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ST. VINCENT AND THE GRENADINES CONSULTATION REPORT: Fisheries Early Warning and Emergency Response

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St. Vincent and the Grenadines Consultation Report: Fisheries Early Warning and Emergency Response

Prepared by:
ICT4Fisheries Consortium
Consultants,

under contract through the Marine sub-component of the Investment Plan for the Caribbean Regional Track of the Pilot Program for Climate Resilience, co-implemented by the Caribbean Regional Fisheries Mechanism (CRFM).

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CRFM Secretariat
Belize, 2018

The Fisheries Early Warning and Emergency Response (FEWER) System has been developed with support from the Regional Track of the Pilot Programme for Climate Resilience (PPCR) in the Caribbean which is executed by The University of the West Indies, Mona, through its Mona Office for Research and Innovation (MORI); and co-implemented by the Caribbean Regional Fisheries Mechanism (CRFM) with resources provided by the Climate Investment Funds (CIF) through the Inter-American Development Bank (IDB).

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ST. VINCENT AND THE GRENADINES CONSULTATION REPORT: FISHERIES EARLY WARNING AND EMERGENCY RESPONSE

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CONTENTS

ACRONYMS AND ABBREVIATIONS

Admin	Administrator
App	Application (related to application program interface)
CAP	Common Alert Protocol
CARICOM	Caribbean Community
CARIFICO	Caribbean Fisheries Co-management project
CC4FISH	Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (Project)
CCA	Climate Change Adaptation
CCCCC	Caribbean Community Climate Change Centre
CDEMA	Caribbean Disaster Emergency Management Agency
CDRT	Community Disaster Response Team
CHARIM	Caribbean Handbook on Risk Information Management
CIF	Climate Investment Funds
CIMH	Caribbean Institute for Meteorology and Hydrology
CLME	Caribbean Large Marine Ecosystem
CNFO	Caribbean Network of Fisherfolk Organisations
CPACC	Caribbean Planning for Adaptation to Climate Change
CRFM	Caribbean Regional Fisheries Mechanism
CTIC	Caribbean Tsunami Information Centre
CWSA	Central Water and Sewerage Authority
DANA	Damage and Needs Assessment
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSC	Digital Selective Calling
EAF	Ecosystem Approach to Fisheries
ECHO	European Commission Humanitarian Aid
ECLAC	Economic Commission for Latin America and the Caribbean
ECMMAN	Eastern Caribbean Marine Managed Area Network
ECTEL	Eastern Caribbean Telecommunications Authority
ER	Emergency Response
EW	Early Warning
EWS	Early Warning System
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization of the United Nations
FEWER	Fisheries Early Warning and Emergency Response
FMP	Fisheries Management Plans
GIS	Geographic Information System
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
Hydro-met	Hydro- meteorological
ICT	Information and Communications Technology
IDB	Inter-American Development Bank
ISDR	International Strategy for Disaster Reduction
ITU-T	International Telecommunication Union, Telecommunication Standardization Sector
MARC	Modelling and Analysis for Coastal Research
MET	Meteorological
MHEWS	Multi-Hazard Early Warning Systems
MORI	Mona Office for Research and Innovation
MOU	Memorandum of Understanding

NBC	National Broadcasting Corporation
NEMO	National Emergency Management Organisation
NGO	Non-Governmental Organizations
NTRC	National Telecommunications Regulatory Commission
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PGIS	Participatory Geographic Information Systems
PPCR	Pilot Program for Climate Resilience
RDS	Radio Data Service
SAME	Specific Area Message Encoding
SAR	Search and Rescue
SocMon	Socio-economic Monitoring for Coastal Management (Global Programme)
SRS	Software Requirements Specification
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
VCA	Vulnerability and Capacity Assessments
VHF	Very High Frequency (marine radio)
WMO	World Meteorological Organization

1 INTRODUCTION

1.1 Background

Fisheries Early Warning and Emergency Response (FEWER) is being implemented under the Caribbean Regional Track of the Pilot Programme for Climate Resilience (PPCR) over the period February 2017 to May 2018. The PPCR is being executed by The University of the West Indies through its Mona Office for Research and Innovation (MORI), with the marine subcomponent in partnership with the Caribbean Regional Fisheries Mechanism (CRFM).

As a programme of the Climate Investment Funds (CIF), the PPCR helps developing countries integrate climate resilience into development planning and investment. It comprises 28 national programmes and two regional tracks (the Caribbean and the Pacific) across the developing world. The CIF, through the Inter-American Development Bank (IDB), has provided grant funding to implement the Caribbean Regional Track. Under the marine sector subcomponent, the CRFM is working to reduce the impact of climate change related risks on the fisheries industry in the Caribbean.

This document sets out the findings from a country consultation visit to St Vincent from 20-22 March 2017 to inform the FEWER solution. The findings are based on semi-structured and unstructured interviews with individuals and groups, a national consultation workshop and visits to fish landing sites. This report does not incorporate literature reviewed, or delve into options, or set out agreements among agencies. These aspects will be addressed in the country-specific FEWER proposal to follow.

1.2 Document Arrangement

This report follows the outline of the often-used checklist on developing early warning systems from the United Nations International Strategy for Disaster Reduction (ISDR). In particular, the findings of the stakeholder consultations are presented in sections drawn from the ISDR's four elements of people-centred early warning systems: (i) Risk Knowledge (ii) Monitoring and Warning Service (iii) Dissemination and Communication and (iv) Response Capability. Similar to the post-tsunami analysis in Asia, and current frameworks used in the Caribbean Large Marine Ecosystem (CLME), we take governance as underlying and underpinning all elements (Figure 1). The scope of interest, and corresponding content of the report, is the set of parameters that would guide the development of a fisher-focused, ICT solution for early warning and emergency response conceptualized, as shown in Figure 2, to accommodate multiple actors, relationships and technologies.

The report details the approach taken in the preparation and execution of the stakeholder consultations; and closes with a section on collaboration and conclusions. Appendices of contacts and other information are provided for reference along with endnotes.

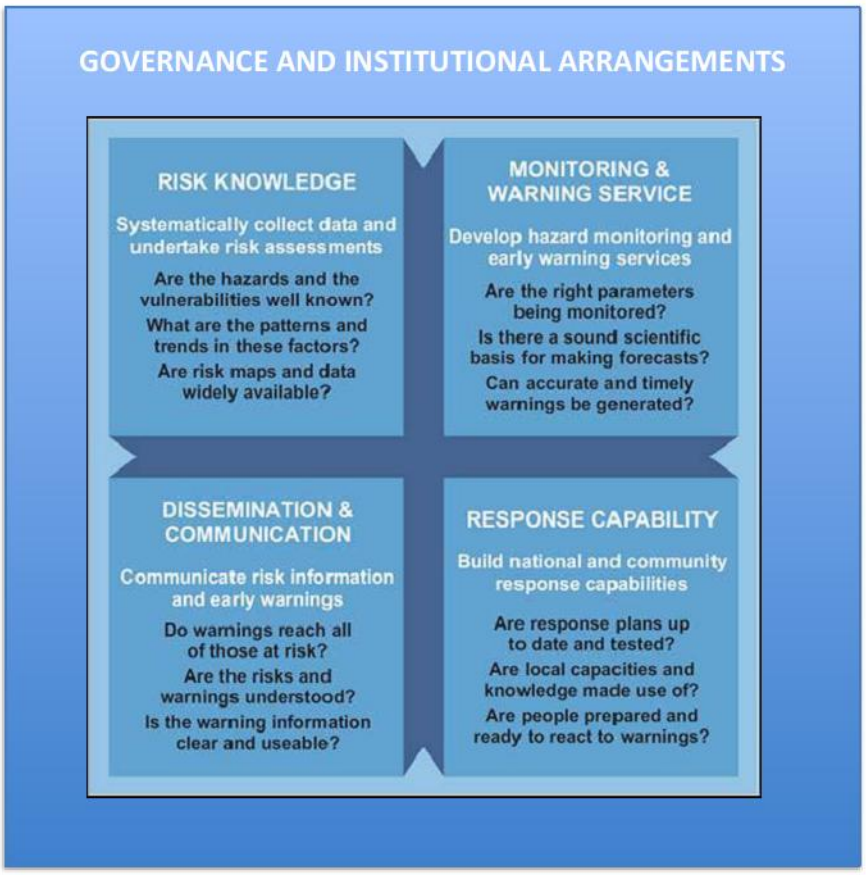


Figure 1. EWS are underpinned by governance

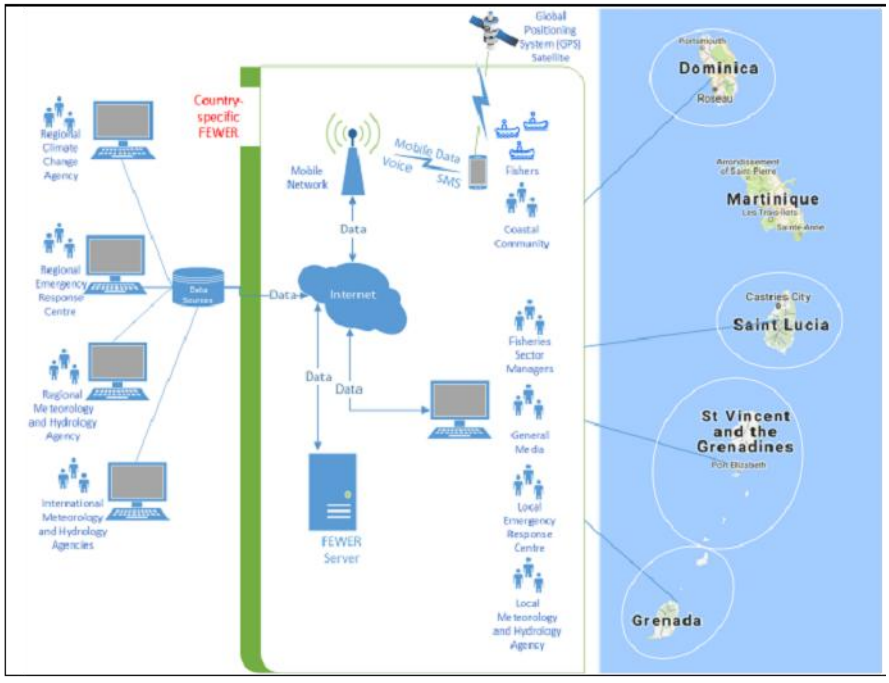


Figure 2. FEWER schematic for country specific solutions

1.3 Intended Audience and Reading Suggestions

As a major input into the country-specific FEWER proposal this report is intended mainly for interested parties and stakeholders in St Vincent, and those regionally associated with the FEWER project, to be aware of and validate the findings. These actors and agencies include the fisheries authority, fisherfolk organisations, individual small-scale fishers and boat owners, meteorological services, disaster management agency, physical planning unit, coast guard, telecommunications regulator, CRFM, Red Cross and others. These actors have different perspectives and interests, and are unlikely to see the national situation in the same way. Yet, we need sufficient consensus on the validity of the findings to serve as the foundation for the solution, and confirm buy-in for its implementation.

