users for climate specific information.
		<b>VFCS:</b> In the Executive Summary it states fundamentally, the greatest and most pressing need is for the development, through consultation with key stakeholders, of tailored climate products (including training on their use); Under Recommendation 4: Provincial Government should work with the VMGD to tailor climate information so that it best meets their needs and directly informs their action and response plan. There is a need for tailoring of climate information (such as long-term climate change maps and seasonal forecasts) for specific fisheries/aquaculture farmers. This should include threshold forecasts for specific indicators. Site specific forecasts would also be very useful. Fisheries sector would benefit from a Climate Watch that specifies, among other things, whether there is an enhanced risk for Ciguatera (a foodborne illness caused by eating contaminated reef fish)
		<b>SNC:</b> In 2014, the Department of Fisheries co-hosted Vanuatu's first Climate Services Dialogue which sought to bring together stakeholders to understand how climate information could be transformed into more useful tools and products for the marine sector. As a result of the dialogue, a Marine Dashboard online tool was developed that brings all major marine climate indicators and predictions into a single location.
		<b>PRSCS:</b> Identify Risk Assessment or Management Evaluation tools to improve the ecosystem approach to the management of fisheries. Undertake lagoon monitoring for aquaculture. Improve understanding of the sensitivity of pearl and seaweed industries to rising sea temperatures.
2	Make weather and marine climate data accessible on Aqua-Tails tablets	<b>NFSP:</b> Under SPO 5: Policy Directive - Establish data management and reporting procedures for climate change monitoring results. Under Strategic Action 28: Policy directives- Undertake trial of electronic reporting and electronic monitoring also develop national ER/EM strategy/Adopt same reporting in aquaculture production farms
		<b>VMGD SDP:</b> KO 2 Improved and sustained quality of meteorological, hydrological and other related environmental datasets on the VMGD Headquarters server. KO 3 Climate databases such as CliDe are maintained and operationalized.
		<b>VFCS:</b> Recommendation 13- VMGD to consider options for dissemination of up-to-date climate information via phone messaging system. Under Section 8 VMGD recommended develop a mobile application through which CLEWS information could be distributed.
		<b>PRSCS:</b> Develop National Oceans Portal
3	Enable additional resource (area council - in remote areas and fishers' association) to support a marine climate early warning system for Vanuatu	<b>NOP:</b> Under Section -Increase Knowledge and Capacity building- Both formal and informal training, capacity building for scientists, technicians, professionals and students at various levels is encourage, specifically around marine science, marine affairs and related disciplines.
		<b>NFSP:</b> Under the heading "Constraints, issues and challenges within the fisheries sector", Issue No 5 Identifies a shortage of human & financial resources within the Fisheries Department, specifically the lack of information, communication, technology and fisheries officer. SPO 1 details the need to create both field officer positions (for rural areas to cover expanding fisheries roles) and positions for ICT and communications officers. Also, an increase in budgetary support.
		<b>VFCS:</b> Recommendation 9: As part of an operational Climate Early Warning System (CLEWS), tailored climate bulletins issued to specific end users and mobile phone apps should be developed. Development of climate early warning for specific fish species, coral bleaching risk. Under Climate and Fisheries improved technology is needed to support a marine climate early warning system for Vanuatu.
		<b>VMGD SDP:</b> Under Climate Change and Risk Reduction, the need for sufficient resources to manage & operate the implementation of climate change and risk reduction programmes.
		<b>NSDP:</b> Access available financing for climate change adaptations and disaster risk management. ENV 3.2 Improve monitoring and early warning systems.
		<b>SNC:</b> Projects/Funding - 7. (V-CAP) Adaptation to Climate Change in the Coastal Zone in Vanuatu. Focus on community-based climate change adaptation measures at 6 different sites with Infrastructure resilience, upland management and coastal resource management components. Early warning systems and policy support as well. Implemented by PMU, PWD, Environment, Agriculture, and Fisheries & Forestry. (2014-2019).
		<b>PRSCS:</b> Develop a Fisheries Climate EWS

Number	Recommendation	Policy & Plan Alignment
4	Incorporate traditional knowledge relating to Fisheries into Fisheries sector	<b>NOP:</b> Under Strategic Action 25 Incorporate traditional and cultural values in community fisheries plans. Under 6.2.2 Build on and share existing traditional knowledge on climate variability and disaster risk management and expand its use.
		<b>NFSP:</b> Under SPO 5 - Strategic Action 25 (Promote community-based management) a) Strengthen community-based management and climate change adaptation through community-based ecosystem plans b) Preserve traditional resource management and fishing practices.
		<b>VMGD SDP:</b> KO 4 -Monthly to seasonal climate information, forecasts, services and warning are continually developed and routinely improved. SO 4.1 An established set of quality management standard manuals is developed and produced for reference for climate services development and engagement with end users, including the capture of traditional knowledge and development of new indicators where needed.
		<b>VFCS:</b> Under Climate and impact data observations and monitoring VMGD collect a variety of climate data including maintain a traditional knowledge database which is utilized by clients. Under Research Gaps - Traditional knowledge is a key area where further scientific understanding is required, with the ultimate goal of ensuring TK is incorporated with climate services wherever relevant.
		<b>NSDP:</b> SOC 1.4 Strengthen links between traditional and formal governance systems. ENV 4.4 Promote the sustainable development of the fisheries sector that values the protection and conservation of the marine freshwater resources. ENV 5.3 Support local conservation and protection of endangered, threatened or endemic species and ecosystems including through traditional knowledge and practices.
5	Climate related impact information available for fisheries & aquaculture	<b>NOP:</b> 3.2.4.4 Build capacity, including of local government and communities, to conduct monitoring, surveillance and enforcement and to share information.
		<b>NFSP:</b> Strategic Action 12 - Policy directives: 1. Undertake environment impact assessment on major developments. SPO 5: Climate Change & Disaster Risk Reduction Policy directives - Implement research studies on the monitoring of the impact of climate change on coral reef health /Established data management and reporting procedures for climate change monitoring results.
		<b>VFCS:</b> Under Climate and Impact data monitoring the VMGD has begun digitalising historic data from paper records. Under Climate and Fisheries more monitoring of climate-related impacts on fish (marine and lagoon) abundance and species mix, plus fish catch is required, and an impacts database needs to be established.
		<b>NSDP:</b> ENV 5.6 Enhance environmental monitoring, evaluation and research with relevant agencies
		<b>SNC:</b> 5.6.2 Research, Data and Information Gaps: Detailed assessments of climate change impacts and risks across a variety of sectors are required in order to develop sound response strategies, in particular focusing on food security, water resources, and coastal resources.
		<b>PRSCS:</b> Contribute to the understanding of the impacts of climate change on Fisheries and Aquaculture.
6	Expand communities using marine monitoring toolkit and add climate information	<b>NFSP:</b> SPO 5 Work with research institutions to establish a long-term climate change monitoring programme and Establish data management and reporting procedures for climate change monitoring results. Also collaborate with other partners in addressing marine environmental monitoring. Implement research studies to monitor coral bleaching, crown-of-thorns outbreak, 4. Work with research institutions to establish a long-term climate change monitoring programme. SPO 5 Established data management and reporting procedures for climate change monitoring results. Under the Climate Change and Risk Reduction Section - The need to a) Establish data management and reporting procedures for climate change monitoring results and b) as well Collaboration with other partners to achieve strong marine environmental monitoring.
		<b>NSDP:</b> ENV 3.2 Improve monitoring and early warning systems. ENV 5.6 Enhance environmental monitoring, evaluation and research with relevant, open and transparent data sharing among relevant agencies.
		<b>VMGD SDP:</b> SO 5.1 Information and communications products and services from the Climate Division are routinely produced according to VMGD policy guidelines and quality management standards.
		<b>VFCS:</b> Under Climate and Impact Data Monitoring (7.2) it is recognised that considerable impact data is collected within the various Sectors of government however it is not centralised as yet and is also cumbersome to access. Under Climate and Fisheries Section there is an acknowledgment ENSO update is needed specifically related to Marine Resource Management. Also, Under Climate and NGO's, recognition that the Climate Information Toolkit is often used at community meetings and events for NGOs, demonstrating toolkits effectiveness/relevance.
		<b>NOP:</b> 6.6.2.1 Strengthen existing systems to improve information capture, access and application in relation to Climate change and Disaster Risk Reduction.

7	Climate change maps for fisheries & aquaculture (freshwater, coastal, offshore)	<b>NFSP:</b> Under Strategic Action 24 (Implement mitigation and adaptation activities in readiness for disasters) Develop of a mapping system to assess scale of impacts on marine environment.
		<b>VFCS:</b> The Vanuatu Monthly Climate Summary (VMCS) bulletin should be enhanced to make more use of observed climate information and products and include impact assessments.
		<b>SNC:</b> Comprehensive vulnerability maps identifying the locations of high vulnerability could support disaster planners in preparing communities for worst case impacts as well as in helping local communities take an active role in identifying appropriate response mechanisms.
		<b>PRSCS:</b> Contribute to the understanding of the impacts of climate change on Fisheries and Aquaculture
8	An update to the ENSO Handbook (Klaud Nasara) for marine resource management is required & Poster distribution	<b>VFCS:</b> Under Recommendation 1 it is specified that ENSO reporting is reliant on external bodies to provide essential information. Under Section 8 of the report it states that with regards to ENSO, the VGMD already provides brochures, posters and fact sheets. Under Climate and Fisheries Section there is an acknowledgment ENSO update is needed specifically related to Marine Resource Management. Also Under Climate and NGO's, recognition that Klaod Nasara is often used at community meetings and events for NGOs demonstrating its relevance.
9	Development of a Climate-freshwater bulletin in partnership with the Department of Fisheries	<b>NFSP:</b> SPO 1: Institutional strengthening and good governance recommends the promoting of electronic, visual and print media, radio programme workshops, seminars and public forums to better inform the public and share fisheries data.
		<b>VMGD SDP:</b> SO 5.1 Information and communications products and services from the Climate Division are routinely produced according to VMGD policy guidelines and quality management standards.
		<b>VFCS:</b> EWS - Recommendation to develop monthly bulletins for Sarakata Hydro Project.

## 6.3 Policies relating to climate and fisheries

Several national and sectoral policies, strategies, frameworks and plans support the need for the development and application of tailored climate information in the Fisheries sector. This section outlines the references to climate and Fisheries in these documents and in related stakeholder engagement platforms. The Global Framework for Climate Information Services is also referenced. The review of these documents focusses on the integration of climate information services into the Fisheries sector, and the findings of the review are provided in the Summary section below. (*Refer to Annexes for specific references from the documents below, on the provision and integration of climate information in the Fisheries sector*).

### 6.3.1 Vanuatu National Fisheries Sector Policy 2016-2031

The Vanuatu National Fisheries Sector Policy 2016–2031 recognises all other fisheries-related sub regional, regional and international policies and treaties that Vanuatu is a signatory to. Examples of these policies and treaties include the Melanesian Spearhead Group Coastal Fisheries Roadmap (2015–2024), the Pacific Islands Forum Fisheries Agency Regional Melanesian Spearhead Group Strategy (2010–2015), A new song for coastal fisheries – pathways to change: the Noumea Strategy (2015), the Pacific Regional Roadmap on Fisheries (2010), the Samoa Pathway (2014) and the Sustainable Development Goals (2014).

This policy seeks to coordinate the fisheries management, development and conservation activities of existing fisheries management plans, and the linkages to high-level strategies and monitoring programs in the fisheries sector.”<sup>16</sup> Strategic Policy objective 5 (SPO 5) addresses *Environmental Management, Climate Change Adaptation And Disaster Risk Reduction*, “Investigate the impacts of development on the environment, and the impacts of climate change and disaster on fisheries resources and habitats, particularly identifying and implementing key priority areas on climate resilience and disaster risk reduction.

SPO 5 has 4 strategic action directives of which 3 are climate related:

- Undertake an environmental impact assessment and baseline study to assess climate change impacts.
- Implement mitigation and adaptation activities in readiness for disasters.
- Promote community-based management and climate change adaptation.

The policy further recognises climate change and its adverse impacts on the environment and humanity, and the need for the fisheries sector to consider adapting and mitigating the impacts to reduce the risk of disasters.

### 6.3.2 National Ocean Policy (NOP) 2016

The National Ocean Policy aims “to achieve an ocean governance framework that supports traditional marine resource management practices and knowledge and manages all line agencies with responsibility for maritime and ocean affairs and harmonises national actions in relation to the marine

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<sup>16</sup> Government of Vanuatu; Vanuatu National Fisheries Sector Policy – 2016-2031

resources of the Republic of Vanuatu...The Ocean Policy embeds the culture of the ocean into ocean management and merges across different uses, users and ocean managers.”<sup>17</sup>

The **National Ocean Policy 2016** aims to build resilience in its marine ecosystems to climate change while achieving its vision and purpose. The policy document recognises that planning for uncertainty, understanding the impacts and effect of climate change and other stressors such as cyclones, coastal flooding is also the key to maintaining a healthy environment.

Key objectives relating to climate are Action areas 7 which is building resilience and managing for uncertainty and 6 which is to conserve, manage and develop the Ocean to help Vanuatu have resilient communities, environment and economy for the long term.

The Strategic Objectives for the Climate Change Sector regarding the ocean are to:

- Promote and support efficient, effective Climate Change & Disaster Risk Reduction efforts using Ecosystem-based Approaches;
- Facilitate and enhance appropriate measures to manage Climate Change & Disaster Risk Reduction knowledge & information.

### **6.3.3 Vanuatu Meteorology and Geohazards Department Strategic Development Plan 2014-2023 (VMGD SDP)**

The VMGD SDP “sets the strategic context and direction for strengthening the capacity of the VMGD, with emphasis on developing and supporting “...state of the art technical services...” collectively through enhanced capacity, coordination and partnerships. The Strategy focuses on the following priorities (amongst others):

- Improved weather, climate and climate change services (including across multiple hazards, stakeholders and time frames)
- Improved observations and associated monitoring networks, and
- Enhanced capacity for both administrative/project management and research and development, outreach and communications.

The Strategy summarises the current situation (capacity, activities, products and services) for the relevant Divisions of the VMGD including Weather Forecasting and Services, Climate, Climate Change and Disaster Risk Reduction, Observations, and Information Communication Technology and Engineering.”<sup>18</sup>

The VMGD SP under the Climate Division section has a specific Key Outcome relating to Fisheries. Under this key outcome number 8 it outlines the importance of developing research capacity and priorities.

### **6.3.4 Vanuatu Framework for Climate Services (VFCS)**

The VFCS is principally guided by the five pillars of the Global Framework for Climate Services, the VMGD Strategic Development Plan and by various national level stakeholder consultations. The stated

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<sup>17</sup> Government of Vanuatu; National Ocean Policy, 2016.

<sup>18</sup> SPREP, GCF Funding Proposal: Climate Information Services for Resilient Development in Vanuatu, 2016

goal of the VFCS is to “...ensure climate services for Vanuatu are of world-class standard, sustainable, are reaching all end-users, and are effectively helping people manage and adapt to climate variability and change in Vanuatu (SPREP 2016). This Framework identifies the most pressing needs as:

- The development, through key stakeholder consultation, of tailored climate products (including training on their use), and
- Improvements to and formalisation of mechanisms for communicating and disseminating climate information.