Readers not immersed in the subject matter may wish to familiarize themselves with the PPCR and project, as well as a recent regional meeting on EWS, plus the most recent national report on disaster risk reduction (DRR). Note that emergency response is typically taken as a final component of EWS. In this work that focuses on the Dissemination and Communication component we treat early warning and emergency response as separate, but closely related, since there are both critical similarities and critical differences regarding communication characteristics and requirements. Readers may use this report as a resource, or baseline, for maintenance and further development of FEWER beyond the lifetime of the original project. The intended audience therefore also includes future teams who may wish to modify or extend the software solution or other aspects of information and communication technology (ICT), as well as those who wish to address associated fisheries-related challenges and opportunities.

2 APPROACH

2.1 Logistics

Following an inception meeting with the CRFM Secretariat, the FEWER project was formally announced (Appendix 1) and liaison contacts assigned by the fisheries authority and the Caribbean Network of Fisherfolk Organisations (CNFO) (Table 1). The dates for the country visit were agreed with the fisheries authority and the visit followed the programme in Table 2. Time and other resources ruled out a visit to the Grenadines islands where conditions are somewhat different. Hence the report is specific to mainland St Vincent. The national workshop (in Kingstown) and two planned site visits (in Calliaqua and Barouallie) were well publicised (Appendix 2) with the assistance of the liaisons. An unplanned site visit to Bottom Town/Rose Place in Kingstown took place after the national consultation, led by the fisherfolk liaison. Site visit locations were selected using criteria in consultation with the fisheries authority. The consultants prepared to use and adapt to the checklist (Appendix 3) for context-specific analysis.

Table 1. National consultation liaisons

Liaison	Affiliation
Lorenzo George	Fisheries authority
Shamal Connell	Fisheries authority
Winsbert Harry	National fisherfolk

Table 2. Pattern of activity for three days

Time	Arrive day	Main day	Leave day
Morning	Arrive	Meeting of national EW and ER key interests	Gap filling meetings and info gathering
Afternoon or evening	Final plan with local organiser	Community site scoping and meeting	Leave

The FEWER team comprised fisheries specialist Patrick McConney and ICT specialist Kyle DeFreitas. Key informant interviews and a fisher meeting at Calliaqua on the first day guided information exchange in the national consultation workshop held at the Fisheries Division in Kingstown on the morning of the

second day. Lorenzo George was host of the workshop, and Winsbert Harry was our guide afterwards in Rose Place. The afternoon fish landing site visit was to Barrouallie. Along with the Kingstown fisherfolk at the national consultation, the country visit engaged three sites (Figure 3). The consultants used their own transportation for the duration of the visit. Appendix 4 lists people contacted in the country consultation interviews and workshop. A slide presentation was used only for the workshop which had the four stages shown in Figure 4.

Figure 3. The three fish landing sites focused on in St Vincent were Calliaqua, Kingstown and Barrouallie

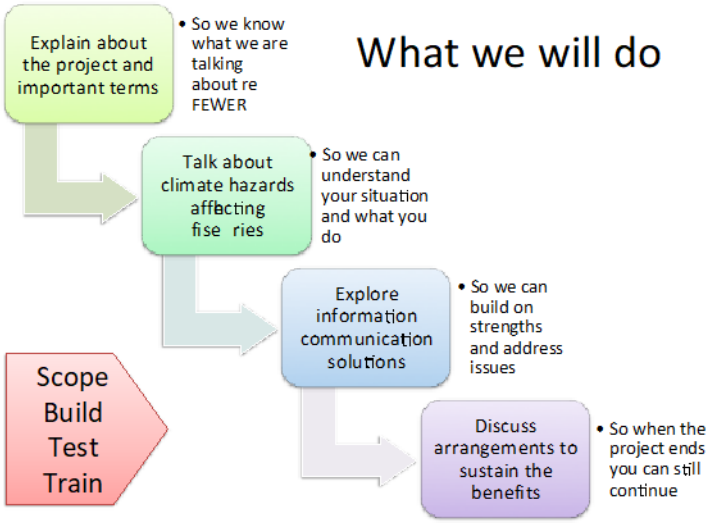


Figure 4. Organisation of the national workshop

2.2 Organisation

Findings from different sources and explanatory graphics from slides are functionally grouped under the checklist headings, rather than be set out by interview sources or day, so as to minimise redundancies. Interviews followed standard research ethics procedures in which the purpose and research affiliations were explained and respondents offered the choice of participating or not. While strict anonymity and

confidentiality were not promised given the small pool of informants, respondents understood that they were not going to be quoted or unnecessarily identified in the reporting. Unless indicated otherwise, the reader can take the reported findings as the collective view of all contacts. We avoided questionnaires and ICT (e.g. smart phone app) demonstrations as these may have restricted or biased responses. In particular, we sought to avoid biases towards a solution that could be supplied prior to understanding the nature of the demand side of the solution, or reasons for lack of demand, freely articulated by the respondents. Interview notes and photos were shared with the remainder of the ICT4Fisheries Consortium for review and analysis. The views of the CNFO were particularly sought for understanding fisherfolk perspectives.

2.3 Scope

Contacts were reminded that the FEWER solution was intended to address the interface in disaster risk management between EW and ER immediately before and after a potential impact (Figure 5). They appreciated that a fisheries sector climate hazard solution needed to fit, and be closely linked to, the cross-sectoral, multi-hazard and multi-level architecture of national and regional systems (Figure 6). Any solution would thus be constrained and enabled by the surrounding system in which it was embedded.

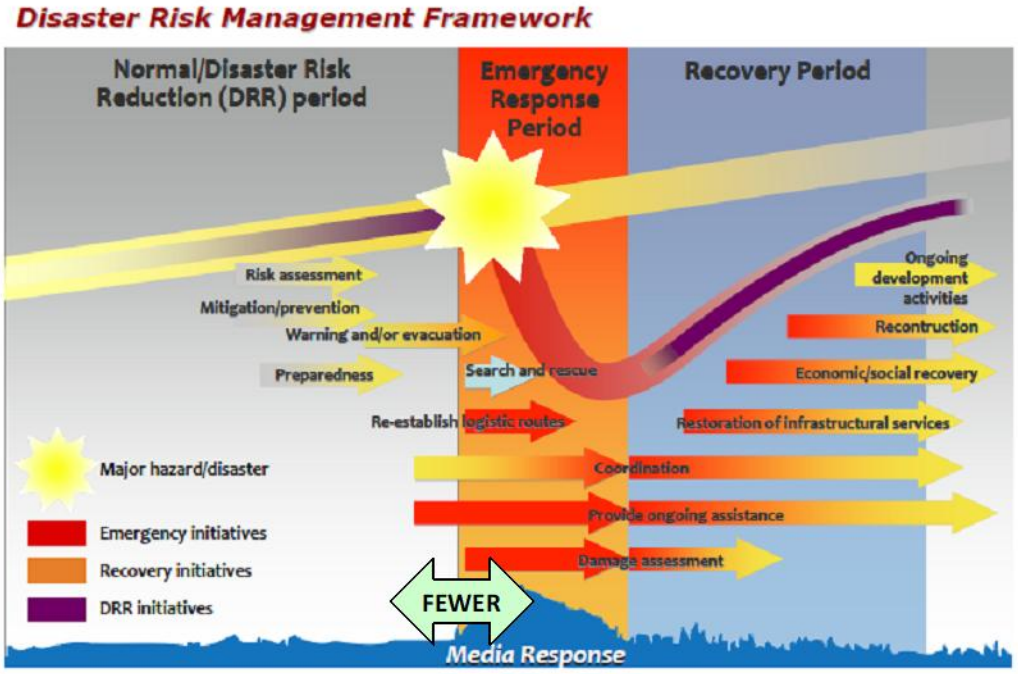


Figure 5. FEWER at the interface between EW and ER

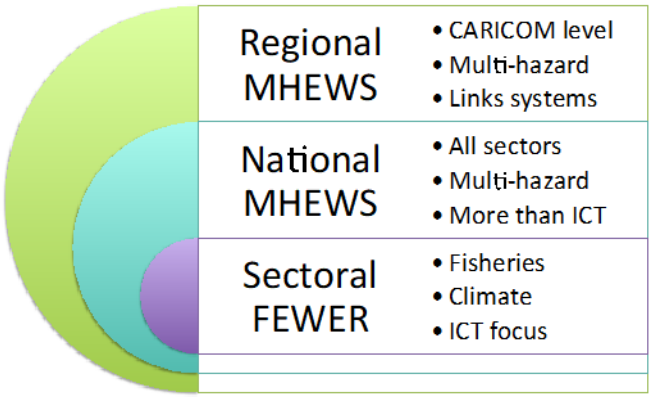


Figure 6. FEWER as a part of a larger multi-hazard and cross-sectoral, nationally to regionally networked EWS

Regarding the climate scope and focus on hydro-meteorological (hydro-met) hazards, contacts were reminded that the aim was primarily to address rapid onset climate variability and extreme weather event risks while also preparing for slower onset changes (Figure 7). While the project scope did not specifically include geological, technological and biological hazards (Figure 8) a FEWER solution would need to be able to accommodate expansion to these in keeping with multi-hazard early warning system (MHEWS) best practices. Conveniently, there are on-going initiatives to tackle some of these such as tsunami early warning[1], sargassum early advisory[2] and oil spill contingency plans[3].