The Framework makes 18 specific recommendations, based around the five pillars and associated structure of the GFCS, as priority actions. The VFCS aims to strengthen climate information development, provision, understanding and use throughout Vanuatu. It describes the following:

- Capacity of both providers and receivers (source and Next/End-Users) of climate services
- The interface platforms and networks used for dissemination of climate information and its value
- The kind of products that can be produced and tailored to user needs
- The research gaps that still require filling, and
- The requirement for high quality climate observations fundamental to all services.”<sup>19</sup>

The VFCS identifies the most pressing needs as tailored climate products and formalisation of mechanisms for communicating and disseminating climate information. It makes five recommendations for fisheries as the need for a climate monitoring of climate-related impacts on fish (marine and lagoon) abundance and species mix, plus fish catch is required, and an impacts database needs to be established. It notes the need for tailoring of climate information (such as long-term climate change maps and seasonal forecasts) for specific fisheries/aquaculture farmers: this should include threshold forecasts for specific indicators. Site specific forecasts would also be very useful. Improved access and ability to apply climate data and information is required, and improved technology is needed to support a marine climate early warning system. Work needs to be done to identify actions that can be taken to lessen climatic impacts to marine resources. An update to the ENSO Handbook for marine resource management is required, and the development of a climate–marine bulletin in partnership with the Department of Fisheries has been suggested

### **6.3.5 National Sustainable Development Plan (NSDP) 2016-2030**

The National Sustainable Development Plan “charts the vision and overarching policy framework for achieving a stable, sustainable and prosperous Vanuatu within the next fifteen years. It sets out the national priorities and context for the implementation of the Sustainable Development Goals over the same period.”<sup>20</sup> Vanuatu’s development priorities are classed under the three pillars of society, environment and economy.

The SDP has under its environmental goals and policy objective pillar ENV3: Climate and Disaster Resilience. The environment pillar seeks to ensure a pristine natural environment on land and at sea

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<sup>19</sup> SPREP; Vanuatu Framework for Climate Services, July 2016.

<sup>20</sup> Government of the Republic of Vanuatu, Vanuatu 2030 The people’s plan: National sustainable development plan 2016 - 2030, 2015.

that continues to serve our food, cultural, economic and ecological needs, and enhance resilience and adaptive capacity to climate change and natural disasters.

### **6.3.6 Republic of Vanuatu National Climate Change and Disaster Risk Reduction Policy 2016-2030**

The Republic of Vanuatu National Climate Change and DRR Policy “provides the overall vision, principles, strategic goals, priorities and strategies for climate change and disaster risk reduction. Vanuatu’s strategic goal for climate change and disaster risk reduction is resilient development.

Strategic priorities are categorised under systems and themes. Systems include governance, finance, and knowledge and information. Strategic priorities that are categorised as themes include climate change adaptation and disaster risk reduction, low carbon development, and response and recovery.<sup>21</sup>

The Strategy notes that some of the projected consequences of climate change on Fisheries are the increase in extreme temperature, becoming more frequent, coral reef deterioration and reduced fisheries productivity.

### **6.3.7 Vanuatu National Adaptation Programme of Action (NAPA)**

Vanuatu’s NAPA “outlines the most urgent and immediate needs with respect to climate change and identified several priority sectors (Agriculture/Food Security, Coastal Zones and Marine Ecosystems, Water Resources and Public Health) for action.”<sup>20</sup>

The NAPA has one adaptation strategy related to fisheries—building capacity to increase the ability to plan for and respond to climate and coastal change. The output is: improving capacity of institutions and human resources to develop and implement adaptation strategies and measures in coastal environment; development of expertise in application of climate and ocean models to forecast impacts and vulnerability; improved managerial skills for decision-makers and coastal stakeholders.

### **6.3.8 Republic of Vanuatu Second National Communication to the UNFCCC (SNC)**

The Second National Communication highlights Vanuatu’s greenhouse gas inventory (GHG) as a baseline for the country to measure its progress towards reduction of greenhouse gases. The inventory for the base year 2000 and subsequent years 2005 and 2010 indicates that Vanuatu is a net sink for CO<sub>2</sub> emissions.

Vanuatu’s SNC also generates and updates information about how projected climate change, climate variability and extreme events may affect Vanuatu’s economic and social sectors as part of its vulnerability and adaptation assessment. Climate change and changing weather patterns are already having a negative impact on all the priority sectors – namely agricultural production, fisheries, human health, tourism and well-being. There is the indication that climatic change has consequences for decreasing national income and increasing key social and infrastructure costs.<sup>20</sup>

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<sup>21</sup> World Meteorological Organization, Enhancing Early Warning Systems to build greater resilience to hydro and meteorological hazards in Pacific Small Island Developing States (SIDS): National consultation report, Jan 2018



The SNC recommended that there should be an adaptation plan designed to address the ‘drivers’ and “root causes” influencing the management of fisheries and aquaculture in the shorter term (e.g. population growth), and climate change in the longer term. Such measures are considered to be ‘win-win’ adaptations. In some cases, ‘lose-win’ adaptations were also recommended, i.e. adaptations involving costs in the shorter term to maintain any natural adaptive capacity of resources to cope with the changing climate.

The SNC also recognised that many of the adaptations to climate change are management actions that should already be in place to deliver sustainable benefits from the nation’s fisheries and aquaculture resources. A prime example is integrated coastal zone management, commonly called the ‘ridge to reef’ approach. The need for ‘ridge to reef’ actions to maintain coastal fisheries production was widely recognised by ni-Vanuatu stakeholders and should help build resilience of coral reefs, mangroves and sea grasses to climate change.

### **6.3.9 Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change**

The Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change is an assessment conducted by SPC of oceanic, coastal and freshwater fisheries, and aquaculture activities in Pacific Island Countries and Territories (PICTs) and spans the area from 130°E to 130°W and 25°N to 25°.

The document proposes the adaptations, policies and investments recommended to reduce the likely impacts of climate change on fisheries and aquaculture. It also gives the sector a roadmap for capitalising on the opportunities expected to arise from the changing climate.

The assessment was based on the analyses described below:

- Observed and projected changes to surface climate and the tropical Pacific Ocean.
- Effects of changes to the surface climate and ocean on the marine and freshwater ecosystems (fish habitats) that support fisheries and aquaculture in the region.
- Direct effects of changes to surface climate and the ocean, and the indirect effects of changes to fish habitats, on the distribution and abundances of the fish and invertebrate stocks underpinning oceanic, coastal and freshwater fisheries and aquaculture in the tropical Pacific.
- Implications of climate change for contributions by fisheries and aquaculture to the economic development and government revenue of PICTs, and the food security and livelihoods of their people.
- Adaptations and suggested policies to minimise the threats and capitalise on the opportunities expected to occur as a result of the changing climate.
- Gaps in knowledge that need to be filled to improve confidence in assessments of vulnerability and the research needed to provide this information.
- Investments required to launch priority adaptations and fill gaps in knowledge.

#### **6.3.10 Pacific Roadmap for Strengthened Climate Services (PRSCS)**

The Pacific Roadmap for Strengthened Climate Services prioritises key actions identified for implanting the GFCS that are relevant to the Pacific. “The Roadmap focuses on the needs of both climate service providers and the key sectors that rely on their information and advice to inform planning and decision-making. It provides a guiding framework for the development of national and regional climate

services targeting the Pacific priority areas.”<sup>22</sup> Pacific Island Countries and Territories have adopted the five priority areas and added a further two priorities: tourism, and fisheries and aquaculture.

The PRSCS provides a regional overview of the fisheries sector in the region. It provides information on the typical studies/activities that climate services can support such as reviewing the current understanding and status of marine and oceanic climate and climate variability in the South Pacific and also the effects of climate and climate variability on seasonal to decadal time scales on oceanic fisheries, including through an evaluation of available historical data on marine climate and oceanic fish abundance.

The document includes some recommended actions which can be undertaken under the GFCS pillars to enhance Climate Information Services for fisheries (Table 3).