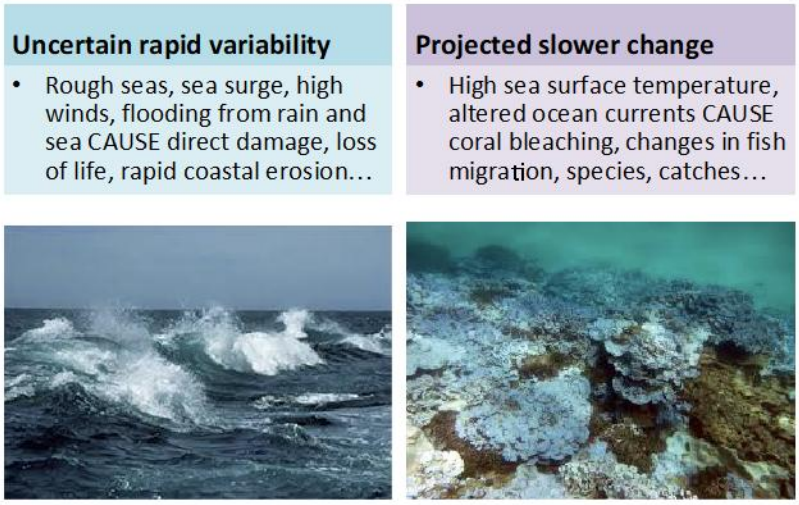


Figure 7. FEWER focuses mainly on rapid onset climate hazards but slow onset changes cannot be ignored in longer term fisheries plans

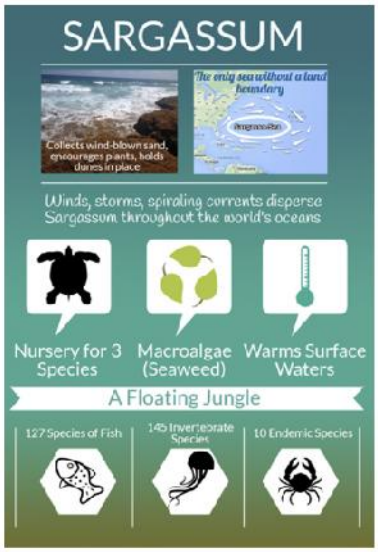
[1] Caribbean Tsunami Information Centre (CTIC) http://www.bb.undp.org/content/barbados/en/home/operations/projects/crisis_prevention_and_recovery/caribbean-tsunami-information-centre.html

[2] Sargassum Early Advisory System http://seas-forecast.com

[3] Caribbean Islands OPRC Contingency Plan http://cep.unep.org/racrempeitc/regional-oprc-plans/caribbean-island-oprc-plan

geological

technological



biological

Figure 8. Some hazards of fisheries interest are not hydro-meteorological, but FEWER can expand to include

Scope also covered the type of information being sought and the form in which it was communicated. In order to emphasise our need in this pre-design phase to understand, not just describe or quantify, the demand side characteristics for a FEWER solution we focused on soliciting "stories" (Figure 9). That is, we sought the reasoning behind actual actions, perceptions and aspirations through probing narratives. Disaster practices are often best understood in the context of livelihoods (Figure 10). Thus, we also sought to get an array of qualitative information ranging from normal everyday practice to actual hazard event experiences, and to what the diverse contacts thought was desirable for the future.

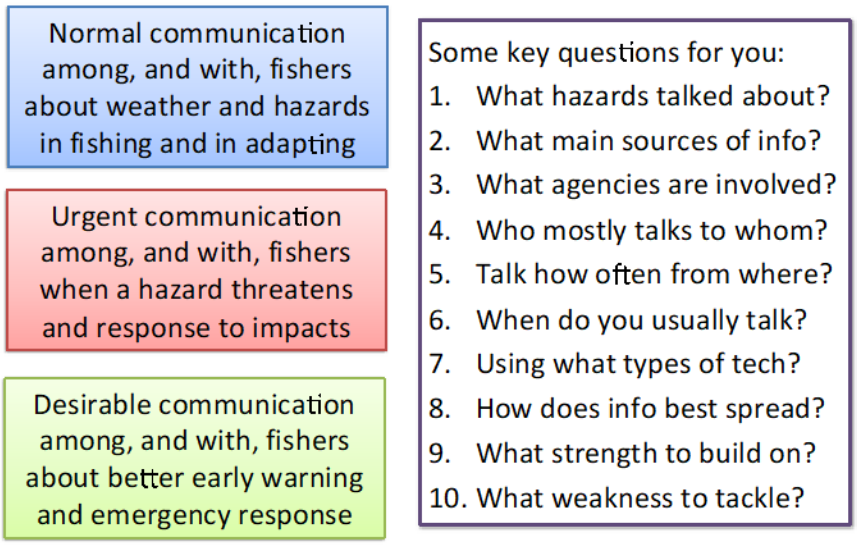


Figure 9. Seeking information on communication practices in real-life experiences through stories

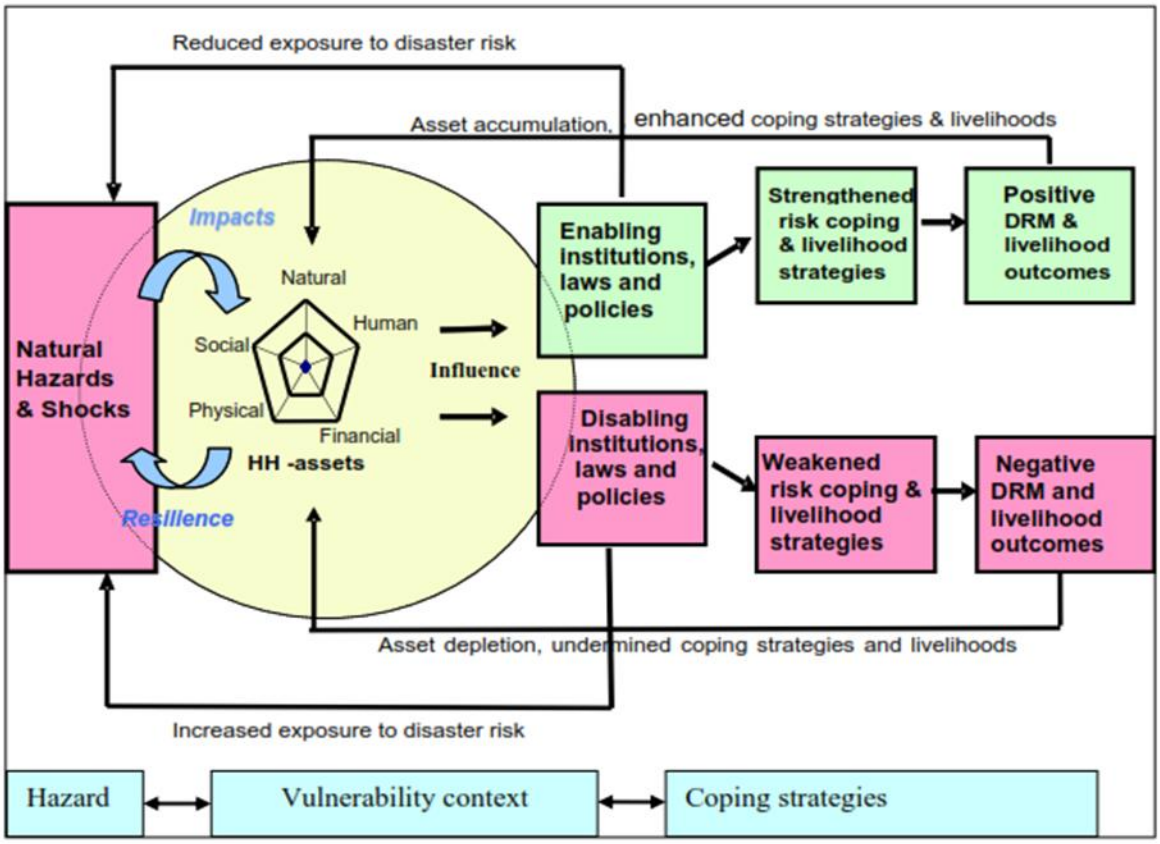


Figure 10. Disaster practices are taken in the context of livelihood assets, institutions and strategies (Source: Baas and others 2008)

Normal conditions reveal what is customary and practical and likely to be used. Behaviour in actual hazard experiences reveals what additional features are important. Ideas on future requirements help to identify emerging needs as well as innovators and early adopters of new technologies and processes. For each of these, similar questions help to characterise practices. The information from interviews, the workshop and observation was assembled from diverse contacts to address the checklist. The following four sections set out the findings most relevant to the FEWER solution, including enabling and constraining factors that go beyond the immediate project scope, but influence viable options.

3 RISK KNOWLEDGE

Risk knowledge is about understanding the nature, pattern and trends of fisheries sector vulnerability based upon which hazards pose serious threat where, when, how and to whom. Contacts were reminded of what EW and ER mean in practical terms (Figure 11) and how EW and ER differ in risk knowledge characteristics (Figure 12).

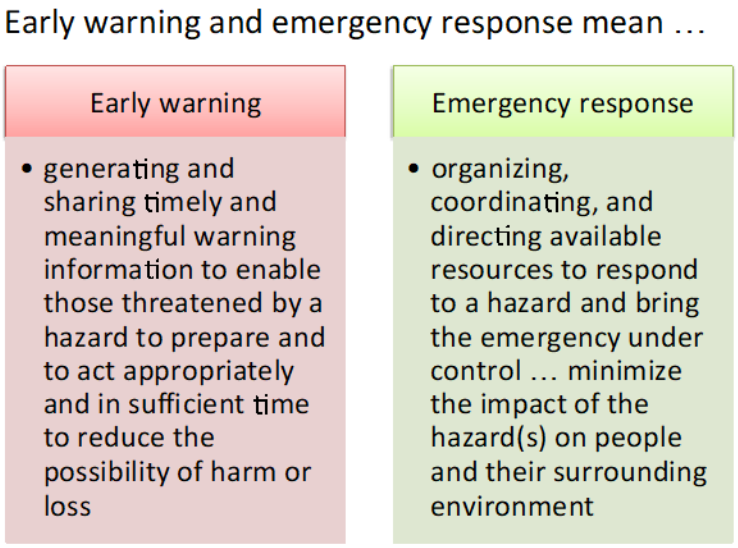


Figure 11. Early warning and emergency response explained

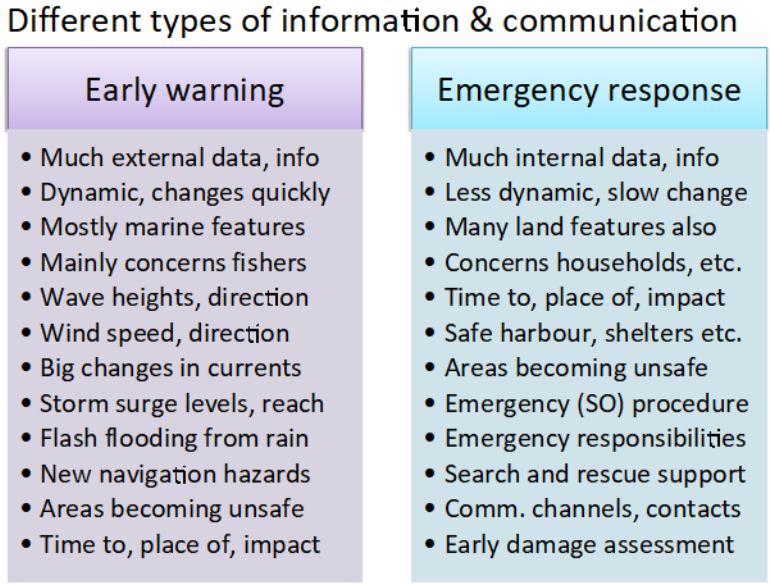


Figure 12. EW and ER differ in information characteristics

Regarding organisational arrangements, contacts (Appendix 4) confirmed that their organisations would be among the main national knowledge contributors and consumers in a FEWER solution, while others would play supporting roles. They said that:

- The National Emergency Management Organisation (NEMO) and Fisheries Division would have the most responsibility in both EW and ER, but especially the former.
- Meteorological Services and Red Cross were deemed crucial for EW and ER respectively.
- The law provides NEMO with a clear mandate and jurisdiction over disaster-related matters and is adequate for the FEWER, and multi-stakeholder engagement was based on NEMO's authority
- Crafting collaborative agreements with agencies included in the national MHEWS is not the norm for NEMO, so a FEWER MOU was considered to be unnecessary but not unacceptable

- National climate and disaster data and information standards are inadequate for the fisheries sector which has focused more on conventional matters such as catch and effort and not yet EAF, CCA and DRM. The recently started FAO project on Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (CC4FISH) offers an opportunity to address deficiencies.
- There is limited national scientific and technical expertise for dealing with fisheries–related risk data but FAO, UNDP and PPCR initiatives may address this.
- Frequent staff changes and poor institutional memory (documentation) plague the public sector
- Regularly collected and updated risk data are limited, risk data being mainly found in ad hoc external project reports which vary in methods and coverage. When CCA and DRM are incorporated into fisheries management plans (FMP) under CC4FISH this should improve.
- Strategies to actively engage fishing communities in risk analyses vary, but NEMO and the Red Cross are actively involved. Under CC4FISH there is provision for conducting fisheries-specific vulnerability and capacity assessments (VCA) that could greatly improve EW and ER data.

During the visit contacts confirmed the climate natural hazards previously identified. In the national consultation workshop they added details on which aspects were of greater or lesser priority for an ICT solution regarding both EW (Figure 13) and ER (Figure 14). They were asked to do so without constraint on feasibility, as operationalization would be addressed in the FEWER proposals once demand was clear.

Hazard features as a fisheries ICT priority

Features to consider in EW	Low priority ————————-High priority				
Rating —->	1	2	3	4	5
Rough seas generally, wherever					x
- Sea swells, in open ocean					x
- Wind waves, in open ocean					x
- High surf, mainly near to shore				x	x
High wind, maybe >20 knots					x
Wind direction and speed					x
Currents, speed and direction				x	x
Storm surge, how high and far					x
Rain flood, flash flooding likely				x	
Water temp., coral bleaching?					x
Visibility, hazy atmosphere				x	
What else?					

Figure 13. Hazard features as a fisheries ICT priority

Emergency response as a fisheries ICT priority

Features to consider in ER	Low priority ————————-High priority				
Rating —->	1	2	3	4	5
Time to, place of, impact					x
Sea areas becoming unsafe				x	
Land areas becoming unsafe				x	
Safe harbour, hurr. shelters etc.			x		
Plans for boats, marinas, etc.			x		
Comm. channels, contacts					x
Emergency (SO) procedures				x	
Emergency responsibilities				x	
Search and rescue support					x
Community disaster team info					x
Early damage assessment info					x
Other? What?					

Figure 14. Emergency response as a fisheries ICT priority

The consultations had no need to go into the vulnerability details of exposure, sensitivity and adaptive capacity but all contacts agreed that cyclonic and other weather events of greatest concern were:

- Tropical depressions to category 5 hurricanes, during the Atlantic hurricane season
- Northerly swells generated by northern storms in the first quarter of the year
- Sudden and surprising squalls, wind gusts and high surf from ocean to shore
- Low visibility from haze (cloud and Sahara dust) that confused visual references
- Flash flooding from rainfall, mainly but not always in the hurricane season
- Coastal inundation particularly from combinations of storm surge and rainfall

Fishers and fisheries officers voiced views on fisher attitudes towards risk such as:

- Fishers normally accept high levels of risk, and actively seek risks that challenge their abilities
- Some fishers want to brag about going to sea when others turned back or did not leave shore
- Despite receiving early warning, some fishers will still venture to sea unless the threat is critical
- Risk-taking fishers may be rewarded by making landings at good price with little competition
- Fishers often say that when the sea is roughest is when the fish are plentiful (for the brave)

Other points made concerning risks, natural hazards and community vulnerability analysis included that:

- Historical data on hazards exist in accessible literature and data sets, but data quantity and quality vary. For example, there is much on precipitation and flash floods but less on sea state
- About 16 fishers went missing at sea in 2016; fish aggregating device (FAD) fishing is partly to assist safety at sea as well as to improve incomes
- Expect sudden rough seas between December and March; happened over past 5 years; too sudden to give warning; Barrouallie one of main places affected by this, but also Owia and Fancy
- There is not usually enough advance warning of marine hazards, except for major storms, based on using model projections alone that do not take small-scale local conditions into account
- Flash flooding damages boats when watershed debris from by rivers enters the inshore region that is experiencing rough seas or storm surge. This type of multi-hazard interaction is of particular concern to the Caribbean Disaster Emergency Management Agency (CDEMA).
- Existing hazard maps do not cover all climate hazards or coastal fishing communities, and hazard interactions are not well researched, but this is improving (note CC4FISH previously mentioned)

- Authorities and NGOs are already sensitive to factors such as gender, poverty, disability, access to infrastructure, economic diversity and environmental impacts, so will consider these
- There seems to be a largely untapped opportunity to incorporate more local knowledge into risk mapping and analysis and make it available to a variety of stakeholder online. This can be via participatory geographic information systems (PGIS) coupled with visualisation.
- Capacity for PGIS was said to be low in the key agencies but has increased such as through the use of SocMon Spatial and other tools often associated with marine spatial planning.
- The physical planning authority was the lead for such information in other climate projects including under the PPCR and with the Caribbean Community Climate Change Centre (CCCCC)
- Physical planning is doing local plans for high risk areas and is best for GIS if needed as neither NEMO nor Fisheries Division regularly use GIS
- National standards and protocols for data storage and access, including open data standards, are receiving some attention, but much of this is project linked and not routine
- Contacts knew that general information on hazards was available from international, regional and national sources. Fishing industry stakeholders said, however, that the available information was not always useful due to difficulties with access to sources, predominance of technical language, how uncertainty was expressed, and other communication deficiencies.

The full potential for incorporating risk assessment into fisheries sector plans, and hence a FEWER solution, is not yet realised for many of the above reasons. However, this is a good time to bring together several compatible initiatives to build more coherent policy, planning and management.

4 MONITORING AND WARNING SERVICE

In this section we address mainly the data aspects of the EW and ER services as communication is dealt with subsequently. The demand side structure for any fisheries-related monitoring and warning service for climate risk reduction and management was discussed with contacts. The few hundred operational vessels in the fishing fleet are mostly small (<10m), wooden or fiberglass, open pirogues or similar design using one or two outboard engines for propulsion. Their target species, fishing methods, fishing gear and range from shore vary. However, for a FEWER ICT solution contacts said fishing enterprises could be treated as one market facing similar risks at sea and ashore. A national monitoring and warning service was deemed to suffice and would probably be the only level feasible and affordable, but some community-based features would be important in keeping with disaster agencies' focus on community-level capacity. This would be especially necessary for the establishment of FEWER in the Grenadines islands even more than on mainland St Vincent.

Interviews and the national consultation workshop explored several online sources, uses and users of hydro-met data and information (Figure 15). Many online sources are open to any user and several are routinely used by the Met Services recently relocated to the new Argyle airport with a view of the sea.