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<sup>22</sup> SPREP, Pacific Roadmap for Enhanced Climate Services, 2017

Table 3: Recommended Actions for Fisheries sector in PRSCS

NUMBER	LEAD GFCS PILLAR	ACTION	NATIONAL ACTIVITY / REGIONAL ACTIVITY
2	User Interface	Develop a fisheries Climate EWS.	Regional and National
3	User Interface	Identify risk assessment or management evaluation tools that incorporate climate variability to improve the ecosystem-approach to management of fisheries.	Regional and National
4	User Interface	Identify how weather and climate tools can inform integrated coastal zone management relevant to coastal fisheries and marine aquaculture.	Regional and National
6	Climate Services Information	Develop national ocean services portal (this can be done by national tailoring of a regional portal such as the COSPPac Ocean Portal).	National
7	Observations and Monitoring	Oceanic and coastal fisheries management organisations to inform their members about the advantages of making and reporting relevant marine meteorological and ocean observations to the various WMO/IOC (Intergovernmental Oceanographic Commission) observation and information systems.	Regional and National
8	Observations and Monitoring	Ensure long-term commitment to monitoring systems for assessing fish stock status and to the conduct of routine integrated ecosystem assessments.	Regional and National
9	Observations and Monitoring	Undertake lagoon monitoring for aquaculture.	National
10	Research, Modeling and Prediction	Improve understanding of the sensitivity of pearl and sea weed industries to rising sea temperatures.	Regional and National
11	Research, Modeling and Prediction	Contribute to the understanding of the impacts of climate change on fisheries and aquaculture.	Regional and National
12	Research, Modeling and Prediction	Crown of Thorns starfish outbreaks and linkages to climate information.	Regional and National
13	Research, Modeling and Prediction	Conduct climate and sea-surge modelling for areas at risk and to inform new coastal development.	Regional and National

### 6.3.11 Global Framework for Climate Services (GFCS)<sup>23</sup>

The Global Framework for Climate Services (GFCS), formed as the principal outcome of the 2009 World Climate Conference 3. The GFCS provides a worldwide mechanism for coordinated actions to enhance the quality, quantity and application of climate services. The five priority areas under GFCS are: Agriculture and Food Security; Disaster Risk Reduction; Energy; Health; and Water. The Framework is built through user–provider partnerships that include all stakeholders.

The GFCS is built upon the following five components, or pillars (see Figure 4 below):

- i. **User Interface Platform (UIP):** a structured means for users, climate researchers and climate information providers to interact at all levels;
- ii. **Climate Services Information System (CSIS):** the mechanism through which information about climate (past, present and future) is routinely collected, stored and processed to generate products and services that inform often complex decision-making across a wide range of climate-sensitive activities and enterprises;
- iii. **Observations and Monitoring (O&M):** to ensure that climate observations and other data necessary to meet the needs of end-users are collected, managed and disseminated and are supported by relevant metadata;
- iv. **Research, Modelling and Prediction (RMP):** to foster research towards continually improving the scientific quality of climate information, providing an evidence base for the impacts of climate change and variability and for the cost-effectiveness of using climate information;
- v. **Capacity Development (CD):** to address the particular capacity development requirements identified in the other pillars and, more broadly, the basic requirements for enabling any Framework-related activities to occur.<sup>24</sup>

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<sup>23</sup> <http://www.wmo.int/gfcs/>

<sup>24</sup> WMO, A step-by-step guide for establishing a national framework for climate services, 2017

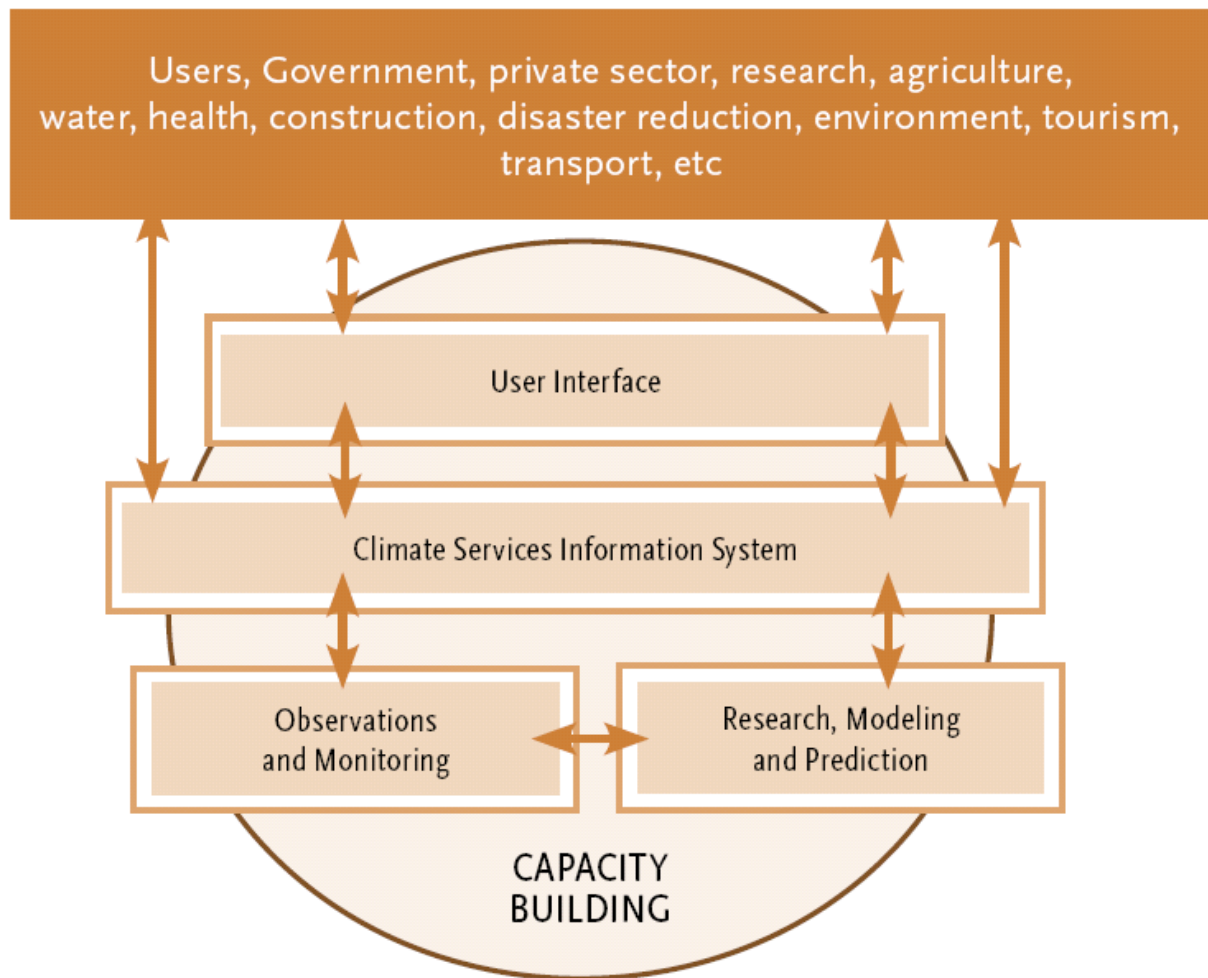


Figure 4: A schematic depicting the functional components of the GFCS (Source WMO)

The primary focus of the GFCS is to enable better access and use of climate information by users.

The Vanuatu Coastal Adaptation Project (VCAP) produced excellent information describing the weather and climate information that could help manage climatic impacts on fisheries. The tables outline what the risk is, what climate/weather triggers the risk, whom it effects, what is the problem and impact is and lastly what early warning information is required.

## 6.4 Climate Information Services (CIS) Action Plan

Based on the final recommendations (Section 6.1), officers from the Vanuatu Fisheries Department developed the CIS Action Plan and the Communication Plan at the Van-KIRAP Sector Consultation workshops (Table 4). The participants identified short-term, mid-term and long-term actions and sub-actions for each recommendation: short-term for periods of up to 6 months, mid-term ranging from 6 months to 2 years, and long-term ranging from 2 to 4 years. Required resources and budget implications are included but they will need to be revised and the actual cost estimated through further consultations amongst the key stakeholders. The following table outlines high level actions and sub-actions: a detailed workplan with costing and timeline will be agreed before the implementation of each recommendation. A Monitoring and Evaluation Plan will help to ensure successful implementation of the actions.

The key objectives of the Action Plan are:

1. To ensure Department of Fisheries personnel and stakeholders are aware of and understand climate information and products; and
2. To enable them to readily access and effectively use this climate information for planning and decision-making at local and national levels.



Table 4: The Action Plan for the Fisheries sector

Rank	Recommendation	Proposed Action	Timing (ST,MT,LT)	Responsible Parties	Resources Required	Training Required	Budget Implication	Assumption/Comments
1	Tailor climate information services for fisheries & aquaculture (freshwater, coastal, offshore)	Implement communication plan including making available climate and marine information at the area council level and information for mariculture	MT	VFD (Management Policy, Research and Aquaculture Division, Development and Capture), VMGD, Sector Coordinator, BoM	Staffing, subject matter expertise, trainers	As outlined in the Proposed Actions	Funding for trainers, training workshops, travel and DSA.	Possible funding from Van-KIRAP Activity 2.1.1
		Training on understanding marine climate variables for fishers/aqua-farmers						
		Training on understanding marine climate variables for VFD (including Provincial FDOs)						
		Training on the COSPPac Ocean Portal						
2	Make weather and marine climate data accessible on Aqua-Tails tablets	Develop weather and marine climate application	MT, LT	VFD (IT, management policy, Research division and Development and capture Division), VMGD and Sector Coordinator	App/software developer, staffing, subject matter expertise (SPC)	Training for VFD on the new App	Funding for technical experts, trainers, training workshops, travel, DSA	Possible funding from Van-KIRAP Activity 3.1.1. SPC will need to be involved to modify Aqua-Tails
		Trial weather and marine climate data linked to Aqua-Tails tablets						
3	Enable additional resource (area council - in remote areas and fishers association) to support a marine climate early warning system for Vanuatu	Training for area council personnel to enhance their capacity in understanding climate information	ST, MT	VFD (Development and Capture Section), VMGD	Trainers	Training the fisheries association to use the app information	Funding for training	Possible funding from Van-KIRAP Activities 1.2.2 and 1.4.1
4	Incorporate traditional knowledge relating to Fisheries into Fisheries sector	Use of Traditional Knowledge relating to fisheries to adapt to climate change	MT, LT	VFD, VMGD, Sector Coordinator, SPREP	Staffing, TK expertise, TK Database System	Training on information gathering and TK DB	Funding for technical expertise and information gathering, training, travel, DSA	Possible funding from Van-KIRAP Activity 2.1.3. This proposed action can be built upon the outcomes of the COSPPac/SPREP TK project
		Undertaken analysis to match weather/climate events to documented traditional knowledge in fisheries.						
5	Climate related impact information available for fisheries & aquaculture	Establish impact (i.e. catch rate over time) database for aquaculture	LT	VFD (Research and Aquaculture Division & Administrative Branch), VMGD	Subject matter expertise, Software developer, staffing	Training on the DB	Funding for technical expertise, data collection, training, travel, DSA	Possible funding from Van-KIRAP Activity 1.6.1. The budget implication may be less there is an existing DB system that can be used.
		Collate impact data for coastal and offshore fisheries						
		Data analysis to understand possible impact of climate on fisheries/aquaculture						
6	Expand communities using marine monitoring toolkit and add climate information	Roll out and expansion of marine monitoring toolkit to include climate specific information	MT	VFD (Research and Aquaculture Division & Management and Policy Division), VMGD	Staffing, subject matter expertise	Training on Climate Information & monitoring	Funding for training, travel, DSA, material development and printing	
7	Climate change maps for fisheries & aquaculture (freshwater, coastal, offshore)	Conduct climate change impacts on fisheries research project	LT	Sector Coordinator, CSIRO, APCC, VMGD, VFD	Subject matter expertise, staffing		Funding for the project	Possible funding from Van-KIRAP Activity 2.1.1, 1.3.1 and 5.5.1
8	An update to the ENSO Handbook (Klaod Nasara) for marine resource management is required & Poster distribution	Develop marine resource management version of Klaod Nasara	MT, LT	Sector coordinator, VMGD, VFD	Staffing, subject matter expertise		Funding for technical expertise, printing	Possible funding from Van-KIRAP Activities 1.4.1 and 2.1.1
		Make printed materials available for communities (posters)		Sector coordinator, VMGD, VFD				
9	Development of a Climate-freshwater bulletin in partnership with the Department of Fisheries	Develop climate-freshwater bulletin similar to ocean climate bulletin for Sarakata river based on new and current river gauges	LT	Sector coordinator, VMGD, VFD	Staffing, new equipment (river gauges)	Training of VFD staff to maintain gauges, and on understanding climate-freshwater bulletin	Funding for equipment, installation and training	Possible case study under Van-KIRAP

## 6.5 Climate Information Services (CIS) Communication Plan

A communication plan is a policy-driven approach to providing stakeholders with information. The Plan formally defines **who** should be given specified (**what**) information, **when** that information should be delivered and what communication channels (**how**) will be used to deliver the information.<sup>25</sup> This section outlines the Communication Plan's objectives, the current status of the communication mechanism, and the content of the Plan. The Plan should be regularly reviewed and updated.

### 6.5.1 The Objectives of the Communication Plan for Department of Fisheries

- To ensure that fisheries personnel and fishermen are receiving timely and relevant climate information and products for planning and decision-making at local and national levels.
- To ensure an effective and efficient channel for communication and information dissemination exists between VMDG and the fisheries sector, and within the fisheries sector.

### 6.5.2 Linking climate information and products to sector specific operations

Table 5 outlines the types of climate information required for specific operational or decision-making processes within the Fisheries sector. This information feeds into the Communication Plan (Table 6).

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<sup>25</sup> <https://whatis.techtarget.com/definition/communication-plan>

Table 5: Climate Information required for Fisheries operation and decision-making processes

Sector operation or decision-making process	Information/Product/Tool	Responsible person
Teach them to save and process fish (solar freezers). Fiberglass Solar Freezers can last for weeks without sunlight	Monthly climate forecasts of rainfall. Sunshine hours	Development and Capture Division & Seafood Division
Near shore FADS and ocean productivity	SST, Chlorophyll, wave height, wind direction, sub-surface temperature, currents	Development and Capture Division & Management Division
Pelagic Fisheries/Deep water	SST, Sub-surface temperature, currents	
Ecosystem monitoring (seagrass, mangroves, coral reefs)	Coral bleaching information, sub-surface temperature, SST, rainfall, sea level, atmospheric temperature, currents, subsurface currents	Research and Aquaculture Division and Development and capture Division
Crown of Thorns spawning and outbreak	SST, Currents	Research and Aquaculture Division
Aquaculture (including Mariculture)	SST, Rainfall data (weekly), ENSO information, coastal inundation, atmospheric temperature, water temperature at major rivers, tides, currents, sub-surface temperature	Research and Aquaculture Division
Subsistence fishing and artisanal fishing	Currents, sub-surface temperature, wave height, wave direction, tides, ENSO information	Development and Capture Division
Ciguatera (fish poisoning)	SST, TC info, precipitation, subsurface temperature	Research and Aquaculture Division and Seafood Division
General awareness	All ocean variables, ENSO, rainfall and temperature in simple language	Management and Policy Branch

### 6.5.3 The current situation in the Fisheries Sector

There is currently limited use of climate data or information by the fishing sector in Vanuatu.

### 6.5.4 Table Description

*Responsibility:* Nominates or delegates the personnel or agency responsible for sending the identified information or products to the intended audience.

*Audiences/Receiver:* Personnel or parties who should receive the information or the products. Figure 5 outlines the information flow from VMGD to various personnel within Fisheries sector.