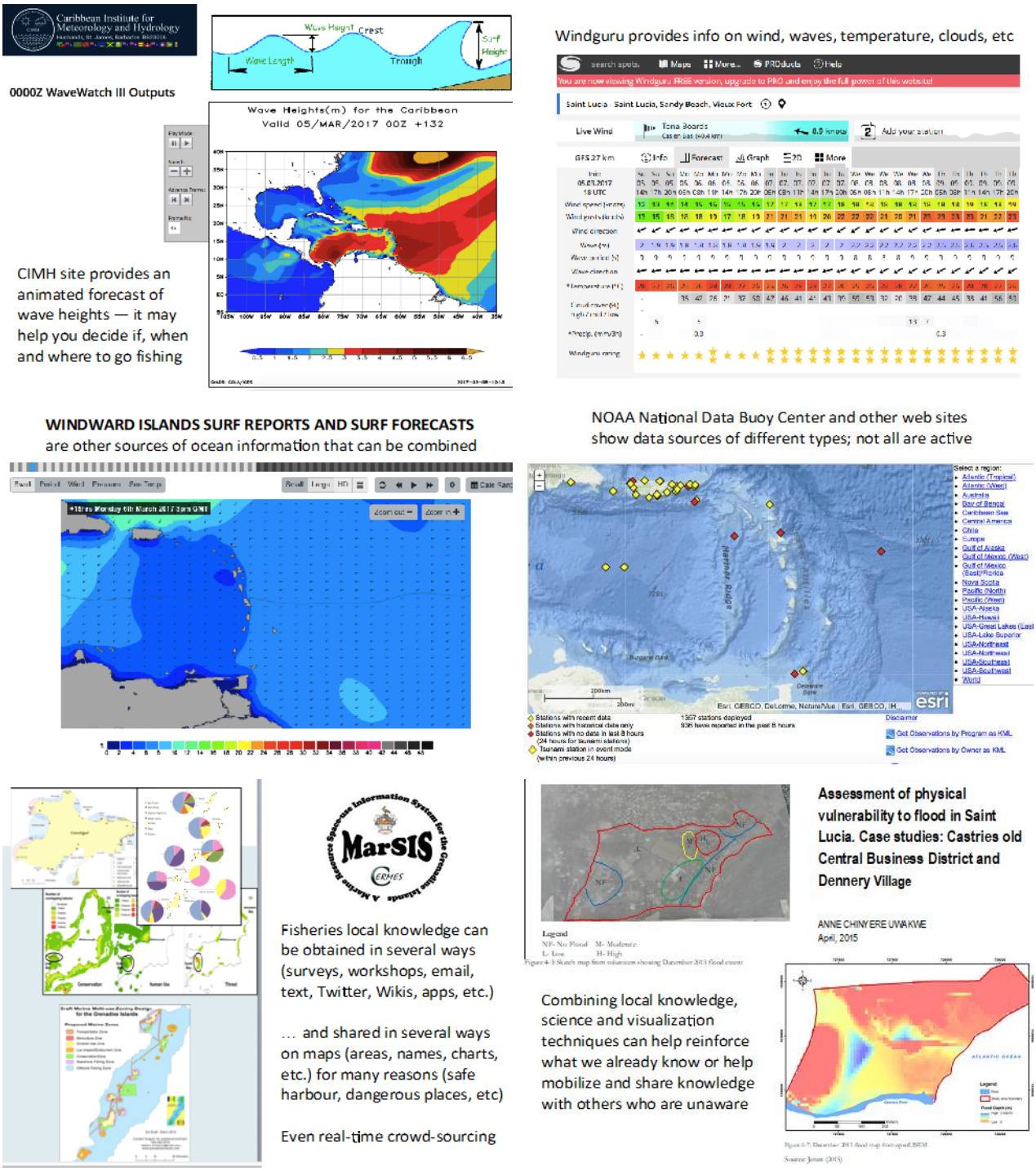


Figure 15. Sources and visualisations of hazard monitoring information form the basis of early warning and emergency response

Referring to the EWS checklist, and ignoring redundancy with points addressed previously under risk, a critical finding was that St Vincent and the Grenadines has invested in implementing the Common Alerting Protocol (CAP) that allows emergency messages to be simultaneously disseminated over a wide variety of existing and emerging public alerting systems. CAP, introduced by a UNDP project currently ending, is examined under communication later. It has implications for data and information types, sources, formats and other requirements in the Software Requirement Specification (SRS) and other parts

of FEWER. NEMO is rebuilding its in-house CAP capacity and stated that FEWER proposals needed to take CAP into account as the core of the current and proposed MHEWS. The national fisherfolk body is only modestly developed, with a mainly informal coordinating role at this time. Most of the fisherfolk organisation capacity rests with primary (fish landing site) organisations. Other points on institutional arrangements and warning systems, made in key informant interviews and the national consultation workshop, were:

- NEMO's institutional mechanisms for fisheries-relates monitoring and warning were reasonably adequate, but a more targeted effort such as by FEWER would be welcomed
- Met Services issues first alerts for hydro-met hazards and NEMO issues first alerts for geological
- Not all agencies in the national disaster management system were sufficiently informed about CAP, which made detailed examination of data types, sources, formats, etc. difficult for them at this point
- Various reports documented issues being addressed in regional to national linkages in the MHEWS
- System-wide tests and exercises were organised, but this did not mean that the fisheries sector was adequately prepared, especially for events that were mainly marine, not requiring national EW or ER
- A much used French service is Modelling and Analysis for Coastal Research (MARC) which has a licensed online web site and a wave forecast for mobile phones
- Public sector agencies and fishing cooperatives with regular working hours would not have the human resources to offer 24/7 support for FEWER unless a threat was imminent
- Many online products presented in the consultation are used regularly by Met Service forecasters
- Marine forecasts are valid for 24 hours around St Vincent and the Grenadines and are issued by email to listed agencies and the public at 0600, 1200 at 1800 daily
- Poor visibility can be a problem for fishers as positioning is often by landmarks described in fishermen terms that Coast Guard does not understand
- Fisher on the east coast said a recent high surf advisory was late as rough seas were experienced days before the forecast; but a fisher on the west coast said the marine forecast was spot on
- The sudden rough seas that fishers experience cannot be forecast and communicated soon enough
- Some fishers do not understand marine forecasts due to met jargon and metric measurements
- Knowing about inshore currents is important for beach seine safety but not part of forecasting
- GPS said to be useful for indicating current speed and direction … determine fuel use, reserves
- Visibility should be included in marine forecast
- Most search and rescue (SAR) is due to engine failure and running out of fuel, not weather related
- Licence fees (estimated USD 2000 – 3000) need to be paid for CAP after initial UNDP project period
- Met Service validates model projections with a real-time Météo-France buoy for wave height, but buoys are often not working; forecasters' personal observations assist in validating forecasts; there used to be a wave height sensor at Calliaqua but storms and lack of maintenance took their toll
- NEMO unsure of functioning sensors (e.g. water level) and systems in use, so currently inventorying all, but leave river monitoring and flood sensors to Central Water and Sewerage Authority (CWSA)
- Met Service normally operates 10 hour work days, and through a longstanding agreement receives forecast information from Barbados which it then customises to be more country-specific
- Met Services often uses the Magic Seaweed site for 48-72 hour forecasts from model runs
- Marine forecasters need more hydro-met buoys at sea for obtaining real-time validation data
- Can get validation from Grenadines airports on Bequia, Canouan, Mustique and Union all of which provide aviation weather
- DEWETRA is seldom used but Met Services appreciates its potential for use by combining model forecasting products and static GIS layers
- 29 Nov 2016 flash flood weather system that caused damage did not show up as impending hazard on DEWETRA; weather threats develop rapidly as they approach the mountains and are not seen as threats by forecasters in Barbados or in online models; better now-casting is needed

- Some fishers said that the whistling of wind in wire fencing gave an indication of hazardous wind speed, so local knowledge and practices that provide simple useful information not to be dismissed

Incorporating local knowledge and impact forecasting was an important issue, in that:

- Met Service is aware of the trend towards impact-based forecasting being promoted by the World Meteorological Organization (WMO), but is not rushing to implement it due to several constraints
- Regular sector-specific and highly localised impact-based forecasting may be impractical due to data requirements and the capacity of the Met Services even if benefits were perceived to exceed costs
- No agreed way to get local knowledge of marine weather or to crowd source (not using Twitter as promoted by CIMH as few people tweet)
- Met Services could be very interested in a value-added layman's informal advisory such as what fishing cooperatives or others familiar with fisheries may be able to offer local fisherfolk groups
- Met Service would welcome community focal points to assist in obtaining local knowledge, getting real-time information on rapidly changing or surprise conditions, regularly validating forecasts, etc.
- NEMO is cautious about citizens issuing informal advisories as these may be mistaken for official advisories and spread misinformation about hazards and required action as was experienced.

5 DISSEMINATION AND COMMUNICATION

The consultations examined the several ICT options available for EW and ER and the need to determine what ICT combinations were useful and feasible in a country-specific situation (Figure 16 and Figure 17). It was agreed that a multi-part solution would be necessary, but further input was needed to specify the parts, the actors, the relationships and the technologies amongst other variables. In order to get a broad view of communication options, none were ruled out in discussions, but contacts expressed their preferences and gave reasons to support their views.

Figure 16. ICT options for features of early warning

Figure 17. ICT options for features of emergency response

In overview, fishers mainly use cell phones for communication ashore and at sea when within range (up to about 15 miles from shore). Many fishers who have smart phones do not take them to sea for fear of loss or damage. Instead they take either regular, or ruggedized and waterproofed, phones to sea. Phones are secured at sea in containers with other valuable and vulnerable property, or worn on the fisher in waterproof transparent pouches. The latter are less common. The phones are treated mainly as emergency devices for making outgoing calls when in distress.

Use of marine VHF radio by fishers is slowly increasing. The Coast Guard promotes handheld VHF radio with Global Maritime Distress and Safety System (GMDSS) digital selective calling (DSC) mainly as a distress device, rather than for routine fisheries communication. The National Telecommunications Regulatory Commission (NTRC) recently supplied the Standard Horizon HX851 Floating Marine Transceiver with global positioning system (GPS) to encourage greater use of marine VHF by fishers. Details from interviews and the national consultation workshop follow.

Summarising findings from the visit with reference to the EWS checklist:

- NEMO has set out institutional powers, processes and protocols for communication in disasters
- NEMO is concerned that there are currently too many separate EW apps, service providers and systems for separate hazards; makes managing a MHEWS too challenging
- Government has recently set up an IT department that could be relevant to integrating FEWER
- Communication networks for reaching fishing enterprises, households and communities are not well defined, are diffuse, and comprise a mix of formal and informal components
- Volunteer EW and ER communication networks, including ham radios, are associated with Community Disaster Response Teams (CDRTs) but not specific to any particular economic sector
- In general, national and community disaster communication systems are well developed and are constantly upgraded mainly through externally funded projects such as what introduced the CAP
- There are current challenges with the CAP, mainly concerning technological problems with the project-supplied Radio Data Service (RDS) EW receivers
- New FM talk and music stations have little interest in EWS and their equipment may not easily allow a broadcast interrupt for the CAP
- The government broadcasting station NBC is the main one for providing EW and ER information but its audience is limited as private stations are more popular for entertainment
- There is no one particularly outstanding radio personality who is important in forecast and EWS
- NEMO's aim is to use the CAP for hazard, location and user specific advisories to be effective; it is currently completing the system to allow this but human resources are constraining progress
- NEMO considers the CAP, with a combination of devices, to be a major part of a FEWER solution
- Issues have occurred with public spreading false alarms via WhatsApp and other social media, and being further spread by radio stations without consulting NEMO; then normal communication channels (cell phone and call-in to radio) are too congested to correct it

Contacts provided additional details in the national consultation workshop and interviews:

- Met Services would support development of an app or other means to communicate better
- Met Services web site is under repair (not to be confused with a weather bloggers site that appears to have become inactive in 2016)
- Many fishers listen to the daily 0600 weather report with marine forecast if not already at sea
- Most fishers are said to heed marine hazard advisories and stay ashore or go to sea cautiously
- Met Services would encourage all mariners to contact them when conditions are not as forecast
- Met Services gets no feedback from fishers but has a Facebook page and wants to get feedback
- Fishers' phones often have little credit and data services are is not usually sought at sea
- WhatsApp and other social networking media are used, but not expressively for fisheries circles
- Fisheries safety regulations do not currently include radios and GPS as mandatory items
- A few technologically advanced boat owners use online weather forecasting products to cross-check the local marine forecast or to receive information between public broadcasts
- Fishers listen to the media broadcast marine forecasts even if not going to sea. Through social networks these fishers are sources of info for other fishers, and this is not dependent on kinship
- Literacy in English does not constrain fishers understanding audio broadcasts and text messages

- Met Service agreed that layman terms are needed to replace technical jargon where possible in forecasting but that this would not be a simple process as terms have very specific meanings
- NEMO would be cautious about encouraging layman value-added impact forecasts as they may be misunderstood or be misinforming regardless of disclaimers by citizen communicators
- Coast Guard accepts and expects cell phone calls from fishers in emergency; typical problems with inability to provide position and fisher impatience with CG questioning to identify vessel, people on board, position and direction of drift if disabled
- Unsure which radio stations use Allan Archer as weatherman but his forecasts are often wrong
- Community fisheries EW communication by word of mouth with neighbours; women included and functions 24/7
- Fishing partners tend to call each other when moving out of cell range

Arguments were heard for increasing the use of marine VHF radio:

- Estimated <10% of fishers who carry marine VHF to sea do so for emergency communication with the port or other vessels such as yachts and ships, not other fishing boats; Fisheries Division says to emphasise use of marine VHF radio in FEWER solution
- While VHF marine band frequencies can be used for transmitting automated recorded EW and ER advisories, if the technologies of the sender and receiver are capable, use would be limited
- VHF can be connected through a repeater to make phone calls and hence reach further
- There was a strong perception that low use of marine VHF radio was in part due to licence cost and administrative processes when compared to the simplicity of obtaining cell phones
- Coast Guard does extension type training for fishers around the island mainly on search and rescue (SAR), and this can accommodate more content on climate and disaster risks
- Coast Guard is promoting VHF GMDSS with DSC (Ch70) for emergencies and positioning for SAR
- Coast Guard base is in a poor location for communication with fishers on marine VHF without a repeater, but it has a high antenna at Mount St Andrew with considerable range at sea
- St Vincent and the Grenadines sought World Bank funding to complete a full GMDSS system for VHF marine coverage; current antennas can cover most of the Grenadines due to height
- Ministry of Tourism is helping water taxis pursue smaller fee for boats <10m to talk to nautical tourists; this could apply to fishing boats even if they are not asking for it

The key role of the NTRC in FEWER was highlighted in that:

- Public agencies had previously received handheld marine radios that were inappropriate (Figure 18), but the National Telecommunications Regulatory Commission (NTRC) is currently distributing high quality devices (Figure 19)
- NTRC key to distributing VHF radios; but issues with battery life due to poor charging practices; fishers need training in radio use and care as get corroded easily with abuse
- Fishers happy with choice of VHF radio, but no rush to obtain them beyond the NTRC project
- Fisheries Division was not informed of NTRC's VHF radio procurement and distribution plans; it only involved when fishers complained about battery life and how they could not use them due to lack of training
- Coast Guard collaborates with NTRC and fisher cooperatives to provide training in VHF use, supporting the distribution of subsidised handheld Standard Horizon marine VHF transceivers
- Standard Horizon handheld is the only radio promoted as the focus is on GMDSS DSC
- Some base stations were also provided, but to police stations not fisherfolk co-operatives
- Unlike most less expensive models, the Horizon handset is capable of maintaining text alerts
- Need for repeaters for marine VHF is not often raised; repeaters are not a NTRC priority

- NTRC is working on getting cell phone coverage maps from service providers but no plan to ground truth the marine coverage
- VHF radio licences issued by NTRC are XCD200 initially then XCD25 for annual renewals
- Licence fee was waived from several radios distributed on promotion; technical proficiency requirements are determined by Maritime Administration, not NTRC
- VHF promotion done with excess funds form World Bank project (10 base stations and 100 handhelds purchased)
- Some VHF radios and 2 base stations were distributed in the Grenadines
- NTRC has no strategic VHF plan with targets; no technical and repair support from local technicians; and no merchants supporting sales; but planning to bring in more handhelds
- NTRC offered (with Coast Guard) five trainings; have brochure and VHF use video on web site
- Fishers got gifts as incentives to turn out to training sessions and this worked fairly well
- Inspired by the NTRC initiative, Fisheries Division is expanding VHF radio use via a current project proposal to Japan for safety equipment

Agencies likely to be involved in the FEWER solution use a variety of ICT, but much is still conventional (Figure 20) rather than using more recent internet and smart phone social media products and services.

Figure 18. Basic marine VHF radio unsuitable for fishers is part of an archived inventory

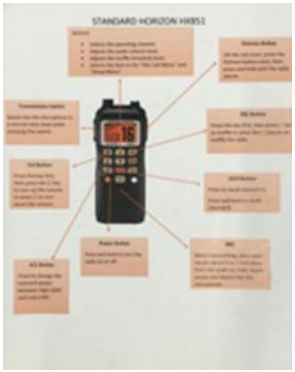


Figure 19. Fishers had a flyer on the many features of a marine VHF radio from NTRC

Actor use of types of com	Phone call	SMS text	Whats App	Mobile App	Desk -top	VHF radio	Ham radio	Email	Face-book	Twitter
Fish Dept	1	0	1	0	0	0/1	0	1	0	0
Fisherfolk	1	0	1/0	0	0	0/1	0	1	0	0
Fisher Org										
Met. Service	1	0	0/1	0	0	0	0	1	1	0
DRM agency	1	1	0	0	1	1	1	1	1	1
C.DRM team										
Red Cross										
Marine SAR	1	0	1	0	1	1	1/0	1	1	0
News media										

Figure 20. Agencies indicated communication technologies they regularly used (1), did not use regularly (0), and seldom or informally used (1/0) to exchange information with fishers

The site visit to Calliaqua (Figure 21), having several fisher leaders at the workshop (Figure 22) and site visits to Rose Place (Figure 23) and Barrouallie (Figure 24) provided opportunity for interaction with fishers and observation of conditions in coastal communities.
Several of the points from these visits were reflected in the above lists, but we also noted at Calliaqua:

- Palangue line fishing, FADs, and open water pelagic fishing done mainly from Calliaqua
- Fishers go up to 50 miles eastward; cell coverage is maybe 20 miles except for area in the NE with shorter range;
- Fishers said VHF radios are bulky items to carry
- Only one person strongly recommended VHF as essential; most others were aware of VHF, yet relied on cell phone as they considered VHF for emergency use and not daily communication
- Fishers with VHF call the signal station for ships as cannot reach Coast Guard without repeater
- Coast Guard can get messages via coastal police stations that have marine VHF base stations
- Complaints persist about the short battery life of available handheld VHF radios and low supply of spare batteries; some suggested inappropriate charging by fishers was shortening battery life
- Suggestions that NTRC provides a marine VHF radio base station for the co-operative
- Calliaqua playing field by the shore is used to haul out local vessels or they go to Canash beach
- Fishers do not need an app to know what to do to secure boats, but it would be reminder

- Fishers liked the idea of a monitor in the co-op displaying weather info conspicuously for them
- Bulletin boards are read by fishers, and the co-operative is seeking one via ECMMAN project
- Some fishers kept the Coast Guard number in their sea-use cell phone contacts list
- There were no established VHF or cell phone calling groups at sea among Calliaqua fishers

Figure 21. Calliaqua fishers with Coast Guard in background

Figure 22. National workshop fisheries stakeholders

Rose Place had several challenges from both land and sea:

- Dense, small urban coastal community with narrow beach and near to river; known for poverty and crime, but close-knit with a high level of self-help and networking to assist fishers in ER
- Boats here are blocked by houses and stalls when they need to be pulled into road as ER, but putting them in the road also blocks a major thoroughfare needed in ER for community
- Has been impacted by heavy rain flooding (shown where river cut a new channel) to beach by the boats; but not impacted as much by rough seas
- Due to risky location fishers have devised their own early response system of boat hauling
- Currently use rollers and manpower to move about 20 boats from congested foreshore
- Want to use a tractor and trailer process for hauling and transporting boats across road
- Residents in area always on alert for bad weather so word spreads fast even without forecast
- Fisher cooperative in re-building process; Goodwill Cooperative lost gas station that provided financial sustainability

Figure 23. Flash flooding has been a hazard at Rose Place

Figure 24. Consulting with fisherfolk at Barouallie

Fishers gathered at Barrouallie on the beach and in the community centre provided similarities as well as different perspectives:

- Barrouallie fishers do not go far from land; always within cell phone range
- Close-knit community with plenty info by word-of-mouth; women included
- The blowing of a conch shell "a certain way" is used to signal danger in the community
- Sudden sea surge and high surf took four boats from Barrouallie beach recently
- Only blackfish (porpoise targeting) boats carry VHF, but cell phone is first choice for all
- Appreciate some of the benefits of VHF but see it mainly for emergency not normal use
- Marine VHF will not get used unless repeaters are installed
- Younger men said they do not listen much to weather forecasts themselves but another person would alert them by word of mouth before going to sea if there was a hazard
- Fishers do not share their cell phone numbers other than with personal friends
- No WhatsApp group of fishers, just informal networks on the basis of friendships
- Vague and uncertain on what benefit FEWER would be for them compared to present

While there are very obvious technical communication constraints the greatest challenge is developing a genuine demand for a FEWER ICT solution given the current limited interest.