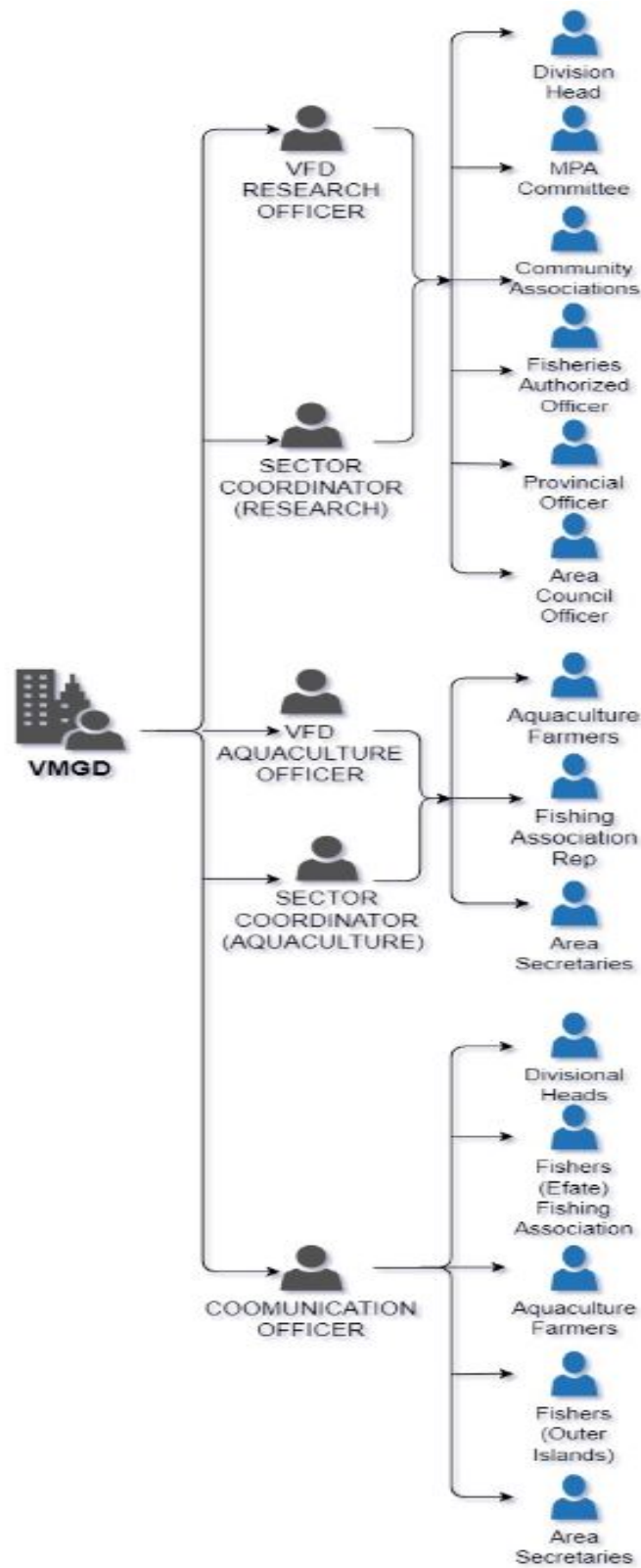


Figure 5: Climate information and products dissemination structure

*Mode of Information Dissemination:* Effective channels or communication medium that can be used to disseminate the information and the products. This may include: email, phone, Internet/webpage, social media (Facebooks), face, to face meetings, print etc.

*Other Information:* Describes the format (e.g. bulletin, brief summary, Excel etc.) and the most appropriate language (i.e. Bislama, English or French) for information or products.

*Frequency and timing:* frequency indicates how often the information is required or disseminated (i.e. weekly, fortnightly, monthly or annually). Timing indicates when in a defined period the information is required or made available (e.g. Vanuatu Climate Updates are available by the second week of each month).

#### Feedback Mechanism:

It is vital to measure results to understand whether objectives have been achieved. The regular evaluation process allows managers to make necessary adjustments during implementation in response to unexpected results and changed circumstances. Several feedback mechanisms are suggested for evaluating the effectiveness and the efficiency of the Communication Plan: regular surveys, feedback forms, follow up via phones, monthly reports, email, and face to face meetings. The timing and the mechanism for feedback can be mutually determined by the Responsible Party and the Audience. Feedback may be scheduled quarterly, six-monthly or yearly.

### **6.5.5 Updating the Communication Plan**

During the life of Van-KIRAP, the Sector Coordinator will be responsible for:

- Initiating and scheduling feedback sessions with VMGD;
- Initiating and following-up on feedback sessions for other Responsible Parties, and providing feedback to VMGD
- Negotiating changes and incorporating agreed changes in the Plan; and
- Circulating the Plan to all Responsible Parties and Audience after each update

After the Van-KIRAP project ends, it is recommended that this responsibility be taken up another relevant officer in Department of Fisheries if the Sector Coordinator position no longer exists. This can be the Communication Officer.

Table 6: A detailed Communication Plan for Fisheries sector

Responsibility (sender)	Audience (receiver)	Type of Information/Product	Language	Mode of information dissemination	Frequency	Feedback Mechanism
VMGD	Division Head (cc: Sector Coordinator and Communications officer)	Vanuatu Ocean Outlook (VOU)	English	Email and website	Monthly	Report in the NCOF
	VFD Research Officer and Sector Coordinator	Coral reef sites, sub-surface temperature, SST, rainfall, sea level, temperature, bleaching risk	English	Ocean portal, Vanuatu Ocean Outlook	As required	Phone call/email
	VFD Aquaculture officer and Sector Coordinator	SST, Rainfall data (weekly), Temperature	English	Ocean portal	As required	Phone call/email
		ENSO Update	English and Bislama	Email, face to face, phone call, website, social media, proposed App, community boards (around Efate currently)	Monthly	Email, face to face meeting, survey
	Communication Officer	All ocean variables	English	Ocean portal	As required	Phone call/email
Communication Officer	Division Head	Summary of VOU	English	Email	Monthly	Email
	Fishers (Efate), Fishing association rep, Aquaculture farmers	Windspeed, Wave height, SST, TC Update, rainfall, temperature, ENSO information	English, Bislama & French	Text and Phone call, App	2 weeks	Phone call, text message, annual fisherman's meeting
	Fishers (Outer Islands), area secretaries	Windspeed, Wave height, SST, TC Update, rainfall, temperature	English, Bislama & French	Text and Phone call, App	2 weeks	Phone call, text message, annual fishermen's meeting
VFD Research Officer/Sector Coordinator	MPA Committee/Community Associations/ Fisheries authorised officers	Coral reef information, sub-surface temperature, SST, rainfall, sea level, temperature	English, Bislama & French	Text and Phone call, App	Monthly	Phone call/email
VFD Aquaculture Officer/Sector Coordinator	Fishers (Aquaculture farmers) Fishing association rep, area secretaries	SST, Rainfall data (weekly), ENSO information, coastal inundation, Temperature	English, Bislama & French	Text and Phone call, App	Weekly and also during La Nina & El Nino	Phone call, text message,
Sector Coordinator, Communications officer and VFD Research Officer	Provincial officer/Area Council Officer	All ocean variables	English	Ocean portal	As required	Phone call/email
		Vanuatu Ocean Outlook (VOU)	English	Email and website	Monthly	Report in the NCOF



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## 8. Annexes

### Vanuatu National Fisheries Sector Policy 2016-2031

Under the Strategic Policy objective 5 (SPO 5) which addresses climate;

Strategic action 24: Undertake an environmental impact assessment and baseline study to assess climate change impacts.

#### Policy directives

1. Develop a policy on long-term monitoring of coral reef health, sea water temperature and resource status
2. Implement research studies to monitor coral bleaching, crown-of-thorns outbreak
3. Work with research institutions to establish a long-term climate change monitoring program
4. Assess the following: impact of coastal uplift caused by earthquakes, fish kill from increased sea surface temperatures, and tropical cyclone damage
5. Coordinate stakeholders to assess crown-of-thorn outbreak and damage
6. Conduct stock assessment to monitor fish stock behaviour, fishing patterns and catch composition as a measure of climate change
7. Establish data management and reporting procedures for climate change monitoring results
8. Collaborate with other partners in addressing marine environmental monitoring

Strategic action 25: Implement mitigation and adaptation activities in readiness for disasters

#### Policy directives

1. Establish marine protected areas as food reserves for use during natural disasters
2. Restrict and ban commercialization of endangered reef resources
3. Minimize wastage of resources by establishing preservation facilities to store and preserve fish for use during disasters
4. Implement and enforce fisheries regulations at the community level
5. Train fishers on fish value-adding for use during disasters
6. Develop alternative livelihood activities for communities, including ecotourism, handicraft production and aquaculture
7. Establish an available stock of fishing gear and FAD materials for use during natural disasters
8. Take into account the expected impact of climate change on tuna stocks when estimating future national fisheries sector revenue
9. Develop mapping system to assess scale of climate change impacts on marine environment
10. Provide adequate training to fishers and strengthen fishers' associations and encourage the cooperation of all fishers.

Strategic action 26: Promote community-based management and climate change adaptation

#### Policy directives

1. Develop guidelines and procedures for community-based fisheries management
2. Strengthen community-based management and climate change adaptation through community-based ecosystem plans
3. Preserve traditional resource management and fishing practices
4. Adapt co-management practices at the community level

## Vanuatu National Ocean Policy 2016

### Key Strategy 7. Building resilience and managing for uncertainty

#### Policy actions

3.2.9.1 Recognise and manage the increasing risk to the whole marine area and climate change through the incorporation of appropriate adaptation and resilience-building strategies into sustainable development, conservation and governance actions at all levels.

3.2.9.2 Adopt and implement National Disaster Prevention and Response Plans in relation to risk management in marine and coastal areas. The implementation of the Plan should be accompanied by protection programs (re-housing, protection and adaptation) for communities settled in high-risk areas on the coasts.

3.2.9.3 Protect naturally resistant or resilient areas including coral reefs that still have high coral cover and mangroves and coastal wetlands which can migrate inland.

3.2.9.4 Integrate uncertainty into marine protected area planning, management & evaluation, for example, by replicating protection across space.

3.2.9.5 Establish controls on the removal of beach sediment that contributes to coastal erosion and loss of protection.

3.2.9.6 Apply adaptive management in coastal and marine areas, including working with traditional leaders, when implementing this policy.

#### Action Areas 6

6.6.1 Promote and support efficient, effective Climate Change & Disaster Risk Reduction efforts using Ecosystem-based Approaches

#### Policy actions

6.6.1.1 Adopt multi-sectoral approaches to address complex climate change impacts upon Vanuatu's ocean

6.6.1.3 Address site specific climate and disaster vulnerabilities

6.6.1.4 Adaptation and risk reduction action in coastal communities addresses real, current and priority vulnerabilities

6.6.1.5 Adaptation and risk reduction in coastal environments is owned and driven by communities

#### 6.6.1.6 Take action around loss and damage

6.6.1.7 Quantify the value and benefit of Vanuatu's marine ecosystem services and build this into adaptation and risk reduction planning and budgeting.

### **Vanuatu Meteorology and Geohazards Division Strategic Development Plan: 2014-2023**

Of particular importance under the Climate Division are the following Key Outcomes (KO), Strategic Outputs (SO) and Key Performance Indicators (KPI):

- KO 1. Improved management of historical meteorological, hydrological and other related environmental data.
  - SO 1.1 The Climate Division is routinely digitizing historical data for weather, climate, agrometeorology, and CBRN stations and has all paper-based records archived and stored according to the VMGD data management and quality policy, including archival of data in back-up sites.
    - KPI-CS01: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets from synoptic weather stations are preserved.
    - KPI-CS02: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets from climate stations are preserved.
    - KPI-CS03: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets for agro-meteorological stations are preserved.
    - KPI-CS01: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets for the CBRN gauges' sites are preserved.
- KO 4. Monthly to seasonal climate information, forecasts, services and warnings are continually developed and routinely improved.
  - SO 4.1 An established set of quality management standard manuals is developed and produced for reference for climate services development and engagement with end users including capture of traditional knowledge and development of new indicators where needed.
    - KPI-CS14: Monthly to Seasonal climate information, forecast services and warnings for Vanuatu developed and produced.
    - KPI-CS15: Mechanism(s) for easy and regular access to climate information, forecasts, services and warnings developed and operational.
    - KPI-CS16: Early warning system for ENSO developed, established, implemented and maintained/sustained.
    - KPI-CS17: Traditional information/indicators collected and integrated with modern climate sciences, forecasts, information, services and warnings.
    - KPI-CS18: Validation on monthly to seasonal climate prediction for all weather and climate observation stations conducted.
- KO 5. Drought information, forecasts, services and warnings are developed and routinely improved.

- SO 5.1 Information and communications products and services from the Climate Division are routinely produced according to VMGD policy guidelines and quality management standards.
  - KPI-CS19: Climate summary for Vanuatu produced each year.
  - KPI-CS21: Early warning system for droughts developed, implemented and maintained/sustained.

### **National Sustainable Development Plan 2016-2030**

“The NSDP articulates the country’s main development priorities for the next 30 years. Of particular importance under the environmental goals and policy objectives are:

- ENV 1 – Food and Nutrition Security<sup>26</sup>
  - ENV 1.1 – Increase agricultural and fisheries food production using sustainable practices to ensure sufficient access to affordable and nutritious food.
- ENV 3 – Climate and Disaster Resilience<sup>27</sup>
  - ENV 3.2 – Improve monitoring and early warning systems.
  - Strengthen post-disaster systems in planning, preparedness, response and recovery
  - ENV 3.4 – Promote and ensure strengthened resilience and adaptive capacity to climate related, natural and man-made hazards.
- ENV 4 – Natural Resource Management
  - ENV 4.4 – Promote the sustainable development of the fisheries sector that values the protection and conservation of marine and freshwater resources.
- ENV 5 Ecosystems and Biodiversity
  - ENV 5.6 – Enhance environmental monitoring, evaluation and research with relevant, open and transparent data sharing among relevant agencies

### **Republic of Vanuatu National Climate Change and DRR Policy 2016-2030**

The document notes that “potential impacts of climate change on Vanuatu’s agriculture, fisheries, forestry, tourism, health, transport and infrastructure sectors were considered. Projected consequences of climate change include:

- coral reef deterioration;
- reduced fisheries productivity.”<sup>28</sup>

### **Pacific Roadmap for Strengthened Climate Services (PRSCS)**

Fish stocks and their rate of replenishment are quite sensitive to climatic variability and longer-term climate change with different fish populations responding in different ways. For example, changes in the distribution patterns of migratory fish varieties have been observed in association with normal seasonal cycles and with multi-year El Niño-scale variations in the ocean environment. Longer-term

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<sup>26</sup> Government of the Republic of Vanuatu, Vanuatu 2030 The people’s plan: National sustainable development plan 2016 - 2030, 2015

<sup>27</sup> Government of the Republic of Vanuatu, Vanuatu 2030 The people’s plan: National sustainable development plan 2016 - 2030, 2015

<sup>28</sup> Government of the Republic of Vanuatu, Vanuatu Climate Change and Disaster Risk Reduction Policy 2016 - 2030, 2015

climate change and its manifestation within the ocean environment can be expected to affect the reproduction, recruitment and growth of oceanic fish species.

To prevent overfishing and rebuild overfished stocks under changing and uncertain environmental conditions, effective partnerships between fisheries scientists and managers and climate service providers are required.

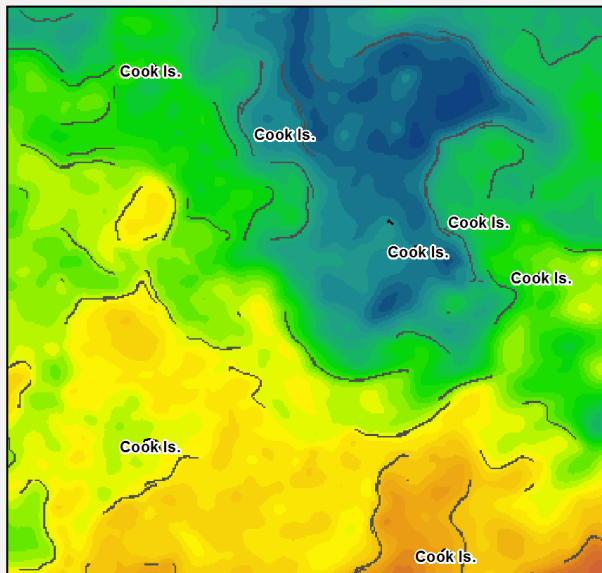
While there has been a significant growth in aquaculture throughout the Pacific, less attention has been given to the actual effects of climate variability on productivity or the potential effects of climate change. The potential affects were addressed however in the report of a workshop in Noumea, New Caledonia in June 2012 sponsored by FAO/ Pacific Community (SPC) on *Priority adaptations to climate change for Pacific fisheries and aquaculture: Reducing risks and capitalizing on opportunities*

<http://www.fao.org/docrep/017/i3159e/i3159e.pdf>

#### COSPPac Ocean Portal

The COSPPac Ocean Portal provides Pacific Island countries with ocean related information that has direct applications in the fields of fishing, tourism, coral reef management, shipping, risk management, planning, and ocean monitoring.