6 RESPONSE CAPABILITY

Contacts agreed that an ICT solution for ER should be more straightforward than for EW. This is primarily because much ER data and information can be obtained locally from existing resources with a longer life span. Points included:

- NEMO was accepted by the fishing industry as a credible source of EW and ER information
- Public perception of risks was heightened by recent experience resulting in a responsive state
- There was relatively little concern about false alarms regarding hydro-met hazards to fishers, but NEMO had to deal with false tsunami information that was difficult to counter
- Red Cross CDRT are treated as part of NEMO's ER network so the integration is seamless
- Fishers do not consider Ottley Hall private marina as a hurricane hole; use Canash beach
- Can maintain community contact lists at the co-op; Red Cross considers this crucial
- More communities were being mapped for vulnerabilities and response teams being trained
- Joint exercises to maintain capacity and readiness were regularly planned and executed; the fishing industry was not specifically targeted in them but many were in coastal communities
- Fishing cooperatives were currently low in capacity concerning climate and disaster awareness
- Fishers may find that the co-operative working hours are an obstacle to responsive self-help
- Damage assessment and many other forms and guidance used by NEMO could be incorporated into a smart phone app, noting that Red Cross also uses an app for its internal management

There already exists a set of resources and communication systems for ER, but what is needed most is better communication to reach the fishing industry specifically, especially when a hazard only impacts a few coastal communities or is mainly felt at sea.

7 COLLABORATION AND CONCLUSIONS

This final section of the country visit findings addresses views on the expected FEWER memorandum of understanding (MOU) and the perspectives of contacts on the main elements of a FEWER solution.

The requirement to develop a draft FEWER inter-agency MOU was discussed especially at the national consultation workshop. Contacts were reminded of the fairly standard components of a MOU (Figure 25) as well as the responsibilities to develop, test, implement and sustain FEWER (Figure 26).

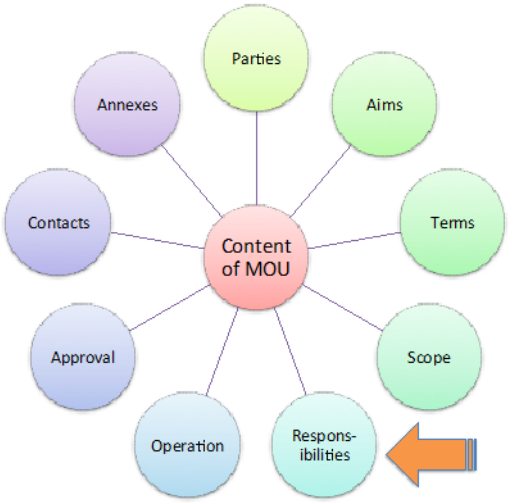


Figure 25. MOUs have a fairly standard content and format

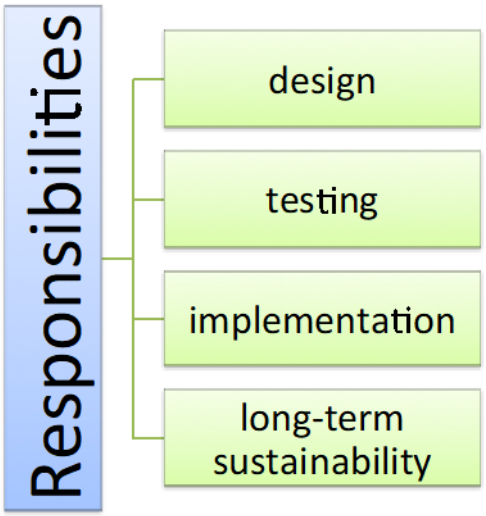


Figure 26. MOU responsibilities are spelled out for FEWER

To ensure that the concept was clear, a few agencies were asked to indicate responsibility preferences at the national level, given that regional level roles were relatively clear in formal organisational mandates. The responses included:

- Fisheries Division — extension to fishers at all stages
- Fisherfolk organisation — "translating" technical information for fishers to better understand
- Met Service — providing and validating forecasts
- Coast Guard — training fisherfolk; broadcast marine forecasts on VHF
- NTRC — focus on licensing responsibility
- NEMO — issue authoritative alerts, obtain community feedback

NEMO, however, suggested that a formal MOU for FEWER was unnecessary as all relationships and responsibilities were already well covered under the National Emergency Act and Red Cross Act. All EWS agencies cooperate well informally. Despite this reservation, contacts were in agreement to having a short, simple and adaptive MOU if one was needed for FEWER.

Contacts provided substantial valuable information for the co-design of the FEWER solution in ways that fit the particular needs of the St Vincent fishing industry and MHEWS. They were reminded of next steps.

8 APPENDICES

Appendix 1. Announcement flyer

UWI PPCR PILOT PROGRAM FOR CLIMATE RESILIENCE IDB Inter-American Development Bank CRFM Caribbean Regional Fisheries Mechanism

Fisheries Early Warning & Emergency Response

What aim guides Fisheries Early Warning and Emergency Response (FEWER)?

FEWER aims to: "reduce the risks to fishers associated with climate change and variability by developing … early warning and emergency response … for fishers in the Caribbean, including training"

Where and when will FEWER be developed with your valuable input?

The project countries are: (1) Dominica (2) Grenada (3) Saint Lucia (4) St Vincent and the Grenadines
The period of the project is: from February 2017 to June 2018 … lots to achieve in just over one year

What types of hazards and risks will be included in FEWER?

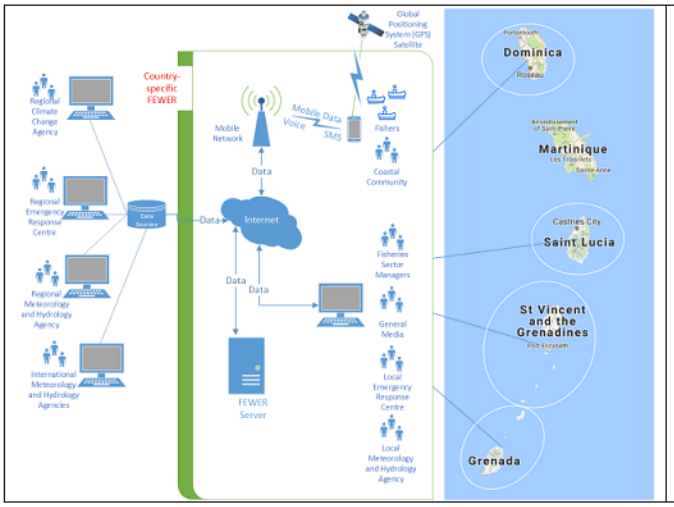
Rough seas, sea surge, high winds, flooding etc. (e.g. from storms, hurricanes)
Other hazards due to any change and variability in climate likely to affect fishers

Climate hazards

Why should this interest you? How will fisherfolk benefit?

Fewer delays or confusion because of clear communication
Fewer losses and anguish because you heed early warning
Fewer post-disaster issues because of emergency response
Fewer uninformed fisherfolk because you share knowledge
Fewer questions to be asked because it is **your own** FEWER

Fewer risks for fishers and other stakeholders



Who will help to develop the FEWER with you?

ICT4Fisheries Consortium

- Caribbean ICT Research Programme
- Caribbean Network of Fisherfolk Organisations
- UWI Cave Hill - Centre for Resource Management & Environmental Studies
- UWI St. Augustine - Department of Computing and IT
- University of Cape Town - Small-scale Fisheries and Coastal Research Group

Working closely with

- Fisheries stakeholders of all types interested in FEWER
- Secretariat of the Caribbean Regional Fisheries Mechanism
- National Fisheries Divisions/Departments in the 4 countries
- National and regional disaster, coastal and climate agencies
- National authorities responsible for finance and planning

Information & Communication Technology (ICT)?

- Smart phone apps, desktop computer software, devices
- People linked to fishing communities trained to use ICT

FOR FISHERFOLK, THEIR FAMILIES AND OTHERS IN FISHERIES…

How can you help to make your FEWER the best that it can be?

- **Tell us** about the climate-related hazards that put you at risk and what you do
- **Be informed** on early warning and emergency response — we will give you info
- **Share** your information on normal everyday communication in your fisheries
- **Show and tell** us about how you have actually communicated in past disasters
- **Tell** ICT4Fisheries Consortium and others what worked well and what did not
- **Disclose** your views on what you would like to see in a FEWER that you make
- **Talk** to us a lot about why, how, when, where and with whom you communicate
- **Suggest** who should take part in a working FEWER, and their responsibilities
- **Participate** in the national consultations and site visits that will soon be organised
- **Keep in touch** with fisherfolk organisations and community leaders on FEWER
- **Make your input** into a FEWER that would be fairly simple and easy to maintain
- **Take part** in the actual design of a FEWER, testing and training on how to use it

What will be delivered in the FEWER? What to expect at the end?

- Consultation and discussion — so there is a written record of what people say on EW and ER
- Consultation and discussion — so all people know what, and what not, to expect from FEWER
- Information on EW and ER — so fisherfolk especially are clear on what is involved in FEWER
- Site visit to a fishing community — so that practical appreciation has informed FEWER design
- Country-specific FEWER proposal — so that each country has a FEWER to meet its needs
- Country-specific FEWER proposal — to also be clear on the gaps and challenges that exist
- Development of mobile app — for a smartphone-based means of early warning, response
- Development of desktop app — to complement mobile app and link land and sea stakeholders
- Hands-on training sessions — so there is practical experience and people who can carry on
- Linking various organisations — so a communication network can be developed for FEWER
- Manuals and training material — so the work on FEWER can continue long after project ends
- Memorandum of agreement — first draft developed among participants to continue FEWER

How to find out more about your FEWER and the project plans?

Contact the Secretariat of the Caribbean Regional Fisheries Mechanism (Email: secretariat@crfm.int)

FEWER is implemented under the Caribbean Regional Track of the Pilot Programme for Climate Resilience (PPCR) with grant funding from the Inter-American Development Bank (IDB). It is executed by The University of the West Indies, Mona through its Mona Office for Research and Innovation (MORI) in partnership with the Caribbean Regional Fisheries Mechanism (CRFM). For further information contact CRFM Secretariat.