The Ocean Portal can provide scientific information to assist Pacific Islands in decision making for fisheries management and provides benefits such as: allowing estimates of fish populations to regulate licensing and provide sustainable catch limits, ensuring adequate fishing capture for subsistence fishing, security management of unlicensed poachers at fertile grounds etc.



An example of front detection using high resolution Sea Surface Temperature in the Cook Islands from the COSPPac Ocean Portal. Fronts indicate areas of possible upwelling, upwelling regions constitute about 1% of the ocean, yet are said to account for 50% of the fisheries catch worldwide.

<http://cosppac.bom.gov.au/products-and-services/ocean-portal/>



## Regional and National Actions for Fisheries and Aquaculture

NUMBER	LEAD GFCS PILLAR	ACTION	NATIONAL ACTIVITY / REGIONAL ACTIVITY
1	User Interface	Encourage collaborative efforts between meteorological, oceanographic, biological and fisheries researchers and management agencies to better monitor and understand the impacts of short-term variability and longer-term change on oceanic fisheries	Regional
2	User Interface	Develop a fisheries Climate EWS	Regional and National
3	User Interface	Identify risk assessment or management evaluation tools that incorporate climate variability in order to improve the ecosystem-approach to management of fisheries.	Regional and National
4	User Interface	Identify how weather and climate tools can inform integrated coastal zone management relevant to coastal fisheries and marine aquaculture.	Regional and National
5	Climate Services Information System	Provide downscaled coastal information for use in Fish Aggregation Device programs	Regional
6	Climate Services Information System	Develop national ocean services portal (this can be done by national tailoring of a regional portal such as the COSPPac Ocean Portal).	National
7	Observations and Monitoring	Oceanic and coastal fisheries management organisations to inform their members about the advantages of making and reporting relevant marine meteorological and ocean observations to the various WMO/IOC (Intergovernmental Oceanographic Commission) observation and information systems	Regional and National
8	Observations and Monitoring	Ensure long-term commitments to monitoring systems for assessing fish stock status and to the conduct of routine integrated ecosystem assessments.	Regional and National
9	Observations and Monitoring	Undertake lagoon monitoring for aquaculture	National
10	Research, Modeling and Prediction	Improve understanding of the sensitivity of pearl and sea weed industries to rising sea temperatures.	Regional and National
11	Research, Modeling and Prediction	Contribute to the understanding of the impacts of climate change on fisheries and aquaculture	Regional and National
12	Research, Modeling and Prediction	Crown of Thorns starfish outbreaks and linkages to climate information	Regional and National
13	Research, Modeling and Prediction	Conduct climate and sea-surge modelling for areas at risk and to inform new coastal development	Regional and National

### **Vanuatu Coastal Adaptation Project (VCAP)**

Fish species and coral health are impacted by the sea temperature, ocean acidification, and ocean currents, all of which are being affected by climate change. The fishing industry is also impacted by storms, high winds and rough sea state.

The following tables describe the weather and climate information that could help manage climatic impacts on ciguatera fish poisoning, fish migration, recruitment patterns of fish and invertebrates, and coral bleaching as discussed in a sector meeting.

The following were prioritized as the initial needs for climate information:

1. Fortnightly sea surface temperature at Reef Check sites as a shape and/or .csv file (fisheries to provide the lat/ long of the sites)
2. Monthly bulletin as a PDF file including:
  - Map of SST for the country
  - Warning and alert areas for coral bleaching (>35°C- warning and >37°C- alert)
  - Map of ocean PH for the country
  - Map of ocean salinity for the country
  - Map of ocean chlorophyll levels for the country
  - Map of main ocean currents and their speed (especially in Tafea province)
  - Rainfall to date
  - Rainfall/ drought outlook
  - ENSO /extreme weather outlook
  - Actions/ recommendations based on the forecasts

Risk or concern	Climate and weather triggers	Whom does it affect? (i.e. government, private sector, and communities)	Why is it a problem? What is the impact (socially, economically and culturally)?	Would early warnings of the climate triggers be helpful?
Fishing conditions	Strong winds; Extreme events; Tropical cyclones	Government, private sector, and communities	National economy relies on fisheries Communities and businesses rely on fish availability	Yes
Fish health - ciguatera	Many factors- hard to define	Communities and private sector	Causes sickness	No- too many factors to properly create a warning
Coral reef health, coral bleaching	High sea surface temperatures PH levels Chlorophyll Salinity	Government, private sector, and communities	Lessens availability of marine ecosystem services, especially for the outer island communities	Yes
Fish migration and availability	Currents Extreme events ENSO Salinity	Government, private sector, and communities	National economy relies on fisheries Communities and businesses rely on fish availability	Yes

Risk or concern (copy from above if early warning would be helpful)	What actions could be taken with early warnings?	What data/ information is needed for the action?	How (i.e. email, text, radio) should the early warnings be communicated and how often?	Who will communicate the warnings and to whom?
Fish availability/fishing conditions	Awareness to fishermen- both local and commercial	Rainfall to date Rainfall/ drought outlook ENSO outlook Extreme weather outlook	Bulletin as a pdf	VMDG to fisheries, and then to stakeholders as needed

Risk or concern (copy from above if early warning would be helpful)	What actions could be taken with early warnings?	What data/ information is needed for the action?	How (i.e. email, text, radio) should the early warnings be communicated and how often?	Who will communicate the warnings and to whom?
Coral reef health, coral bleaching	Awareness to communities	Map of SST for the country Warning and alert areas for coral bleaching (>35°C- warning and >37°C- alert) Map of ocean PH for the country Map of ocean salinity for the country Map of ocean chlorophyll levels for the country	Fortnightly sea surface temperature at Reef Check sites as a shape and/or .csv file	VMDG to fisheries, and then to stakeholders as needed
Fish migration, recruitment patterns	Awareness to fishermen- both local and commercial	Map of main ocean currents and their speed (especially in Tafea province)	Bulletin as a pdf	VMDG to fisheries, and then to stakeholders as needed

Sector	What climate data/ information is the priority for early warnings?	In what format (i.e. email, text, radio) should the early warnings be communicated?	How often?	Who will communicate the warnings?	To whom?
Marine sector	1. Sea surface temperature at Reef Check sites (fisheries to provide the latitude/ longitude of the sites)	E-mail shape and/or .csv file	Fortnightly	VMGD to key Fisheries reps	Fisheries Department to disseminate to the public as required
	2. Monthly bulletin as a PDF file including: <ul style="list-style-type: none"> <li>▪ Map of SST for the country</li> <li>▪ Warning and alert areas for coral bleaching based on SST (&gt;35°C- warning and &gt;37°C- alert)</li> <li>▪ Map of ocean PH for the country</li> <li>▪ Map of ocean salinity for the country</li> <li>▪ Map of ocean chlorophyll levels for the country</li> <li>▪ Map of main ocean currents and their speed (especially in Tafea province)</li> <li>▪ Rainfall to date</li> <li>▪ Rainfall/ drought outlook</li> <li>▪ ENSO /extreme weather outlook</li> <li>▪ Actions/ recommendations based on the forecasts</li> </ul>	E-mail .pdf file	Monthly	VMGD to key Fisheries reps	Fisheries Department to disseminate to the public as required