Appendix 2. Meetings notices

UWI PPCR IDB CRFM

Fisheries **E**arly **W**arning & **E**mergency **R**esponse

Calliaqua FEWER project inception and scoping meeting

4:30pm – 6:30pm Monday 20 March 2017

Agenda

1. Project overview, aims and objectives from scoping to design to training
2. Problems of climate hazards at Calliaqua, with EW and ER experiences
3. Most feasible information and communication technology (ICT) solutions
4. Arrangements at community level to sustain benefits after the project

Refreshments will be served

For further information on the FEWER project or these meetings email patrick.mcconney@gmail.com

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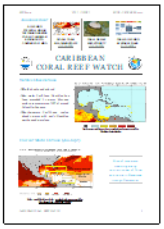
UWI PPCR IDB CRFM

Fisheries **E**arly **W**arning & **E**mergency **R**esponse

Kingstown morning meeting

St Vincent project inception and scoping meeting
08:30am – 1:00pm Tuesday 21 March 2017
Fisheries Division conference room



Agenda

1. Project overview, aims and objectives from scoping to design to training
2. Problems of climate hazards in fisheries, with EW and ER experiences
3. Most feasible information and communication technology (ICT) solutions
4. Arrangements among stakeholders to sustain benefits after the project

Refreshments will be served

Barrouallie afternoon event

Barrouallie inception and scoping meeting
4:30pm – 6:30pm Tuesday 21 March 2017
Old Blackfish Shed

Agenda

1. Project overview, aims and objectives from scoping to design to training
2. Problems of climate hazards at Barrouallie, with EW and ER experiences
3. Most feasible information and communication technology (ICT) solutions
4. Arrangements at community level to sustain benefits after the project

Refreshments will be served

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Appendix 3. Checklist for early warning systems

The checklist on developing early warning systems was developed as a contribution to the Third International Conference on Early Warning by ISDR[4].

1. Risk Knowledge

1.1. Organizational Arrangements Established

- Key national government agencies involved in hazard and vulnerability assessments identified and roles clarified (e.g. agencies responsible for economic data, demographic data, land-use planning, and social data).
- Responsibility for coordinating hazard identification, vulnerability and risk assessment assigned to one national organization.
- Legislation or government policy mandating the preparation of hazard and vulnerability maps for all communities in place.
- National standards for the systematic collection, sharing and assessment of hazard and vulnerability data developed, and standardized with neighboring or regional countries, where appropriate.
- Process for scientific and technical experts to assess and review the accuracy of risk data and information developed.
- Strategy to actively engage communities in local hazard and vulnerability analyses developed.
- Process to review and update risk data each year and include information on any new or emerging vulnerabilities and hazards established.

1.2. Natural Hazards Identified

- Characteristics of key natural hazards (e.g. intensity, frequency and probability) analyzed and historical data evaluated.
- Hazard maps developed to identify the geographical areas and communities that could be affected by natural hazards.
- An integrated hazard map developed (where possible) to assess the interaction of multiple natural hazards.

1.3. Community Vulnerability Analyzed

- Community vulnerability assessments conducted for all relevant natural hazards.
- Historical data sources and potential future hazard events considered in vulnerability assessments.
- Factors such as gender, disability, access to infrastructure, economic diversity and environmental sensitivities considered.
- Vulnerabilities documented and mapped (e.g. people or communities along coastlines identified and mapped).

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[4] UNISDR 2006. Developing Early Warning Systems: A Checklist. Third International Conference on Early Warning *From concept to action*. 27 – 29 March 2006. Bonn, Germany. http://www.unisdr.org/files/608_10340.pdf. Last accessed 28 May 2017.

1.4. Risks Assessed

- Interaction of hazards and vulnerabilities assessed to determine the risks faced by each region or community.
- Community and industry consultation conducted to ensure risk information is comprehensive and includes historical and indigenous knowledge, and local information and national level data. Activities that increase risks identified and evaluated.
- Results of risks assessment integrated into local risk management plans and warning messages.

1.5. Information Stored and Accessible

- Central 'library' or GIS database established to store all disaster and natural hazard risk information.
- Hazard and vulnerability data available to government, the public and the international community (where appropriate).
- Maintenance plan developed to keep data current and updated.

2. Monitoring and Warning Service

2.1. Institutional Mechanisms Established

- Standardized process, and roles and responsibilities of all organizations generating and issuing warnings established and mandated by law.
- Agreements and interagency protocols established to ensure consistency of warning language and communication channels where different hazards are handled by different agencies.
- An all-hazard plan to obtain mutual efficiencies and effectiveness among different warning systems established.
- Warning system partners, including local authorities, aware of which organizations are responsible for warnings.
- Protocols in place to define communication responsibilities and channels for technical warning services.
- Communication arrangements with international and regional organizations agreed and operational.
- Regional agreements, coordination mechanisms and specialized centers in place for regional concerns such as tropical cyclones, floods in shared basins, data exchange, and technical capacity building.
- Warning system subjected to system-wide tests and exercises at least once each year.
- A national all-hazards committee on technical warning systems in place and linked to national disaster management and reduction authorities, including the national platform for disaster risk reduction.
- System established to verify that warnings have reached the intended recipients.
- Warning centers staffed at all times (24 hours per day, seven days per week).

2.2. Monitoring Systems Developed

- Measurement parameters and specifications documented for each relevant hazard.
- Plans and documents for monitoring networks available and agreed with experts and relevant authorities.
- Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance.

- Applicable data and analysis from regional networks, adjacent territories and international sources accessible.
- Data received, processed and available in meaningful formats in real time, or near-real time.
- Strategy in place for obtaining, reviewing and disseminating data on vulnerabilities associated with relevant hazards.
- Data routinely archived and accessible for verification and research purposes.

2.3. Forecasting and Warning Systems Established

- Data analysis, prediction and warning generation based on accepted scientific and technical methodologies.
- Data and warning products issued within international standards and protocols.
- Warning analysts trained to appropriate international standards.
- Warning centers equipped with appropriate equipment needed to handle data and run prediction models.
- Fail-safe systems in place, such as power back-up, equipment redundancy and on-call personnel systems.
- Warnings generated and disseminated in an efficient and timely manner and in a format suited to user needs.
- Plan implemented to routinely monitor and evaluate operational processes, including data quality and warning performance.

3. Dissemination and Communication

3.1. Organizational and Decision-making Processes Institutionalized

- Warning dissemination chain enforced through government policy or legislation (e.g. message passed from government to emergency managers and communities, etc.).
- Recognized authorities empowered to disseminate warning messages (e.g. meteorological authorities to provide weather messages, health authorities to provide health warnings).
- Functions, roles and responsibilities of each actor in the warning dissemination process specified in legislation or government policy (e.g. national meteorological and hydrological services, media, NGOs).
- Roles and responsibilities of regional or cross border early warning centers defined, including the dissemination of warnings to neighboring countries.
- Volunteer network trained and empowered to receive and widely disseminate hazard warnings to remote households and communities.

3.2. Effective Communication Systems and Equipment Installed

- Communication and dissemination systems tailored to the needs of individual communities (e.g. radio or television for those with access; and sirens, warning flags or messenger runners for remote communities).
- Warning communication technology reaches the entire population, including seasonal populations and remote locations.
- International organizations or experts consulted to assist with identification and procurement of appropriate equipment.
- Multiple communication mediums used for warning dissemination (e.g. mass media and informal communication).
- Agreements developed to utilize private sector resources where appropriate (e.g. amateur radios, safety shelters).

- Consistent warning dissemination and communication systems used for all hazards. Communication system is two-way and interactive to allow for verification that warnings have been received.
- Equipment maintenance and upgrade program implemented and redundancies enforced so back-up systems are in place in the event of a failure.

3.3. Warning Messages Recognized and Understood

- Warning alerts and messages tailored to the specific needs of those at risk (e.g. for diverse cultural, social, gender, linguistic and educational backgrounds).
- Warning alerts and messages are geographically-specific to ensure warnings are targeted to those at risk only.
- Messages incorporate the understanding of the values, concerns and interests of those who will need to take action (e.g. instructions for safeguarding livestock and pets).
- Warning alerts clearly recognizable and consistent over time and include follow-up actions when required.
- Warnings specific about the nature of the threat and its impacts.
- Mechanisms in place to inform the community when the threat has ended.
- Study into how people access and interpret early warning messages undertaken and lessons learnt incorporated into message formats and dissemination processes

4. Response Capability

4.1. Warnings Respected

- Warnings generated and distributed to those at risk by credible sources (e.g. government, spiritual leaders, respected community organizations).
- Public perception of natural hazard risks and the warning service analyzed to predict community responses.
- Strategies to build credibility and trust in warnings developed (e.g. understanding difference between forecasts and warnings).
- False alarms minimized and improvements communicated to maintain trust in the warning system.

4.2. Disaster Preparedness and Response Plans Established

- Disaster preparedness and response plans empowered by law.
- Disaster preparedness and response plans targeted to the individual needs of vulnerable communities (Increasingly it is possible to target vulnerable individuals).
- Hazard and vulnerability maps utilized to develop emergency preparedness and response plans.
- Up-to-date emergency preparedness and response plans developed, disseminated to the community, and practiced.
- Previous disaster events and responses analyzed, and lessons learnt incorporated into disaster management plans.
- Strategies implemented to maintain preparedness for recurrent hazard events.
- Regular tests and drills undertaken to test the effectiveness of the early warning dissemination processes and responses.

4.3. Community Response Capacity Assessed and Strengthened

- Community ability to respond effectively to early warnings assessed.

- Response to previous disasters analyzed and lessons learnt incorporated into future capacity building strategies.
- Community-focused organizations engaged to assist with capacity building.
- Community and volunteer education and training programs developed and implemented.

4.4. Public Awareness and Education Enhanced

- Simple information on hazards, vulnerabilities, risks, and how to reduce disaster impacts disseminated to vulnerable people, communities and decision-makers.
- Community educated on how warnings will be disseminated, and which sources are reliable and how to respond to different types of hazards after an early warning message is received.
- Community trained to recognize simple hydro-meteorological and geophysical hazard signals to allow immediate response.
- On-going public awareness and education built in to school curricula from primary schools to university.
- Mass media and folk or alternative media utilized to improve public awareness.
- Public awareness and education campaigns tailored to the specific need of each audience (e.g. children, vulnerable people, emergency managers, and media).
- Public awareness strategies and programs evaluated at least once per year and updated where required.

Appendix 4. List of contacts

Name	Affiliation	Email address(es)
Vibert Piere	Barrouallie Fishermen's Co-operative	vibertdp@yahoo.com
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Chévanev (Chev) Charles	Maritime Administration	
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Nadine Hull	National Telecommunications Regulatory Commission (NTRC)	
Kyron Duncan	National Telecommunications Regulatory Commission (NTRC)	
Keisha Gurley	National Telecommunications Regulatory Commission (NTRC)	
Julia Simmons	Red Cross	svgredcross@vincysurf.com

The CRFM is an inter-governmental organization whose mission is to "Promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region". The CRFM consists of three bodies – the Ministerial Council, the Caribbean Fisheries Forum and the CRFM Secretariat.

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